

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. 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. Note that the deadline for abstracts for consideration for presentation at special sessions is usually three weeks earlier than that specified below.

Meetings

Meeting #	Date	Place	Abstract Deadline	Program Issue
884	† September 18–19, 1993	Syracuse, New York	Expired	September
885	† October 1–3, 1993 (Joint Meeting with the Deutsche Mathematiker-Vereinigung e.V.)	Heidelberg, Germany	Expired	September
886	† October 22–23, 1993	College Station, Texas	Expired	October
887	† November 6–7, 1993	Claremont, California	Expired	October
888	† December 1–4, 1993 (Joint Meeting with the Sociedad Matematica Mexicana)	Merida, Yucatan, Mexico	Expired	November
889	* January 12–15, 1994 (100th Annual Meeting)	Cincinnati, Ohio	October 1	December
890	* March 18–19, 1994	Lexington, Kentucky	December 28	March
891	* March 25–26, 1994	Manhattan, Kansas	December 28	March
892	* April 8–10, 1994	Brooklyn, New York	January 28	April
893	June 16–18, 1994	Eugene, Oregon	April 4	May-June
894	August 15–17, 1994 (97th Summer Meeting)	Minneapolis, Minnesota	May 17	July-August
	October 28–29, 1994	Stillwater, Oklahoma	August 3	October
	November 11–13, 1994	Richmond, Virginia	August 3	October
	January 4–7, 1995 (101st Annual Meeting)	San Francisco, California	October 1	December
	March 4–5, 1995	Hartford, Connecticut		
	March 17–18, 1995	Orlando, Florida		
	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		
	April 19–21, 1996	Baton Rouge, Louisiana		

* Please refer to page 915 for listing of Special Sessions.

† Please refer to the Table of Contents for further information.

Conferences

January 10 and 11, 1994: AMS Short Course on Complex Analytic Dynamics, Cincinnati, Ohio.

June 20–July 1, 1994: AMS-SIAM Summer Seminar in Applied Mathematics on Dynamical Systems and Probabilistic Methods for Nonlinear Waves, Mathematical Sciences Research Institute, Berkeley, California.

Other Events Cosponsored by the Society

October 15–17, 1993: Second International Conference on Ordinal Data Analysis, University of Massachusetts, Amherst. Cosponsored by the University of Massachusetts, Technische Hochschule Darmstadt, and the Classification Societies of North America and Germany.

February 18–23, 1994: Section A (Mathematics) Sessions at the AAAS Annual Meeting, San Francisco, California.

Deadlines

	November Issue	December Issue	January Issue
Classified Ads*	September 30, 1993	November 11, 1993	December 8, 1993
News Items	September 20, 1993	October 28, 1993	December 1, 1993
Meeting Announcements**	September 23, 1993	November 2, 1993	December 2, 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.

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OF THE

AMERICAN MATHEMATICAL SOCIETY

ARTICLES

782 AMS fSU Aid Update

Collected here are a number of articles about AMS efforts to aid mathematics in the former Soviet Union: a report on a trip to the fSU, by Robert MacPherson; an update on the AMS fSU Aid Fund, by Timothy Goggins; an article about mathematical high schools in the fSU, by Alexander Shen; a letter from Lena Efimova, who describes some of the positive effects of the assistance effort that she has observed in the fSU; and a list of AMS fSU grant recipients.

792 Interview with Judith S. Sunley

Judith S. Sunley served as director of the Division of Mathematical Sciences at the National Science Foundation from 1987 until 1992. In this question and answer interview, she reflects on her time at the Division and on prospects for the future of the NSF.

796 Jobs, Grants, and the New Ph.D., Part Two

How do new and recent Ph.D.s feel about the job market and the tight research grant situation? Are senior members of the community addressing the concerns of the young mathematician? This article, the second of a two-part series by Allyn Jackson, explores these questions and reports on some suggestions for change.

800 Some Glimpses of Mathematics in Industry *Paul Davis*

In this article, based on interviews with about forty mathematicians who work in business, industry, and the government, Davis provides insight on what they do, what skills they need, and how their work differs from that of academic mathematicians.

803 Doctoral Department Retention, Expectations, and Teaching Preparation *Betty Anne Case and M. Annette Blackwelder*

This is the second report on a survey conducted by the Committee on Preparation for College Teaching. The report presents a host of interesting findings on the retention of students in doctoral programs, minority students in mathematics, and the preparation doctoral students receive for teaching.

FEATURE COLUMNS

834 Computers and Mathematics *Keith Devlin*

George Grätzer opens this month's column with the second in a series of articles on $\text{T}_\text{E}\text{X}$, the first having appeared in February of this year. Then Butler, Iyer, and O'Brien write about *TwoGroups*, a database for group theory. Finally, Richard Dudley offers a comment on an earlier article in the column.

843 Inside the AMS

This month's column contains the conclusions of the Committee to Review Member Publications, presented by committee chair Hugo Rossi. In addition, there is a report by AMS-MAA Archive Committee chair Albert C. Lewis.

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NOTICES

OF THE

AMERICAN MATHEMATICAL SOCIETY

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ADVERTISING

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From the Executive Director . . .

AWARENESS AND APPRECIATION

In its mission statement the Society has identified several directives to further mathematical research and scholarship. One of these recognizes the importance of public understanding of mathematics and its uses. Specifically, through its programs, services, and activities, the AMS should foster an awareness and appreciation of mathematics and its connections to other disciplines and everyday life.

There is a broadly held public misunderstanding about the difference between mathematics and school arithmetic. Manipulations with numbers and equations and rules about these manipulations are the general images that come to mind when mathematics is mentioned. Therefore, the lack of public awareness of research (new discoveries) in mathematics is not surprising. The magnitude of research in mathematics surprises even many mathematicians; for example, few mathematicians would expect that *Mathematical Reviews* averages approximately 50,000 reviews of research-related mathematics each year and that this represents a conscious effort by the editors to restrict the total number of reviews in order to control costs. The lack of understanding of research in mathematics often reaches into the highest circles where science policy is determined, resulting in the neglect of mathematics in discussions of federal policy and federal funding of science.

There may be even less awareness and appreciation of the impact of mathematics in scientific and technical education, discovery, and advancement. Many modern advances in computing, coding, medicine, economics, etc., are not only dependent upon the results of mathematical research but are directly due to mathematical methods. In mathematics instruction, efforts toward an appreciation of mathematical methods and the powerful uses of mathematics are generally overlooked and may even be missing. As a recent television advertisement put it, "If life were perfect, algebra would be useful."

On the other hand, there seems to be a general human curiosity about things mathematical. We may not be too far from making great gains in the areas of public awareness and appreciation of mathematics. The announced solution to Fermat's Last Theorem has raised great public interest. Over 1000 people turned out for lectures (not free) at the Palace of Fine Arts in San Francisco to learn about number theory, the history of the problem, and its solution.

What is the AMS doing to advance its mission and achieve the goal of increased public understanding of the benefits of the study of mathematics and its importance in science and society?

Through the AMS Washington Office and the Joint Policy Board for Mathematics (JPBM) Public Information Office, the Society has organized a program of regular public information briefs about events in and related to mathematics. These efforts also include increased contact between members of the mathematics community and those involved in science policy and legislation that affect science and mathematics. The AMS has distributed the first of a series of annual publications called *What's Happening in the Mathematical Sciences*. These publications will contain a number of vignettes describing new discoveries in mathematics, new uses of mathematics in science and technology, and new mathematics discovered in solving problems in other disciplines. The expected audience includes undergraduates, federal policymakers, teachers of mathematics, and others. In addition, the AMS will have the first of its "Federal Policy Agendas" in 1994. These will include short narratives about mathematics, identify principal policy issues related to mathematics, and provide a plan of action by the Society.

There are numerous other aspects of the activities, programs, and services of the AMS that enhance public awareness and appreciation of mathematics; however, there is a magnificent opportunity available to the mathematics community that makes any efforts by the AMS seem small in comparison. Each year our community has an audience of hundreds of thousands of undergraduate students in mathematics classes. This is an unparalleled opportunity to bring understanding and appreciation to a most crucial component of the public—among this group are future scientists and engineers, as well as future science policymakers. How can we reach this group, these students in our classes? Are there successful programs that integrate these features into the mathematics curriculum? By identifying means that are successful in bringing better understanding of the power and usefulness of mathematics into our classrooms, we will have taken a great step in advancing public awareness and appreciation for mathematics.

William Jaco

Letters to the Editor

Accessing *CMP* and *MR* On-line

I was happy to read that you are evaluating the feasibility of offering an on-line version of *CMP* [*Current Mathematical Publications*] (*Notices*, May/June 1993, vol. 40, number 5, p. 471).

Until recently I accessed *CMP* and *MR* [*Mathematical Reviews*] through the Knowledge Index [KI] and was quite pleased with the service. It was provided at a reasonable cost to the individual by DIALOG. However, DIALOG has now transferred KI to CompuServe. To obtain KI and/or *MR* I now have to pay more for many services I don't want and also have to learn a whole new set of computer commands.

Many researchers like myself at smaller universities do not have easy access to *CMP*, *MR* and/or MathSci Disc. Thus you will do us a great service if you can find a better way for us to access *CMP* and *MR*. I for one will be very grateful.

John D. O'Neill
University of Detroit
(Received June 14, 1993)

Editor's Note: As indicated in the article referenced in the above letter, the AMS is looking into ways to offer *CMP* more conveniently. In the meantime, for those not interested in CompuServe's extended services, there is a lower monthly rate available. Instead of the regular \$8.95 per month rate (includes e-mail services, weather information, etc.), Knowledge Index users can choose a \$2.50 per month rate that provides access to the KI services. The hourly rate for Knowledge Index remains at \$24.00 per hour. Current KI customers and prospective users who wish to arrange for the lower monthly fees should contact CompuServe at 800-438-3690.

Federal Funding

I was not surprised that the only letters published so far by the *Notices* on flat-

rate funding of research grants were from young mathematicians, who were strongly in favor of it. Polking made a good political case for the current policy, but to me the issue of equity outweighs these considerations. And I believe we will be a more attractive field if it is known that support of young mathematicians is on the same basis as that of well-established senior scholars.

But there are two issues that have not been discussed. At very many institutions support of travel to meetings covers expenses or partial expenses to one (or no) meeting a year. One was never enough for young people, and certainly not if the meeting is a large national one, where it is so difficult now to meet the leaders in your specialty. (Solomon Lefschetz presided over my first 10-minute talk.) Funding for such travel, if for nothing else, would be of great help.

The other issue is the 1-0 grants policy, where you are a 1 and get funding every year, or a 0 or become a 0 and never get funding. When research grants began after World War II, we all looked on them as opportunities to do something special; now they are snugly built into the recipient's budget. I believe that there are very few mathematicians who should always get funding. But many people should get funding every other or every third year, and everyone seriously doing research should sometimes get support. I have in mind a person who every year sent in a proposal to the NSF, and every year got back a letter (from different program directors) saying how good his proposal was, worthy of support, but there just wasn't money that year. That should never happen.

Gail S. Young
Teachers College
Columbia University
(Received June 3, 1993)

Mathematics and Reality

In the February *Notices*, it was very refreshing to read Bernard Beauzamy's article *Free Enterprise in Mathematics*, an article which ties mathematics and its professional practice to reality. To readers interested in a technical or theoretical presentation of how, in general,

concepts are tied to reality and, significantly, the link to mathematics in this tie, I recommend the book *Introduction to Objectivist Epistemology* (second edition) by Ayn Rand.

Suresh Govindachar
San Jose, California
(Received February 16, 1993)

Aleph

Many mathematics students and even some professional mathematicians are reluctant to use the letter Aleph, as it seems to them a many-headed Hydra difficult to draw. Actually Aleph can be (and, in fact, often *is*, wherever Hebrew is an everyday language) written extremely simply:

N

Oved Shisha
The University of Rhode Island
(Received August 6, 1992)

Job Applications

Among the 500 or so pieces of correspondence that I received in academic year 1992-1993 in connection with unsolicited applications for nonexistent openings in my department were two that are worth sharing with the mathematical public at large. Their interest as artifacts of the current job market should be self-evident. I have deleted any identifying information; otherwise, they are presented in their entirety.

Letters to the Editor

Letters submitted for publication in the *Notices* are reviewed by the Editorial Committee.

The *Notices* does not ordinarily publish complaints about reviews of books or articles, although rebuttals and correspondence concerning reviews in *Bulletin of the American Mathematical Society* will be considered for publication.

Letters should be typed and in legible form or they will be returned to the sender, possibly resulting in a delay of publication. All published letters must include the name of the author. Letters which have been, or may be, published elsewhere will be considered, but the Managing Editor of the *Notices* should be informed of this fact when the letter is submitted.

The committee reserves the right to edit letters.

Letters should be mailed to the Editor of the *Notices*, American Mathematical Society, P.O. Box 6248, Providence, RI 02940, or sent by e-mail to notices@math.ams.org, and will be acknowledged on receipt.

Letters to the Editor

First is a letter of recommendation dated 16 December 1991 and received November 30, 1992:

“Letter of recommendation for (name deleted):

“It seems to me the problem in the Confomal [sic] Field Theory he is working on is rather hard. I talked to him many times. He worked hard and did not hesitate to de [sic] hard calculation. The results he came up finally seems [sic] to me deep. I recommend him very strongly.

Sincerely yours
“(name deleted)”

The next is a letter from an applicant dated March 22, 1993, and received March 25, 1993:

“Dear Colleague:

“I am applying for a tenure-track position in your department. Last week I was informed by Dr. (name deleted), the director of (deleted) at NSF, that I will receive an NSF grant for the next two years. I hope this will strengthen my application at your department.

“If you need any more information, please contact me by telephone at (deleted) or by e-mail at (deleted).

“Thank you very much for your consideration.

Sincerely,
“(name deleted)”

Andy R. Magid
The University of Oklahoma
(Received May 17, 1993)

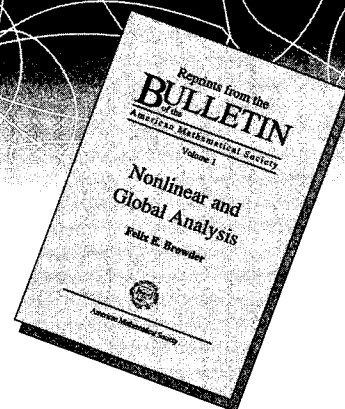
New Series from the AMS

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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.

1991 *Mathematics Subject Classification*: 35, 47, 49, 58

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New Position

American Mathematical Society

PUBLISHER

Applications and nominations are invited for the new position of Publisher of the American Mathematical Society (AMS). The AMS is a major publisher of research literature in the mathematical sciences, currently publishing approximately 20 journals and 70 books annually. The Publisher will lead the Society's efforts to broaden and enhance its publishing program.

The Publisher will direct and administer all aspects of the Society's Publication Division (approx. 90 employees): acquisition, editorial, production, promotion and sales, distribution, and electronic products and services. The Publisher will be responsible for development and implementation of strategic plans for the Publication Division, including acquisition, recommendation of editorial policy, maintenance of scientific and editorial standards, oversight of day-to-day divisional operations, and budgetary planning and control. The Publisher will work closely with the newly created Policy Committee on Publication. The Publisher will report to the Executive Director and be a member of the Staff Executive Committee.

Candidates should have significant, high-level publishing experience, preferably in scientific or scholarly publishing. A broad knowledge of all publishing functions and electronic delivery of information is essential. Candidates should demonstrate results-oriented, visionary leadership with superior analytical, creative, management, and communications skills.

The initial appointment is for up to five years and can be continued thereafter on an indefinitely renewable term or continuing basis. It is desirable that duties begin as soon as possible and preferably before January 1, 1994. Salary is negotiable and will be commensurate with experience. A generous benefits package is available.

Nominations and applications (including a resume along with the name, address, and phone number of at least three references) should be sent on or before **October 15, 1993**, to:

Dr. William H. Jaco, Executive Director
American Mathematical Society
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Report on a Visit to Mathematical Centers in Moscow, St. Petersburg, and Kiev

Robert MacPherson

Massachusetts Institute of Technology

Editor's Note: Robert MacPherson is the chair of the AMS Advisory Committee on fSU Mathematics.

I spent the last two weeks of March 1993 visiting the former Soviet Union (fSU). In Moscow and Kiev I was accompanied by Tim Goggins of the AMS, and in St. Petersburg I was joined by Dan Stroock of MIT. The mission was twofold: to distribute the grants administered by the AMS fSU Aid Fund to individual mathematicians and to gauge the status of the mathematical community there. This is my report on the trip.

1. The State of Mathematical Education

As is well known, the institutions of mathematical education in the former Soviet Union have been extraordinarily successful in producing top-level research mathematicians. Tautologically, in the long term, mathematical life there can only live if these institutions continue their success. In addition to this tautological reason to emphasize mathematical education in this report, there is another reason: the special mathematical traditions of mathematical research of the fSU center around seminars with a combined research and education mission, i.e., seminars in which both high-level research mathematicians and students participate (see [1]). Therefore, success in mathematical education is key to current mathematical research as well as to future mathematical research.

In summary what I found is that college education is doing very well for the moment, high school education is barely surviving the strains of economic disruption, and graduate education is in a state of crisis.

1a. High School Education

The fSU has an extraordinary tradition of special mathematical high schools, olympiads, and extracurricular mathematical "circles" that is unique in the world. These continue to function very well from the students' point of view, but they are endangered. Reference [2] is a report prepared in February on the economic crisis being faced by these special institutions. What I learned on my recent trip only confirmed the extent and urgency of this problem.

A significant start on the solution to the problem can be achieved with a very small amount of money, say \$5,000–\$10,000 per year total. The reasons for this are as follows:

- A very large proportion of the best mathematical education of high school students is concentrated in only a few schools. There were five high schools in particular that came up in conversations during my trip—two in Moscow, one in St. Petersburg, one in Kiev, and one in Siberia. Some of these are correspondence schools or boarding schools, so that they reach the best high school students from a larger area.
- The particularly urgent needs are for things like printing costs, mailing costs, and small supplementary salaries. Because the exchange rate is so favorable, \$1000–\$2000 per year can contribute significantly to these needs at a mathematical high school.

Because of the restrictions on the money coming in to the AMS fSU Aid Fund, we can contribute very little money to the solution of this important problem.

1b. College Education

In all three cities I visited, there is in operation a very effective mechanism to provide exceptional mathematical education of the best college students. In Kiev mathematicians from the Mathematical Institute give lectures on their specialties to selected students in the fourth and fifth years of college. In St. Petersburg the LOMI Potok fills the same role (see [1]). I met with the teachers involved in this project, and I found them to be young, enthusiastic, dedicated, and full of new ideas. In Moscow the Independent University [1], which is a more ambitious institution, fills the role. The mathematicians involved in all three projects are funded by the AMS fSU Aid Fund.

To continue their success, these programs will eventually need some additional funding. Scholarships of \$5–\$10 per month for exceptional undergraduate students would enable them to resist family economic pressures to work instead of studying. Also, there are printing costs, needs for small computers and photocopying machines, etc. None of these needs can be substantially met by the AMS fSU Aid Fund because of the restrictions mentioned above.

1c. Graduate Education

The system of graduate education in the fSU is in danger of major and immediate deterioration. There are two main reasons for this:

- Many graduate students are leaving the fSU to attend graduate school in the U.S. They face a very difficult personal financial situation in the fSU, and, furthermore, the education they receive is not as satisfactory as it once was for the reason stated below. Meanwhile, it is quite easy for them to get a teaching fellowship to study at an American university because, for American universities, graduate teaching fellows are an inexpensive source of instructors in mathematics.
- The traditional graduate education in mathematics hinged on the unique combined teaching and research seminars. Now some seminar leaders have emigrated and most of the others are periodically abroad, leaving the seminars without continuity. The graduate students report that this lack of continuity seriously damages their graduate education.

Because of the urgency of the problem of graduate education in mathematics, I am recommending immediate responses on the part of the AMS fSU Aid Fund and the Moscow Mathematical Institute (see sections 8 and 6). A larger response with better funding will also be needed as soon as it can be made. I hope that the International Science Foundation program for the former Soviet Union (ISF-fSU) will help with this.

2. Mathematical Research

In spite of the emigration of some of the strongest research mathematicians, there remains a very impressive mathematical research community in all three cities that I visited. In mathematical research the fSU is still a major international power.

There are many research needs, such as travel to international conferences and direct support for research workers, that have been well documented elsewhere. In addition to these, mathematical institutions need a small amount of money for incidental expenses. To illustrate: The Mathematical Institute in Kiev could not book a hotel room for us because that would have cost them \$10, which is far beyond what they can afford.

3. Libraries

The mathematical libraries are in dire need of help, as may be ascertained by a quick look at their collections. But they should be helped only if they are open to the mathematical public. I experimentally verified that the libraries at Moscow State University and the Mathematical Institute in Kiev are open. The library of the Steklov Mathematical Institute in Moscow is still not open to the mathematical public.

Help for the major mathematical libraries is under way from the American Mathematical Society through an NSF grant, and through the ISF-fSU.

4. Living Conditions and Support of Individual Mathematicians

For someone with a little hard currency who already has an apartment, living conditions are still good in the cities I visited. A wide variety of goods are available. Waiting in

line is necessary only for special goods and luxuries. The only exception is a shortage of gas in the Ukraine. It is practically impossible to find gas to drive a private car there. (As a consequence, the city is very pleasant from a tourist's perspective, with nearly no traffic.) Public transportation still works relatively well even in Kiev, however.

The AMS and ISF-fSU programs will enable the best mathematicians to live without having to worry too much about daily necessities. There is some evidence that the extraordinarily high exchange rate is diminishing slightly, however. We have to monitor the purchasing power of the dollar in order to keep the value of our grants from eroding too much.

Academic salaries from fSU institutions are very low. For someone trying to survive on an academic salary alone, making ends meet is nearly impossible. The traditional academic institutions will have to make some major economic readjustments if they are to be economically viable after western aid has disappeared. Just like American businesses in difficulty, they may be forced to reduce staff and concentrate on quality.

5. The Independent University of Moscow

The Independent University is providing the education of about half of the top group of students in Moscow. During my trip I taught a class there, inserting problems into my lecture to be solved on the spot by the students. I believe that no American university could assemble a class in mathematics with so much evident talent. The Independent University has recently been officially registered as an educational institution, and they now have a promise of adequate space from some city government officials.

The Independent University receives some salary support for their professors from the AMS fSU Aid Fund, and their joint library with the Moscow Mathematical Institute will receive support from the AMS. They are badly in need of funds for other expenses. I hope that they will receive some Phase II grants from the ISF-fSU.



Robert MacPherson (at blackboard, far left) teaches a class at the Moscow Mathematical Institute.

6. The Moscow Mathematical Institute (MMI)

The MMI has now moved to the Independent University building, so that its seminars can benefit from the traditional Russian cross-fertilization between researchers and students.

I am recommending that the MMI take on the responsibility for creating a good graduate studies environment for a selection of the best graduate students in Moscow (about five per year).

7. The Euler Institute in St. Petersburg

The building of the Euler Institute is extraordinarily beautiful. Their apartments for visitors are fully up to western standards, which is quite unusual in Russia. My only criticism is that there is not much feeling of mathematical activity in the building. Young St. Petersburg mathematicians I talked to said that they had not been made to feel welcome there.

I am working with John Lavery of the National Research Council on setting up an American-funded summer program for American graduate students at the Euler Institute. I think that this will be successful.

8. The AMS fSU Aid Fund

This fund gives grants to individual mathematicians—about 250 mathematicians are currently supported at \$50 per month. These grants are funded by the AMS membership, the Sloan Foundation, and the Soros Foundation. The recipients were selected by a high-level peer review panel of about thirty members, representing all mathematical specialties and several nationalities. A major object of this trip was to deliver by hand salary payments totaling \$28,000, since we have not yet found a satisfactory banking arrangement. The delivery went surprisingly well. It is clear that this form of aid is essential to the survival of mathematics in the fSU.

On the basis of the information gathered during this trip, I am recommending the following three slight modifications in the procedures of the AMS fSU Aid Fund:

- We should give more of our \$25 per month grants to graduate students. I recommend that we fund an additional ten per year in Moscow, ten per year in St. Petersburg, six per year in Kiev, and four per year in Kharkov. This will give some help to the very best. We will have to rely on local committees in each city for the selection of these grant recipients.



Recipients await the distribution of the second round of AMS fSU small grants at a Moscow auditorium.

- Some senior grant recipients who travel abroad frequently, and so need less money, are choosing to give their grants to their students or to younger mathematicians who don't travel. We should encourage this form of charity.
- We should write a letter encouraging our grant recipients to do some service work for their "Supervising Institution". (Each grant recipient is associated with a local mathematical institution, like the St. Petersburg Mathematical Society or the Independent University of Moscow, as their "Supervising Institution".) The service work might be, for example, helping to run a graduate seminar, supervising a graduate student, or giving supplementary classes to high school students.

These changes are designed as an emergency response to the needs outlined in section 1 above.

References

[1] R. MacPherson, *Some Mathematical Institutions in the Former Soviet Union*, Notices of the American Mathematical Society, February 1993.

[2] "Report on Russian Mathematical High Schools", in the Working Papers for the February AAAS - NAS Washington Conference on Science in the Former Soviet Union.

The AMS fSU Aid Fund

This article was written by Timothy Goggins, Development Officer and Assistant to the Executive Director for International Affairs.

The February 1993 issue of the *Notices* reported on the status of the AMS fSU Aid Fund and our efforts to provide assistance to mathematicians in the former Soviet Union. As this is written, individual gifts now total \$94,500. The Association for Symbolic Logic has joined the Society's efforts by raising funds from its membership for this fund. Beyond individual gifts, in addition to the early support of a \$100,000 matching grant from the Alfred P. Sloan Foundation and the \$100,000 grant from the Soros Foundation, the Society has received an additional \$250,000 from the Soros Humanitarian Foundation, \$5,000 from the International Science Foundation (ISF), and \$96,700 in support from the National Science Foundation. The ISF grant is for travel, and the NSF grant is in support of the book and journal donation effort. All other funds received will support the AMS small grant program. Overall, the Society has raised \$646,200 in support of its plan of assistance.

Grants to Individual Mathematicians

The Society plans to assist a total of approximately 450 mathematicians by October 1993. Currently, the program is assisting 262 mathematicians. It is anticipated that support will last up to a period of nearly three years. This will permit a degree of security beyond one-year emergency grant programs.

Support of New Institutions

Both the Moscow Mathematical Institute (MMI) and the Independent University of Moscow benefit by having a number of their faculty and graduate students supported by AMS small grants and both will benefit from the book and journal donation project. Beyond this, the AMS is sponsoring a reading room at the MMI and aiding the legal process to establish the MMI as a joint Russian-American nonprofit organization.

Aid to Libraries

Great progress has been made since our February report. As this is being written our first two shipments of books and

journals have been shipped to the Russian Embassy to be transferred to the Moscow State University Library and the Academy of Sciences Library of Natural Sciences. Once these are shipped and received in Moscow we will begin regular shipments to the Library of the Steklov Institute in St. Petersburg; the Library of the Academy of Sciences of the Ukraine, Institute of Low Temperature Physics and Engineering in Kharkov; and the Library of the Mathematics Institute in Novosibirsk. These libraries, in addition to the AMS Reading Room at the Moscow Mathematics Institute, will become regional mathematics information centers supported with funds from the National Science Foundation. In addition to receiving AMS books and journals these facilities will be equipped with electronic information centers including a copier, fax, modem, and computer (providing security measures can be successfully implemented).

Beyond establishing these centers, the Society intends to send all AMS books and journals to libraries in the following cities: Baku, Dnepropetrovsk, Erevan, Kazan, Kiev, Lvov, Minsk, Nizhni Novgorod, Odessa, Riga, Rostov-on-Don, Vilnius, Tallinn, Tashkent, Tbilisi, Vladivostok, Voronezh, and Yaroslavl.

Finally, the Society is cooperating with the American Association for the Advancement of Science (AAAS) in its effort to provide mathematical literature to important nonsubject-specific science libraries in the former Soviet Union. The AAAS program calls for the Society to ship twelve of its journals to the following sites: National Public Library for Science and Technology (Moscow), Library of the Russian Academy of Sciences (St. Petersburg), St. Petersburg State University Library, Saltykov-Shchedrin Public Library (St. Petersburg), Vernadskii Central Scientific Library of the Ukrainian Academy of Sciences (Kiev), Kiev State University Library, State Public Library of Ukraine (Kiev), Jakub Kolas Library of the Belarussian Academy of Sciences (Minsk), Belarus National Library (Minsk), and Belarus State University Library (Minsk).

Donations in support of this effort may be made to the AMS fSU Aid Fund and sent c/o Tim Goggins, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

Mathematical High Schools: What Are They?

Alexander Shen

Moscow School Number 57

One of the pillars of strength of the mathematical culture in the Soviet Union was its system of mathematical high schools and other special educational programs for mathematically talented young people. With the political and economic changes in the former Soviet Union, the survival of this important tradition is in jeopardy. Alexander Shen has worked for many years in such programs. His article describes some aspects of this tradition and discusses prospects for the future.

The importance of these high schools, together with the fSU's tradition of educational programs for mathematically talented young people, has come to light as the Society has become more involved in providing support for mathematics in the fSU. Therefore, the Advisory Committee on fSU Mathematics has agreed to offer some modes of support from the AMS fSU Aid Fund to these special schools under the category of "special needs" in the Society's original four-point plan. Support for the AMS fSU Aid Fund can help these schools.

I would like to begin with a short description of my personal experience. I graduated from the Second School in 1974 and entered the mathematics department of Moscow State University (undergraduate 1974–1979; graduate 1979–1982; Ph.D. 1985). I worked as a volunteer teacher in a mathematical class in Moscow school #91 (1977–1980), where we had the honor of calling M. Kontsevich our student, and in several mathematical classes in Moscow School #57 (since 1981). This article is based on my personal impressions, and I apologize in advance for not mentioning many activities and enthusiastic people, especially outside Moscow.

An Overview

The typical path of a person through the system of mathematical high schools in the former Soviet Union may go as follows:

7–11 years old: The child is good in school mathematics but does not find the school lessons interesting; his/her parents start to worry.

11–13 years old: The child goes to an evening mathematical school (also called "matematicheskii kruzhek" in Russian),

where once a week he/she participates in a problem-solving session. He/she takes part in mathematics "olympiads" and contests, with good results.

13–17 years old: The pupil is invited to take an entrance exam to a mathematical class, passes it, and is invited to attend the class. He/she continues to participate in math olympiads and wins several prizes. He/she helps to run the evening mathematics school for younger pupils.

After age 17: The student passes the entrance exams to the mathematics department of the Moscow State University. He/she becomes a member of a team responsible for a mathematical class. He/she continues his/her mathematics education, starts research work, and becomes a graduate student. The students of the mathematical class where he/she is teaching graduate from the high school. He/she becomes an informal leader of a team responsible for another mathematical class, and his/her former students become members of that team.

Of course, this picture is oversimplified, and only a few people go the whole way, but most Moscow mathematicians of younger generations went through some stages of it.

Evening Mathematical Schools

Here is an actual example of the problem list used this year for one of the lessons in an evening mathematical school.

1. Prove that among any 13 integers you always can find 2 whose difference is a multiple of 13.
2. Prove that there exists a number of the form $111\dots 111$ that is a multiple of 1993.
3. Prove that among any 15 integers you can select some whose sum is a multiple of 15.
4. Prove that if x, y are integers and $x^2 + y^2$ is a multiple of 3, then x and y are multiples of 3. Are similar assertions valid for 5, 7, 9, 11, and 13?

After a short introduction the problems are given, and pupils start to work on them. The duration of a problem-solving session is about an hour and a half (with a five-minute break after the first half). There are about twenty pupils and three to four teachers in the room. When a pupil thinks that he/she has solved one of the problems, he/she calls one of the teachers and explains the solution. At the end of the lesson the teachers explain some of the solutions. The next lesson may be devoted to the same topic or to a different one (we try

to make the lessons as independent as possible, so pupils may join the evening school at any time). Some lessons have no specific topic, just a list of nice problems to solve.

Mathematical Classes

The lessons in a mathematical class are divided into two categories. First, there are lessons delivered by a professional teacher officially working in the school (say, four hours per week). Another four hours per week are devoted to problem-solving sessions guided by a team of volunteer teachers (undergraduate students, graduate students, professional mathematicians, etc.). Pupils get "problem sheets" (ten to twenty per year); each sheet tries to present some theory in a sequence of problems. Here is a real-life example of a problem sheet for sixteen year old pupils used once in Moscow school #57:

1. Find whether the following series converge or not:

- (a) $\sum x^n$;
- (b) $\sum 1/n$;
- (c) $\sum 1/n$ over all n whose decimal notation does not contain 8;
- (d) $\sum \frac{1}{n(n+2)}$;
- (e) $\sum \frac{1}{n(n+1)(n+2)}$;
- (f) $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots$;
- (g) $1 - \frac{1}{2} - \frac{1}{4} + \frac{1}{3} - \frac{1}{6} - \frac{1}{8} + \frac{1}{5} - \frac{1}{10} + \frac{1}{12} + \dots$;
- (h) $\frac{1}{2} + \frac{1}{3} + \frac{1}{5} + \frac{1}{7} + \frac{1}{11} + \dots$;
- (i) $\sum nx^n$;
- (j) $\sum x^n/n$;
- (k) $\sum n!x^n$;
- (l) $x - x^3/3! + x^5/5! - x^7/7! + \dots$;
- (m) $\sum \Phi_n x^n$, where Φ_n is the n th Fibonacci number;
- (n) $\sum x^{n^2}$;
- (o) $\sum 1/n^x$;
- (p) $\sum (\sin nx)/2^n$;
- (q) $\sum (\sin nx)/n$;
- (r) $\sum (\sin 4^{n^2} x)/3^{n^2}$ (Hint: use the convergence criteria from 3 below);
- (s) find $\lim a_n$ where $a_1 = 1$, $a_{n+1} = 1 + 1/a_n$.

2. Find the sum of the series 1a, 1d, 1e, 1i, 1m (answer: $1/(1-x-x^2)$); **1p**, $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$ (answer: $\pi/4$); **1f** (answer: $\log_e 2$); **1g** (assuming that the answer for the preceding problem is known); **1l** (answer: $\sin x$); $1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \dots$

3. Convergence criteria.

- (a) If $0 \leq a_n \leq b_n$ and $\sum b_n$ converges, then $\sum a_n$ converges;
- (b) (Leibniz) If $a_1 \geq a_2 \geq \dots \geq 0$, and $a_i \rightarrow 0$ then $a_1 - a_2 + a_3 - a_4 + \dots$ converges;
- (c) If $\sum |a_n|$ converges, then $\sum a_n$ converges (hint: use the Cauchy criterion);
- (d) (Dalembert criteria) If $|a_{n+1}/a_n| < q$ for some $q < 1$ and for all sufficiently large n , then $\sum a_n$ converges; if

$|a_{n+1}/a_n| > q$ for some $q > 1$ and for all sufficiently large n , then $\sum a_n$ diverges;

- (e) Replace a_{n+1}/a_n by $\sqrt[n]{a_n}$ in **3d**;
- (f) If $a_1 \geq a_2 \geq \dots \geq 0$, then $\sum a_n$ converges or diverges together with $\sum 2^n a_{2^n}$;
- (g) If $a_1 \geq a_2 \geq \dots \geq 0$ and partial sums $s_n = \sum_{k=1}^n b_k$ are bounded, then the series $\sum a_n b_n$ is convergent (Abel). (Hint: prove that

$$\sum_{k=m}^n a_k b_k = \sum_{k=m}^n (a_k - a_{k+1}) s_k + a_{n+1} s_n - a_m s_{m-1}$$

4. Prove the following.

- (a) Changing the order of terms in a convergent series, we may change its sum or
- (b) make the series divergent;
- (c) this is impossible if terms are non-negative
- (d) or if the series of absolute values is convergent (in this case the series is called absolutely convergent);
- (e) if a series is convergent but not absolutely convergent then we may get any sum by a permutation of its terms;
- (f) the set of all sums of all permutations of a series in \mathbb{R}^2 is either a point or a line or the whole plane (Riemann).

5. Infinite products. Prove that if $0 < a_n < 1$, then the series $\sum a_n$ diverges if and only if

- (a) $\prod (1 + a_n) = \lim (1 + a_1)(1 + a_2) \dots (1 + a_n) = \infty$ or
- (b) $\prod (1 - a_n) = 0$.

6. Find:

- (a) $\prod (1 - 1/n^2)$;
- (b) $\prod (1 - 2/(n^3 + 1))$;
- (c) (Viet) $\prod 2/\sqrt{2 + \sqrt{2 + \dots + \sqrt{2}}}$ (n roots; Hint: find the perimeter of regular n -vertex polygon);
- (d) $\prod (1 + x^{2^n})$ (answer: $\frac{1}{1-x}$);
- (e) (Euler) $\prod (1 - p_n^{-x})^{-1}$ (answer: $\sum n^{-x}$);
- (f) $\prod \cos(x/2^n)$ (answer: $(\sin x)/x$);
- (g) (Euler) $\prod (1 - (x/\pi n)^2)$ (answer: $(\sin x)/x$). (Hints for (d), (e): $(1-a)^{-1} = 1+a+a^2+\dots$; for (f): $\lim n \cdot \sin(x/n) = x$.)

7. (Applications)

- (a) Use the sum of **1m** to get a formula for Φ_n ;
- (b) Use **6e**, **1b**, **5b** to prove the divergence of **1h**;
- (c) Use the sum of **1l** and **6g** to prove that the sum of the last series in **2** is equal to $\pi^2/6$.

The problem sheet contains a form whose entries correspond to problems (fifty-four entries for this specific sheet). The teacher puts a "plus" in this form when the corresponding problem is solved. It is not required that all problems be solved (70% is considered good) because the problems are quite difficult. The use of textbooks and joint work is encouraged, but each solution should be checked by one of the teachers.

Typically, these problem sheets cover calculus in one variable, basic algebra, and sometimes linear algebra. They are prepared by the team responsible for the mathematical

class, so each class has its own version. The next problem sheet depends on the results of the previous one, and this feedback is very important.

Features Making This System Unique

There are some features distinguishing this system from more traditional ways of teaching mathematics in universities.

First, the members of the team are only a few years older than the pupils and have almost no experience in teaching. However, they do not need to deal with the whole class, which is the most difficult part of the teaching job. (Gradually, they become more experienced in teaching, and this is very important. Hearing students giving a talk at a research seminar, one often can perceive the difference between students who have teaching experience and those who do not.) Many high-quality professional mathematicians were members of those teams, e.g., V.A. Ginzburg, M. Kontsevich, and V.A. Vassiliev, to name only a few.

Second, there is close personal contact between teachers and students in mathematical classes: they often go together on excursions, boating, hiking, etc., so pupils can closely observe a lifestyle where mathematics plays a central role.

Third, good students are collected in one class (or in a few classes) from the whole of Moscow, creating a highly competitive atmosphere. This gives strong motivation to students, though it may discourage some who had been the very best pupils in their schools and lost that position.

Fourth, studying in such a system means rediscovering and is therefore much more exciting. Teaching in such a class is also an exciting experience, much more rewarding than delivering lectures or grading assignments in a standard way.

Finally, it is clear that only a few pupils from each class become professional mathematicians. It seems, however, that for others the time spent in a mathematical class is not lost: The language of mathematics remains their native language even if they become philosophers or businessmen.

Some Historical Remarks

The tradition of mathematical contests and “olympiads” for high school students has existed in the former Soviet Union since the 1930s. The first mathematical schools appeared in Moscow in the mid-1960s. The famous “Second School” was founded by a group that included I.M. Gelfand, E.B. Dynkin, and many other prominent mathematicians. One should mention the important role of the first principal of that School, V.F. Ovchinnikov, who had the very difficult job of mediating between the School and always suspicious Communist authorities. However, this School was too remarkable to survive in the dark atmosphere, and in 1971 many teachers including Ovchinnikov were fired. Since then there have been several attempts to revive this School, but with only partial success.

At approximately the same time (in 1963), A.N. Kolmogorov organized a boarding school at Moscow State University, where gifted students from the whole Soviet Union gathered and learned. He spent a lot of time and effort teaching at that school, and it was a great school during this period.

However, the general decline of Moscow State University and its mathematics department influenced this school significantly: Brilliant and enthusiastic mathematicians working there during Kolmogorov’s time were gradually replaced by *Parteigenossen*—Komsomol and Communist party functionaries unable to do real mathematics but willing to have a job in the University.

Another attempt to help the gifted students outside large cities was initiated by a group of mathematicians led by I.M. Gelfand. They created a correspondence school for pupils from the whole Soviet Union. Pupils receive textbooks and assignments by mail (about five to ten per year) and send solutions back. Solutions are graded and returned with corrections. This school still exists, though now it has encountered difficulties connected with increased mail cost, especially for mail to other former Soviet republics.

At the end of the 1960s a group of people started a less visible activity: they had an informal agreement with several Moscow schools which permitted a mathematical class with a high degree of autonomy inside the school. This system was much more flexible; if in one school the conditions worsened, the mathematical class could be moved to another place. The description of the teaching process given above is based on that tradition (in the Second School and in the Kolmogorov boarding school the system was a little more traditional, for lectures played a more important role). This tradition managed to outlive the Communist regime, and now it is continuing in several Moscow schools (notably in school #57 and others). One should mention here N.N. Konstantinov, whose endless enthusiasm and energy in organizing mathematical contests and in teaching mathematics were crucial. Nowadays thousands of pupils take part in contests and “olympiads”; several hundred pupils study in evening mathematical schools; and one, two, or three mathematical classes of high level are organized each year.

What Now?

The exciting changes happening after the liberation of the former Soviet Union are heavily influencing the situation in mathematical schools and classes. Here I mention only some potentially dangerous factors.

During the Communist times the mathematical classes were attractive as an “oasis of freedom”: some pupils were attracted not by mathematics itself but by the general atmosphere of the mathematics classes. Nowadays many means of self-expression other than mathematics are possible, so many people go into other areas.

As is clear from the description above, the role played by enthusiastic students and graduate students is crucial. Usually they were students of the Moscow State University. Therefore, the decline of the mathematics department at that University is very dangerous. During the last two years an attempt has been made to create an alternative system of mathematics education in the Independent University of Moscow. However, we should wait several years to see what comes of it.

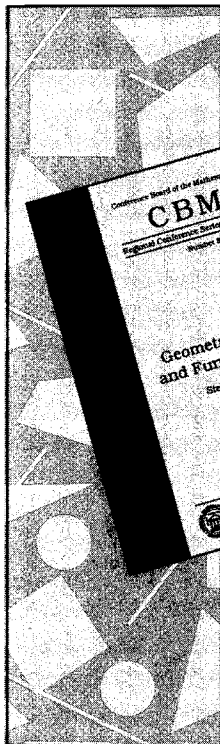
Another factor that is very dangerous for ex-Soviet mathematics in general is massive emigration. Many former

teachers and potential teachers have left the former Soviet Union. The moral factor is probably even more important: If common sense wisdom says that "success means emigration", any reasonable activity is paralyzed.

The tough economic situation forces volunteer teachers (who usually worked for free or for a nominal fee) to look for a part-time job. Therefore, it seems necessary to provide some remuneration for them. Here the help from Western (as well as from local) sources may be very important, and we are grateful to all persons and organizations who are taking or will take part in the assistance programs.

So what is the forecast for the next five to ten years? I see

three possible scenarios: (1) Pessimistic: The public unrest, Communist or Fascist terror, civil war, etc., will destroy life in the former Soviet Union completely; (2) Optimistic: The economic, political, and moral situation in the former Soviet Union becomes better, and a new generation of mathematicians appears to take over the tradition of teaching mathematics in mathematical schools and classes; (3) Intermediate: The negative trends gradually eliminate the ex-Soviet school of mathematics; the mathematical classes lose the connection with living mathematics and turn into places where pupils are prepared to continue their study in the West.



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An Open Letter to the AMS

Since initiating the AMS fSU Aid Fund, the Society has received hundreds of letters from the fSU testifying to the importance of this effort. The following letter is representative of the thoughts conveyed in many of the letters received.

Dear friends,

I feel compelled to write this letter to express my heartfelt gratitude to the people at the AMS for organizing assistance to Russian mathematicians. My gratitude and pride for members of the international mathematical community residing in the U.S. for their help is all the greater because, as far as I know, mathematicians are the only professional group which has succeeded in subsidizing their Russian colleagues as individuals directly, rather than giving money to abstract official organizations.

I am not myself a working mathematician, but I have studied with and live among mathematicians (e.g., both my parents, my former husband, my present husband, my son, and many of my friends), so that I am in a position to say that the present is definitely not their time in Russia. You have given them a period of respite, a chance to breathe, look around, and try to adapt to the new circumstances, and, most importantly, a chance to save what remains of the Russian mathematical school and to continue producing talented mathematicians. In particular, I have in mind the assistance to those self-denying mathematicians who work with young [students] in specialized

mathematical schools and circles.

I would like to convey how necessary and timely your aid is. In recent years, while prices have increased 400–500 fold, salaries of Ph.D.s in mathematics have gone up much slower (about 100 times after recent Yeltsin increases), so that mathematicians and their families, used to a modest but comfortable life style (by Russian standards), suddenly found that they have to live below the poverty line. The price increases [affect] all the most necessary goods, which have now become available in the new market economy, but with prices out of reach for most professional people. One can't afford to buy clothing for children but children continue to grow out of their old clothing. Fresh fruit, chocolate candy, and soft drinks are sold at every street corner, but parents have to explain to their children that they cannot buy any of these things for them. The situation is particularly tragic for the elderly who, for instance, can no longer afford to buy their usual medicine.

I am convinced that mathematicians will be able to adapt and that the standard of living will eventually increase (some signs of that are already evident), but for now let me express my gratitude for your understanding and support.

Sincerely yours,

Lena Efimova

(Moscow)
May 1993

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Interview with Judith S. Sunley

Judith S. Sunley served as director of the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) from 1987 until 1992. Before that she served as deputy director of the DMS and as program officer for Algebra and Number Theory. Last year she was named executive officer of the NSF's Mathematical and Physical Sciences (MPS) directorate. During her tenure as DMS director, she received the Presidential Rank Award for her distinguished service to the NSF. On May 17, 1993, she was interviewed by *Notices* Associate Managing Editor Allyn Jackson. The interview, edited for conciseness and clarity, follows.

Notices: Can you describe what you're doing in your current position?

Sunley: As executive officer for MPS, I do a variety of things. One of the biggest parts of my job has to do with budgeting and planning within the directorate, both for staff and things of that sort and also for the budget requests that go to the Congress, and developing the current plans and operating plans by which we actually spend funds. In fact that's probably the most interesting part of the job because it gives me the opportunity to see what's going on in each of the five MPS divisions and what is most important to them scientifically. There are a lot of other things involved as well. A lot of the oversight functions for the directorate, from a management point of view, come through this office, and I currently chair the MPS Management Coordinating Council where we have discussions of how we are going to balance needs for travel and equipment, how we might change the MPS ways of doing business, and things of that sort. I also see a lot of things like reconsideration requests from all the divisions.

Notices: [DMS director] Fred Wan has said that for the DMS budget to do well, the MPS budget must do well.

Sunley: Well, one can take the argument one level further and say that the better the whole NSF budget does, the better MPS will do and the better mathematics will do too. The larger the percentage increase for the Research and Related Activities portion of the NSF budget, the larger the MPS line gets, and the better off mathematics is. When you look across



Judith S. Sunley

the Foundation, the organizations that have probably gained the most in NSF have been Engineering, CISE [Computer Information and Science Engineering], and Education. This shift is not a new one; it's something you can see in NSF budgets over a period of several years. And I think that part of what Fred is trying to say is that mathematical and physical sciences disciplines should argue that their funding is important because of the long-term impact they have on everything, not just for the sake of the mathematical and physical sciences themselves. Certainly mathematicians can make that case as well as physicists and chemists, and they should make it. As a whole, mathematical and physical sciences play an incredibly important role in science and engineering. As five separate organizations, the MPS divisions aren't as effective as when they work together. This is part of the reason why Bill [Harris, MPS director] and I have emphasized that MPS divisions should work together as a team.

Notices: This year, DMS is operating on something like a modified flat-rate scheme. What do the other divisions think of this?

Sunley: Every division looks at things differently, and every division has problems that are different. One of the things that Bill Harris is very concerned about is making sure that awards to world-class individuals have the dollars in them that allow these people to do what they need to do to carry out their research. I think that Fred has managed to accommodate this very well in the plan he has worked out with the DMS staff.

I actually didn't have much of a role in the flat-rate experiment as it was outlined by the DMS [in the summer of 1992]. In my current position I had seen some preliminary drafts, but I felt any involvement on my part in either establishing, revising, or stopping such an experiment would make it very difficult for any incoming division director to believe they could manage the division without my interference in the future. I think that the final version went forward at a time when I wasn't here.

There are a variety of things going on in the Foundation that concern the size and composition of grants that maybe weren't stimulated by the experiment but are related to it. I doubt that mathematics, or any other discipline, will do something like that until some of the issues that are percolating in Foundation-wide task forces are resolved.

Notices: The current NSF policy is to increase the size and duration of grants. DMS seems to be going in a different direction this year. Is this dangerous for the DMS?

Sunley: Well, I think the way Fred is approaching things is not inconsistent with the policy. You have to look at what makes up a mathematics grant before you can talk about what it means to increase grant size and duration. There's no question that the NSF is increasing the duration of both standard and continuing awards, making more of them at least three years duration. I think one can say that soon the norm will be three years. When you talk about what goes into an award, generally speaking, you're talking about salary that pays for time the researcher is using toward the research project and costs associated with that, such as fringe benefits and overhead; you're talking about such things as graduate students, travel money, maybe funds to bring in a consultant or a visitor. When [former NSF director Walter] Massey or anyone else talked about increasing grant size, they weren't talking about increasing it in a frivolous way, they were talking about increasing it in what is needed to carry out research. The focus has now moved from absolute dollars to also looking at the composition of the grants. So I think, by and large, DMS is not out of step with this effort.

In fact that's an important thing for the math community to think about: What do they need in order to get their research done, and what should the composition of a math grant look like if the objective is to support the research properly and to make sure that the next generation of mathematicians gets properly trained?

Notices: What do you see changing within NSF as a result of the change in the administration? Will there be more

initiatives? Will there be less emphasis on "curiosity-driven" research?

Sunley: I doubt that there will be many more initiatives because there are limits to the effort that people can put into the coordination of these initiatives. It really does require a tremendous amount of coordination, both within an agency like NSF and across agencies. I think at one point they had decided they were going to keep the number of FCCSET [Federal Coordinating Council on Science, Engineering, and Technology] initiatives fixed. That was in the previous administration; I don't know whether the new administration feels the same. But my guess is that, rather than totally new initiatives, we might see offshoots of existing initiatives. For example, in addition to the Global Change initiative you may have an environmental component that's more local; in addition to the High Performance Computing and Communications initiative you may have a more targeted emphasis on networking and the national computing superhighway. I believe manufacturing is scheduled to begin in fiscal year 1994 or 1995 as a formal FCCSET initiative, and again, you may see different kinds of things imbedded in that initiative.

There's no question that the new administration is committed to science and technology. The emphasis in a lot of the documents seems to be more on technology than on science, but there's also language that recognizes the importance of basic science to addressing some of these broad national needs. I think the fact that NSF was part of [President Clinton's] initial stimulus package is a very important statement about their concern for basic science.

I personally don't like the term "curiosity-driven research" because I think all research, if it's decent research, is curiosity-driven. In the same way, all research in one sense is "directed research", directed by different kinds of things, from the imperatives of one's own discipline to wanting to make ties to other disciplines, or something of that sort. I think we've created a dichotomy that isn't real with such terms. The initiatives form a strategic package, and every individual piece of research that is part of that collection doesn't have to be strategic in its focus. It's the package of things taken together that creates the strategic nature. You can do research that is every bit as basic as anything else as part of one of these strategic packages.

Notices: Do you think that the mathematics community has unrealistic expectations of what the DMS can do?

Sunley: I think people expected things not to change, and there is now a more realistic assessment that things are changing. There are a number of things at issue here that make it hard to answer this question directly. I think there was an expectation on the part of many mathematicians that, if you did research at a certain level of quality, you were more or less guaranteed funding. When the community found people at that level of quality being turned down, there was a lot of confusion. They didn't understand why some of these people were being turned down, and they didn't understand how difficult it was for many of the program directors to do that. There was an increasing gap between the number of people at the level of quality where the community felt there should

be funding, and the dollars that we had to do that. I think there's better recognition of that now. A lot of the discussion of flat-rate grants and other things has helped stimulate that recognition.

There's another sense in which one can answer that as well. It is the policy of NSF not to talk about declinations and proposals by name, so it's difficult sometimes to explain to the community how you were comparing one proposal to another proposal; where one ended up as an award and the other one ended up as a declination. By and large, the committees of visitors that we had last year came to the conclusion that the relative comparisons were on track.

I think another thing that the community at large perhaps did not fully recognize was that we were having serious problems with success rates for younger people. The number of new Ph.D.s was growing, and, until we made a concerted effort in fiscal year 1991, we really hadn't been focusing on insuring that those just coming out really had an equal opportunity. So we did try to focus some of our funds on relatively new Ph.D.s, say, within the first five years. That created some of the disconnect with the expectations of senior people. Yet if you asked people individually, they would say that one of the real problems was that their junior faculty colleagues couldn't get awards.

I also think there was a disconnect about what the community expected to see in budget requests. They expected more funding, perhaps focused in the core mathematics areas. But they were not fully aware of the environment in which that funding was taking place, and that has something to do with expectations also.

Notices: I'd like to ask you about your time at the DMS. What was your favorite aspect and your least favorite aspect? What was most satisfying?

Sunley: Well, of course, anyone's favorite thing is being able to tell people "Yes", and everyone's least favorite thing is having to tell people "No". As division director I always thought it was wonderful that someone in the Division of Grants and Contracts got to sign all the award letters, but I had to sign all the declinations!

I believe that in DMS we had a very strong team approach to looking at what was happening in the division and balancing off the various needs of the mathematical sciences. It's a wonderful group of people to work with. I have continually had rotators come in from outside and tell me that the environment was so different from a mathematics department because there is a group of people working together to try to do the right thing for mathematics, instead of fighting over turf questions and parking rights and things of that sort. It really makes a difference when people feel that they're there to try to address things in a common way.

I think involving the division in the education and interdisciplinary activities was very important and will, in the long run, make things easier for the mathematical sciences. We will have a better basis for convincing, say, all of the MPS disciplines that it's important to help mathematics and not just to work toward their own interests. Having accurately assessed the opportunities in the education and interdisci-

plinary areas and worked to convince people, both inside the Foundation and out, that math could and should be involved is likely the most satisfying aspect of my five years as division director because I feel I did good things for DMS and for the Foundation as well.

I think the educational aspect is very important because, when you justify basic research, what you are arguing is the ability of faculty members who do basic research to be strong educators as well. The calculus initiative goes back to when I was first division director, so I suppose there's a particular soft spot for that, and I think it's done some very good things. The Education and Human Resources (EHR) directorate frequently uses it as an example of cooperation. The Regional Geometry Institutes were something that was quite different and quite a departure for DMS. I think we've built a cooperation with EHR in that area that has proven very valuable as well.

And there's the interface between mathematics and biology, for which Andre Manitius [former program officer and former deputy director of DMS] deserves a great deal of credit for having started, and which others, including myself, kept pushing for many years. That is something that has grown as a share of the Applied Mathematics program and of the Statistics and Probability program over a period of four or five years. If you look back five years ago and look now at the interactions with biology, the changes are quite significant.

Seeding some of the activities between mathematics and the geosciences is very important, and you can see some of those come to fruition in fiscal year 1994 budget requests, where DMS actually has a role in the Global Change program. These things take a long time to come to fruition.

I've also taken some satisfaction in watching the Computational Mathematics program evolve and mature over the years. Its existence helped DMS become part of the High Performance Computing and Communications initiative in a natural way. It has also made a real difference in how mathematics is done, and it's exciting to be part of such a change.

I should also say, however, that over that period of time it was the education questions and the interdisciplinary questions that were easier to move on because they fit better with the directions in which science policy and, therefore, budget requests were going.

I would like to have done more for some of the basic subfields of mathematics. If I regret anything in leaving at the time I left, it's that I wasn't there this year to take on the challenge of demonstrating ways in which geometers and analysts and algebraists and number theorists can contribute to and benefit from some of these interdisciplinary initiatives by being aware of what some of the ties are. There is real opportunity here for mathematics because these areas ask interesting mathematical questions that demand new mathematics if we're going to be successful in addressing them. I think Fred is doing a great job in making sure all parts of the division share in the initiatives. I like to think I could have done as well.

Notices: That brings us to the question of the fiscal year

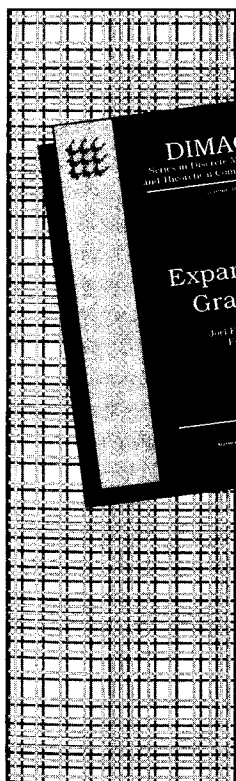
1993 budget request and the community's reaction to the zero increase for disciplinary research. [That request contained a zero increase for the DMS "core" research programs, with the entire increase being framed in terms of federal or NSF-wide initiatives.]

Sunley: I was disappointed that the community would immediately assume that we were trying to kill core mathematics. At about the same time the budget request came out, I wrote a Forum column for the *Notices* (volume 39, April 1992, pp. 300–302). It explained some things about the complexity of the budget process and the changes that can take place between the time a division first outlines its opportunities and needs and the time a formal request to Congress is made. In the reactions to the situation from some members of the community, there was no sense that we might have had a very different structure to our initial formulation of plans. In a year when DMS had some significant breakthroughs in building its budget through cooperation with other parts of the Foundation, the overall reaction of the community was negative. It seemed to be impossible for people to recognize the positive

aspects of the budget request because of the assumptions they made about our interest in disciplinary research.

There are, of course, questions of strategy in describing the budget. There were similar situations throughout the Foundation that were not so obvious because of how the other requests were structured. But Dave Sanchez and I both felt that describing things as we did would let the mathematics community know there were things in the planning environment that were threatening our ability to expand funding for core mathematics.

On the other hand, there have been people in the mathematics community who have been very strongly supportive, who understand the complexity of the process, and who have come and asked what they could do to help make a difference. They deserve a lot of credit because it wasn't always easy to work through the system to make a difference. Understanding its intricacies takes a lot of effort and persistence. I particularly appreciated their willingness to look for the positives in the overall budget picture and to work with the division in shaping a program we could all be happy with.



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Jobs, Grants, and the New Ph.D.

This is the second of a two-part series exploring concerns of new and recent Ph.D.s in mathematics, most notably, the job market and research grants. The first part, which appeared in the July/August issue of the *Notices*, presented some of the experiences that individual job seekers faced on the market this year. This second part presents some perspectives on the market and on research grants, as well as some recommendations for change.

"It would be hard for me to communicate in the remaining space how much I'd like a refund on the last ten years of my life."

—From a response to a survey of job seekers at the Employment Register in San Antonio, January 1993

The job market in mathematics has been tough for the last couple of years. What seems new this year, though, is a strong current of discontent. Many feel betrayed that the "shortage" of mathematicians trumpeted a few years back never materialized. "I do feel quite angry [about] the employment process," wrote another job seeker in the Employment Register survey. The mathematics community "a few years ago was desperately calling for more Ph.D.s and [now] turns its back on many of the capable people responding to such calls. I suspect many other Employment Register applicants feel likewise."

Most new Ph.D.s concede that they went to graduate school because they love mathematics, not because they heard about a mathematician shortage. But, they say, a more realistic picture would have tempered their expectations. "It certainly was a factor to be under the impression that I was going to be a 'hot commodity' when I finished," says David Atkinson, who completed his doctorate at the University of Illinois at Urbana-Champaign and now has a tenure-track position at Western Kentucky University. "Had I been told six or seven years ago that the job prospects would be terrible and that, no matter how you cut it, half of the people [graduating from Illinois] are not going to get jobs—yeah, I might have done something else."

In addition many feel that senior members of the mathematical community still have not caught on to just how bad the market is. "Very few [senior mathematicians] seem to realize the extent of the disaster of the job market this year," says David Cruz-Urbe, who got his Ph.D. from the University of

California at Berkeley this year and after months of searching finally landed a postdoc at Purdue University. Curtis Bennett, who got his Ph.D. from the University of Chicago in 1990 and now has a tenure-track position at Bowling Green State University, says that some of the discontent about the job market stems from the amount of time it took for the community to acknowledge that there was a problem. When he was looking for his first job while still a graduate student, "my entire class at Chicago, with one exception, had an extremely hard time finding a job," he notes. Yet "in that year I recall people talking about the need to get people to go into mathematics because there wouldn't be enough people for the jobs. The next year I heard the same thing at conferences."

New Ph.D.s are also skeptical of continued talk of a "wave of retirements" that's supposed to hit sometime during the 1990s. Their skepticism may be justified. A recent survey by the American Council on Education found that 47% of public four-year colleges and universities have flat or declining budgets. Many institutions are scrambling to maintain enrollments and are offering early retirement packages to reduce faculty size. Add to this the continued flow of highly qualified students and mathematicians from Asia and Eastern Europe, and a wave of retirements seems unlikely to result in more jobs for young people.

Another common complaint is that the hiring policies of many universities keep new Ph.D.s out of the running. For example, many on the job market winced when the University of Illinois at Urbana-Champaign this year hired four new professors, three of them from the former Soviet Union. Atkinson says that he understands the department's desire to hire the very best people it can. "But at the very same time, they see their own graduates unemployed, and I feel like they're not taking into account that the people they might have hired from Princeton or MIT are now going after jobs that their own graduates would have had realistic chances at in the past," he notes. "I feel it's a cavalier attitude." One Ph.D., who asked not to be named, just finished his degree at an Ivy League school and expects to be employed in the finance industry next year. He observed the same phenomenon. Professors, he says, "complain about how tough it is for their graduate students to get jobs, while their hiring policies are reducing the number of positions that would be available to similar people from other graduate schools."

It also rubs new Ph.D.s the wrong way when departments complain about job seekers “blanketing” the market with applications. “The suggestion that we candidates are now applying to 150 schools [each] and that’s causing all the trouble—that’s utter nonsense,” says Ben Lotto. He finished his degree in 1988 and, after a number of temporary positions, has finally landed a tenure-track job at Vassar College. “You’re talking about our livelihoods here. We really have to do whatever we can to try and make a living and keep on eating. . . It’s really up to the senior people in the departments, on the hiring side of things, to come up with a way of coping with the candidates and their applications, rather than up to the candidates to cut back on what they’re doing.”

Deanna Haunsperger, who is finishing a temporary three-year position at St. Olaf College and will be on the job market next year, says she’s frustrated by the attitudes she’s observed in recent articles and letters in *Focus* and the *Notices* by senior mathematicians. “These members of our community believed that *they* were the ones being inconvenienced by the current job market—after all, they had many more job applications to read through,” she declares. “They forgot to make the connection that the job market was not the *fault* of any of the candidates (that may lie on the economy, changes in Eastern Europe, and demographics), but that the candidates were its victims.”

Many Ph.D.s feel frustrated because they have done everything that was supposed to help them land a job, but have still found nothing. “I graduated in 1990 with a Ph.D. degree and had three years teaching experience in a U.S. university with more than a dozen publications,” wrote one job seeker on the Employment Register survey. This individual did not get a single campus interview. “I sent out more than 100 resumes. What’s going on? Now I am preparing [for the] series 7 test and will become a stockbroker soon.”

Discontent over Grants

Another wave of discontent surfaced among new Ph.D.s when, under heavy pressure from senior members of the mathematical community, the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) canceled its “experimental project” on flat-rate grants. The project would have instituted two levels of awards, \$20,000 and \$30,000, with add-ons possible for graduate students, postdocs, and the like. The experiment was prompted by concerns within the DMS and the community that even highly rated research proposals were being turned down because of lack of funds. The purpose was to prevent the number of Principal Investigators (PIs) supported from falling further.

The pros and cons of a flat-rate system were discussed in a point-counterpoint article in the January 1993 issue of the *Notices*. The piece against the flat-rate experiment prompted three letters to the editor from three young mathematicians. One of the letters was from Conrad Plaut, who received his doctorate from the University of Maryland in 1989 and just landed a tenure-track position at the University of Tennessee. Plaut disagreed with the argument that reducing grant size would make mathematics less attractive to young people. “The

field cannot possibly be made more attractive to newcomers by supplementing the salaries of a few already well-paid, established mathematicians while making funding nearly impossible for a young mathematician with a promising but not yet completely developed research program,” he wrote.

Cruz-Uribe, who wrote one of the letters, said in a later interview that the idea that people would be discouraged from going into mathematics if grant size dropped is “literally laughable, from my perspective. I didn’t even know what summer support was until I was in perhaps my third year of graduate school. And even now I don’t completely understand the role that outside support plays in things like tenure decisions and hiring.” Lotto agrees that it’s unlikely that young people would be discouraged from going into mathematics if the NSF grants moved to a flat-rate system. “On the contrary,” he says, “I would say that flat-rate funding or some other method of increasing the number of PIs might encourage people to get into or stay in math.” An unfortunate consequence of the flat-rate debate was that some younger mathematicians ended up feeling they were pawns in a battle between the NSF and the mathematical community.

“I can’t see the rationale for killing the flat-rate proposal,” Plaut remarked in an interview. “Who is more likely to leave mathematics, a young Ph.D. making \$32,000 a year, whose prospects for promotion and tenure are closely linked to that grant he or she can’t get, or a senior researcher earning two or three times as much and whose grant will simply be reduced?” Indeed, even a small amount of money can make a decisive difference for young people. Bennett tells a story about how, when he had just finished graduate school, he wanted to go to a conference in Germany to make contacts and speak about his work. The NSF told him he would have to apply through the regular channels of summer funding in order to get any travel money. “I didn’t think I deserved summer funding,” he says. “All I wanted was enough money to travel to Germany for a conference. And there was no way to get that.” He went ahead and applied for a grant and was turned down. He recalls that one of the referee reports “said something to the effect that, [The proposer] needs to go to an overseas conference to prove himself.” In the end he was able to scrape together enough money out of his own pocket and from his department. Bennett believes that attending that conference was crucial to his getting an NSF Mathematical Sciences Postdoctoral Research Fellowship this year.

Advice for Graduate Students

New Ph.D.s aren’t just grumbling about the job market or the granting system. They have ideas for improvements, and they’re organizing themselves to make their views heard in a constructive way. Many of the young Ph.D.s interviewed for this article offered advice to their contemporaries who will be facing the job market this year.

Edward Aboufadel finished his doctorate at Rutgers University in 1992 and now has a tenure-track position at Southern Connecticut State University. He advises current graduate students “to start thinking about, first of all, where they realistically think they can get a job. For instance, my

impression . . . is that, at this point in time, to get a job at a full-fledged research university coming out of graduate school is not easy at all." He says that most new Ph.D.s are going to end up at places that are less research-oriented and less prestigious, and "you need to think about what's going to make you marketable for those sorts of positions." Like many others, he emphasized teaching experience as an important selling point.

Robert Leduc, a new Ph.D. from the University of Wisconsin who had a tough time on the market and by mid-July still had no job, says that those who have gotten tenure-track offers have "generally marketed themselves as teachers and have had a small stack of publications already accepted, with one or two in print. Others have gotten offers for temporary positions by primarily selling themselves as teachers but having research potential." Competition for postdocs is stiff, he says, so "those people interested in postdocs absolutely, positively must publish *before* leaving graduate school and must meet a lot of people at colloquia and conferences. Having promise just doesn't cut it anymore—you have to have already produced in some quantity." Leduc also warns that today's new doctorates often find themselves competing for jobs against people who got their doctorates three to five years ago and have some postdoctoral experience under their belts.

There are steps one can take to keep as many options open as possible. Fred Gylys-Colwell, who finished his doctorate at the University of Washington in 1993 and has a one-year, half-time position there, has some advice for those looking to industry for employment. He says that computer experience is important, since most industrial jobs for which mathematicians would qualify require some programming. In addition there are no clearly marked career paths for mathematicians going into industry, so one has to rely on talking to lots of people for information on what's out there. "Wander into your professor's office, sit down and pull out your notebook, and make it understood that you're not leaving until you have several names of people who work in industry whom you can call: ex-students, old friends, etc.," Colwell advises. "When you call people up, tell them that you want job hunting advice, not that you want a job. This will get them to talk to you for a while and perhaps give you other names."

Another new Ph.D., who requested anonymity, says that industrial employers are more interested in the "mental training" a mathematics doctorate provides than the particular research a job candidate has done. "They'll ask you about [your research], but they're either being polite about it or they're trying to gauge your ability to explain complicated material to a layman." Changing one's research directions to become more "marketable" in industry is not the way to go, he says. "Given the amount of retraining that goes on in any career now, I think the main thing to do is to get the best education you can and have a good idea of what's going on around you. And this can come in very simple ways. If people had some idea they, say, might be interested in finance, [they could] start reading the *Wall Street Journal* and move on from there." He also suggests going to the career office of one's

university and reading about companies and seeing what they do. He believes that, despite the nation's economic problems, it is still possible to get a job in industry, and he points to finance and telecommunications as being two of the best bets.

Suggestions to Improve the Job Search System

The only thing that will improve the job market is more jobs. However, the tightness of the market has magnified some of the structural problems in the job search process, and many interviewed for this article suggested improvements in this area. Some of the most common suggestions were greater use of electronic means for applying for and communicating about positions, establishing a central database of applicants, and instituting a standardized application form.

A common complaint was that job advertisements are too general. Bennett points out that many departments provide a very general list of areas—for example, algebra, topology, analysis, combinatorics, and statistics—that leaves no one out. "A lot of departments say, 'We are primarily interested in fields X, but all good applicants are encouraged to apply'," he observes. "It's very hard not to apply to a hundred places when those are the advertisements you read." In addition the amount of time it takes departments to sort through applications and decide whom to interview made for months of anxiety and frustration for job seekers. "How many schools did I apply to that said you must have your application in by December 1," asks Cruz-Uribe, "but in the middle of March were still not ready to tell me anything?" In addition there is no consistent timetable by which schools advertise, interview, and hire, so some job seekers found themselves accepting jobs they were less than happy with, only to receive better offers weeks or months later.

Stephen Kennedy of St. Olaf College, who has had a series of temporary appointments and will be on the job market again next year, recommended a number of actions he says could be tackled by a joint committee of mathematical organizations. First, he suggested investigating the possibility of using NSF mathematics funds for "emergency postdocs" for unemployed new Ph.D.s. Funds could be freed up for this purpose by establishing a flat-rate grant system, encouraging proposals to add requests for postdocs, or assessing a "tax" on all research grants.

Second, Kennedy suggested producing a position paper on ethical hiring practices and "[getting] a copy of it into every mathematics department in the country." The paper would address such issues as handling insider candidates, writing thoughtful rejection letters, and notifying candidates on a timely basis of their status. "This may sound stupid," Kennedy notes, "but you'd be shocked at the callous treatment many job applicants receive." In addition he would like to see the AMS issue a statement condemning the practice of hiring new Ph.D.s in one-year positions.

Kennedy and others noted that the best schools do not use the Employment Register and wondered if something could be done to change this. The committee that runs the Register has made many efforts in this direction, but the harsh reality is that the best schools simply do not need the Register: they

have enough top-notch applicants to choose from and can easily arrange informal interviews during the Joint Meetings. For such schools, the Employment Register does not offer many advantages.

The austerity of the job market has moved others to propose measures far more radical than Kennedy's. For example, one individual, who asked that his name be withheld, said he "can't comprehend why the AMS has taken no significant action when there has been a major crisis regarding unemployment going on for the last several years." He calls for cutting graduate admissions by 25%, reducing or eliminating federally funded graduate fellowships, diverting funds for research assistantships on grants to postdoctoral fellowships, limiting severely the number of foreign students admitted to U.S. graduate programs (this individual pointed out that he is himself a foreign citizen), and instituting tougher qualifying and preliminary examinations.

Young Mathematicians' Network

One major development in the past few months has been the organization of an electronic newsletter called the Young Mathematicians' Network (YMN) (the name may change as the organization evolves). Led by Mark Winstead of the University of Virginia, a small group of mathematicians who subscribe to the Young Scientists' Network (YSN) decided that a similar network was needed to address the particular concerns of new and recent doctorates in mathematics (see the May/June issue of the *Notices* for more information about YSN). When the second issue of the YMN newsletter hit the electronic waves on July 12, there were already about 175 subscribers.

The first two issues of the newsletter concentrated on formulating what YMN is and what its activities would be. There were also a number of interesting postings on broader issues facing the new Ph.D. In addition a couple of postings by some senior mathematicians demonstrate that YMN is getting noticed in the upper echelons of the community.

Aboufadel, Winstead, and Bennett, together with Neil Calkin of the Georgia Institute of Technology and Kalin Godev of Pennsylvania State University got the network started. YMN has five goals: (1) to keep the mathematical community "honest" about the MYTH (YSN shorthand for the "myth" that there exists a shortage of scientists, engineers, and mathematicians; (2) to provide information about job searches from both the inside and the outside; (3) to be a support group for those on the job market; (4) to provide information on publishing, grant proposals, obtaining jobs in industry, and other things that many young mathematicians did not get in graduate school; and (5) to inform the mathematical community of the interests and concerns of younger mathematicians. (YMN makes it clear that "young" refers

to Ph.D. age, not chronological age.) (For more information on YMN, or to subscribe, send electronic mail to Charles Yeomans, cyeomans@ms.uky.edu.)

What's Happened to Collegiality?

When they look around at what is happening to them and to their friends, many new Ph.D.s are disillusioned by what they see. "Departments aren't really paying attention to the needs of junior faculty," says Lotto. "I suppose that's the way it's been for the last hundred years, but now that jobs are tight, I think departments are perceived, rightly or not, as being even more exploitative." He pointed to the proliferation of one-year positions as one example of exploitation. On the other hand, he notes that "the people who are being pursued by lots of departments are doing the same thing at the 'seller's' end—they're cutting the best deals that they can. What I would like to see is a little bit less of that on both ends, although I think that the employers are much more guilty of this than [the job seekers]."

Lotto says he would like to see more "collegiality", more loyalty to institutions and to junior faculty. "I think that one of the strengths of academia is the loyalty to the profession that people hold," he declares. "Most mathematicians couldn't conceive of ever doing anything else, and they become very loyal to the institutions where they're working. The end result is a very positive one for mathematics... I think that's in jeopardy because the current situation is not fostering loyalty among junior faculty. If anything, it's fostering more cynicism than loyalty. As a result, you hear senior faculty complaining about junior faculty who change institutions at the drop of a hat... Well, the flip side of the coin is that the senior faculty are willing to drop junior faculty and hire new ones at the drop of a hat. As a result, everyone's kind of looking out for themselves as individuals, and the whole suffers. And the individual suffers too."

Echoing these thoughts, Haunsperger of St. Olaf College says that maybe what the mathematics community needs is a "matriarch—someone who will say to colleges and universities, deans, chairs, hiring committees, and the press, that what we're doing to the young of our profession is unprofessional, exploitative, and unacceptable." This "matriarch", she says, would impose sanctions when institutions violate certain standards and would insure that the voices of the younger members of the community are heard. "We should be encouraging our young, brainstorming ideas of how we can weather this stormy economy together, and not taking advantage of the current demographic and economic forecasts. Organizations like the AMS should be expending [their] energy on preserving the future of our field and the bright, talented young people in whose hands it lies."

Allyn Jackson

Some Glimpses of Mathematics in Industry

Paul Davis

Worcester Polytechnic Institute

Most of us who practice our mathematics in academia know that particular village well; we have lived in it since birth. Once in a while, consulting gives a few of us a chance to catch a glimpse of industrial mathematics, as if we were peeking under a circus tent pitched at the edge of town.

The action in that tent must have some powerful attractions. Most of our undergraduates run away to join it, and some very capable graduates leave town to find satisfying careers there as well.

In fact a closer look suggests that business, industry, and government are not mere sideshows on the outskirts of town, but large and varied arenas in which the mathematical sciences have an important role. To get a better sense of how mathematics is practiced outside of academia, Peter E. Castro (supervisor, applied mathematics and statistics, Eastman Kodak Co.), I. E. Block (managing director, Society for Industrial and Applied Mathematics (SIAM)), and I, in various combinations, interviewed or visited about forty mathematicians working in business, industry, and government.

The observations gleaned from those conversations illuminate the remarkable differences between the culture and values of academia and those of business, industry, and government. For example, there is no assured niche for mathematicians in business, industry, or government as there is in a university, which never lacks a mathematics department.

The academic mathematician might be seen as an organism that has adapted to different environments, from teaching multitudes in a community college to nurturing a few graduate students in a research university. In contrast, the nonacademic mathematician exists in a variety of distinct forms: as a specialist in a large group of mathematicians or as a wide-ranging consultant, either singly or in a team. Sometimes mathematics is not explicitly recognized in titles or job descriptions.

Except perhaps for a common thread of problem solving, the skills valued in industry differ dramatically from those of classical academic scholarship. Teamwork, communication skills (speaking, writing, and listening), and learning new disciplines are valued in industry, but they are seldom critical to academic mathematics. In industry, breadth can be more important than depth, and a timely, incomplete answer to a complex but crucial question may be worth more than a lengthy, complete solution of a model problem. Computational

skills and scientific interests outside of mathematics are commonly valued.

The observations that are described here represent a first step in the Mathematics in Industry project of SIAM*. This effort has two goals: helping mathematics faculty shape educational experiences that better prepare graduates for successful careers outside of academia and helping industry make better use of the productive potential of mathematics.

Formal training in mathematics is much less a prerequisite for employment in business, industry, or government than in academia. Literacy in some other field of science or engineering is often essential, however.

A consultant and head of a scientific computing group at a major pharmaceutical concern has a doctorate in chemistry. A member of the research group for one of the "big three" auto manufacturers has a Ph.D. in differential topology; others have more conventional backgrounds in engineering, scientific computing, or applied mathematics.

With a touch of hyperbole, one mathematician with both academic and industrial experience addresses industry's demand for breadth: "You need literacy in some field of science or engineering to get credibility *or* you need computer expertise. Unless it already had an institutionalized mathematics effort, [my company] wouldn't hire Leonhard Euler without a chemistry course!"

Hiring Mathematicians

A harsh reality is the absence of an assured role for mathematics outside of academia. Few organizations in business, industry, or government have large departments that *must* be staffed with mathematicians. Demonstrating relevance is a key to survival outside of academia. A staff member in an automotive research laboratory says simply, "There is not a market niche for mathematicians." A semiconductor manufacturer "doesn't usually hire mathematicians specifically. It hires to fill technical weaknesses—for example, device physics and modeling. The new hire may be a mathematician, a physicist, or an electrical engineer. We know which universities produce the right people [at the doctoral level]."

*This article is based on the report, "Some Views of Mathematics in Industry," that is part of this project. The report is available two ways: (1) by anonymous ftp via `ae.siam.org`; it is called `siamrpt.dvi` and is located in `/pub/forum`; and (2) from the SIAM Gopher server at `gopher.siam.org`.

Generalists can often function more productively in industry than narrower specialists, particularly when a small group is called upon to serve a diverse clientele. Critical judgment and problem solving ability are always essential.

When there is a conscious decision to hire a mathematician, the desired characteristics might include "a broad background and interest in a variety of mathematical areas, computation, and science in general." The other criteria this mathematician in a pharmaceutical concern had when hiring included the ability "to take a problem out of the blue" and the promise of "day-by-day professional development motivated by intellectual curiosity."

Attributes of Successful Industrial Mathematicians

Much to the surprise of academic mathematicians, their industrial colleagues seldom list knowledge of specific subject matter when asked about the attributes of successful industrial applied mathematicians. Technical competence and (usually) knowledge of computation are taken for granted. The defining criteria are more cultural than purely intellectual.

A prospective industrial mathematician must "show curiosity and the ability to penetrate". "The key is an open mind and flexibility." Such individuals need a "taste for good methods and for good problems. We are all problem solvers in industry, whether we are mathematicians or marketers."

One group of applied mathematicians quickly agreed among themselves, "Communication skills are key." Another mathematician observed that, beyond technical skills, "You need visibility for success. You must show others how and why your ideas work."

"A mathematician needs communication skills to interact with chemists, physicists, and engineers of various stripes. Some cross-training helps you to get involved in problems at a much earlier stage. The cross-training that's important is not in a particular discipline. It is in the ability to approach a problem with an open mind, learning to translate from other disciplines into yours." The financial facts of life can make salesmanship essential. To find new funding in the face of budget cuts, one group at a government contractor now "must make friends and let them know our capabilities."

Listening is important, not just when consulting. One applied mathematician describes a group of colleagues in a pure research organization "who were insulated from the real requirements of [the petroleum industry]. They looked at real problems with disdain. They preferred model problems and they didn't know what the [real] business needs were. [People in the field] would ask, 'What do I get for it? I can't use toy codes.'" This group's research charter lasted only as long as management was willing to protect it.

Problems and Solutions

Many problems are posed to industrial mathematicians by colleagues in other disciplines who may not yet understand the real problems they face. Problems need not be elegant, new, or well posed, just necessary to corporate welfare. In-

dustrial problems are seldom selected by the natural evolution of classical scholarship. For example, two applied mathematicians (one originally trained as a chemist) at a pharmaceutical manufacturer include in their suite of problems developing a model of tumor heterogeneity. That problem was posed by the head of their laboratory.

Many mathematicians work either explicitly or implicitly in a consulting environment that can provide a natural flow of problems. Since their clients "may not yet know the real problem, small questions can grow into big problems."

An applied mathematician working with a major computer graphics manufacturer observes that the problems "don't even have to be interesting—just necessary. If a group has hit the wall and their code release is next week, it's a good feeling when they make their deadline because you helped. You can go back to your other work with a sense of satisfaction." This same mathematician observes, "Every week I ask myself 'Is my job secure from what I'm doing? Am I relevant? Am I known by others?'"

In most cases an acceptable solution is a new piece that fits nicely into a larger puzzle that a multidisciplinary team is working to solve. Relevance and quality of fit can determine the solution's value. *Good solutions answer the question that really should have been asked*, and they often are the consequence of deep involvement with problem formulation.

An experienced consultant within a photographic products manufacturer observes that an applied mathematician "must hear the question that's really being asked. You must lead clients to see the real problems, not just dump a quick answer to the first question they ask." Others warn, "Be prepared to ask questions. [Ask the client], 'What do you really want?'" "You must speak to engineers in a variety of disciplines and understand what their problems really are." Communicating the solution to the user is important. External publication, with a few exceptions, is much less highly valued than in academia and may even be restricted by corporate policy.

In crafting a solution, mathematicians cannot be insulated from the competitive requirements of their businesses. Mathematicians "can't look at real world problems with disdain or prefer model problems or not know what their company's business needs are." "Someone has got to pay the bills."

The Working Environment

The working environment ranges from large groups similar in size to university mathematics departments to isolated individuals. In any case much of the work is joint, sometimes in rather large teams. The challenge of teamwork continues throughout a career, in contrast with the personally directed research path a tenured faculty member can choose to follow.

The dictates of teamwork "may mean you have to do what you don't want to do for a while." "You must have tolerance for a range of abilities and the wisdom to navigate the demands of teamwork and a diversity of personalities."

As one experienced woman makes clear, gender can be a factor in collegial relations. "It's tough for women if they are not aggressive. They must make sure people know what they

did. They can't be afraid to say, "That's *my* idea." (But those recommendations appear to apply equally well to men.)

One mathematician's prescription for success describes the realities of a common working environment: "Learn how to work together in teams, have an openness of mind and people skills. Bring in customers and understand what they want, but understand that neither you nor they can know everything." And keep in mind that "there are few people in the world who can do pure mathematics in industry."

Broadly speaking, industrial mathematicians are supported in three ways. (The rare exception is the laboratory with a pure research charter only loosely related to corporate productivity.) They may be part of a staff whose mission is directly linked to the company's product, production cycle, or service. Examples would be a mathematician developing signal processing algorithms for a defense contractor or a statistician responsible for quality control in a manufacturing plant.

The other two modes of support hinge on consulting. Those who function as consultants may be funded either directly from the corporate operating budget, often called funding from overhead, or they may be supported by billing their time to sponsors inside or outside the organization. Regardless of the source of funding and of problems, most industrial mathematicians agree that "being in the middle of the action pays".

In any case mathematics is seldom the dominant technical discipline. At the corporate laboratories of a major, diversified chemical manufacturer, "Mathematics is always in the background. It is never in front with the physical problem. It is never in the limelight."

Differing Values

What the academic may scornfully dismiss as trivial, the industrial mathematician may need to exploit fully. Trivial problems can be important because they allow demonstrations of success and because their solution can build bridges to more important problems. An applied mathematician in the computer industry says, "You need a Mickey Mouse project where you can quantify progress."

Assisting in the solution of easy problems also provides opportunities to train new users, and hence additional advocates, of mathematics. For one internal consultant in a diversified chemical manufacturer, a chemist's request for help with the numerical solution of a system of seven ordinary differential equations was the beginning of a productive relationship that led to more challenging mathematics and significant contributions to profitable products. The easy response for the mathematician would have been "That's trivial. Use one of the packages in the computer center." But that answer would have pushed the chemist back across the disciplinary divide.

Breadth versus Depth

Although industrial employers do rely on narrow expertise, they often want breadth as well. In the pharmaceutical industry

(and certainly elsewhere), "You do need years of experience to develop your craft," but practitioners also need breadth. "Industry wants breadth but relies heavily on narrow expertise as well." Of course, the latter alone is often the measure of mastery in an academic setting.

At a major corporate research laboratory, "The range of disciplines is so broad it doesn't matter what you know. Can you talk to others?" A mathematician who is an internal consultant to a petroleum company says, "I serve as a consultant. I can't specialize."

The size of the group with which the individual associates may determine the relative needs for depth and breadth. Larger groups of mathematicians can usually support a greater number of narrow specialists than smaller groups.

Corporate culture may favor certain disciplines (typically, an engineering discipline) over mathematics. That bias can make the introduction of mathematical approaches quite difficult. A kind of glass ceiling in the management structure may allow to pass those trained in one or two anointed disciplines into leadership roles, but hold back mathematicians. Questions about favoring other disciplines over mathematics might elicit an explanation like, "Nothing replaces the physical background."

There can be significant cultural barriers to introducing individuals trained primarily in mathematics. For example, engineers at a prominent defense contractor tell stories of lost competitive bids and design disasters that cry out for simple analyses and simulation. However, the corporate culture is not ready for mathematics. Facing the strains of the end of the Cold War, management has little interest in gambling on an unproven (and perhaps secretly threatening) discipline.

A cultural gap also separates academic and nonacademic mathematicians. Careers in industrial mathematics are often viewed as less acceptable than academic pursuits. An experienced independent consultant argues, "We may need to nurture attitude changes among ourselves that produce a comprehensive acceptance of a wide range of professional needs, not just those of the academic research mathematician." Another remarked, "My advisor and faculty treated me like I was lost when I decided to go into industry."

A Personal Perspective

My own reactions to this informal but in-depth examination of mathematics outside academia strengthened and refined educational ideas that had begun to develop when consulting first led me to poke my nose under the tent of industrial mathematics. Teaching communication skills—writing, speaking, and listening—is essential. Likewise, interdisciplinary problem solving must be a central component of mathematics education. It needs to be integrated into the daily classroom experiences of our students just as it is part of the daily professional life of the industrial applied mathematician. Perhaps we can gain more converts to the mathematical sciences by letting students solve problems in the "real world" than by delivering sermons to captives in a classroom.

Doctoral Department Retention, Expectations, and Teaching Preparation

Bettye Anne Case and M. Annette Blackwelder

Florida State University

This report is based on two surveys conducted by the Committee on Preparation for College Teaching, a joint Committee of the AMS, the Mathematical Association of America (MAA), and the Society for Industrial and Applied Mathematics (SIAM). The surveys were framed jointly with the AMS-MAA Data Committee and funded partially through the Fund for the Improvement of Postsecondary Education (FIPSE) of the U.S. Department of Education. The first survey was reported in the *Notices*, May/June 1992, pages 412–418.

Introduction

The mathematical sciences community, through departmental efforts and professional society and government agency initiatives, is currently considering many facets of college mathematics teaching. Among these are the current climate and attitudes regarding teaching in doctoral departments, the composition of the group of graduate students, and the retention of members of underrepresented groups in doctoral programs. Studies over many years have shown that the pool of new doctorates in mathematics, which later forms the pool of junior faculty members, does not reflect population patterns [BMS, CBMS, CT, D, NRC]. To improve the effectiveness of teaching for all students, a first step is to examine the need for and availability of role models in the professoriate from various societal groups.

At its inception in 1987, the Joint Committee on Preparation for College Teaching felt that a paradigm of mathematical breadth and teaching-related activities was lacking in doctoral departments. Little information was available about the citizenship, sex, and race characteristics of doctoral students, and there was none about retention. Thus a proposal was made to FIPSE for funding to assist the development of some example programs and the implementation of a two-stage survey of doctoral departments. FIPSE encouraged sequential surveying for evaluation purposes. The first survey was the subject of a previous report in the *Notices* [CB]. Now the Committee is pleased to report here to the mathematical community the only sequential surveys tracking a particular beginning doctoral student cohort to determine retention rates over the critical first two years.

The wider project assisted by FIPSE centered on the development of organized activities late in doctoral work to ease the transition from prefaculty to junior faculty. The activities are designed to encourage graduate students to

engage in career-long learning and self-evaluation in three areas: mathematical knowledge, teaching, and service. FIPSE has supported the initiation of such programs at the University of Cincinnati, Clemson University, Dartmouth College, the University of Delaware, Harvard University, Oregon State University, the University of Tennessee, and Washington University. The project has shifted into publication activities and presentations and will document what these departments have done.

In its early survey of the literature, the Committee found that collected material for pre- and junior faculty about professional development in the three areas cited above was not available. The need for such information was reinforced by the experience of the faculty mentors of the site programs. A book, *You're the Professor, What Next?*, in the "MAA Notes and Reports" series is intended for those soon to enter or having recently entered the professoriate, as well as the senior faculty who serve as their mentors [C, 1994].

The Surveys, Department Groups, and Response Rates

The demographic information reported in the Committee's first survey [see CB] included race, sex, and citizenship characteristics for all doctoral students and, separately, for the cohort who entered their current department in 1990–1991. The second survey determined retention and degrees awarded at the end of their second academic year in the department for the previously reported 1990–1991 entrants. The first survey also included items about what departments expected of students and the departmental teaching climate. These items were expanded and clarified in the second survey, and this report consolidates the information about teaching from the two surveys.

Persistence through the first two years of graduate school is reported with some information about whether those leaving earned a degree. At the end of academic year 1990–1991, the departments in Groups I, II, III (doctoral mathematics departments), and Group Va (doctoral applied mathematics departments) were asked to provide sex, race, and citizenship data both for all graduate students and, separately, for those entering their programs in the calendar year beginning June 1, 1990. Group IV, comprising separate departments of statistics, and Group Vb, comprising departments of operations research

and management science, fell outside the Committee's charge [CT], which focused on mathematics teaching. (See [G] for an explanation of departmental groupings.)

At the end of academic year 1991–1992 the departments were asked to indicate how many of the 1990–1991 entrants remained in their programs in good academic standing. Several departments that did not respond to the first survey took this second opportunity to participate in the retention study and provided data about their 1990–1991 entrants for both time periods. Table 1 shows the number of departments providing demographic information at each phase of the surveying.

Table 1. Responses about retention by departmental group

	Initial Data	Retention Data
Group I	38 of 39	32
Group II	42 of 43	37
Group III	67 of 88	55
Group Va	12 of 17	11
All Groups	159 of 187	135

Departmental expectations are reflected in the preparation that is expected of incoming graduate students and in the nature of preliminary or qualifying examinations for doctoral candidacy. The survey asked about such expectations, in addition to indicators of mathematical breadth, graduate student teaching duties and preparation for those duties, and additional teaching-related activities. Questions about teaching awards and the importance of teaching qualifications in hiring decisions provide some indication of departmental attitudes toward teaching. The overall responses for teaching-related information appear in Table 2; useable responses vary from one item to another.

Table 2. Responses about teaching in doctoral programs

Group I	39 of 39
Group II	43 of 43
Group III	73 of 88
Group Va	12 of 17
All Groups	167 of 187

A number of points should be made about the information on teaching-related activities. The data constitutes virtually a census on many items from Groups I and II due to the high response rates. Some of the departments in Group III are very small or award few Ph.D. degrees [G]. These surveys may have seemed less meaningful to them, decreasing their response rate. Five departments from Group Va did not provide data. Anecdotal information indicates that at least one of those programs is no longer active, but some are known to be strong programs. In some of these seventeen departments, the graduate students do not teach. The intent of this survey may have been misinterpreted in such departments, causing a lack of response. Finally, characteristics are generally reported as percentages in the tables which follow, so they may be applied to the extent that the user has confidence that they project accurately over all the departments of a group.

Precise answers about persistence to the Ph.D. degree would require a long-term tracking project of at least ten years. Despite the abbreviated tracking time, some reliable conclusions are possible. In particular, it is clear—both in the entire doctoral student cohort and in the subgroup tracked through two years—that the numbers of students from the groups underrepresented among mathematicians are too small to achieve balance in the professoriate. The raw baseline numbers about some minorities are so small that giving percentages is misleading. In addition, these findings predict that rates of persistence through graduate school will be lower for underrepresented groups than for white males. The data is not surprising, since it validates prevailing anecdotal information. These figures are sufficient to conclude that the junior faculty a few years hence will not include a significantly higher proportion of underrepresented ethnic groups than now. The findings are a serious concern for faculty who seek to assure an effective professoriate in mathematics.

Two-Year Retention of Doctoral Department Entrants from Academic Year 1990–1991

In 1992 each U.S. doctoral department reported the following information about the group of graduate students entering that department in the calendar year beginning June 1, 1990: degree held at entry, percentage of U.S. citizens, and numbers and percentages of members of underrepresented minorities. The percentages and numbers were also given for all graduate students enrolled in the departments in academic year 1990–1991 [see CB]. The second survey shows (see Table 3) how many of the 1990–1991 entrants remained in the same department or had received a degree from that department at the end of academic year 1991–1992. The degree awarded was not specified on the survey. Since the time period was two years or less, it is likely that most entrants with only bachelor's degrees (Table 4) were awarded master's degrees.

Table 3. Retention in doctoral programs by department groups

	Total Number Reported	Remaining	Awarded Some Degree	Left Without Degree
Group I	922	82%	5%	13%
Group II	756	81%	3%	16%
Group III	923	78%	3%	19%
Group Va	122	74%	6%	20%
All Groups	2723	80%	4%	16%

Degree at Entry into Doctoral Program

The degree held at entry into the doctoral program was recorded, and, unsurprisingly, more entrants holding only bachelor's degrees had left within two years with new degrees (presumably master's degrees) than did those already holding a master's degree. (See Table 4.) In all department groups the percentage remaining in the doctoral program is highest for entrants holding the master's degree.

Table 4. Retention of bachelor's only holders vs. master's holders

	Bachelor's Entrants Reported	Remaining	Awarded Some Degree	Left Without Degree
Group I	671	81%	6%	13%
Group II	529	80%	4%	16%
Group III	674	77%	4%	19%
Group Va	85	71%	8%	21%
All Groups	1959	79%	5%	16%
	Master's Entrants Reported	Remaining	Awarded Some Degree	Left Without Degree
Group I	182	85%	3%	12%
Group II	227	85%	1%	14%
Group III	249	80%	1%	19%
Group Va	37	81%	none	19%
All Groups	695	83%	1%	16%

If the subgroup of U.S. citizens with bachelor's degrees only is compared to that with master's, most trends are similar to the cohort without regard to citizenship, including a higher percentage remaining from master's entrants. The percentages of those dropping out are consistently a bit higher for U.S. citizens, averaging 17.5% rather than 16% as above. The most significant difference is noted in Group Va where 28% of the U.S. citizen students who entered with master's degrees left graduate school without degrees.

Sex of Entrants

The "champagne glass" shape of the graph by age group representing numbers of women studying mathematics is well known [BR, D, L, NRC]. Nearly 50% of the U.S. citizen undergraduate mathematics majors are women. However, the entering graduate student cohort drops to 34% women, and only 22% of new doctorates were awarded to women in 1992 (up slightly from 20% in 1991) for Groups I, II, III, and Va combined. (This is based on the raw data of [D]; see also [G, J].) One also observes even lower percentages of tenured women in prestigious departments [B, HA, HE, S, W]. These are comparisons at a fixed time, hence of different age groups.

Although the percentage of doctorates awarded to U.S. citizen women has not changed much for a number of years, the reported data gives hope that the percentage of women may rise in three to five years: 33% of the entering 1991–1992 U.S. citizen cohort remaining after two years were women, down less than 1% from percentages of women in the entering group.

Whether one looks at the entire group in Table 5 or U.S. citizens only in Table 6, the percentage leaving within two years without a degree is higher for women than for men when all departments are combined. (This casts doubt on the folklore which holds that the greater attrition of women students in doctoral programs is due to the fact that many of them choose to leave graduate school after receiving master's degrees.)

Table 5. Retention of women vs. men

	Women Reported	Remaining	Awarded Some Degree	Left Without Degree
Group I	226	79%	7%	14%
Group II	249	78%	3%	19%
Group III	337	78%	3%	19%
Group Va	37	59%	3%	38%
All Groups	849	78%	4%	18%
	Men Reported	Remaining	Awarded Some Degree	Left Without Degree
Group I	696	83%	4%	13%
Group II	507	83%	3%	14%
Group III	586	77%	4%	19%
Group Va	85	80%	7%	13%
All Groups	1874	81%	4%	15%

Table 6. Retention of U.S. citizen women vs. men

	Women Reported	Remaining	Awarded Some Degree	Left Without Degree
Group I	134	81%	5%	14%
Group II	164	74%	2%	24%
Group III	223	78%	4%	18%
Group Va	22	59%	none	41%
All Groups	543	77%	3%	20%
	Men Reported	Remaining	Awarded Some Degree	Left Without Degree
Group I	381	78%	5%	17%
Group II	301	82%	3%	15%
Group III	342	79%	4%	17%
Group Va	51	78%	8%	14%
All Groups	1075	80%	4%	16%

Percentages by sex were reported earlier for all graduate students and for the 1990–1991 entering cohort [CB]. Using the database of the second survey, the percentages of women in that U.S. citizen entering cohort for Groups I, II, III, and Va were 26%, 35%, 39%, and 30%, respectively. In Group I the two-year retention of women is better than for men, although it may be significant that the entering percentages of U.S. citizen women are lowest in Group I.

The data for Group Va shows a much larger difference between women and men than that for other department groups. Women (U.S. citizen and others) drop out of Group Va programs without a degree at a rate three times that of men. On the other hand, the rate at which men drop out of Group Va departments is lower than the average for all groups. It should be kept in mind that the average number of students in Group Va departments is significantly lower than for Groups I and II, and that the lower response rate for Group Va departments may mean percentages do not project as accurately (see also the section, "The Surveys, Department Groups, and Response Rates," above).

Retention and Citizenship

The national media have often trumpeted the low percentage of U. S. citizens among new doctorates in mathematics, engineering, and the physical sciences. For mathematics these percentages were 45% in 1991 and 44% in 1992. (This is based on the raw data collected for [D].) There is reason to believe that these percentages may soon rise to reflect higher percentages of U.S. citizens in more recent entering classes. The report of the first survey indicated that 56% of all doctoral department students are U.S. citizens [CB], with even higher percentages of entering students. The percentage of U.S. citizens among the 1990–1991 entering cohort after two years is 59%. The retention information of Table 7 shows that rates for *U.S. citizens* and *others* are not as different as anecdotes sometimes imply; the greater numbers of U.S. citizens in the present doctoral cohort, combined with this persistence rate, may mean higher percentages of U.S. citizens among new doctorates in a few years. (A reasonable anecdotal explanation for the higher dropout rate for noncitizens in Group III departments is that some international students come first to those departments and then, with improved English and perhaps U.S. master's degrees, are accepted at Group I or II departments.)

Table 7. Retention of U.S. citizen vs. others

	U.S. Citizens Reported	Remaining	Awarded Some Degree	Left Without Degree
Group I	515	79%	5%	16%
Group II	465	79%	3%	18%
Group III	565	78%	4%	18%
Group Va	73	73%	5%	22%
All Groups	1618	79%	4%	17%
	Other Citizens Reported	Remaining	Awarded Some Degree	Left Without Degree
Group I	407	86%	4%	10%
Group II	290	85%	4%	11%
Group III	358	76%	3%	21%
Group Va	48	75%	6%	19%
All Groups	1103	82%	4%	14%

Underrepresented Minority Doctoral Students among U.S. Citizens

The total numbers of graduate students from some ethnic minority groups are so small that analysis is difficult. For a more complete discussion of the reported ethnic minority students among all graduate students of 1990–1991 see [CB]. For the first survey a total of 4677 graduate students were counted in 143 doctoral departments. Of this total only 344 were from the following underrepresented minority groups: Black (African American), 134; American Indian, Eskimo, Aleut (Native American), 11; Mexican American, Puerto Rican, other Hispanic (Hispanic), 199.

Since anecdotal evidence indicated that members of these three ethnic minority groups dropped out more often than other graduate students (white, Asian, and unclassified race),

the retention data was compared (See Table 8.) When the rates for the department groups are examined separately, however, minority drop out rates appear higher than that for other students in Groups II and III and lower in I and Va. (Again, it is suggested that the information above about rates of response and the useable responses on these items be kept in mind.) Of course it is not possible to project persistence to the doctorate on the basis of this two-year retention information, but the raw numbers of new doctorates in 1991 (eleven) and 1992 (eight) are interesting to note [D] because the reporting departments indicate about seventy individuals of the 1990–1991 entering cohort remained in programs after two years. (There is no information available about entering numbers when the current individuals awarded new doctorates, totaling nineteen, began their studies.)

Table 8. U.S. citizens leaving doctoral programs without a degree

	Group I	Group II	Group III	Group Va	All Groups
Total Combined Minority*	23	30	40	9	102
Remaining	83%	67%	65%	78%	71%
Awarded some degree	4%	none	3%	11%	3%
Left without degree	13%	33%	32%	11%	26%
Left without degree Other**	16%	17%	17%	24%	17%
Useable Responses	32 of 39	37 of 43	55 of 88	11 of 17	135 of 187

*African American, Native Americans, or Hispanic.

**Asian and Other (includes white; does not include Unknown Race).

Since there are so few students in the entering 1990–1991 graduate cohort from each of the three underrepresented minority groups, the reports retaining the breakdowns by degree at entry and sex are given in Tables 9, 10, and 11. The useable responses on this item for Groups I, II, III, and Va are, respectively, 31, 37, 55, and 11.

Table 9. African American entrants to doctoral departments during academic 1990-1991:

	Number by June 1992 (remaining; awarded some degree; left, no degree)			
	Men Bachelor's Only	Men Master's	Women Bachelor's Only	Women Master's
Group I	(5,0,0)	(1,0,1)	(3,1,0)	none
Group II	(5,0,3)	(2,0,0)	(4,0,3)	none
Group III	(8,0,6)	(8,0,0)	(4,0,1)	(1,0,2)
Group Va	(2,0,1)	none	none	none
All Groups (20,0,10)	(11,0,1)	(11,1,4)	(1,0,2)	

Table 10. Native American entrants to doctoral departments during academic 1990-1991:

Number by June 1992
(remaining; awarded some degree; left, no degree)

	Men		Women	
	Bachelor's Only	Men Master's	Bachelor's Only	Women Master's
Group I	none	none	none	none
Group II	(0,0,1)	(1,0,0)	(1,0,0)	none
Group III	none	none	(1,0,0)	(1,0,0)
Group Va	none	none	none	none
All Groups	(0,0,1)	(1,0,0)	(2,0,0)	(1,0,0)

Table 11. Hispanic entrants to doctoral departments during academic 1990-1991:

Number by June 1992
(remaining; awarded some degree; left, no degree)

	Men		Women	
	Bachelor's Only	Men Master's	Bachelor's Only	Women Master's
Group I	(5,0,1)	(2,0,0)	(2,0,1)	none
Group II	(4,0,2)	(2,0,1)	(1,0,0)	none
Group III	(1,1,2)	(1,0,1)	(1,0,1)	none
Group Va	(3,1,0)	(1,0,0)	(1,0,0)	none
All Groups	(13,2,5)	(6,0,2)	(5,0,2)	none

Academic Expectations and the Teaching Climate

On each survey, departments provided information about entrance and candidacy requirements. From these, departments with two or more separately structured doctoral programs may be identified. Other items report mathematical breadth in doctoral programs, specific preparation for teaching, and some indicators of the departmental climate regarding teaching. Where the first survey revealed a need, items were clarified; some identical items remained. On a few items it is interesting to compare the results from the surveys, although neither the time interval nor the differences noted are large enough to reliably indicate trends.

Departmental Options and Requirements

A number of the Group I, II, and III departments have two or more distinct doctoral programs or options. The reported programs are rather generally classified here as (traditional) *mathematics*, *applied mathematics*, or *collegiate mathematics education*. The existence of distinct programs is implied when a department reports two or more options by either differing entrance expectations or differing doctoral preliminary or qualifying examinations. Useable responses for the purpose of reporting special program options by department groups were: I (31 of 39), II (38 of 43), and III (69 of 88).

Some Group I, II, III, and Va departments list doctoral program options in *statistics*. Since the Departments of Statistics (Group IV) are not included because of the charge to the Committee, options denoted statistics alone are not compiled. (See [CT] and [G].) In doctoral departments of mathematics or applied mathematics which include statisticians, statistics

sometimes appears as a program option jointly with another topic (e.g., applied mathematics and statistics) or as one topic which may be tested on the preliminary examination for either traditional or applied mathematics options.

As expected most departments in Groups I, II, and III report what may be termed a traditional (or pure) mathematics program; the five exceptions are among the smaller doctoral programs in Group III. (See the *Notices* articles referenced in [G].) Among the programs classified as traditional, some include applied mathematics or statistics as one of several testing areas which may be selected for preliminary or qualifying examinations. The next most frequently observed separate programs usually have titles including the terms "applied" or "numerical" mathematics, and they show similarities to programs of Group Va departments. A total of twenty-five departments report that such programs have different entrance expectations, different preliminary examinations, or both. (See Table 12.) The information about these options is shown as an added group called Applied Options (AO) in some subsequent tables.

Table 12. Numbers of Group I, II, and III departments with applied mathematics options (AO) similar to Group Va programs

	I	II	III
different entrance expectations only are reported	2	5	4
different preliminary examinations only are reported	2	0	1
different entrance expectations and examinations are reported	0	6	5

Recent publications about doctoral programs indicate there are programs (or perhaps options within departments) which emphasize collegiate mathematics teaching [BMS; also see CBMS]. In the survey returns, three departments indicate such programs: one department each in Groups II and III which also have a traditional program; and one from the smaller programs of Group III which does not list a traditional program. These programs are titled "Undergraduate Mathematics Pedagogy" or "Mathematics Education". In light of the [BMS] report more such programs would be expected to have been reported. There are probably a few other such programs among reporting departments which were not specified (one is known anecdotally), and there may be departments with such programs among those which did not respond to the survey. The total number of such programs is very small.

Entrance Expectations. The opportunity was provided to report uniform entry recommendations or requirements for the department or to give separate sets of recommendations for various program options. Undergraduate advisors will want to use this information carefully so that students keep many possibilities open [CU]. The two collegiate mathematics education programs in departments which also have traditional mathematics programs indicate that the entrance expectations are similar or identical to the traditional program.

The list of undergraduate courses was clarified after the first survey. The second survey asked, for specific courses listed below, the following two questions, each with a yes/no option:

- Are there courses beyond multivariable calculus that you strongly recommend for students before entering your doctoral program(s)?
- Are students who have not taken these courses allowed or expected to take (“make up”) these courses after admission to your program(s)?

An analysis follows by course, and some conventions and abbreviations will be used. Since the variation appears significant between department groups and types of options, overall percentages (averages) are not given.

Recommended Undergraduate Preparation

SR: Strongly Recommended. Note: A possible misinterpretation may involve timing; the item specifies “SR before entering” but some departments marking “not” SR may require make up for accepted students who do not have it.

MU: Make Up enrollment. Note: Some possible misinterpretation on this item may have occurred; some departments marked “yes” to mean that these are the courses for which make up is *required* (while make up might be allowed on others).

AO: The Groups I, II, and III departments reporting applied program options similar to those of Group Va.

(x, y, z, u, v): A characteristic (such as percentage of SR responses) is given for, respectively, the departments of Groups I, II, III, Va, AO.

Real Analysis I (Adv. Cal. I) (38,43,66,12,22): SR for all of Groups I, II, III and AO; SR for 92% of Group Va. MU (61%, 79%, 77%, 62%, 100%).

Real Analysis II (Adv. Cal. II) (37,43,63,12,19): SR: (95%, 91%, 92%, 75%, 74%). MU: (74%, 91%, 89%, 67%, 100%).

Modern Algebra I (38,42,62,8,17): SR for almost all of Groups I, II, and III with MU, respectively, 63%, 71%, 80%. SR for half of the applied programs for Groups Va and AO; MU for all.

◇ Perhaps a trend is developing toward the necessity in undergraduate preparation for both Real Analysis and Modern Algebra: several more departments strongly recommend them and fewer permit make up than in the earlier reporting.

Linear Algebra I (29,39,59,11,22): SR in almost all programs with lower make up rates in Groups I, II, III (32%, 54%, 53%) than in the applied programs for Groups Va, AO (75%, 73%).

Linear Algebra II (21,32,41,6,15): Many more departments marked neither yes or no on this topic than those above. SR: (62%, 53%, 49%, 50%, 67%); MU: (44%, 87%, 68%, 100%, 100%).

Ordinary Differential Equations (27,34,55,10,21): SR: (81%, 67%, 62%, 90%, 95%). MU: (50%, 74%, 66%, 33%, 80%).

Complex Variables (27,36,53,9,17): (74%, 47%, 49%, 78%, 71%). Groups I and Va schools are less likely to allow make up. MU: (69%, 93%, 95%, 60%, 100%).

◇ For both Ordinary Differential Equations and Complex Variables the general pattern of SR and MU is similar, with most

Group I, Va, and AO schools SR and fewer Group I and Va schools allowing MU.

Partial Differential Equations (21,30,48,7,20): SR: (29%, 37%, 15%, 86%, 90%); MU: (60%, 91%, 100%, 80%, 100%).

Topology or Geometry (28,35,53,4,14): SR: (71%, 46%, 49%, none, 29%); MU: (80%, 93%, 100%, N/A, 100%).

Numerical Analysis (25,29,50,10,21): SR: (4%, 13%, 24%, 90%, 90%). MU is permitted in most cases.

Probability and Statistics (30,33,57,9,18): SR: (13%, 9%, 28%, 77%, 72%); MU: (75%, 100%, 100%, 80%, 89%).

◇ For both probability and statistics and numerical analysis there is a clearly heightened importance in applied programs.

Other: An open question was asked to determine other Strongly Recommended courses. Only six departments responded at all on this line. One, which could not be entered as a useable response for any of the above courses, said “at least six mathematics courses beyond Calculus III”. Two listed computer science, one listed combinatorics, and two included discrete mathematics topics with statistics or programming.

Preliminary or Qualifying Examinations. These items were carefully reworked after the first survey. The simply stated questions of the first survey were not sufficient to reflect the varied and complex formats that exist. Examinations given in two stages, for example, could not be adequately described on the first survey. The new items were:

- **Format:** (oral and written, oral only, written only)
- **Timing:** (Usually completed no more than — years after admission as a graduate student.)
- **Content:** (All students write the same exam which covers (list areas); Students have some choice of areas (describe).)

On the second survey departments were asked to provide information separately for program options (e.g., traditional and applied mathematics). The variety of structure and content formats reflected in this more complete information does not lend itself easily to consolidation with information from the first survey. Useable data was reported for Groups I, II, III, Va, and AO from, respectively, 30, 36, 53, 9, and 14 departments. (See Table 12 and the discussion preceding it about the AO programs within Group I, II, and III departments.)

Examination Format: Twenty formats were reported of the possible combinations of one- or two-stage exams, either or both of which may be written or oral or a combination of the two, and with a choice of topics or fixed content. Five formats were most reported, totaling 90 of the 142 useable responses. With numbers of reportings these are as follows:

Two-stage: written with choice, then oral with choice (28)

Two-stage: written with fixed content, then oral with choice (22)

One-stage: written with choice (15)

Two stage: written with fixed content, then oral and written with choice (13)

One stage: written with fixed content (12)

How many departments reported one-stage exams and how many two-stage? Group I, II, III departments split, respectively, 12–18, 8–28, 19–34. Only two Group Va departments

reported one-stage exams, and one of those was composed of both oral and written parts. AO programs split 6–8. Generally the second stage of examination is likely to be closely related to the research area.

Examination Content: The majority of departments permit some student choice of areas. For one-stage exams, 18 of 47 departments report fixed content. For two-stage exams, 91 of 95 allow a choice of area, though about 40 of these may have a first-stage with no choice. Almost all Group Va and AO exams involve topic choice. It should be noted that many traditional programs specify a choice of areas which includes applied mathematics or statistics in addition to real and complex analysis, algebra, topology, and geometry. In applied departments or program options, mastery of traditional areas at an upper division undergraduate level, particularly for analysis or algebra, is often implied and is sometimes stated. Topics reported are analysis, algebra, numerical analysis, methods of applied mathematics, probability, and, less frequently, differential equations, fluid dynamics, operations research, mathematical ecology, and computer science.

Timing of Examinations: For each group of departments, one-stage exams are most frequently given two or three years after admission, although the range of reports was one to five years. The most frequent time for the first of two-stage exams is after two years, though after one and three years is not unusual. The second of two-stage exams is most often given after the third or fourth year, with a range of second through fifth years.

Breadth of Mathematical Preparation. The earlier recommendations of the Committee on Preparation for College Teaching [CT] say that each graduate student, regardless of employment aims, should become familiar with a wide range of mathematical topics. Furthermore, the Committee believes that the responsibility for assuring this breadth lies with doctoral departments [CT, p.1344]. A later report, which resulted from a conference on graduate education, states, "A Ph.D. program to prepare for college teaching would stress broadly based scholarship rather than narrowly focused research. . ."[CBMS]. Another report places responsibility for these goals jointly on graduate and undergraduate departments [CU, p.4,18, 20].

After the first survey, specificity was added to the item on breadth. Respondents were asked to indicate aspects of their doctoral programs that support a goal of mathematical breadth. About 80% of Group I, II, and III departments, and 50% of Group Va, indicated that they supported this goal through breadth of required courses in the department.

A collection of courses called a *minor* is required in about 30% of Group I and II departments, 15% of Group III departments, and, a much higher, 60% of Group Va departments. A required minor outside the department is most common in Group Va. In Groups I, II, and III a minor is most often a concentration in an area other than the research area within the department or else there is choice of minor area within or outside of mathematics.

An open item asking for other breadth requirements elicited few responses beyond mention of preliminary examinations,

language examinations, or courses which that particular department considers nonstandard but which are routinely reported in a number of similar departments. Another item of the survey was designed to show various activities which provide special preparation for college teaching. One of the options under this item was, "Talks in topical mathematical seminars where breadth is the intent." This activity was reported in Groups I, II, III, and Va by, respectively, 52%, 37%, 47%, and 20%. There were a few other useful suggestions:

- After the qualifying exam is passed, a survey paper on an approved subject is required within a three-week time period.
- Students in mathematical research groups interacting with other departments are encouraged to participate in joint activities with those departments.
- Students are required to attend colloquia.
- An internship is required in government or an industrial research laboratory; there is a required computer project.
- A minor oral in the form of a one-hour talk on a topic outside the area of the dissertation is required.

Factors Related to Teaching

The Committee believes that many activities and attitudes which make up the general environment and scientific life of a doctoral department influence students when they become junior faculty. Actual teaching duties are a direct influence, so the survey asked about orientation, training, duties, and supervision of Teaching Assistants (TAs). Even in departments where graduate students do not have teaching assignments, there are many opportunities for the faculty to help them prepare for future academic careers. (See also [BMS, BR, [C,1994], CH, CBMS, CT].) Since a wide variety of different activities were reported on the open questions of the first survey, a special attempt was made in modifying the second survey items to prompt respondents to indicate those activities while retaining the open item. Two items were included as indirect indicators of the teaching climate: awards to faculty and/or TAs and the importance of teaching qualifications in the department's postdoctoral and other junior faculty appointments.

Teaching Assistants. The training, monitoring, and duties of graduate students who are involved in teaching-related activities were reported on two items of each survey. Some of the items are similar, and, for those, combined data can be presented (e.g., first survey data was retrieved for a few departments which did not respond to the second). On other items the clarifications in wording lead to a more accurate picture, especially for the Group Va departments. The combined data is almost a census of active doctoral programs, with 167 useable responses of 187 potential respondents.

First, departments had the opportunity to indicate whether graduate students involved in these activities are designated as TAs or by a similar title. Only six departments of 167 reported that they do not have this designation. Of those six, four went on to indicate specific teaching-related duties of their graduate students. (Three are in Group Va and are likely of the model where financial aid is termed a fellowship, but there are some

duties.) Of the two departments reporting no TAs and no duties, one is a graduate department associated with a consortium of undergraduate colleges. For such departments anecdotal information indicates that graduate students often teach in the associated undergraduate colleges; the employment is similar to that of a part-time or adjunct instructor.

There is a significant increase in some teaching preparation and monitoring activities since the mid-1980s; this is documented by a previous survey of departments in Groups I, II, and III [C,1984]. It may be significant to note that on the first of the two present surveys (1991) the percentages reporting faculty observations of TAs (81%, 83%, and 72% for Groups I, II, and III, respectively) were somewhat higher than the combined 1991–1992 data. (Anecdotally, it is reported that current economic problems in departments have caused cutbacks on this and other desirable activities.) For Group Va departments there is no information from the 1980s; on the present surveys, 67% report orientations, 56% report faculty observations of TAs, and all report necessary English language training.

Table 13. Percentage of departments reporting teaching assistant orientation programs

	Group I	Group II	Group III
This report	92%	95%	86%
1987 [C, 1989, p. 37]	79%	86%	76%
1985 [C, 1989, p. 37]	66%	88%	64%

Table 14. Percentage of departments reporting English language training when necessary

	Group I	Group II	Group III
This report	100%	95%	76%
1987 [C, 1989, p. 36]	72%	70%	71%
1985 [C, 1989, p. 36]	60%	71%	68%

Table 15. Percentage of departments reporting faculty observations of teaching assistants

	Group I	Group II	Group III
This report	74%	83%	67%
1987 [C, 1989, p. 38]	62%	67%	67%

Table 16. TA duties and activities (see also Tables 13, 14 and 15)

	Group I	Group II	Group III	Group Va	All Groups
Undergraduate teaching:					
Teach own class	82%	90%	86%	33%	82%
Problem sections for faculty lectures	87%	83%	58%	67%	72%
Tutorial sessions	63%	55%	51%	67%	56%
Computer or tutoring laboratories	32%	45%	53%	42%	45%
Substituting	21%	33%	31%	33%	29%
Evaluation methods:					
Videotaping	55%	48%	29%	22%	40%
Student evaluations	89%	90%	88%	78%	88%
Peer observations	26%	35%	17%	none	23%
Grading	92%	95%	96%	92%	94%
Examination design	58%	58%	60%	25%	56%

Doctoral students are assigned to teach undergraduate courses with varying amounts of responsibility and supervision. Four such levels were identified on the survey, and departments indicated a fifth activity, that of occasional substitute teaching for professors; these are reported in Table 16. Sometimes there are departmental examinations in courses at or below the calculus level; an item, “participating in examination design,” shown in Table 16 was intended to elicit evidence of graduate student participation in making such examinations or in a formal discussion of test design.

Preparation for Future Professorial Responsibilities. One item was provided to elicit information about additional activities which prepare advanced graduate students for the role of college professor. The first option on this item was “nothing further”, and only 15% checked this. The option “activities through other departments to enhance teaching abilities” (e.g., courses in mathematics education) was reported in only 7% of the departments. Mathematical talks given by doctoral students are a common activity, reported by 80% of the departments. Some talks are specifically designed to provide mathematical breadth for the audience and are reported above. Other talks are given in disciplinary research seminars. A professional seminar of the type recommended by the Committee on Preparation for College Teaching [CT] and assisted through the Committee’s project [C,1994] explicitly provides an organized set of such activities. In addition to the eight project sites, fourteen departments report such seminars; these are somewhat more frequent in Group I departments.

Teaching Awards. There are university-wide and departmental awards reported for faculty and for TAs, with some departments reporting both kinds of awards. The existence of such awards can be an incentive to graduate students who teach. They may also be indicators to graduate students of the general interest in and importance of teaching in the institution and department. In the case of university-wide awards there is generally no assurance that any recipients will be from mathematics. The reporting is shown in Table 17.

Table 17. Teaching Awards

	Group I	Group II	Group III	Group Va	All Groups
For TAs	71%	85%	47%	67%	64%
For faculty	71%	80%	82%	58%	77%

The Importance of Teaching when Faculty are Hired. An identical item on each survey was intended to provide some indication about the weight departments place on teaching activities. The item asked, “In the view of your department chair, how important was evidence of teaching preparation and experience during graduate school in the decisions which led to appointment of entry-level assistant professors during the last three years?” Because this item is an opinion of an individual, it is reasonable to expect in some cases a significant change in reporting when a new department chair is elected or appointed. For the 119

departments responding to this item on both surveys, about half did change their responses. More of the changes were toward greater importance attached to teaching when hiring new faculty. The percentages of those who changed in their answers indicating {more,less} for Groups I, II, III, and Va were ({35%,19%},{40%,20%},{27%,22%},{29%,14%}).

A scale from 1 (not important) through 5 (very important) was provided. The time interval between the surveys was too small to expect that a trend could be perceived. For the two surveys the total number of departments responding on this item is 156. When the data is combined (using the second survey when both were useable) the responses by Groups I, II, III, and Va, and over all departments were, respectively, 2.9, 3.5, 3.8, 2.9, 3.5. See Figure 1.

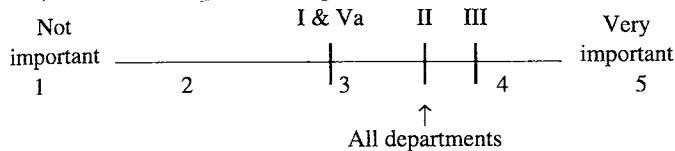


Figure 1: Importance of teaching in hiring decisions, by department groups.

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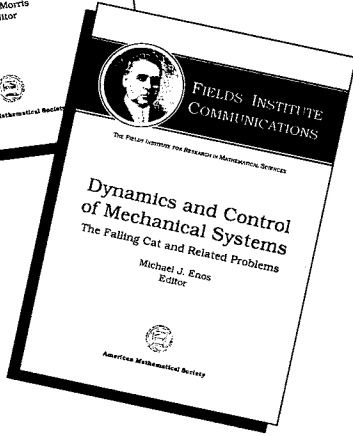
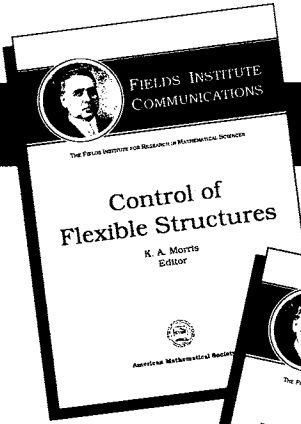
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1993 AMS Election Special Section

In an effort to increase the number of ballots returned in the election process, the Society now includes in the *Notices* all the pertinent election material, including biographies and statements of the candidates, in the upcoming election. The information below is provided in order to assist the members in filling out the ballots that will soon be mailed. The officers of the Society encourage the members to return ballots.

Positions to be filled in contested elections this year are:

President-Elect (one to be elected)

Vice-President (one to be elected)

Member-at-large of the Council (five to be elected)

Trustee (one to be elected)

Member of the Nominating Committee (three to be elected)

Member of the Editorial Boards Committee (two to be elected)

The Council has nominated two candidates for the position of President-Elect. One of these candidates, Hyman Bass or Cathleen Morawetz, will accede to the presidency after serving one year as President-Elect. In addition to biographical information and candidate statements, you will find an article about each candidate—a “nomination” article. This article is intended to inform you, the voter, about the mathematical accomplishments of each of the candidates.

Amendments to the Bylaws also appear on the 1993 ballot, and the text of the changes is included in this section.

I urge you to study the material printed in this section. More importantly, I urge you to look for the ballot that will arrive shortly in the mail and to return a completed ballot. In recent elections, only 18% of the members participated. I hope this figure can be greatly increased.

Robert Fossum
Secretary

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Nominations for President-Elect

Nomination for Hyman Bass

John Milnor

SUNY Stony Brook

It gives me great pleasure to nominate Hyman Bass for the presidency of the American Mathematical Society. Hy's mathematical creativity and expository skill, combined with wide experience in service to the mathematical community, have prepared him extremely well for such a position.

I have known Hy for many years, since he was an undergraduate and I was a very junior faculty member at Princeton University. My outline of some part of his mathematical work will inevitably be heavily weighted towards those parts of his work where I was actively involved, usually as a consumer of the algebraic tools which he developed, but sometimes as a collaborator.

His early work was motivated by the analogy between vector bundles over a topological space and projective modules over a ring. He was particularly interested in Serre's conjecture* that any projective module over a polynomial algebra $k[t_1, \dots, t_n]$ must necessarily be free. Toward this end, he made detailed studies of projective modules and their automorphisms.

This work found application in the developing field of algebraic K-theory. To any associative ring A there is associated an additive group K_0A with one generator $[P]$ for each isomorphism class of finitely generated projective modules P and with relations

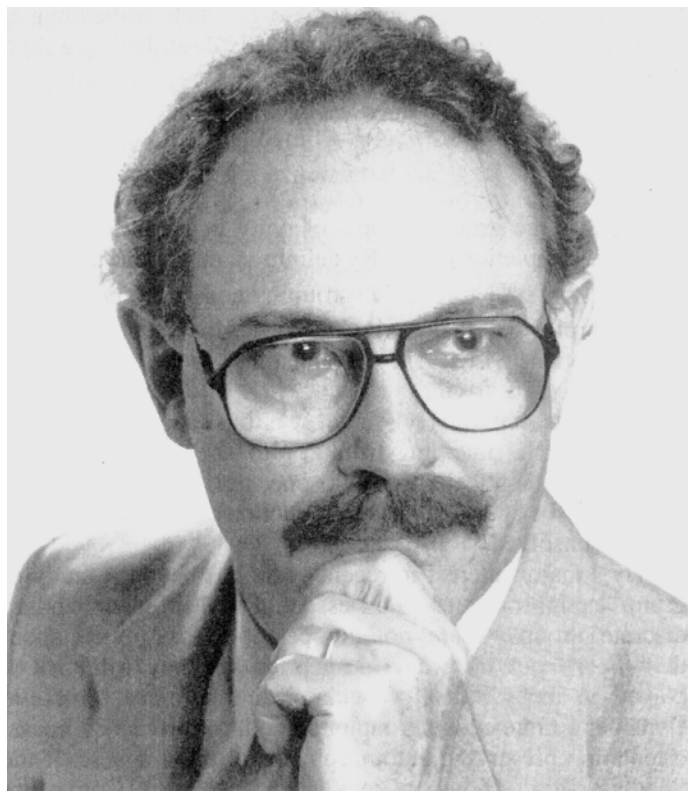
$$[P] + [Q] = [P \oplus Q].$$

(This construction is essentially due to Grothendieck.) In fact, if A is commutative, then K_0A is a commutative ring with product

$$[P][Q] = [P \otimes Q].$$

Bass developed an analogous group K_1A which can be defined briefly as the direct limit $\lim_{n \rightarrow \infty} GL(n, A)$ modulo commutators. The rich theory which results from the interaction between K_0 and K_1 is thoroughly developed in his book *Algebraic K-Theory*.

This work had immediate applications to geometric topology. For example, if $A = \mathbb{Z}\Pi$ is an integral group ring, then



Hyman Bass

$K_1\mathbb{Z}\Pi$ is closely related to Henry Whitehead's theory of torsion for maps between CW -complexes with fundamental group Π . Hy's computation of $(K_1\mathbb{Z}\Pi) \otimes \mathbb{Q}$ for an arbitrary finite group Π provided a sound algebraic foundation for this theory. With the S -cobordism theorem, this became an essential tool also in differential topology.

Similarly, the group $K_0\mathbb{Z}\Pi$ provided a home for Terry Wall's obstruction to the finiteness of a CW -complex with fundamental group Π , and also to Larry Siebenmann's obstruction to fitting a boundary onto an open manifold. As another direct application of these algebraic tools, Hy studied Wall's surgery obstruction groups.

The field of algebraic K -theory, which Bass helped to found, matured with Quillen's introduction of higher groups

*Proved many years later by Quillen and by Suslin.

$K_n A$ and of methods for dealing with them. This study has found rich applications, not only in geometric topology, but also in number theory, algebraic geometry, and in functional analysis.

I collaborated actively with Hy, and later also with Jean-Pierre Serre, on the Congruence Subgroup Problem. It was a wonderful experience to deal with such skilled coworkers, who could immediately bring powerful algebraic tools to flesh out any ideas I might have. To illustrate the Congruence Subgroup Problem, let A be the ring of integers in an algebraic number field. Does every homomorphism from $SL(n, A)$ to a finite group factor through the projection to $SL(n, A/I)$ for some ideal $I \neq 0$? For $n = 2$ this was well known to be false. For $n \geq 3$ we were able to show that it is true if and only if A can be embedded in the real numbers. In the “totally imaginary” case where no such embedding is possible, the obstruction can be explicitly described by a short exact sequence

$$1 \rightarrow \mu_A \xrightarrow{i} \widehat{SL}(n, A) \rightarrow \varprojlim_I SL(n, A/I) \rightarrow 1.$$

Here μ_A is the group of roots of unity in A , and \widehat{SL} is the profinite completion of SL . By definition, any homomorphism $\varphi: \widehat{SL}(n, A) \rightarrow \Pi$ to a finite group extends canonically to a homomorphism $\widehat{\varphi}: \widehat{SL}(n, A) \rightarrow \Pi$. Then φ factors through some quotient $SL(n, A/I)$ if and only if the composition $\widehat{\varphi} \circ i: \mu_A \rightarrow \Pi$ is trivial.

Another focus of Hy’s interest is the Jacobian Problem. If a polynomial mapping from \mathbb{C}^n to itself has a Jacobian determinant identically equal to one, must it necessarily be invertible? In spite of various reductions of the problem, it remains unsolved.

Hy’s major interest in recent years has been the study of groups acting on trees as an essential tool in understanding discrete groups. I am not competent to say much about this theory but do want to mention the key role that it played in the solution of a classical topological problem. Consider a finite cyclic group of smooth (or piecewise linear) orientation preserving automorphisms of the 3-sphere. If the fixed point set is nonvacuous, then the Smith Conjecture asserts that it must be an unknotted circle. The proof, in a volume edited by Bass and Morgan, involved a large constellation of topologists and geometers. In one key case, in order to analyze the possible knot types which might occur, Thurston’s hyperbolization methods were employed to reduce to a problem in Kleinian groups. Here Hy’s detailed analysis of finitely generated subgroups of $GL(2, \mathbb{C})$ played a decisive role.

In these difficult times, with funding for mathematics under sharp attack, it is essential for the American Mathematical Society to have an articulate and experienced spokesman. Hy knows the mathematical and scientific world well. He has served the AMS as Vice-President and as a member of the Executive Committee and numerous other committees. He has been chairman, both of the Board of Trustees and of the Science Advisory Council, for the Mathematical Sciences

Research Institute in Berkeley. He has also served as editor on six different mathematics journals and has been active in organisations as diverse as the Sociétés des collaborateurs de N. Bourbaki, the American Association for the Advancement of Science, the National Research Council, and the National Academy of Sciences. He is experienced, responsible, works well with people, and would make an ideal president for the AMS.

Nomination for Cathleen S. Morawetz

*Andrew J. Majda
Princeton University*

It is a pleasure, as well as a special honor, for me to place Cathleen Morawetz’s name in nomination for the presidency of the American Mathematical Society. Morawetz is one of the leading mathematicians working at the interface of mathematics and its applications. She has discovered and proved deep theorems about partial differential equations, and these results have found significant applications in aerodynamics, acoustics, and optics.



Cathleen S. Morawetz (Photo courtesy of James Hamilton)

Cathleen is a remarkable person with great energy, wisdom, a large dose of common sense, and great love for both mathematics and its applications. She is an enormously positive influence for my generation of mathematicians interested in applications, both through her research and her openness in sharing interesting scientific ideas with young postdocs and visitors. I first met her in the fall of 1973 at the beginning

of the two years I spent as a postdoc at the Courant Institute after receiving my degree in pure mathematics at Stanford. My interests in the fascinating interplay between mathematics and its applications were nurtured through friendly scientific discussion in Courant's 13th floor lounge with Cathleen, as well as Peter Lax and Joe Keller—this opportunity has been the most significant influence in my own scientific career. While at Courant I learned that Cathleen is the daughter of a well-known mathematician and the great-niece of a famous Irish playwright. She is married to a notable polymer chemist and, in addition to her active scientific career, has raised three daughters and a son, now a psychiatrist, a law professor, a corporate vice-president, and a union expert on occupational safety hazards, respectively. Her current summer hobby is sailing and teaching her grandsons to sail on Lake Muskoka in Canada.

In a series of three significant papers in the late 1950s, Cathleen Morawetz used functional analysis coupled with ingenious new estimates for an equation of mixed type, i.e., with both elliptic and hyperbolic regions, to prove a striking new theorem for boundary value problems for partial differential equations. This theorem was motivated by applications and leads to a startling practical prediction. Namely, if one starts with a smooth, steady irrotational flow around an aerodynamic profile like an air wing, then in general, if one changes the shape of the profile slightly, there cannot be a smooth, steady transonic flow around the perturbed profile. Morawetz's predictions have been confirmed subsequently through both actual experiments and careful numerical simulation which indicate the appearance of shock waves in the flow past the perturbed profile. Morawetz's paper in the *Bulletin* from 1982, which is based on her 1981 Gibbs lecture, is a wonderful discussion of this work and subsequent developments.

Beginning in the 1960s Cathleen studied the scattering of sound waves or electromagnetic waves from obstacles. These problems involve solutions of the linear wave equation in the exterior of a region with Dirichlet boundary conditions. While the total energy of solutions is conserved in time, Peter Lax and Ralph Phillips gave a beautiful proof that the local energy of solutions in any bounded set must necessarily decay with time for an arbitrary smooth obstacle due to the radiation of waves to infinity. Furthermore, it was conjectured that, for boundaries with a sufficiently simple geometric shape, the local energy in a solution should decay exponentially.

Morawetz attacked this problem in a series of important papers from the 1960s. Through new nonstandard energy identities which she developed, Morawetz proved the first results on exponential decay of local energy for solutions in the exterior of star-shaped bodies.

Cathleen developed these new identities by exploiting the Lorentz invariance and conformal invariance of solutions of the wave equation; these papers pioneer an approach to hyperbolic equations which systematically exploits the underlying symmetry groups to derive estimates. In the early 1970s she continued to develop and utilize such ideas in her collaboration with Walter Strauss on scattering theory for nonlinear wave equations. Recently, Christodoulou, Klainerman, Machedon, and Shatah, among others, have utilized refined ideas exploiting such invariance principles to prove deep theorems about the Einstein equations of general relativity as well as other nonlinear hyperbolic equations. After the flourishing of microlocal analysis in the early 1970s, Cathleen collaborated with Jim Ralston and Walter Strauss in 1977 to generalize significantly the geometric conditions on the shape of the boundary guaranteeing exponential decay. This work inspired Melrose and Sjostrand to develop essentially necessary and sufficient geometric conditions on the obstacle to guarantee local exponential decay of energy.

Morawetz's research efforts in the 1980s and 1990s have focused once again on important problems involving shock waves and transonic flow. With the striking new ideas from nonlinear functional analysis developed by Tartar and Diperna involving compensated compactness, she succeeded, with some restrictions, in proving the first general existence theorem for transonic flow with shocks in 1985. Her current and very active research interests involve explaining von Neumann's paradox regarding the diffraction of weak shock waves from boundaries.

Cathleen Morawetz is a rarity among mathematicians because her opinions, advice, and judgment are widely sought in the larger circles of society beyond mathematics. Besides her numerous professional activities, she has extensive service on the board of trustees of a major corporation (NCR), a major university (Princeton), and a major charitable foundation (Sloan). These are difficult and uncertain times for the mathematics community. In my opinion Cathleen Morawetz has the versatility, expertise, experience, and vision needed to lead the Society in the years ahead.

Biographies of Candidates

1993

Biographical information about the candidates has been verified by the candidates, although in a few instances prior travel arrangements of the candidate at the time of assembly of the information made communication difficult or impossible. A candidate had the opportunity to make a statement of not more than 200 words on any subject matter without restriction and to list up to five of her or his research papers.

Abbreviations: American Association for the Advancement of Science (AAAS); American Mathematical Society (AMS); American Statistical Association (ASA); Association for Computing Machinery (ACM); Association for Symbolic Logic (ASL); Association for Women in Mathematics (AWM); Canadian Mathematical Society, Société Mathématique du Canada (CMS); Conference Board of the Mathematical Sciences (CBMS); Institute of Mathematical Statistics (IMS); International Mathematical Union (IMU); London Mathematical Society (LMS); Mathematical Association of America (MAA); National Academy of Sciences (NAS); National Academy of Sciences/National Research Council (NAS/NRC); National Aeronautics and Space Administration (NASA); National Council of Teachers of Mathematics (NCTM); National Science Foundation (NSF); Operations Research Society of America (ORSA); Society for Industrial and Applied Mathematics (SIAM); The Institute of Management Sciences (TIMS).

An (*) indicates the individual was nominated in response to a petition.

President-Elect

Hyman Bass

Adrain Professor, Columbia University.

Born: October 5, 1932, Houston, Texas.

Ph.D.: University of Chicago, 1959.

Offices: Member-at-Large of the Council, 1969–1971; Vice-President, 1980–1981.

AMS Committees: Organizing Committee for the Symposium on Applications of Categorical Algebra, April 1968; Committee on Publication Problems, 1977; Nominating Committee, 1977–1978; Committee to Select Hour Speakers for Eastern Sectional Meetings, 1977–1983 (Chair, 1983); Committee on Science Policy, 1981–1990; *Bulletin* (New Series) Editorial Committee, 1982–1986 (Associate Editor, Research-Expository Articles, 1982–1984 and Chair, 1985); Committee on Long-Range Planning, Board of Trustees, 1985–1986; Executive Committee of the Council, 1985–1987; Centennial Program Committee, 1985–1988; Agenda and Budget Committee, 1987; Liaison Committee with AAAS, 1989–1991; AMS-LMS Joint Program Committee, 1990–1992; Committee on Progress in Mathematics, 1990–1992 (Chair, 1991, 1992); Federal Policy Agenda Subcommittee, 1993; Committee on Committees, 1993–1994.

Selected Addresses: International Congress of Mathematicians: Moscow, 1966 and Vancouver, 1974; MAA Hedrick Lecturer, 1968; British Mathematical Colloquium, Spring 1973; CBMS Conference on Algebraic K -Theory, Colorado, August 1973; AMS Colloquium Lectures, Atlanta, January 1978.

Additional Information: NSF Fellow, 1962–1963; Sloan Fellow, 1964–1966; Guggenheim Fellow, 1968–1969; Frank Nelson Cole Prize in Algebra, 1975; Mathematical Sciences Research Institute: Chair, Board of Trustees and Chair, Scientific Advisory Council; Institute for Advanced Study: Member, Board of Trustees; National Academy of Sciences: Member, Board on Mathematical

Sciences and Chair, Mathematical Sciences Education Board.

Selected Publications: 1. with J. Milnor and J.-P. Serre, *Solution of the congruence subgroup problem for SL_n ($n \geq 3$) and Sp_{2n} ($n \geq 2$)*, Inst. Hautes Études Sci. Publ. Math. **33** (1967), 59–137. MR **39** #5574; 2. *Algebraic K -theory*, W. A. Benjamin, New York-Amsterdam, 1968, 762 pp. MR **40** #2736; 3. *Euler characteristics and characters of discrete groups*, Invent. Math. **35** (1976), 155–196. MR **55** #5764; 4. with E. H. Connell and D. Wright, *The Jacobian conjecture: reduction of degree and formal expansion of the inverse*, Bull. Amer. Math. Soc. **7** (1982), 287–330. MR **83K**:14028; 5. with W. Haboush, *Some equivariant K -theory of affine algebraic group actions*, Comm. Algebra **15** (1987), 181–217. MR **88g**:14013; 6. with R. Kulkarni, *Uniform tree lattices*, J. Amer. Math. Soc. **3** (1990), 843–902. MR **91k**:20034.

Statement: The economic and educational challenges facing the U.S. present both problems and opportunities for the mathematics community. The problems are inadequate resources, a shrinking job market, and deficient public and political understanding of what mathematics is about, and of how it best contributes to the national interest. The current political environment demands more attention to pressing economic and social needs, and to education and human resource development. For mathematicians, this translates, in the first instance, into greater interdisciplinary work and emphasis on the enabling role of mathematics for science and technology. In the second instance it calls for strengthening our historic

commitment to quality education at all levels. We have, after all, the most teaching-intensive of the sciences, and this is a role in which we can well serve both ourselves and the nation.

My first priority would be to reemphasize the importance of the broad mathematical culture which basic mathematical research nourishes, and from which science and technology must ultimately draw. Mathematicians must do a better job of explaining this intellectual and enabling process to the public, to policymakers, and to themselves. My second, and equally important, priority would be to reinvigorate the engagement of the research community in educational issues, not only at university levels, but also to support and learn from the pioneering efforts now underway toward national standards-based reform of mathematics education in the schools. One important goal of these efforts is to encourage and support the entry of more women and underrepresented minorities into our very rewarding profession.

Cathleen S. Morawetz

Professor, Courant Institute of Mathematical Sciences, New York University.

Born: May 5, 1923, Toronto, Ontario, Canada.

Ph.D.: New York University, 1951.

Offices: Member-at-Large of the Council, 1973–1975; Board of Trustees, 1976–1985 (Secretary, 1977, 1982; Chair, 1979, 1984).

AMS Committees: Committee on Women in Mathematics, 1972–1974 (Chair); Executive Committee, 1975; AMS-MAA-SIAM Joint Committee on Women in Mathematics, 1975–1979; Interim Editorial Committee for Research Announcements, 1978; Short Course Subcommittee, 1978–1984; *Bulletin* Editorial Committee, Associate Editor for Research Announcements, 1979; Committee to Select Gibbs Lecturers for 1979 and 1980 and for 1993 and 1994; AMS-MAA-NCTM-SIAM Joint Committee on Women in Mathematics, 1980–1981; Centennial Program Committee, 1985–1988; Committee on Science Policy, 1983–1985, 1989–1991, 1993–; Committee on the Publication Program, 1989–1991; Representative, AAAS, 1990–1992; Advisory Committee on the For-

mer Soviet Union Mathematics, 1992–; Committee to Select the Winner of the Satter Prize for 1993–1994.

Selected Addresses: Gibbs Lecture, 1981; Invited Address, SIAM, 1982; Emmy Noether Lecture, AWM, 1983.

Additional Information: Guggenheim Fellow, 1966–1967, 1978–1979; Trustee of Princeton University, 1972–1977; Trustee of Sloan Foundation, 1980–; Outstanding Woman Scientist (1993), Association of Women in Science; Member: AMS, SIAM, NAS, AAAS.

Selected Publications: 1. *Non-existence of transonic flow past a profile*, *Comm. Pure Appl. Math.* **17** (1964), 357–367. MR **32** #1994; 2. with W. A. Strauss, *Decay and scattering of solutions of a nonlinear relativistic wave equation*, *Comm. Pure Appl. Math.* **25** (1972), 1–31. MR **46** #2239; 3. with J. V. Ralston and W. A. Strauss, *Decay of solutions of the wave equation outside nontrapping obstacles*, *Comm. Pure Appl. Math.* **30** (1977), 447–508. MR **58** #23091a; 4. *The mathematical approach to the sonic barrier*, *Bull. Amer. Math. Soc.* **6** (1982), 127–145. MR **83j**:76051; 5. with Alvin Bayliss and Yanyan Li, *Scattering by a potential by hyperbolic methods*, *Math. Comp.* **52** (1986), 321–338. MR **89m**:65088; 6. *On a weak solution for a transonic flow problem*, *Comm. Pure Appl. Math.* **38** (1985), 797–818. MR **87c**:76087.

Statement: As an applied mathematician working on the analysis that joins partial differential equations to applications, I plainly see the problems that all of mathematics is currently facing: reduced support for research, lack of jobs for fresh Ph.D.s, increasing teaching loads, poorly prepared undergraduates. We must continue to pursue energetically the outreach to all levels of mathematical education and to practical applications. But above all, the heart of mathematics needs more support to keep the science alive. As president of the Society I would do my best to further this objective and altogether help to promote the long-term professional interests of the membership. In the interface of the Society with the nonmathematical community, I believe my varied experience will prove useful.

Vice-President

Jerry L. Bona

Raymond Shibley Professor and Chair, Mathematics Department, Pennsylvania State University.

Born: February 5, 1945, Little Rock, Arkansas.

Ph.D.: Harvard University, 1972.

AMS Committees: Committee on Steele Prizes, 1985–1987; Representative, AAAS, Section Q, 1988–1992 (Chair); Committee on Applications of Mathematics, 1990–1992 (Chair); Liaison Committee with AAAS, 1990–1992 (Chair); Committee on Education, 1993–.

Selected Addresses: Invited Address, International Congress of Mathematicians, Helsinki, 1978; Invited Address, Annual Meeting of the American Physical Society, Notre Dame, 1979; Invited Address, International Biennial Fluid Mechanics Meeting, Blazjewko, Poland, 1979; Invited Address, Minneapolis, November 1984; Britton Lecturer, McMaster University, 1986; Karcher Lecturer, University of Oklahoma, 1987; Invited Address, SIAM Annual Meeting, San Diego, 1989; Porcelli Lecturer, Louisiana State University, 1993.

Additional Information: U.K. Science Research Council Senior Visiting Fellow, The University of Essex, 1973–1975, 1977, 1978; National Academy of Sciences exchange visitor to Poland, 1977; Scientific Advisory Committee for Basic Research, Mathematical Sciences, U. S. Army Research Office, 1979–1982; Visiting Professor, Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, 1980; Visiting Professor, Mathematics Research Center, University of Wisconsin, 1980–1981; Visiting Professor, Department of Mathematics, University of Brasilia, 1982; Visiting Professor, Laboratoire for Anvendt Matematisk Fysik, Danmarks Tekniske Høj-skole, 1982; Professeur Invité, Université de Paris-Sud, Centre d'Orsay, 1982, 1986–1987, 1988, 1989, 1992; Professeur Invité l'Institut National de la Recherche Scientifique-Océanologie, Université du Québec, 1982–1992; Review Committee for the Division of Mathematics and Computer Science, Argonne National Laboratory, 1984–1990 (Chair, 1985–1989); Visiting

Professor, Institute for Mathematics and its Applications, University of Minnesota 1985, 1988, 1990, 1991; Editor-in-Chief, *SIAM Journal on Mathematical Analysis*, 1987–1992; Mathematical Association of America Committee on the Undergraduate Program in Mathematics, 1987–1991; National Science Foundation Review Panel and Site Visit Team for Science and Technology Centers 1988; *SIAM* Committee on Committees and Appointments, 1988–; American Mathematical Society Board of Judges for the National Science and Engineering Fairs in Pittsburgh, 1989 and in Tulsa, 1990; CUPM Subcommittee on the Major in the Mathematical Sciences, 1989–1990, CUPM Subcommittee on the Calculus Reform and the First Two Years, 1989–1991; Organizing Committee for the *SIAM* Annual Meeting in Chicago, 1990; National Science Foundation panel to review proposals in Undergraduate Curriculum Development in Mathematics: Calculus, 1990; Advisory Committee to the NSF Division of Mathematical Sciences, 1990–1993 (Chair, 1991–1992); Professeur Invité, Ecole Normale Supérieure de Cachan, 1990, 1991; Panel to review NATO Post-Doctoral Fellowships, 1991; Invited Professor, Instituto de Matemática Pura e Aplicada, Rio de Janeiro, 1991, 1992; Invited Professor, Academia Sinica, Beijing, 1991; Organizing Committee for the MER workshop, “Changing the Culture: Education and the Mathematics Research Community”, Oakland, 1992; *SIAM* Visiting Lecturer 1992–; Organizing Committee for the Seventh international conference on Domain Decomposition to be held at Pennsylvania State University, October 1993; Mathematical Association of America representative to the AAAS Section Committee on Mathematics, 1993–; Member: AAAS, AMS, AWM, MAA, SIAM.

Selected Publications: 1. with T. B. Benjamin and J. J. Mahony, *Model equations for long waves in nonlinear dispersive systems*, Phil. Trans. Roy. Soc. London A **272** (1972), 47–78. MR **55** #898; 2. with R. W. Smith, *The initial-value problem for the Korteweg-de Vries equation*, Phil. Trans. Roy. Soc. London A **278** (1975), 555–601. MR **52**

#6219; 3. with W. G. Pritchard and L. R. Scott, *An evaluation of a model equation for water waves*, Phil. Trans. Roy. Soc. London A **302** (1981), 457–510. MR **83a**:35088; 4. with P. E. Souganidis and W. A. Strauss, *Stability and instability of solitary waves of KdV type*, Proc. Roy. Soc. London A **411** (1987), 395–412. MR **88m**:35128; 5. with T. B. Benjamin and D. K. Bose, *Solitary-wave solutions of nonlinear problems*, Phil. Trans. Roy. Soc. London A **331** (1990), 195–244. MR **91h**:35309.

Statement: In addition to its primary responsibility of encouraging scholarship at the highest levels in our discipline, the AMS should continue to develop a role in mathematics education and should begin to forge more substantial alliances with other mathematical sciences organizations.

Ramesh A. Gangolli

Professor, University of Washington, Seattle.

Born: February 26, 1935, Bangalore, India.

Ph.D.: Massachusetts Institute of Technology, 1961.

Offices: Board of Trustees, 1985–1989 (Secretary, 1986; Chair, 1988)

AMS Committees: Committee to Select Hour Speakers for Far Western Sectional Meetings, 1977, 1984–1985; Committee on Investment, Board of Trustees, 1985–1989; Committee on Corporate Relations, Board of Trustees, 1985– (Chair); Committee on Institutional Membership, Board of Trustees, 1987–; Agenda and Budget Committee, Board of Trustees (ex officio), 1988; Committee on Long Range Planning, Board of Trustees (ex officio), 1988; Committee on the Publication Program, Board of Trustees, 1988– (Chair, 1991–1992); Ad Hoc Committee on AMS Publications in Applied Mathematics, 1989; Committee on Education, 1991– (Chair); AMS-MAA-SIAM Joint Committee on Cooperation, 1991–.

Selected Addresses: Special Session on Markov Processes, Chicago, January 1966; Invited Address, Davis, April 1970; Summer Institute on Harmonic Analysis on Homogeneous Spaces, Williamstown, 1972; Special Session on C^* -algebras and Related Topics, Reno,

April 1976; Special Session on Representations of Lie Groups, San Francisco, April 1978.

Additional Information: Sloan Fellow, 1966–1968; Paul Levy Prize, 1967; Member, Editorial Board, *Indian Journal of Mathematics*, 1974–1980; Member, Advisory Panel, Mathematical Sciences, NSF, 1982–1986; Associate Editor, *Pacific Journal of Mathematics*, 1982–1988.

Selected Publications: 1. *Isotropic infinitely divisible measures on symmetric spaces*, Acta. Math. **111** (1964), 213–246. MR **28** #4557; 2. *Positive definite kernels on homogeneous spaces and certain stochastic processes related to Lévy's Brownian motion of several parameters*, Ann. Inst. H. Poincaré Sect. B (N.S.) **3** (1967), 121–226. MR **35** #6172; 3. *Asymptotic behaviour of spectra of compact quotients of certain symmetric spaces*, Acta. Math. **121** (1968), 151–192. MR **39** #360; 4. *On the Plancherel formula and the Paley-Wiener theorem for spherical functions on semisimple Lie groups*, Ann. of Math. (2) **93** (1971), 150–165. MR **44** #6912; 5. *Zeta functions of Selberg's type for compact space forms of symmetric spaces of rank one*, Illinois J. Math. **21** (1977), no. 1, 1–42. MR **58** #5524; 6. with V. S. Varadarajan, *Spherical Functions on Reductive Lie Groups*, Springer-Verlag, 1989.

Statement: The AMS must vigorously continue to advocate mathematical research, both for its own sake and because of its importance to society. This will be particularly important in the next few decades, as global competition for resources intensifies, and threatens to focus the attention of policy-makers away from purely intellectual or humanistic activities, which have few natural advocates in our economic system. The strongest traditional advocates, namely the universities, will be under enormous pressure to bow to political realities. Therefore it is essential that this role of advocacy must not be compromised by the professional societies.

In addition, I feel that it is essential for societies like the AMS to play an active and visible role in education, broadly defined. In the short term, this is probably essential, because of societal needs and expectations. In the long

term, we cannot expect society to value mathematics unless a significant proportion of the citizenry appreciates both its intrinsic value and its extraordinary usefulness. This can only be done by influencing education at all levels, starting from kindergarten.

If elected, I shall try to propagate this point of view as effectively as the functions of the office of Vice-President allow.

Jean E. Taylor*

Professor, Rutgers University.

Born: September 17, 1944, San Mateo, California.

Ph.D.: Princeton University, 1973.

Offices: Member-at-Large of the Council, 1984–1988.

AMS Committees: Nominating Committee, 1977–1978; Committee on Committees, 1986; Committee on Long-Range Planning, 1986–1987 (Chair, 1987); Executive Committee of the Council, 1986–1988; Committee on Applied Mathematics, 1986–1989 (Chair, 1987–1989); Agenda and Budget Committee, 1988; Committee on the Proposed Structure of the Joint Policy Board for Mathematics, 1988 (Chair); Committee on NCTM Standards, 1989; Program Committee for National Meetings, 1990–1991 (Chair); AMS-MAA Joint Program Committee for the Orono Meeting, 1991; Committee on Steele Prizes, 1992–1994; Arnold Ross Lecture Series Committee, 1993.

Selected Addresses: Invited Address, October 1977; AMS-MAA Joint Address, August 1989; Invited Address, XXVI National Congress of the Sociedad Matematica Mexicana, October 1993; 12 Special Sessions (organizer of three: Calculus of Variations, Wellesley, October 1977; An Introduction to Quasi-Crystals, Amherst, October 1985; Computing Optimal Geometries, San Francisco, 1991); Invited Addresses, Canadian Mathematical Society and Australian Mathematical Society; Invited addresses in sessions of annual meetings of the American Ceramics Society, 1993; TMS (Minerals, Metals, and Materials), 1988, 1991, 1993; Materials Research Society, 1991.

Additional Information: Member, Institute for Advanced Study, 1974–1975;

1977–1978; 1985; Sloan Fellow, 1976–1978; Member of permanent faculty, The Geometry Center (Minneapolis); Visitor, IMA, January–February 1983, MSRI, January 1991; Member: AAAS (Fellow), AMS, AWM, MAA, SIAM, MRS (Materials Research Society); Advisory Board, The Geometry Forum; Advisory Committee, WQED's proposed public television series on mathematics; Member, NRC Committees on Applied Mathematics Training, 1977–1978, and Materials Science and Mathematical Sciences, 1992–1993; Chair, Connections Task Force, MSEB, 1992.

Selected Publications: 1. *The structure of singularities in soap-bubble-like and soap-film-like minimal surfaces*, Ann. of Math. **103** (1976), 489–539. MR **55** #1208a; 2. with Enrico Bombieri, *Quasicrystals, tilings, and algebraic number theory: Some preliminary connections*, in The Legacy of Sonya Kovalevskaya, Contemp. Math. **64** (1987), 241–264. MR **89a**:82031; 3. *On the global structure of crystalline surfaces*, Discrete Comp. Geom. **6** (1991), 225–262. MR **92g**:53009; 4. with John Cahn and Carol Handwerker, Geometric Models of Crystal Growth, *Acta Metall. Mater.* **40** (1992), 1443–1474; 5. *Geometric Crystal Growth in 3D via Faceted Interfaces*, in Computational Crystal Growers' Workshop (Editor) Selected Lectures in Mathematics, American Mathematical Society (1992), 111–113 plus video 20:25–26:00.

Statement: Our profession can be wonderful. Doing mathematics, discovering how things work and why they work, can be a great joy, and when students get turned on to some part of mathematics—when we manage to elicit that aha! response—we feel teaching has got to be one of the most rewarding jobs possible. Unfortunately we also get bogged down in problems of getting reasonable jobs (for ourselves, our students, and our colleagues), getting financial support for our research, teaching large classes of bored students the same old stuff (for them and for us), and so forth. The AMS should be our ally, our voice, and our goad to keep doing better.

What do I have to offer? Strong feelings about fairness and opportunity for all, and a record of speaking out

for what I believe in and making things happen. Also, from my experience with metallurgical societies and meetings, I see that there are other ways to do things than the way we've always done them (sometimes better, sometimes worse). Finally, I worry that the AMS leadership on occasion is more concerned with the needs of its publishing empire than the needs of its members.

Member-at-Large of the Council

Edward Bierstone

Professor, University of Toronto.

Born: December 21, 1946, Toronto, Canada.

Ph.D.: Brandeis University, 1973.

Selected Addresses: AMS Summer Research Institute on Several Complex Variables: plenary address, Santa Cruz, July 1989; CMS Winter Meeting: plenary address, Montreal, 1989; Colloquium, Rutgers University, 1992; Conference on Complex Analysis in Honour of R. C. Gunning and J. J. Kohn, Princeton, 1992; Colloque en l'Honneur de P. Dolbeault, Paris, 1992.

Additional Information: Chair of the Scientific Program Committee, CMS Winter Meeting, Calgary, 1985; Organizer, Special Session on Symmetry and Differential Analysis, Orono Mathfest, August 1991; Fellow of the Royal Society of Canada.

Selected Publications: 1. *Generic equivariant maps*, Proc. Ninth Nordic Summer School/NAVF Sympos. Math., Oslo (1976), pp. 127–161, Sijthoff and Noordhoff, 1977. MR **57** #7649; 2. *Extension of Whitney fields from subanalytic sets*, Invent. Math. **46** (1978), 277–300. MR **58** #1228; 3. with P. Milman, *Composite differentiable functions*, Ann. of Math. **116** (1982), 541–558. MR **84a**:58016; 4. with P. Milman, *Semianalytic and subanalytic sets*, Inst. Hautes Études Sci. Publ. Math. **67** (1988), 5–42. MR **89k**:32011; 5. with P. Milman, *A simple constructive proof of canonical resolution of singularities*, Effective Methods in Algebraic Geometry, pp. 11–30, Prog. Math., vol. 94, Birkhäuser, 1991. MR **92h**:32008.

Statement: The vitality of the mathematics research community depends on the quality of education at all levels and on an appreciation of mathematics

outside academia. Mathematics scholarship is threatened by underfunding at a time that talented students and researchers from North America, Eastern Europe, and Asia need support. I believe I can make a valuable contribution to the Council as a member from a Canadian university.

James W. Cannon
Orson Pratt Professor of Mathematics,
Brigham Young University.

Born: January 30, 1943, Bellefonte, Pennsylvania.

Ph.D.: University of Utah, 1969.

AMS Committees: Nominating Committee, 1986–1987; *Transactions and Memoirs* Editorial Committee, 1988–1992.

Selected Addresses: Invited Address, Seattle, August 1977; International Congress of Mathematicians, Helsinki, 1978; Hedrick Lecturer, MAA, Toronto, 1982; Conference on Ergodic Theory, Symbolic Dynamics, and Hyperbolic Spaces, Trieste, Italy, 1989, 3 lectures; Symposium on Geometry and Computer, Tokyo Institute of Technology, 1992.

Additional Information: NSF Postdoctoral Fellow, 1969; Sloan Fellow, 1971–1973; Romnes Research Fellow, 1979–1984; Faculty, University of Wisconsin at Madison, 1969–1986; Member, Geometry Supercomputing Project and of the Geometry Center, Minneapolis, 1988–; Member, NSF Advisory Committee for the Division of Mathematical Sciences and Chairperson for the Subcommittee on Educational Priorities, 1988–1990; MAA Sectional Teaching Award, 1993.

Selected Publications: 1. with C. E. Burgess, *Embeddings of surfaces in E^3* , Rocky Mountain J. Math. **1** (1971), 259–344. MR **43** #4008; 2. *The recognition problem: what is a topological manifold?* Bull. Amer. Math. Soc. **84** (1978), 832–866. MR **58** #13043; 3. *The combinatorial structure of cocompact discrete hyperbolic groups*, Geom. Dedicata **16** (1984), 123–148. MR **86j**:20032; 4. The combinatorial Riemann mapping theorem, submitted to Acta Math.

Statement: With lots of help from the mathematics community, I would be happy to work on solving some of our

critical problems: research funding, employment, educational reform.

Dennis DeTurck
Professor, University of Pennsylvania.

Born: July 15, 1954, Philadelphia, Pennsylvania.

Ph.D.: University of Pennsylvania, 1980.

Selected Addresses: Invited Address, Mobile, April 1985; Regional Geometry Institute, Mount Holyoke, July 1991 (videotape available from MAA); Co-organizer, Special Session on Eigenvalues in Riemannian Geometry, San Antonio, January 1993; Invited Address, “Making Mathematics Count” Workshop, SIAM Annual Meeting, Philadelphia, July 1993; Special Session on Differential Geometry, Vancouver, August 1993.

Additional Information: Reviewer for *Mathematical Reviews*, 1982–; Sloan Fellow, 1985–1987; Associate Editor, *American Mathematical Monthly*, 1986–; Member, Institute for Advanced Study, 1989–1990; Editorial Board, *Studies in Advanced Mathematics*, 1990–; Panelist, Conference Board in the Mathematical Sciences, 1991–1992; JPBM Public Information Resources Committee, 1992–; Member: AMS, MAA.

Selected Publications: 1. with C. Gordon, *Isospectral deformations. I. Riemannian structures on two-step nilspaces*, Comm. Pure Appl. Math. **40** (1987), 367–387. MR **88m**:58186, and II *Trace formulas, metrics and potentials*, Comm. Pure Appl. Math. **42** (1989), 1067–1095; 2. with H. Goldschmidt and J. Talvacchia, *Connections with prescribed curvature and Yang-Mills currents: the semi-simple case*, Ann. Sci. École Norm. Sup. **24** (1991), 57–112. MR **92a**:53034; 3. with W. Ziller, *Minimal isometric immersions of spherical space forms in spheres*, Comment. Math. Helv. **67** (1992), 428–458; 4. with H. Gluck, C. Gordon, and D. Webb, *The inaudible geometry of nilmanifolds*, Invent. Math., **111** (1993), 271–284; 5. with J. Cao, *The Ricci curvature equation with rotational symmetry*, American J. Math., to appear, 1993.

Statement: Mathematics and mathematicians are faced at once with a vari-

ety of crises (the brutal job market, the erosion of funds for research by individuals, crises of confidence in higher education and science education in general) and opportunities (use of new technologies in mathematics research and education, funding for interdisciplinary research and for initiatives in undergraduate education, an increasingly diverse population of new Ph.D.s and younger colleagues). The AMS should be able to identify valuable and successful strategies for coping with the crises and taking advantage of the opportunities and provide encouragement, support and leadership where it is needed. In particular, in addition to being a strong advocate of the importance of mathematics as science and to other sciences, the AMS must make clear the special role and nature of mathematics in the way it is done and in its relationship with other sciences.

Robert K. Lazarsfeld
Professor, University of California, Los Angeles.

Born: April 15, 1953, New York, New York.

Ph.D.: Brown University, 1980.

AMS Committees: *Bulletin* Editorial Committee (Associate Editor, Research Announcements), 1991–.

Selected Addresses: Crafoord Symposium, Stockholm, September 1988; International Congress of Mathematicians, Kyoto, August 1990; Journées de Géométrie Algébriques, Orsay, July 1992; Invited AMS Address, Los Angeles, November 1992.

Additional Information: AMS Fellow, 1980; Member, Institute for Advanced Study, 1981–1982; Sloan Fellow, 1984–1987; Presidential Young Investigator, 1985–1990; Principal Organizer, Workshop on Algebraic Vector Bundles, UCLA, November 1992.

Selected Publications: 1. with L. Gruson and C. Peskine, *On a theorem of Castelnuovo, and the equations defining space curves*, Invent. Math. **72** (1983), 491–506. MR **85g**:14033; 2. with W. Fulton, *Positive polynomials for ample vector bundles*, Ann. of Math. **118** (1983), 35–60. MR **85e**:14021; 3. *Brill-Noether-Petri without degenera-*

tions, *J. Differential Geom.* **23** (1986), 299–307. MR **88b**:14019; 4. with M. Green, *Deformation theory, generic vanishing theorems, and some conjectures of Enriques, Catanese and Beauville*, *Invent. Math.* **90** (1987), 389–407. MR **89b**:32025; 5. with L. Ein, *Global generation of pluricanonical and adjoint linear series on smooth projective threefolds*, *J. Amer. Math. Soc.*, to appear.

Statement: There are a number of pressing issues facing the mathematical community where the AMS has a role to play. Among these I would cite the following: (1) As a community, we need to do a better job of conveying the excitement and importance of contemporary mathematics to lower division undergraduates and the public at large. (2) The AMS should work with the NSF and other funding agencies to ensure the most effective use of the scarce resources available to support research. (3) The increasing cost of journals and monographs is causing a severe strain on many library budgets, and we need to develop strategies to deal with this. (4) Finally, the AMS should do everything in its power to help address the problems caused by the current job market.

Frank Morgan

Professor and Chair, Department of Mathematics, Williams College.

Ph.D.: Princeton University, 1977.

Selected Addresses: AMS-MAA Joint Invited Address on Compound Soap Bubbles, Shortest Networks, and Minimal Surfaces, San Francisco, January 1991; Mount Holyoke RGI Lectures, 1991; Foreign distinguished lecturer, The First International Research Institute of The Mathematical Society of Japan, 1993; over 100 other talks.

Additional Information: Works in minimal surfaces and studies the behavior and structure of minimizers in various dimensions and settings. Books: *Geometric Measure Theory: a Beginner's Guide*; *Riemannian Geometry: a Beginner's Guide*; *Calculus in One Semester*. MIT: Undergraduate Mathematics Chair, Everett Moore Baker Award for Excellence in Undergraduate Teaching, Cecil and Ida Green Career Development Chair. Williams College: Math Chair

and codirector of NSF undergraduate research project. Four Ph.D. students; 40 undergraduate research students (who published eight papers). NSF Mathematics Advisory Committee 1987–1990. First MAA National Award for Distinguished Teaching, 1993.

Selected Publications: 1. *On finiteness of the number of stable minimal hypersurfaces with a fixed boundary*, *Indiana Univ. Math. J.* **35** (1986), 779–833. MR **88b**:49059 (research announcement, *Bull. Amer. Math. Soc.* **13** (1985), 133–136); 2. *The cone over the Clifford torus in \mathbb{R}^4 is Φ -minimizing*, *Math. Ann.* **289** (1991), 341–354. MR **92b**:49078 (research announcement: *A sharp counterexample on the regularity of Φ -minimizing hypersurfaces*, *Bull. Amer. Math. Soc.* **22** (1990), 295–299); 3. with Jean Taylor, *The tetrahedral point junction is excluded if triple junctions have edge energy*, *Scripta Metallurgica et Materialia* **15** (1991), 1907–1910; 4. with Gary Lawlor, *Paired calibrations applied to soap films, immiscible fluids, and surfaces or networks minimizing other norms*, *Pacific J. Math.*, to appear; 5. *Clusters minimizing area plus length of singular curves*, preprint, 1993.

Statement: I'd like to see a greater appreciation of current mathematics among ourselves, our students, our neighbors, and the general populace. AMS publications and meetings should continue to widen offerings, including, for example, articles and colloquium talks on current research aimed at the uninitiated, graduate students, undergraduates, or high school teachers. (Example: however classical the fact that a round soap bubble provides the least-area way to enclose the given volume, it remains as an open mathematical question whether the standard *double* bubble provides the least-area way to enclose and separate the two given volumes.) Enhanced communication, recognition, and support, more than prescribed procedures, policies, and curricula, foster individual opportunity, initiative, and creativity. Benefits should include further opening mathematics to women and minorities; fostering links to science, medicine, ecology, business; gaining popular and financial support for mathematics; and, most of all, better mathematics.

Donald St.P. Richards

Professor, University of Virginia.

Born: April 4, 1955, Mandeville, Jamaica.

Ph.D.: University of the West Indies, 1978.

AMS Committees: Southeastern Section Program Committee, 1992–1994 (Chair, 1993).

Selected Addresses: Special Session on Generalized Special Functions and Mathematical Physics, College Park, October 1982; Special Session on Analysis on Homogeneous Spaces, Mobile, May 1985; Special Session on Combinatorics and Special Functions, Laramie, August 1985; Special Session on Combinatorics and Representations, Atlanta, January 1988; Special Session on Total Positivity, Atlanta, January 1988; IMA workshop on q -Series and Partitions, University of Minnesota, March 1988; Invited Address, Tampa, March 1991.

Additional Information: Review panel for NSF programs on Research Experience for Undergraduates, 1987–1988; NAS/NRC Committee on Doctoral and Postdoctoral Study in the United States, 1990–1991; Board on Mathematical Sciences, 1993; Member: AMS, IMS.

Selected Publications: 1. with K. I. Gross, *Special functions of matrix argument. I. Algebraic induction, zonal polynomials and hypergeometric functions*, *Trans. Amer. Math. Soc.* **301** (1987), 781–811. MR **88m**:22018; 2. *Analogues and extensions of Selberg's integrals. q -Series and Partitions* (Minneapolis, Minn., 1988), IMA Vol. Math. Appl. **18**, 109–137 (D. Stanton, ed.), Springer, New York-Berlin, 1989. MR **90k**:33003; 3. with R. A. Askey, *Selberg's second beta integral and an integral of Mehta*, *Probability, Statistics and Mathematics: Papers in Honor of Samuel Karlin*, 27–39 (T. W. Anderson et al, eds.), Academic Press, Boston, 1989. MR **91f**:33006; 4. with K. I. Gross, *Total positivity, spherical series and hypergeometric functions of matrix argument*, *J. Approx. Theory* **59** (1989), 224–246. MR **91i**:33005; 5. with R. D. Gupta, *Multivariate Liouville distributions*, III, *J. Multivariate Anal.* **43** (1992), 29–57; 6. Editor, *Hypergeometric Functions on Domains of Positivity, Jack Polynomials*

and Applications, Contemp. Math. **138** (1992).

Statement: In addition to our primary goal of engendering a positive climate for mathematics in general and mathematics research in particular, our Society should continue its efforts to: improve mathematics teaching in all sectors of the educational system; bring Federal support for education and research in the mathematical sciences into equity with the physical sciences; encourage cross-disciplinary research within and without mathematics; increase the participation of traditionally underrepresented groups; and engender broad public support for mathematics education and basic research. I strongly believe that these issues are fundamental to the long-term well-being of our profession, and I will do my best to stimulate fruitful discussions of and sensible solutions to these problems.

Norberto Salinas

Professor, University of Kansas.

Born: Buenos Aires, Argentina, January 26, 1940.

Ph.D.: University of Michigan, Ann Arbor, 1970.

Selected Addresses: 9th Great Plains Operator Theory Symposium, Albuquerque, April 1990; Canadian Conference in Operator Algebras and Operator Theory, Halifax, May 1990; 13th International Conference on Operator Theory, Predeal, Romania, June 1990; Irish Conference in Operator Theory and C^* -Algebras, Cork, May 1991; International NATO Conference on Operator Algebras, Mathematical Physics, and Applications, Istanbul, July 1991; International Conference in Honor of Stephan Banach (two-hour lecture, Centennial Anniversary), Banach International Center, Warsaw, May 1992; International Conference on Operator Algebras, Copenhagen, August 1992; International Conference on Operator Theory at CIRM, Luminy, France, April 1993.

Additional Information: Member, Institute for Advanced Study, 1971–1972 and Spring 1985; Consultant for the Blind in Science Resource Directory of Handicapped Scientists of the American Association for the Advancement of Sciences, March 1980–; Organizer, Special

Session on Operator Theory and Operator Algebras, Denver, January 1983; Member, Mathematical Sciences Research Institute at Berkeley, Fall 1984; Panelist, Conference Board of Mathematical Sciences (CBMS), 1984–1987; Chair, Organizing Committee of the 7th Great Plains Operator Theory Symposium (GPOTS), Lawrence, May 1987; Member, Editorial Board of the *Rocky Mountain Journal of Mathematics*, and University of Kansas representative to the Rocky Mountain Consortium, January 1988–; Organizer, Special Session on Operator Theory and Geometry, Lawrence, October 1988; Principal Editor, *Journal of Operator Theory*, January 1990–; Member, Editorial Board, Research Monographs of CRC Press, August 1990–; Member, Advisory Board on Computerized Books for the Blind, April 1991–; Organizer, Special Session on Multidimensional Complex Analysis and Operator Theory, Fargo, October 1991; Co-chair, Organizing Committee, AMS-IMS-SIAM Summer Research Conference on Multivariate Operator Theory, Seattle, July 10–18, 1993; Member: AMS.

Selected Publications: 1. *Homotopy invariance of Ext(A)*, Duke Math. J. **44** (1977), 777–794. MR **58** #23645; 2. with W.L. Paschke, *C^* -algebras associated with free products of groups*, Pacific J. Math. **28** (1979), 211–221. MR **82c**:22010; 3. with R. Curto, *Generalized Bergmann kernels and the Cowen-Douglas theory*, Amer. J. Math. **106** (1984), 447–488. MR **85e**:47042; 4. *The Grassmann manifold of a C^* -algebra and Hermitian holomorphic vector bundles*, Operator Theory: Adv. and Appl., vol. 28 (1988), 267–289. MR **90a**:46187; 5. with A. Sheu and H. Upmeyer, *Toeplitz operators on pseudoconvex domains and foliation C^* -Algebras*, Ann. of Math. **130** (1989), 531–565. MR **91e**:47026.

Statement: I believe that the AMS should exercise leadership in the commitment to research in mathematics, improvement in undergraduate and graduate education, opportunities for minorities, and services to the community. The shortage of jobs and difficulty in obtaining funding makes it essential that the Council address these issues with

much care. It is also very important to protect the rights of those that are very unlikely to have representation in positions of power. In particular, I think I could contribute (if elected) in helping the Council in assessing the need of the handicapped (especially the blind and visually impaired) in mathematics. In this time of electronic and computer evolution, it is paramount that adaptive technology be kept receptive to the need of the handicapped. For example, support for an accessible mathematical language (such as the Standard Generalized Markup Language) and development of appropriate translation schemes should be monitored carefully. I am convinced that it is through this technology that the disabled can be brought to the level of independence needed to be competitive and hence useful to society. This opinion is shared by many specialists in rehabilitation.

Sylvia M. Wiegand

Professor, University of Nebraska, Lincoln.

Born: March 8, 1945, Cape Town, South Africa.

Ph.D.: University of Wisconsin, 1972.

AMS Committees: Committee on Committees, 1991–1992; Subcommittee to Study the Committee Structure, 1992–1993 (Chair).

Selected Addresses: ICM-90 Satellite Conference on Commutative Algebra and Applications, Nagoya, August 1990; Invited Address, Fargo, ND, October 1991; Special Sessions in Commutative Algebra: Springfield, March 1992; San Antonio, January 1993; Knoxville, March 1993; Commutative Algebra, Mount Holyoke, July 1992; Algebre et Applications, Marseille, May 1993; Commutative Algebra, Columbia, May 1993.

Additional Information: University of Nebraska Pi Mu Epsilon chapter advisor, 1986–1992; Local Arrangements Committee, Lincoln, NE, Regional AMS Meeting, 1987; NSF Graduate Fellowship Panel, 1987–1992 (Chair, 1990–1992); Speakers' Committee for MAA, August 1989; Codirector, NSF Midwest/Great Plains Workshops in Commutative Algebra, 1989–1992; Editorial Boards: *Communications in Algebra*,

1990– ; *Rocky Mountain Journal of Math*, 1991– ; Co-organizer of Special Sessions in Commutative Algebra: Fargo, October 1991; Salt Lake City, April 1993; NSF Visiting Professorships for Women Award at Purdue University, 1992–1993; Codirector of two workshops to encourage young women in mathematics and science (Lincoln, 1978, 1979); presenter at various similar programs for young women; author and speaker on women in mathematics (particularly Grace Chisholm Young); Editorial Board, Complete Works of W. H. and G. C. Young; Member: AMS, AWM, MAA, LMS.

Selected Publications: 1. *Ranks of indecomposable modules over one-dimensional rings*, *J. Pure Appl. Algebra* **55** (1988), 303–314. MR **89k**:13012; 2. with W. Heinzer, *Prime ideals in two-dimensional polynomial rings*, *Proc. Amer. Math. Soc.* **107** (3), 1989, 577–586. MR **90b**:13010; 3. with W. Heinzer and S. Abhyankar, *On the compositum of two power series rings*, *Proc. Amer. Math. Soc.* **112** (1991), 629–636. MR **91j**:13015; 4. with W. Heinzer and D. Lantz, *Projective lines over one-dimensional semilocal domains and spectra of birational extensions*, *Proceedings of Conference on Algebraic Geometry and its Applications at Purdue University*, Springer-Verlag, to appear; 5. with R. Wiegand, *Bounds for one-dimensional rings of finite Cohen-Macaulay type*, *J. Pure Appl. Algebra*, to appear.

Statement: While serving on the restructuring committee I learned a lot about the workings of the AMS. The committee recommended the creation of three Policy Committees in the areas of Meetings and Conferences, The Profession, and Publications; the present committees on Education and Science Policy will serve as Policy Committees for their areas. Three objectives of this plan, approved by the Council in January, 1993, are: to open up the Society to the membership, to involve the Council more in the Society's structure, and to consider the long-term needs of our discipline. In addition, there will be greater efficiency and coordination of existing committees. As a member of the Council, I hope to be able to help implement

the restructuring plan.

There are vital professional issues the AMS must address, such as the job market, funding, women and minorities, foreign mathematicians and graduate education. The Publications and Meetings and Conferences divisions could do even more to increase communication and understanding between mathematicians, by encouraging more expository articles and talks. The Society's major role, however, must remain the fostering of mathematical research, particularly in view of an increasingly hostile national climate for University research.

Robert J. Zimmer
Professor, University of Chicago.

Born: November 5, 1947.

Ph.D.: Harvard University, 1975.

AMS Committees: *Transactions* and *Memoirs* Editorial Committee, 1987–1989; Committee to Select Hour Speakers for Central Sectional Meetings, 1988–1989 (Chair, 1989); Editorial Boards Committee, 1992– ; Federal Policy Agenda Subcommittee, 1993– .

Selected Addresses: Special Session on Ergodic Theory, New York, March 1978; Special Session on Harmonic Analysis on Real Groups, Chicago, November 1978; Invited Address, Notre Dame, March 1981; Special Session on Differential Geometry and Ergodic Theory, Amherst, October 1981; Invited Address, International Congress of Mathematicians, Berkeley 1986; AMS Summer Research Institute on Differential Geometry, Los Angeles, July 1990.

Additional Information: Chair, Organizing Committee, Special Year on Lie Groups and Ergodic Theory, MSRI, 1991–1992; Board of Mathematical Sciences, National Research Council, 1992– .

Selected Publications: 1. *Amenable ergodic group actions and an application to poisson boundaries of random walks*, *J. Funct. Anal.* **27** (1978), 350–372. MR **57** #12775; 2. *Strong rigidity for ergodic actions of semisimple Lie groups*, *Ann. of Math.* **112** (1980), 511–529. MR **82i**:22011; 3. *Ergodic theory and semisimple groups*, Birkhäuser Boston Inc., 1984. 4. *On the automorphism group of a compact Lorentz manifold and other geometric manifolds*,

Invent. Math. **83** (1986), 411–424. MR **87j**:58019; 5. *Arithmeticity of holonomy groups of Lie foliations*, *Journal of Amer. Math. Soc.* **1** (1988), 35–58; 6. *Representations of fundamental groups of manifolds with a semisimple transformation group*, *J. Amer. Math. Soc.* **2** (1989), no. 2, 201–213. MR **90i**:22021.
Statement: It is widely accepted that we are now in a transitional period regarding the funding of scientific (and in particular mathematical) research and education, and that what emerges from this period will have long-term effects on the structure and overall activities of the research and education communities. The Society needs to adopt a more assertive stance and aggressively articulate the importance of basic research and advanced education in “core” and “applied” mathematics to the health of the nation's scientific and technological research enterprise, as well as the funding needs necessary to maintain productivity in these directions. This should be done in the context of seeking a coherent and proper balance for funding between basic research, education, and mission-oriented research.

Another area of significant concern for the Society is the current situation regarding job opportunities for those now or soon to be receiving a degree. The Society should investigate possibilities and encourage university departments to find suitable avenues for allowing students to pursue their interests while at the same time imparting skills and experience that will give them more flexibility when seeking employment.

Trustee

D. J. Lewis

Professor, University of Michigan, Ann Arbor.

Born: January 25, 1926, Adrian, Michigan.

Ph.D.: University of Michigan, 1950.

AMS Committees: *Proceedings* Editorial Committee, Associate Editor, 1964–1966; Chair, Organizing Committee for the 1969 Summer Institute on Number Theory, Analytic Number Theory, Diophantine Problems, and Algebraic Number Theory; Committee to Select Hour Speakers for Western Sectional

Meetings, 1974; Organizing Committee for the Symposium on Mathematical Developments Arising from Hilbert Problems, DeKalb, Illinois, May 1974; *Mathematical Reviews* Editorial Committee, 1975–1977 (Chair); Committee on Publication Problems, 1977; *Notices* Editorial Committee, 1989–1992; Committee on Education, 1991–1993; AMS-ASA-AWM-IMS-MAA-NCTM-SIAM Joint Committee on Women in the Mathematical Sciences, 1992–; Committee on Professional Ethics, 1992– (Chair, 1993); AMS Employment Task Force, 1991–1992 (Chair); Committee on Committees, 1993 (Chair).

Selected Addresses: Invited AMS Address, Urbana, November 1970; Mordell Lecture, Cambridge University, 1980.

Additional Information: NSF Fellow, Institute for Advanced Study, 1952–1953; NSF Senior Fellow, 1959–1961; Senior Visiting Fellow, Cambridge, 1965, 1969; Organizer, 1969 Summer Institute on Number Theory: Analytic Number Theory, Diophantine Problems, and Algebraic Number Theory; Visiting Professor, Japanese Society for the Advancement of Science, 1974; Visiting Fellow, Brasenose College, Oxford, 1976, Humboldt Awardee, Universität Heidelberg, 1980, 1983; Co-organizer, Joint Summer Research Conference on Diophantine Problems, Including Diophantine Approximation and Transcendence, Brunswick, July 1984; Member, NRC Panels: Science and Technology Centers, 1987 and Doctoral and Postdoctoral Education, 1990; Member: AMS, MAA, LMS.

Selected Publications: 1. *Cubic homogeneous polynomials over p -adic fields*, Ann. of Math. **56** (1952), 473–478; 2. with H. Davenport, *Homogeneous additive equations*, Proc. Roy. Soc. London Ser. A **274** (1963), 443–460; 3. with H. Davenport, *Cubic additive equations*, Philos. Trans. Roy. Soc. London Ser. A **264** (1966), 97–136; 4. with H. Davenport, *Simultaneous equations of additive type*, Philos. Trans. Roy. Soc. London Ser. **264** (1969), 557–595. MR **39** #6848; 5. with A. Schinzel, *Quadratic diophantine equations with parameters*, Acta Arith. **37** (1980), 133–141. MR **81m**:10030; 6. with J. Turk, *Repetitiveness of binary recurrences*, J. Reine

Angew. Math. **356** (1985), 19–48. MR **86e**:11015.

Statement: The Mathematics Community faces a number of major issues: declining public support of higher education, the need to rethink and redirect mathematical education at all levels, declining federal support for core research, the need to contribute to technology transfer, the expectation of scientists and mathematicians to contribute to the economic welfare of the nation, publication costs and possible new methods of communication between mathematicians, the need to communicate to the general public, the need to include a more diverse population within the community, and the underutilisation of mathematicians, to name the most obvious. I have given time and thought to and been active regarding most of these issues. Many individuals expect the AMS to address and resolve these and other issues that impinge on the community. But many of these problems must be solved locally by individual groups of mathematicians and others are beyond the control of the AMS, which can at best serve as a spokesperson for the community. The AMS will need to choose carefully those areas where it can have impact and to be effective it will need to involve more mathematicians in its efforts. As I understand the Society's structure, policy should be determined by the Council and various Policy Committees and it is the task of the Trustees to advise as to the financial costs of proposed initiatives and to manage the Society's funds and income prudently in a manner to best advance the mathematicians' weal. While inclined to be highly proactive, as a Trustee I will be aware of the need for prudence.

Marc A. Rieffel
Professor, University of California, Berkeley.

Born: December 22, 1937, New York, New York.

Ph.D.: Columbia University, 1963.

Offices: Member-at-Large of the Council, 1987–1989.

AMS Committees: Committee on Committees, 1982–1984; Committee on the Proposed Structure of JPBM, 1987–

1988; AMS-MAA-SIAM Joint Committee on Employment Opportunities, 1989–1991; *Mathematical Surveys and Monographs* Editorial Committee, 1991– (Chair, 1992–).

Selected Addresses: Invited Address, La Jolla, November 1972; Summer Institute on Operator Algebras and Applications, Kingston, Ontario, 1980; Invited Address, Albuquerque, April 1990; AMS-IMS-SIAM Joint Summer Research Conference on Deformation Theory of Algebras and Quantization with Applications to Physics, Amherst, June 1990; Special Session on C^* -algebras 1943–1993 (A Fifty-Year Celebration), San Antonio, January 1993.

Additional Information: Member: AMS, MAA; Organizing Committee, Joint Summer Research Conference on Group Actions on Rings, Bowdoin, July 1984; Member, Executive Committee of the College of Letters and Science, University of California, Berkeley, 1990–1992.

Selected Publications: 1. *Dimension and stable rank in the K -theory of C^* -algebras*, Proc. London Math. Soc. **46** (1983), 301–333. MR **84g**:46085; 2. *Projective modules over higher-dimensional noncommutative tori*, Canad. J. Math. **40** (1988), 257–338. MR **89m**:46110; 3. *Deformation quantization of Heisenberg manifolds*, Comm. Math. Phys. **122** (1989), 531–562. MR **90e**:46060; 4. *Critical points of Yang-Mills for noncommutative two-tori*, J. Diff. Geom. **31** (1990), 535–546. MR **91b**:58014; 5. *Lie group convolution algebras as deformation quantizations of linear Poisson structures*, Amer. J. Math. **112** (1990), 657–685. MR **92b**:58019.

Statement: The primary responsibility of the Trustees is to maintain the financial good health and the smooth functioning of the AMS. There will be many challenges, ranging, for example, from the possible responses of the AMS to the crisis in the mathematics community of the former Soviet Union, or from the needs of the AMS “Washington office” for resources, to the effect of the coming electronic distribution of journals on the publishing activities and finances of the AMS. I will try to deal with these challenges wisely.

Nominating Committee**Morris W. Hirsch***Professor, University of California, Berkeley.***Born:** June 28, 1933, Chicago, Illinois.**Ph.D.:** University of Chicago, 1958.**AMS Committees:** Committee on Far Western Sectional Meetings (Select Hour Speakers for), 1981–1982; *Bulletin* (New Series) Editorial Committee, 1987–1989; Committee on Committees, 1989–1990.**Selected Addresses:** International Congress of Mathematicians, Moscow, 1966; Invited Address, San Antonio, January 1970; AMS Colloquium Lectures, Toronto, August 1982; Co-organizer, Special Session on Dynamics and Computation in Neural Networks, San Antonio, January 1993.**Additional Information:** Member: AMS, International Neural Network Society, SIAM.**Selected Publications:** 1. with S. Smale, *Differential Equations, Dynamical Systems, and Linear Algebra*, Pure Appl. Math., Vol. 60. Academic Press, New York-London, 1974. MR 58 #6484; 2. with B. Mazur, *Smoothings of Piecewise Linear Manifolds*, Ann. of Math. Stud., No. 80. Princeton University Press, Princeton, 1974. MR 54 #3711; 3. *Differential Topology*. Graduate Texts In Mathematics. No. 33. Springer-Verlag, New York-Heidelberg, 1976. MR 56 #6669; 4. with C. Pugh and M. Shub, *Invariant Manifolds*. Lecture Notes in Mathematics, Vol. 583. Springer-Verlag, Berlin-New York, 1977. MR 58 #18595; 5. *The dynamical systems approach to differential equations*, Bull. Amer. Math. Soc. (N.S.) 11 (1984), 1–64. MR 85m:58060.**Statement:** I believe that the most important tasks facing the Society are: (1) To increase greatly the number of women and ethnic minority mathematicians and (2) To emphasize the importance of basic research rather than mission-oriented projects currently being emphasized by federal agencies.**Hugh L. Montgomery***Professor of Mathematics, University of Michigan, Ann Arbor.***Born:** August 26, 1944, Muncie, Indiana.**Ph.D.:** University of Cambridge, 1972.**AMS Committees:** Nominating Committee, 1980–1981 (Chair, 1981); AMS-MAA Joint Program Committees for the Toronto Meeting, August 23–27, 1982, and for the AMS Centennial, 1988 (Chair); Program Committee for National Meetings, 1981 and 1987–1989.**Selected Addresses:** Invited Address, International Congress of Mathematicians, Vancouver, 1974; Invited Address, Urbana, March 1976; CBMS Lectures, Kansas State University, 1990; MAA Trisection Address, Notre Dame, 1993.**Additional Information:** MAA Board of Governors, 1992–1995.**Selected Publications:** 1. *The analytic principle of the large sieve*, Bull. Amer. Math. Soc. 84 (1978), 547–567. MR 57 #5931; 2. with R. C. Vaughan, *On the distribution of reduced residues*, Ann. of Math. 123 (1986), 311–333. MR 87g:11119; 3. with D. A. Goldston, *On pair correlations of zeros and primes in short intervals*, Analytic Number Theory and Diophantine Problems (Stillwater, 1984), Birkhäuser Boston, Boston, MA, 1987, 183–203; 4. with Ivan Niven and Herbert S. Zuckerman, *An introduction to the theory of numbers*, Fifth Edition. John Wiley & Sons, New York, 1991. MR 91i:11001.**Linda Preiss Rothschild***Professor, University of California, San Diego.***Born:** February 28, 1945.**Ph.D.:** Massachusetts Institute of Technology, 1970.**Offices:** Member-at-Large of the Council, 1977–1979; Executive Committee of the Council, 1979; Vice-President, 1985–1986.**AMS Committees:** Committee on Committees, 1977–1981; Committee on Science Policy, 1980–1982 and 1992–; *Transactions and Memoirs* Editorial Committee, 1983–1986; *Contemporary Mathematics* Editorial Committee, 1991–; Advisory Committee on Former Soviet Union Mathematics, 1993–.**Selected Addresses:** Invited Address, Pittsburgh, August 1981.**Additional Information:** President, Association for Women in Mathematics, 1983–1985; Editorial Board, *Communi-**cations in PDE*, 1983–.**Selected Publications:** 1. with E. M. Stein, *Hypoelliptic differential operators and nilpotent groups*, Acta Math. 137 (1976), 247–320. MR 55 #9171; 2. with A. Grigis, *A criterion for analytic hypoellipticity of a class of differential operators with polynomial coefficients*, Ann. of Math. 118 (1983), 443–460. MR 85f:35054; 3. with L. Corwin, *Solvability of transversally elliptic differential operators on nilpotent Lie groups*, Amer. J. Math. 108 (1986), 589–613. MR 87m:58186; 4. with M. S. Baouendi, *Geometric properties of mappings between hypersurfaces in complex space*, J. Differential Geom. 31 (1990), 473–499. MR 91g:32032; 5. with M.S. Baouendi, *A generalized complex Hopf Lemma and its applications to CR mappings*, Invent. Math. 111 (1993), 331–348.**Statement:** This is a time of crisis for mathematics: employment opportunities are scarce, funding for research is greatly diminishing, mathematical education at all levels is being restructured. It is also a time of challenge and opportunity for the AMS to provide leadership in the community to bring the best talents of its members to tackle these problems. The Nominating Committee should continue to seek out candidates with a variety of perspectives, including young people, minorities, women, and handicapped mathematicians, to help address these serious concerns.**Seymour Schuster***William H. Laird Professor of Mathematics and the Liberal Arts, Carleton College.***Born:** July 31, 1926, Bronx, NY.**Ph.D.:** Pennsylvania State University, 1953.**AMS Committees:** Committee on Human Rights of Mathematicians, 1985–1987.**Selected Addresses:** Special Session on Graph Theory and Combinatorics, Memphis, November 1977; Organizer, Special Session on Combinatorics, Duluth, August 1979.**Additional Information:** Fellow, University of Toronto, 1952–1953; Associate Editor, *American Mathematical Monthly*, 1969–1986; NSF Fellow, 1970–1972; Member, NRC's U.S.

Delegations to ICME II (Exeter, 1972) and ICME III (Karlsruhe, 1976); Foundation Fellow, Institute of Combinatorics and its Applications, 1990–; Sixteen international awards for production of college-level geometry films; Member: AWM, MAA, and NAM.

Selected Publications: 1. with G. A. Dirac, *A Theorem of Kuratowski*, Akademie van Wetenschappen, Series A, LVII, 3 (1954), 342–348; 2. *Pencils of polarities in projective space*, Canad. J. Math., **8** (1956), 119–144; 3. *On the Teaching of Geometry: A Potpourri, Educational studies in mathematics*, IV (1971), 76–86; reprinted in *The Teaching of Geometry at the Pre-college Level*, D. Reidel Publishing Co., Dordrecht, Holland, 1971; 4. with G. Chartrand, *On a variation of the Ramsey number*, Trans. Amer. Math. Soc. **173** (1972), 353–362. MR **47** #6541; 5. *Packing a Tree of Order p with a (p, p) graph*, Graph Theory with Applications to Algorithms and Computer Science, Y. Alavi, et al., eds., Wiley Intersci. Publ., Wiley, New York, 1985, 697–712. MR **87d**:05133.

Statement: Obviously, the AMS exists to promote mathematical scholarship in every way possible. My view is that the Society should also be ministering to the community of mathematicians by attending (or continuing to attend) to matters of social-professional concern. Examples: training the next generation of mathematicians, the present job crisis (especially for young colleagues), making the profession a welcoming place for racial minorities and women, using the good offices of the Society to gain the right to travel freely to international meetings—unimpeded by political and bureaucratic restrictions. If elected, these criteria will affect my choices of nominees for offices in the AMS.

Charles C. Sims

Professor, Rutgers University, New Brunswick.

Born: April 14, 1937, Elkhart, Indiana.

Ph.D.: Harvard University, 1963.

AMS Committees: Associate Editor, *Mathematics of Computation*, 1982–1983.

Selected Addresses: Special Session on Computational Methods in Abstract

Algebra, Evanston, November 1968; Symposium on Computers in Algebra and Number Theory, New York, March 1970; International Congress of Mathematicians, Helsinki, 1978; Summer Research Institute on Finite Group Theory, Santa Cruz, California, 1979; Short Course on Computer Algebra-Symbolic Mathematical Computation, Ann Arbor, August 1980; Special Session on Computational Group Theory, Phoenix, January 1989; Organizer, Special Session on Computational Algebra, Hoboken, October 1989.

Additional Information: Sloan Fellow, 1969; Member, Board of Directors, New Jersey Educational Computer Network, 1975–1980; Visiting Fellow, Australian National University, 1977–1978; Chair, Department of Mathematics, Rutgers University, New Brunswick, 1982–1984; Associate Provost, Rutgers University, New Brunswick, 1984–1987; Editorial Board, *Journal of Symbolic Computation*, 1985–. Member: AMS, MAA.

Selected Publications: 1. *Enumerating p -groups*, Proc. London Math. Soc. **15** (1965), 151–166. MR **30** #164; 2. *Computation with permutation groups*, Proc. Second Symp. on Symbolic and Algebraic Manipulation (1971), 23–28; 3. with J. S. Leon, *The existence and uniqueness of a simple group generated by $(3, 4)$ -transpositions*, Bull. Amer. Math. Soc. **83** (1977), 1039–1040; 4. *Verifying nilpotence*, J. Symbolic Comput. **3** (1987), 231–247; 5. *Implementing the Baumslag-Cannonito-Miller polycyclic quotient algorithm*, J. Symbolic Comput. **9** (1990), 707–723.

Chuu-Lian Terng

Professor, Northeastern University.

Born: February 1, 1949, Hualian, Taiwan.

Ph.D.: Brandeis University, 1976.

Offices: Member-at-Large of the Council, 1986–1988.

Selected Addresses: Invited Address, Eugene, August 1984; Special Session on Differential Geometry, Anaheim, January 1985; Special Session on Differential Geometry of Submanifolds, Worcester, April 1985; Special Session on Nonlinear Problems Arising in Physics and Geometry, Amherst,

October 1985; Special Session on Variational Methods, Differential Analysis and Symmetry, Orono, August 1991.

Additional Information: Sloan Fellow, 1980–1982; AWM Nominating Committee for the Noether Lecture, 1989–1992; Membership: AMS, AWM.

Selected Publications: 1. *Natural vector bundles and natural differential operators*, Amer. J. Math. **100** (1978), 775–828. MR **81c**:58009; 2. with K. Tenenblat, *Bäcklund's Theorem for n -dimensional submanifolds of \mathbb{R}^{2n-1}* , Ann. of Math. **111** (1980), 477–490. MR **82j**:58068; 3. *Isoparametric submanifolds and their Coxeter groups*, J. Differential Geom. **21** (1985), 79–107. MR **87e**:53095; 4. with R. S. Palais, *Critical point theory and submanifold geometry*, Lecture Notes in Mathematics, 1353. Springer-Verlag, Berlin-New York, 1988. MR **90c**:53143; 5. *Convexity theorem for infinite dimensional isoparametric submanifolds*, Invent. Math. **112** (1993), 9–22.

Statement: If elected, I hope to help nominate more young people and new faces in the business of governing the AMS.

Editorial Boards Committee

J. Brian Conrey

Professor and Head, Department of Mathematics, Oklahoma State University.

Born: June 23, 1955, Agana, Guam.

Ph.D.: University of Michigan, 1980.

Selected Addresses: Special Sessions on Analytic Number Theory, Ann Arbor, August 1980 and Notre Dame, March 1981; Special Session on Number Theory and Related Parts of Analysis, Austin, November 1981; Selberg Symposium, Oslo, 1987; Special Session on Analytic Number Theory, Louisville, January 1990; Invited Address, Manhattan, Kansas, March 1990; Special Session on Analytic Number Theory, DeKalb, May 1993.

Additional Information: NSF Postdoctoral Fellow, 1982–1983; Sloan Fellow, 1986–1988

Selected Publications: 1. *Zeros of derivatives of Riemann's ξ -function on the critical line*, J. Number Theory **16** (1983), 49–74. MR **84g**:10070; 2. with

R. Balasubramanian and D. R. Heath-Brown, *Asymptotic mean square of the product of the Riemann zeta-function and a Dirichlet polynomial*, J. Reine Angew. Math. **357** (1985), 161–181. MR **87f**:11061; 3. with A. Ghosh and S. M. Gonek, *Simple zeros of the zeta-function of a quadratic number-field*, I. Invent. Math. **86** (1986), 536–576. MR **87m**:11114; 4. with A. Ghosh, *Simple zeros of the Ramanujan τ -Dirichlet series*, Invent. Math. **94** (1988), 403–419. MR **89k**:11078; 5. *More than two-fifths of the zeros of the Riemann zeta-function are on the critical line*, J. Reine Angew. Math. **399** (1989), 1–26. MR **90g**:11120. **Statement**: I haven't served on an AMS committee before but am happy to do so. I am willing to give a sincere effort to do the best I can to represent the members of the AMS fairly.

Martin Golubitsky

Cullen Professor of Mathematics, University of Houston.

Born: April 5, 1945, Philadelphia, Pennsylvania.

Ph.D.: Massachusetts Institute of Technology, 1970.

AMS Committees: AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences, 1987–1992 (Chair, 1991–1992).

Selected Addresses: Spitalsfeld Lecture, University of Warwick, 1989; Invited Address, Dayton, October 1992; SIAM Plenary Lecture: Dynamical Systems Activity Group, Snowbird, October 1992.

Additional Information: Fellow, AAAS, 1987; SIAM Council, 1990–1992 and 1993–1995 (elected); Editorial Boards: *Archives of Rational Mechanics and Analysis*; *Dynamics and Differential Equations*; *Journal of Bifurcation and Chaos in Applied Sciences and Engineering*; *Journal of Nonlinear Science*. **Selected Publications**: 1. with V. Guillemin, *Stable Mappings and Their Singularities*, Graduate Texts in Mathematics, vol. 14. Springer-Verlag, New York-Heidelberg, 1973. (Russian translation by A. Kushnirenko, 1976); 2. with D. G. Schaeffer, *Singularities and Groups in*

Bifurcation Theory: Vol. I Applied Mathematical Sciences 51. Springer-Verlag, New York-Berlin, 1985. MR **86e**:58014; 3. with I. N. Stewart and D. G. Schaeffer, *Singularities and Groups in Bifurcation Theory*. Vol II. Applied Mathematical Sciences 69. Springer-Verlag, New York-Berlin, 1988. MR **89m**:58038; 4. with I. Stewart, *Fearful Symmetry: Is God a Geometer?* Blackwell Publishers, Oxford, 1992; 5. with M. Field, *Symmetry in Chaos: A Search for Pattern in Mathematics, Art, and Nature*. Oxford University Press, Oxford, 1992.

Statement: The primary functions of the Editorial Boards Committee are to monitor the quality of and to solicit nominations for the editorial boards of the various AMS journals. Since it is important to have high quality general purpose mathematics journals of the type that are published by the AMS, I will work towards the continued success of these journals.

Carolyn Gordon

Professor, Dartmouth College.

Born: December 26, 1950, Charleston, West Virginia.

Ph.D.: Washington University, 1979.

AMS Committees: Central Section Program Committee, 1990–1991; *Notices* Editorial Committee, 1991–.

Selected Addresses: Invited Addresses: Lincoln, October 1987 and San Antonio, January 1993.

Additional Information: AMS Centennial Fellow, 1990–1991.

Selected Publications: 1. with D. Webb and S. Wolpert, *One cannot hear the shape of a drum*, Bull. Amer. Math. Soc. **27** (1992), 134–138. MR **92j**:58111; 2. with E. N. Wilson, *Isospectral deformations of compact solvmanifolds*, J. Differential Geom. **19** (1984), 241–256. MR **85j**:58143; 3. *Riemannian manifolds isospectral on functions but not on 1-forms*, J. Differential Geom. **24** (1986), 79–96. MR **87m**:58174; 4. with C. Benson, *Kähler and symplectic structures on nilmanifolds*, Topology **27** (1988), 513–518. MR **90b**:53042; 5. with D. DeTurck, H. Gluck, and D.

Webb, *The inaudible geometry of nilmanifolds*, Invent. Math. **111** (1993), 271–284.

Carl Pomerance

Research Professor, Department of Mathematics, University of Georgia.

Born: November 24, 1944, Joplin, Missouri.

Ph.D.: Harvard University, 1972.

Offices: Member-at-Large of the Council, 1990–1992.

AMS Committees: Nominating Committee, 1987–1988; Committee on South-eastern Sectional Meetings (Select Hour Speakers for), 1983–1984 (Chair, 1984), 1991–1992 (Chair, 1992); *Mathematics of Computation* Editorial Committee (Associate Editor), 1987 –; *Transactions and Memoirs* Editorial Committee, 1988–1991.

Selected Addresses: One-hour talks at MAA Summer Meetings, 1983, 1984; Journées Arithmétiques, Geneva, 1991; Dutch Mathematical Society Annual Meeting, First Beeger Lecturer, 1992; Lehmer Symposium (at *Mathematics of Computation* 50th Anniversary), Vancouver, 1993.

Additional Information: Chauvenet Prize, MAA; Pólya Lecturer, MAA.

Selected Publications: 1. with P. Erdős, *On the number of false witnesses for a composite number*, Math. Comp. **46** (1986), 259–279. MR **87i**:11183; 2. Editor, *Cryptology and Computational Number Theory – an introduction*, Proc. Sympos. Appl. Math., vol. 42, Amer. Math. Soc., Providence, RI, 1990. MR **92e**:94023; 3. with H. W. Lenstra, Jr., *A rigorous time bound for factoring integers*, J. Amer. Math. Soc. **5** (1992), 483–516. MR **92m**:11145; 4. with J. Buhler and H. W. Lenstra, Jr., *Factoring integers with the number field sieve*, The Development of the Number Field Sieve (A. K. Lenstra and H. W. Lenstra, Jr., eds.), Lecture Notes in Math., 1554, Springer-Verlag, Berlin, to appear; 5. with W. R. Alford and A. Granville, *There are infinitely many Carmichael numbers*, Ann. of Math., Princeton Univ. Press, Princeton, NJ, to appear.

Proposed Amendment to the Bylaws of the American Mathematical Society

The Council has adopted several changes in the manner in which policy matters are funnelled through the Society's governance structure. In particular it has established policy committees in several areas. (Information about these changes has appeared in various issues of the *Notices* during the past year.) The Council then examined the question of membership on the Council of the chair of the Committee on Science Policy and the chair of the Committee to Monitor Problems in Communication. The Council recommended the elimination of this second committee (to be replaced by the policy Committee on Publication).

In order to affect these changes it is necessary to change the Bylaws of the Society. The Council has passed the amendment to the Bylaws noted below and submits it to the membership for ratification in the Election of 1993. The effect of this amendment is to eliminate any mention in the Bylaws of the Committee to Monitor Problems in Communication and the Committee on Science Policy. If this amendment is passed, members of the Council will consist of the officers (a total of nine, five of whom are elected in contested elections), nine chairs of editorial committees (appointed by the Council), fifteen Members-at-Large elected in contested elections, and, when applicable, members of the Executive Committee whose terms on the Council have been extended and a former Secretary. Thus there will be twenty members elected in contested elections and thirteen members (on average) elected by the Council itself.

The Bylaws of the Society state the following concerning amendments to the Bylaws:

These Bylaws may be amended or suspended on recommendation of the Council and with the approval of the membership of the Society, the approval consisting of an affirmative vote by two-thirds of the members present at a business meeting or of two-thirds of the members voting in a mail ballot in which at least ten percent of the members vote, whichever alternative shall have been designated by the Council, and provided notice of the proposed action and of its general nature shall have been given in the call for the meeting or accompanies the ballot in full.

In the statement of the amendment, deleted words are ~~lined out~~ and insertions are in **bold face**.

The ballot on the amendment is on the same sheet as that for officers and Council members.

Article III Committees

Section 1. There shall be nine editorial committees as follows: committees for the *Bulletin*, for the *Proceedings*, for the *Colloquium Publications*, for the *Journal*, for *Mathematical Surveys and Monographs*, for *Mathematical Reviews*; a joint committee for the *Transactions* and the *Memoirs*; a committee consisting of the representatives of the Society on the Board of Editors of the *American Journal of Mathematics*; and a committee for *Mathematics of Computation*.

~~Section 2. There shall be a Science Policy Committee.~~

~~Section 3. There shall be a communications committee called the Committee to Monitor Problems in Communication.~~

Section 2. The size of each committee shall be determined by the Council.

Article IV Council

Section 1. The Council shall consist of fifteen members-at-large and the following *ex officio* members: the officers of the Society specified in Article I, except that it shall include only one associate secretary, the chairman of each of the editorial committees **specified in Article III and of the communications committee and of the Science Policy Committee**, any former secretary for a period of two years following the terms of office, and members of the Executive Committee (Article V) who remain on the Council by the operation of Article VII, Section 4.

Article VI Executive Director

Section 3. The Executive Director shall work under the immediate direction of a committee consisting of the president, the secretary, and the treasurer, of which the president shall be chairman *ex officio*. The Executive Director shall attend

meetings of the Board of Trustees, the Council, and the Executive Committee, but shall not be a member of any of these bodies. ~~The Executive Director shall be a voting member of the Committee to Monitor Problems in Communications but shall not be its chairman.~~

Article VII

Section 2. Each committee named in Article III; ~~Section 4 or 3;~~ shall be appointed by the Council in a manner designated by the Council.

Article XII *Communications*

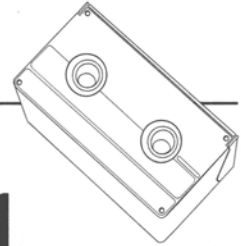
~~The Committee to Monitor Problems in Communication shall perform such tasks in the field of communication of mathematics as are assigned to it by the Council.~~

(Article XII will be deleted and the remaining articles numbered accordingly.)



VIDEOTAPE

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I. M. Gelfand

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1991 *Mathematics Subject Classification*: 00, 01

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An Unfortunate Metaphor

Louis A. Talman

Metropolitan State College of Denver

The metaphor of the assembly line seems to me to express best, and for good reason, a very troublesome problem facing education today. For economic reasons we have had no choice but to use strategies of mass production, including the notion of interchangeable parts: interchangeable faculty, interchangeable courses, interchangeable curricula, interchangeable textbooks, interchangeable students. The use of standardized tests reinforces the metaphor; they are the measuring engines that enforce interchangeability. We—faculty, students, the general public alike—perceive educational institutions as nothing more and nothing less than monstrous assembly lines. That's why the metaphor expresses the problem so well: metaphor has become reality. The metaphor *is* the problem.

We have adopted the metaphor wholeheartedly. I think that many students (*and faculty*) believe that what one is doing at a college or university is *being processed*. Students often seem to presume that simply *going* to college guarantees one the degree one seeks, provided only that one serves one's time. By the same token, many students seem to have the notion that merely *having taken* the prerequisite course should automatically qualify them for the current course. Some of them believe it to the extent that they think they are qualified for the current course even when they earned an "F" in the prerequisite course—"I took it, didn't I?"

I submit that herein lie the reasons underlying the need for calculus reform (as well as the full-fledged curriculum reform

that real calculus reform will engender). Our mathematics curriculum is moribund because we have not paid attention to the dangers that attend the application of techniques of mass production to the education of human beings. We have tried to reduce human beings to hardware capable of retaining processed characteristics indefinitely while awaiting further processing. We may have to use techniques of mass production; let us use them humanely, remembering that neither we nor our students are interchangeable parts. A *re-formed* curriculum, no matter how lean and lively, that ignores this issue will be no *reform* at all.

I suggest that we should rely less on the results of standardized testing (i.e., how closely the student matches the criteria for the part that fits *here* in the machine) and on the number and nature of credit hours a student has accumulated (i.e., the amount of *processing* that a student has endured) when we place that student. We must find ways to determine more accurately what courses students are prepared to profit from, and we should place students into our courses on these new bases.

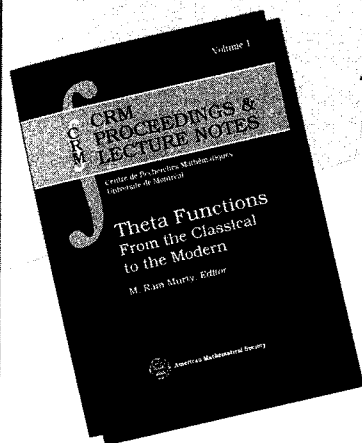
But the metaphor fails here, and we must be wary. I do not mean that we should invent better standardized tests in order to be sure that the part fits into its intended place, for there can be no guarantees that students—especially students who see themselves as passive receivers of processing—will have the capabilities tomorrow that they had yesterday or even today. We must continually assess how students fare in their courses, and we should be willing to advise them to review prerequisite work when they aren't prepared for current work. Sometimes we will have to advise students to retake courses in spite of the good grades they got the last time around. And we must make that advice stick.

Finally, I would like to suggest a metaphor I think likely to serve us better than that of the assembly line. We can conceive of mathematics as a poorly explored mountain range. We are experienced mountaineers. As researchers, we are explorers entering the unknown heart of the range. As teachers, we are mountain guides through more or less well-explored parts of the range. Students come to the mountains seeking many things: recreation, natural resources (including beauty), to become explorers themselves. They must develop not only knowledge of the terrain itself but the skills necessary for safe travel in mountainous country. Ultimately, it is the latter

which are the more important, not the former.

I can't emphasize this point enough: the skills are much more important than familiarity with any particular route or piece of terrain. I should say that in our entire curriculum, as it stands today, we concentrate the lion's share of our efforts on describing trails that lead from one point to another, instead of on inculcating the skills for traveling. We must find ways to free our curriculum from its dependence on fixed-course content so that we can attend to more important matters.

I think we can learn much from this metaphor and its ramifications. For example, one would not ask a tenderfoot to lead even an easy technical climb; and this suggests that one should not ask a freshman to invent an ε - δ proof. Further, an experienced mountain guide does not expect his charges to know the territory—even given that they've been over it before. This observation begins to address our problems with prerequisites; I will leave it to the reader to extend the metaphor further.



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This month's column

George Grätzer opens this month's column with the second in a series of articles on \TeX , the first having appeared in February of this year. Then Butler, Iyer, and O'Brien write about *TwoGroups*, a database for group theory. Finally, Richard Dudley offers a comment on an earlier article in the column.

Editor's address:

Professor Keith Devlin
School of Science
Saint Mary's College of California
P.O. Box 3517
Moraga, California 94575

Correspondence by electronic mail is preferred, to:

devlin@msri.org.

Advances in \TeX Implementations.

I. PostScript Fonts

George Grätzer*

1. Introduction

It is safe to say that mathematicians spend more time using \TeX than any other computer program. Unfortunately, \TeX was frozen in 1984 by Donald E. Knuth:

For more than five years I held firm to my conviction that a stable system was far better than a system that continues to evolve. But during the TUG meeting at Stanford in August 1989 I was persuaded to make one last set of changes in order to bring \TeX and Metafont to a state of completion consistent with their overall philosophy and goals.

Without him any change in \TeX seems very difficult to accomplish.

*George Grätzer, University of Manitoba, Department of Mathematics, Winnipeg, Manitoba R3T 2N2, Canada; e-mail: george.gratzer@umanitoba.ca.

Nevertheless, the advances in *implementing* \TeX have been spectacular. There are significant changes taking place:

- a new macro package, $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$, and a forthcoming version of $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$, Version 3;
- the speed of execution;
- the use of PostScript fonts;
- the emergence of integrated \TeX systems, including the new front end: *Scientific Word*.

\TeX was designed as a “platform” on which *convenient work environments*, so called “macro packages”, can be built. Two such macro packages, $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{T}\mathcal{E}\mathcal{X}$ (see [7]) and $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ (see [6]), were made available to the mathematical community in the early eighties. Both systems became very popular. A few years ago the American Mathematical Society (AMS) (see [2]) undertook to develop $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$, which makes $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{T}\mathcal{E}\mathcal{X}$ a $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ “option”, thereby uniting the two packages. Once the unified macro package is accepted by the mathematical community the advantages will be significant. See [3] for a discussion of $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$.

It is hoped that a significant new version of $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ (version 3) will come out in 1994.

The following example illustrates the increased speed of typesetting with \TeX . Using *Textures* (version 1.4) on a Mac (Ifx), it took 15 minutes to typeset the book [4] in the spring of 1992. A year later, using *Lightning Textures* (version 1.5) on my Mac (Quadra 950), it took 2.5 minutes for the same job—a **six-fold** increase in speed. Big $\text{PCT}\mathcal{E}\mathcal{X}386$ on the PC typesets just as speedily. In fact typesetting is so fast that any further improvements will not really benefit the working mathematician writing a paper, which is typically five to twenty pages long.

Traditionally, \TeX uses Computer Modern (CM) fonts in “rasterized” form, that is, translated into a matrix of 0s and 1s to tell the printer where to print the dots that form the character. Already on medium resolution printers (300 dpi—dots per inch), these matrices become very large, requiring a lot of hard-disk space in the computer and a lot of memory in the printer. With the emergence of 600 dpi printers for personal computers and the use of high resolution printers (1200 dpi and higher) by publishers, it became imperative to use outline font technology for CM fonts. (The CM fonts occupy almost seven megabytes at 300 dpi even though, of the 177 font

sizes and shapes, only 116 are fully represented; at 2602 dpi, *cmr10* grows from 5.4K to about 177K, a more than 30-fold increase. So it is safe to assume that the whole CM set would exceed 200 megabytes at 2602 dpi.) Conversion from bitmap to outline was completed in 1991–1992 for the CM fonts and for the AMS extension set, called *AMSF*onts. (See Section 7 for the products.)

\TeX is not constrained to use CM fonts. Outline fonts such as PostScript fonts and TrueType fonts can be used; for instance, you may want to use the popular Times font for text. A new PostScript font appeared with a complete set of text and mathematical symbols—Lucida Bright and Lucida New Math.

An *integrated \TeX environment* consists of an editor (to create and edit the source document), a typesetter (\TeX), a viewer (to show the typeset version on the screen), and a printer driver (to print the typeset version). On the Mac, *Textures* always had an integrated environment. Now *Lightning Textures* is even better. On the PC, the emergence of *Windows* (version 3.0 or higher) makes it possible to develop integrated \TeX environments. One has already appeared (Turbo \TeX), and another one is in β -testing (PCT \TeX for Windows is currently available). A significant development is *Scientific Word*, which adds a L \LaTeX front-end to \TeX .

In Part I of this article, we shall discuss the PostScript developments; in Part II, the integrated \TeX environments.

If your \TeX previewer (screen driver) cannot handle PostScript fonts, you have to get one that can. *DVIWindow* from Y&Y is such a previewer working under *Windows*. It will be discussed in Part II of this article.

2. Some Terminology

To get started, we clarify some terms we shall use.

Computers: We shall deal exclusively with **personal computers**. An IBM compatible will be called PC, and a Macintosh, Mac.

Font: In typography (see, e.g., Ruari McLean [5]), Times is a **font**; it typically includes a roman (upright), an italic (slanted), a bold, and a bold-italic variant. A **font family** consists of a number of related fonts; for instance, the Rockwell font family from Adobe consists of the Rockwell font and the Rockwell Light font. The Lucida Bright font family consists of four (or more) fonts.

In contrast \TeX defines a **font** as one shape in a given size. So Computer Modern Roman (CMR) size 10 is a font (called *cmr10*).

Outline font: As opposed to a font such as *cmr10* which exists in a fixed size, an **outline font** is designed to be printed in any size. To describe a character, instead of providing a dot pattern it gives instructions, such as draw an arc, where the parameters of the arc are given in terms of the drawing size. A program (screen driver) will rasterize the letter to show it on the screen; another one (printer driver) will print it.

PostScript: The most commonly used outline fonts are defined in the **PostScript** page-description language (see [1]).

Printers that can accept PostScript input are called **PostScript printers**.

As a rule, *Adobe Type Manager (ATM)* is the program that will display PostScript characters on the screen (both for PC and Mac) and send them to the printer.

Actually, **Adobe Type 1 font** is the official name for these fonts; there are many other PostScript fonts (“gray-level” and “composite”, to name two), and a font may be described in more than one form (“Type 1” and “Type 3”, for example). When we write “PostScript”, substitute for it “Adobe Type 1”; an alternative name for it is “ATM compatible”, a somewhat more restrictive class.

TrueType: With *Windows* 3.1 on the PC and System 7 on the Mac came a competing outline font technology called **True Type**. Presently, the number of TrueType fonts is rather small compared to the number of PostScript fonts, and there is no math font. This competition with Adobe resulted in the free distribution of ATM, a savings of about \$150 to the user. We shall not be dealing with TrueType fonts in this article, although much that is said would apply to them.

Hinting: Noncommercial laser printers print 300–600 dots per inch. The newer ones use resolution enhancement technologies, thereby making some curved lines smoother. Outline fonts that are **hinted** produce nicer output on such printers and on the screen.

Point: The size of a character (of a font in \TeX) is given in **points** (sometimes called **Pica points**). Normally, we typeset in 10 point (pt) size, and the baseline of a line is 12 pts from the baseline of the next line (10 pt over 12). There are 72.27 points in an inch. Adobe uses **Didot points** for measurement: there are 72 Didot points in an inch. The difference is small enough so that it seldom causes problems.

3. Font Files and Metric Files

A PostScript font file is a “table” with 256 entries (or more); each nonempty entry is the description of a character. As an example, in the Times-Roman font file, as customary, the first 32 positions are not used (those are the ASCII positions for control characters, such as carriage return, line feed, end of file, etc.). In position 33 is the space character; “A” is 65, and “fi” is 174. A number of positions are unused.

In contrast, in CMR, the first 32 positions are used; the letters and digits occupy the same position as in Times-Roman, but little else is the same. For instance, “fi” is in position 12. The upper 128 positions are not used.

Every font file has a **metric file**. While the font file specifies the shape of the character, the metric file contains dimensions—some for the font file, such as interword space—and a lot of information about each character: the box size in which the character appears, the **Kerning table**, and the **ligature substitution table** for each character.

Some pairs of characters do not look too good if their “boxes” are placed side by side. For instance, “f?” is kerned; without kerning it looks like this: “f?”. Certain groups of characters, when typeset, are joined together; such compound

characters are called *ligatures*. They are five in number in CMR—fi, fl, ff, ffi, and ffl—and only the first two appear in Times-Roman. The metric file shows that “fi” should be replaced by the character “f”. All such information is expressed in terms of character positions; the metric file does not know what character is at a specific position.

The metric file for a \TeX font file has an extension tfm, and it is called a *tfm file*. For Adobe PostScript fonts the metric files have either the extension afm or pfm. The former is in the human readable ASCII form; the latter is in the compact binary form. Human readable does not mean that the information therein is easy to understand. Luckily, there is a utility (TFTOPL, available free of charge by anonymous ftp from a few hundred locations) that converts a tfm file to pl format (and there is a utility that converts it back), and the pl file contains the information in an easy-to-understand format. For instance, the pl file for CMR shows:

```
(CHARACTER C f
  (CHARWD R 0.305557)
  (CHARHT R 0.694445)
  (CHARIC R 0.077779)
  (COMMENT
    (LIG C i 0 14)
    (LIG C f 0 13)
    (LIG C l 0 15)
    (KRN 0 47 R 0.077779)
    (KRN 0 77 R 0.077779)
    (KRN 0 41 R 0.077779)
    (KRN 0 51 R 0.077779)
    (KRN 0 135 R 0.077779)
  )
)
```

So there are three ligature substitutions for “f” and five kerning pairs (the position numbers are in octal).

4. CM and AMS PostScript Fonts

The PostScript version of the CM fonts came out in 1991. The PostScript version of the AMSFonts came out in 1992. These are fully hinted Adobe Type 1 fonts.

4.1. Mac. There is very little difficulty using the PostScript CM and AMSFonts with *Textures* on the Mac. In the “ \TeX fonts” folder you only need the AMS/PS Metrics suitcase. You install the fonts as appropriate for your system. (Unfortunately, the instructions differ whether you use System 6, System 7, or System 7.1; or whether you use Suitcase II.) Of course, you have to tell \TeX that you are using these fonts; how you tell it depends on whether you are using plain \TeX , $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{T}\mathcal{E}\mathcal{X}$, $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$, or $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$. For instance, in $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ there are two files informing the system of the fonts being used—amsfonts.sty and fontdef.max (or variants). Both have to be modified. For instance, in fontdef.max the following

paragraph defines Euler Script (medium):

```
\new@fontshape{eus}{m}{n}{%
  <5>eusm5%
  <6>eusm6%
  <7>eusm7%
  <8>eusm8%
  <9>eusm9%
  <10>eusm10%
  <11>eusm10 at10.95pt%
  <12>eusm10 at12pt%
  <14>eusm10 at14.4pt%
  <17>eusm10 at17.28pt%
  <20>eusm10 at20.74pt%
  <25>eusm10 at24.88pt}{}
```

This shows that Euler Script (medium) is available in sizes 5, 6, 7, 8, 9, and 10; when you need 11, use size 10 magnified to 10.95, and so on. The same paragraph in the modified file reads:

```
\new@fontshape{eus}{m}{n}{%
  <5>eusm5%
  <6>eusm5 at 6pt%
  <7>eusm7%
  <8>eusm7 at 8pt%
  <9>eusm7 at 9pt%
  <10>eusm10%
  <11>eusm10 at 10pt%
  <12>eusm10 at 12pt%
  <14>eusm10 at 14pt%
  <17>eusm10 at 17pt%
  <20>eusm10 at 20pt%
  <25>eusm10 at 25pt}{}
```

PostScript Euler Script is available only in sizes 5, 7, and 10, so if you need size 8, magnify size 7 to 8. (Notice that we got rid of the fractional values.)

The modified files are available from the AMS.

Of course, you have to install ATM—get version 3.0 or higher. If the screen display is too slow, double click on the ATM icon and set the font cache to a higher number (512K or higher).

4.2. PC. To use these fonts on the PC is even easier. The installation is straightforward. Instead of changing the files, amsfonts.sty and fontdef.max, you can simply list the missing sizes in the font substitution file.

4.3. Use in Other Programs. Originally, I got interested in the PostScript version of CM and AMSFonts so that in my diagrams I could label with the same fonts I used in the text. This is not a problem with text; the math symbols are a bit more difficult. You have to know which font contains which symbol and in what location. Then you have to pick that symbol with some utility. On the Mac, I use *KeyFinder* (in the *Norton utilities* package) or *PopChar* from Y&Y; on the PC the utility *CharSelect* is in *Windows* 3.1, or you can use the freeware program *Compose*.

I still remember the pleasure when, on a diagram, I could first label a prime interval p and a vector v .

See, however, Section 6.1 on using these fonts in word processing programs.

5. Using Other PostScript Fonts in T_EX

My odyssey into the uncharted waters of PostScript fonts started with a letter forwarded to me by an editor of the AMS. The letter was written by a mathematician who read the manuscript of [4] for the AMS. He wrote that he liked $\text{AMS-LAT}_{\text{E}}\text{X}$ but he did not like CM fonts. Could he use Times instead?

In Appendix E of [4] I describe a stylesheet option for $\text{AMS-LAT}_{\text{E}}\text{X}$ that introduces Times as the default font for text. I describe this for the Mac and *Textures* because the Times tfm files are included in *Textures*. As a result we avoid the complications that arise for the PC. The same is true of Courier, Helvetica, Palatino, and New Century Schoolbook fonts.

5.1. Standard PostScript Fonts for the Mac. Most laser printers come with a long list of PostScript fonts available on the printer, many more than the five we have just discussed. For instance, there is my favorite, New Century Schoolbook. Unfortunately, it is not that easy to use them in T_EX. If we had the T_EX font metric files, of course, we could proceed as described in Section 4.1

To get the New Century Schoolbook to work in T_EX on the Mac, follow the following steps:

1. Get the afm file for the New Century Schoolbook on the PC.
2. Convert it to a tfm file.
3. Convert the tfm file to pl format.
4. Use the Apple File Exchange (part of the operating system of the Mac) to convert the pl file to Mac format; make sure that you do a "PC to Mac" conversion and that you choose the text file format.
5. Use the utility EdMetrics (it comes with *Textures*) to incorporate the pl file into the font metric file.

5.2. Font Names. "The naming of cats is a serious business," warns T. S. Elliot, and the naming of the font files is of consequence.

The first problem using PostScript fonts on the PC in T_EX is the naming of the font files. When T_EX typesets the source, it uses only the metric files; the names of the metric files used is embedded in the dvi file. You should make sure that the screen fonts bear the same names.

The fun starts with the PC printer font files which have names such as Times-Roman. This problem is solved with the *font substitution file* which would have as a typical line

```
TimesI Times-Italic substitute.
```

This instructs the printer driver to use Times-Italic for the font whose metric file is called TimesI. The syntax of such a line depends on the printer driver.

Of course, once *Windows* is replaced by *WindowsNT*, which allows long file names, we can name the metric file Times-Italic.tfm and such substitutions will not be necessary.

Efforts are being made to introduce some consistent and short naming scheme for font files. Some font vendors use short names, such as "tir" for Times-Roman. The T_EX community supports Karl Berry's scheme which names Times-Roman "ptmr", where "p" is the name of the foundry (Adobe), "tm" is Times, and "r" is Roman. This allows for 676 font names per foundry and 17,576 font names all told. Adobe presently has about 1,500 Type 1 fonts, and one estimates that there are a few hundred foundries and about 14,000 Type 1 fonts on the market.

6. Lucida Bright and Lucida New Math

As we have seen, it is easy to replace the CM text font with Times. It is not surprising that many would want to do that. *Times New Roman* (designed by Stanley Morison for the London *Times*) is undoubtedly the most popular font. In the standard font classification scheme (see [5]) it is a Group III font, *Transitional*, combining the best features of "old face" and "modern". CM is based on a Monotype Modern font, a group IV font—named *Didone* after Didot and Bodoni—more popular in France than elsewhere.

For instance, the *Canadian Journal of Mathematics* uses Times for text. They do not use the CM math symbols; on high resolution printers, if the text is in Times, the CM symbols are too light (on medium resolution printers the "fat" dots make the CM math symbols look much heavier). They designed their own math symbol set.

The only full substitute for CM and AMSFonts (text and math symbols) is *Lucida Bright* and *Lucida New Math*. We should call this a font family because it contains four text fonts in various styles (one in five styles and three in four styles) and three more in one style each. In addition it contains a complete set of math symbols, an extension of the CM symbols and the AMSFonts. The Lucida Bright text fonts are used, for instance, by *Scientific American*. I do not know of a mathematics journal that presently uses Lucida Bright and Lucida New Math. To my eyes the font family is pleasant and distinctive; it is characterized by short descenders in the text font and rather elaborate math letters (compared to the simpler style of CM).

6.1. Encoding. As long as you want to install Lucida Bright and Lucida New Math for T_EX only, you will encounter no difficulty. However, if you want to use Lucida Bright and Lucida New Math (or PostScript CM and AMSFonts) for T_EX *and also* for other applications (such as word processing programs), then you may need some assistance.

The problem is the order in which the characters are placed in the character table of the font, called *encoding*. There are a number of encoding schemes:

- **Windows ANSI encoding.** This is the form in which *Windows* applications expect the encoding. *Windows* may reencode the font to Windows ANSI encoding.
- **Adobe Standard Encoding.** For Adobe PostScript fonts this is the native encoding.
- **T_EX text encoding.** The encoding used by CMR.
- **Textures encoding.** A variant of T_EX text encoding and Adobe Standard Encoding.

Unfortunately, the encoding specifications conflict. Of course, if you install Lucida Bright in different versions (different font files, different metric files)—three on the PC and two on the Mac—then there is no difficulty. However, if you want to use one installed version, then you have to be careful which metric files to use, and the font will probably have to be reencoded. Detailed and carefully thought out installation instructions are provided. But do not expect installation in one minute; there is a lot to understand before you make your choices.

Version 2 of the New Font Selection Scheme utilizes encoding vectors; it should be available by the time you read this.

7. The Products

7.1. T_EX Implementations. The memory allocations in T_EX are fixed. This slows typesetting down. Moreover, larger macro packages may run out of memory.

A “large” implementation of T_EX allocates much larger chunks of memory or will allocate more memory “on demand”.

On the PC, Big PCT_EX386 is a large implementation (Personal T_EX, Inc., 415-388-8853); use version 3.14 or higher. On the Mac, *Lightning Textures* is a large implementation (Blue Sky Research, 503-222-9571); use version 1.5 or higher.

TurboT_EX (Kinch Computer Company, 607-273-0222) is a small T_EX but it successfully typeset the $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ test article (testart.tex) by the AMS.

7.2. PostScript Fonts. The PostScript CM and AMS fonts were developed from the original Metafont design by Blue Sky Research and Y&Y (508-371-3286). They can be purchased from Blue Sky Research, Y&Y, and the T_EX User Group (401-751-7760). The PostScript CM fonts are also available from Personal T_EX.

Lucida Bright and Lucida New Math were designed by Bigelow & Holmes. The conversion to Type 1 format and hinting was done by Y&Y and can be purchased from Y&Y. (Do not confuse this font family with Microsoft’s “LucidaBright & LucidaBrightMath” font set—it is in TrueType format and the math fonts cannot be used with T_EX—or with Adobe’s “Lucida & LucidaMath”.)

All these fonts are fully hinted and ATM compatible.

7.3. PostScript Printer Drivers. Of course, all good T_EX implementations come with a PostScript printer driver. All will print T_EX composed with the use of PostScript fonts, but some are more capable than others.

The standard PostScript printer driver is DVIPS which you can download (with ftp) free of charge.

The most capable commercial PostScript printer driver is a stand-alone product, Y&Y’s DVIPSONE. It is especially suited for inclusion in this article since it was designed to work with PostScript fonts and PostScript printers. DVIPSONE has so many features that we shall not attempt to describe them all. But here are the highlights:

- **Partial font downloading:** Most PostScript printer drivers work as follows: when in the file to be printed, a character is found from a font file and the driver “downloads” (sends to the printer) the complete font file. Since a typical T_EX page contains characters from many font files, this slows the printing down. Moreover, if the printer does not have enough memory, there may be no more room for all the font files.
- DVIPSONE will download a single character from a font file if that is all that is needed.
- **Two-sided and two-page printing:** *Two-sided printing* means that we print on both sides of the paper. *Two-page printing* means that we print two pages per side. The two combined is sometimes used to print small manuals.
- **Output control:** The output can be shifted (left-right, up-down), rotated by any degrees (“landscape” printing is rotation by 90 degrees), and magnified.
- **Paper type:** DVIPSONE can use any of the commonly used American and European paper formats.
- **Substitution file:** DVIPSONE has four keywords for the substitution file: reside, remap, force, and alias, making the substitution file really powerful. For instance, DVIPSONE can reencode printer-resident fonts if so instructed by the substitution file.
- **Illustrations:** All PostScript printer drivers support the inclusion of illustrations in some PostScript format using the T_EX `\special` command. Unfortunately, there is no T_EX standard for illustrations. Almost all printer drivers require a different format. DVIPSONE supports the ten most popular formats.

DVIPSONE comes with a number of useful utilities, and, most importantly, it has the best technical support in the business. Since the topic of PostScript fonts in T_EX can get pretty complicated and since there is no literature to support it, this may prove to be very important for most users.

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TwoGroups: A Database for Group-Theory

G. Butler*, S. S. Iyer*, and E. A. O'Brien*

Abstract. We describe a database which contains data on the 58,761 groups of order dividing 256. We provide information on its availability and mention its use in tackling some group theoretic problems.

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1. Introduction

The *TwoGroups* database provides access to a large body of information on the 58,761 groups of order dividing 256. It also provides a convenient interface for mathematical users via a "natural" set-theoretic query language. Information on other lists of p -groups can be included in the database without major difficulty or alteration.

The database is built using a NU-Prolog implementation platform. For a detailed description of NU-Prolog see Ramamohanarao et al. (1988). It provides an inference engine, a translator for definite-clause grammars which constructs a parser written in Prolog, and a partial match retrieval scheme for external databases. The two-level retrieval scheme, called SIMC, is based on superimposed code words. A detailed description of the underlying platform of the database is provided in Butler, Iyer, and O'Brien (submitted).

The query language is based on set constructors and is a natural and convenient generalization of the proposed language for Magma (see Butler & Cannon, 1989). A set-theoretic query is translated and optimized to an equivalent Prolog goal. The database has an extensive help facility which provides contextual information on the available data, the Prolog predicates, and the syntax and functionality of the set-theoretic query language.

Our work is, in a strong sense, the first serious attempt to provide a fully functional database of group information. Prior to the 1980s, information on groups was almost exclusively distributed in hard copy format. Here we think of such projects as

- the wealth of data on the groups of order dividing 64, published by Hall & Senior (1964),
- the tables on groups of order at most 100, prepared by Neubüser (1967), and
- the Atlas of the sporadic simple groups, prepared by Conway et al. (1985).

Since the early 1980s, various collections of data have been made available as "libraries" with the computational group theory system, *Cayley* (see Cannon, 1984). Such libraries include the primitive groups of small degree (see

Sims, 1970); the simple groups of order of at most one million (see Campbell and Robertson, 1985); and the groups of order dividing 256. All allow user access to each group but provide limited ability to query for groups satisfying certain conditions. The latest version of *GAP* (see Schonert et al., 1993) provides access to similar collections.

In 1987 O'Brien developed a menu-driven Pascal system to provide access to data on the groups of order dividing 128. This program allowed values for various properties of the groups, such as the nilpotency class and the number of conjugacy classes of a given length, to be given and the set of groups with matching properties to be retrieved. This solution set can then be refined by selecting additional properties from the menu and supplying their values. The program used multi-key indexed sequential files and was machine dependent. A description can be found in James, Newman, and O'Brien (1990).

This system provided the prototype for Ley (1988), who built a deductive database of the data in the Pascal system using the NU-Prolog implementation platform.

The database *TwoGroups* in some sense represents the culmination of these efforts. It extends the data stored to include the groups of order 256 and provides an extensive query language.

In this paper we describe the contents of the database, illustrate features of the query language with a few examples, and briefly report on some real life mathematical problems approached using the database.

The database is currently available by anonymous ftp from `pell.anu.edu.au`. It may be available from other sites at a later stage. Interested readers should contact any of the authors by electronic mail for further information. A *User Guide*, which describes the query language and contains a tutorial on using the database, is supplied. Both the raw and processed data are available.

Much of the work for this project was carried out when the first two authors were both at the University of Sydney. Ley's work was also carried out there under the supervision of Butler and with the assistance of Iyer. The work of Butler was supported in part by the Australian Research Council.

2. Contents of the Database

The p -group generation algorithm calculates (presentations for) particular extensions of a finite p -group. In its full generality the algorithm can be used to construct all of the groups of a particular order. It is described in detail in Newman (1977) and O'Brien (1990). The application of this algorithm to determining the groups of order dividing 256 is described in James et al. (1990) and O'Brien (1991).

A group of order p^n has a power-commutator presentation on n generators, say $\{a_1, \dots, a_n\}$. The defining relations are

$$a_i^p = \prod_{k=i+1}^n a_k^{\beta(i,k)}, \quad 0 \leq \beta(i,k) < p, 1 \leq i \leq n,$$

$$[a_j, a_i] = \prod_{k=j+1}^n a_k^{\beta(i,j,k)}, \quad 0 \leq \beta(i,j,k) < p, 1 \leq i < j \leq n.$$

*G. Butler, Concordia University, Montreal, Quebec, e-mail: gregb@cs.concordia.ca; S. S. Iyer, Defense Science and Technology Organization, Salisbury, Australia, e-mail: sridhar@itd.dsto.gov.au; and E. A. O'Brien, Australian National University, Australia, e-mail: obrien@pell.anu.edu.au.

The description of a group produced by the p -group generation algorithm is a power-commutator presentation. The $\binom{n+1}{3}$ exponents, $\beta(i, k)$ and $\beta(i, j, k)$, take values from $0, \dots, p-1$; we view this sequence as a p -adic expansion of an integer. The single integer can be used to provide a compact description of each group of order p^n . Such compact descriptions are used in the 2-group libraries mentioned in the introduction. Each group of order O is identified by a unique identifier $O\#N$, where N is its index position in the sequence of groups of this order.

For each of the groups, the database stores the following information:

- the group identifier $O\#N$;
- the order of the automorphism group;
- the number of conjugacy classes of each length;
- the number of elements of each order;
- the number of defining generators and the number of power-commutator presentation generators;
- the exponent- p class and the nilpotency class;
- the center, the central quotient, the commutator subgroup, and the parent group.

Definitions of unfamiliar terms may be found in O'Brien (1990). Values of these invariants were computed for each group within *Cayley* using the distributed libraries.

3. The Query Language

The query language is based on the familiar notation of set theory and, as already mentioned, it is similar to the proposed language for Magma. It provides statements to query the database and to print solution sets or to print individual groups. The set-theoretic queries can also be used to refine existing solution sets. A query may either directly access stored information or require the derivation of some new information: the exponent and number of conjugacy classes of a group and the order of its inner automorphism group.

Below we present a few sample queries and report the average CPU times taken on a Sparc Station ELC to answer them, both to illustrate some features of the query language and to provide an indication of the database performance.

• {G in database | order(G) eq 256 and #defining generators(G) eq 4 and exponent(G) eq 4 and order(center(G)) eq 2 and nilpotency class(G) eq 3 has 10 solutions and takes 9 seconds.

• {G in database | automorphism group order(G) eq 8192 and order(central quotient(G)) eq 16 and order(commutator subgroup(G)) eq 8 and #classes(G) le 32 has 68 solutions and takes 150 seconds.

• {G in database | order(center(G)) eq order(G)/4 has 221 solutions and takes 6 seconds.

A detailed description of the query language is available as part of the *User Guide*.

4. Mathematical Applications

The database has been primarily used to search for groups which satisfy particular properties.

Cossey (private communication) enquired from Newman and O'Brien whether there are groups of order 128 having a Wielandt quotient which is the direct product of a quaternion group and a cyclic group of order 2. Such a group has a Frattini quotient of rank 3; a commutator subgroup which is the direct product of a cyclic group of order 4 with two copies of the cyclic group of order 2—this commutator subgroup is $16\#10$; there are 96 elements of order 8, at least 8 and at most 32 elements of order 2, and the center is cyclic of order 2. There is exactly one group of order 128 satisfying this list of properties; the search took about 5 seconds of CPU time on a Sparc Station ELC. A calculation in *Cayley* showed that its Wielandt quotient is in fact the desired one.

Conlon (1976) shows that for linear groups of degree p , "linear isomorphism" is equivalent to "abstract isomorphism". Flannery and O'Brien sought to find a group of degree 4 where these concepts were not equivalent. If there is such a group, then the faithful irreducible characters of degree 4 do not all lie in the same orbit under the action of the outer automorphism group. We searched the database for groups with a cyclic center and an outer automorphism group of small order; in practice, we chose to restrict the order of the outer automorphism group to 4. Our search yielded thirty-eight groups, none having the desired property. The search took about 85 seconds of CPU time.

Gross (1976, Theorem) provides a characterization of those 2-groups where the group of automorphisms of a group G transitively permutes the involutions of G . O'Brien and Xu recently investigated one class of these groups; its members have the following partial characterization: they have nilpotency class 2, exponent 4, and their centers are equal to their derived groups. A search of the database yields 546 such groups of order 128. The search took about 41 seconds of CPU time.

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Remarks on Computer System Verification

Richard Dudley*

The article by MacKenzie [2] gave some very interesting news about the treatment of proofs of computer system correctness in legal action and by the Ministry of Defense in the U.K. I thank Professor MacKenzie very much for providing this news and Professor Devlin for publishing it with an introduction that well recalls the tensions between "formal proof" and what we generally call proofs in mathematics. Professor MacKenzie (a sociologist) generally reports on controversies judiciously without taking sides.

Yet, in what has been a very controversial field, I'm afraid there are issues remaining to be clarified. MacKenzie wrote, "Also generally agreed (though with many shades of

*Professor Richard Dudley is in the Mathematics Department at M.I.T., Cambridge, MA 02139, e-mail: rmd@math.mit.edu.

emphasis) is that what can be proven correct is not a physical piece of hardware, or program running on a physical machine, but only a mathematical model of that hardware or program."

I completely agree that physical hardware and programs running on such hardware cannot be proved correct, but I think "many shades of emphasis" doesn't make clear that what were criticized as arguments to the contrary have been based on remarkably incomplete quotations, as I previously pointed out [1]. Unfortunately, MacKenzie [2] cited two articles in which the quotations appeared, one at some length and quite favorably, without citing the original sources or my letter [1].

Also, while I think it is appropriate to talk about mathematical models of hardware and of the external world, I note that programs are written in precise formal languages, even more so than most of mathematics. So what is meant by a "mathematical model" of a program?

I also recall that it's inappropriate to talk about a "program running" in the singular, since an applications program depends on compilers and other systems software whose correctness would also have to be proved. Thus, even if the modeling of the physical world and hardware were accepted, and if one were to accept the usual mathematicians' standard rather than a formal standard of proof, the difficulties of proving a long machine-language program correct remain very serious. In mathematics we have a formal system, specifically Zermelo-Fraenkel set theory, which has been accepted for a long time as a basis for most (although not quite all) of the field and which one can be virtually (though not completely) sure is consistent. There is, I venture to say, no extensive system software which has attained the same status.

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New Position

American Mathematical Society

EDITOR

Notices of the American Mathematical Society

Applications and nominations are invited for the position of Editor of the *Notices of the American Mathematical Society*, to commence January 1, 1994, for an initial term of three years. The Society seeks an individual with strong mathematical research experience, broad mathematical interests, and a commitment to communicating mathematics at a broad range of levels to a diverse audience. The applicant must demonstrate excellent written communication skills.

The Editor will have full editorial responsibility for an "enhanced" *Notices* (thirteen issues per year; the inaugural issue will be in January 1995) within the broad guidelines established by the ad hoc Committee to Review Member Publications (CRMP). The goal of the enhanced *Notices* is to serve all mathematicians by providing a lively and informative magazine, which communicates contemporary mathematics and its applications, news about mathematics and mathematicians, and information about the profession and the Society.

The Editor will be assisted by a board of Associate Editors, nominated by the Editor, who will help fashion the contents of the *Notices* and solicit material for publication. AMS staff in Providence will provide editorial, production, and advertising support, which will include a staff writer, production editor, and marketing staff. The Editor is authorized to hire administrative support half-time.

It is anticipated that the Editor and half-time administrative support position will operate from his/her home institution. The Society will compensate for released time up to a half-time annual salary. Individuals interested in the position are encouraged to refer to the article on the CRMP Report in this issue of the *Notices*.

Nominations and applications (including curriculum vitae; bibliography; and name, address, and phone number of at least three references) should be sent by **October 15, 1993**, to:

Dr. William H. Jaco, Executive Director
American Mathematical Society
P.O. Box 6248
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The Recommendations of the Committee to Review Member Publications (CRMP)

Hugo Rossi
Chair of the CRMP

The term “AMS member publications” sometimes refers to the two journals that go to all AMS members as part of their membership privileges—namely, the *Notices* and the *Bulletin*—but in this article it will also refer to the *Abstracts*, *EIMS*, and to the new e-MATH electronic service that is available over the Internet. What distinguishes these from the other AMS publications is that their primary purpose is to serve as vehicles for communicating with the membership of the Society. Over time the size and composition of the Society have changed. As a result the demands on the member journals have also changed, and they have seen periodic modifications and revisions to their contents and format.

For example, the journal of record of the Society—the publication that must contain the AMS calendar and reports of meetings—was originally the *Bulletin* but is now the *Notices*. In the 1960s the *Bulletin* started publishing Research Announcements; and in 1974, with the change to the *Bulletin, New Series*, came also a change in the method for selecting those announcements. And during the past half decade the *Notices* has dramatically expanded its articles and commentary about mathematics and the profession.

Recently, concerns again arose about the role played by these publications and their effectiveness in carrying out that role. In the spring of 1992, motivated in part by recommendations in the AMS strategic plan of the preceding year, the Executive Committee and Board of Trustees (the ECBT) created a task force to review member publications and charged it with presenting recommendations based on that review at the May 1993 meeting of the ECBT. (See the Appendix for the membership of the CRMP.) In this article we wish to summarize the committee’s recommendations (which were accepted unanimously by the ECBT and are to be discussed and voted upon by the Council at its August 1993 meeting). We would also like to explain some of the rationale behind the committee’s recommendations.

The committee met face-to-face three times during the year, but most of the deliberations took place via e-mail—

about one megabyte’s worth. First, we shall review some of the thinking of the committee during these deliberations, and then we will present an abbreviated version of the Committee’s report to the ECBT.

Purposes of Member Publications

As already suggested above, the member publications of the AMS differ from its other publications in that their goal is to communicate information of many different types to the membership of the Society, as opposed to the research publications and books, which are designed to meet the needs of the discipline for archival publication of original research. These differing goals set member publications apart from research journals, not only in content and in purpose, but also in methods required for generating publishable material. Our committee found it expedient to specify the purposes of the journals under review in order to evaluate their effectiveness. We agreed that three major objectives of these publications are to communicate information to the membership on:

- the current state of the discipline and the directions in which it is advancing;
- mathematical meetings, activities, and programs, especially (and in detail) those of the AMS; and
- the status of the profession.

Mathematicians join the AMS because they support its goals of fostering research, but we found that they join also to have access to this information in the above order of priority. Beyond this, the level of interest and depth of involvement is very highly varied, so that the membership in no way presents a single target audience.

We set goals for our recommendations that were parallel to these objectives, namely:

- to present exposition of contemporary mathematics in a comprehensive way that exhibits both the content and the context of new advances. This should be accomplished in a flexible and varied manner, reflecting the heterogeneity of the membership;
- to provide members with clear and timely information on meetings, conferences, and other AMS activities; and
- to provide news and commentary on the profession, its people, and their activities.

Our review of member publications obtained input from the membership in three different ways: we conducted a

survey of about 10% of the membership, held discussions at the 1993 San Antonio Meeting with representative “focus groups” of selected members, and obtained written commentary from over a hundred mathematicians, some solicited and some volunteered. Based on that information we concluded that, while the present configuration of journals works reasonably well to serve the above purposes at the present time, there were also certain consistent patterns of criticism that made it clear there is room for improvement—most significantly in providing exposition of new mathematics at various appropriate levels to appeal to and satisfy the needs of a larger proportion of our varied membership on a regular basis.

It is a characteristic of our discipline, probably more than almost any other, that while in our conversation we permit ourselves to be vague and intuitive—presenting reasons why we conjectured something might be true, illustrating proofs by example, and elaborating on the dead ends we ran into before we struck upon a proof—little of this aspect of the creative process survives into our writing. Nor is there often much discussion in our papers of the context of our mathematics. Perhaps this is because of the tradition among mathematicians to stress the objectivity of the content of their subject, and somehow this leads to intolerance for subjective commentary. As a result, most mathematicians are more comfortable writing exposition that is narrowly focused than they are writing a survey that covers a broad scope, and they find it easier to explain technical details to other experts than to explain the overarching concepts and important intuitions to interested “outsiders”.

As a result, high-quality survey articles about contemporary mathematics are very difficult to come by; and while the best of the *Bulletin* articles are very good indeed, our committee felt that a substantial part of its role was to confront this difficulty in our profession, to provide strategies that will help editors obtain a steady flow of good survey articles, and to encourage prospective authors to write them. We discarded drastic remedies, realizing that what is needed for success is a long evolution starting with those mathematicians already committed to broad scholarship and its utility to the profession, and gradually increasing their number—one by one if necessary.

Some Distinctions

The members of CRMP manifested a wide range of points of view, and these were often in conflict. That we came, eventually, to a set of recommendations which had unanimous support is remarkable, masking a process in which opposing ideas and opinions were often heatedly debated. We did find that, as we separated out different connotations of the terms we were using, these disparate views became, if not convergent, at least tolerable to one another. These are the most important distinctions we made:

Exposition and Scholarship: From the beginning we agreed that the AMS should, through its member publications, become much more involved in the exposition of mathematics. As we discussed where and how, it became clear that we were not talking about exposition in the common sense of

presentation of mathematical ideas to lay people—or even to students of mathematics—but rather discussion with and explanation for our peers, the members of the mathematical community, of new advances achieved together with the new techniques involved, putting it all in an appropriate context within the whole body of mathematics. This is in reality scholarship rather than exposition, and we then saw the CRMP as an ardent advocate of increased scholarship, asking that authors present their work or the work of others in an appropriate context and with clear indications of the creative line of thought. We also maintain that authors should write, not just for the record, but to an audience. We recognize that because of the highly diverse nature of the membership, there are many selections of “an audience”, and this of course will vary greatly from article to article. But the principle to which we hope to see adherence is that the author of each article demonstrates a consistent conception of an intended audience.

Research Announcements vs. Research Reports: The distinction here follows through the ideas of the preceding paragraph—a Research Announcement (RA) presents a new breakthrough, whereas a Research Report explains new mathematics to the community. Since the inception of the RAs, *Bulletin* editors from time to time have proposed strategies to move the Announcements in the direction of Reports, and those strategies have had some success for limited periods. We concluded that the highest priority for the *Bulletin* is that, integrated over several volumes, it provide a comprehensive presentation of current mathematical research and the state of development of the various fields of mathematics. In this we had much assistance from the then-editor of the Announcements, Frank Quinn, as well as the editors and former editors on our committee. The idea of Research Reports, that they be solicited by the editorial board rather than selected from what appears in the mail, and that they normally be written by some expert in the field other than the mathematicians responsible for the breakthroughs are all Quinn’s contributions, which the CRMP strongly endorsed. The committee did not resolve the question of whether the AMS should also continue to publish Research Announcements, and, if so, then in what form. What we agreed on unanimously was that Research Announcements were unsuited to a journal that goes as a privilege of membership to all members of the Society and that the question of whether and how to publish RAs was better settled by some other committee.

News and Information: The *Notices*, as the Society’s journal of record, is the appropriate forum for “news” and “information” about the Society and the profession. By “information” we mean specific data about meetings and other activities. (We also include here the *Abstracts*, which we regard not as a mathematical publication but as one providing information about AMS meetings. Our recommendation reflects this view.) “News” refers to details of what occurs at meetings, reports on committees or funding agencies, etc. For the purposes of our discussion, under “news” we also mean commentary on political and social issues that affect mathematics. Over the past several years the editors have actively increased the volume of news and commentary in

the *Notices*, and this development has been strongly endorsed by the membership and the CRMP. But this has caused the *Notices* to become cumbersome, and our recommendation that there should be even more coverage of mathematics in the *Notices* can only exacerbate this difficulty. We would like to see the editors reformat and reorganize the *Notices* so as to make it more efficient and easily readable without substantial loss of content. Although we discussed many ideas for accomplishing this, it was clear that the details should be left to the new editor which we are proposing for the *Notices*.

Abbreviated Version of the Report of the CRMP

A brief introduction similar to the above, followed by a review of the early history of the committee, brings us to the following place in the report:

The committee considered a variety of new proposals, the intent of which was to set the stage for wide-ranging and aggressive experimentation with modes of exposition without adversely affecting the success of present publications. We wanted to make recommendations which will:

- move the Society to take leadership in exposition of mathematics at a broad range of levels and depths and to very diverse target audiences; and
- maintain, strengthen, and deepen existing high standards of mathematical communications.

In our view, "furtherance of mathematical research" not only encompasses both of these goals but requires them. It is a fallacy to expect that each member publication, or even most of the articles in any one of them, should appeal to a large majority of the organization. By trying to satisfy everyone we risk satisfying no one. At the same time, it is necessary that in the aggregate, AMS member publications should be varied in approach and style, responding to the very heterogeneity of our community, so that they have made intellectual contact sufficiently often with sufficiently many of our members.

Our work stabilized at a set of recommendations which allows and encourages flexibility and experimentation in communication without compromising the standards of existing publications. The core of these recommendations concerns the *Notices* and the *Bulletin*. For the first, the intent is to introduce into it substantial exposition of mathematics, with its view focused directly on communicating to the diverse constituencies the nature and significance of mathematics as a developing discipline. The intent with the *Bulletin* is to move it toward presentation of a comprehensive view of contemporary mathematical research, with its highest priority being continued faithfulness to the discipline.

The formats and editorial structures we propose are conceived as initiating these transformations, and they themselves are to be perceived as flexible and subject to development. For example, some of our explicit suggestions of directions to take will surely prove unworkable and will be replaced by ones with a better chance of succeeding. We even envision that the new material in the *Notices*, once established and successful, could spin off into a new journal devoted exclusively to exposition. We include with this suggestion a caution to move in new directions only after trials have shown success.

Recent editorial boards of the *Bulletin* and the *Notices* have striven hard for the goals toward which this Committee is pointing the AMS. These remain new and unfamiliar tasks for the Society (and mathematicians in general) and run counter to prevailing measures of success in our community. In this context, the success of these editors is remarkable, and we commend them for it. Our aim is not directed at them or their policies, but beyond to the mathematics community and its values. Our target is renewed vigor in scholarship, in the sense of communication as well as creation. Our hope is that their jobs will become easier and the product better. In the meantime, it would be unwise to start such a new journal until its role in the AMS publication program is clearly established.

Recommendations

1. Proposal for an "Enhanced" *Notices* of the AMS

The principal mission of the AMS is the furtherance of mathematical research through its programs and publications. It does so by publishing a number of research journals, along with the *Bulletin*, all of which are primarily aimed at research mathematicians. On the other hand, the Society has a diverse membership, including many who, while not actively engaged in mathematical research, are intensely interested in learning about new developments and ideas. The goal of the enhanced *Notices of the American Mathematical Society* is to serve all mathematicians by providing a lively and informative magazine, which contains news about mathematics and mathematicians as well as information about the Society and the profession. Our recommendations are designed to provide opportunity to explore and experiment with this concept without adversely affecting existing functions of the *Notices*.

While the enhanced *Notices* would be published for mathematicians, the articles would not be written for the experts. Most articles would be short. They would seldom contain full details but rather strive to inform a large number of readers about the topic or event. An essential feature of the new enhanced *Notices* is a single editor with both the responsibility and control to take the magazine in new directions.

We recommend the following:

(a) **Purpose:** The *Notices* shall communicate information and commentary on the discipline, the profession, and the Society and its activities; be a privilege of membership in the AMS; and serve as the journal of record of the Society. We envision that the journal will contain significant sections on mathematics, ranging from brief, timely paragraphs on new breakthroughs (tentatively called Research News), through expositions of some of those breakthroughs and their context, to broad discursive surveys of the status of sections of contemporary mathematics. There will be overlap with the content of the *Bulletin*, just as the *Bulletin* overlaps significantly with the other research journals of the Society. This will require continuing dialogue among the various editorial boards.

(b) **Editorial Structure:** The *Notices* shall have an editor with full editorial responsibility who shall serve in a half-time position for the AMS. The editor of the *Notices* shall be

a mathematician with strong research experience and broad mathematical interests. The editor and the editorial board (which will be selected by the editor in conjunction with the Editorial Boards Committee) shall have responsibility for content within the broad guideline of communicating information of the discipline, the profession, and the Society and its activities.

(c) The enhanced *Notices* will begin publication with a January 1995 issue, appearing every four (4) weeks for a total of thirteen issues per year with less than 120 pages per issue (with a total of 1496 pages annually). The *Notices* will continue to publish meeting announcements and the scientific programs of meetings.

2. Proposal for an "Improved" *Bulletin of the AMS*

A powerful way of inspiring our community to provide more good expository writing is to set high standards and to provide examples, mathematical and literary, in respected journals. The current *Bulletin* is such a journal; and as such plays an irreplaceable role in maintaining the identity and cohesiveness of the AMS, providing a unique sample of mathematical research to which the entire membership is exposed.

In our proposals we aim to preserve this tradition, while addressing specific shortcomings in the existing journal. To some extent these failings are the result of the natural aging of the institution, and correspondingly we have sought to find ways to sharpen the definitions of its parts. The problems with the Research Announcements are somewhat deeper. Among the failings ascribed to the RAs, we have identified the following:

- the selection of topics they report on does not accurately reflect the major advances in mathematics;
- the format does not produce reports on new advances in mathematics that are maximally useful to the audience;
- the results claimed in them are sometimes of dubious veracity because they are often based on privileged information and not on publicly accessible detailed papers;
- and they are or soon will be obsolete because of the wide electronic accessibility of preprint archives.

The committee also agreed that, despite these drawbacks, the Announcements were initiated for significant reasons which may still retain their validity. Thus we reached unanimous agreement that the Research Announcements cannot continue in their present form in the *Bulletin*, while recommending that the issue of continuing them elsewhere as an AMS publication should be taken up by the newly formed Policy Committee on Publications.

We propose that *The Bulletin of the American Mathematical Society* continue with a division into these sections: "Research Reports," "Research/Expository Surveys," and "Book Reports." Each section represents an evolutionary modification of a corresponding section of the current *Bulletin* but with significant changes in the two with new titles.

Each section will have an editor with a board of associate editors, but the direction of the publication as a whole will be shared by the three editors. We envision the Research News

section of the *Notices* as an appropriate place for members to first learn of new results very quickly. The *Bulletin* can then provide a follow-up which is both archival and timely, including the details for which our profession is noted. Depending on circumstances, this follow-up could be either a Research Report or a Research Survey, or perhaps even a Report followed later by a Survey.

The success of our recommended changes will rest ultimately on the willingness of the intellectual leaders of the mathematical community to redirect more of their energies toward producing expository writing of the highest quality. By the act of joining the Society the members have implicitly stated an interest in supporting and being informed about mathematical research, confirmed by our surveys. This creates a need, now largely unmet, for the AMS to communicate mathematics to its members (and to the world at large) at various appropriate levels. Both the identity and cohesiveness of the AMS will be served by continuing to have a high-quality research publication sent to the entire membership. But this presents a difficult challenge for authors and editors to provide serious exposition that is accessible to a wide audience.

The CRMP recommendations make the role of the editorial board more complex because of the emphasis on coordination among the three sections (especially Research Reports and Research Surveys) and interaction with other AMS publications (in particular the Research News proposed for the *Notices*). Therefore the CRMP recommends that an Editor-in-Chief be chosen from among the three editors by the Editorial Boards Committee. At present, the editors are mainly selecting among submissions and doing so independently, which works well; but, as the content of the *Bulletin* turns more and more to solicited material (as we envision it has to), it becomes essential that there be coherence of editorial policy and responsibility produced by the collaboration of the three main editors under the guidance of one of them.

3. Abstracts of Presentations of the AMS

FINDING: The *Abstracts* provides members with (1) a guide to the scientific content of meetings; (2) an opportunity to inform one's colleagues of one's ideas and progresses; and (3) an overall view of the mathematical activity in the community. Lack of quality control is an essential feature of this publication, but this could have adverse effects when the journal is confused with a research publication. Our recommendation only subtly addresses this issue, as we felt that serving the above purposes remains a high priority for the Society.

RECOMMENDATION: That the abstracts for a particular meeting be available to registrants for that meeting and available for purchase upon request. In addition, that the journal *Abstracts* be published quarterly, with each issue containing the abstracts accumulated since the preceding issue, including by-title abstracts.

4. Meetings Announcements and Promotions

RECOMMENDATION: a) That the *Notices* continue to publish announcements of meetings and scientific information on the

meetings, including their programs. These announcements may be reformatted with an eye toward removing information that is redundant or of use only to participants. b) That the AMS prepare independent announcements and brochures on its annual and sectional meetings for specific target audiences (e.g., math departments). c) That the detailed programs, together with the abstracts, be available to all registrants and be available for purchase upon request.

5. Employment Information in the Mathematical Sciences

FINDING: This is a good publication and seems to be an appropriate format (both electronic and paper) for its purposes. Nevertheless, it together with other employment programs of the AMS is not very effective, either in placement or in reduction of paper work.

RECOMMENDATION: That the Policy Committee on the Profession consider what should be the proper role of the Society in communications concerning employment opportunities.

6. Electronic Publications

FINDING: Part of the Committee's charge concerned electronic publication. It became clear in the Committee's discussion that this is both an extremely important and a very complex area whose development will have great consequences for the discipline, as well as the publishing industry (in particular the AMS). We felt that the CRMP was not equipped to tackle the problem in the large and that it would be inappropriate to do less than that. We also felt that no member publications should be excluded from electronic publication and that it is desirable to make member publications available electronically whenever feasible. Further, it is the sense of the CRMP that electronic access to these publications should be available to all people whether members or not. We have passed this thinking on to the Committee on Electronic Products and Services.

Editor's Note: In order to implement the recommendations of the CRMP for the January 1995 issue of the *Notices*, it is necessary to have the editor in place as quickly as possible (see the beginning of this section of the *Notices* for more information regarding this position). Although the ECBT has unanimously accepted the CRMP's recommendations, the decision of the AMS Council concerning these recommendations was not known at the time this issue of the *Notices* went to the printer. The existence of this position is dependent on that decision.

Appendix

Committee to Review Member Publications

- Hugo Rossi (Committee Chair), University of Utah
- Michael Artin (*ex officio*), Massachusetts Institute of Technology
- Sheldon Axler, Michigan State University
- John Ewing, Indiana University
- Robert Fossum, University of Illinois

- John Franks, Northwestern University
- Ronald Graham (*ex officio*), AT&T Bell Laboratories
- Judy Green, Marymount University
- William Jaco (*ex officio*), AMS Executive Director
- Haynes Miller, Massachusetts Institute of Technology
- Richard Palais, Brandeis University
- John Polking, Rice University
- Carol Wood, Wesleyan University

AMS Staff Consultants to the Committee

- John Bradley, Associate Executive Director for Government and Public Affairs
- Hope Daly, Director of Meetings
- Samuel Rankin, Associate Executive Director for Publications
- William Woolf, Associate Executive Director for Production and Computer Services

Why Archive?

*Albert C. Lewis
McMaster University*

Editor's Note: The following article was written by Albert C. Lewis as a member of the AMS-MAA Committee on Archives.

The premise might seem uncontroversial: if mathematics is to have a history, resources must be available upon which to base it. But, as I hope to illustrate, historical archiving has not been as straightforwardly automatic as, for example, the archiving of computer files is supposed to be.

When civilization is set back by the destruction of a library, such as the Central University Library at Bucharest in 1989, in modern times most of the loss may consist of printed or machine-readable books and journals which effectively have their backups in other libraries and which can therefore eventually be replaced. But unpublished materials at Bucharest, as at other libraries, are rarely duplicated and distributed and thus they can never be replaced. It is these, usually paper documents—correspondence, personal notebooks, drafts, institutional records, photographs—which the historian, at least, needs. Most mathematicians naturally have a strong historical interest, at least to the extent that they regard establishing precedence—who discovered what and when was it discovered—as important.

But is there a need to preserve more than publications today? Gazing upon Gauss's autograph is probably not a source of inspiration for doing mathematics. Students' notes of Hilbert's lectures are probably too out of date for mathematical purposes today. And is it anyone's business anyway to pry into personal correspondence or keep tabs on who was attending whose lectures? Some people may doubt that it is, but many mathematicians share with historians a desire to find out why and how mathematical discoveries are made, received, and taught; and, as good scientists who want the best quality evidence, they are going to make use of whatever such sources of information are available.

Personal archives, like those of Gauss and Hilbert at Göttingen, as well as institutional archives, do exist and continue to be added to libraries around the world. They are deposited so that they may be looked at. Why is this and how do they get there?

We have had some experience during the past thirteen years with American archives since the Mathematical Association of America (MAA) and the American Mathematical Society investigated the establishment of archives, and committees such as ours have tried to aid in the preservation of archival materials. Mathematicians have given a wide range of responses to the notion of archives as the following three examples from my own experience at the University of Texas at Austin illustrate.

Not long after he returned to Austin, R H Bing became president of the AMS and learned something about archives when a proposal was made to have the Society join the MAA in establishing a joint archives. Everett Pitcher, secretary of the AMS at the time, has given a diplomatic account of the fate of this proposal in the chapter "Archives" in *A History of the Second Fifty Years, American Mathematical Society 1939–1988* (American Mathematical Society, Providence, 1988). The AMS chose not to establish an archive at that time (they have since designated Brown University as the repository), but the affair did have the effect of informing some mathematicians about archives, their purpose and functioning. Not long afterwards Bing expressed a concern to me. He had been looking over a file containing drafts of a telegram he had proposed to write on the occasion of the rather controversial forced retirement of his teacher, R. L. Moore, from the University of Texas at Austin in 1969. The archival discussions had alerted him to the fact that these drafts might be looked at by someone sometime. He felt that they could be misunderstood and that he ought to destroy them. I tried to argue that by doing so he was leaving open the possibility of even more inappropriate speculations about his stand or motives at that time. I also suggested that he could always add a note of explanation to the file. (I later found that this is what Bertrand Russell did in his own files which are now at McMaster University.) But I agreed that he should do whatever he felt most comfortable with. I believe he did destroy the drafts, and hence they are not a part of his papers at Texas.

Also during this archival discussion Alex Rosenberg, then a member of the AMS council, expressed doubts about the desirability of saving anything at all in archives. But when we met at an archival exhibition set up for a council meeting at Texas, he told me that he had changed his mind after convincing himself of the soundness of the following argument. He was himself devoted to a branch of algebra which even many mathematicians regard as a particularly recondite field that is not relevant to much else. Nevertheless, he appreciated that mathematicians respected his interest in the field. By the same token, if there were people whose fields involved archives, the fact that he personally did not have such an interest did not entitle him to destroy archival sources. Boxes of material related to his editorship of *The American*

Mathematical Monthly arrived shortly afterwards for addition to the MAA archives.

Soon after the Archives for American Mathematics was established at Texas, its advisory committee was informed that Emil Grosswald was wondering if anyone would be interested in his papers. I did not know Grosswald, but I am told that he was a meticulously organized person who did not like loose ends. He sent some material immediately and arranged for the remainder to be bequeathed to the archives in his will. (This did come after his death in 1988.)

I suspect that none of these three mathematicians gave much weight, if any, to what motives might be attributed to them in depositing their papers. On the one hand, archives as reminders of our mortality are perhaps not surprisingly a subject which some people would prefer to avoid altogether ("Let my family take care of it.") or, on the other, a subject in which some will involve themselves with a view to affecting history. Is handing over one's papers to an archive an egocentric gesture? Is it a creation of an unseemly monument to oneself or a hubristic assumption that one's papers will be of interest to historians? Psychological motives are, I think, quite irrelevant if a larger view is taken.

For a start, what are "one's own" papers? Considering correspondence with others, shared work, mutual benefits of the teacher-student relationship, and other influences, each mathematician, and especially officers, editors, committee members, referees, and others who participate in the functions of a mathematical society or journal or in a mathematical department of a school or university or business, is part of a larger network. Perhaps it is more egocentric to unilaterally withdraw the background record of one's part in this enterprise than to assiduously try to preserve it. The important thing seems to me to consider the possibility that archives are more than monuments to the memories of individuals or even individual institutions and that they help form the living memory of the mathematical experience.

Whether a mathematician saves all or nothing, and, if something in between, then just what, are matters which are probably going to continue to be worked out case by case. Some idea of the sort of things that have been considered worth saving is given by Frederic Burchsted in "Sources for the History of Mathematics in the Archives of American Mathematics", *A Century of Mathematics in America, Part III*, pp. 667–674 (American Mathematical Society, Providence, 1988). These can include audio and visual recordings and memorabilia (such as R. L. Moore's typewriter with mathematical symbols) as well as the more common paper documents mentioned above. There is in general not yet a danger of flooding archives with an excessive amount of material. At this point it seems more important to make an effort to counterbalance the inevitable losses which have occurred and will occur. Albert W. Tucker has a despairing tale of how a box of important files belonging to one of Princeton's well-known mathematicians was inadvertently left in the corridor outside his office door. The next day, when it couldn't be found, it was discovered that the box had been picked up by the night caretaking staff and thrown out, never

to be seen again. More massive disappearances have been known to occur when a department as a whole has moved to a new building.

It is easier to throw things out than to contact your local archivist (or one of the national archives listed below) just as it is easier not to make backups of computer files. If you or someone you know wishes to consider what to archive, our committee stands ready to help with information, advice, and support.

Albert C. Lewis can be reached at McMaster University, Box 57118, Hamilton, Ontario L8P 4W9.

Other members of the AMS-MAA Committee on Archives: Andrew M. Gleason (Harvard University); Karen H. Parshall (University of Virginia); Franklin P. Peterson (MIT); Everett Pitcher (Lehigh University); and Sanford L. Segal, chair (University of Rochester).

National Archives

Archives of American Mathematics
Frederic F. Burchsted, Archivist
University Archives, SRH 2.109
The University of Texas at Austin
Austin, Texas 78713-7330
512-495-4129

Archives of Mathematics and Mathematicians
Mark N. Brown, Curator of Manuscripts
The John Hay Library
Brown University Library
Providence, Rhode Island 02912
401-863-1512

CONTEMPORARY MATHEMATICS

Representation Theory of Groups and Algebras

Ronald L. Lipsman, Jeffrey Adams, Rebecca A. Herb, Stephen S. Kudla,
Jian-Shu Li, and Jonathan M. Rosenberg, Editors
Volume 145

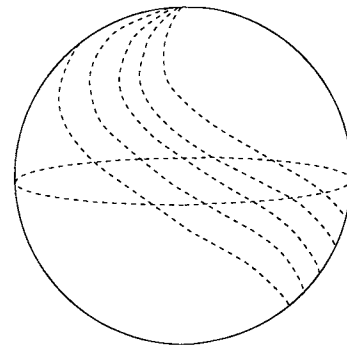
Touching on virtually every important topic in modern representation theory, this book contains proceedings of the activities of the Representation Theory Group at the University of Maryland at College Park during the years 1989–1992. Covered here are the latest results in the field, providing a readable introduction to the work of some of the best young researchers in representation theory. The book spans a very broad spectrum—for example, within real representation theory, both semisimple and nonsemisimple analysis are discussed; within C^* -algebras, both geometric and nongeometric approaches are studied. In addition, the articles are exceptionally well written and range from research papers aimed at specialists to expository articles accessible to graduate students.

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News and Announcements

Christodoulou Receives MacArthur Award

DEMETRIOS CHRISTODOULOU of Princeton University has been awarded a fellowship from the John D. and Catherine T. MacArthur Foundation. A total of thirty-one new MacArthur Fellows were named this year. Christodoulou will receive \$260,000 over five years. The no-strings-attached fellowships support creative work in a wide variety of fields.

Christodoulou was born October 19, 1951, in Greece. Now a professor of mathematics at Princeton, Christodoulou works in the field of general relativity. His recent research has centered on global properties of solutions to Einstein's equations of general relativity. Christodoulou received his M.A. in 1970 and Ph.D. in 1971 from Princeton. He was a research fellow at the California Institute of Technology (1971–1972), a professor at the University of Athens (1972–1973), and a visiting scientist at CERN in Geneva (1973–1974). He spent 1974–1976 at the International Center for Theoretical Physics in Trieste, and during 1976–1978 was a Humboldt Fellow. He has also been a professor at the University of Syracuse (1983–1987) and at the Courant Institute of New York University (1988–1992). His honors include the Otto Hahn Medal (1980) and the Xanthopoulos Prize in Relativity (1991).

Borel Receives Balzan Prize

ARMAND BOREL of the Institute for Advanced Study in Princeton has received the 1992 Balzan Prize for "his fundamental contributions to the theory of Lie groups, algebraic groups, and arithmetic groups, and for his indefatigable action

in favor of high quality in mathematical research and of the propagation of new ideas."

The prize is given by the International Balzan Foundation, which was instituted in 1956 with funds from the estate of Eugenio Balzan. The purpose of the Foundation is to recognize culture and science, outstanding humanitarian ventures, and peace and brotherhood among peoples, regardless of nationality, race, or creed. The Foundation awards three prizes of 350,000 Swiss francs each year to honor achievements in Letters; Moral Sciences and the Arts; Physical, Mathematical, and Natural Sciences; and Medicine. In addition the Foundation occasionally awards the Humanity, Peace, and Brotherhood among Peoples Prize. Other recipients of the Balzan Prize are Andrej Kolmogorov (1962), Enrico Bombieri (1980), and Jean-Pierre Serre (1985).

Armand Borel was born in La Chaux-de-Fonds, Switzerland, on May 21, 1923, and he is a Swiss and American citizen. He served as an assistant professor (1947–1949) and as a professor (1955–1957 and 1983–1986) at the Swiss Federal Institute of Technology in Zürich. He held positions at the Centre Nationale de la Recherche Scientifique in Paris during 1949–1950 and at the University of Geneva during 1950–1952. In 1952 he went to the Institute for Advanced Study in Princeton as a member until 1954, when he went to the University of Chicago for a year as a visiting lecturer. He was appointed to his current position as professor at the Institute in 1957. Among his distinctions are an honorary doctorate from the University of Geneva, the Brouwer Medal

of the Dutch Mathematical Society, and the AMS Steele Prize.

Borel's mathematical work has centered on the theory of Lie groups, in the widest sense. Because of the increasingly important place of this theory in the whole of mathematics, Borel's work has come to influence some of the most important developments of contemporary mathematics. His first great achievement was to apply to Lie groups and homogeneous spaces the powerful techniques of algebraic topology developed by Leray, Cartan, and Steenrod. The rich information now available about the cohomological and homotopic invariants of Lie groups and symmetric spaces is in large part due to Borel and his collaborators.

After 1955 Borel turned to algebraic groups, producing the classic paper, "Groupes linéaires algébriques" (*Annals of Math.*, 1956), which represented a turning point in the history of the subject and which led to many important developments. At the same time, he was studying, and eventually solving (with H. Chandra and A. Baily), some of the most basic and most difficult problems of the theory of arithmetic groups—reduction theory, co-compactness criteria, compactification of quotient spaces, and so on. During the last twenty years, Borel has also worked on the cohomology of arithmetic groups and its applications, as well as various aspects of new cohomological theories, automorphic forms, and the infinite-dimensional representation theory of real and p -adic Lie groups.

A dominant feature of Borel's scientific production is the systematic and conclusive character of his contributions to solving questions that are

diverse, difficult, and always important. He wrote more than 145 articles before 1982, which were collected in a three-volume set published by Springer-Verlag in 1983. But his presence in contemporary mathematics goes beyond his own mathematical production. Borel has played an eminent role as stimulator and propagator of new ideas in the international mathematical community. In particular, he has repeatedly initiated and participated in seminars or summer schools where important new techniques and results were brought forth.

Coron and Aroux Receive Fermat Prizes

JEAN-MICHEL CORON of the Université de Paris-Sud at Orsay has been awarded the 1993 Fermat Prize for Mathematical Research for his contributions to the study of variational problems in control theory. In addition, DENIS AUROUX, a student in the Special Mathematics Class at the Louis-le-Grand High School in Paris, has received the 1993 Junior Fermat Prize for Mathematics for his work on coloring the faces of a hypercube.

The prizes are presented every two years. The Fermat Prize includes a monetary award of 100,000FF, and the Junior Fermat an award of 10,000FF. The prizes will be presented in Toulouse in October. The Fermat Prize recognizes the work of a research mathematician in the areas in which Pierre de Fermat worked, specifically: principles of variational theory, foundations of the calculus of probabilities, analytic geometry, and number theory. The prize is sponsored by the Université Paul Sabatier and Matra Marconi Space. The previous recipients of the Fermat Prize are Abbas Bahri and Kenneth Ribet (1989) and Jean-Louis Colliot-Thélène (1991).

Jean-Michel Coron was born August 8, 1956, in Paris. He was a student at the Ecole Polytechnique and at Corps des Mines, and he received his *Docteur ès Sciences Mathématiques* from the Université Pierre et Marie Curie in 1982. He was a researcher at the Centre d'Automatique et Informatique de l'Ecole de Mines de Paris (1981–1983) and a *Maître de Conférences* at Ecole Polytechnique (1983–1987). He

has been a professor at the Université de Paris-Sud since 1987. His honors and awards include the Cours Peccot (1987) and the Prix Victor Noury from the Académie des Sciences of Paris (1990). He presented a forty-five-minute invited address at the International Congress of Mathematicians in Kyoto in 1990.

Denis Aroux was born April 22, 1977, in Lyons. In 1990 he received first prize in the *Championnat de France de Jeux Mathématiques et Logiques*. The following year, in the *Concours Général*, he received first national prize in physical science and a regional award in mathematics. He also participated in the U.S. Department of Energy High School Honors Program at Oak Ridge National Laboratory in 1991. That same year, he received the *Premier Prix Ampère* in physical sciences. In 1992 he was awarded a silver medal at the International Mathematical Olympiad in Moscow.

LMS Prizes for 1993

The London Mathematical Society (LMS) has announced a number of prizes. The Pólya Prize was awarded to D. REES for his many deep contributions of fundamental significance in commutative Noetherian ring theory and local algebra.

The Senior Whitehead Prize was awarded to B.J. BIRCH for his work in number theory, and in particular for his outstanding contributions to the arithmetic of elliptic curves.

The Junior Berwick Prize was awarded to T.D. WOOLEY for his paper, "On simultaneous additive equations I", *Proc. London Math. Soc.* (3) **63** (1991), 1–34.

Junior Whitehead Prizes were awarded to D.J. BENSON for his work in the representation theory of finite groups and in cohomology theory, to P.B. KRONHEIMER for his work in differential geometry and differential topology, and to D.G. VASSILIEV for his work in the spectral analysis of differential operators.

Wagreich Receives Education Award

PHILIP WAGREICH of the University of Illinois at Chicago, together with Howard

Goldberg, his physicist colleague at the same institution, has received the 1992 Excellence in Integrated Mathematics & Science Award from the School Science and Mathematics Association (SSMA). The award, presented at the SSMA convention in October 1992 in Marquette, Michigan, honors a person or group "who has fostered the integration of mathematics and science in the elementary, secondary, or university level, and who has been active in the development of science and mathematics curriculum for the preparation of teachers."

Wagreich is co-director of the Mathematicians and Education Reform Network. He and Goldberg developed TIMS (Teaching Integrated Mathematics and Science), a nationally recognized K–6 curriculum project in which mathematics is taught in the context of solving real problems. Students using TIMS learn mathematics together with scientific concepts and skills through laboratory experiments and other hands-on activities. A major component of TIMS is the training of mathematics and science leaders at the elementary, secondary, and university levels who, in turn, will be responsible for TIMS staff development programs in their own institutions.

ACE Names Fellows

The American Council on Education (ACE) has named thirty-two college and university administrators and professors to participate in its 1993–1994 fellows program, which supports involvement in academic administration. Among the recipients were two in mathematics: CATHERINE FOLIO of Brookdale Community College and RICHARD E. SOURS of Wilkes University.

Conley Receives Wilkinson Fellowship

ANDREW J. CONLEY has been awarded the Wilkinson Fellowship in Scientific Computing. This fellowship was created in memory of James Hardy Wilkinson, F.R.S., who had a close association with the Mathematics and Computer Science Division of Argonne National Laboratory, serving as consultant and guiding spirit for the EISPACK and LINPACK projects. The Wilkinson Fellowship is supported by the Applied Mathematical

Sciences Program of the Department of Energy.

Conley is currently finishing his doctorate in applied mathematics at the California Institute of Technology under the direction of Herb Keller. Conley's research interests include computational fluid dynamics and partial differential equations, with emphasis on three-dimensional steady incompressible flow.

AMS Awards for Outstanding PME Student Paper Presentations

In commemoration of the Diamond Jubilee of Pi Mu Epsilon (PME) in 1989, the AMS established an annual prize to recognize the best student papers presented during a PME student paper presentation. Each recipient of the AMS Award for an Outstanding Pi Mu Epsilon Student Paper Presentation is presented with a check for \$100. The following lists the names and institutions of the recipients of the past four years.

1989 Awards:

NICHOLAS AHN, Elmhurst College; ROBERT A. CULLEN, Marquette University; BETH-ALYN EGGENS, Youngstown State University; DARRIN FREY, University of Nebraska; M. CHRIS HAASE, Ohio State University; CHIKAKO MESE, University of Dayton; MICHELE PEZET, Andrews University; WILLIAM C. REGLI, St. Joseph's University; and STEPHEN J. SMITH, Dickinson College.

1990 Awards:

ANNA FIEHLER, Miami University; FRANCIS FUNG, Kansas State University; LISA HANSEN, Western Michigan University; RICHARD KINKELA, Youngstown State University; and CHIKAKO MESE, University of Dayton.

1991 Awards:

ANTHONY F. DELIA, University of Central Florida; HEATHER DESIMONE, Youngstown State University; MARK DOBNER, Elmhurst College; LINDA HUGHES, Youngstown State University; MARGUERITE NEDREBERG, Youngstown State University; JOSHUA T. TEMPKIN, Virginia Polytechnic Institute; and MARC WALLACE, Washington University in St. Louis.

1992 Awards:

JEFFERY JOHN BOATS, St. Bonaventure University; FRANCIS FUNG, Kansas State University; SUSAN KOPPENOL, Southeastern Louisiana University; and DANIEL L. VIAR, University of Arkansas.

**NSF Awards
Mathematical Sciences
Postdoctoral Research
Fellowships**

The National Science Foundation (NSF) has awarded Mathematical Sciences Postdoctoral Research Fellowships to thirty-nine recent recipients of doctoral degrees in the mathematical sciences.

As researchers in the mathematical sciences expand their interactions with other disciplines and as the interplay increases between the various areas of mathematics itself, opportunities for postdoctoral research and training become increasingly important. The Fellowship Program helps to provide these opportunities and serves to focus attention on this issue throughout the broad mathematical sciences community.

Awards are made to U.S. citizens, nationals, or permanent residents based on their demonstrated ability and on the significance of career improvement the fellowship would potentially provide. The program is designed to allow recipients to choose research environments at fellowship institutions that will have maximum impact on their future scientific development.

A panel of mathematical scientists, chosen by the American Mathematical Society, the Institute of Mathematical Statistics, and the Society for Industrial and Applied Mathematics, evaluated 175 applications. Final selections were made by the NSF.

The stipend of \$66,000 provides support for two nine-month academic years and three two-month summers. Each awardee may choose between two options for receiving the academic year support: as full-time support for any eighteen academic year months in a three-year period, in intervals not shorter than three consecutive months (the Research Fellowship Option), or as a combination of full-time and half-time support over a period of three academic years, usually one academic year full-

time and two academic years half-time (the Research Instructorship Option).

The 1993 recipients are listed below (institutions in parentheses are the current institutions, those outside the parentheses are those at which the fellowship will be held). Partial support for some of the awards was provided by the following disciplinary divisions at the National Science Foundation: Computer and Computation Research, and Integrative Biology and Neuroscience.

ROBERT BEALS (University of Chicago), University of Oregon; DOUGLAS BOWMAN (University of California, Los Angeles), Pennsylvania State University; ERIC BRUSSEL (University of California, Los Angeles), Harvard University/University of Texas at Austin; LENORE COWEN (Massachusetts Institute of Technology), Rutgers University; KENNETH DYKEMA (University of California, Berkeley), University of California, Berkeley; DAN EDIDIN (Massachusetts Institute of Technology), University of Chicago; JEFF EDMONDS (University of Toronto), University of California, Berkeley; ALEX ESKIN (Princeton University), Institute for Advanced Study; SAMUEL EVENS (University of Arizona), University of California, San Diego; HAITAO FAN (Georgia Institute of Technology), Stanford University; JIANQING FAN (University of North Carolina), Stanford University/University of North Carolina; PAUL FEEHAN (Mathematical Sciences Research Institute), Harvard University; SERGIO FENLEY (Washington University), Mathematical Sciences Research Institute/University of California, Berkeley; VIKTOR GINZBURG (Stanford University), Stanford Univ./Institute for Advanced Study; DOUGLAS HUNTLEY (Northwestern University), Institute for Mathematics and its Applications; TOM ILMANEN (University of Wisconsin, Madison), University of Wisconsin, Madison; LISA JEFFREY (Princeton University/University of Cambridge), Princeton University; KARIN JOHNSGARD (University of Illinois), Cornell University; SMADAR KARNI (University of Michigan), Courant Institute of Mathematical Sciences; NETS KATZ (University of Pennsylvania), Yale University; TANYA KHOVANOVA (None), Massachusetts In-

stitute of Technology; SHARON LUBKIN (University of Pittsburgh), University of Washington; WILLIAM MOROKOFF (Institute for Mathematics and its Applications), University of Arizona; MARY PUGH (University of Chicago), Courant Institute of Mathematical Sciences; GORDAN SAVIN (Yale University), University of Utah; STEPHEN SAWIN (Massachusetts Institute of Technology), Massachusetts Institute of Technology; ERNEST SCHIMMERLING (University of California, Los Angeles), Massachusetts Institute of Technology; RICHARD SCHWARTZ (Mathematical Sciences Research Institute), University of California, San Diego; STEPHEN SIEGEL (University of Chicago), Northwestern University; KAREN SMITH (University of Michigan), Purdue University; RICHARD SOWERS (University of Southern California), University of Maryland; JOHN STALKER (Princeton University), Massachusetts Institute of Technology; THEODORE STANFORD (Columbia University), University of California, Berkeley; LISA TRAYNOR (Mathematical Sciences Research Institute), Stanford University; TODD TROYER (University of California, Berkeley), University of California, San Francisco; ELINOR VELASQUEZ (University of California, Berkeley), University of California, Berkeley; ERIC WEINSTEIN (Harvard University/Hebrew University), Massachusetts Institute of Technology; DAVID WILLIAMSON (Massachusetts Institute of Technology), Cornell University; PING XU (Mathematical Sciences Research Institute), University of California, Davis.

NSF Graduate Fellowships Awarded

The National Science Foundation has made awards for fiscal year 1993 in its Graduate Fellowship Program. The fellowships provide three years of support for doctoral work. The awardees in the mathematical sciences are listed below, followed by their mathematical areas, baccalaureate institutions, and tentative fellowship institutions (in parentheses). [Editor's Note: The institution of graduate study listed for each recipient is from the original application form and, in many cases, may change before study actually begins.]

MELISSA DULDULAO ACZON, Applied Mathematics, Harvey Mudd College (North Carolina State University, Raleigh); JAMES ALAN BERNHARD, Topology, Princeton University (Harvard University); JEFFREY FARLOWE BROCK, Topology, Yale University (University of California at Berkeley); WILLIAM MATTHEW CARLYLE, Operations Research, Georgia Institute of Technology (Stanford University); SEAN GOODWIN CARVER, Applied Mathematics, University of Colorado at Boulder (Cornell University); CHRISTINE JIAYOU CHANG, Algebra, Harvard University (Massachusetts Institute of Technology); NICHOLAS ASHTON COULT, Applied Mathematics, Carleton College (Northwestern University); TRAVIS WADE CUSICK, Applied Mathematics, Washington University (Washington University); JENNIFER MARIE DEANG, Applied Mathematics, Wake Forest University (Virginia Polytechnic Institute and State University); SILVINA DEJTER, Operations Research, University of California at Berkeley (Massachusetts Institute of Technology); JORDAN STUART ELLENBERG, Algebra, Harvard University (University of California at Berkeley); SIGAL GOTTLIEB, Applied Mathematics, Brown University (Brown University); MIKHAIL GRINBERG, Geometry, Massachusetts Institute of Technology (Harvard University); MANSOOR A. HAIDER, Applied Mathematics, University of Waterloo (Rensselaer Polytechnic Institute); THOMAS PATRICK HAYES, Logic, Michigan State University (Princeton University); MICHAEL LOUNSBERY HUTCHINGS, Topology, Harvard University (University of California at Berkeley); RAFAEL ANGEL IRIZARRY, Statistics, University of Puerto Rico at Rio Piedras (University of California at Berkeley); JULIE B. KERR, Algebra, Washington State University (Cornell University); DONALD MARTIN KRAPP, JR., Applied Mathematics, Drexel University (University of California at Berkeley); ANDREW HAROLD KRESCH, Analysis, Yale University (University of California at Berkeley); ROGER W. LEE, Applied Mathematics, Harvard University (Massachusetts Institute of Technology); ROSS ADAMS LIPPERT, Applied Mathematics, Massachusetts Institute of Technology (Mas-

sachusetts Institute of Technology); TREVIS J LITHERLAND, Applied Mathematics, Rose-Hulman Institute of Technology (University of Arizona); ADRIAN V MARIANO, Applied Mathematics, University of Washington (Massachusetts Institute of Technology); GREGORY GEORGE MARTIN, Algebra, Stanford University (University of Michigan); SETH PADOWITZ, Algebra, Brown University (Harvard University); SUSAN JUDITH PATTERSON, Algebra, Oberlin College (University of Michigan); DONNA KAY PAULER, Statistics, University of Texas at Austin (Carnegie Mellon University); NILES ADAMS PIERCE, Applied Mathematics, Princeton University (University of Oxford, England); DAVID JONATHAN POLLACK, Algebra, University of Chicago (Harvard University); ASYARABINOVICH, Statistics, Harvard University (Stanford University); JOHN WESLEY ROBERTSON, Analysis, Brigham Young University (Princeton University); THOMAS WARREN SCANLON, Logic, University of Chicago (University of California at Berkeley); STEVEN LEE SCOTT, Statistics, Texas Christian University (University of Chicago); DEV PRAKASH SINHA, Geometry, Massachusetts Institute of Technology (University of California at Berkeley); CHRISTOPHER MCLEAN SKINNER, Algebra, University of Michigan (Harvard University); ADAM ABRAHAM SZPIRO, Applied Mathematics, University of California at San Diego (Cornell University); MICHAEL GREGORY SZYDLO, Algebra, Boston University (Harvard University); PETER ENGEL TRAPA, Algebra, Northwestern University (Massachusetts Institute of Technology); SAMUEL KENDRICK VANDERVELDE, Analysis, Swarthmore College (Massachusetts Institute of Technology); JOEL MARK WISDOM, Algebra, University of Tennessee, Chattanooga (Massachusetts Institute of Technology); ALAN ANDREW WOLF, Operations Research, Stanford Univ. (Columbia University); and JARED WUNSCH, Analysis, Princeton Univ. (Massachusetts Institute of Technology).

NSF Awards Minority Graduate Fellowships

The National Science Foundation has made awards for fiscal year 1993 in

its Minority Graduate Fellowship Program. The fellowships provide three years of support for doctoral work. The awardees in the mathematical sciences are listed below, followed by their mathematical areas, baccalaureate institutions, and tentative fellowship institutions (in parentheses). [Editor's Note: The institution of graduate study listed for each recipient is from the original application form and, in many cases, may change before study actually begins.]

JOHN DOUMA, Geometry, Rutgers University, (University of California at Berkeley); LUZ ELENA PINZON, Operations Research, Rutgers University (Cornell University); FABIO GUILLERMO ROJAS, Topology, University of California at Berkeley (Princeton University); ADOLFO BUSHY SANTAMARIA, Topology, University of California at Berkeley (Stanford University); EDGAR ALLEN SMITH, JR., Logic, St. Thomas, University of Texas (Rice University); TONYA RENAE STANCIL, Applied Mathematics, North Carolina Agricultural and Technical State University (University of North Carolina at Chapel Hill); and HOWARD M. THOMPSON, Geometry, University of California at Irvine (University of California at Berkeley).

New NSF Director Named

On July 13, President Clinton nominated Neal F. Lane, provost of Rice University, to be the director of the National Science Foundation (NSF). Lane, a theoretical physicist, received his Ph.D. in 1964 from the University of Oklahoma. He has served as assistant professor of physics (1966–1969), associate professor of physics (1969–1972), and professor of physics (1972–1984) at Rice University. In the period 1984–1986 he served as chancellor of the University of Colorado at Colorado Springs. He has been provost at Rice since 1986.

Dr. Lane has served on numerous panels and committees, including the NSF Advisory Panel on Advanced Scientific Computing (1984–1986), the Panel on Science and Engineering Manpower of the Congressional Office of Technology Assessment (1986–1988) (chair), the Universities Research Association Board of Overseers for the Superconducting Supercollider (1987–1993),

the NSF Mathematical and Physical Sciences Advisory Committee (1992–present), and the NSF Blue Ribbon Panel on High Performance Computing (1993–present). He also served as Director of the Division of Physics at the NSF (1979–1980).

Hall to Give Pitcher Lectures

The next series of Everett Pitcher Lectures will be held October 19, 20, and 21, 1993, on the campus of Lehigh University in Bethlehem, Pennsylvania. The speaker will be Professor Peter G. Hall of Australian National University, Canberra. The title of his lectures is *Statistical Estimation of Fractal Dimension*.

The lectures are open to the public and are held in honor of Everett Pitcher, former Secretary of the AMS. Pitcher served in the mathematics department at Lehigh from 1938 until 1978, when he retired as Distinguished Professor of Mathematics. Further information can be obtained by writing to Pitcher Lecture Series, Department of Mathematics, Lehigh University, Bethlehem, PA 18015; or by calling 215-758-3753.

Call for Nominations for A. W. Tucker Prize

The Mathematical Programming Society invites nominations for the A. W. Tucker Prize for an outstanding paper by a student. The award will be presented at the International Symposium on Mathematical Programming, to be held in Ann Arbor, Michigan, August 15–19, 1994. All students, graduate and undergraduate, are eligible. Nominations of students without their first university degree are especially welcome. At most three finalists will be selected. Finalists will be invited, but not required, to give oral presentations at a special session of the symposium.

The paper may concern any aspect of mathematical programming and may be original research, an exposition or survey, a report on computer routines and computing experiments, or a presentation of new and interesting applications. The paper must be solely authored and completed after January 1991. The paper and the work on which it is based should have been undertaken and com-

pleted in conjunction with an academic degree program.

Nominations may be made by faculty members at the institution where the nominee was studying for a degree when the paper was completed. Nomination letters must be accompanied by four copies each of the student's paper; a separate summary, no more than two pages in length, of the paper's contributions, written by the nominee; and a brief biographical sketch of the nominee.

Nominations must be sent by **December 31, 1993**, to the chair of the selection committee: Thomas M. Liebling, Swiss Federal Institute of Technology, Department of Mathematics, MA (Ecublens), CH-1015 Lausanne, Switzerland. The other members of the selection committee are Andrew R. Conn, William H. Cunningham, Clovis Gonzaga, and Jean-Philippe Vial.

Call for Nominations for Dantzig Prize

The Mathematical Programming Society and the Society for Industrial and Applied Mathematics solicit nominations for the George B. Dantzig Prize. The prize is awarded to one or more individuals for original research which, by virtue of its originality, breadth, and depth, is having a major impact on the field of mathematical programming.

The nominee's contributions for the prize must be publicly available and may address any aspect of mathematical programming in its broadest sense. Strong preference is given to nominees under fifty years of age. Past recipients of the Dantzig Prize are M. J. D. Powell and R. T. Rockafellar (1982), E. L. Johnson and M. W. Padberg (1985), M. J. Todd (1988), and M. Groetschel and A. S. Nemirovsky (1991). The prize will be presented at the International Symposium on Mathematical Programming, to be held August 15–19, 1994 in Ann Arbor, Michigan.

Nominations should be sent by **September 30, 1993**, to the chair of the selection committee, Michael J. Todd, School of Operations Research and Industrial Engineering, 206 Engineering and Theory Center Building, Cornell University, Ithaca, NY 14853-3801; e-mail: miketodd@cs.cornell.edu.

Nominations should provide a brief one- or two-page description of the nominee's outstanding contributions and, if possible, a current résumé and list of publications. The other members of the Dantzig Prize Committee are Martin Groetschel, Ellis L. Johnson, and R. Tyrrell Rockafellar.

**News from the
Mathematical Sciences Institute
Cornell University,
the University of Puerto Rico,
and SUNY Stony Brook**

P. Paule from the University of Linz will organize a workshop on Symbolic Computation in Combinatorics to meet September 21–24, 1993, at the Mathematical Sciences Institute (MSI) in Ithaca, New York. For further information please contact P. Paule at ppaule@risc.uni-linz.ac.at.

B. Sturmfels of Cornell University will host the joint U.S.-Italian conference on Hilbert Functions to meet October 27–30, 1993, at MSI. Contact B. Sturmfels for more information at bernd@math.cornell.edu.

R. Getoor from UCSD and H. Kesten from Cornell University are organizing a conference in honor of E. Dynkin of Cornell University. The conference will be held at MSI in Ithaca, New York, from May 22–24, 1994. For information contact H. Kesten at hak@cornella.bitnet.

MSI Director A. Nerode is the program chair for LFCS'94: Logic at St. Petersburg, a symposium on logical foundations of computer science to be held July 14–18, 1994, in St. Petersburg, Russia. For information please contact V. Marek at marek@ms.uky.edu.

A. Nerode of MSI and V. Marek from the University of Kentucky are co-general chairs for the 1994 International Symposium on Logic Programming to meet November 13–17, 1994, in Ithaca, New York. For further information contact V. Marek at marek@ms.uky.edu.

A number of the conferences and workshops hosted by MSI over the past six years have produced abstracts or proceedings volumes. Contact vals@msiadmin.cit.cornell.edu for copies of:

Applied Probability (in honor of N.U. Prabhu), June 1993; *Structural*

Complexity and Recursion-theoretic Methods in Logic Programming, November 1992; *Logical Methods in Mathematics and Computer Science* (in honor of A. Nerode), June 1992; *Combinatorics and Discrete Geometry*, July 1991; *Hybrid Systems*, June 1991; *Mathematics of Computation in Partial Differential Equations* (in honor of J.H. Bramble), January 1991; *Partial Differential Equations* (in honor of L. Payne), October 1990; *Eighth Army Conference on Applied Mathematics and Computing*, June 1990; *Percolation Methods of Material Failure*, May 1990; *Computer Algebra and Parallelism*, May 1990; *Modern Perspectives in Mathematics: Mathematics as a Consumer Good, Mathematics in Academia*, March 1990; *Stable Processes*, January 1990.

For a listing of volumes available from 1988 and 1989, see the *Notices of the American Mathematical Society*, September 1991, vol 38, no 7, page 795.

**News from the
Institute for Mathematics
and its Applications
University of Minnesota**

The Institute for Mathematics and its Applications (IMA) 1993–1994 academic year program is **Emerging applications of probability**. The program coordinators are J. Michael Steele (chairman), D. Aldous, P. Diaconis, R. Durrett, and L. Shepp.

The year is divided into three parts (corresponding to fall, winter, and spring quarters), although it is expected that there will be considerable fluidity between the various parts.

1. Fall: September 9–December 20, 1993, Probability and computer science
2. Winter: January 2–March 31, 1994, two themes: Mathematical genetics; Queueing networks
3. Spring: April 1–June 30, 1994, Probability in geo-systems

Details concerning the fall program can be found in the July/August *Notices*.

The first winter program workshop will be on **Mathematical population genetics**, January 24–28, 1994, organized by S. Tavaré and P. Donnelly.

Much of the progress in mathematical population genetics in the past

decade has resulted from two novel approaches, the study of genealogy and the development of measure-valued diffusions.

For many years there has been a crucial interplay between the analysis of population genetics data and the development of novel probabilistic methods for their interpretation. The recent advent of molecular sequence data must accelerate such developments. The workshop will bring together mathematicians and biologists working in population genetics and will focus on problems in stochastic processes motivated by modern genetic data such as mitochondrial DNA, VNTRs, multigene families, and gene conversion.

R. Williams and F. P. Kelly will run the workshop **Stochastic Networks**, February 28–March 4, 1994. The past decade has seen a proliferation of local area networks and of global communication networks for both computer and human communication. In addition the development of parallel computers with large numbers of moderately powerful processors and the design of flexible and robust manufacturing systems have spurred advances in queueing networks. The analysis and design of such systems require a wide variety of both classical and modern tools of mathematics such as graph theory, mathematical programming, network flows, functional analysis, partial differential equations; and a long list of topics in probability such as Markov chain theory, point processes, diffusion approximations, and large deviations.

Latest research on these and other rapidly developing aspects of stochastic networks will be presented at the workshop.

During March 21–25, 1994, T. Funaki and W.A. Woyczynski will lead a period of concentration on **Stochastic problems for nonlinear partial differential equations**. (Periods of concentration are more informal and less intense than workshops.) The topics of interest are 1) Statistical solutions of Burgers's equation, and 2) Hydrodynamic limit problems.

For more information about IMA activities see the Meetings and Conferences section of this issue or contact the

IMA, ima-staff@ima.umn.edu.

Also, weekly IMA seminar schedules with titles and abstracts are available on Usenet: umn.math.dept and by fingering seminar@ima.umn.edu. TeX files for the Newsletter and the Update, as well as IMA Preprints, are available via anonymous ftp at [ima.umn.edu](ftp://ima.umn.edu).

Isaac Newton Institute for Mathematical Sciences

The Institute's scientific work started in July 1992 in its purpose-designed building in west Cambridge. At any time there are two six-month visitor programs in progress, each with about twenty scientists in residence. In addition, during these programs, there are periods of more expanded activity including instructional courses and workshops. The first four programs, on Low-dimensional Topology and Quantum Field Theory, Dynamo Theory, L-functions and Arithmetic, and Epidemic Models have now been completed. The programs which have been chosen for the next two and a half years are as follows:

Computer Vision (July–Dec. 1993); Random Spatial Processes (July–Dec. 1993); Geometry and Gravity (Jan.–June 1994); Cellular Automata, Aggregation and Growth (Jan.–June 1994); Topological Defects (July–Dec. 1994); Symplectic Geometry (July–Dec. 1994); Exponential Asymptotics (Jan.–June 1995); Financial Mathematics (Jan.–June 1995); Semantics of Computation (July–Dec. 1995); and From Finite to Infinite Dimensional Dynamical Systems (July–Dec. 1995).

The Institute is actively seeking new proposals for programs for 1996 onwards. These new proposals should be addressed to the Deputy Director Professor Peter Goddard, Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge CB3 0EH, UK. Further information about the Institute, about the programs for 1993–1995, and advice on the submission of proposals are available from Peter Goddard (telephone 0223 335999; e-mail: i.newton@newton.cam.ac.uk), who will answer any inquiries.

Information about the Institute is also available in electronic form. The

Institute sends weekly lists of seminars by e-mail in the form of a TeX-source file or an ASCII file; anyone who wishes to be sent these lists should send an e-mail message to info@newton.cam.ac.uk indicating which program he or she is interested in and which file format is preferred. The seminar lists and other information about the Institute's activities are also available via anonymous ftp. In order to use this facility, one should ftp to [newton.newton.cam.ac.uk](ftp://newton.newton.cam.ac.uk) entering ftp as username and one's e-mail address as password. All information is beneath the pub directory (e.g., seminar information is in the directory [pub/seminars](ftp://pub/seminars)). The seminars and lectures held at the Institute are open to all who are interested.

Mathematics Awareness Week 1993

Mathematics Awareness Week (MAW) was held April 25 to May 1, 1993. This year's theme, Mathematics and Manufacturing, recognizes the importance of manufacturing to the nation's competitive position in the global economy and highlights the critical role played by the mathematical and computational sciences in manufacturing.

Since its inception in 1986, MAW activities have increased at the state and regional level. Organized by college and university mathematics departments, institutional public information offices, student groups, and related organizations, MAW activities have included workshops, competitions, exhibits, festivals, lectures, and symposia. Media coverage has been extensive. This year, the Army Research Office contributed funds to the MAW effort and supported the production of posters and postcards to publicize the event.

Here are some examples of MAW activities across the nation. American University in Washington, DC, celebrated MAW with an art contest open to faculty, students, and staff of the Consortium of Universities in the Washington Metropolitan Area. Prizes included two \$1000 cash purchase prizes from Prentice-Hall, dinner for four at a local pizzeria, and several \$100 First American Bankshares. Cerritos Community

College in Norwalk, California, held its fifth annual Math Field Day in which area high school students competed for trophies and awards in four different mathematical contests. The Undergraduate Mathematics Association at Boston University sponsored a number of activities, including a video and activity evening, a lecture on Newtonian fractals, and a picnic. The University of Northern Iowa in Cedar Falls sponsored a showing of video segments illustrating how mathematics assists in the manufacture of metal, machines, medicine, snack food, and music, and the governor of Iowa issued a proclamation designating Mathematics Awareness Week in the state.

Mathematics Awareness Week is coordinated through the Joint Policy Board for Mathematics. For more information about MAW, contact the Board at 1529 Eighteenth Street, NW, Washington, DC 20036; telephone 202-234-9570.

Errata

1992 Annual AMS-MAA Survey (Second Report)

Due to a programming error, the results reported for Group B and Group M in Table 3E (Distribution of Tenured and Tenure-eligible Doctoral Full-time Women Faculty, Fall 1992) on page 606, *Notices*, July/August 1993, were incorrect. The corrected figures are given below.

Table 3E

Group	M	B
Row 1	133	436
Row 2	2229	2342
Row 3	315	443
Row 4	14.1%	18.9%
Row 5	1	45
Row 6	26	49
Row 7	31	109
Row 8	22	92
Row 9	25	67
Row 10	28	74

The first paragraph on page 607, which refers to the incorrect data for Groups B and M, is therefore also incorrect. The

remark about the small sizes of Group M departments is not correct. The corrected text is:

Table 3E does show a nonuniform distribution of p-values in Group B. This is, however, in part a consequence of the small sizes of a large fraction of Group B departments and the resulting discrete nature of the distribution of p-values. Of the 436 responding departments in Group B, 45 have no tenured/tenure-eligible doctoral faculty and 100 have

a total of 1 or 2 tenured/tenure-eligible doctoral faculty.

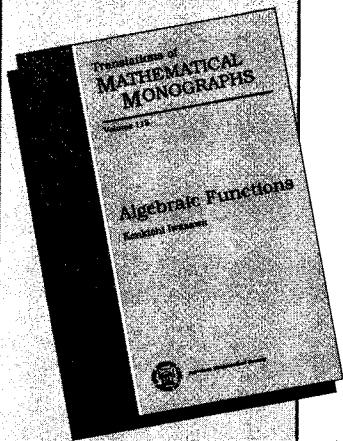
1993 Sloan Research Fellows

In the listing of recipients of Sloan Fellowships on page 642, *Notices*, July/August 1993, the names of three recipients were inadvertently omitted. They are PENGFEI GUAN, McMaster University; STEPHANE MALLAT, New York University; and TAMAR SCHLICK, New York University.

Wolf Prize

The April 1993 issue of the *Notices* carried an announcement that Mikhail Gromov and Jacques Tits had received the Wolf Prize in mathematics. Because of incorrect information supplied to the *Notices*, the announcement mistakenly said that Tits had received the Prix Henri Poincaré in 1976. The prize Tits received in 1976 was the Grand Prix des Sciences Mathématiques et Physiques of the Académie des Sciences de Paris.

TRANSLATIONS OF MATHEMATICAL MONOGRAPHS



Algebraic Functions

Kenkichi Iwasawa

Volume 118

This is a translation of Iwasawa's 1973 book, *Theory of Algebraic Functions*, originally published in Japanese. Because the book treats mainly the classical part of the theory of algebraic functions, emphasizing analytic methods, it provides an excellent introduction to the subject from the classical viewpoint. Directed at graduate students, the book requires some basic knowledge of algebra, topology, and functions of a complex variable.

1991 *Mathematics Subject Classification*: 14, 30; 33

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Funding Information for the Mathematical Sciences

Travel Grants for ICM 94, Zürich

The American Mathematical Society has applied to several funding agencies for funds to permit partial travel support for U.S. mathematicians attending the 1994 International Congress of Mathematicians (ICM 94) in Zürich, Switzerland. In anticipation of the availability of funds, the Society is preparing to administer the selection process.

Applications for support may be made on the form at the back of this issue or submitted electronically. For an electronic version of the form send e-mail to amsdc@math.ams.org or use the menu option on the e-MATH network. Completed forms should be received in our Washington Office (AMS, 1527 18th St. NW, Washington, DC 20036) by **November 1, 1993**.

Junior mathematicians (those within six years of their doctorate), women, and members of minority groups are especially encouraged to apply.

Applications will be evaluated by a panel of mathematical scientists under the terms of a proposal submitted to the National Science Foundation (NSF) by the Society.

Should the proposal to the NSF be funded, the following condition will apply: mathematicians accepting grants for partial support of the travel to ICM 94 may not supplement them with any other NSF funds. Currently, is the intention of NSF's Division of Mathematical Sciences to provide no additional funds on its other regular research grants for travel to ICM in 1994. However, an individual mathematician who does not receive a travel grant may use regular NSF grant funds, subject to the usual restrictions

and prior approval requirements.

The first announcement of the 1994 International Congress of Mathematicians appeared in the July/August issue of the *Notices*.

Target Dates for NSF Proposals

The Division of Mathematical Sciences of the National Science Foundation has introduced target dates for proposal submission for disciplinary research activities for fiscal year 1994. Beginning in the fall of 1993 the Division is establishing the following target dates:

October 22, 1993, for Algebra and Number Theory, Classical Analysis, Modern Analysis, and Topology and Foundations.

November 19, 1993, for Applied Mathematics, Computational Mathematics, Geometric Analysis, and Statistics and Probability.

These dates do not overlap substantially with other known NSF target dates. In addition these dates mesh reasonably well with academic calendars and cluster the programs so as to provide a balance with respect to both overlapping scientific content and anticipated program proposal loads.

Proposals which miss the target dates will be handled as time permits. Priority will be given to proposals arriving on or before the above target dates.

The above dates do not apply to the activities of the Division's Office of Special Projects, as these activities already have specified target or deadline dates.

NSA Grants Update

Since 1987 the National Security Agency (NSA) Mathematical Sciences Program

(MSP) has funded undirected research in selected areas of the mathematical sciences (algebra, number theory, discrete mathematics, statistics, and probability) through research grants providing summer support and some support for students, travel, publishing expenses, and so forth. Also, limited conference support is available. Currently, due to budget constraints, the NSA is only funding one summer month on research grants. As in the past, there is a firm deadline of **October 15, (1993)**, for the next set of research proposals, with grants to be awarded henceforth in **November (1994)**.

Each federal fiscal year begins on October 1. Funding grants late in each federal fiscal year would threaten a loss of funds to other programs. The NSA has moved to fall funding this year despite its inconvenience.

Conference proposals will be accepted anytime, but please allow eight months between time of submission and receipt of funds for successful proposals. At the option of the assistant MSP director, conference proposals may be returned if there is less than eight months between submission and the beginning of a conference.

For a grants brochure please write to: Dr. Charles F. Osgood, NSA Mathematical Sciences Program, National Security Agency, ATTN: R51A, Ft. George G. Meade, MD 20755-6000; 301-688-0400; msp@titan1.math.umbc.edu.

Mathematical Sciences Postdoctoral Research Fellowships

The National Science Foundation's (NSF) Mathematical Sciences Postdoc-

Funding Information

toral Research Fellowship program is designed to permit recipients to choose research environments that will have maximal impact on their future scientific development. Awards will be made for appropriate research in pure mathematics, applied mathematics and operations research, and statistics at an appropriate nonprofit United States institution.

The fellowships will be offered only to persons who 1. are citizens, nationals, or lawfully admitted permanent resident aliens of the United States as of January 1, 1994; 2. will have earned, by the beginning of their fellowship tenure, a doctoral degree in one of the mathematical sciences; 3. will have held the doctorate for no more than five years as of January 1, 1994; and 4. will not previously have held any other NSF postdoctoral fellowship. Subject to the availability of funds, it is expected that in FY 1994 thirty to

forty awards will be made. The evaluation of applicants will be based, in part, on ability as evidenced by past research work and letters of recommendation, likely impact on the future scientific development of the applicant, and scientific quality of the research likely to emerge. Applicants' qualifications will be evaluated by a panel of mathematical scientists. Women, underrepresented minorities, and persons with disabilities are strongly encouraged to submit applications.

For copies of the application brochure or further information, contact the Office of Special Projects, Room 339, Division of Mathematical Sciences, National Science Foundation, 1800 G Street, NW, Washington, DC 20550; 202-357-3453; e-mail msprf@nsf.gov (Internet) or msprf@nsf (Bitnet) or the American Mathematical Society, 401-455-4104;

e-mail nsfpostdocs@math.ams.org.

The deadline for applications is **October 15, 1993**.

Proposed NSF University-Industrial Postdoctoral Program

A proposed university-industry postdoctoral program in the mathematical sciences, to be instituted by the National Science Foundation during the 1994 fiscal year, was described in the July/August issue of the *Notices* ("New Wave at NSF: Industrial Postdocs", page 591, and "NSF Launches Program for Industrial Postdocs", page 649) As the present issue of the *Notices* is going to press, this activity was still subject to administrative approval and the availability of funds in FY 1994.

PROCEEDINGS OF SYMPOSIA IN PURE MATHEMATICS

Differential Geometry

Robert E. Greene and S. T. Yau, Editors

Volume 54

These three parts contain the proceedings of the AMS Summer Institute on Differential Geometry, held at the University of California, Los Angeles, in July 1990. This was the largest AMS Summer Institute ever, reflecting the wide-ranging and intense research activity in the subject. The parts contain many extensive survey articles presenting perspectives on relatively broad topics; these articles would be accessible to advanced graduate students. In addition, the authors of the research articles were encouraged to survey the relevant literature. The three parts together offer the deepest and most comprehensive survey of recent research in differential geometry available today.

1991 *Mathematics Subject Classification*: 32, 53, 58, 81, 83

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For Your Information

Women in Algebraic Geometry Workshop at MSRI

Lenore Blum

Deputy Director, MSRI

Twenty women students, ranging from upper division undergraduate to advanced graduate students, participated in the Women in Algebraic Geometry Workshop held at the Mathematical Sciences Research Institute (MSRI) in Berkeley the last two weeks of May. The students came from sixteen colleges and universities across the country. They were joined by about twenty-five postdocs, senior mathematicians, and scientists who served as lecturers, mentors, panelists, program directors, and friends. The workshop was funded by grants from the National Science Foundation and the Paul and Gabriella Rosenbaum Foundation. This was a unique and historic event, the gathering together of a large group of women students interested in a particular field of mathematics, a field where, in the U.S., there are indeed few women.

The workshop program included introductory as well as advanced talks in algebraic geometry and number theory. During the first few days, the mentors presented informal talks about their research interests and suggested possible mini-research projects. By the end of the first week each student had become part of a small research team working with mentors on a variety of topics such as toric varieties, algebraic curves, elliptic curves, diophantine equations, moduli spaces, and Veronese embeddings. The students had opportunities to present their work to the rest of the group during the second week.

In addition to the mathematical component of the workshop, there were panels and talks with MSRI and Berkeley women mathematicians and scientists on careers in research, computer demonstrations, various social gatherings, and many shared meals, both informal and formal.

Clearly such a workshop would be a stimulating and worthwhile experience for any budding research mathematician; and so the question arises, why have a special program for women? Is it because women have to learn mathematics in a special way? To the contrary, it is to create an environment where women have a chance to do and learn mathematics in ways that most successful male mathematicians take for granted.

Mathematics is a social and communal endeavor. Math-

ematicians enjoy meeting with others in their field to work, talk, and play together. That is what makes programs such as the special-emphasis years at MSRI so popular. Many male mathematicians enjoyed having friends in high school and college with whom they could jointly work on math problems. Much college mathematics is done in dormitory dining rooms and math department commons rooms. There is a natural flow between the personal and professional. For MSRI visitors to spend a day on the bay sailing with their colleagues for yet more professional bonding is not uncommon.

These experiences are rarely part of women mathematicians' experiences; the opposite is more often the rule. Women are often very isolated. Indeed, given this isolation, that women can compete at all is a wonder. An important function of the workshop was to capture some of these crucial professional experiences and have the students recognize the value of cultivating such interactions.

Most of the students, and some of the mentors, lived together in shared rooms at the Durant Hotel. The first morning that we congregated at MSRI very few knew each other. By the second day the students had begun to study and work together, and by the end of the second week potential lifelong collegial relationships and friendships had been formed. After the workshop, almost all the students participated in the four-week Summer Geometry Institute in Utah, which provided further opportunities to consolidate professional friendships and collaborations. As anticipated by Dave Morrison, workshop friend and lecturer in the summer program, these students were among the most active and enthusiastic participants in the Utah program.

Any skepticism the participants themselves may have felt at the beginning of the program was quickly dispelled as they became involved in workshop activities.

As mentor Lucia Caporaso put it on her return to Harvard, "I was curious, and maybe even a little skeptical, about the whole idea, but now I think it worked out very well; it has been a great new experience to talk about mathematics with so many women and to try to be of some help with the younger ones. My mentorees have been a stimulating, active audience, and I do regret I had to leave early. Even if we did not go sailing together, it seems to me that things are changing very fast and that events like the workshop are necessary not to lose momentum."

We hope to stay in touch with the workshop participants and see how they progress along their career paths.

Some immediate reactions and effects can be gleaned from the exit surveys. Practically all students commented on the importance of the mathematical contacts made during the workshop and their intent to continue collaborations. Here are some samples of their comments:

"The most important part of the workshop for me was the people. I've never been around this many mathematicians at once—male or female. So that in itself was a good experience. But more than enjoying their company for a couple of weeks, I made some friends that I think will be a good support system in the future."

"To meet other women in the same area of mathematics had a more positive impact on me than expected. I would like to keep in touch with the people I met during the program."

"There are several women in the program with whom I plan to continue e-mail dialogues on mathematical topics which we began discussing here."

An undergraduate student hopes to use her contacts in choosing a graduate program. "I think the contacts with people from various schools will be very valuable to me as I prepare my grad school application this winter. [When I apply to schools] represented in this program, I will have people to ask about details of life and work at their schools."

Many students commented on feeling more a part of the mathematics community:

"... [L]earning about the people behind the names on articles and in textbooks is important because we become part of the mathematics community that way..."

"Participating in this workshop and the mere fact of its existence have strengthened my belief that there is a place for me in mathematics."

"I feel more connected to mathematics."

"MSRI was a great place to have this program since there are so many people here now that are doing algebraic geometry and related work."

One student's comment was very pragmatic, "I realized that I need to be more serious about my work."

How This Workshop Came to Be

During the planning meetings for the current MSRI Special Year in Algebraic Geometry, the shortage of women on the list of preliminary members was pointed out to the organizers. This prompted the Human Resources Committee of the MSRI Board of Trustees to design guidelines for future program committees outlining pro-active recruitment strategies. The Algebraic Geometry Committee conceived of the workshop as a way to help increase the number of women involved in the program. The result was a proposal to the National Science Foundation written by Herb Clemens and Irving Kaplansky. I was asked to be a principal investigator. One aspect of the proposal was to coordinate efforts with the Regional Geometry Institute's (RGI) summer program. Under the direction of Karen Uhlenbeck, women students accepted to the Summer Geometry Institute were invited to attend the MSRI workshop. Clemens, RGI director, put a great deal of

effort into the planning stages of the workshop. Antonella Grassi, a member of the MSRI Algebraic Geometry year, played a special role in the workshop as scientific organizer, mentor, colleague, and friend. Much of the workshop's success is due to the spectacular efforts of these people.

My Own Assessment

This has been a gratifying project for me. After all, we were working with some of the brightest and best educated women in the country. These are women who love mathematics and have very strong mathematical backgrounds. Yet they are the same women who, in the past, have disappeared from the mathematical mainstream. Very little has to be done to change the situation. Short-term intervention projects such as the MSRI workshop can have important and long-lasting effects. These young women can then use their tremendous enthusiasm, energy, and talents to carry on. The workshop has already had some effect on the pipeline. Program committees will not be able to say there are not any women in algebraic geometry. One student wrote, "[The workshop] made me decide to apply for a postdoc at MSRI when I'm done."

An important message we need to give these young women is that succeeding in a career in research mathematics is possible. To a large extent the students, buoyed by their collaboration with others, gained a growing self-confidence in their own research abilities. The students also need to see successful senior women research mathematicians as role models. In future workshops I would involve the Association for Women in Mathematics (AWM) more centrally. Relying, as we did, on local academics for role models, the not-so-subtle message was that a woman can be successful in academic research science but not in mathematics. By involving the AWM and more women mathematicians from across the country, we can easily change that perception.

Student Participants: Katia Consani, Chicago; Michelle Cook, UCLA; Nancy Cunningham, Rice; Sandra DiRocco, Notre Dame; Lisa Fastenberg, Yale; Karrolyne Fogel, Texas at Austin; Amy Galtman, Brooklyn College; Yoshiko Hayakawa, Maryland; Meeyoung Kim, Notre Dame; Amy Ksir, Rice; Kristin Lauter, Chicago; Ruth Michler, UCB; Maria Miles, Portland; Nina Mirishige, UCB; Jeanne Nielsen, Duke; Judy Eng, UCB; Christine Schwarz, Massachusetts; Margaret Symington, Stanford; Cheryl Taborsky, Stony Brook; Ursula Wunsch, Utah.

Senior Participants: Dan Abramovich, MIT and MSRI; Paolo Aluffi, Florida State and MSRI; Enrique Arrondo, Universidad Complutense and MSRI; Lenore Blum, MSRI; David Butler, Michigan and MSRI; Lucia Caporaso, Harvard; Deanna Caveny, College of Charleston and MSRI; Karen Chandler, Chicago; Herb Clemens, Utah and MSRI; Alessio Corti, Chicago and MSRI; Lisa Goldberg, CUNY and MSRI; Antonella Grassi, Penn and MSRI; Robin Hartshorne, UCB; Eriko Hironaka, Stanford; Elham Izadi, Harvard and MSRI; Mary-Claire King, UCB; Sydney Kustu, UCB; Eduard Looijenga, University of Utrecht and MSRI; David Morrison, Duke and MSRI; Deb Nolan, UCB; Rubi Rodriguez, Universidad Catolica de Chile; Alice Silverberg, Ohio State and MSRI;

Michael Thaddeus, Oxford, England, and MSRI; William Thurston, MSRI; Lisa Traynor, Stanford and MSRI; Elinor Velasquez, UCB.

Reflections on the Education Challenges Faced by Mathematicians

Wayne Harvey
Education Development Center, Inc.

In Berkeley in March 1993, the Mathematicians and Education Reform (MER) Network organized a workshop which was cosponsored by the AMS, the Mathematical Association of America, the Mathematical Sciences Research Institute, the Society for Industrial and Applied Mathematics, and the Department of Mathematics and the Office of Academic Affairs of the University of California at Berkeley. The following article presents some reflections on the workshop.

I recently attended a workshop in Berkeley titled, "Changing Culture: Mathematics Education in the Research Community." There were approximately sixty attendees and twenty presenters. According to the workshop announcement, its goal was to "activate mathematicians within research institutions to become involved in mathematics education reform as part of the process of making systemic changes." Although a high proportion of the attendees were mathematicians, most from colleges and universities, the focus of the conference was on mathematics education, not mathematics.

Yet, two of the most common questions I was asked in social contexts were these: (1) what mathematics am I doing (not what mathematics *education* issues am I involved in), and (2) what mathematics courses am I teaching. One might expect the workshop participants to view things primarily within the context of academia, but the first question always took me by surprise. Mathematics stayed higher on the agenda in individual conversations than mathematics education—maybe because the knowledge and comfort level is higher on that topic even though the workshop was devoted to education issues. My colleague, Al Cuoco, pointed out another possible explanation: it's almost as if a few words about algebraic topology were necessary as passwords to let the other person know you were *safe*. Harvey Keynes alluded to the fact that the award for good teaching at the Massachusetts Institute of Technology is the "kiss of death".

I am not a mathematician. I have a bachelor's degree in mathematics and a master's degree in computer science from the University of California at Berkeley, but I decided fifteen years ago to change directions and obtain my Ph.D. in the then-growing discipline of cognitive science. Actually, my Ph.D., also from Berkeley, is stamped "doctorate in mathematics education".

I don't currently work at a university, although some time ago I taught some undergraduate courses at Berkeley in computer science and some special courses in calculus.

I've worked in research settings since leaving Berkeley (Atari Research and SRI International), and I've spent the past seven years working in a nonprofit research and development organization (Education Development Center) dedicated to improving the human condition through education. I've designed new software for teaching and learning mathematics and new elementary and secondary curricula. I frequent professional meetings of such organizations as the National Council of Teachers of Mathematics (NCTM) and Psychology of Mathematics Education.

I tell you all this to help you better understand my reflections on the Berkeley workshop. You see, I left the workshop quite impressed with the dedication of many in the mathematics community to education reform but also quite discouraged at the isolation of this community from others and the isolation of efforts even within the community.

I am grateful for the efforts of the organizers of this and previous workshops dedicated to activating the community to face the challenges of postsecondary mathematics education. I am also encouraged by those who felt it either in their interests or their department's interests (or, for some, the nation's interests) to attend the meeting. We all can find many other tasks to attend to that we might easily convince ourselves are higher priorities.

After talking to many individuals at the conference, I found myself wondering what was holding this group together. From my vantage point the postsecondary mathematics education movement isn't a movement (yet?); it's still predominantly a collection of independent, individual initiatives and efforts. We don't appear to have a collective, organized strategy for creating policy change. So it was a little disheartening to be in a meeting where the focus necessarily could only be on what some particular individuals were doing and thinking. This is not a criticism of how the conference was organized so much as an observation about the collective state of affairs.

I had to wonder why many mathematicians are working on education problems independently rather than collaboratively. I recognize that many attempts are under way to promote more collaborative efforts on education issues, and the AMS has a Committee on Education thinking about an overall strategy. But these are still early efforts, and they are not yet coalescing into a forceful movement. Yet there is no time to waste.

Joan Ferrini-Mundy of the University of New Hampshire spoke elegantly about the need for more communication. She gently and artfully prodded the community of mathematicians to connect up with other efforts and groups and to educate themselves about mathematics education. She talked about the tension between mathematics educators and mathematicians and promoted the need for collaboration, suggesting that there appears to be a great deal of reinventing of the wheel. She pointed the audience to various specific lines of work in mathematics education, including four well-developed lines of research: those of Carpenter, Cobb, Dubinsky, and Secada.

Joan discussed some of the attitudes she has encountered in her unique integrated department at New Hampshire. For example, Joan has seen mathematicians recommend that their high-quality teaching assistants, who aren't quite the cream

in mathematics, change over to mathematics education. On one hand, to the extent that these individuals would otherwise not find success and happiness in mathematics, this could be excellent advice. On the other hand, it exemplifies a common misconception held by many mathematicians that being good at teaching and being successful in mathematics education are more or less synonymous. The view fails to recognize that the art of teaching requires different skills from those required to produce quality research or effective curriculum reform.

Joan's presentation reinforced one of my stronger impressions of the conference: the feeling that I was in a foreign land with a foreign language and a different culture. Although I certainly felt welcome, I had not expected to feel so out of place.

As a mathematics educator, I heard a variety of comments that gave me a kind of "culture shock". For example, it wasn't unusual to hear phrases like "cover the material" or "students are not prepared" that I don't expect to hear from leaders of education reform. I didn't realize until I heard such comments how mistaken I was as a mathematics educator to presume that my familiarity with and acceptance of a paradigm for cognitive development—a constructivist approach to teaching and learning—is widely shared by others intending to help lead the way on mathematics education reform. I realized I had to spell out much that I take for granted (like what NCTM stands for). I am also much more aware of the large gulf between the two communities: those who practice research in mathematics and those who practice research in mathematics education. Both cultures need to recognize the causes for the gulf and learn to bridge it.

Ken Millet of the University of California at Santa Barbara, who is executive director of the California Coalition for Mathematics, presented a fine account of the cultural chasm. He told a story of how he used to be proud to fail half his class, since that demonstrated that he had lived up to the values that say "students should have to learn this stuff". Now he looks back on that attitude with shame. I give Ken credit for sharing his own experience to make a point about destructive beliefs. The attitude he feels ashamed of is still predominant in mathematics departments today. Ken also identified many other such predominant attitudes: students are not prepared, students are not smart enough, they are incapable of learning mathematics, our job is to weed them out. I agree wholeheartedly with Ken's conclusion that such attitudes demonstrate how we are selling our kids short.

On the positive side, most at the conference recognized that change is needed and will happen one way or another. If departments don't lead the way, change will be forced on them. I didn't hear resistance to that message. Uri Treisman of the University of Texas at Austin spoke forcefully about the external threats to departments and the significance of these threats. He spoke about the lack of public trust in higher education (as did others) and the declining budgets. Most interesting were his comments about what governors are beginning to ask: "Why should the state be supporting graduate education in our state universities? The graduates often come from out of state or out of the country and upon

graduation rarely provide anything back to the state." This trend portends some serious challenges ahead.

Similarly, Harvey Keynes had a wonderful perspective on these challenges. He noted that there is a lot of discussion about mathematics education in mathematics departments. The budget situations right now are horrible, and salaries are decreasing. The system of rewards, promotions, and hiring are barely changing. Meanwhile, the public thinks faculty are lazy and arrogant and feels the system rewards the wrong values. As a result funding for higher education is in the worst shape it has been in since World War II, and there are no signs of improvement.

Harvey's message to the mathematics research community was forceful. They need to recognize and accept the changes—higher education is undergoing restructuring (with or without them), and education is becoming more important. Loss of public trust has caused severe cuts and greater demands for accountability. Departments will absolutely have to change, not just individuals. If there is no change in place beyond the efforts of individuals, then, when those individuals leave, the department just returns to its usual mode of operating. The required alternative is for a departmental *culture* change—a change that lasts. Harvey advised us to be aware that the public judges us collectively, not by individual heroics.

So, Harvey imagined, departments will necessarily become a mix of researchers, educators, and mathematicians. Attitudes will have to change to support the new diverse mission. Harvey envisions the time when funders consider a department's success in its education mission as part of the criteria for funding individual research proposals. So John Q. Mathematician might hear back from the National Science Foundation something like: "Well, sir, your proposal was excellent and your work in topology is extremely valuable. However, I'm sorry to say we cannot fund this proposal. You see, your department has been failing terribly at its education mission, and we feel that our dollars are better spent on faculty in departments who are successful on this mission."

We need to reconsider how we are rewarding faculty now and then have the courage to make needed changes. Calvin Moore of U.C. Berkeley presented some interesting preliminary data gathered for a report of the Joint Policy Board for Mathematics Committee on Professional Recognition and Rewards. This Committee is preparing a plan for institutional change in mathematics departments, the main question being, "Is the reward structure congruent with the institutional mission?" All kinds of institutions, and some business sites, are included in the study. Not surprisingly, the data reflect both the low status of the education mission in the present reward structure and the anticipation and need for this status to change. Once again we recognize the need for change, but we are faced with the challenge of collectively making change happen. This cannot happen through individual effort; it will require concerted efforts by sanctioned organizations and departmental groups. But to be an effective change agent in education, such groups will need to consider more seriously the role of mathematics education researchers in their community.

There was constant reference throughout the workshop to the need to align diverse organizations. Collaborations with other interested parties was all over the agenda, but we need practical ideas for making that work. While I sympathize with the many recommendations to spur and enliven a grassroots movement, the flavor remains one of an individual, independent approach, which can only go so far without more organized movement. So maybe that's a next step. I can't help but wonder, how can those interested in postsecondary education organize themselves to meet these challenges collectively rather than as individuals? This must happen! Maybe something like MER is a start. I hope so.

I wish to thank Al Cuoco, Ed Dubinsky, Paul Goldenberg, and Ilene Kantrov for their comments on earlier drafts of these reflections.

Academy Report on Priorities in Funding Science

Allyn Jackson

The Committee on Science, Engineering, and Public Policy of the National Academy of Sciences has issued a report intended to map out a coherent strategy for making decisions about federal funding for scientific research. The report sets forth national goals for research and development in science and technology and a procedure for assessing how well those goals are being met.

In addition the Committee took the unusual position that no new resources are needed to meet the goals for support of science that the report sets forth. A press release from the Academy quoted Committee chair Phillip A. Griffiths as saying, "We seek to shift debate over science and technology policy away from absolute levels of resources to performance in support of broader national objectives."

The report presents two primary goals for science. The first is that the U.S. should "be among the world leaders in all major areas of science". In an interview, Griffiths said that this goal "set[s] a baseline of support for every field of science that will keep them at the forefront." In recent years there has been a great deal of discussion, much of it fruitless, about setting priorities to guide funding for scientific research. Griffiths maintains that much of this debate was headed in the wrong direction. "You can't set priorities unless you have goals," he says. "So the Committee wanted to put this goal on the table." According to Griffiths, adopting this goal obviates the need for debate about such matters as whether it is more important to support "big science" or "little science". For example, he says, the field of physics comprises big, medium, and little science, all of which should be supported. Adopting this goal means "you don't have to argue about supercolliders versus PIs [principal investigators]", he explains.

The second goal is that the U.S. should maintain "clear leadership" in a number of areas meeting specific criteria, including the contributions those areas make to the nation's social, economic, and cultural goals. For example, the report names molecular biology as one such field because of its critical importance to advances in health care, biotechnology,

agriculture, and industrial processes. "For mathematics the case is not so easy as for molecular biology, but I think it can be made better than in many areas of science," notes Griffiths. "One can make the case on the basis that research in mathematics is interconnected with many other branches of science. . . In addition there is the educational role of mathematics."

The report states three criteria that would call for "clear leadership" in a field: 1) the field is closely tied to national objectives that cannot be met without the U.S. being a clear leader in that field (an example is condensed matter physics); 2) the field captures the public imagination (an example is astronomy); and 3) the field affects many other areas of science and has a "multiplicative effect" on scientific and technological advances (an example is molecular biology).

According to the report the fields in which the U.S. should maintain "clear leadership" would be chosen by government decision makers. Decisions about which fields meet the "clear leadership" criteria "differ in character from decisions about the most promising directions for research *within* an area of science, which are made most effectively by researchers themselves and should be insulated from the political process," the report states. For this reason the report recommends the use of disciplinary panels to conduct field-by-field assessments of the health of science. The panels would examine the nation's standing in the international arena and make recommendations for changes.

For example, if the U.S. is found not to be among world leaders in a field, then the panel may recommend ways of improving support for the field that would bring it up to world standards. The report also says that panels might suggest reductions in funding in fields in which the U.S. leads the rest of the world but which are not ones that meet the "clear leadership" criteria. But wouldn't the panels just ask for more funding? Griffiths points out that their recommendations have a "diabolical" aspect in that if the panel for a field wanted to argue that it needs more money, it would have to argue that it's behind the rest of the world, "and nobody wants to say they're behind".

The report also examines the federal government's historical policy of regarding the development of technology as the province of the private sector. The report recommends the goal of "maintaining a leadership position in those technologies that promise to have a major impact on broad areas of industrial and economic performance." A "new partnership" between the government and the private sector would be needed to meet this goal, the report says.

With its emphasis on the standing of the U.S. in the international arena of science and technology, the report has been criticized as being nationalistic. Griffiths sees it differently. "The report responds to the question of the U.S. public's support of science," says Griffiths. "We tried to articulate a rationale for U.S. taxpayers' funding of science, so the goals [we set] must be in the U.S. national interest."

The report has not been adopted in any official way, but some of its recommendations are being carried out. For example, Presidential Science Adviser John Gibbons has

For Your Information

asked the National Science Board (the governing body of the National Science Foundation) to examine the report and come back with a proposal for how the Board could oversee the field-by-field assessments the report describes.

Griffiths says that much of science policy has focused on the wrong questions, such as whether or not science should be supported. A major achievement of this report, he says, is

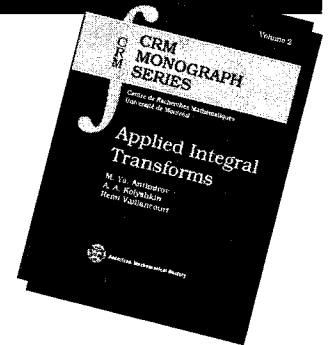
that "this is the first time a proposal has been brought forth in answer to the question, 'How much science is enough?'"

The report, "Science, Technology, and the Federal Government: National Goals for a New Era," is available from the Committee on Science, Engineering, and Public Policy, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, DC 20418; telephone 202-334-2424.

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Syracuse University, Syracuse, New York

September 18–19, 1993

Preliminary Program

The eight hundred and eighty-fourth meeting of the American Mathematical Society (AMS) will be held on the campus of Syracuse University, Syracuse, New York, on Saturday, September 18, and Sunday, September 19, 1993. Special sessions and sessions for contributed papers will be held in the Carnegie Building, and invited addresses will be held in Stolkin Auditorium in the Physics Building.

Invited Addresses

By invitation of the Eastern Section Program Committee there will be four invited one-hour addresses. The speakers, their affiliations, the titles of their talks, and scheduled times of presentation are as follows:

Tadeusz Iwaniec, Syracuse University, *Nonlinear PDEs and harmonic integrals in quasiconformal analysis*, 1:30 p.m., Saturday;

Charles A. McGibbon, Wayne State University, *The rational homology of the p -adic completion of a sphere*, 1:30 p.m., Sunday;

James M. Renegar, Cornell University, *Complexity theory, round-off errors and linear programming*, 11:00 a.m., Sunday;

Alvany Rocha, Graduate School & University Center (CUNY), *Minimal series representations and conformal symmetry*, 11:00 a.m., Saturday.

Special Sessions

By invitation of the same committee there will be ten special sessions of selected twenty-minute papers. The topics of these sessions and the names and affiliations of the organizers are as follows:

Geometric topology, **Douglas R. Anderson**, Syracuse University;

Algebraic topology, **Robert Bruner**, Wayne State University, and **Charles A. McGibbon**;

Commutative algebra and algebraic geometry, **Steven P. Diaz**, Syracuse University, and **Anthony V. Geramita**, Queen's University;

Harmonic analysis, **Allan Greenleaf**, University of Rochester, and **Robert S. Strichartz**, Cornell University;

Differential geometry and global analysis, **Wu-Teh Hsiang**, Syracuse University;

Representations of finite dimensional algebras, **Mark Kleiner** and **Dan Zacharia**, Syracuse University;

Nonlinear potential theory, **Juan J. Manfredi**, University of Pittsburgh;

Topics in probability, **Terry R. McConnell**, Syracuse University;

Computational problems involving polynomials, **Paul Pedersen**, Cornell University and **James M. Renegar**;

Lie theoretic methods in mathematical physics, **Alvany Rocha**.

The deadline for submission of abstracts for consideration in any of these sessions has expired.

Contributed Papers

There also will be sessions for contributed ten-minute papers. The deadline for submission of abstracts for these sessions has expired. Unfortunately, late papers cannot be accommodated.

Registration

The meeting registration desk will be located on the west side of the second-floor reading room near the department of mathematics office and will be open from 8:00 a.m. to 5:00 p.m. on Saturday and 8:00 a.m. to noon on Sunday. The registration fees are \$30 for members of the AMS, \$45 for nonmembers, and \$10 for emeritus members, students, or unemployed mathematicians.

Accommodations

Rooms have been blocked for participants at the Sheraton University Inn and the Genesee Inn. Both hotels are within walking distance of the meeting buildings. The Sheraton University Inn is approximately one-third of a mile from Carnegie, and the Genesee Inn is approximately two-thirds of a mile from Carnegie. The Genesee Inn provides a shuttle to the campus. Nonsmoking rooms are available in both hotels upon request. Participants should make their own arrangements with the hotel of their choice and ask for the AMS regional meeting rate. All rates are subject to applicable tax. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.**

Sheraton University Inn

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Telephone 315-475-3000

Single \$89 Double \$97

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Genesee Inn

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Telephone 800-365-4663 or 315-476-4212

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Meetings

Food Service

A number of eating establishments are located along Marshall Street within walking distance of the Carnegie Building, and several campus eateries will be open. A list of local restaurants will be available at the registration desk.

Parking

Free parking is available in parking lots Q3 and Q4. Enter lot Q3 from Sims Drive and Q4 from College Place.

Travel and Local Information

Syracuse University is located in Syracuse, New York, which is at the approximate geographic center of New York State. Hancock International Airport is located approximately ten miles north of campus and is served by a number of major airlines. MetroPlex (315-455-2695) provides taxi and shuttle service from the airport. Taxi fare to the Sheraton University

Inn or the Genesee Inn is approximately \$15. Shuttle service leaves the airport fifteen minutes after the hour. Shuttle fare is approximately \$5.

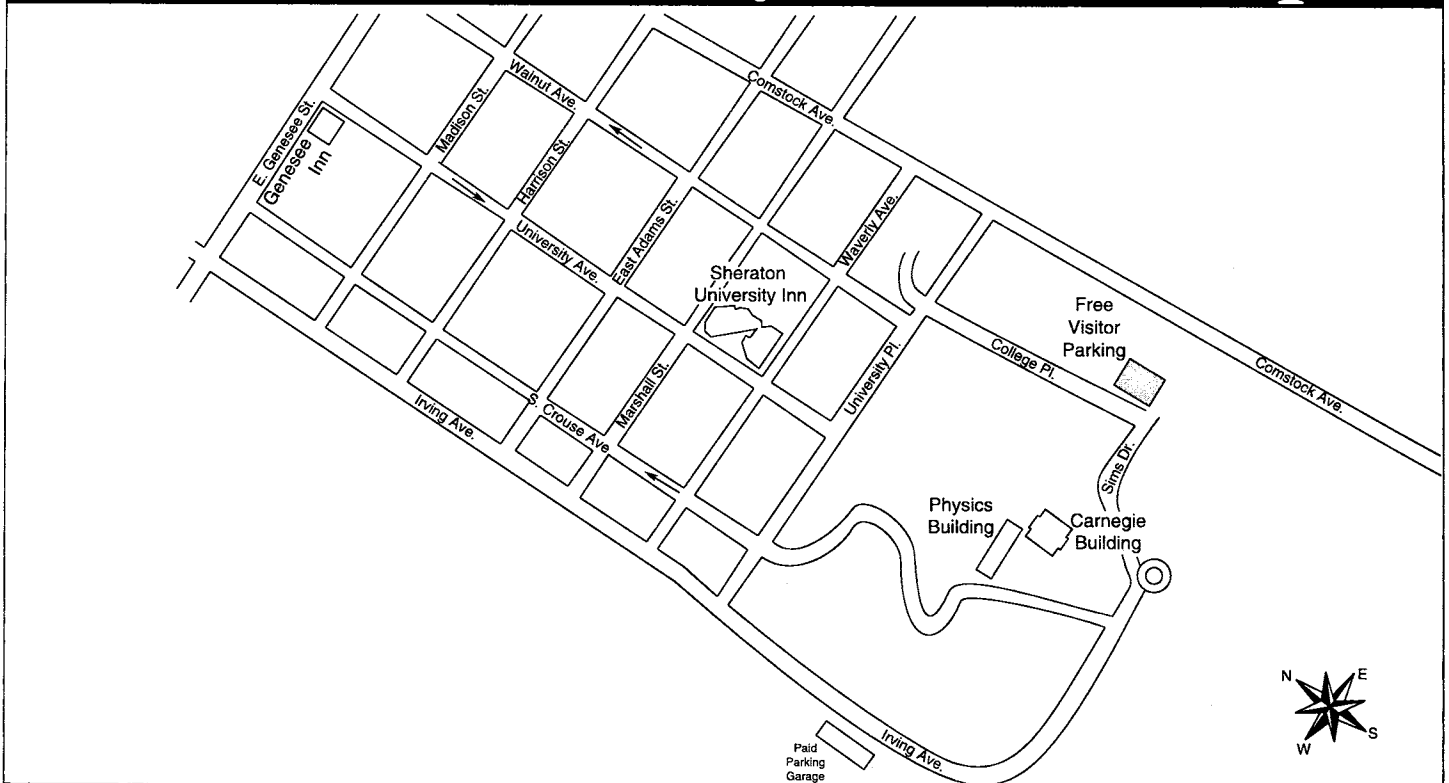
Rail passenger service to Syracuse is provided by Amtrak. For those travelling by car to Syracuse, the New York State Thruway (I-90) is the main east-west route, and I-81 is the main north-south route. The campus is located approximately one mile southeast of the Adams Street exit of I-81.

Weather

In September the average daily high temperature is 73°F and the average daily low temperature is 53°F. Daily weather conditions are highly changeable, and rain should be expected.

Lesley M. Sibner
Associate Secretary
Brooklyn, New York

Syracuse University - North Campus



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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 September 19T 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.

Saturday, September 18

Special Session on Nonlinear Potential Theory, I

8:00 a.m.–10:20 a.m.

- 8:00 a.m. *The branched Schwarz lemma via circle packing.*
(1) **Tomasz Dubejko** and **Kenneth Stephenson***,
University of Tennessee, Knoxville (884-30-46)
- 8:30 a.m. *The commutator spectrum of a discrete two generator group.*
(2) **F. W. Gehring***, University of Michigan, Ann Arbor,
and **G. J. Martin**, University of Auckland, New
Zealand (884-30-44)
- 9:00 a.m. *Quasiconformal manifolds.* Preliminary report.
(3) **Dennis Sullivan**, City College, City University of New
York (884-53-145)
- 9:30 a.m. *Locally conformally flat metrics.* Preliminary report.
(4) **Patricio U. Aviles**, University of Illinois,
Urbana-Champaign (884-31-82)
- 10:00 a.m. *Isoperimetric inequalities on the plane.*
(5) **Roman Kosecki**, University of Alabama, Birmingham
(884-30-60)

Special Session on Harmonic Analysis, I

8:20 a.m.–10:50 a.m.

- 8:20 a.m. *A-priori bounds for the support of a uniformly rotating white dwarf star.*
(6) **S. Chanillo*** and **Y. Y. Li**, Rutgers University, New
Brunswick (884-85-04)
- 9:00 a.m. *L^p estimates on CR manifolds with a diagonalizable Levi form.*
(7) **Der-Chen Chang***, University of Maryland, College
Park, and **Charles Fefferman**, Princeton University
(884-42-16)
- 9:40 a.m. *Pointwise convergence of wavelet expansions.*
(8) **Susan Kelly**, University of Wisconsin, La Crosse,
Mark Kon*, Boston University, and **Louise Raphael**,
Howard University (884-41-65)
- 10:20 a.m. *A polar coordinates wavelet-type expansion.*
(9) Preliminary report.
Jay Epperson, University of New Mexico, and
Michael Frazier*, Michigan State University
(884-41-43)

Special Session on Geometric Topology, I

8:30 a.m.–10:30 a.m.

- 8:30 a.m. *Relaxation and control over the circle.*
(10) **Stratos Prassidis***, Vanderbilt University, and **Bruce Hughes**, Vanderbilt University (884-57-53)
- 9:15 a.m. *Approximate finiteness properties.*
(11) **C. W. Stark**, University of Florida (884-57-149)
- 10:00 a.m. *Controlled algebra and splitting assembly maps.*
(12) **Gunnar Carlsson**, Stanford University, and **Erik Kjaer Pedersen***, State University of New York, Binghamton
(884-55-168)

Special Session on Computational Problems Involving Polynomials, I

8:30 a.m.–10:20 a.m.

- 8:30 a.m. *Improved algorithms for approximating complex polynomial zeros.*
(13) **Victor Y. Pan**, Herbert H Lehman College, City
University of New York (884-68-121)
- 9:00 a.m. *Computing the continued fraction expansion of a real algebraic number.*
(14) **Jeremy Johnson**, Drexel University (884-68-118)
(Sponsored by James M. Renegar)
- 9:30 a.m. *Counting zeros and degrees of polynomial maps from \mathbb{R}^n to itself.*
(15) **Moss Sweedler**, Cornell University (884-68-124)
- 10:00 a.m. *Determinant formulas for the resultant.*
(16) **A. Zelevinsky*** and **J. Weyman**, Northeastern
University (884-12-127)

Special Session on Commutative Algebra and Algebraic Geometry, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Finding sparse systems of parameters.* Preliminary report.
(17) **David Eisenbud**, Brandeis University, and **Bernd Sturmfels***, Cornell University (884-13-08)
- 9:30 a.m. *Contractible threefolds with C^* -action.* Preliminary report.
(18) **Peter Russell**, McGill University, (884-14-88)

- 10:00 a.m. *Resolution of singularities of a quasi-excellent Noetherian scheme.*
(19) **Mark Spivakovsky**, University of Toronto (884-14-106)
(Sponsored by Anthony V. Geramita)
- 10:30 a.m. *Intersections of two quadrics, Clifford algebras and hyperelliptic curves.*
(20) **Ragnar-Olaf Buchweitz**, University of Toronto
(884-14-176)

Session on Contributed Papers, I

9:00 a.m.–10:10 a.m.

- 9:00 a.m. *On monotonic pairs of solid tori.*
(21) **James R. Bozeman**, Lyndon State College, Vermont and Dartmouth College (884-57-21)
- 9:15 a.m. *Torus pairs and Whitehead manifolds.*
(22) **Gabriele M. Germann**, Dartmouth College (884-57-22)
- 9:30 a.m. *Positive braids with a full twist are prime.*
(23) **Michael C. Sullivan**, University of Texas, Austin (884-57-41)
- 9:45 a.m. *Parametrization of pairs of transverse measured foliations without saddle connections on a compact surface.*
(24) **Lev Slutskin**, New York, New York (884-57-31)
- 10:00 a.m. *On automorphism groups of the 4-Sphere.* Preliminary report.
(25) **Duane Randall**, Loyola University (884-57-166)

Special Session on Algebraic Topology, I

9:30 a.m.–10:50 a.m.

- 9:30 a.m. *Suspension orders and Cartesian products.*
(26) **Paul Silberbush**, Dartmouth College (884-55-137)
- 10:00 a.m. *Homotopic nilpotency and Lusternik-Schnirelmann theory.*
(27) **Octavian Cornea**, University of Rochester (884-55-69)
- 10:30 a.m. *The unstable Adams spectral sequence of two-stage Postnikov towers.*
(28) **Kathryn Lesh**, University of Toledo (884-55-159)

Special Session on Representations of Finite Dimensional Algebras, I

9:30 a.m.–10:50 a.m.

- 9:30 a.m. *New properties of almost split sequences.*
(29) **Maurice Auslander**, Brandeis University (884-16-06)
- 10:00 a.m. *Quotient categories of modules.*
(30) **Jon F. Carlson**, University of Georgia (884-20-19)
- 10:30 a.m. *Right approximations and functorial torsion theories.* Preliminary report.
(31) **Ron Gentle***, Eastern Washington University, Cheney, and **Gordana Todorov**, Northeastern University (884-18-98) (Sponsored by Kit Hanes)

Special Session on Topics in Probability, I

9:30 a.m.–10:40 a.m.

- 9:30 a.m. *Subdiffusive fluctuations for internal diffusion limited aggregation.*
(32) **Gregory F. Lawler**, Duke University (884-60-40)
- 10:10 a.m. *The contact process on homogeneous trees.*
(33) **Rinaldo Schinazi**, University of Colorado, Colorado Springs (884-05-51)

Special Session on Lie Theoretic Methods in Mathematical Physics, I

9:30 a.m.–10:40 a.m.

- 9:30 a.m. *Spinor construction of the $c = 1/2$ minimal model.* Preliminary report.
(34) **Alex J. Feingold***, State University of New York, Binghamton, and **John F. X. Ries**, East Carolina University (884-17-174)
- 10:10 a.m. *Global vertex operators on Riemann surfaces.*
(35) **Yongchang Zhu**, California Institute of Technology (884-17-93)

Special Session on Differential Geometry and Global Analysis, I

10:00 a.m.–10:50 a.m.

- 10:00 a.m. *On the harmonic mean curvature flow of surfaces.* Preliminary report.
(36) **Michael E. Gage**, University of Rochester (884-53-160)
- 10:30 a.m. *A pinching and classification theorems for minimal submanifolds.*
(37) **Bang-Yen Chen**, Michigan State University (884-53-23)

Invited Address

11:00 a.m.–11:50 a.m.

- (38) *Minimal series representations and conformal symmetry.*
Aivany Rocha, Graduate School and University Center, City University of New York (884-17-177)

Invited Address

1:30 p.m.–2:20 p.m.

- (39) *Nonlinear PDE's and harmonic integrals in quasiconformal analysis.*
Tadeusz Iwaniec, Syracuse University (884-99-180)

Saturday, September 18 (cont'd)

Special Session on Geometric Topology, II

2:40 p.m.–5:25 p.m.

- 2:40 p.m. *Transversality homology manifolds*. Preliminary report. (40) **John Bryant** and **Washington Mio***, Florida State University (884-57-163)
- 3:25 p.m. *Topological finiteness theorems in Gromov-Hausdorff space*. (41) **Steven C. Ferry**, State University of New York, Binghamton (884-53-171)
- 4:10 p.m. *Ends of G-manifolds, I*. (42) **Frank Connolly** and **Bogdan Vajiac***, University of Notre Dame (884-57-76)
- 4:55 p.m. *Ends of G-manifolds, II*. (43) **Frank Connolly*** and **Bogdan Vajiac**, University of Notre Dame (884-57-77)

Special Session on Commutative Algebra and Algebraic Geometry, II

2:40 p.m.–5:00 p.m.

- 2:40 p.m. *Uniform Artin-Rees, Briançon-Skoda, and resolution of singularities*. (44) **Craig Huneke**, Purdue University, West Lafayette (884-13-84)
- 3:10 p.m. *Hilbert series and Betti numbers*. Preliminary report. (45) **E. Graham Evans, Jr.**, University of Illinois, Urbana-Champaign (884-18-89) (Sponsored by Anthony V. Geramita)
- 3:40 p.m. *Ramification in infinite integral extensions*. (46) **Shreeram S. Abhyankar** and **William J. Heinzer***, Purdue University, West Lafayette (884-13-70)
- 4:10 p.m. *Initial generators of Gorenstein ideals*. (47) **Matthew Miller***, University of South Carolina, Columbia, and **Rafael Villarreal**, Instituto Politécnico Nacional, Mexico (884-13-29)
- 4:40 p.m. *On fat points and fat curves*. (48) **Karen A. Chandler**, University of Chicago (884-14-150) (Sponsored by Steven P. Diaz)

Special Session on Harmonic Analysis, II

2:40 p.m.–4:30 p.m.

- 2:40 p.m. *The pin, the fin and the cone*. Preliminary report. (49) **Gregory Verchota***, Syracuse University, and **Jill Pipher**, Brown University (884-35-175)
- 3:20 p.m. *Mixed boundary value problems for Laplace's equation in Lipschitz domains*. (50) **Russell M. Brown**, University of Kentucky (884-35-54)
- 4:00 p.m. *Weighted norm estimates for some operators related to starlike sets*. (51) **Richard Wheeden**, Rutgers University, New Brunswick (884-42-07) (Sponsored by Allan T. Greenleaf)

Special Session on Representations of Finite Dimensional Algebras, II

2:40 p.m.–5:30 p.m.

- 2:40 p.m. *Algebras whose radicals have top trace filtrations*. (52) **I. Ágoston**, Academy of Sciences, Budapest, Hungary, **V. Dlab***, Carleton University, and **E. Lukács**, Technical University, Budapest, Hungary (884-16-71)
- 3:10 p.m. *Glueings of tilted algebras*. (53) **Ibrahim Assem***, University of Sherbrooke, and **Flavio Ulhoa Coelho**, University of Sao Paulo, Brasil (884-16-10) (Sponsored by Mark Kleiner)
- 3:40 p.m. *Divisible torsion-free modules for successor closed subcategories*. Preliminary report. (54) **Andrew P. Dean**, Bishop's University (884-16-108)
- 4:10 p.m. *Descriptions of some extensionless modules*. Preliminary report. (55) **Frank Okoh**, Wayne State University (884-16-61)
- 4:40 p.m. *A question on classical orders of finite global dimension*. Preliminary report. (56) **James Kuzmanovich** and **Ellen Kirkman***, Wake Forest University (884-16-96)
- 5:10 p.m. *Minimal prime ideals in the enveloping algebras of Lie superalgebras*. Preliminary report. (57) **James Kuzmanovich*** and **Ellen Kirkman**, Wake Forest University (884-16-97)

Special Session on Nonlinear Potential Theory, II

2:40 p.m.–6:30 p.m.

- 2:40 p.m. *Unique continuation for elliptic equations*. Preliminary report. (58) **Tom Wolff**, University of California Berkeley (884-31-114) (Sponsored by Juan J. Manfredi)
- 3:10 p.m. *A-harmonic tensors*. (59) **Craig A. Nolder**, Florida State University (884-30-59)
- 3:40 p.m. *Estimates for solutions of p-harmonic systems*. Preliminary report. (60) **Emanuele DiBenedetto**, Northwestern University (884-35-81)
- 4:10 p.m. *Topological properties of mappings with finite energy*. Preliminary report. (61) **Vladimír Šverák**, University of Minnesota, Minneapolis (884-30-78) (Sponsored by Juan J. Manfredi)
- 4:40 p.m. *A non-existence result for the n-Laplacian*. (62) **Tilak Bhattacharya**, Indian Statistical Institute, India (884-31-80)
- 5:10 p.m. *Weakly elliptic systems with obstacle constraints*. (63) **David R. Adams**, University of Kentucky (884-35-12)
- 5:40 p.m. *On very weak solutions of certain parabolic systems*. (64) **John Lewis**, University of Kentucky (884-30-17)
- 6:10 p.m. *Capacities and harmonic measures for elliptic operators of nondivergence form*. (65) **Jang-Mei Wu**, University of Illinois, Urbana-Champaign (884-31-48)

Special Session on Topics in Probability, II

2:40 p.m.–5:10 p.m.

- 2:40 p.m. *Lim inf results for Gaussian samples and Chung's FLIL.* (66)
James Kuelbs*, University of Wisconsin, Madison and University of Delaware, and **Michael Talagrand**, University of Paris, France (884-60-05)
- 3:20 p.m. *Trimmed sums and the central limit theorem.* (67)
Daniel C. Weiner, Boston University (884-60-155)
- 4:00 p.m. *Stationary additive random fields indexed by sets.* (68)
Loren D. Pitt, University of Virginia (884-60-68)
- 4:40 p.m. *Gaussian chaos and functional LIL's for Ito-Wiener integrals.* (69)
Victor Goodman, Indiana University, Bloomington (884-60-83)

Special Session on Lie Theoretic Methods in Mathematical Physics, II

2:40 p.m.–5:10 p.m.

- 2:40 p.m. *Differential operators on determinant bundles.* (70)
V. Schechtman, State University of New York, Stony Brook (884-17-173)
- 3:20 p.m. *Homotopy lie algebra structures in conformal field theory.* Preliminary report. (71)
Jim Stasheff*, University of North Carolina, Chapel Hill, and **Alexander A. Voronov**, Princeton University (884-81-147) (Sponsored by Alvany Rocha)
- 4:00 p.m. *Operadic formulation of topological vertex algebras and Gerstenhaber-Batalin-Vilkovisky algebras.* (72)
Yi-Zhi Huang, University of Pennsylvania (884-08-85)
- 4:40 p.m. *A classification of type 1 vertex operator algebras.* (73)
Bong H. Lian, University of Toronto (884-17-178)

Session on Contributed Papers, II

2:45 p.m.–4:55 p.m.

- 2:45 p.m. *Preimages of thin sets under inner functions.* (74)
G. T. Cargo, Syracuse University (884-30-107)
- 3:00 p.m. *Harmonic mappings and extremal quasiconformal extensions.* Preliminary report. (75)
Shanshuang Yang, University of California, Los Angeles (884-30-87)
- 3:15 p.m. *Independent variables in electrodynamics.* (76)
Domina Eberle Spencer, University of Connecticut, Storrs (884-78-63)
- 3:30 p.m. *Retarded potentials and Maxwell's equations.* (77)
Philip J. Mann, University of Connecticut, Storrs (884-78-64) (Sponsored by Domina E. Spencer)
- 3:45 p.m. *Characterization of spherical transform of functions and Schwartz multipliers on the Heisenberg group.* Preliminary report. (78)
Tefera Worku, State University of New York, Albany (884-43-02)
- 4:00 p.m. *Hypoellipticity results in spaces of generalized distributions.* (79)
Jeffrey J. Ibbotson, Merrimack College (884-35-101)

- 4:15 p.m. *Non-recursive functions, knots "with thick ropes" and self-clenching "thick" hyperspheres.* (80)
Alexander Nabutovsky, University of Toronto (884-53-38) (Sponsored by Edward Bierstone)
- 4:30 p.m. *Sufficient conditions for one domain to enclose another in the plane of constant curvature.* Preliminary report. (81)
Jiazou Zhou, Temple University (884-53-01)
- 4:45 p.m. *L^p theory of differential forms on manifolds.* (82)
Chad Scott, Syracuse University (884-58-165)

Special Session on Algebraic Topology, II

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *On the realizations of certain a -modules and their properties.* (83)
Binhua Mao, University of Rochester (884-55-86)
- 3:30 p.m. *On the action of Steenrod squares on polynomial algebras.* (84)
Judith Silverman, University of Michigan, Ann Arbor (884-55-132)
- 4:00 p.m. *The functorial approach to ring and module spectra.* (85)
Anthony D. Elmendorf, Purdue University, Calumet Campus (884-55-135)
- 4:30 p.m. *Change of universe functors in equivariant stable homotopy theory.* Preliminary report. (86)
L. Gaunce Lewis, Jr., Syracuse University (884-55-136)
- 5:00 p.m. *Asymptotic calculations in the stable stems.* (87)
Igor Kriz, Chicago University (884-55-134) (Sponsored by Charles A. McGibbon)

Special Session on Differential Geometry and Global Analysis, II

3:00 p.m.–4:50 p.m.

- 3:00 p.m. *Weitzenbock formulas, isometric immersions, and integral homology vanishing theorems.* (88)
K. D. Elworthy, University of Warwick, England, and **Steven Rosenberg***, Boston University (884-53-37)
- 3:30 p.m. *Extremal unit vector fields on the 3-sphere.* (89)
Jiangfan Li, University of Pennsylvania (884-53-03)
- 4:00 p.m. *Focal points and support functions in affine differential geometry.* (90)
Thomas E. Cecil, College of the Holy Cross, Massachusetts (884-53-11)
- 4:30 p.m. *A new isoperimetric estimate and applications to the Martin boundary.* (91)
Jianguo Cao, Cornell University (884-53-66)

Special Session on Computational Problems Involving Polynomials, II

3:00 p.m.–4:50 p.m.

- 3:00 p.m. *Solving systems of real quadratic equations.* (92)
A. Barvinok, Cornell University (884-68-115) (Sponsored by James M. Renegar)

Saturday, September 18 (cont'd)

- 3:30 p.m. *Counting curves over finite fields.*
(93) **Joachim Von Zur Gathen**, University of Toronto, (884-68-116) (Sponsored by James M. Renegar)
- 4:00 p.m. *Complexity of solving systems of linear differential equations.*
(94) **D. Yu Grigorev**, Pennsylvania State University, University Park (884-68-117) (Sponsored by James M. Renegar)
- 4:30 p.m. *Current status of the sparse Nullstellensatz.*
(95) **Paul Pedersen**, Cornell University (884-68-122) (Sponsored by James M. Renegar)

Sunday, September 19

Special Session on Nonlinear Potential Theory, III

8:00 a.m.–10:20 a.m.

- 8:00 a.m. *Weak Schwarzians, bounded hyperbolic distortion and smooth quasisymmetric functions.*
(96) **Brad Osgood**, Stanford University (884-30-49)
- 8:30 a.m. *Convex functions of bounded type.*
(97) **Mario Bonk**, University of Michigan (884-30-24)
- 9:00 a.m. *Absolutely continuous conjugations of Blaschke products. III.*
(98) **David H. Hamilton**, University of Maryland, College Park (884-30-27) (Sponsored by Juan J. Manfredi)
- 9:30 a.m. *Zeros of derivatives of meromorphic functions.*
(99) Preliminary report.
A. Hinkkanen, University of Illinois, Urbana-Champaign (884-30-144)
- 10:00 a.m. *Inequalities for Bloch functions.* Preliminary report.
(100) **C. David Minda**, University of Cincinnati (884-30-55)

Special Session on Topics in Probability, III

8:10 a.m.–10:40 a.m.

- 8:10 a.m. *Sharp inequalities for continuous path Martingales under differential subordination with applications to singular integrals.* Preliminary report.
(101) **Gang Wang***, DePaul University, and **Rodrigo Banuelos**, Purdue University, West Lafayette (884-60-92)
- 8:50 a.m. *On the structure of stationary stable processes.*
(102) Preliminary report.
Jan Rosinski, University of Tennessee, Knoxville (884-60-32) (Sponsored by John B. Conway)
- 9:30 a.m. *Upper bound for the L_p norm of Walsh-Paley Martingales.*
(103) **Paweł Hitczenko**, North Carolina State University, Raleigh (884-60-39)

- 10:10 a.m. *Brownian motion, univalent functions, and the Bass note of a drum.*
(104) **Rodrigo Banuelos***, Purdue University, West Lafayette, and **Tom Carroll**, University College, Republic of Ireland (884-31-52)

Special Session on Computational Problems Involving Polynomials, III

8:30 a.m.–10:20 a.m.

- 8:30 a.m. *A case of the Jacobian conjecture.*
(105) **Takis Sakkalis***, **Charles Ching-An Cheng** and **Stuart Sui-Sheng Wang**, Oakland University (884-12-123)
- 9:00 a.m. *Asymptotically fast solution of Toeplitz-like singular linear systems.*
(106) **Erich Kaltofen**, Rensselaer Polytechnic Institute (884-68-119)
- 9:30 a.m. *On multivariate resultants and triangular sets.*
(107) **Y. N. Lakshman**, Drexel University (884-68-126) (Sponsored by James M. Renegar)
- 10:00 a.m. *Irreducible components of the varieties defined by certain transcendental terms.*
(108) **Nicolai Vorobjov**, Cornell University (884-68-125) (Sponsored by James M. Renegar)

Special Session on Algebraic Topology, III

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Ko-theory of D_8 and Σ_4 and applications to homotopy theory.*
(109) **Dilip Bayen**, Wayne State University (884-55-157)
- 9:30 a.m. *An algebra of extended power operations in unoriented cobordism.* Preliminary report.
(110) **Terrence P. Bisson***, Canisius College, and **Andre Joyal**, University of Quebec at Montreal (884-55-110)
- 10:00 a.m. *Real K-theory and spin-cobordism with singularities.*
(111) **Boris Botvinnik**, University of Oregon, Eugene (884-55-91)
- 10:30 a.m. *Symplectic topology, rational homotopy and the Gottlieb group.* Preliminary report.
(112) **John Oprea**, Cleveland State University (884-55-14)

Special Session on Commutative Algebra and Algebraic Geometry, III

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Self intersections and singularities (1).* Preliminary report.
(113) **Dan Edidin***, **Mike Stillman** and **Wolfgang Vogel**, Cornell University (884-14-75)
- 9:30 a.m. *Thin algebras, fat points, and the Waring problem.*
(114) **J. Emsalem**, University of Paris VII, France, **A. Iarrobino, Jr.***, Northeastern University, and **V. Kanev**, Bulgaria Academy of Sciences, Sofia (884-14-169)

Program of the Sessions

- 10:00 a.m. *Geometric consequences of Macaulay's maximal growth of the Hilbert function.* (115) **Anna Bigatti**, University of Genova, Italy, **Anthony V. Geramita**, Queen's University, and **Juan C. Migliore***, University of Notre Dame (884-13-73)
- 10:30 a.m. *Points in good position in P^2 .* (116) **B. Harbourne**, University of Nebraska, Lincoln (884-14-72)

Special Session on Harmonic Analysis, III

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Singular numbers and integral representations of Hankel forms in the line, the plane and the symplectic plane.* (117) **Mischa Cotlar**, Universidad Central de Venezuela, Venezuela, and **Cora S. Sadosky***, Howard University (884-43-34)
- 9:40 a.m. *Hardy spaces on pseudoconvex domains.* (118) **Galia Dafni**, Princeton University (884-32-33)
- 10:20 a.m. *On L^p and H^1 boundedness of oscillatory singular integrals.* Preliminary report. (119) **Yibiao Pan**, University of Pittsburgh (884-42-42)

Special Session on Differential Geometry and Global Analysis, III

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Exotic black holes.* Preliminary report. (120) **Arthur G. Wasserman**, University of Michigan, Ann Arbor (884-83-113)
- 9:30 a.m. *A variational characterization of K-contact manifolds.* (121) **David E. Blair***, Michigan State University, and **Domenico Perrone**, University Degli Studi, Italy (884-53-36)
- 10:00 a.m. *The topology of spaces of harmonic maps.* (122) **Martin A. Guest***, University of Rochester, and **Yoshihiro Ohnita**, Tokyo Metropolitan University, Japan (884-58-20)
- 10:30 a.m. *Cohomogeneity-two G-invariant stable minimal cones and the Bernstein problem.* Preliminary report. (123) **Wei Chen*** and **Wu-Teh Hsiang**, Syracuse University (884-58-104)

Special Session on Representations of Finite Dimensional Algebras, III

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Quasihereditary algebras of finite type and Schur algebras.* (124) **Stephen Donkin**, Queen Mary & Westfield College, and **Idun Reiten***, University of Trondheim, Norway (884-16-139)
- 9:30 a.m. *Variants of Alperin's conjecture.* Preliminary report. (125) **Geoffrey R. Robinson**, University of Florida (884-20-67)

- 10:00 a.m. *Algebras whose projective modules are reflexive.* (126) **K. R. Fuller***, University of Iowa, **W. K. Nicholson**, University of Calgary, and **J. F. Watters**, University of Leicester, United Kingdom (884-16-94)
- 10:30 a.m. *Universal localization and hereditary rings.* Preliminary report. (127) **Mike S. J. May**, St. Louis University (884-16-161)

Session on Contributed Papers, III

9:00 a.m.–10:40 a.m.

- 9:00 a.m. *Projective modules over subrings of polynomial rings.* Preliminary report. (128) **Hongnian Li**, Washington University in St. Louis (884-13-13)
- 9:15 a.m. *Orders from group schemes.* Preliminary report. (129) **Robert G. Underwood**, State University of New York, College at Oswego (884-13-100)
- 9:30 a.m. *On fine moduli varieties for algebraic threefolds.* (130) **Khomo T. S. Mohapeloa**, Pennsylvania State University, McKeesport (884-14-103)
- 9:45 a.m. *Resolving triangular automorphisms in dimension three.* Preliminary report. (131) **Gene Freudenburg**, Ball State University (884-14-26)
- 10:00 a.m. *Periodicity of the fixed locus of multiples of a divisor on a surface.* (132) **S. Dale Cutkosky*** and **V. Srinivas**, University of Missouri, Columbia (884-14-164)
- 10:15 a.m. *Transfers: K-theory versus Becker-Gottlieb.* (133) **Bruce Williams**, University of Notre Dame (884-19-167)
- 10:30 a.m. *A structure theorem for partially asynchronous relaxations.* (134) **Reza Gharavi** and **Venkat Anantharam***, Cornell University (884-68-172)

Special Session on Geometric Topology, III

9:15 a.m.–10:30 a.m.

- 9:15 a.m. *Surfaces dual to the second Stiefel-Whitney class.* (135) **Laurence R. Taylor**, University of Notre Dame (884-57-148)
- 10:00 a.m. *A space with two non-equivalent non-positively curved triangulations.* Preliminary report. (136) **Pedro A. Ontaneda**, State University of New York at Stony Brook (884-57-99)

Special Session on Lie Theoretic Methods in Mathematical Physics, III

9:30 a.m.–10:40 a.m.

- 9:30 a.m. *The vertex operator Weil algebra and its cohomologies.* Preliminary report. (137) **Fusun Akman**, Mathematical Sciences Research Institute, Berkeley (884-17-109)
- 10:10 a.m. *Twisted representations of vertex operator algebras and orbifold theory.* (138) **Chongying Dong*** and **Geoffrey Mason**, University of California, Santa Cruz (884-46-62)

Sunday, September 19 (cont'd)

Invited Address

11:00 a.m.–11:50 a.m.

- (139) *Complexity theory, round-off errors and linear programming.*
James Renegar, Cornell University (884-68-129)

Invited Address

1:30 p.m.–2:20 p.m.

- (140) *The rational homology of the p -adic completion of a sphere.*
Charles A. McGibbon, Wayne State University (884-99-179)

Special Session on Geometric Topology, IV

2:40 p.m.–4:40 p.m.

- 2:40 p.m. *Surgery theory of manifolds of bounded geometry.*
 (141) **Oliver Attie**, McMaster University (884-55-95)
 (Sponsored by Andrew J. Nicas)
- 3:25 p.m. *A generalization of Serre's invariants branched covering spaces.*
 (142) **Ronnie Lee***, Yale University, and **Steven Weintraub**, Louisiana State University, Baton Rouge (884-54-130)
- 4:10 p.m. *Bounded topology and similarity of group representations.*
 (143) **I. Hambleton***, McMaster University, and **E. K. Pedersen**, State University of New York, Binghamton (884-57-156)

Special Session on Commutative Algebra and Algebraic Geometry, IV

2:40 p.m.–4:30 p.m.

- 2:40 p.m. *Counterexamples to the Hibi conjecture.*
 (144) **Leslie G. Roberts**, Queen's University (884-13-30)
- 3:10 p.m. *Resolutions of some Buchsbaum modules.* Preliminary report.
 (145) **Hara Charalambous**, State University of New York, Albany (884-13-142)
- 3:40 p.m. *Gaps in Rao modules of algebraic space curves.* Preliminary report.
 (146) **Edward D. Davis**, State University of New York, Albany (884-14-74)
- 4:10 p.m. *Self intersections and singularities (2).* Preliminary report.
 (147) **Dan Eddidin**, **Mike Stillman*** and **Wolfgang Vogel**, Cornell University (884-13-143)

Special Session on Harmonic Analysis, IV

2:40 p.m.–3:50 p.m.

- 2:40 p.m. *Multilinear operators, Hardy spaces and compensated compactness.*
 (148) **Loukas Grafakos**, Washington University (884-42-50)
- 3:20 p.m. *Ergodic radial measures on the Heisenberg group.*
 (149) **Carlos A. Berenstein**, University of Maryland, College Park (884-43-25)

Special Session on Representations of Finite Dimensional Algebras, IV

2:40 p.m.–4:00 p.m.

- 2:40 p.m. *Approximating representations of finite dimensional algebras by more tractable ones.*
 (150) **Birge Zimmermann Huisgen**, University of California, Santa Barbara (884-16-162)
- 3:10 p.m. *Functor categories and sets with a group action.*
 (151) **Peter J. Webb**, University of Minnesota (884-20-138)
- 3:40 p.m. *Representations of covering quantum groups.* Preliminary report.
 (152) **Edward L. Green**, Virginia Polytech Institute & State University (884-16-140) (Sponsored by Mark Kleiner)

Special Session on Nonlinear Potential Theory, IV

2:40 p.m.–6:00 p.m.

- 2:40 p.m. *Comparison of solutions of p .d.e.'s by symmetrization.*
 (153) **Albert Baernstein, II**, Washington University (884-30-47)
- 3:10 p.m. *Global integrability of the Jacobian and quasiconformal maps.*
 (154) **Susan Staples**, College of Staten Island, City University of New York (884-30-18)
- 3:40 p.m. *Finite vs. infinite capacity, continuity of Sobolev functions, and Dirichlet finite harmonic measures.* Preliminary report.
 (155) **David A. Herron***, University of Cincinnati, and **Pekka Koskela**, University of Michigan, Ann Arbor (884-31-45)
- 4:10 p.m. *Taylor coefficients and BMOA.* Preliminary report.
 (156) **Thomas A. Metzger**, University of Pittsburgh, Pittsburgh (884-30-79)
- 4:40 p.m. *Nonlinear potential theory and quasiregular maps on Carnot groups.* Preliminary report.
 (157) **Juha Heinonen***, University of Michigan, Ann Arbor, and **Ilkka Holopainen**, University of Helsinki, Finland (884-30-58)
- 5:10 p.m. *Mappings with integrable dilatation.* Preliminary report.
 (158) **Juan J. Manfredi**, University of Pittsburgh, and **Enrique Villamor***, Florida International University (884-30-57)
- 5:40 p.m. *Sobolev-Poincaré inequalities for $0 < p < 1$.* Preliminary report.
 (159) **Stephen Buckley** and **Pekka Koskela***, University of Michigan, Ann Arbor (884-31-56)

Special Session on Lie Theoretic
Methods in Mathematical Physics, IV

2:40 p.m.–4:30 p.m.

- 2:40 p.m. *Spectrum generating affine Lie algebras and correlation functions in massive field theory.* (160) **Andre Leclair**, Cornell University (884-20-105) (Sponsored by Alvany Rocha)
- 3:20 p.m. *A geometric realization of quantum groups and their generalization.* (161) **Jintai Ding**, Yale University (884-17-146)
- 4:00 p.m. *On the Gel'fand-Kirillov conjecture for quantum groups.* (162) **Feodor Malikov**, Yale University (884-16-102)

Session on Contributed Papers, IV

2:45 p.m.–3:55 p.m.

- 2:45 p.m. *Recurrence, amenability, and the universal cover of graphs.* (163) **Sam Northshield**, State University of New York, College at Plattsburgh (884-60-09)
- 3:00 p.m. *Fréchet algebras generated by certain of their elements.* (164) **S. Ouzomgi***, **L. Redlin**, Pennsylvania State University, Ogontz, and **S. Watson**, California State University, Long Beach (884-46-131)
- 3:15 p.m. *Inverse extremum problems and methods of their solution.* (165) **Eynshteyn Averbukh**, Computer Sciences Corporation, Pennsylvania (884-93-151) (Sponsored by Michael Dutko)
- 3:30 p.m. *Macro-dynamics equations with approximately balanced kinetic function.* (166) **Eynshteyn Averbukh**, Computer Sciences Corporation, Pennsylvania, and **Yuly Brodsky***, Adelphi University (884-34-152) (Sponsored by Michael Dutko)
- 3:45 p.m. *A generalization of the classical Cauchy inequality.* (167) **Eynshteyn Averbukh***, Computer Sciences Corporation, and **Dmitry Mavlo**, Joint Institute for Nuclear Research, Russia (884-26-153) (Sponsored by Michael Dutko)

Special Session on Algebraic Topology, IV

3:00 p.m.–4:50 p.m.

- 3:00 p.m. *Looping Bousdfjeld-Kan towers.* (168) **James M. Turner**, Massachusetts Institute of Technology (884-55-158)
- 3:30 p.m. *A corrected version of the telescope conjecture.* (169) **Paul Shick**, John Carroll University (884-55-15)
- 4:00 p.m. *A BP analog of Hopkins' zeta conjecture.* Preliminary report. (170) **Mark A. Hovey**, University of Kentucky (884-55-90)
- 4:30 p.m. *Isogenies and operations in complex oriented cohomology.* (171) **Neil Strickland**, Massachusetts Institute of Technology (884-55-133) (Sponsored by Charles A. McGibbon)

Special Session on Differential
Geometry and Global Analysis, IV

3:00 p.m.–3:50 p.m.

- 3:00 p.m. *On invariants of higher-codimensional CR structures.* (172) **Thomas Garrity** and **Robert I. Mizner***, Williams College (884-53-28)
- 3:30 p.m. *Compactness of isospectral compact manifolds of bounded curvatures up to dimension seven.* (173) **Gengqiang Zhou**, Cornell University (884-58-141)

Special Session on Computational
Problems Involving Polynomials, IV

3:00 p.m.–4:20 p.m.

- 3:00 p.m. *Decomposition of algebraic functions.* (174) **Dexter Kozen***, **Richard E. Zippel**, Cornell University, and **Susan Landau**, University of Massachusetts, Amherst (884-68-120)
- 3:30 p.m. *Effective algorithms for polynomial irreducibility testing.* (175) **Richard Zippel**, Cornell University (884-68-128)
- 4:00 p.m. *Solving sparse polynomial systems.* (176) **Birkett Huber**, Cornell University (884-68-154)

Lesley M. Sibner
Associate Secretary
Brooklyn, New York

International Joint Mathematics Meeting Heidelberg, Germany, October 1–3, 1993

Preliminary Program

The first joint meeting of the American Mathematical Society (AMS) and the Deutsche Mathematiker-Vereinigung (DMV) will be held at the University of Heidelberg, Heidelberg, Germany, from Friday, October 1, to Sunday, October 3, 1993.

Joint Program Committee

The members of the Joint Program Committee are Klaus D. Bierstedt, Joachim Cuntz, Albrecht Dold, Robert M. Fossum, Dale Husemoller, Norbert Schappacher, Friedrich Tomi, and Bernd Ulrich.

Local Organizing Committee

The members of the Local Organizing Committee are Joachim Cuntz, Albrecht Dold, Yvonne Dold, Norbert Quien, A. Stevens, Friedrich Tomi, and N. Weber.

Invited Addresses

By invitation of the Joint Program Committee there will be six invited one-hour addresses. The speakers, their affiliations, and the titles of their talks, where available, are as follows:

Gerd Faltings, Princeton University, *The Verlinde formula*;

Guenter Harder, Universität Bonn, *title to be announced*;
Helmut H. W. Hofer, Universität Bochum, *Holomorphic curves in three-dimensional contact geometry*;

Michael J. Hopkins, Massachusetts Institute of Technology, *Methods of algebraic geometry in algebraic topology*;

Vaughan F. R. Jones, University of California, Berkeley, *The combinatorics of subfactors*;

Robert P. Langlands, Institute for Advanced Study, *Der Bethe-Ansatz und die Lefschetz-Spurformel (The Bethe-Ansatz and the Lefschetz-trace formula)*.

Special Sessions

By invitation of the same committee there will be eleven special sessions of selected twenty-minute papers. The topics of these sessions and the names and affiliations of the organizers are as follows:

Recursion theory, **Klaus Ambos-Spies**, University of Heidelberg, and **Steffen Lempp**, University of Wisconsin;

Optimization, **Hans Georg Bock**, University of Heidelberg, and **Martin Grötschel**, ZIB, Berlin;

Commutative algebra (Betti numbers), **Ragnar-Olaf Buchweitz**, University of Toronto;

Operator algebras, **Joachim Cuntz**, University of Heidelberg;

Complex analysis, **Klas Diederich**, Gesamthochschule Wuppertal, and **John Fornæss**, University of Michigan;

Geometry and computer visualization, **George Francis**, University of Illinois, Urbana-Champaign; **M. Phillips**, University of Minnesota; and **Norbert Quien**, University of Heidelberg;

Arithmetic geometry/automorphic forms, **Jens S. Franke**, Max Planck Institute; **Guenter Harder**, and **Norbert Schappacher**, University Louis-Pasteur;

Mathematical physics, **Jurg Frölich**, ETH Zurich, and **Elliot Lieb**, Princeton University;

Homotopy theory, **Hans-Werner Henn**, University of Heidelberg, and **Michael Hopkins**;

Modelling in science, **Willi Jäger**, University of Heidelberg, and **Paul C. Fife**, University of Utah;

Stochastics, **Hermann Rost**, University of Heidelberg, and **Ruth Williams**, University of California, San Diego.

The deadline for submission of abstracts for consideration in any of these sessions has expired.

Contributed Papers

There will also be sessions for contributed ten-minute papers. The deadline for submission of abstracts for these sessions has expired. Unfortunately, late papers cannot be accommodated.

Registration

Registration will be held in Chemie Hoersalgebäude, INF 252, from 11:00 a.m. to 6:30 p.m. on Friday. An additional registration desk will be in Mathematisches Institut, INF 288, on Friday from 10:00 a.m. to 11:00 p.m. and on Saturday from 8:00 a.m. to 11:00 a.m.

The on-site registration fees are 70 DM for members of the AMS and DMV, and 90 DM for nonmembers. Payment for registration at the meeting can be made by VISA, MasterCard, EuroCard, or Diners Club. The only acceptable form of payment by check is a Foreign Draft (certified check in DM).

Social Events

The Mayor of Heidelberg, Beate Weber, will host a complimentary reception in the Heidelberg City Hall on Friday at 8:00 p.m.

There will be a conference dinner at the Marstallhof der Universität on Saturday at 8:00 p.m. This event may have sold out during advance registration; however, a limited number

Meetings

of tickets may be available at the meeting. The cost of each ticket is 60 DM.

Accommodations

Participants should make their arrangements for hotel reservations through the Heidelberg Convention and Visitors Bureau and use the form found at the back of this issue. The Convention Bureau will assign hotel rooms according to the category indicated on the reservation form. All hotel rates include breakfast. **The deadline for reservations was August 15.** After this date rooms may be reserved on a space-available basis. The AMS cannot guarantee the availability of these rates after August 15 and is not responsible for the quality of these accommodations.

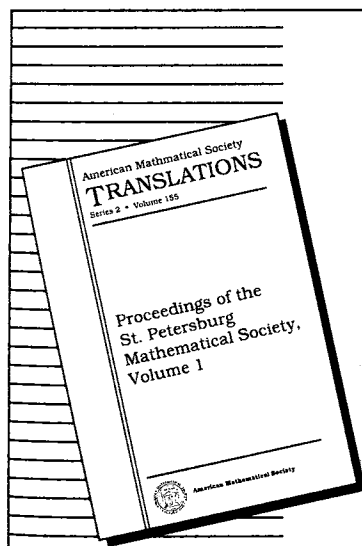
Hotel Categories: Rooms in categories A through D have private bathrooms with shower/bath and WCs. Rooms in category E should have hot and cold water and shared bathroom facilities located on each floor. All hotels are a short commute to the University via public or private transportation.

Student Rooms: A limited number of student rooms located throughout Heidelberg will be available starting in July. Please note that the rates cover the period October 1 through October 15. Rates are 95 DM per person for a double room with shared bathroom facilities and 185 DM per person for a single room with private bathroom.

Room rates will not be prorated for shorter periods of stay. To make reservations for a student room contact the Heidelberg Convention and Visitors Bureau, Friedrich-Ebert-Anlage 2, P. O. Box 10 58 60, D-6900 Heidelberg 1, Germany, or phone 49 6221 10821.

Travel

Frankfurt Airport is the closest airport to Heidelberg and is served by most major airlines. There are frequent train connections to Heidelberg, as well as a more convenient limousine service (80 DM for a roundtrip fare) and a Lufthansa airport shuttle (36 DM one way; 60 DM roundtrip).



American Mathematical Society Translations, Series 2 Proceedings of the St. Petersburg Mathematical Society, Volume 1

O. A. Ladyzhenskaya and A. M. Vershik, Editors
Volume 155

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Presenters of Papers

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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 October 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.

Friday, October 1

Opening Ceremony

14:15–14:45

Invited Address

14:45–15:45

- (1) *The combinatorics of subfactors.*
Vaughan F. R. Jones, University of California, Berkeley (885-99-157)

Special Session on Arithmetic Geometry/Automorphic Forms, I

16:00–17:00

- 16:00 *L-functions of modular forms at the centre.*
(2) **Jan Nekovář**, Charles University, Czechland (885-11-52) (Sponsored by G. Harder)
- 16:40 *An occurrence of L-functions in integrals of Eisenstein classes.* Preliminary report.
(3) **Ulrich Everling**, Ecole Normale Supérieure, France (885-11-112) (Sponsored by Jens S. Franke)

Special Session on Operator Algebras, I

16:00–17:00

- 16:00 *Are separable amenable C^* -algebras classifiable?*
(4) **George Elliott**, University of Copenhagen, Denmark (885-46-62)
- 16:40 *Analytical and combinatorial aspects of subfactors.*
(5) **Dietmar Bisch**, University of California, Berkeley (885-46-59)

Special Session on Complex Analysis, I

16:00–16:50

- 16:00 *The boundary behavior of the complex Green function of convex domains in \mathbf{C}^N .*
(6) **Siegfried Momm**, Heinrich-Heine Universität, Germany (885-31-24)
- 16:30 *Phragmén-Lindelöf conditions and singularities.*
(7) **Rüdiger W. Braun**, Heinrich-Heine Universität, Germany (885-32-02)

Special Session on Optimization, I

16:00–17:05

- 16:00 *Parameter estimation in differential equation models in chemistry.*
(8) **Josef Kallrath**, BASF Aktiengesellschaft, Germany (885-49-86) (Sponsored by Martin Grotschel)
- 16:35 *Production planning system for a multi-product, multi-site production network.*
(9) **Josef Kallrath**, **Beate Brockmueller***, BASF Aktiengesellschaft, Germany, and **Max Wagner**, BASF Corporation, New Jersey (885-90-87) (Sponsored by Martin Grotschel)

Invited Address

17:15–18:15

- (10) *Title to be announced.*
Guenter Harder, Universität Bonn, Germany (885-99-158)

Saturday, October 2

Special Session on Homotopy Theory, I

09:00–11:15

- 09:00 *Combinatorial group theory in homotopy*. Preliminary report.
(11) **Frederick R. Cohen**, University of Rochester (885-55-71)
- 09:40 *The Cooke conjecture at prime two*.
(12) **J. Aguadé, C. Broto***, Universitat Autònoma de Barcelona, Spain, and **D. Notbohm**, Mathematisches Institut, Göttingen, Germany (885-55-118)
- 10:10 *On homotopy types of finite polyhedra*. Preliminary report.
(13) **Hans Joachim Baues**, Max-Planck-Institut für Mathematik, Germany (885-55-38) (Sponsored by Hans J. Baues)
- 10:45 *Title to be announced*.
(14) **Emmanuel Dror-Farjoun**, Hebrew University, Israel (885-99-143)

Special Session on Operator Algebras, II

09:00–11:15

- 09:00 *Nets of local observable algebras over nontrivial spacetimes*.
(15) **Klaus Fredenhagen**, Universität der Hamburg, Germany (885-46-63)
- 09:40 *Perturbation of the rotation C^* -algebras*.
(16) **Uffe Haagerup**, University of Odense, Denmark (885-46-64)
- 10:20 *Groups with simple reduced C^* -algebras*.
(17) **Pierre de la Harpe**, University of Geneva, Switzerland (885-46-60)
- 10:50 *Normal operator-valued weights of finite index between monotone complete C^* -algebras*.
(18) **Michael Frank**, Leipzig University of Technology, Germany (885-46-08)
- 11:05 *Smoothness of the unit sphere of C^* -algebras*.
(19) **Wend Werner**, University of Paderborn, Germany (885-46-69)

Special Session on Geometry and Computer Visualization, I

09:00–11:00

- 09:00 *Geomview—An interactive geometry viewer*.
(20) **M. Phillips***, **S. Levy** and **T. Munzner**, University of Minnesota, Minneapolis (885-51-105) (Sponsored by Robert M. Fossum)
- 09:20 *GRAPE—Working with time-dependent geometries*.
(21) **Konrad Polthier**, Mathematisches Institut der Universität Bonn, Germany (885-51-103) (Sponsored by Robert M. Fossum)

- 09:40 *Maniview. A visualization tool for 3-manifolds*.
(22) **Charlie Gunn**, Technische Universität Berlin, Germany (885-51-94) (Sponsored by Robert M. Fossum)
- 10:00 *Visualization of regular polytopes*.
(23) **Barbara Hausmann**, Universität Erlangen, Germany (885-51-95) (Sponsored by Robert M. Fossum)
- 10:20 *Real-time viewing of conformal geometry*.
(24) **John Sullivan**, University of Minnesota, Minneapolis (885-51-126) (Sponsored by Robert M. Fossum)
- 10:40 *Conformal knot energy and a higher-dimensional generalization*.
(25) **Robert Kusner***, University of Massachusetts, Amherst, and **J. Sullivan**, University of Minnesota, Minneapolis (885-51-113) (Sponsored by Robert M. Fossum)

Special Session on Optimization, II

09:00–11:20

- 09:00 *Optimization aspects of public transportation*.
(26) **Martin Grötschel**, Konrad-Zuse-Zentrum für Informationstechnik, Germany (885-90-114)
- 09:50 *Truck routing*.
(27) **Achim Bachem*** and **Martin Malich**, University of Cologne, Germany (885-90-83)
- 10:20 *Fleet-assignment and routing problems in the airline industry*.
(28) **Bernd Voigt***, **Ulf Dietmar Radicke** and **Klaus-Uwe Koschnick**, Lufthansa Informationstechnik, Germany (885-05-122)
- 10:50 *On the complexity of cycle canceling for submodular flows*.
(29) **U. Zimmermann**, Technische Universität Braunschweig, Germany (885-90-77) (Sponsored by Martin Grötschel)

Special Session on Mathematical Physics, I

09:00–11:15

- 09:00 *Lattice gauge theory and flat bundles on Riemann surfaces*. Preliminary report.
(30) **Giovanni Felder***, Eidgen Technische Hochschule, Switzerland, and **Ping Feng**, Cornell University (885-57-47) (Sponsored by Jürg M. Frohlich)
- 09:35 *AF-Algebras and K-theory in conformal field theory*.
(31) **Andreas Recknagel**, University College of Swansea, United Kingdom (885-81-119) (Sponsored by Jürg M. Frohlich)
- 10:10 *Modularity, subfactors, and indices in quantum field theory*. Preliminary report.
(32) **Karl-Henning Rehren**, Universität der Hamburg, Germany (885-81-20) (Sponsored by Jürg M. Frohlich)
- 10:45 *On the Turaev-Viro approach to topological quantum field theory*.
(33) **R. Schrader**, Free Universität der Berlin, Germany (885-81-121)

Special Session on Modelling in Science, I

09:00–11:15

- 09:00 *Resonance and phase-locking in forced excitable systems.*
(34) **Hans G. Othmer**, University of Utah (885-34-129)
- 09:45 *Chernotaxis-equations as limit dynamics of moderately interacting stochastic processes.*
(35) **Angela Stevens**, Universität der Heidelberg, Germany (885-80-133)
- 10:30 *Mathematical methods in medical imaging.*
(36) **Alfred K. Louis**, Universität der Saarbrücken, Germany (885-92-135)

Special Session on Recursion Theory, I

09:00–10:50

- 09:00 *Boolean algebras, stone spaces, and the iterated turing jump.*
(37) **Carl Jockusch***, University of Illinois, Urbana-Champaign, and **Robert Soare**, University of Chicago (885-03-48)
- 09:30 *Effective search problems.*
(38) **Martin Kummer*** and **Frank Stephan**, Universität der Karlsruhe, Germany (885-03-26)
- 10:00 *Recursively enumerable Boolean algebras with applications.*
(39) **V. L. Selivanov**, Institute of Mathematics, Russia and Mathematisches Institut, Germany (885-03-18)
- 10:30 *Towards a theory of initial segments for the enumeration degrees.* Preliminary report.
(40) **Andrea Sorbi***, University of Siena, Italy, and **Stewart Barry Cooper**, University of Leeds, United Kingdom (885-03-19)

Special Session on Stochastics, I

09:00–11:10

- 09:00 *Diffusion limited aggregation and cluster growth models.*
(41) **Martin Barlow**, University of British Columbia (885-60-54)
- 09:50 *Series expansions of local time functionals of the Wiener process.*
(42) **Peter Imkeller**, Mathematisches Institut LMU, Germany (885-60-74)
- 10:40 *Continuous additive functionals of symmetric Markov processes and their associated Gaussian chaoses.* Preliminary report.
(43) **Michael B. Marcus**, City College, City University of New York (885-60-40) (Sponsored by Ruth J. Williams)

Invited Address

11:30–12:30

- (44) *Holomorphic curves in three-dimensional contact geometry.*
Helmut H. W. Hofer, Ruhr Universität, Germany (885-58-22)

Special Session on Arithmetic Geometry/Automorphic Forms, II

14:00–16:55

- 14:00 *Localization for smooth representations.* Preliminary report.
(45) **Peter Schneider**, Universität zu Köln, Germany (885-22-57) (Sponsored by G. Harder)
- 14:45 *Compactification of Drinfeld moduli schemes.*
(46) **Richard Pink**, Max-Planck Institut für Mathematik, Germany (885-14-82) (Sponsored by G. Harder)
- 15:30 *Rigidity results on K-cohomology and other functors.*
(47) **U. Jannsen**, University of Cologne, Germany (885-99-137)
- 16:15 *Diophantine approximation on P^n .*
(48) **Gisbert Wüstholz**, ETH, Zurich, Switzerland (885-11-111) (Sponsored by Jens S. Franke)

Special Session on Homotopy Theory, II

14:00–15:15

- 14:00 *Title to be announced.*
(49) **Jean Lannes**, Ecole Polytechnic, France (885-99-144)
- 14:45 *A counterexample to the homomorphism question for classifying spaces.*
(50) **John Martino**, University of Virginia, and **Stewart Priddy***, Northwestern University (885-55-43)

Special Session on Geometry and Computer Visualization, II

14:00–16:45

- 14:00 *Dynamics of nonlinear evolutionary flows.*
(51) **Vladimir Oliker**, Emory University (885-51-104) (Sponsored by Robert M. Fossum)
- 14:20 *Fractal image and volume data compression.*
(52) **Dietmar Saupe**, Universität der Freiburg, Germany (885-51-108) (Sponsored by Robert M. Fossum)
- 14:40 *Exploring hyperbolic 3-manifolds with SnapPea.*
(53) **Jeff Weeks*** and **Mark Phillips**, University of Minnesota, Minneapolis (885-51-96) (Sponsored by Robert M. Fossum)
- 15:00 *The surface evolver and polycut.*
(54) **Ken Brakke**, Susquehanna University, Pennsylvania (885-51-91) (Sponsored by Robert M. Fossum)
- 15:20 *Images of 4D knotlike surfaces.*
(55) **Andrew Hanson**, Indiana University, Bloomington (885-51-101) (Sponsored by Robert M. Fossum)

Saturday, October 2 (cont'd)

- 15:30 *Twisting and spinning.*
(56) **Dennis Roseman**, University of Iowa (885-51-102)
(Sponsored by Robert M. Fossum)
- 15:40 *Building polyhedra in complex hyperbolic space.*
(57) **William Goldman**, University of Maryland, College Park (885-51-92) (Sponsored by Robert M. Fossum)
- 15:50 *Hoops in R^3 .*
(58) **Daniel Asimov**, NASA Ames Research Center, California (885-51-88) (Sponsored by Robert M. Fossum)
- 16:00 *Contracting the dunce hat.*
(59) **John Dalbec**, Cornell University (885-51-90)
(Sponsored by Robert M. Fossum)
- 16:10 *Equivariant sphere eversions.*
(60) **F. Apery***, Faculté des Sciences et Techniques, France, **G. Francis** and **H. Hartman**, University of Illinois, Urbana-Champaign (885-51-89) (Sponsored by Robert M. Fossum)
- 16:20 Preview "Outside In"
- 16:40 Problem Session

Special Session on Complex Analysis, II

14:00–16:45

- 14:00 *Estimates on the Szegő projection on convex domains.*
(61) **Jeffery D. McNeal**, Princeton University (885-32-107)
- 14:30 *Local and global analyticity for \square_b on three dimensional CR manifolds.*
(62) **David S. Tartakoff***, University of Illinois, Chicago, and **Makhlouf Derridj**, Université de Paris-Sud, France (885-32-34)
- 15:00 *L^2 estimates and existence theorems for the tangential Cauchy-Riemann equations.*
(63) **Mei-Chi Shaw**, University of Notre Dame (885-32-44)
- 15:30 *Invariant metrics on weakly pseudoconvex domains.*
(64) **Gregor Herbort**, Universität Wuppertal, Germany (885-32-58) (Sponsored by Klas Diederich)
- 16:00 *Some remarks concerning holomorphically convex hulls and envelopes of holomorphy.*
(65) **Burglind Jöricke**, Max-Planck-Arbeitsgruppe, Germany (885-32-151)
- 16:25 *Sets of weak normality of families of meromorphic mappings.*
(66) **Sergey Ivashkovich**, Ruhr Universität, Germany (885-32-152)

Special Session on Mathematical Physics, II

14:00–16:50

- 14:00 *Analytic number theory and classical statistical mechanics.*
(67) **Andreas Knauf**, Technische Universität, Germany (885-11-37) (Sponsored by Jurg M. Frohlich)

- 14:35 *Heavy atoms in high magnetic fields.*
(68) **Jakob Yngvason**, University of Iceland, Iceland (885-81-36) (Sponsored by Jurg M. Frohlich)
- 15:10 *Non-commutative geometry and Toeplitz quantization.*
(69) **Andrzej Lesniewski**, Harvard University (885-81-32) (Sponsored by Elliott H. Lieb)
- 15:45 *Atoms and number theory.*
(70) **Luis A. Seco**, University of Toronto (885-81-09)
- 16:20 *Universal asymptotic for the mean field interatomic potential in molecules.*
(71) **Jan Philip Solovej**, Princeton University (885-81-53)

Special Session on Commutative Algebra (Betti Numbers), I

14:00–16:25

- 14:00 *Jacobian criteria for complete intersections.*
(72) **Luchezar L. Avramov***, Purdue University, West Lafayette, and **Jürgen Herzog**, Universität GH-Essen, Germany (885-13-84)
- 14:30 *Regularity, depth and associated primes in cohomology rings.*
(73) **Jon F. Carlson**, University of Georgia (885-20-46)
- 15:00 *Homological invariants of multigraded modules.*
(74) **Paul C. Roberts**, University of Utah (885-14-79)
- 15:30 *Title to be announced.*
(75) **Steve Halperin**, University of Toronto (885-99-160)
- 16:00 *Title to be announced.*
(76) **Jerzy M. Weyman**, Northeastern University (885-99-161)

Special Session on Recursion Theory, II

14:00–16:50

- 14:00 *On the backward AE- theory of the factor lattice by the major subset relation.*
(77) **E. Herrmann**, Humboldt Universität, Germany (885-03-14) (Sponsored by Steffen Lempp)
- 14:30 *Total objects in inductively defined types. Preliminary report.*
(78) **Lill Kristiansen** and **Dag Normann***, University of Oslo, Norway (885-03-17)
- 15:00 *Feasible torsion-free groups.*
(79) **Douglas Cenzer***, University of Florida, **Rodney Downey**, University of Wellington, New Zealand, and **Jeffrey Remmel**, University of California at San Diego, La Jolla (885-03-12)
- 15:30 *A characterization of inference degrees.*
(80) **Martin Kummer** and **Frank Stephan***, Universität der Karlsruhe, Germany (885-03-27)
- 16:00 *Decidability and undecidability in the r. e. wtt-degrees. Preliminary report.*
(81) **Steffen Lempp**, University of Wisconsin, Madison (885-03-49)
- 16:30 *Algorithmic randomness. Preliminary report.*
(82) **Antonín Kučera**, Charles University, Czech Republic (885-03-25)

Special Session on Stochastics, II

15:30–16:40

- 15:30 *Dirichlet forms with state spaces consisting of measures and corresponding Markov processes.*
(83) **M. Rockner**, Institut für Angewandte Mathematik, Germany (885-60-75) (Sponsored by Jens S. Franke)
- 16:10 *Analysis of symmetric diffusions.*
(84) **K.-Th. Sturm**, Mathematisches Institut, Germany (885-60-76) (Sponsored by Hermann Rost)

Invited Address

17:00–18:00

- (85) *Der Bethe-Ansatz und die Lefschetz-Spurformel.*
Robert P. Langlands, Institute for Advanced Study (885-11-23)

Sunday, October 3

Special Session on Arithmetic
Geometry/Automorphic Forms, III

09:00–11:10

- 09:00 *Title to be announced.*
(86) **Mathias Flach**, Universität der Heidelberg, Germany (885-99-138)
- 09:45 *Fields of definition of abelian varieties with real multiplication.*
(87) **Kenneth A. Ribet**, University of California, Berkeley (885-11-116)
- 10:30 *Title to be announced.*
(88) **Jacques M. Tilouine**, Charge de Recherches, Faculté des Sciences, d'Orsay, France (885-99-139)

Special Session on Geometry and
Computer Visualization, III

09:00–11:20

- 09:00 Problem Session
- 09:40 *Exploring homotopies of surfaces with real-time interactive computer animators.*
(89) **G. Francis***, **G. Chappell** and **C. Hartman**, University of Illinois, Urbana-Champaign (885-51-100) (Sponsored by Robert M. Fossum)
- 10:00 *Computer pictures of algebraic surfaces.*
(90) **Wolf Barth**, Universität Erlangen, Germany (885-51-93) (Sponsored by Robert M. Fossum)
- 10:20 *Visualising singularities using the Liverpool surface package.*
(91) **Richard Morris**, University of Liverpool, United Kingdom (885-51-97) (Sponsored by Robert M. Fossum)

- 10:40 *Moving and tracing in adaptive time-dependent 2D and 3D vector fields.*
(92) **Martin Rumpf*** and **M. Geiben**, Freiburg Universität, Germany (885-51-106) (Sponsored by Robert M. Fossum)
- 11:00 *Title to be announced.*
(93) **Andreas W. M. Dress**, Universität der Bielefeld, Germany (885-99-147)

Special Session on Complex Analysis, III

09:00–10:50

- 09:00 *A Bochner-Martinelli-Koppelman formula on real hypersurfaces.*
(94) **Jürgen Leiterer**, Fachbereich Mathematik der Humboldt-Universität, Germany (885-32-153)
- 09:30 *Regularity of ∂ -bar- b and of embeddings of strictly pseudoconvex real hypersurfaces.*
(95) **Joachim Michel**, Universität der Bonn, Germany (885-32-154)
- 10:00 *The generalized corona theorem for H^∞ .*
(96) **Raymond Mortini**, Universität der Karlsruhe, Germany (885-32-155)
- 10:30 *Attractive basins in higher dimensional complex dynamics.*
(97) **Estela A. Gavosto**, University of Michigan, Ann Arbor (885-99-159)

Special Session on Mathematical Physics, III

09:00–11:15

- 09:00 *Existence of infinitely many smooth global solutions of the Einstein-Yang/Mills equations, and an exotic black hole solution.*
(98) **Joel Smoller**, University of Michigan, Ann Arbor (885-83-10)
- 09:35 *Hydrodynamical limit for lattice gas and Green-Kubo formula. Preliminary report.*
(99) **Horug-Tzer Yau**, Courant Institute of Mathematical Sciences, New York University (885-82-11)
- 10:10 *The counting function for Schrödinger operators with Coulomb singularity and magnetic field. Preliminary report.*
(100) **Heinz Siedentop***, Norwegian Institute of Technology, Norway, and **Bernard Helffer**, DMI-ENS, Cedex, France (885-35-125) (Sponsored by Elliott H. Lieb)
- 10:45 *Fermion hypercontractivity and optimal two-uniform convexity for C_p .*
(101) **Elliott H. Lieb**, Princeton University (885-81-120)

Special Session on Modelling in Science, II

09:00–11:15

- 09:00 *Systems of ordinary differential equations from biology and their stationary long-term behaviour.*
(102) **Erich Bohl**, Universität der Konstanz, Germany (885-92-132)

Sunday, October 3 (cont'd)

- 09:45 *Capture in resonance and the spin/orbit ratio of Mercury.*
(103) **Christopher Jones**, Brown University (885-70-128)
- 10:30 *Modelling with kinetic equations.*
(104) **Helmut Neunzert**, Universität der Kaiserslautern, Germany (885-70-130)

Special Session on Commutative Algebra (Betti Numbers), II

09:00–11:15

- 09:00 *Algebras with small tangent spaces and simply connected manifolds with little symmetry.* Preliminary report.
(105) **Anthony Iarrobino**, Northeastern University, and **Volker Puppe***, Universität der Konstanz, Germany (885-57-42) (Sponsored by Ragnar-Olaf Buchweitz)
- 09:30 *Hochschild homology criteria for smoothness.*
(106) **Micheline Vigué**, Université de Paris-Nord, France (885-18-35) (Sponsored by Ragnar-Olaf Buchweitz)
- 10:00 *Betti numbers of algebra, geometry and topology.*
(107) **Ragnar-Olaf Buchweitz**, University of Toronto (885-14-124)
- 10:45 *Stanley-Reisner rings with pure resolution.*
(108) **Winfried Burns**, Universität der Osnabruck, Germany (885-13-150)

Special Session on Recursion Theory, III

09:00–11:20

- 09:00 *Extending partial order embeddings in the r.e. degrees.* Preliminary report.
(109) **Theodore A. Slaman*** and **Robert I. Soare**, University of Chicago (885-03-56) (Sponsored by Steffen Lempp)
- 09:30 *The last question on recursively enumerable many-one degrees.*
(110) **Andre Nies**, Universität Heidelberg, Germany (885-03-16) (Sponsored by Robert M. Fossum)
- 10:00 *Recursive limit structures.* Preliminary report.
(111) **Julia F. Knight**, University of Notre Dame (885-03-15)
- 10:30 *The strength of Martin-Löf type theories with well-ordering types.*
(112) **Edward Griffor***, Uppsala University, Sweden, and **Michael Rathjen**, Ohio State University, Columbus (885-03-29)
- 11:00 *Inductive inference classes.*
(113) **Piergiorgio Odifreddi**, University of Torino, Italy (885-03-31) (Sponsored by Klaus Ambos-Spies)

Invited Address

11:30–12:30

- (114) *Methods of algebraic geometry in algebraic topology.*
Michael J. Hopkins, Massachusetts Institute of Technology (885-14-156)

Special Session on Arithmetic Geometry/Automorphic Forms, IV

14:00–16:45

- 14:00 *Title to be announced.*
(115) **Henri A. Gillet**, University of Illinois, Chicago (885-99-140)
- 14:45 *Title to be announced.*
(116) **Don M. Blasius**, University of California, Los Angeles (885-99-141)
- 15:30 *The topological trace formula for Hecke-operators and its applications.*
(117) **Günter Harder**, Universität Bonn, Germany (885-11-110) (Sponsored by Jens S. Franke)
- 16:15 *Local Shimura varieties.*
(118) **Thomas Zink**, Universität Bielefeld, Germany (885-99-142)

Special Session on Homotopy Theory, III

14:00–16:45

- 14:00 *Homotopy homomorphisms and the hammock localization.*
(119) **Roland Schwänzl** and **Rainer M. Vogt***, Universität Osnabruck, Germany (885-55-50) (Sponsored by Hans-Werner Henn)
- 14:30 *On the Morava K-theory of some finite 2-groups.*
(120) **Björn Schuster**, Northwestern University (885-55-80)
- 15:00 *v_2 -telescopes and unstable homotopy.* Preliminary report.
(121) **Mark Mahowald**, Northwestern University (885-55-07)
- 15:45 *v_n telescopes and the AdSpectral sequence.*
(122) **Hal Sadofsky***, Johns Hopkins University, Baltimore, and **Mark Mahowald**, Northwestern University (885-55-81)
- 16:15 *Higher real K-theories.*
(123) **Haynes Miller*** and **Michael Hopkins**, Massachusetts Institute of Technology (885-55-13)

Special Session on Operator Algebras, III

14:00–16:45

- 14:00 *Connections between non-commutative geometry and quantum field theory.*
(124) **Daniel Kastler**, University Marseille-Luminy, France (885-46-65)
- 14:40 *On induced representations of quantum Kac-algebras.*
(125) **Eberhard Kirchberg**, Universität der Heidelberg, Germany (885-46-66)

- 15:15 *The Novikov conjecture for groups acting by isometries on metric spaces.*
(126) **Georges Skandalis**, University Paris 7, France (885-46-67)
- 15:50 *Duality of induction and restriction for abelian covariant systems.*
(127) **Siegfried Echterhoff**, Universität Paderborn, Germany (885-46-61)
- 16:15 *Connes fusion in conformal field theory.*
(128) **Antony Wassermann**, University of Cambridge, United Kingdom (885-46-68)

Special Session on Geometry and Computer Visualization, IV

14:00–16:00

- 14:00 *Topologically based vessel tree reconstruction from CT-data.*
(129) **H. Jürgens, C. Zahlten*, C. J. Evertsz, H. O. Peitgen**, Universität Bremen, Germany, **R. Leppke** and **K. J. Klose**, Klinikum der Philipps-Universität, Germany (885-51-109) (Sponsored by Robert M. Fossum)
- 14:20 *Air on the strings of Dirac.*
(130) **L. H. Kauffman***, **D. Sandin**, University of Illinois, Chicago, and **G. Francis**, NCSA, Illinois (885-51-45) (Sponsored by Robert M. Fossum)
- 14:40 *Reconstruction of gothic vaults.*
(131) **N. Quien***, **M. Herrmann** and **C. Kindl**, Universität Heidelberg, Germany (885-51-98) (Sponsored by Robert M. Fossum)
- 15:00 *Video presentation.*
(132) **Thomas F. Banchoff**, Brown University (885-99-148)
- 15:10 *Video presentation.*
(133) **Jean E. Taylor**, Rutgers University, New Brunswick (885-99-149)
- 15:20 *Cutting edge hard copy in the round.*
(134) **Helaman Ferguson**, Supercomputing Research Center, Maryland (885-51-99) (Sponsored by Robert M. Fossum)
- 15:30 *Not Knott*—Video presentation
- 15:40 Problem Session

Special Session on Modelling in Science, III

14:00–16:45

- 14:00 *Unusual interface motions in materials science.*
(135) **Paul C. Fife**, University of Utah (885-73-127)
- 14:45 *An algorithm for mean curvature flow and its application to the dendrite growth problem.*
(136) **Gerhard Dziuk**, Universität der Freiberg, Germany (885-35-131)
- 15:30 *On mathematical models of carrier transport in semiconductors.*
(137) **Herbert Gajewski**, Institute Angewandte Analysis und Stochastik, Germany (885-94-134)
- 16:15 *Modelling of reactive flow through porous media.*
(138) **Peter Knabner**, Institute Angewandte Analysis und Stochastik, Germany (885-76-136)

Special Session on Commutative Algebra (Betti Numbers), III

14:00–15:00

- 14:00 *Title to be announced.*
(139) **Hubert Flenner**, Universität der Osnabrück, Germany (885-99-162)
- 14:30 *Title to be announced.*
(140) **Jürgen Herzog**, Purdue University, West Lafayette (885-99-163)

Special Session on Stochastics, III

14:00–16:15

- 14:00 *Flow decomposition and large deviations.*
(141) **Gerard Ben Arous**, University of Paris-Sud, France (885-34-73) (Sponsored by Hermann Rost)
- 14:35 *The finite systems scheme: Abstract theorem and examples.*
(142) **Andreas Greven**, Institut für Mathematische Stochastik, Germany (885-60-72) (Sponsored by Hermann Rost)
- 15:10 *Representations of superprocesses. Preliminary report.*
(143) **Alison Etheridge**, University of Edinburgh, United Kingdom (885-60-41) (Sponsored by Ruth J. Williams)
- 15:45 *Loop condensation effects in the behavior of the random walks.*
(144) **K. M. Khanin**, Landau Institute for Theoretical Physics, Russia, **A. E. Mazel**, International Institute of Earthquake Prediction, Russia, **S. B. Shlosman***, University of California, Irvine, and **Ya G. Sinai**, Princeton University (885-60-55) (Sponsored by Ruth J. Williams)

Session on Contributed Papers

15:10–16:50

- 15:10 *An American-German mathematical meeting 100 years ago and the American contributions to early combinatorial theory.*
(145) **Harald Gropp**, Heidelberg, Germany (885-01-117)
- 15:25 *On the Mazur-Ulam theorem and the Aleksandrov problem of conservative distances.*
(146) **Themistocles M. Rassias**, University of La Verne, Greece (885-46-123)
- 15:40 *An Omega theorem for a class of arithmetic functions.*
(147) **Manfred Kühleitner** and **Werner Georg Nowak***, Universität für Bodenkultur, Austria (885-11-78)
- 15:55 *Torsion in the cohomology of mapping spaces. Preliminary report.*
(148) **Mark W. Winstead**, University of Virginia (885-55-33)
- 16:10 *The shape of attractors.*
(149) **Bernd Günther**, Johann Wolfgang Goethe-Universität, Germany (885-54-01)
- 16:25 *Poisson geometry of flat $SU(2)$ -connections over a surface.*
(150) **Johannes Huebschmann**, USTL, France (885-81-51)

Program of the Sessions

Sunday, October 3 (cont'd)

16:40 *C**-algebras of dynamical systems of quasi rotations
(151) on tori.
Carla E. Farsi* and **Neil A. Watling**, University of
Colorado, Boulder (885-46-28)

Special Session on Optimization, III

16:20–16:50

16:20 *Stability in Stochastic programming*. Preliminary report.
(152) **Werner Römisch**, Humboldt-Universität zu Berlin,
Germany, and **Rüdiger Schultz***, Institut für
Angewandte Mathematik, Berlin, Germany
(885-49-115) (Sponsored by Hans G. Bock)

Invited Address

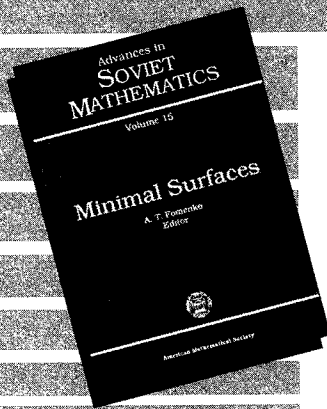
17:00–18:00

(153) *The Verlinde formula*.
Gerd Faltings, Princeton University (885-14-21)

Closing Ceremony

18:00–18:05

ADVANCES IN SOVIET MATHEMATICS



Minimal Surfaces

A. T. Fomenko, Editor

Volume 15

This book contains recent results from a group focusing on minimal surfaces in the Moscow State University seminar on modern geometrical methods, headed by A. V. Bolsinov, A. T. Fomenko, and V. V. Trofimov. The papers collected here fall into three areas: one-dimensional minimal graphs on Riemannian surfaces and the Steiner problem, two-dimensional minimal surfaces and surfaces of constant mean curvature in three-dimensional Euclidean space, and multidimensional globally minimal and harmonic surfaces in Riemannian manifolds. Prepared with attention to clarity and accessibility, these papers will appeal to mathematicians, physicists, and other researchers interested in the application of geometrical methods to specific problems.

1991 *Mathematics Subject Classification*: 05, 53, 58; 81

ISBN 0-8218-4116-5, 342 pages (hardcover), July 1993

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Texas A&M University, College Station, Texas

October 22–23, 1993

Second Announcement

The eight hundred and eighty-sixth meeting of the American Mathematical Society (AMS) will be held on the campus of Texas A&M University, College Station, Texas, on Friday, October 22, and Saturday, October 23, 1993. All sessions will be held in Rudder Tower. The invited addresses will be in Room 601, Rudder Tower.

Invited Addresses

By invitation of the Central Section Program Committee there will be four invited one-hour addresses. The speakers and their affiliations are as follows:

Steven P. Lally, Purdue University, *title to be announced*;

Gilles Pisier, University of Paris VI, *title to be announced*;

Theodore A. Slaman, University of Chicago, *title to be announced*;

Stephen A. Stolz, University of Notre Dame, *title to be announced*.

Special Sessions

By invitation of the same committee there will be thirteen special sessions of selected twenty-minute papers. The topics of these sessions and the names and affiliations of the organizers are as follows:

Harmonic analysis and its applications, **Josefina Alvarez**, New Mexico State University;

Several complex variables, **Harold P. Boas**, **Al Boggess**, and **Emil J. Straube**, Texas A&M University, College Station;

Composition operators on spaces of analytic functions, **Randall K. Campbell-Wright**, University of Tampa; **Carl C. Cowen**, Purdue University; and **Barbara D. MacCluer**, University of Richmond;

Nonlinear partial differential equations, **Alfonso Castro**, **Joseph A. Iaia**, **John W. Neuberger**, and **Henry A. Warchall**, University of North Texas;

Control systems governed by partial differential equations, **Goong Chen** and **Jianxin Zhou**, Texas A&M University, College Station;

Texas geometry and topology, **Tim D. Cochran**, Rice University; **Lorenzo A. Sadun**, University of Texas at Austin; and **Philip B. Yasskin**, Texas A&M University, College Station;

Reaction diffusion systems, **William E. Fitzgibbon**, University of Houston, and **J. J. Morgan**, Texas A&M University, College Station;

Nonselfadjoint operator algebras, **David R. Larson**, Texas A&M University, College Station;

Representation theory and geometry of noncommutative algebras, **Edward S. Letzter**, Texas A&M University, College Station;

Identities and varieties of algebraic structures, **John C. Meakin**, University of Nebraska-Lincoln; **Amitai Regev**, Pennsylvania State University, University Park; **Mark V. Sapir**, University of Nebraska-Lincoln; and **Samuel M. Vovsi**, Trenton State College;

Noncommutative differential geometry, **Efton L. Park**, Texas Christian University;

The geometry of Banach spaces and operator spaces, **Gilles Pisier** and **Thomas Schlumprecht**, Texas A&M University, College Station;

Algebraic combinatorics, **Sung Yell Song**, Iowa State University, and **Paul M. Terwilliger**, University of Wisconsin, Madison.

The sessions on *Several complex variables*, *Control systems governed by partial differential equations*, *Texas geometry and topology*, *Reaction diffusion systems*, *Nonselfadjoint operator algebras*, *Representation theory and geometry of noncommutative algebras*, and *The geometry of Banach spaces and operator spaces* are dedicated to the memory of Ilya Bakelman, professor of mathematics at Texas A&M University and formerly chair professor and head of the geometry section at Leningrad Pedagogical University, who died unexpectedly last year.

The deadline for submission of abstracts for consideration in any of these sessions has expired.

Contributed Papers

There will also be sessions for contributed ten-minute papers. The deadline for submission of abstracts for these session has expired. Unfortunately, late papers cannot be accommodated.

Registration

The meeting registration desk will be located on the second floor reception area of Rudder Tower and will be open from 8:00 a.m. to 5:00 p.m. on Friday and 8:00 a.m. to noon on Saturday. The registration fees are \$30 for members of the AMS, \$45 for nonmembers, and \$10 for emeritus members, students, or unemployed mathematicians.

Associated Symposium

Texas A&M University is planning a two-day meeting as a memorial to Professor Bakelman immediately following the AMS Sectional Meeting on Sunday and Monday, October 24

and 25, 1993. See the Mathematical Sciences Meetings and Conferences section of this issue for more information.

Accommodations

Rooms have been blocked for participants at the Hilton Hotel, Comfort Inn, and the Hampton Inn. All three hotels offer shuttle service to and from Easterwood Airport. Participants should make their own arrangements with the hotel of their choice and ask for the AMS conference rate. All rates are subject to applicable tax. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.**

College Station Hilton and Conference Center

801 University Drive East, College Station, TX 77840
Telephone 409-693-7500 or 800-766-1529
Single \$59 Double \$65

Comfort Inn

104 South Texas Avenue, College Station, TX 77840
Telephone 409-846-7333
Single \$37 Double \$42
Rates include complimentary continental breakfast.

Hampton Inn

320 South Texas, College Station, TX 77840
Telephone 409-846-0814 or 800-HAMPTON
Single or Double \$46

Food Service

The Memorial Student Center adjacent to Rudder Tower offers a variety of cafeteria-style food services on a cash basis. There are several restaurants within walking distance of the campus.

Parking

There is a parking garage located directly across from Rudder Tower which charges \$1 per hour or \$4 per day. There is usually ample free parking on Saturday.

Travel and Local Information

University-owned Easterwood Airport in College Station provides services by American Eagle, Atlantic Southeast Airlines, and Continental Express. Continental has been declared the official airline for this meeting. Special airfares include a 40% discount of the full "Y" or "F" class fares or a 5% discount off restricted round trip fares. Please call Continental at 1-800-468-7022 Monday through Friday, 6:00 a.m.–11:59 p.m., and Saturday and Sunday, 8:00 a.m.–9:00 p.m., for reservations and details of applicable restrictions if any. Refer to Easy Access Number ZMW17. Once reservations have been made, tickets may be purchased from any licensed travel agency, Continental ticket office, or airport ticket counter.

Rental cars and taxi service are available at the airport.

Texas A&M University, founded in 1876, is the oldest public institution of higher learning in Texas. One of the few universities holding land grant, sea grant, and space grant designations, it occupies a 5,142-acre campus in College Station. Originally a small all-male military college, the university is now a major co-educational institution ranking eighth in the nation in annual research expenditures. Including the adjacent city of Bryan, the local metropolitan population exceeds 110,000. Bryan-College Station lies 95 miles northwest of Houston, 100 miles east of Austin, and 195 miles south of Dallas. The Bryan-College Station area enjoys an abundance of recreational and cultural resources.

Weather

In the late part of October the average high temperature is 81°F and the average low temperature is 58°F.

Andy R. Magid
Associate Secretary
Norman, Oklahoma

The Claremont Colleges, Claremont, California

November 6–7, 1993

Second Announcement

The eight hundred and eighty-seventh meeting of the American Mathematical Society (AMS) will be held on the Harvey Mudd College campus of The Claremont Colleges in Claremont, California, on Saturday and Sunday, November 6 and 7, 1993. This meeting will take place concurrently with a meeting of the Southern California section of the Mathematical Association of America (MAA)

Invited Addresses

By invitation of the Western Section Program Committee there will be four invited one-hour addresses. The speakers and their affiliations are as follows:

Krzysztof Burdzy, University of Washington, *title to be announced*;

Nassif Ghoussoub, University of British Columbia, *title to be announced*;

N. Makarov, California Institute of Technology, *title to be announced*;

Nicholai Reshetikhin, University of California, Berkeley, *title to be announced*.

Special Sessions

By invitation of the same committee there will be seven special sessions of selected twenty-minute papers. The topics of these sessions and the names and affiliations of the organizers are as follows:

Mathematical models in epidemiology, Fred Brauer, University of Wisconsin, Madison, and Carlos Castillo-Chavez, Cornell University;

Dynamical systems and chaos, Mario U. Martelli, California State University;

Industrial applied mathematics, Ellis Cumberbatch, Claremont Graduate School;

Computational number theory, David G. Cantor, University of California, Los Angeles;

Brownian motion and applications to potential theory, Steven N. Evans, University of California, Berkeley;

Nonlinear analysis and Banach space theory, Nassif Ghoussoub and Edward Odell, University of Texas at Austin;

Quantum groups and quantum topology, Nicholai Reshetikhin.

The deadline for submission of abstracts for consideration in any of these sessions has expired.

Contributed Papers

There will also be sessions for contributed ten-minute papers. The deadline for submission of abstracts for these sessions has expired. Unfortunately, late papers cannot be accommodated.

Registration

The meeting registration desk will be located in the lobby of Galileo Hall, Harvey Mudd College. The desk will be open from 8:30 a.m. to 2:00 p.m. on both Saturday and Sunday. The registration fees are \$30 for members of the AMS, \$45 for nonmembers, and \$10 for emeritus members, students, and unemployed mathematicians.

Activities of Other Organizations

The Southern California Section of the MAA will meet on Saturday, November 6. **Melvin Henriksen**, Harvey Mudd College, will give the luncheon address, *Rings of continuous functions in the 50s*. Other invited speakers and their titles are **Morris W. Hirsch**, University of California, Berkeley, *Mathematical myths*, and **Herbert A. Dekleine**, California State Polytechnic University, San Luis Obispo, *Recent court rulings on apportioning fractions*. Details about the MAA Luncheon will be announced later.

There is a \$15 special one-day fee for MAA members attending the MAA meeting on Saturday. The special fees for other categories for those attending the MAA meeting on Saturday only are students and unemployed mathematicians \$5, and non-MAA members \$20.

Accommodations

Rooms have been blocked at the following hotels and motels. Participants should make their own reservations directly with the hotel of their choice, identifying themselves as attending the AMS meetings at The Claremont Colleges. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.**

Shuttle service from and to Ontario International Airport is provided free of charge.

Griswold's Inn

555 West Foothill Boulevard, Claremont, CA 91711
Griswold's is within walking distance of the campus and provides a complimentary full buffet breakfast.
Telephone 800-854-5733 (except in California), 800-821-0341 (in California), or 909-626-2411
Rooms (1–4 persons) \$60.00 plus tax
Rooms must be reserved before October 23, 1993.

Meetings

Ramada Inn

840 South Indian Hill Boulevard, Claremont, CA 91711
The Ramada Inn is next to the San Bernardino Freeway (Interstate 10), 2.5 miles from the campus. The Ramada will furnish complimentary shuttle service to the campus and complimentary continental breakfast.
Telephone 800-322-6559 or 909-621-4831
Rooms (single or double) \$48 plus tax
Rooms must be reserved before October 23, 1993.

Parking

Parking is available in the lots on the north and south sides of the Olin Science Center and on the streets surrounding the campus. There is no charge for parking.

Travel and Local Information

Claremont is located 35 miles east of Los Angeles.

Most major airlines serve Ontario International Airport (California). Continental has been declared the official airline for this meeting. Special airfares include a 40% discount off

the full "Y" or "F" class fares or a 5% discount off restricted round trip fares. Please call Continental at 1-800-468-7022 Monday through Friday, 6:00 a.m. to 11:59 p.m., and Saturday and Sunday, 8:00 a.m. to 9:00 p.m., for reservations and details of applicable restrictions if any. Refer to Easy Access Number ZMW17. Once reservations have been made, tickets may be purchased from any licensed travel agency, Continental ticket office, or airport ticket counter.

Driving time from Ontario Airport to campus is 15 to 20 minutes. The drive from Los Angeles International Airport (LAX) is slow, particularly on Friday afternoons (allow at least one hour). To get to the Galileo complex on the Harvey Mudd campus where the meetings will be held you should turn north on Indian Hill Boulevard (Exit 47 on Interstate 10) and then go east for four blocks on Foothill Boulevard to Dartmouth Avenue.

Lance W. Small
Associate Secretary
La Jolla, California

ADVANCES IN SOVIET MATHEMATICS

Idempotent Analysis

V. P. Maslov and S. N. Samborskiĭ, Editors

Volume 13

Idempotent analysis is a new branch of mathematical analysis concerned with functional spaces and their mappings when the algebraic structure is generated by an idempotent operation. The articles in this collection show how idempotent analysis is playing a unifying role in many branches of mathematics related to external phenomena and structures—a role similar to that played by functional analysis in mathematical physics, or numerical methods in partial differential equations. Such a unification necessitates study of the algebraic and analytic structures appearing in spaces of functions with values in idempotent semirings. The papers collected here constitute an advance in this direction.

1991 *Mathematics Subject Classification*: 16, 20, 35, 47, 49, 90; 81
ISBN 0-8218-4114-9, 210 pages (hardcover), December 1992
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International Joint Mathematics Meeting

Merida, Yucatan, Mexico, December 1–4, 1993

First Announcement

The first joint meeting of the AMS and the Sociedad Matemática Mexicana (SMM) will take place December 1–4, 1993, (Wednesday–Saturday) at the University of Yucatan, Merida, Mexico. The Program Committee was coordinated by AMS Secretary Robert M. Fossum and includes L. Gorostiza, J. G. Gómez Larrañaga, and Jorge Ize from SMM; and Idun Reiten, Mary Ellen Rudin, and William Velez from AMS.

Invited Addresses

By invitation of the Program Committee there will be six invited addresses. The names and affiliations of the speakers and the titles of their talks, where available, are as follows:

Maurice Auslander, Brandeis University, *title to be announced*;

Xavier Gómez-Mont, Centro de Investigación en Matemáticas A.C. (CIMAT), *An algebraic formula for the index of a vector field on a variety with an isolated singularity*;

Luis Montejano, CIMAT, *Some applications of topology to the theory of geometric tomography*;

Cathleen S. Morawetz, New York University-Courant Institute, *title to be announced*;

Daniel W. Stroock, Massachusetts Institute of Technology, *title to be announced*;

William Thurston, Mathematical Sciences Research Institute, *title to be announced*.

Special Sessions

By invitation of the same committee there will be nine special sessions of selected twenty-minute papers. The topics of these sessions and the names and affiliations of the organizers are as follows:

Representations of algebras, **Raymundo Bautista**, Instituto de Matemáticas, Universidad Nacional Autónoma de México (UNAM); and **Idun Reiten**, University of Trondheim;

Graphs and combinatorics, **Gilberto Calvillo Vives**, Banco de México, and **Joseph P. Kung**, University of North Texas;

Asymptotic and numerical methods in mechanics and biology, **Carlos Castillo-Chavez**, Cornell University, and **Cristóbal Vargas Jarillo**, Centro de Investigación y Estudios Avanzados (CINVESTAV), Instituto Politécnico Nacional (IPN);

Nonlinear analysis, **Michael G. Crandall**, University of California, Santa Barbara; **Jorge Ize**, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, UNAM; and **Monica Clapp Jiménez**, Instituto de Matemáticas, UNAM;

Holomorphic systems and geometry, **Xavier Gómez-Mont**, and **Domingo Toledo**, University of Utah;

Geometric topology in low dimensions, **Francisco J. González-Acuña**, Instituto de Matemáticas, UNAM; **C. M. Gordon**, University of Texas at Austin; and **Jonathan K. Simon**, University of Iowa;

Stochastic Analysis, **Luis Gorostiza**, CINVESTAV, IPN; **Thomas G. Kurtz**, University of Wisconsin; and **Victor M. Pérez-Abreu Carrión**, CIMAT;

Noncommutative rings, **Sergio R. Lopez-Permouth**, Ohio University; **Francisco Raggi Cárdenas**, Instituto de Matemáticas, UNAM; and **José Ríos Montes**, Instituto de Matemáticas, UNAM;

General topology, **Jerry E. Vaughan**, University of North Carolina at Greensboro, and **Richard Wilson**, Universidad Autónoma Metropolitana, Unidad Iztapalapa.

The deadline for submission of abstracts for consideration in any of these sessions has expired.

Workshops

Also by invitation of the Program Committee there will be at least one workshop, *Technology in the classroom*, organized by **David Lomen**, University of Arizona.

Contributed Paper Sessions

There will be sessions of ten-minute contributed papers. The deadline for submission of abstracts for these sessions has expired. Unfortunately, late papers cannot be accommodated.

Registration

Registration will take place beginning Wednesday from 9:00 a.m. to 6:00 p.m. and continue on Thursday and Friday, 9:00 a.m. to 1:30 p.m. and 5:00 p.m. to 8:00 p.m., and on Saturday, 10:00 a.m. to 1:00 p.m. The registration desk will be in the central yard of the university's main building. The registration fee is US\$30 for all participants.

Social Events

The SMM cordially invites all registered participants to a complimentary reception on Wednesday evening. On Thursday an informal snack bar with show will be offered. Both events will be held in the University's main building at 8:45 p.m.

A conference dinner with an after-dinner show included will take place on Friday at 9:00 p.m. Interested participants must make reservations at the registration desk. Cost is about US\$25 per person.

Also, arrangements have been made for a tour to the archaeological zone of Uxmal at 2:00 p.m. on Saturday. Tickets are about US\$40 each and will be available at the registration desk.

Accommodations

Los Aluxes and **Casa del Balam** are five-star hotels which have been selected as the official hotels for the meeting. A limited number of rooms have been blocked at special rates. Participants should make their own reservations directly with the hotels by **November 24**. Be sure to mention the AMS-SMM meeting. Prices are quoted in U.S. dollars and include taxes and chambermaid tips; porter service is an extra US\$2. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels.**

Los Aluxes

Calle 60, No. 444
 Telephone 52-99-24-2199 or 800-782-8395
 Fax 52-99-23-3858
 Single/Double \$82 Triple \$96

Casa del Balam

Calle 60 No. 488
 Telephone 52-99-24-8844 or 800-624-8451
 Fax 52-99-24-5011
 Single/Double \$70 Triple \$83

Those who would like accommodations other than at the official hotels are encouraged to contact either their local travel agency or Viajes Algaro, the official travel management company for the meeting (telephone 52-5-370-2803 or 5996; fax 52-5-370-5824).

Travel

Continental has been declared the official airline for this meeting. Special airfares include a 25% discount off the full "Y" or "F" class fares or a 5% discount off the lowest applicable fare. Please call Continental at 1-800-468-7022 Monday through Friday, 6:00 a.m. to 11:59 p.m., and Saturday and Sunday, 8:00 a.m. to 9:00 p.m., for reservations and details of applicable restrictions if any. Refer to Easy Access Number ZMW17. Once reservations have been made, tickets may be purchased from any licensed travel agency, Continental ticket office, or airport ticket counter.

Merida International Airport is serviced by several direct flights from Houston, Miami, and Mexico City. Viajes Algaro will be happy to assist you with airline reservations. Ground transportation from the airport is available on an individual (about US\$25) or collective (about US\$7) basis.

Local Information

Merida, a beautiful city founded by the Spaniards in 1542 and where the Mayans left rich cultural traditions, is situated in the eastern part of the country, some 1500 km from Mexico City.

Participants will have an opportunity to explore archaeological sites; enjoy the natural beauty of the "cenotes"; and discover handicraft shops, museums, theaters, parks, restaurants, and colonial architecture.

The climate is a combination of tropical and semidry. In December the sky is sunny and cloudless. While it is rather warm during the day, it cools off in the evening. Daily average temperatures are between 68°F (20°C) and 86°F (30°C).

CBMS Issues in Mathematics Education, Volume 3

Mathematicians and Education Reform 1990-1991

Naomi D. Fisher, Harvey B. Keynes, and Philip D. Wagreich, Editors

The first part of this volume is devoted to detailed descriptions of a wide variety of educational projects undertaken by mathematicians. These descriptions focus for the most part on substantial enterprises with an investment of several years and systematic review and evaluation. By contrast, the second part of the book centers on ideas that could be put into action at a modest level as a springboard for longer term projects. This book is intended to stimulate and inspire mathematical scientists to pursue educational work. Educators also benefit from this exploration of what can be done.

ISBN 0-8218-3503-3, 185 pages (softcover), April 1993
 Individual member \$37, List price \$62, Institutional member \$50
 To order, please specify CBMATH/3NA



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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. For full announcements or programs of meetings occurring prior to the first meeting listed below see the table of contents in this issue. 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 relevant information to the Associate Secretary for the section who will forward it to the Section Program Committee.

Cincinnati, OH, January 1994

Michael Artin (Retiring Presidential Address)	Jacques C. Hurtubise James M. Hyman László Lovász (AMS-MAA)
Georgia M. Benkart (AMS-MAA)	Robert M. May (Gibbs Lecture)
Jean Bourgain (Colloquium Lectures)	Carl Pomerance
Subrahmanyam Chandrasekhar (AMS-MAA)	Gilbert Strang Ruth J. Williams

Lexington, KY, March 1994

Jack J. Dongarra	George F. McNulty
James E. McClure	David R. Morrison

Manhattan, KS, March 1994

Marilyn Breen	David M. Goss
Michael C. Cranston	Mei-Chi Shaw

Brooklyn, NY, April 1994

David Bayer	Debasis Mitra
Peter B. Kronheimer	Nicholai Reshetikhin

Stillwater, OK, October 1994

V. Lakshmibai	David J. Wright
David E. Marker	Joel Zinn

Richmond, VA, November 1994

Loren D. Pitt	Doron Zeilberger
Cora S. Sadosky	

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.

January 1994 Meeting in Cincinnati, Ohio

Associate Secretary: Robert J. Daverman

Deadline for organizers: Expired

Deadline for consideration: September 9, 1993

Fredric D. Ancel, *Topology of high dimensional manifolds*
W. Thomas Archibald and Victor J. Katz, *History of mathematics*

Robert F. Brown, Christopher K. McCord, and Konstantin Mischaikow, *Algebraic topology and dynamical systems*
David C. Carothers and Gerard A. Venema, *Undergraduate research in mathematics*

Bettye Anne Case, *Meetings of mathematicians* (This session is being organized as part of the celebration of the 100th annual meeting. This celebration will take place on Saturday, January 15.)

Paul W. Eloe, *Singular boundary value problems*

Naomi D. Fisher, Harvey B. Keynes, Kenneth C. Millett, Hugo Rossi, and Philip D. Wagreich, *Mathematics and education reform* (AMS-MAA)

Arthur E. Frazno and Gary Weiss, *Operator theory, nonselfadjoint operator algebras and control theory*

Kenneth I. Gross, Donald St. P. Richards, and Paul J. Sally, *Representation theory and harmonic analysis*

Herbert Halpern, Victor G. Kaftal, and Shuang Zhang, *C*-algebras and von Neumann algebras*

David A. Herron and Susan G. Staples, *Quasiconformal mappings in analysis*

Jacques C. Hurtubise, *Geometry and topology of moduli spaces*

Jerome Kaminker, *Geometric applications of operator algebras and index theory*

Krystyna M. Kuperberg and Piotr Minc, *Modern methods in continuum theory*

David B. Leep, Daniel B. Shapiro, and Tara L. Smith, *Quadratic forms and division algebras*

Peter A. McCoy, *Advances in function theoretic methods*

Philip E. Protter, *Stochastic analysis*

Seenith Sivasundaram, *Scientific computing*

Gilbert Strang, *Wavelets and their applications*

Hong-Ming Yin, *Nonlinear partial differential equations and applications*

Invited Addresses and Special Sessions

March 1994 Meeting in Lexington, Kentucky

Southeastern Section

Associate Secretary: Robert J. Daverman

Deadline for organizers: Expired

Deadline for consideration: December 7, 1993

James C. Beidleman and Donald B. Coleman, *Infinite groups and group rings*

Philip L. Bowers, *Geometric group theory and metric geometry*

Russell M. Brown, John L. Lewis, and Zhongwei Shen, *Partial differential equations and minimal smoothness condition*

Karen L. Collins and Ewa M. Kubicka, *Graph theory*

Michael B. Freeman, *Workshop based calculus interventions*

Peter D. Hislop and Peter A. Perry, *Inverse spectral problems: theory and computation*

Mark A. Hovey and James E. McClure, *Homotopy theory*

David R. Morrison, *Quantum algebraic geometry*

Serge Ochanine, *Elliptic genera and elliptic cohomology*

Charles H. Romine, *Large-scale matrix computations with applications*

March 1994 Meeting in Manhattan, Kansas

Central Section

Associate Secretary: Andy R. Magid

Deadline for organizers: Expired

Deadline for consideration: December 7, 1993

Andrew G. Bennett and Charles N. Moore, *Harmonic analysis and probability*

Andrew L. Chermak and Albert L. Delgado, *Groups and geometries*

Louis Crane and David N. Yetter, *Quantum topology*

Robert A. Gustafson, *Special functions*

Lev Kapitanski and Lige Li, *Nonlinear topics and critical phenomena in partial differential equations*

Zongzhu Lin and David B. Surowski, *Representations of algebraic groups and quantum groups*

Gabriel Nagy and Vladimir V. Peller, *Operator theory*

Joseph M. Rosenblatt, *Convergence problems in ergodic theory*

Misha Vishik, *Dynamical systems and fluid dynamics*

Hunan Yang and Qisu Zou, *Computational mathematics and numerical analysis*

April 1994 Meeting in Brooklyn, New York

Eastern Section

Associate Secretary: Lesley M. Sibner

Deadline for organizers: Expired

Deadline for consideration: January 7, 1994

Boris Aronov, *Computational geometry*

Craig J. Benham, *Mathematical problems in molecular biology*

Joan S. Birman, Sylvain E. Cappell, and Edward Y. Miller, *Invariants of low dimensional manifolds*

Jozef Dodziuk and Edgar A. Feldman, *Geometric analysis*

Benjamin Fine, Anthony M. Gaglione, and Kathryn Kuiken, *Combinatorial group theory and related topics*

Fred Gardner and Jun Ping Jiang, *Teichmüller theory and dynamical systems*

Dorian Goldfeld, *Analytic number theory*

Jacob E. Goodman and Erwin Lutwak, *Geometric convexity*
Pao-sheng Hsu and L. Narisi, *Topological methods; topological measure theory*

Yanyan Li, *Partial differential equations*

Janos Pach and William Steiger, *Discrete geometry*

Kurt S. Riedel, *Mathematical methods in plasma physics*

Robert J. Sibner, *Gauge theory and applications*

Alan A. Weiss, *Models in telecommunications*

June 1994 Meeting in Eugene, Oregon

Western Section

Associate Secretary: Lance W. Small

Deadline for organizers: September 7, 1993

Deadline for consideration: March 14, 1994

August 1994 Meeting in Minneapolis, Minnesota

Associate Secretary: Lesley M. Sibner

Deadline for organizers: November 15, 1993

Deadline for consideration: April 26, 1994

October 1994 Meeting in Stillwater, Oklahoma

Central Section

Associate Secretary: Andy R. Magid

Deadline for organizers: January 28, 1994

Deadline for consideration: July 13, 1994

Ara S. Basmajian and Robert R. Miner, *Complex hyperbolic geometry and discrete groups*

Edward T. Cline, *Representations of algebraic groups*

November 1994 Meeting in Richmond, Virginia

Southeastern Section

Associate Secretary: Robert J. Daverman

Deadline for organizers: February 11, 1994

Deadline for consideration: July 13, 1994

January 1995 Meeting in San Francisco, California

Associate Secretary: Andy R. Magid

Deadline for organizers: April 2, 1994

Deadline for consideration: September 9, 1994

March 1995 Meeting in Hartford, Connecticut

Eastern Section

Associate Secretary: Lesley M. Sibner

Deadline for organizers: June 3, 1994

Deadline for consideration: To be announced

March 1995 Meeting in Orlando, Florida

Southeastern Section

Associate Secretary: Robert J. Daverman

Deadline for organizers: June 17, 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

Invited Addresses and Special Sessions

November 1995 Meeting in Kent, Ohio

Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: February 4, 1995
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

Daniel D. Anderson, *Commutative ring theory*

April 1996 Meeting in Baton Rouge, Louisiana

Southeastern Section
Associate Secretary: Robert J. Daverman
Deadline for organizers: July 19, 1995
Deadline for consideration: To be announced

Information for Organizers

Potential organizers should refer to the January, February, March, or April issues of the *Notices* for guidelines on organizing a session. Proposals for any of the meetings mentioned in the preceding section should be sent to the cognizant Associate Secretary by the deadline indicated. No Special Sessions can be approved too late to provide adequate advance notice to members who wish to participate.

Western Section

Lance W. Small, Associate Secretary
Department of Mathematics
University of California, San Diego
La Jolla, CA 92093
E-mail g_small@math.ams.org
Telephone 619-534-3590

Central Section

Andy R. Magid, Associate Secretary
Department of Mathematics
University of Oklahoma
601 Elm PHSC 423
Norman, OK 73019
E-mail g_magid@math.ams.org
Telephone 405-325-6711

Eastern Section

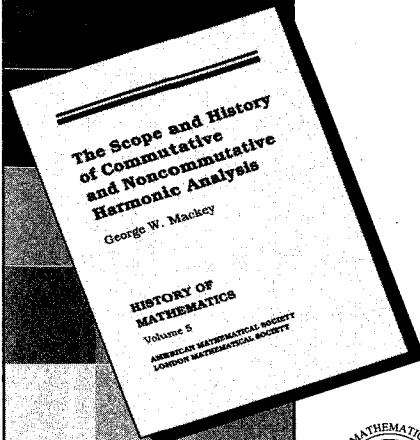
Lesley M. Sibner, Associate Secretary
Department of Mathematics
Polytech University of New York
Brooklyn, NY 11201-2990
E-mail g_sibner@math.ams.org
Telephone 718-260-3505

Southeastern Section

Robert J. Daverman, Associate Secretary
Department of Mathematics
University of Tennessee
Knoxville, TN 37996-1300
E-mail g_daverman@math.ams.org
Telephone 615-974-6577

Information on site selection for Sectional Meetings as well as full instructions for submitting abstracts can be found in the January, February, March, and April issues of the *Notices*.

The Scope and History of Commutative and Noncommutative Harmonic Analysis



History of Mathematics, Volume 5 • George W. Mackey, Editor

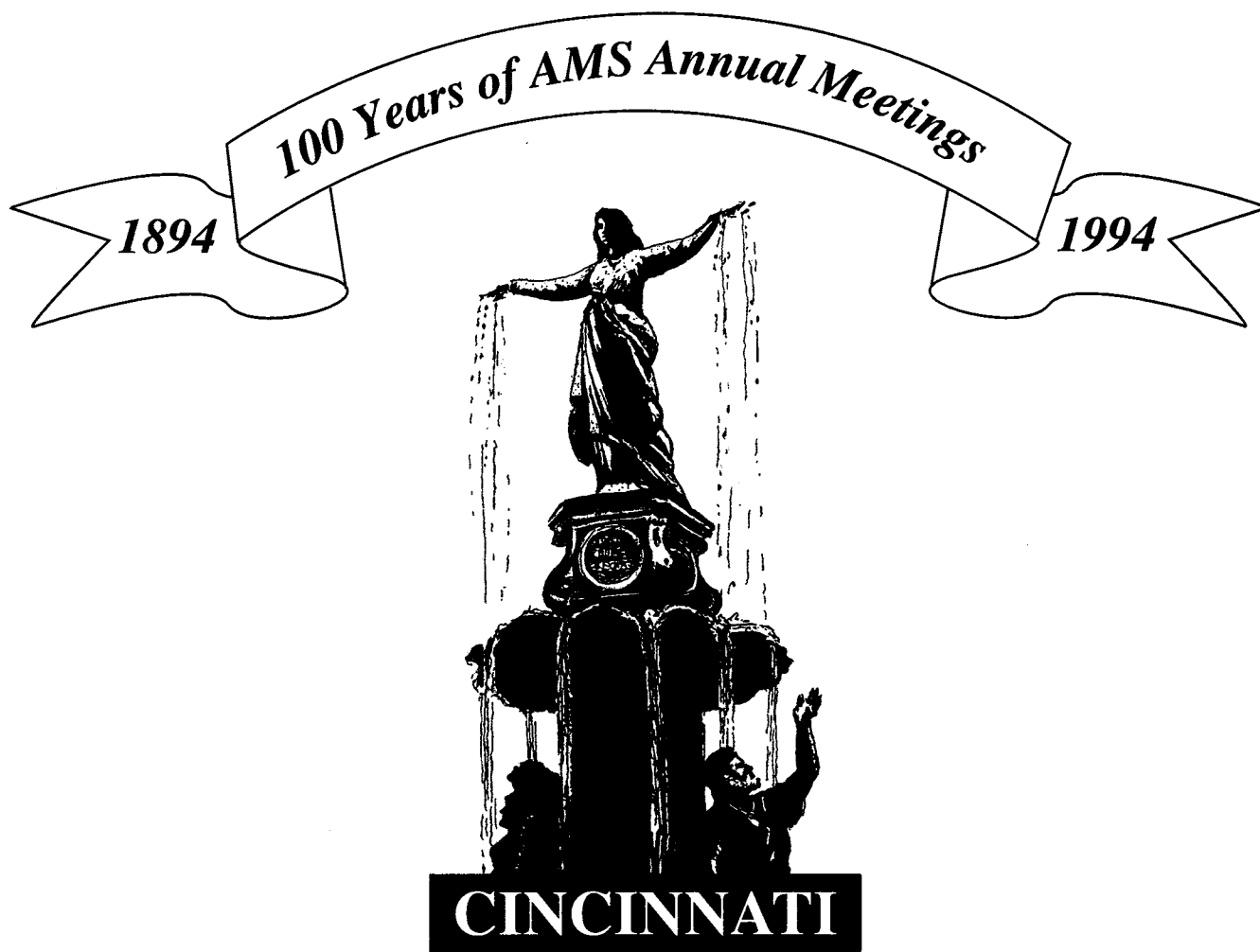
This volume presents a sweeping view of the importance, utility, and beauty of harmonic analysis and its connections to other areas of mathematics and science.

Aimed at mathematicians in all areas as well as mathematically-oriented theoretical physicists and advanced graduate students, Mackey's book is not directed to specialists but is intended to help specialists learn about fields other than their own and about the relationships among fields. Readers will appreciate this book for its lucid expository presentations and for its wide-ranging treatment of the subject. This volume is published jointly with the London Mathematical Society.

1991 *Mathematics Subject Classification*: 00; 01, 11, 22, 81
ISBN 0-8218-9000-X, 370 pages (hardcover), July 1992
Individual member \$31, List price \$52, Institutional member \$42
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We look forward to celebrating 100 years
of AMS annual meetings at the Joint Mathematics Meetings
this coming January in Cincinnati, Ohio.

To commemorate this occasion, we have planned
a program of exciting special events
for Saturday, January 15, 1994.

We hope you will join us!

American Mathematical Society



The program includes these exciting events:

- **CELEBRATION: 1894–1994**
A special opening ceremony featuring Everett Pitcher, former AMS Secretary, followed by a reception and light lunch.
- **RETIRING PRESIDENTIAL ADDRESS**
Michael Artin's Retiring Presidential Address, introduced by President Graham with comments about traditional meeting lecture series.
- **SPECIAL SESSION**
Discussions of the history of mathematics as well as the lives and work of mathematicians, organized by Bettye Anne Case, chair of the Special Committee on 100 Years of Annual Meetings.
- **FUTURE AMS MEETINGS**
A discussion intended to gather information about needs and opportunities for future meetings, led by Hugo Rossi, former AMS Associate Secretary and chair of the new Committee on Meetings and Conferences.
- **SPECIAL PUBLICATIONS EXHIBIT**
Books on the history of mathematics on display at the AMS exhibit.
- **NOSTALGIC PHOTOGRAPHS**
Special display of photographs and mementos of AMS meetings past. Cincinnati group photos planned for posterity.
- **AMS BANQUET**
Cocktails, followed by dinner, to recognize members who joined the Society twenty-five or more years ago. Door prizes include travel certificates worth up to \$1000.

Any member of the planning committee will be happy to receive suggestions:

Richard A. Askey, University of Wisconsin
Paul T. Bateman, University of Illinois
Bettye Anne Case, Florida State University (chair)
W. Wistar Comfort, Wesleyan University

Robert J. Daverman, University of Tennessee
Robert M. Fossum, University of Illinois
Everett Pitcher, Lehigh University
Janice B. Walker, Xavier University

For more information, please contact:

Meetings Department, American Mathematical Society, P. O. Box 6887,
Providence, RI 02940-6887; Telephone: 800-321-4AMS (3267) or 401-455-4138;
Fax: 401-455-4004; e-mail: meet@math.ams.org

American Mathematical Society



Mathematical Sciences

Meetings and Conferences

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. A complete listing of meetings of the Society, and of meetings sponsored by the Society, will be found inside the front cover.

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.

1993

1993–1994. **Mittag-Leffler Institute's Academic Program for 1993–1994: Topology and Algebraic K -theory**, Djursholm, Sweden. (Dec. 1992, p. 1274)

Spring 1993. **IMACS Symposium on Mathematical Modelling**, Wiener Neustadt, Germany. (Jan. 1992, p. 54)

1993. **Second IMACS International Conference on Computational Physics**, Univ. of Colorado, Boulder, CO. (Jan. 1992, p. 55)

September 1993

1–3. **Eleventh International Conference on the New Quality Philosophy in Statistical Research and Education**, Firenze, Italy. (Jul./Aug. 1993, p. 704)

1–9. **Mathematical Society of Japan International Research Institute on the Topology of the Moduli Space of Curves**, Kyoto, Japan.

(May/Jun. 1993, p. 510)

2–5. **French-Norwegian Symposium on Computer-Aided Mathematics in Education and Industry**, Gran, Norway. (May/Jun. 1993, p. 510)

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. (Jan. 1993, p. 62)

5–18. **Algorithms for Continuous Optimization: The State of the Art**, Il Cicocco, Italy. (Jul./Aug. 1993, p. 704)

6–8. **Bi-National France-Israel Symposium: The Brownian Sheet—New Results and Developments**, Bar-Ilan University (Israel). (Feb. 1993, p. 185)

6–8. **Quantum Information Theory and Open Systems**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto,

Japan. (Jul./Aug. 1993, p. 704)

6–10. **Lattice Points in Polyhedra and Applications in Geometry and Topology**, CIRM, Marseille, France. (Please note name change from Mar. 1993, p. 283)

6–11. **Eleventh International Conference on Topology**, Trieste, Italy. (Jan. 1993, p. 62)

7–12. **Algebras in Analysis**, Kent State University, Kent, OH. (May/Jun. 1993, p. 510)

9–15. **IMA Tutorial**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 62)

11. **Mathematica Seminar**, University of Michigan, Ann Arbor, MI. (Jul./Aug. 1993, p. 705)

12–16. **Third Dublin Differential Equations Meeting**, Dublin City University, Dublin, Ireland. (Jan. 1993, p. 62)

12–18. **Topologie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

13–15. **Mathematics and Computer Science—The UK Contribution**, Eastbourne, UK. (Jul./Aug. 1993, p. 705)

13–16. **Marburger Stochastik-Tage**, Marburg, Germany. (Jul./Aug. 1993, p. 705)

13–16. **Workshop: Künstliche Intelligenz und Operations Research**, Berlin, Germany. (Jul./Aug. 1993, p. 705)

13–17. **Fourth European Software Engineering Conference**, Garmisch, Germany. (Jul./Aug. 1992, p. 632)

13–17. **Tenth Conference on Problems and Methods in Mathematical Physics (10. TMP)**, Chemnitz, Federal Republic of Germany. (Feb. 1993, p. 186)

13–17. **Logique de la Connaissance et Théorie de la Décision**, Marseille, France. (Feb. 1993, p. 186)

13–18. **Different Aspects of Differentiability**, Warsaw, Poland. (May/Jun. 1992, p. 497)

14–17. **Mathematical Modelling and Scientific Computation (MMSC-93)**, Sozopol, Bulgaria. (Mar. 1993, p. 283)

14–17. **Recent Results on the Global Asymptotic Stability Jacobian Conjecture**, Trento, Italy. (Jul./Aug. 1993, p. 705)

17–20. **Technology in Mathematics Teaching (TMT '93): A Bridge between Teaching and Learning**, The University of Birmingham, England. (Dec. 1992, p. 1283)

18. **Mathematica Seminar**, Boston University, Boston, MA. (Jul./Aug. 1993, p. 705)

18–19. **Eastern Section**, Syracuse University, Syracuse, NY.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

* 19–23. **3ème Atelier International de Théorie des Ensembles**, Centre International de Rencontres Mathématiques, Marseille, France.

Meetings and Conferences

- ORGANIZER: P. Dehornoy, U. de Caen.
 INFORMATION: Centre International de Rencontres Mathématiques, Case 916, 70, Route Léon-Lachamp, 13288 Marseille Cedex 9, Marseille, France; telephone (91) 41.82.97.
- 19–25. **Mathematical Game Theory**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)
- 20–23. **Miniconference on Analysis and Applications**, The University of Queensland, Australia. (Jul./Aug. 1993, p. 705)
- 20–24. **Méthodes Numériques dans la Théorie des Surfaces de Riemann**, CIRM, Marseille, France. (Nov. 1992, p. 1122)
- 20–24. **Thirteenth Congress of the Austrian Mathematical Society**, Linz, Austria. (Dec. 1992, p. 1284)
- 20–24. **IMA Workshop on Probability and Algorithms**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 63)
- 20–24. **Ordinary Differential Equations and Their Applications**, Firenze, Italy. (Feb. 1993, p. 186)
- 20–25. **International Conference on Number Theory**, Tula State Pedagogical Institute, Tula, Russia. (Mar. 1993, p. 284)
- 20–26. **Seventh Symposium on Classical Analysis**, Kazimierz Dolny, Poland. (Dec. 1992, p. 1284)
- 20–October 1. **Second Workshop on Composite Media and Homogenization**, International Centre for Theoretical Physics, Trieste, Italy. (Apr. 1993, p. 413)
- 21–24. **Sixth International Workshop on Stochastic Geometry, Stereology, and Image Analysis in honor of L.A. Santalo**, Valencia, Spain. (Mar. 1993, p. 284)
- 21–24. **Workshop on Symbolic Computation in Combinatorics**, MSI, Ithaca, NY. (Jul./Aug. 1993, p. 706)
- 23–24. **HOA '93: International Workshop on Higher Order Algebra, Logic, and Term Rewriting**, Amsterdam, The Netherlands. (Jul./Aug. 1993, p. 706)
- 26–29. **SCAN-93 IMACS/GAMM International Symposium on Scientific Computation, Computer Arithmetic, Validated Numerics**, Technical University of Vienna, Austria. (Apr. 1993, p. 413)
- *26–30. **Journées de Probabilités**, Centre International de Rencontres Mathématiques, Marseille, France.
- ORGANIZERS: J. Azéma, M. Yor (U. de Paris 6).
 INFORMATION: Centre International de Rencontres Mathématiques, Case 916, 70, Route Léon-Lachamp, 13288 Marseille Cedex 9, Marseille, France; telephone (91) 41.82.97.
- 26–October 1. **Second International Conference on Approximation and Optimization**, Havana, Cuba. (May/Jun. 1993, p. 511)
- 26–October 2. **Diophantische Approximationen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)
- 27–28. **Workshop on Large Eddy Simulation in Aerodynamics and the Environment**, Université de Montréal. (Jan. 1993, p. 63)
- 27–October 1. **Orbites Périodiques des Systèmes Dynamiques**, CIRM, Marseille, France. (Jan. 1993, p. 63)
- 27–October 1. **Fourth Conference on Discrete Mathematics**, University of Potsdam, Germany. (Mar. 1993, p. 284)
- 28–October 1. **CIRM Workshop on Algebraic Vector Bundles and Applications**, Trento, Italy. (Apr. 1993, p. 413)
- 28–October 2. **Second Conference on Nonlinear Problems of Differential Equations and Mathematical Physics**, Kiev, Ukraine. (May/Jun. 1993, p. 511)
- 29–October 1. **Nonlinear Analysis and Mathematical Economics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 706)
-
- ### October 1993
- October 1993. **Mathematica Seminar**, The New Cannought Rooms in Covent Gardens, London, England. (Jul./Aug./ 1993, p. 706)
- 1–2. **Methods in Module Theory: 1993**, University of Colorado, Colorado Springs, CO. (Jul./Aug. 1993, p. 706)
- 1–3. **Joint Meeting with the Deutsche Mathematiker-Vereinigung e.V.**, University of Heidelberg, Heidelberg, Germany.
- INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.
- 2–3. **Wabash Modern Analysis Miniconference**, Indiana University, Bloomington, IN. (Jul./Aug. 1993, p. 706)
- 3–9. **Arbeitsgemeinschaft mit Aktuellem Thema**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)
- 4–6. **Second International Conference of the ACPC (Austrian Center for Parallel Computation)**, Gmunden (near Salzburg), Austria. (Mar. 1993, p. 284)
- 4–6. **Workshop on Continuous Algorithms and Complexity**, Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain. (May/Jun. 1993, p. 511)
- 4–6. **Moduli Spaces, Galois Representations, and L-Functions**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 706)
- 6–8. **Games, Logic, and Process**, CIRM, Marseille, France. (Jan. 1993, p. 63)
- 6–8. **Symposium on Quantifier Elimination and Cylindrical Algebraic Decomposition**, Linz, Austria. (Jul./Aug. 1993, p. 706)
- *6–8. **Second Great Lakes Symposium**, Kalamazoo, MI.
- INVITED SPEAKERS: *Partial list*: T. Hettmansperger, R. Hogg, S. Lemeshow, I. Olkin, D. Salsburg, C. Sampson, R. Spoeri.
 INFORMATION: M.R. Stoline, Dept. of Math. and Stats., Western Michigan U., Kalamazoo, MI 49008-5152; 616-387-4540; fax 616-357-4530; morrison@wmich.edu.
- 6–9. **Second IMACS International Conference on Computational Physics**, Parks College of St. Louis University, Cahokia, Illinois. (Feb. 1993, p. 186)
- 8–9. **Twenty-first Annual Mathematics and Statistics Conference on the Teaching and Learning of Undergraduate Mathematics**, Miami University, Oxford, OH. (May/Jun. 1993, p. 511)
- *9–11. **Second Workshop on Case Studies of Bayesian Statistics in Science and Technology**, Pittsburgh, PA.
- PROGRAM: Participants will present and discuss in depth a select set of substantial applications of Bayesian statistics to problems in science and technology.
 INFORMATION: R. Kass, Bayes Worksho, Dept. of Stats., Carnegie Mellon U., Pittsburgh, PA 15213-3890; e-mail kass@stat.cmu.edu; 412-268-2718; fax 412 268-7828.
- 9–12. **Semi-annual Regional Workshop in Dynamical Systems and Related Topics**, Penn State University, State College, PA. (Jul./Aug. 1993, p. 706)
- 10–16. **Invariant Ordering in Geometry and Algebra**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 186)
- 10–16. **Adaptive Methoden für Partielle Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 186)
- 11–14. **Gestion de Projets Statistiques**, CIRM, Marseille, France. (Jan. 1993, p. 63)
- 14–17. **International Symposium on Integration Algorithms for Classical Mechanics**, The Fields Institute, Waterloo, Ontario, Canada. (Jul./Aug. 1993, p. 707)
- 14–20. **Wavelets: Theory, Algorithms, and Applications**, Taormina, Sicily, Italy. (Apr. 1993, p. 413)
- 15–16. **Thirteenth Meeting of the Southeastern-Atlantic Regional Conference on Differential Equations**, University of North Carolina at Wilmington, Wilmington, NC. (May/Jun. 1993, p. 512)
- 15–16. **Fifteenth Midwest Probability Colloquium**, Evanston, IL. (May/Jun. 1993, p. 512)
- 15–17. **Second International Conference on Ordinal Data Analysis**, University of Massachusetts, Amherst, MA. (Mar. 1993, p. 284)

Meetings and Conferences

16. **The Midwest Group Theory Seminar**, University of Chicago. (Jul./Aug. 1993, p. 707)
16. **Mathematica Seminar**, Frankfurt University, Frankfurt, Germany. (Jul./Aug. 1993, p. 707)
- 17–20. **Workshop on Application Specific Symbolic Techniques in High Performance Computing Environments**, The Fields Institute, Waterloo, Ontario, Canada. (Jul./Aug. 1993, p. 707)
- 17–23. **Geometrie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)
- 18–20. **Workshop on Coding, System Theory, and Symbolic Dynamics**, Boston area. (Apr. 1993, p. 414)
- 18–20. **Mathematical Analysis of Phenomena in Fluid and Plasma Dynamics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 707)
- 18–20. **Mathematical Topics in Biology**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 707)
- 18–20. **1993 MATLAB Conference**, Cambridge, MA. (Jul./Aug. 1993, p. 707)
- 18–22. **Sixth International Congress on Biomathematics**, Universidad de Costa Rica, San Jose, Costa Rica. (Jul./Aug. 1993, p. 708)
- 18–22. **IMA Workshop on Finite Markov Chain Renaissance**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 63)
- 19–22. **1993 International Conference on Network Protocols (ICNP-93)**, San Francisco, CA. (Jan. 1993, p. 63)
- 19–22. **Analytic Number Theory**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 708)
- 20–22. **Stage de Bibliothécaires de Mathématiques**, CIRM, Marseille, France. (Jan. 1993, p. 63)
- 20–22. **1993 IEEE Workshop on VLSI Signal Processing**, Koningshof, Veldhoven, The Netherlands. (May/Jun. 1993, p. 512)
- 21–24. **Hirsch Symposium. A Special Midwest Dynamical Systems Seminar in Honor of Professor Morris Hirsch's Sixtieth Birthday**, University of California, Berkeley, CA. (Jul./Aug. 1993, p. 708)
22. **Mathematica Seminar**, Esiee School, Paris, France. (Jul./Aug. 1993, p. 708)
- 22–23. **Second Symposium on Matrix Analysis and Applications—A Look at Recent Developments**, Western Michigan University, Kalamazoo, MI. (Jul./Aug. 1993, p. 708)
- 22–23. **Central Section**, Texas A&M University, College Station, Texas.
- INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.
- *24–25. **Symposium in Memory of Ilya Bakelman (1928–1992)**, Texas A&M University, College Station, TX.
- INFORMATION: S. Taliaferro, Mathematics Department, Texas A&M University, College Station, TX 77843-3368; e-mail memorial@math.tamu.edu.
- *24–27. **Functional Analysis on the Eve of the Twenty-first Century, in Honor of the Eightieth Birthday of Israel M. Gelfand**, Rutgers University, New Brunswick, NJ. (Please note additional information to Apr. 1993, p. 414)
- PROGRAM: The program will consist of hour talks by invited speakers.
- INVITED SPEAKERS: *Final List*: K. Aomoto, A. Connes, I. Frenkel, M. Gromov, L. Jeffrey, M. Jimbo, M. Kapranov, D. Kazhdan, M. Kontsevich, B. Kostant, G. Lusztig, R. MacPherson, O. Mathieu, C. Moeglin, A. Polyakov, I. Singer, E. Witten, S.-T. Yau, and A. Zamolodchikov.
- SUPPORT: A limited amount of funding from the National Science Foundation and the Sloan Foundation is available for support of young investigators. Women, minorities, and young investigators are especially encouraged to attend. The deadline for applications for support is September 24, 1993, and for hotel reservations is September 30, 1993.
- INFORMATION: M.A. Jablonski, Administrative Asst., Gelfand Conference, Rutgers, Dept. of Math., Hill Center, Busch Campus, New Brunswick, NJ 08903; e-mail gelfand@math.rutgers.edu; 908-932-3921; fax 908-932-5530.
- 24–30. **Mengenlehre**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 186)
- 25–26. **Visualization '93 Symposia**, San Jose, CA. (May/Jun. 1993, p. 512)
- 25–27. **The State of the Art in Numerical Algorithms and Their Prospects**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 708)
- 25–27. **Second International Conference and Workshop on Approximations and Numerical Methods for the Solution of the Maxwell Equations**, Washington, DC. (Jul./Aug. 1993, p. 708)
- 25–29. **Third SIAM Conference on Geometric Design**, Seattle, WA. (Jul./Aug. 1992, p. 632)
- 27–29. **Mathematical Methods for Wave Phenomena in Fluids and Their Application**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)
- 27–30. **Seventh International Conference on Domain Decomposition Methods**, Penn State University, State College, PA. (Oct. 1992, p. 950)
- 27–30. **Joint U.S.-Italian Conference on Hilbert Functions**, MSI, Ithaca, NY. (Jul./Aug. 1993, p. 709)
- 28–30. **NSF National Conference on Diversity in the Scientific and Technological Workforce**, Washington, DC. (Jul./Aug. 1993, p. 709)
- 29–30. **1993 Mathematical Sciences Department Chairs Colloquium**, Arlington, VA. (Jul./Aug. 1993, p. 709)
31. **Tutorial on Data Reduction and Decomposition Techniques for Curves and Surfaces. (May/Jun. 1993, p. 512)**
31. **Tutorial on NURBS**, Tempe, AZ. (May/Jun. 1993, p. 512)
- 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. (Dec. 1992, p. 1284)
- 3–5. **The Eighth International Symposium on Computer and Information Sciences, ISCIS VIII**, Antalya, Turkey. (Jul./Aug. 1993, p. 709)
- 4–6. **Study of Structures of Solutions to P.D.E.**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)
- 6–7. **Western Section**, Harvey Mudd College, Claremont, CA.
- INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.
- 8–10. **Spectral and Scattering Theory and Related Topics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)
- 9–12. **Singularities of Holomorphic Vector Fields and Related Topics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)
- 12–13. **Eighth Annual Pi Mu Epsilon Regional Undergraduate Mathematics Conference**, St. Norbert College, De Pere, WI. (Jul./Aug. 1993, p. 709)
- 12–14. **Twenty-second Midwest Differential Equations Conference**, University of Missouri, Columbia, MO. (Jul./Aug. 1993, p. 709)
- *13. **New York Graph Theory Day Twenty-six**, Bard College, NY.

ORGANIZING COMMITTEE: P. Dolan, M. Halsey, J.W. Kennedy.

INVITED SPEAKERS: M.B. Cozzens, Northeastern U. and NSF, Stability measures and data fusion networks, some interesting problems; F.S. Roberts, Rutgers U., Choosability and amenability in graph coloring.

INFORMATION: P. Dolan, Math. Dept., Bard

College, Annandale-on-Hudson, NY 12504; 914-758-6822; gtd26@levy.bard.edu.

- 15-17. **Representation Theory of Finite Groups and Algebras**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)
- 15-19. **IMA Workshop on Random Discrete Structures**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 63)
- 15-19. **Systèmes d'Équations Algébriques**, CIRM, Marseille, France. (Jan. 1993, p. 63)
- 15-19. **Supercomputing '93**, Portland, Oregon. (May/Jun. 1993, p. 513)
- 17-19. **European Symposium on Numerical Methods in Electromagnetics**, Toulouse, France. (Jul./Aug. 1993, p. 709)
- 17-19. **Research on Algebraic Combinatorics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)
- *18-21. **Nineteenth Annual Conference of the American Mathematical Association of Two Year Colleges (AMATYC)**, Boston, MA.

PROGRAM: The title and theme of the conference is "The American (Mathematical) Revolution". Many of the conference sessions are appropriate for high school teachers and undergraduate professors from four-year colleges and universities. There will be over 150 conference sessions, including lectures, workshops, and minicourses.

CONFERENCE TOPICS: Calculus/precalculus, developmental math, pedagogy, assessment/placement, math for the fun of it/enrichment, statistics, NCTM Standards, technology, and others. Technology and its applications to the mathematics classroom is a featured topic. The NCTM Standards is offered as a topic for the first time ever.

INFORMATION: J. Keating, Massasoit Community College, Brockton, MA, or H. Savicki, Dean Junior College, Franklin, MA.

- 21-27. **Mathematische Modelle in der Biologie**, Oberwolfach, Federal Republic of Germany. (Mar. 1992, p. 251)
- 22-26. **Géométrie Symplectique et Physique Mathématique**, CIRM, Marseille, France. (Jan. 1993, p. 63)
- *22-26. **Algebraic Combinatorics**, Kyushu University, Fukuoka, Japan.

PROGRAM: This is an international conference intended as a forum for researchers in the area of algebraic combinatorics in the widest sense. Emphasis will be placed on interdisciplinary research relating algebraic combinatorics with other branches of mathematics. The program of the conference consists of invited lectures and seminar talks (possibly parallel). Seminar talks are also by invitation, so please submit

a summary (at least one page and no more than three pages) by mid-October 1993.

ORGANIZING COMMITTEE: E. Bannai, chair; M. Yamada, vice-chair and secretary; A. Munemasa.

CONFERENCE TOPICS: Association schemes; algebraic theory of graphs, designs, and codes; finite groups and finite geometries; spin models and invariants of links; quadratic forms and integral lattices.

INVITED SPEAKERS: M. Aschbacher, A. Brouwer, T. Deguchi, C. Godsil, A.A. Ivanov, F. Jaeger, W. Kantor, H. Koch, T. Kohno, R. Liebler, D. Ray-Chaudhuri, N. Robertson, J. Seidel, N. Singhi, N. Sloane, D. Stanton, P. Terwilliger, B. Venkov, M. Wakimoto, Z. Wan.

INFORMATION: Contact the organizers at the Dept. of Math., Faculty of Science, Kyushu U., 6-10-1 Hakozaki, Higashi-ku, Fukuoka 812 Japan; tel (81) 92-641-1101; fax (81) 92-632-2737; e-mail d75411a@kyu-cc.cc.kyushu-u.ac.jp (Bannai); yamada@math.sci.kyushu-u.ac.jp (Yamada); munemasa@math.sci.kyushu-u.ac.jp (Munemasa).

22-27. **Géométrie Symplectique**, Marseille, France. (Feb. 1993, p. 187)

24-26. **Theory and Applications in Computer Algebra**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

28-December 4. **Nonlinear Equations in Many-Particle Systems**, Oberwolfach, Federal Republic of Germany. (Mar. 1992, p. 251)

December 1993

1-3. **Linear Operators and Inequalities**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

1-4. **Joint Meeting with the Sociedad Matemática Mexicana**, Merida, Yucatan, Mexico.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

*2-5. **First Belgian-French Meeting on PDE**, Han-sur-Lesse, Belgium.

PROGRAM: The purpose of this conference is to promote communication between specialists in partial differential equations from Belgium and France.

INVITED SPEAKERS: Preliminary/Partial: S. Albeverio, Bochum; W. Arendt, Besancon, Ph. Benilan, Besancon; J.E. Bouillet, Buenos Aires; I. Cioranescu, Puerto Rico; Ph. Clement, Delft; J.P. Gossez, Bruxelles; A. Haraux, Paris; M. Hieber, Zurich; W. Jager, Heidelberg; E. Lami Dozo, Buenos Aires; J. Lopez-Gomez, Madrid; G. Lumer, Mons; J. Mawhin, Louvain-la-Neuve; F.

Neubrandner, Baton Rouge; S. Nicaise, Valenciennes; L. Paquet, Mons; J. Van Casteren, Antwerpen; E. Zeidler, Leipzig.

SUPPORT: Financial support is being provided by the EEC project "Evolutionary Systems", the French CNRS, the Belgian FNRS, and the Univ. of Mons (project 1002).

INFORMATION: G. Lumer (Belgian-French PDE Meeting), Institut de Math. et d'Informatique, U. de Mons, 20, Place du Parc, B-7000 MONS, Belgium; sdouf@bmsuem11; telefax 32-65-373054; tel 32-65-373507.

5-9. **1993 International Symposium on Nonlinear Theory and its Applications (NOLTA '93)**, Hawaii. (Apr. 1993, p. 414)

5-11. **Dynamical Zeta Functions**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 187)

5-11. **Model Selection**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 187)

6-10. **International Congress on Modelling Simulation, 1993**, University of Western Australia, Perth. (Feb. 1993, p. 187)

8-10. **Mathematical Structure of Optimization Theory**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

8-11. **International Conference on Vistas in Modern Applied Mathematics**, Goa University, Goa, India. (Jul./Aug. 1993, p. 710)

12-18. **General Principles of Discretization Algorithms, Theory, and Applications**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 187)

12-18. **Methoden und Verfahren der Mathematischen Physik**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 187)

13-15. **Fourth IMA Conference on Cryptography and Coding**, Cirencester, UK. (Jul./Aug. 1993, p. 710)

*13-17. **Statistics in Ecology and Environmental Monitoring**, Dunedin, New Zealand.

PROGRAM: In addition to invited and contributed papers, there will be a number of workshop-style sessions with two themes: modeling ecological populations and environmental monitoring.

INVITED SPEAKERS: R. Cormack (Scotland), R. Green (Canada).

INFORMATION: Centre for Applications of Stats. and Math., Univ. of Otago, P.O. Box 56, Dunedin, New Zealand; tel. (03) 479 7774; fax (03) 479 8427; e-mail casm@math.otago.ac.nz.

15-17. **Groups and Related Topics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

January 1994

- January–June 1994. **A Semester at CRM: Bifurcations and the Geometry of Vector Fields**, Université de Montréal. (Jan. 1993, p. 63)
- 2–5. **Third International Symposium on Artificial Intelligence and Mathematics**, Fort Lauderdale, FL. (Jul./Aug. 1993, p. 710)
- 2–8. **Modelltheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)
- * 3–14. **Joint Workshop on Computational Aspects of Geometric Group Theory I**, The Geometry Center of the University of Minnesota, Minneapolis, MN.

PROGRAM: The workshop will focus on problems of practical computation in geometric group theory.

ORGANIZING COMMITTEE: G. Baumslag, CUNY; D. Epstein, U. of Warwick; R. Gilman, Stevens Inst. of Tech.; H. Short, CUNY; C. Sims, Rutgers U.

INVITED SPEAKERS: D. Bayer, J.W. Cannon, J.J. Cannon, W.J. Floyd, D. Grayson, G. Havas, D. Holt, C.F. Miller III, R. Needham, J. Neubueser, M.F. Newman, E.A. O'Brien, S.E. Rees, I. Rivin, M. Schoenert, M. Stillman, W.P. Thurston.

INFORMATION: R. Gilman, Dept. of Math., Stevens Institute of Technology, Hoboken, NJ 07030; 201-216-5425 or 201-216-5448; rgilman@vaxc.stevens-tech.edu.

- 4–7. **International Symposium on Visco-Elastic Fluids**, Tobago (In the Republic of Trinidad and Tobago). (Feb. 1993, p. 187)
- 4–8. **International Conference on Harmonic Analysis and Operator Theory**, Caracas, Venezuela. (Jan. 1993, p. 64)
- 4–9. **An International Conference on Mathematical Analysis and Signal Processing**, Cairo University, Egypt. (Jul./Aug. 1993, p. 710)
- 5–7. **Semigroup Theory**, Hobart, Tasmania, Australia. (Feb. 1993, p. 187)
- * 5–9. **Twentieth Holiday Mathematics Symposium**, New Mexico State University, Las Cruces, NM.

PROGRAM: C.H. Taubes will give approximately ten lectures on analytical gauge theory. There will also be informal talks and sessions for contributed papers. The deadline for submission of abstracts of contributions is November 30, 1993.

INFORMATION: R.E. Staffeldt, Dept. of Math. Sci., New Mexico State U., Las Cruces, NM 88003; ross@nmsu.edu.

- 9–15. **Algebraic Combinatorics: Association Schemes and Representation Theory**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)
- 10–12. **Nonlinear Partial Differential Equa-**

tions, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

12–15. **Joint Mathematics Meetings**, Cincinnati, OH (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

16–22. **Gruppentheorie (Permutationsgruppen)**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 710)

17–19. **Structure and Statistical Law of Turbulence**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

23–25. **Fifth Annual ACM-SIAM Symposium on Discrete Algorithms**, Arlington, VA. (May/Jun. 1993, p. 513)

23–29. **Singulare Integral- und Pseudo-Differential-Operatoren und Ihre Anwendungen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

24–28. **IMA Workshop on Mathematical Population Genetics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

24–28. **Complex Analysis on Hyperbolic 3-manifolds**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 711)

* 25–29. **Sixth Benin International Conference on Scientific Computing**, University of Benin City, Nigeria.

CONFERENCE TOPICS: Ordinary and partial differential equations; DAEs; computational fluid dynamics; continuous optimization; automatic differentiation; mathematical packages and numerical software; software engineering; large scale computing.

INFORMATION: J. Pryce, Conference Co-director, Software Engineering Group, RMCS, Shrivenham, Swindon, SN6 8LA; e-mail pryce@uk.ac.cranfield.rmcs.

30–February 5. **Nichtstandardanalysis und Anwendungen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

February 1994

February 1994. **Workshop on Dynamical Disease**, Laurentian Mountains north of Montréal. (Jan. 1992, p. 64)

2–4. **IMACS Symposium on Mathematical Modelling**, Vienna, Austria. (Jul./Aug. 1993, p. 711)

6–12. **C^* -Algebren**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

7–11. **Differential Geometry, Hamiltonian Systems, and Operator Theory**, University

of the West Indies, Mona, Jamaica. (Jul./Aug. 1993, p. 711)

13–19. **Funktionentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

* 18–23. **Section A (Mathematics) Sessions at the AAAS Annual Meeting**, San Francisco, CA

INFORMATION: American Association for the Advancement of Science, 1333 H St., NW, Washington, DC 20005; 202-326-6400.

20–26. **Harmonische Analyse und Darstellungstheorie Topologischer Gruppen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

27–March 5. **Mathematical Economics**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

28–March 4. **IMA Workshop on Stochastic Networks**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

March 1994

6–12. **Mathematische Stochastik**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

* 7–11. **Twenty-fifth Southeastern International Conference on Combinatorics, Graph Theory, and Computing**, Florida Atlantic University, Boca Raton, FL.

PROGRAM: This conference brings together mathematicians interested in combinatorics, graph theory, computing, and their interactions. It also aims to promote better understanding of modern applied mathematics, combinatorics, and computer science.

INVITED LECTURERS: P. Erdős, Hungarian Academy of Sciences; R. Graham, Bell Labs; W. Mills, Inst. for Defense Analyses; R. Mullin, U. of Waterloo; R. Stanton, U. of Manitoba; J. Thompson, U. of Florida.

CALL FOR PAPERS: There will be fifteen-minute sessions for contributed papers. Submit the title and an abstract by February 16, 1994. The abstracts must include the title of the paper on the first line, the author's name and institution on the second line, and be 10–20 lines in length.

INFORMATION: Florida Atlantic Univ., College of Science, Dept. of Math., P.O. Box 3091, Boca Raton, FL 33431; 407-367-3341.

7–25. **Workshop on Fluid Mechanics**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 711)

13–19. **Elementare und Analytische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

Meetings and Conferences

- *17–19. **Seminar on Stochastic Processes 1994**, Texas A&M University, College Station, TX.

PROGRAM: The meeting has traditionally been devoted (but not limited) to Markov processes, stochastic analysis, Brownian motion, potential theory, and superprocesses.

INVITED SPEAKERS: K. Burdzy, U. of Washington; T. Kurtz, U. of Wisconsin; C. Neuhauser, U. of Wisconsin; E. Pardoux, U. de Provence, Marseille; J. Walsh, U. of British Columbia.

CALL FOR PAPERS: Several sessions with informal 10–15 minute talks will also be held.

SUPPORT: Some funds have been requested to support the travel of minorities, women, recent Ph.D.s, graduate students, and others who may need help in this respect.

INFORMATION: E. Toby, Dept. of Math., Texas A&M Univ., College Station, TX 77843; 409-845-1650; fax 409-845-6028; e-mail toby@math.tamu.edu.

- 18–19. **Southeastern Section**, University of Kentucky, Lexington, Kentucky.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

- 20–26. **Regelungstheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

- 21–25. **IMA Period of Concentration: Stochastic Problems for Nonlinear Partial Differential Equations**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (May/June 1993, p. 513)

- *21–25. **Symplectic Geometry of Moduli Spaces**, CIRM, Marseille/Luminy.

ORGANIZERS: J. Huebschmann (Lille I) and A. Weinstein (Berkeley).

INFORMATION: CIRM-Luminy, Case 916, 13288 Marseille cedex 9; tel 91 83 30 00; fax 91 41 27 86; or J. Huebschmann, USTL, UFR de Math., F-59 655 Villeneuve d'Ascq cedex; tel 20 43 42 33; huebschm@gat.citilille.fr.

- *22–24. **The Rhine Workshop on Computer Algebra**, Karlsruhe, Germany.

PROGRAM: The two main purposes are to offer an opportunity to young researchers and newcomers to present their work and to be a regional forum for researchers in this field.

WORKSHOP CHAIR: J. Calmet, Karlsruhe.

LOCAL ORGANIZER: K. Homann, Karlsruhe.

WORKSHOP TOPICS: The topics are intended to cover all aspects of computer algebra from theory to applications.

CALL FOR PAPERS: Send four copies of either a full paper or a four-page abstract to

the workshop chair. Deadline for submission: November 15, 1993.

INFORMATION: J. Calmet, Univ. of Karlsruhe, Am Fasanengarten 5, Postfach 6980, D-76128 Karlsruhe, Germany; e-mail calmet@dkauni2.bitnet; +49/ (0)721-608 4208; fax +49/ (0)721-696 893.

- 25–26. **Central Section**, Kansas State University, Manhattan, KS.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

- 27–April 2. **Algebraische Gruppen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

- 27–April 2. **Endliche Modelltheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

- 28–30. **Moduli Spaces, Galois Representations, and L-functions**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 711)

- 28–31. **Twenty-fifth Annual Iranian Mathematics Conference**, Sharif University of Technology, Tehran, Iran. (Jul./Aug. 1993, p. 711)

- *31–April 2. **Mathematical Approaches to the Study of Nonlinear Materials**, Fayetteville, Arkansas.

PRINCIPAL SPEAKER: D. Kinderlehrer, Carnegie Mellon U.

INVITED SPEAKERS: J. Ball, A. De Simone, L.C. Evans, I. Fonseca, R. Hardt, R. James, F.-H. Lin, M. Luskin, L. Ma, S. Muller, R. Nicolaides, L. Tartar, N. Walkington.

CALL FOR PAPERS: Contributed papers should be submitted before February 15, 1994.

INFORMATION: X. Xu or I. Monroe, Dept. of Math. Sciences, SCEN 301, Univ. of Arkansas, Fayetteville, AR 72701.

April 1994

- 3–9. **Arbeitsgemeinschaft Mit Aktuellem Thema (wird in den Mitteilungen der DMV Heft 1/1994 Bekanntgegeben)**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

- 5–9. **MEGA-94, The Third International Symposium on Effective Methods in Algebraic Geometry**, Santander, Spain. (Jul./Aug. 1993, p. 711)

- 5–11. **Effective Methods in Algebraic Geometry (MEGA '93)**, Santander, Spain. (Mar. 1993, p. 286)

- 5–15. **Instructional Conference on Harmonic Analysis and Partial Differential Equations**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jul./Aug. 1993, p. 711)

- 8–9. **Mathematical Breakthroughs in the Twentieth Century**, The State University of

New York at Farmingdale, NY. (Jul./Aug. 1993, p. 712)

- 9–10. **Eastern Section**, Polytechnic University, Brooklyn, NY.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

- 10–16. **Numerical Linear Algebra with Applications**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

- 17–22. **International Conference on New Trends in Computer Science I (NETCOMS I)**, University of Ibadan, Nigeria. (Please note date change from Nov. 1992, p. 1121)

- 17–23. **Designs and Codes**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

- *18–20. **Conference on Emerging Issues in Mathematics and Computation from the Materials Sciences**, Pittsburgh, PA.

ORGANIZER: D. Kinderlehrer, Carnegie Mellon U.

CALL FOR PAPERS: Abstract deadline: October 12, 1993.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; fax 215-386-7999; e-mail meetings@siam.org.

- 24–30. **Geschichte der Mathematik**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

- *25–29. **Third International Conference on p-adic Functional Analysis**, Clermont-Ferrand, France.

INVITED SPEAKERS: *Preliminary*: Spain: J. Araujo, J.M. Bayod, C. Perez Garcia, P.Telleria; France: A. Boutabaa, G. Christol, B. Diarra, A. Escassut, Y. Feneyrol-Perrin, L. Haddad, M.C. Sarmant; Belgium: N. de Grande de Kimpe; The Netherlands: L. Van Hamme, S. Oortwijn, A.C.M. Van Rooij, W. Schikhof; Greece: A.K. Katsaras; Russia: A. Khrennikov, I. Volovich; Chile: S. Navarro Hernandez; Brazil: J. Prolla; U.S.: L. Narici; India: G. Rangan; Switzerland: A. Robert, M. Zuber.

INFORMATION: Universite Blaise Pascal, Mathematiques Pures, Clermont-Ferrand, Complexe Scientifique des Cezeaux, 63177 Aubiere Cedex, France; tel (33)73407070; fax (33)73407064; e-mail puremath@ucfma.univ-bpclermont.fr.

May 1994

- 1–7. **Gruppentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

- 1–7. **Linear Operators and Application**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 712)

- 2–6. **IMA Workshop on Image Models (and**

Meetings and Conferences

- Their Speech Model Cousins**), Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)
- 2–6. **International Conference on Topological Vector Spaces, Algebras, and Related Areas**, McMaster University, Hamilton, Ontario, Canada. (Mar. 1993, p. 286)
- *3–14. **The Fourth International School on Differential Equations: Bifurcations and Chaos**, Katsiveli, Crimea, Ukraine.
- PROGRAM: The program traditionally includes the presentation of the latest achievements of the scientists of the former Soviet Union and other countries in chaotic dynamics and bifurcation phenomena; structures and chaos in differential and difference equations; nonlinear phenomena in electronics, communication systems, optics, information processing, neural networks, etc.; mathematical models of complex behavior in hydrodynamics, biophysics, medicine, chemistry, economics, etc. The program will consist of invited two-hour lectures (two morning lectures each working day) and afternoon seminars. Official language of the school is English.
- INFORMATION: Yu. Maistrenko, Inst. of Math., Academy of Sciences of Ukraine, 3, Tereshchenkivska st., 252601 Kiev, Ukraine; fax (044) 225-20-10; mathem@sovamsu.sovusa.com; or A. Dmitriev, Inst. of Radioengineering and Electronics Academy of Sciences of Russia, 11, Mohovaya st., 121609 Moscow, Russia; fax (095) 203-84-14; e-mail dmitr@ire.uucp.free.msk.su.
- 8–14. **Variationsrechnung**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 14–18. **International Congress Henri Poincaré**, Archives-Centre d'Etudes et de Recherche Henri-Poincaré, Nancy, France. (Jul./Aug. 1993, p. 712)
- 15–21. **Critical Phenomena in Spatial Stochastic Models**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 16–20. **IMA Workshop on Stochastic Models in Geosystems**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)
- 16–20. **Géométrie Algébrique**, CIRM, Marseille, France. (Jan. 1993, p. 64)
- 16–27. **Workshop on Commutative Algebra and its Relation to Combinatorics and Computer Algebra**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 712)
- 22–24. **Conference in Honor of E. Dynkin**, MSI, Ithaca, NY. (Jul./Aug. 1993, p. 712)
- *22–27. **Nonlinear Analysis, Function Spaces, and Applications, V**, Prague, Czech Republic.
- PROGRAM: There will be time for informal discussions, possibly a poster session, or a limited number of short communications.
- INVITED SPEAKERS: F. Chiarenza, Catania; D.E. Edmunds, Sussex; B. Kawohl, Erlangen; F.J. Martin-Reyes, Malaga; E. Sawyer, Hamilton; V.D. Stepanov, Khabarovsk; G. Talenti, Firenze; R.L. Wheeden, New Brunswick.
- INFORMATION: A. Kufner, chair, Inst. of Math. of the Czech Academy of Sciences, Zitna 25, 115 67 Praha 1, Czech Republic; e-mail kufner@csearn.bitnet.
- 22–28. **Diskrete Geometrie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)
- *23–25. **Twenty-sixth Symposium on Theory of Computing (STOC)**, Montreal, Canada.
- CONFERENCE TOPICS: Algorithms and data structures, computability and complexity, computational geometry, on-line computing, cryptography, databases, machine learning, algorithmic graph theory, parallel and distributed computation, probabilistic computations, computer architecture, and robotics.
- CALL FOR PAPERS: Submit 15 copies of an extended abstract to the address below by November 16, 1993.
- INFORMATION: M. Goodrich, Dept. of Comp. Science, Johns Hopkins U., Baltimore, MD 21218-2694.
- 24–27. **Conference on Hermann G. Graßmann (1809–1877)**, Isle of Rügen, Germany. (September 1992, p. 775)
- *24–28. **International Workshop on Mathematical Methods and Tools in Computer Simulation**, St. Petersburg State University, St. Petersburg, Russia.
- PROGRAM: The aim of the conference is to bring together scientists and practitioners who are involved in the development and use of efficient mathematical methods, computational algorithms, and software tools in computer simulation. Presentations, demonstrations, and exhibits concerning all areas of modeling and computer simulation are expected to be present at the workshop.
- ORGANIZERS: S.M. Ermakov, Russia; V.V. Kalashnikov, Russia; B. Nelson, U.S.; C.H. Cheng, UK.
- CONFERENCE TOPICS: Mathematical tools in the foundation of systems modelling and simulation, mathematical models for discrete and continuous systems simulation, methods for simulation of random values and processes, variance reduction techniques, statistical methods in simulation, optimization methods in simulation, mathematical modelling and simulation algorithms and software tools.
- CALL FOR PAPERS: Abstracts deadline: January 30, 1994.
- INFORMATION: S.M. Ermakov, Faculty of Math. and Mechanics, St. Petersburg State Univ., Bibliotchnaya sq. 2, Petrodvoretz, St. Petersburg 198904, Russia; fax (7-812) 428 6649 or 428 7039; e-mail statmod@hqmath.lgu.spb.su.
- *25–28. **Second Conference on Function Spaces**, Southern Illinois University at Edwardsville, Illinois.
- PROGRAM: Topics will include function algebras, spaces of analytic functions, L^p spaces, spaces of vector valued functions, and others.
- INVITED SPEAKERS: J. Arazy, R. Aron, S. Axler, M. Cambern, J. Diestel, P. Enflo, T.W. Gamelin, K.B. Laursen, M. Neumann, A. Pelczynski, R. Rochberg, W. Rudin, L. Tzafriri, J. Wermer, W. Zelazko.
- INFORMATION: K. Jarosz, Dept. of Math. & Stats., Southern Illinois Univ. at Edwardsville, Edwardsville, IL 62026; 618-692-2354; fax 618-692-3174; e-mail cj01@siuemus.bitnet.
- 26–29. **ICANN '94-International Conference on Artificial Neural Networks**, Sorrento Congress Center, near Naples, Italy. (Jul./Aug. 1993, p. 712)
- 29–June 3. **International Conference on Real and Complex Algebraic Geometry**, Soesterberg, The Netherlands. (Jul./Aug. 1993, p. 712)
- 29–June 4. **Singulare Störungsrechnung**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)
- 29–June 4. **Workshop on Harmonic Analysis, Oscillatory Integrals, and Partial Differential Equations**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jul./Aug. 1993, p. 713)
- 30–June 3. **On the Interaction between Functional Analysis, Harmonic Analysis, and Probability**, University of Missouri-Columbia, Columbia, MO. (Jul./Aug. 1993, p. 713)
- 30–June 9. **Workshop on Group Representation Theory**, Technion, Israel Institute of Technology, Haifa, Israel. (Dec. 1992, p. 1284)
- 31–June 3. **IMA Minisymposium on Phase Transitions in Catalytic Surface Reaction Models**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

June 1994

- 1–7. **1994 Barcelona Conference on Algebraic Topology**, Sant Feliu de Guixols (near Barcelona, Spain). (Jan. 1993, p. 64)
- 5–11. **The Navier-Stokes Equations: Theory and Numerical Methods**, Oberwolfach, Germany. (Jul./Aug. 1993, p. 713)

Meetings and Conferences

12–18. **Nichtlinearitäten vom Hysteresistyp**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

13–17. **Fifth International Conference on Hyperbolic Problems: Theory, Numerical Methods, and Applications**, Stony Brook, NY. (May/June. 1992, p. 497)

13–17. **European Conference on Elliptic and Parabolic Problems**, Pont-à-Mousson, France. (May/June. 1993, p. 514)

Summer 1994. **Summer Regional Centers—TRANSIT**, Ohio State University, Columbus, OH. (Oct. 1992, p. 951)

13–17. **IMA Workshop on Classical & Modern Branching Processes**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

* 15–18. **Fifth SIAM Conference on Applied Linear Algebra**, Snowbird, Utah.

ORGANIZER: B.N. Parlett, UC Berkeley.

CALL FOR PAPERS: Abstract deadline: December 6, 1993.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; fax 215-386-7999; e-mail meetings@siam.org.

16–18. **Western Section**, University of Oregon, Eugene, Oregon.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

19–25. **Quantenmechanik von Vielteilchen Systemen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

19–25. **Integrable Systems from a Quantum Point of View**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

20–24. **Probabilités Quantiques**, CIRM, Marseille, France. (Jan. 1993, p. 64)

* 20–24. **IMA Workshop on Mathematics in Manufacturing Logistics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN.

INFORMATION: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church St., S.E., Minneapolis, MN 55455.

* 22–25. **Seventh SIAM Conference on Discrete Mathematics**, Albuquerque, NM.

ORGANIZER: W.T. Trotter, Bellcore.

CALL FOR PAPERS: Abstract deadline: December 20, 1993.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; fax 215-386-7999; e-mail meetings@siam.org.

25–July 2. **Symposium on Diophantine Prob-**

lems in Honor of Wolfgang Schmidt's 60th Birthday, Boulder, Colorado. (May/June. 1993, p. 514)

26–July 2. **Graphentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

26–July 2. **Inverse Problems**, Lake St. Wolfgang, Austria. (May/June. 1993, p. 514)

July 1994

* 2–8. **Fourth Conference of the Canadian Number Theory Association**, Dalhousie University, Halifax, Nova Scotia, Canada.

PROGRAM: In addition to 8–10 invited plenary talks, there will be parallel sessions in the three featured areas with a total of about 25 invited talks, as well as sessions for contributed papers.

CONFERENCE TOPICS: Analytic, algebraic, and computational number theory.

INVITED SPEAKERS: E. Bach, Wisconsin; J. Beck, Rutgers; A. Bremner, Arizona State; J. Buchmann, Saarbrücken; J. Friedlander, Toronto; D. Goldfeld, Columbia; A. Granville, Georgia; J. Hoffstein, Brown; H. Iwaniec, Rutgers; N. Koblitz, Washington; M. Kolster, McMaster; A. Lenstra, Bellcore; K. McKurley, Sandia; Y. Motohashi, Tokyo; K. Murty, Toronto; M. Rosen, Brown; K. Rubin, Ohio State; R. Rumely, Georgia; J. Shallit, Waterloo; J. Silverman, Brown; G. Stevens, Boston; C. Stewart, Waterloo; Yu. Tschinkel, Harvard; R. Vaughan, London; L. Walling, Boulder; K. Williams, Carleton; N. Yiu, Queen's.

INFORMATION: K. Dilcher, Dept. of Math., Dalhousie Univ., Halifax, Nova Scotia, Canada, B3H 3J5; e-mail cnta@cs.dal.ca.

3–9. **Analysis und Geometrie Singulärer Räume**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

4–8. **International Conference on Computer Aided Geometric Design (CAGD)**, Penang, Malaysia. (Jul./Aug. 1993, p. 713)

5–9. **Twenty-fourth National Conference on Geometry and Topology (CNGT 24)**, University of Timișoara, Romania. (Jul./Aug. 1993, p. 713)

5–29. **IMA Summer Program on Molecular Biology**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Apr. 1993, p. 415)

10–16. **Freie Randwertprobleme**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

11–15. **Fourteenth IMACS World Congress on Computational and Applied Mathematics**, Georgia Institute of Technology, Atlanta, GA. (Oct. 1992, p. 951)

14–18. **LFCS'94: Logic at St. Petersburg, a Symposium on Logical Foundations of**

Computer Science, St. Petersburg, Russia. (Jul./Aug. 1993, p. 714)

17–23. **Conférence Internationale de Topologie**, CIRM, Marseille, France. (Jan. 1993, p. 64)

17–23. **Algebraische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

17–23. **Workshop on Harmonic Analysis and Elliptic Partial Differential Equations**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jul./Aug. 1993, p. 714)

18–22. **Sixth International Conference on Fibonacci Numbers and Their Applications**, Washington State University, Pullman, WA. (Jul./Aug. 1993, p. 714)

20–30. **Third Souslin Conference**, Saratov, Russia. (Jul./Aug. 1993, p. 714)

24–30. **Complex Geometry: Moduli Problems**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

25–29. **Représentation des Groupes Reductifs p -adiques**, CIRM, Marseille, France. (Nov. 1992, p. 1122)

25–29. **1994 SIAM Annual Meeting**, San Diego, CA.

ORGANIZER: B.L. Keyfitz, U. of Houston.

CALL FOR PAPERS: Abstract deadline: January 24, 1994.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; fax 215-386-7999; meetings@siam.org.

31–August 6. **Mechanics of Materials**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

August 1994

1–5. **Third World Congress on Computational Mechanics (WCCM III)**, Chiba, Japan. (May/June. 1992, p. 497)

3–11. **The International Congress of Mathematicians 1994**, Zürich, Switzerland. (Jul./Aug. 1993, p. 714)

7–13. **Effiziente Algorithmen**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

13–17. **Third Colloquium on Numerical Analysis**, Plovdiv, Bulgaria. (Apr. 1993, p. 416)

14–20. **Nonlinear Evolution Equations**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

15–17. **Mathfest**, University of Minnesota, Minneapolis, MN (including the summer meetings of the AMS, AWM, MAA, and PME).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

Meetings and Conferences

15–19. **Fifteenth International Symposium on Mathematical Programming**, University of Michigan, Ann Arbor, MI. (May/June 1993, p. 515)

15–26. **Advanced Workshop on Algebraic Geometry**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 714)

16–20. **ICMI-China Regional Conference on Mathematics Education**, Shanghai, China. (Jul./Aug. 1993, p. 714)

18–23. **Fifth Colloquium on Differential Equations**, Plovdiv, Bulgaria. (Apr. 1993, p. 416)

20–26. **International Conference on Rings and Radicals**, Shijiazhuang, China. (Mar. 1993, p. 287)

21–27. **Mathematical Models in Phase Transitions**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

* 22–26. **Sixth Conference on Numerical Methods in Hungary**, Miskolc University, Miskolc, Hungary.

PROGRAM: The program will be focused on the theory of numerical methods, numerical algebra, and the numerical solution of differential equations, both ordinary and partial. One-hour plenary lectures and half-hour lectures in sections will be the principal part of the program. To present other results, short communications in sections for each field of interest will be held, and a poster section will be organized.

INFORMATION: K. Balla, e-mail: h153bal@ella.hu or na.balla@na-net.ornl.gov.

28–September 3. **Komplexe Analysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

September 1994

18–20. **Teaching of Mathematics for Industry**, Prague. (Jul./Aug. 1993, p. 715)

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.

October 1994

28–29. **Central Section**, Oklahoma State University, Stillwater, Oklahoma.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

November 1994

11–13. **Southeastern Section**, University of Richmond, Richmond, VA.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

December 1994

* 12–14. **SIAM Conference on Inverse Problems**, Fish Camp, CA, *tentative*.

ORGANIZER: W. Rundell, Texas A&M U.
CALL FOR PAPERS: Abstract deadline: April 25, 1994.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; fax 215-386-7999; e-mail meetings@siam.org.

January 1995

4–7. **Joint Mathematics Meetings**, San Francisco, CA (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

March 1995

4–5. **Eastern Section**, Hartford, Connecticut.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

17–18. **Southeastern Section**, Orlando, Florida.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

24–25. **Central Section**, DePaul University, Chicago, IL.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

May 1995

* 11–13. **First International Conference on Nonlinear Problems in Aviation and Aerospace 1995**, Embry-Riddle Aeronautical University, Daytona Beach, FL.

PROGRAM: The aim of the conference is to forge unity and to bring cooperation, collaboration, and dissemination into the Community of Aviation and Space. There will be survey and expository lectures and short communications.

CONFERENCE TOPICS: Guidance, stability, control; computational structures; computational fluids; reliability; optimization; artificial intelligence; human factors modeling; ATC design; and validation and verification.

INFORMATION: S. Sivasundaram, Dept. of Math., Embry-Riddle Aeronautical University, 600 S. Clyde Morris Blvd., Daytona Beach, FL 32114; phone 904-226-6298, fax 904-226-6459, e-mail siva@db.erau.edu.

November 1995

3–4. **Central Section**, Kent State University, Kent, Ohio.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

January 1996

10–13. **Joint Mathematics Meetings**, Orlando, Florida (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

March 1996

22–23. **Central Section**, University of Iowa, Iowa City, Iowa.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

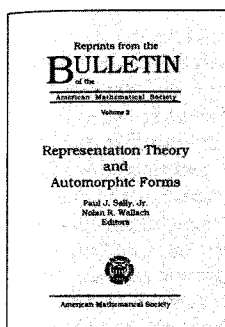
April 1996

19–21. **Southeastern Section**, Baton Rouge, Louisiana.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

New Publications Offered by the AMS

BULLETIN REPRINT SERIES



Representation Theory and Automorphic Forms

Paul J. Sally, Jr. and Nolan R. Wallach, Editors
Volume 2

The eleven papers collected in this volume appeared in the *Bulletin of the AMS* during the years 1955 to 1984 and share the theme of the representation theory of locally compact groups and its numerous applications. The papers provide a glimpse

at the historical development of a subject which has expanded into many areas of mathematics during the past forty years. In addition, this volume provides easy access to a useful set of references. Chronicling some of the most important developments by some of the field's major figures, this book will appeal to specialists in representation theory as well as to researchers in those areas of mathematics in which representation theory plays an important role.

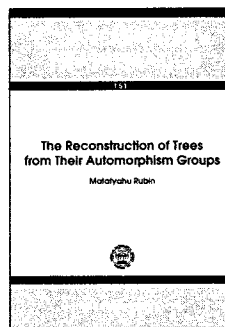
Contents

Harish-Chandra, *On the characters of a semisimple Lie group*; G. W. Mackey, *Infinite-dimensional group representations*; H. Furstenberg, *Translation-invariant cones of functions on semi-simple Lie groups*; B. Kostant, *On the existence and irreducibility of certain series of representations*; J. A. Wolf, *The action of a real semisimple group on a complex flag manifold. I: Orbit structure and holomorphic arc components*; Harish-Chandra, *Harmonic analysis on semisimple Lie groups*; N. R. Wallach, *On the Selberg trace formula in the case of compact quotient*; S. Helgason, *Invariant differential equations on homogeneous manifolds*; R. Howe, *On the role of the Heisenberg group in harmonic analysis*; R. J. Zimmer, *Ergodic theory, group representations, and rigidity*; S. Gelbart, *An elementary introduction to the Langlands program*.

1991 *Mathematics Subject Classification*: 22-XX
ISBN 0-8218-0720-X, LC 89-35474, ISSN 1064-9662
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CONTEMPORARY MATHEMATICS



The Reconstruction of Trees from Their Automorphism Groups

Matatyahu Rubin
Volume 151

Trees, sometimes called semilinear orders, are partially ordered sets in which every initial segment determined by an element is linearly ordered. This book focuses on automorphism groups of trees, providing a nearly complete analysis of when

two trees have isomorphic automorphism groups. Special attention is paid to the class of \aleph_0 -categorical trees, and for this class the analysis is complete. Various open problems, mostly in permutation group theory and in model theory, are discussed, and a number of research directions are indicated. Aimed at graduate students and researchers in model theory and permutation group theory, this self-contained book will bring readers to the forefront of research on this topic.

Contents

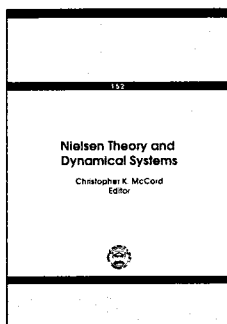
An extended introduction; Some preliminaries concerning interpretations, groups and \aleph_0 -categoricity; A new reconstruction theorem for Boolean algebras; The completion and the Boolean algebra of a U-tree; The statement of the canonization and reconstruction theorems; The canonization of trees; The reconstruction of the Boolean algebra of a U-tree; The reconstruction of $PT(\text{Exp}(M))$; Final reconstruction results; Observations, examples and discussion; Augmented trees; The reconstruction of \aleph_0 -categorical trees; Nonisomorphic 1-homogeneous chains which have isomorphic automorphism groups; Bibliography; A list of notations and definitions.

1991 *Mathematics Subject Classification*: 03C99; 20B27, 20E08, 06A06, 06E99
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Nielsen Theory and Dynamical Systems
 Christopher K. McCord, Editor
 Volume 152

This volume contains the proceedings of the AMS-IMS-SIAM Joint Summer Research Conference on Nielsen Theory and Dynamical Systems, held in June 1992 at Mount Holyoke College. Focusing on the interface between Nielsen fixed point theory and dynamical systems, this book provides

an almost complete survey of the state of the art of Nielsen theory. Most of the articles are expository, making them accessible to both graduate students and researchers in algebraic topology, fixed point theory, and dynamical systems.

Contents

LI. Alesdà, S. Baldwin, J. Llibre, R. Swanson, and W. Szlenk, *Torus maps and Nielsen numbers*; R. F. Brown, *Wecken properties for manifolds*; J. Casasayas, J. Llibre, and A. Nunes, *Lefschetz zeta functions and forced set of periods*; D. Dimovski, *One-parameter fixed point indices for periodic orbits*; A. Fel'shtyn and R. Hill, *Dynamical zeta functions, Nielsen theory and Reidemeister torsion*; J. Franks and M. Misiurewicz, *Cycles for disk homeomorphisms and thick trees*; R. Geoghegan and A. Nicas, *Lefschetz trace formulae, zeta functions and torsion in dynamics*; J. Gilman, *Recent developments in Nielsen theory and discrete groups*; E. Hart, *Local Nielsen fixed point theory and the local generalized H -Lefschetz number*; B. Jiang, *Nielsen theory for periodic orbits and applications to dynamical systems*; J. Lewowicz and J. Tolosa, *Genericity of homeomorphisms with connected stable and unstable sets*; J. Llibre, *Lefschetz numbers for periodic points*; T. Matsuoka, *The Burau representation of the braid group and the Nielsen-Thurston classification*; C. K. McCord, *Computing Nielsen numbers*; K. Mischaikow, *The structure of isolated invariant sets and the Conley index*; H. Schirmer, *A survey of relative Nielsen fixed point theory*; L. Slutskin, *Classification of lifts of automorphisms of surfaces to the unit disk*; P. Wong, *Equivariant Nielsen fixed point theory and periodic points*.

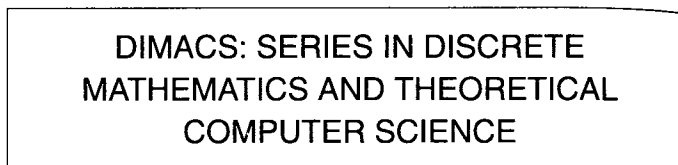
1991 *Mathematics Subject Classification*: 54H20, 54H25, 55M20; 34C35, 58C30, 58F20

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DIMACS: SERIES IN DISCRETE MATHEMATICS AND THEORETICAL COMPUTER SCIENCE

Groups and Computation
 Larry Finkelstein and William M. Kantor, Editors
 Volume 11

This volume contains papers presented at the Workshop on Groups and Computation, held in October 1991. The workshop explored interactions among four areas: symbolic algebra and computer algebra, theoretical computer science, group theory, and applications of group computation. The

relationships between implementation and complexity form a recurrent theme, though the papers also discuss such topics as parallel algorithms for groups, computation in associative algebras, asymptotic behavior of permutation groups, the study of finite groups using infinite reflection groups, combinatorial searching, computing with representations, and Cayley graphs as models for interconnection networks.

Contents

L. Babai, E. M. Luks, and Á. Seress, *Computing composition series in primitive groups*; R. Beals, *Computing blocks of imprimitivity for small-base groups in nearly linear time*; M. Clausen and U. Baum, *Fast Fourier transforms for symmetric groups*; J. H. Conway, *From hyperbolic reflections to finite groups*; G. Cooperman and L. Finkelstein, *Combinatorial tools for computational group theory*; P. Diaconis and D. Rockmore, *Efficient computation of isotypic projections for the symmetric group*; J. D. Dixon, *Constructing representations of finite groups*; D. F. Holt and S. Rees, *A graphics system for displaying finite quotients of finitely presented groups*; W. M. Kantor, *Random remarks on permutation group algorithms*; C. W. H. Lam, *Application of group theory to combinatorial searches*; E. M. Luks, *Permutation groups and polynomial-time computation*; P. D. Mark, *Parallel computation of Sylow subgroups in solvable groups*; C. E. Praeger, *Computation with matrix groups over finite fields*; L. Pyber, *Asymptotic results for permutation groups*; L. Rónyai, *Computations in associative algebras*; A. L. Rosenberg, *Cayley graphs and direct-product graphs*; N. Sarawagi, G. Cooperman, and L. Finkelstein, *Group membership for groups with primitive orbits*; Á. Seress and I. Weisz, *PERM: A program computing strong generating sets*; C. C. Sims, *Complexity issues in infinite group theory*; L. H. Soicher, *GRAPE: A system for computing with graphs and groups*; B. W. York, *Implications of parallel architectures for permutation group computations*.

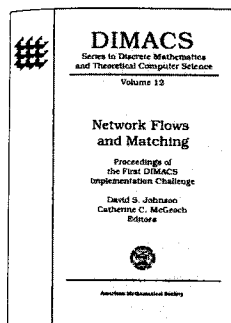
1991 *Mathematics Subject Classification*: 20B40, 20C40

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Network Flows and Matching: First DIMACS Implementation Challenge

David S. Johnson and Catherine C. McGeoch, Editors

Volume 12

Interest has grown recently in the application of computational and statistical tools to problems in the analysis of

algorithms. In many algorithmic domains worst-case bounds are too pessimistic and tractable probabilistic models too unrealistic to provide meaningful predictions of practical algorithmic performance. Experimental approaches can provide knowledge where purely analytical methods fail and can provide insights to motivate and guide deeper analytical results. The DIMACS Implementation Challenge was organized to encourage experimental work in the area of network flows and matchings. Participants at sites in the U.S., Europe, and Japan undertook projects between November 1990 and August 1991 to test and evaluate algorithms for these problems. The Challenge culminated in a three-day workshop held in October 1991 at DIMACS. This volume contains the revised and refereed versions of twenty-two of the papers presented at the workshop, along with supplemental material about the Challenge and the Workshop.

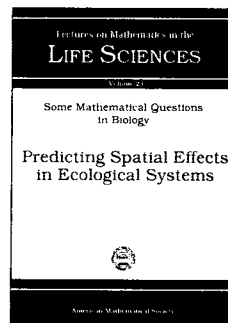
Contents

R. J. Anderson and J. C. Setubal, *Goldberg's algorithm for maximum flow in perspective: A computational study*; Q. C. Nguyen and V. Venkateswaran, *Implementations of the Goldberg-Tarjan maximum flow algorithm*; T. Badics and E. Boros, *Implementing a maximum flow algorithm: Experiments with dynamic trees*; F. Alizadeh and A. V. Goldberg, *Implementing the push-relabel method for the maximum flow problem on a connection machine*; G. E. Shannon, J. MacCuih, and E. Johnson, *A case study in algorithm animation: Maximum flow algorithms*; R. G. Bland, J. Cheriyan, D. L. Jensen, and L. Ladányi, *An empirical study of min cost flow algorithms*; A. V. Goldberg and M. Kharitanov, *On implementing scaling push-relabel algorithms for the minimum-cost flow problem*; I. Maros, *Performance evaluation of the MINET minimum cost netflow solver*; S. Fujishige, K. Iwano, J. Nakano, and S. Tezuka, *A speculative contraction method for minimum cost flows: Toward a practical algorithm*; S. T. McCormick and L. Liu, *An experimental implementation of the dual cancel and tighten algorithm for minimum-cost network flow*; A. Joshi, A. S. Goldstein, and P. M. Vaidya, *A fast implementation of a path-following algorithm for maximizing a linear function over a network polytope*; M. G. C. Resende and G. Veiga, *An efficient implementation of a network interior point method*; S. Neilsen and S. Zenios, *On the massively parallel solution of linear network flow problems*; J. M. Borger, T. S. Kang, and P. N. Klein, *Approximating concurrent flow with unit demands and capacities: An implementation*; T. Leong, P. W. Shor, and C. Stein, *Implementation of a combinatorial multicommodity flow algorithm*; D. A. Castañón, *Reverse auction algorithms for assignment problems*; K. G. Ramakrishnan, N. K. Karmarkar, and A. P. Kamath, *An approximate dual projective algorithm for solving assignment problems*; J. Hao and G. Kocur, *An implementation of a shortest augmenting path algorithm for the assignment problem*; M. Brady, K. K. Jung, H. T. Nguyen, R. Raghavan, and R. Subramonian, *The assignment problem on parallel architectures*; S. T. Crocker, *An experimental comparison of two maximum cardinality matching programs*; R. B. Mattingly and N. P. Richey, *Implementing an $O(\sqrt{NM})$ cardinality matching algorithm*; D. Applegate and W. Cook, *Solving large-scale matching problems*; C. C. McGeoch, *Appendix A: Electronically available materials*; D. S. Johnson, *Appendix B: Panel discussion highlights.*

(continued)

1991 *Mathematics Subject Classification*: 68-04, 68-06, 90B10; 68Q20, 68Q25, 90C05, 90C06
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LECTURES ON MATHEMATICS IN THE LIFE SCIENCES



Some Mathematical Questions in Biology: Predicting Spatial Effects in Ecological Systems

Robert H. Gardner, Editor
Volume 23

This collection of papers addresses a variety of problems and approaches for predicting spatial effects in ecological systems. The central themes are the characterization of effects, exploration

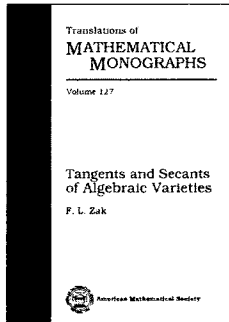
of mechanisms, and understanding of consequences of spatial heterogeneity on ecological systems. Discussed here are the spatial dynamics of natural systems and the impact of economic and sociological changes, as well as recent adaptation methods from statistical lattice physics. Progress in dealing with spatial effects in ecological systems is accelerating as faster computers access the extensive data sets available from remote sensing. The new mathematical approaches presented here will be especially useful for identifying the effect of landscape change on ecosystem productivity and sustainability. Balancing theoretical development and empirical testing, the book provides an excellent introduction to the scope and scale of issues to be addressed in predicting change in ecological systems. Mathematicians and ecologists interested in these issues will find this book useful, and individual chapters will be of interest to physicists, econometricians, landscape ecologists, and human ecologists.

Contents

S. A. Levin, *Introductory remarks*; J. Pastor, J. Bonde, C. Johnston, and R. J. Naiman, *Markovian analysis of the spatially dependent dynamics of beaver ponds*; V. H. Dale, F. Southworth, R. V. O'Neill, A. Rosen, and R. Frohn, *Simulating spatial patterns of land-use change in Rondônia, Brazil*; D. W. Jones and R. V. O'Neill, *A two-sector model of land use and deforestation: Funding urban development with a tax on urban and rural employment*; D. P. Coffin, W. K. Lauenroth, and I. C. Burke, *Spatial dynamics in recovery of shortgrass steppe ecosystems*; B. T. Milne and A. R. Johnson, *Renormalization relations for scale transformation in ecology*; R. E. Plotnick and R. H. Gardner, *Lattices and landscapes*; R. H. Gardner, *Concluding remarks*; J. Pastor, J. Bonde, C. Johnston, and R. J. Naiman, *Appendix, Markov matrices.*

1991 *Mathematics Subject Classification*: 92-06, 92D40; 93A30, 90A25
 ISBN 0-8218-1174-6, LC 93-28548, ISSN 0075-8523
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TRANSLATIONS OF MATHEMATICAL MONOGRAPHS



Tangents and Secants of Algebraic Varieties

F. L. Zak
Volume 127

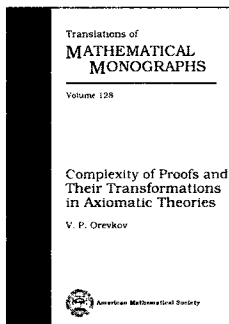
During the last twenty years algebraic geometry has experienced a remarkable shift from development of abstract theories to investigation of concrete properties of projective varieties. Many problems of classical algebraic geometry centered on linear systems, projections, embedded

tangent spaces, and so on. Use of modern techniques has made it possible to make progress on some of these problems. Following these themes, this book covers these topics, among others: tangent spaces to subvarieties of projective spaces and complex tori, projections of algebraic varieties, classification of Severi varieties, higher secant varieties, and classification of Scorza varieties over an algebraically closed field of characteristic zero.

Contents

Theorem on tangencies and Gauss maps; Projections of algebraic varieties; Varieties of small codimension corresponding to orbits of algebraic groups; Severi varieties; Linear systems of hyperplane sections on varieties of small codimension; Scorza varieties; References; Index of notations.

1991 *Mathematics Subject Classification:* 14Jxx
ISBN 0-8218-4585-3, LC 93-17502, ISSN 0065-9282
164 pages (hardcover), September 1993
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Complexity of Proofs and Their Transformations in Axiomatic Theories

V. P. Orevkov
Volume 128

The aim of this work is to develop the tool of logical deduction schemata and use it to establish upper and lower bounds on the complexity of proofs and their transformations in axiomatized theories.

The main results are establishment of upper bounds on the elongation of deductions in cut eliminations; a proof that the length of a direct deduction of an existence theorem in the predicate calculus cannot be bounded above by an elementary function of the length of an indirect deduction of the same theorem; a complexity version of the existence property of the constructive predicate calculus; and, for certain formal systems of arithmetic, restrictions on the complexity of deductions that guarantee that the deducibility of a formula for all natural numbers in some finite set implies the deducibility of the same formula with a universal quantifier over all sufficiently large numbers.

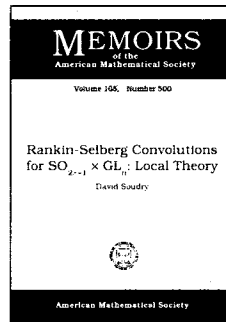
(continued)

Contents

Introduction; Upper bounds on deduction elongation in cut elimination; Systems of term equations with substitutions; Logical deduction schemata in axiomatized theories; Bounds for the complexity of terms occurring in proofs; Proof strengthening theorems; References.

1991 *Mathematics Subject Classification:* 03F20
ISBN 0-8218-4576-4, LC 93-11139, ISSN 0065-9282
153 pages (hardcover), September 1993
Individual member \$52, List price \$86, Institutional member \$69
To order, please specify MMONO/128N

MEMOIRS OF THE AMS



Rankin-Selberg Convolutions for $SO_{2l+1} \times GL_n$: Local Theory

David Soudry
Volume 105, Number 500

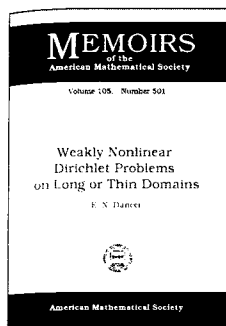
This work studies the local theory for certain Rankin-Selberg convolutions for the standard L -function of degree $2ln$ of generic representations of $SO_{2l+1}(F) \times GL_n(F)$ over a local field F . The local integrals

converge in a half-plane and continue meromorphically to the whole plane. One main result is the existence of local gamma and L -factors. The gamma factor is obtained as a proportionality factor of a functional equation satisfied by the local integrals. In addition, Soudry establishes the multiplicativity of the gamma factor ($l < n$, first variable). A special case of this result yields the unramified computation and involves a new idea not presented before. This presentation, which contains detailed proofs of the results, is useful to specialists in automorphic forms, representation theory, and L -functions, as well as to those in other areas who wish to apply these results or use them in other cases.

Contents

Introduction and preliminaries; The integrals to be studied; Estimates for Whittaker functions on G_l (Nonarchimedean case); Estimates for Whittaker functions on G_l (Archimedean case); Convergence of the integrals (Nonarchimedean case); Convergence of the integrals (Archimedean case); $A(W, \xi_{\tau, s})$ can be made constant (Nonarchimedean case); An analog in the archimedean case; Uniqueness theorems; Application of the intertwining operator; Definition of local factors; Multiplicativity of the γ -factor (case $l < n$, first variable); The unramified computation.

1991 *Mathematics Subject Classification:* 11F70, 11M41, 22E50, 26E30, 32N10
ISBN 0-8218-2568-2, LC 93-2235, ISSN 0065-9266
100 pages (softcover), September 1993
Individual member \$17, List price \$29, Institutional member \$23
To order, please specify MEMO/105/500N



Weakly Nonlinear Dirichlet Problems on Long or Thin Domains

E. N. Dancer

Volume 105, Number 501

The aim of this work is to develop a basic theory for nonlinear elliptic equations on long or thin domains for Dirichlet boundary conditions. This is the first treatment of such Dirichlet problems, which are of significant interest in applications.

Contents

Introduction; Limits of solutions on long bounded domains; Construction of solutions from approximate solutions; The end equation; On the unstable solutions; Some examples; References.

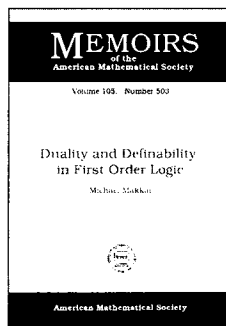
1991 *Mathematics Subject Classification:* 35B30, 35J25

ISBN 0-8218-2563-1, LC 93-2236, ISSN 0065-9266

66 pages (softcover), September 1993

Individual member \$16, List price \$26, Institutional member \$21

To order, please specify MEMO/105/501N



Duality and Definability in First Order Logic

Michael Makkai

Volume 105, Number 503

Using the theory of categories as a framework, this book develops a duality theory for theories in first order logic in which the dual of a theory is the category of its models with suitable additional structure. This duality theory resembles and generalizes M. H. Stone's famous duality

theory for Boolean algebras. As an application, Makkai derives a result akin to the well-known definability theorem of E. W. Beth. This new definability theorem is related to theorems of descent in category theory and algebra and can also be stated as a result in pure logic without reference to category theory. Containing novel techniques as well as applications of classical methods, this carefully written book shows attention to both organization and detail and will appeal to mathematicians and philosophers interested in category theory.

Contents

Beth's theorem in propositional logic; Factorizations in 2-categories; Definable functors; Basic notions for duality; The Stone type adjunction for Boolean pretoposes and ultragroupoids; The syntax of special ultramorphisms; The semantics of special ultramorphisms; The duality theorem; Preparing a functor specification; Lifting Zawadowski's argument to ultra morphisms; The operations on $\mathcal{B}P^$ and $\mathcal{U}G$; Conclusion; References.*

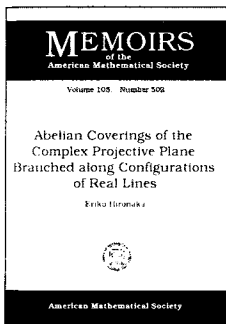
1991 *Mathematics Subject Classification:* 03C20, 03C40, 03G30, 18D05

ISBN 0-8218-2565-8, LC 93-4868, ISSN 0065-9266

106 pages (softcover), September 1993

Individual member \$18, List price \$30, Institutional member \$24

To order, please specify MEMO/105/503N



Abelian Coverings of the Complex Projective Plane Branched along Configurations of Real Lines

Eriko Hironaka

Volume 105, Number 502

This work studies abelian branched coverings of smooth complex projective surfaces from the topological viewpoint.

Geometric information about the coverings (such as the first Betti numbers of a smooth model or intersections of embedded curves) is related to topological and combinatorial information about the base space and branch locus. Special attention is given to examples in which the base space is the complex projective plane and the branch locus is a configuration of lines.

Contents

Introduction; Preliminaries; Intersections of curves on covering surfaces; Hirzebruch covering surfaces; Algorithm for computing the first Betti number; Examples; References.

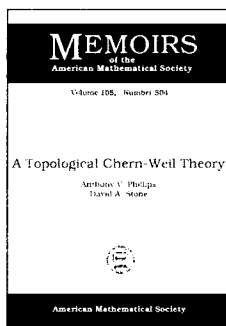
1991 *Mathematics Subject Classification:* 14J25

ISBN 0-8218-2564-X, LC 93-24886, ISSN 0065-9266

85 pages (softcover), September 1993

Individual member \$17, List price \$28, Institutional member \$22

To order, please specify MEMO/105/502N



A Topological Chern-Weil Theory

Anthony V. Phillips and

David A. Stone

Volume 105, Number 504

This work develops a topological analogue of the classical Chern-Weil theory as a method for computing the characteristic classes of principal bundles whose structural group is not necessarily a Lie group, but only a cohomologically finite topological

group. Substitutes for the tools of differential geometry, such as the connection and curvature forms, are taken from algebraic topology, using work of Adams, Brown, Eilenberg-Moore, Milgram, Milnor, and Stasheff. The result is a synthesis of the algebraic-topological and differential-geometric approaches to characteristic classes. In contrast to the first approach, specific cocycles are used, so as to highlight the influence of local geometry on global topology. In contrast to the second, calculations are carried out at the small scale rather than the infinitesimal; in fact, this work may be viewed as a systematic extension of the observation that curvature is the infinitesimal form of the defect in parallel translation around a rectangle. This book could be used as a text for an advanced graduate course in algebraic topology.

(continued)

Contents

Introduction. Combinatorial preliminaries; The universal side of the problem: the topological Lie algebra, tensor algebra and invariant polynomials; Parallel transport functions and principal bundles; The complex C_ , the twisting cochain of a parallel transport function, and the algebraic classifying map $S_* : C_* \rightarrow E_*$; Cochains on C_* with values in Tg_* ; The main theorem; Appendix. The cobar construction, holonomy, and parallel transport functions; Bibliography.*

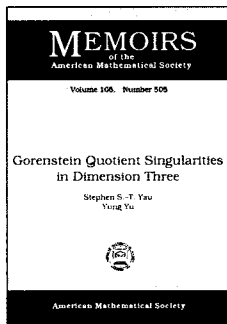
1991 *Mathematics Subject Classification*: 53C05, 55R35, 55R40, 57R20, 57R22, 57T30

ISBN 0-8218-2566-6, LC 93-25081, ISSN 0065-9266

79 pages (softcover), September 1993

Individual member \$17, List price \$28, Institutional member \$22

To order, please specify MEMO/105/504N



Gorenstein Quotient Singularities in Dimension Three

Stephen S.-T. Yau and Yung Yu

Volume 105, Number 505

If G is a finite subgroup of $GL(3, \mathbb{C})$, then G acts on \mathbb{C}^3 , and it is known that \mathbb{C}^3/G is Gorenstein if and only if G is a subgroup of $SL(3, \mathbb{C})$. In this work, the authors begin with a classification of

finite subgroups of $SL(3, \mathbb{C})$, including two types, (J) and (K), which have often been overlooked. They go on to present a general method

for finding invariant polynomials and their relations to finite subgroups of $GL(3, \mathbb{C})$. The method is, in practice, substantially better than the classical method due to Noether. Some properties of quotient varieties are presented, along with a proof that \mathbb{C}^3/G has isolated singularities if and only if G is abelian and 1 is not an eigenvalue of g for every nontrivial $g \in G$. The authors also find minimal quotient generators of the ring of invariant polynomials and relations among them.

Contents

Introduction; Classification of finite subgroups of $SL(3, \mathbb{C})$; The invariant polynomials and their relations of linear groups of $SL(3, \mathbb{C})$; Gorenstein quotient singularities in dimension three.

1991 *Mathematics Subject Classification*: 14B05, 14E15, 14E25, 32B30, 32C40
ISBN 0-8218-2567-4, LC 93-4869, ISSN 0065-9266

88 pages (softcover), September 1993

Individual member \$17, List price \$29, Institutional member \$23

To order, please specify MEMO/105/505N

COLLECTED WORKS • Volume 3

A. ADRIAN ALBERT
Collected Mathematical Papers

Richard E. Block, Nathan Jacobson, J. Marshall Osborn,
David J. Saltman, and Daniel Zelinsky, Editors

This book contains the collected works of A. Adrian Albert, a leading algebraist of the twentieth century. Albert made many important contributions to the theory of the Brauer group and central simple algebras, Riemann matrices, nonassociative algebras, and other topics. Part 1 focuses on associative algebras and Riemann matrices, and Part 2 on nonassociative algebras and miscellany. Because much of Albert's work remains of vital interest in contemporary research, this volume will interest mathematicians in a variety of areas.

1991 *Mathematics Subject Classification*: 11, 12, 14, 16, 17

ISBN (Set) **0-8218-0003-5**; ISBN (Part 1) **0-8218-0005-1**; ISBN (Part 2) **0-8218-0007-8**

743 pages (Part 1); 938 pages (Part 2); 1840 pages (Set) (hardcover), January 1993

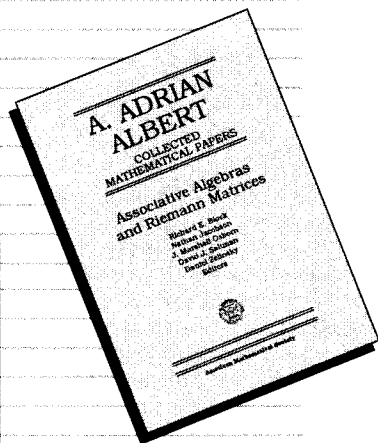
Set: **Individual member \$124**, List price \$206, Institutional member \$165

Part 1: **Individual member \$60**, List price \$100, Institutional member \$80

Part 2: **Individual member \$70**, List price \$117, Institutional member \$94

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AMS Reports and Communications

Recent Appointments

Committee members' terms of office on standing committees expire on January 31 following the year given in parentheses after their names, unless otherwise specified.

The following committees have been discharged by the Council with thanks: *Subcommittee to Study the Committee Structure* and *Committee on Service to Mathematicians in Developing Countries*.

President Ronald L. Graham has appointed Sheldon Axler (1994), John M. Franks (1994), Svetlana R. Katok (1993), Elliott H. Lieb (1993), Haynes R. Miller (1994), Richard S. Palais (1995), Frank S. Quinn (1995), and Bhama Srinivasan (1993); and John C. Polking, chair of the Board, has appointed Paul J. Sally, Jr. (1993), to the *Committee on Publications*. Professor Palais has been appointed chair. Robert M. Fossum, Ronald L. Graham, and William H. Jaco will serve *ex officio*.

Jack D. Cowan (1994) has been appointed by Presidents Avner Friedman (SIAM), Alan Perelson (SMB), and Ronald L. Graham (AMS) to the *AMS-SIAM-SMB Committee on Mathematics in the Life Sciences*. Continuing members of the committee are James W. Curran (1993), Leah Edelstein-Keshet

(1994), Eric S. Lander (1993), Michael S. Waterman (1995), and Carla Wofsy (1995).

Statistics on Women Mathematicians Compiled by the AMS

At its August 1985 meeting, the Council of the AMS approved a motion to regularly assemble and report in the *Notices* information on the relative numbers of men versus women in at least the following categories: membership in the AMS; invited hour addresses at AMS meetings; speakers at special sessions at AMS meetings; and members of editorial boards of AMS journals.

It was subsequently decided that this information would be gathered by determining the sex of the individuals in the above categories based on name identification and that additional information on the number of Ph.D.'s granted to women would also be collected using the AMS-IMS-MAA Annual Survey. Since name identification was used, the information for some categories necessitated the use of three classifications:

Male: names that were obviously male;

Female: names that were obviously female;

Unknown: names that could not be identified as clearly male or female (e.g., only initials given, non-gender-specific names, etc.)

The following is the eighth reporting of this information. Updated reports will appear annually in the *Notices*.

Members of the AMS Residing in the U.S.			
Male:	14,507		72%
Female:	3,495		17%
Unknown:	2,264		11%
Total checked:	20,266		

Invited Hour Address Speakers at AMS Meetings (1983-1992)			
Male:	371		91%
Female:	36		9%
Unknown:	1		0%
Total checked:	386		

Speakers at Special Sessions at AMS Meetings (1988-1992)			
Male:	4,313		84%
Female:	416		8%
Unknown:	437		8%
Total checked:	5,116		

Trustees and Council Members				
	1992	1991	1990	1989
Total:	52	50	52	53
Male:	42 82%	45 90%	45 87%	46 87%
Female:	9 18%	5 10%	7 13%	7 13%

Members of Editorial Boards of AMS Journals

	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983
Total:	178	169	183	194	161	133	109	102	93	90
Male:	163 92%	156 92%	171 93%	182 94%	148 92%	125 94%	104 95%	94 92%	85 91%	84 93%
Female:	15 8%	13 8%	12 7%	11 6%	13 8%	8 6%	5 5%	8 8%	8 9%	6 7%

Ph.D.s Granted to U.S. Citizens

	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983
Total:	430	461	401	411	363	362	386	396	433	455
Male:	327 76%	349 76%	312 78%	313 76%	287 79%	289 80%	304 79%	315 80%	346 80%	366 80%
Female:	103 24%	112 24%	89 22%	98 24%	76 21%	73 20%	82 21%	81 20%	87 20%	89 20%

Officers and Committee Members

Numbers to the left of headings are used as points of reference in an index to AMS committees which follows this listing. Primary and secondary headings are:

- 1 Officers
 - 1.1 Liaison Committee
- 2 Council
 - 2.1 Executive Committee of the Council
- 3 Board of Trustees
- 4 Committees
 - 4.1 Committees of the Council
 - 4.2 Editorial and Communications Committees
 - 4.3 Committees of the Board of Trustees
 - 4.4 Internal Organization of the AMS
 - 4.5 Program and Meetings
 - 4.6 Status of the Profession
 - 4.7 Prizes and Awards
 - 4.8 Institutes and Symposia
 - 4.9 Joint Committees
- 5 Representatives
- 6 Index

Terms of members expire on January 31 following the year given unless otherwise specified.

1. Officers

President	Ronald L. Graham	1994
Ex-President	Michael Artin	1993
Vice-Presidents	Chandler Davis	1993
	Linda Keen	1994
	Anil Nerode	1995
Secretary	Robert M. Fossum	1994
Associate		
Secretaries	Robert J. Daverman	1994
	Andy Roy Magid	1993
	Lesley M. Sibner	1994
	Lance W. Small	1993
Treasurer	Franklin P. Peterson	1994
Associate		
Treasurer	B. A. Taylor	1994

1.1. Liaison Committee

All members of this committee serve *ex officio*.

Chair	Ronald L. Graham
	Robert M. Fossum
	Franklin P. Peterson

2. Council

2.0.1. Officers of the AMS

President	Ronald L. Graham	1994
Ex-President	Michael Artin	1993
Vice-Presidents	Chandler Davis	1993
	Linda Keen	1994
	Anil Nerode	1995
Secretary	Robert M. Fossum	1994
Associate		
Secretaries*	Robert J. Daverman	1994

Treasurer
Associate
Treasurer

Andy Roy Magid	1993
Lesley M. Sibner	1994
Lance W. Small	1993
Franklin P. Peterson	1994
B. A. Taylor	1994

2.0.2. Representatives of Committees

American Journal of Mathematics Bulletin	M. Salah Baouendi	1995
Colloquium	Murray H. Protter	1994
Executive Committee	G. D. Mostow	1993
Executive Committee	Joan S. Birman	1995
Journal of the AMS	Arthur M. Jaffe	1994
Committee to Monitor Problems in Communication	Wilfried Schmid	1993
Mathematical Reviews	Judy Green	1995
Mathematical Surveys and Monographs	Philip J. Hanlon	1995
Mathematics of Computation	Marc A. Rieffel	1994
Proceedings	Walter Gautschi	1995
Science Policy Committee	Irwin Kra	1994
Transactions and Memoirs	Frank W. Warner III	1993
	James E. Baumgartner	1995

2.0.3. Members-at-Large

Ruth M. Charney	1994	James I. Lepowsky	1995
Carl C. Cowen, Jr.	1994	Peter W. K. Li	1995
David A. Cox	1993	Elliott H. Lieb	1994
John M. Franks	1993	Gunther A. Uhlmann	1994
Frank L. Gilfeather	1993	Steven H. Weintraub	1993
Rebecca A. Herb	1994	Ruth J. Williams	1993
Svetlana R. Katok	1995	Susan Gayle Williams	1995
Steven George Krantz	1995		

2.1. Executive Committee of the Council

	Michael Artin	<i>ex officio</i>
	M. Salah Baouendi	1993
	Joan S. Birman	1995
	Robert M. Fossum	<i>ex officio</i>
	John M. Franks	1996
Chair	Ronald L. Graham	<i>ex officio</i>
	Arthur M. Jaffe	1994

3. Board of Trustees

	Roy L. Adler	1997
	Ronald L. Graham	<i>ex officio</i>
Secretary	Maria M. Klawe	1996

* Only one Associate Secretary at a time is a voting member of the Council, namely the cognizant Associate Secretary for the scientific sessions.

Officers and Committee Members

	M. Susan Montgomery	1995
	Franklin P. Peterson	<i>ex officio</i>
Chair	John C. Polking	1994
	Paul J. Sally, Jr.	1993
	B. A. Taylor	<i>ex officio</i>

Associate Editors for Research Announcements				
	Gergory L. Cherlin	1995	Zoltan Furedi	1993
	William G. Dwyer	1993	Harry Kesten	1993
	Charles L. Epstein	1993	Robert Lazarsfeld	1995
	Daniel S. Freed	1993	Paul S. Muhly	1993
	Michael D. Fried	1993	Jeffrey Rauch	1995

4. Committees

4.1. Committees of the Council

Standing Committees

4.1.1. Editorial Boards

	Bryan J. Birch	1995
	Fan R. K. Chung	1995
	Richard James Milgram	1993
Chair	Bhama Srinivasan	1994
	Nolan R. Wallach	1993
	Robert J. Zimmer	1994

4.1.2. Nominating Committee

Terms begin on January 1

	Michael Aschbacher	1993
	Daniel M. Burns, Jr.	1994
	Jerome A. Goldstein	1995
	Vaughan F. R. Jones	1995
	Jerry L. Kazdan	1993
	Joseph Lipman	1994
	Walter David Neumann	1993
	Nancy K. Stanton	1995
Chair	Carol S. Wood	1994

Special Committees

4.1.3. Meetings of the Council

	Joan S. Birman
Chair	Robert M. Fossum
	Franklin P. Peterson
	Steven H. Weintraub

4.2. Editorial and Communications Committees

4.2.1. Abstracts Editorial Committee

All members of this committee serve *ex officio*.

	Robert J. Daverman
Chair	Robert M. Fossum
	Andy Roy Magid
	Lesley M. Sibner
	Lance W. Small

4.2.2. American Journal of Mathematics, Society's Representatives

Chair	M. Salah Baouendi	1995
		1994

4.2.3. Bulletin (New Series)

	Richard S. Palais	1995
Chair	Murray H. Protter	1994
	Frank S. Quinn	1993

Associate Editors for Research – Expository Papers

	John C. Baez	1995	Jerry L. Kazdan	1995
	David Donoho	1995	Haynes R. Miller	1995
	David Eisenbud	1995	Kenneth A. Ribet	1995

4.2.4. Collected Works

	Richard A. Askey	1995
	R. Keith Dennis	1995
		1995

4.2.5. Colloquium

	William Browder	1995
	Luis A. Caffarelli	1994
Chair	G. D. Mostow	1993

4.2.6. Committee to Monitor Problems in Communication

	William Abikoff	1993
	Efraim P. Armendariz	1995
	James H. Curry	1994
Chair	Judy Green	1995
	William H. Jaco	<i>ex officio</i>
	Brian Marcus	1994
	Diane Meuser	1993

4.2.7. Contemporary Mathematics

Chair	Craig Huneke	1995
	Clark Robinson	1994
	Linda Preiss Rothschild	1995
	J. T. Stafford	1995
	Peter M. Winkler	1994

4.2.8. Graduate Studies in Mathematics

	James E. Humphreys	1995
	Robion C. Kirby	1995
	Lance W. Small	1995

4.2.9. Journal of the AMS

	William Fulton	1995
	H. Blaine Lawson, Jr.	1994
	Andrew M. Odlyzko	1994
Chair	Wilfried Schmid	1993
	Elias M. Stein	1995

Associate Editors

	James G. Arthur	1995	Dusa McDuff	1994
	Luis A. Caffarelli	1995	Hugh L. Montgomery	1993
	Persi W. Diaconis	1994	Marina Ratner	1994
	Gerd Faltings	1994	Richard Schoen	1994
	Michael H. Freedman	1993	Richard P. Stanley	1994
	Joe Harris	1993	W. Hugh Woodin	1993

4.2.10. Mathematical Reviews

	Wendell H. Fleming	1994
Chair	Philip J. Hanlon	1995
	Jean-Louis Loday	1996
	John L. Selfridge	1994
	Hans F. Weinberger	1993

Officers and Committee Members

4.2.11. Mathematical Surveys and Monographs

	Robert E. Greene	1995
	David W. McLaughlin	1994
Chair	Marc A. Rieffel	1994
	Bhama Srinivasan	1993

4.2.12. Mathematics of Computation

Chair	Walter Gautschi	1995
	Andrew M. Odlyzko	1994
	Frank W. J. Olver	1993
	Lars B. Wahlbin	1995

Associate Editors

James Bramble	1994	René Schoof	1995
Susanne C. Brenner	1995	Ridgway Scott	1995
E. W. Cheney	1994	Daniel Shanks	1993
James W. Demmel	1994	Chi-Wang Shu	1995
Eugene Isaacson	1995	Frank Stenger	1995
James N. Lyness	1993	Hans J. Stetter	1994
Harald Niederreiter	1993	G. W. Stewart	1995
Jorge J. Nocedal	1993	Nico M. Temme	1995
Syvert P. Nørsett	1993	Vidar C. Thomée	1994
John Osborn	1995	Hugh C. Williams	1994
Stanley J. Osher	1995	John W. Wrench, Jr.	1993
Carl Pomerance	1994		

4.2.13. Notices

	Sheldon Axler	1996
	John S. Bradley	<i>ex officio</i>
	Amassa C. Fauntleroy	1994
Chair	Robert M. Fossum	<i>ex officio</i>
	Susan J. Friedlander	1996
	Carolyn S. Gordon	1994
	Carl R. Riehm	1996
	Ridgway Scott	1994

Associate Editor

Special Articles	Jeffrey C. Lagarias
------------------	---------------------

4.2.14. Proceedings

	William W. Adams	1996
	Dale Alspach	1995
	J. Marshall Ash	1996
	Albert Baernstein	1995
	Eric Bedford	1995
	Andreas Blass	1996
	Andrew M. Bruckner	1993
	Christopher Croke	1995
	Richard T. Durrett	1996
Coordinating	Clifford J. Earle, Jr.	1996
	Eric M. Friedlander	1995
	Theodore W. Gamelin	1994
Coordinating	James G. Glimm	1995
	Kenneth R. Goodearl	1996
	Roe Goodman	1995
	Thomas Goodwillie	1995
	Dennis A. Hejhal	1995
	Palle E. T. Jorgensen	1996
	Jeffry Kahn	1993
Coordinating	Barbara Lee Keyfitz	1995
Chair	Irwin Kra	1994
Coordinating	Peter W. K. Li	1994
	Wei Y. Loh	1995
	Joseph S. B. Mitchell	1995
Coordinating	M. Susan Montgomery	1995
	David Sharp	1995
	Lance W. Small	1993
	Hal L. Smith	1995
	Ronald M. Solomon	1994
	Ronald J. Stern	1995

Franklin Tall	1993
John Trangenstein	1995
Wolmer V. Vasconcelos	1995
James E. West	1995
	1994

4.2.15. Proceedings of Symposia in Applied Mathematics

Chair	Peter S. Constantin	1995
	Robert Krasny	1995
	László Lovász	1995

4.2.16. Transactions and Memoirs

Chair	Avner D. Ash	1994
	James E. Baumgartner	1995
	Robert L. Bryant	1995
	Sun-Yung Alice Chang	1994
	Gregory L. Cherlin	1996
	Richard T. Durrett	1994
	Philip J. Hanlon	1995
	David Jerison	1994
	Wen-Ching Winnie Li	1995
	Mark Mahowald	1996
	John J. Mallet-Paret	1995
	Judith D. Sally	1993
	Peter B. Shalen	1995
	Masamichi Takesaki	1993

4.2.17. Translation from Chinese

	Sun-Yung Alice Chang
	S.-Y. Cheng
Chair	Tsit-Yuen Lam
	Tai-Ping Liu
	Chung-Chun Yang

4.2.18. Translation from Japanese

Chair	Shoshichi Kobayashi
	Katsumi Nomizu

Standing Committees

4.2.19. Electronic Products and Services

	Nancy Anderson	1993
	R. Keith Dennis	1995
Chair	John M. Franks	1994
	Maria M. Klawe	1994
	Frank S. Quinn	1993
Consultant	David Rodgers	
	William B. Woolf	<i>ex officio</i>

4.2.20. History of Mathematics

Chair	Bruce Chandler	1995
	Charles W. Curtis	1994
	Paul R. Halmos	1996
	Guido L. Weiss	1995

4.2.21. Reprinted Books

	Eugenio Calabi	1996
	Charles W. Curtis	1995
Chair	Oscar S. Rothaus	1994

4.2.22. University Lecture Series

	Theodore W. Gamelin	1994
	Donald S. Ornstein	1995
	Leonard L. Scott	1996

4.2.23. What's Happening, Advisory Board for

	Noga Alon
	Randolph E. Bank
	Carl Pomerance
	Herbert S. Wilf

Officers and Committee Members

Special Committee

4.2.24. Member Publications, Committee to Review

Consultant	Sheldon Axler	
Consultant	John S. Bradley	
	H. Hope Daly	
	John Ewing	
	Robert M. Fossum	<i>ex officio</i>
	John M. Franks	
	Ronald L. Graham	<i>ex officio</i>
	Judy Green	
	William H. Jaco	<i>ex officio</i>
	Haynes R. Miller	
	Richard S. Palais	
	John C. Polking	
Consultant	Samuel M. Rankin III	
Chair	Hugo Rossi	
	Carol S. Wood	
Consultant	William B. Woolf	

4.3. Committees of the Board of Trustees

4.3.1. Agenda and Budget

All members of this committee serve *ex officio*.

M. Salah Baouendi
Robert M. Fossum
Ronald L. Graham
Franklin P. Peterson
John C. Polking
B. A. Taylor

4.3.2. Appeals Committee on Discounted Subscriptions

Consultant	Carol-Ann Blackwood	
Consultant	Philip J. Hanlon	
	William H. Jaco	<i>ex officio</i>
Chair	Morton Lowengrub	
	Franklin P. Peterson	
	Paul J. Sally, Jr.	

4.3.3. Audit

All members of this committee serve *ex officio*.

Franklin P. Peterson
John C. Polking

4.3.4. Computer Operations and Facilities, Visiting Committee on

	Maria M. Klawe	<i>ex officio</i>
	Jill P. Mesirov	1994
	Richard S. Palais	1995
Chair	Peter J. Weinberger	1993

4.3.5. Corporate Relations

Chair	Ramesh A. Gangolli
	Maria M. Klawe
	Oscar S. Rothaus

4.3.6. Endowment

Chair	Andrew M. Gleason
	W. Ted Martin
	Cathleen S. Morawetz

4.3.7. Investment

Chair	M. Susan Montgomery	<i>ex officio</i>
	Franklin P. Peterson	<i>ex officio</i>
	T. Benny Rushing	1994
	B. A. Taylor	<i>ex officio</i>

4.3.8. Legal Aid

Chair	Todd Dupont
	Murray Gerstenhaber
	B. A. Taylor

4.3.9. Long Range Planning

All members of this committee serve *ex officio*.

Chair	Joan S. Birman
	Robert M. Fossum
	William H. Jaco
	Arthur M. Jaffe
	Franklin P. Peterson
	John C. Polking

4.3.10. Membership

Consultant	Robert L. Adler	<i>ex officio</i>
	M. Salah Baouendi	1993
	Carol-Ann Blackwood	
	Susan J. Friedlander	1995
	Wen-Ching Winnie Li	1993
Chair	Hugo Rossi	1994

4.3.11. Nominating Committee

Chair	M. Salah Baouendi
	Joan S. Birman
	William H. Jaco
	Paul J. Sally, Jr.
	Carol S. Wood

4.3.12. The Publication Program

Chair	Steve Armentrout	1993
	Robert L. Devaney	1992
	Robert M. Fossum	<i>ex officio</i>
	Eric M. Friedlander	1992
	Ramesh A. Gangolli	1992
	William H. Jaco	<i>ex officio</i>
	Elliott H. Lieb	1994
	Andrew M. Odlyzko	1992
	John C. Polking	<i>ex officio</i>
	Paul J. Sally, Jr.	<i>ex officio</i>
	B. A. Taylor	1992

4.3.13. Salaries

All members of this committee serve *ex officio*.

Chair	M. Susan Montgomery
	Franklin P. Peterson
	John C. Polking
	B. A. Taylor

4.3.14. Staff and Services

Chair	Franklin P. Peterson	<i>ex officio</i>
	Paul J. Sally, Jr.	
Chair	B. A. Taylor	<i>ex officio</i>

Special Committees

4.3.15. Copyright Policy

Chair	Elliott H. Lieb
	M. Susan Montgomery
	Andrew M. Odlyzko
	Samuel M. Rankin III

4.3.16. Institutional Membership

Consultant	Carol-Ann Blackwood
	Ramesh A. Gangolli
Chair	Frederick W. Gehring
	Jeremy J. Soldevilla
	William A. Veech

4.4. Internal Organization of the American Mathematical Society

Standing Committees

4.4.1. Archives

Chair Andrew M. Gleason
Franklin P. Peterson
Everett Pitcher

4.4.2. Committee on Committees

Chair M. Salah Baouendi 1994
Hyman Bass 1994
Lenore Blum 1994
Ingrid Daubechies 1994
Persi W. Diaconis 1994
James A. Donaldson 1994
Robert M. Fossum *ex officio*
Ronald L. Graham *ex officio*
Rebecca A. Herb 1994
D. J. Lewis 1994
Peter W. K. Li 1994
Richard S. Palais 1994
Carl Pomerance 1994
William Yslas Velez 1994

4.4.3. Library Committee

Co-chair Nancy Anderson 1994
Richard A. Askey 1993
R. Keith Dennis 1994
Robert S. Doran 1993
Dorothy McGarry 1994
James Rovnyak 1994
Mary Ann Southern 1994
Jack Weigel 1993

4.4.4. Publications

Chair Sheldon Axler 1994
Robert M. Fossum *ex officio*
John M. Franks 1994
Ronald L. Graham *ex officio*
William H. Jaco *ex officio*
Svetlana R. Katok 1993
Elliott H. Lieb 1993
Haynes R. Miller 1994
Richard S. Palais 1995
Frank S. Quinn 1995
Paul J. Sally, Jr. 1993
Bhama Srinivasan 1993

4.5. Program and Meetings

Standing Committees

4.5.1. Meetings and Conferences

Chair Robert M. Fossum *ex officio*
William H. Jaco *ex officio*
Linda Keen 1994
Peter W. K. Li 1995
M. Susan Montgomery 1994
Hugo Rossi 1994
Nancy K. Stanton 1996
William Yslas Velez 1994
Ruth J. Williams 1993
_____ 1995
_____ 1995
_____ 1996

4.5.2. Program Committee for National Meetings

Chair Hermann Flaschka 1994
Robert M. Fossum *ex officio*
H. W. Lenstra 1994
Jerrold E. Marsden 1995
Dusa McDuff 1993
Nancy K. Stanton 1993
Mary F. Wheeler 1994

4.5.3. Short Course Subcommittee

Chair Stefan Burr 1995
Ingrid Daubechies 1995
Robert L. Devaney 1995
Lisl Novak Gaal 1995
Jeffrey C. Lagarias 1994
Patrick D. McCray 1994
James J. Tattersall 1993

4.5.4. Central Section Program Committee

Chair Rodrigo Banuelos 1993
Julia Knight 1993
Andy Roy Magid *ex officio*
Christel Rotthaus 1994
Karl Rubin 1994

4.5.5. Eastern Section Program Committee

Chair Roy L. Adler 1993
Lawrence A. Shepp 1994
Lesley M. Sibner *ex officio*
Birgit Speh 1994
Gregg J. Zuckerman 1993

4.5.6. Southeastern Section Program Committee

Chair Steven L. Batterson 1994
Robert J. Daverman *ex officio*
Jean Larson 1993
Matthew Miller 1994
Donald St.P. Richards 1993

4.5.7. Western Section Program Committee

Chair Josefina Alvarez 1994
F. Michael Christ 1993
Robert R. Phelps 1993
Lance W. Small *ex officio*
Ruth J. Williams 1994

4.5.8. Agenda for Business Meetings

Chair Carl C. Cowen, Jr. 1994
Robert M. Fossum 1994
Rebecca A. Herb 1994

4.5.9. Arnold Ross Lecture Series Committee

Chair Harvey B. Keynes 1994
Paul J. Sally, Jr. 1995
Jean E. Taylor 1996

4.5.10. Gibbs Lecturer for 1993 and 1994, Committee to Select

Chair Michael Atiyah
Cathleen S. Morawetz
Michael O. Rabin
Thomas Spencer

4.5.11. Progress in Mathematics

Chair Michael G. Crandall 1995
John B. Friedlander 1994
Peter W. K. Li 1993
Haynes R. Miller 1993
James B. Serrin 1994

Officers and Committee Members

Special Committee

4.5.12. Special 100th Meeting Celebration

Chair	Richard A. Askey	
	Paul T. Bateman	
	Bettye Anne Case	
	Robert J. Daverman	
	Everett Pitcher	
	Janice B. Walker	

4.6. Status of the Profession

Standing Committees

4.6.1. Academic Freedom, Tenure, and Employment Security

Chair	Josefina Alvarez	1993
	Leon Brown	1994
	Murray Gerstenhaber	1995
	Simon Hellerstein	1995
	Rhonda J. Hughes	1995
	Lawrence E. Morris	1993

4.6.2. Academic Review

Chair	Frederick W. Gehring
	Frank L. Gilfeather
	Andrew M. Gleason
	J. K. Goldhaber

4.6.3. Education

Chair	Jerry L. Bona	1995
	Ramesh A. Gangolli	1994
	Ronald L. Graham	<i>ex officio</i>
	Deborah Hughes Hallett	1995
	William H. Jaco	<i>ex officio</i>
	Harvey B. Keynes	1995
	Judith Roitman	1995
	Alan H. Schoenfeld	1995
	Alan C. Tucker	1993
	Frank W. Warner III	<i>ex officio</i>

4.6.4. Education in Mathematics, Liaison Committee on

Chair	John A. Dossey
	Melvin Hochster
	Rogers J. Newman
	Louise A. Raphael
	Paul J. Sally, Jr.
	James D. Stasheff
	Lynn Arthur Steen

4.6.5. Human Rights of Mathematicians

Chair	Raymundo Bautista	1994
	Alfred Gray	1995
	Sufian Y. Husseini	1994
	Wen-Ching Winnie Li	1993
	Murray H. Protter	1995
	Cora S. Sadosky	1995
	Alice T. Schafer	1993
	Jonathan M. Wahl	1994
	Hung-Hsi Wu	1993

4.6.6. Pi Mu Epsilon Liaison Committee

	David W. Ballew	1993
	Joseph P. Brennan	1995
	Mary B. Martin	1994
	Bruce Reznick	1993
	De Witt Sumners	1994
	_____	1993

4.6.7. Profession

Chair	Roy L. Adler	1995
	M. Salah Baouendi	1994
	Ruth M. Charney	1994
	Robert M. Fossum	<i>ex officio</i>
	Ronald L. Graham	<i>ex officio</i>
	Richard J. Griego	1995
	William H. Jaco	<i>ex officio</i>
	Elliott H. Lieb	1996
	Joseph Lipman	1996
	Ronald J. Stern	1995
	Steven H. Weintraub	1994
	_____	1994
	_____	1994
	_____	1995
	_____	1996

4.6.8. Professional Ethics

Chair	Leonard D. Berkovitz	1993
	Simon Hellerstein	1995
	Donald J. Lewis	1994
	Albert Marden	1994
	Judith Roitman	1993

4.6.9. Science Policy

Chair	Michael Artin	<i>ex officio</i>
	James A. Donaldson	1993
	Richard Ewing	1995
	Eric M. Friedlander	1994
	Ramesh A. Gangolli	<i>ex officio</i>
	Ronald L. Graham	<i>ex officio</i>
	Rhonda J. Hughes	1993
	William H. Jaco	<i>ex officio</i>
	Raymond L. Johnson	1994
	Linda Keen	1993
	Donald L. Kreider	<i>ex officio</i>
	William James Lewis	1994
	Cathleen S. Morawetz	1995
	John W. Morgan	1995
	Melvyn Nathanson	1995
	Linda Preiss Rothschild	1994
	Frank W. Warner III	1993

4.6.10. Federal Policy Agenda Subcommittee

Chair	Hyman Bass	
	John S. Bradley	<i>ex officio</i>
	Arthur M. Jaffe	
	Linda Keen	
	John W. Morgan	
	John C. Polking	
	Frank W. Warner III	
	Margaret H. Wright	
	Robert J. Zimmer	

Special Committees

4.6.11. Employment Task Force

Chair	S.-Y. Cheng	
	Ronald M. Davis	
	Helen G. Grundman	
	D. J. Lewis	
	Bernard L. Madison	
	James W. Maxwell	<i>ex officio</i>
	Donald E. McClure	
	Calvin C. Moore	
	Carol S. Wood	

Officers and Committee Members

4.6.12. Ethical Conduct

Chair Chandler Davis
Lee D. Mosher
Frank S. Quinn

4.6.13. Former Soviet Union Mathematics, Advisory Committee on

Chair Michael Artin
Felix Browder
Susan J. Friedlander
Ronald L. Graham
William H. Jaco
David Kazhdan
Robert D. MacPherson
Cathleen S. Morawetz
John C. Polking
Linda Preiss Rothschild
Daniel Stroock

4.6.14. Professional Ethics, Advisory Committee on

Chair Murray Gerstenhaber
Frank L. Gilfeather
Judy Green
Linda Keen
Elliott H. Lieb

4.6.15. Resource Needs for Excellence in Mathematics Instruction

Chair Richard W. Beals
John B. Garnett
Felix Haas
Raymond L. Johnson
Barbara Lee Keyfitz
Joan P. Leitzel
William James Lewis
Donald E. McClure
Alan Newell
Alan C. Tucker
David A. Vogan, Jr.

4.7. Prizes and Awards

Standing Committees

4.7.1. Award for Public Service, Committee to Select the Winner of the

Chair	William Browder	1995
	Kenneth M. Hoffman	1996
	Harvey B. Keynes	1997
	John C. Polking	1994
	David P. Roselle	1993

4.7.2. Centennial Fellowships

Terms expire on June 30

Chair	H. Jerome Keisler	1994
	Peter Sarnak	1994
	Alice Silverberg	1995
	Birgit Spoh	1994
	Kari Vilonen	1995
	Lai-Sang Young	1994
		1995

4.7.3. National Awards and Public Representation

	Michael Artin	<i>ex officio</i>
	Joan S. Birman	1993
Chair	Robert M. Fossum	<i>ex officio</i>
	Ronald L. Graham	<i>ex officio</i>
	Richard S. Palais	1993

4.7.4. Subcommittee on Appointments of the Committee on National Awards and Public Representation

	Robert M. Fossum	<i>ex officio</i>
Chair	Irwin Kra	
	John C. Polking	

4.7.5. Satter Prize for 1993, Committee to Select the Winner of the

Chair	Dusa McDuff	1993
	Cathleen S. Morawetz	1994
	Alan D. Weinstein	1993

4.7.6. Steele Prizes

Terms expire on June 30

	Eugenio Calabi	1995
	Vaughan F. R. Jones	1994
	Robert P. Langlands	1995
	Barry Mazur	1996
	Paul Rabinowitz	1995
	Marina Ratner	1996
	Jane Cronin Scanlon	1994
	Jean E. Taylor	1994
	William P. Thurston	1996

Special Committees

4.7.7. AMS Prizes and Awards

	Joan S. Birman
	Frederick W. Gehring
	Ronald L. Graham
	Joseph J. Kohn
	Gian Carlo Rota
Chair	Joseph L. Taylor

4.7.8. Automatic Theorem Proving, Committee to Recommend Winners of Prizes for

Chair	David Mumford
	Jacob T. Schwartz
	John L. Selfridge

4.7.9. Bôcher Prize

	Luis A. Caffarelli
	Richard B. Melrose
Chair	Richard M. Schoen

4.8. Institutes and Symposia

Standing Committees

4.8.1. Liaison Committee with AAAS

	Efraim P. Armendariz	<i>ex officio</i>
	Ronald L. Graham	<i>ex officio</i>
	Deborah Tepper Haimo	<i>ex officio</i>
	Alfred W. Hales	1993
	Raymond L. Johnson	<i>ex officio</i>
	Philip C. Kutzko	1993
	Warren Page	<i>ex officio</i>
	Louise A. Raphael	1993
	V. Frederick Rickey	<i>ex officio</i>
Chair	M. Beth Ruskai	1993
	Chih-Han Sah	<i>ex officio</i>
	Alice T. Schafer	<i>ex officio</i>
	Melvin Thornton	<i>ex officio</i>

Officers and Committee Members

4.8.2. Summer Institutes and Special Symposia

Terms expire on February 28

Chair	Jonathan L. Alperin	1996
	Donald L. Burkholder	1995
	Lawrence Craig Evans	1994
	Melvin Hochster	1995
	Edward Witten	1994
	Lai-Sang Young	1996

4.9. Joint Committees

4.9.1. AMS-AAAS-MAA Committee on Opportunities in Mathematics for Underrepresented Minorities

Chair	Joaquin Bustoz	1995
	Gloria F. Gilmer	1995
	Leon A. Henkin	1995
	Shirley Malcom	<i>ex officio</i>
	James C. Turner	1995
Consultant	Argelia Veléz-Rodriguez	

4.9.2. AMS-ASA-AWM-IMS-MAA-NCTM-SIAM Committee on Womens in the Mathematical Sciences

NCTM members' terms expire April 1 of the year given.

	Lynne Billard (IMS)	1994
	Lynne Butler (SIAM)	1995
	Kathryn M. Chaloner (ASA)	1995
	Margaret B. Cozzens (SIAM)	1995
	Susan Groshen (IMS)	1995
	Joan Hutchinson (AWM)	1994
	Patricia C. Kenschaft (MAA)	1994
	Don J. Lewis (MAA)	1994
	J. Peter May (AMS)	1994
	Anita McDonald (MAA)	1994
	Joyce R. McLaughlin (SIAM)	1993
	Frances Rosamond (MAA)	1995
Chair	M. Beth Ruskai (AMS)	1995
	Evelyn Silvia (AWM)	1993
	Berit Stenones (AMS)	1995
	Sandra Stinnett (ASA)	1994
	Tilla Weinstein (AMS)	1995
	Patricia S. Wilson (NCTM)	1993

4.9.3. AMS-ASL-IMS-SIAM Committee on Translations from Russian and Other Slavic Languages

Chair	James D. Stasheff (AMS)	1995
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AMS Subcommittee Members

Consultant	V. I. Arnol'd	
	Luchezar Avramov	1994
	Igor Dolgachev	1994
Consultant	S. G. Gindikin	
Consultant	Askol'd Georgievič Khovanskiĭ	
	Arunas Liulevicius	1993
Consultant	N. K. Nikol'skiĭ	
	Washek Pfeffer	1993
Chair	James D. Stasheff (AMS)	1995

ASL Subcommittee Members

	George Boolos	1995
	Vladimir Lifschitz	1993
	Grigori Mint	1993
	Boris I. Zil'ber	1994

IMS Subcommittee Members

Chair	M. I. Freidlin
	B. Pittel
	A. Rukhin
	W. J. Studden

4.9.4. AMS-CMS Joint Program Committee

	Spencer Bloch (AMS)
	David W. Boyd (CMS)
Chair	Carl Herz (CMS)
	Dusa McDuff (AMS)
	Victor P. Snaith (CMS)
	Nancy K. Stanton (AMS)

4.9.5. AMS-DMV Joint Program Committee

	Klaus D. Bierstedt
	Joachim Cuntz
	Albrecht E. Dold
	Yvonne Dold
	Robert M. Fossum
	Dale Husemoller
	Norbert Schappacher
	Friedrich Tomi
	Bernd Ulrich

4.9.6. AMS-IMS-MAA Data Committee

Consultant	Edward A. Connors (AMS)	1993
	Lincoln K. Durst	
	John D. Fulton (MAA)	1994
	James F. Hurley (AMS)	1994
	Don O. Loftsgaarden (MAA)	1993
	David J. Lutzer (MAA)	1993
	James W. Maxwell (AMS)	<i>ex officio</i>
Chair	Donald E. McClure (AMS)	1993
	Donald B. Rubin (IMS)	1993
	Donald C. Rung (AMS)	1995
	Ann K. Stehney (AMS)	1995

4.9.7. AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences

Terms expire on June 30

	Alan F. Karr (AMS)	1996
	Stewart B. Priddy (AMS)	1994
	Robert J. Serfling (IMS)	1993
	Michael Shub (AMS)	1994
	Clifford Taubes (AMS)	1997
	Sue Whitesides (AMS)	1996
	_____ (AMS)	1997
	_____ (AMS)	1997
	_____ (SIAM)	1994
	_____ (SIAM)	1994

4.9.8. AMS-MAA Committee on Research in Undergraduate Mathematics Education (CRUME)

Chair	Thomas P. Dick (AMS)	1993
	Ed Dubinsky (MAA)	1995
	Joan Ferrini-Mundy (NCTM)	1995
	James J. Kaput (MAA)	1993
	George S. Monk (MAA)	1994
	Warren Page (AMATYC)	1995
	Samuel M. Rankin III (AMS)	1993
	Alan H. Schoenfeld (AMS)	1995
	John Selden (AMS)	1994
	Robert S. Smith (MAA)	1994

Officers and Committee Members

4.9.9. AMS-MAA Committee on Teaching Assistants and Part Time Instructors (TA/PTI)

Reuben C. Drake (MAA)	1994
Deborah Hughes Hallett (AMS)	1993
Timothy L. Lance (AMS)	1994
Suzanne Lenhart (AMS)	1995
Daniel J. Madden (AMS)	1994
Shelba J. Morman (MAA)	1995
Stephen B. Rode (MAA)	1994
Raymond O. Wells (MAA)	1995

4.9.10. AMS-MAA Joint Archives Committee

Andrew M. Gleason (AMS)	1993
Albert C. Lewis (MAA)	1993
Karen Parshall (MAA)	1995
Everett Pitcher (AMS)	1994
Sanford L. Segal (MAA)	1994

Chair

4.9.11. AMS-MAA Joint Meetings Committee

All members of this committee serve *ex officio*.

Consultant	H. Hope Daly
	Robert M. Fossum
	William H. Jaco
Chair	Kenneth A. Ross
	Marcia P. Sward

4.9.12. Subcommittee on Summer Meetings

David W. Ballew
Robert M. Fossum
Kenneth A. Ross
Nancy K. Stanton

Chair

4.9.13. AMS-MAA Arrangements Committee for the Cincinnati Meeting January 12–15, 1994

Franklin W. Briese	
Joseph K. Casey	
Milton D. Cox	
Robert J. Daverman	<i>ex officio</i>
William H. Jaco	<i>ex officio</i>
Edward P. Merkes	
Melinda Michael	
Kenneth A. Ross	<i>ex officio</i>
David Styer	
Marcia P. Sward	<i>ex officio</i>
Janice B. Walker	

Chair

4.9.14. AMS-MAA Joint Program Committee for the Cincinnati Meeting

Richard A. Askey (MAA)
Thomas F. Banchoff (MAA)
H. W. Lenstra (AMS)
Peter M. Winkler (AMS)

Chair

4.9.15. AMS-CMS-MAA Arrangements Committee for the Vancouver Meeting August 15–19, 1993

David Boyd	
Afton H. Cayford	
Alan Cooper	
Katherine Heinrich	
William H. Jaco	<i>ex officio</i>
David Leeming	
Dale Rolfson	
Kenneth A. Ross	<i>ex officio</i>
Denis Sjerve	
Lance W. Small	<i>ex officio</i>
Marcia P. Sward	<i>ex officio</i>

Co-chair

Co-Chair

4.9.16. AMS-MAA-SIAM Joint Administrative Committee

All members of this committee serve *ex officio*.

Chair	Gerald L. Alexanderson (MAA)
	I. Edward Block (SIAM)
	Robert M. Fossum (AMS)
	Avner Friedman (SIAM)
	Samuel Gubins (SIAM)
	William H. Jaco (AMS)
	Donald L. Kreider (MAA)
	Franklin P. Peterson (AMS)
	Marcia P. Sward (MAA)

4.9.17. AMS-MAA-SIAM Joint Committee on Employment Opportunities

Chair	Stanley Benkoski (AMS)	1993
	Ronald M. Davis (MAA)	1993
	Frank R. Demeyer (AMS)	1994
	James W. Maxwell	<i>ex officio</i>
	S. Brent Morris (MAA)	1994
	Leon H. Seitelman (SIAM)	1994
	Ivar Stakgold (SIAM)	1995

4.9.18. AMS-MAA-SIAM Joint Policy Board for Mathematics (see 1993 Mathematical Sciences Professional Directory, page 28)

4.9.19. AMS-SIAM Committee on Applied Mathematics

Chair	Marsha J. Berger	1994
	James W. Demmel	1995
	Paul C. Fife	1994
	James M. Hyman	1993
	Tai-Ping Liu	1995
	Michael Shub	1993

4.9.20. AMS-SIAM Committee to Select the Winner of the Birkhoff Prize for 1994

Chair	Thomas Kurtz
	Mary Fanett Wheeler

4.9.21. AMS-SIAM-SMB Committee on Mathematics in the Life Sciences

Chair	Jack D. Cowan	1994
	James W. Curran	1993
	Leah Edelstein-Keshet	1994
	Eric S. Lander	1993
	Michael S. Waterman	1995
	Carla Wofsy	1995

4.9.22. AMS-SMM Joint Program Committee

Robert M. Fossum (AMS)	<i>ex officio</i>
Jorge Andrés Ize Lamache (SMM)	
José Carlos Gómez Larrañaga (SMM)	
Luis Gorostiza Ortega (SMM)	
Idun Reiten (AMS)	
Mary Ellen Rudin (AMS)	
William Yslas Velez (AMS)	

Special Committees

4.9.23. AMS-MAA Committee on Cooperation

Co-chair	Gerald L. Alexanderson (MAA)	
	Susan Forman (MAA)	
	Robert M. Fossum (AMS)	
	Ramesh A. Gangolli (AMS)	
	Ronald L. Graham (AMS)	<i>ex officio</i>
	Deborah Tepper Haimo (MAA)	<i>ex officio</i>

Officers and Committee Members

Staff	William H. Jaco (AMS)
Co-chair	Donald L. Kreider (MAA)
	M. Susan Montgomery (AMS)
	Mary Ellen Rudin (AMS)
	David A. Sanchez (AMS)
	Andrew Sterrett (MAA)
Staff	Marcia P. Sward (MAA)
	Alan C. Tucker (MAA)

4.9.24. AMS-MAA-SIAM Committee on Preparation for College Teaching

Chair	Donald W. Bushaw
	Bettye Anne Case
	Robert H. McDowell
	Richard S. Millman
	Robert R. Phelps
	Richard D. Ringeisen
	Stephen B. Rodi
	James G. Simmonds
	Guido L. Weiss

5. Representatives

5.0.1. Advisory Board of the National Translations Center of the John Crerar Library

5.0.2. American Association for the Advancement of Science

Terms expire on February 21

Section A	Raymond L. Johnson	1995
Section B	Chih-Han Sah	1995
Section L	V. Frederick Rickey	1995
Section Q	Efraim P. Armendariz	1995
Section T	Melvin Thornton	1995

5.0.3. Commission on Professionals in Science and Technology

Edward A. Connors

5.0.4. Committee on the American Mathematics Competition

Term expires on June 30

Richard P. Stanley 1994

5.0.5. Conference Board of the Mathematical Sciences

Ronald L. Graham 1994

5.0.6. Fulkerson Prize Committee

Alan J. Hoffman

5.0.7. MAA Committee on Guidelines

Donovan H. Van Osdol 1992

5.0.8. MAA Committee on Undergraduate Program in Mathematics

Harvey B. Keynes 1992
Kathy O'Hara 1993

5.0.9. U.S. National Committee on Theoretical and Applied Mechanics

Term expires on October 31

Constantine M. Dafermos 1996

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Miscellaneous

Personals

Ismat Beg, of Kuwait University, was appointed Group Associate Member of the International Centre for Theoretical Physics (ICTP, IAEA, and UNESCO) from January 1, 1993, to December 31, 1998.

George D. Byrne, formerly of the Exxon Research and Engineering Company and of the University of Pittsburgh, is now a visiting professor in the department of mathematics at Southern Methodist University.

Jayaram Sethuraman, of Florida State University, was recently designated as the Robert O. Lawton Distinguished Professor, which is the highest honor that the faculty at Florida State University can bestow on one of its members.

Xianke Zhang, of the University of Science and Technology of China, has accepted a position at Tsinghua University at Beijing, and recently has been conferred the prize "Ph. Doctor Having Outstanding Merit of China" by the National Education Committee and the National Academic-Degree Committee, the National Natural-Science Prize, and the Scientific Progress Prize of Academia Sinica (with Keqin Feng and Hongwen Lu).

Deaths

Peter Hall, of the University of Alabama, died on April 30, 1993. He was born on June 5, 1956, and was a member of the Society for 11 years.

Pierce W. Ketchum, Professor Emeritus of the University of Illinois at Urbana-Champaign, died on February 24, 1993. He was born on September 5, 1903, and was a member of the Society for 65 years.

John F.X. Ries, of East Carolina University, died on July 6, 1993. He was born on May 16, 1954, and was a member of the Society for 12 years.

Visiting Mathematicians Supplementary List

Mathematicians visiting other institutions during the 1992–1993 academic year have been listed in recent issues of the *Notices*: October 1992, p. 960; November 1992, p. 1129, December 1992, p. 1291, January 1993, p. 70, February 1993, p. 193, and July/August 1993, p. 731.

Mark Mahowald (U.S.A.), Mittag-Leffler Institute, Sweden, Topology, 9/93–12/93.

Stewart Priddy (U.S.A.), Mittag-Leffler Institute, Sweden, Homotopy Theory, 9/93–10/93.

Yoshikazu Giga (Japan), Johns Hopkins University, Nonlinear Partial Differential Equations, 3/94–6/94.

Dmitry Ioffe (Israel), Northwestern University, Probability, 9/93–8/95.

Suichi Jimbo (Japan), Johns Hopkins University, Nonlinear Partial Differential Equations, 3/94–4/94.

Yuri Kifer (Israel), Northwestern University, Probability, 9/93–10/93.

Jens-Peter Lynov (Denmark), University of New Mexico, Applied Mathematics, 8/93–12/93.

Takeyuki Nagasawa (Japan), Johns Hopkins University, Nonlinear Partial Differential Equations, 3/94–6/94.

Takayoshi Ogawa (Japan), Johns Hopkins University, Nonlinear Partial Differential Equations, 1/94–4/94.

Yoshio Tsutumi (Japan), Johns Hopkins University, Nonlinear Partial Differential Equations, 3/94–4/94.

Mate Wierdl (Hungary), Northwestern University, Ergodic Theory, 9/93–8/95.

Tomasz Zastawniak (Poland), Northwestern University, Probability, 9/93–8/94.

Zbigniew S. Szafraniec (Poland), University of New Mexico, Geometry and Topology, 8/93–5/94.

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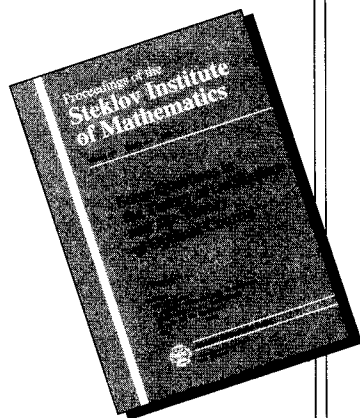
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Department of Mathematics
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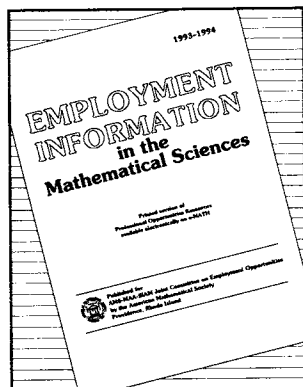
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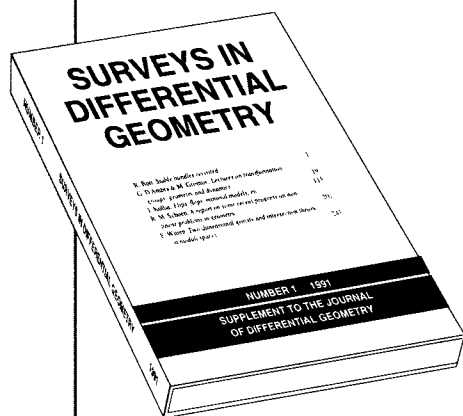


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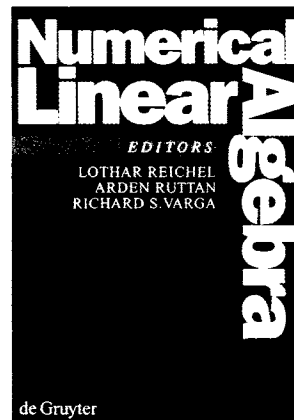
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Mathematical World

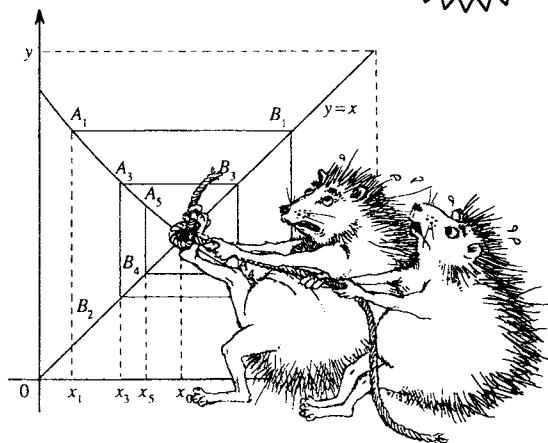
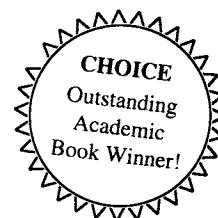
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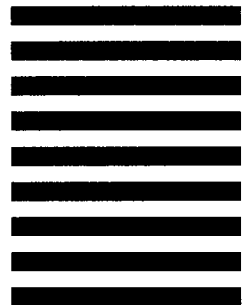
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OCTOBER 1–3, 1993

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