

# NOTICES

OF THE

AMERICAN MATHEMATICAL SOCIETY

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# Calendar of AMS Meetings and Conferences

This calendar lists all meetings and conferences approved prior to the date this issue went to press. The summer and annual meetings are joint meetings of the Mathematical Association of America and the American Mathematical Society. The meeting dates which fall rather far in the future are subject to change; this is particularly true of meetings to which no numbers have been assigned. Programs of the meetings will appear in the issues indicated below. First and supplementary announcements of the meetings will have appeared in earlier issues. Abstracts of papers presented at a meeting of the Society are published in the journal *Abstracts of papers presented to the American Mathematical Society* in the issue corresponding to that of the *Notices* which contains the program of the meeting, insofar as is possible. Abstracts should

be submitted on special forms which are available in many departments of mathematics and from the headquarters office of the Society. Abstracts of papers to be presented at the meeting must be received at the headquarters of the Society in Providence, Rhode Island, on or before the deadline given below for the meeting. The abstract deadlines listed below should be carefully reviewed since an abstract deadline may expire before publication of a first announcement. Note that the deadline for abstracts for consideration for presentation at special sessions is usually three weeks earlier than that specified below. For additional information, consult the meeting announcements and the list of special sessions.

## Meetings

Meeting #	Date	Place	Abstract Deadline	Program Issue
879	* March 26–27, 1993	Knoxville, Tennessee	January 5	March
880	* April 9–10, 1993	Salt Lake City, Utah	January 29	April
881	* April 17–18, 1993	Washington, D.C.	January 29	April
882	* May 20–23, 1993	DeKalb, Illinois	February 26	May-June
883	* August 15–19, 1993 (96th Summer Meeting) (Joint Meeting with the Canadian Mathematical Society)	Vancouver, British Columbia	May 18	July-August
884	* September 18–19, 1993	Syracuse, New York	May 18	September
885	* October 1–3, 1993 (Joint Meeting with the Deutsche Mathematiker-Vereinigung e.V.)	Heidelberg, Germany	May 18	September
886	* October 22–23, 1993	College Station, Texas	August 4	October
887	* November 6–7, 1993	Claremont, California	August 4	October
888	* January 12–15, 1994 (100th Annual Meeting)	Cincinnati, Ohio	October 1	December
889	* March 18–19, 1994	Lexington, Kentucky		
890	* March 25–26, 1994	Manhattan, Kansas		
891	* April 9–10, 1994	Brooklyn, New York		
892	* June 16–18, 1994	Eugene, Oregon		
	October 28–29, 1994	Stillwater, Oklahoma		
	January 25–28, 1995 (101st Annual Meeting)	Denver, Colorado		
	March 24–25, 1995	Chicago, Illinois		
	November 3–4, 1995	Kent, Ohio		
	January 10–13, 1996 (102nd Annual Meeting)	Orlando, Florida		
	March 22–23, 1996	Iowa City, Iowa		

\* Please refer to page 1265 for listing of Special Sessions.

## Conferences

June 7–18, 1993: AMS-SIAM Summer Seminar in Applied Mathematics on Tomography, Impedance Imaging, and Integral Geometry, Mount Holyoke College, South Hadley, Massachusetts.

July 10–August 6, 1993: Joint Summer Research Conferences in the Mathematical Sciences, University of Washington, Seattle, Washington.

July 11–30, 1993: AMS Summer Institute on Stochastic Analysis, Cornell University, Ithaca, New York.

August 9–13, 1993: AMS Symposium on Mathematics of Computation 1943–1993: A Half-Century of Computational Mathematics, University of British Columbia, Vancouver, Canada.

## Other Events Cosponsored by the Society

February 11–16, 1993: Section A (Mathematics) Sessions at the AAAS Annual Meeting, Boston, Massachusetts.

May 30–June 13, 1993: First Caribbean Spring School of Theoretical Physics and Mathematics on Infinite Dimensional Geometry, Noncommutative Geometry, Operator Algebras, and Particle Physics, Pointe à Pitre, Guadeloupe. Cosponsored by the Société Mathématique de France.

## Deadlines

	February Issue	March Issue	April Issue	May-June Issue
Classified Ads*	January 7, 1993	February 4, 1993	February 24, 1993	April 1, 1993
News Items	December 24, 1992	January 22, 1993	February 19, 1993	March 19, 1993
Meeting Announcements**	December 24, 1992	January 26, 1993	February 22, 1993	March 23, 1993

\* Please contact AMS Advertising Department for an Advertising Rate Card for display advertising deadlines.

\*\* For material to appear in the Mathematical Sciences Meetings and Conferences section.

# NOTICES

OF THE

AMERICAN MATHEMATICAL SOCIETY

## ARTICLES

### 1171 Flat-Rate Funding Project at NSF

In a two-day meeting, the NSF's Advisory Committee for the Mathematical Sciences debated the pros and cons of shifting to a two-tiered, flat-rate grant system. Allyn Jackson reports on the Committee's discussion of this controversial measure.

### 1174 Commission on the Future of the NSF

The NSF has assembled a Commission to examine how the Foundation can adapt to changes in science, society, and the economy. The Commission's call for comments resulted in more than 800 letters. After a brief introduction by Allyn Jackson, four letters to the Commission from the mathematical sciences community are reprinted here.

### 1183 Ethnomathematics: A Research Program on the History and Philosophy of Mathematics with Pedagogical Implications *Ubiratan D'Ambrosio*

Ethnomathematics provides a new perspective on the history and philosophy of mathematics by viewing mathematical practices and developments within a cultural context. Ubiratan D'Ambrosio, one of the main founders of ethnomathematics, describes some of the motivations and aims of the field.

## FEATURE COLUMNS

### 1186 Computers and Mathematics *Keith Devlin*

Keith Devlin offers some year-end thoughts on mathematics and its future, and discusses a workshop on "Visualization of Geometric Structures" held at the Mathematical Sciences Research Institute at Berkeley, California, in October.

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# NOTICES

OF THE  
AMERICAN MATHEMATICAL SOCIETY

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## From the Executive Director . . .

### PROGRAMS AT MEETINGS

The AMS was originally established by a "Call to Mathematicians" to hold meetings. The first meeting was held on November 24, 1888, in New York City. Next month, the Society will hold its 99th annual meeting in San Antonio.

Meetings are a central component of the Society's activities. They provide a forum for communicating mathematics, which is the principal activity of the Society, and for committees and other groups to meet and work. In addition, meetings generate AMS publications and increasingly provide a place for discussion of issues influencing the profession.

Today we face numerous demands on the programming of meetings. The major demand is on the scientific program—that part of the program dealing with communicating mathematics. The scientific program comprises AMS invited addresses; joint invited addresses; special sessions; contributed paper sessions; and the Colloquium, Gibbs, and Progress in Mathematics Lectures. The invited lectures and addresses are designed to provide a broad spectrum of mathematics with varying levels of exposition. Special sessions, a very successful forum for the communication of mathematics, have been expanded in recent years to include sessions on mathematics education and history of mathematics. The scientific program is generally seen as successfully serving the mathematics community.

The National Joint Meetings activities have been gradually broadened to include more activities outside the scientific program. These activities address such issues as federal science policy and its impact on mathematics, connections of mathematics to its uses, education reform, crisis in academic research libraries, employment of mathematicians, national reports, etc. These issues are brought to meetings through the initiative of Society committees. In particular, the AMS Committees on Science Policy and Education regularly schedule meetings activities. There is a need for such a forum to inform mathematicians about these issues, and currently the meetings are one of the best ways to provide this service to the community. The Society is considering ways to better coordinate these activities with the scientific program at National Joint Meetings.

Another important activity at meetings that is receiving more attention is the program for students. There are exciting plans for the San Antonio Meeting, including student paper sessions; selected invited addresses; sessions for invited and contributed papers; MathChats, where students meet with mathematicians on an informal and personal basis; a student hospitality center; a Career Fair; etc. The Society has an ad hoc committee that is preparing a report that will, among other things, address student activities at AMS meetings. The student activities at National Joint Meetings are coordinated with student activities of the Mathematical Association of America and other organizations that participate in these meetings.

As the National Joint Meetings activities have expanded, pressures on time and space have sometimes caused conflicts. There have been many discussions about how to introduce new activities into a meetings program filled with traditional activities that must be scheduled without conflict. In addition, there is the question of how to strike a balance between lectures aimed at a broad audience and those that are more technical and specialized. The Society is devoting careful attention to providing well-designed, balanced meetings that successfully serve as broad a segment of the community as possible.

William Jaco

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# Flat-Rate Funding Project at NSF

## *Advisory Committee Recommends against the Project, but Encourages Alternate Funding Modes*

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Late last summer, mathematics departments around the country were abuzz with talk about a new funding scheme at the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF). The basic idea of the "Flat-Rate Budget Demonstration Project" was to institute a two-tiered grant system, with one tier at \$20,000 and one at \$30,000 (actually, there is also a set level of \$15,000 for postdocs, which essentially amounts to a third tier). Those figures include salary and overhead, but support for graduate students, equipment, and so on would be added separately. After a description of the project was sent out on email in early September, the DMS, under intense pressure from the community, decided to postpone initiation of the project.

At a meeting held October 26–27 at NSF headquarters in Washington, DC, the Foundation's Advisory Committee for the Mathematical Sciences passed a resolution saying they did not support the flat-rate demonstration project. Ironically, it was this Committee that last spring passed a resolution recommending that the DMS "consider a two-tiered award system". Evidently, after hearing comments from their colleagues and arguments for and against the project, they felt in the end they couldn't support it. If it seems as though everyone was pretty confused, that's probably true: the entire proceedings illustrates the difficult position DMS is in as it tries to balance the expectations of the community with fiscal and political realities at the NSF.

### **Arguments for the Flat-Rate System**

A driving force behind the flat-rate system is the conviction that not enough mathematicians receive grant support for their research. In reviewing the proposals funded and declined by DMS, the Committee has routinely found that the caliber of researchers turned down is very high. Given a basically flat DMS budget over the past few years—and the zero increase for core research last year—the Committee concluded that the only way to get more people funded was to give everyone less. Complaints that such a strategy sold mathematicians cheaply were not so persuasive as the perception that, given the tight budget climate, reducing grant size was the only way to forestall a crisis.

Arguments for a flat-rate system have often been phrased in terms of "unlinking" grant size from salary size. The idea has a logical appeal: suppose two proposals get equally good

reviews, but one investigator's salary is much higher than the other's. Which is the better "buy"? Or, take the case of young investigators who need time and support to get their research careers off the ground. Sometimes as many as four postdoctoral researchers could be supported over a summer for the same "price" as a senior researcher. A flat-rate system, the argument goes, would allow the DMS to focus more on the scientific merit of the proposals and less on how much they cost. In addition, if grants are "unlinked" from salary, investigators can choose how they use the funds: for travel, postdocs, equipment, or, if they wish, salary compensation.

Although there are indications of strong support for the flat-rate project, there has also been a lot of misunderstanding. Judith S. Sunley, who served as director of the DMS for five years and is currently executive officer of the Mathematical and Physical Sciences directorate at NSF, made a presentation to the Committee about comments she received concerning the flat-rate project. She said that the great majority of comments were favorable, but that many of them revealed misunderstandings about the nature and goals of the project. A common reaction was just plain surprise: people felt this was a major policy change that was undertaken without consultation with the community. The matter of overhead also caused confusion. The initial announcement did not make it clear that the tier amounts were to include overhead, so some thought the entire project was designed to circumvent payment of overhead. As Sunley took pains to point out, this is contrary to NSF policies for research grants.

In addition, many assumed that the aim of the project was to increase the number of principal investigators (PIs) supported and wondered why this was not stated up front in the initial announcement. (This was not an unreasonable assumption: the Advisory Committee's resolution about the two-tiered award system stated, "One of the intentions of this resolution is to significantly increase the number of principal investigators supported.") The question of how many more investigators could be supported is in fact not easy to answer. One difficulty is that about half the DMS budget goes toward continuing grants, which must be honored at the level at which they were originally negotiated. Therefore, the flat-rate system would affect only new grants. In addition, the DMS is facing an approximate cut of about 10% this year, further eroding the number of investigators that could be supported.

Furthermore, for the past two or three years, as budgets only kept pace with inflation, DMS program officers have been squeezing grant amounts in order to try to fund more people. And last year, almost all the program directors, to one extent or another, departed from the standard formula of paying two-ninths of the investigators' academic year salary. In trying to follow the idea of "unlinking" grant sizes from salaries, a number of program officers made awards based on median award sizes from the previous year. For example, the Geometric Analysis program essentially limited salaries to \$15,000 per summer, and this figure is based on the median of grant sizes for senior investigators the previous year. Although a consistent strategy was followed within each program, there were wide differences between the programs. This means that grant sizes have already been reduced substantially, so the savings gained by the flat-rate system are not as great as one might hope. Out of all this confusing haze, one clear statement did emerge during the Committee meeting: had the DMS followed the standard two-ninths plan last year, about 300 fewer people would have been supported.

### Supporting More PIs Doesn't Sell

The DMS is caught between two opposing forces: the mathematics community, which seems to hold increasing the number of investigators supported as the top priority for the Division, and the upper echelons of the NSF, where arguments to spread money farther and wider simply don't sell. For one thing, NSF director Walter Massey has stated that one of his priorities is to give larger grants of longer duration. During the Committee meeting, it became clear that, outside of the DMS, the NSF was interested in the flat-rate project mainly as a means of streamlining the workload associated with negotiating budgets for grants.

Ostensibly because of concern over the flat-rate project, there were a number of visitors at the meeting who don't usually attend, such as AMS President Michael Artin of the Massachusetts Institute of Technology, SIAM President Robert O'Malley of the University of Washington at Seattle, and John C. Polking of Rice University, who served a term as DMS director five years ago. In a presentation to the Committee, Polking asserted that higher-ups at the NSF don't look at all the excellent mathematicians turned down by the DMS; they only look at the total number of investigators supported by the DMS, which is high compared to other NSF divisions. (This is in part due to the fact that, for many areas of the mathematical sciences, the NSF is the sole source of federal support.) Polking served during a time of increase in the DMS budget, and he said it was made clear to him at the time that the number of investigators supported by the DMS should not rise. Sunley pointed out to the Committee that, within the Foundation, the flat-rate project was not promoted as a way to increase the number of investigators, but rather as one of several experiments in alternative ways to support science.

Polking also said that, although he believes more mathematicians should be supported, the flat-rate system is short-sighted. For one thing, he noted, the purpose of grants is to

provide resources to do research. One resource is time, and time should be paid for. He also believes that mathematics has difficulty competing with other areas of science for the best graduate students because support for mathematics research is meager compared to that for other sciences; a flat-rate system would only worsen this situation. Finally, what would prevent higher-ups at the NSF from concluding that the DMS doesn't really need more funding, but that it can make do simply by giving smaller and smaller grants? "The long term effect will be to reduce the overall level of funding for mathematics," Polking concluded.

During the meeting, it was also pointed out that many other divisions at the NSF do not give two-ninths summer salary. One example is the Division of Materials Research, which routinely gives one-ninth or less. Recently, this Division has enjoyed large funding increases. It was able to get these increases not by saying that it had to turn down too many good people, but by convincing people inside and outside the NSF that materials research is important science for the nation to support. So, whether or not the DMS moves to a flat-rate system has less impact on the DMS budget than does the level of awareness within the federal government of the importance of mathematical sciences research to the health of science.

### What Happens This Year?

Many of the Committee members were persuaded by Polking's arguments, and all seemed to agree that ultimately, it would be best to aim for returning to the traditional two-ninths funding mode. But what to do for the current fiscal year? The DMS drew up a list of seven different schemes it could follow for this year, ranging from returning to the traditional two-ninths mode, to giving only one-ninth, to moving to the flat-rate system. During the two-day meeting, it was impossible for the Committee to evaluate the merits and demerits of these various plans. The resolution the Committee finally passed encouraged the DMS to continue exploring alternate funding modes, but did not endorse a specific plan. So, what will happen this year is still up in the air.

One of the program officers said during the Committee meeting that he is unwilling to do again what he did last year—making endless phone calls to investigators explaining why he had to reduce their budgets—without some kind of clear policy or consistent system to back him up. The DMS staff developed the flat-rate project over the summer exactly for the purpose of imposing some order and consistency. In addition, they believed that they were acting on the instructions the Committee gave them last spring. It was clear that some of the program officers feel burned by the entire episode. One of them remarked that the DMS staff would never again put that much time and effort into developing such a project. On the other hand, many of the Advisory Committee members felt they were not consulted properly during the formulation of the flat-rate project. Neither side was happy with the outcome.

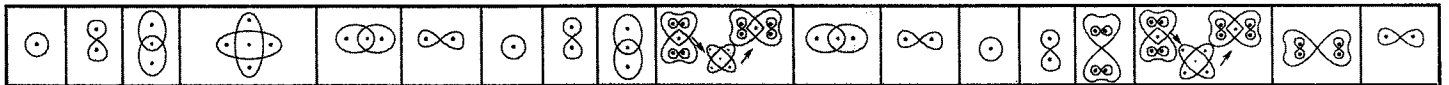
In addition to discussing the flat-rate project, the Advisory Committee also considered the idea of having a special "mathematics commission" that would work with the DMS to try to make improvements and plan for the future. (This idea

is partly spurred by the creation of the Commission on the Future of the NSF; see the article on the Commission in this issue of the *Notices*.) Such a group could help to rebuild some of the trust lost between the community and the DMS during the flap over the flat-rate project. Also, the newly named DMS director, Frederic Wan of the University of Washington at Seattle, attended the meeting and seemed to be well received by the Committee. Wan indicated an interest in the idea of a mathematics commission.

During its two-day meeting, the Committee didn't have time to formulate any clear policies that could help guide

the DMS as it navigates its way through the various political and fiscal pressures at the NSF. Indeed, it seems clear that coming to Washington twice a year for two-day meetings barely suffices to get the Committee up to speed on what the NSF is doing. Given the winds of change and the budget climate at the Foundation these days, the DMS is going to need all the good advice it can get.

Allyn Jackson  
Staff Writer



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# Commission on the Future of the NSF

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The members of the National Science Board Commission on the Future of the National Science Foundation are:

**William Danforth**, chancellor of Washington University in St. Louis (co-chair); **Robert Galvin**, chairman of the Executive Committee and former Chief Executive Officer of Motorola Corporation (co-chair); **John Armstrong**, International Business Machines Corporation; **Jacqueline Barton**, professor of chemistry, California Institute of Technology; **Lindy Boggs**, former U.S. Representative from Louisiana; **Lewis Branscomb**, professor of public service, Harvard University; **Peter Eisenberger**, director, Princeton Materials Institute, Princeton University; **Marye Anne Fox**, professor of chemistry, University of Texas at Austin; **C. Peter Magrath**, president, National Association of State Universities and Land-Grant Colleges; **Ruben Mettler**, retired chairman and CEO, TRW Inc.; **Percy Pierre**, vice president of research and graduate studies, Michigan State University; **Frank Rhodes**, president, Cornell University; **Earl Richardson**, president, Morgan State University; **Ian Ross**, president emeritus, AT&T Bell Laboratories; **William Rutter**, chairman of the board, Chiron Corporation of Emeryville, California; and **Donna Shalala**, chancellor, University of Wisconsin, Madison.

The National Science Foundation (NSF) provides about half of all federal funding for research in the mathematical sciences. It has therefore been with some trepidation that the community has watched the NSF over the past several years attempt to address the nation's "economic competitiveness" through various means: Engineering Research Centers; Science and Technology Centers; participation in major efforts like the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET) initiatives, and so on. During this period, fears have surfaced that the NSF is moving away from its commitment to basic research and toward areas having direct applications to technology. Could the National Science Foundation of the future become the National Technology Foundation?

Such a dramatic shift in focus is unlikely. However, in conjunction with the development of a strategic plan, the NSF is doing some fundamental rethinking about its basic mission. To this end, the National Science Board (NSB), the policymaking body for the Foundation, has assembled a Special Commission on the Future of the NSF. With representation from academia, industry, and the government, this group will try to provide a vision for the future of the NSF. As it faces new pressures brought on by such factors as the end

of the Cold War, competition in world markets, the domestic recession, and declining science literacy, the Foundation must plan ways to respond to the changing environment.

Although the outcome of the Commission's deliberations is far from clear, many believe that substantial changes are afoot. In remarks made to the NSB last August (see "The Future of the NSF," the *Notices*, November 1992, pages 1021–1023), NSF director Walter Massey said there were three routes he believes the NSF could take in the future: reverting to supporting only basic research; remaining as it is now, with peripheral programs having connections to technology and economic competitiveness (such as the Science and Technology Centers); or adopting "an expanded portfolio of programs that would be integrated with ongoing activities and closely aligned with industry and other government agencies." Massey says he prefers the latter scenario but has also clearly stated his conviction that the NSF should continue to support basic research. The question is, should the NSF also move in new directions?

The Commission asked for input from the science and engineering community—and got it. Nearly 500 letters flooded NSF within a few weeks, and the count at the time of this writing had reached 800. In a call for comments in the *Federal Register* and in letters to college and university officials, the NSF asked two questions: (1) The National Science Foundation support plays an important role in the health of the nation's academic system, which is the source of new ideas and human resources in science and engineering. How can NSF maintain and enhance the health of this vital national resource? (2) In light of the many changes in both science and world affairs (such as the increasing inseparability of science and technology, the rise of the global economy, and the end of the cold war), should NSF build on its traditional mission by pursuing a broader array of research and education objectives and doing more to link academia and industry? If so, what strategies could the agency adopt to move in this direction?

When the Commission saw the tremendous response generated by the call for comments, it decided to extend the October 15 deadline for comments, but also said it could not promise to read all the material that came in after that date. An analysis conducted by the public affairs office of the American Physical Society found that, of the letters from academic scientists, 51% "flatly opposed broadening



NSF's mission to include stronger links to industry, while another 14% said it should be done only if basic research could be maintained or strengthened" (quoted from electronic newsletter "What's New", October 23, 1992).

By the time this issue of the *Notices* reaches its readers, the Commission will have presented its report to the NSB: the deadline is November 20. The NSB will discuss the report during a retreat in January, and there will also be public hearings. In addition, activities promoting discussion of the Commission's report and the future of the NSF are being planned for the Joint Mathematics Meetings.

For the information of the mathematical sciences community, the *Notices* reprints here four letters written by members of the mathematical sciences community to the Commission on the Future of the NSF.

**Allyn Jackson**  
Staff Writer

The following letter was written by AMS President Michael Artin of the Massachusetts Institute of Technology and AMS President-Elect Ronald L. Graham of AT&T Bell Laboratories.

October 15, 1992

National Science Board Commission on the Future of NSF  
Room 546  
National Science Foundation  
1800 G Street, NW  
Washington, DC 20550

Dear Commission Members:

We appreciate the opportunity to communicate our thoughts on the task before the Commission on the Future of the National Science Foundation. The Foundation provides the bulk of federal support for basic, undirected research in mathematics, as well as a sizable fraction of federal support for directed research in mathematics. There is no doubt that this support has been a major factor in placing U.S. mathematics in its preeminent position worldwide. Thus, the future role of NSF in federally sponsored research is vitally important to the future of mathematics and basic research in the U.S.

We recognize the need to position federal funding to meet the new challenges which result from the great changes taking place throughout the world. With the end of the Cold War, the nation's attention is shifting from building military strength to handling economic troubles, reducing the federal deficit, and addressing social problems. This shift in attention creates, quite properly, an impetus for examination of the role the scientific community can play in these areas, and therefore, the role of the NSF in federal research funding.

In examining the role of the NSF, we note that:

- A healthy science and mathematics research enterprise requires undirected research.

- Basic, undirected science and mathematics research needs government support, and the NSF is the premier agency charged to carry out the federal programs in this area.

- The connections of basic, undirected research to its uses and to education are essential and should be enhanced.

- Education and technology transfer are vast undertakings, which are properly distributed across numerous agencies.

While these points seem clear, the benefits of a healthy scientific enterprise to technological progress and achievement of societal goals needs to be regularly and clearly articulated. Currently, the benefits of government investments in basic, undirected science and mathematics research appear to be in doubt within influential segments of the federal government. It is essential that NSF support of undirected research be maintained and, in fact, in many cases it should be enhanced.

Our third point suggests an expanded role of the NSF. However, the last point indicates that great foresight and careful monitoring will be necessary in such an expanded role. For the NSF to take on a major effort in education and technology transfer would dwarf the basic science and mathematics research mission of the Foundation, and it could result in a loss of focus at the NSF. Moreover, current emphasis on short term payoff and directed research carries with it a serious risk of a gradual shift in support away from such basic, undirected research and in the direction of (possibly equally valuable) technology and education projects. The history of federal funding of science contains many examples of this tendency.

How can the NSF adopt an expanded portfolio while enhancing its mission to support basic, undirected research? We suggest that:

- The NSF reaffirm the necessity of government support for undirected research and of the NSF's premier role in this area.

- The NSF assume responsibility for connecting science and mathematics research with education.

- The NSF examine an expanded portfolio of support for enhancing interdisciplinary research and connecting basic research to its uses.

To carry out these suggestions would require intensive planning and an examination of current support. We therefore suggest that:

- The NSF review its current mode of operation and its disciplinary support.

Such a review could be done discipline by discipline, examining changes, current needs, future directions (priorities), and effective and efficient modes of support that are consistent with the Foundation's mission and goals.

The NSF's Directorate for Education and Human Resources could adopt, as a new focus, the task of closing the gap between research and education and of involving the nation's science and mathematics research community actively in educational reform. The connection of research to education is missing from federal support for education; the NSF would have the primary role of making this essential connection.

Fostering interdisciplinary research and connecting basic research to its uses is an exciting and important role the NSF could have to enhance technology transfer.

These recommendations outline an appropriate role for the NSF for expansion into advancing economic competitiveness and achieving societal goals. And, they recognize the unique role the NSF has in support of undirected research and the health of the science and mathematics research enterprise.

There will be concerns with any new direction, and in some cases these concerns may well be justified and need to be addressed. For example, the recent trend in federal support to mathematics has been away from basic, undirected research. This trend threatens to harm the long term health of U.S. mathematics. So we ask that new directions not be undertaken without addressing the question:

- What mechanisms can be established to ensure that, in moving into new directions, the support of basic, undirected research is not eroded?

Again, we welcome this opportunity to share in addressing this important national concern and are willing to contribute further in any way we can.

Sincerely yours,

Michael Artin, President  
 Ronald L. Graham, President-elect  
 cc: Dr. Charles Brownstein  
 Dr. Bernard McDonald  
 Dr. William Harris  
 Dr. Judith Sunley  
 Dr. Walter Massey  
 Dr. Fred Wan

The following letter was written by Richard Herman of the University of Maryland, who is chair of the Joint Policy Board for Mathematics (JPBM). Sponsored by the AMS, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics, JPBM undertakes projects of interest to the three societies to promote the health of the mathematical sciences.

October 14, 1992

Dr. William H. Danforth and Dr. Robert W. Galvin  
 Cochairmen  
 Commission on the Future of the National Science Foundation  
 National Science Board  
 1800 G Street NW,  
 Room 546  
 Washington, DC 20550

Dear Drs. Danforth and Galvin:

We are writing to convey some views of the mathematical sciences community concerning the possible expansion of the mission of the National Science Foundation. We would like to commend NSF Director Walter Massey for initiating

this important discussion and express our appreciation to the National Science Board for establishing the Commission to assess the concerns of the scientific community as the mission of the NSF is reexamined.

The Joint Policy Board for Mathematics was established by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics to undertake joint action in matters of policy regarding the health of the mathematical sciences. The three JPBM societies represent over 56,000 mathematical scientists and educators.

The National Science Foundation provides approximately half of all federal support for the mathematical sciences. NSF support covers the broadest range of mathematical fields, some of which receive no other federal support for research and the development of human resources. A recent assessment indicated that the mathematical sciences in the United States have led the world with an impressive list of accomplishments in pure and applied mathematical research since World War II and that opportunities for progress in mathematical research are at an all-time high.

The U.S. mathematical community has also played and continues to play a leading role in education reform. Evidence of this can be found in the broad acceptance of the National Council of Teachers of Mathematics curriculum and teaching standards, which are now serving as a model for K–12 science education reform. Similarly, the mathematical community continues to develop recommendations on reforms in undergraduate mathematics education, as well as graduate and postdoctoral mathematics education and the inclusion of underrepresented groups in the mathematical sciences. The National Science Foundation, as the only federal agency charged with maintaining the strength and progress of the scientific enterprise and with important responsibilities in mathematics and science education, is surely a significant factor in the preeminence of U.S. mathematical sciences and the discipline's efforts on behalf of mathematical education at all levels.

**We believe strongly that the NSF must continue its unique federal role in maintaining the health of basic science in the U.S., including investing in the expansion of the scientific knowledge base and the development of human resources.** Furthermore, the NSF should take the lead in defending the importance of a healthy academic research and education enterprise. **The adoption of new roles for the NSF should not come at the expense of its traditional role, as progress in basic science and science education is a crucial stage in the application of science and technology to economic and social needs.**

In recent years, the world has undergone vast changes marking the end of the postwar period: the collapse of communism, the rise of global industrial competition, etc. The NSF must of course evolve to respond to these changes. **It is entirely appropriate for the Foundation to expand its mission to include support for research in areas of importance to industrial science and technology and to forge new ties between the academic research enterprise**

**and industry to facilitate the transfer of knowledge and technology.**

However, we are skeptical that the NSF is the appropriate federal agency to take the lead in promoting U.S. economic competitiveness. With only \$2.7 billion of a domestic discretionary budget exceeding \$200 billion and only 3% of the federal research and development budget, it is unlikely NSF can have the kind of impact required to address fully U.S. economic problems. We believe an effective economic competitiveness program will require a sizable investment and coordination with nonscience economic activities of the federal government.

In recent years, there has been a proliferation of proposals and federal programs to improve industrial competitiveness. These programs are not proceeding in a coordinated fashion and operate in an environment of some disagreement over the appropriate federal role in industrial competitiveness. It therefore seems premature for the NSF to define such a bold role for itself beyond its proven strengths.

Moreover, appropriate balances between discipline-driven research and mission-driven research need to be determined; it is possible the optimal balance will not be the same for all disciplines. The expanded mission should be formulated to complement the traditional mission and to avoid a competition for funds, especially since, in a tight fiscal climate, applied research is sometimes favored at the expense of basic, technology at the expense of science. The NSF should proceed with caution so as not to jeopardize continued achievement of its traditional mission. Discipline-driven research in the mathematical sciences—whether labeled pure or applied—is the breeding ground for major mathematical breakthroughs that have significant impact on science, technology, industry, and other areas important to the Nation.

The mathematical sciences community has been examining its relationship with industry and seeks a role in addressing the mathematical needs of industry. Last year the Board on Mathematical Sciences (BMS) of the National Research Council issued a report, "Mathematical Sciences, Technology, and Economic Competitiveness," that called for intensified efforts in the transfer of mathematical sciences technology. A more recent BMS publication, "Educating Mathematical Scientists," discusses the need to change doctoral and post-doctoral education to produce more mathematical scientists that can be effective in solving industrially oriented problems. And a new report from the Society for Industrial and Applied Mathematics documents significant possibilities for mathematics and manufacturing.

The discipline is prepared to contribute to new NSF thrusts in industrially oriented science and technology. In fact, the NSF has already initiated a number of promising programs, including establishment of The Institute for Mathematics and its Applications, which is succeeding in making connections with industry. We believe it will require further effort and new thinking to discover optimal ways to link research in the mathematical sciences, mathematics education, and industrial science and technology in a way that leads to manifest improvement in industrial competitiveness. Flexible approaches

and new mechanisms to make effective connections between the mathematical sciences community and the users of mathematics, designed with the full participation of the mathematical community, must be found. We also believe that transferring or applying the results of basic research should not be a global requirement of all mathematical researchers.

Effective mathematics, science, and engineering education for all students and the related development of human resources is as essential to the health of basic research and economic competitiveness as improved technology transfer is. Ongoing coordinated reviews by the mathematical sciences community have generated recommendations on undergraduate, graduate, and postdoctoral education, and the inclusion of underrepresented groups. NSF support is crucial to their full implementation. **In particular, the NSF should place increased emphasis on undergraduate mathematics education so that more college students will succeed in mathematics and future school mathematics teachers will be better prepared to implement established reforms at the K-12 level. Furthermore, the NSF should enhance its role in connecting teaching and research in the mathematical sciences.**

**To summarize, we believe the NSF can and should capitalize on its success in basic research and mathematics and science education by expanding its role in education reform and research in areas of national importance. The mathematical sciences community is ready to participate as the agency responds to new conditions and concerns. We encourage the Commission and the National Science Board to ensure the preservation of the traditional mission as new policies and programs are adopted.**

On behalf of the JPBM, I thank you for this opportunity to contribute to your discussions on the future of the NSF. We look forward to working with the NSF as it examines and implements its mission, policies, and programs. If JPBM can be of further assistance, please do not hesitate to contact me.

Sincerely,

Richard Herman, Chair

cc: Dr. James Duderstadt  
 Dr. Walter Massey  
 Dr. William Harris  
 Dr. Judy Sunley  
 Dr. Frederic Wan  
 Dr. Bernard McDonald

The following letter was written by chairs (or their representatives) of ten of the leading mathematics departments in the country.

TO: Special Commission on the Future of the National Science Foundation

FROM: Hyman Bass, Columbia University; Wilfried Schmid, Harvard University; David Benney, Massachusetts Institute of Technology; S. Varadhan, New York University, Courant

Institute; Peter Sarnak, Princeton University; Ralph Cohen, Stanford University; Alan Weinstein, University of California at Berkeley; Robert J. Zimmer, University of Chicago; Donald J. Lewis, University of Michigan; and George Daniel Mostow, Yale University.

We are a group of chairs, or their representatives, of several leading university mathematics departments. We felt it would be useful and appropriate for us to express to the Commission our perception of the role of mathematics research and education in the national scientific and technological effort, particularly with respect to the current discussions taking place regarding the future role of the National Science Foundation in this effort. We believe that mathematics research and education is an indispensable component of any serious attempt to create and foster a structure which encourages the development of science and technology at a high level. We shall discuss the reasons for this and what we feel are the necessary implications for policy that would allow the mathematics community to make its necessary contribution.

We shall divide our discussion into three parts:

1. mathematics and the nature of its contribution to the national scientific effort;
2. nature of funding needs;
3. the present situation and future directions.

### **1. Mathematics and the nature of its contribution to the national scientific effort.**

There are three main components to the contribution of mathematics research and education to the national scientific and technological effort:

1. human resources and education;
2. basic research in mathematics;
3. goal-oriented research.

All three of these are integral components of this contribution. To discuss any of these in the proper context, it is necessary to be clear about why mathematics has been for over two millennia an integral part of scientific and technological advance, and why, in an age of rapidly increasing complexity, it will of necessity continue to be so in an ever more important way.

Mathematics is the systematic in-depth study of issues of a quantitative or spatial nature that arise from experience. These issues arise across a vast expanse of both practical and scientific problems. Many of the quantitative and spatial issues that arise from a variety of scientific, practical, and technological sources share common structures. Mathematical methods provide the means through which these structures can be most profitably analyzed and understood in a coherent and unified manner. A central part of modern mathematics has been the ongoing and increasingly sophisticated identification and analysis of these common underlying structures. A basic feature of the mathematical analysis of these structures has been the development of a coherent fabric incorporating the insights derived from the diverse sources in which these structures arise. In turn the use of this mathematical fabric yields further insight into particular cases. In this sense mathematics is the fundamental interdisciplinary subject from the perspec-

tive of all science and technology. Questions and problems that arise in one area of science or technology can be analyzed and understood in terms of the accumulated and developing mathematical knowledge about common structures that have arisen in other disciplines. The understanding of the new problems and issues can be used not only to provide answers to the current problems, but can be incorporated as a further component of the integrated mathematical fabric to apply to other areas in the future.

The related but differing roles of basic research and goal-oriented research can be seen in this framework. Roughly speaking, goal-oriented research involves the application or modification of existing mathematical structure to the questions arising in a specific domain. Basic research involves the structure itself, drawing on insights that have arisen from analysis of other such issues in other disciplines, in turn integrating the new insights and thereby creating a richer structure on which future goal-oriented research may draw. It is absolutely essential to understand that without basic research there is a double loss to goal-oriented research: first, the withering of the structure on which goal-oriented research may draw, and second, a loss of the structural insights that might be gained from integrating particular goal-oriented research to future work in other areas.

The success of mathematics in its contributions to science, technology, and the integration and application of ideas across disciplines has been nothing short of spectacular. Mathematics has spawned the entire fields of computer science, statistics, and operations research. Virtually every domain within modern mathematics has seen its insights applied to a wide variety of problems. Precisely because of its nature as an integrating and multidisciplinary activity from the perspective of science and technology, mathematics will of necessity become increasingly important to any serious national scientific effort. The increasing complexity of ideas and processes makes understanding of the underlying structures and the manner in which they relate to each other essential for further advance.

The education and human resources contribution of the mathematics community is multifaceted. First, there is the obvious necessity of educating and training the future generations of those who will perform basic and goal-oriented research. Much has been written recently about this. However, we wish to emphasize two points about this education process. First, it is impossible to train someone to do either basic or goal-oriented research unless those who are doing the training are themselves involved in the research process. One cannot learn to do research from a manual. It is a difficult process that is very labor intensive, and demands intensive and extensive interaction with various members of a vibrant community in which research is being carried out. Second, the training of those who will go on to do goal-oriented research must involve at least two components: major exposure to basic mathematics and major exposure to the specific issues involved in the project of the goal-oriented research. The greater the exposure that an individual has to basic mathematics, the greater will be the ability to draw on the knowledge,

ideas, and experience of other disciplines as integrated in basic mathematical structures. Thus, training in an environment in which basic research is being performed and taught is an invaluable experience for those who will do goal-oriented research, and the type of training that this experience provides is not reproducible in any other environment.

Aside from the training of those who will go on to do research, the mathematical education of those who will pursue other directions remains of paramount importance to a coherent national scientific and technological effort. It is crucial for persons in a wide variety of positions to recognize when a problem or issue might profitably involve mathematical analysis. Thus, their exposure to mathematical ideas and the types of issues that mathematical sciences can address is basic to being able to call upon the mathematical resources of others when appropriate. Lack of exposure in this direction leads to a situation in which vast amounts of mathematical and technical expertise are available but remain untapped or underutilized.

## 2. Nature of funding needs

The education and research enterprise is a long-term one. The training of a student from the time he or she enters college to the time he or she is a capable productive researcher can be eight to ten years. Research projects, both of a basic and goal-oriented nature, can involve large numbers of persons and require years of work. Long-term dependable funding is required to support such an education and research structure.

It is very important to understand that the three components of the mathematics contribution to the national scientific effort cannot be easily separated if one wants a coherent long-term successful structure. All three are inextricably intertwined, as we have described above, and the long-term success of the effort depends upon adequate support in all three directions. It should be emphasized that the National Science Foundation has for decades been the funding agency which has provided the vast majority of support for basic research and education and training of graduate students, both those who go on to do basic research and those who go on to do goal-oriented research. The effect of the NSF on the mathematics contribution to the national scientific effort is profound and is difficult to overestimate.

Government agency funding of mathematics research and education is justified by its indispensable and central position in the national scientific and technological effort. This funding is necessary on two accounts. First, to provide support related to the actual costs of research and training. Second, to provide a commitment to establishing a stable environment and infrastructure that can attract young talented persons to pursue research and/or education as a career choice. A large percentage of current new researchers in mathematics in this country are of foreign origin, particularly those from economically less well-developed countries. It is not a satisfactory situation to have to rely upon this type of influx to maintain the viability of the mathematics research and education community. Young talented persons in this country have numerous options; it is imperative

that mathematics research and education be viewed as a viable choice. The nature of support that is required for the mathematics community to make its necessary contribution includes the following types of items.

a) Adequate support for graduate training. The most important feature here is the adequate funding of graduate students in an environment in which they can be trained in the most successful manner. It needs to be clearly understood that the best environment for training researchers (either in basic or goal-oriented research) is in the active and vibrant research environment that one finds in the major mathematics research departments of universities. Adequate support entails both the direct support of graduate students as research assistants, and support of the educational infrastructure of the major research universities. One cannot expect to attract the most talented undergraduates into mathematical research and education unless they can expect adequate support as a graduate student.

b) Adequate support at the postdoctoral level. This is a crucial time in the development of a researcher, both in the basic and goal-oriented directions.

c) Adequate and stable salary support for senior principal investigators. This both reflects the real cost of doing research as well as addresses the pipeline issue discussed above.

d) Support for computational equipment. This is becoming increasingly important throughout mathematics research and education at all levels.

e) Support for conferences, travel for joint research, and other means of communication, dissemination, and exchange of ideas.

f) Support for special undergraduate programs and undergraduate research opportunities. It is crucial to involve young, talented students at the undergraduate stage of their careers.

g) Support for the ancillary costs of research: staff support, copying and distribution costs, and other research expenses.

## 3. The present situation and future directions

The support for mathematics education and research has been deteriorating both in terms of actual allocation of funds and in terms of the coherence of the programs through which funds are allocated. We are now reaching a crisis situation in which the basic mathematics research and training infrastructure is coming under tremendous strain and is being put at severe risk. Funds for research and training are being cut from a situation in which research and training were severely underfunded to begin with. Mathematics has an essential and indispensable role to play in the development of the nation's scientific and technological activity. It is inappropriate and counter-productive that the support for mathematics has been of a dramatically more restricted nature than support for other sciences. Typical mathematics support has not included the full cost of training researchers as has support in other sciences, and it has not included staff, equipment, and other ancillary costs to nearly the same degree. It is imperative that this situation be rectified. Many of these costs have been borne by universities themselves, but at a time of severe economic pressure on universities, their ability and willingness to bear the brunt of these costs in mathematics, costs that are not

present for them in other sciences, will inevitably wane. This will translate directly into a decrease in the number of students who will be able to be trained for future research of both basic and goal-oriented natures, and it will have a negative impact on the general level of mathematics education. This lack of support for mathematics research and education will in turn make this a less attractive career path for the young, talented persons that we most need to attract. In sum, we are facing a downward spiral in the entire level of effort in mathematics education and research.

There have been suggestions on a number of fronts that funds be aimed more directly to goal-oriented research. We certainly feel that more could be done than has been done to date to increase the level of goal-oriented research. The idea of sponsoring more activity in this direction is a positive one that we support. But it is absolutely imperative that this not be done at the expense of the support for basic research and education. As we have explained, the health and effectiveness of the entire enterprise depends upon the healthy state and contribution of all three components we have discussed above. To simply move funds from basic research to goal-oriented research would be a grievous mistake. It would in short order lead to the deterioration of basic research in mathematics and of the training of future workers in both basic and goal-oriented research. Shortly thereafter, it would show dramatically negative effects in our ability to compete in goal-oriented research. We would see the same sort of downward spiral that we have seen in many other national endeavors where a suitable long-term approach has been abandoned and support of necessary infrastructure has been sacrificed. We would see the deterioration of what remains at present, in spite of severe and increasing stress, a very valuable national resource: the mathematics research and training effort being carried on in universities and institutes.

We believe that the following are mandatory for a coherent and successful approach to a competitive national scientific and technological effort.

1. Recognition of the importance to this effort of the training of future researchers and educators in major mathematics research centers, and of the importance of attracting talented persons to the field. This must be reflected in increased support of training and research which reflects the actual cost of this training and research, and which will help to create a stable infrastructure and environment that makes research (of both basic and goal-oriented nature) and education a viable career choice.

2. Recognition of the importance to this effort of both basic and goal-oriented research and the understanding of the way in which they are linked. Increased support for goal-oriented research is necessary, but this must be accompanied by a very significant increase for basic research and training as well in order to create a stable productive effort.

3. The current chaos and instability of funding, as well as the general inadequacy of the level of funding, must be replaced by a coherent, adequately funded, stable program that acknowledges the multifaceted nature of the contribution of mathematics to the national scientific effort.

The following material was prepared by Saunders Mac Lane of the University of Chicago. The first section is a brief introduction to the work of the Commission. The second section is a letter to the Commission from an informal committee established by Mac Lane. The third section is a letter Mac Lane sent to the Commission, which describes a number of "case studies" of interest to the Commission. This last letter was accompanied by a number of appendices presenting the case studies; due to space considerations, those appendices could not be included here.

### Preface

National concern about competitiveness, the economy, and the decrease in size of industrial labs has led to concern in the Congress. Most recently, a report from a House-Senate conference committee on the 1993 NSF budget vigorously calls for the NSF to support transfer and perhaps to revise the current budget to this end.

Dr. Walter Massey, Director of the NSF, was well aware of earlier such congressional concerns and of their effect on the NSF budget. In a white paper, he suggested three options for the future NSF: Revert to a small agency, continue the present structure, or combine this with new programs closely aligned with the users of research, especially industry. This is described in more detail in "Reexamining Federal Science Policy" in the Washington Outlook section of the *Notices*, November 1992.

My own extensive experience with Washington helps me to understand that such an outlook may not fully represent the opinions of scientists. Many mathematicians, recalling the zero increase in the NSF budget for disciplinary mathematics which was intended to accommodate room for several FCCSET initiatives and which arose without much input from the community, began to worry. For my part, with the support of Dean Stuart Rice of the University of Chicago, I set up an informal committee on the future of the NSF. Many former members of the National Science Board are members. This informal committee hoped to help and inform the official Commission on the Future of the NSF (which, as happens so often, has no mathematician as member). The informal group has now sent to the Commission the following report. It is my own view that such policy decisions also need specific accounts as to how research connects with applications. I tried to formulate this in a letter entitled "Case Studies", which has also been sent to the Commission. I have not here included the six appendices, available on request.

### TO: The Commission on the Future of the NSF

The undersigned scientists, many of them former members of the NSB, are keenly aware of the complex problems which the Commission is now facing so suddenly. We have joined in an informal committee in the hope of providing you with some comments which might help, but which may restate

observations already well-known to you.

Thanks to support from the NSF and other agencies, American universities and American science are today first in the world. If new tasks for industry should be added to the charge of the NSF, this should be combined with increased support for basic research. For example, with added funds for connections with industry, there might well be matching funds for added investigator-initiated research.

As the commission well knows, Fundamental Science is the root of technological advance, often in unanticipated ways. The NSF is the only federal agency with a clear mission to foster fundamental science. Tampering with a successful program design does risk damaging that program (if it isn't broke, don't fix it).

We recognize the current, real difficulties in the transfer of scientific results to American industry. Thus, "Science Indicators 1992" (NSB), page 144, observes that funding for industrial research labs has diminished. Such reduction currently is often in product development efforts, to which universities can make little contribution. What science and the NSF can best do in this situation is to transfer information to industry. The most important form of information transfer is by education of students (undergraduate, graduate) and their subsequent employment in industry. Graduate education and research are inseparable; they cannot be tightly coupled to short-term industrial needs. Education benefits society as a whole.

Information transfers in both directions are important. Often, industry leadership may not fully appreciate scientific results or may deem them too expensive to use (there are examples). Industry will not be able to exploit the results of fundamental research without having its own in-house "over the horizon" research conducted both by scientists and engineers. Significant collaboration (which is the only way to affect technology transfer) can occur only when both the university and the industrial lab have complementary fundamental programs. The NSF could take many useful steps, say by supporting university-industry conferences and funding summer internships in industry, etc., all without assigning NSF the prime responsibility for technological transfer. Were the NSF made the primary agency for technology transfer from universities to industry, there is a danger that many industries would decrease or eliminate many in-house research efforts. Ironically, this would preclude any opportunity for transfer.

Basic research and short-term applied research do not coexist happily; the latter usually drowns out the former. This was firmly stated in *Science, the Endless Frontier*, the book by Vannevar Bush which is the foundation stone of the NSF. It is still true today.

Different sciences differ sharply in the extent and form of their relation to industry. For this reason, some of our members will write to you describing the situation in their field. We hope that this may help in your difficult task.

For example, Kenneth Prewitt, who is responsible for a client-focussed research program at a major private foundation [Rockefeller Foundation], takes note of the powerful and practical results that can emerge from such programs, but

notes as well the costs—"it is difficult to attract the best scientific talent; research advances are limited to those areas where there is basic knowledge to be harvested; the practical justification for the research investment takes on a life of its own, sometimes directing the research along fruitless paths; the time frame of the research to be done and of the practical problem to be solved are not easily meshed; client-centered research tends to be governed by nonscientists, making the line between client-focussed and client-controlled research hard to draw, hard to protect."

In making these various observations, we realize that the Commission has taken on a difficult task, at a political moment—driven by the lingering recession, the heated election, and public anxieties about industrial competitiveness—when the proper role of science in the national economy is not well enough understood by those who can do much damage by short-sighted policy changes. The colleagues who have signed this letter acknowledge the pressures operating on the commission, but they are confident that the Commission will advise our political leaders about the unique and uniquely important tasks of a National Science Foundation dedicated to pushing beyond today's frontiers on behalf of tomorrow's new knowledge.

Saunders Mac Lane, for the following Committee:

Herbert D. Doan, NSB, 1976–1982  
 William Fowler, NSB, 1968–1974  
 Ernestine Friedl, NSB, 1978–1984  
 Norman Hackerman, NSB, 1970–1982  
 Rev. Theo. M. Hesburgh, NSB, 1954–1966  
 Daniel Kleppner  
 Marian Koshland, NSB, 1976–1982  
 Saunders Mac Lane, NSB, 1974–1980  
 William Nierenberg, NSB, 1986–1992  
 Mary Jane Osborne, NSB, 1980–1986  
 Kenneth Prewitt  
 Richard Quisenberry  
 Stuart Rice, NSB, 1980–1986  
 Alexander Rich, NSB, 1976–1982  
 Norman Rasmussen, NSB, 1982–1988  
 Edwin Salpeter, NSB, 1978–1984  
 Charles Slichter, NSB, 1975–1984  
 H. Guyford Stever, NSB, 1970–1976

### Case Studies

Recommendations for the future course of the Foundation could make use of explicit studies of the ways in which scientific research has actually contributed to industry and to society. In this memo, I hope to provide a sample of such observations, based on my own experience in mathematics and related fields. Each point will be stated briefly, with documentation in several one-page appendices.

A. Science has long-range and often unanticipated uses, as in Relativity, Cat scans, and Quantum Field Theory, as cited here.

**B.** Able and well-educated scientists can switch to new problems, provided they have first-hand information.

**C.** New NSF programs can actually decrease funding for basic research. This may suggest that the choice of research topics for individuals is directed from Washington by earnest officials. I doubt that such direction of research will work. (Example: Current FCCSET Initiatives.)

**D.** Sudden ample new funding for applications can promote shabby research: an example. (It is possible that new funding often causes less able scientists to switch to a new field.)

**E.** Should basic research and industrial application be combined in one agency? I cite an example in math where separate institutes were clearly more effective.

**F.** Other specific cases are needed. I attach here comments from a statistician and a surgeon at the University of Chicago. I believe that information (which I do not have) from economists would be useful. For example: How does one quantify the economic return on scientific research? Since the return cannot be captured by the scientist, should research be supported by society? What caused corporations to cut down on research?

**G.** "How can we plan for new ideas and the startling new but unrecognized technology?" This question by Charles H.

Townes, a coinventor of the laser, is in his article in *Science* (16 Feb. 1968, vol. 159, pg. 699ff) where he also says, as of the laser, "Bell's patent department at first refused to patent our amplifier. . . optical waves had never been of any importance to communications" (p. 701 middle column). I will send a copy of this very informative article.

CONTINUITY of research seems to me a central issue here. In some sciences, people may rapidly turn to new or fashionable fields. But in many cases an idea or an impetus takes a long time to fully work out; a sudden call to "switch" attention to a new field may block the fruition of the prior studies. Items **B**, **C**, and **D** above all bear on this question of switching.

May I cite my own experience. In 1941, I started a joint study of algebraic topology with Samuel Eilenberg. There was an interruption for war research, and right then a chance for me to start in a brand new field (Computer Science). I did not switch. Eilenberg and Mac Lane worked jointly, 1941-1954, to produce fifteen major papers. Continuity was vital to our effective work. It often is.

Saunders Mac Lane  
University of Chicago

## ADVANCES IN SOVIET MATHEMATICS

### Topics in Nonparametric Estimation

*R. Z. Khasminskiĭ, Editor*  
Volume 12

This book contains papers presented at the Seminar on Mathematical Statistics held at the Institute for Problems of Information Transmission of the Academy of Sciences in the former Soviet Union. The topics covered include density, regression, image estimation, adaptive estimation, stochastic approximation, median estimation, sequential experimental design, and large deviations for empirical measures. This collection is distinguished by the high scientific level of the papers and their modern approach. This book will be of interest to scientists and engineers who use probability and statistics, to mathematicians and applied statisticians who work in approximation theory, and to computer scientists who work in image analysis.

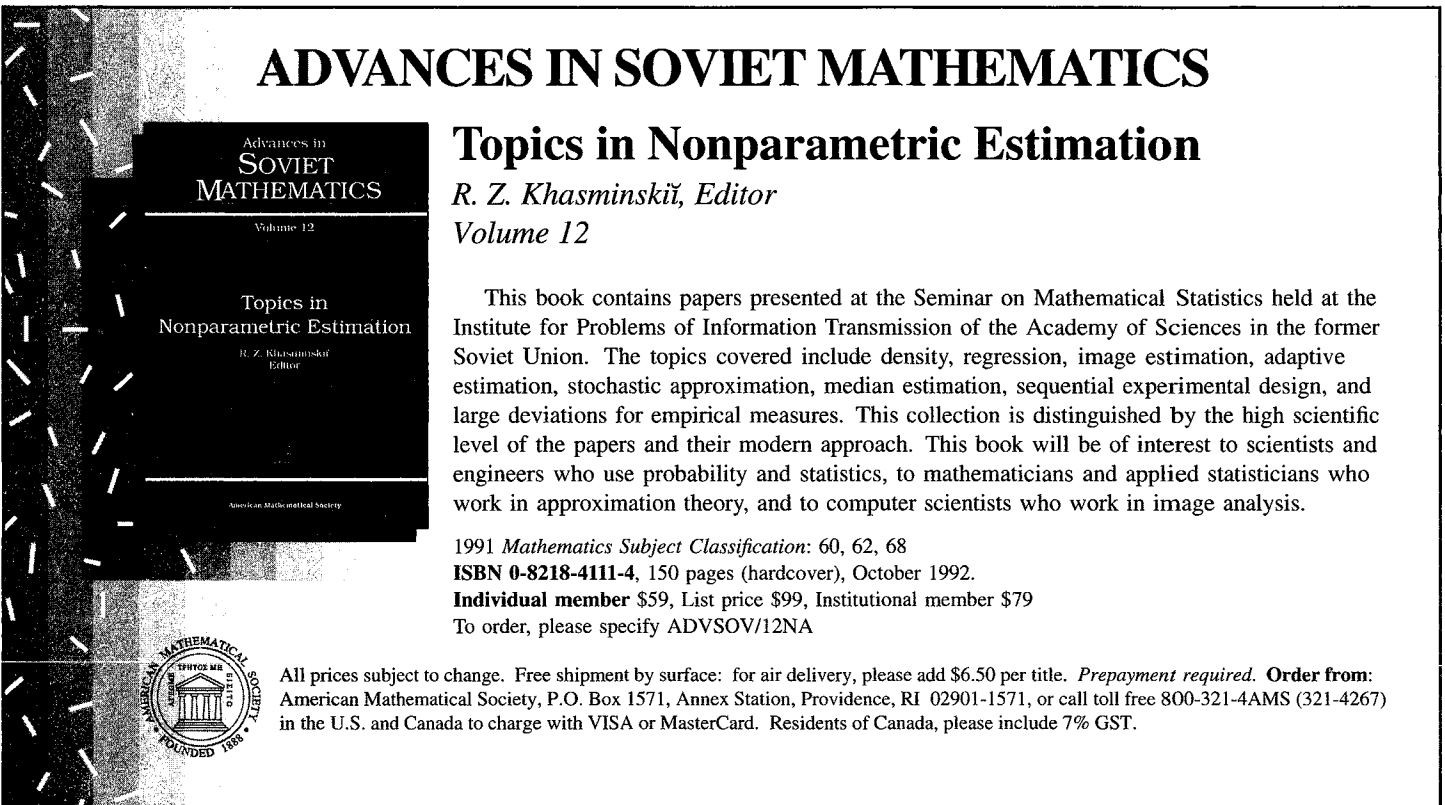
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# Ethnomathematics: A Research Program on the History and Philosophy of Mathematics with Pedagogical Implications

*Ubiratan D'Ambrosio*

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Ubiratan D'Ambrosio is President of the Brazilian Society for the History of Science. He is a professor at the Institute of Mathematics, Statistics, and Computer Science at the State University of Campinas in Brazil.

For some years, the word ethnomathematics has been used among mathematics educators, historians of mathematics, and mathematicians. Papers have been published with the word in the title, theses have been presented, and the 1991 Mathematics Subject Classification of *Mathematical Reviews/Zentralblatt für Mathematik* introduces a new subject: 01A07 Ethnomathematics, general. The *Journal for Research in Mathematics Education* and other journals introduced ethnomathematics as a research subject, the 1992 International Congress of Mathematics Education (ICME 7) had a special session in the program on ethnomathematics, and the XIXth International Congress of History of Science, to take place in Zaragoza in 1993, has a Symposium on Ethnomathematics. An International Study Group on Ethnomathematics (ISGEM) was organized in 1985, with a membership of the order of 300 and a Newsletter with 17 issues in print, published regularly in English, and more recently translated into Spanish and French. In the last two years, two books have been published with the title Ethnomathematics: U. D'Ambrosio, *Ethnomathematics. The Art or Technique of Explaining and Understanding* [in Portuguese, São Paulo: Editora Atica, 1990; English translation in progress] aims to lay theoretical foundations for ethnomathematics, with special emphasis on historical and epistemological issues; Marcia Ascher, *Ethnomathematics: A Multicultural View of Mathematical Ideas* [Pacific Grove: Brooks/Cole Publishing Company, 1991] presents a number of cases of mathematical notions appearing in different cultural systems that do not have a written language. A collection of booklets by Paulus Gerdes under the general title *Ethnomatemática* [in Portuguese; Instituto Pedagógico Superior de Maputo, Mozambique] describes historical and contemporary mathematical practices of African peoples, providing a very rich source of material. Together with a body of published research by psychologists, sociologists, historians, and, of course, mathematicians and mathematics educators, these books support what I like to call a research program in the historical and epistemological foundations of mathematics with

pedagogical implications. Pedagogical implications should be understood in the broad sense of teaching at all levels and of mathematical research.

Although the idea of examining the strong links between mathematics and the socio-cultural and natural environment has been around for some time, these links have always been seen as less fundamental than the inner organization of mathematical theories themselves. With some timid exceptions mainly found in some elementary curricula, mathematics has been seen as context-free. The opportunity I was given to deliver the Opening Plenary Lecture at the 1984 International Congress of Mathematics Education (ICME 5) in Adelaide, Australia was decisive in bringing these ideas to the attention of the broad community of mathematics educators. Indeed, since then, ethnomathematics has been catching up.

But what is, after all, ethnomathematics? In short, ethnomathematics covers all the practices of a mathematical nature, such as sorting, classifying, counting, and measuring, which are performed in different cultural settings, through the use of practices acquired, developed, and transmitted through generations. The work of anthropologists since the beginning of the century, and more recently of psychologists and sociologists, has recognized different ways of counting and measuring, even of classifying and of inferring, in distinct native cultures all over the world.

Achievement in schools has been decreasing steadily in the prosperous nations. In particular, the U.S.A. and some European countries have shown in the last thirty years a decline in school achievement in mathematics. For some time, educators who have studied school achievement in rural and urban communities have recognized that children do well in their daily life, and indeed grow as successful citizens, while performing very poorly in school mathematics, in some cases dropping mathematics very early in their studies. Increasingly, educators have looked to the cultural surroundings of children as a factor affecting their achievement in school mathematics. This led to increasing evidence that cognitive power, learning capabilities, and attitudes towards learning are closely related to cultural background. Add to this a socio-political dimension which creates learning barriers affecting particularly children from deprived minorities. Outside the school environment, the performance of these children, lower achievers in schools, is successful. The same is true with adults. These children

and adults perform “mathematically” well in their out-of-school environment: counting, measuring, solving problems, and drawing conclusions using “the arts or techniques of explaining, understanding, coping with their environment” that they have learned in their cultural setting. These practices have been generated or learned by their ancestors, transmitted through generations, modified through a process of cultural dynamics, and learned in a more casual, less formal way than with school mathematics. It is a patrimonial knowledge of their cultural group. It is the ethnomathematics of the group.

This socio-cultural behavior has been identified in rural and urban communities, in workers performing specific duties, and in several other populational groups found in industrial nations, in the so-called less developed countries, and in native communities.

Particularly interesting is the ethnomathematics of mathematical researchers in different fields. They develop their own jargon, even special codes and symbols; they relax or conveniently modify rules to satisfy their modes of work, in a sense to conform to their modes of thought; and they generate, organize, and even transmit this “mathematics”, which in many cases is even denied mathematical status by the mathematical establishment. The history of mathematics abounds with examples—recent ones include distributions and fuzzies, among others. All these are manifestations that can be understood in the sense of ethnomathematics. Essentially, the program of ethnomathematics is the study of the generation, organization, transmission, dissemination, and use of these jargons, codes, styles of reasoning, practices, results, and methods.

These steps, from the generation through the progress of knowledge, in particular of mathematical knowledge, are the result of a complex conjunction of factors. Among them, we recognize practices resulting from immediate need, relations with other practices, critical reflection, theorization, curiosity, and some sort of intrinsic cultural interest. Of course, there is little doubt that these factors produce ad-hoc knowledge. The main questions are to understand when ad-hoc knowledge passes to methods and theories and, from those theories, how one proceeds to invention. These questions are germane to any investigation of the nature of mathematical knowledge, both from the historical viewpoint as well as from exciting questions related to mathematical progress. Where do mathematical ideas come from and how are they organized? How does mathematical knowledge advance? Do these ideas have anything to do with the broad environment, be it socio-cultural or natural?

To understand the program of ethnomathematics, it is first of all necessary to accept the fact that mathematics is a construct of the human mind. It is knowledge generated by human beings and organized in a certain intellectual framework which is recognized by its practitioners as mathematics. Let us not attempt to define mathematics. The breadth of the domain of mathematics is seen in the Subject Classification of *MR/ZM*, as well as in the recently published Volume II of the AMS Centennial Publications: *Mathematics into the Twenty-first Century*. Although some trace the history of

mathematics back to classical antiquity, the characteristics of current mathematics are easier to recognize after the 17th century. It is very significant that the *Encyclopedic Dictionary of Mathematics* (edited by Shokichi Iyanaga and Yukioji Kawada, for the Mathematical Society of Japan, translation reviewed by Kenneth O. May, 2 volumes, Cambridge: The MIT Press, 1977), has historical sections only as “Mathematics in the 17th Century”, “Mathematics in the 18th Century”, and “Mathematics in the 19th Century”. Indeed, it is difficult to isolate and sometimes even to distinguish mathematics from other forms of knowledge and from the general cultural effervescence of the Middle Ages in various distinct cultures. Looking into the Roman times and to other cultures of the period, there are many practices, modes of thought, and theories that have many mathematical characteristics but that would not be called mathematics nowadays. This is true also in many pieces of Greek and Islamic mathematics.

If we go back to the Greeks, what is the origin of the word mathematics? Etymology tells us that *mathema* or *mathemata* means explanation or understanding, while *tics* comes from *techné*, which is the same root that gave us art and technique. It is coherent with early Greek writings to say that *Mathematics* is the art or technique of explaining, understanding, in fact coping. So mathematics is a means for explaining, understanding, and coping with the socio-cultural and natural environment. This has been the driving force behind human behavior since the early ages of our species, and, of course, it has been done in different ways in distinct environments. I coined the word *ethnomathematics* to mean the arts or techniques developed by different cultures to explain, to understand, to cope with their environments. It is possible that the term ethnomathematics was used before, although I have not seen it before. Ethnobotany, ethnopsychiatry, ethnomethodology, and several others of a similar nature have been in use for some time. In most cases, they are similar to the less general concept of ethnomathematics, referring to the respective practices of native populations.

I was first faced with these questionings about twenty-five years ago while I was Director of Graduate Studies in S.U.N.Y. at Buffalo. I was invited by UNESCO to integrate a team of scientists from several universities to set up a graduate program in the Republic of Mali, in West Africa. The country had decided to generate a critical mass of researchers as a preliminary step towards creating a university. It was an alternative to the model adopted by most African countries in the early years of independence of creating a university and then sending students for graduate studies abroad. Both conceptually and economically, this was a worthwhile endeavor. It was a program in which, instead of a long period of residence, the faculty would visit the country for two- or three-week periods every two or three months. In the interim, the students would work on material left by the visitors.

I will not comment on the details of this imaginative program, but only say that it gave me the opportunity to be part of an interdisciplinary team that penetrated the cultural roots of the important civilization of Mali. It flourished in

the 14th century with enormous power and richness. Was there any mathematics in their culture? Surely yes. How much of this was noticeable? Practically nothing in the academic circles. But once the conversation would move to their traditions, the students would reveal their interest in and search for traces of their current research in their cultural past. This situation never or, at best, rarely occurred outside of the cultural atmosphere that surrounded our academic practices. Going for a walk after classes, asking and commenting on the weather, on monuments, on the mood of the people, all this led to discussions of tradition. The fact that the group was interdisciplinary was a major factor in overcoming the cultural artificiality introduced by the disciplines. Moving back into their past, we find that mathematics, physics, arts, linguistics, and religion are constructs of analysis characteristic of modern Western thought. The intellectual organization of knowledge, as well as its social organization, is culturally bound. Who obtained knowledge and how was this knowledge organized? How much of it was part of the daily practices of the people, of their modes of thought? How much of it was transformed through contacts with other cultures? These were some of the main questions raised in these cultural colloquia.

Africa, although reasonably stable during the imperial Middle Ages and after Islamization, was a ground for intense mutual exposition of different African cultures and was later brought under the influence of the Arabs and Europeans in the colonial period. I was very curious to see how these processes would reflect the attitude, interest, and creativity of my students. We have to recognize that the richness of cultural diversity and, in particular, the process of cultural dynamics in these last seven or eight centuries has not been adequately studied, especially when it comes to mathematics and the sciences. Of course, my students were highly devoted, and on my periodic trips back I noticed progress equivalent to the students I had in the U.S.A. But it was clear, mainly in our conversations touching other subjects, that their full creative power was attached to the power of their culture. This is no different than one would expect of an artist or a musician or a philosopher.

A few years later, I started a similar program in Latin America, under the sponsorship of the Organization of American States. The same questions posed above, which had intrigued me in the visits to Africa, arose during my visits to Andean communities and when I met with groups of students

from all over Latin America. There, the different patterns of building up a *criollo* mode of thought and behavior were even more intense. Later, I had limited experience in Asia. But my experience was very intensive in both the urban environment of modern cities and rural communities founded by immigrants in the Americas—as it is the case in most of the U.S.A., Argentina, Brazil, and many areas of Latin America. There we find practically no presence of native culture, but much evidence of the struggle of Europeans and Africans to make their ways of living, doing, and explaining compatible with the new environment. This analysis has much in common with what nowadays we call “technology transfer” affecting the so-called Third World countries.

Modern theories of cognition support this view. Cognition and culture are indeed closely related, and there is not much hope of reaching creative power without cultural roots. The interdisciplinary atmosphere allowed me to see these connections. A careful comparison enticed me to look into the history of mathematics, initially Greeks, Romans, Hebrews, and Arabs, focusing on the aspects of cultural dynamics which were clearly noticeable in my experiences in Mali and in Latin America, and the categories of analysis I had been using. For example, concepts of time and space, features associated with form, such as color, and mythical associations with concepts of mathematics and of truth, as well as modes of property and production. The main strategy for understanding antiquity was to look into different sources. Limitations of language present the main obstacle to research when we move into other cultures. The difficulties of looking into cultures which were less successful in resisting the dominating cultures, such as the Amazonian Indians for example, are enormous. Above all, it is difficult to overcome their lack of memories, which reflects a sense of inferiority of the culture which was dominated. Elimination of the memory of the conquered by the conqueror is normally facilitated by the lack of cultural self-esteem.

Thus, ethnomathematics offers not only a broader view of mathematics, embracing practices and methods related to a variety of cultural environments, but also a more comprehensive, contextualized perception of the processes of generating, organizing, transmitting, and disseminating mathematics throughout the history of mankind. Validating the history of different cultures presents an opportunity to generate cultural self-esteem, a key factor in opening the way for individuals to reach their full creative power.

# Computers and Mathematics

*Edited by Keith Devlin*

## Year-End Thoughts

Statistics, operations research, computer science: each of these fields started out as a branch of mathematics; the early workers in these areas generally thought of themselves as mathematicians; mathematics was the discipline they had been trained in. But, though you can still find people working in each of these fields in college and university departments of mathematics, particularly at smaller institutions, it is an inescapable fact that they have long since been essentially “lost” to mathematics. The reason is the same factor that has created a gulf between pure and applied mathematics, which for all the commonality in the name are generally regarded as separate subjects, at least by many who work in those two areas. It comes down to how the mathematical community as a whole conceives its goals. For what determines the nature of mathematics *in practice* are the criteria brought to bear when it comes to making hiring, tenure, and promotion decisions in college and university departments of mathematics.

Surely, the breaking away and institutional compartmentalization of any discipline generally leaves each impoverished. This certainly seemed to be the feeling of many of the participants in the “Visualization of Geometric Structures” workshop held at the Mathematical Sciences Research Institute (MSRI) at Berkeley, California, in the middle of October. The last day of this five-day event featured a group discussion on the future of visualization tools in mathematics, i.e., the use of sophisticated computer graphics techniques to visualize geometric structures and complex mathematical data arising from areas such as fluid dynamics. It was George Francis, the topologist from the University of Illinois, who expressed most forcibly the fear that mathematical visualization will follow fields such as operations research and evolve into an institutionally quite separate discipline. If this does indeed occur, then mathematics will be the poorer for it, just as it is poorer as a result of the loss of all those other intellectual offspring.

Of course, taken at a purely intellectual level, none of this should matter. Bright, inquisitive people doing interesting work is what matters, regardless of what you call it. In a world where such people were indeed able to pursue their interests, this is how matters would proceed. But that is not the world we live in. Few of us are hired by colleges or universities; we are hired by departments. Not only do we have to fit the mold

of the hiring department, our work has to continue to match the departmental expectations in order to satisfy tenure and promotion criteria for that department.

What bothers me about this, and I detected that I was by no means alone at the workshop in holding this view, was that much of the fragmentation of mathematics stems from a fairly narrow view of what our subject actually is. Like most of my contemporaries, I grew up and learned my mathematics in an age when “definition–theorem–proof” ruled supreme. In that era, the question “What is a mathematician?” could be answered succinctly with the definition “A mathematician is someone who proves theorems”. My doctoral dissertation consisted of a sequence of definitions, lemmas, theorems, and proofs. All my early research papers followed the same format, and so did my early books. Also, I have to confess, at the time I believed it: for me and, I presume, for most readers of this column, this was what mathematics was about.

Today I view things very differently. For the panel discussion at the MSRI workshop, I jotted down the various aspects of mathematics that I think form an essential part of the subject. At the top of my list I put “understanding”. Following this, in no particular order of importance, I noted: observation (of some domain, either real-world or mathematical), identification of abstract (“mathematical”) structure in the observed domain, classification of those observed structures, analysis of the objects and structures both in and across those classifications, the construction of descriptions of those objects, structures, and classifications, the formulation of hypotheses concerning them, the creation of heuristic arguments in favor of those conjectures, and, finally, the proof of those conjectures (possibly accompanied by the formulation of appropriate new axioms). As a result of developments in information technology, I would add experimentation and visualization to today’s list, and the use of virtual reality technology to the mathematics of tomorrow. (The MSRI workshop included a contribution on this topic from workers at the nearby NASA/Ames Research Center.)

From what little I know of the great mathematicians of the past, I suspect many would agree with most of this list; surely Newton, Gauss, and Fourier would. So would many of the “mathematicians” that now occupy positions in departments of statistics, operations research, and computer science, as well as many of the participants at the MSRI workshop. But

I also know that any challenge to the “proving theorems” view causes many mathematicians to recoil in horror. (I can probably say this here in reasonable safety, since such mathematicians probably do not read this column!) If this narrow view of what constitutes “real mathematics” continues to hold sway, as it appears to have done in the past several decades, then I am certain that experimental mathematics (which recently started its own journal) and what one might call “visualization mathematics” will very soon break off and distance themselves from “mathematics”. The result will be a continuation of the decline in the size of university mathematics departments, a continuation of the fall in federal funding support for “mathematics”, and a continuation of the drift of large numbers of bright, young, mathematically-gifted students away from the mathematics department.

But maybe I am being unduly pessimistic. After all, the visualization workshop was hosted by MSRI, with considerable support from the Geometry Center in Minnesota; and the editorial board of the new journal *Experimental Mathematics* reads like a *Who's who?* of distinguished mathematicians. But what happens in the mathematical community as a whole is what will count in the long run. There are only so many of our new students who will secure positions in the pioneering institutions; the bulk of the new generations will have to seek their future elsewhere in the mathematical community at large.

In the end it comes down to a matter of definition: where do you draw the boundaries around mathematics? If you insist that the definition is proving theorems, then the result is a somewhat narrow field that may well find itself increasingly impoverished as time goes by. A considerably broader definition, suggested by one of the leading figures at the MSRI workshop, was that any study that has the *formulation* of a “theorem” as an ultimate *goal* should count as a *bona fide* part of mathematics, with the possibility left open that the “theorem” might defy proof for many generations (and may only be proved in novel ways, ways that cannot be effectively reformulated to fit our present conception of proof).

These days the company I keep ranges over researchers employed in university departments of mathematics, computer science, information science, linguistics, cognitive science, psychology, philosophy, and sociology, together with a smattering of folk in industry; and it is no doubt a reflection of that mix that I tend to see mathematics as a very broad subject that touches many other areas. But these people also see mathematics—from the outside—in much the same way. They are not concerned with issues of proof. To them, what mathematics offers above all else is *precision*. As a descriptive tool, it surpasses all others in the precision it brings to those domains in which it may be applied. That precision may be quantitative, as in the case of statistics, organizational, as in operations research, representational, as in computer science, or descriptive and analytic, as Chomsky demonstrated in the case of linguistics.

Now, “mathematical” work will undoubtedly continue to be done in each of the areas I just mentioned, and in several

others. No doubt about that. But unless we change the way we define our subject, and the criteria we apply in hiring, tenure, and promotion decisions, it will increasingly be done with little or no input from the “mathematics departments”. Though many may disagree with me, I think this will be a mistake.

It was, I believe, Stan Ulam who first used the phrase “our fortress mathematics”. If that fortress is one that gives us the strength to move out and help to conquer new domains, as I am sure Ulam intended it to mean, then our subject will grow and flourish. But if we regard the fortress as a “safe haven”, drawing ourselves in behind its walls in search of “proof and purity” and cutting ourselves off from the outside world as a result, then I fear the rest of the world will move on without us.

Well, enough of worries and musings; what of the workshop itself? Its tone was set by the opening remarks of MSRI's new director, Bill Thurston.

He commenced by noting the difference between the way we think about mathematics and the various ways we communicate it. For many of us, mathematical thought is, Thurston observed, very visual, often accompanied by the drawing of highly cryptic and extremely simple pictures and diagrams on a sheet of paper.

Likewise, informal, working communication between mathematicians in the office or the coffee room often involves the drawing of many simple pictures.

Seminar talks and lectures frequently involve the use of pictures drawn in advance on overhead-projector transparencies, especially in subjects having an overtly visual aspect, such as geometry, knot theory, and surface topology. Thurston observed that such pictures are often drawn in a stylized fashion, which changes over time, citing by way of illustration the different ways people have drawn a torus.

But when it comes to publishing our work in research papers, pictures are either omitted altogether, or else their presence is purely to illustrate an argument presented in full in the text.

“Why is this”, Thurston asked. The answer, he suggested, may lie in the difference between the way we acquire and transmit information. We are extremely well-suited to pictorial input. Indeed, from the moment we are born we spend most of our waking hours seeing “pictures”. All our visual input is in the form of two-dimensional images cast on our retinas, which the brain interprets as a three-dimensional object. Yet most of us find it extremely hard to communicate our ideas pictorially: drawing is hard. Even such basic skills as the use of perspective and shading to convey depth have to be learned, as can be seen by looking at the drawings of small children and the work of pre-Renaissance artists.

But what if we were presented with tools that would make it very easy for all of us to draw good pictures very rapidly, pictures that would make as much sense to the viewer as to the creator? What if those pictures could also be animated, to provide us with a “walk-around” or “walk-through” view of the object? And what if we were able to make high-quality, accurate movies that could take us on a visual tour of various

mathematical objects that could not be constructed within our three-dimensional physical universe?

Well, Thurston's question is not one that requires a hypothetical answer, of course. Those tools are with us now. All we have to do is wait and see what their proliferation will lead to.

The production of the classic *Hypercube* movie by Tom Banchoff and his colleagues at Brown University in 1978 showed us that computer-graphics based visualization could indeed help to communicate mathematical ideas. More recently, the *Not Knot* video, produced by the Geometry Center in Minnesota, gave us a feeling for life in a hyperbolic universe.

But both of these examples involve preprepared visualizations, and as such are really just a modern extension of the use of pictures and diagrams in text books. The real change, already underway, stems from the provision of *interactive* computer drawing tools. With systems now available, a mathematician is able to create a picture either by hand, using software drawing tools, or by inputting a system of equations, and may then add color and shading to that picture to highlight features of particular interest, may manipulate that picture to examine it from various angles, may cut it into pieces, and may project, slice, and even "fly through" it. Moreover, in many cases this can all be done in "real time", enabling the mathematician, or mathematics student, to make use of visualization in an investigative and experimental way, as part of the research or learning process.

*Geomview*, developed by researchers at the Geometry Center, was one such tool, which Thurston demonstrated. Attendants at the workshop saw a number of other visualization systems, including a glimpse at the "next generation" of virtual reality systems, which promise to add an "experimental" component to the visualization presented by existing technologies. At the moment, most of these systems require powerful graphics workstations to run properly, but none of us can be ignorant of the rapid pace with which today's expensive "toy" becomes tomorrow's commonplace appliance. (The laptop computer on which I am writing this article on my flight back from MSRI, a device roughly the same size as a typical calculus textbook, provides me with *Mathematica* on my lap.)

Of course, there are many areas of mathematics that will continue much as before, unchanged by the arrival of interactive visualization tools; and there are others for which the effects will be fairly peripheral. The same was true for the arrival of the computer in the first place. But, taken as a whole, mathematics will clearly change. Within a couple of years, most of the incoming high school students who populate our freshmen classes will have learned their mathematics with the aid of sophisticated graphing calculators; and when they get to college they will learn calculus and linear algebra with the aid of computer algebra systems such as *Mathematica* or *Maple*. Given an introduction to mathematics quite unlike the one we all experienced, it would be strange indeed if they did not develop a view of the subject very different from their professors. That different approach will, in due course, lead to a different profile for mathematics as a whole.

I was prompted into these musings by the visualization workshop, the approaching end of the year, and the fact that the diligence of the various article writers and software reviewers who have contributed to this column have left me with no room in my annual page-limit for a regular column. In the same vein, let me end on a speculative note. My guess is that not only will visualization and experimental (computational) mathematics come to be regarded as genuine mathematical pursuits, to be carried out and encouraged in departments of mathematics, but the borders of mathematics will become increasingly blurred and the balance will shift away from the almost total dominance of proofs, leaving the proving of theorems as just one of a number of goals for mathematical research. (Okay, I'll soften that a little, and agree that proving theorems will always remain a *very important* activity.)

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## News and Announcements

### Ralph P. Boas, Jr. 1912–1992

Ralph Philip Boas, Jr., Henry S. Noyes Professor Emeritus of Mathematics at Northwestern University and a member of the faculty at Northwestern since 1950, died on July 25, 1992, two weeks before his 80th birthday.

The complete professional, Ralph excelled in all aspects of mathematics: research, exposition, education, and service. His devotion to the science and art of mathematics and to the professional mathematics community was exemplary.

Ralph received his Bachelor's degree (1933) and his Ph.D. (1937) from Harvard University; D. V. Widder was his thesis adviser. He was, in turn, a Sheldon Fellow at Harvard, a National Research Council Fellow at Princeton and in Cambridge, England, an instructor at Duke University, a member of the faculty of the U.S. Navy Pre-Flight School, and a visiting lecturer at Harvard University before becoming Executive Editor of *Mathematical Reviews* in 1945. He arrived at Northwestern in 1950 (as a full professor, skipping the usual intermediate steps) and remained on its faculty until his formal retirement in 1980. He continued to teach, write, and edit after retirement, first in Evanston and later in Seattle, Washington, where he and his wife Mary moved in 1988.

The many positions Ralph held in the professional mathematics community include: Vice-President of the American Mathematical Society (1959–1960); President of the Mathematical Association of America (1973); and Chairman of the Mathematics Section of the AAAS (1980). He served on the Committee on

the Undergraduate Program in Mathematics, chairing it from 1968 to 1970. He was the editor of *The American Mathematical Monthly*, *Selecta Mathematica Sovietica*, coeditor of the *Journal of Mathematical Analysis and Applications*, and served on a wide assortment of other editorial boards. He was a Guggenheim Fellow in 1951–1952 and in 1981 received the Distinguished Service Award from the Mathematical Association of America.

The author or coauthor of over 200 papers and five books, Ralph wrote mathematics with ease and style at both the research and expository levels. His research was largely concerned with functions of one variable, both real and complex, and particularly entire functions of exponential type. However, his work touched deeply on many topics in classical analysis: trigonometric and Fourier series, moment problems, integral transforms, and inequalities, a subject to which he returned again and again. Ralph also edited the collected works of Hidehiko Yamabe and the first two volumes of those of George Pólya.

A lucid expositor of mathematics, Ralph's papers and books, particularly the Carus Monograph "A Primer of Real Functions", are models of clarity and precision. His text *Entire Functions* is still the standard reference in the field. Ralph was widely knowledgeable about mathematics, about many individual mathematicians, and about mathematics in the wider, cultural sense. He enjoyed bringing what he knew about mathematics to others. He published extensively in *The American Mathematical Monthly*, the *Mathematics Maga-*

*zine*, *The Two-Year College Mathematics Journal*, the *Mathematical Intelligencer*, and other expository journals. His article "Can we make mathematics intelligible?" (*Amer. Math. Monthly* **88** (1981)) is a gem of common sense about teaching, writing, and speaking mathematics; it belongs on every professional mathematician's "must read" list. Ralph also wrote about mathematics for lay audiences with great success; I best recall "Snowfalls and Elephants, Pop Bottles and  $\pi$ " which he wrote for a College of Arts and Sciences publication. He once taught a course at a local community college on "mathematics as an art form".

Ralph and Frank Smithies co-authored the tongue-in-cheek "The Mathematical Theory of Big Game Hunting" (*Amer. Math. Monthly* **45** (1938)) under the pseudonym H. Petard and submitted it under the second-order pseudonym of E. S. Pondiczery. In *Math. Intelligencer* **8** (1986), Ralph recounts an amusing interchange involving Bourbaki. While executive editor of *Mathematical Reviews*, Ralph was asked to write the mathematics section of the *Encyclopaedia Britannica* Book of the Year. In this he wrote that Bourbaki was a pseudonym for a collection of French mathematicians. "Bourbaki" protested to the *Britannica* editors that he did, indeed, exist. Ralph, of course, was not denying the existence of Bourbaki, only his non-individuality! The worried editors finally acquiesced to Ralph's position when J. R. Kline, the secretary of the AMS, revealed that he had refused AMS membership for Bourbaki on the grounds that the AMS had two types of memberships: individual and institutional; and that he

understood that the application was not from an individual.

Languages seemed to hold a particular fascination for Ralph. He studied Greek, Latin, French, German, and Sanskrit. He mastered Russian by reviewing papers for *Math Reviews*; he even learned a little Georgian. His knowledge of Russian brought many translation tasks to his desk; in recent years he was actively involved in revising the *AMS Russian-English Dictionary of the Mathematical Sciences*.

Ralph contributed willingly and with distinction, not only to the mathematical community but, as well, to his immediate academic community. He served on a host of Northwestern University committees and was chairperson of the department of mathematics for 15 years (1957–1972). When he stepped down, the department found it necessary to appoint three people to do what Ralph had done singlehandedly. In 1989, in recognition of his many years of distinguished service to Northwestern, the department library was named the Ralph P. Boas, Jr. Mathematics Library.

Ralph's poise, good humor, common sense, and his outstanding knowledge of mathematics will be greatly missed by those of us fortunate enough to have known and worked with him. He is survived by his wife of 51 years, Mary, Professor Emeritus of Physics, DePaul University (and coauthor of several papers with him), a daughter Anne, and by two sons, Ralph and Harold. Harold is Professor of Mathematics at Texas A&M University.

A memorial service in Evanston was held on October 9, 1992.

Stephen D. Fisher  
Northwestern University

### Daniel Gorenstein 1923–1992

Daniel Gorenstein died from cancer at his summer home in Martha's Vineyard on August 26, 1992. Gorenstein was one of the most influential mathematicians of the last few decades. In particular, he was one of the primary architects of the Classification of the finite simple groups.

Gorenstein was a member of the National Academy of Sciences and the

American Academy of Arts and Sciences. He was awarded the Steele Prize of the American Mathematical Society in 1989, gave a plenary address at the International Congress of Mathematicians in 1978, and was the Colloquium Lecturer for the American Mathematical Society in 1984.

In the late seventies Gorenstein served as chairman of the Rutgers mathematics department. It was in this decade that the department improved dramatically in quality to become one of the better departments in the country. At the time of his death he was Director of the Center for Discrete Mathematics and Computer Science in New Brunswick, one of the eleven National Science Foundation Science and Technology Centers established five years ago.

Gorenstein was born in Boston on January 1, 1923. He attended the Boston Latin School and went on to receive an A.B. degree from Harvard in 1943 and a Ph.D. from Harvard in 1950. He married his wife Helen in 1947. They had three daughters and a son.

Oscar Zariski was Gorenstein's advisor. His thesis was in algebraic geometry, but he published only one paper in that area after his dissertation, as he soon moved on to finite group theory. However, geometers still know his name through the notion of a *Gorenstein ring*, a concept growing out of his thesis.

Gorenstein became interested in finite groups through his work on cryptography and codes. During this time, he and N. Zierler produced the first algorithm for decoding general BCH-codes, and he also wrote several papers on finite groups with his friend I. N. Herstein, motivated by cryptographic questions. Gorenstein's serious work on simple groups began in 1960 at the University of Chicago during the famous year on finite groups organized by A. A. Albert. There he began his fruitful collaboration with John Walter and began to confront problems that would in time lead him to his program to classify the finite simple groups.

Gorenstein contributed to the Classification in at least four general ways. First, he proved some of the deepest and most important theorems underlying the Classification, and he did so through all

of the thirty-year period of maximal activity in simple group theory from about 1960 to the present. For example, his paper with John Walter in 1965 on groups with dihedral Sylow 2-subgroups was one of the first major characterizations of an infinite family of simple groups, while his 730 page *AMS Memoir* with Richard Lyons in 1983 supplied one of the last steps in the Classification.

Second, he was an innovator, introducing some of the most important concepts and techniques forming the foundation of the Classification. In particular, he introduced the notion of a signalizer functor and proved the first signalizer functor theorem. This notion is one of the four or five most important technical tools used in the Classification.

Third, and perhaps most important, was Gorenstein's role as chief strategist in the effort to classify the simple groups. From the beginning he was not content to work in some corner of finite group theory, but took a larger view and attempted to develop broad strategies for classifying the simple groups. In the last two chapters of his 1968 text *Finite Groups* (which became the basic reference in finite group theory), we find Gorenstein beginning to speculate about how to classify the finite simple groups. In the summer of 1972, he gave a series of lectures at the University of Chicago speculating in some detail as to how the finite simple groups might be classified. At that time many of the senior people in finite group theory viewed Gorenstein's program as science fiction, but it was his vision that proved to be accurate. While the program he sketched in 1972 was not implemented in all respects, it turned out to be remarkably close in many ways to the eventual proof of the Classification. The text of Gorenstein's Chicago lectures appears as an appendix to his article on the Classification in volume 1 of the new series of the *Bulletin*.

Fourth, Gorenstein organized the large and complex effort to classify the simple groups. He suggested problems and means to attack problems to numerous people, and inspired everyone in the field of simple group theory with his great enthusiasm and energy. In this way he was a great influence on young finite group theorists. A list



of his students includes Jui-Chi Chang, Andrew Chermak, Martin Guterman, Thomas Hearne, Gerard Kiernan, Kenneth Klinger, Robert Miller, Michael O'Nan, and Bernadette Tutinas. (O'Nan got his degree at Princeton, but Gorenstein was his de facto advisor.) Moreover, almost all finite group theorists of my age group were at least indirectly his students.

In 1981 the proof of the Classification was completed. However, the proof was spread over hundreds of articles running to thousands of pages, and even today, more than 10 years later, some of the results have yet to appear in print. In the early eighties Gorenstein wrote two books supplying a detailed exposition of the proof of the Classification. In writing those books he came to realize that the proof of the Classification could not be left in such a state. So he decided to begin a program to write out a simplified, self-contained proof of the Classification that would be more accessible and put the proof on more solid ground. To aid him in this monumental effort, he recruited Richard Lyons and Ronald Solomon as his major collaborators. The revised proof is to appear in a series of volumes published by the AMS. Lyons and Solomon expect to complete the project.

Danny Gorenstein's untimely death is a great loss to finite group theory. The Gorenstein-Lyons-Solomon revision program is perhaps the only chance to produce a readable proof of the Classification in one place, since the expertise which produced the Classification is fast disappearing. Without Gorenstein's boundless energy and enthusiasm to drive it, the project will certainly take longer to complete. But for Danny's friends the personal loss is greater. For us, mathematics conferences will not be the same without Danny Gorenstein, and life will be much less interesting.

Michael Aschbacher  
California Institute of Technology

**Diane M. Henderson  
Wins Packard Award**

DIANE M. HENDERSON, assistant professor of mathematics at Pennsylvania State University, has received a five-year, \$500,000 Fellowship in Science

and Engineering from the David and Lucile Packard Foundation. The fellowship is one of twenty awarded nationally this year.



Diane M. Henderson

Established in 1988, the Packard Fellowships provide unrestricted funds to young faculty in the natural sciences and engineering who have demonstrated unusual creative ability in research. Henderson's work centers on the behavior of waves in fluids. In nominating her for the award, Jerry L. Bona, head of the mathematics department at Penn State, said, "Her experimental technique is phenomenal and her insight into the properties of fluids belies her age. Especially unusual is her grasp of the relationship between theoretical and practical issues and laboratory experiments."

Henderson's interests focus on doing experiments that can test and guide theoretical predictions about wave motion. Penn State's mathematics department is one of the few in North America that supports a fluid mechanics laboratory, allowing a combination of experimental, theoretical, and numerical research. Henderson says she plans to use the award primarily for laboratory equipment and to support graduate students.

Henderson earned her bachelor's degree in engineering sciences in 1984 and her master's degree in 1986, both from the University of Florida. She completed a doctoral degree in physical oceanog-

raphy in 1989 at the Scripps Institution of Oceanography at the University of California at San Diego. Before coming to Penn State in 1991, she held a research position at the University of Florida. Henderson was awarded the Achievement Reward for College Scientists Fellowship at Scripps in 1989 and a National Science Foundation Young Investigator Award in 1992.

**Radon Medal Awarded**

The Österreichische Akademie der Wissenschaften (Austrian Academy of Sciences) has awarded the first Radon medal to FRITZ JOHN, emeritus of the Courant Institute in New York. The Radon medal will be given irregularly to mathematicians for contributions to fields in which Johann Radon (1887-1956) worked. John received the medal for his contributions to the integral transform which today is called the Radon transform, and his use of it in the fields of partial differential equations and elasticity.

**Ian F. Putnam  
Wins Aisenstadt Prize**

IAN F. PUTNAM of the University of Victoria has received the second André Aisenstadt Mathematics Prize of the Centre de Recherches Mathématiques (CRM) in Montreal. Putnam was cited for his work on  $C^*$ -algebras and their interplay with topological dynamics.

Putnam received his B.Sc. in mathematics from the University of Victoria and his Ph.D. from the University of California at Berkeley in 1985. He held positions at the University of Pennsylvania, Dalhousie University, and the University of Trondheim, Norway, before coming to the University of Victoria, where he is currently an assistant professor. He is a Canada University Research Fellow of the Natural Sciences and Engineering Research Council. In 1990, he received the Israel Halperin Prize.

The Aisenstadt Prize of \$3000, named for the philanthropist André Aisenstadt, is intended to recognize and reward talented young Canadian mathematicians. The winner was selected by a CRM committee of distinguished mathematicians.

**Joel E. Schneider Wins Communications Award**

JOEL E. SCHNEIDER, content director for the Children's Television Workshop's *Square One TV*, has been awarded the Communications Award of the Joint Policy Board for Mathematics (JPBM). The award will be conferred during a ceremony at the 1993 Joint Mathematics Meetings in January in San Antonio.



Joel E. Schneider

*Square One TV* is a half-hour television program focusing on mathematics. Schneider has been content director for the program since its inception in 1985. The author of numerous books and articles about mathematics and mathematics education, Schneider is also adjunct professor at Teacher's College of Columbia University. He earned his doctorate in mathematics at the University of Oregon.

In announcing the award, JPBM chair Richard Herman of the University of Maryland said, "Joel's work with *Square One TV* exemplifies the spirit of the JPBM Communications Award. There is no doubt that many Americans have an increased interest in and enthusiasm for mathematics as a result of viewing the program. As the creative mathematics genius behind the program, it is fitting Joel Schneider should be so honored."

*Square One TV* is aired weekdays by the Public Broadcasting Service. Math-

ematical topics are drawn from probability, statistics, data representation and analysis, as well as arithmetic and geometry. Children's Television Workshop developed *Square One TV* for home viewing to make mathematics more enjoyable, interesting, and exciting for eight- to twelve-year-old children. Its magazine format features "Mathnet", a daily continuing detective serial, original music videos, animation, and comedy sketches.

Previous recipients of the JPBM Communications Award are James Gleick, author of *Chaos: Making a New Science*; Hugh Whitmore, author of the play *Breaking the Code*; and Ivars Peterson, author of several books and an editor at *Science News*.

**52nd Putnam Competition Results**

The fifty-second William Lowell Putnam Mathematical Competition was held on December 7, 1991.

The first prize of \$5000 was awarded to the Department of Mathematics of Harvard University. The members of the winning team were: JORDAN S. ELLENBERG, SAMUEL A. KUTIN, and ERIC K. WEPSIC. Each received a prize of \$250.

The second prize of \$2500 was awarded to the Department of Mathematics of the University of Waterloo. The members of the winning team were: DANIEL R. L. BROWN, IAN A. GOLDBERG, and COLIN M. SPRINGER. Each received a prize of \$200.

The third prize of \$1500 was awarded to the Department of Mathematics of Harvey Mudd College. The members of the winning team were: TIMOTHY P. KOKESH, JON H. LEONARD, and GUY D. MOORE. Each received a prize of \$150.

The fourth prize of \$1000 was awarded to the Department of Mathematics of Stanford University. The members of the winning team were GREGORY G. MARTIN, GARRETT R. VARGAS, and ANDRÁS VASY. Each received a prize of \$100.

The fifth prize of \$500 was awarded to the Department of Mathematics of Yale University. The members of the winning team were ZUWEI THOMAS FENG, EVAN M. GILBERT, and ANDREW

H. KRESCH. Each received a prize of \$50.

The five highest ranking individual contestants, in alphabetical order, were: XI CHEN, University of Missouri, Rolla; JOSHUA B. FISCHMAN, Princeton University; SAMUEL A. KUTIN, Harvard University; RAVI D. VAKIL, University of Toronto; and ERIC K. WEPSIC, Harvard University. Each was designated a Putnam Fellow by the Mathematical Association of America and awarded a prize of \$500 from the Putnam Prize Fund.

The next five highest ranking individuals, in alphabetical order, were: DANIEL R. L. BROWN, University of Waterloo; GREGORY G. MARTIN, Stanford University; DAVID M. PATRICK, Carnegie Mellon University; JUN TENG, California Institute of Technology; and JEFFREY M. VANDERKAM, Duke University. Each was awarded a prize of \$250.

**NSF "Grand Challenge" Grants Awarded**

The National Science Foundation (NSF) has awarded the first set of grants for Grand Challenge Applications Groups. The research groups will address fundamental problems in science and engineering having broad economic and scientific impact and requiring high performance computing techniques and resources. The first year's funding for these seven research projects totals \$4.1 million, and over the five-year duration of the awards total support is expected to exceed \$20 million. Funding assistance also came from the Defense Advanced Research Projects Agency.

The three grants with a significant mathematical component are described below.

*High Performance Computing for Learning*, Massachusetts Institute of Technology. Robert Berwick of MIT will coordinate a group of researchers including biologists, mathematicians, computer scientists, and engineers from MIT, Brown University, and Harvard University. They will develop, implement, and test new mathematical techniques, software, and hardware for high performance computers with the ultimate goal of getting computers to see, move, and speak.

*High Performance Computational Methods for Coupled Field Problems and GAFD Turbulence*, University of Colorado at Boulder. Carlos Felippa and Juri Toomre of the University of Colorado at Boulder will coordinate a group of researchers at their home institution and at the University of Colorado at Denver, University of Minnesota, and the National Center for Atmospheric Research. The group includes aerospace engineers, astrophysicists, computer scientists, and numerical mathematicians. They will develop and implement algorithms and software on parallel computers for solving field problems in structural and fluid dynamics and studying highly turbulent flows which arise in geophysical and astrophysical fluid dynamics.

*Computational Biomolecular Design*, University of Houston. Ridgway Scott of the University of Houston will coordinate a group of chemists, biophysicists, computer scientists, and mathematicians who will use emerging scalable parallel computers and software to develop and implement new methods for solving critical problems in biomolecular design.

### CBMS Regional Conferences

Five NSF-CBMS Regional Research Conferences are planned for the summer of 1993. Supported by the National Science Foundation (NSF) and coordinated by the Conference Board of the Mathematical Science (CBMS), the conferences are intended to stimulate interest and activity in a specific topic of mathematical sciences research.

Each five-day conference features a distinguished lecturer who delivers ten talks on a topic of current research in a sharply focused area. Support for about thirty participants is provided. The conference organizers invite both established researchers and interested newcomers, including postdoctoral researchers and graduate students.

Information about the conferences is listed below: the title of the conference, the name of the principal speaker, the dates, the location, and the organizer.

*Semiparametric mixture models: Theory and methods—with applications in empirical Bayes, measurement error,*

*and random effects models*, Bruce G. Lindsay. Mid-May, University of South Carolina at Columbia. Contact: John M. Grego, telephone: 803-777-4651, email: n540006@univscvm.bitnet.

*Applications of the representation theory of quantum affine Lie algebras to solvable lattice models*, Tetsuji Miwa. June 1–5, North Carolina State University. Contact: Kailash C. Misra, telephone: 919-515-3320, email: misra@ncsuvvm.cc.ncsu.edu.

*Compensated compactness, homogenization, and H-measures*, Luc C. Tartar. June 28–July 3, University of California at Santa Cruz. Contact: Maria E. Schonbeck, telephone: 408-459-4657.

*Equivariant homotopy and cohomology*, J. Peter May. August 2–6, University of Alaska at Fairbanks. Contact: Robert J. Piacenza, telephone: 907-474-7772, email: ffrjp@alaska.bitnet.

*Classification of amenable subfactors and related topics*, Sorin T. Popa. August 24–28, University of Oregon. Contact: N. Christopher Phillips, telephone: 503-346-4714, email: phillips@bright.uoregon.edu.

Those wishing further information about a particular conference should contact the individuals indicated above. For general information about the Regional Conference series and about submitting proposals for support of future conferences, contact: CBMS, 1529 Eighteenth Street, NW, Washington, DC 20036; telephone 202-293-1170. (In addition, see the call for proposals in the Funding Information section of this issue of the *Notices*.)

### DoE Mathematics Program

The Department of Energy (DoE) funds research in the mathematical sciences in a number of areas, particularly applied mathematics and areas connected with the High Performance Computing and Communications (HPCC) initiative. The applied mathematics program is run by Frederick A. Howes (telephone: 301-903-3166, email: athowes@er.doe.gov); the computer science program is run by Dan Hitchcock (telephone: 301-903-6767, email: hitchcock@er.doe.gov); and the HPCC program is run by Tom Kitchens (telephone: 301-903-5152, email: kitchens@er.doe.gov). These pro-

grams are managed by the Offices of Scientific Computing (telephone: 301-903-5800, fax: 301-903-7774).

### Nominations Sought for Householder Award

Nominations are solicited for the Alston S. Householder Award VI for 1993. The award is intended to recognize the best dissertation in numerical algebra submitted by the recipient of a doctorate awarded between January 1, 1990 and December 31, 1992.

To qualify, the dissertation must have been submitted to fulfill requirements for a degree at the level of a U.S. doctorate. Candidates from countries in which a formal dissertation is not normally written at that level may submit an equivalent piece of work. For the purposes of the award, the term numerical analysis is intended to describe those parts of mathematical research that have both algebraic aspects and numerical content or implications. So, for example, the term covers linear algebra that has numerical applications, and the algebraic aspects of differential, integral, and nonlinear equations.

The most recent Householder Award went jointly to Alan Edelman of the Massachusetts Institute of Technology and Maria Beth Ong of the University of Washington. Entries will be assessed by a committee consisting of Ludwig Elsner of University of Bielefeld, Beresford Parlett of University of California at Berkeley, Axel Ruhe of University of Goteborg, Paul Van Dooren of University of Illinois, and Olof Widlund of Courant Institute.

The candidate's sponsor (the supervisor of the candidate's research) should submit five copies of the qualifying work, together with an appraisal of the candidate's work, to: Beresford Parlett, Department of Mathematics, University of California, Berkeley, CA 94720 by **February 28, 1993**. The award will be presented at the Householder Symposium XII, June 13–19, 1993, at Lake Arrowhead near Los Angeles. Candidates on the short list will be invited to the meeting.

### Congress of Applied Mechanics

The Twelfth U.S. National Congress of Applied Mathematics will be held June 26 to July 1, 1994 at the University of Washington in Seattle. Sessions are being planned for general lectures, symposia, and contributed papers covering all aspects of research of general interest to the applied mechanics community. Contributed research papers will be selected from 300–500 word summaries, which must be submitted for consideration by **October 1993**.

Inquiries regarding the Congress should be addressed to: Albert Kobayashi, Department of Mechanical Engineering, FU-10, University of Washington, Seattle, WA 98195. Telephone: 206-543-5488; fax: 206-685-8047; email: kobayashi@u.washington.edu.

The U.S. National Congress of Applied Mathematics is organized by the U.S. National Committee on Theoretical and Applied Mechanics under the general sponsorship of the National Academy of Sciences and the National Academy of Engineering. The AMS is one of the cooperating societies.

### Report on First-Year College Mathematics

“Currently, if a student drops out of serious study of mathematics after a year of calculus, he or she has no idea of how mathematics can deal with probabilistic matters, has no idea of how mathematics provides a conceptual basis for much of computer science, has only a limited concept of abstraction, and, perhaps most damning, has seen little or no mathematics more modern than the 18th century.”

So reads the introduction of a new report from the Consortium for Mathematics and its Applications (COMAP). The report, *Math 101–102: A New Start for College Mathematics*, doesn’t simply lambast calculus. It provides alternative ideas for a first-year mathematics course that gives broad-based introduction to the entire field of mathematics, not just to one topic. One of the points the report makes is that, although the calculus reform movement is likely to improve the calculus course, it does not address the fact that calculus cannot introduce

students to modern ideas in mathematics and to the breadth of current applications in science and engineering.

Without using buzzwords or resorting to hand-wringing over the current state of mathematics instruction, the report jumps right into the task of designing a prototype Math 101-102, providing outlines for six different topics that could be covered in such a course: change, geometry, linear algebra, discrete mathematics, chance, and algebraic structures. A small disclaimer before this part of the report concedes that what’s presented “may be a little ambitious”, and indeed it is difficult to imagine all of these topics being covered in a one-year course. Nevertheless, there are many interesting ideas presented here. A running theme is the use of concrete examples to illustrate abstract ideas. For example, the section on geometry begins with a problem of a robot sensor that is sent out to find a light source in a two-dimensional world containing various obstacles. The section on linear algebra utilizes a problem about an oil refinery to illustrate such ideas as matrix-vector products and Gaussian elimination. It would be difficult to argue that today’s college students don’t need to be familiar with the discrete mathematics ideas presented here: graph theory, algorithms, complexity, the use of logic in designing computers, primality testing, and so on.

In the second part of the report, there are a number of position papers that discuss some of the philosophical aspects and practical difficulties of constructing a course like Math 101–102. In one of the papers, “Some Lights in the Middle of the Mathematics Tunnel,” Sheldon P. Gordon takes on the image of the mathematics “pipeline” so often used in reports on the state of mathematics education. He argues that, to students, the mathematics curriculum is not a pipeline but a tunnel: “a long, dark subterranean tunnel that they slowly crawl along, constantly scraping their knees.” The tunnel, he says, does not allow for a wide view of mathematics, and only those with exceptional “night vision” make it very far. He goes on to point out some specific ways in which the curriculum could be made richer, more varied, more relevant, and more accessi-

ble to students. In a paper on geometry, Joseph Malkevitch views Math 101–102 as a way of training mathematics majors to be trained as “ambassadors” for mathematics—people who understand something of the breadth, depth, utility, and history of the field.

This report is unlikely to disappear without a trace, as so many of its kind do: A number of colleges have agreed to field test this material and a publisher is interested in a textbook based on these ideas. The project is coordinated by COMAP and funded by the Exxon Education Foundation and the National Science Foundation. The project leaders, Sol Garfunkel of COMAP and Walter Meyer of Adelphi University, invite readers to field test the materials and to contribute comments. Copies of the report were sent to all mathematics departments; they are also available free of charge from COMAP, Suite 210, 57 Bedford Street, Lexington, MA 02173; telephone 617-863-1202.

### 1993 Summer Institute for Talented Undergraduates

Two institutes will be held this summer in the San Francisco Bay Area for mathematically talented undergraduates. Both will be held from June 19 to July 31, 1993.

The first is the Summer Mathematics Institute at the University of California at Berkeley. Applications are sought from African-American, Hispanic-American, and Native American undergraduate men and women who are considering research careers in mathematics and related fields. Approximately thirty students will receive room and board, a \$2000 stipend, and transportation costs to and from Berkeley. The Institute is organized by Leon Henkin of UC Berkeley and Uri Treisman of the University of Texas at Austin and is a cooperative project of those two institutions.

The other institute is an intensive mathematics program at Mills College in Oakland. Applications are sought from women in all ethnic groups who are considering research careers in mathematics and related areas. Twenty students will be admitted to the 1993 program. Each will receive room and board, a \$2000 stipend, and transportation costs to and

from Oakland. The program is organized by Lenore Blum of the International Computer Science Institute, Steven Givant of Mills College, and Leon Henkin and Deborah Nolan of UC Berkeley.

These two institutes are supported by a grant from the National Science Foundation. Faculty are urged to seek out candidates for the programs and encourage them to apply. All applicants must have completed with distinction at least one year of collegiate mathematics beyond freshman calculus by June 1993. In addition, applicants to the Mills program must have completed one course that involves extensive exposure to discovering and writing proofs.

The deadline for applying to both programs is **February 12, 1993**. For more information and application forms for the Berkeley institute, call Olga Alvarez, 512-471-3285, or write to: Office of Special Projects, College of Natural Sciences, University of Texas, W. C. Hogg Building #204, Austin, TX 78712. For information and application forms for the Mills institute, call Kathy Guarnieri, 510-430-2226, or write to: Summer Mathematics Institute, c/o Mills College, Oakland, CA 94613.

### Working Group in Mathematics Established in Germany

In June 1990, a working group on Mathematics in Research and Practice was established at the Centre for Arts and Sciences North Rhine-Westphalia in Germany. The group was founded to address the fact that, although mathematics is an essential resource in a high-technology society, interactions between theoretical developments and applications do not always fulfill their potential. The working group provides a forum for specialists in various disciplines to exchange information, explore research and application ideas, initiate collaborations, and discuss changes in mathematics as a science. Public awareness of mathematics is also a concern of the working group.

Mathematics in Research and Practice has held symposia in a number of areas, including the role of mathematics in industry (October 1990), optimization and control theory (March 1991), career opportunities in mathematics (October 1991), mathematics

and environmental research (November 1991), pattern recognition and image processing (March 1992), and mathematics in medicine, biology, and agriculture (November 1992). In addition, the working group organized an exhibition at the Hanover Trade Fair in April 1992, which focused on the importance of mathematics in industry and attracted the attention of television, radio, and newspapers.

Mathematics in Research and Practice now has over 350 members in Germany and elsewhere. For more information, write to: Simon Golin, Head, Mathematics in Research and Practice, Centre for Arts and Sciences North Rhine-Westphalia, Reichsstr. 45, D-4000 Düsseldorf 1, Federal Republic of Germany.

### News from the Mathematical Sciences Institute

A number of long-term visitors are currently in residence at the Mathematical Sciences Institute (MSI) at Cornell University.

G. Pottinger is visiting Institute Director A. Nerode and has recently published an MSI Technical Report (92-23) entitled "Classical Type Theory with Transfinite Types". B. Khoussainov from Novosibirsk University, Russia and Tashkent University, Uzbekistan is also visiting Nerode.

R. Durrett of the MSI Center for Stochastic Analysis is hosting two visitors. K. Crowe from the University of Arizona and UC Davis is working with Durrett and with C. Castillo-Chavez of Cornell's Biometrics Unit. I. Benjamini of the Hebrew University is investigating harmonic functions, random walks, and tree index processes.

The Center for Symbolic Methods in Algorithmic Mathematics (ACSyAM), directed by M. Sweedler, is sponsoring research by N. Vorobjov of the Steklov Institute. In addition, K. Shirayanagi, a senior research scientist in computer algebra with NTT, is working with Sweedler, L. Billera, and M. Stillman.

Additional MSI visitors include R. Valdivia, an AAUW dissertation fellow from Washington State University who is working on a mathematical model of transdermal drug delivery; B. Jaggi, a

researcher from the University of Berne working with Cornell's R. Connelly; B. Wykoff from Cornell's Center for the Environment; and D. Schwartz from the Mathematics department of Ithaca College.

Postdoctoral researchers interested in visiting MSI should contact either A. Nerode, M. Sweedler, or R. Durrett at MSI/Cornell or J. Glimm at MSI/Stony Brook.

In the coming months, MSI will support a workshop on Random Walks, Trees, and Groups organized by R. Pemantle of the University of Wisconsin (April 18-20, 1993); a conference in honor of N.U. Prabhu organized by D. Heath and S. Resnick of Cornell (June 28-29, 1993); a workshop on Linear Logic organized by A. Scedrov (June 14-18, 1993); and a conference in honor of E. Dynkin organized by R. Getoor of UCSD and H. Kesten of Cornell (May 22-24, 1994).

In addition, at the University of Puerto Rico MSI will sponsor the Tenth International Symposium on Applied Algebra, Algebraic Algorithms, and Error correcting codes in San Juan from May 10-14, 1993. MSI director A. Nerode will chair a meeting at the Second International workshop on Logic Programming and Nonmonotonic Reasoning to meet in Lisbon June 14-18, 1993. Contact W. Marek at [marek@ms.uky.edu](mailto:marek@ms.uky.edu).

### Philosophia Mathematica to be Published

Under the auspices of the Canadian Society for History and Philosophy of Mathematics, a new series of *Philosophia Mathematica* will be published in the spring of 1993 by University of Toronto Press. Founded in 1964 by J. Fang, this is the only journal specifically devoted to philosophy of mathematics. The journal is intended to be a forum for discussion of philosophical aspects of mathematics, its state and nature, what can be learned of mathematics by consideration of its study, and the philosophical problems of applying mathematics. The new Editorial Board includes: Jon Barwise, Douglas Bridges, Ubiratan D'Ambrosio, Nicolas Goodman, Reuben Hersh, Saunders Mac Lane,

Fred Richman, and Gian-Carlo Rota, as well as a number of logicians and other philosophers. Institutional subscription is U.S.\$60 per year, individual U.S.\$29. Inquiries about subscriptions or about the membership in the Canadian Society for History and Philosophy of Mathematics, should be directed to the editor, Robert Thomas, Department of Applied Mathematics, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2; email: Robert.Thomas@UManitoba.ca.

**New Publication on  
Research in Undergraduate  
Mathematics Education**

*Following the announcement (Notices, October 1992) that the Conference Board of Mathematical Sciences will publish an annual volume of papers on Research in Undergraduate Mathematics Education under the aegis of the MAA committee of that name, the editors are calling for papers to be submitted. The following editorial statement should provide authors with all necessary information.*

*The editors suggest that, to be given full consideration for the first volume, manuscripts should be submitted by **March 1, 1993**. Papers submitted after that date are more likely to be considered for the second volume.*

**Editorial Policy:**

The papers published in these volumes will serve both pure and applied purposes, contributing to the field of research in undergraduate mathematics education and informing the direct improvement of undergraduate mathematics instruction. The dual purposes imply dual but overlapping audiences and articles will vary in their relationship to these purposes. The best papers, however, will interest both audiences and serve both purposes.

**Content:**

We invite papers reporting on research that addresses any and all aspects of undergraduate mathematics education. Research may focus on learning within particular mathematical domains. It may be concerned with more general cognitive processes such as problem solving, skill acquisition, conceptual development, mathematical creativity, cognitive styles, etc. Research reports may deal with issues associated with variations in teaching methods, classroom or laboratory contexts, or discourse patterns. More broadly, research may be concerned with institutional arrangements intended to support learning and teaching, e.g., curriculum design, assessment practices, or strategies for faculty development.

**Method:**

We expect and encourage a broad spectrum of research methods ranging from traditional statistically-oriented studies of populations, or even surveys, to close studies of individuals, both short and long term. Empirical studies may well be supplemented by historical, ethnographic, or theoretical analyses focusing directly on the educational matter at hand. Theoretical analyses may illuminate or otherwise organize empirically based work by the author or that of others, or perhaps give specific direction to future work. In all cases, we expect that published work will acknowledge and build upon that of others—not necessarily to agree with or accept others' work, but to take that work into account as part of the process of building the integrated body of reliable knowledge, perspective, and method that constitutes the field of research in undergraduate mathematics education.

**Review Procedures:**

All papers, including invited submissions, will be evaluated by a minimum of three referees, one of whom will be a Volume editor. Papers will be judged on the basis of their originality, intellectual quality, readability by a diverse audience, and the extent to which they serve the pure and applied purposes identified earlier.

**Submissions:**

Papers of any reasonable length will be considered, but the likelihood of acceptance will be smaller for very large manuscripts.

Five copies of each manuscript should be submitted. Manuscripts should be typed double-space, with bibliographies done in the style used by the American Mathematical Society's and the Mathematical Association of America's journals. Manuscripts should eventually be prepared using either  $\text{\LaTeX}$  (amspt) or  $\text{\LaTeX}$  (amsart). The macro packages are available through email without charge (ams-tex@math.ams.org; ams-latex@math.ams.org, respectively).

**Correspondence:**

Manuscripts and editorial correspondence should be sent to one of the three editors:

Ed Dubinsky, Purdue University, 1395 Mathematical Science Building, W. Lafayette, IN 47907-1395; (bbf@j.cc.purdue.edu);

James Kaput, Department of Mathematics, University of Massachusetts, Dartmouth, North Dartmouth, MA 02747; (jkaput@umassd.edu); or

Alan Schoenfeld, School of Education, University of California, Berkeley, CA 94720; (alans@violet.berkeley.edu).

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# Funding Information for the Mathematical Sciences

## **ONR Initiative for Joint Research**

The Office of Naval Research (ONR) has begun a Research Initiation Program as part of the 1993 University Research Initiative. The focus of the program is on joint research in probability and statistics, ocean engineering, and nonlinear dynamics.

Proposals are sought for research on methods for the evaluation of the response of nonlinear dynamical systems to stochastic excitation with emphasis on response characteristics of significance for reliability behavior. The focus of the program is on extremes of response motivated by concern for catastrophic failure and on crossing rates of typical response levels motivated by concern for fatigue-based failure. The system models will be differential equations characteristic of ocean structures, such as piers and moorings, with excitations that are non-Gaussian processes characteristic of wind, wave, and current forcing. Interdisciplinary proposals which combine the expertise of the mathematics, physics, and engineering communities are encouraged.

Because the intent of the program is to broaden the university research base to institutions that historically have not been major recipients of Department of Defense research funding, sixty universities have been excluded from participation in the program. Program announcements have been sent to all university grants and contracts offices, and individual copies can be obtained through the online information service FEDIX at 301-353-9520 (help line 301-353-9542). ONR's Special Projects Office has some copies of the program announcement to mail out upon request (mailing address:

Code 11SP, ONR, Arlington, VA 22217-5660). Proposals must be received by **January 15, 1993**.

For information about technical aspects of the program, contact Julia Abrahams of the ONR's Mathematical Sciences Division, telephone 703-696-4320. Other contacts are Michael Shlesinger of the Physics Division, telephone 703-696-4220; and Steven Ramberg of the Ocean Engineering Division, 703-696-4358.

## **Proposals Sought for IUTAM Symposia**

The U.S. National Committee on Theoretical and Applied Mechanics is seeking proposals from U.S. authors and institutions to host International Union of Theoretical and Applied Mechanics (IUTAM) Symposia any time during the years 1996-1997.

The aim of IUTAM Symposia is to assemble a group of active scientists within a well-defined field. In order to achieve effective communication within the group, the number of active participants is limited to about sixty, about twenty-five of whom present prepared lectures. Invitations to participate are made solely on the basis of merit by a Scientific Committee appointed by IUTAM. The chair of the Committee is normally the submitter of the proposal, but the other members will be chosen from the international scientific community. The proposal may indicate a preference for 1996 or 1997, but actual scheduling for the year will be worked out jointly by the Scientific Committee and IUTAM.

IUTAM provides a small amount of financial support to pay some travel ex-

penses, primarily for young scientists and for scientists from developing countries. Symposia organizers are encouraged to seek additional financial support from other sources.

On request, the secretary of the U.S. National Committee will send a Symposium-Invitation Kit containing an application form, examples of approved applications, and a list of recent symposia. Inquiries should be addressed to: Philip G. Hodge, Jr., Secretary, USNC/TAM, 107 Ackerman Hall, University of Minnesota, Minneapolis, MN 55455; telephone: 612-625-8000; email: pghodge@vx.cis.umn.edu.

## **Request for Proposals for NSF-CBMS Regional Conferences**

The National Science Foundation (NSF) intends to support six NSF-CBMS Regional Research Conferences in 1994. A panel chosen by the Conference Board of the Mathematical Sciences (CBMS) will make the selection from submitted proposals. There have been a total of 237 NSF-CBMS regional conferences held in the twenty-four year history of this conference series.

Each five-day conference features a distinguished lecturer who delivers ten lectures on a topic of important current research in one sharply focused area of the mathematical sciences. The lecturer also prepares an expository monograph based on the lectures. Depending on the conference topic, the monograph is published by the AMS, the Society for Industrial and Applied Mathematics, or jointly by the American Statistical Association and the Institute of Mathematical Statistics.

## Funding Information

Support is provided for about thirty participants at each conference. The conference organizer invites both established researchers and interested newcomers, including postdoctoral researchers, graduate students, and members of underrepresented groups.

Colleges and universities with at least some research competence in the field of the proposal are eligible to apply. Since a major goal of these conferences is to attract new researchers into the field of the conference and to stimulate new research activity, institutions that are interested in upgrading or improving their research efforts are especially encouraged to apply.

Proposals must arrive at the NSF by **April 1, 1993**. Principal investigators are usually notified of the status of their proposals by late summer. For further information about submitting proposals, contact: CBMS, 1529 Eighteenth Street, NW, Washington, DC 20036; telephone 202-293-1170. A news item about the 1993 NSF-CBMS Regional Research Conferences appears in the News and Announcements section of this issue of the *Notices*.

### Telephone Numbers for NSF's International Programs

The Stipends for Study and Travel section in the October 1992 issue of the *Notices* carried information about the programs of the International Division of the National Science Foundation. Since the time that the *Notices* received that information, there have been several changes in the Division. There are now seven programs, listed below with tele-

phone numbers. All are in the 202 area code.

*Africa, Near East, South Asia:* 653-5361  
*Americas:* 653-5749

*East Asia and Pacific:* 653-5343

*Eastern Europe:* 653-5277

*Western Europe:* 653-5437

*Japan:* 653-5862

*International Science and Engineering*

*Issues:* 653-7758.

### Friedrichs Fellowship at Courant

The Courant Institute of Mathematical Sciences at New York University is seeking applications for the K. O. Friedrichs Fellowship, a postdoctoral research fellowship in computational mathematics. Specific areas of interest are combustion, computational fluid dynamics, and parallel computing. The fellowship is supported by the Office of Scientific Computing of the Department of Energy. Candidates must be U.S. citizens or permanent residents.

The appointment is for two years starting September 1993. Interested candidates should send a résumé, research statement, preprints or thesis if available, and the names of three references to: K. O. Friedrichs Fellowship Committee, Courant Institute, 251 Mercer Street, New York, NY 10012. The deadline for applications is **February 15, 1993**.

### Wilkinson Fellowship at Argonne

Argonne National Laboratory invites outstanding candidates to apply for the 1993 J. H. Wilkinson Fellowship in Sci-

entific Computing. The Wilkinson Fellowship is intended to encourage young scientists actively engaged in state-of-the-art research in scientific computing. The eligible candidate must be a U.S. citizen and must be about to earn a Ph.D. or must have earned a Ph.D. within the past three years. The appointment will be in the Mathematics and Computer Science Division of Argonne, which has strong research programs in scientific computing, software tools, computational mathematics, and applied analysis. There is special interest in numerical methods for linear algebra, optimization, and partial differential equations; software tools for parallel computing; and state-of-the-art numerical methods for computational science problems.

The appointment is for one year and may be renewed for a second year. It includes a competitive salary, moving expenses, a travel allowance, and access to high-performance computing facilities. Applications should include a résumé, a statement of research goals, and the names of three references. The closing date to apply is **January 22, 1993**. Applications should be sent to: Nancy Griparis, Box J-MCS93, Employment and Placement, 9700 South Cass Avenue, Argonne National Laboratory, Argonne, IL 60439-4832.

The applications will be reviewed by a selection committee, and the decision will be announced in March 1993. The position will commence during 1993. For further information, contact Jorgé J. More, telephone 708-252-7162, or email [more@mcs.anl.gov](mailto:more@mcs.anl.gov).



# 1993 AMS Elections

## *Nominations by Petition*

### **Vice-President or Member-at-Large**

One position of vice-president and member of the Council ex officio for a term of three years is to be filled in the election of 1993. The Council intends to nominate at least two candidates, among whom may be candidates nominated by petition as described in the rules and procedures.

Five positions of member-at-large of the Council for a term of three years are to be filled in the same election. The Council intends to nominate at least ten candidates, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

Petitions are presented to the Council, which, according to Section 2 of Article VII of the bylaws, makes the nominations. The Council of 23 January 1979 stated the intent of the Council of nominating all persons on whose behalf there were valid petitions.

Prior to presentation to the Council, petitions in support of a candidate for the position of vice-president or of member-at-large of the Council must have at least 50 valid signatures and must conform to several rules and operational considerations, which are described below.

### **Editorial Boards Committee**

Two places on the Editorial Boards Committee will be filled by election. There will be four continuing members of the Editorial Boards Committee.

The President will name at least four candidates for these two places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

### **Nominating Committee**

Three places on the Nominating Committee will be filled by election. There will be six continuing members of the Nominating Committee.

The President will name at least six candidates for these three places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

---

### **Rules and Procedures**

Use separate copies of the form for each candidate for vice-president, member-at-large, or member of the Nominating and Editorial Boards Committees.

1. To be considered, petitions must be addressed to Robert M. Fossum, Secretary, P. O. Box 6248, Providence, Rhode Island 02940, and must arrive by 28 February 1993.

2. The name of the candidate must be given as it appears in the *Combined Membership List (CML)*. If the name does not appear in the list, as in the case of a new member or by error, it must be as it appears in the mailing lists, for example on the mailing label of the *Notices*. If the name does not identify the candidate uniquely, append the member code, which may be obtained from the candidate's mailing label or the Providence office.

3. The petition for a single candidate may consist of several sheets each bearing the statement of the petition, including the name of the position, and signatures. The name of the candidate must be exactly the same on all sheets.

4. On the next page is a sample form for petitions. Copies may be obtained from the Secretary; however, petitioners may make and use photocopies or reasonable facsimiles.

5. A signature is valid when it is clearly that of the member whose name and address is given in the left-hand column.

6. The signature may be in the style chosen by the signer. However, the printed name and address will be checked against the *Combined Membership List* and the mailing lists. No attempt will be made to match variants of names with the form of name in the *CML*. A name neither in the *CML* nor on the mailing lists is not that of a member. (Example: The name Robert M. Fossum is that of a member. The name R. Fossum appears not to be.)

7. When a petition meeting these various requirements appears, the Secretary will ask the candidate whether he is willing to have his name on the ballot. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving his consent.

# NOMINATION PETITION FOR 1993 ELECTION

The undersigned members of the American Mathematical Society propose the name of

\_\_\_\_\_

as a candidate for the position of (check one):

- Vice-President**
- Member-at-Large of the Council**
- Member of the Nominating Committee**
- Member of the Editorial Boards Committee**

of the American Mathematical Society for a term beginning 1 February, 1994.

Name and Address (printed or typed)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Signature

# ***CALL FOR SUGGESTIONS***



There will be a number of contested seats in the 1993 AMS elections.  
Your suggestions are wanted by

## **THE NOMINATING COMMITTEE**

for president-elect, vice-president, trustee, and five  
members-at-large of the council  
and by

## **THE PRESIDENT**

for three Nominating Committee members and two  
Editorial Boards Committee members.

*In Addition*

## **THE EDITORIAL BOARDS COMMITTEE**

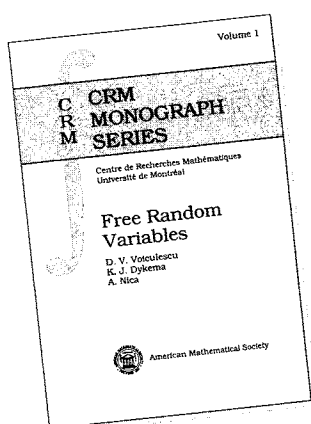
requests suggestions for appointments to various editorial boards  
of Society publications.

*Send your suggestions for any of the above to:*

Robert M. Fossum, Secretary  
American Mathematical Society  
Department of Mathematics  
University of Illinois  
1409 West Green Street  
Urbana, Illinois 61801

# American Mathematical Society & Centre de Recherches Mathématiques

The AMS and the CRM are very pleased to announce  
a new copublishing agreement for two important new book series!



## CRM Monograph Series

Upcoming titles include:

**Free Random Variables** (see page 1285 of this *Notices* )

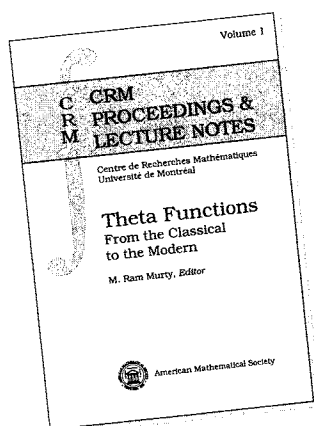
D. V. Voiculescu, K. J. Dykema, and A. Nica

**Applied Integral Transforms**

M. Ya. Antimirov, A. A. Kolyshkin, and Rémi Vaillancourt

**Introduction to Abelian Varieties**

V. Kumar Murty



## CRM Proceedings & Lecture Notes

Upcoming titles include:

**Theta Functions, From the Classical to the Modern**

M. Ram Murty, Editor

**Elliptic Curves and Related Topics**

Hershy Kisilevsky and M. Ram Murty, Editors

**Optimal Control via Nonsmooth Analysis**

Philip D. Loewen



The Centre de Recherches Mathématiques, located on the campus of l'Université de Montréal, carries out research primarily in certain applied and interdisciplinary areas: control, dynamical systems, optimization, engineering design, biology, mathematical physics, analysis, etc. As a national research center, the CRM also organizes a wide range of activities spanning all pure and applied areas, involving hundreds of scientists annually from around the world.

# Joint Mathematics Meetings

## January 13–16, 1993

### San Antonio, Texas

## *Preliminary Program*

The preliminary program for the San Antonio Joint Mathematics Meetings follows. Individuals who preregistered by November 13 and who so elected will have their badge and the final program mailed to them before the meetings. All other registrants will receive the final program at the meetings. Participants who have not yet registered should read the information in the October and November issues of the *Notices* and the October issue of *Focus* for further details. The additional information below is to assist those who will register at the meetings and those preregistrants who elected not to receive their badges and final programs by mail.

### Program Updates

#### *AMS-MAA Sessions*

The title of the AMS-MAA Joint Invited Address to be presented by **Mary F. Wheeler** has been changed to *Parallel algorithms for modeling flow in porous media problems*.

**Steve Monk**, MAA Committee on Research in Undergraduate Mathematics Education, is a coorganizer for the AMS-MAA Special Session, *The state of research in undergraduate mathematics education: problems and prospects*.

The AMS-MAA Special Session on *Environmental modeling* has been canceled.

The AMS-MAA panel discussion, *Best snapshots from doctoral departments*, will include **Joel V. Brawley**, Clemson University; **Henry Frandsen**, University of Tennessee; **Dennis J. Garity**, Oregon State University; **Daniel L. Goroff**, Harvard University; **Marcia J. Groszek**, Dartmouth College; **Steven G. Krantz**, Washington University; **Edward P. Merkes**, University of Cincinnati; and **Ivar Stakgold**, University of Delaware, as panelists. **Bettye Anne Case**, Florida State University, will act as moderator.

#### *AMS Sessions*

The title of **Wu-Yi Hsiang**'s Invited Address has been changed to *The proof of Kepler's conjecture on the sphere packing problem*.

In addition to his invited address, Professor Hsiang will discuss *Technical discussion of the proofs* at an informal session on Wednesday from 6:15 p.m. to 7:30 p.m.

**Committee on Science Policy Speaker:** The Committee on Science Policy (Frank W. Warner III, Chair) will sponsor an address by **William Danforth**, Chancellor of Washington University, St. Louis, and Cochair, National Science Board Commission on the Future of the NSF, on Wednesday at 4:25 p.m.

**The Future of Federal Science and Mathematics Funding:** This panel discussion cosponsored by the same committee and the Joint Policy Board for Mathematics is from 8:30 a.m. to 9:50 a.m. on Wednesday. Panelists include **Jerry L. Bona**, Pennsylvania State University; **Phillip A. Griffiths**, Institute for Advanced Study; **Ettore Infante**, University of Minnesota; and **Saunders Mac Lane**, University of Chicago. **John C. Polking**, Rice University, will serve as moderator.

The Thursday afternoon panel discussion on *Publication costs: are they controllable?* will also include **Daniel H. Jones**, Assistant Library Director of Collection Development, Briscoe Library, University of Texas Health Science Center, as a panelist.

#### *AMS Short Course*

**Pierre-Gilles Lemarié-Rieusset**, Université de Paris-Sud, will speak at the AMS Short Course on *Projection operators in multiresolution analysis* at 10:45 a.m. on Monday. The talk by Yves Meyer has been cancelled.

#### *MAA Minicourses*

**Minicourse #12:** **John K. Williams**, University of Hartford, is a coorganizer for *Bringing calculus to life*.

#### *Other MAA Sessions*

Panelists for the Friday morning panel discussion on *Precalculus reform* include **David C. Arney**, United States Military Academy; **Franklin D. Demana**, Ohio State University; **Sheldon P. Gordon**, Suffolk County Community College; and **Daniel J. Teague**, North Carolina School of Science and Mathematics.

There will be a poster session on *Laboratory approaches in undergraduate mathematics* from 8:00 p.m. to 10:00 p.m. on Thursday, organized by **James R. C. Leitzel**, University of Nebraska, Lincoln, and **Arnold Ostebee**, St. Olaf College. Laboratory experiences with suitable technology are playing

an increasing role in the teaching and learning of undergraduate mathematics. This poster session will highlight some of the innovative approaches mathematical sciences faculty are using in various programs. The projects discussed have been supported in part by the National Science Foundation through its Division of Undergraduate Education's program in Instrumentation and Laboratory Improvement/Leadership Projects in Laboratory Development.

Panelists for the Saturday afternoon panel discussion on *Mathematical research for undergraduate students* include **David L. Housman**, Drew University; **Robby Robson**, Oregon State University; **Brigitte Servatius**, Worcester Polytechnic Institute; and **Gary J. Sherman**, Rose-Hulman Institute of Technology.

#### Activities of Other Organizations

The updated schedule of **Association for Symbolic Logic** invited speakers and their titles follows:

**Sy Friedman**, Massachusetts Institute of Technology, *Inner models, class forcing, and the structure of  $V$* , 9:00 a.m. on Friday;

**Eberhard Herrmann**, Humboldt University, Berlin, *Automorphism properties of the lattice of r.e. sets*, 10:00 a.m. on Friday;

**Toniann Pitassi**, University of California, San Diego, *The complexity of counting principles*, 1:00 p.m. on Friday;

**Jan Krajíček**, Academy of Sciences of the Czech Republic and University of Toronto, *Weak logical systems and complexity theory*, 9:00 a.m. on Saturday;

**Chris Laskowski**, University of Maryland, College Park, *How absolute is nonisomorphism of models?*, 10:00 a.m. on Saturday.

**Richard Laver**, University of Colorado, Boulder, *Some remarks on braids, algebra, and set theory*, 1:00 p.m. on Saturday;

The **Association for Women in Mathematics'** (AWM) fourteenth Emmy Noether Lecture will be presented by **Linda Keen**, Herbert H. Lehman College (CUNY). Professor Keen will speak on *Hyperbolic geometry and space of Riemann surfaces* at 9:00 a.m. on Thursday. A dinner to be held in her honor is described in the Social Events section.

The **Joint Policy Board for Mathematics** will grant its fourth annual Communications Award to **Joel E. Schneider** during the meeting. Dr. Schneider will be cited for his work with *Square One TV*.

#### Social Events

The menu for the AWM Workshop Dinner on Tuesday, January 12, includes Caesar salad, chicken picatta, fresh vegetables, rolls and butter, pecan pie, coffee, and tea. Vegetarian meals are available upon advance request. Tickets are \$28 each, including taxes and gratuity.

The AWM Noether Lecturer will be honored on Wednesday evening at a dinner; further details and a sign-up sheet will be at the AWM table, the panel discussion, and the Business Meeting.

#### Registration at the Meetings

Meeting preregistration and registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register and should be prepared to show the meeting badge, if so requested. Badges are required to obtain discounts at the AMS and MAA Book Sales and to cash a check with the meeting cashier. If preregistrants should arrive too late in the day to pick up their badges, they may show the acknowledgment received from the Mathematics Meetings Service Bureau (MMSB) as proof of registration.

**Registration fees:** Registration fees may be paid at the meetings in cash, by personal or travelers' check, or by VISA or MasterCard. Canadian checks must be marked for payment in U.S. funds. Although other credit cards are being accepted by hotels for housing payments, only VISA or MasterCard can be accepted for registration. Letters verifying attendance at the meetings can be obtained from the cashier or at the Registration Assistance section of the registration desk.

Please note that there will be two registration cashiers on Tuesday and Wednesday, January 12 and 13. One cashier will accept cash and checks only, and the other, credit cards only. Participants should take care to get into the correct line for the cashier accepting their desired method of payment. Unfortunately, it will not be possible for the credit card cashier to provide a cash register receipt, and the only proof of payment will be the participant's copy of the credit card charge slip.

Participants wishing to attend sessions for one day only may take advantage of a one-day fee which is equal to 55% of the on-site registration fee for either members or nonmembers. These special fees are effective daily, January 13 through 16, and are available at the meetings to both members and nonmembers. These one-day fees are not applicable to librarians, high school teachers, unemployed or emeritus participants, or high school, undergraduate, or graduate students.

#### Joint Mathematics Meetings

Member of AMS, ASL, Canadian Mathematical Society, MAA	\$150
Emeritus Member of AMS, MAA	39
Nonmember	231
Student/Unemployed	39
Librarians/High School Teachers	39
High School Students	5

#### Joint Mathematics Meetings One Day

Member of AMS, ASL, CMS, MAA	\$ 83
Nonmember	127

#### Employment Register

Employer	\$175
Additional interviewer (each)	75
Applicant	60
Employer posting fee	30

## Meetings

### AMS Short Course

Student/Unemployed	\$ 40
Emeritus Member of AMS, MAA	40
All Other Participants	85

### MAA Minicourses

(if openings available)

Minicourses #3, 4, 6, 7, 8, 9, 11, 12, 13, 16, 17	\$ 36
Minicourses #1, 2, 5, 10, 14, 15	45

There is no extra charge for members of the families of registered participants, except that all professional mathematicians who wish to attend sessions must register independently.

All **full-time** students currently working toward a degree or diploma qualify for the student registration fees, regardless of income. Students are asked to determine whether their status can be described as graduate (working toward a degree beyond the bachelors'), undergraduate (working toward a bachelors' degree), or high school (working toward a high school diploma), and make the appropriate indication on the preregistration/housing form.

The librarian registration category refers to any librarian who is not a professional mathematician.

The unemployed status refers to any person currently unemployed, actively seeking employment, and not a student. It is not intended to include any person who has voluntarily resigned or retired from his or her latest position.

Persons who qualify for emeritus membership in either the Society or the Association may register at the emeritus member rate. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more and is retired because of age or long term disability from his or her latest position.

Nonmembers who preregister or register at the meeting and pay the nonmember fee will receive mailings from AMS and MAA containing information about a special membership offer after the meeting is over.

An income tax deduction is allowed for education expenses, including registration fees, cost of travel, meals, and lodging incurred to (i) maintain or improve skills in one's employment, trade, or business or (ii) meet express requirements of an employer or a law imposed as a condition to retention of employment, job status, or rate of compensation. This is

true even for education that leads to a degree. However, the Tax Reform Act of 1986 introduced significant changes to this area. In general, the deduction for meals is limited to 80% of the cost. Unreimbursed employee educational expenses are subject to a 2% of adjusted gross income floor. There are exceptions to these rules; therefore, one should contact one's tax advisor to determine the applicability of these provisions.

### Accommodations

Participants who did not reserve a room during preregistration but who would like to obtain a room at one of the hotels listed on pages 904 and 905 in the October issue of the *Notices* and pages 35 and 36 of *Focus* should call the hotels directly **after December 16**. However, we regret that after that date the MMSB can no longer guarantee availability of rooms or of the special convention rates.

### Registration Dates, Times, and Locations

#### AMS Short Course

Outside River A, San Antonio Convention Center

Monday, January 11 8:00 a.m. to 3:00 p.m.

#### Joint Mathematics Meetings

##### and MAA Minicourses (until filled)

Gallery, San Antonio Convention Center

Tuesday, January 12 3:00 p.m. to 7:00 p.m.

Wednesday – Friday,  
January 13 – 15 7:30 a.m. to 4:00 p.m.

Saturday, January 16 7:30 a.m. to 3:00 p.m.

#### Employment Register

South Banquet Hall, San Antonio Convention Center

Wednesday, January 13 7:30 a.m. to 4:00 p.m.  
(Registration only)

Thursday & Friday  
January 14 & 15 9:00 a.m. to 5:00 p.m.  
(Interviews only)

Employment Register participants must register and fill out interview request forms on **Wednesday, January 13**. There will be no registration on Thursday and Friday; only interviews will take place on these days.

# Presenters of Papers

Numbers following the names indicate the speakers' positions on the program.

- ◊ AMS-MAA Invited Lecturer
- ◊ MAA Invited Lecturer
- NAM William W.S. Claytor Lecturer
- \* AMS Special Session Speaker
- AMS Invited Lecturer
- AWM Emmy Noether Lecturer
- △ ASL Invited Lecturer

- |  |  |  |   |
|--|--|--|---|
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**CONTEMPORARY  
MATHEMATICS**  
138

Hypergeometric Functions  
on Domains of Positivity,  
Jack Polynomials,  
and Applications



AMERICAN MATHEMATICAL SOCIETY

# CONTEMPORARY MATHEMATICS

**Volume 138**

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on Domains of Positivity,  
Jack Polynomials, and Applications

Donald St. P. Richards, *Editor*

This volume is based largely on lectures presented at a Special Session at the AMS meeting in Tampa, Florida, in March 1991, which was devoted to hypergeometric functions of matrix argument and to fostering communication among representatives of the diverse scientific areas in which these functions are utilized. Accessible to graduate students and others seeking an introduction to the state of the art in this area, this book is a suitable text for advanced graduate seminar courses, as it contains many open problems.

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# Program of the Sessions

The time limit for each contributed paper in the sessions is ten minutes. In the special sessions, the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

Abstracts of papers presented in the sessions at this meeting will be found in the January 1993 issue of *Abstracts of papers presented to the American Mathematical Society*, ordered according to the numbers in parentheses following the listings below.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

## Monday, January 11

### AMS Short Course

#### 8:00 a.m.–5:15 p.m.

- 8:00 a.m. Short Course Registration
- 9:15 a.m. *Orthonormal wavelet bases on wavelet transforms.*  
(1) **Ingrid Daubechies**, Rutgers University, New Brunswick
- 10:45 a.m. *Projection operators in multiresolution analysis.*  
(2) **Pierre-Gilles Lemarié-Rieusset**, Université Paris-Sud, France
- 2:00 p.m. *Wavelets and fast numerical algorithms.*  
(3) **Gregory Beylkin**, University of Colorado, Boulder
- 3:30 p.m. *Adapted waveform analysis, wavelet packets and local cosine libraries.*  
(4) **Ronald R. Coifman**, Yale University
- 4:45 p.m. Discussion period

## Tuesday, January 12

### MAA Board of Governors

#### 8:30 a.m.–4:00 p.m.

### Association for Women in Mathematics Workshop

#### 9:00 a.m.–5:00 p.m.

### AMS Short Course

#### 9:15 a.m.–5:00 p.m.

- 9:15 a.m. *Wavelets and differential operators with variable coefficients.*  
(5) **Philippe Tchamitchian**, Faculté des Sciences et Techniques de Saint-Jérôme, France

- 10:45 a.m. *Nonlinear wavelet methods for recovery of objects from noisy and indirect observations.*  
(6) **David Donoho**, Stanford University

- 2:00 p.m. *Adapted bases in analysis and signal processing.*  
(7) **M. Victor Wickerhauser**, Washington University

- 3:30 p.m. Discussion period

### AMS Council

#### 2:00 p.m.–7:00 p.m.

## Wednesday, January 13

### AMS Special Session on Continuum Theory and Dynamical Systems, I

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Periodic behavior of continuous functions on trees.*  
(8) **Stewart Baldwin**, Auburn University, Auburn (878-58-903)
- 8:30 a.m. *Concurrent nonoverlapping translates of a planar disk.*  
(9) **A. Bezdek**, **K. Kuperberg\*** and **W. Kuperberg**, Auburn University, Auburn (878-58-490)
- 9:00 a.m. *A periodic point free homeomorphism of a tree-like continuum.*  
(10) **Piotr Minc**, Auburn University, Auburn (878-54-672)
- 9:30 a.m. *Nonwandering structures at a period doubling limit.*  
(11) **Russell Walker\*** and **Marcy Barge**, Montana State University (878-58-434) (Sponsored by Kathleen T. Alligood)
- 10:00 a.m. *The dynamics of continuous maps through inverse limits.*  
(12) **Marcy Barge**, Montana State University, and **Beverly Diamond\***, College of Charleston (878-54-522)
- 10:30 a.m. *Jordan curves as repellers. Preliminary report.*  
(13) **Dan Mauldin\*** and **Mariusz Urbanski**, University of North Texas (878-58-331)

## Wednesday, January 13 (cont'd)

### AMS Special Session on Combinatorial Methods in Computational Algebraic Geometry, I

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Maximal minors of a generic matrix form a universal Gröbner basis.* (14)  
**Andrei Zelevinsky**, Northeastern University (878-13-451)
- 8:30 a.m. *Gröbner bases for algebras related to minors.* (15)  
 Preliminary report.  
**Rosa Huang** and **Edward L. Green\***, Virginia Polytechnic Institute and State University (878-13-494)  
 (Sponsored by David A. Cox)
- 9:00 a.m. *Graded modules of group representations.* (16)  
**S. Onn**, Rutgers University, Piscataway (878-13-255)
- 9:30 a.m. *Computation of polynomial invariants for finite groups.* (17)  
**L. C. Grove\***, University of Arizona, and **J. M. McShane**, Northern Arizona University (878-20-495)
- 10:00 a.m. *Young straightening rule and the flag variety.* (18)  
**Helene Barcelo**, Arizona State University (878-05-279)
- 10:30 a.m. *Sums of powers of complex linear forms.* (19)  
**Bruce Reznick**, University of Illinois, Urbana-Champaign (878-14-321)

### AMS Special Session on $C^*$ -algebras: 1943-1993 (A 50-Year Celebration), I

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *New approaches to problems that were first studied from the  $C^*$ -algebra point of view.* (20)  
**Israel M. Gelfand**, Rutgers University, New Brunswick (878-46-373) (Sponsored by Robert S. Doran)
- 8:30 a.m. Discussion
- 9:00 a.m. *Operator algebras and index theory.* (21)  
**Ronald G. Douglas**, State University of New York, Stony Brook (878-46-601)
- 9:30 a.m. *The invasion of algebraic topology.* (22)  
**Claude Schochet**, Wayne State University (878-19-736)
- 10:00 a.m. *Twenty-five years in the theory of type III von Neumann algebras.* (23)  
**Masamichi Takesaki**, University of California, Los Angeles (878-46-922)
- 10:30 a.m. *Asymptotic morphisms and operator  $K$ -theory.* (24)  
 Preliminary report.  
**Nigel Higson**, Pennsylvania State University, University Park (878-19-801)

### AMS Special Session on Stability and Asymptotic Behavior of Difference Equations, I

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Stability analysis of difference equations of finite delay.* (25)  
 Preliminary report.  
**Saber Elaydi**, Trinity University (878-39-275)
- 8:30 a.m. *LQ-optimal problems for systems of difference equations.* (26)  
**C. Corduneanu**, University of Texas, Arlington (878-39-437)
- 9:00 a.m. *Exponential dichotomy of difference equations and weighted composition operators.* (27)  
**Yuri Latushkin**, University of Missouri, Columbia (878-39-141)
- 9:30 a.m. *Existence and stability of equilibria and cycles of some nonlinear systems of difference equations.* Preliminary report. (28)  
**J. M. Cushing**, University of Arizona (878-39-207)
- 10:00 a.m. *On stability of interval matrices.* (29)  
**M. E. Sezer**, Bilkent University, Turkey, and **D. D. Siljak\***, Santa Clara University (878-15-410)  
 (Sponsored by Saber N. Elaydi)
- 10:30 a.m. *Spectral measures for limit circle difference operators.* (30)  
**Mourad E. H. Ismail\***, University of South Florida, and **David R. Masson**, University of Toronto, (878-33-839)

### AMS Special Session on Topology and Geometry, I

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Classifying sphere-foliated CMC submanifolds of space forms.* (31)  
**William C. Jagy**, Midwestern State University (878-53-156)
- 8:30 a.m. *Recent results in the Holonomy manifolds with an affine connection.* (32)  
**Robert McLean**, Texas A & M University, College Station (878-51-693)
- 9:00 a.m. *Critical points of the determinant of the Laplace operator.* (33)  
**Ken Richardson**, Rice University (878-53-753)
- 9:30 a.m. *Volume preserving diffeomorphisms of a manifold with boundary.* (34)  
**Guojun Liao**, University of Texas, Arlington (878-58-907)
- 10:00 a.m. *Initial boundary value problems for the Ricci flow.* Preliminary report. (35)  
**Georgi Kamberov**, Rice University (878-53-908)
- 10:30 a.m. *Twistor theory for indefinite Kähler manifolds.* (36)  
**Edward G. Dunne**, Oklahoma State University, Stillwater (878-53-936)

AMS Special Session on Holomorphic Spaces, I

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Schröder models for compact composition operators.*  
(37) **Joel H. Shapiro\***, Michigan State University, **Wayne Smith** and **David A. Stegenga**, University of Hawaii (878-47-187)
- 8:30 a.m. *Uniform approximation by rational functions.*  
(38) **James Thomson**, Virginia Polytechnic Institute and State University (878-30-99)
- 9:00 a.m. *Geometric interpolation between Hilbert spaces.*  
(39) **John E. McCarthy**, Washington University, and **Liming Yang\***, Virginia Polytechnic Institute and State University (878-30-58)
- 9:30 a.m. *Hyponormal Toeplitz operators with polynomial symbols.*  
(40) **Kehe Zhu**, State University of New York, Albany (878-47-59)
- 10:00 a.m. *Bounded point evaluations. Preliminary report.*  
(41) **Tavan T. Trent**, University of Alabama (878-47-708)
- 10:30 a.m. *Composition operators on weighted Hardy spaces.*  
(42) **Barbara D. MacCluer\***, University of Richmond, and **Carl C. Cowen**, Purdue University, West Lafayette (878-47-40)

AMS-MAA Special Session on Mathematics and Education Reform, I

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *SUMMA. Preliminary report.*  
(43) **William A. Hawkins, Jr.**, University of the District of Columbia (878-98-607)
- 8:30 a.m. *A change in perspective.*  
(44) **Julian F. Fleron**, State University of New York, Albany (878-97-211)
- 9:00 a.m. *Connections: The key to change.*  
(45) **Mary Montgomery Lindquist**, Columbus College (878-98-210)
- 9:30 a.m. *Writing, reflection, and communication in the high school mathematics curriculum.*  
(46) **Dan Fendel**, San Francisco State University and Interactive Mathematics Project (878-97-209)
- 10:00 a.m. *Recent geometry and its applications in grades K-12.*  
(47) **Joseph Malkevitch**, City University of New York, York College (878-97-530)
- 10:30 a.m. Discussion

MAA Minicourse #1: Part A

8:00 a.m.–10:00 a.m.

*Alternatives to the lecture method in collegiate mathematics.*  
**Julian Weissglass**, Mathematical Sciences Education Board

MAA Minicourse #2: Part A

8:00 a.m.–10:00 a.m.

*How to make effective use of inexpensive pocket computers to develop the concepts and techniques of calculus.*  
**Franklin Demana** and **Bert K. Waits**, Ohio State University

MAA Minicourse #3: Part A

8:00 a.m.–10:00 a.m.

*All right! I've got a graphing calculator. What happens next?*  
**Iris B. Fetta**, Clemson University

MAA Minicourse #4: Part A

8:00 a.m.–10:00 a.m.

*Unifying themes in discrete mathematics.*  
**Ralph Grimaldi**, Rose-Hulman Institute of Technology

AMS Session on Complex-Valued Functions, I

8:00 a.m.–10:55 a.m.

- 8:00 a.m. *On certain subclasses of meromorphic close-to-convex functions.*  
(48) **Hassoon Al-Amiri\*** and **Petru T. Mocanu**, Bowling Green State University (878-30-400) (Sponsored by John T. Gresser)
- 8:15 a.m. *On the coefficient multipliers of Bergman spaces.*  
(49) **Dragan Vukotic**, University of Michigan, Ann Arbor (878-30-164)
- 8:30 a.m. *A constructive approach to the Nevanlinna factorization theorem.*  
(50) **Gregory Bomash**, Michigan State University (878-30-140)
- 8:45 a.m. *An extension of a theorem of Hadamard and domination in the Bergman space.*  
(51) **Michael Stessin**, State University of New York, Albany (878-30-146)
- 9:00 a.m. *Remarks on functions with positive real part on the ball in  $C^n$ .*  
(52) **Clinton Kolaski**, University of Minnesota-Duluth (878-32-189)
- 9:15 a.m. *Vector spaces of functions with real zeroes.*  
(53) **Michael K. Oberle**, Oklahoma State University, Stillwater, **Steven L. Scott\***, **George T. Gilbert**, **Rhonda L. Hatcher** and **David F. Addis**, Texas Christian University (878-30-631) (Sponsored by Rhonda L. Hatcher)
- 9:30 a.m. *Some orthogonal polynomials associated with the Heisenberg algebra.*  
(54) **Warren Johnson**, University of Wisconsin, Madison (878-33-854)
- 9:45 a.m. *Face cluster sets of  $H^\infty(D^n)$  functions.*  
(55) Preliminary report.  
**John Riley**, Bloomsburg University of Pennsylvania (878-32-477)

## Wednesday, January 13 (cont'd)

- 10:00 a.m. *Annular solutions of Mahler's functional equation.* Preliminary report.  
(56) **Richard Daquila**, Ohio State University, Columbus (878-30-641) (Sponsored by Francis W. Carroll)
- 10:15 a.m. *Conformal mapping of a thick doubly connected domain.* Preliminary report.  
(57) **Richard Laugesen**, Washington University (878-30-733)
- 10:30 a.m. *Bounds for Faber coefficients of functions univalent in an ellipse.*  
(58) **Engin Haliloglu\*** and **Elgin H. Johnston**, Iowa State University (878-30-845)
- 10:45 a.m. *Geometric properties of some support points of univalent functions.*  
(59) **Intisar Qumsiyeh Hibschiweiler**, Daemen College (878-30-79)

### AMS Session on Partial Differential Equations, I

#### 8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Global existence of solutions of a nonlinear diffusion equation with forcing at the boundary.*  
(60) **Jeffrey R. Anderson**, Winona State University (878-35-150)
- 8:15 a.m. *Sampling theorems associated with boundary value problems for elliptic partial differential equations in  $R^n$ .*  
(61) **Peter A. McCoy**, United States Naval Academy (878-35-235)
- 8:30 a.m. *The inverse scattering problem for acoustic waves in an unbounded inhomogeneous medium.*  
(62) **Andrzej W. Kedzierawski**, Delaware State College (878-35-915)
- 8:45 a.m. *A priori estimates and regularization for a class of porous media equations.* Preliminary report.  
(63) **Koffi B. Fadimba\*** and **Robert C. Sharpley**, University of South Carolina, Columbia (878-35-883)
- 9:00 a.m. *A multigrid method for the solution of a semilinear elliptic equation.*  
(64) **A. W. Shaker**, Naval Postgraduate School (878-35-320) (Sponsored by Ismor Fischer)
- 9:15 a.m. *The approximation of solution of partial differential equations.* Preliminary report.  
(65) **Hushang Poorkarimi**, University of Texas-Pan American (878-35-251) (Sponsored by Monty B. Taylor)
- 9:30 a.m. *Separation of zeroes of solutions to a problem involving critical exponents.*  
(66) **Alexandra Kurepa\***, Texas Christian University, and **Alfonso Castro**, University of North Texas (878-35-811)
- 9:45 a.m. *On the qualitative behavior of some semilinear parabolic problems.*  
(67) **Escher Joachim**, University of Besancon, France (878-35-877) (Sponsored by Frank Neubrander)

- 10:00 a.m. *Identification of semiconductor doping profile from LBIC image.*  
(68) **Weifu Fang\***, West Virginia University, and **Kazufumi Ito**, North Carolina State University (878-35-344) (Sponsored by Stavros N. Busenberg)
- 10:15 a.m. *Approximation of the solution of a free boundary problem for the  $p$ -Laplacian.*  
(69) **Ruth Meyer**, Wichita State University (878-35-385)
- 10:30 a.m. *A characterization of solutions to a perturbed Laplace equation.*  
(70) **John Kelingos\*** and **Peter Massopust**, Vanderbilt University (878-35-807)
- 10:45 a.m. *Solitary waves with spin.* Preliminary report.  
(71) **Henry Warchall**, University of North Texas (878-35-796)

### MAA Session on Assessment Programs for the Undergraduate Major, I

#### 8:00 a.m.–10:25 a.m.

- 8:00 a.m. *Overview*  
(72) **Bernard L. Madison**, University of Arkansas (878-00-1212)
- 8:25 a.m. *Assessing students' reactions to new courses and to computers in the calculus.*  
(73) **Edith H. Luchins**, Rensselaer Polytechnic Institute (878-00-1001)
- 8:50 a.m. *Classroom assessment techniques in university mathematics.*  
(74) **Mary B. Martin**, Winthrop College (878-00-1002)
- 9:15 a.m. *Analyzing the value of a transitional mathematics course in the undergraduate mathematics program.*  
(75) **Judith Palagallo**, University of Akron (878-00-1005)
- 9:40 a.m. *Evaluating a new departmental common core curriculum.*  
(76) **John W. Emert**, Ball State University (878-00-1000)
- 10:05 a.m. *Evaluation of student mathematical growth.*  
(77) **Richard D. West**, United States Military Academy (878-00-1007)

### MAA Session on Empowering the Mathematical Community, I

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Empowering students to make the transition from pre-calculus to calculus.*  
(78) **Lee A. Norris**, Clark Atlanta University (878-00-1050)
- 8:10 a.m. *A math course taught from the student's perspective.*  
(79) **Suzanne Mente**, Alverno College (878-00-1048)



Program of the Sessions

- 8:20 a.m. *Toward a feminist algebra.*  
(80) **Randall K. Campbell-Wright\***, University of Tampa, and **Mary Anne Campbell**, Purdue University, West Lafayette (878-00-1035)
- 8:30 a.m. *Intermediate algebra using cooperative learning and peer study groups; empowering female students.*  
(81) **Marie T. McKellar**, Mercy College (878-00-1047)
- 8:40 a.m. *Empowering students to learn mathematics: Data analysis and the TI-81 graphics calculator.*  
(82) **Maria A. Reid**, Borough of Manhattan Community College of the City University of New York (878-00-1054)
- 8:50 a.m. *The "new majority" student: Do we have the right perspective?*  
(83) **James A. Epperson**, University of Texas, Austin (878-00-1040)
- 9:00 a.m. Question and answer period
- 9:05 a.m. *Empowering students through the faculty mentors program.*  
(84) **Jean B. Chan**, Sonoma State University (878-00-1036)
- 9:15 a.m. *Empowerment through involvement and enrichment.*  
(85) **Charles Roberts**, Michigan State University (878-00-1055)
- 9:25 a.m. *Teachers and parents as partners of the teaching and learning process in a multicultural society.*  
(86) **Yolanda de la Cruz**, Arizona State University (878-00-1039)
- 9:35 a.m. *Mathematical empowerment through the AUGMENT program.*  
(87) **Larry Copes**, Augsburg College (878-00-1037)
- 9:45 a.m. *Why ask why? Challenge and confidence building.*  
(88) **James Morrow**, Mount Holyoke College (878-00-1049)
- 9:55 a.m. *Empowering minority students with mathematical thought processes. Preliminary report.*  
(89) **Sohindar S. Sachdev**, Elizabeth City State University (878-00-1056)
- 10:10 a.m. *Empowering a learning community of underprepared mathematics students.*  
(90) **Arthur B. Powell**, Rutgers University, Newark (878-00-1052)
- 10:20 a.m. *Empowering students to learn from and with each other.*  
(91) **Kathleen Shannon**, Salisbury State University (878-00-1057)
- 10:30 a.m. *Encouraging individual learning, as well.*  
(92) **Simon Quint**, Stockton State College (878-00-1053)
- 10:40 a.m. *Let's give them something to talk about.*  
(93) **Jo Anne S. Growney**, Bloomsburg University (878-00-1042)

MAA Session on Interactive Learning Environments, I

8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Collaborative learning in intensive seminars.*  
(94) **Annalisa Crannell**, Franklin & Marshall College (878-00-1076)
- 8:15 a.m. *Workshop calculus with applications.*  
(95) **Nancy H. Baxter\*** and **Peter E. Martin**, Dickinson College (878-00-1072)
- 8:30 a.m. *Goals, benefits, and implications of networking.*  
(96) **Joseph D. Myers**, United States Military Academy (878-00-1085)
- 8:45 a.m. *Development and maintenance of student interactive learning environments.*  
(97) **Charles Roberts**, Michigan State University (878-00-1087)
- 9:00 a.m. *Interactive methods in differential equations.*  
(98) **John T. Nassar\***, Muhlenberg College, and **Chris Bruening**, Kiski School, Saltsburg, Pennsylvania (878-00-1086)
- 9:15 a.m. *Interactive laboratories in high school mathematics.*  
(99) **David M. Wells\*** and **Roy E. Myers**, Pennsylvania State University, New Kensington Campus (878-00-1091)
- 9:30 a.m. *Spreadsheets in a population dynamics course.*  
(100) **Charlie Jacobson**, Elmira College (878-00-1079)
- 9:45 a.m. *Graphing calculators need special learning environments.*  
(101) **Carole A. Bauer**, Triton College (878-00-1071)
- 10:00 a.m. *The role of cooperative studying in a college remedial mathematics class.*  
(102) **Julia K. McDonald**, University of Dubuque (878-00-1083)
- 10:15 a.m. *Computer algebra systems – tools that empower.*  
(103) **Robert J. Lopez**, Rose-Hulman Institute of Technology (878-00-1081)
- 10:30 a.m. *Using collaborative computers labs to learn about sequences and series.*  
(104) **Si Meyer** and **Jerry Przybylski\***, Elmira College (878-00-1084)
- 10:45 a.m. *When two cultures converge: Faculty collaboration as a model for student interaction.*  
(105) **Marcia Birken\*** and **Anne Coon**, Rochester Institute of Technology (878-00-1073)

MAA Session on Using Data and Computers in Teaching Statistics, I

8:00 a.m.–10:40 a.m.

- 8:00 a.m. *Teaching concepts in an introductory statistics course.*  
(106) **James Guffey**, Northeast Missouri State University (878-00-1197)
- 8:15 a.m. *Illustration of some theorems in an applied regression analysis course.*  
(107) **K. L. D. Gunawardena**, University of Wisconsin, Oshkosh (878-00-1198)

## Wednesday, January 13 (cont'd)

- 8:30 a.m. *Developing statistical thinking in a mathematical statistics course.* (108)  
**Mary R. Parker**, Austin Community College (878-00-1205)
- 8:40 a.m. *Data analysis: An adjunct to mathematical statistics at Oberlin College.* (109)  
**Jeffrey Witmer**, Oberlin College (878-00-1210)
- 8:55 a.m. *The evolution of an activity centered statistics course.* (110)  
**Michael A. Grajek**, Hiram College (878-00-1195)
- 9:05 a.m. *Visualization of statistical concepts.* (111)  
**James Lang**, Valencia Community College (878-00-1200)
- 9:20 a.m. *AIDS case projection for undergraduate statistics students.* (112)  
**Emelie Kenney**, Siena College (878-00-1199)
- 9:30 a.m. *Statistical explorations using student generated data.* (113)  
**Roland W. Dedekind**, Muhlenberg College (878-00-1192)
- 9:45 a.m. *Simulations, spreadsheets, and statistics.* (114)  
**Rosemary C. Farley\*** and **Marvin Bishop**, Manhattan College (878-00-1194)
- 9:55 a.m. *Generating data for simulation experiments.* (115)  
**Phil Steitz**, Beloit College (878-00-1208)
- 10:10 a.m. *Sampling + simulation - statistical understanding: computer graphics simulations of sampling distributions.* (116)  
**Sheldon P. Gordon\***, Suffolk Community College, and **Florence S. Gordon**, New York Institute of Technology (878-00-1196)
- 10:20 a.m. *Parallels between calculus reform and statistics education reform.* (117)  
**Patti Frazer Lock\*** and **Robin H. Lock**, Saint Lawrence University (878-00-1201)
- 10:30 a.m. Discussion

### AMS Session on Logic and Foundations

#### 8:15 a.m.–10:55 a.m.

- 8:15 a.m. *Forcing below  $\aleph_1$  in models of  $IS_1$ .* (118)  
**Annalisa M. Peterson**, Dartmouth College (878-03-880)
- 8:30 a.m. *An asymmetry in Gödel numbering.* (119)  
**Miriam Lipschutz-Yevick**, Rutgers University, Newark (878-03-661)
- 8:45 a.m. *Nonstandard methods and the primitive element theorem-hyperalgebraic primitive elements.* (120)  
**Matt Insall**, University of Missouri, Rolla (878-03-02)
- 9:00 a.m. *On the equivalence of certain consequences of the proper forcing axiom.* (121)  
**Leszek Piatkiewicz**, University of South Carolina (878-03-486)

- 9:15 a.m. *Effective versions of Ramsey's theorem.* (122)  
 Preliminary report.  
**Tamara J. Hummel**, University of Illinois, Urbana-Champaign (878-03-547)
- 9:30 a.m. *A special class of almost disjoint families.* (123)  
**Thomas E. Leathrum**, Dartmouth College (878-03-115)
- 9:45 a.m. *Embeddings into the lattice of ideals of R.E. degrees and its initial segments.* (124)  
**Frank P. Weber**, Concordia University-Wisconsin (878-03-492)
- 10:00 a.m. *Fiat sets.* (125)  
**Arthur D. Grainger**, Morgan State University (878-03-84)
- 10:15 a.m. *Analytic cell decomposition and the closure of  $p$ -adic semianalytic sets.* (126)  
**Nianzheng Liu**, Purdue University, West Lafayette (878-03-122)
- 10:30 a.m. *Borel diagonalization theorems and second-order arithmetic.* Preliminary report. (127)  
**Tianwen Ling**, Cameron University (878-03-87)
- 10:45 a.m. *Set-valued mappings on the reals.* (128)  
**Kandasamy Muthuvel**, University of Wisconsin, Oshkosh (878-04-327)

### AMS Session on Questions Arising From Physics

#### 8:15 a.m.–10:55 a.m.

- 8:15 a.m. *A minimalization principle for dynamic plastic flow.* Preliminary report. (129)  
**James D. Walker**, Southwest Research Institute, San Antonio, Texas (878-73-829)
- 8:30 a.m. *Integration over Hilbert spaces: Examples inspired by the harmonic oscillator.* (130)  
**Gopinath Kallianpur**, University of North Carolina, Chapel Hill, and **Vassilis G. Papanicolaou\***, Wichita State University (878-81-552)
- 8:45 a.m. *Moment maps at the quantum level.* (131)  
**Jiang-Hua Lu**, Massachusetts Institute of Technology (878-81-890)
- 9:00 a.m. *An example of a quantum group: The twisted  $Sp(2)$ .* (132)  
**Anna Paolucci**, University of Iowa (878-81-721)
- 9:15 a.m. *When do simulations reproduce statistics?* (133)  
**Gal Berkooz**, Cornell University (878-76-933)
- 9:30 a.m. *Three dimensional numerical and asymptomatic solutions for the peristaltic transport of a heat-conducting fluid.* (134)  
**Dalin Tang**, Worcester Polytechnic Institute (878-76-212)
- 9:45 a.m. *Numerical simulation of an incompressible thermal boundary layer.* Preliminary report. (135)  
**Wing Kwong Chui**, Tulane University (878-76-479)
- 10:00 a.m. *Critical levels for internal gravity waves in compressible shear flows.* (136)  
**Lokenath Debnath**, University of Central Florida (878-76-705)
- 10:15 a.m. *1-D Closure models for thin, viscoelastic, annular jets.* (137)  
**Karen D. Bolinger**, Arkansas State University (878-76-885) (Sponsored by Kichoon Yang)

- 10:30 a.m. (138) *A discrete velocity model for coagulation and diffusion of gases.* Preliminary report.  
**Matthew Ikle'**, University of Wisconsin, Madison (878-76-855)
- 10:45 a.m. (139) *Numerical solution of the 2-D, steady, Navier-Stokes equations using an upwind starter.*  
**Shyla Ranganath**, University of Texas, Arlington (878-65-535)

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AMS Session on Ordinary Differential Equations

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8:15 a.m.–10:55 a.m.

- 8:15 a.m. (140) *Construction of a cone for the method of cone-valued Lyapunov functions.* Preliminary report.  
**Semen Koksai**, University of Southwestern Louisiana (878-34-763)
- 8:30 a.m. (141) *Asymptotic behavior of a system of Itô-type stochastic differential equations.*  
**Bonita A. Lawrence\*** and **G. S. Ladde**, University of Texas, Arlington (878-34-544)
- 8:45 a.m. (142) *Functions that solve both initial value problems and delays.* Preliminary report.  
**G. Edgar Parker**, James Madison University (878-34-592)
- 9:00 a.m. (143)  *$C^1$ -wellposedness of a class of higher order abstract Cauchy problem.*  
**Ti Jun Xiao**, Yunnan Normal University, People's Republic of China (878-34-317)
- 9:15 a.m. (144) *Solutions of abstract second order differential equations with infinite delay.*  
**Jin Liang**, Kunming Institute of Technology, People's Republic of China (878-34-315)  
(Sponsored by Ti J. Xiao)
- 9:30 a.m. (145) *Semilinear equations at resonance with unbounded nonlinearity.* Preliminary report.  
**Zachariah Sinkala**, Middle Tennessee State University (878-34-354)
- 9:45 a.m. (146) *Nonlinear boundary value problems for ordinary differential equations.*  
**Jeffrey Ehme**, Spelman College (878-34-433)
- 10:00 a.m. (147) *A class of superlinear multi-parameter semi-positone problems.*  
**V. Anuradha\*** and **R. Shivaji**, Mississippi State University (878-34-514)
- 10:15 a.m. (148) *A connection problem for a certain differential equation of W. B. Ford's type.*  
**T. K. Puttaswamy**, Ball State University (878-34-306)
- 10:30 a.m. (149) *Variation of Lyapunov's method for dynamic systems on time scales.*  
**Billur Kaymakçalan**, Florida Institute of Technology (878-34-367)
- 10:45 a.m. (150) *A weaker "non-resonance" condition for nonlinear integro-differential equations with infinite delay.* Preliminary report.  
**Lance D. Drager\***, Texas Tech University, and **William Layton**, University of Pittsburgh (878-34-844)

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AMS Session on Commutative Algebra, I

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8:30 a.m.–10:55 a.m.

- 8:30 a.m. (151) *Hodge-components of cyclic homology for affine (quasi-homogenous) hypersurfaces.* Preliminary report.  
**Ruth Ingrid Michler**, University of California, Berkeley (878-13-161)
- 8:45 a.m. (152) *The ideal structure of  $Z * Z$ .*  
**Tilak De Alwis**, Southeastern Louisiana University (878-13-943)
- 9:00 a.m. (153) *Resultants and embeddings of the line in the plane.*  
**Jietai Yu**, University of Notre Dame (878-13-113)
- 9:15 a.m. (154) *When a free module of finite rank is an infinite direct product.*  
**John D. O'Neill**, University of Detroit (878-13-138)
- 9:30 a.m. (155) *Some interesting properties of modular arithmetics.* Preliminary report.  
**Paul T. Fjelstad**, Northfield, Minnesota (878-13-869)
- 9:45 a.m. (156) *Indecomposable modules over valuation domains.* Preliminary report.  
**Matt D. Lunsford**, Tulane University (878-13-485)
- 10:00 a.m. (157) *Some containment relations between classes of regular ideals.*  
**Nick Vaughan\***, University of North Texas, and **Denise Race**, E-Systems, Garland, Texas (878-13-597)
- 10:15 a.m. (158)  *$R$ -Hopf algebra orders in  $KC_4$ .* Preliminary report.  
**Robert Underwood**, State University of New York, College at Oswego (878-13-624)
- 10:30 a.m. (159) *Projective modules over monoid rings.*  
**Hongnian Li**, Washington University (878-13-60)
- 10:45 a.m. (160) *Universally coefficient domains and their relation to the cancellation problem for rings.*  
**Donald E. Spickler, Jr.**, University of Virginia (878-13-185)

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AMS Session on Structures With a Partial Order

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8:30 a.m.–10:55 a.m.

- 8:30 a.m. (161) *Tensor products of orthoalgebras.*  
**D. J. Foulis** and **M. K. Bennett\***, University of Massachusetts, Amherst (878-06-506)
- 8:45 a.m. (162) *Local ideals in orthoalgebras.*  
**David J. Foulis\*** and **M. K. Bennett**, University of Massachusetts, Amherst (878-06-764)
- 9:00 a.m. (163) *Distributivity and wellfounded semilattices.*  
**Carlos Serra Alves**, Trenton State College (878-06-101)
- 9:15 a.m. (164) *Posets of lists equivalent mod  $N$  and asynchronous embryonic cellgrowth. The algebra of monotonous ways and the lattice conjecture.* Preliminary report.  
**Dov Tamari**, New York, New York (878-06-06)

## Wednesday, January 13 (cont'd)

- 9:30 a.m. *Ideals in commutative BCK-algebras with condition(S).* (165)  
**Mary E. Hansen**, Indiana University, Kokomo (878-06-630)
- 9:45 a.m. *The lattice of ideals of a polynomial semiring.* (166)  
**Francisco E. Alarcon\***, Indiana University of Pennsylvania, and **Daniel D. Anderson**, University of Iowa (878-06-619)
- 10:00 a.m. *Perfect extensions of regular double Stone algebras.* (167)  
**Stephen D. Comer**, The Citadel (878-06-252)
- 10:15 a.m. *Mixed lattice semigroups.* (168)  
**Sirkka-Liisa Eriksson-Bique**, McGill University, (878-06-230)
- 10:30 a.m. *Reflexive and irreflexive dimension.* (169)  
**Larry J. Langley**, Dartmouth College (878-06-488)
- 10:45 a.m. *A categorical view of the Lindenbaum-Tarski theorem.* (170)  
**Han Zhang**, Tulane University (878-06-29)

### AMS Session on Probability, I

#### 8:30 a.m.–10:55 a.m.

- 8:30 a.m. *Some subspaces of  $M_p$  ( $p < 1$ ) with nonzero duals.* (171)  
**Michael R. Lloyd**, Kansas State University (878-60-195) (Sponsored by Andrew G. Bennett)
- 8:45 a.m. *Spectral analysis of  $M/G/1$  type markov chains.* (172)  
**H. R. Gail**, **S. L. Hantler\***, IBM T. J. Watson Research Center, Yorktown Heights, New York, and **B. A. Taylor**, University of Michigan, Ann Arbor (878-60-18)
- 9:00 a.m. *A uniformly modulated stationary model for forecasting athletic records.* (173)  
**Gholamreza G. Dargahi-Noubary**, Bloomsburg University of Pennsylvania (878-60-12)
- 9:15 a.m. *Base invariance implies Benford's Law.* (174) Preliminary report.  
**Theodore P. Hill**, Georgia Institute of Technology (878-60-237)
- 9:30 a.m. *Subexponentiality with remainder.* (175)  
**J. L. Geluk**, Erasmus University, (878-60-233)
- 9:45 a.m. *Minimax theorem for job search optimal stopping problems.* (176)  
**Frans A. Boshuizen**, Erasmus University, Rotterdam (878-60-232) (Sponsored by Theodore P. Hill)
- 10:00 a.m. *Strategic planning for capacity expansion under uncertainty.* Preliminary report. (177)  
**Michael Monticino\***, University of North Texas, and **James Weisinger**, Applied Decision Analysis, Inc., Menlo Park, California (878-60-432)

- 10:15 a.m. *A procedure for detection of periodicities in time series.* (178)  
**Zahira S. Khan\*** and **G. R. Dargahi-Noubary**, Bloomsburg University of Pennsylvania (878-60-359)
- 10:30 a.m. *On Bernoulli processes and fractal densities having infinitely-many singularities.* (179)  
**Chamont Wang\***, Trenton State College, and **Arthur R. Silverberg**, American Cyanamid, Princeton, New Jersey (878-60-325) (Sponsored by Carlos S. Alves)
- 10:45 a.m. *A short probabilistic proof for finiteness of moment conditions of  $GI/G/c$  queues.* (180)  
**Saeed Ghahramani**, Towson State University (878-60-841) (Sponsored by Coy L. May)

### AMS Session on History of Mathematics

#### 9:15 a.m.–10:40 a.m.

- 9:15 a.m. *Euler's Proof of  $\sum_{n=1}^{\infty} 1/n^2 = \pi^2/6$ .* (181)  
**Mark B. McKinzie\***, University of Wisconsin, Madison, and **Curtis D. Tuckey**, American Tel & Tel Bell Laboratories (878-01-881)
- 9:30 a.m. *Omar Khayyam Nishabouri (1048-1131): Mathematician, astronomer, poet.* (182)  
**Mohammad K. Azarian**, University of Evansville (878-01-33)
- 9:45 a.m. *Escher and mathematics.* (183)  
**Anne Hughes**, Saint John's University (878-01-152)
- 10:00 a.m. *An historical calculus for liberal arts honor students.* (184)  
**Daniel E. Otero**, Xavier University (878-01-136)
- 10:15 a.m. *Lebesgue integrals without measure.* (185) Preliminary report.  
**John Synowiec**, Indiana University, Northwest (878-01-68)
- 10:30 a.m. *Fréchet and early concepts of compactness.* (186)  
**Sebron C. Dale, Jr.**, Auburn University, Auburn (878-01-249)

### AMS CSP-JPBM Panel Discussion

#### 8:30 a.m.– 9:50 p.m.

*The future of federal science and mathematics funding.*

### Calculus Reform Study Group and MAA CUPM Subcommittee on Calculus Reform and the First Two Years Panel Discussion

#### 9:30 a.m.–10:55 a.m.

*Calculus reform and the AP calculus exam.*

### AMS-MAA Joint Panel Discussion

#### 9:30 a.m.–10:55 a.m.

*Best snapshots from doctoral departments.*

AMS Invited Address

10:05 a.m.–10:55 a.m.

- (187) *The proof of Kepler's conjecture on the sphere packing problem.*  
**Wu-Yi Hsiang**, University of California, Berkeley (878-00-956)

AMS-MAA Invited Address

11:10 a.m.–noon

- (188) *Geometry of the universe.* Preliminary report.  
**Robert Osserman**, Mathematical Sciences Research Institute, Berkeley and Stanford University (878-00-952)

National Science Foundation  
 Informal Discussion Group

noon–1:00 p.m.

Colloquium Lectures: Lecture I

1:00 p.m.–2:00 p.m.

- (189) *Nonlinear differential equations and Lagrangian coordinates.*  
**Luis A. Caffarelli**, Institute for Advanced Study

MAA Invited Address

2:15 p.m.–3:05 p.m.

- (190) *I am ashamed to tell you to how many figures I carried these computations, having no other business at the time.*  
**Peter B. Borwein**, Dalhousie University (878-00-960)

AMS Special Session on Continuum  
 Theory and Dynamical Systems, II

2:15 p.m.–5:35 p.m.

- 2:15 p.m. *Periodic point free maps of the torus with big rotation sets.*  
 (191) **Marcy Barge\*** and **Russ Walker**, Montana State University (878-58-523)
- 2:45 p.m. *Pisot numbers, strong shift equivalence, and SOB surfaces.*  
 (192) **Robert F. Williams**, University of Texas, Austin (878-58-218)
- 3:15 p.m. *A one parameter family where  $RLR^\infty$  occurs on an interval.*  
 (193) **Karen M. Brucks** and **Roza Galeeva\***, University of Wisconsin-Milwaukee (878-54-859)

- 3:45 p.m. *A partial order on the mapping class group of the three punctured disk.* Preliminary report.  
 (194) **Michael Handel**, City University of New York, Herbert H. Lehman College (878-58-692)

- 4:15 p.m. *The dance of the critical orbit for the tent family.* Preliminary report.  
 (195) **K. M. Brucks\***, **R. Galeeva**, University of Wisconsin-Milwaukee, **M. V. Otero-Espinar**, University de Santiago de Compostela, Spain, and **C. Tresser**, IBM, T.J. Watson Research Center, Yorktown Heights, New York (878-54-734)

- 4:45 p.m. *The shadowing property in totally disconnected spaces.* Preliminary report.  
 (196) **F. Botelho\*** and **M. Garzon**, Memphis State University (878-54-267)

- 5:15 p.m. *Rotation vectors for surface homeomorphisms.*  
 (197) **John Franks**, Northwestern University (878-58-548)

AMS Special Session  
 on History of Mathematics, I

2:15 p.m.–5:55 p.m.

- 2:15 p.m. *Early reactions to the set-theoretic paradoxes.* Preliminary report.  
 (198) **Alejandro R. Garciadiego**, Universidad Nacional Autonoma de Mexico, Mexico (878-01-106) (Sponsored by Victor J. Katz)

- 2:55 p.m. *Historical development of the Newton-Raphson method.*  
 (199) **Tjalling J. Ypma**, Western Washington University (878-01-13)

- 3:25 p.m. *Coping with the political past of East German mathematics.*  
 (200) **Reinhard Siegmund-Schultze**, Harvard University (878-01-577) (Sponsored by Thomas Archibald)

- 3:55 p.m. *Leonhard Euler's contributions to the foundations of celestial mechanics.*  
 (201) **Louise A. Golland**, University of Chicago, and **Ronald W. Golland\***, University of Chicago Computing Organizations (878-01-54)

- 4:25 p.m. *Historical environments for finite fields.*  
 (202) **Uta C. Merzbach**, LHM Institute, Georgetown, Texas (878-01-754)

- 5:05 p.m. *Eisenstein's misunderstood geometric proof of the quadratic reciprocity theorem.*  
 (203) **Reinhard C. Laubenbacher** and **David J. Pengelley\***, New Mexico State University, Las Cruces (878-01-147)

- 5:35 p.m. *Evolution of a class of traditional algebra problems.* Preliminary report.  
 (204) **David E. Kullman**, Miami University, Oxford (878-01-377) (Sponsored by Zoltan Balogh)

## Wednesday, January 13 (cont'd)

### AMS Special Session on Small Divisor Problems in Nonlinear Analysis, I

#### 2:15 p.m.–6:05 p.m.

- 2:15 p.m. *Normal forms for water waves.* (205) **Walter Craig**, Brown University (878-35-241)
- 2:45 p.m. *Bifurcations of periodic solutions for nonlinear telegraph equations.* Preliminary report. (206) **Guozhang Sun**, University of Massachusetts, Amherst (878-35-134)
- 3:15 p.m. *Global quasiperiodic solutions for the forced duffing equation in the symmetric case.* Preliminary report. (207) **Lu Ping Zhang**, University of Massachusetts, Amherst (878-34-133)
- 3:45 p.m. *Generating functions and the computation of homoclinic points.* Preliminary report. (208) **Eduardo Tabacman**, University of Minnesota, Minneapolis (878-99-378)
- 4:15 p.m. *On the structure of the rotation set in higher dimensions.* (209) **Hector E. Lomeli**, University of Minnesota, Minneapolis (878-34-598)
- 4:45 p.m. *Computation of domains of analyticity for some perturbative expansions of mechanics.* (210) **Rafael de la Llave** and **Stathis Tompaids\***, University of Texas, Austin (878-39-489) (Sponsored by Daniel L. Goroff)
- 5:15 p.m. *Dynamics of symplectic monotone recursion maps.* Preliminary report. (211) **Philip Boyland**, State University of New York, Stony Brook (878-58-649)
- 5:45 p.m. *Generalized energy barriers and the breakup of invariant curves in twist maps.* (212) **Daniel L. Goroff**, Harvard University (878-34-439)

### AMS Special Session on Combinatorial Methods in Computational Algebraic Geometry, II

#### 2:15 p.m.–5:35 p.m.

- 2:15 p.m. *Free and supersolvable arrangements between  $A_{n-1}$  and  $B_n$ .* (213) **Paul H. Edelman** and **Victor Reiner\***, University of Minnesota, Minneapolis (878-52-98)
- 2:45 p.m. *Computing with exponential sums over finite fields.* (214) **Despina Polemi**, State University of New York Agricultural and Technical College, Farmingdale (878-11-45)
- 3:15 p.m. *Representations of bond matroids and Picard groups of graph curves.* (215) **Rick Miranda**, Colorado State University (878-14-452)

- 3:45 p.m. *Maximum Betti numbers and a generalization of Macaulay's theorem.* (216) **Heather Hulett**, University of Illinois, Urbana-Champaign (878-13-652)
- 4:15 p.m. *Frobenius Borel ideals.* Preliminary report. (217) **Keith Pardue**, Brandeis University (878-14-898)
- 4:45 p.m. *On the component structure of the Hilbert scheme.* (218) **Alyson Reeves**, Brandeis University (878-14-493)
- 5:15 p.m. *Hook differences of a partition, and families of graded ideals in  $k[x,y]$ .* (219) **A. Iarrobino**, Northeastern University (878-05-250)

### AMS Special Session on $C^*$ -algebras: 1943-1993 (A 50-Year Celebration), II

#### 2:15 p.m.–5:35 p.m.

- 2:15 p.m. *Some current problems of  $C^*$ -algebraic quantum phenomenology.* (220) **Irving E. Segal**, Massachusetts Institute of Technology (878-46-363)
- 2:45 p.m. Discussion
- 3:15 p.m. *Numerical linear algebra and  $C^*$ -algebras.* (221) **William Arveson**, University of California, Berkeley (878-46-293)
- 3:45 p.m.  *$C^*$ -algebras and transformation groups.* (222) Preliminary report. **Judith A. Packer**, National University of Singapore, Republic of Singapore (878-46-461)
- 4:15 p.m. *Operator spaces and quantized functional analysis.* (223) **Edward G. Effros\***, University of California, Los Angeles, and **Zhong-Jin Ruan**, University of Illinois, Urbana-Champaign (878-46-620)
- 4:45 p.m. *Index theory without symbols.* (224) **Henri Moscovici**, Ohio State University, Columbus (878-58-546)
- 5:15 p.m.  *$C^*$ -algebras and the index of elliptic operators.* Preliminary report. (225) **Paul Baum**, Pennsylvania State University, University Park (878-19-806)

### AMS Special Session on Differential Geometry, I

#### 2:15 p.m.–6:05 p.m.

- 2:15 p.m. *Length comparisons for closed curves in Alexandrov spaces with curvature bounded above.* Preliminary report. (226) **Stephanie B. Alexander** and **Richard L. Bishop\***, University of Illinois, Urbana-Champaign (878-53-894)
- 2:45 p.m. *Proper conformal symmetries of spacetimes with divergence-free Weyl conformal tensor.* (227) **Ramesh Sharma**, University of New Haven (878-53-41)
- 3:15 p.m. *The "total Scalar curvature" as a symplectic invariant.* (228) **David E. Blair**, Michigan State University (878-53-38)

- 3:45 p.m. *Curves and surfaces.*  
(229) **Alfred Gray**, University of Maryland, College Park (878-53-770)
- 4:15 p.m. *Lightlike submanifolds of semi-Riemannian manifolds.*  
(230) **Aurel Bejancu**, Polytechnic Institute of Iasi, Romania, and **K. L. Duggal\***, University of Windsor (878-53-97)
- 4:45 p.m. *Classical geometries arising in feedback equivalence of control systems.*  
(231) **Robert B. Gardner**, University of North Carolina, Chapel Hill (878-49-362)
- 5:15 p.m. *Absolute equivalence of differential systems and applications to control theory.*  
(232) **W. F. Shadwick**, The Fields Institute, Ontario, Canada (878-58-469)
- 5:45 p.m. *Conservation laws for Darboux-integrable hyperbolic equations in the plane.* Preliminary report.  
(233) **N. Kamran**, McGill University, (878-58-341)

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AMS Special Session on Stability and Asymptotic Behavior of Difference Equations, II

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2:15 p.m.–7:05 p.m.

- 2:15 p.m. *Asymptotic behavior of solutions of Poincaré recursion equations.* Preliminary report.  
(234) **William F. Trench**, Trinity University (878-39-570)
- 2:45 p.m. *Linearized oscillations and global stability of difference equations.*  
(235) **Gerasimos Ladas**, University of Rhode Island (878-39-248)
- 3:15 p.m. *Boundedness and convergence to zero of solutions of a nonhomogeneous difference equation.*  
(236) **John R. Graef** and **Paul W. Spikes\***, Mississippi State University (878-39-748)
- 3:45 p.m. *Comparison theorems for a difference equation with memory.* Preliminary report.  
(237) **Allan Peterson**, University of Nebraska, Lincoln (878-39-70)
- 4:15 p.m. *Differentiation of solutions of difference equations with respect to boundary values and parameters.*  
(238) **Johnny Henderson\***, **Mark Horn** and **Laura Howard**, Auburn University, Auburn (878-39-21)
- 4:45 p.m. *Asymptotic behavior of discrete linear Hamiltonian systems.* Preliminary report.  
(239) **Calvin D. Ahlbrandt\***, University of Missouri, Columbia, **John W. Hooker** and **William T. Patula**, Southern Illinois University, Carbondale (878-39-569)
- 5:15 p.m. *Asymptotic properties of a discrete Schrödinger equation.*  
(240) **Ronald E. Mickens\*** and **Issa Randhani**, Clark Atlanta University (878-39-07)
- 5:45 p.m. *Multiple zeros of solutions of difference equations.* Preliminary report.  
(241) **Jerry Ridenhour**, Utah State University (878-39-926)
- 6:15 p.m. *Discrete linear oscillations.* Preliminary report.  
(242) **Shaozhu Chen**, Shandong University, People's Republic of China (878-39-474)

- 6:45 p.m. *Permanence and global attractivity in nonlinear difference equations.*  
(243) **V. L. Kocic\*** and **G. Ladas**, University of Rhode Island (878-34-741)

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AMS Special Session on Topology and Geometry, II

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2:15 p.m.–6:05 p.m.

- 2:15 p.m. *Chern-Simons theory via path integrals.*  
(244) **Dana S. Fine**, University of Massachusetts, Dartmouth (878-81-124)
- 2:45 p.m. *Intersections of topologically tame Kleinian groups.* Preliminary report.  
(245) **James W. Anderson**, Rice University (878-30-666)
- 3:15 p.m. *Nonsimple geodesics in hyperbolic 3-manifolds.* Preliminary report.  
(246) **Kerry N. Jones\*** and **Alan W. Reid**, University of Texas, Austin (878-57-819)
- 3:45 p.m. *Unlinked graphs in 3-manifolds.*  
(247) **Ying-Qing Wu**, University of Texas, Austin (878-57-154) (Sponsored by John E. Luecke)
- 4:15 p.m. *The Nielsen theory of fibrations.* Preliminary report.  
(248) **Edward C. Keppelmann**, Texas A & M University, College Station (878-55-909)
- 4:45 p.m. *Movie diagrams and simplex equations.*  
(249) **J. Scott Carter**, University of South Alabama, and **Masahico Saito\***, University of Texas, Austin (878-57-457)
- 5:15 p.m. *Two-generator links.*  
(250) **Amelia C. Jones**, University of Oregon (878-57-158) (Sponsored by Hans A. Koch)
- 5:45 p.m. *Homotopy unknotting number.* Preliminary report.  
(251) **Chris L. Morin**, University of Texas, Austin (878-57-254)

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AMS Special Session on Model Theory and Algebra, I

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2:15 p.m.–6:05 p.m.

- 2:15 p.m. *Reducts of countably categorical structures.* Preliminary report.  
(252) **Simon Thomas**, Rutgers University, New Brunswick (878-03-181) (Sponsored by Philip H. Scowcroft)
- 2:45 p.m. *Definable subsets of finite fields.*  
(253) **Zoe Chatzidakis\***, University of Paris VII, France, **Lou van den Dries**, University of Illinois, Urbana-Champaign, and **Angus Macintyre**, Oxford University, Mathematical Institute, England (878-03-680) (Sponsored by David E. Marker)
- 3:15 p.m. *How to classify Zassenhaus groups of finite Morley rank.*  
(254) **Ali Nesin**, University of California, Irvine (878-03-108)

## Wednesday, January 13 (cont'd)

- 3:45 p.m. *Definability of algebraic structures in separably closed fields.* (255)  
**Margit Messmer**, University of Freiburg, Germany (878-03-406)
- 4:15 p.m. *Cell decomposition of  $C$ -minimal structures.* (256)  
**Deirdre Haskell\***, College of the Holy Cross, and **Dugald Macpherson**, University of London, England (878-03-424)
- 4:45 p.m. *Trees and discs in valued fields.* (257)  
**Jan Holly**, Robert S. Dow Neurological Sciences Institute, Portland, Oregon (878-03-500)
- 5:15 p.m. *Locally finite existentially complete commutative rings.* (258)  
**Dan Saracino**, Colgate University (878-03-602) (Sponsored by David E. Marker)
- 5:45 p.m. *Linear orders definable in  $\sigma$ -minimal structures.* (259) Preliminary report.  
**Charles Steinhorn**, Vassar College (878-03-803)

## AMS Special Session on Holomorphic Spaces, II

### 2:15 p.m.–6:05 p.m.

- 2:15 p.m. *Multipliers of de Branges-Rovnyak spaces.* (260)  
**B. A. Lotto\*** and **D. Sarason**, University of California, Berkeley (878-47-921)
- 2:45 p.m. *The Paley-Wiener spaces  $E^p$ ,  $0 < p \leq 1$ .* (261) Preliminary report.  
**Carolyn M. Eoff**, University of Arkansas, Fayetteville (878-30-191)
- 3:15 p.m. *Hyponormal Toeplitz operators.* (262)  
**Carl C. Cowen**, Purdue University, West Lafayette (878-47-291)
- 3:45 p.m. *Some recent results about Bourgain algebras.* (263)  
**Pamela Gorkin**, Bucknell University (878-46-669)
- 4:15 p.m. *Beurling-type invariant subspaces of  $L^p_a(\mathbb{D})$  and their extremal functions.* (264)  
**Hakan Hedenmalm**, Uppsala University, Sweden, and **Boris Korenblum\***, State University of New York, Albany (878-30-190)
- 4:45 p.m. *An invariant subspace problem for  $p = 1$  Bergman spaces on slit domains.* (265)  
**William T. Ross**, University of Richmond (878-30-30)
- 5:15 p.m. *Pointwise bounded limits of rational functions on the string of beads.* (266)  
**John B. Conway**, University of Tennessee, Knoxville, **James J. Dudziak\***, Bucknell University, and **Mark S. Melnikov**, University Autonoma de Barcelona, Spain (878-30-177)
- 5:45 p.m. *Computing with harmonic functions.* (267)  
**Sheldon Axler**, Michigan State University (878-31-90)

## AMS-MAA Special Session on Mathematics and Education Reform, II

### 2:15 p.m.–6:05 p.m.

- 2:15 p.m. *Applied mathematics in the undergraduate curriculum.* (268)  
**Jerry Bona**, Pennsylvania State University, University Park (878-98-892)
- 2:45 p.m. *Effective curriculum, effective teaching, effective learning.* (269)  
**Amy Cohen**, Rutgers University, New Brunswick (878-98-925)
- 3:15 p.m. *The object of teaching is learning - Not teaching.* (270)  
**Hugo Rossi**, University of Utah (878-98-475)
- 3:45 p.m. *What research mathematicians can do for K-6 and vice versa.* Preliminary report. (271)  
**Judith Roitman**, University of Kansas (878-96-110)
- 4:15 p.m. *Getting mathematics to the right people.* (272)  
**Paul J. Sally, Jr.**, University of Chicago (878-96-891)
- 4:45 p.m. *Thoughts on the mathematical preparation of teachers.* Preliminary report. (273)  
**Alan Schoenfeld**, University of California, Berkeley (878-98-578)
- 5:15 p.m. *Changing institutions.* (274)  
**Judith S. Sunley**, National Science Foundation (878-98-821)
- 5:45 p.m. *The bump, bump, bumpety road.* Preliminary report. (275)  
**D. J. Lewis**, University of Michigan, Ann Arbor (878-98-635)

## MAA Minicourse #5: Part A

### 2:15 p.m.–4:15 p.m.

*Using supercalculators to enhance instruction and learning in linear algebra.* **Donald R. LaTorre**, Clemson University

## MAA Minicourse #:6 Part A

### 2:15 p.m.–4:15 p.m.

*Teaching the introductory statistics course.* **Donald L. Bently**, Pomona College, **Robin Lock**, S. Lawrence University, **Thomas L. Moore**, Grinnell College, **Mary Parker**, Austin Community College, and **Jeffrey A. Witmer**, Oberlin College

## AMS Session on Operator Theory, I

### 2:15 p.m.–4:40 p.m.

- 2:15 p.m. *Solvability of nonlinear equations with strong nonlinearities.* (276)  
**P. S. Milojević**, New Jersey Institute of Technology (878-47-24)



- 2:30 p.m. *Decomposable measures on locally compact abelian groups.* Preliminary report.  
(277) **Michael M. Neumann**, Mississippi State University (878-47-392)
- 2:45 p.m. *Sets of nonlinear operators paired with non-negative, continuous functions.* Preliminary report.  
(278) **David Gurney**, Southwestern Louisiana University (878-47-512)
- 3:00 p.m. *Elementary chains of invariant sub-spaces of a Banach space.* Preliminary report.  
(279) **Jon M. Clauss**, University of Oregon (878-47-50)
- 3:15 p.m. *Hilbert spaces and orthogonal polynomials.*  
(280) **Xianjin Li**, Purdue University, West Lafayette (878-47-850)
- 3:30 p.m. *On exponentially bounded  $C$ -cosine functions.*  
(281) **Sen-Yen Shaw**, National Central University, (878-47-816)
- 3:45 p.m. *Existence & convergence theorems for fixed points of asymptotically pseudocontractive mappings.*  
(282) **Xinlong Weng**, Marshall University (878-47-691)
- 4:00 p.m. *On the bifurcation from an eigeninterval.*  
(283) **Dan D. Pascali**, Forest Hills, NY (878-47-757)
- 4:15 p.m. *Random approximations and random fixed point theorems for continuous  $I$ -set-contractive random maps.*  
(284) **Tzu-Chu Lin**, University of Wisconsin, Milwaukee (878-47-358)
- 4:30 p.m. *Operators disjoint from lattice homomorphisms.* Preliminary report.  
(285) **David C. Carothers**, Hope College (878-47-918)

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### AMS Session on Commutative Algebra, II

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#### 2:15 p.m.–3:55 p.m.

- 2:15 p.m. *A ring representing a finite projective geometry.*  
(286) **Kazuchika Ushijima**, University of California, Riverside (878-13-847)
- 2:30 p.m. *Connectedness of a variety generated by an order ideal on the punctured spectrum.*  
(287) **Saeja Oh Kim**, University of Massachusetts, Dartmouth (878-13-162)
- 2:45 p.m. *Weakly abelian groups and cyclotomic rings.* Preliminary report.  
(288) **Ron Brown\***, University of Hawaii, Honolulu, and **David K. Harrison**, University of Oregon (878-13-443)
- 3:00 p.m. *Overrings of integral domains.*  
(289) **Sharon Emerson\***, Longwood College, and **Nick Vaughan**, University of North Texas (878-13-386)
- 3:15 p.m. *Seperable polynomials and weak henselizations.* Preliminary report.  
(290) **Thomas McKenzie**, University of Oregon (878-13-304)
- 3:30 p.m. *Kernel coefficient ideals.*  
(291) **Da-Qing Chen**, University of California, Riverside (878-13-163)

- 3:45 p.m. *Rings with an almost division algorithm.*  
(292) **Amir M. Rahimi**, University of Texas, Arlington (878-13-172)

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### AMS Session on Algebraic Structures, Topologized

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#### 2:15 p.m.–4:25 p.m.

- 2:15 p.m. *( $E$ - $M$ )-topological functors on topological algebras.*  
(293) **Vijaya L. Gompaa**, Ball State University (878-22-102) (Sponsored by Raghu R. Gompaa)
- 2:30 p.m. *Left continuous and right continuous operations in the Stone-Cech compactification of non-commutative semigroups.* Preliminary report.  
(294) **Patty Anthony**, Howard University (878-22-270) (Sponsored by Neil B. Hindman)
- 2:45 p.m. *Groups coarse quasi-isometric to the hyperbolic plane cross the real line.*  
(295) **Eleanor G. Rieffel**, University of California, Los Angeles (878-22-665)
- 3:00 p.m. *Cancellation in the Stone-Cech compactification of a discrete semigroup.*  
(296) **Neil Hindman\***, Howard University, and **Dona Strauss**, University of Hull, England (878-22-268)
- 3:15 p.m. *The locally finite hypertopology.*  
(297) **S. A. Naimpally**, Kuwait University, Kuwait (878-54-14)
- 3:30 p.m. *On the Nachbin compactification of products of totally ordered spaces.*  
(298) **D. C. Kent**, **Dongmei Liu\***, Washington State University, and **T. A. Richmond**, Western Kentucky University (878-54-402)
- 3:45 p.m. *Ordered compactifications with countable remainders.*  
(299) **D. C. Kent**, Washington State University, and **T. A. Richmond\***, Western Kentucky University (878-54-586)
- 4:00 p.m. *One-point compaction on convergence spaces.*  
(300) **Shing Seung So**, Central Missouri State University (878-54-794)
- 4:15 p.m. *The Baire property of function spaces with the compact-open topology.*  
(301) **Daniel K. Ma**, Auburn University, Auburn (878-54-640)

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### AMS Session on Geometry and Convexity

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#### 2:15 p.m.–3:55 p.m.

- 2:15 p.m. *Integer polyhedra and the perfect box.*  
(302) **B. E. Peterson\*** and **J. H. Jordan**, Washington State University (878-51-224)
- 2:30 p.m. *Dihedral angles of  $n$ -simplices.*  
(303) **Eung Chun Cho**, Kentucky State University (878-51-727)
- 2:45 p.m. *Between geometry and algebra.*  
(304) **Guanshen Ren**, College of Saint Scholastica (878-51-104)

## Wednesday, January 13 (cont'd)

- 3:00 p.m. *Two inequalities for rectangular solids.*  
(305) Preliminary report.  
**George Baloglou\***, State University of New York, College at Oswego, and **Phil E. Tracy, Jr.**, Liverpool, New York (878-52-509)
- 3:15 p.m. *Astral ( $n_4$ ) configurations.*  
(306) **Branko Grünbaum**, University of Washington (878-52-791)
- 3:30 p.m. *Tiling rectangular boards with trominoes.*  
(307) **Christopher Jepsen**, Grinnell College (878-52-515) (Sponsored by Charles H. Jepsen)
- 3:45 p.m. *On the Euler characteristic of finite unions of convex sets.*  
(308) **Beifang Chen**, Massachusetts Institute of Technology (878-52-504)

### AMS Session on Applied Mathematics

#### 2:15 p.m.–5:55 p.m.

- 2:15 p.m. *Chronal isomorphism, singularities, and black holes.*  
(309) **U. D. Vyas**, Winston-Salem State University (878-83-67)
- 2:30 p.m. *Values for partially defined games.* Preliminary report.  
(310) **David Housman**, Drew University (878-90-870)
- 2:45 p.m. *Extending Eaves' basic theorem of complementarity.*  
(311) **Charles Holly**, Portland State University (878-90-868)
- 3:00 p.m. *An average per capita formula for the Shapley value.*  
(312) **Irinel Dragan**, University of Texas, Arlington (878-90-48)
- 3:15 p.m. *Stability and stablization of neural networks.*  
(313) **E. Lin**, University of Illinois, Chicago (878-92-858)
- 3:30 p.m. *An SEI disease transmission model with density-dependent demographics.*  
(314) **Qing Lin Gao\*** and **Herbert W. Hethcote**, University of Iowa (878-92-793)
- 3:45 p.m. *Modeling the growth of cancer cell cultures by incorporating tumor growth factors.*  
(315) **Sophia A. Maggelakis**, Rochester Institute of Technology (878-92-789)
- 4:00 p.m. *Quantitative curriculum development for the life sciences.*  
(316) **Louis J. Gross**, University of Tennessee, Knoxville (878-92-480)
- 4:15 p.m. *Discrete parameter singular control problem with state dependent noise.*  
(317) **Kandethody Ramachandran**, University of South Florida (878-93-94)
- 4:30 p.m. *On the stability properties of linear systems on Hilbert spaces.* Preliminary report.  
(318) **Yuanyin Wu\*** and **Raimund Ober**, University of Texas, Dallas (878-93-902)

- 4:45 p.m. *Polynomial fitting in a discrete control system.*  
(319) **Ali A. Ansari**, Virginia State University (878-93-767)
- 5:00 p.m. *A neural network approach for control of flexible systems.* Preliminary report.  
(320) **M. Nouri-Moghadam**, Pennsylvania State University, Lehman (878-93-762)
- 5:15 p.m. *Root locus for Birkhoff regular distributed parameter control systems.*  
(321) **Jianqiu He**, Texas Tech University (878-93-681)
- 5:30 p.m. *Nonlinear algebraic and differential equations.*  
(322) **John Jones, Jr.**, Air Force Institute of Technology (878-93-656)
- 5:45 p.m. *On the reconstruction of band-limited signals from their Hilbert transforms.*  
(323) **Ahmed I. Zayed**, University of Central Florida (878-94-266)

### AMS Session on Functions, Sequences, and Measures

#### 2:15 p.m.–5:40 p.m.

- 2:15 p.m. *Recursive relations.* Preliminary report.  
(324) **Firooz Khosraviyani\***, Laredo State University, **M. H. Moadab**, Virginia State University, and **John Abramowich**, 5335 N. Grandview, Odessa, Texas (878-65-919)
- 2:30 p.m. *Truth of a conjecture of Erdős on sequences and measurable sets.*  
(325) **Yu Chuen Wei**, Castleton State College (878-28-616)
- 2:45 p.m. *The Takaga operator, Bernoulli sequences, smoothness conditions and fractal curves.*  
(326) **Anca Deliu\***, Georgia Institute of Technology, and **Peter Wingren**, University of Umea, Sweden (878-28-679)
- 3:00 p.m. *The Kantorovich metric for probability measures on the circle.*  
(327) **Carlos A. Cabrelli\*** and **Ursula M. Molter**, University of Waterloo (878-28-852)
- 3:15 p.m. *Some remarks on Bernstein sets.* Preliminary report.  
(328) **Brian King**, Augusta College (878-28-595)
- 3:30 p.m. *Best filters for the general Fatou boundary limit theorem.*  
(329) **Jürgen Bliedtner**, University of Frankfurt, Germany, and **Peter A. Loeb\***, University of Illinois, Urbana-Champaign (878-28-244)
- 3:45 p.m. *Common periodic points of commuting functions.*  
(330) **Ahiasghar Alikhani-Koopaei**, University of Isfahan, Iran (878-26-368)
- 4:00 p.m. *Prevalance of chaotic differences for unpredictable functions.*  
(331) **J. W. Neuberger**, University of North Texas (878-26-326)
- 4:15 p.m. *McShane integration and strong differentiation.*  
(332) **Russell A. Gordon**, Whitman College (878-26-261)
- 4:30 p.m. *Approximate symmetry and L-points.* Preliminary report.  
(333) **Dean M. Oppegaard**, North Carolina State University (878-26-809)

## Program of the Sessions

- 4:45 p.m. *A generalization of Lyapounov's theorem.*  
(334) **Jose M. Gouweleeuw**, Vrije University, Amsterdam (878-28-226) (Sponsored by Theodore P. Hill)
- 5:00 p.m. *Characterizations of pre-turbulent functions.*  
(335) Preliminary report.  
**Selvaratnam Sridharma**, Northern Michigan University (878-26-766)
- 5:15 p.m. *Walsh functions and Grey codes.*  
(336) **Nasser Dastrange**, Buena Vista College (878-26-357)
- 5:30 p.m. *Fuzzy fractal functions and fuzzy fractal surfaces.*  
(337) **Peter R. Massopust**, Vanderbilt University (878-26-440)

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### MAA Session on Impact of Nontraditional Instructional Methods on Testing and Evaluation, I

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#### 2:15 p.m.–5:05 p.m.

- 2:15 p.m. *Changes in the testing environment resulting from heavy computer use in teaching.*  
(338) **Carol S. O'Dell**, Elizabeth City State University (878-00-1067)
- 2:40 p.m. *Writing intensive linear algebra, a successful accident.*  
(339) **Sherry Ettlich**, Southern Oregon State College (878-00-1062)
- 3:05 p.m. *Evaluating student presentations.*  
(340) **Mark Michael**, King's College (878-00-1066)
- 3:30 p.m. *The role of testing in a self-paced precalculus course.*  
(341) **Vincent P. Schielack, Jr.\*** and **Kirby C. Smith**, Texas A & M University, College Station (878-00-1068)
- 3:55 p.m. *Different goals, different assessments - Evaluating student learning in project CALC.*  
(342) **Jack Bookman**, Duke University (878-00-1059)
- 4:20 p.m. *Evaluating individual and group presentations in earth algebra, an innovative replacement for college algebra.*  
(343) **Chris Schaufele**, **Tina Straley\*** and **Nancy Zumoff**, Kennesaw State College (878-00-1069)
- 4:45 p.m. *The use of expository papers to evaluate homework problems.*  
(344) **John Koker**, University of Wisconsin, Oshkosh (878-00-1065)

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### MAA Session on Linear Algebra, I

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#### 2:15 p.m.–5:55 p.m.

- 2:15 p.m. *ATLAST: Augmenting the Teaching of Linear Algebra through the use of Software Tools.*  
(345) **Steven J. Leon**, University of Massachusetts, Dartmouth (878-00-1114)
- 2:40 p.m. *Motivating the Gram-Schmidt process by projections and graphics.*  
(346) **David R. Hill\*** and **David E. Zitarelli**, Temple University (878-00-1105)

- 2:55 p.m. *Computer graphics applications of linear algebra for mathematics students.*  
(347) **Karen E. Donnelly**, Saint Joseph's College (878-00-1101)
- 3:10 p.m. *Graphics for plane linear transformations.*  
(348) **David E. Zitarelli\*** and **David R. Hill**, Temple University (878-00-1125)
- 3:25 p.m. *There may be a vector space under your pillow.*  
(349) **Peter Ross**, Santa Clara University (878-00-1119)
- 3:40 p.m. *MATLAB tools for certain best approximation problems.*  
(350) **Donald F. Bailey**, Trinity University (878-00-1094)
- 3:55 p.m. *Computer exercises for linear algebra.*  
(351) **Renate McLaughlin**, University of Michigan, Flint (878-00-1116)
- 4:10 p.m. *Using MATLAB to help teach applications.*  
(352) **Jane Day**, San Jose State University (878-00-1100)
- 4:30 p.m. *An application of linear algebra: Exploring a three-dimensional dynamical system.*  
(353) **John Wilson**, Centre College (878-00-1123)
- 4:45 p.m. *Consequences of commutativity.*  
(354) **Scott H. Hochwald**, University of North Florida (878-00-1106)
- 5:00 p.m. *Minimum and characteristic polynomials of low-rank matrices.*  
(355) **William P. Wardlaw**, United States Naval Academy (878-00-1122)
- 5:15 p.m. *Square roots of (odd-ordered) identity matrices.*  
(356) **Robert Kantrowitz**, Hamilton College (878-00-1111)
- 5:30 p.m. *Generalized Vandermonde determinants.*  
(357) **Andre Yandl**, Seattle University (878-00-1124)
- 5:45 p.m. *Geometric introduction to linear algebra.*  
(358) **M. S. Jagadish**, Barry University (878-00-1107)

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### AMS-MAA-NAM Session, Program A

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#### 2:15 p.m.–6:00 p.m.

*Mathematics: A catalyst for educational progress in the year 2000 and beyond – filling the educational pipeline.*

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### Board on Mathematical Sciences Session

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#### 2:15 p.m.–3:45 p.m.

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### MAA Invited Address

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#### 3:20 p.m.–4:10 p.m.

- (359) *A special curriculum for exceptional students and integration in finite terms.*  
**Robert D. Richtmyer**, University of Colorado, Boulder

## Wednesday, January 13 (cont'd)

### AWM Panel Discussion

3:20 p.m.–4:20 p.m.

*Is geography destiny?*

### National Science Foundation Address

3:30 p.m.–4:20 p.m.

*The fiscal year 1993 budget and opportunities at NSF.*

### AWM Business Meeting and Prize Session

4:20 p.m.–4:50 p.m.

### CSP Invited Address

4:25 p.m.–5:15 p.m.

*Title to be announced.* **William Danforth**, Washington University, St. Louis

### MAA Minicourse #7: Part A

4:30 p.m.–6:30 p.m.

*Project CALC: Calculus as a laboratory course.* **Lawrence C. Moore** and **David A. Smith**, Duke University

### MAA Minicourse #8: Part A

4:30 p.m.–6:30 p.m.

*Environmental models.* **Roland H. Lamberson**, Humboldt State University

### MAA Section Officers

4:30 p.m.–6:30 p.m.

### AMS Informal Discussion Session

6:15 p.m.–7:30 p.m.

*Technical discussion of the proofs.* **Wu-Yi Hsiang**, University of California, Berkeley

## Interagency Commissions for Extramural Mathematics Programs Session

7:15 p.m.–8:15 p.m.

*Opportunities at ICEMAP agencies.*

### AMS Josiah Willard Gibbs Lecture

8:30 p.m.–9:30 p.m.

(360) *Fluid dynamics and fiber architecture of the heart and its valves.*

**Charles Samuel Peskin**, Courant Institute of Mathematical Sciences, New York University

## Thursday, January 14

### AMS Special Session on Continuum Theory and Dynamical Systems, III

8:00 a.m.–10:50 a.m.

8:00 a.m. *Periodicity and indecomposability.*

(361) **W. T. Ingram**, University of Missouri, Rolla (878-54-694)

8:30 a.m. *The geometry of laminations.*

(362) **R. J. Fokkink**, Delft University of Technology, Netherlands, and **L. G. Oversteegen**, University of Alabama, Birmingham (878-54-648)

9:00 a.m. *Inverse limits of unimodal interval maps.*

(363) Preliminary report. **Sarah Holte**, University of Missouri, Rolla (878-54-281)

9:30 a.m. *Topology of quadratic Julia sets.* Preliminary report.

(364) **John C. Mayer**, University of Alabama, Birmingham (878-30-865)

10:00 a.m. *Boundaries of Siegel disks.*

(365) **James T. Rogers, Jr.**, Tulane University (878-58-337)

10:30 a.m. *Knaster-like continua and complex dynamics.*

(366) **Robert L. Devaney**, Boston University (878-58-39)

### AMS Special Session on Combinatorial Methods in Computational Algebraic Geometry, III

8:00 a.m.–10:50 a.m.

8:00 a.m. *The sparse nullstellensatz.*

(367) **Paul Pedersen**, Cornell University (878-14-940)

8:30 a.m. *Algorithms for the Quillen Suslin theorem for monoid rings.* Preliminary report.

(368) **Cynthia Woodburn**, New Mexico State University, Las Cruces (878-14-651)

Program of the Sessions

- 9:00 a.m. *Barycentric coordinates for convex polytopes.*  
(369) Preliminary report.  
**Joe Warren**, Rice University (878-52-804)  
(Sponsored by David A. Cox)
- 9:30 a.m. *A convex geometric approach to counting the  
roots of a polynomial system.*  
(370) **J. Maurice Rojas**, University of California,  
Berkeley (878-14-856)
- 10:00 a.m. *An efficient algorithm for computing the sparse  
polynomial resultant.*  
(371) **Ioannis Z. Emiris**, University of California,  
Berkeley (878-14-899) (Sponsored by David A.  
Cox)
- 10:30 a.m. *Homogeneous coordinates for toric varieties.*  
(372) **David A. Cox**, Amherst College (878-14-496)

AMS Special Session on C\*-algebras:  
1943-1993 (A 50-Year Celebration), III

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Notes on the Gelfand-Neumark theorem.*  
(373) **Richard V. Kadison**, University of Pennsylvania  
(878-46-04)
- 8:30 a.m. Discussion
- 9:00 a.m. *C\*-algebras and Mackey's theory of group  
representations.*  
(374) **Jonathan Rosenberg**, University of Maryland,  
College Park (878-46-239)
- 9:30 a.m. *C\*-algebras and deformation quantization.*  
(375) Preliminary report.  
**Marc A. Rieffel**, University of California,  
Berkeley (878-46-324)
- 10:00 a.m. *Projections in C\*-algebras.*  
(376) **Bruce Blackadar**, University of Nevada  
(878-46-690)
- 10:30 a.m. *Products of exponentials in C\*-algebras.*  
(377) **N. Christopher Phillips**, University of Oregon  
(878-46-462)

AMS Special Session on Differential Geometry, II

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Astigmatic conjugacy and achronal boundaries.*  
(378) **Paul Ehrlich\*** and **Gerard Emch**, University of  
Florida (878-53-109)
- 8:30 a.m. *Spaces of geodesics.*  
(379) **John K. Beem**, University of Missouri,  
Columbia, **Robert J. Low**, Coventry  
Polytechnic, United Kingdom, and **Phillip E.  
Parker\***, Wichita State University (878-53-121)
- 9:00 a.m. *Casuality and Cauchy horizons.* Preliminary  
(380) report.  
**John K. Beem\***, University of Missouri, and  
**Andrzej Krolak**, Polish Academy of Sciences,  
Poland (878-53-19)
- 9:30 a.m. *Conformally stationary spacetimes. Hausdorff  
orbit spaces, and the shape of space.*  
(381) Preliminary report.  
**Steven G. Harris\***, Saint Louis University, and  
**Robert J. Low**, Coventry University, United  
Kingdom (878-53-76)

- 10:00 a.m. *Aspects of Lorentzian Buseman functions.*  
(382) Preliminary report.  
**Gregory J. Galloway\*** and **Arnaldo Horta**,  
University of Miami (878-83-923)
- 10:30 a.m. Discussion

AMS Special Session on Stability and Asymptotic  
Behavior of Difference Equations, III

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Some asymptotic properties of solutions of  
nonhomogeneous difference equations.*  
(383) **John R. Graef\*** and **Paul W. Spikes**,  
Mississippi State University (878-39-747)
- 8:30 a.m. *Riccati techniques for difference systems.*  
(384) Preliminary report.  
**Lynn Erbe**, University of Alberta (878-39-470)
- 9:00 a.m. *Differences between difference equations and  
differential equations.*  
(385) **John Hooker**, Southern Illinois University,  
Carbondale (878-39-896)
- 9:30 a.m. *Stability and oscillation in difference equations  
of infinite order.*  
(386) **Joseph Wiener**, University of Texas-Pan  
American (878-34-72)
- 10:00 a.m. *Oscillation, permanence, stability, and  
periodicity in a genotype selection model.*  
(387) **E. A. Grove\***, **V. L. Kocic**, **G. Ladas**, University  
of Rhode Island, and **R. Levins**, Harvard  
School of Public Health, Massachusetts  
(878-39-542)
- 10:30 a.m. *Boundedness of delay difference equations.*  
(388) **Shunian Zhang**, Anhui University, China  
(878-39-423) (Sponsored by John R. Graef)

AMS Special Session on  
Topology and Geometry, III

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Floppy curves and applications to nonsingular  
real algebraic curves.* Preliminary report.  
(389) **Patrick M. Gilmer**, Louisiana State University,  
Baton Rouge (878-57-139)
- 8:30 a.m. *Non-hyperbolic manifolds obtained by Dehn  
surgery on an hyperbolic knot.* Preliminary  
(390) report.  
**Mario Eudave-Muñoz**, Ciudad University,  
Mexico (878-57-780)
- 9:00 a.m. *Topological methods to compute Chern-Simons  
invariants.*  
(391) **Dave Auckly**, University of Texas, Austin  
(878-53-906)
- 9:30 a.m. *Curves in the boundary of a handlebody.*  
(392) **Edith Starr**, Rice University (878-57-743)
- 10:00 a.m. *Least area tori in 3-manifolds.*  
(393) **Max Neumann-Coto**, University National  
Autonoma de Mexico, Mexico (878-53-634)
- 10:30 a.m. *Continuity of the Liouville form of metrics of  
non-positive curvature.* Preliminary report.  
(394) **Sassan Mohseni**, University of Dallas  
(878-51-667)

## Thursday, January 14 (cont'd)

### AMS Special Session on Model Theory and Algebra, II

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Geometries of amalgamated vector spaces.*  
(395) Preliminary report.  
**Kitty Holland**, Simon Fraser University,  
(878-03-422)
- 8:30 a.m. *Quantifier elimination in wreath products.*  
(396) **Gregory Cherlin\***, Rutgers University, New  
Brunswick, and **Gary Martin**, University of  
Massachusetts, Dartmouth (878-03-346)
- 9:00 a.m. *Finitely presented right modules over a left  
pure-semisimple ring.*  
(397) **Ivo Herzog**, Brandeis University (878-16-333)  
(Sponsored by David A. Blair)
- 9:30 a.m. *Lie algebras of finite Morley rank.*  
(398) **Richard Rosengarten**, New Brunswick, New  
Jersey (878-03-857)
- 10:00 a.m. *Fields definable in  $O$ -minimal expansions of real  
closed fields.* Preliminary report.  
(399) **Anand Pillay**, University of Notre Dame  
(878-03-702)
- 10:30 a.m. *On reducts of differentially closed fields.*  
(400) Preliminary report.  
**Zeljko M. Sokolovic**, University of Notre Dame  
(878-03-798)

### AMS Special Session on Holomorphic Spaces, III

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Projected composition operators.*  
(401) **Richard Rochberg**, Washington University  
(878-46-527)
- 8:30 a.m. *General Carleson measures and similarity of  
subnormal operators.* Preliminary report.  
(402) **James Z. Qiu**, Virginia Polytechnic Institute and  
State University (878-30-198)
- 9:00 a.m. *On the commutant of Hilbert space operators.*  
(403) **W. R. Wogen**, University of North Carolina,  
Chapel Hill (878-47-240)
- 9:30 a.m. *On semigroups of operators on Hardy spaces.*  
(404) **J.-Cl. Evard** and **F. Jafari\***, University of  
Wyoming (878-47-11)
- 10:00 a.m. *Automorphism invariance of the operator-valued  
Poisson transform.*  
(405) **Raúl E. Curto**, University of Iowa (878-47-420)
- 10:30 a.m. *Hilbert space representations of spaces of  
bounded analytic functions.*  
(406) **Hari Bercovici**, Indiana University, Bloomington  
(878-47-332)

### AMS-MAA Special Session on Mathematics and Education Reform, III

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Mathematicians and primary grade teachers  
need each other.*  
(407) **Patricia Clark Kenschaft**, Montclair State  
College (878-96-335)
- 8:30 a.m. *A case study in mathematics education reform:  
The Arkansas mathematics crusade.*  
(408) **Calvin Piston**, John Brown University  
(878-98-259) (Sponsored by William G. Lau)
- 9:00 a.m. *Exploring creative mathematics with high school  
students and teachers.*  
(409) **Glenn Stevens**, Boston University (878-97-465)
- 9:30 a.m. *Faculty development at a large research  
university: We changed the culture by delta,  
now where's the epsilon?*  
(410) **Pat Shure**, University of Michigan, Ann Arbor  
(878-98-534)
- 10:00 a.m. *Northwestern's integrated science program: An  
experiment in Math/Science education.*  
(411) **Michael R. Stein**, Northwestern University  
(878-98-82)
- 10:30 a.m. *A project report about preparation for college  
teaching.*  
(412) **Bettye Anne Case**, Florida State University  
(878-98-290)

### MAA Minicourse #1: Part B

#### 8:00 a.m.–10:00 a.m.

*Alternatives to the lecture method in collegiate mathematics.*  
**Julian Weissglass**, Mathematical Sciences Education Board

### MAA Minicourse #9: Part A

#### 8:00 a.m.–10:00 a.m.

*Earth algebra: College algebra with applications to  
environmental issues.* **Christopher Schaufele** and **Nancy  
Zumoff**, Kennesaw State College

### AMS Session on Numerical Analysis and Dynamics

#### 8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Fast computation of eigenvalues, eigenvectors,  
and Schur canonical form.* Preliminary report.  
(413) **Jeffrey B. Haag\***, Humboldt State University,  
and **David S. Watkins**, Washington State  
University (878-65-792)
- 8:15 a.m. *Numerical solutions of differential-algebraic  
equations.*  
(414) **Ming-Gong Lee\***, University of Redlands, and  
**Tsung-Chieh Lin**, University of Iowa  
(878-70-603)

Program of the Sessions

- 8:30 a.m. *General-approximation-solvability of nonlinear equations involving A-regular operators.* Preliminary report.  
**Ram Verma**, University of Central Florida (878-65-180)
- 8:45 a.m. *A recursive approach to multivariate automatic differentiation.*  
**Dan Kalman\*** and **Robert Lindell**, The Aerospace Corporation, Los Angeles, California (878-65-723)
- 9:00 a.m. *Generalized rational identities of division rings involving derivations, automorphisms, and anti-automorphisms.* Preliminary report.  
**Gordon A. Swain**, University of Massachusetts, Amherst (878-16-615)
- 9:15 a.m. *Some observations for increasing the effectiveness of continuous Runge-Kutta processes.*  
**Curtis Outlaw**, **Leroy Derr** and **Diran Sarafyan\***, University of New Orleans (878-65-593)
- 9:30 a.m. *Distribution of floating point sums.* Preliminary report.  
**John K. Scheidt** and **Charles W. Schelin\***, University of Wisconsin, La Crosse (878-65-383)
- 9:45 a.m. *Quadratures for a class of singular integrals.* Preliminary report.  
**Javad Abdalkhani**, Ohio State University, Lima (878-65-355) (Sponsored by Mohamed F. Yousif)
- 10:00 a.m. *SOR method and singular value decomposition.*  
**Saadat Moussavi**, University of Wisconsin, Oshkosh (878-65-545)
- 10:15 a.m. *The dynamics of piecewise endomorphisms of free monoids.*  
**John Harrison**, State University of New York, Binghamton (878-68-932)
- 10:30 a.m. *Vector fields represented on the Torus and Klein bottle.*  
**Margaret M. LaSalle**, University of Southwestern Louisiana (878-68-214)
- 10:45 a.m. *A sinc method for the numerical solution of Abel integral equations.*  
**Bruce V. Riley**, University of Wisconsin, La Crosse (878-65-311)

AMS Session on Optimization,  
Stability and Uniqueness

8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Stability for functional differential equations.*  
(425) **Zhivko S. Athanassov**, Bulgarian Academy of Science, Bulgaria (878-34-797)
- 8:15 a.m. *Monotone iterative technique for nonlinear periodic integrodifferential systems with singular coefficients.* Preliminary report.  
(426) **Josaphat A. Uvah**, University of West Florida (878-34-783)

- 8:30 a.m. *The standard triple bubble type is the least-perimeter way to enclose three connected areas.* Preliminary report.  
(427) **Chris Cox**, **Michael Hutchings\***, **Lisa Harrison**, **Susan Kim**, **Janette Light**, **Andrew Mauer** and **Meg Tilton**, Northwestern University (878-49-199) (Sponsored by Frank Morgan)
- 8:45 a.m. *A Lagrange multiplier rule for optimal control and constrained calculus of variation problems.*  
(428) **John Gregory\*** and **Cantian Lin**, Southern Illinois University, Carbondale (878-49-313)
- 9:00 a.m. *Integral global optimization of robust discontinuous functions.*  
(429) **Quan Zheng**, Clemson University (878-49-683)
- 9:15 a.m. *Optimal control theory in cancer chemotherapy.* Preliminary report.  
(430) **Alireza Farahani**, University of Rhode Island (878-49-520)
- 9:30 a.m. *Group classification and partially invariant solutions for generalized Burgers equations.*  
(431) **S. K. Rai\***, University of Arkansas, and **C. C. A. Sastri**, Dalhousie University, (878-35-884)
- 9:45 a.m. *Uniqueness of the Hopf weak solutions of the Navier-Stokes equations.*  
(432) **T. L. Gill** and **W. W. Zachary\***, Howard University (878-35-403)
- 10:00 a.m. *A priori estimates and uniqueness of inflection points for positive solutions of semipositone problems.* Preliminary report.  
(433) **Joseph A. Iaia**, University of North Texas (878-34-318)
- 10:15 a.m. *Existence and uniqueness of entire function solutions of higher order differential equations.*  
(434) **Ti Jun Xiao**, Yunnan Normal University, People's Republic of China, and **Jin Liang\***, Kunming Institute of Technology, People's Republic of China (878-34-316)
- 10:30 a.m. *Asymptotic stability results for a class of singular diffusion problems.* Preliminary report.  
(435) **J. B. Garner\*** and **R. J. Schilling**, University of Arkansas, Little Rock (878-34-285)
- 10:45 a.m. *Restrictive stability results by Lyapunov's second method.* Preliminary report.  
(436) **A. S. Vatsala**, University of Southwestern Louisiana (878-34-759)

AMS Session on Elementary Number Theory

8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Lucas' theorem for generalized binomial coefficients.*  
(437) **Diana L. Wells**, University of North Dakota, Grand Forks (878-11-35)
- 8:15 a.m. *On certain digital properties of integers.*  
(438) **Robert E. Kennedy\*** and **Curtis Cooper**, Central Missouri State University (878-11-795)
- 8:30 a.m. *On the number of 1's in the sequence of positive integers less than  $n$ .*  
(439) **Curtis Cooper\*** and **Robert E. Kennedy**, Central Missouri State University (878-11-815)
- 8:45 a.m. *Finite upper half planes are pseudo-random graphs.*  
(440) **Steven C. Poulos**, Xavier University (878-11-745)

## Thursday, January 14 (cont'd)

- 9:00 a.m. *"Upper" half planes over various fields.*  
(441) **Cynthia E. Trimble**, University of California at San Diego, La Jolla (878-11-732)
- 9:15 a.m. *Finite upper half planes.*  
(442) **Jeffrey P. Angel**, University of California at San Diego, La Jolla (878-11-719)
- 9:30 a.m. *On the density of rational and irrational real numbers.*  
(443) **C. Muses**, Mathematics & Morphology Education and Research Centre, British Columbia, Canada (878-11-707)
- 9:45 a.m. *The Ramanujan number.* Preliminary report.  
(444) **Baikunth Prasad Ambasht\***, , and **Jamuna P. Ambasht**, Benedict College (878-11-388)  
(Sponsored by Jamuna P. Ambasht)
- 10:00 a.m. *On the last factor of period polynomials for finite fields.*  
(445) **Stanley Gurak**, University of San Diego (878-11-366) (Sponsored by Stacy G. Langton)
- 10:15 a.m. *Infinite products and Fibonacci numbers.*  
(446) **Don Redmond**, Southern Illinois University, Carbondale (878-11-662)
- 10:30 a.m. *Irrational sums.*  
(447) **Jau-Shyong Peter Shiue**, University of Nevada (878-11-614)
- 10:45 a.m. *A number - Theoretic proof concerning algebraic differential equations.*  
(448) **Georg Martin Reinhart**, University of Illinois, Chicago (878-11-939)

### AMS Session on Partial Differential Equations, II

#### 8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Head-of-the-line processor sharing for many symmetric queues with finite capacity.*  
(449) **John A. Morrison**, American Tel & Tel Bell Laboratories (878-35-57)
- 8:15 a.m. *Almost periodic solutions to an integro-partial equation.*  
(450) **Yoshihiro Hamaya**, University of Texas, Arlington (878-35-628) (Sponsored by Constantin Corduneanu)
- 8:30 a.m. *Blow-up of solutions for nonlinear reaction-diffusion systems.*  
(451) **Hongwei Chen**, Christopher Newport College (878-35-450)
- 8:45 a.m. *An inverse scattering algorithm for layered, electromagnetically dispersive media.*  
(452) **Thomas M. Roberts**, AL/OEDA, Armstrong Laboratory, Brooks Air Force Base, Texas (878-35-773)
- 9:00 a.m. *Center manifolds for quasilinear reaction diffusion systems.*  
(453) **Gieri Simonett**, University of California, Los Angeles (878-35-638) (Sponsored by Hector O. Fattorini)

- 9:15 a.m. *Some results for a nonlinear system of evolution equations.* Preliminary report.  
(454) **Seth F. Oppenheimer**, Mississippi State University (878-35-752)
- 9:30 a.m. *Growth and regularity of solutions of hypoelliptic equations.*  
(455) **Morteza Shafii-Mousavi**, Indiana University, South Bend (878-35-582)
- 9:45 a.m. *Recovering the impedance from the transmission data.*  
(456) **T. Maheswaran**, Iowa State University (878-35-751)
- 10:00 a.m. *Asymptotics of weakly nonlinear equations.*  
(457) **Chirakkal V. Easwaran**, State University of New York, College at New Paltz (878-35-725)
- 10:15 a.m. *Microstructure models with secondary flux.*  
(458) **John Cook**, University of Texas, Austin (878-35-722)
- 10:30 a.m. *Radial solutions to a problem with jumping nonlinearities.*  
(459) **Alfonso Castro**, University of North Texas (878-35-717)
- 10:45 a.m. *Branches of radial solutions for semipositone problems.*  
(460) **Alfonso Castro, Sudhasree Gadam**, University of North Texas, and **R. Shivaji\***, Mississippi State University (878-35-650)

### MAA Session on Assessment Programs for the Undergraduate Major, II

#### 8:00 a.m.–9:45 a.m.

- 8:00 a.m. *Assessing majors through a capstone course.*  
(461) **Charles F. Peltier**, St. Mary's College (878-00-1006)
- 8:25 a.m. *Assessment at Hood College.*  
(462) **M. Elizabeth Mayfield**, Hood College (878-00-1003)
- 8:50 a.m. *Mathematics as a part of common evaluation across the sciences.*  
(463) **Roger Nelson**, Ball State University (878-00-1004)
- 9:15 a.m. Open discussion of issues raised regarding assessment

### MAA Session on Interactive Learning Environments, II

#### 8:00 a.m.–10:40 a.m.

- 8:00 a.m. *Yet one more innovative approach to calculus.*  
(464) **Gary A. Harris**, Texas Tech University (878-00-1078)
- 8:15 a.m. *Cooperative learning in a computerized classroom.*  
(465) **G. Daniel Callon**, Franklin College (878-00-1075)
- 8:30 a.m. *Cooperative learning in a mathematics course for prospective elementary teachers.*  
(466) **Jane F. Schielack**, Texas A & M University, College Station (878-00-1088)



## Program of the Sessions

- 8:45 a.m. *Calculus for chemists - A short course.*  
(467) **James M. Sobota**, University of Wisconsin, La Crosse (878-00-1090)
- 9:00 a.m. *Female students react to collaborative learning.*  
(468) **Janet Andersen**, Hope College (878-00-1070)
- 9:15 a.m. *A study of mathematics classes with computer and non-computer laboratories.*  
(469) **Wendy Coulombe**, North Carolina State University, and **David Mathews\***, Longwood College (878-00-1082)
- 9:30 a.m. *The effect of the graphing calculator on female students cognitive levels and spatial visualization.*  
(470) **Mary Margaret Shoaf-Grubbs**, College of New Rochelle (878-00-1089)
- 9:45 a.m. *How to develop and assess cooperative learning activities in mathematics.*  
(471) **Regina Baron Brunner**, Cedar Crest College (878-00-1074)
- 10:00 a.m. *An independent integrated calculus laboratory.*  
(472) **Vivian Kraines**, Meredith College (878-00-1080)
- 10:15 a.m. *Algebra applications for lotus: Linear.*  
(473) **Roosevelt Gentry**, Jackson State University (878-00-1077)
- 10:30 a.m. *The use of conjectures in cooperative learning.*  
(474) **Joe Yanik**, Emporia State University (878-00-1092)

### MAA Session on Use of Visualization in the Teaching of Mathematics, I

#### 8:00 a.m.–10:35 a.m.

- 8:00 a.m. *Mathematica in the classroom.*  
(475) **Stan Wagon**, Macalester College (878-00-1187)
- 8:15 a.m. *Some visual experiences with the TI-85 and the Harvard Consortium Calculus.*  
(476) **John F. Lucas**, University of Wisconsin, Oshkosh (878-00-1174)
- 8:30 a.m. *The effect of the graphing calculator on female students' cognitive levels and spatial visualization.*  
(477) **Mary Margaret Shoaf-Grubbs**, College of New Rochelle (878-00-1181)
- 8:45 a.m. *Algebra tutorial for excel spreadsheet: Advanced.*  
(478) **Roosevelt Gentry**, Jackson State University (878-00-1170)
- 9:10 a.m. *Teaching ordinary differential equations using computer software.*  
(479) **Mahmoud M. Fath El-Den**, Fort Hays State University (878-00-1168)
- 9:25 a.m. *Using visualization to promote understanding of solutions to first order ordinary differential equations.*  
(480) **Lila Roberts\***, Georgia Southern University, and **Frank Purcell**, MathSoft, Inc., Cambridge, Massachusetts (878-00-1178)
- 9:40 a.m. *An introduction to the vibrating spring using PHASER.*  
(481) **Mark Farris**, Midwestern State University (878-00-1167)

- 9:55 a.m. *Euclid's (Gaussian) algorithm: A lattice approach.*  
(482) **Steve Benson**, Santa Clara University (878-00-1163)
- 10:10 a.m. *Visualizing the chain rule and a neural network application.*  
(483) **Raul Rojas**, Free University of Berlin, Germany (878-00-1179)
- 10:25 a.m. *Critical thinking and teaching with DERIVE.*  
(484) **Tingxiu Wang**, Oakton Community College (878-00-1188)

### MAA Committee on Mathematicians Outside Academia Panel Discussion

#### 8:00 a.m.–9:20 a.m.

*Mathematical life outside academia: Common problems, goals and solutions.*

### SUMMA Workshop

#### 8:00 a.m.–9:50 a.m.

*Intervention projects for minority pre-college students.*

### AMS Session on Semigroups, et al

#### 8:15 a.m.–10:55 a.m.

- 8:15 a.m. *Conjugacy in groups of alternating links.*  
(485) **Karin Johnsgard**, University of Illinois, Urbana-Champaign (878-20-196)
- 8:30 a.m. *Endomorphism near-rings of  $p$ -groups generated by the automorphisms and inner automorphism groups.*  
(486) **Gary L. Peterson**, James Madison University (878-20-256)
- 8:45 a.m. *Matrices as products of involutions.*  
(487) **Francis A. Arlinghaus**, Youngstown State University (878-20-920)
- 9:00 a.m. *Mutually interassociative semigroups. Preliminary report.*  
(488) **Sheri J. Boyd\*** and **Matthew Gould**, Vanderbilt University (878-20-867)
- 9:15 a.m. *Lattice isomorphism. Preliminary report.*  
(489) **Kazem Mahdavi\***, State University of New York, College at Potsdam, and **John Poland**, Carleton University (878-20-77)
- 9:30 a.m. *The congruence extension property, the ideal extension property, and ideal semigroups.*  
(490) **Karen Dommert Aucoin**, Louisiana State University, Baton Rouge (878-20-85)
- 9:45 a.m. *The congruence extension property for completely simple semigroups.*  
(491) **Jill A. Dumesnil**, Louisiana State University, Baton Rouge (878-20-74)
- 10:00 a.m. *A  $q$ -analogue of the Cortex complex.*  
(492) **Andrew Mathas**, University of Illinois, Chicago (878-20-642) (Sponsored by Stephen D. Smith)

## Thursday, January 14 (cont'd)

- 10:15 a.m. *Inverse monoids of dot-depth two.*  
(493) **D. Cowan**, University of Lethbridge  
(878-20-686)
- 10:30 a.m. *Representations of right quasigroups.*  
(494) **T. S. R. Fuad**, Iowa State University  
(878-20-698)
- 10:45 a.m. *On the determination of commutative semigroups by their inverse semigroups of partial automorphisms.*  
(495) **Shu Zhang**, University of Arizona (878-20-613)

### AMS Session on Probability, II

#### 8:15 a.m.–10:55 a.m.

- 8:15 a.m. *Convergence of stochastic delay iterative processes.*  
(496) **G. S. Ladde**, University of Texas, Arlington  
(878-60-543)
- 8:30 a.m. *Wiener distributions and stochastic calculus.*  
(497) Preliminary report.  
**Mylan Redfern**, University of Southern Mississippi (878-60-472)
- 8:45 a.m. *Quantum field path integrals and the Johnson-Kallianpur formula.*  
(498) **David Betounes**, University of Southern Mississippi (878-60-460) (Sponsored by Mylan Redfern)
- 9:00 a.m. *Analytic conditions for Lyopounov functions on countable Markov chains.* Preliminary report.  
(499) **Mitchell Kotler**, University of Massachusetts, Amherst (878-60-617)
- 9:15 a.m. *Potential operators for some class of Markov processes.*  
(500) **Mikhail Novikov**, Western Kentucky University  
(878-60-585)
- 9:30 a.m. *Locally harmonizable random fields.* Preliminary report.  
(501) **Randall J. Swift**, Western Kentucky University  
(878-60-583)
- 9:45 a.m. *The symmetry group of a full probability measure.*  
(502) **Mark M. Meerschaert\***, Michigan State University, and **Jerry Alan Veeh**, Auburn University, Auburn (878-60-775) (Sponsored by John A. Wenzel)
- 10:00 a.m. *Hyperfinite representation of Brownian meander.*  
(503) **Vesna Musicki-Kovacevic**, University of Iowa  
(878-60-755)
- 10:15 a.m. *Generalized Feynman integrals via conditional Feynman integrals.*  
(504) **Dong Chung**, Sogang University, Korea, **Chull Park**, Miami University, Oxford, and **David Skoug\***, University of Nebraska, Lincoln  
(878-60-80)

- 10:30 a.m. *An operator-valued Yeh-Wiener integral, and a Kac-Feynman Wiener integral equation.*  
(505) **Chull Park\***, Miami University, Oxford, and **David L. Skoug**, University of Nebraska, Lincoln (878-60-231)
- 10:45 a.m. *Stochastic boundary value problems.*  
(506) **G. S. Ladde**, University of Texas, Arlington, and **M. Sambandham\***, Clark Atlanta University  
(878-60-710)

### AMS Special Session on History of Mathematics, II

#### 8:30 a.m.–10:50 a.m.

- 8:30 a.m. *Mathematical physics and the American mathematical community between the wars.*  
(507) **Loren J. Butler**, University of Chicago  
(878-01-280) (Sponsored by Thomas Archibald)
- 9:00 a.m. *Al-Kuhi's generalization of Archimedes' problem.*  
(508) **J. L. Berggren**, Simon Fraser University  
(878-01-464) (Sponsored by Victor J. Katz)
- 9:40 a.m. *Cox, Woodard and Claytor: Three early African American Mathematicians.*  
(509) **J. A. Donaldson**, Howard University  
(878-01-622)
- 10:20 a.m. *The origins of an interpolation formula.*  
(510) **J. J. Tattersall**, Providence College  
(878-01-155)

### AWM Emmy Noether Lecture

#### 9:00 a.m.–9:50 a.m.

- (511) *Hyperbolic geometry and spaces of Riemann surfaces.*  
**Linda Keen**, Lehman College

### MAA Panel Discussion

#### 9:30 a.m.–10:55 a.m.

*Reflections on ICME-92.*

### MAA Invited Address

#### 10:05 a.m.–10:55 a.m.

- (512) *Processing our image of minorities in mathematics.*  
**Sylvia T. Bozeman**, Spelman College  
(878-00-961)

AMS-MAA Invited Address

11:10 a.m.–noon

- (513) *Ramanujan, the lost notebook and I.*  
**George E. Andrews**, Pennsylvania State University, University Park (878-00-950)

National Science Foundation  
 Informal Discussion Group

noon–1:00 p.m.

Colloquium Lectures: Lecture II

1:00 p.m.–2:00 p.m.

- (514) *Nonlinear differential equations and Lagrangian coordinates.*  
**Luis A. Caffarelli**, Institute for Advanced Study

AMS Invited Address

2:15 p.m.–3:05 p.m.

- (515) *Sparse systems of polynomial equations.*  
**Bernd Sturmfels**, Cornell University (878-00-958)

AMS Special Session on  
 History of Mathematics, III

2:15 p.m.–4:05 p.m.

- 2:15 p.m. *The roots of commutative algebra in algebraic number theory.* Preliminary report.  
 (516) **Israel Kleiner**, York University (878-01-20) (Sponsored by Martin E. Muldoon)
- 3:00 p.m. *Hardy and mathematical realism.*  
 (517) **Thomas Drucker**, University of Wisconsin, Madison (878-01-576)
- 3:30 p.m. *F. Riesz's main period of functional-analytic work.*  
 (518) **Erwin O. Kreyszig**, Carleton University (878-01-08)

AMS Special Session on Small Divisor  
 Problems in Nonlinear Analysis, II

2:15 p.m.–4:35 p.m.

- 2:15 p.m. *Small denominators in partial differential equations.*  
 (519) **Clarence Eugene Wayne**, Pennsylvania State University, University Park (878-58-677)

- 2:45 p.m. *Resolving some small divisor problems via Sobolev spaces and the calculus of variations.* Preliminary report.  
 (520) **M. S. Berger**, University of Massachusetts, Amherst (878-34-132)

- 3:15 p.m. *An approach to the study of the break-up of invariant curves.*  
 (521) **John N. Mather**, Princeton University (878-34-412)

- 3:45 p.m. Discussion

AMS Special Session on Differential Geometry, III

2:15 p.m.–4:05 p.m.

- 2:15 p.m. *Harmonic deformations.* Preliminary report.  
 (522) **Bang-Yen Chen**, Michigan State University (878-53-42)
- 2:45 p.m. *Some low type submanifolds of projective spaces.* Preliminary report.  
 (523) **Ivko Dimitric**, Pennsylvania State University, Uniontown (878-53-376)
- 3:15 p.m. *Variational problems on contact manifolds.*  
 (524) **Shangrong Deng**, Southern College of Technology (878-53-343) (Sponsored by Krishan L. Duggal)
- 3:45 p.m. *A solution of Ambrose's problem in dimension two.*  
 (525) **James J. Hebda**, Saint Louis University (878-53-25)

AMS Special Session  
 on Model Theory and Algebra, III

2:15 p.m.–4:05 p.m.

- 2:15 p.m. *Two dimensional rigid subanalytic sets.* Preliminary report.  
 (526) **Leonard Lipshitz\*** and **Zachary Robinson**, Purdue University, West Lafayette (878-03-499)
- 2:45 p.m. *Limit sets of definable families.* Preliminary report.  
 (527) **Lou van den Dries**, University of Illinois, Urbana-Champaign (878-03-835)
- 3:15 p.m. *Defining exponential and power functions in  $O$ -minimal structures.* Preliminary report.  
 (528) **Chris Miller**, University of Illinois, Urbana-Champaign (878-03-349)
- 3:45 p.m. *Specializations in spaces of  $p$ -adic types.*  
 (529) **Luc Belair**, University of Quebec (878-03-449)

AMS Special Session on Low Dimensional  
 Geometric Dynamical Systems, I

2:15 p.m.–4:05 p.m.

- 2:15 p.m. *Infinite cascades of braids and smooth dynamical systems.*  
 (530) **Jean-Marc Gambaudo**, University of Nice, France, **Dennis Sullivan**, Graduate School & University Center, City University of New York, and **Charles Tresser\***, IBM (878-58-456)

## Thursday, January 14 (cont'd)

2:45 p.m. *Integration over chains with infinite mass and applications to dynamical systems.* Preliminary report.  
(531)

**Jenny Harrison**, University of California, Berkeley (878-58-900)

3:15 p.m. *The rigidity of dynamically defined cantor sets in one dimensional systems.*  
(532)

**Rafael de la Llave** and **R. Philip Schafer\***, University of Texas, Austin (878-58-947)

3:45 p.m. *Combinatorics, geometry and attractors of unimodal maps.*  
(533)

**Mikhail Lyubich**, State University of New York, Stony Brook (878-58-528)

### AMS Special Session on Quantum Groups, I

2:15 p.m.–4:05 p.m.

2:15 p.m. *Cohomology of quantum groups at roots of unity.*  
(534)

**Shrawan Kumar**, Tata Institute of Fundamental Research, (878-17-836)

2:45 p.m. *Quantum affine algebras and crystal bases.*  
(535)

**Kailash C. Misra**, North Carolina State University (878-17-271)

3:15 p.m. *Quantum groups and integrals of motion.*  
(536)

**Edward Frenkel**, Harvard University (878-17-837)

3:45 p.m. *Quantum affine algebras and holomorphic vector bundles.*  
(537)

**Pavel I. Etingof**, Yale University (878-17-838)

### MAA Minicourse #2: Part B

2:15 p.m.–4:15 p.m.

*How to make effective use of inexpensive pocket computers to develop the concepts and techniques of calculus.* **Franklin Demana** and **Bert K. Waits**, Ohio State University

### MAA Minicourse #3: Part B

2:15 p.m.–4:15 p.m.

*All right! I've got a graphing calculator. What happens next?* **Iris B. Fetta**, Clemson University

### MAA Minicourse #4: Part B

2:15 p.m.–4:15 p.m.

*Unifying themes in discrete mathematics.* **Ralph Grimaldi**, Rose-Hulman Institute of Technology

### MAA Minicourse #9: Part B

2:15 p.m.–4:15 p.m.

*Earth algebra: College algebra with applications to environmental issues.* **Christopher Schaufele** and **Nancy Zumoff**, Kennesaw State College

### AMS Session on Linear Spaces (Geometric Aspects)

2:15 p.m.–4:10 p.m.

2:15 p.m. *Extreme points of convex sets and Morse's lemma.* Preliminary report.  
(538)

**K. Sundaresan**, Cleveland State University (878-46-103)

2:30 p.m. *On the extreme point structure of the unit ball of  $IP(\mu, X)^*$ .* Preliminary report.  
(539)

**Zhibao Hu**, Miami University, Oxford (878-46-176)

2:45 p.m. *Geometry of spaces of vector-valued harmonic functions.*  
(540)

**Patrick Dowling**, **Zhibao Hu** and **Mark A. Smith\***, Miami University, Oxford (878-46-182)

3:00 p.m. *On extensions of norms which conserve geometrical properties.*  
(541)

**Marian Fabian**, Miami University (878-46-183) (Sponsored by Patrick N. Dowling)

3:15 p.m. *On a topological property of certain Calkin algebras.*  
(542)

**Michael J. Meyer**, Georgia State University (878-46-425)

3:30 p.m. *Uniform Kadec-Klee-Huff properties of vector-valued Hardy spaces.*  
(543)

**P. N. Dowling\***, Miami University, Oxford, and **C. J. Lennard**, University of Pittsburgh, Pittsburgh (878-46-174)

3:45 p.m. *A rigid space admitting compact operators.*  
(544)

**Paul Sisson**, University of South Carolina, Columbia (878-46-478)

4:00 p.m. *Maps associated with lattice homomorphisms on Banach lattices.*  
(545)

**William A. Feldman\*** and **Paula G. Young**, University of Arkansas, Fayetteville (878-46-760)

### AMS Session on Algebraic Geometry and Applied Group Theory

2:15 p.m.–3:55 p.m.

2:15 p.m. *Resultant techniques and Hensel's lemma.*  
(546)

**Edward Bishop**, University of Texas, El Paso (878-14-639)

2:30 p.m. *A new interpretation of the character of the group  $SO(2n+1)$ .*  
(547)

**Shi-Yuan Wei\***, Pennsylvania State University, Mont Alto Campus, and **David Bressoud**, Pennsylvania State University, University Park (878-05-371)

- 2:45 p.m. *Quotients for group actions over non-closed fields.* (548)  
**Ralph Bremigan**, Ball State University (878-14-769)
- 3:00 p.m. *Characters of centralizer algebras of mixed tensor representations of  $GL(r, \mathbb{C})$  and  $U_q(\mathfrak{gl}(r, \mathbb{C}))$ .* (549)  
**Thomas M. Halverson**, University of Wisconsin, Madison (878-05-846)
- 3:15 p.m. *Complete homogeneous varieties in prime characteristic.* (550)  
**Niels Lauritzen**, University of Illinois, Urbana-Champaign (878-14-119)
- 3:30 p.m. *Hadamard difference sets in nonabelian groups of order  $4p^2$ .* (551)  
**Joel E. Iiams**, Colorado State University (878-05-551)
- 3:45 p.m. *Quotients of  $G$ -stable subschemes, Cartesian diagrams, and embeddings.* (552)  
**Mark E. Huibregtse**, Skidmore College (878-14-215)

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### AMS Session on Operator Theory, II

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#### 2:15 p.m.–4:10 p.m.

- 2:15 p.m.  *$C_0$  and  $C_{11}$  contractions with finite defect. Dual operator algebras and multiplicity.* Preliminary report. (553)  
**George R. Exner\***, Bucknell University, **S. Jo Young**, Keimyung University, Korea, and **Il Bong Jung**, Kyungpook National University, Korea (878-47-89)
- 2:30 p.m. *Boundedness in  $L^1$  for Hankel operators on Bergman space.* Preliminary report. (554)  
**Daniel H. Luecking\***, University of Arkansas, and **Huiping Li**, State University of New York, Buffalo (878-47-827)
- 2:45 p.m. *Local derivations on operator algebras.* (555)  
**Randall L. Crist**, Texas A & M University (878-47-790)
- 3:00 p.m. *Semigroups affiliated with algebras of operators.* (556)  
**Paul L. Patterson\***, Saint Louis University, and **Timothy W. Randolph**, University of Missouri, Rolla (878-47-220)
- 3:15 p.m. *A model of families of doubly commuting quasinormal operators.* Preliminary report. (557)  
**Ximena Catepillan\***, Millersville University of Pennsylvania, **Marek Ptak**, University of Agriculture, Poland, and **Waclaw Szymanski**, West Chester University of Pennsylvania (878-47-605)
- 3:30 p.m. *Local spectral theory for composition operators.* Preliminary report. (558)  
**R. C. Smith**, Mississippi State University (878-47-393)
- 3:45 p.m. *Riemann surfaces and Toeplitz operators.* Preliminary report. (559)  
**Gholamreza Akbari**, University of Georgia (878-47-431)
- 4:00 p.m. *Natural conditions on the spectra of operators.* (560)  
**Scott H. Hochwald**, University of North Florida (878-47-69)

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### AMS Session on Teaching Mathematics: When, What and How

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#### 2:15 p.m.–4:10 p.m.

- 2:15 p.m. *A collaborative partnership between high school and university mathematics faculty.* Preliminary report. (561)  
**Connie Schrock**, **Elizabeth Yanik\*** and **Joe Yanik**, Emporia State University (878-97-390)
- 2:30 p.m. *Finding topics for students with limited backgrounds.* (562)  
**Jonathan M. Huntley** and **David E. Tepper\***, Bernard M. Baruch College, City University of New York (878-11-167)
- 2:45 p.m. *Using a computer algebra system in linear algebra.* (563)  
**John W. Davenport**, Georgia Southern University (878-98-398) (Sponsored by Arthur G. Sparks)
- 3:00 p.m. *Trigonometric identities in teaching calculus.* (564)  
**Bella Wiener**, University of Texas-Pan American (878-98-581) (Sponsored by Monty B. Taylor)
- 3:15 p.m. *Basing a calculus course on graphing calculator exploratory assignments.* (565)  
**Al Shenk**, University of California at San Diego, La Jolla (878-98-785)
- 3:30 p.m. *Narcissism and mathematical learning: Are they related?* Preliminary report. (566)  
**Malcolm Goldman\***, Courant Institute of Mathematical Sciences, New York University, and **Ruby S. Goldman**, New York, New York (878-98-521)
- 3:45 p.m. *Change of basis.* (567)  
**Glenn Adamson**, Ottawa University (878-98-828)
- 4:00 p.m. *Polynomial divisibility under composition.* (568)  
**Daniel Cass** and **Gerald Wildenberg\***, Saint John Fisher College (878-98-625) (Sponsored by John D. Blanton)

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### MAA Session on Empowering the Mathematical Community, II

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#### 2:15 p.m.–4:10 p.m.

- 2:15 p.m. *Proof as a convincing argument that answers-why?* (569)  
**David W. Henderson**, Cornell University (878-00-1044)
- 2:30 p.m. *Some ideas on empowerment that work.* (570)  
**Lee Lorch**, York University (878-00-1046)
- 2:45 p.m. *Collaborative learning of fractal geometry and chaos theory by educationally disadvantaged students.* (571)  
**Martin Hoffman**, Queens College, City University of New York (878-00-1045)
- 3:00 p.m. *Empowering the mathematics major.* (572)  
**Henry Gore**, Morehouse College (878-00-1041)
- 3:15 p.m. Question and answer period

## Thursday, January 14 (cont'd)

- 3:20 p.m. *Active power through noneurocentric critical math.*  
(573) **S. E. Anderson**, Eugene Lang College (878-00-1034)
- 3:35 p.m. *Empowerment in mathematics education and ethnomathematics.*  
(574) **Ubiratan D'Ambrosio**, University Estadual de Campinas, Spain (878-00-1038)
- 3:50 p.m. *Empowering students of topology.*  
(575) **Nancy Lineken Hagelgans**, Ursinus College (878-00-1043)
- 4:05 p.m. Question and answer period

### MAA Session on Impact of Nontraditional Instructional Methods on Testing and Evaluation, II

#### 2:15 p.m.–4:15 p.m.

- 2:15 p.m. *Evaluation of student performance in a revised core mathematics program.*  
(576) **David C. Arney** and **Frank R. Giordano\***, United States Military Academy (878-00-1063)
- 2:40 p.m. *Graphics calculators? Fine, but how do we test students?*  
(577) **Elaine Hubbard**, Kennesaw State College (878-00-1064)
- 3:05 p.m. *Evaluation of groups and individuals when instruction is based on research in how people learn.*  
(578) **Ed Dubinsky**, Purdue University, West Lafayette (878-00-1060)
- 3:30 p.m. *A group oral final examination.*  
(579) **Theodore S. Erickson**, Wheeling Jesuit College (878-00-1061)
- 3:55 p.m. *Evaluation and testing techniques used with nontraditional learning activities.*  
(580) **Jean M. Alliman**, Hesston College (878-00-1058)

### MAA Session on Mathematics and the Arts, I

#### 2:15 p.m.–4:00 p.m.

- 2:15 p.m. *Mathematics and the visual arts.*  
(581) **Helen Christensen, RSM**, Loyola College (878-00-1129)
- 2:30 p.m. *Coordinate geometry, fact and fiction.*  
(582) **William P. Berlinghoff**, Farmington, Maine (878-00-1127)
- 2:45 p.m. *The symbiotic evolution of mathematics and art.*  
(583) **Raymond F. Coughlin**, Temple University (878-00-1130)
- 3:05 p.m. *A tiling scheme from M. C. Escher.*  
(584) **Daniel Davis**, Kingsborough Community College (878-00-1131)

- 3:20 p.m. *The art of curved mirrors.*  
(585) **Radoslav Dimitric**, Pennsylvania State University, University Park (878-00-1132)
- 3:35 p.m. *Variations on theme: Exploring mathematics through Hofstadter's Gödel, Escher, Bach.*  
(586) **John W. Emert**, Ball State University (878-00-1133)
- 3:50 p.m. *Musical composition and chaos.*  
(587) **Andrea K. Polli**, The School of the Art Institute of Chicago (878-00-1141)

### AMS Library Committee Panel Discussion

#### 2:15 p.m.–4:10 p.m.

*Publication costs: are they controllable?*

### MAA Committee on Computers in Mathematics Education Panel Discussion

#### 2:15 p.m.–4:10 p.m.

*Progress in mathematics education using computer graphics.*

### MAA Committee on Testing Panel Discussion

#### 2:15 p.m.–4:10 p.m.

*Assessment—its role in mathematics reform.*

### AMS-MAA-NAM Session, Program B

#### 2:15 p.m.–4:10 p.m.

*Mathematics: A catalyst for educational progress in the year 2000 and beyond—filling the educational pipeline.*

### MAA Session on Using Data and Computers in Teaching Statistics, II

#### 2:20 p.m.–4:15 p.m.

- 2:20 p.m. *Investigational statistics: A data driven course.*  
(588) **Donald Bentley**, Pomona College (878-00-1190)
- 2:40 p.m. *Introductory statistics: The "workshop" approach.*  
(589) **Allan J. Rossman**, Dickinson College (878-00-1206)
- 2:50 p.m. *A comparison of student versions of PC statistics packages.*  
(590) **Robin H. Lock**, Saint Lawrence University (878-00-1202)
- 3:05 p.m. *When does the "T statistic" have a t distribution?*  
(591) **Elliot A. Tanis\***, Hope College, and **Alexey G. Stepanov**, Michigan State University (878-00-1209)

Program of the Sessions

- 3:15 p.m. *Sometimes I get lucky.*  
(592) **Andre Michelle Lubecke**, Lander College  
(878-00-1203)
- 3:30 p.m. *Computer-based and research and quality  
control oriented course in basic statistics.*  
(593) **Sohindar Sachdev\***, **Ivory L. Lyons** and  
**Muhammad Mannan**, Elizabeth City State  
University (878-00-1207)
- 3:40 p.m. *Using Data Desk and projects in teaching  
probability and statistics.*  
(594) **Ernest J. Manfred**, United States Coast Guard  
Academy (878-00-1204)
- 3:55 p.m. *Personal data sets and computer technology in  
teaching statistics.*  
(595) **Cathy W. Carter\***, Christian Brothers University,  
and **Nancy F. Ellis**, Neumann College  
(878-00-1191)
- 4:05 p.m. *Using your college data as a data base.*  
(596) **Neil Eklund\***, Centre College, and **Robert  
Piziak**, Baylor University (878-00-1193)

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AMS Invited Address

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3:20 p.m.–4:10 p.m.

- (597) *You can't hear the shape of a drum.*  
**Carolyn S. Gordon**, Dartmouth College  
(878-00-955)
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MAA Business Meeting

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4:25 p.m.–4:55 p.m.

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AMS Business Meeting

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5:00 p.m.–5:30 p.m.

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MAA Minicourse #5: Part B

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6:00 p.m.–8:00 p.m.

*Using supercalculators to enhance instruction and learning in  
linear algebra.* **Donald R. LaTorre**, Clemson University

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MAA Minicourse #6: Part B

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6:00 p.m.–8:00 p.m.

*Teaching the introductory statistics course.* **Donald L. Bently**,  
Pomona College, **Robin Lock**, St. Lawrence University,  
**Thomas L. Moore**, Grinnell College, **Mary Parker**, Austin  
Community College, and **Jeffrey A. Witmer**, Oberlin College

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MAA Minicourse #7: Part B

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6:00 p.m.–8:00 p.m.

*Project CALC: Calculus as a laboratory course.* **Lawrence C.  
Moore** and **David A. Smith**, Duke University

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MAA Minicourse #8: Part B

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6:00 p.m.–8:00 p.m.

*Environmental models.* **Roland H. Lamberson**, Humboldt  
State University

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Joint Policy Board for Mathematics Session

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6:30 p.m.–7:30 p.m.

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MAA CAS Reunion

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7:00 p.m.–8:30 p.m.

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MAA Session on Linear Algebra, II

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7:30 p.m.–9:55 p.m.

- 7:30 p.m. *What are "gems" and why should you share  
yours?*  
(598) **Charles R. Johnson**, College of William &  
Mary (878-00-1109)
- 7:55 p.m. *Matrix factorizations.*  
(599) **Gilbert Strang**, Massachusetts Institute of  
Technology (878-00-1121)
- 8:20 p.m. *Difference equations in linear algebra  
instruction.*  
(600) **David C. Lay**, University of Maryland, College  
Park (878-00-1113)
- 8:40 p.m. *Down with determinants!*  
(601) **Sheldon Axler**, Michigan State University  
(878-00-1093)
- 9:00 p.m. *Supercalculators in linear algebra.*  
(602) **Donald R. LaTorre**, Clemson University  
(878-00-1112)
- 9:20 p.m. *The recommendations of the linear algebra  
study group and some of their classroom  
implications.*  
(603) **A. Duane Porter**, University of Wyoming  
(878-00-1118)
- 9:40 p.m. *Implementing the linear algebra curriculum  
study group recommendations.*  
(604) **David Carlson**, San Diego State University  
(878-00-1097)
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MAA Testing User Group

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7:30 p.m.–9:30 p.m.

## Thursday, January 14 (cont'd)

### MAA Poster Session

8:00 p.m.–10:00 p.m.

*Laboratory approaches in undergraduate mathematics.*

### MAA Open Discussion

8:00 p.m.–9:00 p.m.

*Open meeting on MAA strategic planning.*

## Friday, January 15

### AMS Special Session on History of General Topology, I

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Toward an outline history of general topology.*  
(605) **C. E. Aull**, Virginia Polytech Institute & State University (878-54-353)
- 8:30 a.m. *Maurice Fréchet and abstract general topology.*  
(606) **Angus E. Taylor**, University of California, Berkeley (878-01-135)
- 9:00 a.m. *Dilemma in topology (and in science): Bizarre vs. common.*  
(607) **Andrew Lelek**, University of Houston (878-54-427)
- 9:30 a.m. *The Alexandroff-Sorgenfrey line.*  
(608) **Douglas E. Cameron**, Clemson University (878-54-429) (Sponsored by Charles E. Aull)
- 10:00 a.m. *The history of some famous counterexamples in topology.*  
(609) **Stephen Watson**, York University, (878-01-800)
- 10:30 a.m. *Counterexamples in topology.* Preliminary report.  
(610) **George M. Reed**, University of Oxford, England (878-54-633) (Sponsored by Philip J. Moody)

### AMS Special Session on Commutative Algebra, I

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Strong Prüfer rings and the ring of finite fractions.*  
(611) **Thomas G. Lucas**, University of North Carolina, Charlotte (878-13-213)

- 8:30 a.m. *On the embedded primary components of ideals. I.*  
(612) **William Heinzer\***, Purdue University, West Lafayette, **L. J. Ratliff, Jr.**, University of California, Riverside, and **Kishor Shah**, Southwest Missouri State University (878-13-129)
- 9:00 a.m. *Feedback cyclization over PID's.*  
(613) **James W. Brewer\*** and **Lee C. Klingler**, Florida Atlantic University (878-13-417)
- 9:30 a.m. *Equivariant asanuma algebras.*  
(614) **Hyman Bass**, Columbia University (878-13-309)
- 10:00 a.m. *The probability of maximal rank for a matrix over a finite field.*  
(615) **David E. Dobbs\***, **Mark J. Lancaster** and **Robert M. McConnell**, University of Tennessee, Knoxville (878-13-171)
- 10:30 a.m. *Almost Dedekind domains and integer valued polynomials.*  
(616) **Alan Loper**, Ohio State University, Newark (878-13-413)

### AMS Special Session on Operator Theory and Triangular Operator Algebras, I

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Mayer Vietoris for Hochschild cohomology of operator algebras.* Preliminary report.  
(617) **Frank L. Gilleather\***, **Florin Pop**, University of New Mexico, and **Roger R. Smith**, Texas A & M University, College Station (878-47-438)
- 8:30 a.m. *Trace formulas and complete unitary invariant for some subnormal tuples.* Preliminary report.  
(618) **Daoxing Xia**, Vanderbilt University (878-47-47)
- 9:00 a.m. *When locally contractive representations are completely contractive.*  
(619) **Kenneth R. Davidson**, University of Waterloo (878-47-458)
- 9:30 a.m. *Nonstationary function theory: Point evaluation, Nevanlinna-Pick interpolation and commutant lifting.*  
(620) **Joseph A. Ball**, Virginia Polytechnic Institute and State University (878-47-260)
- 10:00 a.m. *Reflexivity of subnormal operators and  $n$ -tuples.*  
(621) **John E. McCarthy**, Washington University (878-47-142)
- 10:30 a.m. *Some results on maximal triangular algebras.*  
(622) **John L. Orr**, University of Nebraska, Lincoln (878-47-935)

### AMS Special Session on Integro-differential Equations: Stability and Control, I

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Trends in stability theory for IDE's of Volterra type.*  
(623) **V. Lakshmikantham**, Florida Institute of Technology (878-34-274)



Program of the Sessions

- 8:30 a.m. *Integro-differential equations as models for the spread of communicable diseases.* (624)  
**Fred Brauer**, University of Wisconsin, Madison (878-92-43)
- 9:00 a.m. *Weak exponential stability for IDE's of Volterra type.* (625)  
**S. Leela**, State University of New York, College at Geneseo (878-34-273)
- 9:30 a.m. *Differential approximations for viscoelasticity.* (626)  
**R. C. MacCamy**, Carnegie Mellon University (878-45-360)
- 10:00 a.m. *Optimal control of infinite dimensional systems governed by integro differential equations.* (627)  
**N. U. Ahmed**, University of Ottawa (878-93-71)
- 10:30 a.m. Discussion

AMS Special Session on Low Dimensional Geometric Dynamical Systems, II

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Smooth immersions of hypersurfaces.* (628)  
 Preliminary report.  
**Michael Hirsch**, Princeton University, and **Charles Pugh\***, University of California, Berkeley (878-58-781)
- 8:30 a.m. *A zeta function for positive templates.* (629)  
**Mike Sullivan**, University of Texas, Austin (878-58-22)
- 9:00 a.m. *A new Cayley-Hamilton theorem.* (630)  
**Stephen Kennedy**, Saint Olaf College, **Matthew Stafford\***, Northwestern University, and **R. F. Williams**, University of Texas, Austin (878-58-498)
- 9:30 a.m. *A cutting and stacking approach to pseudo-Anosov automorphisms.* (631)  
**C. R. Carroll**, State University of New York at Stony Brook (878-58-675)
- 10:00 a.m. *Dynamics of annulus homeomorphisms.* (632)  
 Preliminary report.  
**Philip Boyland**, State University of New York, College at Stony Brook (878-58-655)
- 10:30 a.m. *Structural stability in competitive and cooperative systems of ODEs.* (633)  
**Morris W. Hirsch**, University of California, Berkeley (878-34-345)

AMS-MAA Special Session on The State of Research in Undergraduate Mathematics Education: Problems and Prospects, I

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Undergraduate students' interpretations of statements of theorems.* Preliminary report. (634)  
**John Selden**, Vanderbilt University, and **Annie Selden\***, Tennessee Technological University (878-98-580)
- 8:40 a.m. *On learning fundamental concepts of group theory.* (635)  
**Rina Zazkis**, Simon Fraser University, (878-98-258) (Sponsored by Ed Dubinsky)

- 9:15 a.m. *Visualization in advanced mathematical thinking.* Preliminary report. (636)  
**Libby Krussel**, State University of New York, College at Cortland (878-98-415)
- 9:50 a.m. *Teachers' understanding of recursion.* Preliminary report. (637)  
**Eric W. Hart**, Maharishi International University (878-98-904)
- 10:25 a.m. *Leaks in the pipeline: College women's persistence in engineering and physical science from entry to graduation.* Preliminary report. (638)  
**Ann K. Schonberger**, University of Maine, Orono (878-98-533) (Sponsored by Ed Dubinsky)

MAA Minicourse #10: Part A

8:00 a.m.–10:00 a.m.

*Why, when and how to use CAS calculators in calculus and differential equations instruction.* **John Kenelly** and **Gil Proctor**, Clemson University

MAA Minicourse #11A: Part A

8:00 a.m.–10:00 a.m.

*Using group projects in calculus.* **Stephen Hilbert**, **John Maceli**, **Eric Robinson**, **Diane Schwartz** and **Stanley Seltzer**, Ithaca College

MAA Minicourse #12: Part A

8:00 a.m.–10:00 a.m.

*Bringing calculus to life.* **Robert Decker** and **John K. Williams**, University of Hartford

MAA Minicourse #13: Part A

8:00 a.m.–10:00 a.m.

*Teaching mathematical modeling.* **J. S. Hartzler**, Pennsylvania State University, Harrisburg

AMS Session on Complex-Valued Functions, II

8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Integrals of products of Bessel functions and applications.* (639)  
**Mihr Jahanian Shah**, Kent State University (878-33-426)
- 8:15 a.m. *Positive holomorphic line bundles over compact, flat manifolds – an algebraic description.* (640)  
**N. Michelacakis**, University College of London, England (878-32-128)

## Friday, January 15 (cont'd)

- 8:30 a.m. *BMO functions and global integrability of the gradient.* (641)  
**Craig A. Nolder**, Florida State University (878-30-879)
- 8:45 a.m. *Circle packing mappings form regularly exhaustible surfaces.* (642)  
**Kevin Callahan**, University of California at San Diego, La Jolla (878-30-312)
- 9:00 a.m. *Some simple criteria for starlikeness and convexity.* (643)  
**Petru T. Mocanu**, Bowling Green State University (878-30-56) (Sponsored by Sanford S. Miller)
- 9:15 a.m. *Differential inequalities and boundedness preserving integral operators.* (644)  
**Sanford Miller\***, State University of New York, College at Brockport, and **Petru Mocanu**, Babes-Bolyai University, Romania (878-30-507)
- 9:30 a.m. *The  $L^p$ -theory of first order elliptic systems of PDE's.* (645)  
**Qazi M. Dawood**, Syracuse University (878-30-487)
- 9:45 a.m. *Application of a distortion theorem to uniqueness of circle packings.* Preliminary report. (646)  
**Tomasz Dubejko\*** and **Kenneth Stephenson**, University of Tennessee, Knoxville (878-30-823)
- 10:00 a.m. *Sieved orthogonal polynomials.* Preliminary report. (647)  
**Blaise DeSesa**, Drexel University (878-33-389)
- 10:15 a.m. *Stirling relationships, II.* (648)  
**Joseph Arkin**, **David C. Arney**, **Frank R. Giordano** and **Rickey A. Kolb\***, United States Military Academy (878-11-17)
- 10:30 a.m. *Asymptotic formulas for the coefficients in the expansions of certain modular forms.* Preliminary report. (649)  
**Paul Bialek**, University of Illinois, Urbana-Champaign (878-11-197)
- 10:45 a.m. *Non-discrete discrepancy applications of a generalized energy integral.* Preliminary report. (650)  
**Allen D. Rogers**, Elmhurst College (878-11-848)

### AMS Session on Number Theory

#### 8:00 a.m.–10:40 a.m.

- 8:00 a.m. *An extension of a classical diophantine problem, II.* Preliminary report. (651)  
**Joseph Arkin\***, **David C. Arney**, **Frank R. Giordano**, **Rickey A. Kolb** and **Gerald E. Bergum**, United States Military Academy (878-11-16)
- 8:15 a.m. *Polynomials with a given discriminant over fields of algebraic functions of arbitrary characteristic.* (652)  
**Alexandra Shlapentokh**, East Carolina University (878-11-234)

- 8:30 a.m. *Diagonalizing spaces of Hilbert cusp forms.* (653)  
**Timothy W. Atwill**, Dartmouth College (878-11-302)
- 8:45 a.m. *A radial Erdős-Turán inequality.* (654)  
**Jeffrey J. Holt**, University of Texas, Austin (878-11-253)
- 9:00 a.m. *On construction of Jacobi forms.* (655)  
**Youngju Choie\*** and **Hyun Kwang Kim**, Pohang Institute of Science & Technology, Korea (878-11-930)
- 9:15 a.m. *Eigenvectors of circulant matrices of prime dimension.* (656)  
**Andrew J. Lazarus**, Berkeley, California (878-11-887)
- 9:30 a.m. *On concentrating sums of exponentials.* (657)  
**J. Marshall Ash**, DePaul University (878-11-874)
- 9:45 a.m. *A computer search for hexadecimal narcissistic numbers and loops.* (658)  
**John F. Lamb, Jr.**, East Texas State University (878-11-86)
- 10:00 a.m. *A propriety of smarandache function.* (659)  
**J. Thompson**, Tuscon, Arizona (878-11-758)
- 10:15 a.m. *A Lucas-type theorem for fibonomial-coefficient residues.* (660)  
**John M. Holte**, Gustavus Adolphus College (878-11-391)
- 10:30 a.m. *Elliptic units of cyclic unramified extensions of complex quadratic fields.* (661)  
**Farshid Hajir**, Massachusetts Institute of Technology (878-11-61)

### AMS Session on Fourier Analysis and Nonlinear Equations

#### 8:00 a.m.–10:55 a.m.

- 8:00 a.m. *On generalized  $d$ -functionals.* (662)  
**Bernd S. W. Schröder**, Hampton University (878-42-194)
- 8:15 a.m. *Monotonic doubling measures on the unit circle.* (663)  
**David Cruz-Uribe, SFO**, University of California, Berkeley (878-42-928)
- 8:30 a.m. *The uncertainty principle on Cayley graphs.* (664)  
**Elinor Velasquez**, University of California, Berkeley (878-42-889)
- 8:45 a.m. *Comparisons of absolutely convergent Fourier series.* (665)  
**Chin-Cheng Lin**, National Central University, and **Wei-Chi Yang\***, Radford University (878-42-663)
- 9:00 a.m. *Hypercontractive estimates for a class of probability measures.* Preliminary report. (666)  
**J. Michael Pearson**, Mississippi State University (878-42-788)
- 9:15 a.m. *Construction of a family of continuous wavelets via infinite products of two simultaneously triangularizable or symmetrizable matrices.* Preliminary report. (667)  
**Mohsen Maesumi**, Lamar University (878-42-851)

Program of the Sessions

- 9:30 a.m. *Orthogonal wavelets on the Cantor dyadic group*. Preliminary report.  
(668) **W. Christopher Lang**, Mississippi State University (878-43-750)
- 9:45 a.m. *New results on association of variables for solution of non linear equations*.  
(669) **Joyati Debnath**, Winona State University (878-44-15)
- 10:00 a.m. *Numerical inversion of multi-dimensional laplace transforms*. Preliminary report.  
(670) **M. V. Moorthy**, Ohio Dominican College (878-44-606)
- 10:15 a.m. *Tempered boehmians*. Preliminary report.  
(671) **Piotr Mikusinski**, University of Central Florida (878-44-265)
- 10:30 a.m. *On the existence and uniqueness for nonlinear integro-differential equations*.  
(672) **Mohammad Khavanin**, University of North Dakota (878-45-618) (Sponsored by Bruce G. Dearden)
- 10:45 a.m. *Nonlinear integral equations which model explosive behavior*.  
(673) **Catherine A. Roberts**, University of Rhode Island (878-45-130)

AMS Session on Manifolds of Low Dimension

8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Compact cores of good 3-orbifolds*.  
(674) **Elizabeth Camp McGuire**, Virginia Military Institute (878-57-28)
- 8:15 a.m. *One-dimensional properties of pairs of transverse measured foliations without connections*.  
(675) **Lev Slutskin**, New York, New York (878-57-170)
- 8:30 a.m. *Vertex-minimal immersions of the Klein bottle into three-space*.  
(676) **Davide P. Cervone**, Brown University (878-57-670)
- 8:45 a.m. *On 4-dimensional bundle theories*.  
(677) **Duane Randall**, Loyola University (878-57-657)
- 9:00 a.m. *An invariant for cyclic covers of  $S^3$  branched over torus knots*.  
(678) **John W. Emert**, Ball State University (878-57-878)
- 9:15 a.m. *Free reductions and deformations of two complexes in four manifolds*. Preliminary report.  
(679) **Paul J. Kapitzka**, University of Illinois, Urbana-Champaign (878-57-720)
- 9:30 a.m. *A new invariant for split 2-complexes in 4-manifolds*. Preliminary report.  
(680) **W. T. Haight, II**, University of Illinois, Urbana-Champaign (878-57-689)
- 9:45 a.m. *The complements of classical wild sets*.  
(681) **Ronald J. Knill**, Tulane University (878-57-165)
- 10:00 a.m. *Classification of taut foliations of knot complements*. Preliminary report.  
(682) **John Cantwell\***, Saint Louis University, and **Lawrence Conlon**, Washington University (878-57-160)

- 10:15 a.m. *Higher-order flatness of immersed manifolds*. Preliminary report.  
(683) **Jeff C. Lutgen**, University of Oregon (878-57-550)
- 10:30 a.m. *Higher order Conway invariants for links*.  
(684) **Fred Hickling**, Santa Clara University (878-57-587)
- 10:45 a.m. *On the ribbon disc complement conjecture*. Preliminary report.  
(685) **Catherine E. Cavagnaro**, University of Illinois, Urbana-Champaign (878-57-687)

AMS Session on Functional Analysis, I

8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Spectrum of F-P operator*.  
(686) **Jiu Ding\***, University of Southern Mississippi, **Q. Du** and **T. Y. Li**, Michigan State University (878-46-188) (Sponsored by Joe B. Thrash)
- 8:15 a.m. *Relative spectra in complete LMC algebras*.  
(687) **Michael E. Boardman**, Lake Forest College (878-46-219)
- 8:30 a.m. *Dense subalgebras of  $C^*$ -algebras*.  
(688) **Larry B. Schweitzer**, University of California, Berkeley (878-46-223)
- 8:45 a.m. *Analogues of the Fejér-Riesz theorem for the Dirichlet spaces*.  
(689) **Valentin V. Andreev**, Lamar University (878-46-716)
- 9:00 a.m. *State space of an LMC-algebra as an inductive limit*.  
(690) **A. K. Gaur**, Duquesne University (878-46-511)
- 9:15 a.m. *Free product von Neumann algebras of type III*. Preliminary report.  
(691) **Lance Barnett**, University of California, Los Angeles (878-46-481)
- 9:30 a.m.  *$L_1$  of a vector measure*. Preliminary report.  
(692) **Gunnar Stefansson**, Pennsylvania State University, Altoona (878-46-467)
- 9:45 a.m. *Perturbations of von Neumann algebras*. Preliminary report.  
(693) **Florin Pop**, University of New Mexico (878-46-242) (Sponsored by Frank L. Gilfeather)
- 10:00 a.m. *Some remarks on non-maximal closed prime ideals in commutative Banach algebras*. Preliminary report.  
(694) **Ramesh V. Garimella**, Northwest Missouri State University (878-46-356)
- 10:15 a.m. *Bundles of Banach algebras*.  
(695) **J. W. Kitchen**, Duke University, and **D. A. Robbins\***, Trinity College (878-46-328)
- 10:30 a.m. *A new class of Banach spaces*.  
(696) **Tepper L. Gill**, Howard University (878-46-397)
- 10:45 a.m. *Saturated actions of finite dimensional Hopf  $*$ -algebras on  $C^*$ -algebras*.  
(697) **Costel Peligrad** and **Wojciech Szymanski\***, University of Cincinnati, Cincinnati (878-46-384)

## Friday, January 15 (cont'd)

### MAA Session on "Capstone" Courses for Senior Mathematics Majors, I

#### 8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Using an historical development of the foundations of mathematics for a capstone course.* (698)  
**Robert L. Brabenec**, Wheaton College (878-00-1010)
- 8:30 a.m. *Mathematical modeling using projects from industry.* (699)  
**Thomas Kelley**, Metropolitan State College of Denver (878-00-1024)
- 8:45 a.m. *Videos and vastness.* (700)  
**Scott H. Hochwald**, University of North Florida (878-00-1019)
- 9:00 a.m. *A multiskill history of mathematics course.* (701)  
**Pam Crawford** and **Christopher E. Barat\***, Randolph-Macon College (878-00-1008)
- 9:15 a.m. *Cryptology as a capstone course.* (702)  
**John F. Kurtzke**, University of Portland (878-00-1025)
- 9:30 a.m. *Including a capstone experience in existing courses.* (703)  
**Mary Beth Dever**, Illinois Benedictine College (878-00-1014)
- 9:45 a.m. *Experiences for senior mathematics majors. Preliminary report.* (704)  
**Deborah A. Frantz**, Kutztown University of Pennsylvania (878-00-1016)
- 10:00 a.m. *Using outcomes assessment to design a capstone course.* (705)  
**Marie Sheckels**, Mary Washington College (878-00-1033)
- 10:15 a.m. *A "capstone" course in a small liberal arts college.* (706)  
**Richard M. Park**, Franklin College (878-00-1030)
- 10:30 a.m. *The senior seminar at Hamilton College.* (707)  
**Richard Bedient\***, **Sally Cockburn** and **Larry Knop**, Hamilton College (878-00-1009)

### MAA Session on Teaching Mathematics to Multicultural and Multilingual Students

#### 8:00 a.m.–9:55 a.m.

- 8:00 a.m. *What can mathematics education for indigenous peoples teach us? A report from ICME-7.* (708)  
**Emelie A. Kenney**, Siena College (878-00-1158)
- 8:30 a.m. *Mathematical hemispheric preference among minority community college students.* (709)  
**Ronald Sklar**, St. John's University (878-00-1160)
- 9:00 a.m. *Instructional programming for a diverse society.* (710)  
**Charles Roberts**, Michigan State University (878-00-1159)

### MAA Session on Use of Visualization in the Teaching of Mathematics, II

#### 8:00 a.m.–10:35 a.m.

- 8:00 a.m. *Solids for teaching volume calculation.* (711)  
**Robbin Lerch O'Leary**, Seattle Pacific University (878-00-1176)
- 8:15 a.m. *Visualization in mathematics through spreadsheets.* (712)  
**Deane Arganbright**, Whitworth College (878-00-1161)
- 8:40 a.m. *Visualization of group theory concepts using "The Geometer's Sketchpad".* (713)  
**Doris Schattschneider**, Moravian College (878-00-1180)
- 8:55 a.m. *Teaching geometry with interactive, programmable software - Sketchpad, CABRI, and Logo.* (714)  
**James King**, University of Washington (878-00-1172)
- 9:20 a.m. *Visualization in elementary partial differential equations.* (715)  
**William E. Boyce**, Rensselaer Polytechnic Institute (878-00-1164)
- 9:35 a.m. *Visualization exercises for multivariable calculus.* (716)  
**Caspar R. Curjel**, University of Washington (878-00-1165)
- 10:00 a.m. *Visualization in calculus and linear algebra using animated 3D graphing with GyroGraphics™.* (717)  
**Jerry A. Johnson\***, Oklahoma State University, and **Stephen R. Murdock**, Tulsa Junior College (878-00-1171)
- 10:25 a.m. *Teaching numerical analysis with MapleV at small colleges.* (718)  
**Shine-Min Lin**, Bethel College (878-00-1173)

### MAA Science Policy Committee Panel Discussion

#### 8:00 a.m.–9:20 a.m.

### AMS-MAA Poster Session

#### 8:00 a.m.–10:55 a.m.

*Calculus reform.*

### AMS-LaTeX Presentation

#### 8:00 a.m.–9:00 a.m.

*Informal seminar.*

AMS Session on Algebraic Topology

8:15 a.m.–10:55 a.m.

- 8:15 a.m. *On the index of vector fields and electrostatics.*  
(719) Preliminary report.  
**Malhab C. Keirouz**, University of Puerto Rico,  
Humacao College (878-55-111)
- 8:30 a.m. *Computer search for nilpotent complexes.*  
(720) Preliminary report.  
**Robert H. Lewis\***, Fordham University, and  
**Guy Moore**, Princeton University (878-55-204)
- 8:45 a.m. *A note on the Kirby-Melvin formulation of the*  
(721) *Witten 3-manifold invariant, II.* Preliminary  
report.  
**Francis D. Lonergan**, Webster, Massachusetts  
(878-55-37)
- 9:00 a.m. *The semi-localization of a one pointed Kan*  
(722) *complex.*  
**Phillip B. Thurber**, Lewis & Clark College  
(878-55-688)
- 9:15 a.m. *Finding the inverse of a matrix using Newton's*  
(723) *method.*  
**N. R. Nandakumar**, Delaware State College  
(878-55-832)
- 9:30 a.m. *Enhanced cohomology and obstruction theory.*  
(724) **M. A. Galecki**, University of Tennessee,  
Knoxville (878-55-910)
- 9:45 a.m. *Transition functions for abelian lattice gauge*  
(725) *fields on the  $n$ -torus.*  
**Janet C. Woodland**, State University of New  
York, College at Stony Brook (878-55-853)
- 10:00 a.m. *Computability of the local generalized*  
(726)  *$H$ -Lefschetz number.*  
**Evelyn L. Hart**, Hope College (878-55-73)
- 10:15 a.m. *Transfer and steenrod squares.* Preliminary  
(727) report.  
**Peter Litvanyi**, University of Alaska, Fairbanks  
(878-55-466) (Sponsored by Robert J.  
Piacenza)
- 10:30 a.m. *Estimation of Nielson type numbers for periodic*  
(728) *points.*  
**Peter Wong**, Bates College (878-55-310)
- 10:45 a.m. *Obstruction theory for diagrams.* Preliminary  
(729) report.  
**Robert J. Piacenza**, University of Alaska,  
Fairbanks (878-55-131)

AMS Invited Address

9:00 a.m.–9:50 a.m.

- (730) *General hypergeometric functions and the*  
*representation theory of Lie algebras and*  
*quantum groups.*  
**Alexander Varchenko**, University of North  
Carolina, Chapel Hill (878-00-959)

ASL Invited Address

9:00 a.m.–9:50 a.m.

- (731) *Inner models, class forcing, and the structure of*  
 *$V$ .*  
**Sy Friedman**, Massachusetts Institute of  
Technology

AMS Special Session on Eigenvalues  
in Riemannian Geometry, I

9:00 a.m.–10:50 a.m.

- 8:00 a.m. Discussion
- 9:00 a.m. *Dimension, volume, and spectrum of a*  
(732) *Riemannian manifold.*  
**Jeffrey M. Lee**, Texas Tech University  
(878-53-701) (Sponsored by Kent Pearce)
- 9:30 a.m. *Spectral geometry in dimension 3.*  
(733) **Robert Brooks\***, University of California, Los  
Angeles, **Peter Perry**, University of Kentucky,  
and **Peter Petersen**, University of California,  
Los Angeles (878-58-297)
- 10:00 a.m. *Remarks on Dirichlet and Neumann*  
(734) *eigenvalues.*  
**L. Friedlander**, University of Arizona  
(878-35-455)
- 10:30 a.m. *Microlocal analysis of some introspectral*  
(735) *deformations.*  
**F. Marhuenda**, University of Alicante  
(878-58-294) (Sponsored by Carolyn S.  
Gordon)

MAA Panel Discussion

9:30 a.m.–10:55 a.m.

*Precalculus reform.*

MAA CUPM Subcommittee on Quantitative  
Literacy Requirements Panel Discussion

9:30 a.m.–10:55 a.m.

*Tilting at windmills – Quantitative literacy for college students.*

AMS Panel Discussion

9:35 a.m.–10:55 a.m.

*Discussion on the advanced test of the Graduate Record  
Examination.*

## Friday, January 15 (cont'd)

### ASL Invited Address

10:00 a.m.–10:50 a.m.

- (736) *Automorphism properties of the lattice of r.e. sets.*  
**E. Herrmann**, Humboldt University, Berlin

### AMS Invited Address

10:05 a.m.–10:55 a.m.

- (737) *Quantum groups: At the gates of the non-commutative world.* Preliminary report.  
**Leon A. Takhtajan**, State University of New York, Stony Brook (878-00-957)

### AMS-MAA Invited Address

11:10 a.m.–noon

- (738) *Sign-solvable linear systems and their matrices.*  
**Richard A. Brualdi**, University of Wisconsin, Madison (878-00-951)

### National Science Foundation Informal Discussion Group

noon–1:00 p.m.

### Colloquium Lectures: Lecture III

1:00 p.m.–2:00 p.m.

- (739) *Nonlinear differential equations and Lagrangian coordinates.*  
**Luis A. Caffarelli**, Institute for Advanced Study

### ASL Invited Address

1:00 p.m.–1:50 p.m.

- (740) *The complexity of counting principles.*  
**Toniann Pitassi**, University of California at San Diego, La Jolla

## AMS Special Session on Banach Space Theory, I

1:00 p.m.–3:50 p.m.

- 1:00 p.m. *A distributional version of Rosenthal's inequality for identically distributed random variables.*  
 (741) **S. J. Montgomery-Smith**, University of Missouri, Columbia (878-60-83)
- 1:30 p.m. *From weak to strong types of  $l_1$  convergence.*  
 (742) **Maria Girardi\***, University of South Carolina, Columbia, and **Erik Balder**, University of Utrecht, Netherlands (878-46-786)
- 2:00 p.m. *Isometries of rearrangement-invariant function spaces.*  
 (743) **Nigel Kalton\*** and **Beata Randrianantoanina**, University of Missouri, Columbia (878-46-238)
- 2:30 p.m. *Random Banach spaces. The limitations of the method.*  
 (744) **S. Szarek\***, Case Western Reserve University, and **P. Mankiewicz**, Polish Academy of Sciences, Poland (878-46-739)
- 3:00 p.m. *An inequality that implies the fixed point property in Banach spaces.*  
 (745) **Mohamed A. Khamsi**, University of Texas at El Paso (878-46-277)
- 3:30 p.m. *A  $\ell_1$ -predual which is not isomorphic to an  $A(K)$  space.* Preliminary report.  
 (746) **Dale E. Alspach**, Oklahoma State University, Stillwater (878-46-347)

## AMS Special Session on History of General Topology, II

1:00 p.m.–3:50 p.m.

- 1:00 p.m. *Observations on topologies of the 1940's.*  
 (747) **A. H. Stone**, Northeastern University (878-54-53)
- 1:30 p.m. *Witold Hurewicz and dimension theory.*  
 (748) **K. Kuperberg**, Auburn University, Auburn (878-01-497)
- 2:00 p.m. *The work and influence of R. L. Moore.*  
 (749) **Ben Fitzpatrick, Jr.**, Incarnate Word College (878-01-32)
- 2:30 p.m. *Bing's general topology.*  
 (750) **Michael Starbird**, University of Texas, Austin (878-54-673)
- 3:00 p.m. *The early work of F. B. Jones.*  
 (751) **Mary Ellen Rudin**, University of Wisconsin, Madison (878-54-03)
- 3:30 p.m. *The history of the normal Moore space problem.*  
 (752) **Peter J. Nyikos**, University of South Carolina, Columbia (878-01-761)

AMS Special Session on Commutative Algebra, II

1:00 p.m.–3:50 p.m.

- 1:00 p.m. *Torsion in the genus class group.* Preliminary report. (753)  
**Roger Wiegand**, University of Nebraska, Lincoln and Purdue University, West Lafayette (878-13-653)
- 1:30 p.m. *Some factorization properties of Krull domains with infinite cyclic divisor class group.* (754)  
**David F. Anderson\***, University of Tennessee, Knoxville, **Scott T. Chapman**, Trinity University, and **William W. Smith**, University of North Carolina, Chapel Hill (878-13-92)
- 2:00 p.m. *Prime  $t$ -ideals in polynomial rings.* (755)  
**Evan G. Houston**, University of North Carolina, Charlotte (878-13-66)
- 2:30 p.m. *Finitely generated monoids of fractional ideals.* (756)  
**D. D. Anderson**, University of Iowa, **Joe L. Mott\***, Florida State University, and **J. Park**, University of Iowa (878-13-779) (Sponsored by Robert Gilmer)
- 3:00 p.m. *Prime ideal structure of birational extensions of polynomial rings.* (757)  
**William J. Heinzer**, Purdue University, West Lafayette, **David Lantz**, Colgate University, and **Sylvia Wiegand\***, University of Nebraska, Lincoln and Purdue University, West Lafayette (878-13-822)
- 3:30 p.m. *Two-generated ideals in non-noetherian commutative rings.* (758)  
**David E. Rush**, University of California, Riverside (878-13-654)

AMS Special Session on Operator Theory and Triangular Operator Algebras, II

1:00 p.m.–3:50 p.m.

- 1:00 p.m. *Hilbert modules over the bounded analytic functions on a domain and applications.* Preliminary report. (759)  
**Robert F. Olin**, Virginia Polytech Institute & State University (878-47-911)
- 1:30 p.m. *Compression limit algebras.* Preliminary report. (760)  
**Alan Hopenwasser\*** and **Cecelia Laurie**, University of Alabama (878-47-459)
- 2:00 p.m. *An operator-theoretic approach to wavelet theory.* (761)  
**Xingde Dai\***, University of North Carolina, Charlotte, and **David Larson**, Texas A & M University, College Station (878-47-203)
- 2:30 p.m. *Computer simplification of expressions in operator model theory.* (762)  
**J. William Helton\*** and **John J. Wavrik**, University of California at San Diego, La Jolla (878-47-81)
- 3:00 p.m. *Truncated moment problems and positivity.* Preliminary report. (763)  
**Lawrence Fialkow**, State University of New York, College at New Paltz (878-47-409) (Sponsored by Raul E. Curto)

- 3:30 p.m. *Multi-variable operator theory on generators and relations.* (764)  
**Palle E. T. Jorgensen**, University of Iowa (878-47-202)

AMS Special Session on Quadratic Forms, I

1:00 p.m.–3:50 p.m.

- 1:00 p.m. *Representations of positive definite Hermitian forms.* (765)  
**J. S. Hsia**, Ohio State University, Columbus (878-11-501)
- 1:30 p.m. *Rigid fields and solvable Galois groups.* Preliminary report. (766)  
**Roger Ware**, Pennsylvania State University, University Park (878-12-330)
- 2:00 p.m. *Class groups of rank 2 lattices over number fields.* Preliminary report. (767)  
**Dennis R. Estes**, University of Southern California (878-11-247)
- 2:30 p.m. *Higher level forms schemes.* (768)  
**Murray Marshall**, University of Saskatchewan, and **Victoria Powers\***, Emory University (878-11-305)
- 3:00 p.m. *Primitive representations by spinor genera of ternary quadratic forms.* (769)  
**A. G. Earnest**, Southern Illinois University, Carbondale, **J. S. Hsia**, Ohio State University, Columbus, and **D. C. Hung\***, State University of New York, Binghamton (878-11-322)
- 3:30 p.m. *On the trace form.* Preliminary report. (770)  
**Boas Erez**, Harvard University (878-11-276)

AMS Special Session on Eigenvalues in Riemannian Geometry, II

1:00 p.m.–3:50 p.m.

- 1:00 p.m. *Spectral dimensions and Weyl's problem for the eigenvalue distribution of Laplacians on p.c.f. self-similar fractals.* (771)  
**Jun Kigami**, Osaka University, Japan, and **Michel L. Lapidus\***, University of California, Riverside (878-58-149)
- 1:30 p.m. *Marked length spectral in negatively curved manifolds.* (772)  
**Yiping Mao**, Washington University (878-53-604)
- 2:00 p.m. *Families of closed geodesics on hyperbolic surfaces with common self-intersections.* (773)  
**Thea Pignataro\***, City College of New York, New York, and **Hanna Sandler**, American University (878-30-799)
- 2:30 p.m. *A new construction of higher-step isospectral nilmanifolds.* (774)  
**Ruth Gornet**, Washington University (878-58-350)
- 3:00 p.m. *Locally non-isometric yet strongly isospectral manifolds.* (775)  
**Zoltan I. Szabo**, City University of New York, Herbert H. Lehman College (878-58-623) (Sponsored by Dennis DeTurck)

**Friday, January 15 (cont'd)**

- 3:30 p.m. *Divisor of the Selberg zeta function for Kleinian groups.* (776)  
**Peter A. Perry\***, University of Kentucky, and **S. J. Patterson**, University of Gottingen, Germany (878-30-825)

**AMS Special Session on Dynamics of Systems with Infinitely Many Degrees of Freedom, I**

**1:00 p.m.–3:50 p.m.**

- 1:00 p.m. *Application of wavelets to group-valued sigma models.* (777)  
**Guy Battle**, Texas A & M University (878-34-563) (Sponsored by Charles Radin)
- 1:30 p.m. *A relative entropy approach to 2-point logarithmic Sobolev inequalities.* (778)  
**Mary Beth Ruskai**, University of Massachusetts, Lowell (878-82-78)
- 2:00 p.m. *Spectral gap for Kawasaki dynamics and Dobrushin-Shlosman mixing condition.* (779)  
**Hornng-Tzer Yau\***, Courant Institute of Mathematical Sciences, New York University, and **Shenglin Lu**, University of Michigan, Ann Arbor (878-82-153)
- 2:30 p.m. *The ground state energy of large atoms.* (780)  
**Luis Seco**, University of Toronto (878-34-557) (Sponsored by Charles Radin)
- 3:00 p.m. *Patterns and multi-valued solutions of the phase diffusion equation.* (781)  
**Nicholai Ercolani**, University of Arizona (878-34-566) (Sponsored by Charles Radin)
- 3:30 p.m. *Nonlinear dispersive evolution equations of Hamiltonian type.* (782)  
**Michael Weinstein**, University of Michigan, Ann Arbor (878-34-560) (Sponsored by Charles Radin)

**AMS Special Session on Low Dimensional Geometric Dynamical Systems, III**

**1:00 p.m.–3:50 p.m.**

- 1:00 p.m. *On the dynamics of some polynomial root-finding algorithms.* Preliminary report. (783)  
**Scott Sutherland**, State University of New York, Stony Brook (878-58-454)
- 1:30 p.m. *Some global dynamical properties of numerical algorithms for ODE's.* (784)  
**Kevin Hockett**, George Washington University (878-58-44)
- 2:00 p.m. *On the multiplier of a repelling periodic cycle.* (785)  
**Lisa Goldberg**, University of California, Berkeley (878-58-946)
- 2:30 p.m. *Towers of finite type complex analytic maps.* (786)  
**Adam Epstein**, Graduate School & University Center, City University of New York (878-58-944)

- 3:00 p.m. *Dynamical systems.* (787)  
**Elise Cawley**, University of California, Berkeley (878-58-945)
- 3:30 p.m. *The dissipative/conservative dichotomy for group actions at infinity or hyperbolic space.* (788)  
**John A. Velling**, City University of New York, Brooklyn College (878-53-468)

**AMS Special Session on Modular Forms and Related Topics, I**

**1:00 p.m.–3:50 p.m.**

- 1:00 p.m. *Refinements of Capparelli's conjecture.* (789)  
**Krishnaswami Alladi**, University of Florida, **George E. Andrews\***, Pennsylvania State University, University Park, and **Basil Gordon**, University of California, Los Angeles (878-11-329)
- 1:30 p.m. *Ramanujan's theories of elliptic functions to alternative bases.* (790)  
**Bruce C. Berndt\***, University of Illinois, Urbana-Champaign, **S. Bhargava**, University of Mysore, India, and **Frank G. Garvan**, University of Florida (878-11-644)
- 2:00 p.m. *Properties of Koosterman, Hermite and LaGuerre sums.* (791)  
**Julie C. Autuore**, Dartmouth College (878-11-905)
- 2:30 p.m. *Expansions of zero.* (792)  
**Leon Ehrenpreis**, Temple University, Philadelphia (878-11-374) (Sponsored by L. A. Parson)
- 3:00 p.m. *Applying Ehrenpreis' "basis" method.* Preliminary report. (793)  
**Jane Friedman**, University of San Diego (878-11-145)
- 3:30 p.m. *Modular equations as a missing link between Hecke and Klein modular functions.* Preliminary report. (794)  
**Harvey Cohn**, City College, City University of New York (878-11-36)

**AMS Special Session on Quantum Groups, II**

**1:00 p.m.–3:50 p.m.**

- 1:00 p.m. *Hopf algebras and 3-manifold invariants.* (795)  
**Louis H. Kauffman**, University of Illinois, Chicago (878-57-411)
- 1:30 p.m. *String bases for quantum groups of type  $A_r$ .* (796)  
**Andrei Zelevinsky**, Northeastern University (878-17-575)
- 2:00 p.m. *Lie bialgebra structures on the Witt algebra.* (797)  
**Earl J. Taft**, Rutgers University, New Brunswick (878-17-405)
- 2:30 p.m. *Primitive spectra of quantum groups.* (798)  
**Timothy J. Hodges\***, University of Cincinnati, and **Thierry Lecomte**, University of Poitiers, France (878-81-206)



Program of the Sessions

- 3:00 p.m. *Integral intertwining operators and complex powers of differential ( $q$ -difference) operators.*  
(799) **Feodor Malikov**, Kyoto University, Japan (878-17-937) (Sponsored by A. N. Varchenko)
- 3:30 p.m. *New algebraic structures in the construction of manifold invariants.*  
(800) **Ruth J. Lawrence**, Harvard University (878-57-941) (Sponsored by A. N. Varchenko)

AMS-MAA Special Session on The State of Research in Undergraduate Mathematics Education: Problems and Prospects, II

1:00 p.m.–3:50 p.m.

- 1:00 p.m. *Qualitative modes of research applied to undergraduate mathematics education: Promise and potential pitfalls.*  
(801) **M. Kathleen Heid**, Pennsylvania State University, University Park (878-98-610) (Sponsored by Ed Dubinsky)
- 1:40 p.m. *Issues in the use of qualitative methods for research in mathematics education.*  
(802) **Alan Schoenfeld**, University of California, Berkeley (878-98-579)
- 2:15 p.m. *Making sense of students' sense-making: The mathematics education researcher as anthropologist.*  
(803) **Steven Monk**, University of Washington (878-98-404)
- 2:50 p.m. *Assessment of prerequisite mathematics vocabulary terms for intermediate and college algebra: Culture and gender difference.* Preliminary report.  
(804) **Frances A. Rosamond\***, National University, **Cynthia A. Miller** and **Brenda D. Smith**, Georgia State University (878-98-632) (Sponsored by Ed Dubinsky)
- 3:25 p.m. *Diversity and achievement: Whose responsibility is it?*  
(805) **Martin V. Bonsangue**, California State University, Fullerton (878-11-611)

AMS Session on Complex Variables (Geometric Considerations)

1:00 p.m.–2:10 p.m.

- 1:00 p.m. *Smooth points of  $p$ -adic subanalytic sets.*  
(806) **Zachary Robinson**, Purdue University, West Lafayette (878-32-901)
- 1:15 p.m. *Local patching and a basis of pseudoconvex neighborhoods for convex sets.*  
(807) **Carl D. Mueller**, University of Wisconsin, Madison (878-32-771)
- 1:30 p.m. *Iteration of functions and a non-fractal slide show.* Preliminary report.  
(808) **Lawrence Crone**, American University (878-30-382)

- 1:45 p.m. *Quasiconformal groups in 3-space leaving a ball invariant that are not quasiconformally conjugate to mobius groups.*  
(809) **Manouchehr Ghamsari**, Christopher Newport University (878-30-430)
- 2:00 p.m. *Jacobian lattice for Klein's surface.*  
(810) **J. R. Quine**, Florida State University (878-30-817)

MAA Session on Linear Algebra, III

1:00 p.m.–4:05 p.m.

- 1:00 p.m. *Experiences with the core curriculum and the use of MATLAB.*  
(811) **S. K. Jain\*** and **Larry Snyder**, Ohio University (878-00-1108)
- 1:20 p.m. *Linear algebra: MATLAB and HP 48SX's mean new methods for teaching and testing.*  
(812) **Conduff G. Childress, Jr.\***, Shaw University, and **Carol O'Dell**, Elizabeth City State University (878-00-1098)
- 1:35 p.m. *A modeling approach to linear algebra using DERIVE and the TI-81.*  
(813) **Barbara Flajnik**, Wittenberg University (878-00-1102)
- 1:50 p.m. *Teaching linear algebra using MAPLE.*  
(814) **Lisa Osterman Coulter**, Stetson University (878-00-1099)
- 2:05 p.m. *Using the computer to explore theoretical concepts in linear algebra.*  
(815) **Louise McNertney Berard\***, Wilkes University, and **Anthony D. Berard, Jr.**, King's College (878-00-1096)
- 2:20 p.m. *Modeling the dual space in ISETL.*  
(816) **Donald L. Muench**, Saint John Fisher College (878-00-1117)
- 2:35 p.m. *Using TEMATH to explore linear algebra.*  
(817) **Adam O. Hausknecht**, University of Massachusetts, Dartmouth (878-00-1104)
- 2:50 p.m. *The singular value decomposition.*  
(818) **Dan Kalman**, The Aerospace Corporation, Los Angeles, California (878-00-1110)
- 3:10 p.m. *Using technology in teaching linear algebra.*  
(819) **Ralph C. Steinlage**, University of Dayton (878-00-1120)
- 3:25 p.m. *Algebra tutorial for excel spreadsheet: Matrices.*  
(820) **Roosevelt Gentry**, Jackson State University (878-00-1103)
- 3:40 p.m. *Final project in a linear algebra course.*  
(821) **M. Elizabeth Mayfield**, Hood College (878-00-1115)
- 3:55 p.m. *Iteration and active learning.*  
(822) **Richard Barshinger**, Pennsylvania State University, Dunmore (878-00-1095)

JPBM Committee on Professional Recognition and Rewards Panel Discussion

1:00 p.m.–2:30 p.m.

*Discussion of committee's interim report.*

**Friday, January 15 (cont'd)**

**MAA Calculus Reform Study  
Group Informal Discussion**

**1:00 p.m.–3:00 p.m.**

*Calculus reform today.*

**MAA Committee on Student  
Chapters' Student Workshop A**

**1:00 p.m.–3:00 p.m.**

*Mathematics via hands-on experimentation.*

**MAA Minicourse #14: Part A**

**2:00 p.m.–4:00 p.m.**

*Linear algebra, applications and computing.* **Gareth Williams**, Stetson University

**MAA Minicourse #15: Part A**

**2:00 p.m.–4:00 p.m.**

*The Harvard calculus reform project. Hands-on experience with the project materials.* **Sheldon P. Gordon**, Suffolk Community College, **Deborah Hughes Hallett**, Harvard University, **William McCallum**, University of Arizona, and **Thomas W. Tucker**, Colgate University

**ASL Contributed Paper Session**

**2:00 p.m.–3:15 p.m.**

**MAA Monthly Celebration, I**

**2:15 p.m.–3:05 p.m.**

- (823) *The birth of the Monthly.*  
**Robert A. Rosenbaum**, Wesleyan University
- (824) *Do mathematicians read the Monthly?—Then and now.*  
**Paul R. Halmos**, Santa Clara University

**NAM Contributed Paper Session**

**2:15 p.m.–4:00 p.m.**

*Presentations by recent doctoral recipients.*

**Rocky Mountain Mathematics Consortium  
Board of Directors' Meeting**

**2:15 p.m.–4:10 p.m.**

**AMS Committee on Science  
Policy Panel Discussion**

**2:30 p.m.–4:00 p.m.**

*Resources for excellence in academic mathematical sciences departments.*

**MAA Monthly Celebration, II**

**3:20 p.m.–4:10 p.m.**

- (825) *The Monthly problem section.*  
**Murray S. Klamkin**, University of Alberta,
- (826) *The Putnam Prize Competition and the Monthly.*  
**Andrew M. Gleason**, Harvard University

**AMS-MAA Joint Prize Session**

**4:25 p.m.–6:25 p.m.**

**NAM Birds-of-a-feather Session**

**7:00 p.m.–9:00 p.m.**

**JPBM Mathematics Department Chairs  
Committee Panel Discussion**

**7:00 p.m.–9:00 p.m.**

*Chairing the mathematics department in the 1990s.*

**Third Annual MAA Student Chapters' Lecture**

**7:30 p.m.–8:20 p.m.**

- (827) *Touring a torus.*  
**Joseph A. Gallian**, University of Minnesota,  
Duluth (878-00-964)

**MAA Actuarial Faculty Forum**

**7:30 p.m.–10:00 p.m.**

*Informal session on actuarial education.*

MAA Committee on the Participation of  
Women Special Presentation

7:30 p.m.–9:00 p.m.

*1992 Micro-inequities skits.*

MAA Video Presentation

7:30 p.m.–9:00 p.m.

*The Alhambra past and present—a geometer's odyssey.*

Saturday, January 16

AMS Special Session  
on Banach Space Theory, II

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Uniform homeomorphisms between spheres of Banach lattices.* (828)  
**Fouad Chaatit**, University of Texas, Austin (878-46-246)
- 8:30 a.m. *Polynomial Schur, Dunford-Pettis and reflexive properties of Banach spaces.* (829)  
**Jeff Farmer**, University of Missouri (878-46-646)
- 9:00 a.m. *A Banach space without an  $l_p$  spreading model.* (830)  
**E. Odell\***, University of Texas, Austin, and **Th. Schlumprecht**, Texas A & M University, College Station (878-46-221)
- 9:30 a.m. *A restriction-extension property of operators.* (831)  
**Vania Mascioni**, University of Texas, Austin (878-46-292)
- 10:00 a.m. *Unconditional averages in the Banach spaces  $C(\alpha)$ .* Preliminary report. (832)  
**Barbara J. Wahl**, University of Texas, Austin (878-46-491)
- 10:30 a.m. *Thread.* (833)  
**Peter G. Casazza**, University of Missouri, Columbia (878-46-572)

AMS Special Session on History of  
General Topology, III

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *History of topological groups.* (834)  
**Dmitri B. Shakhmatov**, Miami University (878-54-205)
- 8:30 a.m. *Metriization.* Preliminary report. (835)  
**Robert W. Heath**, University of Pittsburgh, Pittsburgh (878-01-531)
- 9:00 a.m. *Generalized metric spaces.* (836)  
**Gary Gruenhage**, Auburn University, Auburn (878-01-445)

- 9:30 a.m. *Minimal spaces—Now and then.* Preliminary report. (837)  
**Jack R. Porter\***, University of Kansas, and **Robert M. Stephenson, Jr.**, University of South Carolina, Columbia (878-54-407)
- 10:00 a.m. *Rings of continuous functions in the 1950's.* (838)  
**Melvin Henriksen**, Harvey Mudd College (878-01-573)
- 10:30 a.m. *History of cardinal invariants.* (839)  
**A. V. Arhangel'skii**, Moscow University, Russia (878-54-706) (Sponsored by Charles E. Aull)

AMS Special Session  
on Commutative Algebra, III

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *The  $k$ -HFD property for Dedekind domains with finite cyclic class group.* Preliminary report. (840)  
**William W. Smith\***, University of North Carolina, Chapel Hill, and **Scott T. Chapman**, Trinity University (878-13-257)
- 8:30 a.m. *First coefficient domains and ideals of reduction number one.* (841)  
**William Heinzer**, Purdue University, West Lafayette, **Bernard Johnston**, Florida Atlantic University, and **David Lantz\***, Colgate University (878-13-897)
- 9:00 a.m. *Factorization of elements in integral domains and rings.* Preliminary report. (842)  
**D. D. Anderson**, University of Iowa (878-13-49)
- 9:30 a.m. *Almost split sequences for two-pullback rings.* Preliminary report. (843)  
**David M. Arnold\***, Baylor University, and **Reinhard Laubenbacher**, New Mexico State University (878-13-64)
- 10:00 a.m. *Posets embedded in  $\text{spec } R[X]$ .* (844)  
**Stephen McAdam**, University of Texas, Austin (878-13-46)
- 10:30 a.m. *Divisorial ideals in a group ring.* (845)  
**Byung Gyun Kang**, Pohang, South Korea (878-13-65) (Sponsored by Scott T. Chapman)

AMS Special Session on Operator Theory  
and Triangular Operator Algebras, III

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Corners of operator algebras: An introduction to the Morita theory.* (846)  
**Vern Paulsen**, University of Houston, Downtown (878-47-711)
- 8:30 a.m. *Hilbert polynomials of Hilbert modules.* Preliminary report. (847)  
**Keren Yan**, Indiana University-Purdue University, Indianapolis (878-47-713)
- 9:00 a.m. *Completely bounded homomorphisms and the infinitesimal Caratheodory and Kobayashi metrics.* (848)  
**Norberto Salinas**, University of Kansas (878-47-282)

## Saturday, January 16 (cont'd)

- 9:30 a.m. *Spectral properties of semicrossed products.*  
(849) Preliminary report.  
**Tom Hoover**, University of Hawaii, Honolulu,  
**Justin Peters\***, Iowa State University, and  
**Warren Wogen**, University of North Carolina,  
Chapel Hill (878-46-704)
- 10:00 a.m. *Polynomially bounded, centered and weakly*  
(850) *centered operators.* Preliminary report.  
**Vern I. Paulsen**, University of Houston,  
Downtown, **Carl M. Pearcy\*** and **Srdjan**  
**Petrović**, Texas A & M University, College  
Station (878-47-873)
- 10:30 a.m. *Interpolation with meromorphic matrix functions.*  
(851) **Joseph A. Ball**, Virginia Polytechnic Institute  
and State University, and **Kevin F. Clancey\***,  
University of Georgia (878-30-137)

### AMS Special Session on Ordered Algebraic Structures, I

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *The automorphism group of the countable*  
(852) *universal partially ordered set.*  
**A. M. W. Glass** and **Stephen H. McCleary\***,  
Bowling Green State University (878-06-435)
- 8:30 a.m. *Special-valued subgroups of lattice-ordered*  
(853) *groups.*  
**Yuanqian Chen\***, Central Connecticut State  
University, and **Paul Conrad**, University of  
Kansas (878-06-31)
- 9:00 a.m. *The Stone-Ćech compactification of a flow.*  
(854) Preliminary report.  
**Richard N. Ball\*** and **James N. Hagler**,  
University of Denver (878-46-805)
- 9:30 a.m. *Can  $L$  be in a lattice-ordered field?*  
(855) **R. H. Redfield**, Hamilton College (878-06-599)
- 10:00 a.m. *Locally indicable Engel groups.*  
(856) **Y. K. Kim** and **A. H. Rhemtulla\***, University of  
Alberta (878-06-600)
- 10:30 a.m. *Prime spectra of distributive lattices and*  
(857) *lattice-ordered groups.*  
**Constantine Tsinakis**, Vanderbilt University  
(878-06-453)

### AMS Special Session on Quadratic Forms, II

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Hyperbolic involutions.*  
(858) **Eva Bayer-Fluckiger**, Universite de  
Franche-Comte, France, **Daniel B. Shapiro\***,  
Ohio State University, Columbia, and **J.-P.**  
**Tignol**, University Catholique de Louvain,  
Belgium (878-16-571)

- 8:30 a.m. *On the Haar measure of representations of*  
(859) *quadratic forms.*  
**Y. Y. Shao**, Ohio State University, Columbus  
(878-11-647)
- 9:00 a.m. *On tame equivalence and 2-ranks.*  
(860) **Robert Perlis\***, **P. E. Conner**, Louisiana State  
University, Baton Rouge, and **Kazimierz**  
**Szymiczek**, Silesian University, Poland  
(878-11-861)
- 9:30 a.m. *The number of embeddings of integral forms.*  
(861) **Donald G. James**, Pennsylvania State  
University, University Park (878-11-62)
- 10:00 a.m. *The  $u$ -invariant of a rational function field  $F(t)$ .*  
(862) Preliminary report.  
**David B. Leep**, University of Kentucky  
(878-12-860)
- 10:30 a.m. *Recent developments in lattices, quadratic*  
(863) *forms and sphere packings.*  
**N. J. A. Sloane**, AT&T Bell Laboratories,  
Murray Hill, New Jersey (878-11-23)

### AMS Special Session on Dynamics and Computation in Neural Networks, I

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Introduction to neural networks.*  
(864) **Morris W. Hirsch**, University of California,  
Berkeley (878-34-682)
- 8:30 a.m. *Neural network models and higher mental*  
(865) *function.* Preliminary report.  
**Daniel Levine**, University of Texas, Arlington  
(878-92-175)
- 9:00 a.m. *Convergent and oscillatory activation dynamics*  
(866) *for cascades of neural nets.* Preliminary report.  
**Hal L. Smith**, Georgia Institute of Technology  
(878-34-840)
- 9:30 a.m. *A dynamical system model for a neural network*  
(867) *having cross-coupling between cells within a*  
*single layer.*  
**Virginia W. Noonburg**, University of Hartford  
(878-34-186)
- 10:00 a.m. *Neural networks as spatially-extended*  
(868) *dynamical systems: Coupled quasi-periodic and*  
*chaotic oscillators.*  
**Xin Wang**, University of Southern California  
(878-58-685)
- 10:30 a.m. *Discrete-time and continuous-time models of*  
(869) *neural networks.*  
**Edward K. Blum**, University of Southern  
California (878-92-473)

### AMS Special Session on Dynamics of Systems with Infinitely Many Degrees of Freedom, II

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. Discussion
- 9:00 a.m. *Disordered tilings of space.*  
(870) **Charles Radin**, University of Texas, Austin  
(878-34-659)

Program of the Sessions

- 9:30 a.m. *Classifying some two-dimensional subshift of finite type with group structure.* (871)  
**Mark A. Shereshevsky**, Mathematical Science Research Institute (878-34-863) (Sponsored by Charles Radin)
- 10:00 a.m. *The Voronoi limit for competitive cellular dynamics with rare nucleation.* (872)  
**Janko Gravner**, University of California, Davis, and **David Griffeath\***, University of Wisconsin, Madison (878-34-567) (Sponsored by Charles Radin)
- 10:30 a.m. *Estimates on Brownian motion with drift.* (873)  
**Joseph Conlon\*** and **Juan Redondo**, University of Michigan, Ann Arbor (878-60-52)

AMS Special Session on Integro-differential Equations: Stability and Control, II

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Integro differential equations: Stability.* (874)  
**S. Sivasundaram**, Embry-Riddle Aeronautical University (878-45-272)
- 8:30 a.m. *On a competing species problem.* (875)  
**Shair Ahmad**, University of Texas, San Antonio (878-34-446)
- 9:00 a.m. *Stability and convergence of numerical approximations to Riccati equations arising in hyperbolic boundary control problems*  
**E. Hendrickson** and **I. Lasiecka\***, University of Virginia (878-49-100)
- 9:30 a.m. *A numerical method for verifying Liapunov stability conditions for non linear partial differential equations.* (877)  
**John H. George**, Embry-Riddle Aeronautical University (878-34-699)
- 10:00 a.m. *Qualitative comparison theory for integro-differential equations: Results involving stability preserving mappings.* (878)  
**Anthony N. Michel\*** and **Kaining Wang**, University of Notre Dame (878-93-339)
- 10:30 a.m. *On numerical solutions of singular integro-differential equations of neutral type.* (879)  
**Terry Herdman**, Virginia Polytech Institute & State University (878-45-314) (Sponsored by Seenith Sivasundaram)

AMS Special Session on Modular Forms and Related Topics, II

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Poles of Rankin-Selberg convolutions and zeros of the Riemann zeta-Function.* (880)  
**Xian-Jin Li**, Purdue University, West Lafayette (878-11-262)
- 8:30 a.m. *Cusp forms on  $Sl(3, Z)$ .* (881)  
**Jonathan M. Huntley** and **David E. Tepper\***, Bernard M. Baruch College, City University of New York (878-11-338)
- 9:00 a.m. *Modular forms and combinatorics.* (882)  
**Wen-Ching Winnie Li**, Pennsylvania State University, University Park (878-11-228)

- 9:30 a.m. *Determining multiplicities of half-integral weight newforms.* (883)  
**Thomas R. Shemanske\***, Dartmouth College, and **Lynne H. Walling**, University of Colorado, Boulder (878-11-159)
- 10:00 a.m. *Modular forms and the classification of Hilbert modular threefolds.* (884)  
**H. G. Grundman**, Bryn Mawr College (878-14-148)
- 10:30 a.m. *Continued fractions whose partial quotients are 1 or 2.* (885)  
**Joseph Lehner**, Jamesburg, New Jersey (878-11-09)

AMS Special Session on Quantum Groups, III

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Orbit method for the quantized function algebras.* (886)  
**Yan Soibelman**, Harvard University (878-22-674)
- 8:30 a.m. *Tensor products of QYBE solutions.* (887)  
**Larry Lambe\***, Kent State University, and **Paolo Cotta-Ramusino**, University of Milano, Italy (878-81-776) (Sponsored by George E. Andrews)
- 9:00 a.m. *Differentiable structure for direct limit groups.* (888)  
**Loki Natarajan\***, University of Texas, El Paso, **Enriqueta Rodriguez-Carrington**, Staten Island College, City of New York, and **J. A. Wolf**, University of California, Berkeley (878-22-866)
- 9:30 a.m. *Schur's double centralizer theorem and co-triangular Hopf algebra.* (889)  
**David Fischman** and **Susan Montgomery\***, University of Southern California (878-16-777)
- 10:00 a.m. *Closed string field theory and operands.* (890)  
**Jim Stasheff**, University of North Carolina, Chapel Hill (878-55-913)
- 10:30 a.m. Discussion

MAA Minicourse #16: Part A

8:00 a.m.–10:00 a.m.

*Instituting a mathematics placement program: Creating order out of chaos in freshman mathematics.*  
**Geoffrey Akst**, Manhattan Community College/CUNY

MAA Minicourse #17: Part A

8:00 a.m.–10:00 a.m.

*Mathematics in a real and complex world.*  
**Frank Wattenberg**, University of Massachusetts, Amherst

## Saturday, January 16 (cont'd)

### AMS Session on Combinatorics

#### 8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Partition regularity of multilinear expressions.* Preliminary report.  
(891) **Gregory L. Smith**, Howard University (878-05-269) (Sponsored by Neil B. Hindman)
- 8:15 a.m. *The combinatorics of symmetric functions and permutation enumeration.*  
(892) **Desiree A. Beck\*** and **Jeffrey B. Remmel**, University of California at San Diego, La Jolla (878-05-286)
- 8:30 a.m. *Sums of powers of general arithmetic sequences.*  
(893) **Donald R. Snow**, Brigham Young University (878-05-505)
- 8:45 a.m. *Topology and combinatorics of arrangements in  $CP^2$ .*  
(894) **T. Jiang**, University of Illinois, Urbana-Champaign (878-05-917)
- 9:00 a.m. *Arrangements and Grassmann strata.*  
(895) **Michael J. Falk**, Northern Arizona University (878-05-929)
- 9:15 a.m. *O-1 quadratic assignment approach for single machine scheduling.*  
(896) **Bahram Alidaee**, West Texas State University (878-05-471)
- 9:30 a.m. *On quaternary paving matroids.*  
(897) **James G. Oxley**, **Kenneth P. Bogart**, Louisiana State University, Baton Rouge, and **Sanjay Rajpal\***, Dartmouth College (878-05-812)
- 9:45 a.m. *The strata of random mappings.*  
(898) **Bernard Harris**, University of Wisconsin, Madison (878-05-596)
- 10:00 a.m. *An improved bound for  $\lambda(G)$  and additional results on  $\lambda$ -labellings.* Preliminary report.  
(899) **Kimball Jonas**, University of South Carolina (878-05-730)
- 10:15 a.m. *Extremal problems for the Möbius function.*  
(900) **Margaret A. Readdy**, Michigan State University (878-05-729)
- 10:30 a.m. *Bijjective analysis of the performance of optimal triconnectivity algorithms.*  
(901) **Laura A. Bloom**, University of California at San Diego, La Jolla (878-05-671)
- 10:45 a.m. *Complex D-optimal designs.* Preliminary report.  
(902) **Hadi Kharaghani**, University of Lethbridge (878-05-643)

### AMS Session on Theory of Manifolds

#### 8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Fixed sets of commuting involutions.*  
(903) **R. J. Shaker, Jr.**, University of Virginia (878-57-319) (Sponsored by Ismor Fischer)

- 8:15 a.m. *An algebraic approach to equivariant Whitehead torsion for compact Lie groups.* Preliminary report.  
(904) **Aaron I. Stucker**, United States Military Academy (878-57-34)
- 8:30 a.m. *Minimal stretch geometry in outer space.*  
(905) **Tad White**, University of California, Riverside (878-57-831)
- 8:45 a.m. *On spines of homotopy  $n$ -balls.*  
(906) **Fredric Ancel\*** and **Craig Guilbault**, University of Wisconsin-Milwaukee (878-57-784)
- 9:00 a.m. *Reduced free groups.*  
(907) **James R. Hughes**, Haverford College (878-57-715)
- 9:15 a.m.  *$C^1$  immersed manifolds pierce the ambient space.*  
(908) **Michael D. Hirsch\***, Princeton University, and **Charles C. Pugh**, University of California, Berkeley (878-57-724)
- 9:30 a.m. *Bridge number is well behaved with respect to tangle connect sum.* Preliminary report.  
(909) **Ollie Nanyes**, Bradley University (878-57-517)
- 9:45 a.m. *Manifolds of Lipschitz maps.* Preliminary report.  
(910) **Raymond Y. Wong**, University of California, Santa Barbara (878-57-369)
- 10:00 a.m.  *$C^1$ -type embeddings of metric spaces in Banach spaces.* Preliminary report.  
(911) **Hossein Movahedi-Lankarani**, Pennsylvania State University, Altoona (878-57-394)
- 10:15 a.m. *Hochschild homology and free loop spaces: Computations.*  
(912) **John McCleary**, Vassar College (878-57-637)
- 10:30 a.m. *A comparison of the Andreotti and alpha invariants.*  
(913) **Gregory A. Fredricks**, Lewis & Clark College (878-57-591)
- 10:45 a.m. *Quaternionic Toric spaces.* Preliminary report.  
(914) **Richard Scott**, Massachusetts Institute of Technology (878-57-169)

### AMS Session on Differential Geometry

#### 8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Riemannian foliations in constant curvature.*  
(915) **Gerard Walschap**, University of Oklahoma (878-53-96)
- 8:15 a.m. *Kinematic formulas for the power of the mean curvature of the intersection of two hypersurfaces.* Preliminary report.  
(916) **Jiazou Zhou**, Temple University (878-53-10)
- 8:30 a.m. *Vector bundles with no soul.*  
(917) **Murad Özaydin\*** and **Gerard Walschap**, University of Oklahoma (878-53-116)
- 8:45 a.m. *Regularity of surfaces of minimal energy and given maps with volume.*  
(918) **Libin Mou\*** and **Paul Yang**, University of Southern California (878-53-216)
- 9:00 a.m. *Closed geodesics in 2-step nilmanifolds.*  
(919) **Maura B. Mast**, University of Northern Iowa (878-53-193)

## Program of the Sessions

- 9:15 a.m. *Ricci solitons on complete three-manifolds.* (920) Preliminary report.  
**Thomas A. Ivey**, University of California at San Diego, La Jolla (878-53-217)
- 9:30 a.m. *Spacelike surfaces in Lorentzian manifold.* (921) **Rahim Elghanmi**, Franklin College (878-53-184)
- 9:45 a.m. *Flat distributions in vector bundles.* Preliminary report. (922) **Krzysztof Sarnowski**, University of Alaska, Fairbanks (878-53-914) (Sponsored by Robert J. Piacenza)
- 10:00 a.m. *Graded manifolds with spin-conformal structure.* Preliminary report. (923) **Rick Kreminski**, East Texas State University (878-53-830)
- 10:15 a.m. *Ricci-flat metrics on complexifications of rank one symmetric spaces.* (924) **Matthew B. Stenzel**, University of California, Riverside (878-53-442)
- 10:30 a.m. *Semi-invariant submanifolds of almost  $r$ -paracontact Riemannian manifolds.* (925) **A. Bucki**, Oklahoma School of Science & Mathematics (878-53-370)
- 10:45 a.m. *On properties of special holomorphic curves in spaces of spinors.* Preliminary report. (926) **Gary Kerbaugh**, East Carolina University (878-53-629) (Sponsored by Robert L. Bernhardt)

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### MAA Session on Mathematics and the Arts, II

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#### 8:00 a.m.–11:00 a.m.

- 8:00 a.m. *Exploring the infinite using art and geometry.* (927) **Catherine A. Gorini**, Maharishi International University (878-00-1135)
- 8:20 a.m. *The arts and mathematics education: Political cartoons, visual analogies, material culture, and maps.* (928) **Marilyn Frankenstein**, University of Massachusetts, Boston (878-00-1134)
- 8:35 a.m. *A mathematically based tool for computer art.* (929) **Gary Greenfield**, University of Richmond (878-00-1136)
- 8:55 a.m. *Audible group theory.* (930) **Joel K. Haack**, University of Northern Iowa (878-00-1137)
- 9:10 a.m. *A mathematical approach to pitch-class sets.* (931) **R. Daniel Hurwitz\***, Skidmore College, and **Rachel Malinow**, Yale University (878-00-1138)
- 9:25 a.m. *The origins of time.* (932) **Robert Lewand**, Goucher College (878-00-1139)
- 9:40 a.m. *Authenticating works of art.* (933) **Catherine A. Roberts**, University of Rhode Island (878-00-1143)
- 9:55 a.m. *Escher's visual metaphors of abstract mathematical concepts.* (934) **Doris Schattschneider**, Moravian College (878-00-1144)
- 10:15 a.m. *Problem solving, plane isometries, and tessellating figures.* (935) **Kay I. Meeks**, Ball State University (878-00-1140)

- 10:35 a.m. *Mathematics as a topic of aesthetic inquiry.* (936) **Frederick Reiner**, The Key School, Annapolis, Maryland (878-00-1142)
- 10:50 a.m. *Mathematics and aesthetics.* Preliminary report. (937) **Jon Phillips, Jr.**, Saint Mary's College (878-00-1128)

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### MAA Session on Recruitment and Retention of Women in Mathematics

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#### 8:00 a.m.–10:15 a.m.

- 8:00 a.m. *Equity and excellence in the University of Minnesota Talented Youth Mathematics Program (UMTYMP).* (938) **Harvey Keynes**, University of Minnesota, Minneapolis (878-00-1154)
- 8:20 a.m. *Useful new research on mathematics and gender for college faculty.* (939) **Miriam P. Cooney**, Saint Mary's College (878-00-1153)
- 8:40 a.m. *MathConn 89, 90, 91, 92, and 93: Five events at Cedar Crest College to encourage young women in mathematics.* (940) **Regina Baron Brunner**, Cedar Crest College (878-00-1152)
- 9:00 a.m. *Increasing women's access to higher mathematics.* (941) **Donal O'Shea\*** and **Harriet Pollatsek**, Mount Holyoke College (878-00-1156)
- 9:20 a.m. *Math options: A career day for seventh grade girls.* (942) **Gloria S. Dion**, Frostburg State University (878-00-1211)
- 9:40 a.m. *Mathematics and absolute truth.* (943) **Kathy Merrill**, Colorado College (878-00-1155)
- 10:00 a.m. *The SIUC women in science model program.* (944) **Mary H. Wright\*** and **Sandra L. Shea**, Southern Illinois University, Carbondale (878-00-1157)

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### MAA Student Chapter Session

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#### 8:00 a.m.–10:55 a.m.

- 8:00 a.m. *Organizing a student-run math competition.* (945) **Richard L. Poss**, Saint Norbert College
- 8:20 a.m. *Wooster reaches out with "infinity".* (946) **Donald G. Beane**, College of Wooster
- 8:40 a.m. *Mathematics service programs.* (947) **Donald Marxen**, Loras College
- 9:00 a.m. *A gathering of the mathematical community.* (948) **Paul Patterson**, Saint Louis University
- 9:20 a.m. *Student-organized chapter activities.* (949) **Catherine A. Gorini**, Maharishi International University
- 9:40 a.m. *Student chapters: A dual perspective.* (950) **Karen J. Schroeder**, Bentley College
- 10:00 a.m. *Careers in mathematics' student conference.* (951) **Deborah A. Frantz**, Kutztown University of Pennsylvania
- 10:20 a.m. *Activities of the Ohio section.* (952) **Judith Palagallo**, University of Akron

## Saturday, January 16 (cont'd)

10:40 a.m. *Student activities in the Texas section of MAA.*  
(953) **Ronald F. Barnes**, University of  
Houston-Downtown

### AMS Session on Analysis on Manifolds

#### 8:15 a.m.–10:55 a.m.

8:15 a.m. *On the Chern character of a Fredholm module*  
(954) *of Toeplitz type.* Preliminary report.  
**Nicolae Anghel**, University of North Texas  
(878-58-482)

8:30 a.m. *Multiplicity two actions and loop space*  
(955) *homology.*  
**Gabriel P. Paternain**, Max Planck Institute for  
Mathematics, Germany (878-58-728)

8:45 a.m. *Separatrix crossing with small periodic forcing.*  
(956) **Jerry Brothers\*** and **Richard Haberman**,  
Southern Methodist University (878-58-931)

9:00 a.m. *Basin of attraction and Hamiltonian dissipation*  
(957) *due to separatrix crossi.*  
**Eric Ho\*** and **Richard Haberman**, Southern  
Methodist University (878-58-749)

9:15 a.m. *Cohomogeneity-two G-invariant minimal*  
(958) *submanifolds.* Preliminary report.  
**Wei Chen\*** and **Wu-Teh Hsiang**, Syracuse  
University (878-58-264)

9:30 a.m. *Lipschitz constant of periodic iterations.*  
(959) **David Fisher\*** and **Terry Chen**, University of  
Colorado, Denver (878-58-200)

9:45 a.m. *The link-type critical points and applications.*  
(960) **Soon-Kyu Kim**, University of Connecticut,  
Storrs, and **Tixiang Wang\***, University of  
Connecticut, Groton (878-58-208)

10:00 a.m. *Asymptotic measures for skew products of*  
(961) *Bernoulli shifts with Morse-Smale*  
*diffeomorphisms.*  
**Donna Molinek**, Davidson College  
(878-58-143)

10:15 a.m. *The closing of Arnol'd tongues for a*  
(962) *periodically forced limit cycle.*  
**John Norris**, University of Birmingham, United  
Kingdom (878-58-126)

10:30 a.m. *Equivariant de Rham theorem on free loop*  
(963) *spaces.*  
**P. Manoharan**, Kent State University, East  
Liverpool (878-58-117)

10:45 a.m. *Symmetries of generalized Mandelbrot sets.*  
(964) **Xiang Sheng**, Jefferson Pilot Life Insurance  
Company, Greensboro, North Carolina, and  
**Michael J. Spurr\***, East Carolina University  
(878-58-387)

### AMS Session on Statistics

#### 8:30 a.m.–10:40 a.m.

8:30 a.m. *A characterization of*  
(965) *Farlie-Gumbel-Morgenstern distributions via*  
*Spearman's rho and chi-square divergence.*  
**Roger B. Nelsen**, Lewis & Clark College  
(878-62-229)

8:45 a.m. *Nonlinear transformations to speed up*  
(966) *numerical minimization: Special cases.*  
**S. K. Katti**, University of Missouri, Columbia  
(878-62-26)

9:00 a.m. *A survey of statistical tests for seasonality in*  
(967) *monthly data.*  
**Oswaldo Marrero**, Villanova University  
(878-62-645)

9:15 a.m. *Confidence intervals for finite stratified*  
(968) *population quantile intervals.*  
**John S. Meyer**, Muhlenberg College  
(878-62-93)

9:30 a.m. *Linear models—A variational form for Bayes*  
(969) *estimators of variance.*  
**Alfredo J. Julian, Jr.**, University of California at  
San Diego, La Jolla (878-62-826)

9:45 a.m. *On selecting the best natural exponential*  
(970) *families with quadratic variance function.*  
**Mansour M. Abughalous\***, University of  
Wisconsin, Platteville, and **Naveen K. Bansal**,  
Marquette University (878-62-351) (Sponsored  
by G. G. Hamedani)

10:00 a.m. *The efficiency of max-type rank tests and some*  
(971) *tests of goodness of fit.*  
**Piotr Bajorski**, University of British Columbia  
(878-62-718)

10:15 a.m. *Parameter estimation.* Preliminary report.  
(972) **B. B. Bhattacharyya**, North Carolina State  
University, and **G. D. Richardson\***, University  
of Central Florida (878-62-695) (Sponsored by  
Kuppalapalle Vajravelu)

10:30 a.m. *Order restricted inference in polynomial*  
(973) *regression.* Preliminary report.  
**Hari Mukerjee** and **Renjin Tu\***, Wichita State  
University (878-62-813)

### AMS Committee on Education Panel Discussion

#### 8:30 a.m.–10:00 a.m.

*The Federal Coordinating Council for Science, Engineering,  
and Technology initiative on education and human resources.*

### MAA Special Presentation

#### 9:00 a.m.–9:50 a.m.

(974) *What students do know, could know, and*  
*should know about functions: Implications for*  
*the undergraduate mathematics curriculum.*  
**Patrick W. Thompson**, San Diego State  
University (878-00-963)



ASL Invited Address

9:00 a.m.–9:50 a.m.

- (975) *Weak logical systems and complexity theory.*  
**Jan Krajiček**, Czechoslovak Academy of Sciences, Czechoslovakia and University of Toronto

MAA Committee on Student Chapters' Student Workshop B

9:00 a.m.–10:55 a.m.

*Mathematics via hands-on experimentation.*

NAM Panel Discussion

9:00 a.m.–10:00 a.m.

*Underrepresented minorities in the graduate school mathematical pipeline.*

ASL Invited Address

10:00 a.m.–10:50 a.m.

- (976) *How absolute is non-isomorphism of models?*  
**Chris Laskowski**, University of Maryland, College Park

NAM Business Meeting

10:00 a.m.–10:55 a.m.

MAA Monthly Celebration, III

10:05 a.m.–10:55 a.m.

- (977) *A pearl of algebra from the Monthly.*  
**Harley Flanders**, University of Michigan, Ann Arbor
- (978) *Ramanujan, the Monthly, and serendipity.*  
**George E. Andrews**, Pennsylvania State University, University Park

AMS-MAA Invited Address

11:10 a.m.–noon

- (979) *Parallel algorithms for modeling flow in porous media problems.*  
**Mary Fanett Wheeler**, Rice University (878-00-953)

National Science Foundation Informal Discussion Group

noon–1:00 p.m.

NAM William W.S. Claytor Lecture

1:00 p.m.–1:50 p.m.

- (980) *Some results on the approximation of invariant measures of finite dimensional mathematics.*  
**Fern Y. Hunt**, Howard University

ASL Invited Address

1:00 p.m.–1:50 p.m.

- (981) *Some remarks on braids, algebra, and set theory.*  
**Richard Laver**, University of Colorado, Boulder

AMS Special Session on Banach Space Theory, III

1:00 p.m.–5:20 p.m.

- 1:00 p.m. *Homothetic floating bodies.*  
 (982) **Carsten Schütt**, Oklahoma State University, Stillwater, and **Elisabeth Werner\***, Case Western Reserve University (878-46-222)
- 1:30 p.m. *A characterization of Banach spaces containing  $c_0$ .*  
 (983) **Haskell Rosenthal**, University of Texas, Austin (878-46-288)
- 2:00 p.m. *A class of productive angelic spaces.*  
 (984) Preliminary report.  
**Helmut Knaust**, University of Texas, El Paso (878-46-348)
- 2:30 p.m. *Polyhedral Banach spaces and certain subclasses of the Baire-1 functions.*  
 (985) **George Androulakis**, University of Texas, Austin (878-46-556)
- 3:00 p.m. *Perturbed minimization principles in Banach spaces.*  
 (986) **Nassif Ghousseub**, University of British Columbia (878-46-802)
- 3:30 p.m. *Norms of minimal projections.*  
 (987) **N. Tomczak-Jaegermann\***, University of Alberta, and **H. König**, University of Kiel, Germany (878-46-737)
- 4:00 p.m. *On the  $\ell_p$ -spaces which are finitely block represented in a given Banach space.*  
 (988) **T. Schlumprecht**, Texas A & M University, College Station (878-46-738)
- 4:30 p.m. *Stable measures, positive definite functions and isometries on Banach spaces.*  
 (989) **Aleksandr Koldobsky**, University of Missouri, Columbia (878-46-05)

## Saturday, January 16 (cont'd)

- 5:00 p.m. *The distribution of vector-valued Rademacher series.*  
(990) **Steve Dilworth\***, University of South Carolina, Columbia, and **Steve Montgomery-Smith**, University of Missouri, Columbia (878-46-568)

### AMS Special Session on Commutative Algebra, IV

#### 1:00 p.m.–4:50 p.m.

- 1:00 p.m. *Monoid rings with the  $n$ -generator property.*  
(991) **James S. Okon** and **James Paul Vicknair\***, California State University, San Bernardino (878-13-361)
- 1:30 p.m. *On a theorem of Kaplansky.*  
(992) **Daniel Anderson**, University of Iowa, and **Muhammad Zafrullah\***, Winthrop University (878-13-380)
- 2:00 p.m. *An improved Briançon-Skoda theorem with applications to the Cohen-Macaulayness of Rees algebra.*  
(993) **Ian M. Aberbach\*** and **Craig Huneke**, Purdue University, West Lafayette (878-13-502)
- 2:30 p.m. *The higher-dimensional multiplicity formula associated to the length formula of Hoskin and Deligne.*  
(994) **Bernard Johnston**, Florida Atlantic University (878-13-849)
- 3:00 p.m. *The associated graded ring and the index of a Cohen-Macaulay local ring.*  
(995) **Songqing Ding**, Texas Technical University (878-13-227)
- 3:30 p.m. *Linkage by Cohen-Macaulay ideals.* Preliminary report.  
(996) **Heath M. Martin**, Louisiana State University, Baton Rouge (878-13-503)
- 4:00 p.m. Discussion

### AMS Special Session on Operator Theory and Triangular Operator Algebras, IV

#### 1:00 p.m.–5:20 p.m.

- 1:00 p.m. *Cohomology for certain finite von Neumann algebras.* Preliminary report.  
(997) **Roger Smith**, Texas A&M University, College Station (878-46-416)
- 1:30 p.m. *Pure composition operators on  $L^2$ .* Preliminary report.  
(998) **Jim Campbell\***, Memphis State University, and **Alan Lambert**, University of North Carolina, Charlotte (878-47-703)

- 2:00 p.m. *Some new results in the theory of dual algebras.*  
(999) **H. Bercovici**, Indiana University, Bloomington, **B. Chevreau**, University of Bordeaux I, France, and **WingSuet Li\***, Georgia Institute of Technology (878-47-549)
- 2:30 p.m. *Limit algebras and homology.*  
(1000) **Stephen Power**, University of Lancaster, England (878-46-336)
- 3:00 p.m. *Invariance of essential spectra under quasi-similarities.*  
(1001) **Mihai Putinar**, University of California, Riverside (878-47-168)
- 3:30 p.m. *Some recent results on CSL algebras.*  
(1002) **David R. Pitts**, University of Nebraska, Lincoln (878-47-912)
- 4:00 p.m. *Operator theory and the  $L^\infty$ - $L^2$  Nehari simultaneous optimization problem.*  
(1003) **Victor Kaftal** and **Gary Weiss\***, University of Cincinnati, Cincinnati (878-47-824)
- 4:30 p.m. *On the spectra of Schrödinger operators.*  
(1004) **Jingbo Xia**, State University of New York, College at Buffalo (878-47-476)
- 5:00 p.m. *Hilbert modules and partial orders.*  
(1005) **Paul Muhly**, University of Iowa, and **Baruch Solel\***, Technion-Israel Institution of Technology, Israel (878-46-608)

### AMS Special Session on Ordered Algebraic Structures, II

#### 1:00 p.m.–5:20 p.m.

- 1:00 p.m. *Still more on  $f$ -rings that are subdirect products of valuation domains.*  
(1006) **Melvin Henriksen**, Harvey Mudd College (878-06-574)
- 1:30 p.m. *The semigroup of idempotent  $p$ -endomorphisms of vector lattice  $V(\Delta, R)$ .*  
(1007) **Paul Conrad**, University of Kansas, **Shine-Min Lin\***, Bethel College, and **David Nelson**, Mercer University (878-06-55)
- 2:00 p.m. *Factorial rings of quotients.*  
(1008) **Anthony W. Hager\***, Wesleyan University, and **Jorge Martinez**, University of Florida (878-06-712)
- 2:30 p.m. *Polynomial inequalities in lattice-ordered algebras.*  
(1009) **Art M. Duval** and **Piotr J. Wojciechowski\***, University of Texas, El Paso (878-06-893) (Sponsored by Art Duval)
- 3:00 p.m. *Infinitely near points and the real spectrum.*  
(1010) Preliminary report.  
**James J. Madden**, Louisiana State University, Baton Rouge (878-14-668)
- 3:30 p.m. *The class of vector lattices is not a torsion class.*  
(1011) **David G. Nelson**, Mercer University (878-06-532)
- 4:00 p.m. *An algorithm to solve the word problem for certain two generator subgroups of  $A(R)$ .*  
(1012) **Sunil Koswatta**, Kent State University, East Liverpool (878-06-278)

- 4:30 p.m. *Minimal varieties of lattice-ordered groups.*  
(1013) **W. Charles Holland\***, Bowling Green State University, and **Nikolai Ya Medvedev**, Altai State University, Russia (878-06-263)

5:00 p.m. Discussion

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AMS Special Session on Quadratic Forms, III

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1:00 p.m.–4:50 p.m.

- 1:00 p.m. *Theta series mod  $p$  and modular Galois representations.*  
(1014) **Paul Ponomarev**, Ohio State University, Columbus (878-11-862)
- 1:30 p.m. *Hilbert's 17th problem for fields which are not necessarily formally real.*  
(1015) **Ron Brown**, University of Hawaii, Honolulu, and **Jonathan L. Merzel\***, Holy Names College (878-12-379)
- 2:00 p.m. *Quadratic lattices for which local representation implies global representation.*  
(1016) **Andrew G. Earnest**, Southern Illinois University, Carbondale (878-11-436)
- 2:30 p.m. *On a reciprocity law and its uniqueness for function fields of hyperelliptic curves.*  
(1017) Preliminary report.  
**Jonathan Shick**, Loyola University (878-12-787)
- 3:00 p.m. *On the Witt ring of an elliptic curve.* Preliminary report.  
(1018) **Jon Kr Arason**, University of Iceland, **Richard S. Elman\***, University of California, Los Angeles, and **Bill Jacob**, University of California, Berkeley (878-11-323)
- 3:30 p.m. *Class numbers and computations in quadratic fields.*  
(1019) **Dan O'Leary**, Varian Associates, Inc., Beverly, Massachusetts (878-11-178)
- 4:00 p.m. *Quadratic forms, Galois theory and Clifford algebras.*  
(1020) **Jan Minac**, University of Western Ontario, (878-12-307)
- 4:30 p.m. Discussion

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AMS Special Session on Eigenvalues in Riemannian Geometry, III

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1:00 p.m.–4:50 p.m.

- 1:00 p.m. *Principal eigenvalues of normal geodesic balls.*  
(1021) **Mark Pinsky**, Northwestern University (878-58-201)
- 1:30 p.m. *Systems of left invariant differential operators.*  
(1022) Preliminary report.  
**Nets Katz**, University of Pennsylvania (878-35-524) (Sponsored by Rui Guo)
- 2:00 p.m. *The  $p$ -spectrum of the Laplacian on compact hyperbolic three manifolds.*  
(1023) **Jeffrey McGowan**, Central Connecticut State University (878-58-408)

- 2:30 p.m. *Optimal inequalities for the first two Dirichlet eigenvalues of the Laplacian for domains on spheres.* Preliminary report.  
(1024) **Mark S. Ashbaugh\***, University of Missouri, and **Rafael D. Benguria**, Pontificia University Catolica, Chile (878-53-740)

- 3:00 p.m. *The spectral geometry of  $k$ -regular graphs.* Preliminary report.  
(1025) **Gregory Quenell**, Bucknell University (878-58-295)

- 3:30 p.m. *Spectra which contain that of the sphere.* Preliminary report.  
(1026) **Martin Engman**, University of New Mexico (878-53-744)

- 4:00 p.m. *Experimental verification of the theorem of isospectral domains.*  
(1027) **S. Sridhar\*** and **A. Kudrolli**, Northeastern University (878-58-927) (Sponsored by Dennis DeTurck)

4:30 p.m. Discussion

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AMS Special Session on Dynamics and Computation in Neural Networks, II

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1:00 p.m.–5:20 p.m.

- 1:00 p.m. *Supervised learning by adaptive resonance networks.*  
(1028) **Gail A. Carpenter**, Boston University (878-92-526)
- 1:30 p.m. *Topographic map formation in two layer neural networks.*  
(1029) **Todd Troyer**, University of California, Berkeley (878-34-658)
- 2:00 p.m. *On the nature of limit sets for learning algorithms.*  
(1030) **Michel Benaim**, University of California, Berkeley (878-60-284) (Sponsored by Morris W. Hirsch)
- 2:30 p.m. *Approximation of functions by neural nets.*  
(1031) **Andrew R. Barron**, Yale University (878-34-938)
- 3:00 p.m. *Degree of approximation results for Feedforward networks approximating unknown mappings and their derivatives.*  
(1032) **Kurt Hornik**, Technical University of Vienna, Austria, **Maxwell Stinchcombe**, **Halbert White\***, University of California at San Diego, La Jolla, and **Peter Auer**, Technical University of Vienna, Austria (878-41-843) (Sponsored by Morris W. Hirsch)
- 3:30 p.m. *Estimating the Lyapunov exponent of a chaotic system with nonparametric regression.*  
(1033) **Daniel F. McCaffrey**, Rand Corporation, Santa Monica, California, **Stephen Ellner**, **Ronald Gallant\*** and **Douglas W. Nychka**, North Carolina State University (878-62-609) (Sponsored by Morris W. Hirsch)
- 4:00 p.m. *An approach to consistent testing using duality and Banach space limit theory.*  
(1034) **Maxwell B. Stinchcombe\*** and **Halbert White**, University of California at San Diego, La Jolla (878-62-834)

## Saturday, January 16 (cont'd)

- 4:30 p.m. *Convergence of certain neural network controllers.*  
(1035)  
**Clark Jeffries**, Clemson University (878-93-364) (Sponsored by Morris W. Hirsch)
- 5:00 p.m. *Neural networks in systems stabilization and control.*  
(1036)  
**Hector J. Sussmann**, University of Minnesota, Minneapolis (878-93-414)

### AMS Special Session on Dynamics of Systems with Infinitely Many Degrees of Freedom, III

#### 1:00 p.m.–5:20 p.m.

- 1:00 p.m. *Liapunov exponents for systems with many degrees of freedom.*  
(1037)  
**Thomas Spencer**, Institute for Advanced Study (878-34-558) (Sponsored by Charles Radin)
- 1:30 p.m. *Nonlinear wave equations and the KAM theorem: Resonance and hyperbolic orbits.*  
(1038)  
**Walter Craig**, Brown University (878-34-565) (Sponsored by Charles Radin)
- 2:00 p.m. *Aubry-Mather theory for configurations on lattices.*  
(1039)  
**Rafael de la Llave\***, **Hans Koch** and **Charles Radin**, University of Texas, Austin (878-34-864)
- 2:30 p.m. *Normal forms for partial differential equations.*  
(1040)  
**Henri Epstein**, Institute des Hautes Etudes Sciences, France, **Jean Pierre Eckmann**, University of Geneva, Switzerland, and **C. Eugene Wayne\***, Pennsylvania State University, University Park (878-34-559) (Sponsored by Charles Radin)
- 3:00 p.m. *Anisotropic curvature driven evolution of hypersurfaces of  $\mathbb{R}^n$ .*  
(1041)  
**Sigurd Angenent**, University of Wisconsin, Madison (878-34-562) (Sponsored by Charles Radin)
- 3:30 p.m. *Hydrodynamic instability of certain ABC-flows and estimates of the growth rate.*  
(1042)  
**Misha Vishik\***, University of Texas, Austin, and **Susan Friedlander**, University of Illinois, Chicago (878-34-820) (Sponsored by Charles Radin)
- 4:00 p.m. *Long-time dispersive equations for shallow water with a varying bottom.*  
(1043)  
**Daryl Holm**, Los Alamos National Laboratory, New Mexico (878-34-555) (Sponsored by Charles Radin)
- 4:30 p.m. *Main "physical" phenomena in extended dynamical systems: Some rigorous results.*  
(1044)  
**Leonid Bunimovich**, Georgia Institute of Technology (878-34-564) (Sponsored by Charles Radin)
- 5:00 p.m. *Finite-dimensional dynamics in lattice dynamical systems.*  
(1045)  
**Valya Afraimovich**, Georgia Institute of Technology (878-34-561) (Sponsored by Charles Radin)

### AMS Special Session on Integro-differential Equations: Stability and Control, III

#### 1:00 p.m.–4:50 p.m.

- 1:00 p.m. *Boundedness of solutions for impulsive integro-differential equations.*  
(1046)  
**M. R. M. Rao**, University of Texas, San Antonio (878-45-421) (Sponsored by S. Sivasundaram)
- 1:30 p.m. *Stability of impulsive integro-differential equations.*  
(1047)  
**Xinzhì Liu**, University of Waterloo (878-34-283)
- 2:00 p.m. *Approximation of transfer functions for viscoelastic systems. Preliminary report.*  
(1048)  
**Olof J. Staffans**, Helsinki University of Technology, Finland, **Kenneth B. Hannsgen\*** and **Robert L. Wheeler**, Virginia Polytechnic Institute and State University (878-93-27)
- 2:30 p.m. *Optimal control of the growth of income of nations.*  
(1049)  
**Ethelbert N. Chukwu**, North Carolina State University (878-93-298)
- 3:00 p.m. Discussion
- 3:30 p.m. *Stochastic integro-differential equations: Approximations and stability.*  
(1050)  
**Jordan Stoyanov**, University of Ottawa (878-60-144) (Sponsored by Seenith Sivasundaram)
- 4:00 p.m. Discussion
- 4:30 p.m. *Uniform asymptotic stability on functional differential equations.*  
(1051)  
**Tingxiu Wang**, Oakton Community College (878-34-107)

### AMS Special Session on Modular Forms and Related Topics, III

#### 1:00 p.m.–5:20 p.m.

- 1:00 p.m. *Expressing a positive integer as a sum of a given number of distinct squares of positive integers.*  
(1052)  
**Paul T. Bateman\***, University of Illinois, Urbana-Champaign, and **George B. Purdy**, University of Cincinnati (878-11-676)
- 1:30 p.m. *Dedekind sums and lattice points. Preliminary report.*  
(1053)  
**Jeffrey C. Lagarias**, AT&T Bell Laboratories, Murray Hill, New Jersey (878-11-525)
- 2:00 p.m. *On groups related to the Hecke groups.*  
(1054)  
**Marvin I. Knopp**, Temple University, Philadelphia, and **Morris Newman\***, University of California, Santa Barbara (878-20-375)
- 2:30 p.m. *Rational period functions on  $\Gamma(1)$ ,  $G(\sqrt{2})$ , and  $G(\sqrt{3})$ .*  
(1055)  
**Ellen Gethner**, Swarthmore College (878-11-778)
- 3:00 p.m. *On the cohomology defined by rational period functions.*  
(1056)  
**Thomas A. Schmidt**, Macquarie University, Australia and Widener University (878-11-245)

- 3:30 p.m. *Nonvanishing of L-series associated to cubic twists of elliptic curves.*  
(1057)  
**Daniel B. Lieman**, Mathematical Sciences Research Institute, Berkeley (878-11-151)
- 4:00 p.m. *The highest point method for fundamental domains.* Preliminary report.  
(1058)  
**H. M. Stark**, University of California at San Diego, La Jolla (878-11-684)
- 4:30 p.m. *A non-Euclidean circle problem.*  
(1059)  
**Douglas Grenier**, University of Texas of the Permian Basin (878-11-123)
- 5:00 p.m. *Selberg's trace formula on finite upper half planes.*  
(1060)  
**Audrey Terras**, University of California at San Diego, La Jolla (878-11-308)

AMS-MAA Special Session on The State of Research in Undergraduate Mathematics Education: Problems and Prospects, III

1:00 p.m.–5:20 p.m.

- 1:00 p.m. *Rethinking the mathematics education of teachers: What do we know and what do we need to figure out?*  
(1061)  
**Glenda Lappan**, Michigan State University (878-98-419) (Sponsored by Ed Dubinsky)
- 1:35 p.m. *Research on learning to teach mathematics: Problems and prospects.* Preliminary report.  
(1062)  
**Catherine Brown**, University of Pittsburgh, Pittsburgh (878-98-621) (Sponsored by Ed Dubinsky)
- 2:10 p.m. *Implications of research and researching for undergraduate mathematical education.*  
(1063)  
**F. Alexander Norman**, University of North Carolina, Charlotte (878-98-418)
- 2:45 p.m. *Student thinking in applying a formal understanding of limit to the concepts of derivative and integral.*  
(1064)  
**Ed Dubinsky**, Purdue University, West Lafayette (878-98-299)
- 3:20 p.m. *Revitalizing functions through student inventions, contextual problems and multi-representational software.*  
(1065)  
**Jere Confrey\*** and **Erick Smith**, Cornell University (878-98-612) (Sponsored by Ed Dubinsky)
- 3:55 p.m. *Student's management of computer algebra systems.* Preliminary report.  
(1066)  
**Thomas Dick**, Oregon State University (878-98-529)
- 4:30 p.m. *Interactive graphics laboratories and electronic books and introductory differential geometry.*  
(1067)  
**Thomas Banchoff**, Brown University (878-98-334)
- 5:05 p.m. Discussion

MAA Minicourse #10: Part B

1:00 p.m.–3:00 p.m.

*Why, when and how to use CAS calculators in calculus and differential equations instruction.*  
**John Kenelly** and **Gil Proctor**, Clemson University

MAA Minicourse #11: Part B

1:00 p.m.–3:00 p.m.

*Using group projects in calculus.*  
**Stephen Hilbert**, **John Maceli**, **Eric Robinson**, **Diane Schwartz** and **Stanley Seltzer**, Ithaca College

MAA Minicourse #12: Part B

1:00 p.m.–3:00 p.m.

*Bringing calculus to life.*  
**Robert Decker** and **John K. Williams**, University of Hartford

MAA Minicourse #13: Part B

1:00 p.m.–3:00 p.m.

*Teaching mathematical modeling.*  
**J. S. Hartzler**, Pennsylvania State University, Harrisburg

AMS Session on Graph Theory

1:00 p.m.–5:25 p.m.

- 1:00 p.m. *On mixed Ramsey numbers and the total chromatic number of a graph.* Preliminary report.  
(1068)  
**N. Achuthan**, Curtin University of Technology, (878-05-289) (Sponsored by Glen H. Swindle)
- 1:15 p.m. *The edge reconstruction number of a tree.*  
(1069)  
**Robert Molina**, Colorado State University (878-05-731)
- 1:30 p.m. *Classification of trivalent symmetric graphs of small order.*  
(1070)  
**Margaret Morton\*** and **Marston Conder**, University of Auckland, New Zealand (878-05-808)
- 1:45 p.m. *Compositions and rook theory.*  
(1071)  
**James Haglund**, University of Georgia (878-05-876)
- 2:00 p.m. *On the independence number of regular graphs with large odd girth.*  
(1072)  
**Tristan Denley**, University of Cambridge, England (878-05-872) (Sponsored by Bela Bollobas)
- 2:15 p.m. *Parsimonious 2-multigraphs.*  
(1073)  
**Todd G. Will\*** and **Douglas B. West**, University of Illinois, Urbana-Champaign (878-05-810)

## Saturday, January 16 (cont'd)

- 2:30 p.m. *Orders and hypergraph representations of cwatsets.* (1074)  
**Julie Kerr**, Washington State University (878-05-541)
- 2:45 p.m. *Locally finite, 3-connected, edge-transitive, planar graphs.* (1075)  
**Jack Graver\*** and **Mark Watkins**, Syracuse University (878-05-537)
- 3:00 p.m. *Well-balanced signings of digraphs and 0-1 matrices.* (1076)  
**Joseph R. Barr**, California Lutheran University, and **John Frederick Fink\***, University of Michigan, Dearborn (878-05-510)
- 3:15 p.m. *Bandwidth of the complete  $k$ -ary tree.* (1077)  
**Lawren Smithline**, Harvard University (878-05-303)
- 3:30 p.m. *The vertices of edge domination critical graphs.* (1078)  
**Matteo Paris**, Harvard University (878-05-342)
- 3:45 p.m. *Steinhaus graphs are first order random.* (1079)  
**Neal Brand\*** and **Steve Jackson**, University of North Texas (878-05-448)
- 4:00 p.m. *Non-embeddable designs.* (1080)  
**V. D. Tonchev**, Michigan Technological University (878-05-441) (Sponsored by Alphonse H. Baartmans)
- 4:15 p.m. *Tensor products of graphs with no perfect matchings.* Preliminary report. (1081)  
**John C. George**, Lubbock, Texas (878-05-01)
- 4:30 p.m. *On graphs associated with fractal constructions.* Preliminary report. (1082)  
**John Stoughton\*** and **Paul Warner**, Hope College (878-05-287) (Sponsored by David C. Carothers)
- 4:45 p.m. *Bounds on frame rigidity via graph decomposition.* Preliminary report. (1083)  
**D. S. Franzblau**, Vassar College (878-05-157)
- 5:00 p.m. *The star chromatic number.* (1084)  
**David Guichard**, Whitman College (878-05-553) (Sponsored by Robert A. Fontenot)
- 5:15 p.m. *Families of sets with locally bounded width.* (1085)  
**Emanuel Knill**, Los Alamos National Laboratory (878-05-772)

### AMS Session on Summability and Approximation

#### 1:00 p.m.–5:10 p.m.

- 1:00 p.m. *Convexity preserving interpolation by algebraic curves and surfaces.* (1086)  
**David Levin**, Tel Aviv University, Israel, and **Edmond Nadler\***, Wayne State University (878-41-924)
- 1:15 p.m. *Approximation and probability revisited.* Preliminary report. (1087)  
**George Anastassiou**, Memphis State University (878-41-842)

- 1:30 p.m. *Generalized D'Alembert functional equation in distributions.* (1088)  
**Elias Deeba**, University of Houston, Downtown, and **E. L. Koh\***, University of Regina (878-39-372)
- 1:45 p.m. *Factoring biquadratic mappings on modules.* (1089)  
**Bruce Ebanks**, University of Louisville (878-39-401)
- 2:00 p.m. *Nonorthogonal spline wavelets of minimal support.* (1090)  
**Debao Chen**, University of Texas, Austin (878-41-768)
- 2:15 p.m. *Solutions of matrix dilation equations.* (1091)  
**Douglas P. Hardin\***, **Peter R. Massopust**, Vanderbilt University, and **Jeffrey S. Geronimo**, Georgia Institute of Technology (878-41-735)
- 2:30 p.m. *Abel's test and its relatives for integrals.* (1092)  
**Oved Shisha**, University of Rhode Island (878-40-765)
- 2:45 p.m. *Exponentially improved stationary phase approximations for an oscillatory double integral.* Preliminary report. (1093)  
**D. Kaminski**, University of Lethbridge (878-41-114)
- 3:00 p.m. *Different types of Hankel operators and poles of rational symbol functions of the best Hankel approximants.* (1094)  
**Xin Li**, University of Nevada, Las Vegas (878-41-127)
- 3:15 p.m. *Interpolation of entire functions associated with some Freud weights, II.* (1095)  
**Radwan Al-Jarrah\***, Southwestern Oklahoma State University, and **Sayel Ali**, Moorhead State University (878-41-179)
- 3:30 p.m. *Compression of multivariate biorthogonal wavelet packet decomposition.* (1096)  
**Baiqiao Deng**, University of South Carolina (878-41-726)
- 3:45 p.m. *A class of weakly translation invariant orthogonal wavelets.* (1097)  
**Gilbert G. Walter**, University of Wisconsin-Milwaukee (878-41-696)
- 4:00 p.m. *Simultaneous Stone-Weierstrass approximation of a function and its partial derivatives in Banach spaces.* (1098)  
**J.-Cl. Evard** and **F. Jafari\***, University of Wyoming (878-41-365)
- 4:15 p.m. *The sup norm of a weighted polynomial: A direct approach.* (1099)  
**Sayel Ali\***, Moorhead State University, and **Radwan Al-Jarrah**, Southwestern Oklahoma State University (878-41-396)
- 4:30 p.m. *Uniform approximations and the Euler-Maclaurin formula.* (1100)  
**Ronald E. Rietz**, Gustavus Adolphus College (878-41-594)
- 4:45 p.m. *Wavelets and their applications.* Preliminary report. (1101)  
**Mei Kobayashi**, IBM Tokyo Research Laboratory, Tokyo, Japan (878-41-554)
- 5:00 p.m. *Relation of zeros of partial sums of the series for  $f(x)$  to zeros of  $f(x)$ .* (1102)  
**R. Kit Kittappa**, Millersville University (878-40-381)

AMS Session on Associative  
and Nonassociative Algebra

1:00 p.m.–5:10 p.m.

- 1:00 p.m. *A two-parameter version of the centralizer algebra of mixed tensor representations of  $GL(r, \mathbb{C})$  and  $U_q(\mathfrak{gl}(r, \mathbb{C}))$ .* Preliminary report.  
**Robert E. Leduc**, University of Wisconsin, Madison (878-17-833)
- 1:15 p.m. *More results on Kac-Moody subspace products.*  
**P. E. Singer**, University of Missouri, Rolla (878-17-519)
- 1:30 p.m. *Centroids and Cartan algebras.*  
**Duncan J. Melville**, St Lawrence University (878-17-51)
- 1:45 p.m. *Everything about matrices of quaternions.* Preliminary report.  
**Fuzhen Zhang**, University of California, Santa Barbara (878-15-700)
- 2:00 p.m. *Comtrans algebras and bilinear forms.*  
**Xiaorong Shen**, John Carroll University (878-15-463)
- 2:15 p.m. *Stability and McMillan degree for rational matrix interpolants.*  
**Joseph A. Ball**, Virginia Polytech Institute & State University, and **Jeongook Kim\***, Chonnam National University, (878-15-444) (Sponsored by Sungkwon Kang)
- 2:30 p.m. *Polynomial identities of  $3 \times 3$  matrices.*  
**Siamack Bondari**, Iowa State University (878-15-399)
- 2:45 p.m. *Bounds on zeros of polynomials.*  
**Fuad Kittaneh**, University of Jordan, Amman, Jordan (878-15-236)
- 3:00 p.m. *On semi-commutative regular rings.* Preliminary report.  
**Ayman Badawi**, University of North Texas (878-16-105)
- 3:15 p.m. *Semiprimeness theorems for the tensor product of algebras with constraints on central elements.*  
**Hossain Khabazian**, Isfahan University of Technology, Israel (878-16-112)
- 3:30 p.m. *Non-split extensions over Artin algebras of finite representation type.* Preliminary report.  
**Peter Brown**, Syracuse University (878-16-536)
- 3:45 p.m. *More on endomorphism near-rings of dicyclic groups.*  
**J. J. Malone**, Worcester Polytechnic Institute (878-16-508)
- 4:00 p.m. *A note on linearizations of polynomial forms.* Preliminary report.  
**Steven B. Tesser\***, Indiana State University, Terre Haute, and **Ph. Revoy**, University of Montpellier II, (878-16-173)
- 4:15 p.m. *Prime ideals in structural matrix near-rings.*  
**Enoch K. Lee**, University of Southwestern Louisiana (878-16-395)
- 4:30 p.m. *On quasi-continuous rings.*  
**W. K. Nicholson**, University of Calgary, and **M. F. Yousif\***, Ohio State University, Lima (878-16-95)

4:45 p.m. *The inverse function theorem for some associative and Lie algebras.*

(1118)  
**Vladimir Shpilrain**, Technion, Israel (878-16-88)

5:00 p.m. *An example of a semi-simple algebra and its structure.*

(1119)  
**Alexander Abian\***, Iowa State University, and **Paula A. Kemp**, Southwest Missouri State University (878-16-590)

AMS Session on Group Theory

1:00 p.m.–3:55 p.m.

- 1:00 p.m. *Overgroups of irreducible linear groups.* Preliminary report.  
**Benjamin J. Ford**, University of Oregon (878-20-447)
- 1:15 p.m. *Products of simple groups related to simple orthogonal groups.*  
**Gary L. Walls**, University of Southern Mississippi (878-20-782)
- 1:30 p.m. *Squares of two-sets.*  
**Daniel C. Silitay**, State University of New York, Binghamton (878-20-540) (Sponsored by Gary J. Sherman)
- 1:45 p.m. *Class functions on finite classical groups.* Preliminary report.  
**Essam Aboiteen**, Emporia State University (878-20-589)
- 2:00 p.m. *The regular components of induced cuspidal characters and the irreducible components of degenerate Gelfand-Graev characters in finite reductive groups.*  
**Daniel Kotlar**, Humacao University College, Puerto Rico (878-20-85)
- 2:15 p.m. *The nonabelian tensor square and powers of a group.*  
**Michael R. Bacon**, Wilkes University (878-20-875)
- 2:30 p.m. *The arithmetic of nilpotency.*  
**Michael Galloy**, Rose-Hulman Institute of Technology (878-20-539) (Sponsored by Gary J. Sherman)
- 2:45 p.m. *How nilpotent can a non-nilpotent group be?*  
**Jason Fulman**, Harvard University (878-20-538) (Sponsored by Gary J. Sherman)
- 3:00 p.m. *Infinite groups in abelian like varieties and Ramsey's theorem.*  
**Luise-Charlotte Kappe\***, State University of New York, Binghamton, and **Michael Tomkinson**, University of Glasgow, England (878-20-895)
- 3:15 p.m. *The geometry of finite groups through the use of splitting systems.*  
**Joseph Kirtland**, Marist College (878-20-63)
- 3:30 p.m. *Valuated vector spaces, Kurepa's hypothesis and abelian  $p$ -groups.*  
**Doyle Cutler**, University of California, Davis, and **Radoslav Dimitrić\***, Pennsylvania State University, Uniontown (878-20-91)
- 3:45 p.m. *Disjunctive identities of groups and identities of their regular representations.* Preliminary report.  
**Samuel M. Vovsi**, Trenton State College (878-20-888)

## Saturday, January 16 (cont'd)

### AMS Session on Set-Theoretic Topology

#### 1:00 p.m.–5:25 p.m.

- 1:00 p.m. *Some results of covering spaces of homogeneous continua.*  
(1132) **Sergio Macias**, Tulane University (878-54-484)
- 1:15 p.m. *Fibered products of homogeneous continua.*  
(1133) **Karen Villarreal**, Loyola University (878-54-300)
- 1:30 p.m. *Properties of zigzag continua.*  
(1134) **Julien Doucet**, Tulane University (878-54-886)
- 1:45 p.m. *0-Dimensionality of biconvergence spaces.*  
(1135) Preliminary report.  
**Jamuna Prasad Ambasht**, Benedict College (878-54-627)
- 2:00 p.m. *Completion remainders in Moore spaces.*  
(1136) Preliminary report.  
**Ben Fitzpatrick, Jr. and D. Reginald Traylor\***, Incarnate Word College (878-54-340)
- 2:15 p.m. *Reflection and weakly collectionwise Hausdorff spaces.*  
(1137) **Timothy J. LaBerge\*** and **Avner Landver**, University of Kansas (878-54-483)
- 2:30 p.m. *Totally bounded frame quasi-uniformities.*  
(1138) Preliminary report.  
**Peter Fletcher**, Virginia Polytechnic Institute and State University, **Worthen Hunsaker**, Southern Illinois University, Carbondale, and **William Lindgren\***, Slippery Rock University of Pennsylvania (878-54-516) (Sponsored by Worthen N. Hunsaker)
- 2:45 p.m. *Function spaces and self-similar sets.*  
(1139) Preliminary report.  
**Gary Lewellen**, Appalachian State University (878-54-513)
- 3:00 p.m. *Some relations between certain completeness properties and cardinal boundedness properties in uniform spaces.*  
(1140) **Bruce S. Burdick**, Roger Williams University (878-54-588)
- 3:15 p.m. *H-bounded sets.* Preliminary report.  
(1141) **Douglas D. Mooney**, Western Kentucky University (878-54-584)
- 3:30 p.m. *Local monotone properties II.* Preliminary report.  
(1142) **Robert E. Buck**, Slippery Rock University of Pennsylvania (878-54-518)
- 3:45 p.m. *Pairwise concepts in a bitopological setting.*  
(1143) Preliminary report.  
**Jamuna Prasad Ambasht**, Benedict College, and **Sanjay Tiwari\***, Gaya, India (878-54-626)
- 4:00 p.m. *On functions having the property of Baire.*  
(1144) Preliminary report.  
**D. Jankovic'** and **D. A. Rose\***, East Central University (878-54-664)
- 4:15 p.m. *On almost paracompact spaces.*  
(1145) **T. R. Hamlett\*** and **D. Jankovic'**, East Central University (878-54-714)

- 4:30 p.m. *Construction of compactly supported wavelet basis using fractal functions.*  
(1146) **J. S. Geronimo**, Georgia Institute of Technology (878-54-746)
- 4:45 p.m. *Totally and totally semi disconnected with generalizations.* Preliminary report.  
(1147) **Charles Dorsett**, Louisiana Tech University (878-54-660)
- 5:00 p.m. *Box products and Hurewicz spaces.*  
(1148) **Louis Wingers**, University of Wisconsin, Madison (878-54-934)
- 5:15 p.m. *Compact spaces and products of finite spaces.*  
(1149) **Douglas Harris**, Marquette University (878-54-916)

### AMS Session on Functional Analysis, II

#### 1:00 p.m.–4:55 p.m.

- 1:00 p.m. *Limits of triangular matrix algebras using direct sums of refinement embeddings.* Preliminary report.  
(1150) **Allan P. Donsig\***, Texas A & M University, and **Alan Hopenwasser**, University of Alabama (878-46-871)
- 1:15 p.m. *Isotone projection cones: A continuation.*  
(1151) **S. J. Bernau**, University of Texas, El Paso (878-46-882)
- 1:30 p.m. *A nonstandard approach to the Bochner integral.*  
(1152) **G. Beate Zimmer**, University of Illinois, Urbana-Champaign (878-46-118)
- 1:45 p.m.  *$C^*$ -algebras of dynamical systems on non-commutative tori.*  
(1153) **Carla Farsi\*** and **Neil Watling**, University of Colorado, Boulder (878-46-120)
- 2:00 p.m. *Convergence of conditional expectation operators and the compact range property.*  
(1154) **Bryan Dawson**, Emporia State University (878-46-166)
- 2:15 p.m. *Automatic continuity of infinite matrices.*  
(1155) Preliminary report.  
**Christopher E. Stuart**, New Mexico State University, Las Cruces (878-46-225)
- 2:30 p.m. *The  $n$ -fold central Haagerup tensor product.*  
(1156) **Keith J. Coates**, Texas A & M University, College Station (878-46-942)
- 2:45 p.m. *Shift operators on  $C(X)$  with  $X$  compact and extremally disconnected.*  
(1157) **M. Rajagopalan**, Tennessee State University (878-46-192)
- 3:00 p.m. *Approximation of semigroups of operators and the abstract Cauchy problem.*  
(1158) **Nazar H. Abdelaziz**, Louisiana State University, Baton Rouge (878-46-352)
- 3:15 p.m. *Crossed products by partial automorphisms and  $K$ -theory.*  
(1159) **Ruy Exel**, University of New Mexico (878-46-243) (Sponsored by Frank L. Gilfeather)
- 3:30 p.m. *The complete continuity property in Bochner function spaces.*  
(1160) **Narcisse Randrianantoanina\*** and **Elias Saab**, University of Missouri, Columbia (878-46-301)



## Program of the Sessions

- 3:45 p.m. *A sufficient condition for a Banach space to be an Asplund space.* Preliminary report.  
(1161) **Ossama Obeid**, University of North Texas (878-46-678)
- 4:00 p.m. *Co-dimension one minimal projections onto the quadratics and their adjoints.*  
(1162) **Michael Prophet**, University of California Riverside (878-46-636)
- 4:15 p.m. *Hankel transforms in generalized Fock spaces.*  
(1163) **John Schmeelk**, Virginia Commonwealth University (878-46-428)
- 4:30 p.m. *Almost transitivity of some functions spaces.*  
(1164) **P. Greim**, The Citadel, **J. E. Jamison** and **A. Kaminska\***, Memphis State University (878-46-818)
- 4:45 p.m. *Second order nonlinear systems arising in convection flow of a micropolar fluid.*  
(1165) **K. Vajravelu\***, **E. Soewono**, **R. N. Mohapatra** and **J. Nayfeh**, University of Central Florida (878-34-697)

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### MAA Poetry Reading

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1:00 p.m.–2:00 p.m.

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### MAA Session on "Capstone" Courses for Senior Mathematics Majors, II

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1:00 p.m.–5:25 p.m.

- 1:00 p.m. *Senior independent study at Wooster.*  
(1166) **Charles R. Hampton**, College of Wooster (878-00-1018)
- 1:30 p.m. *Mathematical modeling: A capstone course for senior mathematics majors.*  
(1167) **Mark M. Meerschaert**, Michigan State University (878-00-1026)
- 1:45 p.m. *Senior seminar at a small liberal arts college.*  
(1168) **Paul L. Irwin**, Randolph-Macon Woman's College (878-00-1020)
- 2:00 p.m. *A senior seminar course based on cooperative learning.*  
(1169) **David W. Jensen\*** and **Gerald Diaz**, United States Air Force Academy (878-00-1021)
- 2:15 p.m. *Bridging mathematical gaps.*  
(1170) **Walter Elias, Jr.**, Virginia State University (878-00-1015)
- 2:30 p.m. *The senior paper requirement at Elmhurst College.*  
(1171) **Jon L. Johnson**, Elmhurst College (878-00-1022)
- 2:45 p.m. *The history of mathematics as a "capstone" course for senior mathematics majors.*  
(1172) **Herbert E. Kasube**, Bradley University (878-00-1023)
- 3:00 p.m. *A versatile capstone course.*  
(1173) **Thomas O'Neil**, California Polytechnic State University (878-00-1029)
- 3:15 p.m. *Running a successful student seminar.*  
(1174) **D. S. Franzblau**, Vassar College (878-00-1017)

- 3:30 p.m. *Interrelations in contemporary mathematics.*  
(1175) **Simon Quint**, Stockton State College (878-00-1032)
- 3:45 p.m. *Senior research seminar as a "capstone" course for mathematics majors.*  
(1176) **Janet Beery\***, **David Bragg** and **Mary Scherer**, University of Redlands (878-00-1011)
- 4:00 p.m. *Great theorems: The art of mathematics; A course based on original sources.*  
(1177) **David J. Pengelley**, New Mexico State University, Las Cruces (878-00-1031)
- 4:30 p.m. *The experience of one college with senior projects.*  
(1178) **N. Christian Meyer**, Pacific Lutheran University (878-00-1028)
- 4:45 p.m. *Senior seminar.*  
(1179) **Miriam Cooney**, Saint Mary's College (878-00-1013)
- 5:00 p.m. *A real analysis course with capstone content.*  
(1180) **Richard J. Cleary**, Saint Michael's College (878-00-1012)
- 5:15 p.m. *A combined entrance and exit course.*  
(1181) **Richard Metzler**, University of New Mexico (878-00-1027)

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### MAA Session on Recreational Mathematical Computing

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1:00 p.m.–4:50 p.m.

- 1:00 p.m. Introductory Remarks
- 1:15 p.m. *Computer solutions for generalizations of the coupon collector's problem.*  
(1182) **Thomas J. O'Reilly**, Saint Joseph's University (878-00-1151)
- 1:45 p.m. *Optimal stopping in "The Showcase Showdown".*  
(1183) **Paul R. Coe\***, Roosevelt University, and **William Butterworth**, Barat College (878-00-1147)
- 2:15 p.m. *A computer investigation of shuffling.*  
(1184) **Steve Cohen\*** and **Paul Coe**, Roosevelt University (878-00-1148)
- 2:45 p.m. *Counting certain triangles of absolute differences.*  
(1185) **Harry L. Nelson**, Lawrence Livermore National Laboratory (878-00-1150)
- 3:15 p.m. *PLANIM, the thinking person's game.*  
(1186) **Ada Booth\***, Santa Clara University, and **Thomas Booth**, (878-00-1146)
- 3:45 p.m. *Programs to solve Pentamino problems.*  
(1187) **Charles D. Ashbacher**, Kirkwood Community College (878-00-1145)
- 4:15 p.m. *Mathematical black holes.*  
(1188) **Michael W. Ecker**, Pennsylvania State University, Wilkes-Barre (878-00-1149)
- 4:45 p.m. Closing Remarks

## Saturday, January 16 (cont'd)

### MAA Session on Use of Visualization in the Teaching of Mathematics, III

1:00 p.m.–4:15 p.m.

- 1:00 p.m. *Visualization of applicaiton of calculus and differential equation.* (1189)  
**Howard Lewis Penn**, United States Naval Academy (878-00-1177)
- 1:15 p.m. *Conjecturing with a computer.* (1190)  
**John W. Emert**, Ball State University (878-00-1166)
- 1:30 p.m. *Visualizing probability in the first year calculus.* (1191)  
**Martin E. Flashman**, Humboldt State University (878-00-1169)
- 1:55 p.m. *Conditional probability at a glance: The "car and goats problem".* (1192)  
**Alan E. Wessel**, Santa Clara University (878-00-1189)
- 2:10 p.m. *Visualization via computer graphics: Examples from calculus.* (1193)  
**Lisa Townsley Kulich**, Illinois Benedictine College (878-00-1185)
- 2:35 p.m. *Using graphics to enhance the teaching of calculus.* (1194)  
**Arthur G. Sparks\*** and **John W. Davenport**, Georgia Southern University (878-00-1183)
- 2:50 p.m. *HyperCard in the mathematics classroom.* (1195)  
**Ronald K. Smith**, Graceland College (878-00-1182)
- 3:05 p.m. *A visual approach to accelerated convergence of series.* (1196)  
**Richard Barshinger**, Pennsylvania State University, Dunmore (878-00-1162)
- 3:20 p.m. *Using Petersen in a graph theory class.* (1197)  
**Christopher Mawata**, University of Tennessee, Chattanooga (878-00-1175)
- 3:35 p.m. *Visualization with graphing calculators in precalculus.* (1198)  
**Agnes Tuska**, California State University, Fresno (878-00-1186)
- 3:50 p.m. *Computer algebra systems and visualization in mathematics.* (1199)  
**Louis A. Talman**, Metropolitan State College of Denver (878-00-1184)
- 4:05 p.m. *An introductory calculus course using graphing calculators and discovery style teaching.* (1200)  
**George Emese**, St. Cloud State University (878-00-1213)

### MAA CUPM Subcommittee on Undergraduate Research in Mathematics and Council on Undergraduate Research Panel Discussion

1:00 p.m.–2:20 p.m.

*Mathematical research for undergraduate students.*

### AMS Invited Address

2:15 p.m.–3:05 p.m.

(1201) *Simulation of flows in multiscaled porous media.*  
**Jim Douglas, Jr.**, Purdue University, West Lafayette (878-00-954)

### MAA Committee on Symbolic Computer Systems Panel Discussion

2:15 p.m.–3:45 p.m.

### MAA Minicourse #14: Part B

3:15 p.m.–5:15 p.m.

*Linear algebra, applications and computing.* **Gareth Williams**, Stetson University

### MAA Minicourse #15: Part B

3:15 p.m.–5:15 p.m.

*The Harvard calculus reform project: Hands-on experience with the project materials.* **Sheldon P. Gordon**, Suffolk Community College, **Deborah Hughes Hallett**, Harvard University, **William McCallum**, University of Arizona, and **Thomas W. Tucker**, Colgate University

### MAA Minicourse #16: Part B

3:15 p.m.–5:15 p.m.

*Instituting a mathematics placement program: Creating order out of chaos in freshman mathematics.* **Geoffrey Akst**, Manhattan Community College/CUNY

### MAA Minicourse #17: Part B

3:15 p.m.–5:15 p.m.

*Mathematics in a real and complex world.* **Frank Wattenberg**, University of Massachusetts, Amherst

### MAA Special Inaugural Teaching Award Session

3:30 p.m.–5:30 p.m.

**W. Wistar Comfort**  
AMS Associate Secretary  
Middletown, Connecticut

**Kenneth A. Ross**  
MAA Associate Secretary  
Eugene, Oregon

# Invited Addresses and Special Sessions

## Invited Addresses at AMS Meetings

The individuals listed below have accepted invitations to address the Society at the times and places indicated. For some meetings, the list of speakers is incomplete. Invited addresses at Sectional Meetings are selected by the Section Program Committee, usually twelve to eighteen months in advance of a meeting. Members wishing to nominate candidates for invited addresses should send the relevant information to the Associate Secretary for the Section who will forward it to the Section Program Committee.

### *Knoxville, TN, March 1993*

Paul R. Blanchard	Richard A. Tapia
Olav Kallenberg	Michelle L. Wachs

### *Washington, DC, April 1993*

Fan R. K. Chung	Joel Spruck
Leopold Flatto	A. Zamolodchikov

### *Salt Lake City, UT, April 1993*

Michael Christ	Robert M. Guralnick
Kenneth M. Golden	Michael S. Waterman

### *DeKalb, IL, May 1993*

Susan J. Friedlander	Clark Robinson
Russell D. Lyons	

### *Vancouver, British Columbia, Canada*

#### *August 1993*

Armand Borel (Progress in Mathematics Lecture)	Yuri Manin (Colloquium Lectures)
Avner Friedman (Progress in Mathematics Lecture)	Curt McMullen (AMS-CMS)
Robert E. Gompf (AMS-CMS)	Louis Nirenberg (AMS-CMS)
H. Blaine Lawson (AMS-CMS)	Jill Pipher (AMS-CMS)

### *Syracuse, NY, September 1993*

Tadeusz Iwaniec	James M. Renegar
Charles A. McGibbon	Alvany Rocha

### *College Station, TX, October 1993*

Steven P. Lalley	Theodore A. Slaman
Gilles Pisier	Stephan A. Stolz

## Organizers and Topics of Special Sessions

The list below contains all the information about Special Sessions at meetings of the Society available at the time this issue of the *Notices* went to the printer. The section below entitled **Information for Organizers** describes the timetable for announcing the existence of Special Sessions.

### *March 1993 Meeting in Knoxville, Tennessee*

Southeastern Section

Associate Secretary:

Joseph A. Cima (until 1/31/93)

Robert J. Daverman (after 1/31/93)

*Deadline for organizers: Expired*

*Deadline for consideration: December 15, 1992*

David F. Anderson and David E. Dobbs, *Commutative ring theory*

Betty Anne Case, *Interventions to assure success: calculus through junior faculty*

Ben G. Fitzpatrick and Suzanne M. Lenhart, *Optimal control and applications*

Alexandre S. Freire and Conrad P. Plaut, *Variational problems in geometry*

Don B. Hinton and Kenneth Shaw, *Sturm-Liouville operators, applications, and extensions*

Tim Kelley, *Numerical methods in optimization*

John C. Mayer, *Continua theory and dynamical systems*

Balram S. Rajput and Jan Rosinski, *Stochastic processes*

Michelle L. Wachs, *Algebraic combinatorics*

### *April 1993 Meeting in Salt Lake City, Utah*

Western Section

Associate Secretary: Lance W. Small

*Deadline for organizers: Expired*

*Deadline for consideration: January 6, 1993*

M. Salah Baouendi and Linda P. Rothschild, *Partial differential equations and several complex variables*  
 Andrej Cherkaev and Kenneth M. Golden, *Effective properties of inhomogeneous materials*  
 Davida Fischman, *Hopf algebras and Hopf algebra actions*  
 Naomi Fisher and Hugo Rossi, *Mathematics and education reform*  
 Libin Mou and Nat Smale, *Singularities of geometric partial differential equations*  
 Paul C. Roberts, Roger A. Wiegand, and Sylvia M. Wiegand, *Commutative algebra and modules*  
 Simon Tavaré, *Stochastic processes in population genetics*

**April 1993 Meeting in Washington, DC**

Eastern Section  
 Associate Secretary:  
 W. Wistar Comfort (until 1/31/93)  
 Lesley M. Sibner (after 1/31/93)  
*Deadline for organizers: Expired*  
*Deadline for consideration: January 6, 1993*

Roy L. Adler and Leopold Flatto, *Geodesic flows, hyperbolic geometry, and symbolic dynamics*  
 Joseph A. Ball and Cora S. Sadosky, *Dilation and interpolation: operator theoretic methods*  
 John J. Benedetto and Rodney B. Kerby, *Wavelets in sampling theory and signal processing*  
 Joseph E. Bonin, *Geometric methods in combinatorics*  
 Nathaniel Dean, *Graph theory*  
 Edward Frenkel, *Mathematics of two-dimensional quantum field theory*  
 Anant P. Godbole and Gary J. Sherman, *Undergraduate research in applied mathematics*  
 Anant P. Godbole and Gary J. Sherman, *Undergraduate research in pure mathematics*  
 Valentina S. Harizanov and James C. Owings, *Pure and applied recursion theory*  
 Kevin G. Hockett and E. Arthur Robinson, *Ergodic theory, dynamical systems, and applications*  
 Victor J. Katz, *History of mathematics*  
 Yongwu Rong, *Low dimensional topology*  
 Joel Spruck, *Nonlinear elliptic problems in geometry and physics*

**May 1993 Meeting in DeKalb, Illinois**

Central Section  
 Associate Secretary: Andy R. Magid  
*Deadline for organizers: Expired*  
*Deadline for consideration: February 3, 1993*

Gregory S. Ammar, *Advances in linear algebra: theory, computation, application*  
 Michael A. Filaseta and Carl Pomerance, *Number theory*  
 Susan J. Friedlander, *Mathematical topics in fluid dynamics*  
 Zoltan Füredi, *Combinatorics*  
 Andrew J. Granville, *Analytic number theory*  
 Frank Harary, *Beautiful graph theory*  
 Mohsen Pourahmadi, *Stochastic processes*  
 Jeanne LaDuke, *History of mathematics*  
 Linda R. Sons, *Function theory*

Joel H. Spencer, *Probabilistic methods*  
 Peter Waterman, *Discrete groups*

**August 1993 Meeting in Vancouver, British Columbia, Canada**

Associate Secretary: Lance W. Small  
*Deadline for organizers: November 11, 1992*  
*Deadline for consideration: April 27, 1993*

David M. Austin, *Four-manifolds* (AMS-CMS)  
 Nassif Ghoussoub, *Variational methods in partial differential equations* (AMS-CMS)  
 Linda Keen, *Dynamical systems* (AMS-CMS)  
 James L. Lewis and Barry Mazur, *Algebraic cycles* (AMS-CMS)  
 Ram M. Murty and Rajiv Gupta, *Number theory* (AMS-CMS)  
 Gregory Verchota, *Harmonic analysis techniques in partial differential equations* (AMS-CMS)

**September 1993 Meeting in Syracuse, New York**

Eastern Section  
 Associate Secretary: Lesley M. Sibner  
*Deadline for organizers: December 17, 1992*  
*Deadline for consideration: April 27, 1993*

Douglas R. Anderson, *Geometric topology*  
 Mark Kleiner and Dan Zacharia, *Representations of finite dimensional algebras*  
 Juan J. Manfredi, *Nonlinear potential theory*  
 Terry R. McConnell, *Topics in probability*  
 Robert S. Strichartz, *Harmonic analysis*

**October 1993 Meeting in Heidelberg, Germany**

(Joint Meeting with the Deutsche Mathematiker-Vereinigung e.V.)  
 Associate Secretary: Robert M. Fossum  
*Deadline for organizers: December 23, 1992*  
*Deadline for consideration: April 27, 1993*

**October 1993 Meeting in College Station, Texas**

Central Section  
 Associate Secretary: Andy R. Magid  
*Deadline for organizers: January 22, 1993*  
*Deadline for consideration: July 14, 1993*

Randall K. Campbell-Wright, Carl C. Cowen, and Barbara D. MacCluer, *Composition operators on spaces of analytic functions*  
 David R. Larson, *Non self adjoint operator algebras*  
 John C. Meakin, Amitai Regev, Mark V. Sapir, and Samuel M. Vovsi, *Identities and varieties of algebraic structures*  
 Efton L. Park, *Noncommutative differential geometry*  
 Sung Yell Song and Paul M. Terwilliger, *Algebraic combinatorics*

**November 1993 Meeting in Claremont, California**

Western Section  
 Associate Secretary: Lance W. Small  
*Deadline for organizers: February 5, 1993*  
*Deadline for consideration: July 14, 1993*

**January 1994 Meeting in Cincinnati, Ohio**

Associate Secretary:  
Joseph A. Cima (until 1/31/93)  
Robert J. Daverman (after 1/31/93)  
*Deadline for organizers: April 5, 1993*  
*Deadline for consideration: September 23, 1993*

**March 1994 Meeting in Lexington, Kentucky**

Southeastern Section  
Associate Secretary:  
Joseph A. Cima (until 1/31/93)  
Robert J. Daverman (after 1/31/93)  
*Deadline for organizers: June 18, 1993*  
*Deadline for consideration: To be announced*

**March 1994 Meeting in Manhattan, Kansas**

Central Section  
Associate Secretary: Andy R. Magid  
*Deadline for organizers: June 25, 1993*  
*Deadline for consideration: To be announced*

**April 1994 Meeting in Brooklyn, New York**

Eastern Section  
Associate Secretary: Lesley M. Sibner  
*Deadline for organizers: July 9, 1993*  
*Deadline for consideration: To be announced*

**June 1994 Meeting in Eugene, Oregon**

Western Section  
Associate Secretary: Lance W. Small  
*Deadline for organizers: September 7, 1993*  
*Deadline for consideration: To be announced*

**October 1994 Meeting in Stillwater, OK**

Central Section  
Associate Secretary: Andy R. Magid  
*Deadline for organizers: January 28, 1994*  
*Deadline for consideration: To be announced*

**January 1995 Meeting in Denver, Colorado**

Associate Secretary: Andy R. Magid  
*Deadline for organizers: April 20, 1994*  
*Deadline for consideration: To be announced*

**March 1995 Meeting in Chicago, Illinois**

Central Section  
Associate Secretary: Andy R. Magid  
*Deadline for organizers: June 24, 1994*  
*Deadline for consideration: To be announced*

**January 1996 Meeting in Orlando, Florida**

Associate Secretary: Lance W. Small  
*Deadline for organizers: April 12, 1995*  
*Deadline for consideration: To be announced*

**March 1996 Meeting in Iowa City, Iowa**

Central Section  
Associate Secretary: Andy R. Magid  
*Deadline for organizers: June 22, 1995*  
*Deadline for consideration: To be announced*

**Information for Organizers**

Special Sessions at Annual and Summer Meetings are held under the supervision of the Program Committee for National Meetings (PCNM). They are administered by the Associate Secretary in charge of that meeting with staff assistance from the Meetings Department in the Society office in Providence.

According to the "Rules for Special Sessions" of the Society, Special Sessions are selected by the PCNM from a list of proposed Special Sessions in essentially the same manner as individuals are selected to give Invited Addresses. The number of Special Sessions at a Summer or Annual Meeting is limited. The algorithm that determines the number of Special Sessions allowed at a given meeting, while simple, is not repeated here, but can be found in "Rules for Special Sessions" on page 614 in the April 1988 issue of the *Notices*.

Each person selected to give an Invited Address is invited to generate a Special Session, either by personally organizing one or by having a Special Session organized by others. Proposals to organize a Special Session are sometimes requested either by the PCNM or by the Associate Secretary. Other proposals to organize a Special Session may be submitted to the Associate Secretary in charge of that meeting (who is an *ex-officio* member of the committee and whose address may be found below). These proposals must be in the hands of the PCNM at least nine months prior to the meeting at which the Special Session is to be held in order that the committee may consider all the proposals for Special Sessions simultaneously. Proposals that are sent to the Providence office of the Society, to the *Notices*, or directed to anyone other than the Associate Secretary will have to be forwarded and may not be received in time to be considered for acceptance.

It should be noted that Special Sessions must be announced in the *Notices* in such a timely fashion that any member of the Society who so wishes may submit an abstract for consideration for presentation in the Special Session before the deadline for such consideration. This deadline is usually three weeks before the deadline for abstracts for the meeting in question.

Special Sessions are very effective at Sectional Meetings and can usually be accommodated. The processing of proposals for Special Sessions for Sectional Meetings is handled in essentially the same manner as for Annual and Summer Meetings by the Section Program Committee. Again, no Special Session at a Sectional Meeting may be approved so late that its announcement appears past the deadline after which members can no longer send abstracts for consideration for presentation in that Special Session.

The Society reserves the right of first refusal for the publication of proceedings of any Special Session. These proceedings appear in the book series *Contemporary Mathematics*.

More precise details concerning proposals for and organizing of Special Sessions may be found in the "Rules for Special Sessions" or may be obtained from any Associate Secretary.

**Proposals for Special Sessions to the  
Associate Secretaries**

The programs of Sectional Meetings are arranged by the Associate Secretary for the section in question:

Western Section

Lance W. Small, Associate Secretary  
Department of Mathematics  
University of California, San Diego  
La Jolla, CA 92093  
Electronic mail: g\_small@math.ams.org  
(Telephone 619-534-3590)

Central Section

Andy R. Magid, Associate Secretary  
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University of Oklahoma  
601 Elm PHSC 423  
Norman, OK 73019  
Electronic mail: g\_magid@math.ams.org  
(Telephone 405-325-6711)

Eastern Section

W. Wistar Comfort, Associate Secretary (until January 31, 1993)  
Department of Mathematics  
Wesleyan University  
Middletown, CT 06457  
Electronic mail: g\_comfort@math.ams.org  
(Telephone 203-347-9411)

Lesley M. Sibner, Associate Secretary (beginning February 1, 1993)  
Department of Mathematics  
Polytech University of New York  
Brooklyn, NY 11201-2990  
Electronic mail: g\_sibner@math.ams.org  
(Telephone 718-260-3505)

Southeastern Section

Joseph A. Cima, Associate Secretary (until January 31, 1993)  
Department of Mathematics  
University of North Carolina, Chapel Hill  
Chapel Hill, NC 27599-3902  
Electronic mail: g\_cima@math.ams.com  
(Telephone 919-962-1050)

Robert J. Daverman, Associate Secretary (beginning February 1, 1993)  
Department of Mathematics  
University of Tennessee  
Knoxville, TN 37996-1300  
Electronic mail: g\_daverman@math.ams.org  
(Telephone 615-974-6577)

As a general rule, members who anticipate organizing Special Sessions at AMS meetings are advised to seek approval at least nine months prior to the scheduled date of the meeting. No Special Sessions can be approved too late to provide adequate advance notice to members who wish to participate.

Proposals for Special Sessions at the October 1-3, 1993 meeting in Heidelberg, Germany, only, should be sent to Robert M. Fossum at the Department of Mathematics, University of Illinois, Urbana, IL 61801, Telephone: 217-244-1741, email: rmf@math.ams.org.

**Information for Speakers**

A great many of the papers presented in Special Sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a Special Session, provided it is received in Providence prior to the special early deadline announced above and in the announcements of the meeting at which the Special Session has been scheduled. Contributors

should know that there is a limitation in size of a single Special Session, so that it is sometimes true that all places are filled by invitation. Papers not accepted for a Special Session are considered as ten-minute contributed papers.

Abstracts of papers submitted for consideration for presentation at a Special Session must be received by the Providence office (Abstracts Coordinator, Meetings Department, American Mathematical Society, P. O. Box 6887, Providence, RI 02940) by the special deadline for Special Sessions, which is usually three weeks earlier than the deadline for contributed papers for the same meeting. The Council has decreed that no paper, whether invited or contributed, may be listed in the program of a meeting of the Society unless an abstract of the paper has been received in Providence prior to the deadline.

Electronic submission of abstracts is available to those who use the  $\text{T}_{\text{E}}\text{X}$  typesetting system. Requests to receive the electronic package of files via email should be sent to **abs-request@math.ams.org**. Users may also obtain the package on IBM or Macintosh diskettes, available free of charge by writing to: Electronic Abstracts, American Mathematical Society, Meetings Department, P.O. Box 6887, Providence, RI 02940, USA. When requesting the abstracts package, users should be sure to specify whether they want the plain  $\text{T}_{\text{E}}\text{X}$ ,  $\text{A}_{\text{M}}\text{S-}\text{T}_{\text{E}}\text{X}$ , or the  $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$  package. Requests for general information concerning abstracts may be sent to **abs-misc@math.ams.org**.

**Number of Papers Presented**

**Joint Authorship**

Although an individual may present only one ten-minute contributed paper at a meeting, any combination of joint authorship may be accepted, provided no individual speaks more than once. An author can speak by invitation in more than one Special Session at the same meeting.

An individual may contribute only one abstract by title in any one issue of *Abstracts*, but joint authors are treated as a separate category. Thus, in addition to abstracts from two individual authors, one joint abstract by them may also be accepted for an issue.

**Site Selection for Sectional Meetings**

Sectional Meeting sites are recommended by the Associate Secretary for the Section and approved by the Committee of Associate Secretaries and Secretary. Recommendations are usually made eighteen to twenty-four months in advance. Host departments supply local information, ten to twelve rooms with overhead projectors for contributed paper sessions and Special Sessions, an auditorium with twin overhead projectors for invited addresses, and registration clerks. The Society partially reimburses for the rental of facilities and equipment, and for staffing the registration desk. Most host departments volunteer; to do so, or for more information, contact the Associate Secretary for the Section.

# Joint Summer Research Conferences in the Mathematical Sciences

*University of Washington, Seattle, July 10 to August 6, 1993*

The 1993 Joint Summer Research Conferences in the Mathematical Sciences will be held at the University of Washington, Seattle, from July 10 to August 6. It is anticipated that the series of conferences will be supported by grants from the National Science Foundation and other agencies.

There will be seven conferences in seven different areas of mathematics. The topics and organizers for the conferences were selected by the AMS, the Institute of Mathematical Statistics (IMS), and the Society for Industrial and Applied Mathematics (SIAM) Committee on Joint Summer Research Conferences in the Mathematical Sciences. The selections were based on suggestions made by the members of the committee and individuals submitting proposals. The committee considered it important that the conferences represent diverse areas of mathematical activity, with emphasis on areas currently especially active, and paid careful attention to subjects in which there is important interdisciplinary activity at present.

The conferences emulate the scientific structure of those held throughout the year at Oberwolfach. These conferences are intended to complement the Society's program of annual Summer Institutes and Summer Seminars, which have a larger attendance and are substantially broader in scope. The conferences are research conferences and are not intended to provide an entree to a field in which a participant has not already worked.

It is expected that funding will be available for a limited number of participants in each conference. Others, in addition to those funded, will be welcome, within the limitations of the facilities of the campus. In the spring a brochure of information will be mailed to all who are requesting to attend the conferences. The brochure will include information on room and board rates, the residence and dining hall facilities, travel, local information, and a Residence Housing Form to request on-campus accommodations. Information on off-campus housing will also be included in the brochure. Participants will be responsible for making their own housing and travel arrangements. Each participant will be required to pay a conference fee.

Those interested in attending one of the conferences should send the following information to the Summer Research Conference Coordinator, Conferences Department, American Mathematical Society, Post Office Box 6887, Providence, RI 02940 or by email [cak@math.ams.org](mailto:cak@math.ams.org).

## **Please type or print the following:**

1. Title and dates of conference desired;
2. Full name;
3. Mailing address;
4. Telephone number and area code for office and home, email addresses, FAX number;
5. A short paragraph describing your scientific background relevant to the topic of the conference;
6. Financial assistance requested; please estimate cost of travel;
7. Indicate if support is not required and if interested in attending even if support is not offered.

**The deadline for receipt of requests for information is March 1, 1993.** Requests to attend will be forwarded to the Organizing Committee for each conference for consideration after the deadline of March 1. All applicants will receive a formal invitation, Brochure of Information, notification of financial assistance, and a tentative scientific program (if the Chair has prepared one in advance; otherwise, programs will be distributed at on-site registration) from the AMS by May 1. Funds available for these conferences are limited and individuals who can obtain support from other sources should do so. The allocation of grant funds is administered by the AMS office, and the logistical planning for the conferences is also done by the AMS. However, it is the responsibility of the Chair of the Organizing Committee of each conference to determine the amount of support participants will be awarded. This decision is **not** made by the AMS. Women and minorities are encouraged to apply and participate in these conferences.

Any questions concerning the scientific portion of the conference should be directed to the Chair or any member of the Organizing Committee.

The Joint Summer Research Conferences in the Mathematical Sciences are under the direction of the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences. The following committee members chose the topics for the 1993 conferences: John A. Burns, Fan R. K. Chung, Leonard Evens, Martin Golubitsky, Anthony W. Knapp, Peter W. K. Li, Stewart B. Priddy, Robert J. Serfling, Michael Shub, and Gregg J. Zuckerman.

**N.B. Lectures begin on Sunday morning and run through Thursday. Check-in for housing begins on Saturday. No lectures are held on Saturday.**

Please refer to the complete announcement with descriptions of each conference which appeared in the November *Notices*.

**Saturday, July 10 to Friday, July 16**

*Curvature equations in conformal geometry*

SUNG-YUNG A. CHANG (University of California, Los Angeles), Co-Chair

RICK SCHOEN (Stanford University), Co-Chair

**Saturday, July 10 to Sunday, July 18**

*Multivariable operator theory*

RAÚL E. CURTO (University of Iowa), Co-Chair

RONALD G. DOUGLAS (SUNY at Stony Brook), Co-Chair

JOEL D. PINCUS (SUNY at Stony Brook), Co-Chair

NORBERTO SALINAS (University of Kansas), Co-Chair

**Saturday, July 17 to Friday, July 23**

*Spectral geometry*

ROBERT BROOKS (University of Southern California), Co-Chair

CAROLYN GORDON (Dartmouth College), Co-Chair

PETER PERRY (University of Kentucky), Co-Chair

**Saturday, July 17 to Friday, July 23**

*Recent developments in the inverse Galois problem*

WALTER FEIT (Yale University), Chair

MIKE FRIED (University of California, Irvine), Co-Chair

**Saturday, July 24 to Friday, July 30**

*Mathematics of superconductivity*

M. GUNZBURGER (Virginia Tech), Co-Chair

J. OCKENDON (University of Oxford), Co-Chair

**Saturday, July 31 to Friday, August 6**

*Distributions with fixed marginals, doubly stochastic measures, and Markov operators*

HOWARD SHERWOOD (University of Central Florida), Co-Chair

MICHAEL D. TAYLOR (University of Central Florida), Co-Chair

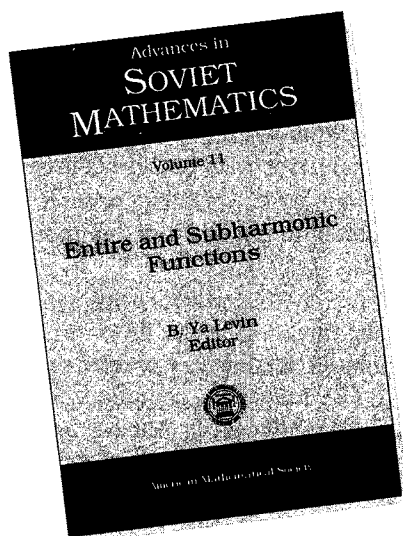
**Saturday, July 31 to Friday, August 6**

*Applications of hypergroups and related measure algebras*

WILLIAM C. CONNETT (University of Missouri, St. Louis), Co-Chair

OLIVIER GEBUHRER (Université Louis Pasteur, Strasbourg), Co-Chair

ALAN L. SCHWARTZ (University of Missouri, St. Louis), Co-Chair



## Advances in Soviet Mathematics

Volume 11

### Entire and Subharmonic Functions

B. Ya. Levin, *Editor*

The papers in this collection, written by participants of the Research Seminar on the Theory of Functions at Khar'kov University, primarily address the theory of entire and subharmonic functions. Founded in 1953 by B. Ya. Levin and still functioning today, this seminar ranges over different problems in the theory of functions, functional analysis, and related problems in calculus and mathematical physics. *Entire and Subharmonic Functions* contains works presented recently in the seminar.

1991 *Mathematics Subject Classification*: 14, 30, 31, 34, 42, 60  
ISBN 0-8218-4110-6, 275 pages (hardcover), October 1992  
Individual member \$88, List price \$147, Institutional member \$118  
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# 1993 Summer Research Institute

*Stochastic analysis*

Cornell University, Ithaca, New York, July 11–30

The forty-first Summer Research Institute sponsored by the American Mathematical Society will be devoted to Stochastic Analysis and will be held at Cornell University from July 11–30, 1993. The Co-Chairs of the Organizing Committee are **Mike Cranston**, University of Rochester; **Rick Durrett**, Cornell University; and **Mark Pinsky**, Northwestern University. The speakers were selected with the advice of a committee that consists of **Rodrigo Banuelos**, Purdue University; **Peter Baxendale**, University of Southern California; **Hans Föllmer**, Universität Bonn; **Nobuyuki Ikeda**, University of Osaka; **Paul Malliavin**, Université Pierre et Marie Curie; **Alain Sznitman**, ETH Zurich; and **Ruth Williams**, University of California, San Diego.

The topic was selected by the 1992 AMS Committee on Summer Institutes whose members at the time were: Craig Evans, Nicholas Katz, Barbara Lee Keyfitz, Brian Parshall (chair), Francois Treves, and Edward Witten.

In recent years there have been exciting interactions between probability theory and analysis, geometry, and mathematical physics, with these three fields furnishing a rich source of problems for probability theory. The conference will highlight recent achievements in the field and promising directions for future research. The meeting will be divided into six two-and-one-half day periods (Sunday morning to Tuesday noon, Wednesday morning to Friday noon, etc.) that will feature the following topics in the order indicated:

1. Stochastic ordinary differential equations (7/11–7/13)
2. Applications to analysis (7/14–7/16)
3. Applications to geometry (7/18–7/20)
4. Stochastic flows (7/21–7/23)
5. Infinite-dimensional problems (7/25–7/27)
6. Stochastic partial differential equations (7/28–7/30)

The institute will have approximately sixty-six one-hour lectures, eleven in each period. To allow time and energy for informal discussions there will be no short talks or parallel sessions. The precise content of the meeting will reflect the interests of the following list of speakers who have indicated that they will attend: L. Arnold, S. Albeverio, R. Banuelos, P. Baxendale, G. Ben-Arous, I. Benjamini, E. Bolthausen, J. Brossard, K. Burdzy, E. Carlen, R. Carmona, K. L. Chung, R. Dalang, B. Davis, D. Dawson, B. Driver, E. B. Dynkin, D. Elworthy, M. Emery, H. Föllmer, L. Gross, T. Hida, E. Hsu, N. Ikeda, G. Kallianpur, W. Kendall, Y. Kifer, S. Kotani, P. Kotelenetz, N. Krylov, H. Kunita, S. Kusuoka, T. Kurtz, R. Léandre, F. Ledrappier, J.F. Le Gall, Y. Le Jan, T. Lindstrom, M. Liao, T. Lyons, P. Malliavin, P. March, S. Molchanov, C.

Mueller, D. Nualart, D. Ocone, B. Øksendal, G. Papanicolaou, E. Pardoux, E. Perkins, R. Pinsky, M. Röckner, C. Rogers, B. Rozovskii, T. Shiga, I. Shigekawa, A. Sznitman, A. Truman, A.S. Ustunel, M. van den Berg, S. Watanabe, V. Wihstutz, R. Williams, Z. Zhao, and W. Zheng.

It is anticipated that the institute will be partially funded by a grant from the National Science Foundation. Proceedings will be published in the AMS series titled *Proceedings of Symposia in Pure Mathematics*. It is expected that the papers for the proceedings will closely parallel the content of the lectures and will be distributed to the conference participants at the time of the lectures.

All persons who are interested in this topic are welcome to attend. The organizers anticipate being able to provide partial support for travel and subsistence for young researchers, especially women and minorities. Those interested in receiving an invitation to participate in the institute should send the following information to: Summer Institute Conference Coordinator, American Mathematical Society, P.O. Box 6887, Providence R.I. 02940, **prior to April 1, 1993**, or through electronic mail to [wsd@math.ams.org](mailto:wsd@math.ams.org).

Please type or print the following:

1. Full name;
2. Mailing address;
3. Telephone number and area code for office and home, FAX number, and email address;
4. Which week or weeks you wish to attend;
5. Your scientific background relevant to the institute topic;
6. Financial assistance required (or indicate if no support required).

Information on housing, dining, travel, and the local area will be sent to invited participants in the Spring. Each participant will be required to pay a Conference fee. Questions about the scientific program can be addressed to any of the organizers, preferably by email to [cran@uordbv.bitnet](mailto:cran@uordbv.bitnet), [rtd@cornella.bitnet](mailto:rtd@cornella.bitnet), or [m.pinsky@math.nwu.edu](mailto:m.pinsky@math.nwu.edu). Questions about local arrangements should be sent to Rick Durrett via email or write to him at the Department of Mathematics, White Hall, Cornell University, Ithaca, NY 14853–7901.

Requests for invitations will be forwarded to the Organizing Committee for consideration up to the deadline of April 1. All applicants will receive formal invitations. Participants receiving financial support will be notified beginning in mid-May.

## 1993 Summer Seminar in Applied Mathematics

*The mathematics of tomography, impedance imaging, and integral geometry*

Mount Holyoke College, South Hadley, Massachusetts, June 7–18

The twenty-third AMS-SIAM Summer Seminar in Applied Mathematics will be held June 7–18, 1993, at Mount Holyoke College, South Hadley, Massachusetts. The seminar will be sponsored by the American Mathematical Society and the Society for Industrial and Applied Mathematics. It is anticipated that the seminar will be supported by grants from federal agencies. The proceedings of the seminar will be published by the American Mathematical Society in the *Lectures in Applied Mathematics* series.

One of the most exciting features of tomography is the strong relationship between high level pure mathematics (such as harmonic analysis, partial differential equations, integral geometry, microlocal analysis, and Lie group theory) and applications to medicine, impedance imaging, radiotherapy, and industrial nondestructive evaluation.

The aim of the conference is to strengthen the connection between the pure and applied aspects of these areas and to facilitate dialogue between researchers in the various areas. The seminar will provide introductory talks on tomography, impedance imaging, and integral geometry intended for younger researchers and other beginners in the field (in the first part of the conference) and a research component in which researchers will have the opportunity to define and articulate the main problems of current interest and to isolate common themes and approaches. A number of the anticipated participants will be experts from foreign countries.

The organizing committee consists of **Margaret Cheney**, Rensselaer Polytechnic Institute; **Simon Gindikin**, Rutgers University; **Peter Kuchment**, Wichita State University; **Eric Todd Quinto** (Chair), Tufts University; and **Lawrence Shepp**, Bell Laboratories.

A tentative list of proposed introductory lecturers includes David Barber, Gregory Beylkin\*, Allan Cormack, Leon

Ehrenpreis\*, Simon Gindikin\*, Sigurdur Helgason, David Isaacson\*, Frank Natterer\*, Lawrence Shepp\*, and Gunther Uhlmann\* (those with \* have accepted as of October 21, 1992). It is anticipated they will give research talks as well. A very preliminary and partial list of other possible speakers includes Carlos Berenstein, Jan Boman, Adel Faridani, Josip Globevnik, Fulton Gonzalez, Allan Greenleaf, Eric Grinberg, Alberto Gruenbaum, Gabor Herman, Michael Klivanov, Alfred Louis, Wolodymyr Madych, Ziqi Sun, John Sylvester, and Michael Vogelius.

Those interested in attending the Seminar should send the following information **before March 15, 1993**, to AMS-SIAM Summer Seminar Conference Coordinator, American Mathematical Society, P.O. Box 6887, Providence, R.I. 02940, email [dls@math.ams.org](mailto:dls@math.ams.org). Please type or print the following:

1. Full name;
2. Mailing address;
3. Telephone number and area code for office and home;
4. email address if available;
5. Anticipated arrival and departure dates;
6. Your scientific background relevant to the topic of the seminar;
7. Financial assistance requested (please estimate cost of travel), indicate if support is not required and if interested in attending even if support is not offered.

Participants who wish to apply for a grant-in-aid should so indicate; however, funds available for the seminar are very limited and individuals who can obtain support from other sources should do so. Graduate students who have completed at least one year of graduate school are encouraged to participate.

# 1993 Symposium

## Mathematics of Computation 1943–1993:

*A half-century of computational mathematics*

University of British Columbia, Vancouver, Canada, August 9–13, 1993

Under the auspices of the American Mathematical Society (AMS) and in celebration of the 50th anniversary of the journal *Mathematics of Computation*, an international symposium devoted to all aspects of computational mathematics will take place at the University of British Columbia, Vancouver, Canada, August 9–13, 1993. The symposium will be held immediately prior to the joint AMS/CMS/MAA summer meeting. As part of the meeting there will be a two-session minisymposium on computational number theory dedicated to the memory of **D. H. Lehmer**. Invited speakers will be presenting survey and state-of-the-art lectures in plenary sessions. There will also be poster sessions and 15-minute contributed paper sessions.

The topic was selected by the 1992 AMS Committee on Summer Institutes and Special Symposia, whose members at the time were: **Lawrence Craig Evens**, **Nicholas Katz**, **Barbara Lee Keyfitz**, **Brian Parshall** (Chair), **Francois Treves**, and **Edward Witten**.

The Organizing Committee for the symposium consists of **James H. Bramble**, Cornell University; **Walter Gautschi**, Purdue University (Chair); **Eugene Isaacson**, New York University; **Vidar Thomée**, Chalmers University of Technology; and **Hugh C. Williams**, University of Manitoba.

The invited speakers are: **James H. Bramble**, Cornell University; **Johannes Buchmann**, Universität des Saarlandes; **Bjørn Engquist**, UCLA; **Donald Goldfarb**, Columbia University; **James N. Lyness**, Argonne National Laboratory; **J. C. Nedelec**, Ecole Polytechnique Palaiseau; **Andrew M. Odlyzko**, AT&T Bell Laboratories; **Frank W. J. Olver**, Uni-

versity of Maryland; **Carl Pomerance**, University of Georgia; **Larry L. Schumaker**, Vanderbilt University; **Hans J. Stetter**, Technical University of Vienna; **G. W. Stewart**, University of Maryland; and **Roger Temam**, Indiana University.

The deadline for submission of contributed papers is **April 1, 1993**. Abstracts should be prepared on AMS abstract forms and should indicate whether they are being submitted for a poster session or for a contributed paper session. Abstract forms are available at most universities or obtainable from the AMS upon request. Abstracts should be sent in duplicate to **Walter Gautschi**, Department of Computer Sciences, Purdue University, West Lafayette, IN 47907, USA. Decisions on acceptances will be made by May 1, 1993. Proceedings will be published by the AMS.

The deadline for preregistration/housing is **June 6, 1993**. Preregistration and housing forms can be obtained after February 1, 1993 from the Mathematics Meetings Service Bureau, P.O. Box 6887, Providence, RI 02940-6887. There will be a registration fee of \$50. Inquiries with regard to registration and housing should be directed to that address or by email to **jlm@math.ams.org**, or telephone: 401-455-4143. Other inquiries should be sent to **Walter Gautschi**, Chair of the Organizing Committee at the address indicated in the previous paragraph.

It is anticipated that the symposium will be partially supported by a grant from the National Science Foundation. Additional funds for support are being sought from other agencies.

# Mathematical Sciences

## Meetings and Conferences

ference on Computational Physics, Univ. of Colorado, Boulder, CO. (Jan. 1992, p. 55)

### January 1993

- 1–3. **International Symposium on Statistical Physics**, Salt Lake City, Calcutta, India. (Jul./Aug. 1992, p. 629)
- 3–7. **International Conference on Scientific Computation and Differential Equations**, Auckland, New Zealand. (May/June 1991, p. 477)
- 3–9. **Grundlagen der Geometrie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)
- 3–9. **Extensions of Buildings and Geometries**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)
- 4–8. **International Conference on Scientific and Differential Equations "SCADE '93"**, Auckland, New Zealand. (Oct. 1992, p. 946)
- 4–9. **Advances in Computational Mathematics**, India International Center, New Delhi, India. (Feb. 1992, p. 149)
5. **Short Course on Nonlinear Dynamics and Chaos**, Arizona State University, Tempe, AZ. (Sep. 1992, p. 770)
- 6–9. **Dynamics Days Arizona, Twelfth Annual International Workshop**, Arizona State University, Tempe, AZ. (Sep. 1992, p. 770)
- 7–11. **Conference on Evolution Equations**, Louisiana State University, Baton Rouge, LA. (Sep. 1992, p. 770)
- 10–15. **First Panamerican Workshop in Applied and Computational Mathematics**, Simon Bolivar University, Caracas, Venezuela. (May/June 1992, p. 494)
- 10–16. **Computational Methods for Nonlinear Phenomena**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)
- 12–14. **Topology and Field Theory of 3-4 Dimensional Algebras**, Research Institute for Mathematical Sciences, Kyoto University. (Jul./Aug. 1992, p. 629)
- 13–16. **Joint Mathematics Meetings**, San Antonio, TX. (including the annual meetings of the AMS, AWM, MAA, and NAM)
- INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.
- 15–16. **1992–1993 ASL Winter Meeting**, San Antonio, TX. (Nov. 1992, p. 1115)
- 15–17. **International Conference on Complex Analysis and its Applications**, Hong Kong University of Science and Technology, Hong Kong. (Sep. 1992, p. 771)
- 17–22. **1993 IEEE International Symposium on Information Theory**, San Antonio, TX. (Feb. 1992, p. 149)
- 17–23. **Combinatorial Optimization**, Ober-

THIS SECTION contains announcements of meetings and conferences of interest to some segment of the mathematical public, including *ad hoc*, local, or regional meetings, and meetings or symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations.

AN ANNOUNCEMENT will be published in the *Notices* if it contains a call for papers, and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in each issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (\*) mark those announcements containing new or revised information.

IN GENERAL, announcements of meetings and conferences held in North America carry only date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of the *Notices*, care of the American Mathematical Society in Providence, or electronically to notices@math.ams.org.

DEADLINES for entries in this section are listed on the inside front cover of each issue. In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence SIX MONTHS prior to the scheduled date of the meeting.

EFFECTIVE with the 1990 volume of the *Notices*, the complete list of Mathematical Sciences Meetings and Conferences will be published only in the September issue. In all other issues, only meetings and conferences for the twelve-month period following the month of that issue will appear. As new information is received for meetings and conferences that will occur later than the twelve-month period, it will be announced at the end of the listing in the next possible issue. That information will not be repeated until the date of the meeting or conference falls within the twelve-month period.

### December 1992

- \*4–5. **Ninth Auburn Miniconference on Harmonic Analysis and Related Areas**, Auburn University, Auburn, AL.

PROGRAM: Wavelets and Applications.

INVITED SPEAKERS: C. Bennett, R. De Vore, and R. Sharpley (U. of South Carolina); V. Wickhauser (Washington Univ.).

INFORMATION: G. DeSouza, 228 PKH, Div. of Math., Auburn U., AL 36849-5310; 205-844-6565; email gdesouza@ducvax.auburn.edu.

- 17–19. **Algebraic Combinatorics**, Research Institute for Mathematical Sciences, Kyoto University. (Jul./Aug. 1992, p. 629)

- 17–19. **Applied Logic Conference**, University of Amsterdam. (Nov. 1992, p. 1114)

- 27–31. **Holiday Symposium on Lie Group Representations and Combinatorics**, New Mexico State University, Las Cruces, NM. (Nov. 1992, p. 1114)

### 1993

- 1992–1993. **Mittag-Leffler Institute's Academic Program for 1992–1993: Special Problems in Mathematical Physics**, Djursholm, Sweden. (Nov. 1991, p. 1171)

- \*1993–1994. **Mittag-Leffler Institute's Academic Program for 1993–1994: Topology and Algebraic K-theory**, Djursholm, Sweden.

PROGRAM: Emphasis will mainly be on homotopy theory (fall term), algebraic K-theory and manifold theory (spring term).

FELLOWSHIP DEADLINE: Application deadline for postdoctoral fellowships: April 1, 1993, to the Mittag-Leffler Inst., Auravägen 17, S-182 62 Djursholm, Sweden.

INFORMATION: I. Madsen, Dept. of Math., Aarhus Univ., DK-8000 Aarhus C, Denmark.

- Spring 1993. **IMACS Symposium on Mathematical Modelling**, Wiener Neustadt, Germany. (Jan. 1992, p. 54)

1993. **Second IMACS International Con-**

wolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

18–21. **Numerical Analysis of Partial Differential Equations in Engineering and Related Topics**, Research Institute for Mathematical Sciences, Kyoto University. (Jul./Aug. 1992, p. 630)

20–22. **Hyperfunctions and Differential Equations**, Research Institute for Mathematical Sciences, Kyoto University. (Jul./Aug. 1992, p. 630)

24–30. **Optimale Steuerung Partieller Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

25–27. **Fourth ACM-SIAM Symposium on Discrete Algorithms (SODA)**, Austin, Texas.

25–29. **IMA Workshop on Robotics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1171)

26–28. **The Development of Algebraic Topology**, Research Institute for Mathematical Sciences, Kyoto University. (Jul./Aug. 1992, p. 630)

27–29. **Modern Developments in Complex Analysis and Related Topics on the Occasion of the 70th Birthday of J. Korevaar**, University of Amsterdam, The Netherlands. (Nov. 1992, p. 1115)

31–February 6. **Asymptotics and Adaptivity in Computational Mechanics**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

## February 1993

1–3. **IMA Minisymposium on Biological Control of Movement**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

\* 5–6. **Conference on Applied Mathematics (CAM)**, University of Central Oklahoma, Edmond, OK.

PROGRAM: The ninth CAM invites papers on any aspect of applied mathematics and for special interest sessions on: Computational physics, optimization mathematics, environmental mathematics, chemical applications of mathematics, and applications of MATLAB.

INFORMATION: Conference on Applied Mathematics, College of Mathematics and Science, University of Central Oklahoma, Edmond, OK 73054; 405-341-2980, ext. 2722.

\* 5–7. **Representation Theory and Analysis on Homogeneous Spaces in Memory of Lawrence Corwin**, Rutgers University, New Brunswick, NJ. (Please note additional information to Sep. 1992, p. 771)

INVITED SPEAKERS: J. Arthur, I.M. Gelfand, R. Howe, R.P. Langlands, N.R. Wallach, P. Sally, F. Greenleaf, R.L. Lipsman, N.V. Pedersen, C. Pfeffer, T. Hales, D. Keys, P. Kutzko, L. Morris, A. Moy, F. Murnaghan, D. Shelstad.

INFORMATION: Barbara Miller, Corwin Conference, Dept. of Math., Rutgers U., New Brunswick, NJ 08904; email: bamiller@math.rutgers.edu.

\* 6–7. **Second Southern California Geometric Analysis Seminar**, University of California, Irvine.

INVITED SPEAKERS: A. Chang (UCLA), J. Cheeger (Courant Institute), N. Hitchin (U. of Warwick), J. Morgan (Columbia), A. Weinstein (UC Berkeley), S. Tung Yau (Harvard).

INFORMATION: P. Li, Dept. of Math., Univ. of California, Irvine, CA 92717; email: pli@oac.uci.edu; 714-856-7049; FAX: 714-856-7993.

7–11. **The 29th Australian Applied Mathematics Conference (AMC '93)**, Hahndorf, South Australia. (Sep. 1992, p. 771)

7–13. **Partielle Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

8–17. **IMA Workshop on Nonsmooth Analysis and Geometric Methods in Deterministic Optimal Control**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Mar. 1992, p. 250)

14–20. **Applicable Algebra**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

15–19. **1993 Mathematics-in-Industry Study Group**, Melbourne, Australia. (Sep. 1992, p. 771)

15–19. **International Conference on Mathematics, Computer, Control, and Investments**, Moscow, Russia. (Oct. 1992, p. 947)

21–27. **Curves, Images, Massive Computation**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

\* 22–28. **Workshop on Pattern Formation and Symmetry Breaking in PDE's**, Fields Institute for Research in Mathematical Sciences, Waterloo, Ontario. (Please note update to Apr. 1992, p. 351)

PROGRAM: This workshop will bring together mathematicians and other scientists studying pattern formation and symmetry breaking phenomena, particularly as they arise in partial differential equations. Significant progress has been achieved through interdisciplinary work in this area in the past decade. The emphasis in the workshop will be on developing the mathematical theory to understand the underlying mechanisms, as well as on physical applications which yield new insights. Stationary, periodic and

chaotic patterns, in both dissipative and Hamiltonian systems, will be discussed.

INVITED SPEAKERS: *To be confirmed*: D. Armbruster (Arizona State), P. Chossat (Nice), M. Dellnitz (Houston), M. Field (Sydney), K. Gatermann (Berlin), J. Gervais (Laval), J. Guckenheimer (Cornell), P. Holmes (Cornell), G. Iooss (Nice), J. Ize (Mexico), R. Kapral (Toronto), B. Keyfitz (Houston), K. Kirchgassner (Stuttgart), E. Knobloch (Berkeley), M. Krupa (Groningen), J. Mallet-Paret (Brown), J. Marsden (Fields), B. Matkowsky (Northwestern), I. Melbourne (Houston), W. Nagata (UBC/Fields), S. Schecter (N. Carolina), J. Scheurle (Hamburg), I. Stewart (Warwick), J. Swift (N. Arizona), H. Swinney (Texas), A. Vanderbauwhede (Gent), S. Wiggins (Caltech), J. Wu (York).

INFORMATION: Workshop information: Organizer, W. Langford, 519-725-0096, ext. 3026; email: langford@fields.uwaterloo.ca. For registration: S. Albers, 519-725-0096; FAX: 519-725-0704; email: symmetry@fields.uwaterloo.ca.

25–March 1. **A Conference on Numerical Analysis with Automatic Result Verification**, Lafayette, LA. (May/June 1992, p. 495)

28–March 6. **Medical Statistics: Statistical Methods for Risk Assessment**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

## March 1993

\* 2–6. **The European Consortium for Mathematics in Industry**, Montecatini Terme, Italy.

PROGRAM: The scientific program consists of eight half-day sessions, each containing one invited lecture followed by two parallel sessions for shorter presentations. The social program includes a half-day excursion (price included in conference fee) and a banquet (cost 50,000 Lira).

INVITED SPEAKERS: D.G. Crighton (UK); M. Frémond (France); S.A. Halvorsen (Norway); A. Linan (Spain); P. Markovich (Germany); S. Paveri Fontana (Italy); J. Sprekels (Germany); S. Van der Zee (The Netherlands).

INFORMATION: A. Fasano, ECMI 93, Dip. Mat. U. Dini, viale Morgagni 67a, 50134, Firenze (Italy); FAX: 0039-55-4222695; email: fismat@ifiidg.bitnet; tel: 0039-55-4361129.

\* 5–7. **Workshop on Convexity, Monotonicity, and Differentiability**, Fields Institute, Waterloo, Ontario.

PROGRAM: A previous workshop on this topic, held at the Centre de Recherches Mathématiques in Montreal in 1986, was extremely successful at drawing together

researchers from a variety of areas in functional analysis, optimization, and variational analysis. The focus was on first order theory, and significant outcomes include seminal results on differentiability of Lipschitz, convex and lower semicontinuous functions and smooth variational principles. The aim of this workshop is to capitalize on substantial subsequent work in this area, especially variational applications, second order theory and renorming results. Selected topics will include: set convergences and generalized derivatives, topological methods (CUSCOS), differentiation of multifunctions, second-order differentiability, viscosity solutions, applications to optimization, control and nonlinear equations.

INVITED SPEAKERS: J. Beer (Cal State U.), F. Clarke (U. of Montreal), M. Fabian\* (Miami U., Ohio and U. of Prague), J.-B. Hiriart-Urruty (U. of Toulouse), A. Ioffe (Technion, Haifa), P. Kenderov\* (Bulgarian Academy of Sciences), P. Loewen (UBC), B. Mordukhovich (Wayne State U.), D. Noll\* (U. of Stuttgart), R. Phelps (U. of Washington), R. Poliquin\* (U. of Alberta), D. Preiss (London), R.T. Rockafellar (U. of Washington), L. Thibault (U. of Montpellier), J. Vanderwerff\* (U. of Waterloo), J. Whitfield (Lakehead U.), V. Zizler (U. of Alberta). (\*-confirmed)

INFORMATION: Workshop Information: A.S. Lewis, 519-885-1211, ext. 6983; email: aslewis@orion.uwaterloo.ca. Registration information: S. Albers, 519-725-0096; FAX: 519-725-0704; cmd@fields.uwaterloo.ca.

7-13. **Mathematische Stochastik**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

10-12. **Equations d'Evolution, Theorie du Controle et Biomathematiques**, CIRM, Marseille, France. (Nov. 1992, p. 1115)

10-13. **The Fourth Annual Ulam Mathematics Conference**, West Palm Beach, FL. (Nov. 1992, p. 1115)

\* 11-13. **Twenty-seventh Annual Spring Topology Conference**, University of South Carolina, SC.

PROGRAM: This conference has grown to encompass most of the major branches of topology. There will be approximately 20 invited speakers giving 50-minute and 30-minute talks, and three parallel sessions of 15-minute contributed talks.

CONFERENCE TOPICS: Geometric topology, dynamical systems, continua theory, set-theoretic topology, general topology, and applications of topology to biology, chemistry, physics, and computer science.

INVITED SPEAKERS: *Preliminary*: A. Blass, L. Kauffman, M. Henriksen, S. Weinberger, S. Purisch.

INFORMATION: P. Nyikos or R.M. Stephen-

son, Dept. of Math., Univ. of South Carolina, Columbia, SC 29208; nyikos@math.sc.edu or t410159@univscvm.bitnet.

11-14. **1992-1993 Annual ASL Meeting**, University of Notre Dame, Notre Dame, IN. (Nov. 1992, p. 1115)

14-20. **Gewöhnliche Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

15-18. **Arithmetic Geometry with an Emphasis on Iwasawa Theory**, Arizona State University, Tempe, AZ. (Sep. 1992, p. 771)

15-19. **IMA Workshop on Systems and Control Theory for Power Systems**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

17-20. **Pure and Applied Linear Algebra: The New Generation**, University of West Florida, Pensacola, FL. (May/June 1992, p. 495)

\* 21. **Tutorial on Distributed Computing Using PVM and HeNCE**, Norfolk, VA.

ORGANIZER: J.J. Dongarra, Oak Ridge National Laboratory and Univ. of Tennessee, Knoxville.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; FAX: 215-386-7999; meetings@siam.org.

21-27. **Analysis auf Lokalsymmetrischen Räumen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

22-24. **Sixth SIAM Conference on Parallel Processing for Scientific Computing**, Norfolk, VA. (Oct. 1992, p. 947)

22-28. **Workshop on Pattern Formation in Earth Sciences and Biology**, Fields Institute for Research in Mathematical Sciences, Waterloo, Ontario. (Apr. 1992, p. 351)

24-28. **Conference on Quantum Topology**, Kansas State University, Manhattan, KS. (Nov. 1992, p. 1116)

\* 25-27. **1993 Barrett Memorial Lectures on Infinite Dimensional Stochastic Differential Equations**, University of Tennessee, Knoxville, TN.

PROGRAM: The general theme of the Lectures will be infinite dimensional stochastic differential equations. Each lecturer will present a series of three expository talks. The Southeastern Regional AMS Meeting is also being held on the Univ. of Tennessee Campus during March 26-27, 1993. O. Kallenberg (Auburn U., Auburn) will give an invited address at the AMS meeting. In addition, a special session on stochastic processes is also being organized at the AMS meeting. This session and the invited address are being coordinated with the Bar-

rett Lectures in order to make the AMS meeting and the Barrett Lectures more successful and beneficial for the participants.

PRINCIPAL BARRETT LECTURERS: D. Dawson (Carleton U.), Long term behavior of measure valued processes; E. Dynkin (Cornell U.), Measure-valued branching processes and partial differential equations; G. Kallianpur (University of North Carolina), Infinite dimensional stochastic differential equations.

PROGRAM COMMITTEE: R. Anderson, S. Cambanis, O. Kallenberg, H.H. Kuo, V. Mandrekar, J. Mitro, A. Mukherjea, L. Pitt, B.S. Rajput (chair), J. Rosinski, G. Samorodnitsky, J. Szulga, M.S. Taquq, W. Woyczynski.

ORGANIZING COMMITTEE: B. Rajput (615-974-0925); email: rajput@utkvtx.utk.edu and J. Rosinski (615-974-4309; email: rosinski@utkvtx.utk.edu).

INFORMATION: Contact a member of the Organizing Committee or write to: 1993 Barrett Lectures, Dept. of Math., University of Tennessee, Knoxville, TN 37996-1300; 615-974-2461; FAX: 615-974-6576.

26-27. **Southeastern Section**, Knoxville, TN.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

28-April 3. **Combinatorial Convexity and Algebraic Geometry**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

29-April 2. **Workshop on Diophantine Geometry**, Mathematical Sciences Research Institute, Berkeley, CA. (May/June 1992, p. 495)

\* 29-April 3. **Zeta Functions in Number Theory and Geometric Analysis, in honor of Jun-ichi Igusa**, Johns Hopkins University, Baltimore, MD.

PROGRAM: The conference will emphasize (i) zeta functions of prehomogeneous vector spaces and Igusa zeta functions, and (ii) the zeta functions which arise in the spectral theory of the Laplacian. Connections between the analytic and number-theoretic aspects, such as the zeta functions associated to quotients of symmetric spaces arising in the spectral theory of automorphic forms, will be included.

ORGANIZING COMMITTEE: S. Zelditch (Chair), J. Denef, N. Katz, D. Meuser, P. Sarnak, B. Shiffman, T. Sunada.

INFORMATION: JAMI Conference, Dept. of Math., Johns Hopkins U., Baltimore, MD 21218; 410-516-7399; email: dept@math.jhu.edu.

29-April 8. **Workshop on Geometric and Combinatorial Methods in Group Theory**, International Centre for the Mathematical Sciences, Edinburgh, Scotland. (Nov. 1992, p. 1116)

30-April 1. **IEEE Data Compression Con-**

ference (DCC '93), Snowbird, Utah. (Nov. 1992, p. 1116)

### Spring 1993

Spring 1993. **Valuations, Topological Fields, and Geometries**, CIRM, Marseille, France. (Nov. 1992, p. 1116)

### April 1993

4-7. **First International Conference on Mathematical Linguistics**, Barcelona, Spain. (Sep. 1992, p. 772)

4-9. **Copper Mountain Conference on Multigrid Methods**, Copper Mountain, Colorado. (Nov. 1992, p. 1116)

4-10. **Topics in Pseudo-Differential Operators**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

5-9. **IMA Tutorial: Design and Analysis of Adaptive Systems**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

7-10. **The Ninth Conference on the Mathematical Foundations of Programming Semantics**, New Orleans, LA. (Nov. 1992, p. 1116)

8-10. **Clifford Algebras in Analysis**, University of Arkansas, Fayetteville, AR. (Sep. 1992, p. 772)

9-10. **Western Section**, University of Utah, Salt Lake City, Utah.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

\* 9-11. **The Second Boise Extravaganza in Set Theory (BEST)**, Boise State Univ., Boise, Idaho.

INVITED SPEAKERS: A. Blass (Michigan), J. Baumgartner (Dartmouth), C. Laflamme (Calgary), and B. Velickovic (Toronto).

CALL FOR PAPERS: Abstracts should be submitted to T. Bartoszynski (tomek@math.idbsu.edu) or M. Scheepers (marion@math.idbsu.edu) at the Dept. of Math., Boise State Univ., Boise, Idaho 83725.

INFORMATION: A. Feldman (alex@math.idbsu.edu).

11-17. **Arbeitsgemeinschaft mit Aktuellem Thema**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

12-16. **IMA Workshop on Adaptive Control, Filtering, and Signal Processing**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

12-16. **GAMM-Jahrestagung 1993**, Dresden, Germany. (Sep. 1992, p. 772)

14-16. **Seventh SEFI European Seminar**

**on Mathematics in Engineering Education**, Eindhoven University of Technology, The Netherlands. (Feb. 1992, p. 149)

14-16. **The Mathematics of Food Production, Processing, and Presentation**, Belfast, Great Britain. (Sep. 1992, p. 772)

14-23. **International Conference in Abstract Analysis**, Kruger National Park, Republic of South Africa. (Oct. 1992, p. 948)

\* 15-22. **Symposium on Analytic and Geometric Aspects of Hyperbolic Geometry: Research Level Workshop**, University of Warwick, Coventry, UK. (Please note updated information to Mar. 1992, p. 250)

PROGRAM: There will be three minicourses, given by R.D. Canary, S.P. Kerckhoff, and J.P. Otal, devoted to the general problem of putting hyperbolic structures on 3-dimensional manifolds, orbifolds, and cone-manifolds. Canary and Otal will discuss methods developed by Thurston, McMullen, and others. Kerckhoff will talk about his joint work with Hodgson, explaining the use of harmonic theory in this problem. There will also be lectures on other topics.

17-18. **Eastern Section**, Washington, DC.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

\* 18. **Tutorial on Introduction to Parallel Computation**, Houston, TX.

ORGANIZERS: C. Dawson and T. Arbogast, Rice Univ.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; FAX: 215-386-7999; email: meetings@siam.org.

18-24. **The Arithmetik of Fields**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

18-24. **Mathematische Grundlagen und Numerische Verfahren bei Transsonischen Strömungen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

19-20. **IMA Minisymposium on Fuzzy Control**, University of Minnesota, Minneapolis, MN. (Nov. 1992, p. 1117)

19-21. **SIAM Conference on Mathematical and Computational Issues in the Geosciences**, Houston, TX. (Jul./Aug. 1992, p. 631)

25-May 1. **Low Dimensional Dynamics**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

26-29. **NCGA '93 Computer Graphics Solutions: Applications for Implementation**, Philadelphia, PA. (Nov. 1992, p. 1117)

27-29. **NSF/DoD's National SBIR Conferences**, Minneapolis, MN. (Sep. 1992, p. 772)

\* 30-May 2. **Third Midwestern Geometry**

**Conference**, University of Missouri, Columbia, MO. (Nov. 1992, p. 1117)

INVITED SPEAKERS: Please add José Escobar to the list of invited speakers.

### May 1993

2-4. **Workshop on Operator Algebras**, Institute for Advanced Studies in Mathematics, Technion, Haifa, Israel. (Oct. 1992, p. 948)

\* 2-7. **Algebraic Geometry Workshop on the Occasion of the 65th Birthday of F. Hirzebruch**, Emmy Noether Institute, Bar-Ilan Univ., Ramat Gan, Israel.

PROGRAM: The workshop will concentrate on the following subjects: algebraic surfaces, topology of algebraic varieties, 3-folds, and vector bundles.

INFORMATION: M. Teicher, S. Zur, Emmy Noether Institute, Math. Dept., Bar-Ilan Univ., Ramat Gan, Israel; tel: 972-3-6042122; FAX: 972-3-5442877; email: czur@bimacs.bitnet; teicher@bimacs.bitnet.

3-7. **IMA Tutorial: Verification Issues in Discrete Event Systems, as well as Performance and Control**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

3-7. **Problemes aux Limites, Equations & Integrales de Bord dans des Domaines Non Reguliers**, CIRM, Marseille, France. (Nov. 1992, p. 1117)

3-9. **Workshop on Ecological Systems**, Fields Institute for Research in Mathematical Sciences, Waterloo, Ontario. (Apr. 1992, p. 352)

4-8. **The Third International Colloquium on Cognitive Science (ICCS-93)**, Donostia-San Sebastian, Spain. (Nov. 1992, p. 1117)

9-15. **Reelle Algebraische Geometrie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

9-17. **Jerusalem Combinatorics '93**, Hebrew University of Jerusalem, Israel. (Jul./Aug. 1992, p. 631)

10-12. **IMACS Symposium on Signal Processing and Neural Networks-SPANN '93**, Université du Québec at Montréal, Canada. (Jan. 1992, p. 56)

10-14. **IMA Workshop on Discrete Event Systems, Manufacturing Systems, and Communication Networks**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

10-14. **The Tenth International Symposium on Applied Algebra, Algebraic Algorithms, and Error Correcting Codes**, San Juan de Puerto Rico. (Oct. 1992, p. 948)

10-14. **Geometrie et Topologie des Sous-Varietes**, CIRM, Marseille, France. (Nov. 1992, p. 1117)

13-16. **ASL Spring Meeting in Conjunction with a Meeting of the Society for Exact Philosophy**, York University, Toronto, Canada. (Nov. 1992, p. 1117)

16-22. **Mathematical Problems in Viscoelastic Flows**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

\* 17-19. **Third International Conference on Expert Systems for Numerical Computing**, Purdue University, West Lafayette, IN.

CONFERENCE RATIONAL: Many diverse groups have started work on projects to aid in the use of complex software systems, and to guide nonspecialists in the many choices that have to be made when they want to use computers for scientific applications. This international conference will bring together active researchers to exchange ideas, viewpoints, and techniques.

CONFERENCE TOPICS: Artificial intelligence and expert systems for numerical computing; knowledge-based systems for scientific applications; expert systems for mapping applications to parallel architectures and to support parallel processing; advisory expert systems for general-purpose scientific software libraries; tools and methods for knowledge acquisition about numerical computing; problem solving environments for scientific/engineering applications; and natural language for scientific interfaces.

CALL FOR PAPERS: The conference will include invited and contributed papers. Authors should submit three copies of an extended abstract (two or three type written pages) by January 15, 1993. Send to the address below.

INFORMATION: E. Houstis, Purdue Univ., 1398 Computer Science Building, West Lafayette, IN 47907; 317-494-6181; FAX: 317-494-0739; enh@cs.purdue.edu.

18-21. **Eighth Annual Conference on Structure in Complexity Theory**, San Diego, CA. (Oct. 1992, p. 948)

20-22. **International Symposium on Ordinary Differential Equations and Applications**, Western Michigan University, Kalamazoo, MI. (Nov. 1992, p. 1117)

\* 20-22. **International Conference on Approximation, Probability, and Related Fields**, University of California, Santa Barbara.

PROGRAM: The main purpose of the conference is to bring together national and international researchers in approximation, probability, and related fields in an intense and intimate environment conducive to interacting. The emphasis is on the interplay of important topics in approximation theory and probability.

CONFERENCE TOPICS: Approximation of functions by polynomials, spline operators and their applications to stochastics; numerical methods for approximation of de-

terministic and stochastic integrals; orthogonal polynomials and stochastic processes; positive linear operators and related deterministic and stochastic inequalities; multivariate approximation and interpolation; approximations and martingales; deterministic and stochastic inequalities; stability of deterministic and stochastic models; signal analysis; prediction theory; and wavelets and approximations.

INVITED SPEAKERS: R. Adler, Technion Univ.; P.L. Butzer, RWTH, Aachen; S. Cambanis, Univ. of North Carolina; P. Erdos, Hungarian Academy of Sciences; R. Karandikar, Indian Statistical Institute; J.H.B. Kemperman, Rutgers Univ.; G.G. Lorentz, Univ. of Texas; M. Maejima, Keio Univ.; C. Micchelli, IBM; L. Ruschendorf, Univ. of Munster; G. Samorodnitsky, Cornell Univ; G. Strang, MIT; M. Taqqu, Boston Univ.; W. Vervaat, Catholic Univ. at Nijmegen.

INFORMATION: Organizing Committee Chairmen: G. Anastassiou, Dept. of Math. Sciences, Memphis State Univ., Memphis, TN 38152; or S.T. Rachev, Dept. of Stats. and Applied Prob., Univ. of California, Santa Barbara, CA 93106.

20-23. **International Conference on Approximation Probability and Related Fields**, University of California, Santa Barbara, CA. (May/June 1991, p. 477)

20-23. **Central Section**, Northern Illinois University, DeKalb, IL.

INFORMATION: W.S. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

23-29. **Differentialgeometrie im Grossen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

24-27. **COMPEURO '93**, Paris-Evry, France. (Jul./Aug. 1992, p. 631)

24-27. **Eurocrypt '93: A Workshop on the Theory and Applications of Cryptographic Techniques**, Lofthus, Norway. (Nov. 1992, p. 1118)

24-28. **Matroides et Matroides Orientes**, CIRM, Marseille, France. (Nov. 1992, p. 1118)

\* 24-28. **Ergodic Theory and Its Connections with Harmonic Analysis**, Alexandria, Egypt.

PROGRAM AND SPEAKERS: There will be survey talks on: Singular measures on the circle and spectral theory (J.F. Méla, U. of Paris-Nord); Noncommutative harmonic analysis and rigidity phenomena in dynamics (R. Spatzier, U. of Michigan); Fourier methods and almost everywhere convergence (M. Wierdl, U. of North Carolina, and J. Rosenblatt, Ohio State U.); relations among spectral properties and dynamic structure (J.P. Thouvenot, U. of Paris, France); relations with number theory and combinatorics (V. Bergelson, Ohio

State U.). There will be invited addresses as well as sessions for contributed papers.

CALL FOR PAPERS: To give a short talk, please send an abstract by March 15, 1993. SHORT COURSES: To provide the necessary background for people new to this research area, the week before the meeting the conference will offer short courses on ergodic theory, harmonic analysis, and number theory.

INFORMATION: I. Salama, School of Business, North Carolina Central Univ., Durham, NC 27707; email: salama@unc.edu.

26-29. **First International Conference on Dynamic Systems and Applications**, Morehouse College, Atlanta, GA. (Oct. 1992, p. 948)

30-June 1. **Canadian Society for the History and Philosophy of Mathematics**, Carleton University, Ottawa, Ontario, Canada. (Sep. 1992, p. 772)

30-June 5. **Funktionalanalysis und Nicht-lineare Partielle Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

30-June 13. **First Caribbean Spring School of Mathematics and Theoretical Physics**, Guadeloupe (French West Indies). (Nov. 1992, p. 1118)

31-June 4. **Workshop on Nonnegative Matrices, Applications, and Generalizations**, Technion, Haifa, Israel. (Nov. 1992, p. 1118)

## June 1993

June 1993. **Fourth IMACS International Symposium on Computational Acoustics**, Cambridge, England. (Jan. 1992, p. 56)

June 1993. **GAMM/IFIP - Workshop on Stochastic Optimization: Numerical Methods and Technical Applications**, Neubiberg/München, Germany. (Sep. 1992, p. 773)

June 1993. **Summer Workshop: Calculus, Computers, Concepts, and Cooperative Learning**, Purdue University, West Lafayette, IN. (Nov. 1992, p. 1118)

1-4. **Rigidite et Deformation pour les Systemes Hyperboliques**, CIRM, Marseille, France. (Nov. 1992, p. 1118)

\* 2-4. **The Lars Onsager Symposium. Coupled Transport Processes and Phase Transitions**, Trondheim, Norway.

PROGRAM: In addition to the invited lectures, there will be two parallel sessions of contributed talks and a poster session.

INVITED SPEAKERS: R. Baxter (Canberra), M.E. Fisher (Maryland), H.L. Friedman (Stony Brook), L. Kadanoff (Chicago), J.L. Lebowitz (Rutgers), H.N.W. Lekkerkerker (Utrecht), E. H. Lieb (Princeton), J. Nagle (Carnegie Mellon), G. Stell (Stony Brook). CALL FOR PAPERS: The deadline for submission of abstracts is February 1, 1993.



INFORMATION: The Onsager Symposium, The Norwegian Institute of Technology, N-7034 Trondheim, Norway; email: onsager93@imf.unit.no.

2-5. **Ninth Biennial Conference of the Association of Christians in the Mathematical Sciences**, Westmont College, Santa Barbara, CA. (Sep. 1992, p. 773)

6-9. **Annual Meeting of the Statistical Society of Canada**, Wolfville, Nova Scotia, Canada. (Feb. 1992, p. 149)

6-12. **Analysis auf Kompakten Varietäten**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

7-10. **SIAM Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena**, University of Delaware, Newark, DE. (Jul./Aug. 1992, p. 631)

7-10. **The Eighth Haifa Matrix Theory Conference**, Technion, Haifa, Israel. (Nov. 1992, p. 1119)

7-11. **IMA Tutorial: Mathematical Theory which Has become an Integral Part of Modern Financial Economics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

7-11. **Colloque International en l'Honneur de G. Freiman. La Methode Additive Inverse et ses Applications**, CIRM, Marseille, France. (Nov. 1992, p. 1119)

\*7-11. **Art and Mathematics Conference (AM93)**, State University of New York, Albany, NY.

PROGRAM: AM93 is an international interdisciplinary conference relating art and mathematics. The emphasis is on visualization with examples from architecture, geometry, graphics, quilts, painting, sculpture, and topology.

INVITED SPEAKERS: T. Banchoff, J. Conway, P. Davis, S. Dickson, M. Emmer, H. Ferguson, Z. Hecker, C. Meadmore, T. Milkowski, C. Perry, R. R. Shearer, and K. Snelson. There will be panel discussions, a slide and video registry, and space available for displays.

INFORMATION: N. Friedman, Dept. of Math., SUNY-Albany, Albany, NY 12222; FAX: 518-442-4731; email: artmath@math.albany.edu; tel: 518-442-4621.

7-12. **International Conference in Honour of Bernard Malgrange**, Grenoble, France. (Nov. 1992, p. 1119)

7-13. **Workshop on Pattern Formation and Cellular Automata**, Fields Institute for Research in Mathematical Sciences, Waterloo, Ontario. (Apr. 1992, p. 352)

\*13-18. **The Householder Symposium XII Meeting on Numerical Algebra**, UCLA Conference Center, Lake Arrowhead, CA.

PROGRAM: This meeting is the twelfth in a series, previously called the Gatlinburg Symposia, renamed to honor Alston S. Householder. The meeting will be very informal. Extended talks are given during the day and special workshops organized by the participants in the evening. The following topics are emphasized: parallel computation issues, signal and image processing, control, wavelets, nonsymmetric conjugate gradient methods, domain decomposition and multilevel methods and industrial problems.

INFORMATION: Householder 93, c/o B. Dalton, Dept. of Math., Univ. of California, Los Angeles, 405 Hilgard Ave., Los Angeles, CA 90024-1555; householder93@math.ucla.edu.

13-19. **Differential-Algebraic Equations: Theory and Applications in Technical Simulation**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

14-17. **The Fifth Asian Logic Conference**, National University of Singapore, Singapore. (May/Jun. 1992, p. 496)

14-18. **IMA Workshop on Mathematical Finance**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

14-18. **Linear Logic Workshop**, Mathematical Sciences Institute, Cornell University, Ithaca, NY. (May/Jun. 1992, p. 496)

14-18. **Homologie des Algebres et Applications**, CIRM, Marseille, France. (Nov. 1992, p. 1119)

15-17. **IEEE Computer Society Conference on Computer Vision and Pattern Recognition**, Omni Park Central, New York City, NY. (Nov. 1992, p. 1119)

15-18. **Third IMACS International Workshop on Qualitative Reasoning and Decision Technologies-QR&DT-3**, Polytechnique of Barcelona, Spain. (Jan. 1992, p. 56)

\*17-19. **ATLAST 1993 Linear Algebra Workshops**, Michigan State University, East Lansing, MI.

PROGRAM: ATLAST is an NSF-ILAS Project to Augment the Teaching of Linear Algebra through the use of Software Tools. The project will offer five faculty workshops during the summer of 1993 on the use of software in teaching linear algebra. Workshop participants will learn about existing commercial linear algebra software packages and will be trained in the use of the MATLAB software package. Attendees will learn how to effectively incorporate exercises and laboratories into undergraduate linear algebra courses. Participants will learn to design computing exercises at a level suitable for assigning to an undergraduate linear algebra class. These exercises will be class-tested during

the school year following the workshop and then submitted to the project director for inclusion in an edited manual which will be distributed to the attendees. The ATLAST Project provides room and board for participants attending the workshops. Participants will also receive a stipend of \$200 for their submitted exercises.

DIRECTORS: S.J. Leon, Director (ILAS Education Committee, Univ. of Massachusetts, Dartmouth) and Asst. Director R.E. Faulkenberry (Univ. of Massachusetts, Dartmouth). WORKSHOP PRESENTER: S.J. Leon, UMass Dartmouth.

APPLICATIONS: All teachers of undergraduate linear algebra courses at colleges or universities in the U.S. are invited to apply. Deadline for applications is March 12, 1993. Each workshop will be limited to thirty participants.

INFORMATION: R. Faulkenberry, ATLAST Project Assistant Director, Dept. of Math., Univ. of Massachusetts Dartmouth, North Dartmouth, MA 02747; 508-999-8928; FAX: 508-999-8901; email: atlast@umassd.edu.

\*18-19. **Conference on Integration of Precalculus with Calculus**, Moravian College, Bethlehem, PA.

PROGRAM: The program will focus on issues related to teaching calculus to underprepared students, and special courses that integrate precalculus concepts as they are needed in a first course in calculus.

CONFERENCE TOPICS: Courses that integrate precalculus with calculus, research in learning precalculus-calculus, teaching calculus to the underprepared student or to the nontraditional student, assessment of attitudes and mathematical understanding, the role of technology in a precalculus course.

CALL FOR PAPERS: Abstracts (1 page or less) must be submitted for review (address below) by April 1, 1993.

INFORMATION: Registration deadline is May 15, 1993. For further information, write to: D. Schattschneider, Dept. of Math., 1200 Main St., Moravian College, Bethlehem, PA 18018-6650; 215-861-1373; FAX: 215-861-3919; email: schattdo@moravian.edu.

20-23. **Eighth Annual IEEE Symposium on Logic in Computer Science (LICS)**, Montreal, Canada. (Nov. 1992, p. 1119)

20-26. **Konvexgeometrie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

21-25. **Twenty-second Conference on Stochastic Processes and their Applications**, Amsterdam, The Netherlands. (Sep. 1992, p. 773)

21-25. **Graphs on Surfaces**, Johns Hopkins University, Baltimore, MD. (Sep. 1992, p. 773)

21-25. **Fifth International Conference on**

**Formal Power Series and Algebraic Combinatorics**, University of Florence, Florence, Italy. (Oct. 1992, p. 949)

21–26. **Homogenisation et Methodes de Convergence en Calcul des Variations**, CIRM, Marseille, France. (Nov. 1992, p. 1119)

22–24. **The Twenty-third Annual International Symposium on Fault-Tolerant Computing (FTCS 23)**, Toulouse, France. (Nov. 1992, p. 1119)

22–25. **Third International Conference on Algebraic Methodology and Software Technology (AMAST '93)**, Enschede, The Netherlands. (Nov. 1992, p. 1119)

23–26. **Convergence in Ergodic Theory and Probability**, Ohio State University, Columbus, OH. (May/June 1992, p. 496)

\* 24–26. **Twenty-fifth Anniversary of the Classification Society of North America**, Pittsburgh, PA.

**PURPOSE:** The purpose of the annual meeting is to provide a forum for presentation and cross-disciplinary discussion of data-oriented approaches related to classification and understanding of complex data structures.

**PROGRAM:** The program will include plenary talks by invited speakers and symposia on neural network, genetic algorithm, multivariate density estimation, and visual clustering approaches to classification. Invited sessions will feature the application areas of numerical taxonomy, numerical ecology, molecular biology, and information retrieval.

**CALL FOR PAPERS:** Abstracts due by March 15, 1993. Contributed papers will be allotted 20 minutes, including discussion.

**INFORMATION:** S.C. Hirtle, Dept. of Information Science, Univ. of Pittsburgh, PA 15260; tel: 412-624-9434; FAX: 412-624-5231; email: csna93@lis.pitt.edu.

\* 24–26. **ATLAST 1993 Linear Algebra Workshops**, Los Angeles Peirce College, Woodland Hills, CA.

**PROGRAM:** ATLAST is an NSF-ILAS Project to Augment the Teaching of Linear Algebra through the use of Software Tools. The project will offer five faculty workshops during the summer of 1993 on the use of software in teaching linear algebra. Workshop participants will learn about existing commercial linear algebra software packages and will be trained in the use of the MATLAB software package. Attendees will learn how to effectively incorporate exercises and laboratories into undergraduate linear algebra courses. Participants will learn to design computing exercises at a level suitable for assigning to an undergraduate linear algebra class. These exercises will be class-tested during the school year following the workshop

and then submitted to the project director for inclusion in an edited manual which will be distributed to the attendees. The ATLAST Project provides room and board for participants attending the workshops. Participants will also receive a stipend of \$200 for their submitted exercises.

**DIRECTORS:** S.J. Leon, Director (ILAS Education Committee, Univ. of Massachusetts, Dartmouth) and Asst. Director R.E. Faulkenberry (Univ. of Massachusetts, Dartmouth). **WORKSHOP PRESENTER:** J. Day, San Jose State University.

**APPLICATIONS:** All teachers of undergraduate linear algebra courses at colleges or universities in the U.S. are invited to apply. Deadline for applications is March 12, 1993. Each workshop will be limited to thirty participants.

**INFORMATION:** R. Faulkenberry, ATLAST Project Assistant Director, Dept. of Math., Univ. of Massachusetts Dartmouth, North Dartmouth, MA 02747; 508-999-8928; FAX: 508-999-8901; email: atlast@umassd.edu.

27–July 3. **Algebraische K-Theorie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

28–30. **Second International Workshop on Logic Programming and Nonmonotonic Reasoning**, Lisbon, Portugal. (Nov. 1992, p. 1120)

28–July 2. **Geometrie Algebrique et Theorie des Codes**, CIRM, Marseille, France. (Nov. 1992, p. 1120)

28–July 3. **Conference in Honour of Jean-Pierre Kahane**, University Paris-Sud at Orsay. (Nov. 1992, p. 1120)

\* 28–July 9. **Conference on Matrix Analysis for Applications**, University of Wyoming, Laramie, WY.

**PROGRAM:** Mornings will be devoted to lecture and discussion of matrix topics that support a variety of applications and provide an entry into current research in matrix analysis. Some modern applications and research-level open problems of current interest will be mentioned. Representative of the topics to be covered are: Partitioned matrices and Schur complements, eigenvalues and eigenvectors, unitary similarity and normal matrices, Hermitian and positive definite matrices, fundamental factorizations: Schur triangularization, Jordan canonical form, LU, QR, polar decomposition, singular value decomposition, etc.; magnitudinal theory: norms and Gersgorin theory, nonnegative matrices, the field of values, Kronecker, Hadamard products and matrix equations, matrix stability, graphs and matrices, factorization of sparse matrices, matrix inequalities, inequalities for singular values, matrices and functions. Af-

ternoons will be available for organized discussion of sample problems, discussion of computational tools, informal exploration of research topics of common interest, and discussion of curricula issues associated with the first and second linear algebra courses. There is no registration fee.

**PRINCIPAL SPEAKER:** Charles R. Johnson (The College of William and Mary).

**OTHER SPEAKERS:** D.H. Carlson (San Diego State U.), and D.C. Lay (U. of Maryland).

**INFORMATION:** A.D. Porter, Math. Dept., P.O. Box 3036, Univ. Station, Univ. of Wyoming, Laramie, WY 82071.

29–July 2. **Number Theoretic and Algebraic Methods in Computer Science**, International Center of Scientific and Technical Information (ICSTI), Moscow. (Sep. 1992, p. 773)

### July 1993

\* 2–4. **T.I.Tec/K.E.S. Conference on Non-linear and Convex Analysis in Economic Theory**, Tokyo, Japan.

**CONFERENCE THEMES:** Nonlinear dynamical systems and business fluctuations, fixed point theory, convex analysis and optimization, eigenvalue of positive operators and von Neumann model, stochastic analysis and financial market, equilibrium analysis on infinite dimensional spaces, game theory and economic analysis, computational aspects in equilibrium theory.

**INFORMATION:** Chief Director, W. Takahashi, Tokyo Institute of Technology, Dept. of Information Science, 2-12-1, OhOkayama, Meguro-ku, Tokyo 152, Japan; Tel: 03-3726-1111 (ex. 3208); FAX: 03-3729-0231; email: wataru@is.titech.ac.jp.

4–9. **Fifth International Fuzzy Systems Association World Congress**, Seoul, Korea. (Mar. 1992, p. 250)

4–10. **Freie Randwertprobleme**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

4–10. **Fifth International Congress on Algebraic Hyperstructures and Applications**, Iasi, Romania. (Sep. 1992, p. 773)

5–9. **Communications et Reseaux d'Interconnexion**, CIRM, Marseille, France. (Nov. 1992, p. 1120)

5–9. **The Thirty-seventh Annual Meeting of the Australian Mathematical Society (AMS '93)**, University of Wollongong, Australia. (Nov. 1992, p. 1120)

\* 5–9. **CTAC93 Conference and Workshops**, Australian National University, Canberra, A.C.T., Australia.

**PROGRAM:** CTAC93 is the 6th biennial conference on computational techniques and applications organized by the Applied

Math. Div. of the Australian Math. Society. INVITED SPEAKERS: A. Cooper (Lausanne), C. Elliott (Sussex), D. Green (ANU), A. Griewank (Argonne), S. McCormick (UC Denver), J. Monaghan (Monash).

WORKSHOPS: Will be held on July 8-9. Topics are: Computational problems in fluids, mhd, and plasmas; optimization, complementarity problems, and variational inequalities; and programming distributed memory multiprocessors.

CALL FOR PAPERS: Titles and abstracts of intended contributions should be submitted by March 31, 1993.

INFORMATION: CTAC93 Committee, School of Mathematical Sciences, Australian National Univ., Box 4 PO Canberra, A.C.T. 2601, Australia; FAX: (61+6) (06) 247 2347; email: ctac-reg@thrain.anu.edu.au. A conference information file ftp/pub/CTAC93/ctac93.info is held on thrain.anu.edu.au for access via anonymous ftp.

\* 5-9. **British Combinatorial Conference**, Keele University, Staffordshire, UK.

INVITED LECTURES: N. Alon (Tel-Aviv), Restricted colorings of graphs; A. Blokhuis (Eindhoven), polynomials in finite geometries and combinatorics; G. Brightwell (London), models of random partial orders; A. Frank (Bonn), applications of submodular functions; A.J.W. Hilton (Reading), weighted quasi-groups; A.A. Ivanov (Chicago), 2-transitive graphs with projective sub-constituents and small girth; B. Jackson (London), cycle decompositions and covers of graphs; M. Saks (Rutgers), restrictions of labelled hypercubes; D.R. Stinson (Nebraska), combinatorial cryptography.

INFORMATION: K. Walker, Dept. of Math., Keele Univ., Staffordshire, ST5 5BG, UK; tel: 0782 583268; FAX: 0782 715194; email: maa06@uk.ac.keele.seq1.

5-31. **NSF Regional Geometry Institute: Discrete Geometry**, Smith College, Northampton, MA. (Nov. 1992, p. 1120)

6-9. **European Multigrid Conference '93**, Amsterdam, The Netherlands. (May/Jun. 1992, p. 496)

6-23. **IMA Summer Program on Modeling, Mesh Generations, and Adaptive Numerical Methods for Partial Differential Equations**, University of Minnesota, Minneapolis, MN. (Nov. 1992, p. 1120)

7-10. **The Second International Conference on Fluid Mechanics (ICFM-II)**, Beijing, China. (Sep. 1992, p. 773)

\* 8-10. **ATLAST 1993 Linear Algebra Workshops**, University of Houston-Downtown, Houston, TX.

PROGRAM: ATLAST is an NSF-ILAS Project

to Augment the Teaching of Linear Algebra through the use of Software Tools. The project will offer five faculty workshops during the summer of 1993 on the use of software in teaching linear algebra. Workshop participants will learn about existing commercial linear algebra software packages and will be trained in the use of the MATLAB software package. Attendees will learn how to effectively incorporate exercises and laboratories into undergraduate linear algebra courses. Participants will learn to design computing exercises at a level suitable for assigning to an undergraduate linear algebra class. These exercises will be class-tested during the school year following the workshop and then submitted to the project director for inclusion in an edited manual which will be distributed to the attendees. The ATLAST Project provides room and board for participants attending the workshops. Participants will also receive a stipend of \$200 for their submitted exercises.

DIRECTORS: S.J. Leon, Director (ILAS Education Committee, Univ. of Massachusetts, Dartmouth) and Asst. Director R.E. Faulkenberry (Univ. of Massachusetts, Dartmouth). WORKSHOP PRESENTER: E. Herman, Grinnell College.

APPLICATIONS: All teachers of undergraduate linear algebra courses at colleges or universities in the U.S. are invited to apply. Deadline for applications is March 12, 1993. Each workshop will be limited to thirty participants.

INFORMATION: R. Faulkenberry, ATLAST Project Assistant Director, Dept. of Math., Univ. of Massachusetts Dartmouth, North Dartmouth, MA 02747; 508-999-8928; FAX: 508-999-8901; email: atlast@umassd.edu.

11-17. **Nonlinear Evolution Equations, Solitons and the Inverse Scattering Transform**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

\* 12-16. **SIAM Annual Meeting**, Philadelphia, PA.

ORGANIZER: G. Kriegsmann, New Jersey Inst. of Tech.

ABSTRACT DEADLINE: February 5, 1993.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; FAX: 215-386-7999; email: meetings@siam.org.

12-16. **Chaotic Numerics (An International Workshop on the Approximation and Computation of Complicated Dynamical Behavior)**, Deakin University, Geelong, Australia. (Oct. 1992, p. 949)

12-17. **Colloque Takeuti: Theorie de la Demonstration et Applications en Informa-**

tique, CIRM, Marseille, France. (Nov. 1992, p. 1121)

12-17. **Third International Conference on Nonassociative Algebra and its Applications**, University of Oviedo, Spain. (Nov. 1992, p. 1121)

12-23. **Conference on Universal Algebra and Category Theory**, Mathematical Sciences Research Institute, Berkeley, CA. (May/Jun. 1992, p. 496)

\* 15-17. **ATLAST 1993 Linear Algebra Workshops**, Georgia State University, Atlanta, GA.

PROGRAM: ATLAST is an NSF-ILAS Project to Augment the Teaching of Linear Algebra through the use of Software Tools. The project will offer five faculty workshops during the summer of 1993 on the use of software in teaching linear algebra. Workshop participants will learn about existing commercial linear algebra software packages and will be trained in the use of the MATLAB software package. Attendees will learn how to effectively incorporate exercises and laboratories into undergraduate linear algebra courses. Participants will learn to design computing exercises at a level suitable for assigning to an undergraduate linear algebra class. These exercises will be class-tested during the school year following the workshop and then submitted to the project director for inclusion in an edited manual which will be distributed to the attendees. The ATLAST Project provides room and board for participants attending the workshops. Participants will also receive a stipend of \$200 for their submitted exercises.

DIRECTORS: S.J. Leon, Director (ILAS Education Committee, Univ. of Massachusetts, Dartmouth) and Asst. Director R.E. Faulkenberry (Univ. of Massachusetts, Dartmouth). WORKSHOP PRESENTER: K. Sigmon, University of Florida.

APPLICATIONS: All teachers of undergraduate linear algebra courses at colleges or universities in the U.S. are invited to apply. Deadline for applications is March 12, 1993. Each workshop will be limited to thirty participants.

INFORMATION: R. Faulkenberry, ATLAST Project Assistant Director, Dept. of Math., Univ. of Massachusetts Dartmouth, North Dartmouth, MA 02747; 508-999-8928; FAX: 508-999-8901; email: atlast@umassd.edu.

18-24. **Dynamische Systeme**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

\* 18-24. **Twelfth International Conference on Near-rings and Near-fields**, University of New Brunswick, Fredericton, N.B., Canada.

PRINCIPAL SPEAKERS: G. Betsch, Tübingen,

Germany; H. Heatherly, Lafayette; and J.J. Malone, Worcester, MA.

SESSIONS: Connections to geometry, near-rings of group endomorphisms, coding theory, ideals and radicals, matrix near-rings, topological considerations, etc.

INFORMATION: G. Mason, Dept. of Math. and Stats., Univ. of New Brunswick, P.O. Box 4400, Fredericton, N.B., E3B 5A3; FAX: 506-453-4705; email: gmason@unb.ca; or H. Bell, Dept. of Math., Brock Univ., St. Catharines, Ontario, L2S 3A1; FAX: 416-688-2789; email: hbell@spartan.ac.brocku.ca.

19-23. **Singularities**, CIRM, Marseille, France. (Nov. 1992, p. 1121)

\* 19-23. **International Congress on Computer Systems and Applied Mathematics**, St. Petersburg, Russia.

PROGRAM: The congress will provide a forum to bring together scientific computing, applied and computational mathematics, and to explore common interests and interplay across disciplines.

CALL FOR PAPERS: Papers and minisymposia are invited in all areas of: applied and computational mathematics; applied probability and statistics; theory of computing; optimization and operations research; scientific computation; parallel processing; programming languages; symbolic computation; supercomputing; CASE tools; fuzzy systems; databases; networks; neural nets; artificial intelligence; computer graphics; data security; simulation and modelling; mathematical education.

CALL FOR PAPERS: Submissions due May 1, 1993.

INFORMATION: S.S. Voitenko, Director, Center of Modern Communications, Univ. of St. Petersburg, 14th Line 29, 199178 St. Petersburg, Russia; email: serge@spfac.lgu.spb.su.

20-29. **1993 ASL European Summer Meeting (Logic Colloquium '93)**, University of Keele, United Kingdom. (Nov. 1992, p. 1121)

\* 22-24. **ATLAST 1993 Linear Algebra Workshops**, University of Maryland, College Park, MD.

PROGRAM: ATLAST is an NSF-ILAS Project to Augment the Teaching of Linear Algebra through the use of Software Tools. The project will offer five faculty workshops during the summer of 1993 on the use of software in teaching linear algebra. Workshop participants will learn about existing commercial linear algebra software packages and will be trained in the use of the MATLAB software package. Attendees will learn how to effectively incorporate exercises and laboratories into undergraduate linear algebra courses. Participants will learn to design computing exercises at a level suitable for assigning

to an undergraduate linear algebra class. These exercises will be class-tested during the school year following the workshop and then submitted to the project director for inclusion in an edited manual which will be distributed to the attendees. The ATLAST Project provides room and board for participants attending the workshops. Participants will also receive a stipend of \$200 for their submitted exercises.

DIRECTORS: S.J. Leon, Director (ILAS Education Committee, Univ. of Massachusetts, Dartmouth) and Asst. Director R.E. Faulkenberry (Univ. of Massachusetts, Dartmouth). WORKSHOP PRESENTER: D. Hill, Temple University.

APPLICATIONS: All teachers of undergraduate linear algebra courses at colleges or universities in the U.S. are invited to apply. Deadline for applications is March 12, 1993. Each workshop will be limited to thirty participants.

INFORMATION: R. Faulkenberry, ATLAST Project Assistant Director, Dept. of Math., Univ. of Massachusetts Dartmouth, North Dartmouth, MA 02747; 508-999-8928; FAX: 508-999-8901; email: atlast@umassd.edu.

25-31. **Geometric Methods in Theoretical and Computational Mechanics**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

26-30. **NATO Advanced Research Workshop: Classical and Axiomatic Potential Theory**, Les Arcs, Savoy, France. (Oct. 1992, p. 950)

\* 26-August 6. **SMS-NATO ASI: Complex Potential Theory**, Université de Montréal, Montréal, Canada.

PROGRAM: The main topics are: approximation, interpolation, quadratures, plurisubharmonic functions, multifunctions, analytic functions on a Banach space,  $q$ -convexity, and holomorphic isometries.

INVITED SPEAKERS: B. Aupetit, K. Diederich, J.E. Fornæss, T.W. Gamelin, P.M. Gauthier, C.O. Kiselman, J. Korevaar, N. Sibony, N. Tarkhanov, J. Verdera, E. Vesentini, J. Wermer.

DEADLINE FOR APPLICATION: March 15, 1993.

INFORMATION: G. David, Dept. de Math. et de Stats., Univ. de Montréal, C.P. 6128-A, Montréal H3C 3J7, Canada.

### August 1993

August 1993. **International Conference on New Trends in Computer Science I (NET-COMS I)**, University of Ibadan, Nigeria. (Nov. 1992, p. 1121)

1-7. **Abelsche Gruppen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

1-14. **Groups 93 Galway/St. Andrews**, Galway, Ireland. (Nov. 1992, p. 1121)

\* 2-6. **Second Gauss Symposium**, Munich, Germany. (Please note updated information to May/June 1992, p. 497)

CONFERENCES: (A) Mathematics and theoretical physics (chair: R. Fritsch); (B) statistical sciences (chair: H. Schneeweiss); (C) computing and information (chair: E. Novak); (D) medical mathematics and physics (chair: D. Ghista).

KEYNOTE ADDRESSES: H. Grauert (Germany); C.F. Gauss and the spirit of old mathematics in Goettingen; F.L. Bauer (Germany): automatik und informatik im Deutschen Museum; M. Eigen (Germany): the problem of generating information in biology; D. Colquhoun (UK): life at the probabilistic level: the interpretation of recordings from single ion channel to molecules in cell membrane.

INVITED SPEAKERS: *Tentative*: (A): H. Araki (Japan), A. Arenas (Spain), C. DeWitt-Morette (US), R.M. Erdahl (Canada), H. Fischer (Germany), O. Forster (Germany), E. Knobloch (Germany), J. von Plato (Finland), D. Puppe (Germany), K. Reich (Germany), R. Remmert (Germany), P. Ribenboim (Canada); (B): D.A.S. Fraser (Canada), S.S. Gupta (US), D.A. Sprott (Canada), K. Weichselberger (Germany); (C): K. Ritter (Germany), H. Wozniakowski (Poland/US), H. Wussing (Germany); (D): A. Alavi (US), S. Davis (Australia), M. Diksic (Canada), M.G. Fiori (Italy), J. Fowler (US), H.J.G. Gundersen (Denmark), R. Heinrich (Germany), M.A. Livshits (Russia), T. Mayhew (UK), M.M. Paula-Barbosa (Portugal), A. Ohnishi (Japan), T.L. Peters (Belgium), H. Reul (Germany), S. Salinari (Italy), G. Sedvall (Sweden), A.A.F. Sima (US), P.K. Thomas (UK), A.P. Wolf (US), Y.L. Yamamoto (Canada).

INFORMATION: R. Fritsch, Math. Inst., Univ. Muenchen, Theresienstrasse 39, W-8000 Munich 2, Germany; email: fritsch@mathematik.uni-muenchen.dpb.de; telefax: (49)-(89)-2805248.

2-6. **International Symposium on the Mathematical Theory of Networks and Systems**, Regensburg, Germany. (Sep. 1992, p. 774)

2-13. **Georgia International Topology Conference**, University of Georgia, Athens, GA. (May/June 1992, p. 497)

\* 4-6. **SIAM Conference on Simulation and Monte Carlo Methods**, San Francisco, CA. (Please note new information and title change from Jul./Aug. 1992, p. 632)

INVITED PRESENTATIONS: Monte Carlo methods using quasi-random sequences, R. Cafiisch; Trade-off between path length  $t$  and number of paths  $n$  when starting

in steady state, G.S. Fishman; Gradient estimation in discrete-event simulations, P. Glasserman; Derandomizing algorithms, M. Luby; Evolution and ecology of digital organisms, T. Ray; Evolutionary algorithms versus mathematical programming techniques, H.-P. Schwefel; Aspects of Markov chain Monte Carlo in Bayesian statistical calculations, A. Smith; Computer simulation of biological molecules, R.H. Swendsen; Error analysis of stochastic algorithms for nonlinear partial differential equations, D. Talay.

CALL FOR PAPERS: Deadline for abstract submission: January 22, 1993.

7–21. **Semigroups and their Applications**, York, England. (Sep. 1992, p. 774)

8–14. **Konstruktive Approximationstheorie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

9–12. **Joint Statistical Meetings**, San Francisco, CA. (Nov. 1991, p. 1172)

9–13. **Sixth International Conference on Structural Safety and Reliability (ICOSSAR '93)**, Innsbruck, Austria. (Sep. 1992, p. 774)

13–17. **Second International Colloquium on Numerical Analysis**, Plovdiv, Bulgaria. (Dec. 1991, p. 1341)

14–17. **First Workshop on Oscillation Theory**, Plovdiv, Bulgaria. (Oct. 1992, p. 950)

15–21. **Noncommutative Algebra and Representation Theory**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

15–27. **XI Latin American School of Mathematics (ELAM)**, Mexico. (Nov. 1992, p. 1121)

\* 16–19. **Third SIAM Conference on Linear Algebra in Signals, Systems, and Control**, University of Washington, Seattle, WA. (Please note additional information to Jul./Aug. 1992, p. 632)

INVITED PRESENTATIONS: Computational methods in linear least squares, A. Björck; Parallel algorithms and numerical stability for Toeplitz solvers, R.P. Brent; Signals, seismics, and supers, G. Cybenko; Sampled data systems in signal processing and control, B. Francis; Theory and practice of estimator design in sensor array signal processing, M. Kaveh; H-infinity control from a classical circuit viewpoint, H. Kimura; Quadratic eigenvalue problems, B.N. Parlett; Linear algebra and neural networks, M. Vidyasagar.

CALL FOR PAPERS: Contributed paper abstracts due: January 29, 1993.

16–20. **First European Nonlinear Oscillations Conference**, Hamburg, Germany. (Sep. 1992, p. 774)

17–20. **The Mathematical Heritage of Sir William Rowan Hamilton**, Dublin, Ireland. (May/Jun. 1992, p. 497)

17–20. **International Symposium on Statistics with Non-precise Data**, Innsbruck, Austria. (Sep. 1992, p. 774)

17–21. **Second International Conference on Finite Fields: Theory, Applications, and Algorithms**, University of Nevada, Las Vegas. (Sep. 1992, p. 774)

18–22. **Fourth International Colloquium on Differential Equations**, Plovdiv, Bulgaria. (Dec. 1991, p. 1341)

22–28. **Special Complex Varieties**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

22–29. **Twenty-ninth International Congress of History of Science**, Zaragoza, Spain. (Apr. 1992, p. 352)

23–28. **International Conference on Algebra Dedicated to the Memory of M.I. Kargapolov**, Krasnoyarsk, Russia. (Jul./Aug. 1992, p. 632)

\* 23–September 4. **NATO Advanced Study Institute on Polytopes: Abstract, Convex, and Computational**, Scarborough, Ontario, Canada.

INFORMATION: T. Bisztriczky, Dept. of Math. and Stats., University of Calgary, Calgary, Alberta, T2N 1N4, Canada.

\* 24–28. **Equadiff 8**, Bratislava, Czechoslovakia.

CONFERENCE TOPICS: Differential equations and their applications.

INVITED SPEAKERS: I. Babuska, P. Constantin, O. Dosly, G. Dziuk, E. Feireisl, B. Fiedler, M. Golubitsky, J. Hale, J. Hofbauer, J. Jaros, H. Matano, A. Mielke, K. Mischaikow, R. Koplatazde, X.-B. Lin, M. Mrozek, Y. Nishiura, P. Polacik, S. Schecter, M. Silhavy, J. Sola-Morales, J. Soucek, V. Sverak, and J.L. Vazquez.

INFORMATION: EQUADIFF 8, Faculty of Math. and Physics, Comenius Univ., Mlynska dolina, 842 15 Bratislava, Czechoslovakia, Tel: 0042-7-725 741; FAX: 0042-7-725 882; email: equadiff@mff.uniba.cs.

25–September 3. **Forty-ninth Biennial Session of the International Statistical Institute**, Firenze, Italy. (Nov. 1991, p. 1172)

\* 29–30. **Conference on Rings, Extensions, and Cohomology on the Occasion of the Retirement of Daniel Zelinsky**, Northwestern University, Evanston, IL.

PROGRAM: The conference will have 20 talks, including 8 hour talks and 12 twenty minute talks.

INFORMATION: A.R. Magid, Dept. of Math., Univ. of Oklahoma, Norman, OK 73019; email: amagid@nsfuvax.math.uoknor.edu.

29–September 4. **Random Graphs and Combinatorial Structures**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

30–September 3. **Inverse Problems: Principles and Applications in Geophysics, Technology, and Medicine**, Potsdam (near Berlin), Germany. (Sep. 1992, p. 774)

30–September 3. **Représentations des Groupes et Analyse Complexe**, CIRM, Marseille, France. (Nov. 1992, p. 1121)

### September 1993

5–11. **Novikov Conjectures, Index Theorems and Rigidity**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

5–11. **Nonlinear Numerical Methods and Rational Approximation**, University of Antwerp, Belgium. (Oct. 1992, p. 950)

5–12. **First World Conference on Branching Processes**, Varna, Bulgaria. (May/Jun. 1992, p. 497)

12–18. **Topologie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

13–17. **Fourth European Software Engineering Conference**, Garmisch, Germany. (Jul./Aug. 1992, p. 632)

13–18. **Different Aspects of Differentiability**, Warsaw, Poland. (May/Jun. 1992, p. 497)

\* 17–20. **Technology in Mathematics Teaching (TMT '93): A Bridge between Teaching and Learning**, The University of Birmingham, England.

PROGRAM: This is the first European edition of the sixth annual international conference in the series Technology in Collegiate Mathematics. There will be a diversity of themes, both educational and technological, and opportunities for talks, workshops, research reports, symposia, and discussion groups. The three strands running throughout TMT '93 are: 1) the mathematical content of teaching and learning environments; 2) technology as a resource for the teacher; 3) hands-on interaction between learners and technology.

CALL FOR PAPERS: Participants are invited to make contributions under one of the following headings by January 31, 1993:

A) A 30 minute presentation. An 8 page (maximum) paper if required; B) A 15 minute presentation. A 500 word abstract is required. C) To chair a 90-minute symposium. A 500 word outline indicating purpose is required; D) To lead a 90 minute hands-on workshop. A 500 word outline indicating purpose is required; E) To display a poster and participate in a discussion together with other poster presenters in a 90 minute session.

INFORMATION: P. Bishop, CTICMS, Faculty of Education, The University of Birmingham, Edgbaston, Birmingham B15 2TT, UK; Tel: (outside UK +44 21) 414 4800; FAX: (+44 21) 414 4865; email: tmt93@bham.ac.uk.

## Meetings and Conferences

### 18–19. Eastern Section, Syracuse, NY.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

### 19–25. Mathematical Game Theory, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

### 20–24. Methodes Numeriques dans la Theorie des Surfaces de Riemann, CIRM, Marseille, France. (Nov. 1992, p. 1122)

### \* 20–24. Thirteenth Congress of the Austrian Mathematical Society, Linz, Austria.

INVITED SPEAKERS: M. Aigner (Berlin), R. Bulirsch (Munich), G. Frey (Essen), J. Globevnik (Ljubljana), P. Mani (Bern), D. Preiss (London), M. Primicerio (Firenze), A. Hibner-Koblitz (US).

CALL FOR PAPERS: Contributed talks of twenty minutes can be submitted for the following sections: Algebra; number theory; discrete mathematics, logic, theoretical informatics; geometry; topology, differential geometry; real and complex analysis; functional analysis; differential equations; applied and industrial mathematics; numerical mathematics; probability and statistics; elementary mathematics, mathematics education, history of mathematics.

INFORMATION: H.W. Engl, Johannes Kepler Universitaet, A-4040, Linz, Austria; email: engl@indmath.uni-linz.ac.at.

### \* 20–26. Seventh Symposium on Classical Analysis, Kazimierz Dolny, Poland.

PROGRAM: Original research contributions are welcome as well as expository papers. The scientific program will consist of invited lectures and scientific communications. Abstract deadline: May 30, 1993.

INVITED SPEAKERS: J. Kisynski, S. Krantz, E. Ligocka, J. Lawrynowicz, J. Siciak, M. Skwarczynski.

INFORMATION: T. Mazur, Dept. of Math., Technical University, Malczewskiego 29, 26-600 Radom, Poland.

CONFERENCE TOPICS: Several complex variables, especially L2-methods; Riemannian

and Hermitian geometry, spectral theory in the Hilbert space, probability and applications in the mathematical physics.

### 26–October 2. Diophantische Approximationen, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

## October 1993

### 3–9. Arbeitsgemeinschaft mit Aktuellem Thema, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

### 17–23. Geometrie, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

### 22–23. Central Section, Texas A&M University, College Station, TX.

INFORMATION: W.S. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

### 25–29. Third SIAM Conference on Geometric Design, Seattle, WA. (Jul./Aug. 1992, p. 632)

### 27–30. Seventh International Conference on Domain Decomposition Methods, Penn State University, State College, PA. (Oct. 1992, p. 950)

### 31–November 6. Algorithmische Methoden der Diskreten Mathematik, Oberwolfach, Federal Republic of Germany. (Mar. 1992, p. 251)

## November 1993

### \* 1–5. Third SIAM Conference on Geometric Design, Tempe, AZ.

ORGANIZERS: R.E. Barnhill, Arizona State U., and R.E. Chang, Silicon Graphics Computer Systems.

ABSTRACT DEADLINE: March 22, 1993.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; FAX: 215-386-7999; meetings@siam.org.

### 6–7. Western Section, Claremont, CA.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

### 21–27. Mathematische Modelle in der Biologie, Oberwolfach, Federal Republic of Germany. (Mar. 1992, p. 251)

### 28–December 4. Nonlinear Equations in Many-Particle Systems, Oberwolfach, Federal Republic of Germany. (Mar. 1992, p. 251)

The following new announcements will not be repeated until the criteria in the last paragraph in the box at the beginning of this section are met.

## April 1994

### 9–10. Eastern Section, Brooklyn, NY.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

## May 1994

### \* 30–June 9. Workshop on Group Representation Theory, Technion, Israel Institute of Technology, Haifa, Israel.

INVITED SPEAKERS: R.W. Carter, J.A. Green, B. Huppert, I.M. Isaacs.

INFORMATION: D. Chillag and A. Juhasz, Dept. of Math., Technion, Israel Inst. of Tech., Haifa 32000, Israel; email: math555@technion.bitnet.

## August 1994

### 3–11. The International Congress of Mathematicians 1994, Zürich, Switzerland. (Oct. 1992, p. 951)

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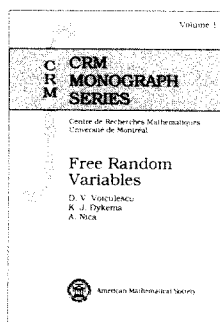
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provided by convolution operators on free groups and by the asymptotic behavior of large Gaussian random matrices. The probabilistic approach to free products has led to a recent surge of new results on the von Neumann algebras of free groups. The book is ideally suited as a textbook for an advanced graduate course and could also provide material for a seminar. In addition to researchers and graduate students in mathematics, this book will be of interest to physicists and others who use random matrices.

(continued)

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*Free products; Free random variables in noncommutative probability theory; Free harmonic analysis; Random matrices and asymptotic freeness; Free product factors.*

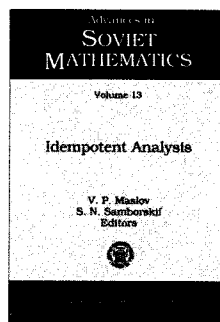
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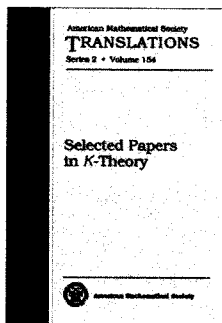
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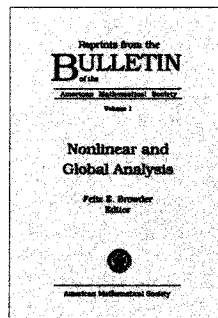
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(continued)



**Nonlinear and Global  
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Felix E. Browder, Editor  
Volume 1

This volume contains a number of research-expository articles that appeared in the *Bulletin of the AMS* between 1979 and 1984 and that address the general area of nonlinear functional analysis and global analysis and their applications. The central theme concerns qualitative methods in the study of nonlinear problems arising in applied mathematics, mathematical physics, and geometry. Since these articles first appeared, the methods and ideas they describe have been applied in an ever-widening array of applications. Readers will find this collection useful, as it brings together a range of influential papers by some of the leading researchers in the field.

**Contents**

**General theory**: **R. Bott**, *Lectures on Morse Theory, old and new*; **F. E. Browder**, *Fixed point theory and nonlinear problems*; **I. Ekeland**, *Nonconvex minimization problems*; **L. Nirenberg**, *Variational and topological methods in nonlinear problems*; **R. S. Hamilton**, *The inverse function theorem of Nash and Moser*; **Applications**: **S. S. Antman**, *The influence of elasticity on analysis: modern developments*; **H. Brezis**, *Periodic solutions of nonlinear vibrating strings and duality principles*; **D. H. Sattinger**, *Bifurcation and symmetry breaking in applied mathematics*; **J. William Helton**, *Non-Euclidean functional analysis and electronics*; **Dynamical Systems**: **M. W. Hirsch**, *The dynamical systems approach to differential equations*; **S. Smale**, *The fundamental theorem of algebra and complexity theory*; **P. Blanchard**, *Complex analytic dynamics on the Riemann sphere*; **D. Sullivan**, *Discrete conformal groups and measurable dynamics*;

1991 *Mathematics Subject Classification*: 35Jxx, 35Kxx, 47Hxx, 49-XX, 58-XX, 58Bxx

ISBN 0-8218-8500-6, LC 92-36618, ISSN 1064-9662

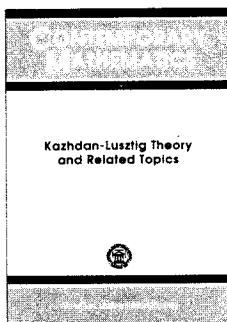
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## CONTEMPORARY MATHEMATICS



### Kazhdan-Lusztig Theory and Related Topics

Vinay Deodhar, Editor

Volume 139

This volume attests to the far-reaching influence of Kazhdan-Lusztig theory on several areas of mathematics by presenting a diverse set of research articles centered on this theme. Although there has been a great deal of work in Kazhdan-Lusztig theory, this book is

perhaps the first to discuss all aspects of the theory and gives readers a flavor of the range of topics involved. The articles present recent work in Kazhdan-Lusztig theory, including representations of Kac-Moody Lie algebras, geometry of Schubert varieties, intersection cohomology of stratified spaces, and some new topics such as quantum groups.

#### Contents

**B. Boe**, *A counterexample to the Gabber-Joseph conjecture*; **J.-L. Brylinski**, *Equivariant intersection cohomology*; **J. B. Carrell**, *Some remarks on regular Weyl group orbits and the cohomology of Schubert varieties*; **E. Cline**, **B. Parshall**, and **L. Scott**, *Infinitesimal Kazhdan-Lusztig theories*; **D. H. Collingwood** and **R. S. Irving**, *Harish-Chandra modules for semisimple Lie groups with one conjugacy class of Cartan subgroups*; **R. Dabrowski**, *A simple proof of a necessary and sufficient condition for the existence of nontrivial global sections of a line bundle on a Schubert variety*; **J. Du**, *Kazhdan-Lusztig bases and isomorphism theorems for  $q$ -Schur algebras*; **M. J. Dyer**, *Hecke algebras and shellings of Bruhat Intervals II*; *Twisted Bruhat Orders*; **I. Grojnowski** and **G. Lusztig**, *On bases of irreducible representations of quantum  $GL_n$* ; **T. J. Hodges**, *Morita equivalence of primitive factors of  $U(\mathfrak{sl}(2))$* ; **C. Huneke** and **V. Lakshmibai**, *Degeneracy of Schubert varieties*; **R. S. Irving**, *Singular blocks of the category  $\mathcal{O}$ , II*; **B. Kostant** and **S. Kumar**, *A geometric realization of minimal  $\mathfrak{k}$ -Type of Harish-Chandra modules for complex  $S. S.$  groups*; **L. E. Renner**, *Towards a generalized Bruhat decomposition*.

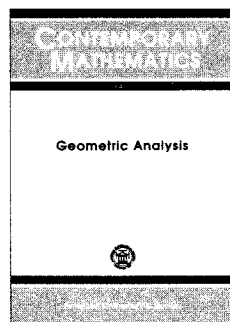
1991 *Mathematics Subject Classification*: 14M15, 17B35, 20G05, 20H15, 22E47; 14E15, 14F45, 14M20, 17B20, 51M35, 55N35

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### Geometric Analysis

Eric L. Grinberg, Editor

Volume 140

This volume contains the refereed proceedings of the Special Session on Geometric Analysis held at the AMS meeting in Philadelphia in October 1991. The term "geometric analysis" is being used with increasing frequency in the mathematical community, but its meaning is not entirely fixed. The papers in this

collection should help to better define the notion of geometric analysis by illustrating emerging trends in the subject. The topics covered range over a broad spectrum: integral geometry, Radon transforms, geometric inequalities, microlocal analysis, harmonic analysis, analysis on Lie groups and symmetric spaces, and more. Containing articles varying

from the expository to the technical, this book presents the latest results in a broad range of analytic and geometric topics.

#### Contents

**C. A. Berenstein** and **E. Casadio Tarabusi**, *On the Radon and Riesz transforms in real hyperbolic spaces*; **J. Boman**, *Holmgren's uniqueness theorem and support theorems for real analytic Radon transforms*; **G. D. Chakerian** and **E. Lutwak**, *On the Petty-Schneider theorem*; **L. Ehrenpreis**, *Nonlinear Fourier transform*; **H. Goldschmidt**, *On the infinitesimal rigidity of the complex quadrics*; **A. Greenleaf** and **G. Uhlmann**, *Microlocal analysis of the two-plane transform*; **E. L. Grinberg**, *Aspects of flat Radon transforms*; **P. Kuchment**, *On positivity problems for the Radon transform and some related transforms*; **A. Meziari**, *Cohomology relative to the germ of an exact form*; **V. Oliker**, *Generalized convex bodies and generalized envelopes*; **E. Todd Quinto**, *A note on flat Radon transforms*; **R. S. Strichartz**, *Self-similarity on nilpotent Lie groups*; **J. Zhou**, *A kinematic formula and analogues of Hadwiger's theorem in space*.

1991 *Mathematics Subject Classification*: 53-06, 58-06, 52-06, 44-06

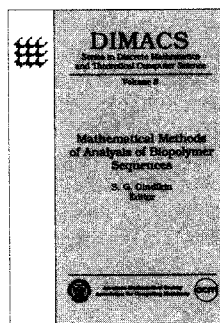
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### DIMACS: SERIES IN DISCRETE MATHEMATICS AND THEORETICAL COMPUTER SCIENCE



### Mathematical Methods of Analysis of Biopolymer Sequences

S. G. Gindikin, Editor

Volume 8

This collection contains papers by participants in the seminar on mathematical methods in molecular biology who worked for several years at the Laboratory of Molecular Biology

and Bioorganic Chemistry (now the Institute of Physical and Chemical Problems in Biology) at Moscow State University. The seminar united mathematicians and biologists around the problems of biological sequences. The collection includes original results as well as expository material and spans a range of perspectives, from purely mathematical problems to algorithms and their computer realizations. For this reason, the book is of interest to mathematicians, statisticians, biologists, and computational scientists who work with biopolymer sequences.

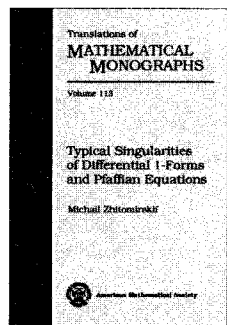
#### Contents

**I. Some problems of mathematical statistics**: **A. M. Leontovich**, *On the optimality of the Dayhoff matrix for computing the similarity score between fragments of biological sequences*; **V. I. Piterberg**, *On the distribution of the maximum similarity score for fragments of two random sequences*; **II. Surveys and methodology**: **M. S. Gelfand**, *Computer functional analysis of nucleotide sequences: problems and approaches*; **E. V. Koonin**, *Comparative analysis of biopolymer sequences: reflections on the validity of the methodology and the underlying general principles*; **III. Methods and algorithms**: **D. R. Davydov**, **I. Erlikh**, **E. E. Klotz**, and **V. G. Fridman**, *A new method for recognition of structural and functional motifs in protein sequences based on the principal component analysis of profiles of physico-chemical properties*; **M. S. Gelfand**, *Prediction of protein-coding regions in DNA of higher Eukaryotes*; **P. Pevzner**, *DNA physical mapping, flows in networks and minimum cycles mean in graphs*;

M. A. Roytberg, *Fast algorithm for optimal aligning of symbol sequences*; IV. Software: L. I. Brodsky, A. V. Vassilyev, Ya. L. Kalaydzidis, Yu. S. Osipov, R. L. Tatuzov, and S. I. Feranchuk, *GeneBee: The program package for biopolymer structure analysis*; R. L. Tatuzov and T. A. Mamikonova, *Data compression and the use of vector operations for the fast search problems in analysis of biological sequences*; R. L. Tatuzov and T. A. Mamikonova, *Organization and storage of information in molecular genetics data banks.*

1991 *Mathematics Subject Classification*: 62E17, 62P10, 90B10, 92-04, 92D20; 05C38, 62B10, 62H30, 90C05, 92D20, 94A17  
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**TRANSLATIONS OF MATHEMATICAL MONOGRAPHS**



**Typical Singularities of Differential 1-Forms and Pfaffian Equations**  
 M. Ja. Zhitomirskii  
 Volume 113

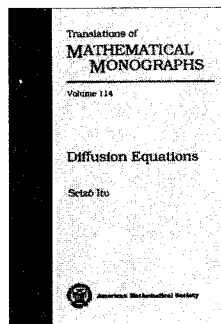
Singularities and the classification of 1-forms and Pfaffian equations are interesting not only as classical problems, but also because of their applications in contact geometry, partial

differential equations, control theory, nonholonomic dynamics, and variational problems. In addition to collecting results on the geometry of singularities and classification of differential forms and Pfaffian equations, this monograph discusses applications and closely related classification problems. Zhitomirskii presents proofs with all results and ends each chapter with a summary of the main results, a tabulation of the singularities, and a list of the normal forms. The main results of the book are also collected together in the introduction.

**Contents**

*Main results; Basic notions, definitions, notation, and constructions; Classification of germs of differential forms; Classification of germs of odd-dimensional Pfaffian equations; Classification of germs of even-dimensional Pfaffian equations; Appendices; Local classification of first-order partial differential equations; Classification of submanifolds of a contact manifold; Feedback equivalence of control systems; Analytic classification of differential forms and Pfaffian equations; Distributions and differential systems; Topological classification of distributions; Degenerations of closed 2-forms in  $\mathbb{R}^{2k}$ .*

1991 *Mathematics Subject Classification*: 58-02; 35F20, 53C15, 58A10, 58A17, 58A30, 58F36, 93B52  
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**Diffusion Equations**  
 Seizô Itô  
 Volume 114

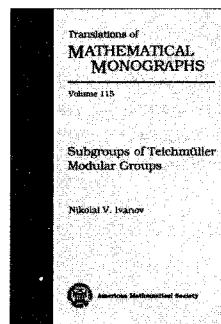
This book presents a self-contained exposition of the theory of initial-boundary value problems for diffusion equations. Intended as a graduate textbook, the book is of interest to mathematicians as well as theoretical physicists. Because it uses as little knowledge of functional analysis as

possible, the book is accessible to those with a background in multivariable calculus, elementary Lebesgue integral theory, and basic parts of the theory of integral equations. Itô treats diffusion equations with variable coefficients associated with boundary conditions and the corresponding elliptic differential equations. The fundamental solution of the initial-boundary value problem and Green's function for the elliptic boundary value problem are constructed, and the existence of solutions of these problems is proved. In addition, the book discusses several important properties of the solutions.

**Contents**

*Fundamental solutions of diffusion equations in Euclidean spaces; Diffusion equations in a bounded domain; Diffusion equations in unbounded domains; Elliptic boundary value problems; Some related topics in vector analysis.*

1991 *Mathematics Subject Classification*: 35K15, 35K20, 35K05, 35J25, 35D10; 35J15  
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**Subgroups of Teichmüller Modular Groups**  
 Nikolai V. Ivanov  
 Volume 115

Teichmüller modular groups, also known as mapping class groups of surfaces, serve as a meeting ground for several branches of mathematics, including low-dimensional topology, the theory of Teichmüller spaces, group theory, and, more recently, mathematical

physics. The present work focuses mainly on the group-theoretic properties of these groups and their subgroups. The technical tools come from Thurston's theory of surfaces—his classification of surface diffeomorphisms and the theory of measured foliations on surfaces. The guiding principle of this investigation is a deep analogy between modular groups and linear groups. For some of the central results of the theory of linear groups (such as the theorems of Platonov, Tits, and Margulis-Soifer), the author provides analogous results for the case of subgroups of modular groups. The results also include a clear geometric picture of subgroups of modular groups and their action on Thurston's boundary of Teichmüller spaces. Aimed at research mathematicians and graduate students, this book is suitable as supplementary material in advanced graduate courses.

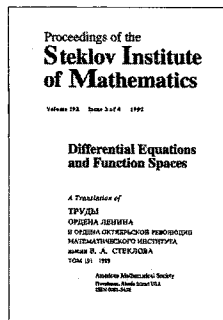
**Contents**

*Diffeomorphisms acting trivially in  $H_1(S, \mathbb{Z}/m\mathbb{Z})$ . Subgroups  $\Gamma_S(m)$ ; Preliminary information from the theory of surfaces; The action of pure diffeomorphisms on the Thurston boundary. I; The action of pure diffeomorphisms on the Thurston boundary. II; Pseudo-Anosov elements in irreducible subgroups of the group  $\Gamma_R(m_0)$ ,  $m_0 \geq 3$ ; Irreducible subgroups of the*

group  $\Gamma_R(m_0)$ ,  $m_0 \geq 3$ , for disconnected surfaces  $R$ ; The cutting of surfaces, and reduction systems; Free and abelian subgroups; Maximal subgroups of infinite index; Frattini subgroups.

1991 Mathematics Subject Classification: 57M99, 57N05, 57R30; 20F34, 20F38, 30F60, 32G15  
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PROCEEDINGS OF THE STEKLOV  
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**Differential Equations and Function Spaces**  
 S. M. Nikol'skiĭ, Editor  
 Volume 192

This commemorative volume honors the memory of S. L. Sobolev by presenting eighteen papers reflecting the area of Sobolev's main contributions: applications of functional analysis to differential equations. The papers examine various problems in the theory

of partial differential equations (linear and nonlinear) and the theory of differentiable functions of several real variables. Applications to problems of mathematical physics and approximate methods of conformal mapping are also treated. Foreign (e.g., Leray, Lions, Fichera) as well as domestic (e.g., Besov, Oleĭnik, Il'in) authors are represented.

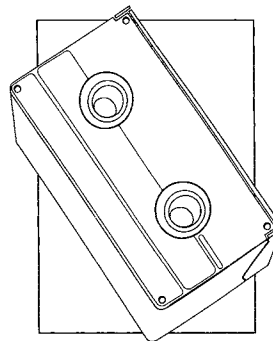
**Contents**

*In Memory of Sergei Lvovich Sobolev*; **N. S. Bakhvalov and M. È. Èglit**, *Variational properties of averaged equations for periodic media*; **O. V. Besov**, *On Sobolev-Liouville and Lizorkin-Triebel spaces on a domain*; **E. A. Volkov**, *Approximate conformal mapping of the exterior of a lattice of ellipses onto the exterior of a lattice of plates by the block method*; **Yu. D. Golovatyĭ, S. A. Nazarov, and O. A. Oleĭnik**, *Asymptotic expansions of eigenvalues and eigenfunctions in problems on oscillations of a medium with concentrated perturbations*; **Yu. V. Egorov and V. A. Kondrat'ev**, *On the negative spectrum of an elliptic operator*; **V. P. Il'in**, *On imbedding theory for anisotropic classes of functions with power smoothness and a metric of  $L_p$ -type*; **L. D. Kudryavtsev**, *Variational problems with a different number of boundary conditions*; **G. P. Kheĭnig [H. P. Heinig] and A. Kufner**, *Hardy's inequality for higher order derivatives*; **Zh. Lerè [J. Leray]**, *Le demi-plan élastique et la théorie des distributions*; **P. I. Lizorkin**, *Classes of functions constructed on the basis of averages over spheres (the case of spaces of Sobolev type)*; **Zh. L. Lions [J. L. Lions]**, *On nonlinear sentinels for distributed systems*; **S. I. Pokhozhaev**, *On the method of fibering a solution in nonlinear boundary value problems*; **S. G. Samko**, *Hypersingular integrals and differences of fractional order*; **È. Sanches-Palensiya [E. Sanchez Palencia]**, *Some elasticity problems in unbounded domains and applications to junctions*; **V. N. Temlyakov**, *On the behavior of the partial sums, over hyperbolic crosses, of Fourier series of periodic functions of several variables*; **G. Triebel [H. Triebel]**, *Characterizations of  $F_{pq}^s$  spaces via local means; the extension problem*; **S. V. Uspenskiĭ and E. M. Vasil'eva**, *On the behavior at infinity of a solution of a problem in hydrodynamics*; **G. Fikera [G. Fichera]**, *On the optimal constant for the trace inequality.*

1991 Mathematics Subject Classification: 01A70, 26A33, 26D10, 26D15, 30C20, 30C30, 35B20, 35B40, 35J05, 35J30, 35J65, 35P99, 35Q30, 42B05,

42B20, 46E30, 46E35, 46F12, 47F05, 47H15, 49H05, 49K20, 73B27, 73C10, 73D10, 76U05; Secondary 26A33, 26D10, 31B10, 34C29, 35A15, 35B25, 35J10, 35K05, 46E35, 47B39, 65E05, 73K03, 73K05, 73K12, 76D05  
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VIDEOTAPES



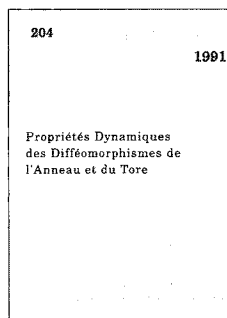
**Computational Crystal Growers Workshop**  
 Jean E. Taylor

This fascinating videotape provides a glimpse into how researchers are using state-of-the-art computer technology to investigate and simulate the intricacies of crystal growth. Based on a workshop held at the Geometry Center in Minneapolis in February 1992, this videotape contains fourteen segments ranging over a

variety of theoretical methods and software tools being used today in computational crystal growth. The contributions to the tape come from researchers in a range of areas, including materials science, physics, and mathematics. The visual beauty of the videotape and the cutting-edge science it illuminates appeal to a range of viewers, from undergraduate mathematics majors to researchers in mathematics, physics, and materials science. Accompanying this videotape is a booklet of just over 100 pages with an introduction and 29 short papers containing outlines of various methods and references to the literature.

1991 Mathematics Subject Classification: 65-06  
 ISBN 0-8218-8072-1  
 NTSC format on 1/2" VHS videotape; approx. 1 hour and 45 minutes, October 1992  
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SOCIÉTÉ MATHÉMATIQUE DE FRANCE,  
 ASTÉRISQUE



**Propriétés Dynamiques des Difféomorphismes de l'Anneau et du Tore**  
 Patrice Le Calvez  
 Number 204

The first chapter of this monograph presents a survey of the theory of monotone twist maps of the annulus. First, the author covers the conservative case by presenting a short survey of Aubry-Mather theory and Birkhoff theory, followed by some criteria for existence of periodic orbits without the area-preservation property. These are applied in the area-decreasing case, and the properties of Birkhoff attractors are discussed. A diffeomorphism of the closed annulus which is isotopic to the identity can be written as the

composition of monotone twist maps. The second chapter generalizes some aspects of Aubry-Mather theory to such maps and presents a version of the Poincaré-Birkhoff theorem in which the periodic orbits have the same braid type as in the linear case. A diffeomorphism of the torus isotopic to the identity is also a composition of twist maps, and it is possible to obtain a proof of the Conley-Zehnder theorem, with the same kind of conclusions about the braid type, in the case of periodic orbits. This result leads to an equivariant version of the Brouwer translation theorem which permits new proofs of some results about the rotation set of diffeomorphisms of the torus.

Titles in this series are published by the Société Mathématique de France and distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, Case 916-Luminy, F-13 288 Marseille Cedex 9, France, or to OFFILIB, 48 rue Gay-Lussac, 75240 Paris Cedex 05, France.

**Contents**

**Présentation et comparaison des différentes approches de la théorie des difféomorphismes de l'anneau déviant la verticale:** *Exemples; Définitions*

*et notations: applications déviant la verticale, nombres de rotation; Etude variationnelle des difféomorphismes déviant la verticale et préservant l'aire: la théorie d'Aubry-Mather; Etude topologique des difféomorphismes déviant la verticale et préservant l'aire: la théorie de Birkhoff; Le cas général des applications déviant la verticale; Etude du cas dissipatif: les attracteurs de Birkhoff; Phases génératrices des difféomorphismes du tore ou de l'anneau: Présentation des résultats; Composition de difféomorphismes du plan déviant la verticale; Etude des difféomorphismes conservatifs de l'anneau; Un énoncé équivariant du théorème de translation de Brouwer; Etude des ensembles de rotation des difféomorphismes du tore; Orbites périodiques des difféomorphismes du tore.*

1991 *Mathematics Subject Classification:* 58F  
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# Mathematical World

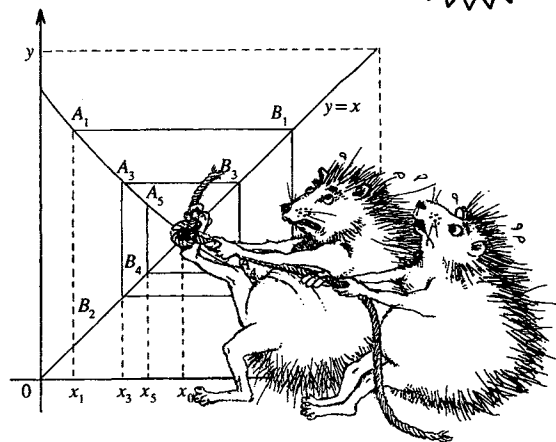
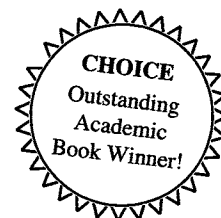
Volume 2

## Fixed Points

Yu. A. Shashkin

Shashkin's book contains a popular exposition of fixed point theory. Theorems on fixed points for continuous maps of a segment, a square, a circle, and a two-dimensional sphere are proved. All required notions such as continuity, compactness, and degree of a map are explained. Auxiliary propositions, such as Sperner's lemma, are proved. Applications and exercises are given. *Fixed Points* is accessible even to students at the high school level.

1991 *Mathematics Subject Classification:* 01, 54  
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# Miscellaneous

## Personals

**James Eells**, Professor Emeritus of the University of Warwick, has been made an Honorary Fellow of the University of Leeds, and has been awarded the Senior Berwick Prize of the London Mathematical Society.

**Leonid S. Frank**, of the University of Reims, has been appointed chair of the applied and numerical analysis department of that institution as well as Editor-in-Chief of the journal *Asymptotic Analysis*.

**Frank Harary**, Professor Emeritus of the University of Michigan, Ann Arbor, and of New Mexico State University, Las Cruces, was awarded an honorary degree (Doctor of Science, Honoris Causa) by the University of

Exeter for his contributions to graph theoretic models in computer science and other fields.

**Shyam L. Kalla**, of Kuwait University, received the Fco. Eugenio Bustamante Research Award from Zulia University.

**Robert B. Kusner**, of the University of Massachusetts, Amherst, has been promoted to associate professor at that institution.

**Leopoldo Nachbin**, who had been at the University of Rochester since 1963, retired from that institution on December 31, 1991.

## Deaths

**James J. Stoker**, former Director of the Courant Institute of Mathematical

Sciences at NYU, died on October 19, 1992, at the age of 87. He was a member of the Society for 57 years.

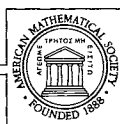
**Krzysztof Trautman**, of the University of Notre Dame, died on September 5, 1992, at the age of 26. He was a member of the Society for 2 years.

## Visiting Mathematicians

### Supplementary List

Mathematicians visiting other institutions during the 1991-1992 academic year have been listed in recent issues of the *Notices*: May/June 1992, p. 519-521; July/August 1992, p. 640-641; October 1992, p. 960; and November 1992, p. 1129.

**K. Oshiro**, (Japan), Ohio University, Ring Theory, 10/92-7/93.



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# Reciprocity Agreements

## Supplementary List

The American Mathematical Society has "reciprocity agreements" with a number of mathematical organizations around the world. A supplement to the complete list, which appeared on page 642 of the July/August 1992 issue of the *Notices*, appears below.

These Reciprocity Agreements provide for reduced dues for members of these organizations who choose to join the AMS and who reside outside of the U.S. and Canada. Reciprocally, members of the AMS who reside in the U.S. or Canada may join these organizations at a reduced rate. Summaries of the privileges available to AMS members who join under the terms of reciprocity agreements are given on the following pages. Members of these organizations who join the AMS as reciprocity members enjoy all the privileges available to ordinary members of the Society. AMS dues for reciprocity members are \$52 for 1992 and \$54 for 1993. Each organization was asked to review and update its listing in the Spring. A bullet (•) before the name of an organization indicates that application forms for that organization may be obtained by writing the American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940-6248.

### Asia

#### •Allahabad Mathematical Society

**Apply to:** S. N. Lal, Secretary, Allahabad Mathematical Society, Jodhpur Colony, Banarus Hindu University, Varanasi-211 005, India.

**Dues:** US \$60 (annual), US \$300 (life); payable to Allahabad Mathematical Society.

**Privileges:** *Indian Journal of Mathematics* or *Communications in Theoretical Physics*. Other publications available at concession rates.

**Officers:** Pramila Srivastava (President), S. N. Bhatt, A. M. Vaidya (Vice-Presidents), S. C. Srivastava (Treasurer), S. N. Lal (Secretary), G. D. Dikshit (Editor, *Indian Journal of Mathematics*), V. Singh (Librarian).

#### •Mathematical Society of Japan

**Apply to:** Takako Watanabe, Secretary, Mathematical Society of Japan, 25-9-203, Hongo 4-chome, Bunkyo-ku, Tokyo 113, Japan.

**Dues:** US \$50; payable to Mathematical Society of Japan.

**Privileges:** *Journal of the Mathematical Society of Japan; Sugaku* (in Japanese) for US \$8 additional dues.

**Officers:** Daisuke Fujiwara (President), Yuko Mizutani (Treasurer), Takako Watanabe (Secretary).

### Europe

#### Polskie Towarzystwo Matematyczne

**Apply to:** Polskie Towarzystwo Matematyczne, Śniadeckich 8, 00-950 Warszawa, Poland.

**Dues:** \$40; payable to Polskie Towarzystwo Matematyczne.

**Privileges:** Participation in scientific conferences organized by the Polish Mathematical Society and in its scientific sessions; in addition, members receive one of the following five series of the publication *Annales Societatis Mathematicae Polonae: Commentationes Mathematicae* in congress languages, *Wiadomości Matematyczne* (Mathematical News) in Polish, *Matematyka Stosowana* (Applied Mathematics) in Polish, *Fundamenta Informaticae* in congress languages, *Dydaktyka Matematyki* (Didactics of Mathematics) in Polish.

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#### •Unione Matematica Italiana

**Apply to:** Enrico Obrecht, Treasurer, Segreteria della Unione Matematica Italiana, Dipartimento di Matematica, Piazza Porta S. Donato, 5, 40126 Bologna, Italy.

**Dues:** 50,000 lire; payable to Unione Matematica Italiana.

**Privileges:** Free *Notiziario dell'UMI* (monthly), *Bollettino dell'UMI, ser. A* (3 issues a year), and membership list. 30,000 Lires only for subscriptions to *Bollettino dell'UMI, Ser. B*. (4 issues per year).

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## Latin America

### •Sociedade Brasileira de Matemática

**Apply to:** Diretoria da SBM, Estrada Dona Castorina - 110, Jardim Botânico, Rio de Janeiro, RJ, Brazil, 22.460.

**Dues:** US \$50; payable to Sociedade Brasileira de Matemática.

**Privileges:** *Boletim da SBM* (two issues per year); *Revista Matemática Universitária* (two issues per year); *Ensaio*s and other publications can be purchased at a 25% discount.

**Officers:** César Camacho (President), Paulo Sad (Vice President), Arualdo Garcia (Treasurer), Abramo Hefez (Secretary).

### Unión Matemática Argentina

**Apply to:** Eleonor Harboure, Unión Matemática Argentina, INTEC-PEMA, Güemes 3450, 3000 Santa Fe - Argentina.

**Dues:** US \$16; payable to Unión Matemática Argentina.

**Privileges:** Free subscription to *Noticiero UMA* and one of either *Revista de la Unión Matemática Argentina* or *Revista de Education Matemática*.

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## Middle East

### Iranian Mathematical Society

**Apply to:** S. H. Javadpour, Iranian Mathematical Society, P. O. Box 13145-418, Tehran, Iran.

**Dues:** \$20; payable to I.M.S., Dollar Acc. #700247, Bank Melli Iran, Daneshgah Br., Enghelab Ave., Tehran 14174, Iran.

**Privileges:** *Bulletin of the Iranian Mathematical Society* and reduced rate for participation in the annual Iranian Mathematics conferences and other seminars organized by I.M.S.

**Officers:** A. Haghany (President-Secretary), M. Toomanian (Vice President), S. H. Javadpour (Treasurer), A. Parsian (Secretary).

### Israel Mathematical Union

**Apply to:** Israel Mathematical Union, Department of Mathematics and Computer Science, Ben-Gurion University, Beer-Sheva 84105, Israel.

**Dues:** \$10; payable to Israel Mathematical Union.

**Privileges:** Newsletter, TECMAT-NET, may attend and present papers at meetings.

**Officers:** M. Cohen (President), A. Melkam (Treasurer), D. Berend (Secretary).

## Statistical Mechanics and the Theory of Dynamical Systems

### Proceedings of the Steklov Institute of Mathematics, Volume 191

*N. N. Bogolyubov, Jr., Editor*

This volume contains articles covering a wide range of current directions in modern statistical mechanics and dynamical systems theory. Scientists, researchers, and students working in mathematical physics and statistical mechanics will find this book of great interest. Among the topics covered are: phase transition problems, including superconductivity and superfluidity; methods of nonequilibrium statistical mechanics and fluctuation theory; quantum collective phenomena; superradiance; spin glasses; polaron problems; chains of Bogolyubov equations and kinetic equations; algebraic aspects of quantum-dynamical semigroups; the collective variables method; and qualitative properties of classical dynamical systems.

1991 *Mathematics Subject Classification*: 11, 45, 46, 47, 57, 58, 81, 82; 42, 70

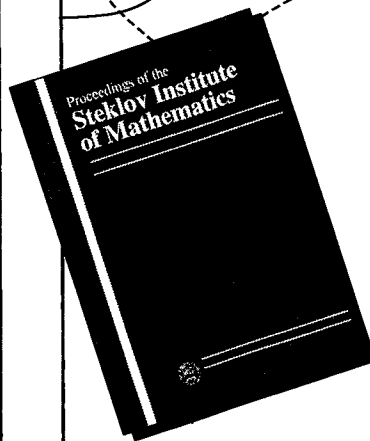
ISBN 0-8218-3144-5, 243 pages (softcover), September 1992.

Individual member \$117, List price \$195, Institutional member \$156

To order, please specify STEKLO/191NA



All prices subject to change. Free shipment by surface: for air delivery, please add \$6.50 per title. **Prepayment required. Order from:** American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-321-4AMS (321-4267) in the U.S. and Canada to charge with VISA or MasterCard. Residents of Canada, please include 7% GST.



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**SUGGESTED USES** for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.

**THE 1992 RATE IS** \$60 per inch on a single column (one-inch minimum), calculated from the top of the type; \$30 for each additional 1/2 inch or fraction thereof. No discounts for multiple ads or the same ad in consecutive issues. For an additional \$10 charge, announcements can be placed anonymously. Correspondence will be forwarded.

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**U. S. LAWS PROHIBIT** discrimination in employment on the basis of color, age, sex, race, religion or national origin. "Positions Available" advertisements from institutions outside the U. S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U. S. laws. Details and specific wording may be found near the Classified Advertisements in the January and July/August issues of the *Notices*.

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**SEND AD AND CHECK TO:** Advertising Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Individuals are requested to pay in advance, institutions are not required to do so. AMS FAX 401-455-4004.

## POSITIONS AVAILABLE

### ALABAMA

#### UNIVERSITY OF ALABAMA, HUNTSVILLE Mathematical Sciences Department

The Mathematical Sciences Department of the University of Alabama in Huntsville invites applications for two or more tenure track faculty positions beginning in September 1993. Rank and salary will depend on the credentials of the appointee. A Ph.D. in mathematics or related field with emphasis in applied mathematics, evidence of good teaching skills, and excellent research ability are essential. Preferred specialty areas include discrete mathematics, mathematical modeling, fluid dynamics, differential equations, numerical analysis, and probability/statistics.

Send letter of application, vita, and three letters of reference to Peter M. Gibson, Chairman, Mathematical Sciences Department, University of Alabama in Huntsville, AL 35899. Review of applicants will begin February 3, 1993, and continue until all positions are filled.

The University of Alabama in Huntsville is an affirmative action, equal opportunity institution.

### ARIZONA

#### UNIVERSITY OF ARIZONA Department of Mathematics Tucson, AZ 85721

The Mathematics Department at the University of Arizona will have tenure-track and postdoc-

toral positions available beginning Fall 1993.

**Tenure-track positions.** Excellent research record or potential, strong commitment to teaching required. Fields should complement but not duplicate existing department research strengths in arithmetic geometry, computational science, dynamical systems, differential geometry, nonlinear science, and number theory.

**Postdoctoral Fellowships** (Research Associates). Applicants with strengths in all areas compatible with department interests are encouraged to respond. In addition, special Center of Excellence Awards in nonlinear optics and fluid mechanics are available.

The Mathematics Department may also have several *visiting positions* for next year.

We encourage early application. **Deadline** date will be **December 15, 1992**, or whenever positions are filled. *Women and minority applicants are especially welcome.* Send application, which should include a letter of interest, curriculum vitae with a list of publications, and a minimum of three (3) letters of recommendation (enclose or arrange to be sent) to:

Personnel Committee  
Department of Mathematics  
University of Arizona  
Tucson, Arizona 85721, U.S.A.

The University of Arizona is an Affirmative Action/Equal Opportunity Employer.

### CALIFORNIA

#### OCCIDENTAL COLLEGE Los Angeles, California

Applications are invited to a tenure-track position in the Department of Mathematics at the

assistant or associate professor level.

Excellence in teaching and substantial professional achievement are the major expectations. The department is involved in curricular reform and encourages innovative teaching. The normal teaching schedule is 5-6 courses per year. New faculty members are currently released for one course during the initial year. Some institutional support for extended leaves is available.

Occidental College is a selective private college of the liberal arts and sciences with 1650 undergraduate students, a college faculty of 133, and a mathematics faculty of nine. Occidental is located in northeast Los Angeles, easily accessible to USC, UCLA, and Caltech.

Salary is competitive. An excellent benefits package includes a choice of health care plans, tuition grants for children of faculty, and a mortgage subsidy program.

Completed applications must include a current resume and three letters of reference (at least one evaluating teaching performance and potential). Please include a clear statement of commitment to teaching in a liberal arts college environment as well as indicating professional goals. All materials should be received by February 16, 1993. Address all materials of Faculty Search Committee, Department of Mathematics, Occidental College, 1600 Campus Drive, Los Angeles, CA 90041.

Occidental College is an Equal Opportunity/Affirmative Action Employer and encourages applications from women and ethnic minorities.

#### SCRIPPS COLLEGE Claremont, California 91711 Assistant Professor of Math, Beginning Fall 1993

Scripps College is seeking outstanding candidates for a two-year position as Assistant Professor of Mathematics commencing fall 1993. (The position is potentially tenure-track, pending budgetary considerations.) Candidates must submit evidence of excellence in undergraduate teaching and continuing mathematical activity as well as commitment to play a major role in the development of a mathematics curriculum at a liberal arts college for women. The teaching load is five courses, including precalculus and calculus as well as other offerings such as upperdivision mathematics classes and mathematics for liberal arts students. Teaching at the graduate level on an occasional basis is also possible. Scripps College is one of the six undergraduate and graduate institutions of the Claremont Colleges. The successful applicant will become a member of the intercollegiate mathematics group with approximately 40 faculty in all areas of mathematics; the group meets regularly for research seminars.

Send vita and statement of teaching interests and philosophy and direct three letters of reference to: Chair, Mathematics Search Committee, Scripps College, 1030 Columbia Avenue, Claremont, CA 91711. Consideration of applications will begin January 15, 1993 and continue until the position is filled. Scripps College is an equal opportunity/affirmative action

## Classified Advertisements

employer which strongly invites and encourages applications from women and minorities.

### UNIVERSITY OF CALIFORNIA, BERKELEY Department of Statistics

Pending final budgetary approval, applications are invited for two special Neyman Visiting Assistant Professor positions, beginning Fall 1993 or Spring 1994. The appointment is of two-year duration (but can be shorter by mutual agreement) and is not renewable. Applicants should have exhibited exceptional research potential in any of the following areas: Theoretical or applied statistics, computational statistics, probability theory, applied probability. Appointees will be expected to teach effectively as well as carry out a vigorous program of research. Send applications or inquiries (including resume and names of three references) by January 31, 1993 to: T.P. Speed, Chair, Department of Statistics, University of California, Berkeley, California 94720. The University of California is an Equal Opportunity, Affirmative Action Employer.

### UNIVERSITY OF REDLANDS Department of Mathematics P.O. Box 3080, Redlands, CA 92363

The Department of Mathematics invites applications for one or two tenure-track positions at the assistant professor level beginning September 1, 1993. Responsibilities include teaching six undergraduate courses per year, including computer-based courses; directing student research projects; and engaging in scholarly activity. Requirements include the Ph.D. in mathematics (any specialization) and evidence of excellence in and commitment to undergraduate teaching.

The University of Redlands, which enrolls 1500 undergraduates, is a selective, private, comprehensive university located in Southern California.

To apply, submit a letter of application, a resumé, and three letters of reference, two of which must address teaching, to Dr. Allen Killpatrick, Chair. Application deadline is 5:00 p.m., February 15, 1993. Department representatives will attend the AMS-MAA Joint Meetings in San Antonio, Texas. The University of Redlands is an EEO employer. We especially encourage women and members of minority groups to apply.

### UNIVERSITY OF SOUTHERN CALIFORNIA Los Angeles, California

The Department of Mathematics has available several tenure-track or tenured positions at the Assistant and/or Associate Professor level. Applicants must show strong research promise and possess excellent communications skills for teaching undergraduate mathematics courses. The Department of Mathematics also seeks to fill at least one tenured position at the senior level. Successful applicants will have an outstanding record of mathematical research and scholarship, and proven administrative skills

for academic leadership. Visiting positions (at all levels) and postdoctoral appointments will also be available.

To apply, please submit the following materials in a single package: letter of application (including your email address and fax number), and a curriculum vitae. Candidates for junior positions should also provide at least three letters of recommendation. Mail application to: Chair of Appointments Committee, Department of Mathematics - DRB 155, University of Southern California, Los Angeles, CA 90089-1113. USC is an Equal Opportunity/Affirmative Action employer. Women and minorities are especially encouraged to apply.

## COLORADO

### UNIVERSITY OF NORTHERN COLORADO Greeley, Colorado

**Pos. #20245.** One or two tenure-track, assist. or assoc. We seek candidates with a doctorate in math education, master's in math (or equiv.), strong commitment to teaching and research in educational math, evidence of successful college teaching. Direct dissert. in our Ed. Math Ph.D. program, 9-hour teaching per sem.

**Pos. #20231.** One or two tenure-track entry level positions. A Ph.D. in mathematics, strong commitment to excellent teaching (9-hour teaching per sem.) research, involvement in the Ed. Math. Ph.D. program.

For all positions: send letter of applications stating position #, resume, grad. transcripts, evidence of teaching success, 3 letters of recommendation to: Professor Richard Grassl, Chair, Department of Mathematical Sciences, University of Northern Colorado, Greeley, CO 80639. Applications received by January 13, 1993 will be given full consideration. Positions are contingent upon funding. AAEO

## FLORIDA

### FLORIDA INTERNATIONAL UNIVERSITY

The Department of Mathematics announces tenure track positions beginning August 1993. These positions are usually at the beginning Assistant Professor level. Candidates must have a Ph.D. in Mathematics and a commitment to research and quality teaching. Qualified candidates in all areas of Mathematics will be considered.

Teaching load consists of no more than five 3-credit courses per academic year. Send resume and arrange for 3 letters of recommendation to be sent to: Recruitment Committee, Department of Mathematics, Florida International University, Miami, FL 33199.

Florida International University is an equal opportunity/affirmative action employer. It is a member of the State University system of Florida, with approximately 23,000 students. The department offers bachelor's and master's degrees.

### ROLLINS COLLEGE Department of Mathematical Sciences Winter Park, FL 32789

A one-year visiting position is available for September 1993, pending approval. The area of specialization is open. A Doctorate or ABD is preferred, but a masters with teaching experience will be considered. A strong commitment to teaching undergraduates is required. The Department offers majors in mathematics and computer science and is well-equipped with Macintosh II computers. The teaching load is 8-10 hours per week. Winter Park, a delightful city of 40,000, is located in the greater Orlando area. To ensure full consideration, applications must be complete by 15 Feb. 1993. Send resume, transcripts and three letters of recommendation (at least one of which must comment on teaching) to: David Kurtz, Chair. Rollins College is an affirmative action/equal opportunity employer and women and members of minority groups are encouraged to apply.

### THE UNIVERSITY OF SOUTH FLORIDA Department of Mathematics

We invite applications for two tenure-track positions at the Assistant Professor level effective August 1993, contingent on availability of funds. Applicants must have or expect to have a Ph.D. in mathematics upon assuming the position, and must show evidence of strong research potential. Candidates demonstrating research experience beyond the Ph.D. are particularly encouraged to apply. The duties include research activity and both graduate and undergraduate teaching. We encourage applications from the following fields: Analysis, Discrete Mathematics/Foundations of Computing, Numerical Analysis, and Probability. Applicants must indicate in which of these four fields they wish to be considered, although outstanding candidates in other areas may apply.

The University of South Florida is the second largest state university in the Southeast, with more than 34,000 students enrolled. The Mathematics Department offers B.A., M.A., and Ph.D. degrees.

To apply, send a letter of application, with a curriculum vitae, and arrange to have at least three letters of recommendation sent to: Search Committee, Department of Mathematics, University of South Florida, 4202 Fowler Avenue, PHY 114, Tampa, Florida 33620-5700 (email: mathdept@math.usf.edu, FAX: (813) 974-2700).

Applications, which may be submitted by email or FAX, must be submitted by February 1, 1993. USF is an Equal Opportunity/Affirmative Action Employer and follows ADA guidelines.

## GEORGIA

### EMORY UNIVERSITY Department of Mathematics and Computer Science

The Department of Mathematics and Computer Science, Emory University, invites applications

## Classified Advertisements

for two anticipated tenure track Assistant Professorships for 1993-94.

Applicants must have a Ph.D. in Mathematics, with a promising research program centered in Algebra or Topology. As the department offers several undergraduate programs within Emory College, and the Ph.D. in Mathematics, applicants are expected to have strong records, or promise, as undergraduate and graduate teachers.

Applicants should send their CV's (including at least three recommenders' names) and see that recommendation letters are sent to

Professor Dwight Duffus, Screening Committee

Department of Mathematics and Computer Science

Emory University  
Atlanta GA 30322

Screening of applications will begin on 1 January 1993. Emory University is an Affirmative Action/Equal Opportunity Employer.

### GEORGIA INSTITUTE OF TECHNOLOGY

The School of Mathematics expects to have some visiting and tenure-track positions in several areas, including probability and statistics, at various levels beginning in Fall 1993. Candidates with strong research and teaching records or potential should send a resume, at least three letters of reference, and a summary of future research plans to The Hiring Committee, School of Mathematics, Georgia Institute of Technology, Atlanta, Georgia 30332-0160 U.S.A. Georgia Tech, a member of the University System of Georgia, is an Equal Opportunity/Affirmative Action Employer.

### GEORGIA INSTITUTE OF TECHNOLOGY

The Center for Dynamical Systems and Non-linear Studies expects to have some long- and short-term visiting positions beginning Fall 1993. These positions are in nonlinear differential equations, dynamical systems, computational methods and related areas. In addition to a resume and at least three letters of reference, candidates should send a summary of future research plans to Professor Jack K. Hale, Director, CDSNS, Georgia Institute of Technology, Atlanta, GA 30332-0190. Deadline for applications: postmarked no later than 2/15/93. Georgia Tech, a member of the University System of Georgia, is an Equal Opportunity/Affirmative Action Employer.

### GEORGIA SOUTHWESTERN COLLEGE

Department of Mathematics  
Americus, GA 31709-4693

Georgia Southwestern College invites applications for two tenure-track positions in Mathematics at the Assistant Professor level beginning September 1, 1993. The positions are in a five-member department offering undergraduate degrees in mathematics, mathematics education, and a master in education/secondary mathematics. A Ph.D. in mathematics is required. Send

a letter of application, resume, and three letters of reference addressing overall qualifications to: Dr. John Stroyls, Chair, phone (912) 928-1251, FAX (912) 928-1630. The positions will remain open until filled, but to ensure consideration, please apply by January 30, 1993. GSW is an Affirmative Action, Equal Opportunity Employer.

### VALDOSTA STATE COLLEGE

**Mathematics and Computer Science:** Assistant/Associate Professor (tenure track). Teach lower division courses in mathematics and statistics and upper division courses in the area of specialization. Student advising, committee work, and scholarly activities are also required. *Qualifications:* Ph.D. preferred in the area of analysis, applied mathematics, probability and statistics, number methods, operations, or optimization. ABD with master's in mathematics or statistics required. Prior teaching at the college or university level preferred. *Deadline:* A letter of application, resume, and names and phone numbers of three references should be received by December 15, 1992, in order to receive full consideration. Starting date is September 1, 1993. *Contact:* Dr. John W. Schleusner, Head, Department of Mathematics and Computer Science, Valdosta State College, Valdosta, GA 31698. AA/EOE.

### ILLINOIS

#### BRADLEY UNIVERSITY

Applications are invited for one or more tenure-track positions at the rank of Assistant Professor beginning August 1993. Candidates should have a strong commitment to undergraduate teaching. The Ph.D. in mathematics is required, and continuing professional growth (publication) is required for tenure and advancement. Preference will be given to applicants in the fields of dynamical systems, numerical analysis, or ring theory. Salary is competitive. The closing date is January 18, 1993, or until the position is filled. Send letter of application, vita, copy of graduate transcript, description of research, and three or more letters of recommendation (at least one of which addresses teaching ability and one scholarly activity) to: Dr. T. V. Sastry, Search Committee, Department of Mathematics, Bradley University, Peoria, IL 61625. Bradley University gives preference in hiring to U.S. Citizens, permanent residents, and aliens authorized to work in the U.S. Bradley University is an affirmative-action/equal-opportunity employer.

### ILLINOIS STATE UNIVERSITY

Mathematics Department  
Chairperson  
Department of Mathematics

The Department of Mathematics at Illinois State University invites nominations and applications for the position of Chairperson. *Qualifications:* Applicants should have a doctorate in Math-

ematics or Mathematics Education, a strong record of achievement in research and teaching, and demonstrated leadership and administrative skills. Experience with undergraduate programs is necessary and experience with graduate programs is desirable. Rank and salary are commensurate with qualifications. Duties begin on or about August 1, 1993.

The Department: The ISU Department of Mathematics is a broad-based department including Mathematics and a nationally recognized Mathematics Education program. The Department has 44 full time faculty positions and offers undergraduate and masters' programs in mathematics and mathematics education and a Ph.D. in Mathematics Education. Current Faculty Research Interests: in mathematics, analysis, combinatorics, graph theory, linear algebra, operations research, number theory, statistics; in mathematics education: instructional decision making, technology and mathematics, teaching of algebra, and children's understanding of number. The department serves over 4000 students each semester.

Illinois State University is located in Normal, Illinois, midway between Chicago and St. Louis, and currently enrolls approximately 21,000 students. It is a multipurpose university, with nationally acclaimed programs in a variety of disciplines. The community, with two universities, provides a variety of cultural opportunities. It has a high-tech automobile assembly plant, the home offices of two major insurance companies, and a good balance of business, industry, and education.

*Application Procedures:* Applicants should send a letter of application, a complete vita, and names and addresses of at least three references to Charles B. Harris, Secretary, Mathematics Chair Search Committee, 4240 Department of English, Illinois State University, Normal, IL 61761. To ensure consideration all materials (including letters of recommendation) should be received by February 15, 1993. Illinois State University is an Equal Opportunity/Affirmative Action Employer.

### UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN Department of Mathematics

Applications are invited for the following positions commencing August 1993: 1) one or more assistant professor tenure-track faculty positions, 2) one rank open faculty position. We are particularly interested in hiring in the areas of applied mathematics, combinatorics, optimization, partial differential equations, and probability. Outstanding candidates in all fields of mathematics are encouraged to apply and will be seriously considered. Some visiting appointments for the 1993-94 academic year are also anticipated. Salary and teaching load are competitive. Candidates must have completed the Ph.D. by the time the appointment begins. Candidates should send a letter of application, curriculum vitae and publication list, and arrange to have three letters of reference sent directly to Gerald J. Janusz, Chair  
Department of Mathematics

## Classified Advertisements

University of Illinois at  
Urbana-Champaign  
1409 W. Green St.  
Urbana, Illinois 61801  
tel. (217)333-3352

email: search@symcom.math.uiuc.edu.

In order to ensure full consideration, all application materials including letters of reference should be received by December 7, 1992. Interviews may be conducted prior to December 7, but all completed applications received by that date will receive full consideration. Candidates are expected to present evidence of excellence, or potential for excellence, in research and teaching. Applications from women and minority candidates are especially encouraged. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

### WOLFRAM RESEARCH, INC.

#### Mathematica Research and Development

We are looking for more top quality mathematicians to join the *Mathematica* research and development team. We anticipate openings in several areas. At present, a position is available in our algebraic computation group. Applicants should be able to work in a fast-paced environment and be capable of interacting well with mathematicians and others. Applicants should have a broad knowledge of mathematics. Research experience in algebraic geometry, complex analysis, or a related field is desirable. Applicants should have considerable programming experience; knowledge of *Mathematica* is required; experience with C is preferred. A Ph.D. in mathematics (or equivalent experience) is required.

Send resumes to: Attn: Personnel Department, Wolfram Research, Inc., 100 Trade Center Drive, Champaign, IL 61820 or send email to resumes@wri.com. Wolfram Research, Inc. is an affirmative action, equal opportunity employer.

### INDIANA

#### BALL STATE UNIVERSITY Mathematics

Applications are invited for a tenure-track position at the rank of Assistant Professor in the Department of Mathematical Sciences, Ball State University, effective August 1993. A doctorate in one of the mathematical sciences, completed by August 23, 1993, and evidence of successful college or university teaching are required. Demonstrated research potential is preferred. Salary and benefits are competitive and commensurate with qualifications. Duties include teaching, predominantly at the undergraduate level, mathematical research, and professional service. The Department of Mathematical Sciences includes faculty in pure and applied mathematics, statistics, actuarial science, and mathematics education. The department offers a range of academic programs leading to B.A., B.S., M.A., M.S., and M.A.E. degrees in these areas. Outstanding candidates in any area of the mathematical sciences

will be considered, although preference will be given to candidates whose research interest are compatible with those of the present faculty or with departmental needs. Candidates with interests in differential equations or number theory are encouraged to apply. Applications from women and minorities are strongly encouraged. Initial evaluation of applications will begin in December and will continue until position is filled. Interested applicants should request a departmental application form from: Dr. Norman K. Lee, Chair, Faculty Search Committee, Department of Mathematical Sciences, Ball State University, Muncie, IN 47306-0490; email: OONKLEE@LEO.BSUVC.BSU.EDU

Ball State University is an Equal Opportunity, Affirmative Action Employer and is strongly and actively committed to diversity within its community.

#### INDIANA STATE UNIVERSITY Chairperson Department of Mathematics and Computer Science

The Department of Mathematics and Computer Science, Indiana State University, invites applications for the position of Chairperson. Applicants should have a doctorate in Mathematics or Computer Science, a record of successful teaching and research with credentials sufficient to justify appointment at the rank of Professor, and a commitment to promoting research, teaching, and other scholarly activities. Applicants should possess demonstrated leadership skills necessary to chair a large department which has diverse teaching and research responsibilities.

The Department offers BS and BA degrees in Mathematics, Mathematics Education, and Computer Science, as well as MS and MA degrees in Mathematics and Mathematics Education.

Salary and rank will be commensurate with qualifications and experience. Please send a letter of application and vita, and have three letters of recommendation sent to: Chairperson Search Committee, Department of Mathematics and Computer Science, Indiana State University, Terre Haute, IN 47809.

Screening of applications will begin on February 1, 1993, and continue until the position is filled. U.S. citizenship or eligibility for U.S. employment will be required. Indiana State University is an Equal Opportunity/Affirmative Action Employer.

#### INDIANA UNIVERSITY-PURDUE UNIVERSITY AT INDIANAPOLIS (IUPUI) Department of Mathematical Sciences

The Department of Mathematical Sciences at IUPUI is seeking applicants for two tenure-track positions to begin in August 1993. Rank is open depending on qualifications. Applicants must have an earned doctorate by the starting date, either a strong research record or excellent research potential, and a commitment to quality graduate and undergraduate teaching.

Some preference may be given to applicants in algebra, scientific computing and applied statistics. However, strong applicants from all areas of mathematical sciences are encouraged to apply.

IUPUI is a comprehensive urban university with over 28,000 students. The department offers programs of study leading to Purdue University B.S., M.S. and Ph.D. degrees and we anticipate significant growth in our faculty during the next few years. The university offers competitive salaries and provides excellent fringe benefits. Send resumé and three letters of recommendation to Prof. Bart S. Ng, Chair, Department of Mathematical Sciences, IUPUI, 1125 E. 38th St., Indianapolis, IN 46205-2820. Closing date: February 1, 1993. Late applications will be considered until positions are filled.

IUPUI is an Affirmative Action/Equal Opportunity Employer. Women and minority candidates are encouraged to apply.

#### MANCHESTER COLLEGE

The Department of Mathematical Sciences anticipates a position beginning Fall semester 1993. Ph.D. in mathematics is preferred; strong background in statistics and computer science is desirable. The position requires teaching a wide variety of undergraduate mathematics courses and possibly some computer science. A commitment to excellence in teaching in liberal arts education is essential. Send letter of application, vita, and three letters of recommendation to: Stan Beery, Chair, Department of Mathematical Sciences, Box 161, Manchester College, North Manchester, IN 46962. Applications will be reviewed beginning March 1, 1993. AA/EO Employer.

#### PURDUE UNIVERSITY CALUMET

The Department of Mathematics, Computer Science & Statistics will have one (1) tenure-track mathematics position available for August 1993 at the rank of Assistant Professor.

*Requirements:* A Ph.D. in Mathematics. Responsibilities will include undergraduate and graduate teaching, research, and curriculum development and oversight. Candidates with expertise in numerical analysis, combinatorics, or history of mathematics will be given preference.

Submit a letter of application, a curriculum vita, graduate and undergraduate school transcripts. Also, arrange for three (3) letters of recommendation, at least one (1) of which addresses your research potential and at least one (1) of which addresses your teaching ability. All material should be sent to:

Professor Jay Wood  
Department of Mathematics, Computer  
Science and Statistics  
Purdue University Calumet  
Hammond, IN 46323

Review of documents will begin on January 4, 1993 and will continue until position is filled. Minorities and women are encouraged to apply. A representative of the Department will be inter-

## Classified Advertisements

viewing at the Employment Register associated with the Annual Meeting of the American Mathematical Society, San Antonio, Texas, January 1993. Purdue University Calumet is an Equal Opportunity/Affirmative Action Employer.

### PURDUE UNIVERSITY CALUMET

The Department of Mathematics, Computer Science and Statistics at Purdue University Calumet announces a tenure-track position in mathematics education available in August 1993. The salary will be commensurate with qualifications and experience. The duties and responsibilities include: teaching a range of mathematics courses including content and methods courses for prospective K-12 teachers, supervising field experiences, working collaboratively with public schools, and active involvement in research. Applicants should hold a doctorate in mathematics or mathematics education and at least a master's degree in mathematics. Candidates should also have a strong commitment to teacher education and to quality teaching at both the graduate and undergraduate level.

Review of applications will begin December 1, 1992 and continue until the position is filled. To apply, submit a letter of application, full curriculum vitae, graduate and undergraduate transcripts, and three letters of reference (at least one of which addresses your research potential and at least one of which addresses your teaching ability) to: Professor J. Paul McLaughlin, Department of Mathematics, Computer Science and Statistics, Purdue University Calumet, Hammond, IN 46323. An Equal Opportunity/Affirmative Action Employer.

## IOWA

### IOWA STATE UNIVERSITY Department of Mathematics

Subject to budgetary approval, there will be two tenure-track positions starting in August 1993. The positions will be full time during the 9-month academic year; they require a Ph.D. or equivalent.

One position will be in numerical analysis, and will be at the assistant professor or associate professor level. The successful candidate should have a strong interest in teaching at both the graduate and undergraduate level. He or she should maintain an active research program in some branch of numerical analysis. The candidate will be expected to apply for externally funded grants. Senior candidates should have a strong record of publications and grants. Start-up funds for a workstation will be available. The salary will be commensurate with qualifications.

The second position will be in mathematics education, at the assistant professor level. Candidates should have strong interest and qualifications in teaching both mathematics and mathematics education, the latter at both the graduate and undergraduate level. They should maintain an active research program in mathematics education. The duties will include teaching, advising, supervision of student teach-

ers, and participation in regional and national math ed activities.

Iowa State University is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

The department will begin screening applications January 15, 1993; applications will be accepted, however, until the positions are filled. Applications (vita, description of research plans, and three letters of recommendation) should be sent to Stephen J. Willson, Chair, Department of Mathematics, Iowa State University, Ames, Iowa 50011.

### UNIVERSITY OF NORTHERN IOWA Department of Mathematics Cedar Falls, IA 50614-0506

Tenure-track position to aid in teaching general education courses and to support our majors and graduate students. Applications and nominations are invited for a position at the assistant professor level. The department seeks to hire a candidate with a Ph.D. in Analysis. Candidates with expertise in any area of modern analysis will be considered; however, individuals with specialization in Functional Analysis are preferred.

Appointment is for the academic year beginning in August 1993. Salary is very competitive; fringe benefits are excellent. Application screening begins February 15, 1993, and will continue until an appointment is made. For more information, contact Gregory Dotseth, Mathematics Department, University of Northern Iowa, Cedar Falls, IA 50614-0506. (319)-273-2397; dotseth@math.uni.edu

An affirmative action, equal opportunity educator and employer.

## KANSAS

### KANSAS STATE UNIVERSITY Department of Mathematics

Subject to budgetary approval, applications are invited for several tenure track and visiting positions commencing August 18, 1993; rank and salary commensurate with qualifications. All fields will be considered, but for some of the tenure-track positions, preference will be given to candidates in Differential Equations, Geometry/Topology, Algebra, and Functional Analysis. Applicants must have strong research credentials and a commitment to excellence in teaching. A Ph.D. in mathematics or a Ph.D. dissertation accepted with only formalities to be completed is required. Letter of application, current vita, description of research and three letters of recommendation should be sent to:

Louis Pigno  
Department of Mathematics  
Cardwell Hall 137  
Kansas State University  
Manhattan, KS 66506

It is expected that offers will begin on December 15, 1992, but applications for all positions will

be accepted until February 1, 1993, or until positions are closed. AA/EOE

### THE WICHITA STATE UNIVERSITY

The Department of Mathematics and Statistics invites applications for tenure-eligible positions starting August, 1993. Special consideration will be given to persons having expertise in the following areas of research: probability and statistics, geometric analysis, numerical analysis, or complex analysis. We seek persons whose research interests are consonant with those of our faculty. Senior candidates should have distinguished research records, and junior candidates are expected to have excellent research potential and progress toward establishing a strong research record. All candidates should have a strong commitment to excellence in teaching and the ability to participate in and contribute to our doctoral program in Applied Mathematics. Salary and rank negotiable. Ph.D. in Mathematics or Statistics is required. Women and minority candidates are especially urged to apply. Send application letter, detailed resume, and arrange to have three reference letters sent to:

The Wichita State University  
Professor Stephen W. Brady, Search  
Committee Chair  
Department of Mathematics and  
Statistics  
Wichita, Kansas 67260-0033  
email: brady@twsvum  
fax: 316-689-3748

Deadline is January 15, 1993 (or monthly until positions are filled).

AA/EOE

### UNIVERSITY OF KANSAS Department of Mathematics

Applications are invited for a tenure-track position at the assistant professor level and for a visiting position at the assistant professor level (pending on funding) beginning August 17, 1993 or as negotiated. For the tenure-track position, preference will be given to candidates first in statistics, then computational mathematics (e.g., in numerical analysis, PDE, or dynamical systems), then to candidates whose specialties mesh well with those already represented in the department, then to all other areas of mathematics. For the visiting position, preference will be given to candidates whose research interests mesh well with those of our faculty. Candidates must have a Ph.D. or its requirement completed by August 15, 1993. Postdoctoral experience for tenure-track position is preferred but optional.

Application, detailed resume with description of research, and three recommendation letters should be sent to C. J. Himmelberg, Chairman, Department of Mathematics, 405 Snow Hall, University of Kansas, Lawrence, KS 66045-2142.

Deadlines: Review of applications will begin on December 1, 1992 and will continue until the positions are filled.

EO/AA Employer.

**KENTUCKY**

**MURRAY STATE UNIVERSITY  
Department of Mathematics & Statistics**

Applications are invited for a tenure-track position in mathematics education beginning August 1993.

Candidates must have a doctorate in mathematics or a doctorate in mathematics education with at least a masters degree in mathematics. Evidence of outstanding teaching, a successful record of scholarly activity or the potential for continuing scholarly activity, and a strong commitment to teacher education are required.

Responsibilities include a maximum three course teaching load, continuing research/scholarly activities, and university/departmental service. The person who fills this position will teach a range of mathematics courses, including content and methods courses for prospective K-12 teachers, supervise field experience, seek external funding to conduct workshops and seminars for public school teachers, and work in collaboration with public schools to help implement the Kentucky Education Reform Act which was recently enacted by the state legislature.

The application package must include a vita, copies of graduate transcripts, and a statement of teaching philosophy. The immigration status of non-U.S. citizens should be indicated on the vita. All applicants must meet federal guidelines for working in the U.S. For full consideration, applications must be complete by December 15, 1992.

Send the application package and direct three letters of recommendation to:

Dr. Robert Pervine, Search Committee  
Chair  
Department of Mathematics & Statistics  
Murray State University  
Murray, KY 42071

MSU does not discriminate on the basis of race, color, national origin, sex or handicap in its programs or activities. For information contact the MSU Affirmative Action Office, 502/762-3155.

**LOUISIANA**

**LOUISIANA STATE UNIVERSITY  
Department of Mathematics  
Baton Rouge, LA 70803;  
(504)388-1534**

Applications are invited at the Assistant/Associate Professor level for three anticipated tenure-track or visiting positions. Duties include teaching at the graduate and undergraduate level and maintenance of a strong research program. Selection is based on demonstration and promise of excellence in research and teaching. An applicant must complete all requirements for a Ph.D. or equivalent degree by August 1993. The department is primarily seeking to build on its strengths in probability, analysis and pde's, algebra, combinatorics, and topology. To apply, send a current vita and arrange for at least three letters of evaluation to be sent to Prof. James R. Retherford, Chair (address above).

LSU IS AN EQUAL OPPORTUNITY UNIVERSITY.

**MAINE**

**COLBY COLLEGE  
DEPARTMENT OF MATHEMATICS AND  
COMPUTER SCIENCE**

Subject to final budgetary approval, we expect to have a tenure-track opening in pure mathematics at the assistant professor level, commencing September 1, 1993. Ph.D. required. The salary is competitive and based on experience.

Colby is a small, private, highly selective liberal arts college located in central Maine. The student body numbers some 1700, the faculty 180. The Department of Mathematics and Computer Sciences currently numbers nine full-time and two part-time. All full-time faculty have the Ph.D. We have major and minor programs in mathematics and computer science.

We are a young, active department, which places a high value on both teaching and research. The annual teaching load is 5 courses. The largest class size is 30.

We have no preferences with regards to area of research specialization within pure mathematics. Candidates who are able to demonstrate excellence in teaching and are familiar with the use of computer algebra systems (in particular, *Mathematica*) in mathematics education are likely to be ranked higher in our selection process. An ability to teach some basic courses in computer science would also be desirable.

Colby is an AA/EO employer and actively encourages applications from women and minority candidates. Particularly well-qualified female applicants may be eligible for appointment to one of the College's Claire Booth Luce Assistant Professorships for Women Scientists.

Review of applications will begin January 20, 1993, and continue until the position is filled.

Send a letter of application and a current curriculum vita to: Keith Devlin, Chair, Department of Mathematics and Computer Science, Colby College, Waterville, Maine 04901. Also, arrange for three letters of reference to be sent to the same address. These letters should deal with both your research and your teaching abilities.

**MARYLAND**

**THE JOHNS HOPKINS UNIVERSITY  
Department of Mathematical Sciences**

Applications are invited for 3 anticipated faculty positions within the areas of

- 1) numerical linear algebra (Senior applicants preferred),
- 2) statistics,
- 3) operations research,
- 4) applied discrete mathematics.

Selection is based on demonstration and promise of excellence in research, teaching and innovative applications.

Minority and women candidates are encouraged to apply. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer.

Applicants are asked to furnish a curriculum vitae, transcripts (junior applicants only), reprints (if available), a letter describing professional interests and aspirations, and to arrange for three letters of recommendation to:

Prof. John C. Wierman, Chair  
Department of Mathematical Sciences  
220 Maryland Hall  
The Johns Hopkins University  
Baltimore, Maryland 21218-2689

Applications are requested by January 15, 1993.

Applicants whose primary research is in algebra, analysis, geometry, logic, number theory, or topology will not be considered.

**THE JOHNS HOPKINS UNIVERSITY  
Department of Mathematics**

Applications are invited for anticipated faculty positions (beginning fall 1993) within the general areas of algebra, analysis, geometry, number theory and topology. Of particular interest is the area of algebraic number theory, and one position may be filled at the senior level. Minority and women candidates are encouraged to apply. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer.

Applicants should submit a curriculum vitae and arrange for letters of recommendation to be sent to: Appointments Committee, Dept. of Mathematics, 404 Krieger Hall, Johns Hopkins Univ., Baltimore, MD 21218. (Applications in probability, statistics, operations research, and numerical methods will not be considered; applicants in these areas should instead contact the Dept. of Mathematical Sciences in the School of Engineering.)

**UNIVERSITY OF MARYLAND  
UNIVERSITY COLLEGE  
Teach in Asia or Europe**

University of Maryland University College seeks excellent teachers for openings on U.S. military bases overseas. Appointments begin August 1993. Requirements include M.A. or Ph.D., recent college teaching experience, and U.S. citizenship. Competence to teach in another discipline desirable. Benefits include transportation and military base privileges (PX, commissary, etc.). Frequent travel and the cost of schooling make these positions difficult for those with children. Send resume to: Dr. Ralph E. Millis, Assistant to the President, Overseas Programs, University of Maryland University College, College Park, MD 20742-1642. AA/EO.

**MASSACHUSETTS**

**TUFTS UNIVERSITY**

*The Department of Mathematics invites applications for the following positions.*

Assistant Professorships, two or three positions, to begin Sept. 1, 1993. Initial one-year contract, renewable to a maximum of three years. Ph.D., promise of strong research and evidence of strong teaching ability required.

Relation of research interests to those of members of the department will be a consideration. Research interests preferred: For Position No. 1, probability and statistics; Position No. 2, Lie group representations; Position No. 3, combinatorial group theory including braid theory. Send application with Position No. and three letters of recommendation by March 1, 1993, to R. Weiss, Search Committee Chair.

As an EO/AA employee, Tufts encourages applications from minority and women candidates.

Tufts University  
Math Department  
Medford, MA 02155

**WILLIAMS COLLEGE**  
Department of Mathematics  
Williamstown, Massachusetts 01267

One or possibly two anticipated positions, one of them preferably in statistics, probably at the rank of assistant professor, for Fall 1993. Strong commitment to both teaching and scholarship is essential.

Please have a vita and three letters of recommendation on teaching and research sent to Hiring Committee. Formal evaluation of applications will begin November 15, 1992, and continue until the positions are filled. AA/EOE.

**MICHIGAN**

**CENTRAL MICHIGAN UNIVERSITY**

One to two tenure track positions for Fall 1993, subject to budgetary approval. Rank is open but candidates at senior ranks should have experience directing doctoral dissertations. Priorities are 1. Mathematics Education, 2. Statistics. Candidates should have doctorate in appropriate field, promise of excellence in teaching, demonstrated research capability, and an interest in problems of teaching mathematics at the College and University level. Preference given to candidates whose research complements existing departmental interest. Duties include teaching and research with normal teaching load of 9 semester hours. Candidates in Math Education should have K-12 teaching experience, ability to teach undergraduate math courses, and expectations of participating in field-based experiences. Salaries are competitive and benefits include university paid TIAA, medical, dental, and group life. Send resume, transcripts, and names of three references to R.J. Fleming, Dept. of Mathematics, Central Michigan University, Mt. Pleasant, MI 48859 by January 24, 1993. Late applications will be received while positions remain open. CMU (AA/EO Institution) encourages diversity and resolves to provide equal opportunity regardless of race, sex, disability, sexual orientation, or other irrelevant criteria.

**GMI ENGINEERING & MANAGEMENT INSTITUTE**  
Faculty Position in  
Applied Mathematics

GMI Engineering & Management Institute invites applications for a tenure-track position in Applied Mathematics. This position is at the Assistant Professor level, however, candidates with exceptional qualifications will be considered for a more senior appointment. It is intended that the position be filled by July 1, 1993.

GMI Engineering & Management Institute, with a total student enrollment of 3,100 including 2,400 undergraduates, is the nation's only accredited college of engineering and management operating on a five-year cooperative plan of education. Founded in 1919, GMI was part of General Motors Corporation until 1982, when it became an independent institution and ceased to be known as General Motors Institute.

The college offers bachelor of science degrees in mechanical, industrial, electrical, and manufacturing systems engineering, and management and applied mathematics. Masters degrees are offered in manufacturing management and engineering. Undergraduate students alternate 12-week periods of classroom and laboratory academic studies with work experience at more than 560 business and industrial organizations in nearly 750 locations throughout the U.S. and Canada.

The Science and Mathematics Department offers a Bachelor of Science degree in Applied Mathematics. The department also offers courses at all levels in support of the various Engineering and Management bachelors and masters degree programs. Department faculty typically teach 3 courses per term, and are expected to participate in curriculum development, research and professional development, student advising, and service activities.

Qualifications for this position include an earned Ph.D. in Mathematics or in a related field, a strong background in applied mathematics, the ability to be an effective teacher while pursuing an active research program, and communication skills in the English language. Experience in computational mathematics and the modeling of fluid, solid, or control systems is highly desirable.

Please send resume, statement of research interests, and three letters of reference to: Dr. J. J. Salacuse, Search Committee Chair, Science and Mathematics Department, GMI Engineering & Management Institute, 1700 W. Third Avenue, Flint, Michigan 48504-4898. Applications will be accepted until February 1, 1993.

GMI is an affirmative action/equal opportunity employer and actively seeks the candidacy of women and minorities. Preference will be given to citizens and permanent residents of the U.S.

**GRAND VALLEY STATE UNIVERSITY**  
Mathematics Department

Assistant Professor or Instructor (tenure eligible) positions in Mathematics and Developmental Mathematics starting 8/93. Candidates must be professionally active, have strong teaching

recommendations, and have a commitment to undergraduate research and teaching, including the use of technology in the classroom. Ph.D. required for candidates in Mathematics with preference given to Analysis or Topology. Master's degree (Ph.D. preferred) required for candidates in Developmental Mathematics; must have strong mathematical backgrounds, and provide evidence of a commitment to teaching precalculus level mathematics. Send resume, three reference letters, teaching philosophy statement, and letter describing qualifications 1/11/93 to: Mathematics Search Committee, Mathematics Department, Grand Valley State University, Allendale, MI 49401. AA/EOE

**MICHIGAN TECHNOLOGICAL UNIVERSITY**  
Department of Mathematical Sciences  
Houghton, MI 49931

Applications are invited for four tenure track positions as well as visiting and temporary positions starting August 1993.

Subject to funding, the department anticipates tenure track openings in the areas of algebra (1 position), applied mathematics (2 positions) and mathematics education (1 position). Candidates for the positions in algebra and applied mathematics must have a Ph.D. in mathematics while candidates in mathematics education are expected to have a Ph.D. or Ed.D. degree and be able to teach undergraduate mathematics courses.

The successful candidates are expected to have strong teaching credentials and outstanding research potential. Appointment at the senior level will require a strong research record. Duties include teaching, service and research with a normal teaching load of courses (6 to 8 hours) per quarter. Preference will be given to candidates who can complement existing research interests in the department.

Send curriculum vitae, transcript and three letters of recommendation to  
Alphonse Baartmans, Head  
Department of Mathematical Sciences  
Michigan Technological University  
1400 Townsend Drive  
Houghton, MI 49931-1295

Review of applications will begin on December 1, 1992. Applications will be accepted until the positions are filled.

MTU is an equal opportunity educational institution/equal opportunity employer.

**WESTERN MICHIGAN UNIVERSITY**

**MATHEMATICS:** Western Michigan University seeks applicants to fill the position of chair of the department of mathematics and statistics with tenure and the rank of professor beginning July 1, 1993, pending budgetary approval. Position requires a Ph.D. degree in mathematics and experience in academic administration. Specialization in one of the following is preferred: analysis, computational mathematics, algebraic topology or graph theory and combinatorics. Applicant must demonstrate excellence in teaching, scholarship and publication. Western Michigan University, a Carnegie Classification

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## Classified Advertisements

Doctoral I Institution, has embarked upon a vigorous affirmative action program and encourages applications from women and members of minority groups. Send letter of application, vita, academic transcripts and three letters of recommendation to Ruth Ann Meyer, Interim Chair, Mathematics and Statistics Department, Western Michigan University, Kalamazoo, MI 49008-5152. Review of applications will begin January 15, 1993 and continue until position is filled.

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### MINNESOTA

**MACALESTER COLLEGE**  
Mathematics/Computer Science  
1600 Grand Avenue  
St. Paul, MN 55105

Applications are invited for a one year position in Mathematics for academic year 1993/94. Candidates must have the Ph.D., and a strong commitment to teaching and research in an undergraduate liberal arts college; they need not be entry level.

Applicants should send a resumé and arrange for three letters of reference to be sent to John Schue at the address above. Evaluation of applications will begin on January 4 and will continue until the position is filled. Macalester is an Affirmative Action/Equal Opportunity employer and encourages applications from women and members of minority groups.

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### UNIVERSITY OF ST. THOMAS

**Faculty Position**  
**Mathematics**

The Department of Mathematics at the University of St. Thomas invites applications for a non-tenure track position at the rank of assistant professor. The successful applicant will hold a Ph.D. in an appropriate area of mathematics, applied mathematics, or statistics, be recognized for undergraduate teaching, have a well-defined research agenda, and share a commitment to quality liberal arts education. Candidates should consider their role in contributing to the mission of the University. The Department of Mathematics with a faculty of 14 representing a variety of mathematical interests, offers a comprehensive undergraduate program. The University of St. Thomas, Minnesota's largest private college or university, is an urban, liberal arts, Catholic, coeducational, comprehensive university with over 10,000 students, about one half at the undergraduate level. The University, which offers programs at the baccalaureate, masters, and doctorate levels, is located equidistant from downtown Minneapolis and downtown St. Paul. Application materials, including a letter of interest, curriculum vita, and three letters of recommendation (including comments on the applicant's experience and promise in the areas of teaching and scholarship) will be accepted until January 31, 1993. Applications should be sent to John T. Kemper, Chair, Department of Mathematics, Mail #5046, University of St. Thomas, 2115 Summit Avenue, St. Paul, MN

55105. Concise email inquiries may be directed to JKEMPER@STTHOMAS.edu. Women and persons of color are encouraged to apply. The University of St. Thomas is an Equal Opportunity/Affirmative Action Employer.

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### MISSISSIPPI

**MISSISSIPPI STATE UNIVERSITY**  
**Professor and Head**  
**Department of Mathematics and Statistics**

Nominations and applications are invited for the position of Professor and Head of the Department of Mathematics and Statistics at Mississippi State University. Mississippi State University is a comprehensive land-grant institution and is rated as a Research I Institution by the Carnegie Foundation and a Doctoral I Institution by the SREB. The department is housed in the College of Arts and Sciences and offers programs for the B.A., B.S., and M.S. in Mathematics, M.S. in Statistics, and the Ph.D. in Mathematical Sciences. The department currently has 36 faculty members, approximately 100 undergraduate majors, and 30 full-time graduate students. The active interaction with research programs in the College of Engineering and the Mississippi Research and Technology Park, coupled with the anticipated retirement of up to eight present faculty members over the next five years offers the incoming head a unique opportunity to shape the department. The applicant should have earned doctorate in any area of Mathematical Sciences, strong administrative skills, an established record in research, and a commitment to excellence in teaching, research and other scholarly activities.

Screening of applicants will begin in December 1992, and will continue until the position is filled. The position is available July 1, 1993. Send nominations or applications and resumes, including names, addresses, and telephone numbers of at least three references, to:

Lewis R. Brown, Chairman  
Mathematics and Statistics Head  
Search Committee  
P. O. Drawer GY  
Mississippi State University  
Mississippi State, MS 39762  
Mississippi State University is an Affirmative Action/Equal Opportunity Employer.

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### MISSOURI

**SOUTHWEST MISSOURI**  
**STATE UNIVERSITY**

Southwest Missouri State University, Department of Mathematics. An Assistant Professor position in Mathematics Education is anticipated beginning August 20, 1993. This is a tenure-track position. Applicants must have a Ph.D. or Ed.D. in Mathematics Education, evidence of excellence in teaching, and a commitment to continued research. For this position preference will be given to applicants with research interests compatible with those of the current faculty. Demonstrated proficiency in both spo-

ken and written English is required. Duties include teaching, research, and service. Send application (resume, three letters of reference, graduate transcripts, and a letter of interest) to Dr. M. Michael Awad, Head, Department of Mathematics, Southwest Missouri State University, Springfield, MO 65804-0094. To ensure consideration, application materials should be received by February 1, 1993. AA/EOE.

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### NEBRASKA

**CREIGHTON UNIVERSITY**

Creighton University invites applications for a tenure track entry level faculty position in the Mathematics/Computer Science Department beginning in the Fall 1993. Applicants qualifications required include: a Ph.D. in Mathematics, an interest in curriculum development, a commitment to quality teaching and potential for research.

Creighton University is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

Applicants must submit a current curriculum vitae; three letters of recommendation independent of the candidate; original transcripts of all college-level work; evidence of successful teaching and research interests. Applications are accepted until March 1, 1993, or until the position is filled. Applications should be addressed to: Dr. John Mordeson, Chair, Search Committee, Department of Mathematics/Computer Science, Creighton University, Omaha, NE 68178-209000, before December 31, 1992, and after this date send to Dr. Shih-Chuan Cheng at the same address.

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### UNIVERSITY OF NEBRASKA-LINCOLN

We invite applications for two Assistant Professor tenure-track positions beginning in fall 1993. Candidates must have a Ph.D. in mathematics by August 1993, and have excellent teaching ability and outstanding research potential in an area that complements existing expertise in the department. Strong preference given to candidates in the areas of: (1) combinatorics and graph theory; or (2) nonlinear partial differential equations with emphasis on applications, dynamical systems, or numerics. Send vita and three letters of recommendation to Search Committee Chair, Department of Mathematics and Statistics, University of Nebraska-Lincoln, Lincoln, NE 68588-0323. Women and minority candidates are particularly encouraged to apply. The University of Nebraska is committed to a pluralistic campus community through Affirmative Action and Equal Opportunity, and is responsive to the needs of dual career couples. We assure reasonable accommodation under the Americans with Disabilities Act. Contact AA/EO at (402) 472-3417. The review of applications will begin February 1, 1993, and continue until suitable candidates are selected.



## Classified Advertisements

### NEVADA

#### UNIVERSITY OF NEVADA, RENO

The mathematics department at the University of Nevada, Reno seeks a Director for the Mathematics Center to be established in the Fall of 1993. The primary goal of the Mathematics Center is to improve students' quantitative thinking abilities through the integration of Mathematics into various courses across the curriculum. The Director's position is a tenure track position in the Department of Mathematics. Specific duties for the Director include: providing expertise and support to faculty for developing creative and appropriate methods of integrating mathematics instruction into various core curriculum courses; serving as a resource person for the development and/or purchase of technologies related to the instruction of mathematics; supervising student mathematics mentors for the class rooms; and generally providing leadership in the area of mathematics across the curriculum, and to teach courses regularly in the mathematics department.

Minimum qualifications are: a Ph.D. degree in mathematical sciences and a proven record of research and experience in improving mathematics education through curriculum development and innovative uses of technology and pedagogy. Rank is open and salary is competitive and commensurate with rank.

Screening of applications will begin January 15, 1993 and continue until the position is filled. Each applicant should send a resume and arrange to have three letters of reference sent to: Dr. Chaitan Gupta, Chair, Math Center Search Committee, Department of Mathematics, University of Nevada, Reno, NV 89557.

AA/EEO

#### UNIVERSITY OF NEVADA, RENO Assistant Professor

The Department of Mathematics of the University of Nevada, Reno, has openings for two tenure-track positions, position "P" and position "O", at the Assistant Professor level. Minimum qualifications for both of the positions are a Ph.D. in a mathematical science; strong potential for continued research productivity; demonstrated excellence and interest in teaching, both at the undergraduate and graduate level; leadership potential and demonstrated interest in curricular and programmatic development; ability to communicate and work effectively with students and faculty; and compatibility with the programmatic and research needs of the department.

For position "P" preference will be given to candidates with expertise in one or several of the following areas: Probability and Statistics, Applied and Computational Mathematics. Women and minorities are especially encouraged to apply.

Send application, vita, and three letters of recommendation to: Dr. Chaitan Gupta, Department of Mathematics, University of Nevada, Reno, NV 89557.

Candidates must specify in their application the position they are applying for. Screening

of applications will begin Jan. 15th, 1993, and continue until the position is filled.

AA/EEO

### NEW HAMPSHIRE

#### DARTMOUTH COLLEGE

##### John Wesley Young Research Instructorship in Mathematics

The John Wesley Young Research Instructorship is a two year post-doctoral appointment for promising new or recent Ph.D.'s whose research interests overlap a department member's. Current departmental interests include areas in algebra, analysis, algebraic geometry, combinatorics, computer science, differential geometry, logic and set theory, number theory, probability and topology. Teaching duties of four ten-week courses spread over two or three quarters typically include at least one course in the instructor's specialty and include elementary, advanced and (at instructor's option) graduate courses. Nine-month salary of \$34,000 supplemented by summer (resident) research stipend of \$7,556 (two-ninths). Send letter of application, résumé, graduate transcript, thesis abstract, description of other research activities and interests if appropriate, and 3 or preferably 4 letters of recommendation (at least one should discuss teaching) to Phyllis A. Bellmore, Mathematics and Computer Science, 6188 Bradley Hall, Hanover, NH, 03755-3551. Applications received by Jan. 15 receive first consideration; applications will be accepted until position is filled. Dartmouth College is committed to affirmative action and strongly encourages applications from minorities and women.

#### DARTMOUTH COLLEGE

The Department of Mathematics and Computer Science has an opening for a tenure-track Assistant Professor in Differential Geometry, with initial appointment in the 1993-1994 academic year. A candidate for the position must be committed to outstanding teaching at all levels of the undergraduate and graduate curriculum and must give evidence of a well-regarded research program that shows real promise for the future. Candidates with several years of experience should in addition be ready to direct Ph.D. theses.

To create an atmosphere supportive of research, Dartmouth offers new faculty members grants for research-related expenses, a quarter of sabbatical leave for each three academic years in residence and flexible scheduling of teaching responsibilities. The teaching responsibility in mathematics is four courses spread over two or three quarters. The department encourages good teaching with a combination of committed colleagues and bright, responsive students.

Though first priority is to appoint a differential geometer, our second priority is in algebra. Exceptional circumstances could lead to making the appointment in some third field. To apply, send a letter of application, curriculum vitae, and a brief statement of research results and

interests. Also arrange for four letters of reference to be sent, at least one of which addresses teaching, and, if the applicant's native language is not English, the applicant's ability to use English in a classroom. All application materials should be addressed to Phyllis Bellmore, Recruiting Secretary, Mathematics and Computer Science, 6188 Bradley Hall, Dartmouth College, Hanover, NH 03755-3551. Applications completed by February 1 will receive first consideration. Dartmouth is committed to Affirmative Action and encourages applications from African Americans, Asian Americans, Hispanics, Native Americans, and women. Inquiries about the progress of the selection process can be directed to Richard E. Williamson, Recruiting Chair.

### NEW JERSEY

#### RUTGERS UNIVERSITY Department of Mathematics and Computer Science

We anticipate one Moses Newall Combs Assistant Professorship beginning September 1993, contingent on funding. This is a three-year, nonrenewable term appointment. Candidates should have recently received the Ph.D., show outstanding promise for research in mathematics, and demonstrate a commitment to effective teaching. Preference will be given to candidates with research interests similar to those in the department. The teaching load will be two courses per semester.

Applicants should send a curriculum vitae and arrange for at least three letters of recommendation, including one which addresses teaching, to be sent directly to the Personnel Committee, Department of Mathematics and Computer Science, Rutgers University, Newark, NJ 07102.

Rutgers University is an equal opportunity/affirmative action employer.

### NEW MEXICO

#### NEW MEXICO STATE UNIVERSITY Department of Mathematical Sciences

The department invites applications for possible visiting and tenure track positions in pure and applied mathematics and statistics for academic year 1993-94. New tenure track positions will be primarily at the assistant professor level, but appointments at a higher rank may be possible. Strong commitment to both research and teaching required. The department welcomes applications from women and members of minority groups.

The department has 32 tenure faculty positions, and offers B.S., M.S., and Ph.D. degrees. Applications are kept on file through hiring period and positions filled as openings occur. Arrange for vita, short research description, and at least three reference letters to be sent to: Hiring Committee, Department of Mathematical Sciences, New Mexico State University, Las Cruces, NM 88003.

## Classified Advertisements

An Equal Opportunity/Affirmative Action Employer.

### NEW YORK

#### CLARKSON UNIVERSITY

The Department of Mathematics and Computer Science at Clarkson University invites applications for a tenure-track position in mathematics. Candidates must have: Ph.D. in mathematics or a closely related discipline; demonstrated excellence in research and in teaching; expertise in numerical analysis or computational mathematics. Rank and salary are negotiable.

Applications including vita and names of at least three references must be received by March 1, 1993. Starting date is August 16, 1993. Applications should be submitted to Professor A. Fokas, Department of Mathematics and Computer Science, Clarkson University, Potsdam, NY 13699-5815. Clarkson University is an equal opportunity/affirmative action employer. Women and minorities are urged to apply. POS #437

#### CLARKSON UNIVERSITY

The Department of Mathematics and Computer Science at Clarkson University invites applications for tenure-track positions in mathematics. Candidates must have: Ph.D. in mathematics or a closely related discipline; demonstrated excellence in research and in teaching; expertise in probability and statistics; the ability to provide leadership for undergraduate statistics and actuarial studies. Rank and salary are negotiable.

Applications including vita and names of at least three references must be received by March 1, 1993. Starting date is August 16, 1993. Applications should be submitted to Professor A. Fokas, Department of Mathematics and Computer Science, Clarkson University, Potsdam, NY 13699-5815. Clarkson University is an equal opportunity/affirmative action employer. Women and minorities are urged to apply. Pos #438

#### MATHEMATICAL SCIENCES INSTITUTE

The Mathematical Sciences Institute (MSI) of Cornell University and the State University of New York at Stony Brook has positions available for scientific visitors for the year beginning August 1993. For these positions, MSI prefers visitors not more than five years beyond the doctoral degree. Appointments are for the academic year with possible extension to a second year. Salary is \$34,000, plus benefits. Send application, to include letter of interest, curriculum vitae with list of publications, and three letters of support, one from the thesis advisor, to the attention of the coordinator listed below. Reprints of publications are appreciated. Applications are due January 15, 1993.

Appointments are available in Nonlinear Analysis (attn. J. Glimm), Hybrid Systems (attn. A. Nerode), and Symbolic Computa-

tion/Computer Algebra/Computational Complexity (attn. M. Sweedler).

Send to:

Mathematical Sciences Institute  
Suite 321, 409 College Avenue  
Ithaca, New York 14850-4697

For information, contact MSI: 607/255-8005, FAX 607/255-9003, or email: deedee@msiadmin.cit.cornell.edu. Appointments are contingent upon continued Army Research Office funding of the above research areas. MSI is partially funded by the U.S. Army Research Office. Cornell University is an Equal Opportunity/Affirmative Action Employer.

#### THE MOUNT SINAI SCHOOL OF MEDICINE

New York, NY

##### Assistant or Associate Professor

The Department of Biomathematical Sciences of The Mount Sinai School of Medicine invites applications for a tenure-track faculty position. A Ph.D. degree is required; postdoctoral and teaching experience is desirable. The department is looking for applicants with research and teaching interests in the area of mathematical and theoretical approaches to the structure and interactions of biological macromolecules, with experience in an appropriate field of mathematics, physical chemistry, or biophysics. Candidates will be evaluated according to their potential to sustain a nationally recognized, funded research program. The position is open at the level of assistant or associate professor; rank and salary to be commensurate with qualifications. Applicants should submit a curriculum vitae, including a summary of current research, a list of publications and a brief description of research plans; and should arrange for three letters of reference, to be sent before January 15, 1993, to Professor Craig J. Benham, Department of Biomathematical Sciences, Box 1023, The Mount Sinai School of Medicine, One Gustave L. Levy Place, New York, NY 10029-6574. An Equal Opportunity Employer.

### NORTH CAROLINA

#### UNC-CHARLOTTE

The Department of Mathematics  
Charlotte, NC 28223

Two tenure-track positions at Assistant Professor level, one each in areas of Statistics and Mathematics Education. Another Assistant Professor position, in an open area, is possible. Possible senior level positions (Associate/Full Professor level) in the area of Applied Mathematics. Possible visiting positions. Rank and salary for senior positions and visiting positions depend on experience and qualifications. Possible Postdoc positions available. Ph.D. and serious commitment to teaching and research required for all positions. The applicant should send vitae and a short abstract of current research interest; and should indicate which position and at what rank for which she/he wishes to be considered. Address to Professor R. F. Anderson at the above address. The applicant

should also arrange for 4 letters of reference, addressed to Professor Anderson. For full consideration, applications should be submitted by January 15, 1993; otherwise, applications will be accepted until positions are filled.

UNCC IS AN AFFIRMATIVE ACTION/EQUAL OPPORTUNITY EMPLOYER

### OHIO

#### MIAMI UNIVERSITY

Oxford, Ohio

##### Department of Mathematics and Statistics

The department anticipates, pending budgetary approval, one or more tenure track assistant professorships beginning August 1993. Duties include teaching undergraduate and graduate courses, continuing scholarship, and service. Applicants should have a Ph.D. in pure or applied mathematics by 8/93. Applicants in all areas of mathematics will be considered; however, preference will be given to candidates in the areas of optimization, numerical analysis, algebra and complex analysis. Please send vita, graduate transcript, and three reference letters to Mathematics Search, Department of Mathematics and Statistics, Miami University, Oxford, Ohio 45056. Screening of applications will begin on January 11, 1993. Women and minorities are encouraged to apply. AA/EOE.

#### OBERLIN COLLEGE

A one year position starting September 1993. Responsibilities include teaching undergraduate courses (5/year). All fields considered but preference given to candidates with experience and/or expertise in statistics. Qualifications required include the Ph.D. degree (in hand or expected by Fall 1993). Candidates must demonstrate potential excellence in teaching. Please send letter of application, curriculum vitae, academic transcripts, and 3 letters of reference to: Michael Henle, Department of Mathematics, Oberlin College, Oberlin, OH 44074 by January 8, 1993. Applications received afterwards may be considered until the position is filled. AA/EOE.

#### OHIO UNIVERSITY Department of Mathematics

The Department of Mathematics anticipates the appointment of two tenure-track assistant professors beginning September 1, 1993. One position is in operator theory or functional analysis and the other in general topology or set theory with possible applications to topology. Salary is competitive dependent on the candidate's qualifications and experience, with a minimum of \$29,000. Applicants must have a Ph.D. in mathematics before September 1, 1993. Send resume and have three letters of recommendation sent to Shih-liang Wen, Chairman, Department of Mathematics, Ohio University, Athens, Ohio 45701. The deadline for applications is January 31, 1993.

## Classified Advertisements

Ohio University is an Equal Opportunity/  
Affirmative Action Employer.

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### UNIVERSITY OF TOLEDO Department of Mathematics

The department invites applications for a tenure-track position in statistics at the rank of assistant professor, to begin in September 1993. Requirements include a Ph.D. (or the completion of all requirements for a Ph.D. by Fall 1993) and commitment to excellence in both teaching and research.

Applicants should send curriculum vitae and arrange for three letters of reference to be sent to: Harvey Wolff, Chair, Department of Mathematics, University of Toledo, Toledo, OH 43606.

The University of Toledo is an equal opportunity/affirmative action employer. Applications from women and minorities are especially welcome.

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### UNIVERSITY OF TOLEDO Department of Mathematics

The department invites applications for a tenure-track position in statistics at the advanced assistant professor level, to begin in September 1993. Requirements include a Ph.D., an established research record, commitment to excellence in teaching, and willingness to provide leadership for the department's statistics group.

Applicants should send curriculum vitae and arrange for three letters of reference to be sent to: Harvey Wolff, Chair, Department of Mathematics, University of Toledo, Toledo, OH 43606. Screening will commence in December, but applications will be accepted until the position is filled.

The University of Toledo is an equal opportunity/affirmative action employer. Applications from women and minorities are especially welcome.

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### UNIVERSITY OF TOLEDO Department of Mathematics

The department invites applications for a tenure-track assistant professor position in applied mathematics beginning in September 1993. Applicants should have a Ph.D. (or the completion of all requirements for a Ph.D. by Fall 1993) and be committed to excellence in both teaching and research.

Applicants should send curriculum vitae and arrange for three letters of reference to be sent to: Harvey Wolff, Chair, Department of Mathematics, University of Toledo, Toledo, OH 43606.

The University of Toledo is an equal opportunity/affirmative action employer. Applications from women and minorities are especially welcome.

### UNIVERSITY OF TOLEDO Department of Mathematics

The department invites applications for a visiting assistant professor position beginning in September 1993. Applicants should have a Ph.D. (or the completion of all requirements for a Ph.D. by Fall 1993) and be committed to excellence in both teaching and research. Research interests should mesh with those represented in the department.

Applicants should send curriculum vitae and arrange for three letters of reference to be sent to: Harvey Wolff, Chair, Department of Mathematics, University of Toledo, Toledo, OH 43606.

The University of Toledo is an equal opportunity/affirmative action employer. Applications from women and minorities are especially welcome.

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## OREGON

### UNIVERSITY OF OREGON Department of Mathematics Eugene, Oregon 97403 Frank W. Anderson, Head

Assistant or Associate Professor tenure track position in pure mathematics beginning September, 1993. Preference given to person with research interests that complement those currently represented. Competitive salary with excellent fringe benefits. Send complete resume and three letters. Closing date is January 18, 1993. Women and minorities are encouraged to apply. An EO/AA Institution committed to cultural diversity.

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## PENNSYLVANIA

### BRYN MAWR COLLEGE Department of Mathematics

Applications are invited for positions in Mathematics and Computer Science, starting September 1993. They should be sent to the appropriate committee, Department of Mathematics, Bryn Mawr College, Bryn Mawr, PA 19010.

**MATHEMATICS POSITIONS:** One tenure track assistant professorship and one three-year renewable lectureship. Candidates must have completed a doctorate in a mathematical science by the starting date, and must show promise in research and a serious commitment to undergraduate and graduate teaching. All fields are acceptable, with a preference for applied mathematics or geometry. Please send a vita, research plan and three letters of recommendation to the Mathematics Search Committee.

**COMPUTER SCIENCE POSITION:** Three-year renewable lectureship. Candidates should have completed a doctorate in computer science or a related field by the starting date, and must display a commitment to both teaching and scholarship, and an interest in curriculum development in a joint program with Haverford College. Please send a vita and three letters

of recommendation to the Computer Science Search Committee.

Bryn Mawr College is an equal opportunity affirmative action employer. The college wishes particularly to encourage applications from individuals interested in joining a multicultural/international academic community. Minority candidates and women are especially encouraged to apply. **CLOSING DATE:** 1 January 1993 (late applications may be considered). Telephone: (215)526-5348. Email: msearch@cc.brynmawr.

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### CARNEGIE MELLON UNIVERSITY Richard J. Duffin Assistant Professorship in Mathematics

The Richard J. Duffin Assistant Professorship was established in 1990 to honor Professor Emeritus Duffin. The position available is for an initial period of one or two academic years, beginning in September 1993, and extendable for one additional year when mutually agreeable. It carries a reduced academic year teaching load of six hours per week during one semester and three hours per week during the other. Applicants are expected to show exceptional research promise, as well as clear evidence of achievement and should have research interests which intersect those of current faculty of the Department. Applicants should send a vita, list of publications, and a statement describing current and planned research, and arrange to have three letters of recommendation sent to the committee. All communications should be addressed to: Appointments Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

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### CARNEGIE MELLON UNIVERSITY Zeev Nehari Assistant Professorship in Mathematics

The Zeev Nehari Assistant Professorships have been instituted in the Department of Mathematics of Carnegie Mellon University to honor the memory of Professor Zeev Nehari, a member of the Department from 1954 to his death in 1978. The position available is for an initial period of one or two academic years, beginning in September 1993, and extendable for one additional year when mutually agreeable. It carries a reduced academic year teaching load of six hours per week during one semester and three hours per week during the other. Applicants are expected to show exceptional research promise, as well as clear evidence of achievement and should have research interests which intersect those of current faculty of the Department. Applicants should send a vita, list of publications, and a statement describing current and planned research, and arrange to have three letters of recommendation sent to the committee. All communications should be addressed to: Appointments Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mel-

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## Classified Advertisements

lon University is an Affirmative Action/Equal Opportunity Employer.

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### **CARNEGIE MELLON UNIVERSITY** Department of Mathematics

The Department invites applications for a senior level appointment in Computational Mathematics/Numerical Analysis. We are particularly interested in candidates who will enhance existing computational and analytical programs which involve continuum models in fluid dynamics, mechanics of solids including microstructure, phase transitions as well as other aspects of materials science. Applicants should send a vita, list of publications, and a statement describing current and planned research, and arrange to have a least three letters of recommendation sent to: Computational Mathematics Search Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

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### **CARNEGIE MELLON UNIVERSITY** CENTER FOR NONLINEAR ANALYSIS Department of Mathematics

The Center for Nonlinear Analysis expects to make four to five Postdoctoral appointments for 1993–1994 in the area of applied analysis. This is a one-year (twelve-month) joint appointment by the Center and Department of Mathematics. Recipients will teach at most one course per semester. Applicants should send a vita, list of publications, a statement describing current and planned research, and arrange to have at least three letters of recommendation sent to the committee. The deadline for application is January 20, 1993; late applications may be considered on a space-available basis. All communications should be addressed to: Postdoctoral Appointments Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

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### **CARNEGIE MELLON UNIVERSITY** Department of Mathematics

The Department expects to make two or more tenure-track appointments, to begin in the Fall of 1993, at the Assistant Professor level. We seek candidates in areas of research which strongly intersect those of the current faculty of the Department.

Applicants should send a vita, list of publications, and a statement describing current and planned research, and arrange to have at least three letters of recommendations sent to the committee. All communications should be addressed to: Tenure-track Appointments Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

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### **LAFAYETTE COLLEGE** Department of Mathematics Easton, PA 18042

Anticipated one-year position at the rank of assistant professor beginning in late August 1993. Requirements include Ph.D. and strong commitment to undergraduate teaching. Teaching load of 6 courses for the year. Lafayette is a highly selective college offering liberal arts and engineering to 2000 students.

Send vita and 3 letters of reference (at least one of which concerns teaching) to Mathematics Search Committee. To ensure consideration, all application materials must be received by February 1. Application materials received after that date may be considered until the position is filled. Lafayette College is an Equal Opportunity Employer and particularly encourages applications from women and minority candidates.

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### **TEMPLE UNIVERSITY**

The Department of Mathematics seeks to fill one or more tenure-track positions at the assistant professor level. The search is for talented researchers and teachers in one or more of the following fields: Scientific Computing, Nonlinear PDE, Mathematical Physics. Outstanding applications in other fields will be given serious consideration as well.

Send applications, including a vita and at least three letters of recommendation by Dec. 20, 1992 to: Search Committee, Department of Mathematics, Temple University, Philadelphia, PA 19122-2585. Temple University is an equal opportunity employer. Women and minorities are encouraged to apply.

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### **UNIVERSITY OF PITTSBURGH** Department of Mathematics and Statistics

The department invites applications for the following position, which will be available for September 1993 if funding permits.

Assistant Professor in mathematical biology. We have a preference for an individual with a strong computational aspect to their research. This is a tenure track position.

Requirements include outstanding research accomplishment and potential commensurate with experience, and ability and interest in excellent teaching.

Applicants should send a resume and arrange to have at least three letters of recommendation sent to: S. Hastings, Chairman, Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, PA 15260. Applications which are complete by January 10, 1993 are assured of complete consideration.

The University of Pittsburgh is an equal opportunity/affirmative action employer. Women and minorities are especially encouraged to apply.

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### **UNIVERSITY OF PITTSBURGH** Department of Mathematics and Statistics

The department invites applications for the following position, Professor of Mathematics, with specialty in Ring Theory.

This would be a tenured senior position. It is dependent on funding. We anticipate that it will be available in either Fall 1993 or Fall 1994.

Requirements include outstanding research accomplishment commensurate with experience, and ability and interest in excellent teaching.

Applicants should send a resume to S. Hastings, Chairman, Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, PA 15260. Do not have letters of recommendation sent at this time. Applications which are received by January 20, 1993 are assured of complete consideration.

The University of Pittsburgh is an equal opportunity/affirmative action employer. Women and minorities are especially encouraged to apply.

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## **RHODE ISLAND**

### **BROWN UNIVERSITY** Division of Applied Mathematics

The Division of Applied Mathematics expects to have a position at the Assistant Professor level in the general area of nonlinear analysis. The ideal candidate should be able to combine research on the theory of partial differential equations and/or dynamical systems with applications to the physical or life sciences.

Applicants should have a curriculum vita, at least three letters of recommendation, and relevant publications sent to: Professor Wendell H. Fleming, Chair, *Nonlinear Analysis position*, Division of Applied Mathematics, Brown University, 182 George Street, Providence, RI 02912. The closing date for applications is January 15, 1993.

Brown University is an affirmative action/equal opportunity employer.

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### **UNIVERSITY OF RHODE ISLAND** Department of Mathematics

Applications are invited for two tenure-track positions at the assistant professor level to teach undergraduate/graduate courses and to contribute to the research efforts of the department. A Ph.D. in mathematics is required by August 31, 1993. Must have excellent communication skills, strong commitment to teaching plus excellent research accomplishments or strong research promise. Applicants must have specialized in one of the following areas: Approximation Theory, Analysis (Modern and Classical), Combinatorics, Control Theory, Differential Equations. Must be able to work with culturally diverse populations. Submit a letter of application and vitae, and have three letters of reference sent by January 20, 1993 to: E. Suryanarayan, Search Committee Chair, Log #021174, UNIVERSITY OF RHODE ISLAND,

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## Classified Advertisements

P. O. Box G, Kingston, RI 02881. An Affirmative action/equal opportunity employer.

### SOUTH CAROLINA

#### CLEMSON UNIVERSITY Clemson, SC

Applicants are invited for a tenure-track position at the assistant professor level, and possibly other levels. The department encompasses the areas of algebra/combinatorics, analysis, computational math, operations research and statistics. One position will be in statistics with possible positions in our other mathematical areas. Desirable attributes for candidates include an interdisciplinary research orientation in the mathematical sciences and an interest in innovative applications. Candidates should have strong potential or demonstrated capability for effective research and teaching. Applications received by February 15, 1993, will be given highest priority, but others will be considered until position is filled. Applicants should indicate in the cover letter their research specialties. Vita and names of three references should be sent to address below. Reference letters should *only* be sent when requested. CU is an AA/EEO employer.

Professor R. D. Ringeisen, Head  
File A, Box 341907  
Department of Mathematical Sciences  
Clemson University  
Clemson, SC 29634-1907

#### UNIVERSITY OF SOUTH CAROLINA Department of Mathematics

The Department of Mathematics invites applications for expected tenure-track faculty positions for Fall 1993, at all ranks. Applications in all areas of mathematics will be considered. Research is supported by excellent inhouse library and computing facilities. The Ph.D. degree or its equivalent is required. Appointments will be consistent with the Department's commitment to excellence in research and in teaching at the undergraduate and graduate levels. A detailed resumé, containing a summary of research accomplishments and goals, and four letters of recommendation should be sent to:

Dr. George F. McNulty, Chairman  
Department of Mathematics  
University of South Carolina  
Columbia, SC 29208

The University of South Carolina is an Affirmative Action/Equal Opportunity Employer.

### TENNESSEE

#### TENNESSEE TECHNOLOGICAL UNIVERSITY Department of Mathematics Cookeville, TN 38505

Two tenure-track Asst. Prof. positions to begin August 1993. Ph.D. in Mathematical Sciences, evidence of excellent teaching ability/potential

& strong promise of research required. Analyst preferred for one position. Duties including teaching grad. & undergrad. courses, directing master's students, engaging in research activities & participating in course development. Initial review of applications to begin 1-15-93; applications accepted until positions filled. Transcripts, curriculum vitae & 3 letters of recommendation should be sent to: Dr. J. T. B. Beard, Jr., Chairperson, Search Committee. TTU will hire only U.S. citizens and aliens lawfully authorized to work in the U.S. Qualified women, minorities & disabled individuals strongly urged to apply. AN AA/EEO/ADA EMPLOYER.

#### UNIVERSITY OF TENNESSEE AT CHATTANOOGA Department Head

The University of Tennessee at Chattanooga invites applications for Head of the Department of Mathematics. A Ph.D. in a mathematical science and at least five years of college mathematics teaching experience are required. Applicants should provide evidence of leadership in curriculum development, teaching, public service and research/scholarly activities. In this primarily undergraduate institution, the faculty is expected to exhibit excellence in teaching while maintaining a strong commitment to research and public service. The mathematics department has 22 faculty members including a Chair of Excellence in Applied Mathematics. Located in a very scenic metropolitan area of 400,000, UTC has a student enrollment of 8100. Send applications with current vita to: Dr. Irene Loomis; Chair of the Search Committee, Dept. of Mathematics, UTC, Chattanooga, TN 37403-2598. Consideration of applications will begin November 1, 1992, and will continue until the position is filled. Women and minorities are encouraged to apply. UTC is an Equal Opportunity Employment/Affirmative Action/Title IX Section 504 Institution.

#### UNIVERSITY OF TENNESSEE Knoxville, Tennessee

The Mathematics Department of the University of Tennessee, in an effort to significantly improve its research position, seeks to fill 3 or 4 tenure-track assistant or beginning associate professorships in several areas. A Ph.D. is required. Some postdoctoral experience is preferred. There will be one and possibly two positions available in Numerical Mathematics; candidates should be well versed in the core areas of Numerical Analysis with research interests in the numerical solution of differential equations. Preference will be shown those candidates working in numerical fluid dynamics. Another position will be offered in differential equations, with preference given to those having expertise in the nonlinear qualitative theory of differential equations. Another position will be offered in Stochastic Differential Equations and related fields of Stochastic Analysis. Employment begins August 1993. Substantial research promise as well as dedication to teaching are paramount. Interested applicants should ar-

range to have a vita, three reference letters, and a research statement sent to Professor John B. Conway, Mathematics Search, University of Tennessee, Knoxville, TN 37996-1300. recruit@novell.math.utk.edu. Review of applications will begin December 1 and will continue until the positions are filled.

UTK is an EEO/AA/Title IX/Section 504/ADA Employer.

### TEXAS

#### ANGELO STATE UNIVERSITY Department of Mathematics

Angelo State University is seeking applications for a faculty position at the Assistant Professor level for the 1993-94 academic year. Candidates must hold the Ph.D. degree in mathematics. Teaching load is twelve semester hours per semester at a nine-month salary of \$33,790 to \$37,339, depending upon academic qualifications and college teaching experience, plus other University benefits. Some summer teaching is normally available. Job requirements include ability to communicate effectively with undergraduate students, dedication to excellence in teaching, and a strong commitment to high academic and professional standards. Deadline is open but may be closed at any time after February 1, 1993. Inquiries should be directed to:

Dr. J. M. Bailey, Head  
Department of Mathematics  
Angelo State University  
San Angelo, Texas 76909  
Telephone: 915-942-2111

**U.S. News and World Report's 1993 College Guide, "America's Best Colleges,"** lists Angelo State University as one of the three highest ranked state-supported regional universities in Texas. The University has one of the most modern and attractive campuses in the nation and is fully accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award degrees at the associate, bachelors' and masters' levels. The University student body of approximately 6,100 ranks first among regional universities in Texas in the high percentile ranking of entering freshmen in their high school graduating classes. The University offers one of the largest and most distinctive academic scholarship programs in the nation.

Angelo State University is an equal opportunity/affirmative action employer.

#### LAMAR UNIVERSITY Beaumont, Texas

The Department of Mathematics seeks applications for a tenure-track Assistant/Associate Professor position beginning Fall 1993. Applicants must hold an earned Ph.D., should be active researchers in Analysis and/or Applied Mathematics, and have a strong commitment to teaching.

Lamar is a state supported educational and research institution of approximately 12,000 students. The Department, which is located within the College of Engineering, offers the

## Classified Advertisements

B.A., B.S., and M.S. degrees in Mathematics and has 16 full-time faculty.

For the approximately 250,000 people in the Beaumont area, there are eight museums, a symphony orchestra, ballet, opera, and other theatrical productions. Other facilities and events are found in Houston 85 miles west. Nearby outdoor recreational opportunities include two of the largest freshwater lakes in Texas, the Big Thicket National Preserve, four national forests, the Gulf of Mexico, and a large inland saltwater lake.

Salary and rank are commensurate with qualifications and experience. Send a resume and three letters of recommendation to: Dr. John R. Cannon, Chair, Department of Mathematics, Lamar University, P. O. Box 10047, Beaumont, TX 77710. Full consideration will be given to completed applications received before March 15, 1993. Lamar is an EEO/AA employer.

### RICE UNIVERSITY Computational & Applied Mathematics Department

The Department of Computational & Applied Mathematics invites applications for tenure-track assistant professorship appointment in applied analysis and partial differential equations, mathematical programming, and numerical optimization. Applicants should demonstrate both breadth of interest and promise in research and teaching. The Department seeks especially those applicants whose expertise directly strengthens existing programs within the department.

Rice University is a private research university with a long tradition of excellence in undergraduate science and engineering education. The Computational & Applied Mathematics Department also hosts and active and expanding graduate program, has superb computing facilities and ongoing research in Linear and Integer Programming, Numerical Optimization, Numerical Linear Algebra, Parallel Computing, Flow in Porous Media, and Optimal Design and Inverse Problems for Partial Differential Equations. The department has excellent relations with other departments at Rice and the University of Houston, with industrial and governmental research groups, and is actively involved in the Center for Research in Parallel Computation which is funded by the NSF Science and Technology Centers program.

Please furnish vita, transcripts, reprints, and three letters of recommendation before March 1, 1993, to:

Chair, Staffing Committee  
Computational & Applied Mathematics  
Department  
Rice University  
PO Box 1892  
Houston, TX 77251-1892

Rice University is an affirmative action/equal opportunity employer.

### TEXAS A&M UNIVERSITY Research Instructorships in Mathematics

The department expects to have several Research instructorships available for the 1993-1994 academic year. These are two year positions, and candidates should have recently received their Ph.D., show promise of research excellence in an area of pure or applied mathematics, and have a commitment to teaching. Preference will be given to applicants whose expertise augments our existing research strengths.

Application material consisting of a vita which should include a statement of research goals, and 3 letters of recommendation should be sent to

William Rundell, Interim Head  
Department of Mathematics  
Texas A&M University  
College Station, Texas 77843-3368

Texas A&M University is an Equal Opportunity/Affirmative Action employer. Women and minority applicants are especially encouraged.

### TEXAS A&M UNIVERSITY Department of Mathematics

Applications are invited for one or more tenure-track or tenured faculty positions beginning in the 1993-1994 academic year. Outstanding candidates in all fields of mathematics are encouraged to apply. Significant research accomplishments or, in the case of a junior appointment, exceptional promise plus an earned Ph.D., together with evidence of good teaching ability, will be expected of successful applicants. Salary will be commensurate with qualifications. Candidates should send a letter of application, full vita, and arrange to have at least 3 letters of recommendation sent to

William Rundell, Interim Head  
Department of Mathematics  
Texas A&M University  
College Station, Texas 77843-3368

Texas A&M University is an Equal Opportunity/Affirmative Action employer. Women and minority applicants are especially encouraged.

### TEXAS TECH UNIVERSITY Department of Mathematics P.O. Box 41042 Lubbock, TX 79409

The Department of Mathematics at Texas Tech University anticipates openings for at least one tenure track Assistant Professorship beginning in the fall semester of 1993. To qualify the applicants must:

1. have a Ph.D. from a recognized university,
2. have a strong dedication to both teaching and research,
3. exhibit research interests that are compatible with ongoing programs in the department, and
4. be willing and able to work with students at both the undergraduate and graduate level.

To apply, please send a resume and have three letters of recommendation sent to Harold Bennett, Chairman of Hiring Committee, Depart-

ment of Mathematics, Texas Tech University, P.O. Box 41042, Lubbock, TX 79409 EOE/AA

### UNIVERSITY OF TEXAS AT ARLINGTON Department of Mathematics

The Department invites applications for two to three anticipated tenure-track positions beginning with the Fall Semester, 1993. We seek candidates in various areas of Mathematics which are complementary to those of the current faculty and would enhance and support the goals of the Department. Salary and rank are commensurate with qualifications which must include the Ph.D. degree (in hand or expected by September 1993). Assistant Professor candidates must show strong potential for excellence in teaching and research. For an Associate or Full Professorial appointment the candidate must have excellent teaching credentials and a nationally established research record; some success in attracting outside funding is preferred. A resume with three letters of recommendation should be sent to:

Chairman  
Recruiting Committee  
University of Texas at Arlington  
Department of Mathematics  
Box 19408  
Arlington, TX 76019-0408

The University of Texas at Arlington is an Affirmative Action/Equal Opportunity Employer.

### THE UNIVERSITY OF TEXAS AT AUSTIN Department of Mathematics Austin, Texas 78712

For Fall 1993 openings are expected only at the Instructor level. Instructorships at The University of Texas at Austin are postdoctoral appointments, renewable for up to three years. They are restricted to recent Ph.D. recipients: applicants are expected to have completed all Ph.D. requirements by no later than August 31, 1993 but not to have received their degrees prior to January 1, 1991. Candidates should have outstanding research ability and a solid commitment to teaching. Strong preference will be shown toward applicants whose research interests are closely allied with those of the permanent faculty. Duties include teaching undergraduate or graduate courses and conducting independent research. The anticipated salary is \$31,000 for the nine-month academic year.

Individuals wishing to apply should send a vita and a brief research summary to the above address, % Recruiting Committee. Transmission of these materials via e-mail to [recruit@math.utexas.edu](mailto:recruit@math.utexas.edu) is encouraged. **Please do not have any letters of recommendation sent with your application.** Following an initial screening, the Recruiting Committee will request additional information, part of which will be letters of recommendation from selected applicants. Unsolicited letters of recommendation will be disregarded. The screening of applicants will begin on December 1, 1992.

## Classified Advertisements

The University of Texas at Austin is an equal opportunity employer. Qualified women and minority group members are urged to apply.

### UNIVERSITY OF TEXAS - PAN AMERICAN

F92/93-04. University of Texas-Pan American, Department of Mathematics and Computer Science. Applications are invited for a tenure-track appointment at the level of assistant professor to begin August 1993. Requirements include a Ph.D. in mathematics with research interests in applied mathematics and a strong commitment to excellence in teaching. Applicants should send a vita and arrange to have three letters of reference sent to:

Dr. Joseph Wiener, Chair of Search Committee  
Dept. of Mathematics and Computer Science  
University of Texas-Pan American,  
1201 W. University Drive  
Edinburg, Texas 78539

Closing date for the search is April 1, 1993 or until the position is filled. The University of Texas-Pan American is an Affirmative Action, Equal Opportunity Employer.

### UTAH

#### BRIGHAM YOUNG UNIVERSITY Department of Mathematics

Applications are invited for two positions: a one-year appointment in the specialty of partial differential equations, and a potential tenure-track appointment to complement existing department strengths in mathematics education, analytic number theory, or algebraic geometry.

Selection will be based upon a proven record of research and teaching ability. Applications will be accepted until 1 February 1993. Please send a curriculum vitae, clearly specify your specialty of interest, and have 3 letters of reference sent to:

Peter W. Bates, Chair  
292 TMCB  
Department of Mathematics  
Brigham Young University  
Provo, UT 84602

BYU is an Equal Opportunity/Affirmative Action Employer.

#### UTAH STATE UNIVERSITY Department of Mathematics and Statistics

Applications are invited for one or more tenure-track positions in mathematics at the assistant professor level, to begin September 1993. Requirements include a Ph.D. (by September 1993) in mathematics or mathematical sciences, potential for excellence in research, and demonstrated commitment to both undergraduate and graduate teaching. Candidates with research interests in algebra or related areas, integrable or dynamical systems, or computational optimization are especially encouraged to apply.

Utah State University, located in the Wasatch Range of the Rocky Mountains, offers competitive salaries and excellent medical, retirement, and professional benefits.

Applications, including resume and three letters of reference, should be sent to LeRoy Beasley, Search Committee, Department of Mathematics & Statistics, Utah State University, Logan, UT 84322-3900 or email: lbeasley@usu.edu. The selection process will begin February 1, 1993 and will continue until the position is filled.

Women and minorities are particularly encouraged to apply. EO/AEE.

#### UNIVERSITY OF UTAH Department of Mathematics

The University of Utah, Department of Mathematics, invites applications for the following positions:

1. At least two **full time tenure track appointments** on the professional levels. The Department is primarily interested in applicants who work in the research areas represented in the Department and who received their Ph.D. degrees prior to 1992. Selection will be based on research and teaching ability.

2. Two or more nonrenewable **three-year instructorships**. Persons of any age receiving Ph.D. degrees in 1992 or 1993 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary will be \$33,000; future cost of living increases are contingent on action by the State Legislature. Duties consist of teaching five courses during the three quarter academic year.

3. One **C. R. Wylie Instructorship**. The term of this instructorship is one year, but it may be renewed for up to three years. It will be awarded either to an incoming instructor or to one of the instructors already in residence on the basis of ability and potential in teaching and research. The stipend is \$37,000. Duties consist of teaching four courses during the three quarter academic year.

4. One or more **visiting faculty positions** of one year or less in any of the professorial ranks. Selection will be based on potential contributions to the department's research program, and on teaching ability.

It is expected that offers of instructorships will begin on January 1, 1993, but applications for all positions will be accepted until January 31, 1993, or until all positions are filled. Applications for any of these positions should include curriculum vitae, bibliography and three letters of reference. (Instructorship applications should also include an abstract of the thesis and either a list of graduate courses completed or a transcript of graduate work.) Visiting faculty applications should indicate the portion of the three-quarter academic year during which the applicant wishes to visit. Please send your application to Committee on Staffing, Department of Mathematics, University of Utah, Salt Lake City, Utah 84112. The University of Utah is an Equal Opportunity, Affirmative Action Employer and encourages nominations and applications from women and minorities.

### VIRGINIA

#### UNIVERSITY OF VIRGINIA Department of Mathematics Charlottesville, Virginia 22903

The Department of Mathematics is seeking outstanding candidates to fill its Whyburn Instructorship. Applicants should show exceptional promise in teaching and research. Preference is to be given to applicants who have received the Ph.D. within the past two years, and who are working in analysis. The Instructorship is a two-year appointment with reduced teaching load and partial summer support.

Please send application materials by January 15, 1993 to the Committee on Hiring. The University of Virginia is an Equal Opportunity/Affirmative Action Employer.

#### VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY Department of Mathematics

We are seeking applicants for an anticipated tenure-track appointment at the Assistant Professor level in the area of Computational Mathematics/Numerical Analysis beginning with the 1993-94 academic year. We seek applicants with a strong research potential as well as the ability to be an effective teacher. A vita, brief description of research interests, three letters of recommendation including at least one which addresses teaching, and any supporting materials should be sent to Janet S. Peterson, Chair, Computational Mathematics Search Committee, ICAM, Wright House, Virginia Tech, Blacksburg, VA 24061-0531. Applications will be accepted for as long as there is a possibility of making an appointment or until 3/15/93; however, applications completed by 1/1/93 will be included in the first round of evaluations. Equal Opportunity/Affirmative Action Employer. The University takes its affirmative action mission seriously and is especially interested in receiving applications from women and people of color.

#### VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY Department of Mathematics

The Department of Mathematics is actively seeking applications for an anticipated tenure-track position at the Assistant Professor level in the area of discrete mathematics, combinatorics, and graph theory beginning with the 1993-94 year. A Ph.D. in mathematics, strong research potential, and good teaching credentials are required. Preference will be given to candidates with postdoctoral experience. Applications will be accepted for as long as there is a possibility of making an appointment or until March 15, 1993. Those completed by January 1, 1993 will be included in the first round of evaluations. Applicants should send a curriculum vitae and arrange to have three letters of reference sent to Professor Charles Parry, Chair, Discrete Math Search Committee, Department of Mathematics, VPI&SU, Blacks-

burg, VA 24061-0123. At least one letter should address the applicants teaching credentials. VPI&SU is an Equal Opportunity/Affirmative Action Employer. The University takes its affirmative action mission seriously and is especially interested in receiving applications from women and people of color.

**VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY**  
**Department of Mathematics**

Applications are invited for an anticipated tenure-track appointment at the Assistant Professor level in the general area of Dynamical Systems beginning with the 1993-94 academic year. A Ph.D. and strong research potential are required. The likelihood of productive interaction with current faculty members, such as the group in partial differential equations and continuum mechanics, will be a consideration. Position involves teaching duties of approximately six hours per week. Evidence that candidate is or will become an effective teacher should be included in application materials; in particular, at least one reference letter should address this issue. Send a vita and arrange to have three letters of reference submitted to Kenneth Hannagen, Chair, Dynamical Systems Search, Mathematics Department, Virginia Tech, Blacksburg, VA 24061-0123. Applications will be accepted for as long as there is a possibility of making an appointment or until 3/15/93. Those completed by 1/1/93 will be included in the first round of evaluations. Equal Opportunity/Affirmative Action Employer. The University takes its affirmative action mission seriously and is especially interested in receiving applications from women and people of color.

**VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY**  
**Department of Mathematics**

Applications are invited for an anticipated tenure-track appointment in Geometry (differential or algebraic, or related areas) beginning Fall 1993. Because we seek applicants who will be able to develop a strong case for eventual promotion and tenure, preference will be given to those with postdoctoral or instructorship experience and established research programs. Please send vita and brief description of research and have three letters of reference sent to Prof. William Floyd, Chair, Geometry Search Committee, Department of Mathematics, Virginia Tech, Blacksburg, VA 24061-0123. At least one letter should address the applicant's qualifications as a teacher. Applications will be accepted until March 15, 1993, or until position is filled. Applications completed by January 1, 1993 will be included in the first round of evaluations. Virginia Tech is an Equal Opportunity/Affirmative Action Employer. The University takes its affirmative action mission seriously and is especially interested in receiving applications from women and people of color.

**WASHINGTON**

**EASTERN WASHINGTON UNIVERSITY**  
**Department of Mathematics**

Applications from persons with a Ph.D. in statistics or mathematics with a background in time series and categorical data analysis are sought for a probationary, tenure track assistant professor position to begin September 1, 1993 if funded. Responsibilities include teaching two courses per quarter at the undergraduate or graduate level, aid in developing statistics curriculum and degree options at both levels, and research. This department seeks to strengthen its ties to local industry, so an interest in industrial applications is desirable. Review of applications will begin January 1, 1993 and will continue until the position is filled. Applications should include statements of personal objectives and philosophy in teaching and research, a curriculum vita, graduate transcripts, and names of three references. Apply to: Dr. Ronald H. Dalla, Chairman, Mathematics Department, MS 22, Eastern Washington University, Cheney, WA 99004. Eastern Washington University is committed to increasing the diversity of its faculty staff, students and academic program offerings and to strengthening sensitivity to diversity throughout the institution. We are an affirmative action/equal opportunity employer, and applications from members of historically underrepresented groups are especially encouraged.

**WASHINGTON STATE UNIVERSITY**  
**Department of Mathematics**

The Department of Pure and Applied Mathematics has a permanent, tenure track position available beginning fall 1993. Assistant Professor level, salary commensurate with qualifications and experience. Applications are invited from individuals expert in dynamical systems with special interest in bifurcation analysis. Applicants should have significant mathematical research accomplishments and strong commitment to teaching. The successful applicant's research will be expected to complement existing department research strengths in mathematical modelling, numerical analysis and optimization. The position requires a Ph.D. with competence in teaching relevant graduate and undergraduate courses in Mathematics. Applicants should send a curriculum vitae, a statement of current research and long-term research interests to: **Prof. V.S Manoranjan, Search Committee, Department of Pure & Applied Mathematics, Washington State University, Pullman, Washington 99164-3113.** Screening of applications will begin on February 1, 1993. WSU is an EO/AA educator and employer. Protected group members are encouraged to apply.

**WISCONSIN**

**UNIVERSITY OF WISCONSIN-MADISON**

University of Wisconsin-Madison  
 Department of Mathematics  
 Hiring Committee  
 480 Lincoln Drive  
 223 Van Vleck Hall  
 Madison, WI 53706

The Mathematics Department solicits applications for a tenure-track Assistant Professor position in the area of applied mathematics with an emphasis on large-scale scientific computation. The position would be available in the fall of 1993. All candidates should exhibit evidence of outstanding research and a strong commitment to good teaching. Application forms are available from the above address. The deadline for submission of applications is February 1, 1993. The University of Wisconsin is an Affirmative Action, Equal Opportunity Employer, and encourages women and minorities to apply. Unless confidentiality is requested in writing, information regarding the applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

**UNIVERSITY OF WISCONSIN-PLATTEVILLE**  
**Department of Mathematics**

At least two tenure-track positions in mathematics will be available starting August 22, 1993. A Ph.D. in mathematics or statistics, or a Doctoral degree with teaching experience at the elementary or middle school level is preferred. Applicants that are ABD will be considered. Undergraduate teaching will be the primary responsibility. Applicants must furnish evidence of excellent undergraduate teaching experience and communication skills, and be capable of maintaining a continuing program of scholarly activity. The applicant with teaching experience in elementary or middle school will be expected to work with local school districts and write grant proposals. The Department of Mathematics is comprised of 21 members who serve a student body of approximately 5000 with majors in Agriculture; Arts and Sciences; Business, Industry, and Communication; Education; and Engineering. Salary: \$30,000-\$35,000+ depending upon qualifications and experience. UW-Platteville is an affirmative action, equal opportunity employer. Women and minorities especially are encouraged to apply. The names of nominees and applicants who have not requested in writing that their identity not be revealed, and of all finalists will be released upon request. Send vita, transcript, and three letters of recommendation to Dr. Allan Richert, Chairperson, Department of Mathematics, UW-Platteville, Platteville, WI 53818. Deadline: February 12, 1993.



**WYOMING**

**UNIVERSITY OF WYOMING  
Department of Mathematics  
Tenure-Track Position in Analysis**

The University of Wyoming Mathematics Department invites applications for a tenure-track position in Analysis starting August 1993. Applicants must demonstrate strong ability in research, breadth of mathematical knowledge, interest in collaboration with mathematicians in other areas, strong commitment to high quality undergraduate and graduate teaching, and willingness to supervise masters and doctoral students. Preference will be given to researchers with strength in the areas of functional, complex and harmonic analysis. The Mathematics Department has 25 full-time faculty in applied mathematics, algebra/combinatorics, analysis and mathematics education.

Complete applications consist of a vita, a list of publications, a summary of research interests, and three letters of recommendation sent directly to Professor Myron B. Allen, Chair, Department of Mathematics, University of Wyoming, Laramie, WY 82071-3036. Completed applications received by 1 January 1993 receive first consideration. Women and minorities are encouraged to apply. The University of Wyoming is an affirmative action/equal-opportunity employer.

**UNIVERSITY OF WYOMING  
Department of Mathematics  
Tenure-Track Position in  
Applied Mathematics**

Applications are invited for a tenure-track position in Applied Mathematics at the rank of assistant professor. Candidates should demonstrate promise for excellence in both teaching and research. Strong consideration will be given to, but is not limited to, numerical analysis and mathematical modeling. Salary is competitive and commensurate with experience and qualifications. The Mathematics Department has 25 full-time faculty members and about 35 M.S. and Ph.D. students. Applicants should send vita, three letters of recommendation, and brief description of research plans to: Dr. Myron Allen, Chair, Department of Mathematics, University of Wyoming, Laramie, Wyoming 82071. Applications completed by January 1, 1993 will receive first consideration. The University of Wyoming is an equal-opportunity employer and encourages applicants from women and minorities.

**BRITISH COLUMBIA**

**UNIVERSITY OF BRITISH COLUMBIA  
Assistant Professorship  
Mathematics Department**

The Mathematics Department is seeking an outstanding candidate for a tenure track Assistant Professorship to begin July 1, 1993. Our highest priority is for a candidate in one of the

following fields: Algebra, algebraic geometry, combinatorics and combinatorial optimization, or differential geometry. Applicants should have a proven research record of high quality and have demonstrated interest and ability in teaching. Preference will be given to candidates who have one or more years of postdoctoral experience. This position is subject to final budgetary approval. In very exceptional circumstances, this position may be upgraded. The salary will be commensurate with experience and research record. Applications must be received before January 15, 1993. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. UBC welcomes all qualified applicants, especially women, aboriginal people, visible minorities, and persons with disabilities.

Applicants should send a C. V. including list of publications, statement of research and teaching interests, and arrange for three letters of recommendation to be sent directly to: The Head, Department of Mathematics, University of British Columbia, Vancouver, B.C. Canada V6T 1Z2.

**CANADA**

**McMASTER UNIVERSITY  
Department of Mathematics & Statistics**

Applications are invited for the **Britton Post-doctoral Fellowship in Mathematics**. Named after Dr. Ronald Britton, the Britton Fellowship is intended for talented research mathematicians who have recently completed the Ph.D. degree. The Britton Fellowship is open to candidates of any nationality and selection will be based upon the candidates research potential. In this year's competition, preference will be given to candidates working in algebraic number theory. The Britton Fellowship is tenable for a period of two years with effect from July 1, 1993 at a salary of \$35,000 per year plus a research grant of \$5,000. In addition, the successful candidate will be considered for leave in 1993-94 to participate in the "L-Functions" program at the Fields Institute for Research in Mathematical Sciences. Applications, including three letters of reference, should be completed by January 15, 1993 and sent to: **Dr. L. Hambleton, Chair or V.P. Snaithe, Sc.D., FRSC, Britton Professor of Mathematics, Department of Mathematics & Statistics, McMaster University, Hamilton, Ontario, Canada, L8S 4K1**

**CMS INSTRUCTORSHIP AT THE  
UNIVERSITY OF OTTAWA**

The Canadian Mathematical Society and the University of Ottawa will jointly fund an Instructorship at the University of Ottawa.

The Instructorship, at the salary of an Assistant Professor, has a reduced teaching load of one course per term and is intended for a promising young researcher. The appointment is normally for 2 years starting July 1, 1993. Recent Ph.D.s and those about to complete the degree in any area of mathematics of statistics are invited to apply. A c.v. along with at least

three letters of recommendation should be sent by January 30, 1993 to:

Michel R. Racine, Chairman  
Department of Mathematics  
University of Ottawa  
Ottawa, Ontario K1N 6N5

**UNIVERSITY OF TORONTO  
Department of Mathematics**

The Department solicits applications for a limited term Assistant Professorship at the downtown (St. George) campus, for the three-year period from July 1, 1993 to June 30, 1996. Duties consist of teaching and research, and candidates must demonstrate clear strength in both.

Applicants should send their complete C.V. including a list of publications and any appropriate material about their teaching, and arrange to have at least four letters of reference sent directly to Professor K. Murty, Associate Chair, Department of Mathematics, University of Toronto, Toronto, Canada M5S 1A1. At least one letter should deal with the candidate's teaching. To insure full consideration, this information should be received by January 31, 1993.

The University of Toronto encourages both women and men to apply. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents.

**UNIVERSITY OF TORONTO  
Department of Mathematics**

The Department solicits applications for a tenure-stream appointment in Geometry. Preference will be given to researchers in the areas of algebraic geometry, arithmetic algebraic geometry, and differential geometry.

The appointment is at the downtown (St. George) campus, to begin July 1, 1993. Candidates are expected to have at least three years experience in teaching and research after the Ph.D., and to be able to demonstrate excellence in each. In particular, a candidate's research should show clearly the ability to make significant original and independent contributions to Mathematics. Salary is commensurate with qualifications.

Applicants should send their complete C.V. including a list of publications and any appropriate material about their teaching, and arrange to have at least four letters of reference sent directly to Professor K. Murty, Associate Chair, Department of Mathematics, University of Toronto, Toronto, Canada M5S 1A1. At least one letter should be primarily concerned with the candidate's teaching. To insure full consideration, this information should be received by January 31, 1993.

The University of Toronto encourages both women and men to apply. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and landed immigrants.

## Classified Advertisements

### UNIVERSITY OF WATERLOO Department of Pure Mathematics

The Department of Pure Mathematics at the University of Waterloo invites applications for one or more tenure track positions at the Assistant Professor level starting July 1, 1993. For its first appointment the Department is particularly interested in candidates whose research interests are related to Algebraic Geometry, Algebraic Topology or Differential Geometry. A second appointment (tenure track or definite term) may also be made in the above areas or in some area of Analysis. In order to be considered for the position, a Ph.D. is required. An appointment will be offered only to someone with very strong research and teaching qualifications. The University of Waterloo is committed to increasing the number of its female faculty, and therefore applications from women mathematicians are particularly welcome. Duties will include research, and teaching at all levels. Salary will depend on the candidate's qualifications. The deadline for applications is January 15, 1993. An application should contain the curriculum vitae of the candidate plus three letters of reference sent directly from the referees. In accordance with Canadian immigration regulations this advertisement is directed at Canadian citizens and permanent residents of Canada. The University of Waterloo encourages applications from qualified women and men, members of visible minorities, native peoples and persons with disabilities. All appointments are subject to the availability of funds. Please send applications to: Dr. J.W. Lawrence, Chair, Department of Pure Mathematics, University of Waterloo, Waterloo, Ontario, Canada, N2L 3G1.

### GERMANY

#### UNIVERSITÄT BONN Research Institute of Discrete Mathematics Director: Professor Bernhard Korte Postdoctoral Fellowships in Discrete Mathematics

The Research Institute of Discrete Mathematics announces three Postdoctoral Fellowships for the academic year 1993-1994.

These awards are intended for young mathematicians and computer scientists with exceptional research promise in Discrete Mathematics and its applications. The postdoctoral fellows will be able to take part in all research activities of the Institute, but the teaching of one graduate course per semester is expected.

The award will range between DM 36,000 and DM 39,600 for the academic year depending upon qualifications and experience, and is not subject to German income tax.

Applications should include a curriculum vitae, a bibliography, two letters of reference, and a research plan. To be eligible for one of the 1993-1994 fellowships, please send a complete application at your earliest convenience, but not later than January 31, 1993, to: Professor B. Korte, Research Institute of Discrete Mathemat-

ics, University of Bonn, Nassestrasse 2, D-5300 Bonn 1, Germany.

### ITALY

#### SISSA/ISAS TRIESTE Postdoctoral Positions

The International School for Advanced Studies (SISSA/ISAS) in Trieste expects to offer a number of postdoctoral positions in the following fields:

Nonlinear Analysis and Geometry, Mathematical Physics, Theoretical Particle Physics, Theory of Condensed Matter, Theoretical Astrophysics and Cosmology

These positions will be available from the Fall of 1993 for one year and renewable for a second year. Candidates, who must not be over 36 years of age, should submit their applications by 16 January 1993 with their Curriculum Vitae, list of published works, and their research programme. They should arrange for two letters of reference to be sent by the same date.

Applications and correspondence should be sent to:

Postdoc Programme  
International School for Advanced  
Studies  
Via Beirut 2-4  
34013 TRIESTE-ITALY

### KOREA

#### SEOUL NATIONAL UNIVERSITY Global Analysis Research Center Postdoctoral Positions

The Global Analysis Research Center expects to have several postdoctoral positions beginning Spring 1993. Applications are welcome in all fields of mathematics. Applicants must have a Ph.D. in Mathematics earned or anticipated by 3/1/93. These positions are available for a one-year period. Applicants should send a vita, list of publications, a statement describing current and planned research, and ask two people to send letters of recommendation by **January 31, 1993**. All communications should be addressed to: Search Committee, Global Analysis Research Center, Department of Mathematics, Seoul National University, Seoul, 151-742, Republic of Korea.

### SWITZERLAND

#### THE SWISS FEDERAL INSTITUTE OF TECHNOLOGY IN ZURICH (ETHZ) Assistant Professor of Mathematics

Duties of the new professor include research as well as an active participation in undergraduate and graduate courses for students of mathematics, natural sciences and engineering.

Candidates should have a university degree and successfully completed own research work. Willingness to teach at all university levels and to cooperate with colleagues is expected.

The positions of assistant professors have been established to promote the careers of younger scientists. They are available for three years in the first instance, with the possibility of renewal for an additional three years.

Applications with curriculum vitae and a list of publications should be submitted no later than January 31, 1993, to the President of the ETH Zurich, Prof. Dr. J. Nüesch, ETH Zentrum, CH-8092 Zurich. The ETHZ specifically encourages female candidates to apply with a view towards increasing the proportion of female professors.

### TAIWAN

#### NATIONAL CHUNG CHENG UNIVERSITY Department of Mathematics Taiwan, R.O.C.

The Department of Mathematics invites applications for faculty positions or visiting positions at the level of associate professor or above, available August 1, 1993. Candidates with specialization in the following fields are preferred: Nonlinear PDE, Differential Geometry, Number Theory, Statistics and Numerical Analysis. A degree of Ph.D. is required. Applicants should send a curriculum vitae, reprints of published papers, description of current research and three letters of recommendation to Professor C.S. Lin, Chairman, Department of Mathematics, National Chung Cheng University, Ming-Hsiung, Chia-Yiu 621, Taiwan, Republic of China. Fax number: 011-886-5-272-0497.

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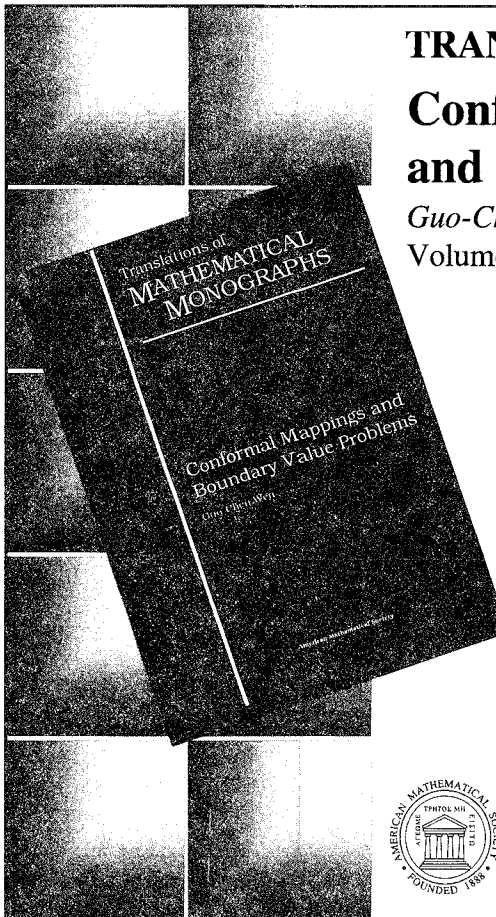
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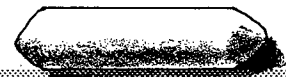
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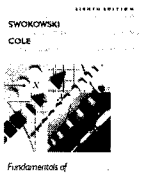
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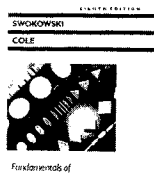
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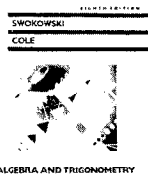
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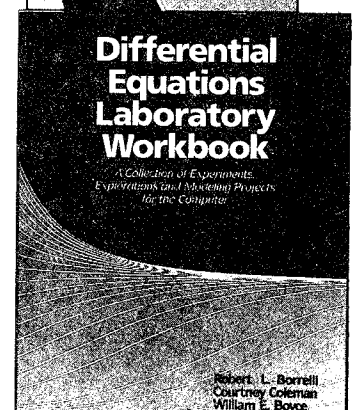
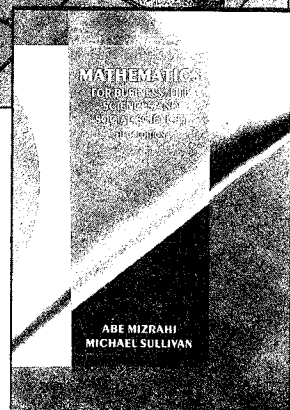
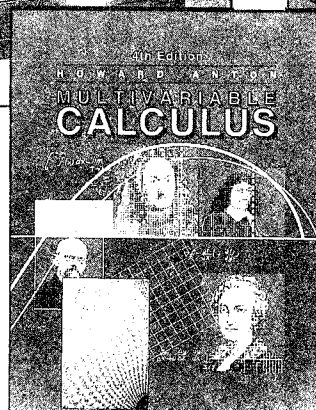
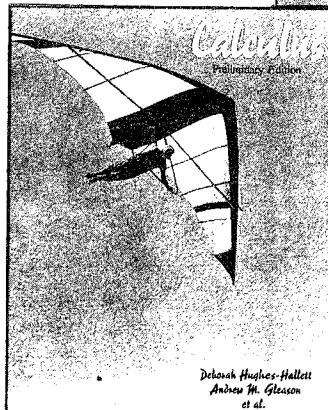
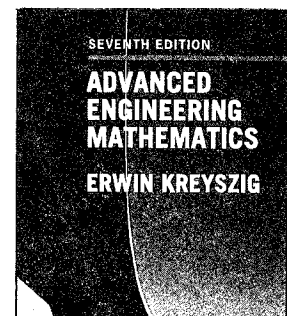
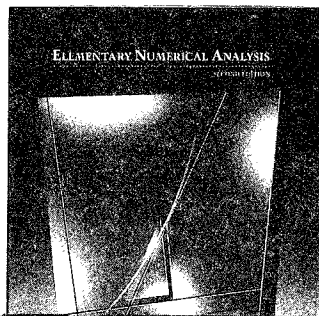
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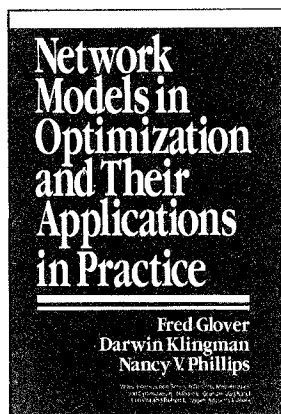
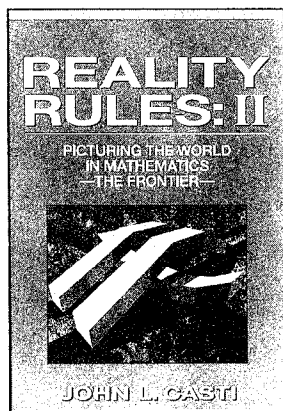
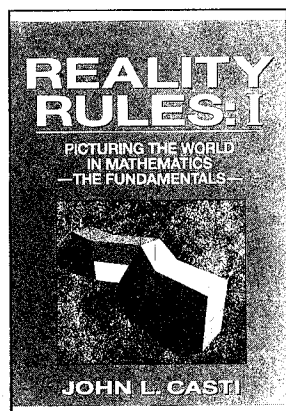


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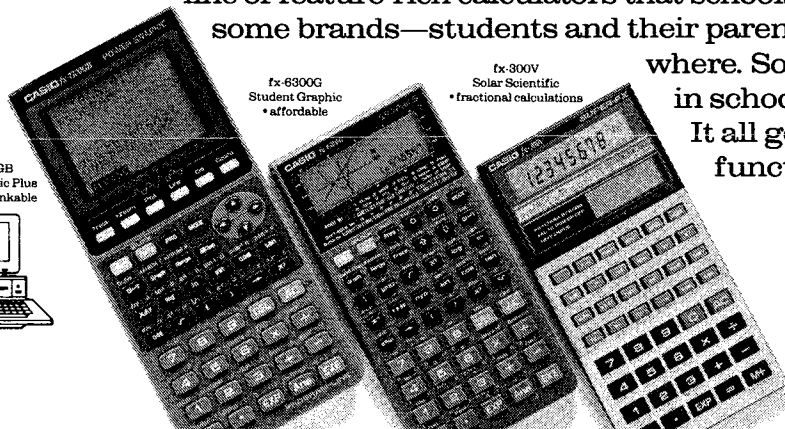
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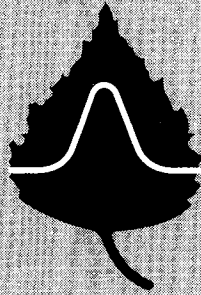
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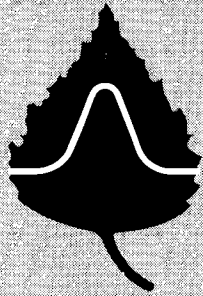
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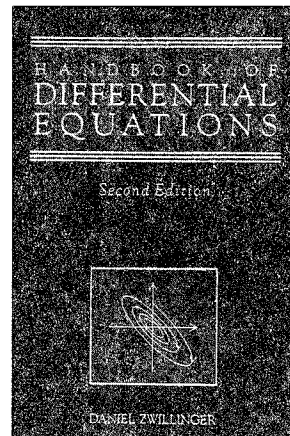
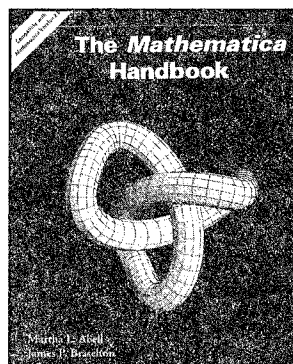
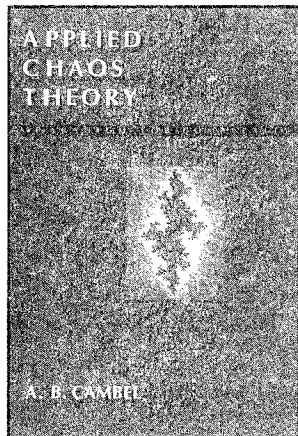
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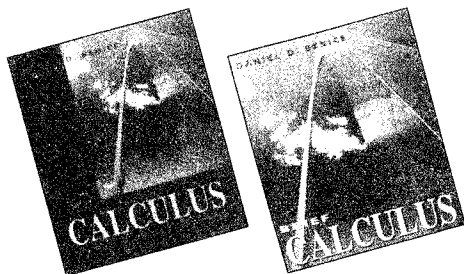
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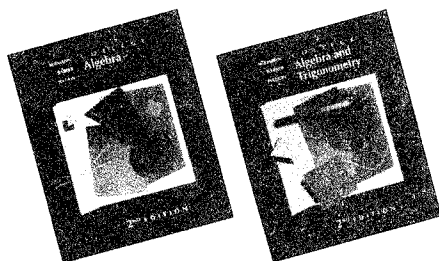
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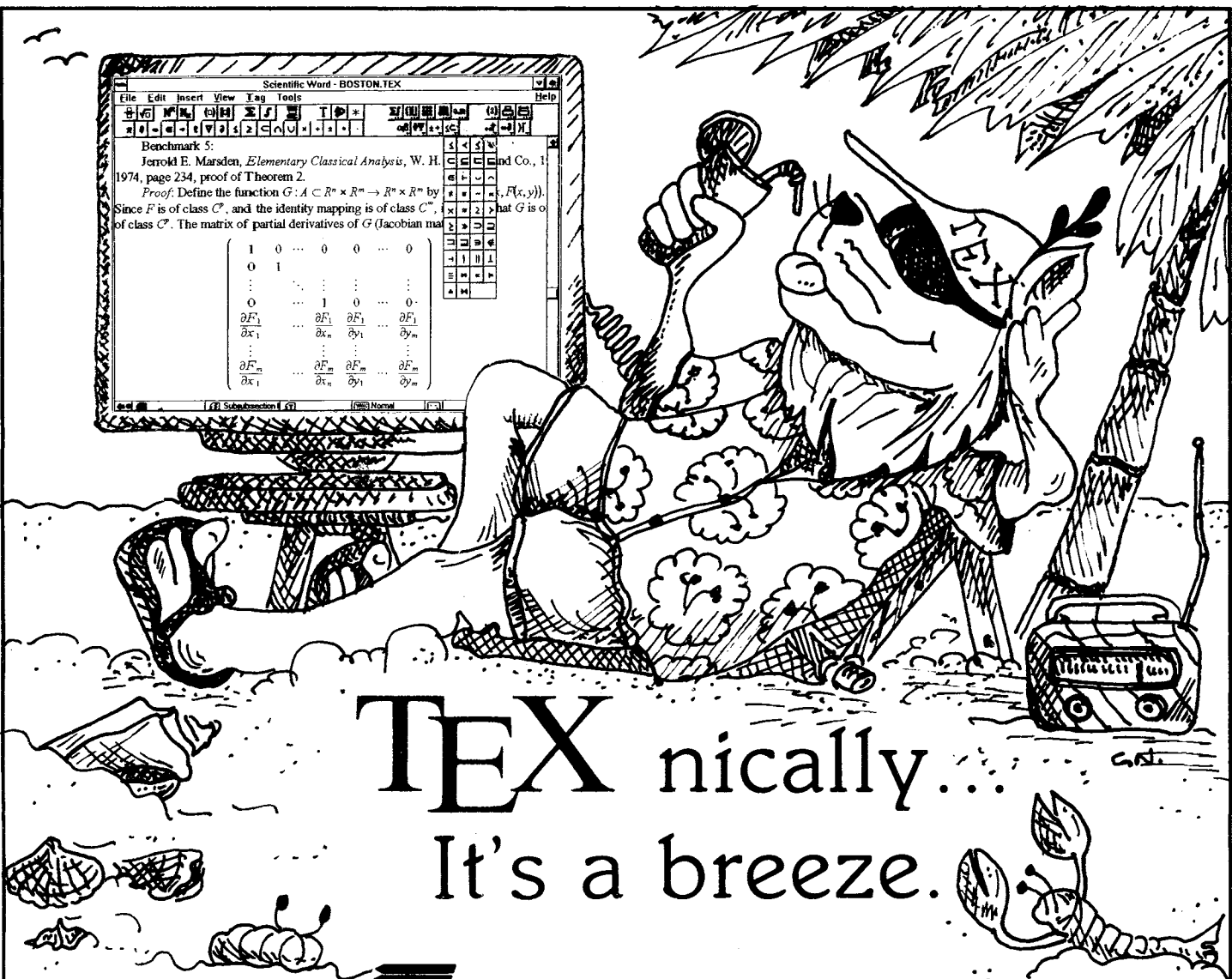
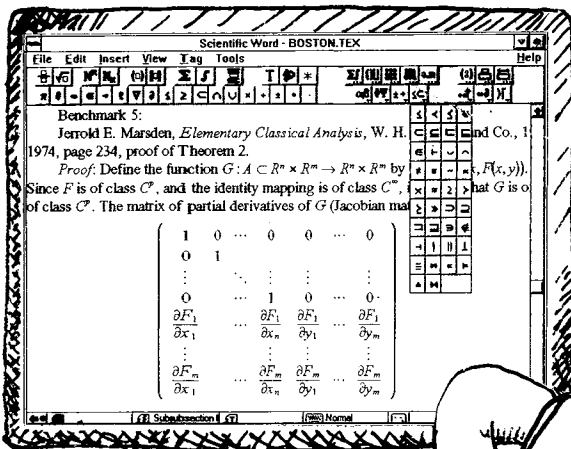
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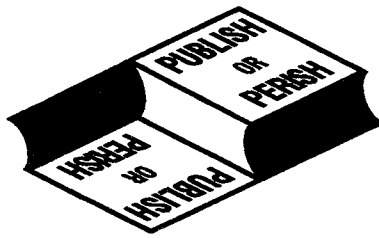
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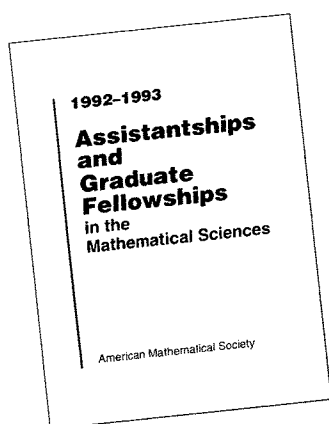
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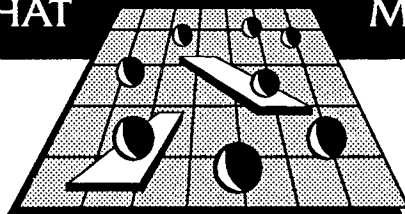
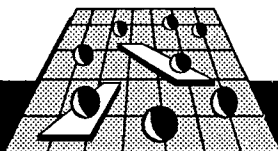
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- 92 Biology and other natural sciences, behavioral sciences
- 93 Systems theory; control
- 94 Information and communication, circuits

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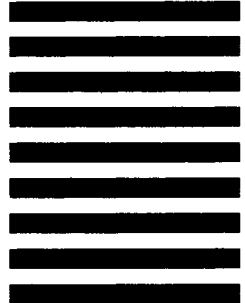
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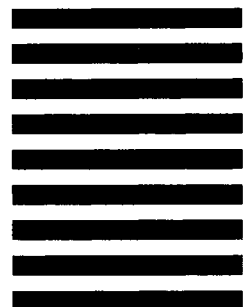


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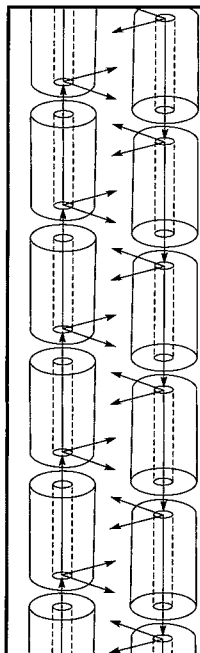
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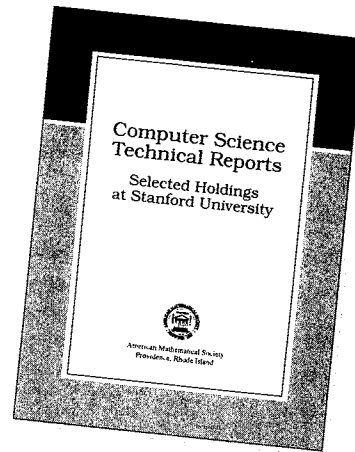
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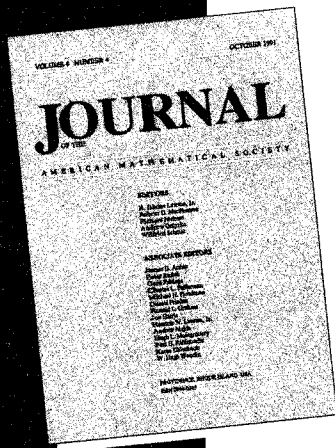
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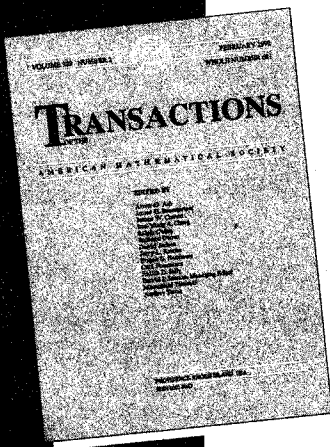
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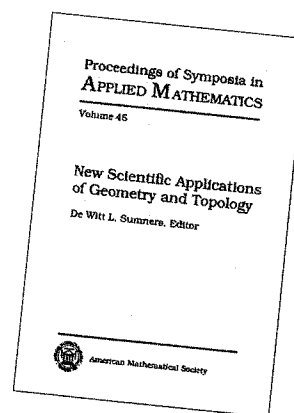
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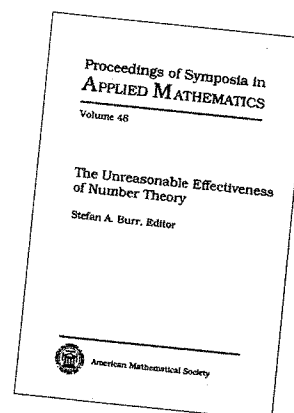


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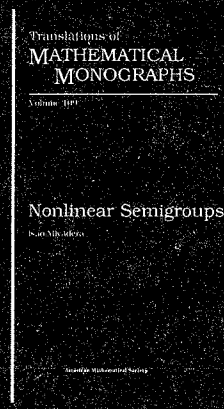
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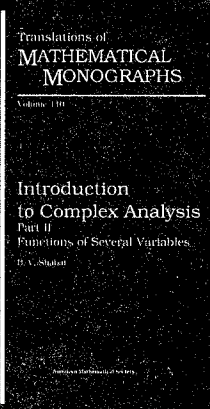
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