



*Department of Electrical and  
Computer Engineering*

2003 - 2004  
Annual Report

July 1, 2003 - June 30, 2004

[www.bu.edu/ece](http://www.bu.edu/ece)

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# one: *Highlights*

This report provides a detailed description of the instructional and research activities of the faculty, staff, and students of the Department of Electrical and Computer Engineering (ECE) at Boston University during the 2003-2004 academic year. Instructional activities are reported for Fall 2003, Spring 2004, and Summer 2004 semesters. Publications and scholarly activities, as well as budget information, are reported for the 2004 fiscal year (July 1, 2003 to June 30, 2004). Key data for this year are also compared to previous years to show progress and identify trends. More information on ECE's recent activities is reported at the department website, <http://www.bu.edu/ece>.

## 1.1 Faculty

One new full-time faculty joined the ECE Department this year. **Roberto Paiella** was appointed Assistant Professor (tenure-track) beginning September 1, 2003. He received his Ph.D. from the California Institute of Technology in 1998. His research interests include nanoscale photonic devices and circuits. (*See sidebar below.*)

The Department also continued its vigorous efforts to recruit new faculty in selected strategic areas. As a result, three new faculty members will be joining the ECE faculty in September 2004 at the rank of Assistant Professor (tenure-track): **Wei Qin**, **Prakash Ishwar**, and **Joshua Semeter**. Qin expects to defend his Ph.D. thesis, in retargetable software development tools for microprocessor Modeling, at Princeton, this summer. Ishwar received his Ph.D. from the University of Illinois, Urbana-Champaign in 2002 and is currently a postdoctoral fellow at UC-Berkeley. His current research is in sensor networks and multimedia-over-wireless. Semeter received his



Roberto Paiella received his Ph.D. in Applied Physics in 1998 from the California Institute of Technology. He spent two years as a post-doctoral researcher at Lucent/Bell Laboratories working on high-speed quantum cascade lasers and ultrafast mid-infrared optics. When Agere Systems spun off of Lucent in 2000, he became a member of the technical staff there. He joined the

faculty of Boston University at the rank of Assistant Professor effective September 1, 2003.

His research interests include optical technologies for information processing, photonic devices based on semiconductor quantum structures, including group-III nitride quantum wells, nanoscale photonic devices and circuits and ultrafast optics.

Ph.D. from Boston University in 1997, and is currently at SRI. His research interests include remote sensing and ionospheric and space plasma physics.

Four faculty members were promoted to the rank of Full Professor: **W. Clem Karl**, **Hamid Nawab**, **Alexander Sergienko**, and **Selim Ünlü**. Additionally, **Jeffrey Carruthers** was promoted to Associate Professor with tenure.

Sabbatical leaves this year included Professor **David Castañón** for the full 2003-2004 academic year, and Professors **Mark Karpovsky** and **Alexander Sergienko** in the Spring of 2004.

## 1.2 Faculty Awards and Honors

**Venkatesh Saligrama** received the Presidential Early Career Award for Scientists and Engineers (PECASE). This award is the highest honor bestowed by the US government on outstanding scientists and engineers beginning their independent careers. The award was conferred at the White House on May 4, 2004. Saligrama is cited for "pioneering research on statistical modeling and learning in context of limited data with applications to signal processing in networked environments, and for significant contributions to control-oriented system identification and non-stationary and robust signal processing."

**Murat Alanyali** received an NSF CAREER award in support of his research on "scalable architectures for self-managed networks." This brings the number of ECE faculty who received NSF PYI or CAREER awards to 9.

**Michael Ruane** received the 2004 ASEE New England Section Outstanding Teaching Award. **Mark Horenstein** received the 2003/2004 ECE Faculty Teaching Excellence Award from the Department, and **Murat Alanyali** and **Martin Herboldt** received the College of Engineering 2004 Legacy Gift Award.

**Thomas Skinner** was named Microsoft® Most Valuable Professional (MVP). He is recognized for his significant contributions to the Microsoft Academic Alliance and his "willingness to share with peers in technical communities around the globe."

### 1.3 Staff

A number of new staff joined the ECE Department in 2003-2004. **Carly Marchioni** accepted the position of Academic Programs Administrator. **Michael Pastore** joined the staff as Administrative Assistant in October and **Jim Gilbert** was hired as Senior Administrative Secretary in November. **Vladimir Klepstyn** accepted the position of Electronics/Circuits Laboratory Manager.

### 1.4 Undergraduate Program

This was the year for the ABET evaluation of the EE and CSE programs for re-accreditation. The ABET visit in October, 2003 was successful, and as a result the ECE Department gained re-accreditation for another six years, the maximum period for which ABET re-accreditation may be obtained. The report applauded the College's "strong commitment to the philosophy and processes of quality improvement," and the "investment in laboratory space, equipment, and personnel," which has resulted in "spectacular laboratory facilities." Program strengths included the student exposure to a "rigorous, thorough, and hands-on professional component," and the "exceptional laboratory experience."

Enrollment in the BS programs has been steady in recent years. A total of 334 students enrolled in the Electrical Engineering (EE) and Computer Systems Engineering (CSE) programs, with CSE enrollment now making up roughly 57% of the total undergraduate enrollment. The number of EE and CSE BS degrees awarded this year were 48 and 51, respectively. *(See details in Section 3.1 and enrollment history in Section 6.1.)*

High-quality instruction continues to be of paramount importance to the ECE Department. The curriculum has been continuously updated to meet the needs of tomorrow's engineers. A process of continual program improvement has been established with the goal of meeting our program educational objectives. Specific expected outcomes have been defined, and mechanisms for assessing their achievement include review of the core courses by a faculty committee, graduation surveys, review by the ECE Industrial Advisory Council, and meetings with student representatives to obtain their feedback. The program objectives are also assessed through alumni surveys. *(See Section 3 for a detailed description of our program for improvement.)*

Efforts to enhance the undergraduate laboratories are successfully ongoing, with new equipment, maintenance, and upgrades this year at a total cost of \$344k. In both classrooms and laboratories, emphasis is placed on design, laboratory practice, and applications. Successful ideas that were initiated in previous years, such as the Teaching Workshop, the ECE Project Conference Day, ECE Advising Day, and the ECE Teaching Excellence Award, continued this year. *(See Section 3 for more information.)*

### Undergraduate Students Awards

ASEE New England Section, Student Paper Competition Awards: Team 18 from Senior Design won 2nd place in the Design project competition (advisor Michael Ruane). *(See section 3 for a detailed description of the team's project.)*

Undergraduate student **Gavin Gray** took 2nd place in the Northeast Student Paper Contest, Research Project Session, for his paper "Least-Distance Curve Fitting" (advisor William Oliver).

A team of ECE students (**David Hotchkiss**, **Benoit Schmitlin**, **Adam Kustwan**, and **Patrick Sexton**) won First Place at the Eastern Regional Imagine Cup 2004 Competition at Princeton, N.J. Their project Kitchen.NET is a mobile software solution for personal kitchen management.

### 1.5 Graduate Program

New student recruiting efforts were successful in 2003-2004. ECE continued the use of a new recruiting tool: the Dean's Research Fellowship, initiated last year, which provided one year of funding to those applicants selected from nominated departments. DRF's cover 8 credit hours per semester and allow the students to be engaged in research early in their graduate studies and to prepare for PhD qualifying exams. Out of the first batch of 8 DRF's, 7 of them are continuing towards their degree programs and we have recruited 5 additional DRF's for the Fall 2004 semester.

The Graduate committee developed a new PhD student database of existing paper files to provide easier access to student records. All critical information about current PhD students is now organized in a relational database and the records are accessible to ECE faculty over a web portal.

There were also substantial updates to the graduate curriculum this year. We are continuing the practice of developing new special topics courses. When these courses are successful, they are frequently assigned a course number and integrated into the curriculum as a regular offering.

### Graduate Student Awards

Graduate students have had an excellent Showing in the Science and Technology Day. The "College Of Engineering Award" was received by **Olufemi Dosunmu** for his poster "Resonant Cavity Enhanced Ge Photodetectors for 1550 nm Operation on Reflecting Si Substrates." (Advisor: Selim Ünlü) The "Censis Award" was received by **David Bergstein**, "Resonant Cavity Imaging Biosensor." (Advisor: Michael Ruane)

Graduate students **George Atia** and **Shey-Sheen Chang** received the 2003/2004 ECE Graduate Teaching Fellow of the Year Award.

## 1.6 Research

New research funding this year totaled approximately \$6.2M, of which \$4.4M were grants for which the Principal Investigators (PI) were ECE faculty, and \$1.8M were shares in grants for which ECE faculty were Co-PIs on grants for which the PI's were from other departments. Similar figures for the 2002-2003 fiscal year were \$6.9M (\$6.0M + \$0.9M). (See Section 5.5 for details on research funding.)

Several large research grants received this year were in support of inter-departmental collaborative research. A new grant was received from NSF for research entitled "Sensors and Sensor Networks: A Control and Optimization Science Base for Sensor Networks in Adverse and Stochastic Environments," (\$2.5M), with Christos Cassandras (PI) and David Castañón as one of three co-PI's (in conjunction with the Center for Information and Systems Engineering -- CISE). Another new grant was received from HHS/NIH/NICHD for research entitled "Harnessing Moroneuron Activity: from Lab to Clinic," (\$580k), with Carlo DeLuca (PI) and Hamid Nawab (co-PI). David Mountain (PI) and Allyn Hubbard (co-PI) received a grant from HHS/NIH/NIDCD (\$462k) entitled "EarLab: A Virtual Hearing Laboratory," in conjunction with the Hearing Research Center. Several new and renewed grants from DOD (including a new MURI grant), NSF and a number of industries in support of the research of Theodore Moustakas in GaN devices (totaling approximately \$1M). Funding for the NSF Center for Subsurface Imaging and Sensing Systems (CenSSIS) has been renewed this year. Boston University's share of this four-university coalition totals approximately \$3.5M (5 year period). This effort is led by Bahaa Saleh, David Castañón, and Michael Ruane in the ECE Department and involves several other ECE and College faculty. Also renewed this year, is DARPA funding in support of the research of Alexander Sergienko, Bahaa Saleh, and Malvin Teich in the area of quantum cryptography (\$366k this year). Internal research funding included Provost's SPRInG (Special Program for Research Initiation Grants Award) to Michael Ruane for his research in biosensors.

This year, the ECE faculty, academic staff, and graduate students have published fifty-nine research papers in archival journals, authored or co-authored five books or book chapters, and made ninety-nine conference contributions (papers, abstracts, and presentations). They have also filed eight patents or patent disclosures. (See Section 5.4 for a complete listing of faculty publications.) The Department continued its weekly Research Spotlight Seminar series this year. Thirteen ECE faculty presented highlights of their research.

## 1.7 Special Events

### ECE Day 2004

Initiated in 1997, the ECE Day is a forum for presentation of the students' senior design projects. Held at the end of the Spring semester, ECE Day 2004 included xx presentations on different projects conducted by groups of 2 to 4 students. The presentations were attended by students, faculty, alumni, company representatives, and members of the ECE Industrial Advisory Council. (For more information on ECE Day 2004 see Section 3.4.)

### ECE Retreat

The ECE Department held its annual Faculty Retreat on May 5, 2003. This year, the faculty discussed the future of ECE discipline and identified roadmaps in microelectronics, nanotechnology, distributed signal processing, information technology, computer systems, photonics, and biomedical technology. Also discussed was a comparison with other peer departments and the strengthening of our relation with other BU departments and research centers.

### Industrial Advisory Council

The IAC held its annual meeting on April 29, 2004. The council discussed the ABET visit report, particularly ABET metrics for career objectives. Other discussions included the expected impact of outsourcing on student enrollment down the road, and existing and anticipated economic and industrial paradigm shifts that might necessitate different training for our graduates,

## Industrial Advisory Council Members

Hassan Ahmed  
President  
Sonus Networks, Inc.



Tom Arseneault  
Vice President Engineering  
Information and Electronic Warfare Systems

Paul Hoffman  
Director of Engineering Operations  
BAE Systems



Jihad Boura  
Senior Member, Technical Staff  
Altera



William Bowers  
Engineering Manager  
Teradyne



Julie M. Cubino  
Manager, ASIC Design Kit  
IBM Microelectronics



D. George Gata  
Texas Instruments  
Mixed Signal Custom Products Department  
Advanced Analog Core Design

Katie Hall  
CTO  
PhotonEx



Anuj Jain  
Technical Staff  
IBM



Micah Knapp  
Staff Engineer  
SGI



Christina Knopp  
Marketing Manager  
DUSA Pharmaceuticals Inc.



Kevin Knopp  
Director of Engineering  
Ahura Corporation



David Kukulinsky  
President  
SIR, Inc.



Ben H. Mbugua  
Front Line Application Manager  
Analog Devices, Inc., DSP Division

Rich Molnar  
Technical Staff  
MIT Lincoln Laboratory



Anthony Palmieri  
Marketing Applications Manager  
Applied Micro Circuits Corporation



John Reinke  
Sr. Director, eBusiness Solutions Group  
Siebel Systems, Inc.



Gary Smith  
Principal Engineer  
Corning Lasertron, Inc.



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two: *Faculty & Staff*



## 2.1 Faculty



**Murat Alanyali, Assistant Professor**

- Ph.D., University of Illinois, Urbana-Champaign, 1996
- Communication networks, stochastic networks, performance analysis and optimization



**Enrico Bellotti, Assistant Professor**

- Ph.D., Georgia Institute of Technology, 1999
- Computational electronics; semiconductor materials and device simulations; power electronics; parallel and cluster computing
- 2003 ONR Young Investigator Award



**Irving Bigio, Professor**

- Ph.D., University of Michigan, 1974
- Medical application of optics, lasers, and spectroscopy; biophotonics; applied spectroscopy; nonlinear optics, quantum electronics, and laser physics
- Fellow - Optical Society of America and American Society for Lasers in Medicine and Surgery



**Richard Brower, Professor**

- Ph.D., Physics, University of California, 1969
- Quantum field theory of Strings and Particles; lattice methods for QCD and statistical mechanics; molecular dynamics simulation for biomolecules



**Maja Bystrom, Associate Professor**

- Ph.D., Rensselaer Polytechnic Institute, 1997
- Source and channel coding; multimedia communications; digital signal processing
- NSF CAREER Award



**David Campbell, Professor & Dean**

- Ph.D., Cambridge University, 1970
- General nonlinear phenomena and complex systems; novel electronic materials, including conducting polymers and organic and high  $T_c$  superconductors; electron transport in semiconductor superlattices
- Fellow - American Physical Society and American Association for the Advancement of Science; Editor-in-Chief, *Chaos*; Editor, *Physics Reports*



**Jeffrey Carruthers, Associate Professor**

- Ph.D., University of California, Berkeley, 1997
- Wireless infrared communications; broadband communications; mobile and wireless networks
- NSF CAREER Award
- 2000/01 ECE Faculty Award for Excellence in Teaching



**David Castañón, Professor**

- Ph.D., Massachusetts Institute of Technology, 1976
- Stochastic control; estimation optimization; image understanding and parallel computation
- Associate Editor, *Computational Optimization and Applications*; Associate Director, Center for Subsurface Sensing and Imaging Systems



**Azza Fahim, Assistant Professor**

- Ph.D., Cairo University, 1984
- Electric machines; computations in electromagnetics



**Roscoe Giles, Professor**

- Ph.D., Stanford University, 1975
- Advanced computer architectures; distributed and parallel computing; computational science
- NSF Partnerships for Advanced Computational Infrastructure (PACI): Co-Chair, National Educational Outreach and Training Coordinating Committee; Co-Chair, Alliance Collaborative and Data Storage Team
- 1996 College of Engineering Award for Excellence in Teaching



**Martin Herbordt, Associate Professor**

- Ph.D., University of Massachusetts, 1994
- Computer architecture; design automation; switch design; computer vision architecture; bioinformatics
- NSF CAREER Award



**Mark Horenstein, Professor & Associate Dean for Graduate Programs**

- Ph.D., Massachusetts Institute of Technology, 1978
- Applied electromagnetics; electrostatics, micro-electromechanical systems (MEMS)
- President, Electrostatics Society of America
- Registered Professional Engineer
- 2003/2004 ECE Faculty Award for Excellence in Teaching





**Allyn Hubbard, Professor**

- Ph.D., University of Wisconsin-Madison, 1977
- VLSI circuit design; digital, analog, subthreshold analog, biCMOS, CMOS; information processing in neurons, neural net chips, synthetic aperture radar (SAR) processing chips, sonar processing chips; auditory models and experiments
- 2002 College of Engineering teaching award



**Floyd Humphrey, Research Professor**

- Ph.D., California Institute of Technology, 1956
- Computer simulations of magnetic materials and storage devices; magnetic sensors
- Life Fellow, IEEE; IEEE - 100th Anniversary Gold Medal for Service; Magnetics Society 1988 Achievement Award; Millennium Medal



**W. Clement Karl, Professor**

- Ph.D., Massachusetts Institute of Technology, 1991
- Multidimensional and multiscale signal and image processing and estimation, particularly applied to geometrically and medically oriented problems
- 1999/00 ECE Faculty Award for Excellence in Teaching



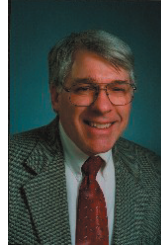
**Mark Karpovsky, Professor**

- Ph.D., Leningrad Electrotechnical Institute, 1967
- Testing and diagnosis of computer hardware; fault-tolerant computing; error correcting codes
- Fellow, IEEE



**Thomas Kincaid, Professor**

- Ph.D., Massachusetts Institute of Technology, 1965
- Signal and image processing; neurodynamics; non-destructive testing



**Ronald Knepper, Professor**

- Ph.D., Carnegie Mellon University, 1969
- VLSI integrated circuit technology; silicon CMOS & bipolar devices; numerical device simulation; SiGe BICMOS device and circuit modeling
- Fellow, IEEE



**Janusz Konrad, Associate Professor**

- Ph.D., McGill University, 1989
- Multimedia communications; image and video processing; stereoscopic and 3-D imaging; digital signal processing
- Associate Editor, *IEEE Trans. on Image Processing*, 1996-2000; Associate Technical Editor, *IEEE Communications Magazine*
- IEEE Signal Processing Magazine Award



**Robert Kotiuga, Associate Professor**

- Ph.D., McGill University, 1985
- Electromagnetics; numerical methods for three-dimensional vector field problems; Whitney forms and the Finite Element Method; geometric inverse problems
- Member, Electromagnetics Academy



**Min-Chang Lee, Professor**

- Ph.D., University of California, San Diego, 1977
- Radio communications; experimental plasma physics; ionospheric plasma physics



**Lev Levitin, Distinguished Professor**

- Ph.D., USSR Academy of Sciences, Gorky University, 1969
- Information theory; physics of communication and computing; quantum theory of measurements; complex and organized systems; reliable computing
- Fellow, IEEE; Member, New York Academy of Sciences; Member of the International Academy of Informatics



**Thomas Little, Associate Professor**

- Ph.D., Syracuse University, 1991
- Multimedia Computing, Mobile Ad Hoc Networks, Sensor Networks
- Editorial Board Member, ACM/Springer Multimedia Systems, Journal of Multimedia Tools and Applications
- Entrepreneur



**Fei Luo, Research Associate Professor**

- Ph.D., Chongqing University, 1991
- Distributed fiber optic sensors and systems; optical fiber grating sensors; interferometric sensors and fiber optic smart structures



**Theodore Morse, Professor**

- Ph.D., Northwestern University, 1961
- Photonic material processing; optical fiber fabrication, lasers, and sensors
- Fulbright Fellow, Germany



**Theodore Moustakas, Professor**

- Ph.D., Columbia University, 1974
- III-nitride semiconductors (materials growth and device fabrication); growth by MBE, MOCVD, HVPE and gas-cluster ion beam deposition (GCIB); growth, fabrication and characterization of optical devices, electronic devices and electromechanical devices
- Fellow - American Physical Society and Electrochemical Society; Member - Advisory Board, North American MBE; Governing Body, Dielectric Science and Technology Division of the Electrochemical Society
- 1997/98 ECE Faculty Award for Excellence in Teaching



**S. Hamid Nawab, Professor & Associate Chair for Undergraduate Studies**

- Ph.D., Massachusetts Institute of Technology, 1982
- Digital signal processing, real-time, low-power, and distributed signal processing; image processing; communication and biomedical applications; integrated DSP environments and architectures, knowledge-based signal processing, and applications in auditory scene interpretation, music and EMG signal analysis.
- 1988 Best Paper Award, *IEEE Signal Processing Society*; 1993 Metcalf Award for Excellence in Teaching; 1998 College of Engineering Award for Excellence in Teaching

**Peter O'Connor, Research Assistant**



**Professor**

- Ph.D., Cornell University, 1995
- Mass spectrometry instrumentation and applications
- Assistant Director, Mass Spectrometry Resource, Boston University School of Medicine



**William Oliver, Associate Professor**

- Ph.D., University of Illinois, 1973
- Radar studies of the upper atmosphere and ionosphere; geophysical modeling and simulation; global change in the upper atmosphere



**Roberto Paiella, Assistant Professor**

- Ph.D., California Institute of Technology, 1998
- Optical technologies for information processing; photonic devices based on semiconductor quantum structures, including group-III nitride quantum wells; nanoscale photonic devices and circuits, ultrafast optics



**Tatyana Roziner, Associate Professor**

- Ph.D., Moscow Scientific Research Institute, 1975
- Digital design; testing and diagnostics of computer hardware; fault-tolerant computing



**Michael Ruane, Professor**

- Ph.D., Massachusetts Institute of Technology, 1980
- Magneto-optical materials; micro-magnetic modeling; optical data storage; optical systems
- 1998/99 ECE Faculty Award for Excellence in Teaching
- 2004 ASEE New England Section Outstanding Teaching Award



**Bahaa E.A. Saleh, Professor & Chair**

- Ph.D., Johns Hopkins University, 1971
- Quantum optics; statistical optics; optical processing; image Processing; liquid crystal displays
- Fellow – IEEE, Optical Society of America, and John Simon Guggenheim Foundation; Editor-in-Chief, *Journal of the Optical Society of America A* (1991-1997); Deputy Director, Center for Subsurface Sensing and Imaging Systems
- Optical Society of America Beller Award (1999)



**Venkatesh Saligrama, Assistant Professor**

- Ph.D., Massachusetts Institute of Technology, 1997
- Statistical signal processing and its applications to communications and information control theory



**Alexander Sergienko, Professor**

- Ph.D., Moscow State University, 1987
- Quantum optics, including quantum radiometry and metrology; laser physics; nonlinear optics; quantum communications; remote laser sensing; correlation spectroscopy, field optical microscopy and spectroscopy of semiconductor materials and devices
- NSF CAREER Award
- 2001 College of Engineering Award for Excellence in Teaching



**Thomas Skinner, Associate Professor**

- Ph.D., Boston University, 1982
- Microprocessors; computer networks; operating systems; distributed systems
- 1997 College of Engineering Award for Excellence in Teaching



**David Starobinski, Assistant Professor**

- Ph.D., Technion, Israel Institute of Technology, 1999
- Networks performance evaluation; wireless networking; mobile computing
- NSF CAREER Award



**Anna Swan, Research Assistant Professor**

- Ph.D., Boston University, 1993
- Material characterization and spectroscopy of low dimensional systems, semiconductors and devices; Development of nanoscale optical self-interference microscopy



**Alexander Taubin, Associate Professor**

- Ph.D., Electrotechnical University of St. Petersburg, 1981
- Asynchronous circuit, logic design; computer architecture; CAD; methods of format verification



**Malvin C. Teich, Professor**

- Ph.D., Cornell University, 1966
- Quantum optics and imaging; photonics; fractal stochastic processes; information transmission in biological sensory systems
- Fellow – IEEE, Optical Society of America, American Physical Society, Acoustical Society of America, American Association for the Advancement of Science, and John Simon Guggenheim Foundation; IEEE Browder J. Thompson Memorial Prize; IEEE Morris E. Leeds Award; Palacky University Memorial Gold Medal



**Tommaso Toffoli, Associate Professor**

- Ph.D., University of Michigan, 1977
- Fundamental connections between physics and computation; fine-grained modeling of physics-like systems technology (cellular automata machines) and methodology (programmable matter); personal knowledge structuring
- Editorial Board Member, *Complex Systems*; *The Interjournal*



**Ari Trachtenberg, Assistant Professor**

- Ph.D., University of Illinois, Urbana-Champaign, 2000
- Error correcting codes; data synchronization (especially for PDAs and mobile networks); sensor-based location detection; algorithms
- NSF CAREER Award
- 2002/2003 ECE Faculty Award for Excellence in Teaching



**Selim Ünlü**, *Associate Professor & Associate Chair for Graduate Studies*

- Ph.D., University of Illinois, Urbana-Champaign, 1992
- Design, processing, characterization and simulation of semiconductor optoelectronic devices; near-field optical microscopy and spectroscopy of semiconductor materials and devices
- NSF CAREER Award; ONR Young Investigator Award
- 2001/2002 ECE Faculty Award for Excellence in Teaching



**Solomon Eisenberg**, *Associate Professor & Associate Dean for Undergraduate Programs* (primary appointment with the Department of Biomedical Engineering)

- Sc.D., Massachusetts Institute of Technology, 1983
- Electrically mediated phenomena in tissues and biopolymers
- NSF Presidential Young Investigator (1987-1993)
- 1990 Metcalf Award for Excellence in Teaching



**Leopold Felsen**, *Professor* (primary appointment with the Department of Aerospace and Mechanical Engineering)

- D.E.E., Polytechnic Institute of Brooklyn, 1952
- Wave propagation and diffraction in various disciplines; high-frequency and time domain asymptotics; wave-oriented data-processing and imaging
- Member, National Academy of Engineering; Fellow – IEEE, Optical Society of America, Acoustical Society of America, John Simon Guggenheim Foundation; IEEE Medals: Heinrich Hertz Gold Medal, 1991, Centennial, 1984, 3rd Millennium, 2000; Humboldt Foundation, Senior Scientist Award, 1980; Honorary Doctorate, Technical University of Denmark, 1979; URSI Balthasar Van der Pol Gold Medal, 1975

## Affiliated Faculty



**John Baillieux**, *Professor* (primary appointment with the Department of Aerospace and Mechanical Engineering)

- Ph.D., Harvard University, 1975
- Robotics; control of mechanical systems; mathematical system theory
- Chairman, Department of Aerospace and Mechanical Engineering; past Editor-in-Chief, IEEE Transactions on Automatic Control; Director, Boston University, Center for Control and Dynamics of Smart Structures and Center for Communicating Networked Control Systems; IEEE Fellow, IEEE Control Systems Society Distinguished Member, and Vice-President Technical Activities



**Christos Cassandras**, *Professor* (primary appointment with the Department of Manufacturing Engineering)

- Ph.D., Harvard University, 1982
- Analysis and control of discrete event dynamic systems; stochastic control and optimization; dynamic control of computer and communication networks
- Editor-in-Chief, *IEEE Transactions on Automatic Control*; Member, IEEE Control Systems Society Board of Governors; Fellow, IEEE; 1991 Lilly Fellow



**Theodore Fritz**, *Professor* (primary appointment with the Department of Astronomy and the Center for Space Physics)

- Ph.D., University of Iowa, 1967
- Space plasma and magnetospheric physics; magneto sphere-ionosphere coupling; substorms; charged particles and compositions; rocket and satellite experiments



**Supriya Chakrabarti**, *Professor* (primary appointment with the Department of Astronomy and the Center for Space Physics)

- Ph.D., University of California, Berkeley, 1982
- Planetary atmospheres; ultraviolet spectroscopy, rocket and ground based experiments
- Director, Center for Space Physics



**Bennett Goldberg**, *Professor* (primary appointment with the Department of Physics)

- Ph.D., Brown University, 1987
- Room- and low-temperature, near-field microscopy of semiconductors and biological systems; magneto-optics and magneto-transport of two- and one-dimensional electron fields
- Alfred P. Sloan Fellow, NSF Presidential Young Investigator



**Michael Mendillo, Professor** (primary appointment with the Department of Astronomy and the Center for Space Physics)

- Ph.D., Boston University, 1971
- Signal processing in Space Physics; Low-light-level CCD instrumentation; atmospheric emission tomography; GPS satellite communications; space plasmas in the solar system
- Fellow, American Geophysical Union



**Eric Schwartz, Professor** (primary appointment with Department of Cognitive and Neural Systems)

- Ph.D., Columbia University, 1973
- Computational neural science; machine vision, neuroanatomy; neural modeling



**William Skocpol, Professor** (primary appointment with Department of Physics)

- Ph.D., Harvard University, 1974
- Nanofabrication; device processing; transport experiments in materials
- Fellow, American Physical Society

## Emeritus Faculty



**John Brackett, Professor Emeritus**

- Ph.D., Purdue University, 1963
- Software engineering; software requirements definition; object-oriented testing; rapid prototyping of embedded systems



**David Perreault, Professor Emeritus**

- Ph.D., Purdue University, 1968
- Nonlinear networks; computer-aided design; micro-processors; distributed digital networks



**Richard Vidale, Professor Emeritus**

- Ph.D., University of Wisconsin-Madison, 1964
- Modeling and simulation, software engineering



**Moe Wasserman, Professor Emeritus**

- Ph.D., University of Michigan, 1955
- Semiconductor processing, electronic circuits

## Visiting Faculty

**Silvia Carrasco, Visting Research Assistant Professor**

- Ph.D., Universitat Politecnica de Catalunya, 2003
- Assitant Professor in the Department of Signal Theory and Communications at Universitat Politecnica de Catalunya, Barcelona, Spain. Research in nonlinear optics effects in collaboration with Professor Alexander Sergienko.

**Jonathan Newell, Visiting Professor**

- Ph.D., Physiology- Albany Medical College, 1974
- Professor of Biomedical Engineering at Rensselaer Polytechnic University and Professor of Physiology and of Surgery at Albany Medical College
- Collaboration with Professors David Castanon and W. Clem Karl in developing new signal processing algorithms for breast cancer imaging.

**Richard Quimby, Visting Associate Professor**

- Ph.D., University of Wisconsin, 1979
- Associate Professor at Worcester Polytechnic University
- Research with rare earth doping of glasses and ceramics in collaboration with Professor Theodore Morse

## IEEE Fellows

Christos Cassandras	Ronald Knepper
Leopold Felsen	Lev Levitin
Floyd Humphrey	Bahaa E.A. Saleh
Mark Karpovsky	Malvin C. Teich

## NSF PYI/CAREER Awards

Murat Alanyali	Alexander Sergienko
Maja Bystrom	David Starobinski
Jeffrey Carruthers	Ari Trachtenberg
Martin Herbordt	Selim Ünlü
Thomas Little	

## 2.2 Adjunct Faculty

The ECE Department looks outside the department and university for individuals to teach a few specific courses, as the need arises. These individuals bring a vast amount of engineering expertise, in both academic and industrial capacities, to the classroom. To the right is a list of people who have helped the Department meet its teaching needs over the past year.

**Alan Pisano**, SC463 (Fall 2003) & SC402 (Spring 2004)

- PhD, Northeastern University, 1974

**Vladimir Kleptsyn**, EK130 (Fall 2003)

- PhD, Moscow Lomonosov's Institute of Fine Chemical Technology, 1983

## 2.3 Research Staff

Name	Title	Sponsor
Abouraddy, Ayman*	Research Associate	Bahaa Saleh
Belkacemi, Samir	Visiting Scholar	Martin Herbordt
Bertazzi, Francesco	Research Assistant	Enrico Bellotti
Carlson, Erica*	Research Associate	David Campbell
Capobianco, Silvio*	Visiting Scholar	Tommaso Toffoli
Cohen, Howard	Research Assistant	Allyn Hubbard
Di Giuseppe, Giovanni*	Research Associate	Alexander Sergienko
Emsley, Matthew*	Research Associate	Selim Ünlü
Guillet de Chatellus, Hugues	Research Associate	Alexander Sergienko
Jaspan, Martin	Senior Research Associate	Alexander Sergienko
Kwon, Oh-Hyun*	Research Assistant	Bahaa Saleh
Redjidal, Makhoulouf	Research Associate	Floyd Humphrey
Shubochkin, Roman	Research Assistant	Theodore Morse
Thomidis, Christos	Research Assistant	Theodore Moustakas
Tsai, Shan-Wen	Research Associate	David Campbell
Wong, Wai Yan	Research Assistant	Malvin Teich

\* Completed Appointment during 2003/2004

## 2.4 Administrative and Technical Staff

### Administrative Staff

<b>Anderson, Kristen*</b>	<i>Academic Programs Administrator</i>
<b>Enos, Scott</b>	<i>Grants Administrator</i>
<b>Gilbert, Jim</b>	<i>Senior Administrative Secretary</i>
<b>Goodman, Jeremy*</b>	<i>Administrative Assistant</i>
<b>Levin, Yefim</b>	<i>Microprocessor Laboratory Manager</i>
<b>Nabiel, Hemayat</b>	<i>Financial Manager</i>
<b>Pastore, Michael</b>	<i>Administrative Assistant</i>
<b>Reigadas, Rosemarie*</b>	<i>Senior Administrative Secretary</i>
<b>Rennie, Wayne</b>	<i>Department Director</i>

\* Resigned during 2003/2004

### Technical Staff

<b>Albro, Jeffrey</b>	<i>Systems Analyst/Administrator I</i>
<b>Caine, Aaron</b>	<i>Systems Analyst/Administrator III</i>
<b>Fedyunin, Yuri</b>	<i>MBE Laboratory Manager</i>
<b>Kleptsyn, Vladimir</b>	<i>Electronics/Circuits Laboratory Manager</i>
<b>Levin, Yefim</b>	<i>Microprocessor Laboratory Manager</i>
<b>Rodriguez, Raul*</b>	<i>Electronics Laboratory Manager</i>

\* Resigned during 2003/2004

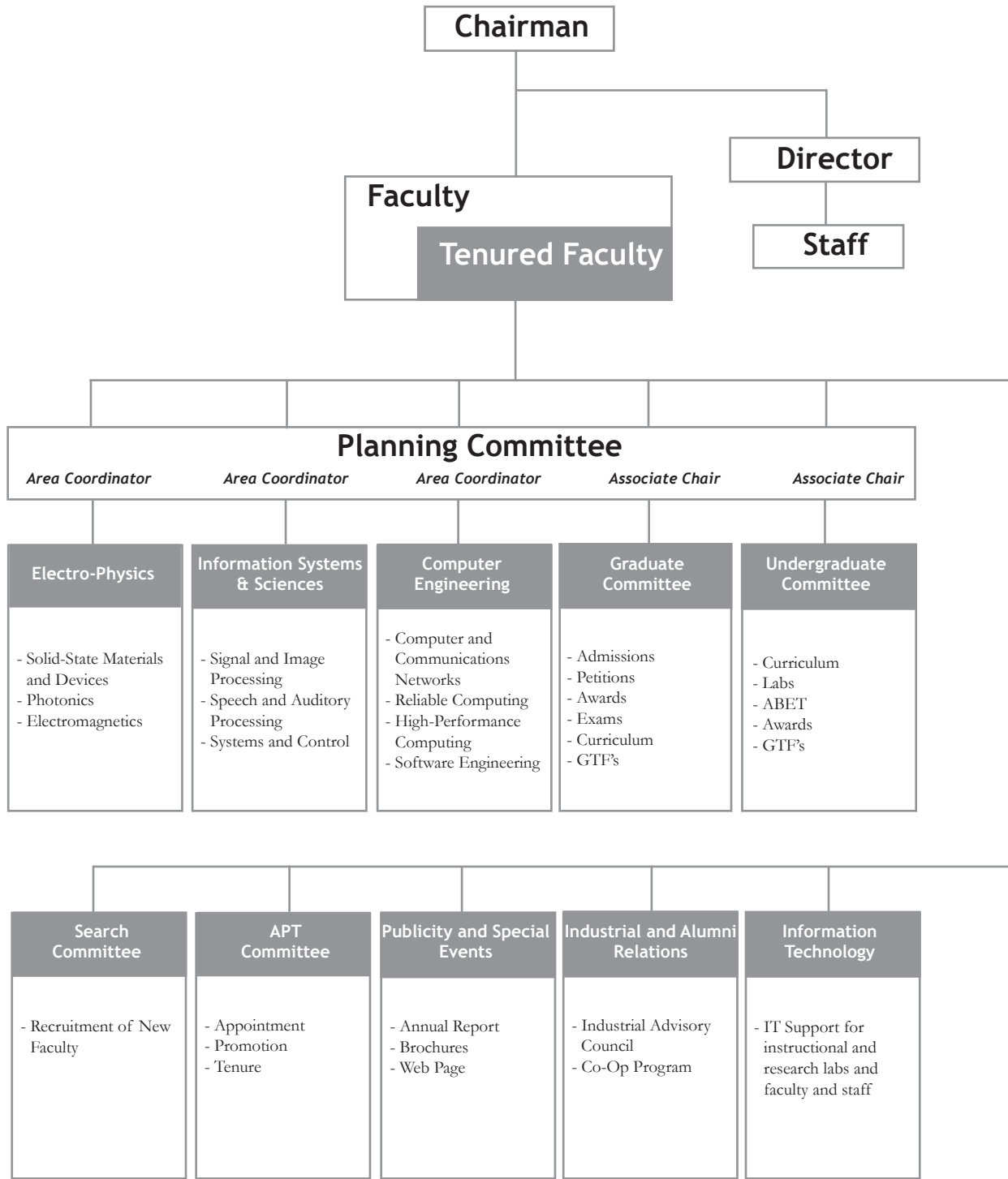
## 2.5 Department Administration & Committees

Saleh, Bahaa	<i>Department Chair</i>
Nawab, Hamid	<i>Associate Chair for Undergraduate Studies</i>
Ünlü, Selim	<i>Associate Chair for Graduate Studies</i>
Rennie, Wayne	<i>Department Director</i>

Faculty committees direct the academic operations and planning for the ECE Department. The Undergraduate and Graduate Committees are responsible for curricular and student affairs. The Planning Committee is comprised of the coordinators of the three areas of research and instruction (electro-physics, information systems and sciences, and computer engineering), the Chairman, Director, and the two Associate Chairs, and is responsible for strategic initiatives.

Planning Committee	Graduate Committee	Undergraduate Committee	Search Committee	APT Committee
<b>Saleh (Chair)</b> Ünlü (Assoc. Chair) Nawab (Assoc. Chair) Herbordt (Comp. Eng.) Karl (I.S.S.) Ruane (Electro-Phys.) Rennie (ex-officio)	<b>Ünlü (Chair)</b> <b>Oliver (Assoc. Chair)</b> Alanyali Bellotti Karpovsky Saligrama Taubin Trachtenberg	<b>Nawab (Chair)</b> Bystrom Fahim Kincaid Knepper Lee Roziner Ruane Starobinski	<b>Saleh (Chair)</b> Bystrom Carruthers Giles Herbordt Konrad Lee Moustakas Rennie (ex-officio) Sergienko Teich	<b>Saleh (Chair)</b> Bigio Brower Giles Karl Levitin Moustakas Rennie (ex-officio) Teich
Publicity and Special Events	Industrial and Alumni Relations	Information Technology Advisory Committee	EK100 Advisors	Senior Design Advisors
<b>Saleh (Chair)</b> Alanyali Konrad Kotiuga Pastore (ex-officio) Rennie Ruane Toffoli	<b>Saleh (Chair)</b> Brackett Hubbard Kincaid Knepper Morse Pisano Rennie Skinner	<b>Konrad (Chair)</b> Bellotti Caine (ex-officio) Carruthers Giles Herbordt Hubbard Rennie Toffoli	Alanyali Brackett Brower Karl Lee Nawab Ruane Starobinski	Bystrom Toffoli Carruthers Trachtenberg Giles Ünlü Horenstein Konrad Kotiuga Morse Nawab Saleh

## 2.6 Department Organizational Chart





## 2.7 ECE Representation in the College of Engineering and the University

College of Engineering Committee	Faculty
APT Committee	Bigio, Hubbard, Levitin
Graduate Committee	Ünlü
Scholarship Exam Committee	Ünlü
Undergraduate Committee	Nawab
Student Conduct Committee	Kincaid
Professional Practice Advisory Group	Knepper

University Committee	Faculty
Committee on Research Activities and Libraries	Ünlü
Faculty Council	Giles, Ünlü
Patent Policy Committee	Moustakas
Undergraduate Research Opportunity Program	Ünlü
Student Conduct Committee	Ünlü

Advisory Group	Faculty
IEEE	Nawab
Minority Engineers' Society (MES)	Giles
Student Association of Graduate Engineers (SAGE)	Ruane
Society of Hispanic Professional Engineers (SHPE)	Castañón
Tau Beta Pi	Nawab
Engineering House	Nawab
Eta Kappa Nu	Lee



# three: *Undergraduate Programs*

## 3.1 Academic Programs

This has been an excellent academic year for our undergraduate programs in Electrical Engineering and Computer Systems Engineering. In October 2003, the ECE Department underwent an ABET visit for the purpose of re-accreditation of our undergraduate programs. As a result of the visit, ECE was successful in gaining re-accreditation for another six years, the maximum period for which ABET re-accreditation may be obtained. In evaluating our programs the evaluators noted that our undergraduate programs had absolutely no “deficiencies” or “weaknesses.”

ECE continues to pride itself in developing a strong laboratory curriculum to accompany our classroom teaching for undergraduates. Having moved into a new building in the Spring of 1997, we have excellent teaching labs with up-to-

date equipment. Undergraduates are encouraged to get involved with research and development efforts in faculty labs, through UROP (Undergraduate Research Opportunity Program), work study, or student employment. Engineering is an applied science, and we believe it is important to start applying what is learned in the classroom as soon as possible.

In October 2003, the department underwent an ABET visit for the purpose of re-accreditation of our undergraduate programs. As a result of the visit, ECE was successful in gaining re-accreditation for another six years, the maximum period for which ABET re-accreditation may be obtained. In evaluating our programs the evaluators noted that our undergraduate programs had absolutely no “deficiencies” or “weaknesses.”



### Enrollment and Degrees Awarded

#### Fall 2003 Enrollment

	Electrical	Computer Systems	Total
Freshmen*	22	30	52
Sophomores*	37	44	81
Juniors	40	55	95
Seniors	54	52	106
<b>Total</b>	<b>153</b>	<b>181</b>	<b>334</b>

\* Note: ENG students are not required to declare their major until their Junior year.

#### Degrees Awarded

Electrical Engineering	48
Computer Systems Engineering	51
<b>Total</b>	<b>99</b>

#### Honors Students

Summa Cum Laude	13
Magna Cum Laude	11
Cum Laude	14
<b>Total</b>	<b>38</b>

**ECE Advising Day**

Continuing a tradition initiated in 1998, each semester an ECE Advising Day was held just prior to the commencement of the telephone registration period for the next term. On these days many ECE faculty volunteered up to four hours of pre-registration advising time for their students.

**Teaching Workshops**

The ECE tradition of holding teaching workshops every semester continued this year. Now a requirement (as course SC850) for all new graduate teaching fellows in the College of Engineering, six 1-hour workshops were held each semester. These workshops included panel and solo discussions as well as role-playing scenarios on teaching methodology, presentation techniques, pedagogy, ethics, etc.



**ECE Teaching Award 2003/2004**

During the 1997-98 academic year, the ECE Department instituted an award to recognize innovation and excellence in teaching in the department. The award, based on nominations from College students, faculty, and staff, carries with it a \$1000 prize to be used towards instructional activities. A committee of ECE professors and students evaluated the nominees. They looked at teaching statements and classroom material, sat in on classes, and collected comments from students.

Professor Mark Horenstein was the winner of the 2004 ECE Award for Excellence in Teaching. The 2004 ECE Teaching Award Committee, chaired by Professor Nawab, recommended this award.

**3.2 Instructional Laboratories**

**Expenditures for Instructional Laboratories 2003-2004**

Facility	Equipment	Approximate Cost
Microprocessor Lab and Software Engineering Lab	Lab kits, software licenses, maintenance, etc.	\$15,247.76
VLSI Lab and Signals/ Networks Lab	Software licenses, maintenance, etc.	\$15,656.22
Electronics Lab	Lab kits, electronics kits, maintenance, etc.	\$8,048.82
Senior Design Lab	Workstations, software licenses, etc.	\$41,509.91
Photonics/Optics Lab	Lab equipment and supplies, software, etc.	\$27,287.96
RF/Electromagnetics Lab	Lab equipment and supplies, software, etc.	\$110,677.51
IMSIP Lab	Workstations, software licenses, etc.	\$61,610.14
Other	Network/Wireless Infrastructure upgrade, etc.	\$64,387.85
<b>Total</b>		<b>\$344,426.17</b>

## Instructional Laboratories

### Control Systems Laboratory

This laboratory houses 4 ECP model 220 Industrial Plant Emulators for studying the control of practical systems. These systems consist of an electromechanical apparatus including an adjustable mechanical mechanism (“plant”) with actuators and sensors. Various types of controllers (e.g. PID, State-Feedback, LQR) can be designed and implemented in either continuous or discrete time formulations using a DSP-based real-time controller with a Windows XP graphical interface. Non-ideal conditions that are often present in real-world applications can be studied. Integrated with the systems are MATLAB and SIMULINK design tools, which can be used to design control systems that can then be implemented in the hardware. Analytical models of both the “plant” and the “controller” can be validated with actual hardware responses. *Pisano*



### Electronic Design Automation/VLSI Laboratory

This laboratory is involved in almost every aspect of digital design. Students design circuits and systems using state-of-the-art Electronic Design Automation facilities. Hardware includes 32 Sun Workstations, plus chip testing equipment and associated display and software systems. Software tools include Synopsis, Mentor Graphics, and Cadence. *Hubbard, Knepper, Rozjner, Kincaid, Herbordt, Taubin*

### Electronics Laboratory

This laboratory has 30 stations, equipped with a PC, GPIB-controlled Agilent test instruments and National Instruments ELVIS development stations linked by LabVIEW. This facility supports introductory ECE courses in circuits and electronics with modern industry-standard equipment and software. The lab also supports more advanced experiments in signals and systems, communications, electromagnetics, and photonics. Senior design and project students use the lab on an open basis, and freshman EK130 modules are held here. A small parts window sells discrete components. OrCAD software including PSpice supports circuit simulations.. *Navab, Carruthers, Fabim, Horenstein, Knepper, Kotinga, Lee, Oliver, Rozjner, Ruane, Sergienko*

### High Performance Computing Laboratory

The High Performance Computing Laboratory at Boston University was created with support from the National Science Foundation (NSF) in order to support the development of undergraduate courses in parallel and high performance computing. The courses offered at Boston University serve as a national model for computational science education. The lab features a network of multimedia graphics workstations linked at high speed to the supercomputers at the Center for Computational Science and the Scientific Computing and Visualization Lab. *Giles, Brower*

### High Tech Tools and Toys Laboratory

HTTTL is the instructional laboratory associated with Boston University’s NSF-funded Engineering Research Center for Subsurface Sensing and Imaging Systems (CenSSIS). The laboratory houses a variety of PC-based imaging camera systems, machine vision systems and acoustic imaging systems. Software for imaging includes MATLAB, Image Processing Toolbox, Image Builder, Vision Foundry, ENVI and LabVIEW. The HTTTL supports freshman EK130 modules in imaging and subsurface imaging, senior design capstone projects in imaging, and experiments in senior level electives related to imaging. *Ruane*

### Image and Signal Processing Laboratory

This laboratory serves graduate instructional and research needs by providing advanced computational resources and associated software packages. Fast workstations are connected to dual servers through a gigabit network which include access to high capacity monochrome and color printers and storage devices. State of the art processing and optimization software is available. This laboratory was developed with funds from the National Science Foundation. *Karl*



### Microprocessor and PC Laboratory

This laboratory features instruction in the programming and interfacing of microcomputers and digital controllers. Higher-level courses emphasize the design of systems using microprocessors. Various simulators, and analysis packages are available. *Toffoli, Giles, Skinner, Taubin*

### Network Computing Laboratory

The Network Computing Laboratory studies interconnection network topologies; routing, network flow control, and deadlocks in multicomputer networks; multicast and broadcast, fault-tolerance in interconnection networks; modules for realization (nodes and routers); performance metrics and scalability; message passing interference, protocols and programming, scalable coherent interface (SCI), and distributed shared memory; network of workstations (NOW), case studies of high performance scalable networks, and cluster computing.

*Karpovskiy*

### Photonics Laboratory

The Photonics Laboratory supports the introductory and intermediate level courses in the MS in Photonics program. Four stations each have a vibration isolated optical table, lasers, fiber components and systems, electronic test equipment, and GBIP connected PCs for data logging and instrument control. Shared equipment exists for experiments and demonstrations in interferometry, spectrometry, diffraction, holography, acoustic and electro-optic modulation, and optical spectrum analysis. A secure annex room houses two additional isolated tables, electronics and optical equipment to support thesis and senior design projects that require long-term setup of apparatus.

*Ruane, Ünlü, Teich*

### Senior Project Laboratory

This laboratory supports ECE's senior design teams, serving real-world customers such as NASA, Analog Devices, Boston public schools, social service agencies, artists, and small businesses, as well as faculty and staff across the University. Each team has twenty-four hour access to a permanent bench setup with a networked Pentium PC, benchtop GPIB-based HP test equipment, and software for schematic design, simulation, and PCB layout. Electronics and shop support is provided. Shared tools include high speed scopes, logic analyzers, spectrum analyzers, E-prom, PLA and FPGA burners, and various compilers and crosscompilers for DSP and micro-controller development. Software from MSDNAA is available for all teams. *Ruane, Knepper, Pisano*

### Signals and Networks (SIGNET) Laboratory

This laboratory provides instructional facilities for courses in the areas of signal processing and communication networks. This laboratory houses numerous workstations for digital signal processing, image processing, and various real-time applications covering the complete audio frequency spectrum. Equipment includes Linux-based workstations, microphones, DSP boards, speakers, amplifiers, digital cameras, and software packages such as MATLAB and Hyperception. The courses served by this laboratory include SC401 (Signals and Systems), SC416 (Intro to Digital Signal Processing), SC 512 (Digital Signal Processing), and some ECE modules in EK130 (Introduction to Engineering). On the communications side, experiments involving data communication links, local-area networks, and wide-area networks are supported. Powerful computer-based simulation and analysis tools are available to compare and evaluate network designs. Facilities are also provided for experimentation with local-area network switching and routing hardware. *Bystrom, Carruthers, Kincaid, Konrad, Nawab*

### Software Engineering Laboratory

An instructional and research lab, the Software Engineering Laboratory (SEL) supports courses and research on the economical design of reliable software for large-scale, computer-based systems. The laboratory provides a network of workstations running Windows XP and provides students with state-of-the-art development and modeling tools for the design, implementation and testing of distributed software systems. *Brackett*



## 3.3 Undergraduate Courses

Course Number and Title		Fall 03	Spring 04	Summer 04
EK100	Freshman Seminar	Faculty		
EK130	Intro to Engineering	Horenstein Kincaid Ruane	Toffoli Morse Konrad Lee	
EK307	Electric Circuit Theory	Fahim Fahim	Fahim Roziner Roziner Fahim	Nourzad
EK317	Circuit Theory I	Fahim		
EK318	Circuit Theory II		Giles	
SC311	Intro to Logic Design	Roziner	Kincaid	Roziner
SC312	Computer Organization	Taubin	Herbordt	Bach
SC330	Applied Algorithms	Brower	Trachtenberg	
SC401	Signals and Systems	Kincaid	Bystrom	Carruthers
SC402	Control Systems		Pisano	
SC410	Intro to Electronics	Knepper Kotiuga Lee	Lee	Fedyunin
SC412	Analog Electronics		Knepper	
SC415	Communication Systems	Carruthers	Roziner	
SC416	Intro to Digital Signal Processing	Bystrom	Nawab	
SC440	Intro to Operating Systems	Skinner	Skinner	Skinner
SC447	Software Design	Skinner	Skinner	Skinner
SC450	Microprocessors	Giles	Giles Toffoli	
SC455	Electromagnetic Systems I	Kotiuga	Lee	
SC456	Electromagnetic Systems II	Lee	Kotiuga	
SC463	Senior Design Project I	Ruane/Pisano	Ruane	
SC464	Senior Design Project II	Knepper	Knepper	

### 3.4 ECE Day Senior Projects

All ECE seniors complete a team-based, two semester capstone senior design project. Teams must design and prototype a product, electronic device, or software system for a real-life “customer.” Customers are drawn from industry, small businesses, community groups, and faculty and staff. Initially students learn design methods, project management, team dynamics, communication skills, and legal and ethical standards for design. They form teams, research their project concept, and prepare project proposals. A substantial “first-deliverable” milestone and oral presentation complete the first semester. The second semester is spent in the Senior Project Laboratory, PHO111/113. Students must make presentations to their customer, write inter- and intra-office memos, design their project to meet customer specifications, manage the project budget, and deliver their working prototype, including a detailed instruction manual. Project records are maintained in personal design logbooks. Teams have 24/7 access to their dedicated, fully-equipped laboratory bench, and can use professional CAD and prototyping tools for circuits, embedded systems, and software development. ECE Day comprises student project presentations, awards for best team presentations, and delivery of the projects.

### 2004 P.T. Hsu Award

Honoring Professor P.T. Hsu, the Outstanding Senior Design Project Award acknowledges the best overall ECE senior design project. A faculty selection committee considers degree of success, difficulty, scope, creativity, cost, project communications, and team effectiveness. Team EverTronica, working for Professor Harlan Spence (Boston University Astronomy Department), was the 2004 winner of the P.T. Hsu award. Team members included Zakhar Raskin, Victor Banjo, Patrick Sexton, and Joe Jones. The Wireless Classroom Response System allows a person giving a presentation to create an interactive learning environment using the system to wirelessly poll the audience and get an immediate numerical and graphical analysis to a multiple choice question. The system consists of multiple RF handheld remotes, a single RF receiver and the software package, including a voting grid display with graphing functionality. Each remote is mapped with a unique user and the results of a poll can be stored in Excel format for grading purposes. The RF receiver can be connected to the serial port of the user’s computer and the software package can be run from any Windows-based PC.

### Notable Seniors Projects 2003-2004

Team and Members	Project and Customer
Team 01 - Triband Arturo Aviles Brian Cassell Michael Collins Todd Etzel	Multi-Channel, Configurable Wireless LAN Packet Sniffer Professor Jeffrey Carruthers, BU ECE Department “Low-cost device that monitors (or ‘sniffs’) 802.11b packets simultaneously for academic and research use”
Team 03 - Oz Optics Brian Dolan David Juralewicz Gregory Mazzaro Colin Starrett	LITE Spectrophotometer Professor Kenneth Brecher, BU Astronomy Department “Spectrometer that meets educational needs while costing \$100 or less making it readily accessible to the average undergraduate student”
Team 09 - Team 9 Inc. Karin Griffis Aaron Severance Si Ming Liu Naoki Kobayashi	Lane Departure on the Blackfin DSP Mr Rick Gentile, Analog Devices Incorporated “Camera and DSP designed to be intergrated into a car to warn a driver upon lane departure to prevent accidents”
Team 13 - Computational Technologies Etc. Albert Conti Michael Mepham Christopher Taclas Brad Phylis	FPGA-based PC-Accelerator for Bioinformatics Professor Martin Herbordt, BU ECE Department “Cost effective high performance sequence analysis system designed to identify repetitive structures at less than 100th the cost of other methods”
Team 15 - The Musketeers Jonathan Bettencourt Michael Corcoran Christopher Joines Daniel Leonardis	Wireless Sensor Network Professors Ari Trachtenberg and David Starobinski, BU ECE Department “Smoke detector using wireless sensors designed to show the temperature and smoke status of four rooms”



### 3.5 Student Activities

The ECE Department supports two active undergraduate students groups, an IEEE Student Section and the Eta Kappa Nu honor society, which was founded in 2003. These groups both held a number of successful events this past year, ranging from lectures and panel presentations to social events for members to educational service activities. Events for 2003-2004 are detailed below.

#### **IEEE Student Section Lectures/Presentations/Panels MIT AI Lab Presentation**

Dr. David Demirdjian from the MIT AI Lab gave a presentation about the Interactive Wall project, for which he is a principal investigator, in which a user can move through a virtual world through gestures observed by a stereo camera.

#### **Digital Biomechanics Presentation**

Dr. Martin de Lasa and Dr. Michael LaFiandra from Boston Dynamics, Inc. gave a presentation titled “Digital Biomechanics”, a physics-based human simulation tool being developed at Boston Dynamics. Boston Dynamics is a software engineering company that specializes in simulating human movement, with many applications for the U.S. Army. With Digital Biomechanics, an equipment designer can test different designs, for example, on a variety of simulated soldiers running an obstacle course.

#### **Lincoln Laboratory Laser and Sensor Applications Presentation**

Dr. Heinrichs, the Group Leader of Lincoln Laboratory’s Laser and Sensor Applications Group in the Aerospace Engineering Division gave a presentation titled “Three-Dimensional Laser Radar with APD Arrays.” MIT Lincoln Laboratory is actively developing laser and detector technologies that make it possible to build a three-dimensional laser radar (3-D lidar) with several attractive features, including capture of an entire 3-D image on a single laser pulse, tens of thousands of pixels, few-centimeter range resolution, and small size, weight, and power requirements.

#### **Tour of Draper Laboratories**

Students attended a tour of of Draper Laboratory in Cambridge related to research including robotics and computer simulation.

#### **Educational Activities Fundamentals of Engineering Review Sessions**

To encourage students to take the Fundamentals of Engineering Examination, the IEEE worked with the Boston University ASME Student Chapter to continue the program where the various engineering departments at Boston University provide a 100% exam fee reimbursement to seniors who take the exam and report their scores. A stipulation that students be reimbursed the fees associated with taking the FE exam is that

they attend review sessions. Study materials were provided to students who registered for the exam and a weekend was organized when professors would be on hand to do problems and answer questions from the various sections of the exam. These review sessions were held for both sittings of the FE exam, in both the Fall and Spring semesters.

#### **Other Activities Recruiting Booths**

Our branch had booths set up at a variety of engineering events on campus to let students know who we are, what we do, and that we’re active:

**Student Activities Fair:** This fair allows freshmen to learn about the various student organization represented in the College of Engineering.

**Fall/Spring Engineering Career Fair:** We attended both engineering career fairs to talk with both student and companies about our IEEE branch.

**National Engineers Week:** A booth was set up so students could learn about the IEEE and to promote our E-Week events.

#### **Eta Kappa Nu Honor Society**

The Kappa Sigma Chapter of Eta Kappa Nu (HKN), the National Society of Electrical and Computer Engineering, was established here at Boston University on March 21, 2003. Today, as a newly established chapter, HKN is trying to keep its mission in helping students achieve their academic goals by launching an ECE tutoring program in which the members of HKN volunteer their time to help needy undergraduates in their coursework from EK307 through SC571.3.7 Accreditation Visit

### 3.6 Accreditation Visit

In October 2003, the department underwent an ABET visit for the purpose of re-accreditation of the undergraduate programs in electrical and computer engineering. We have already received the final report from ABET indicating that both our programs have been successful in gaining re-accreditation for another six years (the maximum period for which ABET re-accreditation may be obtained). In evaluating our programs the evaluators noted that our undergraduate programs had absolutely no “deficiencies” or “weaknesses.” It should be noted that these two categories of program problems, if cited by the evaluators, would have required immediate corrective actions by the department and a written report to ABET about the corrective actions.

The ABET reviewers for our CSE and EE programs both expressed a “concern” that our programs had not had sufficient time to evaluate the effects of two new categories of metrics that had recently been added by us to the process for evaluating our program objectives (see Section 3.8 for a description of the added metrics). In accordance with ABET

rules, a “concern” is meant as a signal to the department to take positive action to ensure that the identified aspect of a program remains in compliance with accreditation criteria but there is no requirement to report anything to ABET. While we agree that sufficient time had not yet passed to evaluate the effects of our added metrics, we do not agree with it being labeled a “concern” that requires “positive action” (other than what would be a normal course of action as part of our efforts for continual improvement of our program and its associated assessment and evaluation processes) to ensure continued compliance with accreditation criteria. At the time of the ABET visit, data collection for the three original metrics as well as the processes for their evaluation had been in place for well over a year. The three years prior to that we meticulously carried out a thorough process of establishing and revising the program objectives in consultation with the program constituencies (students, alumni, industrial advisory council) and developing the instruments for collecting and analyzing the data associated with those objectives. The process of formulating our program objectives over the last five years took place in the context of ABET guidelines that were themselves in a state of flux. Ultimately (circa 2002) ABET appeared to settle on defining program objectives as a set of stated expectations on what program graduates are expected to achieve a few years after graduation. We revised our objectives (again, in consultation with our constituencies) in Spring 2002 and modified our data collection and evaluation processes accordingly. By 2003 we used feedback from our constituencies to add two further metrics for evaluating our educational objectives

The ABET reviewer for our CSE program expressed another “concern” that “while some improvements have been made [on the basis of results from our outcomes assessment processes], all collected data have not yet been applied to the further development and improvement of the program.” However, we once again disagree with the “concern” label because one has to expect a reasonable time lag between the collection of assessment data and its utilization toward program improvement. The fact is that we have implemented the appropriate processes and as the reviewer himself recognized “some improvements have already been made” on the basis of these processes. Our processes themselves will ensure that “positive action” to obtain further improvements shall continue in the future.

### 3.7 The Revised Process for Evaluating Program Objectives

The evaluations are to be conducted by the ECE Undergraduate Committee (UgC) and are based on the following information:

- Data collected by means of an online ECE Alumni Survey, which has been placed on the web since June 2002. The data include facts about the careers of our alumni and their professional service, as well as the alumni’s self assessment of

their own career paths and their competitiveness in the market place.

- Data gathered by the College of Engineering Career Development Office and Development and Alumni Relations Office. Such data will be synchronized with data in the ECE Alumni Survey and Alumni Portfolios are created for both development and program assessment purposes.

- Employer Survey obtained from industrial representatives who regularly attend the career fairs organized by the College Career Development Office to recruit our graduates.

- Formal and informal reports from:

- ECE Industrial Advisory Council (IAC), which represents an industrial perspective. Several of the IAC members are also alumni.

- Company recruiters and co-op program coordinators.

- Faculty, including many with strong industrial contacts and familiarity with graduate-student recruiting programs at other schools.

- Individual ECE alumni visiting during special events, or having ongoing contacts with our faculty.

The following information is collected by the Undergraduate Committee and used collectively to assess the achievement of each of our objectives:

#### **Objective 1** (*Build a career path with informed choices about its EE/CSE aspects*)

Knowing the current employers and the position titles in the Alumni Portfolios, the UgC will assess the degree of alignment of the current professional activities of alumni with the knowledge/skills provided by the BS program.

- The Alumni Survey (Entry 3) provides the alumni’s own assessment of the degree of correlation between their current career paths and the knowledge/skills gained through their BS education.

- Formal and informal reports from other sources will provide additional information that can be useful in the assessment process.

#### **Objective 2** (*Be competitive in the EE/CSE job market*)

Using data in the Alumni Portfolios, the selectivity of each employer in hiring EE/CSE engineers is judged by the UgC, based on national reputation and standing. This also applies to graduate schools.

- The Alumni Survey (Entry 4) provides the alumni’s own assessment of their competitiveness in the job market.

- The Employer Survey provides an independent assessment of the competitiveness of our graduates in relation to graduates of other programs. (see attached copy of survey).

- Formal and informal reports from other sources can also provide additional useful information.

#### **Objective 3** (*Contribute to the well being of profession and community*)

- Data on membership and activities in relevant professional societies and organizations, as provided by the alumni themselves in the Alumni Survey (Entry 12).
- Data acquired by us (Alumni Portfolios) using web searches for special activities and leadership positions held by our alumni in the relevant professional societies.
- Data on the graduates' involvement in their community, including volunteering and cultural/social/civic activities, obtained from the Alumni Survey (Entry 13).
- Formal and informal reports from other sources will also provide additional information that can be useful in the assessment process.

### Career-Choice Objective

Our Program Objectives identify six career paths that our graduates are expected to select from. Statistics of career choices made by our alumni will be prepared from the Alumni Portfolios. Such demographic employment data will be checked for balance in accordance with set metrics, as described below.

### Metrics and Achievement Standards for Program Objectives

Our original metrics as well as standards for assessment of the realization/achievement of the Objectives, were based solely on data derived from the Alumni Survey. A summary of the original metrics is provided here for convenience.

### Summary of Metrics Described in the SSR

**Objective 1** (*Build a career path with informed choices about its EE/CSE aspects*)

*Metrics Tracked:* (Alumni Survey Entry 3). Percentages of respondents reporting that their career path and their program-gained knowledge/skills are a) strongly related, b) somewhat related, and c) not related. The percentage in a) should be increased, and that in c) should be decreased. Achievement Standard: When averaged over a 3-year period, these percentages should be above 50% and below 10%, respectively.

**Objective 2** (*Be competitive in the EE/CSE job market*)

*Metrics Tracked:* (Alumni Survey Entry 4). Percentages of respondents reporting that their position in the job market for their chosen career is a) competitive, b) somewhat competitive, and c) not competitive. The first percentage should be increased, and the last should be decreased. Achievement Standard: When averaged over a 3-year period, these two percentages should be above 50% and below 10%, respectively.

**Objective 3a** (*Contribute to the well being of profession*)

*Metrics Tracked:* (Alumni Survey Entry 12). Percentage of respondents who are member in relevant professional organization & percentage of respondents who are members, or were members, or plan to become members in such organizations. Both of these percentages should be increased. Achievement Standard: When averaged over a 3-year period,

the first percentage should be more than 50% and the second should be more than 90%.

**Objective 3b** (*Contribute to the well being of community*)

*Metrics Tracked:* (Alumni Survey Entry 13). Percentage of respondents who are involved in volunteering, cultural/social activities, civic activities, mentorship, sports, charity, or similar activities. This percentage should be increased. Achievement Standard: when averaged over a 3-year period, this percentage should be greater than 90%.

### Career Choice Objective

*Metrics Tracked:* (Alumni Survey). Percentage of respondents who reported pursuing at least one of these career paths. This percentage should be increased. Achievement Standard: Using a 3-year moving average, our goal is to make this ratio exceed 90%.

Based upon feedback from our various constituencies, two criticisms were raised about the above metrics: 1) the Alumni Survey is subjective, and 2) data obtained from other sources are not included in the metrics.

The Alumni Survey provides a combination of facts and opinions. The facts include the names of employers, position titles, graduate degrees pursued, membership of professional societies, etc. Such facts may be used to reach certain conclusions with regard to the achievement of objectives, much the same as the U.S. Government uses census data provided by the citizens for public policy. In our case, such data will also be supplemented by and synchronized with data obtained by other means.

The opinions compiled from the Alumni Survey include self-assessment of success and competitiveness of each graduate. We believe that self-assessments offer valuable information about attitudes and resolve to continue along the selected career path. However, we appreciate the need to include other assessments. We are modifying our plan to include additional metrics based on our own assessment as well as employer assessment of the degree of success and competitiveness of our graduates.

We are also modifying our plans to enrich the career-choice objective metric by adding new metrics that ensure some balance in the distribution of the career paths that we envision for our graduates. We believe that such balance may be achieved if the ratios of those selecting each career path are constrained by certain minima and/or maxima. The strategy is to regard violations of these constraints as threats to our program objectives. We acknowledge valuable discussion with our CSE program evaluator, which have led to this particular revision.

The following are revised metrics approved by the Undergraduate Committee at its October 24, 2003, meeting:

## Revised Metrics

**Objective 1** (*Build a career path with informed choices about its EE/CSE aspects*)

*Metrics Tracked:* (Alumni Survey Entry 3). Percentages of respondents reporting that their career path and their program-gained knowledge/skills are a) strongly related, b) somewhat related, and c) not related. The percentage in a) should be increased, and that in c) should be decreased. Achievement Standard: When averaged over a 3-year period, these percentages should be above 50% and below 10%, respectively.

*Metrics Tracked:* (Alumni Portfolios). Percentages of alumni employed in businesses or organizations in positions strongly aligned, and not aligned, with the knowledge/skills provided by our BS program, and not (as judged by the UgC). Achievement Standard: When averaged over a 3-year period, this percentage should be above 50% and below 10%, respectively.

**Objective 2** (*Be competitive in the EE/CSE job market*)

*Metrics Tracked:* (Alumni Survey Entry 4). Percentages of respondents who find that their position in the job market for their chosen career is a) competitive, and b) not competitive. The percentage in a) should be increased, and that in b) should be decreased. Achievement Standard: When averaged over a 3-year period, these two percentages should be above 50% and below 10%, respectively.

*Metrics Tracked:* (Alumni Portfolios). Percentages of alumni employed in competitive businesses or organizations (as judged by UgC). Achievement Standard: When averaged over a 3-year period, this percentage should be above 50%.

*Metrics Tracked:* (Employer Survey). Percentages of respondents finding our graduates to be competitive with those of other institutions. This percentage should increase. Achievement Standard: When averaged over a 3-year period, this percentage should be above 50%.

**Objective 3a** (*Contribute to the well being of profession*)

*Metrics Tracked:* (Alumni Survey Entry 12). Percentage of respondents who are member in relevant professional organization & percentage of respondents who are members, or were members, or plan to become members in such organizations. Both of these percentages should be increased. Achievement Standard: When averaged over a 3-year period, the first percentage should be more than 50% and the second should be more than 90%.

*Metrics Tracked:* (Alumni Portfolios). Percentage of alumni who are member in relevant professional organization. This percentage should be increased. Achievement Standard: When averaged over a 3-year period, this percentage should be more than 50%.

**Objective 3b** (*Contribute to the well being of community.*)

*Metrics Tracked:* (Alumni Survey Entry 13). Percentage of respondents who are involved in volunteering, cultural/social activities, civic activities, mentorship, sports, charity, or similar activities. This percentage should be increased. Achievement Standard: when averaged over a 3-year period, this percentage

should be greater than 90%.

**Career Choice Objective**

*Metrics Tracked:* (Alumni Portfolios). Percentages of alumni employed in businesses or organizations fitting our list of six career paths (as judged by our UgC). This percentage should be increased. Achievement Standard: When averaged over a 3-year period, this percentage should be above 90%.

*Metrics Tracked:* (Alumni Portfolios). Percentages of alumni pursuing graduate education in engineering or allied fields within their first 5 years. This percentage should be increased. Achievement Standard: This percentage should be above 20%.

*Metrics Tracked:* (Alumni Portfolios). Percentages of graduates pursuing each of the career paths listed in the program Objectives. Achievement Standard:

- A minimum of 20% and a maximum of 75% pursue careers requiring specialized expertise within a large company environment
- A minimum of 10% and a maximum of 60% pursue careers with breadth of responsibilities in a small company environment
- A maximum of 25% pursue careers in sales/marketing in technology companies.
- A minimum of 10% our graduates pursue basic and applied research within their first 5 years.
- A maximum of 20% of our graduates pursue careers in engineering applications in other professions, such as medicine, and law.

**Use of Evaluation Results to Improve Effectiveness of Program**

It is important to note here that the metrics discussed above are to be combined with other data and reports (from alumni, faculty, employers, etc.) that provide more information on the career paths followed by our graduates and their degree of success or failure. As it makes its recommendations for program changes, the UgC will carefully study the totality of the evidence, both quantitative and qualitative, along with relevant reports and studies published by professional societies and government organizations, and will become acquainted with external factors such as changes in the economy and the business environment. The UgC will also examine our data in relation to available data for our peers, as it identifies changes that are common, and others that are unique to our curriculum.

# four: Graduate Programs

## 4.1 Course and Program Development

During the 2003-04 academic year, we have continued to improve our graduate program by adding new courses and refining the degree requirements. As a result of our rapidly growing graduate program, we have a number of new course offerings as special topics (listed as SC500 or SC700). In the past, there were confusions regarding the requirements that can be fulfilled by special topics courses. Starting last year, we now maintain a listing of core and breadth areas for all special topics courses. The Master of Science Program Planning Sheet was amended in December 2003 to remove minor ambiguities and to reflect curricular changes.

Several new courses have been approved by the College of Engineering and formally added to our program after being successful during their first offering. New courses added to the inventory this year include the following:

- SC726** Personal Knowledge Engineering, developed by Professor Toffoli
- SC727** Advanced Coding Theory, developed by Professor Trachtenberg

We have also developed new courses either offered during 2003-2004 or to be offered in Fall 2004 as special topics. For example, SC500 Subsurface Imaging, SC700 Non-Cooperative Networks by Professor Alanyali, SC700 Semiconductor Photonic Devices and Quantum Structures by Professor Paiella, and SC700 Sensor Networks and Systems by Professor Saligrama were offered during Spring 2004. In Fall 2004, SC500 Fundamentals of Optical System Design by Leah Ziph-Schatzberg (of the Photonics Center), SC500 Enterprise Client-Server Software Systems by Professor Skinner, and SC500 Electromagnetic Modeling by Professor Kotiuga will be offered.

The Graduate committee has also developed a new PhD student database to organize existing paper files and to provide rapid access to the student records. All of the critical information about current PhD students is now organized in a relational database and the records are accessible to ECE faculty over a web portal at <http://www.bu.edu/ece/grad>.

## 4.2 Graduate Student Recruitment

Last year we tested the effectiveness of the new scholarship, the Dean's Research Fellowship, which provided one year of funding to those applicants selected from nominated departments. DRF's cover 8 credit hours per semester and allow the students to be engaged in research early in their graduate studies and to prepare for PhD qualifying exams. In order to increase the number of offers made and to provide an early research opportunity for the new students, many of these Fellowships were split into half; and the balance of the funding was in the form of a Research Assistant supported by individual faculty members. Out of the first batch of 8 DRF's, 7 of them are continuing towards their degree programs. During last year we continued to use DRF as a recruiting tool. We have 5 incoming DRF's for the Fall 2004 semester.

The admissions process has been streamlined to make early decisions and financial aid offers. Led by Professor William Oliver, we developed procedures and achieved significant reduction in our response time to applicants. The number of applications received was down this year due to the fact that the number of international applicants dropped by approximately 35-40%, which is consistent with the national trend.

ECE held the traditional graduate student recruiting event in March. The open house weekend gave the opportunity for professors and potential students to meet and evaluate one another. This year we experimented with a different approach to tours and presentations. Rather than having all open house attendees participating in the same lab tours and sitting through the same presentations, each attendee had an individual itinerary with a focus on their particular area. Each area developed area specific presentations, including poster presentations, discussions about current research opportunities and tours of research laboratories. Attendees also met with faculty members and current graduate students in both academic and social environments. Feedback given by the attendees indicated that their interactions with faculty members and graduate students were extremely helpful.

The new University-wide agreement to subsidize medical insurance for full-time Teaching Fellows and Research Assistants was implemented during the 2003/2004 academic year. A fringe benefits line on future grant funding applications now accounts for coverage of the graduate assistant's participation in the Boston University Medical Insurance Plan. All continuing graduate students as well as new incoming Boston University graduate students are covered under this medical insurance plan.

### **4.3 Graduate Teaching Fellow & Undergraduate Teaching Fellow Programs**

Each department's Graduate Teaching Fellow (GTF) allocation within the College of Engineering is determined by the College's Undergraduate Committee and is based on specific course and laboratory requirements. ECE's allocation of the College of Engineering's 53 GTF slots will decrease from 21 in Fall 2003 to 20 for Fall 2004. ECE also provides an additional GTF (and a professor) to teach the Electric Circuits course in the BU Metropolitan College Science and Engineering Program, most of whose students join the College of Engineering formally in their junior year. We have continued successful use of Undergraduate Teaching Fellows (UTF's) that are selected through a formal procedure led by Professor Taubin. During the 2003-2004 academic year we had a total of 13 undergraduate students participating in the UTF program. The feedback from students and faculty has been both positive and encouraging. This program not only continues to provide support for courses with insufficient GTF presence, but also offers valuable teaching experience to the participating students.

### **4.4 Qualifying Exams**

The College of Engineering Math Qualifying Exam was offered in January and May as usual. ECE graduate students have been very successful in general and were recognized for having the top scores in both Math exams during the last year. The ECE Subject Qualifying Exam was conducted on April 3, 2004. The first Saturday in April has now become the regular date for the exam. This date allows new students sufficient time to prepare for the exam by taking courses in the Spring as well as the Fall semester and also gives the students nearly one month before the May Math Exam. Other engineering departments are considering adopting similar dates for their subject exams. For the first time, all PhD matriculants that entered the program in the Fall semester were required to take the ECE qualifying exam during their first year. We believe that taking the qualifying exams within the first year will allow our graduate students to start their research early and secure funding for their doctoral programs. In addition to the PhD students, several MS students have petitioned to take the qualifying exams. The overall performance of the record number (33) of students attempting the ECE Qualifying Exam was indicative of a growing program.

### **4.5 Colloquia and Seminars**

The ECE Colloquium Series continued for another successful year. Prominent speakers from both inside and outside the University gave research talks on current issues. We encourage graduate students to attend these talks.

During the Spring 2003 semester, the ECE Department started a new seminar series called Research Spotlight Seminars (RSS) to encourage collaboration among faculty from different disciplines. Although the intended audience was ECE faculty, graduate students often attended these seminars and contributed to discussions. We expect continued participation of graduate students in RSS in the future.

A list of speakers for the academic year for these two seminar series, as well as other relevant seminars, is given on pages 4-12 through 4-14.

## 4.6 New Matriculants

### New Students Entering 2003-2004

		Male	Female	FT	PT	GTF	RA	Fellow	DRF
MS	US	34	8	30	12	1	0	0	1
	Intl.	9	6	14	1	3	0	0	2
Ph.D.	US	8	1	7	2	1	1	1	4
	Intl.	11	6	16	1	9	3	0	1
<b>Total</b>		<b>62</b>	<b>21</b>	<b>67</b>	<b>16</b>	<b>14</b>	<b>4</b>	<b>1</b>	<b>8</b>

### Fall 2003 Mean GRE Scores

		Verbal	%	Quantitative	%	Analytical	%	Analytical Writing	%
MS	US	501	58	725	79	715	83	4.6	51
	Intl.	494	55	764	86	697	80	4.2	38
PhD	US	532	68	740	79	658	75	4.9	60
	Intl.	610	79	787	94	749	90	4.1	37
<b>Mean</b>		<b>534</b>	<b>70</b>	<b>754</b>	<b>85</b>	<b>705</b>	<b>82</b>	<b>4.5</b>	<b>47</b>

### Spring 2004 Mean GRE Scores

		Verbal	%	Quantitative	%	Analytical	%	Analytical Writing	%
MS	US	532	66	730	78	630	65	4.8	57
	Intl.	482	52	746	81	653	70	4.1	33
PhD	US	400	31	723	77	460	25	4.0	41
	Intl.	541	63	779	90	658	70	4.5	48
<b>Mean</b>		<b>489</b>	<b>53</b>	<b>745</b>	<b>82</b>	<b>600</b>	<b>58</b>	<b>4.4</b>	<b>45</b>

## 4.7 MS Students

Student Name	Advisor	Research Area or Thesis Title
Acosta, Juan*	Trachtenberg	Computer Systems Engineering
Adamson, Benjamin	Hubbard	Electrical Engineering
Aeron, Shuchin*	Saligrama	Capacity Scaling Laws in Wireless Ad-Hoc and Sensor Networks
Afkhami, Ehsan	Saligrama	Electrical Engineering
Agniel, Philippe*	Konrad, Janusz	Subsampling Models and Anti-Alias Filters for 3-D Automultiscopic Displays
Al Daoud, Ashraf	Skinner	Computer Systems Engineering
Albanese, Marc*	Morse	A Compact Adaptive Optics Scanning Laser Ophthalmoscope Using a MEMS Deformable Mirror
Almeida, Nuno	Bellotti	Electrical Engineering
Anandaraman, Deepa*	Levitin	Computer Systems Engineering
Atkinson, John	Kincaid	Electrical Engineering
Azua, Tommy	Bellotti	Electrical Engineering
Basiaga, Dariusz	Levitin	Photonics
Bassotti, Mark	Herbordt	Electrical Engineering
Biello, Michael	Starobinski	Computer Systems Engineering
Bycenski, Kenneth*	Moustakas	Production and Characterization of Entangled Quantum States
Castelli, Thomas*	Trachtenberg	Computer Systems Engineering
Chalasani, Poornima*	Herbordt	Computer Systems Engineering
Chauhan, Vikas	Trachtenberg	Reconciliation Puzzles
Chen, Kan	Toffoli	Computer Systems Engineering
Chen, Kevin*	Saligrama	Electrical Engineering
Chow, Melissa	Hubbard	Electrical Engineering
Christiaanse, Catherine	Bellotti	Electrical Engineering
Ciriello, Sarah	Kincaid	Electrical Engineering
Clark, James*	Saligrama	Electrical Engineering
Coles, Michael	Hubbard	Computer Systems Engineering
Corporon, Jay*	Ünlü	Photonics
Dain, Oliver*	Knepper	Computer Systems Engineering
Davenport, Jason	Roziner	Electrical Engineering
Diaz, Marcos	Oliver	Electrical Engineering
Donnenfeld, Michael	Herbordt	Electrical Engineering
Driscoll, Kristina	Bigio	Electrical Engineering
Dua, Aarti	Herbordt	Computer Systems Engineering
Dutta, Madhuparna	Ünlü	Electrical Engineering
Egnaczyk, Jeff*	Skinner	Computer Systems Engineering
Ermis, Erhan	Konrad	Electrical Engineering
France, Ryan	Teich	Electrical Engineering
Fu, Zhicong*	Levitin	Computer Systems Engineering
Gali, Srikrishna*	Carruthers	Computer Systems Engineering
George, John	Kotiuga	Electrical Engineering
Gervais, David*	Sergienko	Electrical Engineering
Ghosh, Soma	Alanyali	Computer Systems Engineering
Gore, Tyler*	Hubbard	Electrical Engineering
Gregorowicz, Andrew	Karl	Computer Systems Engineering
Gupta, Vikas	Herbordt	Electrical Engineering
Hu, Lan	Toffoli	Computer Systems Engineering
Imhausen, Brian	Sergienko	Electrical Engineering
Iwai, Yasuko*	Herbordt	Computer Systems Engineering
Joo, Eduardo	Taubin	Computer Systems Engineering
Kulenica, Ervin	Paiella	Electrical Engineering
Kumssa, Mequanent*	Nawab	Electrical Engineering
Lancia, David*	Alanyali	Computer Systems Engineering
LaRosa, Gregory	Paiella	Photonics
Lee, Dong-Hoon	Carruthers	Computer Systems Engineering



Student Name	Advisor	Research Area or Thesis Title
Leonard, Edward	Ruane	Electrical Engineering
Lichtenstein, Lee	Toffoli	Computer Systems Engineering
Lopez, Mariela	Oliver	Electrical Engineering
Lutzer, Christiaan	Trachtenberg	Computer Systems Engineering
Lyla, Gary	Giles	Electrical Engineering
Lynch, Eric	Teich	Photonics
MacDonald, Daniel	Taubin	Electrical Engineering
MacKenzie, Alexander	Nawab	Electrical Engineering
Makris, Emmanouil*	Alanyali	Computer Systems Engineering
Martin, Andrew	Castanon	Electrical Engineering
McNerney, Peter*	Konrad	Electrical Engineering
Mehta, Nehal	Karpovsky	Computer Systems Engineering
Menn, Steven	Ünlü	Electrical Engineering
Misic, Mead	Knepper	Electrical Engineering
Mitchell, Brian	Carruthers	Electrical Engineering
Movaghar, Azhand	Hubbard	Electrical Engineering
Mueller, Alexander*	Saligrama	Electrical Engineering
Mundada, Vikas	Moustakas	Electrical Engineering
Narayan, Savitha	Trachtenberg	Computer Systems Engineering
Nguyen, Tung	Lee	Computer Systems Engineering
Ntaikos, Dimitrios*	Carruthers	Electrical Engineering
O'Hare, Brendan*	Cassandras	Optimal Control of Energy Efficient Systems
Owen, Russell	Bellotti	Electrical Engineering
Pant, Pavan*	Carruthers	Computer Systems Engineering
Paradis, Daniel*	Castañon	Electrical Engineering
Patel, Keni*	Saleh	Electrical Engineering
Patel, Mitul	Karpovsky	Computer Systems Engineering
Pikalo, Oleksiy	Saleh	Photonics
Pinkney, Errol*	Knepper	Computer Systems Engineering
Praino, Julie	Saleh	Photonics
Raman, Supriya*	Carruthers	Predictive Data Mining Analysis of Right Handed Parallel Beta-Helix Proteins
Rao, Seema	Konrad	Computer Systems Engineering
Rao, Suyog	Toffoli	Computer Systems Engineering
Raybardhan, Amit	Knepper	Electrical Engineering
Reese, Gilbert	Carruthers	Computer Systems Engineering
Rendon, Christian	Hubbard	Electrical Engineering
Roy, Sanchita	Giles	Computer Systems Engineering
Rustomji, Arnaz	Carruthers	Electrical Engineering
Sacteng, Nipha*	Saleh	Electrical Engineering
Sardo, Brian	Hubbard	Computer Systems Engineering
Sarkhili, Sara*	Kincaid	Electrical Engineering
Satheesh, Chindu*	Castañon	Electrical Engineering
Sebastian, Christina	Carruthers	Electrical Engineering
Shekher, Parag	Kincaid	Electrical Engineering
Shekher, Rahul	Nawab	Electrical Engineering
Shibata, Kosaku	Ruane	Electrical Engineering
Skaf, Antoine	Kotiuga	Electrical Engineering
Solanki, Parikha*	Bigio	Electrical Engineering
Stewart, Jason	Bifano	Electrical Engineering
Subramanian, K.	Saligrama	Electrical Engineering
Sukumar, Sumithira*	Konrad	Electrical Engineering
Sumorok, Daniel	Starobinski	Computer Systems Engineering
Suresh, Lavanya*	Toffoli	Electrical Engineering
Sweetser, Russell*	Castañon	Computer Systems Engineering
Thulin, Lukas	Levitin	Photonics
Vajda, Viktor*	Hubbard	Computer Systems Engineering
Velagapalli, Sireesha	Trachtenberg	Computer Systems Engineering

Student Name	Advisor	Research Area or Thesis Title
Vellanki, Harshavardhan	Bellotti	Electrical Engineering
Wang, Kai	Saleh	Electrical Engineering
Wang, Chun-Kai	Kincaid	Electrical Engineering
Wei, Chih-Chung	Bystrom	Electrical Engineering
Westfried, Jerome	Carruthers	Computer Systems Engineering
Williams, Cliff	Sergienko	Photonics
Williams, Genja*	Hubbard	Electrical Engineering
Yalcin, Ayca	Ünlü	Photonics
Zhai, Qingtai	Fritz	Electrical Engineering
Zhang, Wei*	Carruthers	Electrical Engineering
Zhao, Wei	Konrad	Electrical Engineering
Zhou, Yunsheng	Brackett	Computer Systems Engineering

\* degree received in 2002/2003

### 4.8 PhD Students

Student Name	Advisor	Research Area or Dissertation Title
Abell, Joshua	Moustakas	Electrical Engineering
Abu Ayyash, Salma	Carruthers	Electrical Engineering
Agarwal, Ashish	Trachtenberg	Computer Engineering
Agarwal, Sachin	Trachtenberg	Efficient Reconciliation of Unstructured and Structured Data Over Networks
Atia, George	Kincaid	Electrical Engineering
Bach, Edward	Toffoli	A Rational Framework for ‘Crystalline Computation’ (cellular automata, lattice gases, and the like)
Bergstein, David	Ünlü	Electrical Engineering
Beriont, Walter	Levitin	Computer Engineering
Bhattacharyya, Anirban	Moustakas	III-Nitride UV Emitters Produced by MBE
Bilici, Temel	Ünlü	Electrical Engineering
Borogovac, Tarik	Carruthers	Systems Engineering
Bozinovic, Nikola	Konrad	Electrical Engineering
Bynoe, Wayne	Carruthers	Computer Engineering
Cabalu, Jasper	Moustakas	Electrical Engineering
Carroll, Sarah*	Carruthers	Modeling Wireless Infrared Communications for Network Simulation
Chandrasekaran, Ramya	Moustakas	Electrical Engineering
Chang, Shey-Sheen*	Nawab	Electrical Engineering
Chauhan, Vikas	Trachtenberg	Computer Engineering
Chen, Fangyi	Hubbard	A Hydro-Mechanical Biomimetic Cochlea: Experiments and Models
Chen, Tai-Chou	Moustakas	Electrical Engineering
Chivas, Robert	Morse	Electrical Engineering
Colerico, Marlene	Mendillo	Electrical Engineering
Collier, Patrick	Morse	Electrical Engineering
Crager, Joseph*	Horenstein	Energy Dissipation in Electrostatic Discharges from Charged Insulating Surfaces
Cvetkovski, Andrej	Bystrom	Electrical Engineering
Dai, Haitao	Knepper	Electrical Engineering
Davis, Brynmor	Karl	Electrical Engineering
Dobson, Jennifer	Bigio	Elastic Scattering Spectroscopy for the Detection of Apoptosis in Vivo
Dosunmu, Olufemi	Ünlü	Electrical Engineering
Egorov, Roman	Levitin	Computer Engineering

Student Name	Advisor	Research Area or Dissertation Title
Eraslan, Mesut†	Ünlü	Electrical Engineering
Ghosh, Soma	Alanyali	Computer Engineering
Goode, Darryl	Teich	Electrical Engineering
Gu, Yongfeng	Herbordt	Computer Engineering
Gunna, Sulakshana	Bellotti	Computer Engineering
Hasan, Qader-UI*	Levitin	Computer Engineering
He, Zhihua	Bystrom	Electrical Engineering
Hock, Robert	Moustakas	Electrical Engineering
Hu, Lan	Toffoli	Computer Engineering
Huang, Chien Chih	Knepper	Electrical Engineering
Ince, Serdar	Konrad	Electrical Engineering
Ippolito, Stephen*	Ünlü	Electrical Engineering
Jastrzebski, Piotr	Lee	Electrical Engineering
Jones, Lawrence	Levitin	Computer Engineering
Karl, Christian	Hubbard	Electrical Engineering
Kaur, Parminder	Trachtenberg	Computer Engineering
Ke, Wang	Little	Adaptive Semantic Routing for Energy Aware Networks
Keene, Sam	Levitin	Electrical Engineering
Kim, Duk Joong	Hubbard	Electrical Engineering
Kim, Soo Il	Herbordt	Electrical Engineering
Knaian, Ara	Bystrom	Electrical Engineering
Krishnan, Rajesh*	Starobinski	Efficient Self-Organization of Large Wireless Sensor Networks
Kulikowski, Konrad	Knepper	Computer Engineering
Kunapareddy, N.	Bigio	Electrical Engineering
Lalooses, Francine	Toffoli	Computer Engineering
Laurent, Sophie	Mendillo	Design of a High Definition Imaging Analysis (HDI) Technique Adapted to Challenging Environments
Li, Ning	Morse	Electrical Engineering
Li, Wei	Moustakas	Electrical Engineering
Li, Xiaojun	Morse	Electrical Engineering
Li, Yan	Saleh	Electrical Engineering
Litvin, Andrey	Karl	Shape Distribution Based Shape Priors
Liu, Huajun*	Perreault	Remote Control of Computer Hardware Interfaces
Lu, Shan	Hubbard	Computer Engineering
Lu, Ye	Bystrom	Electrical Engineering
Martin, Benjamin	Castañón	Electrical Engineering
Mathur, Raman	Karpovsky	Electrical Engineering
Mazooji, Mohammad	Paiella	Electrical Engineering
Mei, Kao-Chi	Karpovsky	Computer Engineering
Miao, Lei	Karpovsky	Electrical Engineering
Mustafa, Mehmet	Karpovsky	High Performance Routing in Multicomputers
Nasr, Magued	Saleh	Electrical Engineering
Nintanavongsa, Prusayon	Levitin	Computer Engineering
Nourzad, Marianne	Hubbard	Computer Engineering
Ormecci, Pinar	Starobinski	Electrical Engineering
Pan, Haidong	Caramanis	Systems Engineering
Pavlovich, Julia	Karl	Electrical Engineering
Perreault, Julie*	Horenstein	Development and Control of Kilo-Pixel MEMS Deformable Mirrors and Spatial Light Modulators
Polimeni, Jonathan	Schwartz	Electrical Engineering

## Graduate Programs

Ray, Saikat	Oliver	Transmission Strategies in Wireless Networks
Ristivojevic, Mirko	Konrad	Electrical Engineering
Rodriguez, Eladio	Castañon	Electrical Engineering
Rossa, Brian	Toffoli	Computer Engineering
Ruan, Dan†	Konrad	Electrical Engineering
Rykalova, Yelena	Levitin	Computer Engineering
Savas, Onur	Alanyali	Electrical Engineering
Sharma, Abhishek	Alanyali	Computer Engineering
Shi, Yonggang	Karl	Signal Processing
Smirnov, Alexander	Taubin	Computer Engineering
Srivastava, Rashmi	Nawab	Computer Engineering
Su, Ming	Taubin	Computer Engineering
Toussaint, Kimani*	Ruane	Electrical Engineering
Vamivakas, Anthony	Ünlü	Electrical Engineering
Van Court, Thomas	Herbordt	User Design of Bioinformatics Processors
Walton, Zachary*	Toffoli	Computer Engineering
Wang, Yang	Bellotti	Physics
Weisenseel, Robert	Karl	Exploiting Shared Image Structure Fusion in Multi-Modality Data Inversion for Atherosclerotic Plaque Characterization
Williams, Adrian	Oliver	Electrical Engineering
Wotiz, Robert	Nawab	Integrated Processing and Understanding of Signals for EMG Decomposition
Wu, Tao	Starobinski	Electrical Engineering
Wynne, Rosalind	Morse	Fabrication Modeling of Microstructured Optical Fiber
Xu, Tao	Moustakas	Electrical Engineering
Yang, Zibing*	Hubbard	Low-Frequency Analog Integrated Circuit Design Using Current-Mode Techniques
Yarnall, Timothy	Teich	Experimental Demonstrations of Free-Space Quantum Key Distribution
Yoon, Ji Sun	Hubbard	Electrical Engineering
Zettergren, Matthew	Oliver	Electrical Engineering
Zhai, Qingtai	Fritz	Electrical Engineering
Zhao, Wei	Konrad	Electrical Engineering

\* received degree in 2003/2004

† received MS as part of program in 2003/2004

## 4.9 Degrees Awarded

MS Degrees Awarded	
Electrical Engineering	28
Computer Systems Engineering	23
Photonics	1
<b>TOTAL</b>	<b>52</b>

PhD Degrees Awarded	
Electrical Engineering	8
Computer Systems Engineering	3
<b>TOTAL</b>	<b>11</b>

## 4.10 Graduate Teaching Fellows

### Fall 2003

Student Name	Course
Afkhami, Ehsan	SC463/464
Atia, George	SC410
Bach, Ted	SC312
Bilici, Temel	SC463/464
Chang, Shey-Sheen	SC416
Clark, James	SC410
Dasika, Vaishno	SC463/464
Ermis, Erhan	MET EK317
Gu, Yongfeng	SC450
Imhausen, Brian	EK307
Jenkins, Karen	SC415
Lalooses, Francine	SC441
Li, Xiaojun	SC560
Li, Yan	SC401
Miao, Lei	SC410
Sharma, Abishek	SC311
Smirnov, Alexander	SC330
Su, Ming	SC311
Subramanian, Krishnakumar	SC312
Van Court, Tom	SC440/447
Williams, Genja	SC571
Yalcin, Ayca	SC410

### Spring 2004

Student Name	Course
Afkhami, Ehsan	SC463/464
Agarwal, Ashish	SC410
Atia, George	EK307/MET EK318
Bach, Ted	SC312
Bilici, Temel	SC463/464
Chang, Shey-Sheen	SC416
Chen, Fangyi	SC571
Cvetkovski, Andrej	SC401
Dai, Haitao	SC412
Ermis, Erhan	EK307/MET EK318
France, Ryan	EK307/MET EK318
Ghosh, Soma	SC440/447
Gu, Yongfeng	SC450
Imhausen, Brian	SC311
Jenkins, Karen	SC450
Lalooses, Francine	SC463/464
Li, Xiaojun	Photonics Lab
Li, Yan	EK307/MET EK318
Miao, Lei	SC441
Smirnov, Alexander	SC330
Su, Ming	SC311
Subramanian, Krishnakumar	SC415
Yalcin, Ayca	EK307/MET EK318

### Summer 2004

Student Name	Course
Yan Li	EK307
Ming Su	SC312
Madhuparna Dutta	SC410
Konrad Kulikowski	SC440/447

## 4.11 Research Assistants

Student Name	Advisor	Student Name	Advisor
Aeron, Shuchin	Saligrama	Li, Shan	Mountain
Abell, Joshua	Moustakas	Li, Wei	Moustakas
Abu Ayyash, Salma	Little	Li, Xiaojun	Morse
Agarwal, Sachin	Trachtenberg	Lichtenstein, Lee	Mountain
Atia, George	Saligrama	Litvin, Andrey	Karl
Bergstein, David	Ruane	Lopez, Mariela	Ruane
Bhattacharyya, Anirban	Moustakas	Lu, Shan	Mountain
Borogavac, Tarik	Carruthers	Lu, Ye	Bystrom
Bozinovic, Nikola	Konrad	Ma, Xiang	Castanon
Browning, Cassandra	Swan	Martin, Benjamin	Castanon
Bycenski, Kenneth	Sergienko	Mathur, Raman	O'Connor
Cabalu, Jasper	Moustakas	Menn, Steven	Unlu
Chandrasegaran, Ramya	Moustakas	Miao, Lei	Cassandras
Chang, Shey-Sheen	Roy, Serge	Nasr, Magued	Saleh
Chen, Fangyi	Hubbard	Nourzad, Marianne	Hubbard
Chen, Tai-Chou	Moustakas	Ntaikos, Dimitrios	Fritz
Chivas, Robert	Morse	Ormecci, Pinar	Starobinski
Crager, J. Casey	Horenstein	Pavlovich, Julia	Karl
Davis, Brynmor	Swan	Perreault, Julie	Baillieul
Diaz, Marcos	Oliver	Polimeni, Jonathan	Schwartz
Dobson, Jennifer	Castanon	Praino, Julie	Saleh
Dogan, Mehmet (Physics)	Swan	Ray, Saikat	Starobinski
Driscoll, Kristina	Bigio	Ristivojevic, Mirko	Konrad
Eraslan, Mesut	Unlu	Rodriguez, Eladio	Castanon
Ermis, Erhan	Karl	Ruan, Dan	Castanon
France, Ryan	Moustakas	Savas, Onur	Alanyali
Friel, Ian (Physics)	Moustakas	Sharma, Abhishek	Alanyali
Goode, Darryl	Saleh	Shi, Yonggang	Karl
Gore, Tyler	Hubbard	Smirnov, Alexandre	Taubin
Gu, Yongfeng	Herbordt	Srivastava, Rashmi	Nawab
Gunna, Sulakshana	Bellotti	Stewart, Jason	Bifano
He, Zhihua	Bystrom	Su, Chang	Paschalidis
Hu, Lan	Mountain	Sumorok, Daniel	Starobinski
Ince, Serdar	Konrad	Vajda, Victor	Mountain
Ippolito, Stephen	Goldberg	Vamivakas, Nick	Unlu
Jenkins, Karen	Castanon	Van Court, Thomas	Herbordt
Karabacak, Devrez (AME)	Ekinci/Unlu	Walton, Zachary	Sergienko
Karl, Christian	Hubbard	Wang, Yang	Bellotti
Kaur, Parminder	O'Connor	Weisenseel, Robert	Karl
Ke, Wang	Little	Williams, Adrian	Moustakas
Kim, Duk Joong	Bifano	Wotiz, Robert	DeLuca
Knaian, Ara	Saligrama	Wynne, Rosalind	Morse
Kulikowski, Konrad	Karpovsky	Xu, Tao	Moustakas
Kunapareddy, Nagapratima	Bigio	Yalcin, Ayca	Unlu
Lancia, David	Vajda	Zettergren, Matthew	Oliver
Laurent, Sophie	Mendillo	Zhai, Qingtai	Fritz
Li, Ning	Morse	Zhao, Chenming (MFG)	Castanon

## 4.12 Graduate Courses

Course Number and Title	Fall 03	Spring 04	Summer 04
SC500 Special Topics in ECE		Saleh	
SC501 Dynamic Systems Theory	Dupont		
SC504 Advanced Data Structures	Trachtenberg		
SC505 Stochastic Processes	Karl	Karl	
SC511 Software Design System	Brackett		
SC513 Computer Architecture	Herbordt		
SC515 Digital Communication	Saligrama		
SC516 Digital Signal Processing	Nawab		
SC518 Software Project Mangement		Brackett	
SC520 Image Processing and Communication	Konrad		
SC524 Optimization Theory and Methods	Paschalidis		
SC533 Introduction to Discrete Mathematics	Levitin		
SC534 Discrete Stochastic Models		Levitin	
SC541 Computer Communication Networks	Alanyali	Starobinski	
SC551 Advanced Digital Design	Taubin		
SC560 Introduction to Photonics	Paiella	Ruane	
SC561 Error-Control Codes	Karpovsky		
SC563 Fiber-Optic Communication Systems		Morse	
SC568 Optical Fiber Sensors	Morse		
SC570 Lasers and Applications		Ünlü	
SC571 VLSI Principles and Applications	Hubbard	Hubbard	
SC575 Semiconductor Devices	Bellotti		
SC577 Solid State Devices		Moustakas	
SC578 Fabrication Technology for Integrated Systems	Klepstyn	Klepstyn	
SC579 Microelectronic Device Manufacturing		Cole	
SC582			
SC700 Advanced Special Topics in ECE	Toffoli		
SC700 Advanced Special Topics in ECE		Alanyali	
SC700 Advanced Special Topics in ECE		Paiella	
SC700 Advanced Special Topics in ECE		Saligrama	
SC710 Dynamic Programming and Stochastic Control		Caramanis	
SC712 Advanced Software		Skinner	
SC713 Parallel Computer Architecture		Herbordt	
SC715 Wireless Communication		Carruthers	
SC720 Digital Video Processing		Konrad	
SC730 Informational-Theoretical Design of Algorithms		Levitin	
SC733		Cassandras	
SC744 Mobile Ad hoc Networking and Computing		Little	
SC749 Interconnection Networks for Mulicomputers	Karpovsky		
SC751 Design of Asynchronous Circuit and Systems		Taubin	
SC761 Information Theory and Coding	Levitin		
SC762 Quantum Optics		Sergienko	
SC765 Biomedical Optics and Biophotonics	Bigio		
SC771 Physics of Compound Semiconductor Devices		Bellotti	
SC850 Graduate Teaching Seminar	Nawab	Nawab	
SC892 Seminar:Electro-Physics	Moustakas	Moustakas	
SC892 Seminar:Electro-Physics	Ünlü	Ünlü	
SC900 Research	Faculty	Faculty	Faculty
SC901 Thesis	Faculty	Faculty	Faculty
SC910 Computer Engineering Design Project	Faculty	Faculty	Faculty
SC911 Systems Engineering Design Project	Faculty	Faculty	
SC912 Software Engineering Project		Brackett	

Course Number and Title	Fall 02	Spring 03	Summer 03
SC913 Electrical Engineering Design Project	Faculty	Faculty	
SC939 Continuing Study	Faculty	Faculty	
SC951 Independent Study	Faculty	Faculty	
SC991 Dissertation	Faculty	Faculty	Faculty

#### 4.13 Colloquia & Seminars

Date	Speaker	Title
September 17 <sup>a</sup>	Michael Ruane BU ECE Department	Micromagnetics Modelings for Data Storage
October 2 <sup>c</sup>	James Spall Applied and Computational Mathematics Program Johns Hopkins University	Some Issues in Stochastic Search and Optimization
October 10 <sup>c</sup>	Michael C. Caramanis Director, CISE BU Department of Manufacturing Engineering	Stochastic Supply Chain Planning and Coordination: Problem Aspects, Results, and Interesting Open Research Direction
October 15 <sup>a</sup>	Federico Capasso Harvard University	Multiwavelength, Ultrafast and Photonic-Crystal Quantum Cascade Lasers
October 17 <sup>c</sup>	Gerald Fine BU Department of Manufacturing Engineering	Managing Impairments in Optical Systems
October 24 <sup>c</sup>	Christos G. Cassandras BU ECE Department and Department of Manufacturing Engineering	Stochastic Flow Models for Communication Networks
October 31 <sup>b</sup>	Irving Bigio BU ECE Department and Department of Biomedical Engineering	Optical Biopsy: Noninvasive Detection of Cancer with Elastic-Scattering Spectroscopy
October 31 <sup>c</sup>	Ari Trachtenberg BU ECE Department	Scalable Synchronization of Networked Data
November 5 <sup>a</sup>	Sergio D. Servetto Cornell University	Capacity, Stability and Flows in Large-Scale Random Networks
November 7 <sup>b</sup>	Murat Alanyali BU ECE Department	A Game-Theoretic Perspective to Computer Communications
November 7 <sup>c</sup>	David Starobinski BU ECE Department	Robust Location Detection in Sensor Networks
November 14 <sup>c</sup>	Michael Fu University of Maryland	American-Asian Options: Optimal Exercise Policies and Simulation-base Valuation
November 19 <sup>a</sup>	Caroline A. Ross Department of Materials Science and Engineering Massachusetts Institute of Technology	Magnetic Nanostructures - Rings, Bars and Dots



November 21 <sup>b</sup>	Lev Levitin, Tommaso Toffoli BU ECE Department	The Maximum Speed of Quantum Gate Operation
November 21 <sup>c</sup>	Pirooz Vakili BU Department of Manufacturing Engineering	Credit Risk Modeling and Valuation: An Overview with Emphasis on Modeling Dependent Defaults
December 3 <sup>a</sup>	C. Jagadish IEEE LEOS Distinguished Lecturer Australian National University	Quantum Well and Quantum Dot Intermixing for Optoelectronic Device Integration
December 5 <sup>c</sup>	Venkatesh Saligrama BU ECE Department	Distributed Hypothesis Testing in Sensor Networks
December 5 <sup>b</sup>	Anna Swan BU ECE Department	Carbon Nanotubes - Properties, Applications and Optical Measurements
January 16 <sup>b</sup>	Maja Bystrom BU ECE Department	Images and Video: Issues in Compression, Transmission, and Information Assurance
January 23 <sup>b</sup>	Venkatesh Saligrama BU ECE Department	Classification in Sensor Networks
January 30 <sup>b</sup>	Mark Horenstein BU ECE Department	Electrostatic Discharge Energies of Propagating Brush Discharges: A Paradigm for Industrial Safety
January 30 <sup>c</sup>	Vijay Kumar University of Pennsylvania	Multirobot Manipulation: Mechanics, Algorithms, And Control
January 30 <sup>c</sup>	Kagan Gökbayrak Bilkent University	Internet Traffic Engineering by OSPF Link Weight Optimization
February 4 <sup>a</sup>	R. Heintzmann Max-Planck Institute for Biophysical Chemistry	Patterned Excitation Microscopy
February 6 <sup>b</sup>	Frederic Beihold CST of America	Applying CST (Computer Simulation Technology) MWS (Microwave Studio) Version 5 to New Antenna Technologies
February 6 <sup>c</sup>	Stephen Wilkerson Weapons Technology Analysis Branch U.S. Army	Cooperative Behaviors for Unmanned Systems
February 18 <sup>b</sup>	Jeff S. Shamma University of California - Los Angeles	Multiagent Repeated Games and Convergence to Nash Equilibria
February 20 <sup>b</sup>	Mark Karpovsky BU ECE Department	Testing of Computer Hardware and Error-Detecting Codes
February 20 <sup>c</sup>	Gemunu Gunaratne University of Houston	How to Find Out When Bones May Break
February 25 <sup>b</sup>	Dennis L. Goeckel University of Massachusetts - Amherst	Asynchronous Cooperative Wireless Communications
February 27 <sup>b</sup>	Enrico Bellotti BU ECE Department	Research Activity of the Computational Electronics Group
February 27 <sup>c</sup>	Francesco Bullo University of Illinois at Urbana-Champaign	Distributed Coordination Algorithms For Mobile Sensing Networks

## Graduate Programs

February 27 <sup>c</sup>	J.Q. Hu BU Department of Manufacturing Engineering	Design and Optimization Problems in WDM Optical Networks
March 17 <sup>a</sup>	Steve Homer BU Computer Science Department	Quantum Computing with Constant Depth Quantum Circuits
March 26 <sup>b</sup>	Mike Ruane BU ECE Department	Resonant Cavity Biosensor
March 26 <sup>c</sup>	Erol Pekoz BU Department of Operations and Technology Management, School of Management	Do More Hospital Beds in an Area Induce Excess Demand?
April 2 <sup>c</sup>	Yannis Paschalidis BU Department of Manufacturing Engineering	Optimizing Wireless Sensor Networks
April 2 <sup>b</sup>	Ted Morse BU ECE Department	Research in the Laboratory for Lightwave Technology
April 7 <sup>a</sup>	Govind P. Agrawal University of Rochester	Nonlinear Effects in Optical Fibers: Recent Advances
April 9 <sup>c</sup>	Chang Su BU Department of Manufacturing Engineering	Target-Pursuing Policies for Scheduling and Routing in Multiclass Queueing Networks
April 9 <sup>c</sup>	Eric Kolaczyk BU Department of Mathematics and Statistics	Multiscale/Multigranular Image Segmentation
April 16 <sup>c</sup>	Edmund Yeh Yale University	Information Theory, Queueing, and Resource Allocation in Multi-user Wireless Communications
April 22 <sup>c</sup>	Dennis S. Bernstein University of Michigan	Adaptive Control of the Triaxial Attitude Control Testbed
April 23 <sup>b</sup>	David Campbell BU ECE Department	Computational Nanoscience: Modeling Novel Electronic Materials and Devices at the Nanoscale
April 30 <sup>c</sup>	Costis Maglaras Columbia University	Pricing and Design of On-Demand Information Services
May 14 <sup>c</sup>	John Byers BU Department of Computer Science	Approximate Aggregation Techniques for Sensor Databases

<sup>a</sup> ECE Colloquium Series

<sup>b</sup> Research Spotlight Seminar

<sup>c</sup> CISE Seminar

## 5.1 Areas of Research

### Electro-Physics

Coordinator: Michael Ruane

#### Solid-State Materials and Devices

- Bellotti
- Campbell
- Eddy
- Humphrey
- Knepper
- Moustakas
- Schubert
- Skocpol

#### Photonics

- Bellotti
- Bigio
- Carruthers
- Eddy
- Goldberg
- Kincaid
- Levitin
- Luo
- Morse
- Moustakas
- Paiella
- Ruane
- Saleh
- Sergienko
- Swan
- Teich
- Ünlü

#### Electromagnetics

- Fahim
- Felsen
- Fritz
- Giles
- Horenstein
- Humphrey
- Kotiuga
- Lee
- Mendillo
- Oliver

### Information Systems & Sciences

Coordinator: W. Clem Karl

#### Signal & Image Processing

- Bystrom
- Carruthers
- Castañón
- Karl
- Kincaid
- Konrad
- Mendillo
- Nawab
- Oliver
- Saligrama
- Teich

#### Systems & Control

- Baillieul
- Castañón
- Karl
- Saligrama

### Computer Engineering

Coordinator: Martin Herbordt

#### Computer & Communication Net-

- Alanyali
- Carruthers
- Cassandras
- Hubbard
- Karpovsky
- Levitin
- Roziner
- Starobinski
- Toffoli
- Trachtenberg

#### Software Applications

- Brackett
- Brower
- Castañón
- Giles
- Knepper
- Kotiuga
- Levitin
- Little
- Nawab
- Schwartz
- Skinner
- Toffoli
- Trachtenberg

#### Hardware

- Herbordt
- Hubbard
- Karpovsky
- Knepper
- Taubin
- Toffoli

## 5.2 Research Labs

### Applied Electromagnetics Laboratory

This laboratory is devoted to problems in experimental electromagnetics with a primary focus on industrial electrostatics, sensors, and micro-electromechanical systems (MEMS). Current projects include a study of spark energies from insulating surfaces, studies of the electrostatic properties of insulating materials, development of a circular electrode array plasma-torch system, and charge-control systems for MEMS actuators. *Horenstein*

### Biological Information Processing Laboratory

Work carried out in this laboratory is principally concerned with the wavelet analysis of biological signals. Particular examples include the analysis of fractal behavior of neural spike trains in hearing and vision; the analysis of the human heart rate and the differentiation of pathological from normal heart rhythms; and information transmission in biological sensory systems. *Teich*

### Biomedical Optics and Biophotonics Laboratory

The core theme of biomedical optics/ photonics is minimally invasive optical diagnostics and therapeutics. This laboratory focuses on the development of optics-based technologies for clinical applications and biomedical research. Current research topic areas include:

- Advanced spectroscopic technologies for tissue diagnosis
- Noninvasive measurement of drug concentrations in tissue
- Interstitial laser thermotherapy and photodynamic therapy
- Computational methods for modeling optical transport in tissue
- Optical interferometry for imaging nerve activation

*Bigio*

### Broadband Wireless Communications Laboratory

This laboratory supports research projects on the design, theory, and prototyping of broadband wireless communication systems. The major focus is on the use of infrared light as the transmission medium for high-data-rate indoor wireless local-area networks. The laboratory includes facilities for the fabrication and testing of experimental prototypes as well as computing resources for system design and analysis. *Carruthers*



### Computational Electronics Laboratory

The Computational Electronics Laboratory (CEL) is equipped with state-of-the-art computing tools. The lab has two computer clusters, one XP1000 Alpha Cluster (8 CPUs) running True UNIX 64, and an AMD Athalon MP Cluster (13 CPUs) running Linux. The lab also operates a variety of high performance PCs and printers. The Computational Electronics Group develops software to study semiconductor materials and to perform electronics and optoelectronics device simulation. Commercial simulation packages, such as ISE Genesis and Silvaco Virtual Wafer Fab are currently employed. *Bellotti*

### Computer Architecture and Automated Design Laboratory

Work focuses on experimental computer architecture, particularly on the application of emerging technology to

computationally intensive application. Projects include developing design tools for application specific coprocessors, designing MPP router switches, vision computers, and the application of configurable computing to bioinformatics.

*Herbordt*

### Functorial Electromagnetics Laboratory

The Functorial Electromagnetic Analysis Lab considers the difficulties encountered in the finite element analysis of three-dimensional electromagnetic fields that cannot be anticipated through experience with two-dimensional simulations. The lab has focussed its efforts in the development of Whitney form techniques, homology calculations, algorithms for total magnetic scalar potentials in multiply-connected regions, helicity functional techniques, and data structures based on semi-simplicial objects. Torsion invariants of complexes and rational homotopy theory are currently being exploited in the context of direct and inverse three-dimensional problems such as impedance tomography and magnetic field synthesis. *Kotzinga*

### Imaging Science Laboratory (ISL)

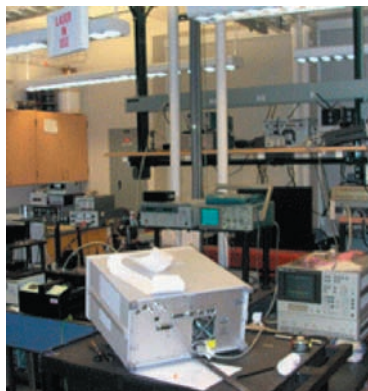
Affiliated with the Boston University Center for Space Physics, the ISL applies state-of-the-art optical imaging technology to the study of the Earth, Moon, planets and comets. Activities include equipment design and fabrication, field campaigns to observing sites worldwide, and digital signal processing.

*Mendillo*

### Integrated DSP Environments and Architectures Laboratory (IDEA)

This laboratory conducts research in digital signal processing and its integration into application systems. Issues of interest include DSP algorithms, knowledge-based systems, software architectures for

integrated DSP, software environments for the development of integrated DSP systems, integration of numeric and symbolic processing, statistical signal processing, and multidimensional signal processing. This research is carried out in the context of many applications, ranging from the interpretation of musical signals to the analysis of spread spectrum signals and the knowledge-based decomposition of electromyographic (EMG) signals. *Navab*



### Lightwave Technology Laboratory

This lab is one of the few university laboratories capable of designing, fabricating, and characterizing silica optical fibers. The research activities of this laboratory focus on new processing techniques for optical fibers and planar waveguides, high power optical fiber lasers, and a variety of optical fiber sensors. The components of this facility consist of a fabrication laboratory with three glass lathes including a new state-of-the-art Nextrom MCVD system, an optical laboratory with numerous pump lasers for fiber lasers, five isolation tables, and an 8m optical fiber draw tower, newly outfitted with Nextrom winding and control equipment. In addition, there is a CVD laboratory for studies of thin films. *Morse*

### Magnetic and Optical Devices Laboratory (MODL)

Properties and applications of magnetic and magneto-optical materials are studied using optical, electrical, and computational

methods in the MODL. Recent work has included micromagnetics modeling, using supercomputer facilities, for commercial read/write heads, GMR memory devices, and nano-structured magnetic materials. Kerr and Faraday effect imaging are used to measure the structure and dynamics of magnetic thin films and hard magnetic wires. *Ruane, Humphrey*

### Multi-Dimensional Signal Processing (MDSP) Laboratory

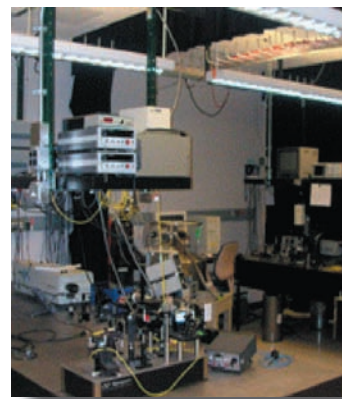
The MDSP Lab conducts research in the areas of multidimensional and multiresolution signal and image processing and estimation, and geometric-based estimation. The applications that motivate this research include, but are not limited to, problems arising in automatic target detection and recognition, geophysical inverse problems (such as finding oil and analyzing the atmosphere), and medical estimation problems (such as tomography and MRI). The general goal is to develop efficient methods for the extraction of information from diverse data sources in the presence of uncertainty. The lab's approach is based on the development of statistical models for both observations, prior knowledge, and the subsequent use of these models for optimal or near-optimal processing. *Karl*

### Multimedia Communications Laboratory

The focus of this laboratory is the enabling technology for distributed and multimedia applications. Research includes investigation of distributed modes interaction among wireless computers; aggregation and clustering techniques for scaling large-scale Mobile Ad Hoc Networks (MANETs) and Sensor Networks; communication systems for continuous media; and conceptual and physical database organizations. The laboratory is equipped a high-performance simulation environment and a wireless testbed for proof-of-concept prototype development. *Little*

### Near-Field Spectroscopy Laboratory

Near-Field Microscopy/Spectroscopy is being developed as a new technique to extend the resolution of optical imaging beyond the diffraction limit, bringing a new level of optical characterization. Near-field optical microscopy has application to many areas of materials and device development, and this laboratory will serve as a resource for researchers throughout Boston University as well as industry partners. Emphasis is currently placed on the optical characterization of semiconductor devices and biological materials. In particular, this includes imaging laser diode emission and material-defect and compositional analysis for semiconductor applications. *Goldberg, Ünli*



### Laboratory of Networking and Information Systems

This lab is involved in providing novel perspectives on modern networking issues, including scalability, heterogeneity, and performance. The lab is equipped with sophisticated hardware and software and promotes research into the fields of network synchronization, mobile computing, Internet traffic engineering, distributed Web caching, and coding theoretic approaches to real-time information reconciliation. *Starobinski, Trachtenberg*

### Picosecond Spectroscopy Laboratory (PSL)

This state-of-the-art optical characterization facility was recently established. The Picosecond Spectroscopy Laboratory provides excitation sources, spectrometers, and microwave electronic test equipment for the investigation of the linear and non-linear optical properties of materials and devices. The research emphasis in this laboratory is on high-speed photodetectors, particularly time-resolved characterization of photodiodes. *Ünlü*

### Quantum Imaging Laboratory

Research in the Quantum Imaging Laboratory focuses on photonic imaging systems that make use of the special properties of nonclassical light. Experiments are conducted on nonlinear optical parametric down-conversion; quantum coherence; quantum imaging; quantum interferometry and microscopy; and quantum communications and cryptography. *Saleh, Sergienko, Teich*

### Radio Communications and Plasma Research Laboratories

Field experiments are conducted in this lab using ground-based facilities and spacecraft-borne instruments to investigate radio-wave propagation and interactions with ionospheric plasmas, with applications to establishing artificial radio communication paths. Laboratory experiments with a large, toroidal plasma device are also conducted to study the microwave interactions with magnetoplasmas, simulating and cross-checking the results obtained in the field experiments. *Lee*

### Reliable Computing Laboratory

Members of the Reliable Computing Laboratory conduct research on a broad variety of topics, including the design of computer chips; efficient hardware testing at the chip, board, and system levels; functional software testing; efficient signal processing algorithms; coding and

decoding; fault-tolerant message routing for multiprocessor systems; and the design of reliable computer networks. *Karpovsky, Levitin, Rožiner*

### Software Engineering Laboratory (SEL)

An instructional and research lab, the Software Engineering Laboratory (SEL) supports courses and research on the economical design of reliable software for large-scale and embedded computer-based systems. The lab is comprised of more than twenty-five Silicon Graphics and Gateway 2000 networked workstations, plus four Motorola embedded computer development systems. The laboratory provides a network of workstations running Windows XP and provides students with state-of-the-art development and modeling tools for the design, implementation and testing of distributed software systems. *Brackett*



### Visual Information Processing (VIP) Laboratory

The VIP Laboratory provides computational and visualization infrastructure for research in the area of visual information processing. The particular topics of interest are: manipulation, compression, transmission and retrieval of visual information, whether in the form of still images, video sequences, or multimedia data. In addition to standard monoscopic (2-D) images, also stereoscopic and multiscopic (3-D) images are studied. The primary application of this research is in the next-generation multimedia communications: life-like (3-D), efficient (low bit rate),

reliable (error-resilient), and flexible (object-based). The VIP Laboratory is equipped with a network of state-of-the-art workstations to serve computational needs, while its visualization infrastructure includes 2-D and 3-D digital cameras and capture systems, as well as 3-D displays (shuttered and 9-view automultiscopic “Synthagram”). *Konrad*

### VLSI and Neural Networks Systems (VNNS) Laboratory

The VNNS group designs, builds, and tests innovative architectures that span a wide variety of VLSI applications in electrical and biological fields. Chips designed using digital, analog, and subthreshold methodologies are realized using CMOS BiCMOS and Bipolar technologies. Applications include neural-net image processing, integrated photonic devices and parallel photonic testing, automatic partial-valued dynamic logic synthesis, single-chip large-molecule and DNA analyzers, and neural tissue interface chips. The group is equipped with a full suite of design tools and testing instrumentation for analog and digital systems. *Hubbard*

### Wide Band Gap Semiconductors Laboratory

In this laboratory, we investigate the growth, fabrication and characterization of devices based on the family of III-Nitride semiconductors. The materials are grown by MBE, MOCVD, HVPE and Gas cluster Ion-beam deposition (GCIB). The current focus is in the development of Optical Devices (UV-LEDs, UV-LDs, Optical Modulators, Detectors), Electronic Devices (High Power Diodes, Transistors and Thyristors) and Electromechanical Devices (SiC/III-Nitride MEMS sensors). Materials physics issues are also addressed and the group collaborates closely with Professor Enrico Bellotti in the area of theoretical modeling, Professor Karl Ludwig (Physics) in the area of materials structure and Professor Kevin Smith (Physics) in the area of electronic structure. *Moustakas*

## 5.3 Centers and Interdisciplinary Activities

### Center for Computational Science

<http://satchmo.bu.edu>

The Boston University Center for Computational Science (CCS) was founded in 1990 to coordinate and promote computationally based research, to foster computational science education and to provide for the expansion of computational resources and support.

CCS provides a forum for the multidisciplinary exchange of ideas among researchers, educators and students. Regularly scheduled seminars as well as workshops and symposia are offered to highlight advances in computational science. CCS has acted to develop and facilitate the formulation of projects in computationally based research and education, working with scientists from 20 different departments and centers.

CCS works in close collaboration with the Office of Information Technology, in particular with its Scientific Computing and Visualization Group (SCV) group, in the development of resources to support computational science. The high performance computing and visualization systems at Boston University currently include IBM p690 servers with 112 processors and peak capacity approximately 600 Gflops, 64 processor IBM RS/6000 SP, The Deep Vision Display Wall, and Live: Laboratory for Immersive Virtual Environments.

The University's support of computational research has been extended to institutions throughout New England by means of the NSF funded MARINER (<http://mariner.bu.edu/>) project, a collaboration between CCS and SCV. MARINER offers education and training programs, access to state-of-the-art computing facilities and opportunities for pilot projects, Internet connectivity and industrial partnerships. Under the auspices of MARINER, CCS takes its place as a leader in developing computational applications in collaboration with regional schools and companies.

Building on MARINER, the University is extending its programs on a national scale as a partner in the National Computational Science Alliance, one of two national Partnerships for Advanced Computational Infrastructure supported by the NSF.

### Center for Space Physics

<http://www.bu.edu/csp/>

The Center for Space Physics provides a focus for research and graduate training in space physics. It is a multidisciplinary center within the Graduate School of Arts and Sciences that includes faculty from the College of Engineering and the College of Arts and Sciences.

The mission of the Center is to promote and foster space physics research and to provide a central base for that research and for the teaching of space physics, especially at the graduate level.

The Center seeks to fulfill this mission by creating an intellectual atmosphere conducive to research and to the exchange and exploration of new ideas. The Center organizes a seminar series in space physics as well as internal research discussion groups, and often hosts visits of scholars from the



United States and abroad. Although the Center itself offers no degree program, graduate education is a major component of Center activities. Graduate students from programs in Astronomy, Applied Physics, and Engineering conduct their thesis research at the Center. The Center provides a formal link between research groups in the Colleges of Engineering and Arts and Sciences, allowing them to co-locate research students and post-doctoral associates to allow greater interaction to everyone's benefit. The Center also provides administrative support for research projects, particularly in the areas of grant management and proposal development.

### Photonics Center

<http://www.bu.edu/photonics>

To help industry bridge the gap between basic research and practical application, Boston University launched the Photonics Center in 1994 with \$29 million in seed funding from the federal government. The Center is now forging true business partnerships in which companies draw on the University's exceptional expertise and resources in engineering, science, medicine, and management to build actual product prototypes and spawn a growing stream of new companies.

The Photonics Center at Boston University is a bold new model for university-industry collaboration. It has been established to work directly with investors and industrial partners to turn emerging concepts in photonics technology into commercial products. The Center is staffed and equipped to help industry partners reduce the technical and financial risk involved in developing new ideas, refining them in the laboratory, building working prototypes, and starting up companies. To date the Center has forged joint ventures with nearly a dozen companies to develop new products in data storage, environmental monitoring, opto-electronics, and biotechnology.

In 1997, the University completed the nine-story, 235,000 square-foot Photonics Building to house this ambitious initiative. The \$80 million facility includes a full complement of state-of-the-art laboratories as well as meeting rooms, lecture halls, and an entire floor devoted to incubator space for start-up companies that complements its existing incubator

at 1106 Commonwealth Avenue. Faculty affiliated with the Center have in-depth expertise in all aspects of photonics technology, including the core areas of opto-electronics, photonic materials, data storage, imaging systems, medical applications, and sensors.

Resources available to industry partners, government, faculty, and students through the Photonics Center support development and testing of ideas and products. These resources include several research and development laboratories: Scanning Infrared Near-Field Microscopy Laboratory, Optoelectronic Device Characterization Laboratory, Femtosecond Laser Facility, Photochemical Processes Laboratory, Photonic Systems Engineering Laboratory, Liquid Crystal Display Laboratory, Quantum Imaging Laboratory, Precision Optics Laboratory, Optoelectronic Materials Laboratory, Precision Measurement Laboratory, Optoelectronic Processing Facility, Laser Measurement and Fiber Optic Sensors Laboratory, Magnetic and Optical Devices Laboratory, Near-Field Scanning Optical Microscopy Laboratory, Picosecond Spectroscopy Laboratory, and the Advanced Electronic Materials and Devices Processing Research Laboratory.

### Center for Subsurface Sensing and Imaging Systems (CenSSIS)

<http://www.censsis.neu.edu/>

The Center for Subsurface Sensing and Imaging Systems (CenSSIS) is a National Science Foundation Engineering Research Center (ERC) established in 2000. It seeks to revolutionize the ability to detect and image objects that lie underground or underwater, or are

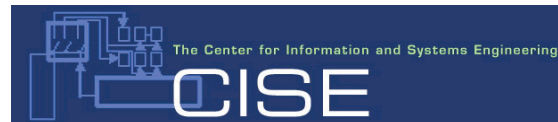


embedded within cells, inside the human body, or within manmade structures. CenSSIS is a collaborative effort of 4 academic institutions: Northeastern University, Boston University, Rensselaer Polytechnic Institute, and the University of Puerto Rico at Mayagüez; and 4 strategic affiliates: Massachusetts General Hospital, Brigham and Women's Hospital, Lawrence Livermore National Laboratory, and the Woods Hole Oceanographic Institution. Together, the CenSSIS partnership works with industrial partners who provide their insight into research challenges.

The Center's primary focus is on detecting, locating, and identifying objects obscured beneath the covering media, such as underground plumes, tumors under the skin or developmental defects in an embryo. Utilizing electromagnetic, photonic, or acoustic probes, CenSSIS will engage biomedical

and environmental problems, developing techniques for sensing subsurface conditions. Projects integrate new methods of subsurface sensing and modeling, physics-based signal processing and image-understanding algorithms, and image and data information management methods. Research topics being addressed include: humanitarian de-mining, multilayer hyperspectral oceanography, 3-D subretinal visualization, nonlinear ultrasound medical imaging, subcellular biological imaging, electrical impedance tomography, acoustic diffraction tomography, and multi-sensor civil infrastructure assessment.

Overall, the CenSSIS program is a vehicle enabling substantial leverage of industrial investments because of the substantial level of funding available for basic research. In addition to research, the Center has established programs for education, industry collaboration, and technology transfer.



### Center for Information Systems Engineering (CISE)

<http://www.bu.edu/systems>

The Center for Information and Systems Engineering (CISE) provides an interdepartmental home for faculty and students interested in research in information and control systems theory and its relevance to various application domains encompassing the analysis, design, and management of complex systems that have come to prominence as a result of the information, communication, and computation revolution.

Information and systems engineering research at Boston University is strong and accomplished, but it is spread across departments, colleges and schools within the University. Approved by the Trustees in 2002, with administrative support added in Fall 2002, CISE has been raising the visibility of that strength and is beginning to foster greater interactions among researchers. As of June 2003, CISE has grown from 13 to 19 affiliated faculty from the Departments of Manufacturing Engineering, Aerospace & Mechanical Engineering, and Electrical & Computer Engineering in the College of Engineering; the Department of Mathematics & Statistics in the College of Arts and Sciences; and the Department of Operations Management in the School of Management.

Electrical and Computer Engineering Department faculty affiliated with CISE are Professors Alanyali, Baillieul, Carruthers, Cassandras, Castañón, Karl, Saligrama, Starobinski and Trachtenberg. The application interests of their CISE related research include Automation, Robotics and Control; Communications, Networking and Information Systems; Production and Service Systems and Supply Chain Management; and Signal Processing and Pattern Recognition.



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- Sergienko, AV**. "Engineering Entanglement for Quantum Information Processing and Quantum Measurement." *International Meeting "Foundations of Quantum Information"*. University of Camerino, Camerino, Italy. April 16-19, 2004.
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- Venkatesh, S, M. Alanyali**, O. Savas and S. Aeron. "Classification in Sensor Networks." *2004 IEEE International Symposium on Information Theory*. ISIT2004. Chicago, Illinois. June 2004.
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## Patents & Patent Disclosures

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## Invited Lectures

**Alanyali, M.** "Distributed In-network Decision Making in Sensor Networks," *RPI-NSF Workshop on Pervasive Computing and Networking*. Troy, New York. April 29-30, 2004.

**Alanyali, M.** "On Non-Cooperative Interaction via Reinforcement Learning and Its Control," *41st Allerton Conference on Communications, Control and Computing*. Champaign, Illinois. October 2003.

**Bigio, IJ.** "Advances in optical technologies for medical diagnostics." *Symposium talk, School of Medicine Annual Retreat*. Boston University. Sept. 2003.

**Bigio, IJ.** "Optical Biopsy: noninvasive detection of cancer with optical spectroscopy," *School of Engineering Colloquium*. Tufts University. October 2003.

**Bigio, IJ.** "Optical spectroscopy for sensing subsurface tissue pathology." *CenSSIS Lecture*. Northeastern University. October 2003.

**Bigio, IJ.** "The BU multi-institutional translational research program in Optical Pharmacokinetics." *Lecture at "Hot Topics" plenary session of SPIE Biomedical Optics 2004*. San Jose, California. January 2004.

**Bigio, IJ.** "Opportunities for Optical Diagnostics and Treatment in Prostate Cancer." *Think-Tank on Novel Technologies for Prostate Cancer and Treatment*. Washington, DC. February 2004.

**Bigio, IJ.** "Optical Biopsy: noninvasive detection of cancer with elastic-scattering spectroscopy." *Biophysics Colloquium*. Tel Aviv University. March 2004.

**Brower, RC.** "Domain Wall Implementation for Chiral Fermions" *XXII International Symposium on Lattice Field Theory*. Fermi National Accelerator Laboratory. June 2004.

**Brower, RC.** "QCD Strings." *Eighth Workshop of Non-Perturbative Quantum Chromodynamics*. Paris, France. June 7-11, 2004.

**Brower, RC.** "Status of SciDAC Software Infrastructure." *4th International Lattice Data Grid Workshop*. May 21, 2004.

**Brower, RC.** "Report on Software" *All Hands Meeting for SciDAC*. Brookhaven National Laboratory. Long Island, New York. March 2004.

**Bystrom, M.** "Image Restoration." Robert Gordon University. Aberdeen, UK. June 2003

**Castañón, DA.** Dynamic Algorithms for Sensor Management, invited seminar at Chalmers University of Technology, Gotteborg, Sweden, Nov. 20, 2003

**Castañón, DA.** "Approaches for Multimode Active Radar Control", Opponent lecture, Ph. D. defense, Chalmers University of Technology, Gotteborg, Sweden, Nov. 21, 2003

**Castañón, DA.** "Multimodality Sensor Fusion for Atherosclerotic Plaque Characterization." *Institute for Mathematical Analysis Workshop on Adaptive Sensing and Multimodal Data Inversion*. Minneapolis, Minnesota. June 2004.

**Herbordt, MC.** "Environment for Creating and Running BCB Applications of FPGA-based PC Accelerator Cards." *Xilinx*. San Jose, California. August 25, 2003.

**Herbordt, MC.** "Accelerating Bioinformatics and Computational Biology Applications with FPGAs." *Mayo Clinic*. Rochester, Minnesota. January 22, 2004.

**Humphrey, FB.** "Domain Walls in Nano-Thin Permalloy Films" (*Distinguished Speaker*) *International Symposium on Magnetic Materials and Applications*. Deajeon, Korea. December 3-6, 2003.

**Karl, WC.** "Level-set Methods for Dynamic Tomography." *Invited lecture at the Symposium on Biomedical Imaging*. Washington, DC. April 2004.

**Karl, WC.** "High-Resolution Biosensor Spectral Peak Shift Estimation." *Invited lecture at the Asilomar Conference on Signals, Systems, and Computers*. November 2003.

**Karpovsky, M.** "Design of Smart Cards with Self-protection Against Side-Channel Attacks." *Tampere International Center for Signal Processing*. Tampere, Finland.

- Karpovsky, M.** "Robust Identifying Codes." *Ecole Nationale Supérieure des Telecommunications*. Paris, France
- Karpovsky, M.** "New Class of Robust Error Detecting Codes." *Tel-Aviv University*. Tel-Aviv, Israel.
- Kotiuga, PR.** "The Hurewicz Map Distinguishes Intuitive vs. Computable Topological Aspects of Computational Electromagnetics." *Mathematischen Forschungsinstitutes Oberwolfach; Computational Electromagnetics Meeting*. Oberwolfach, Germany. February 22 - 28, 2004.
- Kotiuga, PR.** "Whitney Forms: The Enduring Legacy and New Applications." *Tuesday Einstein Chair Seminar*. Graduate Center, City University of New York. February 10, 2004.
- Kotiuga, PR.** "Intuitive vs. Computable Topological Aspects of Computational Electromagnetics." *IMA "Hot Topics" Workshop: Compatible Spatial Discretizations for Partial Differential Equations*. University of Minnesota, Minnesota. May 11 - 15, 2004.
- Moustakas, TD.** "Basic and Applied Research and their Benefits to Society." Presentation upon receiving an Honorary Doctoral Degree from the Aristotle University of Thessaloniki. June 26, 2003.
- Moustakas, TD.** "Physics and Technology of Optoelectronic Materials and Devices." *Graduate Program "Physics of Materials" Lecture Series*. Aristotle University of Thessaloniki, Greece. June 23-27, 2003.
- Moustakas, TD.** "Optoelectronic Devices based on Nitride Quantum Well Structures." Aristotle University of Thessaloniki, Greece. June 27, 2003.
- Moustakas, TD.** "Wide Band Gap Semiconductors: Photonic and Electronic Applications." *International Conference on Electroceramics*. Massachusetts Institute of Technology. August 3-7, 2003.
- Moustakas, TD.** "GaN LEDs for Solid State Lighting." *The Electrochemical Society-New England Section*. Northeastern University. March 9, 2004.
- Ruane, M.** "The High Tech Tools & Toys Lab." *National Instruments Scientific Imaging Symposium*. Chelmsford, Massachusetts. November 13, 2003.
- Teich, MC.** "Neural Coding in Vision: How Images Arrive at the Brain." *IEEE Providence Section*. Providence, Rhode Island. October 2003.
- Teich, MC.** "Neuronal Variability and Information Transmission in Vision." *Vision Journal Club, Department of Neuroscience*. University of Pennsylvania, Philadelphia, Pennsylvania. October 2003.
- Teich, MC.** "Entangled-Photon Optical Coherence Tomography." *Herman P. Schwan 2003 Lectureship*. Department of Bioengineering, University of Pennsylvania, Philadelphia, Pennsylvania. October 2003.
- Teich, MC.** "Entangled-Photon Optical Coherence Tomography." *Colloquium Series*. University of Nottingham, England. January 2004.
- Teich, MC.** "Quantum Optical Coherence Tomography." *Physics Colloquium*. University of Bristol, England. January 2004.
- Teich, MC.** "Heart Rate Variability." *Invited Joint Colloquium*. Oregon Health & Science University and University of Portland, Portland, Oregon; and Oregon Graduate Institute. Beaverton, Oregon. April 2004.
- Teich, MC.** "Heart Rate Variability: A Window on the Health of the Cardiovascular System." *Oregon Chapter of the IEEE Engineering in Medicine & Biology Society*. Portland, Oregon. April 2004.
- Trachtenberg, A.** "Robust Identifying Codes: Finding Yourself in a Chaotic World." *Boston University Complexity Theory Seminar*. February 27, 2004.
- Trachtenberg, A.** "Research in the Laboratory for Networking and Information Systems." Weston High School. (part of NSF grant ANI-0240333). February 11, 2004.
- Venkatesh, S.** "Network Signal Processing." *Distinguished Electrical Engineering Seminar Series*. Harvard University. April 30, 2004.
- Venkatesh, S.** "Distributed Signal Processing." *Statistical Signal Processing Group*. Department of EECS, Massachusetts Institute of Technology. May 5, 2004
- Venkatesh, S.** "Statistical Signal Processing over Networks." Center for Systems, Dynamics and Control, University of California. Los Angeles, California. April 23, 2004.
- Venkatesh, S.** "Distributed Hypothesis Testing in Sensor Networks." *Communications and Networks Seminar Series*. Yale University. November 19, 2003.
- Ünlü, MS.** "The Intriguing World of Resonance: From Photodetectors to High resolution Biological Imaging." *Bioengineering Department Colloquium*. University of Illinois, Chicago. October 2003.
- Ünlü, MS.** "Nanotechnology Research at Boston University Subsurface Imaging and Nanobiotechnology." *Nanotechnology Colloquium*. Nanoparticles Application Center. October 2003.
- BB Goldberg and MS Ünlü.** "Nanoscale Measurements: Seeing Inside Chips and Cells." *NIST-NNI, Grand Challenges*. Washington DC. January 2004.
- Ünlü, MS.** "Solid Immersion Lens Techniques for High-Resolution Subsurface Microscopy." *Electromagnetics Seminar*. University of Illinois, Urbana-Champaign. February 2004.
- Ünlü, MS.** "Microscopy Beyond the Diffraction Limit: Guided and Propagating Waves." *Institute of Optics Colloquium*. University of Rochester, New York. April 2004.
- Ünlü, MS.** "Microscopy Beyond the Diffraction Limit: Guided and Propagating Waves." *CENS Seminar, Department of Applied Physics*. Ludwig Maximilian University, München, Germany. June 2004.
- Ünlü, MS.** "Microscopy Beyond the Diffraction Limit: Guided and Propagating Waves." *Laser Seminar, Institute of Quantum Electronics*. Swiss Federal Institute, ETH, Zurich, Switzerland, June 2004.

## Technical Reports & Other Publications

Oddson, L, Wall III, C, P. Meyer, and **J. Konrad**. "A virtual environment with simulated gravity for balance rehabilitation of bedridden patients and frail individuals." *XV-th Congress of the International Society of Electrophysiology and Kinesiology*. June 2004.

## 5.5 Grants, Contracts, and Gifts

The table on the next six pages delineates the new grants awarded over the 2004 fiscal year. The funding level for new grants, where an ECE faculty member is the Principal Investigator (PI) is approximately \$4.5k. ECE faculty members were also Co-PIs on grants with PIs from other departments, as noted in the table. Their share of the funding for new grants awarded is approximately \$1.7k. The total of new grants is therefore approximately \$6.2k.

### New Grants with ECE Principal Investigators

Recipient	Title of Award	Source	Begin Date	End Date	Amount
Alanyali, Murat	CAREER: Scalable Architectures for Self-Managed Networks (in conjunction with CISE)	NSF	07/01/03	07/31/08	\$400,000.00
Bellotti, Enrico	STTR-Development of HgCdTe Material Models for Next Generation Infrared Focal Plane Architectures (subcontract via Magnolia Optical Technologies, Inc.)	DOD/Army	08/01/03	01/15/04	\$18,024.00
Bellotti, Enrico	Young Investor Program: Single-Photon 3D Image Sensors	DOD/Navy	03/15/03	04/30/06	\$70,000.00
Bellotti, Enrico	Young Investor Program: Single-Photon 3D Image Sensors	DOD/Navy	03/15/03	04/30/06	\$22,921.00
Bigio, Irving	Graduate Student Support (N. Kunapareddy) (subcontract via Los Alamos National Laboratory)	Department of Energy	06/01/03	05/31/04	\$32,067.00
Bigio, Irving	Graduate Student Support (N. Kunapareddy) (subcontract via Los Alamos National Laboratory)	Department of Energy	6/01/03	05/31/05	\$33,580.00
Castañon, David	Center for Subsurface Sensing and Imaging Systems (CenSSIS) - Research Thrust 2 (subcontract via Northeastern University)	NSF	09/01/03	08/31/04	\$306,085.00
Castanon, David Saligrama, Venkatesh	Dynamic Replanning and Multi-Vehicle Control for Intelligent Unmanned Vehicles (in conjunction with Center for Information and Systems Engineering)(subcontract via ALPHATECH, Inc.)	DOD/Navy	08/01/03	01/31/06	\$29,000.00
Castanon, David Saligrama, Venkatesh	Dynamic Replanning and Multi-Vehicle Control for Intelligent Unmanned Vehicles (in conjunction with Center for Information and Systems Engineering)(subcontract via ALPHATECH, Inc.)	DOD/Navy	08/01/03	01/31/06	\$56,000.00
Castanon, David Cassandras, Christos	Cooperative Mission Control for Unmanned Air Vehicles in Complex Stochastic Environments (in conjunction with Center for Information and Systems Engineering)	DOD/Air Force	03/01/04	02/28/05	\$150,710.00
Herbordt, Martin	Exploratory/Development Grant: FPGA-Based Computational Accelerators	PHS/NIH/NCRR	07/01/04	06/30/05	\$157,191.00
Hubbard, Allyn	Photonics Technology Development and Insertion-Task 25: Acoustics Sniper Detection	DOD/Army	06/01/04	05/31/05	\$145,000.00
Karl, W. Clement	Anatomic Morphologic Analysis of MR Brain Images (in conjunction with Center for Computational Science (subcontract via MGH)	HHS/NIH/NINDS	9/01/03	08/31/04	\$81,994.00
Karl, W. Clement	Foundations of Automatic Target Recognition (in conjunction with Center for Computational Science)	DOD/Air Force	09/01/03	08/31/05	\$77,250.00
Konrad, Janusz	Joint Space-Time Analysis and Characterization of Image Sequences	NSF	07/01/04	06/30/05	\$94,208.00



Recipient	Title of Award	Source	Begin Date	End Date	Amount
Morse, Theodore	ONR HBCU Future Engineering Faculty Fellowship (R. Wynne) (subcontract via North Carolina Agricultural and Technical State University)	DOD/Navy	09/01/03	12/31/03	\$23,801.00
Morse, Theodore	ONR HBCU Future Engineering Faculty Fellowship (R. Wynne) (subcontract via North Carolina Agricultural and Technical State University)	DOD/Navy	01/01/04	04/30/04	\$22,927.00
Morse, Theodore	Research in Fiber Lasers	DOD/Air Force	11/01/03	10/31/04	\$150,000.00
Morse, Theodore	US-Mexico Planning Visit: Ultra-Sensitive Polarization Mode Beating Techniques in the Detection of Bio Materials	NSF	01/01/04	06/30/04	\$2,709.00
Morse, Theodore	Photonics Technology Development and Insertion/Taks 1: Fiber Laser Technology (Photonics Center Award)	DOD/Army	05/01/04	04/30/05	\$125,288.00
Morse, Theodore	ONR HBCU Future Engineering Faculty Fellowship (R. Wynne) (subcontract via North Carolina Agricultural and Technical State University)	DOD/Navy	05/01/04	12/31/04	\$4,839.00
Moustakas, Theodore	MURI: Gas Cluster Ion Beam (GCIB) Epitaxy (subcontract via Georgia Institute of Technology)	DOD/Navy	05/15/03	05/14/06	\$88,500.00
Moustakas, Theodore	Large-Area GaN Substrates for Illumination Applications (subcontract via Boston Microsystems, Inc.)	NSF	7/01/03	12/31/03	\$33,300.00
Moustakas, Theodore	Cluster Ion Beam Epitaxy of III-Intrades	DOD/Navy	10/01/02	09/30/05	\$126,747.00
Moustakas, Theodore	Novel GaN HBT for Advanced T/R Modules for X-band Radar Performance Enhancement (subcontract via Viatronix, Inc.)	DOD/Air Force	08/01/03	01/31/04	\$23,000.00
Moustakas, Theodore	Ultraviolet Emitters and Detectors (subcontract via Research Foundation of CUNY)	NASA	09/01/03	09/30/04	\$150,000.00
Moustakas, Theodore	MURI: Gas Cluster Ion Beam (GCIB) Epitaxy (subcontract via Georgia Institute of Technology)	DOD/Air Force	5/01/03	05/14/06	\$128,957.00
Moustakas, Theodore	Comparative Studies of UV LEDs Emitting at 280 nm Grown Along Polar and Non-Polar Direction of AlN Substrates and Templates	DOD/Air Force	03/18/04	06/15/05	\$124,885.00
Moustakas, Theodore	Electric Cooler (subcontract via Astralux, Inc.)	DOD/Army	12/01/03	10/31/04	\$70,000.00
Moustakas, Theodore	Deep Ultraviolet Laser Diode for UV-Resonance Enhanced Raman Identification of Biological Agents (subcontract via Photon Systems)	DOD/DARPA	02/15/04	02/15/06	\$155,000.00
Moustakas, Theodore	Photonics Technology Development and Insertion/Task 6: Gallium Nitride Vertical Cavity Surface-Emitting Lasers (GaN VCSEL) Technology (Photonics Center Award)	DOD/Army	05/01/04	04/30/05	\$125,878.00
Oliver, William	Incoherent Scatter Radar Studies of Hot Oxygen (in conjunction with Center for Space Physics)	NSF	11/15/03	10/31/04	\$141,795.00
Oliver, William	REU: Incoherent Scatter Radar Studies of Hot Oxygen (in conjunction with Center for Space Physics)	NSF	11/15/03	10/31/04	\$52,650.00
Ruane, Michael	Center for Subsurface Sensing and Imaging Systems (CenSSIS) - Education Program (subcontract via Northeastern University)	NSF	09/01/03	08/31/04	\$59,537.00
Saleh, Bahaa	CenSISS - Quantum Optical Coherence Tomography (subcontract via Northeastern University)	NSF	02/01/03	08/31/03	\$35,000.00

## Research

Recipient	Title of Award	Source	Begin Date	End Date	Amount
Saleh, Bahaa	Center for Subsurface Sensing and Imaging Systems (GenSSIS) -- Research Thrust 1 Photonics(subcontract via Northeastern University)	NSF	09/01/03	08/31/04	\$130,993.00
Saligrama, Venkatesh	Intelligent Sensor and Relay Platforms (InSAR) (Young Investigator Program)	DOD/Navy	05/01/02	04/30/05	\$40,400.00
Saligrama, Venkatesh	Intelligent Sensor and Relay Platforms (InSAR) (Young Investigator Program)	DOD/Navy	05/01/02	04/30/05	\$70,000.00
Sergienko, Alexander	Automatic Control for Secure Optical Communication Link (C. Willimas) (subcontract via MIT/Lincoln Laboratory)	DOD/Air Force	09/01/03	12/31/03	\$12,413.00
Sergienko, Alexander Saleh, Bahaa Teich, Malvin	I TR: Integrated Source of High-Fidelity Entangled States for Quantum Information Processing	NSF	09/01/03	08/31/04	\$159,997.00
Sergienko, Alexander Saleh, Bahaa Teich, Malvin	Ultrafast Quantum Optics (Amendments 5 & 6) (subcontract vea BBNT Solutions LLC)	DOD/DARPA	08/01/01	03/30/05	\$365,983.00
Swan, Anna	4 Schools for WIE (subcontract via Northeastern University)	NSF	12/15/02	11/30/04	\$59,968.00
Swan, Anna Goldberg, Bennett	RET Supplement - Nanometer Resolution Spectral Self-Interference Fluorescence Microscopy	NSF	06/01/04	04/30/05	\$20,000.00
Unlu, M. Selim Goldberg, Bennett Ekinci, Kamil Mohanty, Pritiraj Novotny, L.	NIRT: Advanced Characterization Techniques in Optics for Nanostructures (ACTION)	NSF	10/01/03	09/30/04	\$37,500.00
Unlu, M. Selim Goldberg, Bennett	MURI: New Instrumentation for Nanoscale Subsurface Spectroscopy and Tomography subcontract via University of Rochester)	DOD/Navy	06/15/03	01/14/04	\$56,963.00
Unlu, M. Selim	MURI: New Instrumentation for Nanoscale Subsurface Spectroscopy and Tomography (subcontract via University of Rochester)	DOD/Air Force	06/15/03	01/04/05	\$96,269.00
Unlu, M. Selim	Photonics Technology Development and Insertion/Task 2: Optical Communication and Polarization Sensing (Photonics Center Award)	DOD/Army	05/01/04	04/30/05	\$125,342.00
Unlu, M. Selim Goldberg, Bennett Ekinci, Kamil Mohanty, Pritiraj Novotny, L.	NIRT: Advanced Characterization Techniques in Optics for Nanostructures (ACTION)	NSF	10/01/04	09/30/05	\$37,500.00
<b>Subtotal</b>	<b>Grants with ECE PIs</b>				<b>\$4,532,171.00</b>

## New Grants with ECE co-PIs

Recipient	Title of Award	Source	Begin Date	End Date	Amount
Goldberg, Bennett Swan, Anna Unlu, M. Selim Karl, W. Clement	Nanoscale Imaging Subcellar Processes (\$78,900.00)	HHS/NIH/NIBIB	07/01/03	06/30/04	\$59,175.00
Goldberg, Bennett Unlu, M. Selim	MURI: New Instrumentation for Nanoscale Subsurface Spectroscopy and Tomography (subcontract via University of Rochester) (\$39,036.00)	DOD/Air Force	06/15/03	01/14/04	\$19,518.00
Cassandras, Christos Castanon, David Paschalidis, Ioannis Baillieul, John	Sensors and Sensor Networks: A Control and Optimization Science Base for Sensor Networks in Adverse and Stochastic Environments (in conjunction with the Center for Information and Systems Engineering)(\$2,487,460.00)	NSF	09/01/03	08/31/08	\$621,865.00
DeLuca, Carlo Nawab, S. Hamid	Harnessing Motoneuron Activity: From Lab to Clinic (\$576,376.00)	HHS/NIH/NICHHD	06/01/04	05/31/05	\$288,188.00
Giles, Roscoe	ITR/EWF: New Approaches to Human Capital Development Through Information Technology Research (subcontract via Portland State University) (\$101,826.00)	NSF	09/01/03	08/31/04	\$101,826.00
Mountain, David Hubbard, Allyn	EarLab: A Virtual Hearing Laboratory (in conjunction with Hearing Research Center) (\$462020.00)	HHS/NIH/NIDCD	09/01/03	08/31/04	\$231,010.00
Mountain, David Hubbard, Allyn	Models of Whale Auditory Function (in conjunction with Hearing Research Center) (\$120,636)	DOD/Navy	09/01/03	09/30/04	\$60,318.00
Rebbi, Claudio Coker, David Caramanis, Michael Giles, Roscoe	IGERT: Multidisciplinary Approach to the Integration of High-Performance Computing in Science Education (\$433092.00)	NSF	12/15/02	11/30/04	\$108,273.00
Goldberg, Bennett Ruane, Michael Garik, Peter Phillips, Constance	GK-12: Project STAMP - Science Technolgy and Mathematics Partnerships (in conjunction with Science and Math Education Center)(\$538,228.00)	NSF	06/01/04	05/31/05	\$137,057.00
Giles, Roscoe Holmes, Raquell	PACI: Education, Outreach, and Training (subcontract via University of Illinois/National Center for Supercomputing Applications)	NSF	10/01/03	09/30/04	\$110,000.00
Rebbi, Claudio Bresnahan, Glenn Giles, Roscoe Porter, John	PACI: MARINER, A Mid-Level Alliance Resource in the North East Region (subcontract via University of Illinios/National Center of Supercomputing Applications)	NSF	10/01/03	09/30/04	\$60,000.00
<b>Subtotal</b>	<b>Grants with ECE co-PIs</b>				<b>\$1,797,230.00</b>
<b>Grand Total</b>					<b>\$6,184,401.00</b>

## Continuing Grants and Contracts

Recipient	Title of Award	Source	Begin Date	End Date
Bellotti, Enrico	Photonics Technology Development and Insertion/ Task 18: Computational Support for ARL Program (Photonics Center Award)	DOD/Navy	03/01/03	02/29/04
Bystrom Maja	CAREER: Research and Education in Video Coding and Wireless Communications	NSF	09/01/02	07/31/04
Bystrom Maja	CAREER: Research and Education in Video Coding and Wireless Communications (REU Supplement)	NSF	09/01/03	07/31/04
Castanon, David	Cooperative Control in Adversarial Environments	DOD/Air Force	12/01/01	05/31/04
Hubbard, Allyn	A Biomimetic Smart Acoustic Sensor (in conjunction with Hearing Research Center)	DOD/Navy	06/08/00	07/31/03
Karl, W. Clement	Anatomic Morphologic Analysis of MR Brain Images (in conjunction with Center for Computational Science) (subcontract via Massachusetts General Hospital)	HHS/NIH/NINDS	09/30/02	08/31/03
Konrad, Janusz	Automultiscopic 3-D Visual Communication System Based on Joint Reconstruction/Multiplexing of Views	NSF	09/01/02	08/31/05
Konrad, Janusz Karl, W. Clement	US-France Cooperative Research: Segmentation and Reconstruction of Scenes with Dynamic Objects	NSF	05/01/03	04/30/06
Little, Thomas	Rapid Task-Based Self-Organization in Distributed Ad-hoc Spaces	NSF	09/01/00	04/30/04
Morse, Theodore	Optical Fiber Fabrication (subcontract via Optoelectronics Industry Development Association)	DOC/NIST	11/26/02	01/31/30
Moustakas, Theodore	UV Resonant Cavity Light-Emitting Diodes Grown by MBE on Non-Polar GaN Substrates (Subcontract via Crystal Photonics, Inc.)	DOD/DARPA/Air Force	06/28/02	08/31/03
Moustakas, Theodore	Photonics Technology Development and Insertion/Task 6: Gallium Nitride Vertical Cavity Surface-Emitting Lasers (GaN VCSEL) Technology (Photonics Center Award)	DOD/Army	03/31/03	02/29/04
Moustakas, Theodore	Cluster Ion Beam Epitaxy of III-Nitrides	DOD/Navy	10/01/02	09/30/05
Moustakas, Theodore	Electronic Cooler (subcontract via Astralux, Inc.)	DOD/Army	12/01/02	11/30/03
Moustakas, Theodore	Harsh Environment Fluid Viscosity-Density Sensor (subcontract via Boston Microsystems, Inc.)	NSF	04/01/03	01/31/05
Saleh, Bahaa Teich, Malvin Sergienko, Alexander	Modeling and Optimization of Ultrafast, Low-Noise Avalanching Photodiodes for Optical Communications (subcontract via University of New Mexico)	NSF	08/15/01	08/31/03
Starobinski, David	CAREER: Quality of Service Engineering with Multiple Time-Scale Traffic	NSF	08/01/02	07/31/07
Starobinski, David	CAREER: Quality of Service Engineering with Multiple Time-Scale Traffic (REU Supplement)	NSF	05/01/03	07/31/07
Swan, Anna Goldberg, Bennett Unlu, M. Selim Karl, W. Clement	Nanometer Resolution with Spectral Self-Interference Microscopy	NSF	04/01/02	04/30/05
Swan, Anna Goldberg, Bennett Unlu, M. Selim Karl, W. Clement	Nanometer Resolution with Spectral Self-Interference Fluorescence Microscopy (additional co-PI.: C. Cantor)	NSF	01/01/03	04/30/05

Recipient	Title of Award	Source	Begin Date	End Date
Teich, Malvin Saleh, Bahaa	Functional Imaging of Synapses by Entangled Photon Microscopy	The David and Lucille Packard Foundation	08/01/99	08/31/04
Teich, Malvin	XYX on a Chip: Development and Fabrication of	NSF	09/01/01	08/31/03
Saleh, Bahaa	Three-Dimensional Microdevices (subcontract via Boston College)	NSF	09/01/01	08/31/03
Trachtenberg, Ari Starobinski, David	A Scalable Middleware for Data Reconciliation in PDAs and Mobile Networks	NSF	06/01/03	05/31/06
Trachtenberg, Ari	CAREER: Practical Data Synchronization - Minimizing Communication	NSF	02/01/02	01/31/05
Unlu, Selim	U.S. Switzerland Cooperative Research	NSF	01/01/02	12/31/04
Unlu, Selim	Photonics Technology Development and Insertion/ Task 2: Optical Communication and Polarization Sensing (in conjunction with Photonics Center)	DOE	08/31/01	08/30/03
Unlu, M. Selim Goldberg, Bennett Ekinci, Kamil Mohanty, Pritiraj	NIRT: Advanced Characterization Techniques in Optics for Nanostructures (ACTION)	NSF	10/01/02	09/30/05
Unlu, Selim Goldberg, Bennett Lutchen, Kenneth	Development and Study of Hyper-Polarized Noble Gas System for Magnetic Resonance Imaging (in conjunction with Photonics Center) (subcontract via Brigham & Women's Hospital)	NSF	09/01/01	08/31/04

# six: *Outlook*

The last decade has witnessed the maturation of the ECE department from a primarily undergraduate program to a more balanced department with high quality instruction, a substantial research program, and an increasingly distinguished faculty. Key statistics of enrollment, degrees awarded, faculty size, and grant funding in the last decade are exhibited in the following tables and charts.

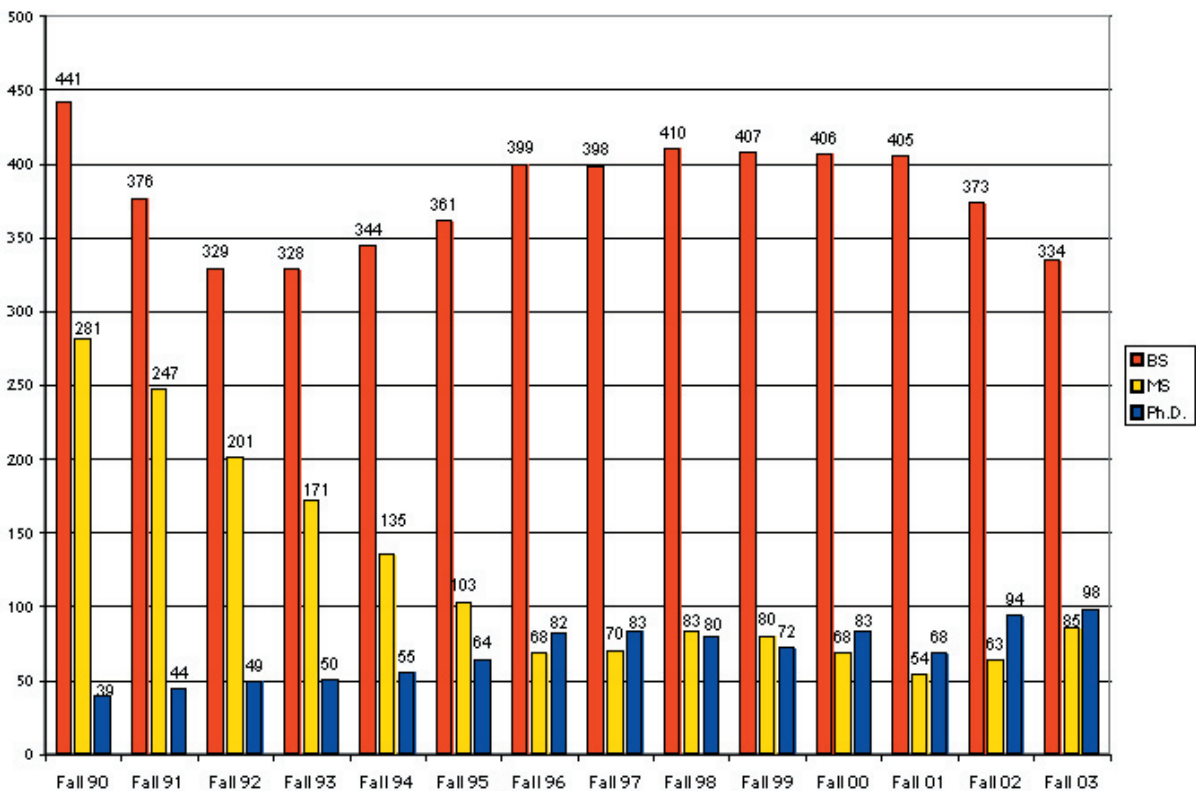
## 6.1 Enrollment

Fall enrollments in the BS, MS, and PhD programs are listed in Table 6-1 and Chart 6-1. Important undergraduate trends in ECE have tended to mirror national patterns. These include the following:

- After a period of stable undergraduate enrollment in 1996-2001, a demographic decline is occurring, as College enrollment restrictions implemented to attain a higher quality student body continue. Last year the BS enrollment dropped by 10%. (See Chart 6-1.)

**Table 6-1: Enrollments Fall 1993-Fall 2003**

	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03
<b>BS</b>	328	344	361	399	398	410	407	406	405	373	334
<b>MS</b>	171	135	103	68	70	83	80	67	54	63	85
<b>Ph.D.</b>	50	55	64	78	83	80	72	83	68	94	98
<b>Total</b>	<b>549</b>	<b>534</b>	<b>528</b>	<b>545</b>	<b>551</b>	<b>573</b>	<b>559</b>	<b>556</b>	<b>527</b>	<b>530</b>	<b>517</b>



**Chart 6-1: Undergraduate and Graduate Student Enrollments**

- While the enrollment in the EE program has remained stable in the last decade, the large increase in CSE enrollment that occurred in the late 1990s has been followed by a decline. CSE enrollment is now 54% of our total undergraduate enroll

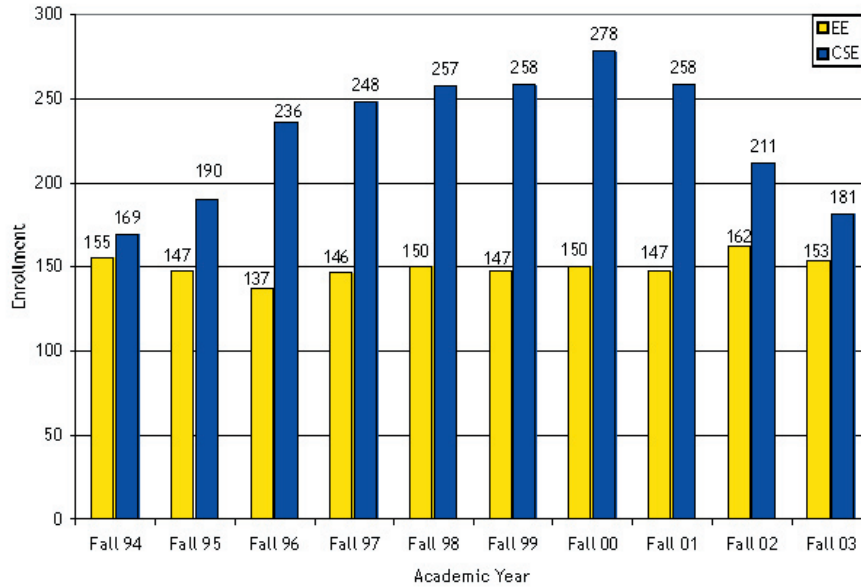


Chart 6-2: Enrollments in the EE and CSE Undergraduate Programs

At the graduate level, the emphasis has shifted from professional MS-oriented students to Ph.D. students:

- MS degree enrollments has increased by 35% in the last year after a period of decline, which started in the early 1990s due to the demise of the Corporate Classroom program, and a stable period in the late 1990s and early 2000.
- PhD enrollment has risen, along with the number of applications. This year, we have reached an all-time high number of 98 PhD students.
- Graduate teaching fellowship resources have remained fixed, while RA support grew with grant funding.

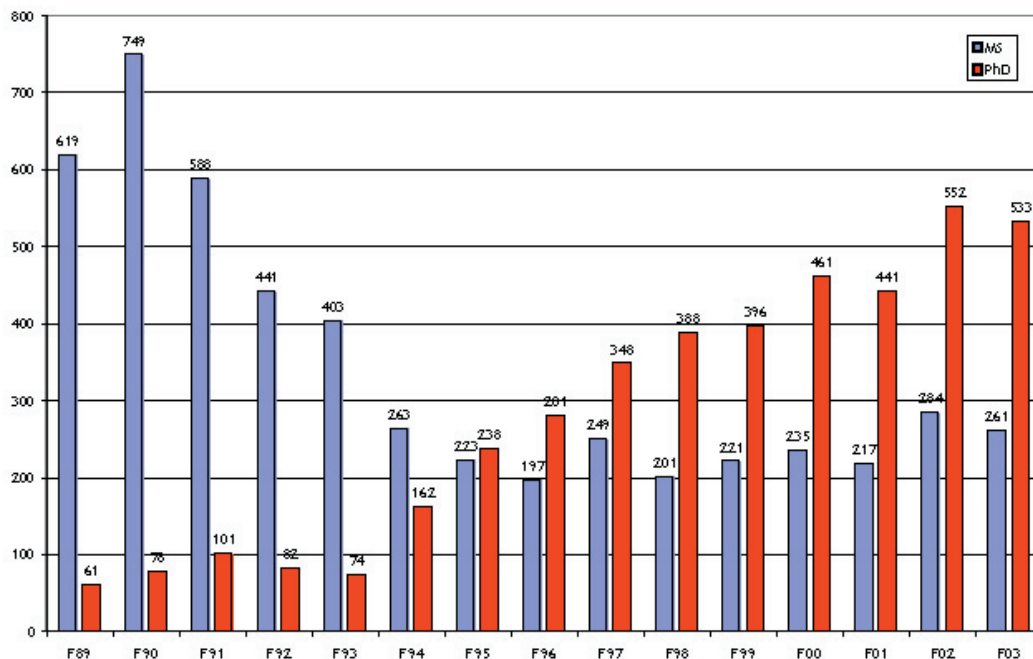


Chart 6-3: Graduate Student Applications

## 6.2 Degrees Awarded

Data on the degrees granted by the department in the last ten years are shown in Table 6-2 and Charts 6-4 to 6-6. As expected, the numbers of degrees granted in the various programs follow the enrollment trends. The number of Ph.D. degrees awarded in the last decade is stable at 9 per year, while the number of MS degrees awarded is rising, with 54 degrees awarded this year.

**Table 6-2: Degrees Awarded 1994-2004**

	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04
<b>BS</b>	78	85	90	88	96	98	99	102	101	106	101
<b>MS</b>	91	92	70	52	28	43	38	45	41	35	54
<b>Ph.D.</b>	6	10	4	10	15	4	10	7	9	7	11
<b>Total</b>	<b>175</b>	<b>187</b>	<b>164</b>	<b>150</b>	<b>139</b>	<b>145</b>	<b>147</b>	<b>154</b>	<b>151</b>	<b>148</b>	<b>166</b>

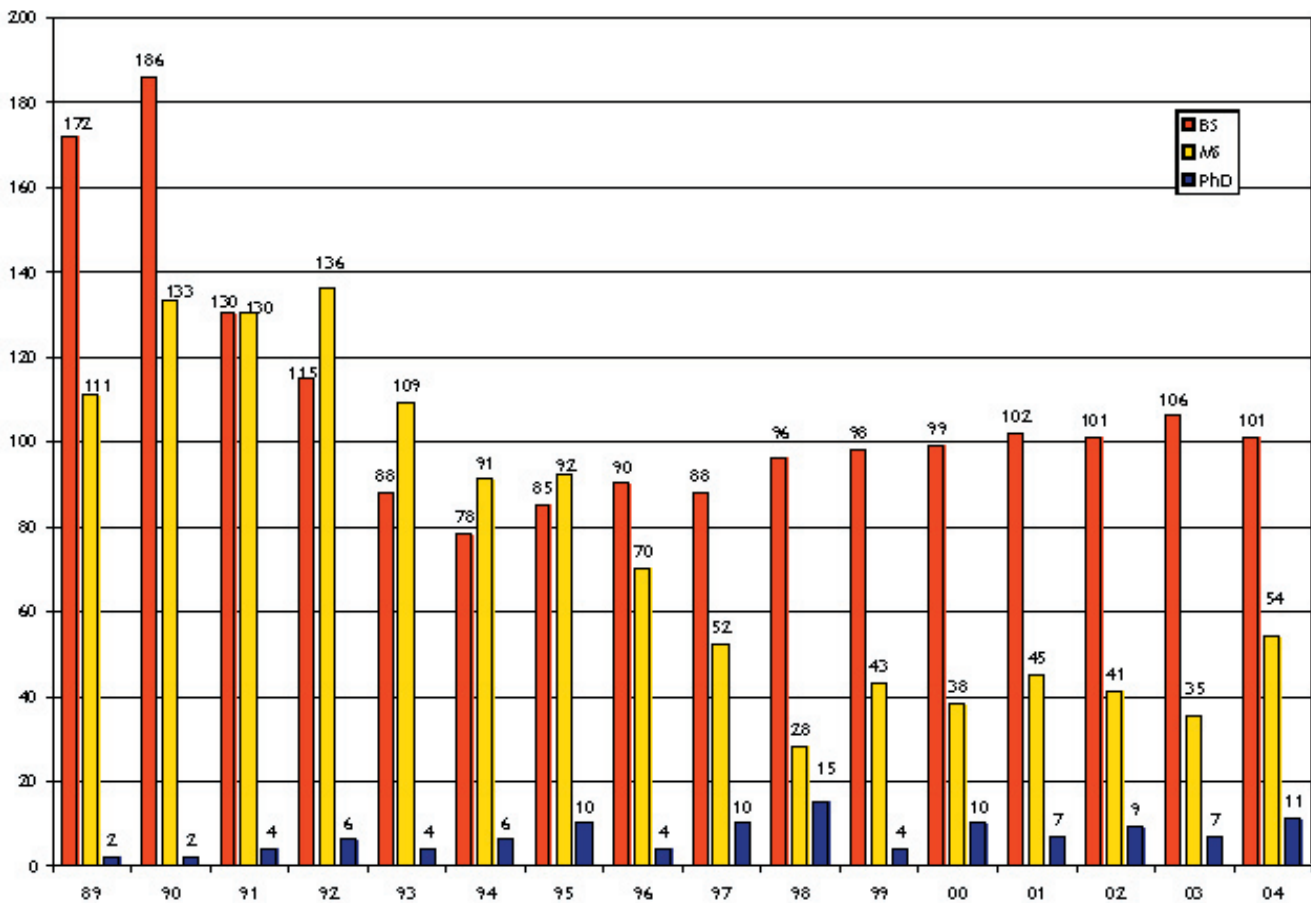
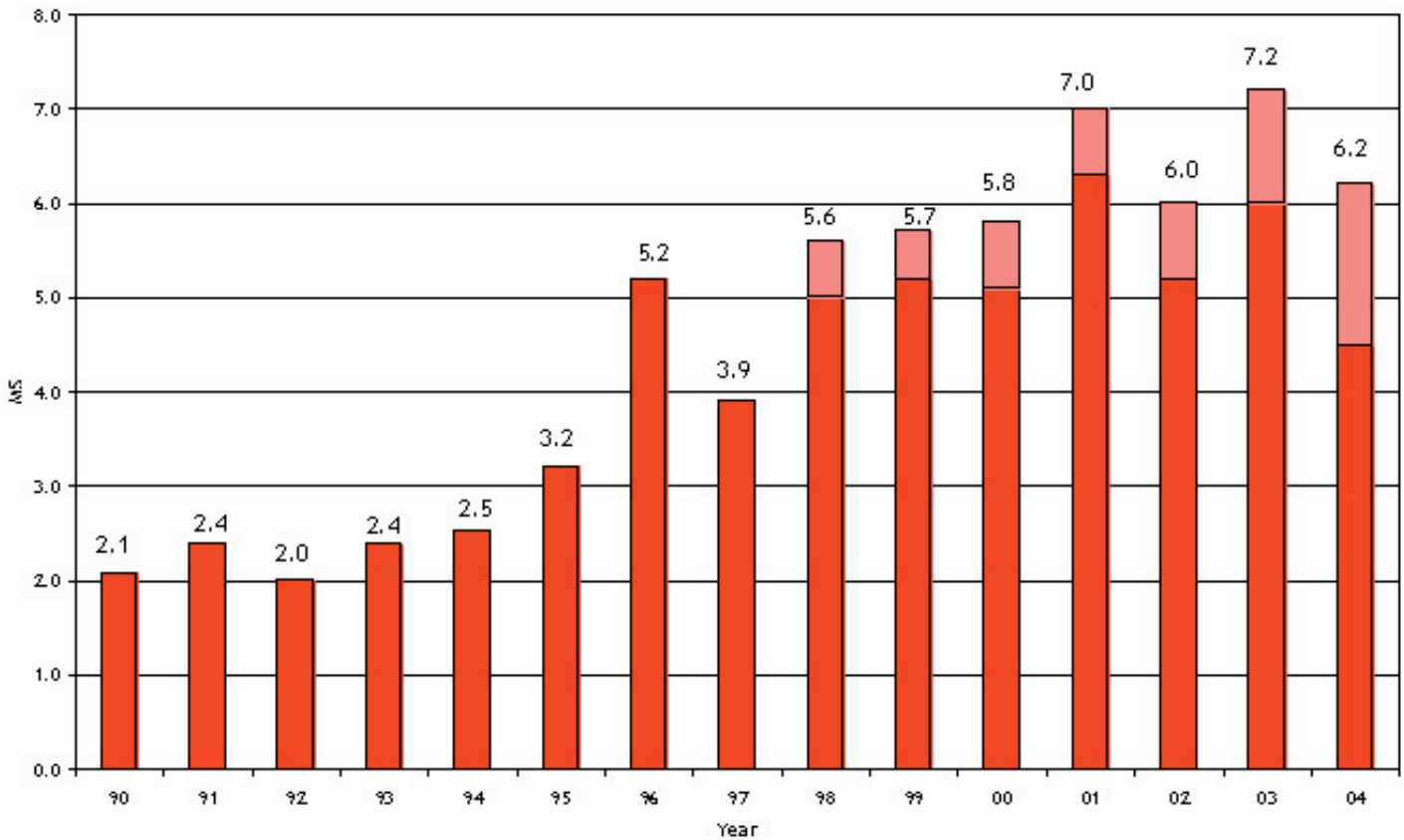


Chart 6-4: Degrees Awarded



### 6.3 Research Funding

As a result of a strong emphasis on research, funding has grown significantly in the last decade. However, total funding this year was approximately \$6.2M, which is a decline from last year's \$7.2M. These figures include grants for which ECE faculty were PIs (a total of \$4.5M this year) and the share of ECE faculty on collaborative grants with PIs at other departments (a total of \$1.7M this year). The average funding per faculty this year is approximately \$160k. The increase of funding for collaborative work with faculty in other departments and university centers is marked.



**Chart 6-7: New Research Grants and Contracts** These figures include grants and contracts for which the Principal Investigators (PI) were ECE faculty. The share of grants for which ECE faculty were Co-PIs totaled approximately \$1.8M in 2003/2004, so that the total funding is approximately \$6.2M.

### 6.4 Faculty and Staff

Faculty hiring has largely replaced departures, with small net growth in recent years. The appointment of three new faculty to begin in AY04-05, and the absence of departures this year is a step in the right direction, but filling open faculty positions in key areas remains to be a key departmental goal. Additionally, new faculty are needed in certain strategic areas.

Staff development has lagged behind the faculty and programmatic changes:

- Scientific staff (post docs, visitors) has increased with associated space and administrative demands.
- Technical lab staff positions have remained at 6.
- Administrative staff has grown much slower than the faculty/scientific staff head count and research volume.

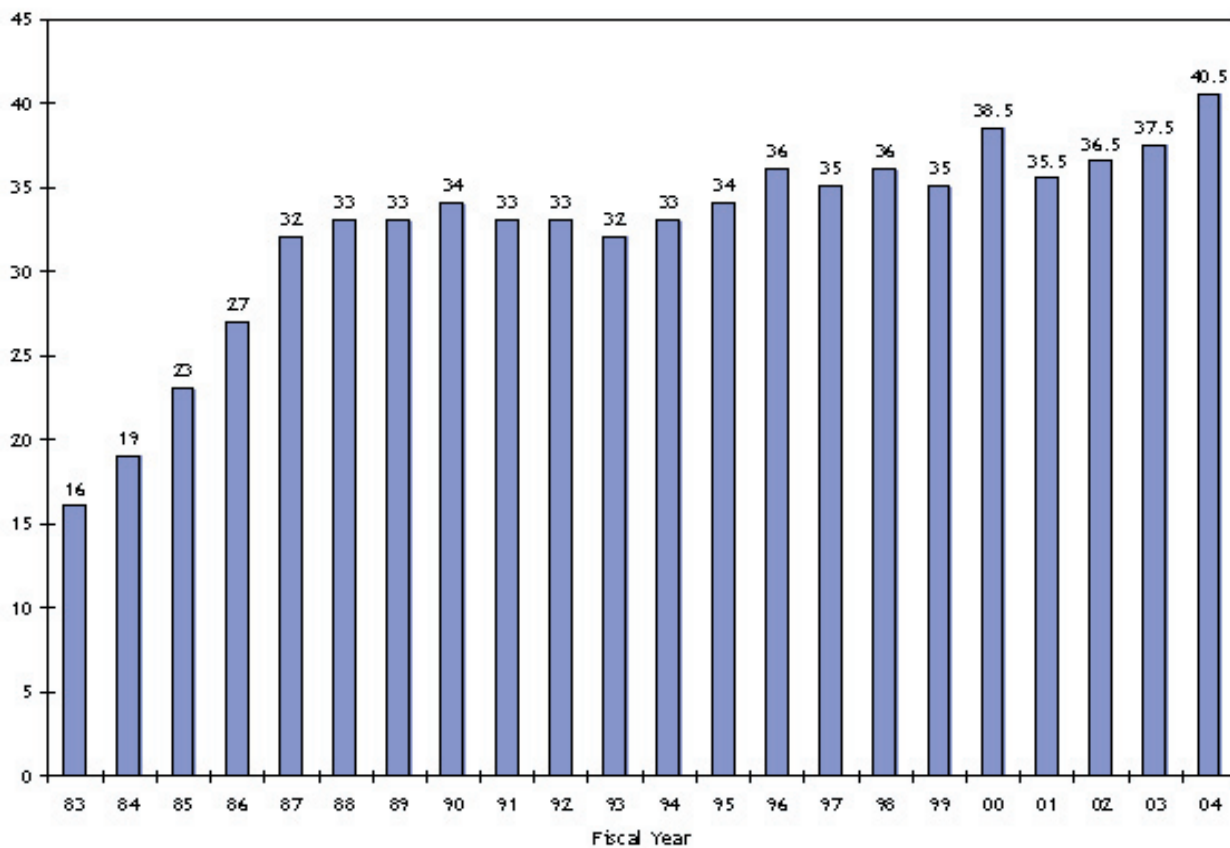


Chart 6-8: Faculty Growth and Turnover Since 1983 Affiliate faculty and research faculty with no teaching responsibilities are not included in this chart.

## 6.5 Outlook

ECE is a multidisciplinary department, with a strong systems perspective. Faculty have been trained in electrical engineering, computer engineering, physics, mathematics, material science, computer science and information systems. The Department encompasses three main areas of research and instruction: **electrophysics** (which includes photonics, solid state materials and devices, and electromagnetics), **information systems & sciences** (which includes signal and image processing, and control and communication systems), and **computer systems engineering** (which includes hardware, software applications, and computer and communication networks). These areas overlap and are mutually supportive. We have strong collegial ties to important Boston University centers, most notably the Photonics Center, the Center for Space Physics, the Center for Computational Science, the Center for Subsurface Sensing and Imaging Systems, and the Center for Cognitive and Neural Systems. We also have strong links with several other departments at Boston University. (See Chart on page 6-7.) Many faculty have strong extramural ties in larger centers, multi-university initiatives, and industry collaboratives.

Our strategy has been to focus on a few important areas of excellence that will create outstanding programs of research and innovation while contributing to a strong undergraduate learning experience and cutting edge graduate research. Plans for faculty growth have been motivated by the need to strengthen existing research areas to become more competitive at a national level, develop new expertise in areas of ECE to keep up with the rapidly-changing face of our profession and to play a leading role in shaping future technological advances, and respond to shifting and growing student enrollments at both the undergraduate and graduate levels. We also aim at exploiting the synergies between our existing research areas as well as links with other departments and centers at Boston University. We expect a strong rebound in high tech over the next five years, and plan to invest wisely now to benefit from these coming opportunities. The continued excellence of our faculty and students will lead to the increased prominence desired for Boston University's ECE Department.

### Electrophysics

Electrophysics encompasses several strong and emerging areas of electrical engineering, including photonics, solid-state materials and devices, and nanotechnology. The electrophysics faculty have strong campus collaborations in the Photonics Center and the Center for Space Physics, and play key roles in the NSF Engineering Research Center for Subsurface Sensing and Imaging Systems (CenSSIS) (see page 5-19).

When BU established the Photonics Center, it made a strategic commitment to become a national center of excellence in photonics. World-class research facilities have been developed and a number of senior and junior ECE faculty have been added and have become core partners in the Photonics Center. The photonics faculty have infused a large number of new courses into the curriculum, have led the creation of the new MS in Photonics degree program, and are working to increase distance learning offerings for the courses in photonics. The instructional program, facilities, and courses in photonics were supported by external fellowships from the Department of Education and curriculum development funds from industry and the National Science Foundation. Our plan is to maintain the momentum and to continue to strengthen this program with new faculty, also enriching the scientific base of the Photonics Center and its technical vitality.

Research in photonics and solid state includes photonic and semiconductor materials and devices, computational electronics, quantum optics and its applications to information and communication systems, fiber optics, magneto-optics and optical storage, biophotonics, microscopy, and sensing and imaging systems. The 2000 award of Boston University's first Engineering Research Center, the Center for Subsurface Sensing and Imaging Systems (CenSISS), was a significant and widely publicized accomplishment.

We have a timely opportunity to reshape the direction of electrophysics due to the recent departure of a number of faculty members in this area. This allows us to shape new research strengths in evolving areas of national need, while maintaining the traditional areas vital to the success of our educational mission, especially the new MS in Photonics. New hires in electrophysics will be carefully coordinated to establish a credible group of collaborating faculty that will enable us to respond fully to new national priorities. We will exploit university-wide initiatives and synergies in the area of micro- and nano-structures while maintaining the strong interest in photonic systems.

At the instructional level, we intend to continue our efforts to bring outstanding laboratory instruction to every undergraduate electrophysics course. This effort began with our move to new laboratories in the Photonics Center and coincided with changes in national accreditation standards that now emphasize laboratory and open-ended investigations as effective learning strategies.

### Information Systems and Sciences

The ECE Department has a strong group in information systems and sciences with significant research in digital signal processing, image and video processing, multimedia communication, optimization and control, distributed processing, and mobile and wireless communication. This group has established an excellent reputation and enjoys strong graduate student interest. Members of the group are active in the NSF Engineering Research Center for Subsurface Sensing and Imaging Systems (CenSSIS) (see page 5-19), the Center for Information Systems and Engineering (CISE), and the Center for Space Physics.

We have had some recent departures of faculty in this area, and we are endeavoring to replace them in order to maintain our momentum and preserve our critical mass. We are also seeking opportunities for growth in areas including wavelets and filterbanks, multiresolution and adaptive representation and processing, signal and image compression and coding, distributed sensing and control, collaborative communication and signal processing. Applications relating to medical imaging and space-physics remote sensing are of particular interest since they exploit synergies with existing BU centers.

## Computer Systems Engineering

Computer systems engineering has a special significance as a vital technology for the 21st century with very broad applications. This can be seen, for example, in the three national priorities outlined by the NSF -- Nanotechnology, Information Technology, and Bioinformatics. Their confluence lies directly within computer and systems engineering. Some opportunities include: combining nanotechnology with computing technology on a chip, development of computer systems for bioinformatics and computational biology, application of knowledge engineering to information technology and bioinformatics, and development of embedded systems for communications.

We have strengths within the ECE Department in computer systems and architecture, VLSI systems, testing and fault-tolerant computing, coding and cryptography, high-performance computing, computer and communication networks, and wireless cellular networks.

VLSI electronics continues to be an area of fundamental importance since VLSI circuits constitute the principal hardware for computers and embedded systems. Maintaining a strong instructional program in this area is essential for both our degree programs. Application of VLSI electronics to biological sensors is an area of great potential, and interests both the ECE and the Biomedical Engineering Departments.

Telecommunications and computer networking have dramatically changed our society and are expected to continue to have a significant economic impact and to drive much of the electronics and computer technology. The student demand for telecommunication and networking courses has been high and the Department has recently enhanced the curriculum at both the undergraduate and graduate levels. ECE research in this area has recently increased. The Computer Science Department has also targeted computer networks as a strong research thrust, and the Department of Manufacturing Engineering has a strong systems group with a related interest in discrete event systems. Our combined effort has created a strong BU program in this important area.

Research in high-performance computing is strong and is linked with the Center for Computational Science and the Scientific Computing and Visualization Center. Another link offering particularly strong synergistic possibilities with the high-performance computing group is that with the Center for Space Physics, a BU research center with strong links to ECE.

Our plans for faculty growth in computer systems engineering are dictated primarily by the undergraduate instructional needs and by the growing demands of graduate students for research sponsorship. The addition of more faculty is essential to meet increased teaching needs, to reduce the current burden on research active faculty, and to give this research area the critical mass necessary to gain a higher national recognition and competitiveness for research funds. With targeted hires in areas such as embedded systems, hardware/software codesign, and VLSI, we will position ourselves to be among the leaders in these critical technologies, both in driving their development and in preparing students.

