Contents

2 MESSAGE FROM THE CHAIR

HIGHLIGHTS
4 New Faculty
4 Faculty Awards and Honors
5 Promotions and Tenure
5 Undergraduate Program
5 Graduate Program
6 Major Grants
7 Events

FACULTY AND STAFF
8 Faculty
14 Staff
16 Department Administration and Committees

UNDERGRADUATE PROGRAM
17 Undergraduate Enrollment and Degrees Awarded
17 Course and Program Development
19 Undergraduate Courses
20 Instructional Laboratories

GRADUATE PROGRAM
24 Graduate Recruitment
25 Graduate Enrollment and Degrees Awarded
25 Course and Program Development
26 PhD Student Progress
26 Graduate Teaching Fellows and Research Assistants
27 PhD Dissertations
28 Graduate Courses
30 Instructional Laboratories
31 Colloquia and Seminars

RESEARCH
34 External Research Funding
41 Faculty Publications
60 Research Areas and Laboratories
66 Affiliated Research Centers
This report provides a description of the instructional and research activities of the Department of Electrical & Computer Engineering at Boston University during the 2008–2009 academic year. Instructional activities are reported from the Fall 2008 through Summer 2009 semesters while scholarly activities and budget information are reported from July 1, 2008 to June 30, 2009.

Boston University’s policies provide for equal opportunity and affirmative action in employment and admission to all programs of the University.

For more information or to download this report as a PDF, please visit our website at www.bu.edu/ece.
Message From the Chair

It is hard to believe that a year has already gone by. As I am writing, I remember how in August 2008, I was driving from Madison to Boston, a U-Haul trailer securely hitched to my car, carrying all the important items that make up one’s life—computers, books, the cat. Boston University’s ECE Department was a largely unknown quantity, not to speak of the College of Engineering, and the University at large. Colleagues were still just names, and I had to carry a “cheat sheet” of their photos with me at the first few faculty meetings.

Now, twelve months later, I don’t strain to remember names. I have learned about their passions and achievements, and shared great news (“Franco, about that proposal!”) and not-so-great news (“Franco, about that proposal…”). After teaching one of the introductory courses (EK307) and ending up relying much more than I had planned on the help of two colleagues who taught the other sections, I also have a better understanding of the importance of undergraduate education at BU.

I’ve learned much about the Department, faculty, staff, and students over the course of the year while also overseeing the graduation of the PhD students I had in Madison (three of them—lots of miles), and the startup of my new laboratory at BU (on Nano-DNA).

Suffice it to say, it’s been a busy first year.

The 2008–09 academic year has been a challenging one, primarily because of the financial crisis, and the associated anxiety and uncertainty among students and faculty. The Department stepped up advising and counseling for the students. Staff and faculty helped in every possible way. Austerity measures were put in place to help manage shortfalls. It is remarkable that the University has been able to maintain growth, with an expanding budget, while most other universities had to undergo painful cuts and downsizing. Much of the credit goes to the steady hand of BU’s administration, and to the faculty who have been able to shoulder the downturn.

I count as a major achievement our recent addition of three new members to the faculty: Ayse Coskun and Ajay Joshi as assistant professors in computer engineering and Siddharth Ramachandran as an associate professor with tenure in electrophysics, specifically in photonics. The Search Committee did an exceptional job, and its members should be commended.

I continue to work hard to increase diversity and retention...
of our junior faculty. To this end, I have set up a mentoring program to help our junior colleagues navigate the waters of academic life.

In addition to the new hires, early in the year, we welcomed Professors Christos Cassandras (Head of the Division of Systems Engineering) and Ioannis Paschalidis (co-Director of the Center for Information and Systems Engineering) to the Department, as part of the College reorganization. We have successfully completed the integration process, moving their laboratories and students to our home in the Photonics Center building. I have no doubts that the new Systems Division will play an important role in the growth of our department. Along a parallel path, the Materials Science Division is establishing itself, and co-Director Professor Theodore Moustakas did a superb job of arranging an outstanding seminar series.

The divisions are an essential ingredient in the development of the departments and College toward becoming more interdisciplinary and open entities. I firmly believe that having rigid divisions (i.e., vertical research areas and disciplines) is obsolete, and that the future belongs to networks of specialties that range from energy and power on one extreme, to synthetic and systems biology on the other. We need to move forward in becoming a more open and outreaching department, welcoming new views and approaches in interdisciplinary fields. This will be reflected more and more in the new additions to the Department’s faculty.

The Department continues to be very productive as a whole, with an aggregate of 103 papers, 155 conference presentations, $10.3 million in new and ongoing grants, and 19 PhD graduates in 2008-09. The more junior tier of the Department is performing very well in terms of funding, publications, and student support—this bodes well for the future.

There is concern about current undergraduate enrollment. After decreasing for several years, the numbers have not rebounded yet. While this is a nationwide trend, it is important that we understand its causes, and move to reverse it. This will be one of my major focus areas for the coming year. In September 2009, we will have a group of distinguished colleagues from peer universities visit ECE to review the activities in our department and provide feedback. This kind of independent input is essential to help foster the Department’s development. In November 2009, ABET will review the Department’s programs in EE and CE to renew our certification. As you can imagine, this is consuming a significant amount of time, especially for the Associate Chair of Undergraduate Studies, Prof. Jeff Carruthers.

For a growing and forward-looking department like ECE at BU, it is absolutely essential to have the infrastructure to support expansion; we could not have moved forward without the dedicated help of our excellent departmental staff.

In summary, the outlook for the Department’s growth is bright, and I look forward to an even better report next year.

Franco Cerrina
Department Chair
September 2009
Highlights

ECE Welcomes New Faculty Members

The Department of Electrical & Computer Engineering (ECE) welcomed two new professors to its ranks this year. Following the merger of the Aeromechanical (AME) and Manufacturing (MFG) Engineering departments, Professor **CHRISTOS CASSANDRAS** and Associate Professor **IOANNIS PASCHALIDIS** (both formerly of MFG), joined ECE as its newest faculty members.

Prof. Cassandras (PhD Harvard University, 1982) is the Head of the Division of Systems Engineering and co-founder of the University’s Center for Information and Systems Engineering (CISE). Prior to joining Boston University in 1996, he was a member of the Electrical and Computer Engineering faculty at the University of Massachusetts, Amherst for twelve years.

He specializes in discrete event and hybrid systems, stochastic optimization, and computer simulation, with applications to computer and sensor networks, manufacturing systems, and transportation systems. Cassandras has published more than 250 refereed papers and four books. He is currently Editor-in-Chief of *IEEE Transactions on Automatic Control* and serves on several Editorial Boards. He has been a plenary speaker at various international conferences and is the recipient of several awards, including the Distinguished Member Award of the IEEE Control Systems Society (2006), the 1999 Harold Chestnut Prize, and a 1991 Lilly Fellowship. He is a Fellow of both the IEEE and IFAC.

Prof. Paschalidis (PhD Massachusetts Institute of Technology, 1996) is Co-Director of CISE and Academic Director of the Sensor Network Consortium (SNC). He has been a member of the BU faculty since 1996 and has held visiting appointments with MIT and the Columbia University Business School. His research interests include systems and control, networking, applied probability, optimization, operations research, computational biology, and bioinformatics, with applications to communication and sensor networks, protein docking, manufacturing systems, and supply chains.

His work on communication networks was recognized with a CAREER award from the National Science Foundation and the second prize in the 1997 George E. Nicholson paper competition by INFORMS. He is a senior member of the IEEE and an associate editor of *IEEE Transactions on Automatic Control* and *Operations Research Letters*.

Faculty Awards and Honors

**HATICE ALTUG** received a Massachusetts Life Sciences Center New Investigator Award.

**CHRISTOS CASSANDRAS** was named as a Fellow of the International Federation of Automatic Control (IFAC). He was also a keynote speaker at two conferences: the 2009 LIDS Student Conference and the 2008 UK Automatic Control Conference.

**DAVID CASTAÑÓN** was elected to President of the IEEE Control Systems Society and named as a member of the IEEE Society Review Committee.

**FRANCO CERRINA** was elevated to the rank of Fellow by both the SPIE and American Association for the Advancement of Science (AAAS).

**MARK HORENSTEIN** served as the General Chair of the 2009 Electrostatics Joint Conference.

**PRAKASH ISHWAR** and **JANUSZ KONRAD** were members of the VCon Technologies team, which won First Prize in the Boston University College of Engineering Entrepreneur Design Contest. Their proposal aims to provide state-of-the-art algorithms that help close the gap between the massive amounts of surveillance information that is amassed by modern security systems and the
Undergraduate Program

This year, the Department participated in the completion of a suite of College-wide minors. Minors are now offered in Biomedical, Systems, Materials, Mechanical, Electrical, and Computer engineering. In addition, two concentrations were created: one in Environmental Engineering and Energy, and the other in Nanotechnology.

Combined enrollment in the BS programs was 201 students across the EE and CE majors. We continue to enjoy a strong record of placement of our graduating seniors in both programs. The number of EE and CE BS degrees awarded this year were twenty-nine and thirty-two, respectively.

Efforts to enhance the undergraduate laboratories are successfully ongoing, with new equipment, maintenance, and upgrades this year. In both classrooms and laboratories, emphasis is placed on design, laboratory practice, and applications. Successful ideas that were initiated in previous years, such as ECE Day and the ECE Teaching Excellence Award continued this year.

Undergraduate Student Awards

Students KEVIN ALLGAIER, BRIANNA CARGES, AMY COSTANDI, BARRY LAI, and JEFF LI of team Phoney Money (iPhone Credit Card System) were selected by Senior Project faculty as recipients of the 2009 P.T. Hsu Memorial Award for the best overall ECE senior design project.

This year, three senior design teams were honored for their efforts on ECE Day with Best Presentation awards (see page 23):

» The 5 Moniteers: Christopher Arensdorf, Matthew Carey, Shawn Fitzpatrick, Michael Tirgardoon, and Andrew Velasco
» Macrosoft: Abin Ajayakumar, Moses Chen, Nael Musleh, Christopher Ogorzalek, and Patrick Raspante
» Phoney Money: Kevin Allgaier, Brianna Carges, Amy Costandi, Barry Lai and Jeff Li

Graduate Program

Three new PhD students were awarded Dean’s Fellowships (DFs) and matriculated in Fall 2008. All three of these students will be continuing their degree programs and are making excellent progress. Sixteen new graduate students matriculated with Graduate Teaching Fellowships (GTFs) in the same period; seven of these students were offered Research Assistantships (RAs) for the Summer or Fall 2009 semesters. We also recruited one new DF and thirteen new GTFs for the Fall 2009 semester.
The BU Photonics Center continued the Photonics Fellowship program, funding photonics graduate students in the sciences and engineering. ECE PhD student Ronen Adato was a recipient of the Senior Student Award. Fall 2009 matriculate Arif Cetin was also awarded the Photonics Fellowship for the 2008-2009 academic year.

Graduate Student Awards
ECE graduate students made an excellent showing in the 2009 Science and Engineering Day hosted by the University. ERHAN ERMIS received the Center for Information and Systems Engineering Award for his poster entitled “Multicamera Fusion for Uncalibrated Cameras” (Advisor: Prof. VENKATESH SALIGRAMA). Mr. Ermis was also the recipient of the ECE Award for the same poster at this event.

New in the 2008-2009 academic year was the creation of a college-wide best dissertation award. The College of Engineering Best Dissertation award was created to annually recognize the most outstanding PhD research by a student completing during the twelve-month period prior to May. The inaugural award was given to SHUCHIN AERON for his dissertation entitled, “Efficient Sensing and Reconstruction of Sparse Phenomena: Bounds and Algorithms.” Aeron’s research was conducted under the guidance of advisor Prof. VENKATESH SALIGRAMA and is in the Information Systems and Sciences research area.

Two ECE student/faculty teams won top honors in the Boston University College of Engineering Second Annual Entrepreneur Design Contest (EDC), which was held in the spring of 2009 and culminated in a final round and award ceremony held on April 23, 2009. First prize ($2,000) was awarded for VCon, a business concept for video monitoring by AJAY BANGLA, STEPHEN CHAO, Prof. PRAKASH ISHWAR, and Prof. JANUSZ KONRAD. Second prize ($1,000) went to Smart Travel, Inc. a company focused on route optimization and traffic congestion monitoring by ASHISH AGARWAL, MATT WOOL, LONN DRUCKER, Prof. THOMAS LITTLE, and Prof. IAIN COCKBURN.

Major Grants
New research funding this year totaled approximately $10.3M in awards for research, of which $6.7M were awarded to ECE Principal Investigators (PI) and $3.6M were awarded to ECE faculty members working as Co-PI on projects outside of the Department. Of the PI awards, twenty-one were for new research projects, while thirty-four awards were for continuing projects.

This year, ENRICO BELLOTTI received $311k in new funding for a National Science Foundation (NSF) award for “Theoretical Investigation of Optoelectronic Devices Based on the ZnO Material System.” ROBERTO PAIELLA, THEODORE MOUSTAKAS, and Bellotti also received new funding from the NSF in the amount of $400k for their project “GaN-Based Quantum-Structure Devices for THz Light Emission and Photodetection.”

THOMAS LITTLE, JEFFREY CARRUTHERS, and HATICE ALTUG received $625k in new funds from the NSF for the launch of the Smart Lighting Center at Boston University, a joint Engineering Research Center with Rensselaer Polytechnic Institute (RPI) and the University of New Mexico that focuses on the creation and application of new-generation solid-state light sources. This grant is subcontracted via RPI and in conjunction with the Center for Information and Systems Engineering (CISE).

ECE faculty received several other grants in conjunction with CISE. DAVID CASTAÑÓN, CLEM KARL, and VENKATESH SALIGRAMA received $275k in new funding from the Department of Homeland Security through a subcontract with Northeastern University relative to awareness and location of explosives-related threats. PRAKASH ISHWAR received $250k for his research “Towards a Paradigm-Shift in Distributed Information Processing - Harnessing Group Structure and Interaction.” Castaño and CHRISTOS CASSANDRAS received $178k in continued funding from the Department of Defense (Air Force) for their project “Distributed Mission Control for Unmanned Air Vehicles in Stochastic Environments.” IOANNIS PASCHALIDIS and Cassandras also received $252k of continued funding for “Distributed Wireless Sensor Networks for Long-Term Deployments.”

The NSF research center, Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS), a multi-university collaborative between Boston University, Northeastern University, Rensselaer Polytechnic Institute, and the University of Puerto Rico Mayagüez, continued its ninth year with Research Thrust 1 led by MALVIN TeICH and funded at $84k; Research Thrust 2 led by DAVID CASTAÑÓN and funded at $196k; the education program led by MICHAEL RUANE funded at $40k; and a $35k supplement led by BAHAA SALEH and Teich.

MARTIN HERBORDT continued his research regarding “FP-GA-Based High Performance Computing” funded by HHS/NIH/NCRR in the amount of $279k. THEODORE MORS, in conjunction with the Center for Nanoscience and Nanobiotechnology, received $750k of continuing funding from the Department of Defense (Navy) for research on “A New Approach to High-Power, Eye-Safe, Laser Technology Applications.” Also, MALVIN TEICH and BAHAA SALEH received $204k in continued funding from the Department of Defense (Army) for a MURI award in conjunction with the Boston University Photonics Center through a subcontract with the University of Rochester relative to “Quantum Imaging: New Methods and Applications.”
Events

**ECE Day 2009**
Initiated in 1997, ECE Day is a forum for seniors to present their capstone projects and graduate students to present their research posters. Held at the end of the Spring semester, ECE Day 2009 included eleven graduate research posters, eleven senior design presentations, and three thesis presentations attended by students, faculty, alumni, and industry representatives.

**MS Project Symposia**
The MS Project Symposia are events that give MS students who have participated in a faculty-advised Project Course an opportunity to present their completed work to their peers and the faculty. Symposia are held at the end of each semester. This year's events were August 8, 2008, December 12, 2008, and May 4, 2009.

**Bernard M. Gordon CenSSIS NSF Site Visit**
The Gordon-CenSSIS (Center for Subsurface Sensing and Imaging Systems) NSF Site Visit, held April 22-23, 2009, brought together CenSSIS researchers and students from Boston University, Northeastern University, Rensselaer Polytechnic Institute, and University of Puerto Rico Mayagüez; NSF evaluators; and Gordon-CenSSIS industry and institutional collaborators. The Year Nine site visit included a student kick-off bowling and billiards event at Jillians; faculty presentations on the Center’s three research thrusts; research and sustainability plans for Gordon-CenSSIS; a student-industry luncheon; industrial and science boards’ meetings; a student poster session; a presentation on education and diversity; and a closed meeting with the NSF site team for the student SWOT analysis. More than 185 people, including approximately 80 students, attended.

**Electrostatics 2009**
The 2009 Electrostatics Joint Conference, which included the Electrostatics Society of America, IEEE-IAS Electrostatic Processes Committee, Institute of Electrostatics Japan, La Société Française d’Electrostatique, and the International Electrostatic Assembly, was held in the Photonics Center building June 16-18, 2009. The conference, sponsored by the ECE Department and chaired by Prof. Mark Horenstein, included three days of technical sessions and opening and closing receptions held at the Brookline Holiday Inn.
Faculty and Staff

Core Faculty

**Murat Alanyali**
Associate Professor
Communication networks; performance analysis and optimization; stochastic systems
- PhD, University of Illinois, Urbana-Champaign 1996
- 2003 NSF CAREER Award
- 2004 Legacy Gift Award, College of Engineering
- Associate Editor, IEEE Control Systems Society Conference Editorial Board

**Hatice Altug**
Assistant Professor
Nano-photonic devices and sensors; photonic switches for communication and bio-sensing applications
- PhD, Stanford University, 2006
- 2009 New Investigator Award, Massachusetts Life Sciences Center
- 2008 BU Peter Paul Career Development Professorship
- 2008 BU College of Engineering Dean’s Catalyst Award
- 2006 Best Research Paper, IEEE LEOS Conference

**Enrico Belloti**
Associate Professor
Computational electronics; semiconductor materials and device simulations; power electronics; parallel computing
- PhD, Georgia Institute of Technology, 1999
- 2005 NSF CAREER Award
- 2001 ONR Young Investigator Award

**Irving Bigio**
Professor
Medical application of optics, lasers, and spectroscopy; biophotonics; nonlinear optics; applied spectroscopy; laser physics
- PhD, University of Michigan, 1974
- Fellow - Optical Society of America, American Society for Lasers in Medicine and Surgery, American Institute for Medical & Biological Engineering
- 2007 Faculty Service Award
- Associate Editor, Journal of Biomedical Optics
- Associate Editor, Lasers in the Life Sciences
- Invited Nominator, 2007 Nobel Prize in Physics

**Richard Brower**
Professor
Molecular dynamics simulation for biomolecules; lattices; methods for QCD and statistical mechanics; quantum field theory of strings and particles
- PhD, University of California, 1969
- A.P. Sloan Research Fellow, SLAC and M.I.T., 1974-1976
- Past Managing Editor, International Journal of Computational Physics

**Maja Bystrom**
Associate Professor
Source and channel coding; multi-media communications; image processing
- PhD, Rensselaer Polytechnic Institute, 1997
- 1999 NSF CAREER Award
- 2005 ECE Award for Excellence in Teaching
- 2001 Fulbright Award
- Associate Editor, Signal Processing Letters

**David Campbell**
Professor & Provost
General nonlinear phenomena and complex systems; novel electronic materials, electron transport in semiconductor superlattices
- PhD, Cambridge University, 1970
- Fellow - American Physical Society, American Association for the Advancement of Science
- Editor-in-Chief, Chaos; Editor, Physics Reports

**Jeffrey Carruthers**
Associate Professor & Associate Chair for Undergraduate Studies
Wireless infrared communications; broadband communications; mobile and wireless networks
- PhD, University of California, Berkeley, 1997
- 1999 NSF CAREER Award
- Senior Member, IEEE
- 2001 ECE Award for Excellence in Teaching

**Christos Cassandras**
Professor
Analysis and control of discrete event dynamic systems; stochastic control and optimization; dynamic control of computer and communication networks
- PhD, Harvard University, 1982
- Fellow, IEEE and IFAC
- Editor-in-Chief, IEEE Transactions on Automatic Control
- IEEE Control Systems Society Board of Governors
- 1991 Lilly Fellow
- 2006 Distinguished Member Award, IEEE Control Systems Society
- 1999 Harold Chestnut Prize
- IEEE Distinguished Lecturer
- Department Editor, Journal of Discrete Event Dynamic Systems
- Past Associate Editor, Automatica and IEEE Transactions on Automatic Control
- Past Editor, Technical Notes and Correspondence, IEEE Transactions on Automatic Control
- Honorary Professor, Huazhong University of Science and Technology and Wuhan University of Science and Technology
David Castañón
Professor
Stochastic control; estimation optimization; image understanding and parallel computation
» PhD, Massachusetts Institute of Technology, 1976
» Associate Director, CenSSIS; Co-Director, BU CISE
» Past President, IEEE Control Systems Society (CSS)
» IEEE CSS Distinguished Member Award.
» Air Force Advisory Board member
» 2007 ECE Teaching Award
» Associate Editor, Computational Optimization and Applications; Past Associate Editor, IEEE Transactions on Automatic Control

Franco Cerrina
Professor and Chair
Semiconductor devices and fabrication modeling, nanolithography, nanofabrication, optics, optical systems, X-rays, synchrotrons, DNA synthesis, system and synthetic biology
» PhD, University of Rome, 1974
» Fellow: IEEE, Optical Society of America, American Physical Society, American Association for the Advancement of Science, SPIE

Luca Dal Negro
Assistant Professor
Optical amplification phenomena and laser physics; optical spectroscopy of semiconductor nanostructures; photonic crystals, Anderson light localization and aperiodic dielectrics; nanophotonics and plasmonics
» PhD, University of Trento, 2003
» Dean’s Catalyst Award, 2007

Azza Fahim
Assistant Professor
Electric machines; computations in electromagnetics
» PhD, Cairo University, 1984

Roscoe Giles
Professor
Advanced computer architectures; distributed and parallel computing; computational science
» PhD, Stanford University, 1975
» One of the “50 Most Important Blacks in Research Science,” The Career Communications Group (CCG)
» A. Nico Haberman Award, CRA
» 1996 ENG Award for Excellence in Teaching

Martin Herbordt
Associate Professor
Computer architecture; electronic design automation; configurable computing; bioinformatics
» PhD, University of Massachusetts, 1994
» 2008 IBM Faculty Award
» 1997 NSF CAREER Award

Mark Horenstein
Professor
Applied electromagnetics; electrostatics; microelectromechanical systems
» PhD, Massachusetts Institute of Technology, 1978
» Editor-in-Chief, Journal of Electrostatics

Allyn Hubbard
Professor
VLSI design using analog and digital techniques in CMOS; neural net chips, smart sensor chips, and chips with biological applications; models of the peripheral auditory system
» PhD, University of Wisconsin-Madison, 1977
» 2002 College of Engineering Award for Excellence in Teaching

Prakash Ishwar
Assistant Professor
Signal, image, and video processing (statistical, multiresolution, distributed); information theory and communications (network coding, computation, security)
» PhD, University of Illinois Urbana-Champaign, 2002
» 2005 NSF CAREER Award
» 2007 Dean’s Catalyst Award

W. Clem Karl
Professor
Multidimensional and multiscale signal and image processing and estimation, particularly applied to geometrically and medically oriented problems
» PhD, Massachusetts Institute of Technology, 1991
» 2000 ECE Award for Excellence in Teaching
» Past Associate Editor, Tomography & MRI, IEEE Transactions on Image Processing; Past Assistant Editor, Systems Control Newsletter

Mark Karpovsky
Professor
Design of secure cryptographic devices and smart cards; routing in interconnection networks; design and protection of cryptographic devices; fault-tolerant computing; error correcting codes; testing and diagnosis of computer hardware
» PhD, Leningrad Electrotechnical Institute, 1967
» Fellow, IEEE

Ronald Knepper
Professor
VLSI integrated circuit technology; SiGe BICMOS device and circuit modeling; silicon CMOS & bipolar devices; numerical device simulation; RF/analog IC design
» PhD, Carnegie Mellon University, 1969
» Life Fellow, IEEE
» 1989 IBM Outstanding Innovation Award; 1988 IBM Division Award; 1983 IBM Outstanding Technical Achievement Award
» Past Editor, Solid State Electronics
Janusz Konrad  
Professor  
Multimedia communications; image and video processing; stereoscopic and 3-D imaging; digital signal processing  
- PhD, McGill University, 1989  
- Fellow, IEEE  
- 2001 IEEE Signal Processing Magazine Award  
- 2004-2005 EURASIP Image Commns Best Paper  
- 2007 Dean’s Catalyst Award  
- Associate Technical Editor, IEEE Communications Magazine; Associate Editor, EURASIP Journal on Image and Video Processing; Past Associate Editor, IEEE Signal Processing Letters; Past Associate Editor, IEEE Transactions on Image Processing  

Robert Kotiuga  
Associate Professor  
Electromagnetics; numerical methods for three-dimensional vector field problems; Whitney forms and the Finite Element Method; micromagnetics; nanoscale magnetics; geometric inverse problems; Topological aspects of magnetic scalar potentials; helicity functionals; analysis of high performance interconnects  
- PhD, McGill University, 1985  
- Member, Electromagnetics Academy  
- 2007 Dean’s Catalyst Award  

Min-Chang Lee  
Professor  
Alternative energy sources and environmental impacts, radio communications, experimental plasma physics, ionospheric plasma physics  
- PhD, University of California, San Diego, 1977  
- 2008 BU ECE Award for Excellence in Teaching  
- Past Associate Editor, AGUA Radio Science  

Lev Levitin  
Professor  
Information theory; physics of communication and computing; complex and organized systems; bioinformatics; quantum theory of measurement; reliable communication and computing  
- PhD, USSR Academy of Sciences, Gorky University, 1969  
- Life Fellow, IEEE  
- Member, International Academy of Informatization  

Thomas Little  
Professor & Associate Chair for Graduate Studies  
Mobile Ad Hoc Networks (MANETs); multimedia computing; computer networking; software engineering; embedded sensor networks  
- PhD, Syracuse University, 1991  
- 1995 NSF CAREER Award  
- 2007 Dean’s Catalyst Award  
- 2009 BU College of Engineering Faculty Service Award  
- Editorial Board Member, ACM/Springer Multimedia Systems, Journal of Multimedia Tools and Applications  

Theodore Morse  
Professor  
Photonic material processing; optical fiber fabrication, lasers, and sensors; high power double clad fiber lasers  
- PhD, Northwestern University, 1961  
- Fulbright Fellow, Germany  

Theodore Moustakas  
Professor  
Growth by MBE, HVPE and MOCVD of Nitride Semiconductors; Optical devices (LEDs, LDs, Optical modulators, Detectors) from deep UV to THz  
- PhD, Columbia University, 1974  
- Associate Director of the Materials Science and Engineering Division  
- Honorary Doctorate, Aristotle University for excellence in Research  
- Fellow, American Physical Society  
- Fellow, Electrochemical Society  
- Senior member, IEEE  
- 1998 ECE Award for Excellence in Teaching  
- Cited in “Technology Transfer Works: 100 Cases from research to realization;” Better World Project  

S. Hamid Nawab  
Professor  
Cognition and brain signal processing; short-time and short-space signal processing; artificial intelligence in signal processing  
- PhD, Massachusetts Institute of Technology, 1982  
- 2005 College of Engineering Service Award  
- 1998 College of Engineering Award for Excellence in Teaching  
- 1993 Metcalf Award for Excellence in Teaching  
- Fellow - American Institute for Medical & Biological Engineering  

William Oliver  
Associate Professor  
Radar studies of the upper atmosphere and ionosphere; modeling and simulation; global change in the upper atmosphere  
- PhD, University of Illinois, 1973  

Roberto Paiella  
Assistant Professor  
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  
- PhD, California Institute of Technology, 1998  
- Senior Member, IEEE  
- 2008 BU Office of Technology Development Ignition Award  
- 2009 BU College of Engineering Dean’s Catalyst Award  

Ioannis Paschalidis  
Associate Professor  
Design, performance analysis, and control of communication and sensor networks, supply chains, and distribution systems; computational biology; Queueing theory and stochastic systems; Optimization and decision theory  
- PhD, Massachusetts Institute of Technology, 1996  
- Senior Member, IEEE  
- National Science Foundation CAREER Award, 2000  
- Second Prize, 1997 George E. Nicholson paper comp  
- Associate Editor, IEEE Trans. Automatic Control  
- Associate Editor, Operations Research Letters  
- Elected Full Member of Sigma Xi, 1996
Wei Qin
Assistant Professor
Tools, methods and architectures for embedded systems; synthesis and verification of programmable processors; design languages for electronic systems
» PhD, Princeton University, 2004
» 2006 ECE Award for Excellence in Teaching

Michael Ruane
Professor
Resonant cavity imaging system; micro-magnetics modeling; optical systems; AFRL Loss Cone Imager DSX Satellite
» PhD, Massachusetts Institute of Technology, 1980
» Senior Member, IEEE
» 2004 ASEE Outstanding Teacher Award
» 1999 ECE Award for Excellence in Teaching
» 1991 College of Engineering Faculty Service Award

Bahaa E.A. Saleh
Professor
Quantum optics; nonlinear optics; image processing
» PhD, Johns Hopkins University, 1971
» Fellow, IEEE, OSA, Guggenheim Foundation
» 2008 OSA Distinguished Service Award
» 2006 Kuwait Prize, 2004 BACUS Award, 1999 OSA Beller Award
» Deputy Director, CenSSIS
» Past Editor-in-Chief, Journal of the Optical Society of America: Optics, Image Science and Vision

Venkatesh Saligrama
Associate Professor
Information and control theory; statistical signal processing; applications to sensor networks
» PhD, Massachusetts Institute of Technology, 1997
» 2005 NSF CAREER Award
» 2003 ONR Presidential Early Career Award
» 2002 ONR Young Investigator Award

Joshua Semeter
Associate Professor
Ionospheric and space plasma physics; spectroscopy of atmospheric airglow and the aurora borealis; image processing; radar systems and radar signal processing
» PhD, Boston University, 1997
» 2004 SRI Presidential Achievement Award
» 2000 Prize Lecture, NSF Cedar Workshop
» Associate Editor, Journal of Geophysical Research
» 2006 NSF CAREER Award
» 2009 ECE Award for Excellence in Teaching
» Associate Director, BU Center for Space Physics

Alexander Sergienko
Professor
Correlation spectroscopy, field optical microscopy and spectroscopy of semiconductor materials and devices; quantum communications; remote laser sensing; laser physics; nonlinear optics; quantum optics, including quantum radiometry and metrology
» PhD, Moscow State University, 1987
» 1999 NSF CAREER Award
» Fellow, Optical Society of America
» 2001 ECE Award for Excellence in Teaching

Thomas Skinner
Associate Professor
Microprocessors; computer networks; operating systems; distributed systems
» PhD, Boston University, 1982
» 2003 Microsoft Most Valuable Professional Award
» 1997 College of Engineering Award for Excellence in Teaching

David Starobinski
Associate Professor
Wireless and sensor networks; QOS and traffic engineering; networks performance evaluation
» PhD, Technion, Israel Institute of Technology, 1999
» 2009 EPFL Visiting Professor Fellowship
» 2004 Department of Energy Early Career Award
» 2002 NSF CAREER Award

Anna Swan
Associate Professor
Development of nanoscale optical self-interference microscopy; optical properties of carbon nanotubes
» PhD, Boston University, 1993
» Senior Member, IEEE

Alexander Taubin
Associate Professor
Asynchronous circuit, logic design; computer architecture; CAD; attack resistant hardware
» PhD, Electrotechnical University of St. Petersburg, 1981
» Senior Member, IEEE

Malvin Teich
Professor
Quantum optics and imaging; photonics; fractal stochastic processes; information transmission in biological sensory systems
» PhD, Cornell University, 1966
» Fellow, IEEE, American Physical Society, Acoustical Society of America, American Association for the Advancement of Science, John Simon Guggenheim Foundation, Optical Society of America
» IEEE EMBS Distinguished Lecturer
» OSA Traveling Lecturer
» Editorial Advisor, Photonics and Physical Electronics, Physics Today

2008–2009 Annual Report
Research Faculty

**Ari Trachtenberg**
Associate Professor
Error correcting codes; data synchronization (especially for PDAs and mobile networks); sensor-based location detection; algorithms

- PhD, University of Illinois, Urbana-Champaign, 2000
- 2002 NSF CAREER Award
- 2003 ECE Award for Excellence in Teaching
- Senior Member, IEEE

**Selim Ünlü**
Professor and Associate Dean for Research and Graduate Programs
Photodetectors; nano-optics: high-resolution and solid immersion lens microscopy, subsurface imaging of semiconductor devices and circuits, biophotonics; biosensor fabrication and biological imaging techniques

- PhD, University of Illinois, Urbana-Champaign, 1992
- 1996 NSF CAREER Award
- 1996 ONR Young Investigator Award
- 2008 TUBITAK Special Award
- 2002 ECE Award for Excellence in Teaching
- Fellow, IEEE
- Associate Editor, IEEE Journal of Quantum Electronics
- 2006 College of Engineering Service Award
- 2007 Dean’s Catalyst Award
- 2007 ARCNN Distinguished Lecturer
- 2005-2007 IEEE/LEOS Distinguished Lecturer

**Malay Mazumder**
Research Professor
Particle technology, material engineering, electrostatic engineering

**Tommaso Toffoli**
Research Professor
Fundamental connections between physics and computation; fine-grained modeling of physics-like systems technology (cellular automata machines) and methodology (programmable matter); personal knowledge structuring

Affiliated Faculty

**John Bailleul**
Professor, Mechanical Engineering
Robotics; control of mechanical systems; mathematical system theory

**Solomon Eisenberg**
Professor and Chair, Biomedical Engineering
Electrically mediated phenomena in tissues and biopolymers

- PhD, University of Illinois, Urbana-Champaign, 1992
- 1996 NSF CAREER Award
- 1996 ONR Young Investigator Award
- 2008 TUBITAK Special Award
- 2002 ECE Award for Excellence in Teaching
- Fellow, IEEE
- Associate Editor, IEEE Journal of Quantum Electronics
- 2006 College of Engineering Service Award
- 2007 Dean’s Catalyst Award
- 2007 ARCNN Distinguished Lecturer
- 2005-2007 IEEE/LEOS Distinguished Lecturer

**Supriya Chakrabarti**
Professor, Astronomy
Space experimentation; ultraviolet spectroscopy

**Farouk El-Baz**
Research Professor and Director, Center for Remote Sensing
Remote sensing with emphasis on arid lands; surface features of solar system planets as part of comparative planetology

**Carlo De Luca**
Professor, Biomedical Engineering
Motor control of normal and abnormal muscles, objective evaluation of muscle fatigue in humans, objective assessment of functional activities in humans, advanced technology for detecting and applying biosignals

**Theodore Fritz**
Professor, Astronomy
Space plasma and magnetospheric physics; magneto sphere-ionosphere coupling; substorms; charged particles and compositions; rocket and satellite experiments

**Selim Ünlü**
Professor and Associate Dean for Research and Graduate Programs
Photodetectors; nano-optics: high-resolution and solid immersion lens microscopy, subsurface imaging of semiconductor devices and circuits, biophotonics; biosensor fabrication and biological imaging techniques

- PhD, University of Illinois, Urbana-Champaign, 1992
- 1996 NSF CAREER Award
- 1996 ONR Young Investigator Award
- 2008 TUBITAK Special Award
- 2002 ECE Award for Excellence in Teaching
- Fellow, IEEE
- Associate Editor, IEEE Journal of Quantum Electronics
- 2006 College of Engineering Service Award
- 2007 Dean’s Catalyst Award
- 2007 ARCNN Distinguished Lecturer
- 2005-2007 IEEE/LEOS Distinguished Lecturer

**Malay Mazumder**
Research Professor
Particle technology, material engineering, electrostatic engineering

**Tommaso Toffoli**
Research Professor
Fundamental connections between physics and computation; fine-grained modeling of physics-like systems technology (cellular automata machines) and methodology (programmable matter); personal knowledge structuring

**Ari Trachtenberg**
Associate Professor
Error correcting codes; data synchronization (especially for PDAs and mobile networks); sensor-based location detection; algorithms

- PhD, University of Illinois, Urbana-Champaign, 2000
- 2002 NSF CAREER Award
- 2003 ECE Award for Excellence in Teaching
- Senior Member, IEEE
Emeritus Faculty

**John Brackett**  
Professor Emeritus  
Software engineering; software requirements definition; object-oriented testing; rapid prototyping of embedded systems  
» PhD, Purdue University, 1963

**Thomas Kincaid**  
Professor Emeritus  
Signal and image processing; neurodynamics; non-destructive testing  
» PhD, Massachusetts Institute of Technology, 1965

**David Perreault**  
Professor Emeritus  
Nonlinear networks; computer-aided design; microprocessors; distributed digital networks  
» PhD, Purdue University, 1968

**Richard Vidale**  
Professor Emeritus  
Modeling and simulation, software engineering  
» PhD, University of Wisconsin-Madison, 1964

Adjunct Faculty

**Edward Bach**  
EC440 (Spring 2009)  
» PhD, Boston University, 2007

**John Brackett**  
EC700 (Fall 2008) & ECS18 (Spring 2009)  
» PhD, Purdue University, 1963

**Vladimir Kleptsyn**  
ECS18 (Fall 2008) & EC410 (Summer 2009)  
» PhD, Moscow Lomonosov’s Institute of Fine Chemical Technology, 1983

**Babak Kia Montazam**  
EC464 (Spring 2009) & EC757 (Summer 2009)  
» MS, Boston University, 1996

**Alan Pisano**  
SC463 (Fall 2008) & SC402 (Spring 2009)  
» PhD, Northeastern University, 1974

**Makhlouf Redjdal**  
EK307 (Summer 2009)  
» PhD, Boston University, 1997
Tatyana Roziner

Associate Professor TATYANA ROZINER, a dedicated teacher who called thousands of students her “kids,” passed away March 12, 2009, at the age of seventy-two.

Roziner was a member of the Department of Electrical & Computer Engineering for twenty-two years when she retired in February 2008. She worked on research in computer engineering and communications, but is best remembered by the Boston University community for her great dedication to teaching and care for each student she taught. Roziner’s teaching schedule typically included three large undergraduate classes per semester, but despite the great numbers of students, her classes never became routine and she gave all of her students an exceptional degree of personal attention.

Roziner earned her doctorate degree at the USSR Academy of Sciences and worked in the military and industry in the Soviet Union. In 1978, she moved to Israel where she worked in the aircraft industry. In 1985, she emigrated to the United States, settling in Newton, Massachusetts. She began teaching at ECE in January 1986 and instructed thousands of undergraduates, guiding them through foundational principles in engineering, from circuit theory to communication systems.

Departures

After 14.5 years as an ECE Professor—thirteen of which were spent as Department Chair—BAHAH SALEH relocated to Orlando to become Dean of the College of Optics and Photonics at the University of Central Florida (UCF). Under his guidance as Chair, the ECE Department grew significantly, adding twelve faculty positions, tripling its research funding, emerging as a top fifty program in both electrical and computer engineering disciplines, and becoming one of the world’s finest research institutions for photonics and information sciences and systems.

Assistant Professor AZZA FAHIM, one of the Department’s outstanding teachers, was also with ECE for 14.5 years and relocated to Orlando. She is now a lecturer in the Department of Electrical Engineering & Computer Science at UCF.

Staff

Administrative Staff

WAYNE RENNIE
Director

CARLY MARCHIONI
Assistant Director

JULIE GUTHRIE
Academic Programs Manager

KAREN GALVEZ
Senior Programs Coordinator

BECKY BELL
Assistant to the Chair

JAMES GOEBEL
Manager, Technology and Systems

ELBERT JORDAN
Financial Administrator

DAVID DELAKAS
Grants Administrator

GORDON RYAN
Publications, New Media, and Promotions Administrator

Technical Staff

JIM BARDIN
Systems Analyst/Administrator I

DAN BERKOVITCH
Systems Analyst/Administrator I

ALEXEY NIKIFOROV
MBE Laboratory Manager

VLADIMIR KLEPSTYN
Electronic/Circuits Laboratory Manager

HOWARD COHEN
VNNS Laboratory Manager

14 Boston University College of Engineering
Department of Electrical & Computer Engineering
# Research Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Advisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atia, George</td>
<td>Research Associate</td>
<td>Castañón</td>
</tr>
<tr>
<td>Benezeth, Yannick</td>
<td>Research Assistant</td>
<td>Saligrama</td>
</tr>
<tr>
<td>Bergstein, David Alan</td>
<td>Research Associate</td>
<td>Ünlü</td>
</tr>
<tr>
<td>Bertazzi, Francesco</td>
<td>Research Assistant</td>
<td>Bellotti</td>
</tr>
<tr>
<td>Bhattacharyya, Anirban</td>
<td>Research Associate</td>
<td>Moustakas</td>
</tr>
<tr>
<td>Bonato, Cristian</td>
<td>Research Assistant</td>
<td>Sergienko</td>
</tr>
<tr>
<td>Borisina, Svetlana</td>
<td>Research Associate</td>
<td>Dal Negro</td>
</tr>
<tr>
<td>Boura, Jihad</td>
<td>Visiting Scholar</td>
<td>Hubbard</td>
</tr>
<tr>
<td>Cetin, Mujdat</td>
<td>Visiting Scholar</td>
<td>Karl</td>
</tr>
<tr>
<td>Chanley, Paul</td>
<td>Visiting scholar</td>
<td>Ruane</td>
</tr>
<tr>
<td>Chivas, Robert</td>
<td>Research Associate</td>
<td>Morse</td>
</tr>
<tr>
<td>Chu, Larry</td>
<td>Visiting Scholar</td>
<td>Cerrina</td>
</tr>
<tr>
<td>Dimakis, Emmanouil</td>
<td>Research Associate</td>
<td>Moustakas</td>
</tr>
<tr>
<td>Do, Synho</td>
<td>Visiting scholar</td>
<td>Karl</td>
</tr>
<tr>
<td>Dorgnac, Jerome</td>
<td>Research Associate</td>
<td>Campbell</td>
</tr>
<tr>
<td>Feng, Ning-Ning</td>
<td>Research Associate</td>
<td>Dal Negro</td>
</tr>
<tr>
<td>Forestiere, Carlo</td>
<td>Research Assistant</td>
<td>Dal Negro</td>
</tr>
<tr>
<td>Furno, Enrico</td>
<td>Visiting Scholar</td>
<td>Bellotti</td>
</tr>
<tr>
<td>Jiang, Fan</td>
<td>Research Associate</td>
<td>Cerrina</td>
</tr>
<tr>
<td>Jodoin, Pierre-Marc</td>
<td>Research Associate</td>
<td>Saligrama</td>
</tr>
<tr>
<td>Laifenfeld, Moshe</td>
<td>Research Associate</td>
<td>Trachtenberg</td>
</tr>
<tr>
<td>Li, Keyong</td>
<td>Research Associate</td>
<td>Paschalidis</td>
</tr>
<tr>
<td>Lopez, Carlos</td>
<td>Research Associate</td>
<td>Ünlü</td>
</tr>
<tr>
<td>Mao, Jianfeng</td>
<td>Research Associate</td>
<td>Cassandras</td>
</tr>
<tr>
<td>Minaeva, Olga</td>
<td>Research Assistant</td>
<td>Sergienko</td>
</tr>
<tr>
<td>Moe, Craig</td>
<td>Research Associate</td>
<td>Moustakas</td>
</tr>
<tr>
<td>Mustafa, Mehmet</td>
<td>Visiting Scholar</td>
<td>Levitin</td>
</tr>
<tr>
<td>Nasr, Magued</td>
<td>Research Assistant</td>
<td>Teich</td>
</tr>
<tr>
<td>Ozkumur, Emre</td>
<td>Research Associate</td>
<td>Ünlü</td>
</tr>
<tr>
<td>Park, Jin</td>
<td>Sr. Research ASC</td>
<td>Herbordt</td>
</tr>
<tr>
<td>Penna, Michele</td>
<td>Research Assistant</td>
<td>Bellotti</td>
</tr>
<tr>
<td>Perez, Samuel</td>
<td>Visiting scholar</td>
<td>Ruane</td>
</tr>
<tr>
<td>Roberts, Carson</td>
<td>Visiting Scholar</td>
<td>Morse</td>
</tr>
<tr>
<td>Rykalova, Yelena</td>
<td>Visiting Scholar</td>
<td>Levitin</td>
</tr>
<tr>
<td>Shubochkin, Roman</td>
<td>Research Associate</td>
<td>Morse</td>
</tr>
<tr>
<td>Thomidis, Christos</td>
<td>Research Assistant</td>
<td>Moustakas</td>
</tr>
<tr>
<td>Vacelet, Valentine</td>
<td>Visiting Scholar</td>
<td>Kotiuga</td>
</tr>
<tr>
<td>Veeravalli, Venugopal</td>
<td>Visiting Scholar</td>
<td>Ishwar</td>
</tr>
</tbody>
</table>
Department Administration and Committees

Franco Cerrina  
Department Chair

Jeffrey Carruthers  
Associate Chair for Undergraduate Studies

Thomas Little  
Associate Chair for Graduate Studies

Wayne Rennie  
Department Director

The Planning Committee directs strategic planning and is involved in all strategic decisions for the Department. It plans the annual ECE Day and ECE Retreat and also recommends the scheduling of courses and the assignments of instructors. The Committee is composed of three research area coordinators, the Department Chair, and a representative from the College of Engineering (ENG). Cerrina (Chair), Little (Assc. Chair, Grad), Carruthers (Assc. Chair, Undergrad), Herbordt (CE), Castañón (ISS), Sergienko (EP), Rennie (Director), Ünlü (ENG)

The Undergraduate Committee is responsible for all aspects of the undergraduate program, including program and curricular changes; new courses; evaluation of instruction and student advising; and recommendations for fellowships, scholarships, and awards. It is in charge of closing the ABET planning feedback loop and preparing for the ABET visit. A subcommittee makes recommendations for the ECE Teaching Excellence Award. Carruthers (Chair), Bystrom, Castañón, Horenstein, Ishwar, Ruane, Semeter, Starobinski, Galvez, Guthrie

The Graduate Committee is responsible for all aspects of the graduate programs, including program and curricular changes; new courses; recruitment of new graduate students; making recommendations for fellowships, scholarships, and awards; evaluating Graduate Teaching Fellows; assignment of theses committees; and coordination of poster presentations on ECE Day. Little (Chair), Oliver (Assc. Chair), Alanyali, Altug, Dal Negro, Ishwar, Konrad, Paschalidis, Qin, Swan, Taubin, Trachtenberg

The Search Committee is responsible for the recruitment of new faculty. It coordinates advertisements, interviews of candidates, and makes recommendations to the faculty for new appointments. Cerrina (Chair), Herbordt, Hubbard, Karl, Karpovsky, Paiella, Saligrama, Trachtenberg, Rennie (ex-officio), Bell

The APT Committee makes recommendations on appointments of tenure-track, non-tenure-track, and affiliate faculty; promotion and tenure of tenure-track faculty; and promotion to Full Professor. Cerrina (Chair), Brower, Karl, Levitin, Moustakas, Sergienko, Saligrama, Rennie (ex-officio), Bell

The Publicity, Special Events, and Seminars Committee makes strategic recommendations for the Department’s website, brochures, reports, exhibits, and all media events aimed at promoting the Department and enhancing its visibility at the local, national and international level. It is also in charge of the ECE Colloquium, the Department Spotlight Seminar series, and other ad hoc seminars and research talks. Ryan (Coordinator), Ishwar, Kotiuga, Paiella, Qin, Rennie, Toffoli

The Industrial and Alumni Relations Committee is in charge of promoting relations to local and national industry, recruitment of members of the Industrial Advisory Council (IAC), and planning IAC meetings. It helps promote strong relations to alumni by coordinating alumni visits on special events such as ECE Day and others. Cerrina (Chair), Horenstein, Hubbard, Knepper, Marchioni, Pisano, Rennie, Ruane, Skinner, Bell

The Information Technology Committee is tasked with maintaining, upgrading, and improving the information technology infrastructure of the Department. Starobinski (Chair), Giles, Hubbard, Konrad, Semeter, Toffoli, Rennie, Goebel

The Awards Committee is responsible for researching awards and other recognition opportunities for department faculty members and developing strategies to strengthen the candidacies of faculty who are considered for recognition. Cerrina (Chair), Bigio, Brower, Giles, Karpovsky
The Department of Electrical & Computer Engineering continues to pride itself on developing a strong laboratory curriculum to complement our classroom teaching for undergraduates. Our labs are stocked with up-to-date equipment and we encourage undergraduates to become involved with research and development efforts through UROP (Undergraduate Research Opportunity Program), work study, and 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.

Central to this philosophy, the capstone design project provides our graduating seniors with real engineering experience and the student projects have continued to be outstanding, with several projects receiving awards.

We are dedicated to improving our undergraduate programs and this year exemplified that commitment. Through careful examination of student surveys, student feedback forums, and faculty review of courses and outcomes, ECE has implemented a number of curriculum changes aimed at enhancing the undergraduate experience.

## Fall 2008 Enrollment

<table>
<thead>
<tr>
<th></th>
<th>Electrical</th>
<th>Computer Systems</th>
<th>Computer**</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshmen*</td>
<td>22</td>
<td>16</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>Sophomores*</td>
<td>30</td>
<td>16</td>
<td></td>
<td>46</td>
</tr>
<tr>
<td>Juniors</td>
<td>31</td>
<td>25</td>
<td>1</td>
<td>56</td>
</tr>
<tr>
<td>Seniors</td>
<td>31</td>
<td>30</td>
<td></td>
<td>61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>114</td>
<td>87</td>
<td>1</td>
<td>201</td>
</tr>
</tbody>
</table>

* ENG Students are not required to declare a major until their Junior year.
** “Computer Systems Engineering” has been renamed “Computer Engineering.” For current students, the degree name change is optional, but all new declared majors will be Computer Engineering.

## Undergraduate Degrees Awarded

<table>
<thead>
<tr>
<th>Major</th>
<th>Degree Recipients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Systems Engineering</td>
<td>32</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>29</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>61</strong></td>
</tr>
</tbody>
</table>

## Course and Program Development

This year, the College completed its reorganization into three departments and two divisions. As part of this process, the College has now created six minors and two concentrations available to ECE students. The minors available are Biomedical, Computer, Electrical, Materials, Mechanical, and Systems engineering. The concentrations are in Nanotechnology and Environmental Engineering and Energy. In support of the Nanotechnology concentration, a new course, EC481 Fundamentals of Nanotechnology, was created by Profs. Swan and Al tug.

Our senior design course continues to evolve in response to evaluation and assessment from students, alumni, and faculty. Some recent changes include increased emphasis on testing, introduction of project management tools, skill clinics, and a move from four-person teams to five-person teams.

Student surveys were conducted to collect and analyze data on student perceptions of how well our programs are achieving their outcomes.
## Undergraduate Courses

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Fall '08</th>
<th>Spring '09</th>
<th>Summer '09</th>
</tr>
</thead>
<tbody>
<tr>
<td>EK131</td>
<td>Intro to Engineering</td>
<td>Toffoli</td>
<td>Kotiuga</td>
<td>Gill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ruane</td>
<td>Giles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trachtenberg</td>
<td>Starobinski</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dal Negro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EK307</td>
<td>Electric Circuit Theory</td>
<td>Fahim</td>
<td>Semeter</td>
<td>Redjdal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sergienko</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cerrina</td>
<td></td>
</tr>
<tr>
<td>EK317</td>
<td>Circuit Theory I</td>
<td>Fahim</td>
<td>Oliver</td>
<td></td>
</tr>
<tr>
<td>EK318</td>
<td>Circuit Theory II</td>
<td>Oliver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EK501</td>
<td>Math Methods I</td>
<td>Kotiuga</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC 311</td>
<td></td>
<td>Qin</td>
<td>Karpovsky</td>
<td>Taubin</td>
</tr>
<tr>
<td>EC312</td>
<td>Computer Organization</td>
<td>Taubin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC327</td>
<td>Intro to Software Engineering</td>
<td>Trachtenberg</td>
<td>Brows</td>
<td></td>
</tr>
<tr>
<td>EC330</td>
<td>Applied Algorithms</td>
<td>Trachtenberg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC381</td>
<td>Probability Theory in ECE</td>
<td>Castañón</td>
<td>Castañón</td>
<td></td>
</tr>
<tr>
<td>EC401</td>
<td>Signals and Systems</td>
<td>Carruthers</td>
<td>Bystrom</td>
<td>Carruthers</td>
</tr>
<tr>
<td>EC402</td>
<td>Control Systems</td>
<td>Pisano</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC410</td>
<td>Intro to Electronics</td>
<td>Sergienko</td>
<td>Knepper</td>
<td>Kleptsyn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ünlü</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knepper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC412</td>
<td>Analog Electronics</td>
<td>Sergienko</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC413</td>
<td>Computer Organization</td>
<td>Herbordt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC416</td>
<td>Intro to Digital Signal Processing</td>
<td>Nawab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC440</td>
<td>Intro to Operating Systems</td>
<td>Bach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC441</td>
<td>Intro to Computer Networks</td>
<td>Starobinski</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC447</td>
<td>Software Design</td>
<td>Skinner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC450</td>
<td>Microprocessors</td>
<td>Giles</td>
<td>Giles</td>
<td>Lee</td>
</tr>
<tr>
<td>EC455</td>
<td>Electromagnetic Systems I</td>
<td>Semeter</td>
<td>Kotiuga</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electromagnetic Systems II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC456</td>
<td>Senior Design Project I</td>
<td>Ruane/Pisano</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC463</td>
<td>Senior Design Project II</td>
<td>Ruane/Montazam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC464</td>
<td>Physics of Semiconductor Devices</td>
<td>Swan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC500</td>
<td>Special Topics in ECE</td>
<td>Moustakas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC501</td>
<td>Dynamic Systems Theory</td>
<td>Dupont</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC505</td>
<td>Stochastic Processes</td>
<td>Karl</td>
<td>Saligrama</td>
<td></td>
</tr>
<tr>
<td>Course Number</td>
<td>Course Title</td>
<td>Fall '08</td>
<td>Spring '09</td>
<td>Summer '09</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------------------</td>
<td>----------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>EC512</td>
<td>Enterprise Client-Server Software Systems Design</td>
<td></td>
<td>Skinner</td>
<td></td>
</tr>
<tr>
<td>EC513</td>
<td>Computer Architecture</td>
<td></td>
<td>Herboldt</td>
<td></td>
</tr>
<tr>
<td>EC514</td>
<td>Simulation</td>
<td></td>
<td>Vaikili</td>
<td></td>
</tr>
<tr>
<td>EC515</td>
<td>Digital Communication</td>
<td></td>
<td>Ishwar</td>
<td></td>
</tr>
<tr>
<td>EC516</td>
<td>Digital Signal Processing</td>
<td></td>
<td>Bystrom</td>
<td></td>
</tr>
<tr>
<td>EC517</td>
<td>Introduction to Information Theory</td>
<td></td>
<td>Ishwar</td>
<td></td>
</tr>
<tr>
<td>EC518</td>
<td>Software Project Management</td>
<td></td>
<td>Brackett</td>
<td></td>
</tr>
<tr>
<td>EC520</td>
<td>Image Processing and Communication</td>
<td></td>
<td>Konrad</td>
<td></td>
</tr>
<tr>
<td>EC524</td>
<td>Optimization Theory and Methods</td>
<td></td>
<td>Paschalidis</td>
<td></td>
</tr>
<tr>
<td>EC533</td>
<td>Intro to Discrete Mathematics</td>
<td></td>
<td>Levitin</td>
<td></td>
</tr>
<tr>
<td>EC534</td>
<td>Discrete Stochastic Models</td>
<td></td>
<td>Levitin</td>
<td></td>
</tr>
<tr>
<td>EC535</td>
<td>Intro to Embedded Systems</td>
<td></td>
<td>Qin</td>
<td></td>
</tr>
<tr>
<td>EC541</td>
<td>Computer Communication Networks</td>
<td></td>
<td>Starobinski</td>
<td></td>
</tr>
<tr>
<td>EC544</td>
<td>Networking the Physical World</td>
<td></td>
<td>Little</td>
<td></td>
</tr>
<tr>
<td>EC545</td>
<td>Advanced Digital Design</td>
<td></td>
<td>Taubin</td>
<td></td>
</tr>
<tr>
<td>EC560</td>
<td>Intro to Photonics</td>
<td></td>
<td>Altug</td>
<td>Altug</td>
</tr>
<tr>
<td>EC561</td>
<td>Error-Control Codes</td>
<td></td>
<td>Karpovsky</td>
<td></td>
</tr>
<tr>
<td>EC566</td>
<td>The Atmosphere and Space Environment</td>
<td></td>
<td>Oliver</td>
<td></td>
</tr>
<tr>
<td>EC568</td>
<td>Optical Fiber Sensors</td>
<td></td>
<td>Morse</td>
<td></td>
</tr>
<tr>
<td>EC570</td>
<td>Lasers</td>
<td></td>
<td>Dal Negro</td>
<td></td>
</tr>
<tr>
<td>EC571</td>
<td>VLSI Principles and Applications</td>
<td></td>
<td>Hubbard</td>
<td>Hubbard</td>
</tr>
<tr>
<td>EC574</td>
<td>Physics of Semiconductor Materials</td>
<td></td>
<td>Bellotti</td>
<td></td>
</tr>
<tr>
<td>EC575</td>
<td>Semiconductor Devices</td>
<td></td>
<td>Bellotti</td>
<td></td>
</tr>
<tr>
<td>EC578</td>
<td>Fabrication Technology for Integrated Systems</td>
<td></td>
<td>Klepstyn</td>
<td></td>
</tr>
<tr>
<td>EC579</td>
<td>Microelectronic Device Manufacturing</td>
<td></td>
<td>Cole</td>
<td></td>
</tr>
<tr>
<td>EC580</td>
<td>Modern Active Circuit Design</td>
<td></td>
<td>Knepper</td>
<td></td>
</tr>
<tr>
<td>EC582</td>
<td>RF/Analog IC Design Fundamentals</td>
<td></td>
<td>Knepper</td>
<td></td>
</tr>
<tr>
<td>EC591</td>
<td>Special Topics in ECE Lab</td>
<td></td>
<td>Paiella</td>
<td></td>
</tr>
</tbody>
</table>

### Instructional Lab Expenditures

<table>
<thead>
<tr>
<th>Description</th>
<th>Approx. Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microprocessor and Software Engineering Labs</td>
<td>$11,298.95</td>
</tr>
<tr>
<td>VLSI and Signals/Networks Lab</td>
<td>$5,952.39</td>
</tr>
<tr>
<td>Electronics Lab</td>
<td>$10,431.39</td>
</tr>
<tr>
<td>Senior Projects Lab</td>
<td>$36,153.69</td>
</tr>
<tr>
<td>Other (includes materials and equipment for courses not assigned to a specific lab)</td>
<td>$34,699.83</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$98,536.25</strong></td>
</tr>
</tbody>
</table>
Instructional Laboratories

Control Systems Laboratory
Faculty: Pisano
This laboratory houses four 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 with actuators and sensors. Various types of controllers (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 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.

Electronic Design Automation/VLSI Laboratory
Faculty: Herbordt, Hubbard, Knepper, Taubin
The VLSI Laboratory is involved in almost all aspects of digital design. It has a wide range of CAD tools available for student use, including Cadence, Synopsys, and the NCSU Design Toolkit.

Electronics Teaching Laboratory
Faculty: Carruthers, Horenstein, Knepper, Lee, Ruane, Sergienko
The Electronics Teaching Laboratory supports the laboratory component of the core courses EK307 – Electric Circuit Theory, EC410 – Introduction to Electronics, and EC412 – Analog Electronics. In addition, several modules of EK 131/132 – Introduction to Engineering make use of the facility. Staffed by a full-time technician, each of the thirty-six lab benches includes fully digital, PC-linked oscilloscopes, power supplies, multimeters, and function generators. Each networked PC is loaded with OrCAD, PSpice, schematic capture, PCB layout, and LabView software. Some stations are equipped with National Instruments data acquisition hardware. A variety of common electronic parts are available for sale at the equipment window. When not in use by scheduled lab sections, the facility is available for open use by all ECE students. A handicapped-accessible lab station is available.

High Performance Computing Laboratory
Faculty: Brower, Giles
The High Performance Computing Laboratory was created with support from the National Science Foundation to support 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 to supercomputers at the Center for Computational Science and the Scientific Computing and Visualization Lab.

High Tech Tools and Toys Laboratory
Faculty: Ruane
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, ENVI, and LabVIEW. The HTTTL supports freshman EK131/132 modules in imaging and subsurface imaging, senior design capstone projects in imaging, and experiments in senior level electives related to imaging. The lab also hosts summer research through UROP, REU, RET, and High School Honors programs. Some undergrads are supported during the academic year to work on improving stations in the HTTTL.

Microprocessor and PC Laboratory
Faculty: Giles, Skinner, Taubin, Toffoli
This lab 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.

Senior Project Laboratory
Faculty: Knepper, Pisano, Ruane
This lab supports our 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 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 MS-DNAA is available for all teams.
Undergraduate Program

Senior Design

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 real-life customers, who are drawn from industry, small businesses, community groups, and faculty and staff. Students learn design methods, project management, team dynamics, communication skills, and legal and ethical standards for design. A substantial first-deliverable milestone and oral presentation complete the first semester.

The second semester is spent in the Senior Project Laboratory. 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. The year culminates in student project presentations on ECE Day to faculty, industry representatives, and fellow students. On May 4, 2009, eleven teams and three BS Honors Thesis student presented their projects across two parallel sessions. Best presentation awards for each session were presented at a luncheon for faculty, customers, and seniors.

IEEE Student Branch

The ECE Department supports the Boston University student branch of the IEEE. There were three chapter meetings during the 2008-2009 school year. The theme for these meetings was “circuit of the month.” Chapter President, Ricardo Fuentes, held these meetings in the ECE Electronics Laboratory and participating students learned about a new circuit at each meeting, while socializing with classmates.

BUSAT

The Boston University Student satellite for Application and Training was a collaboration between BU and Taylor University and was funded through the Air Force’s University Nanosatellite 5 Program (UNP). The UNP is a contest between eleven universities which provided each team with $110K to construct a working nanosatellite. At the end of two years, the school with the most complete satellite that closest meets Air Force objectives is selected to be launched. Throughout the process, the Air Force provided opportunities for feedback to the teams through design reviews, expert area teleconferences, and hands-on training workshops. BUSAT had a strong technological objective in a novel bus design and a mission to better understand the coupling between energetic particles in the magnetosphere and their subsequent effect on the ionosphere. PhD student David Voss was the project manager and Professor Theodore Fritz was the PI.

The project was managed by the Center for Space Physics.

Senior Design

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 real-life customers, who are drawn from industry, small businesses, community groups, and faculty and staff. Students learn design methods, project management, team dynamics, communication skills, and legal and ethical standards for design. A substantial first-deliverable milestone and oral presentation complete the first semester.

The second semester is spent in the Senior Project Laboratory. 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. The year culminates in student project presentations on ECE Day to faculty, industry representatives, and fellow students. On May 4, 2009, eleven teams and three BS Honors Thesis student presented their projects across two parallel sessions. Best presentation awards for each session were presented at a luncheon for faculty, customers, and seniors.

2009 ECE Award for Excellence in Teaching

Professor JOSHUA SEMETER (right) was the winner of the 2009 ECE Award for Excellence in Teaching. He received the award for his outstanding contributions to core ECE courses, including circuits and electromagnetics, and his commitment to advising both individual students and the IEEE student branch.

The Department instituted this award during the 1997-98 academic year to recognize innovation and excellence in teaching among its faculty. The award, based on nominations from College of Engineering students, faculty, and staff, carries with it a $1,000 prize to be used toward instructional activities. A committee of ECE professors and students evaluate the nominees, using teaching statements, classroom material, and student comments.
Notable Senior Design Projects

Phoney Money

Cell phones can do that?

It seems that without fail, mobile technology advances at such a rate that the devices we carry with us—everywhere—can do things that we couldn’t have imagined only a year before. Who would have thought the brick and battery pack phones of only twenty years ago would transform into super-slim, elegant designs capable of not only making phones calls, but managing email, taking photos, playing video games, browsing the Web, and mapping routes via GPS?

Then again, who would have thought that a phone could replace their wallet?

A team of ECE seniors developed a software system that aims to do just that. “Phoney Money,” created by KEVIN ALLGAIER, BRIANNA CARGES, AMY COSTANDI, BARRY LAI, and JEFF LI, enables Apple iPhone users to make secure in-store credit card payments—with their phones—and also provides retailers with the means to seamlessly accept those payments. The traditional stack of plastic cards with magnetically encoded strips appears to be the latest casualty of the mobile virtualization trend.

Developing such a system is no simple task, though. It is, in fact, handling people’s money.

“Because we were focused on creating a real-world product, we faced many challenges in ensuring that our system is both scalable and secure,” said the team. “A major issue was determining how the customer’s phone and the merchant’s point-of-sale system could ‘find’ each other in order to communicate. Once we determined this, we also spent a great deal of effort researching the protocol to use for message-passing between the devices. Both of these issues required us to consider cost, implementation difficulty, convenience, security features, and the ability to support a large number of concurrent users.”

While this is a new concept for the U.S. market, phone-based payments systems are fairly commonplace in countries such as Japan. But Phoney Money has a unique advantage.

“It doesn’t require any special hardware or dedicated credit/debit accounts,” said Allgaier. “By focusing on using proven, scalable technologies like Java, MySQL, and XMPP instant messaging, the system allows customers to use the accounts they already have, and merchants can integrate the software directly into their existing PC-based checkout systems.”

Intellimonitor

Humans are a mechanically complicated species surrounded by a host self-created obstacles that their bodies were not designed to handle gracefully. The result? Bad posture and a plethora of strange injuries that stem from seemingly harmless activities. Unfortunately, since so much of the physical activity we engage in is unnatural from an anatomical standpoint, we have trouble analyzing what it is that causes us to punish our backs, knees, and shoulders throughout the day.

ECE Senior Design team “The 5 Moniteers” (CHRISTOPHER ARENSDORF, MATTHEW CAREY, SHAWN FITZPATRICK, MICHAEL TIRGARDOON, and ANDREW VELASCO) hope their IntelliMonitor system will be a positive step toward solving these problems. IntelliMonitor is a personal activity monitoring system optimized for human use that consists of a group of wireless, wearable...
activity monitoring devices (AMDs), composed of four MEMS sensors each, that interface with the wearer’s Windows Mobile smartphone. By permitting flexible positioning of its nodes, it allows the wearer to see his or her posture and movement in real-time in graphical and model forms that are easily analyzed to determine ways to improve locomotion and posture.

The system also has a number of enhanced features. To improve its corrective capabilities, the AMDs feature vibration feedback that can be set to trigger on specific motions. Also, the device’s data can be continuously sent via a wireless connection to a server for remote observation and analysis.

“Because of its configurable nature,” said Carey, “the IntelliMonitor can be used for a variety of applications. While it was designed with clinical research in mind, it could also be employed in applications like geriatric activity tracking, athletic enhancement, and employee monitoring.”

Though a solid understanding of both electrical and computer engineering drove the development of the system and its devices, it was the areas that they didn’t have a foundation in that truly enlightened the team.

“Some of the greatest challenges that we faced in this project were in understanding the framework of human kinematics that our product was designed around,” said Carey. “We were new to the study of human posture and gait. We had to broaden our engineering education and learn more about this study to be successful. More importantly, though, this enforced the idea that a good engineer must engage in lifelong learning in many concentrations.”

T-NAV
Boston’s Green Line subway riders know well the futility in following the system’s published schedule; unless you are catching a train at its origin, you won’t see it arrive “on time.” Unfortunately, much of the Green Line runs above ground on the same streets as automobile traffic, so its trains are subject to the same stop and go rules of the road. Add in the need to wait for large groups of people to exit and enter the trains at each stop and what you get is a painfully unreliable commute.

ECE Senior Design team “Macrosoft” (ABIN AJAYAKUMAR, MOSES CHEN, NAEL MUSLEH, CHRISTOPHER OGORZALEK, and PATRICK RASPANTE) designed an innovative system called “T-NAV” that aims to at least partially solve this problem by adding a measure of predictability to the subway waiting game.

The project is based on a collaborative effort between GPS-enabled cell phone users to create a network of nodes feeding data to a central system. When the T-NAV cell phone application is activated by a user while on a train, the phone will send anonymous position data to a centralized server. The data is then run through a series of calculations and compared to current data and historical data from other users. The result is a system that can predict where the train currently is, and at what times it will arrive at the remaining stations in its route. End-users can then access this information on a public website.

Learning the intricacies of cell phone systems and programming for mobile devices were noted as major hurdles for the project; no one had experience in those areas. But it was the “nitty gritty” that really tested the team’s ability to successfully complete the system.

“Since the project consisted of many sub-components that were being developed in parallel, it was particularly hard to make it all work together,” said Ogorzalek. “Everyone knew that the project was ‘almost done,’ and it was that way for a good three to four months before we could actually demonstrate full functionality. Small things like a website pop-up window grabbing data from the central server in the wrong way, or a minor bug in the train motion logic, created cascading problems. Resolving these issues required a lot of testing and debugging time and a lot of patience with teammates. Communication and cooperation was key.”
Graduate Program

Recruitment

Three new PhD students were awarded Dean’s Fellowships (DFs) and matriculated in Fall 2008. All three of these students will be continuing their degree programs and are making excellent progress. Fifteen new graduate students matriculated with Graduate Teaching Fellowships (GTFs) in the same period; seven of these students were offered Research Assistantships (RAs) for the Fall 2009 semester. We also recruited seventeen new funded PhD students for the Fall 2009 semester: one Dean’s Fellow, thirteen GTFs, two RAs, and one Photonics Fellow.

We received 565 applications for the Fall 2009 semester, and offered admission to a total of 300 students; 249 of which were to the MS program (84 of these applied for the post-BS PhD program). Thirty-four students were offered admission as post-BS PhDs and seventeen as post-MS PhDs.

The numbers indicate a recruiting cycle comparable to prior years in terms of overall volume. However, for the Fall 2009 period we have secured a new class of funded PhD students by using fewer financial aid and admissions offers. This suggests the increased competitiveness of our offer package and the desirability of our program.

<table>
<thead>
<tr>
<th>NEW MATRICULANTS 2008–2009</th>
<th>Male</th>
<th>Female</th>
<th>FT</th>
<th>PT</th>
<th>GTF</th>
<th>RA</th>
<th>Fellow</th>
<th>DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS US</td>
<td>11</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Intl.</td>
<td>21</td>
<td>8</td>
<td>29</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PHD US</td>
<td>6</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Intl.</td>
<td>9</td>
<td>4</td>
<td>13</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>18</td>
<td>57</td>
<td>8</td>
<td>17</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FALL 2008 MEAN GRE SCORES</th>
<th>Verbal</th>
<th>%</th>
<th>Quantitative</th>
<th>%</th>
<th>An. Writing</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS US</td>
<td>514</td>
<td>59</td>
<td>730</td>
<td>79</td>
<td>4.23</td>
<td>53</td>
</tr>
<tr>
<td>Intl.</td>
<td>455</td>
<td>48</td>
<td>773</td>
<td>88</td>
<td>3.69</td>
<td>26</td>
</tr>
<tr>
<td>PHD US</td>
<td>557</td>
<td>74</td>
<td>788</td>
<td>92</td>
<td>4.58</td>
<td>56</td>
</tr>
<tr>
<td>Intl.</td>
<td>531</td>
<td>66</td>
<td>767</td>
<td>89</td>
<td>3.8</td>
<td>29</td>
</tr>
<tr>
<td>Mean</td>
<td>514</td>
<td>62</td>
<td>765</td>
<td>87</td>
<td>4</td>
<td>41</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPRING 2009 MEAN GRE SCORES</th>
<th>Verbal</th>
<th>%</th>
<th>Quantitative</th>
<th>%</th>
<th>An. Writing</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS US</td>
<td>410</td>
<td>36</td>
<td>620</td>
<td>53</td>
<td>3.5</td>
<td>22.5</td>
</tr>
<tr>
<td>Intl.</td>
<td>430</td>
<td>40</td>
<td>800</td>
<td>94</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>PHD US</td>
<td>570</td>
<td>79</td>
<td>780</td>
<td>90</td>
<td>4.5</td>
<td>54</td>
</tr>
<tr>
<td>Intl.</td>
<td>250</td>
<td>1</td>
<td>790</td>
<td>92</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Mean</td>
<td>415</td>
<td>39</td>
<td>748</td>
<td>82</td>
<td>4</td>
<td>26</td>
</tr>
</tbody>
</table>
Graduate Enrollment

MS Degree Enrollment

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>ENROLLMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Systems Engineering</td>
<td>40</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>46</td>
</tr>
<tr>
<td>Photonics</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>91</strong></td>
</tr>
</tbody>
</table>

PhD Degree Enrollment

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>ENROLLMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Engineering</td>
<td>16</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>81</td>
</tr>
<tr>
<td>Systems</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>99</strong></td>
</tr>
</tbody>
</table>

Graduate Degrees

MS Degrees Awarded

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>ENROLLMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Systems Engineering</td>
<td>28</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>24</td>
</tr>
<tr>
<td>Photonics</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55</strong></td>
</tr>
</tbody>
</table>

PhD Degrees Awarded

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>ENROLLMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Engineering</td>
<td>4</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

Course and Program Development

The ECE Department continues to refine the graduate curriculum, with one new course developed and offered during 2008-2009. In addition, three courses that were developed as special topics were approved to become part of the regular curriculum and were assigned course numbers.

In Spring 2009, one new course was offered: EC500 - Electronic Optical and Magnetic Properties of Materials by Prof. Theodore Moustakas. During the year, this course, as well as two others that were originally developed as special topics courses (EC500 and EC700), were given course numbers and entered into the course inventory:

» EC728 - Design and Testing for Distributed Software-Intensive Systems
» EC573 - Solar Energy Systems
» EC577 - Electronic Optical and Magnetic Properties of Materials

There were also two courses developed by the Systems Division and approved by ECE faculty to be cross-listed in ECE:

» SE/EC543 - Sustainable Power Systems: Planning, Operation and Markets
» SE/EC734 - Hybrid Systems
PhD Student Progress

The number of PhD graduates per year is an important measure of the strength of the graduate programs. In prior years, we saw the results of the procedural improvements to keep the progress of the PhD students on track. Our requirement that students must pass the PhD prospectus within two years of PhD candidacy is intended to guide the students to identify dissertation topics, focus on their research, and reach their degrees in a timely manner. The chart below shows the number of PhD students achieving candidacy, completing prospectus defense, and graduating over the last four academic years.

Graduate Teaching Fellows and Research Assistants

<table>
<thead>
<tr>
<th></th>
<th>SUMMER 2008</th>
<th>FALL 2008</th>
<th>SPRING 2009</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Teaching Fellows</td>
<td>4</td>
<td>19</td>
<td>19</td>
<td>42</td>
</tr>
<tr>
<td>Research Assistants</td>
<td>83</td>
<td>103</td>
<td>89</td>
<td>275</td>
</tr>
<tr>
<td>STUDENT NAME</td>
<td>DISSERTATION ADVISOR</td>
<td>DISSERTATION TITLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------</td>
<td>------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aeron, Shuchin</td>
<td>Saligrama, Venkatesh</td>
<td>Efficient Sensing and Reconstruction of Sparse Phenomena: Bounds and Algorithms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atia, George</td>
<td>Saligrama, Venkatesh</td>
<td>Robust Strategies for Cooperative and Cognitive Wireless Communication Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chang, Shey-Sheen</td>
<td>Nawab, S. Hamid</td>
<td>Emergent Behavior Search in Precision Decomposition of EMG Signals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diaz, Marcos</td>
<td>Semeter, Joshua</td>
<td>Particle-in-Cell Simulation of Electron Beam Instabilities in the Ionosphere and Their Effect on ISR Spectra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driscoll, Kristina</td>
<td>Paiella, Roberto</td>
<td>Novel Nitride and Silicon-Based Quantum Structures for Intersubband Light Emitting Devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>El Katerji, Ahmad</td>
<td>Mountain, David</td>
<td>Brainview: A Functional Neuroanatomy Knowledge System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keene, Samuel</td>
<td>Carruthers, Jeffrey</td>
<td>Cross Layer Techniques for Collision Recovery in Wireless LANs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kulikowski, Konrad</td>
<td>Karpovsky, Mark</td>
<td>Codes and Circuits for Secure Hardware Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lu, Shan</td>
<td>Hubbard, Allyn</td>
<td>A Nonlinear Multicompartmental Cochlear Model</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ozkumur, I. Emre</td>
<td>Ünlü, M. Selim</td>
<td>Optical Interference Based Microarray Imaging for Label-free Multi-Analyte Detection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rodriguez-Diaz, Eladio</td>
<td>Castañón, David Bigio, Irving</td>
<td>Pattern Recognition Algorithms for Diagnosis/Screening of Cancer Using Elastic-Scattering Spectroscopy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Savas, Onur</td>
<td>Alanyali, Murat</td>
<td>Consensus Algorithms for Power-Constrained Wireless Sensor Networks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smirnov, Alexandre</td>
<td>Taubin, Alexander</td>
<td>Asynchronous Micropipeline Synthesis System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stern, Alvin</td>
<td>Cole, Daniel</td>
<td>Design and Analysis of a Novel Avalanche Photodiode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stewart, Jason</td>
<td>Bifano, Thomas</td>
<td>Development and Control of a New Class of Segmented Deformable Mirrors for Advanced Astronomical Imaging Applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yalcin, Ayca</td>
<td>Ünlü, M. Selim</td>
<td>Spectral fluorescence measurements on reflecting surfaces shedding light onto conformation and orientation of macromolecules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zettegren, Matthew</td>
<td>Semeter, Joshua</td>
<td>Model-based Optical and Radar Remote Sensing of Transport and Composition in the Auroral Ionosphere</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Graduate Courses

<table>
<thead>
<tr>
<th>Course Number and Title</th>
<th>Fall ‘08</th>
<th>Spring ‘09</th>
<th>Summer ‘09</th>
</tr>
</thead>
<tbody>
<tr>
<td>EK501 Math Methods I</td>
<td>Kotiuga</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC500 Special Topics in ECE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC501 Dynamic Systems Theory</td>
<td>Dupont</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC504 Advanced Data Structure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC506 Stochastic Processes</td>
<td>Karl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC512 Enterprise Client-Server Software Systems Design</td>
<td>Skinner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC513 Computer Architecture</td>
<td>Herbordt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC514 Simulation</td>
<td>Vaikili</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC515 Digital Communication</td>
<td>Ishwar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC516 Digital Signal Processing</td>
<td>Bystrom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC517 Introduction to Information Theory</td>
<td>Ishwar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC518 Software Project Management</td>
<td>Brackett</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC520 Image Processing and Communication</td>
<td>Konrad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC524 Optimization Theory and Methods</td>
<td>Paschalidis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC533 Intro to Discrete Mathematics</td>
<td>Levitin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC534 Discrete Stochastic Models</td>
<td>Levitin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC535 Intro to Embedded Systems</td>
<td>Qin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC541 Computer Communication Networks</td>
<td>Starobinski</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC544 Networking the Physical World</td>
<td>Little</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC551 Advanced Digital Design</td>
<td>Taubin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC560 Intro to Photonics</td>
<td>Altug</td>
<td>Altug</td>
<td></td>
</tr>
<tr>
<td>EC561 Error-Control Codes</td>
<td>Karpovsky</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC563 Fiber-Optic Communication Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC566 The Atmosphere and Space Environment</td>
<td>Oliver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC568 Optical Fiber Sensors</td>
<td>Morse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC570 Lasers</td>
<td>Dal Negro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC571 VLSI Principles and Applications</td>
<td>Hubbard</td>
<td>Hubbard</td>
<td></td>
</tr>
<tr>
<td>EC574 Physics of Semiconductor Materials</td>
<td>Bellotti</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC575 Semiconductor Devices</td>
<td></td>
<td></td>
<td>Bellotti</td>
</tr>
<tr>
<td>EC578 Fabrication Technology for Integrated Systems</td>
<td>Klepstyn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC579 Microelectronic Device Manufacturing</td>
<td>Cole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC580 Modern Active Circuit Design</td>
<td>Knepper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC582 RF/Analog IC Design Fundamentals</td>
<td>Knepper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC591 Special Topics in ECE Lab</td>
<td>Paiella</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC700 Advanced Topics in Electrical and Computer Engineering</td>
<td>Brackett</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC710 Dynamic Programming and Stochastic Control</td>
<td>Carananas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Number and Title</td>
<td>Fall '08</td>
<td>Spring '09</td>
<td>Summer '09</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>----------------</td>
<td>-------------</td>
<td>------------</td>
</tr>
<tr>
<td>EC713 Parallel Computer Architecture</td>
<td></td>
<td></td>
<td>Herbordt</td>
</tr>
<tr>
<td>EC717 Image Reconstruction and Restoration</td>
<td></td>
<td></td>
<td>Karl</td>
</tr>
<tr>
<td>EC719 Statistical Pattern Recognition</td>
<td></td>
<td></td>
<td>Saligrama</td>
</tr>
<tr>
<td>EC724 Advanced Optimization Theory and Methods</td>
<td></td>
<td></td>
<td>Paschalidis</td>
</tr>
<tr>
<td>EC725 Queueing Systems</td>
<td></td>
<td></td>
<td>Perkins</td>
</tr>
<tr>
<td>EC726 Personal Knowledge Engineering</td>
<td></td>
<td></td>
<td>Toffoli</td>
</tr>
<tr>
<td>EC730 Information-Theoretical Design of Algorithms</td>
<td></td>
<td></td>
<td>Levitin</td>
</tr>
<tr>
<td>EC752 Theory of Computer Hardware Testing</td>
<td></td>
<td></td>
<td>Karpovsky</td>
</tr>
<tr>
<td>EC757 Advanced Microprocessor Design</td>
<td></td>
<td></td>
<td>Montazam</td>
</tr>
<tr>
<td>EC761 Information Theory and Coding</td>
<td></td>
<td></td>
<td>Levitin</td>
</tr>
<tr>
<td>EC763 Nonlinear and Ultrafast Optics</td>
<td></td>
<td></td>
<td>Saleh</td>
</tr>
<tr>
<td>EC764 Optical Measurement</td>
<td></td>
<td></td>
<td>Swan</td>
</tr>
<tr>
<td>EC765 Biomedical Optics and Biophotonics</td>
<td></td>
<td></td>
<td>Mertz</td>
</tr>
<tr>
<td>EC771 Physics of Compound Semiconductor Devices</td>
<td></td>
<td></td>
<td>Bellotti</td>
</tr>
<tr>
<td>EC774 Semiconductor Quantum Structures and Phononic Devices</td>
<td></td>
<td></td>
<td>Paiella</td>
</tr>
</tbody>
</table>
Instructional Laboratories

IMSIP Instructional Laboratory
Faculty: Karl, Konrad, Nawab, Oliver
This laboratory serves the graduate instructional needs of the Department in the areas of multidimensional signal processing (including image and video processing), statistical signal processing, pattern recognition, and earth and space sciences. The laboratory provides advanced computational resources and associated software packages. Fast, dual-processor workstations connected through a gigabit network form a computational backbone, while high-capacity printers serve the hardcopy needs. State-of-the-art processing and optimization software is available. This laboratory was developed with funds from the National Science Foundation, and is currently being upgraded with departmental funds.

Photonics Laboratory
Faculty: Bigio, Morse, Paiella, Ruane, Saleh, Teich, Ünlü
This lab supports introductory and intermediate level courses in the MS in Photonics program. Four stations have vibration isolated optical tables, HeNe and semiconductor lasers, fiber components and systems, electronic test equipment, and GPIB-connected PCs for LabVIEW 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.

RF Measurements Lab
Faculty: Knepper
The RF Measurements Lab provides an opportunity to train students in advanced radio frequency experimental techniques. The lab contains up-to-date high frequency equipment for testing RF printed circuit boards, MMICs, and other high frequency components in the frequency range 100 MHz to 26 GHz. The lab is used for both undergraduate and graduate instruction for courses SC580 and SC582, as well as for research in coupled electrical substrate noise effects in RF/mixed-signal IC technology. Included in the RF Measurements Lab are recent Agilent high frequency tools: a 26 GHz vector network analyzer, 26 GHz spectrum analyzer, high frequency oscilloscope, and RF signal generator. Students use the equipment to learn the basics of S-parameter measurements, as well as characterization of RF mixers, VCOs, amplifiers, and other components.

Signals and Networks (SIGNET) Laboratory
Faculty: Bystrom, Carruthers, Konrad, Nawab
This laboratory provides instructional facilities for courses in the areas of signal processing and communication networks. The lab 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 Hyperperception. The courses served by this laboratory include SC401 (Signals and Systems), SC415 (Communication 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.

Software Engineering Laboratory
Faculty: Brackett, Herboldt, Skinner, Taubin, Toffoli, Trachtenberg
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 networked workstations, four Motorola embedded computer development systems, and state-of-the-art development and modeling tools for the design, implementation, and testing of distributed software systems.
The ECE Colloquium Series and Department Spotlight Seminar (DSS) series continued for another successful year. Prominent speakers from inside and outside the University delivered engaging research talks on current issues to graduate students, faculty, and other students and guests from the greater Boston area.

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/10/2008</td>
<td>Dr. Marcella Chiari</td>
<td>Integration of Materials and Functions in Microfluidic Devices</td>
</tr>
<tr>
<td></td>
<td>Institute of Chemistry of Molecular Recognition National Research Council, Italy</td>
<td></td>
</tr>
<tr>
<td>9/11/2008</td>
<td>Alexander Taubin</td>
<td>Automated Asynchronous Fine-Grain Pipelining in Mitigation of Timing Variability and Hardware Security Applications</td>
</tr>
<tr>
<td></td>
<td>Electrical &amp; Computer Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boston University</td>
<td></td>
</tr>
<tr>
<td>9/15/2008</td>
<td>Roberto Paiella</td>
<td>Novel Semiconductor Quantum Structures for Intersubband Device Applications: from Ultrafast All-Optical Switching to Terahertz Light Emission</td>
</tr>
<tr>
<td></td>
<td>Electrical &amp; Computer Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boston University</td>
<td></td>
</tr>
<tr>
<td>9/22/2008</td>
<td>Vincent Harris</td>
<td>Advances in Microwave Ferrites: A New Twist on Old Materials</td>
</tr>
<tr>
<td></td>
<td>Electrical and Computer Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Northeastern University</td>
<td></td>
</tr>
<tr>
<td>10/6/2008</td>
<td>Ertem Tuncel</td>
<td>When Channel Does the Binning: A Joint Source-Channel Coding Approach for Broadcast Channels</td>
</tr>
<tr>
<td></td>
<td>Electrical Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University of California Riverside</td>
<td></td>
</tr>
<tr>
<td>10/9/2008</td>
<td>Elizabeth Dobisz</td>
<td>Nanofabrication for Patterned Magnetic Media</td>
</tr>
<tr>
<td></td>
<td>San Jose Research Center</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hitachi Global Storage Technologies</td>
<td></td>
</tr>
<tr>
<td>10/9/2008</td>
<td>Richard Tiberio</td>
<td>Electron Beam Lithography for Integrated Optics</td>
</tr>
<tr>
<td></td>
<td>Center for Nanoscale Science and Technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stanford University</td>
<td></td>
</tr>
<tr>
<td>10/20/2008</td>
<td>Ajay Joshi</td>
<td>Building Many-Core Logic-to-Memory Networks Using Monolithic Silicon Photonics</td>
</tr>
<tr>
<td></td>
<td>Integrated Systems Group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Massachusetts Institute of Technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrical &amp; Computer Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University of Massachusetts Amherst</td>
<td></td>
</tr>
<tr>
<td>11/6/2008</td>
<td>Jelena Kovacevic</td>
<td>Problems in Biological Imaging: Opportunities for Signal Processing</td>
</tr>
<tr>
<td></td>
<td>Center for Bioimage Informatics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carnegie Mellon University</td>
<td></td>
</tr>
<tr>
<td>11/12/2008</td>
<td>Keigo Hirakawa</td>
<td>Enhancing Image Fidelity through Spatio-Spectral Design for Color Image Acquisition, Reconstruction, and Display</td>
</tr>
<tr>
<td></td>
<td>Engineering and Applied Sciences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Harvard University</td>
<td></td>
</tr>
<tr>
<td>11/17/2008</td>
<td>Richard Soref</td>
<td>Silicon-based Longwave Integrated Optoelectronics</td>
</tr>
<tr>
<td></td>
<td>Sensors Directorate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U.S. Air Force Research Laboratory</td>
<td></td>
</tr>
<tr>
<td>11/17/2008</td>
<td>Vahid Tarok</td>
<td>Capacity Bounds and Signaling Schemes for Bi-Directional Coded Cooperation Protocols</td>
</tr>
<tr>
<td></td>
<td>Electrical Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Harvard University</td>
<td></td>
</tr>
<tr>
<td>11/24/2008</td>
<td>Katherine Compton</td>
<td>System-Level Support for Reconfigurable Computing</td>
</tr>
<tr>
<td></td>
<td>Electrical and Computer Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University of Wisconsin</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Speaker</td>
<td>Title</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Materials Science and Technology Division Oak Ridge National Laboratory</td>
<td></td>
</tr>
<tr>
<td>12/4/2008</td>
<td>Jacob Khurgin</td>
<td>Linear and Nonlinear Optical Devices Based on Slow Light Propagation: Figures of Merit</td>
</tr>
<tr>
<td></td>
<td>Johns Hopkins University</td>
<td></td>
</tr>
<tr>
<td>12/8/2008</td>
<td>Siddharth Ramachandran</td>
<td>Non-Zero-Order Light: Beams That Can Do What a Gaussian Cannot</td>
</tr>
<tr>
<td></td>
<td>OFS Laboratories</td>
<td></td>
</tr>
<tr>
<td>12/10/2008</td>
<td>Saul Youssef</td>
<td>Simple Cyberinfrastructure</td>
</tr>
<tr>
<td></td>
<td>Center for Computational Science Boston University</td>
<td></td>
</tr>
<tr>
<td>12/15/2008</td>
<td>Marvin Minsky</td>
<td>Missteps toward Artificial Intelligence</td>
</tr>
<tr>
<td></td>
<td>Artificial Intelligence Laboratory Massachusetts Institute of Technology</td>
<td></td>
</tr>
<tr>
<td>1/16/2009</td>
<td>Stephen Cronin</td>
<td>One-Dimensional Physics in Individual Suspended Carbon Nanotubes</td>
</tr>
<tr>
<td></td>
<td>Electrical Engineering University of Southern California</td>
<td></td>
</tr>
<tr>
<td>1/28/2009</td>
<td>Patrick Thiran</td>
<td>Fairness, Spatial Reuse and Phase Transition in CSMA/CA Wireless Networks</td>
</tr>
<tr>
<td></td>
<td>School of Computer and Comm. Sciences Ecole Polytechnique Fédérale de Lausanne</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrical and Computer Engineering McGill University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrical and Computer Engineering Rice University</td>
<td></td>
</tr>
<tr>
<td>3/3/2009</td>
<td>Ajay Joshi</td>
<td>Interconnect Design: From Emerging Devices to Energy-efficient Networks</td>
</tr>
<tr>
<td></td>
<td>Integrated Systems Group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Massachusetts Institute of Technology</td>
<td></td>
</tr>
<tr>
<td>3/16/2009</td>
<td>Sharon Goldberg</td>
<td>Securing Internet Routing</td>
</tr>
<tr>
<td></td>
<td>Electrical Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Princeton University</td>
<td></td>
</tr>
<tr>
<td>3/17/2009</td>
<td>Christopher Batten</td>
<td>Manycore Vector-Thread Architectures</td>
</tr>
<tr>
<td></td>
<td>Electrical Engineering and Computer Science Massachusetts Institute of Technology</td>
<td></td>
</tr>
<tr>
<td>3/18/2009</td>
<td>Amy Reibman</td>
<td>Monitoring Video Quality Inside a Network</td>
</tr>
<tr>
<td></td>
<td>Comm. Sciences and Artificial Intelligence AT&amp;T Labs Research</td>
<td></td>
</tr>
<tr>
<td>3/19/2009</td>
<td>Deniz Gunduz</td>
<td>Cross-layer Design for Wireless Networks without Sacrificing Modularity</td>
</tr>
<tr>
<td></td>
<td>Electrical Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Princeton University</td>
<td></td>
</tr>
<tr>
<td>3/23/2009</td>
<td>Sergey Rudin</td>
<td>Non-linear plasma waves in gated graphene and application for the detection of terahertz signals</td>
</tr>
<tr>
<td></td>
<td>Electro-Optics and Photonics Division U.S. Army Research Laboratory</td>
<td></td>
</tr>
<tr>
<td>3/25/2009</td>
<td>Noel Giebink</td>
<td>Advances in organic light emitting diodes and lasers</td>
</tr>
<tr>
<td></td>
<td>Electrical Engineering and Physics Princeton University</td>
<td></td>
</tr>
<tr>
<td>3/25/2009</td>
<td>Diana Young</td>
<td>From Music Performance to Rehabilitation: Measuring Human Motion Using Local Sensing Systems</td>
</tr>
<tr>
<td></td>
<td>Media Lab</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Massachusetts Institute of Technology</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Speaker</td>
<td>Title</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3/26/2009</td>
<td>Tammar Massey, Computer Science Department, University of California Los Angeles</td>
<td>Data Driven and Optimization Techniques for Mobile Health Systems</td>
</tr>
<tr>
<td>3/30/2009</td>
<td>Dr. Joseph Rizzo, Center for Innovative Visual Rehabilitation, Massachusetts Eye and Ear Infirmary</td>
<td>Engineering Technologies for Retinal Prosthetic Devices to Restore Vision to the Blind: What is the Visual Potential of these Devices?</td>
</tr>
<tr>
<td>3/31/2009</td>
<td>Jing Li, Electrical and Computer Engineering, Purdue University</td>
<td>Robust Heterogeneous Systems in Emerging Technologies: A TFT-CMOS 3D System for Testable/Reliable Operation</td>
</tr>
<tr>
<td>4/6/2009</td>
<td>Gerasimos Konstantatatos, Electrical and Computer Engineering, University of Toronto</td>
<td>Solution-processed quantum dot photodetectors</td>
</tr>
<tr>
<td>4/9/2009</td>
<td>Ayse Coskun, Computer Science and Engineering, University of California San Diego</td>
<td>Efficient Dynamic Thermal Management for Multiprocessor Systems</td>
</tr>
<tr>
<td>4/30/2009</td>
<td>Lara Dolecek, Lab. for Information and Decision Systems, Massachusetts Institute of Technology</td>
<td>High-Speed Complex Systems: Harnessing Core Structures and Randomness</td>
</tr>
<tr>
<td>5/1/2009</td>
<td>Irena Knezevic, Electrical and Computer Engineering, University of Wisconsin Madison</td>
<td>Thermoelectric properties of silicon nanowires</td>
</tr>
<tr>
<td>5/7/2009</td>
<td>Vinod Prabhakaran, Coordinated Science Laboratory, University of Illinois, Urbana-Champaign</td>
<td>Wireless Interference Management: A Fundamental Approach</td>
</tr>
</tbody>
</table>

*a ECE Colloquium Series  
b Research Spotlight Seminar*
Research

ECE is a multidisciplinary department with a strong systems perspective. There are three overlapping areas of research and instruction: Electro-Physics, which includes photonics, solid state materials and devices, and electromagnetics and space physics; Information Systems and Sciences, which includes signal and image processing, control and communication systems, and networks; and Computer Systems Engineering, which includes hardware, software applications, and computer networks.

External Research Funding

Research funding has grown significantly in the last decade. Total annual new research funding in the last five years averaged to approximately $8.7M, compared to $6.5M in the 2000-2004 period, and $4.8M in 1995-99.

The following tables delineate the new and continuing grants awarded over the 2009 fiscal year. The funding level for new grants, where an ECE faculty member is the Principal Investigator (PI) is approximately $6.7M. 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 $3.6M. The total of new grants is therefore approximately $10.3M.
## New Grants with ECE Principal Investigators

<table>
<thead>
<tr>
<th>Recipient</th>
<th>Title of Award</th>
<th>Source</th>
<th>Begin</th>
<th>End</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altug, Hatice</td>
<td>SGER: Investigation of Plasmonic Crystal Based Nanostructures for Biomolecule Detection (w/ Photonics Center &amp; CNN)</td>
<td>National Science Foundation (NSF)</td>
<td>10/1/2008</td>
<td>9/30/2009</td>
<td>$55,000</td>
</tr>
<tr>
<td>Bellotti, Enrico</td>
<td>SBIR: Development of Low Stress Ohmic Contacts to HgCdTe (Subcontract via Photonix, Inc.)</td>
<td>Department of Defense (DOD)</td>
<td>9/22/2006</td>
<td>12/14/2008</td>
<td>$697</td>
</tr>
<tr>
<td>Bellotti, Enrico</td>
<td>Theoretical Investigation of Optoelectronic Devices Based on ZnO Material System</td>
<td>National Science Foundation</td>
<td>6/1/2009</td>
<td>5/31/2012</td>
<td>$311,360</td>
</tr>
<tr>
<td>Castañón, David</td>
<td>Center for Subsurface Sensing and Imaging Systems -- Research Thrust 2 - Core MVT (Subcontract via Northeastern)</td>
<td>National Science Foundation</td>
<td>9/1/2008</td>
<td>8/31/2009</td>
<td>$196,487</td>
</tr>
<tr>
<td>Castañón, David</td>
<td>ALERT: Awareness and Location of Explosives-Related Threats (in conj. w/ CISE) (Subcontract via Northeastern)</td>
<td>Department of Homeland Security</td>
<td>7/1/2008</td>
<td>6/30/2009</td>
<td>$100,000</td>
</tr>
<tr>
<td>Dal Negro, Luca</td>
<td>Biodegradable Communications System (subcontract via Tufts University)</td>
<td>Department of Defense</td>
<td>1/1/2008</td>
<td>10/31/2009</td>
<td>$30,710</td>
</tr>
<tr>
<td>Dal Negro, Luca</td>
<td>Biodegradable Communications System (subcontract via Tufts University)</td>
<td>Department of Defense</td>
<td>1/1/2008</td>
<td>1/31/2011</td>
<td>$118,830</td>
</tr>
<tr>
<td>Herboldt, Martin</td>
<td>FPGA-Based High Performance Computing</td>
<td>HHS/NIH/NCRR</td>
<td>5/1/2009</td>
<td>4/30/2010</td>
<td>$278,688</td>
</tr>
<tr>
<td>Horenstein, Mark</td>
<td>STTR Phase II: Low Power MEMS Retroreflectors for Optical Communication (Subcontract via Boston Micromachines Corp.)</td>
<td>Department of Defense</td>
<td>11/1/2007</td>
<td>10/31/2009</td>
<td>$123,445</td>
</tr>
<tr>
<td>Recipient</td>
<td>Title of Award</td>
<td>Source</td>
<td>Begin</td>
<td>End</td>
<td>Amount</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>-------------</td>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td>Horenstein, Mark Sherr, David</td>
<td>Transdermal Injection of Nanoparticles via Electrospray and Pulsed-Field Assist (Subcontract via MGH/CIMIT)</td>
<td>Department of Defense</td>
<td>4/14/2008</td>
<td>3/21/2009</td>
<td>$6,300</td>
</tr>
<tr>
<td>Hubbard, Allyn</td>
<td>Clare Booth Luce Fellowship</td>
<td>Luce Foundation</td>
<td>8/1/2008</td>
<td>7/31/2009</td>
<td>$26,958</td>
</tr>
<tr>
<td>Ishwar, Prakash</td>
<td>CIF: Small: Collaborative Research: Towards a Paradigm-Shift in Distributed Information Processing - Harnessing Group Structure and Interaction (in conj. w/ CISE)</td>
<td>National Science Foundation</td>
<td>7/1/2009</td>
<td>6/30/2012</td>
<td>$249,999</td>
</tr>
<tr>
<td>Lee, Min-Chang</td>
<td>Controlled Studies of Whistler Wave Interactions and Energetic Particles in Radiation Belts</td>
<td>Department of Defense</td>
<td>12/1/2008</td>
<td>2/28/2009</td>
<td>$25,000</td>
</tr>
<tr>
<td>Lee, Min-Chang</td>
<td>Investigation of Ionospheric Turbulence and Whistler Wave Interactions with Space Plasmas</td>
<td>Department of Defense</td>
<td>6/1/2009</td>
<td>11/30/2009</td>
<td>$206,992</td>
</tr>
<tr>
<td>Little, Thomas Carruthers, Jeffrey Altug, Hatice</td>
<td>NSF Engineering Research Center for Smart Lighting (Subcontract via Rensselaer Polytechnic Institute) (in conj. with CISE)</td>
<td>National Science Foundation</td>
<td>9/1/2008</td>
<td>8/31/2009</td>
<td>$625,000</td>
</tr>
<tr>
<td>Little, Thomas Konrad, Janusz Ishwar, Prakash</td>
<td>NeTS-NOSS: Localized Computation and Network Path Formation to Enable Pervasive Video Sensing (REU Supplement) (in conjunction with CISE)</td>
<td>National Science Foundation</td>
<td>5/1/2008</td>
<td>8/31/2009</td>
<td>$12,000</td>
</tr>
<tr>
<td>Little, Thomas Konrad, Janusz Ishwar, Prakash</td>
<td>NeTS-NOSS: Localized Computation and Network Path Formation to Enable Pervasive Video Sensing (in conj. with CISE)</td>
<td>National Science Foundation</td>
<td>9/1/2009</td>
<td>8/31/2010</td>
<td>$150,000</td>
</tr>
<tr>
<td>Morse, Theodore</td>
<td>A Novel Broad-Band Light Source for Advanced Fiber Optic Gyroscope System</td>
<td>Draper Laboratories</td>
<td>7/1/2008</td>
<td>6/26/2009</td>
<td>$124,999</td>
</tr>
<tr>
<td>Morse, Theodore</td>
<td>HOM Fibers for Blue Laser Applications</td>
<td>DOD</td>
<td>11/1/2008</td>
<td>10/31/2009</td>
<td>$100,000</td>
</tr>
<tr>
<td>Oliver, William</td>
<td>CEDAR: Meteor Plasmas - Theory, Simulations and Observations</td>
<td>National Science Foundation</td>
<td>1/1/2009</td>
<td>12/31/2009</td>
<td>$101,000</td>
</tr>
<tr>
<td>Recipient</td>
<td>Title of Award</td>
<td>Source</td>
<td>Begin</td>
<td>End</td>
<td>Amount</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>--------</td>
<td>-------</td>
<td>-----</td>
<td>--------</td>
</tr>
<tr>
<td>Paiella, Roberto</td>
<td>Collaborative Research: Quantum-Cascade-Laser Active Materials Based on Silicon-Germanium Nanomembranes</td>
<td>National Science Foundation</td>
<td>7/1/2009</td>
<td>6/30/2010</td>
<td>$75,790</td>
</tr>
<tr>
<td>Paiella, Roberto, Moustakas, Theodore, Bellotti, Enrico</td>
<td>GaN-Based Quantum-Structure Devices for THz Light Emission and Photodetection (in conj. with the Photonics Center)</td>
<td>National Science Foundation</td>
<td>9/1/2008</td>
<td>8/31/2011</td>
<td>$399,967</td>
</tr>
<tr>
<td>Paschalidis, Ioannis, Cassandras, Christos</td>
<td>Distributed Wireless Sensor Networks for Long-Term Deployments (in conj. w/ CISE)</td>
<td>Department of Energy</td>
<td>9/1/2008</td>
<td>8/31/2009</td>
<td>$252,000</td>
</tr>
<tr>
<td>Ruane, Michael</td>
<td>CenSSIS -- Education Program (Subcontract via Northeastern Univ.)</td>
<td>National Science Foundation</td>
<td>9/1/2008</td>
<td>8/31/2009</td>
<td>$39,693</td>
</tr>
<tr>
<td>Saleh, Bahaa, Teich, Malvin</td>
<td>Quantum Optical Coherence Tomography (CenSSIS Supplement) (Subcontract via Northeastern University)</td>
<td>National Science Foundation</td>
<td>9/1/2008</td>
<td>8/31/2009</td>
<td>$35,000</td>
</tr>
<tr>
<td>Saligrama, Venkatesh</td>
<td>Networked Sensing Systems for Urban Target Recognition (in conj. w/CISE)</td>
<td>Department of Defense</td>
<td>12/31/2005</td>
<td>12/30/2008</td>
<td>$49,000</td>
</tr>
<tr>
<td>Semeter, Joshua</td>
<td>CAREER: Magnetosphere-Ionosphere Coupling Through Multi-Sensor Data Fusion</td>
<td>National Science Foundation</td>
<td>5/1/2009</td>
<td>4/30/2010</td>
<td>$81,997</td>
</tr>
<tr>
<td>Swan, Anna</td>
<td>REU Supplement - Vibrational and Electronic Aspects of Carbon Nanotubes and Their Interactions</td>
<td>National Science Foundation</td>
<td>10/14/2008</td>
<td>8/31/2010</td>
<td>$7,000</td>
</tr>
<tr>
<td>Teich, Malvin, Saleh, Bahaa, Sergienko, Alexander</td>
<td>Quantum Imaging: New Methods and Applications (MURI) (subcon. via University of Rochester) (in conj w/Photonics Center)</td>
<td>Department of Defense</td>
<td>5/1/2005</td>
<td>9/30/2009</td>
<td>$204,381</td>
</tr>
<tr>
<td>Teich, Malvin, Saleh, Bahaa, Sergienko, Alexander</td>
<td>Quantum Imaging: New Methods and Applications (MURI) (subcontract via University of Rochester) (in conjunction with Photonics Center)</td>
<td>Department of Defense</td>
<td>5/1/2005</td>
<td>9/30/2009</td>
<td>$22,730</td>
</tr>
<tr>
<td>Teich, Malvin</td>
<td>Center for Subsurface Sensing and Imaging Systems -- Research Thrust 1-Photonics (Subcontract via Northeastern Univ.)</td>
<td>National Science Foundation</td>
<td>9/1/2008</td>
<td>8/31/2009</td>
<td>$84,090</td>
</tr>
<tr>
<td>Trachtenberg, Ari</td>
<td>A Theory of Monitoring Based on Identifying Codes and Their Variants (REU Supplement)</td>
<td>National Science Foundation</td>
<td>5/1/2009</td>
<td>9/30/2010</td>
<td>$12,000</td>
</tr>
<tr>
<td>Trachtenberg, Ari, Starobinski, David</td>
<td>Secure and Efficient Data Distribution in Varying-Topology Networks (in conjunction with CISE)</td>
<td>Deutsche Telekom AG (Germany)</td>
<td>7/1/2008</td>
<td>8/31/2009</td>
<td>$55,518</td>
</tr>
<tr>
<td>Ünlü, M. Selim</td>
<td>High Speed Diagnostic of Temperature and Intensity Variation of Diode-Laser Facets (subcontract via Science Research Laboratory, Inc.)</td>
<td>Department of Defense</td>
<td>10/15/2008</td>
<td>7/31/2008</td>
<td>$32,999</td>
</tr>
<tr>
<td>Ünlü, M. Selim</td>
<td>Research Agreement</td>
<td>The Mitre Corp.</td>
<td>6/1/2009</td>
<td>10/2/2009</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

**Subtotal Grants With ECE PIs** | **$6,679,436** |
### New Grants with ECE co-PIs

<table>
<thead>
<tr>
<th>Recipient</th>
<th>Title of Award</th>
<th>Source</th>
<th>Begin</th>
<th>End</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wagenaar, Robert Little, Thomas</td>
<td>Body-Area Instrumentation (LIFT Monitor) for Avoidance of Workplace Injury (in conjunction with CISE) ($78,442)</td>
<td>The Hartford</td>
<td>10/1/2008</td>
<td>12/31/2008</td>
<td>$39,221</td>
</tr>
<tr>
<td>Campbell, David Horenstein, Mark</td>
<td>No Longer a Dream Deferred: Greater Minority STEM Participation through Academic and Institutional Change - Participant Support Costs (subcontract via Umass, Amherst) ($85,200)</td>
<td>NSF</td>
<td>3/1/2006</td>
<td>2/28/2010</td>
<td>$42,600</td>
</tr>
<tr>
<td>Wagenaar, Robert Little, Thomas</td>
<td>Continuous Monitoring of Functional Activities in Home and Community-Based Settings (subcontract via Boston Medical Center) ($73,125)</td>
<td>HHS/NIH/NIA</td>
<td>9/1/2008</td>
<td>5/31/2009</td>
<td>$36,563</td>
</tr>
<tr>
<td>Baillieul, John Castañón, David</td>
<td>Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (MURI-07) (in conj. w/ CISE) ($1,393,925)</td>
<td>Department of Defense/ Air Force</td>
<td>12/1/2008</td>
<td>11/30/2009</td>
<td>$696,963</td>
</tr>
<tr>
<td>Dal Negro, Luca</td>
<td>COBRA Detection: SERS Engineered Substrates ($289,140)</td>
<td>DOD/Army</td>
<td>7/1/2008</td>
<td>6/30/2009</td>
<td>$289,140</td>
</tr>
<tr>
<td>Morse, Theodore Bystrom, Maja Saleh, Bahaa</td>
<td>Ultra High Resolution Digital X-ray for Clinical Applications ($248,865)</td>
<td>DOD/Army</td>
<td>7/1/2008</td>
<td>6/30/2009</td>
<td>$248,865</td>
</tr>
<tr>
<td>Altug, Hatice Ünlü, M. Selim</td>
<td>Rapid, Portable Biosensors for Virus Detection ($100,000)</td>
<td>DOD/Army</td>
<td>7/1/2008</td>
<td>6/30/2009</td>
<td>$100,000</td>
</tr>
</tbody>
</table>
### Research Recipient Title of Award Source Begin End Amount

**Dal Negro, Luca**  
Bio-Compatible Label-Free Colormetric Responder ($100,000)  
DOD/Army  
7/1/2008  
6/30/2009  
$100,000

**Sergienko, Alexander**  
RADSCAN: Portable IR Laser Bio-Dosimetry Radiation Scanner ($250,000)  
DOD/Army  
7/1/2008  
6/30/2009  
$250,000

**Hubbard, Allyn**  
Miniaturized Digital Electronics for a Biomimetic Acoustic Sniper Detection and Localization System ($175,000)  
DOD/Army  
7/1/2008  
6/30/2009  
$175,000

**Morse, Theodore**  
High Performance Incoherent Light Source for fiber Optical Gyro ($100,000)  
DOD/Army  
7/1/2008  
6/30/2009  
$100,000

**Moustakas, Theodore**  
Development of III Nitride Based UV LED's for Biochemical Threat Detection ($100,000)  
DOD/Army  
7/1/2008  
6/30/2009  
$100,000

**Subtotal Grants With ECE co-PIs**  
$3,634,451

**Grand Total**  
$10,313,887

### Continuing Grants

**Recipient Title of Award Source Begin End**

**Saligrama, Venkatesh**  
Automatic Dispersion Extraction from Acoustic Array Data  
Schlumberger  
1/1/2007  
12/31/2009

**Moustakas, Theodore**  
Ultraviolet Electroabsorption Modular Based on III-Nitride Quantum Wells  
NSF  
9/1/2007  
8/31/2010

**Swan, Anna**  
Vibrational and Electronic Aspects of Carbon Nanotubes and Their Interactions  
NSF  
9/1/2007  
8/31/2010

**Bellotti, Enrico**  
Sbir Phase II - New Sensing Capabilities For Situational Awareness  
AFOSR/Photronics  
3/20/2007  
9/20/2009

**Sergienko, Alexander**  
Phase-sensitive Quantum-optical Sensor  
ARO  
8/1/2007  
9/10/2009

**Starobinski, David**  
Management of Secondary Markets in Deregulated Wireless Network  
NSF  
9/1/2007  
8/31/2010

**Trachtenberg, Ari**  
A Theory Of Monitoring Based On Identifying Codes And Their Variants  
NSF  
10/1/2007  
9/30/2010

**Bellotti, Enrico**  
Simulation Models For IR FPAS  
CSC/BAE Systems  
9/1/2007  
8/31/2009

**Saleh, Bahaa**  
Learning and Integrated View of Engineering  
NSF  
1/15/2008  
12/31/2009

**Morse, Theodore**  
Miniature Laser Therapy Endoscope  
HHS/PHS/NIH/NIBIB via MGH  
8/1/2007  
7/31/2009

**Morse, Theodore**  
Ultra-High Definition (1um) Digital X-Ray Imaging  
MA Technology Transfer Center  
5/1/2008  
7/31/2009

**Horenstein, Mark**  
Differential Stiffness Endoscope With Smart Articulated Joints  
MA Technology Transfer Center  
8/1/2008  
8/31/2009

**Cassandras, Christos**  
EFRI-ARESCI: Event-driven Sensing For Enterprise Reconfigurability And Optimization  
NSF  
11/1/2007  
10/31/2011
<table>
<thead>
<tr>
<th>Recipient</th>
<th>Title of Award</th>
<th>Source</th>
<th>Begin</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paschalidis, Ioannis</td>
<td>Diagnosis And Assessment Of Faults, Misbehavior And Threats In Distributed Systems</td>
<td>NSF</td>
<td>9/15/2004</td>
<td>8/31/2009</td>
</tr>
<tr>
<td>Ruane, Michael</td>
<td>REU Site: Research Experience For Undergraduates In Photonics</td>
<td>NSF</td>
<td>5/1/2008</td>
<td>10/31/2009</td>
</tr>
<tr>
<td>Teich, Malvin</td>
<td>Quantum Optical Coherence Tomography (CenSsIS supplement)</td>
<td>NSF/Northeastern</td>
<td>2/1/2003</td>
<td>8/31/2009</td>
</tr>
<tr>
<td>Paiella, Roberto</td>
<td>Intersubband All-Optical Switching and Optically-Pumped Light Emission with</td>
<td>NSF</td>
<td>9/1/2006</td>
<td>8/31/2010</td>
</tr>
</tbody>
</table>
Faculty Publications

Books


Book Chapters


### Journal Articles


H Dai and R.W. KNEPPER, “Modeling and Experimental Measure-


H. Rishbeth, M. MENDILLO, J. Wroten, and R. G. Roble, “Day-by-


ence Tomography of a Biological Sample,” *Optical Communications*, 282, March 2009.


**Conference Papers**


M. Austwick, J. Woodhams, C. Mosse, C. Elliot-Laîze, V. Chalau, A. J. MacRobert, **I. J. BIGIO** and S. G. Bown, “Optical pharmaco-


P.R. Kotiuga, "Near force-free magnetic fields, contact structures, and Heegaard-Floer homology," Special session on low-dimensional topology, 1042nd meeting of the AMS, Wesleyan University, Middletown, CT. Oct.11-12, 2008.


M. MENDILLO, “No two ionospheric storms are the same….nonsense!,” Amer. Geophys. Union annual meeting, San Francisco, December 2008.


O. Minaeva, A. Divochiy, A. Korneev, A. V. Sergienko, and G. N.


E. Ozkumur, A. Yalcin, F. Damin, B. B. Goldberg, M. Chiari, and M.


Invited Lectures


M. Alanyali, “Network coexistence in emerging models of unlicensed spectrum access,” Bilkent University, March 2009.


R. Brower, “Multigrid in the Chiral limit” and “Lattice Chiral


C.J. DE LUCA, “Clinical Applications of sEMG, American Asso-
ciation of Neuromuscular & Electrodiagnostic Medicine,” Providence, RI, September 18, 2008.


M. HERBORDT, “Elements of High Performance Reconfigurable Computing with Applications in Bioinformatics and Computational Biology,” Keynote Talk; Many-Core and Reconfigurable Supercomputing Conference; Berlin, Germany, March 24, 2009.


V. Saligrama, “Video Analytics over Camera Networks, In-Q-Tel (A CIA Venture Arm),” Nov. 2008.


V. Saligrama, “Department of Computer Science Video Analytics over Multi-Camera Networks,” University of Maryland, College Park, March 2009.


A. V. Sergienko, “Quantum Communication and Measurement with Non-classical Light,” Joint Colloquium Department of Phys-
ics and Fondazione Bruno Kessler, University of Trento, Trento, Italy May 21, 2009.


**M. C. TEICH**, “Multi-Photon and Entangled-Photon Imaging and Lithography,” Department of Physics and OSA Section, Humboldt University, Berlin, Germany and Max Born Institute, Berlin-Adlershof, Germany, November 2008.


**M. C. TEICH**, “Fractal Point Events in Physics, Biology, and Communication Networks,” Department of Physics and OSA Section, Humboldt University, Berlin, Germany and Max Born Institute, Berlin-Adlershof, Germany, November 2008.

**M. C. TEICH**, “Multi-Photon and Entangled-Photon Imaging and Lithography,” Department of Physics and OSA Section, Humboldt University, Berlin, Germany and Max Born Institute, Berlin-Adlershof, Germany, November 2008.


**M. C. TEICH**, “Fractal Point Events in Physics, Biology, and Communication Networks,” Department of Physics and OSA Section, Humboldt University, Berlin, Germany and Max Born Institute, Berlin-Adlershof, Germany, November 2008.

**Patents and Disclosures**


**T.D. MOUSTAKAS** and Philip Lamarre, Method for Growing Selective Areas on Substrate and Devices Thereof”, Provisiona Patent Application No. 60/961,829

**T.D. MOUSTAKAS**, “Low-cost blue/UV LEDs with very high photon conversion and extraction efficiency for white lighting” U.S. Provisional Patent Application No. 61/068,605


The ECE Department has three overlapping areas of research:

» **Electrophysics**: photonics, solid state materials and devices, and electromagnetics and space physics;

» **Information Systems & Sciences**: signal and image processing, and control and communication systems;

» **Computer Systems Engineering**: hardware, software applications, and computer and communication networks.

### Applied Electromagnetics

**Horenstein, Mazumder**

This laboratory is devoted to problems in experimental electromagnetics with a primary focus on medical and industrial electrostatics, micro-electromechanical systems (MEMS), and sensors. Current projects include transdermal injection of medicinal nanoparticles via pulsed electric fields, development of a passive laser communication node using a MEMS retro-reflective mirror, the design of a “smart-joint” variable-stiffness endoscope, the use of an electrodynamic screen to remove dust particles from solar electric installations, and the development of a new type of electrostatic-based, dry power inhaler.

### Biological Sensing and Imaging

**Ruane, Ünlü**

The Biological Sensing and Imaging Laboratory develops optical, electrical, and computational methods to study biological problems. Researchers develop sensing and imaging devices that emphasize label-free, high throughput data collection on extremely small quantities of biomaterials. Applications include disease and biohazard detection, drug discovery, and equipment development. Projects include the Resonant Cavity Imaging Biosensor which applies hyperspectral IR imaging of transmissive and reflective resonant optical cavities for DNA and protein measurements; the Fabricator—a mask-free optical synthesizer for bio-arrays (the “Fabricator” project) used in RCIB and other biochip systems, and self-interference microscopy. The group is interdisciplinary, with engineers, physicists, chemists, and biologists, and encourages undergraduate researchers.

### Biomedical Optics and Biophotonics

**Bigio**

The focus of research in the Biomedical Optics and Biophotonics Laboratory is the development of minimally-invasive diagnostics and therapeutics based on optical and photonic technologies. Faculty often collaborate with clinical researchers who test the new technologies on animals or human subjects. With noninvasive optical measurements, there is minimal risk to the patient, but significant medical benefits are possible. Some of the ongoing projects include:

» “Optical biopsy”: development of fiber-optic probes that perform spectroscopic measurements on tissue in vivo and noninvasively to instantly diagnose cancer and other pathologies in specific organ areas.

» “Optical pharmacokinetics”: fiber-optic probes designed to measure drug concentrations in tissue, dramatically reducing the number of animals required for drug studies. This can also be used to determine the optimum type and dosage of novel (light-activated) chemotherapy agents for individual patients.

» Sensors to monitor the response of tumors to specific treatments.

» Optical methods for noninvasive imaging of neuronal activation and brain function.

» Optical methods for identifying different types of infectious agents.

### Broadband Wireless Communications

**Carruthers**

This laboratory supports research projects on the design, theory, and prototyping of broadband wireless communication systems. The major focus is on the use of 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.

### Complex BioSignal Processing

**Nawab**

Complex Signal Processing is an umbrella term used to describe processes that act upon signals in order to achieve desired objectives. The term is purposely meant to subsume what is traditionally meant by signal processing, signal analysis, signal modeling, signal classification, and signal recognition, but it is also meant to be inclusive of signal interpretation, signal understanding, signal data mining, signal forensics, signal visualization, etc. Complex signal processing research at ECE encompasses the conceptualization, formalization, implementation, and evaluation of signal computing with an emphasis on applied artificial intelligence and biosignal applications.
Computational Electronics
Bellotti
The Computational Electronics group develops software to study semiconductor materials and to perform electronics and optoelectronics device simulation. The group also uses commercial simulation software to simulate for technologically mature semiconductor devices. The laboratory is equipped with state-of-the-art computing and software tools, including two computer clusters, one SGI ALTIX 350 (16 CPUs, 64GB of memory and 1TB disk array) running Red Hat Linux, and an AMD Opteron Cluster (32 CPUs and a 6TB disk array) running Gentoo Linux. The lab also operates high performance PCs and printers.

Computer Architecture and Automated Design
Herbordt
Work focuses on experimental computer architecture, particularly on the application of emerging technology to computationally intensive applications. Projects include developing design tools for application specific coprocessors, designing MPP router switches, vision computers, and the application of configurable computing to bioinformatics.

Control of Discrete Event Systems
Cassandras
The Control of Discrete Event Systems (CODES) Laboratory involves faculty and graduate students from the Division of Systems Engineering and operates within the Center for Information and Systems Engineering (CISE). Members of CODES conduct research on modeling, design, analysis, performance evaluation, control, and optimization of a variety of discrete event and hybrid systems including communication and sensor networks, manufacturing, transportation, and command/control. CODES research activities cover a wide spectrum, from basic research to the development of software tools. These activities include:
» Design and real-time control of communication and sensor networks, manufacturing systems, and transportation systems
» Decision support systems for quality-of-service guarantees or optimal performance
» Software testing and verification
» Strategic planning: getting information to decision makers fast and in a comprehensive form
» Developing a new generation of concurrent and parallel simulation tools
» New methods for cooperative control of wirelessly networked devices
» Autonomously reconfigurable systems

Embedded Systems
Qin
Research in embedded systems covers design methods and performance evaluation tools. This includes system level design of embedded multiprocessor systems, fast system simulation techniques using multi-processing, high-level modeling of digital systems, and functional test generation of microprocessors.

Functorial Electromagnetic Analysis
Kotiuga
The Functorial Electromagnetic Analysis laboratory 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.

Imaging Science
Mendillo, Semeter
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 world-wide, and digital signal processing.

A Senior Design team’s auto-tuning electric guitar.
Integrated Nanophotonics and Biosensing Systems
Altug
The capability to confine and manipulate photons at nanometer-length scales can open up unprecedented opportunities in both the fields of classical and quantum information processing, as well as in fundamental life sciences. The Integrated Nanophotonics and Biosensing group is developing nanophotonic devices for optical communications and on-chip biosensing. For communication applications, researchers are developing ultrafast lasers, ultra-efficient light emitting diodes and photonic crystal devices that can slow down light. For biotechnology applications, plasmonic nanostructures and photonic crystal cavities are being used for realization of high-throughput, ultra sensitive, and label free biosensors. To accomplish the group’s goals, new computational modeling and advanced nanofabrication techniques are being developed, including nano/bio-patterning and microfluidics. Its biosafety level-2 lab is capable of cell culturing and includes a modified AFM for surface functionalization. The lab also houses state-of-the art optical measurement equipments and computational clusters.

Lightwave Technology
Morse
One of the few university laboratories capable of designing, fabricating, and characterizing silica optical fibers, Lightwave Technology research focuses on developing new processing techniques for optical fibers, high-power optical fiber lasers, and a variety of optical fiber sensors. Researchers are developing a new technique for combining multimode pump radiation into double clad fibers. The facility consists of a fabrication labora-

tory with three glass lathes including a Nextrom MCVD system, an optical laboratory with numerous pump lasers for fiber lasers, five isolation tables, and an 8m optical fiber draw tower, outfitted with Nextrom widening and control equipment. In addition, there is a CVD laboratory for studies of thin films.

Multi-Dimensional Signal Processing
Karl
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.

Multimedia Communications
Little
The Multimedia Communications Laboratory (MCL) focuses on topics in ubiquitous distributed computing. Current research includes (a) the investigation and development of low-power wireless video camera networks, (b) applications in ecological monitoring using remote cameras, (c) the exploitation of mobility in vehicular networks, (d) visual light communications—communications using LED lighting as the network substrate, and (e) body area networking using multi-tier networking components.

Nano-DNA
Cerrina
DNA is the molecule that encodes the “blueprint” of living organisms. Research in the Nano-DNA laboratory looks at the creation of synthetic DNA by using a combination of techniques from the semiconductor industry, chemistry, and biology. Thus, the work is highly interdisciplinary. Broadly speaking, researchers work in both Nanotechnology and Synthetic Biology. The DNA synthesized can be used to replace natural DNA entirely or in bits and pieces, to create altogether new biological functions and also to create novel nanostructures, where DNA can be used as “smart” construction material. Nanotechnology is based on the ability to fabricate smaller and smaller devices and structures, and the lab studies methods and techniques to push patterning (lithography) to the true nanometer region. For this, beams of electrons
or X-rays are used, and the group collaborates closely with the semiconductor industry. Both experimental work (especially in the DNA area) and theoretical studies (in lithography) are conducted.

**Nano-spectroscopy**

**Swan**

Research in the Nano-spectroscopy Lab uses both elastic and inelastic light scattering to probe properties of nanoparticles, with the largest research effort focused on individual carbon nanotubes. Optical techniques include resonant Rayleigh scattering, interference techniques, resonant Raman scattering, and photo luminescence.

**Network Computing**

**Karpovsky**

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 interfact (SCI), and distributed shared memory; network of workstations (NOW); case studies of high performance scalable networks; and cluster computing.

**Networking and Information Systems**

**Starobinski, Trachtenberg**

This lab is involved in providing novel perspectives to modern networking with emphasis on scalability, heterogeneity, and performance. Its research roots into the mathematical fields of graph theory and algorithms, probability and stochastic processes, and coding theory with applications to content synchronization, network monitoring, wireless spectrum management, and advanced networking for scientific applications.

**Network Optimization and Control**

**Cassandras, Paschalidis**

Research deals with fundamental aspects of optimizing the design and operation of networks as well as designing control algorithms to regulate their operation. Networks are pervasive in a variety of application domains, from computer, communication, and sensor networks to supply chains, distribution networks, and biological networks like protein interaction and metabolic networks. Recent research topics include transmission scheduling in wireless networks, optimal deployment of networks of mobile agents, network routing, network anomaly detection, pricing and resource allocation, network simulation, intelligent warehouse management, protein docking, and optimization of metabolic networks.

**Optical Characterization and Nanophotonics**

**Goldberg, Ünlü, Swan**

Nanophotonics addresses a broad spectrum of optics on the nanometer scale covering technology and basic science. Compared to the behavior of isolated molecules or bulk materials, the behavior of nanostructures exhibit important physical properties not necessarily predictable from observations of either individual constituents or large ensembles. Researchers in this lab develop and apply advanced optical characterization techniques to the study of solid-state and biological phenomena at the nanoscale. Current projects include development of high-resolution subsurface imaging techniques based on numerical aperture increasing lens (NAIL) for the study of semiconductor devices and circuits and spectroscopy of quantum dots; micro resonant Raman and emission spectroscopy of individual carbon nanotubes; biosensors based on microring resonators; and development of new nanoscale microscopy techniques utilizing interference of excitation as well as emission from fluorescent molecules. In addition to microscopy, optical resonance is nearly ubiquitous in the research projects including development of resonant cavity enhanced photodetectors and imaging biosensors for DNA and protein arrays.

**Quantum Communication and Measurement**

**Sergienko**

Research in the Quantum Communication & Measurement (QCM) laboratory focuses on fundamentals of quantum optics and quantum information processing with the purpose of developing quantum-optical communication networks and engineering novel ultra-precise measurement techniques in nanophotonics and life sciences that outperform conventional solutions. Experimental projects include quantum cryptography in metropolitan network, super-resolution phase sensors based on quantum dispersion cancellation effect, quantum imaging and microscopy with spatial aberration cancellation, quantum spectroscopic ellipsometry for characterizing nanoscale devices in semiconductor industry and proteomics, and high-resolution fluorescent correlation spectroscopy and microscopy.

Research and development projects at QCM Laboratory concentrate on:

- Quantum optical device engineering using parametric amplification in specially designed periodically polled nonlinear structures, entanglement manipulation and processing on a chip, micro- and nano-photonics, ultra-fast quantum optics
» High-performance single-photon detection and correlation measurement in a wide spectral range from ultraviolet to mid-infrared and terahertz
» Quantum information processing, quantum communication and cryptography, linear-optical quantum computing, quantum networks
» Quantum bio-photonics: characterization and diagnostic of biological materials and devices in life sciences, picosecond-resolution fluorescent correlation spectroscopy in the visible and in the infrared spectral range for early disease diagnostic

Quantum Photonics
Teich
Research studies in the Quantum Photonics Laboratory (QPL) focus on photonic systems that rely on the quantum properties of light. Experiments are carried out on single-photon detection; the photon-counting statistics of various sources of light; and the response of the human visual system to small numbers of quanta incident at the retina. Investigations are conducted on multi-photon and entangled-photon absorption, photomission, microscopy, and lithography; as well as on nonlinear optical processes such as parametric down-conversion and second-harmonic generation. Research is carried out on quantum-imaging paradigms such as quantum optical coherence tomography (QOCT); photon-counting optical coherence tomography (PCOCT); and digital quantum imaging based on entangled-photonic qubits in spatial-parity space.

Radio Communications and Plasma
Lee, Semeter, Knepper
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 crosschecking the results obtained in the field experiments.

Semiconductor Photonics
Paiella
Semiconductor Photonics research is aimed at the development of novel optoelectronic devices based on artificially-structured material systems, whose properties can be tailored by design to meet specific applications in a way that is not afforded by simply using bulk materials. One important example is that of semiconductor quantum structures, in which nanoscale layers (or wires or dots) of different semiconductor materials are assembled to create an energy landscape in which electrons behave in a markedly quantum-mechanical fashion. By controlling the dimensions and geometry of these structures, one can tune their most basic electronic and optical properties to enable entirely new device concepts—an approach that has become known as bandgap engineering. Heterostructures involving materials with different optical properties (e.g. metals and dielectrics) can also be designed in a similar manner, and used to control the flow of light and its interaction with the underlying matter in novel and often useful ways.

Using this general approach, researchers are investigating several device concepts to address a wide range of applications, literally spanning three orders of magnitude in optical wavelength. These include: light sources tunable by design over a broad portion of the mid- and far-infrared spectrum, including wavelengths currently not accessible with any other semiconductor technology; nonlinear all-optical switching devices for future ultrafast fiber-optic communications; high-efficiency surface-plasmon-enhanced visible LEDs for solid state lighting; and ultraviolet optical modulators based on the quantum confined Stark effect. Research in these areas involves both theoretical and experimental activities, including design and simulations (often based on the proverbial particle-in-a-box problem of quantum mechanics), device fabrication, and electrical and optical characterization.
Sensor Networks
Cassandras, Paschalidis

Sensor networks are formed by a typically large number of small battery-powered nodes that can sense their respective environments, process information, communicate (mostly wirelessly), and on occasions move in their physical environment. Sensor networks give rise to a rapidly expanding array of applications from building/industrial automation, environmental, agricultural, and wildlife monitoring, monitoring of critical infrastructure, and health monitoring. Research spans fundamental problems in the design, optimization, and control of these networks such as energy-aware routing, power management, multi-access control, and optimal coverage. Specific applications and protocols are also investigated including node localization, formation detection, and anomaly detection.

Testing, Reliable, and Secure Computing
Karpovsky, Levitin, Taubin

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. In addition, research is conducted on architectures based on asynchronous circuits for computer security and side-channel attacks resistance.

Visual Information Processing
Konrad

The VIP Laboratory provides computational and visualization infrastructure for research in the area of visual information processing. The topics of interest are: retrieval, analysis, compression, and transmission of visual information, whether in the form of still images, video sequences, or multimedia data. Two research thrusts are currently pursued. Videopsy (video autopsy) is concerned with the analysis of streaming video data from networked cameras. Some of its goals are: segmentation and tracking of moving objects, detection of normal and abnormal events, characterization of object flow patterns. The second thrust is concerned with the analysis, compression and visualization of stereoscopic and multispectral (3-D) imagery. One application of this research is in the next-generation of 3-D multimedia communications, while another is in biomedical visualization. Some of the problems studied are: disparity estimation (correspondence) under occlusions, wavelet-based compression in space-time, data pre-filtering for automultiscopic rendering. 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”).

VLSI and Neural Networks Systems
Hubbard

The VNNS group designs, builds, and tests innovative architectures that span a wide variety of VLSI applications in electrical, biomedical, and defense-related fields. Chips designed using digital and analog integrated circuit methodologies are built using CMOS technologies and tested in the lab. The group is equipped with a full suite of design tools and testing instrumentation for analog and digital systems. Applications include neural-net processing, single-chip large-molecule and DNA analyzers, and chips that emulate the functioning of the mammalian peripheral auditory system for the purpose of weapons classification and localization. Recent work has moved in the direction of algorithm development and FPGA implementations for event-based processing of signals from special-purpose hardware, the prototypes of which originating in the VLSI lab. This hardware is now being advanced by a spun-out, local company started by former students, the second one of which the VNNS Research Lab has produced.

Wide Band Gap Semiconductors
Moustakas

This laboratory investigates 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 research focus is in the development of optical devices (blue, green, and 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, Professor Kevin Smith (Physics) in the area of electronic structure, and Professor Roberto Paiella in the area of devices based on intersubband transitions.
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 the IBM Blue Gene, IBM pSeries 690, an IBM pSeries 655, an Intel Pentium III Linux Cluster, our Deep Vision Display Wall, the Access Grid Conference Facility, the Laboratory for Virtual Environments and the Computer Graphics Laboratory.

CCS offers a Certificate in Computational Science to graduate students in engineering and science pursuing a PhD through a multidisciplinary training program ACES (Advanced Computation in Engineering and Science).

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 Center carries out a wide variety of research in many fields of space physics including space plasma physics; magnetospheric physics; ionospheric physics; atmospheric physics; and planetary and cometary atmospheric studies.

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 a dozen companies to develop new products in data storage, environmental monitoring, optoelectronics, and biotechnology.

In 1997, the University completed the nine-story, 235,000 square-foot Photonics Building to house this ambitious initiative. The $85 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 Infra-red Near-Field Microscopy Laboratory, Optoelectronic Device Characterization Laboratory, Femtosecond Laser Facility, Photocatalysis 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.

Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS)
http://www.censsis.neu.edu

The Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS) is a National Science Foundation (NSF) Engineering Research Center (ERC), one of an elite group of only nineteen ERCs in the nation. 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 man-made structures. CenSSIS is a collaborative effort of four academic institutions: Boston University, Northeastern University, Rensselaer Polytechnic Institute, and the University of Puerto Rico at Mayagüez; and four strategic affiliates: Massachusetts General Hospital, Memorial Sloan-Kettering Cancer Center, 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 a 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. An important outcome of this process is the education of students well-trained in these crucial fields for the future of public health and the preservation of the planet’s physical resources.

Center for Information and 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. Approved by the Trustees in 2002, with management support added in Fall 2002, CISE has raised the visibility of that strength and fostered greater interactions among researchers.

The Center fosters interdisciplinary collaboration and research in emerging applications and the use of methodologies such as Optimization methods, Information theory, Control theory, Applied probability and statistics, Simulation and modeling. Primary application interests are in the areas of automation, robotics, and control; communication, networking and information systems; production, service and supply chain systems; and signal processing and pattern recognition.

As of June 2009, CISE has grown from thirteen to twenty-eight affiliated faculty from the Departments of Mechanical Engineering, Biomedical Engineering, and Electrical & Computer Engineering in the College of Engineering; the Departments of Computer Science and Mathematics & Statistics in the College of Arts and Sciences; and the Department of Operations Management in the School of Management. There are approximately sixty graduate students affiliated through these faculty. CISE maintains a searchable data base of academic “systems” publications authored by the affiliated faculty and their students.

As of November 2004, CISE launched the Sensor Network Consortium (SNC) to facilitate interactions among the academic community and industry participants who support the growth of the sensor network industry through focused research and development activities. The SNC’s goals are to develop, test and
accelerate adoption of sensor network related technologies in strategic applications areas; develop strategic partnerships to access federal and regional research funding; and educate graduate students and facilitate their involvement with industry. Industry participation includes a diverse group of companies, start-ups, system integrators and adopters of sensor network technology that currently includes Arch Rock Corporation, BP International, Ember Corporation, The Hartford, Honeywell, IBM, Millennial Net, Mitre Corporation, SAP, Siemens Building Technologies, Sun Microsystems, and Textron Systems.

Electrical & Computer Engineering Department faculty affiliated with CISE are Professors Alanyali, Baillieul, Carruthers, Cassandras, Castañón, Ishwar, Karl, Levitin, Little, Paschalidis, 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. Professors David Castañón and Ioannis Paschalidis currently serve as Co-Directors of the Center. Several ECE faculty also serve on the CISE Management Committee.

**Center for Remote Sensing**
http://www.bu.edu/remotesensing

The Center was established in 1986 as a facility for scientific research in the fields of archaeology, geography, and geology. The Center uses satellite images and other data from airborne and ground sensors to study the Earth and its resources, particularly groundwater. This includes the monitoring of environmental changes due to both natural processes and human activities. In 1997, the Center was selected by NASA as a "Center of Excellence in Remote Sensing."

**Center for Nanoscience and Nanobiotechnology**
http://nanoscience.bu.edu

Boston University formed the Center for Nanoscience and Nanobiotechnology (CNN) to advance academic and technological research and development by extending discoveries in nanoscale materials and platforms toward applications that examine and seek to understand and manipulate biological systems. The Center serves as a hub for nanoscience researchers from the Charles River and Medical Campuses and builds interdisciplinary research and training. The Center connects scientists and engineers from disparate disciplines with each other in seminars, meetings, joint visitors programs, interdisciplinary courses, industrial collaborations, and seeded projects.

CNN has three core functions: First, to develop interdisciplinary research and education in nanoscience and nanobiotechnology; second, to develop and run an industrial liaison program that partners researchers with external companies for mutual benefit; and third, to connect researchers to resources for technological commercialization. CNN and affiliated faculty are also involved in outreach activities, organizing hands-on activities, discussions, and panels on nanoscience for grade school students and local organizations and museums.

**Smart Lighting Center**
http://smartlighting.bu.edu

The Smart Lighting Center at Boston University (SLC/BU) is part of the National Science Foundation’s Smart Lighting Engineering Research Center (ERC) established in September 2008 by Rensselaer Polytechnic Institute, the University of New Mexico, and Boston University.

The Center focuses on the creation and application of a new generation of smart light sources whose properties are fully controllable and tunable in terms of their spectral composition, color temperature, polarization, and spatial and modulation properties. These solid state light sources, adaptable to myriad requirements and environments, will result in tremendous benefits to society and humankind, including:

- Reduced pollution and global warming through increased energy conservation
- Novel modes of communication, networking, and sensing for enhanced privacy, security and pervasive connectivity
- Increased automobile safety. Localized directional communication provides active braking and collision avoidance
- Fundamental advances in biotechnology including the rapid highly specific identification of cells
- Displays with high efficiency and large color gamut enabled by polarized emitters
- Reduced dependency on sleep-inducing pharmaceuticals, reduced risk of cancer, and better support of the natural circadian rhythm, thereby enabling higher productivity and a better quality of life

These benefits are enabled through the systematic exploration and development of smart-lighting principles in three vertically integrated research thrusts: (i) novel materials, (ii) device technology, and (iii) system applications and impacts.

In addition to these research thrusts, other key components of the Center include an Industrial Advisory Board, to drive industry requirements and technology commercialization; and a network of educational outreach partners, to foster the development of a new, globally competitive science and technology workforce.
Department of Electrical & Computer Engineering
Boston University College of Engineering
Department of Electrical & Computer Engineering

8 Saint Mary's Street, Room 324
Boston, MA 02215

617-353-2811
ece@bu.edu
www.bu.edu/ece