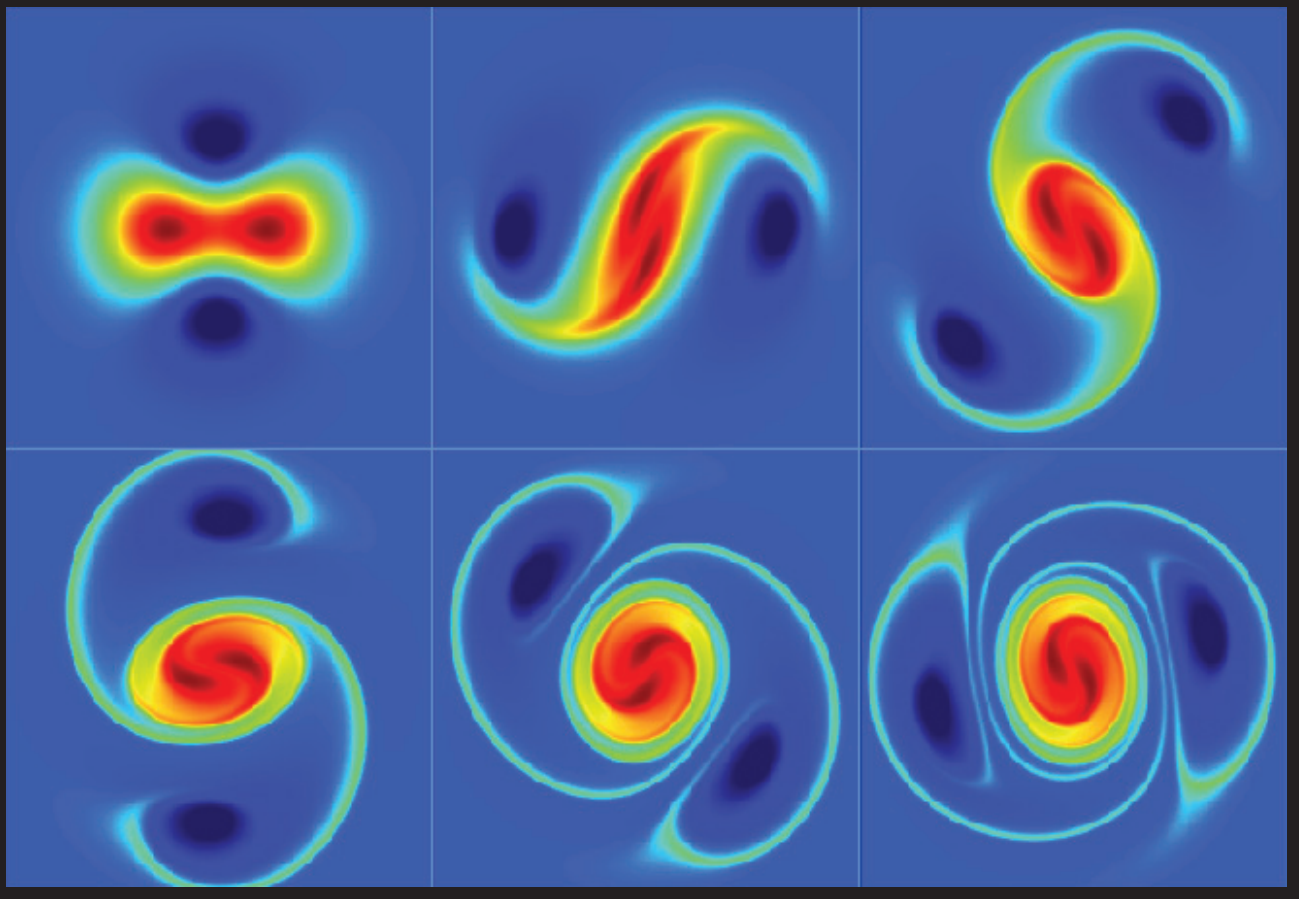
College of Engineering

Annual Report 2009-2010

Department of Mechanical Engineering



BOSTON
UNIVERSITY

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MESSAGE FROM THE CHAIR

Ronald A. Roy

I am pleased to share with you the 2009-2010 edition of the Boston University Department of Mechanical Engineering Annual Report. It has been another year of growth and change as we continue with the phased restructuring of our undergraduate programs, a process that began when the former Manufacturing Engineering and Aerospace and Mechanical Engineering departments merged in 2008 to form a single, unified department. Boasting over 40 full time faculty dedicated to quality undergraduate and graduate instruction and active in a multiplicity of research topics, ME faculty have joint appointments in other Departments and participate heavily in the College's Divisions of Material Science and Engineering and Systems Engineering. Add to the mix almost $10M in new extramural research funding and you have a rich tapestry of applied and basic research activity that cuts across disciplines and offers enhanced breadth and depth of opportunity to our students. Current areas of strength include acoustics and vibrations, automated manufacturing, biomaterials and biomedical applications of mechanical engineering, thermo-fluid sciences, materials engineering and mechanics, energy, MEMS & NEMS, nanobiotechnology, robotics & controls, photonics, and systems engineering.

For students who matriculated as of September 2008, we offer accredited BS degrees in mechanical (ME), aerospace (AE), and manufacturing engineering (MFG). However, the Department is engaged in a 4-year process by which we will discontinue our BS degree programs in AE and MFG and replace them with an accredited ME degree coupled with optional concentrations in aerospace and manufacturing, to go along with new College-wide concentrations in nanotechnology and in energy technologies and environmental engineering. This provides students with the best of both worlds: a solid foundational degree in the highly marketable and intellectually mobile discipline of mechanical engineering, coupled to optional, specialized education in selected sub-disciplines.

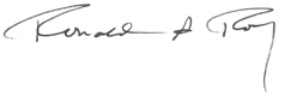
At the graduate level, the department offers the PhD in ME as well as MS degrees in both ME and MFG. Both thesis and non-thesis options are available, and interested students can choose to pursue the MS in manufacturing via distance learning, as part of an international partnership with a consortium of German institutions, or even as a dual MS/MBA degree offered jointly with the School of Management. This programmatic diversity is a direct consequence of the merger, and positions the ME department to respond to new challenges and opportunities in both education and research.

During the 2009-2010 academic year we made new additions to the ranks of ME faculty at both the non-tenured teaching and tenure-track levels. Matthias Schneider joined us from Augsburg, Germany, and Harold Park joined us from the University of Colorado, Boulder. New additions to the ranks of teaching faculty include Dr. Caleb Farny and Dr. William Hauser.

A number of ME faculty members received well-deserved awards. Greg McDaniel received Boston University's principal teaching award, the Metcalf Cup and Prize. Ronald Roy was awarded the Helmholtz-Rayleigh Silver Medal of the Acoustical Society of America. Harold Park received the 2009 Richard H. Gallagher Young Investigator Award from the United States Association for Computational Mechanics. Several faculty received College of Engineering teaching, research and service awards, and the department benefitted from a number of young faculty and foundation awards.

In 2009-2010, the ME department featured a total undergraduate enrollment of 456 and conferred 99 bachelor of science degrees in ME, AE, and MFG. The ME faculty supported approximately 158 MS/PhD students, to whom 33 degrees were conferred in ME, MFG, and other graduate programs within the College. It is important to stress that the ME faculty research portfolio is extremely diverse and cross-cutting. ME professors serve as principal investigator on grants administered by numerous College departments and research centers, as well as the BU Medical Center. Indeed, almost 40% of the PhD students supported by ME faculty are earning degrees in programs outside of mechanical engineering, such as BME, ECE, or one of the Divisions.

It is both an honor and a challenge to lead the new BU Department of Mechanical Engineering into the future. The next few years will witness exciting changes in our research portfolio, faculty demographics, and degree programs. I invite you to peruse the Report and learn more about the depth and breadth of our programs, the spectrum of student activities, profiles of award-winning faculty, research interests, and facilities.



Ronald A. Roy
Professor and Chair
Department of Mechanical Engineering

OVERVIEW

Highlights

Fiscal Year 2010 was a very active year that saw many accomplishments on all fronts. In only the second year for the "new" Department of Mechanical Engineering – the result of a merger of the Departments of Aerospace and Mechanical Engineering (AME) and Manufacturing Engineering (MFG) – we continued to strengthen all aspects of the Department. The two-year process of updating the undergraduate ME curriculum culminated in a new design sequence, and the focus of the Department shifted to the graduate programs. The list of specific activities and accomplishments is too long to address here. Rather than launch into a lengthy narrative, we instead provide an itemized summary of the activities in a number of areas, some of which are expanded upon in other sections of this Report.

PROGRAMMATIC HIGHLIGHTS

• We created a 10 Year Plan for the Department.

• We strengthened our design sequence for ME undergraduates with the adoption of new courses and an enhanced senior capstone experience.

• We voted to create two new professional Masters degrees: an MEng in Mechanical Engineering, and an MEng in Manufacturing Engineering.

• We continued the Distance Learning Program in MFG, and began the process of expanding that to the proposed professional MEng degrees, and to new certificate programs in topical areas such as engineering management.

• We began the process of creating a Visiting Committee for the Department.

• We had an extremely successful faculty recruiting season, and for the first time in decades hired teaching faculty, see page 12.

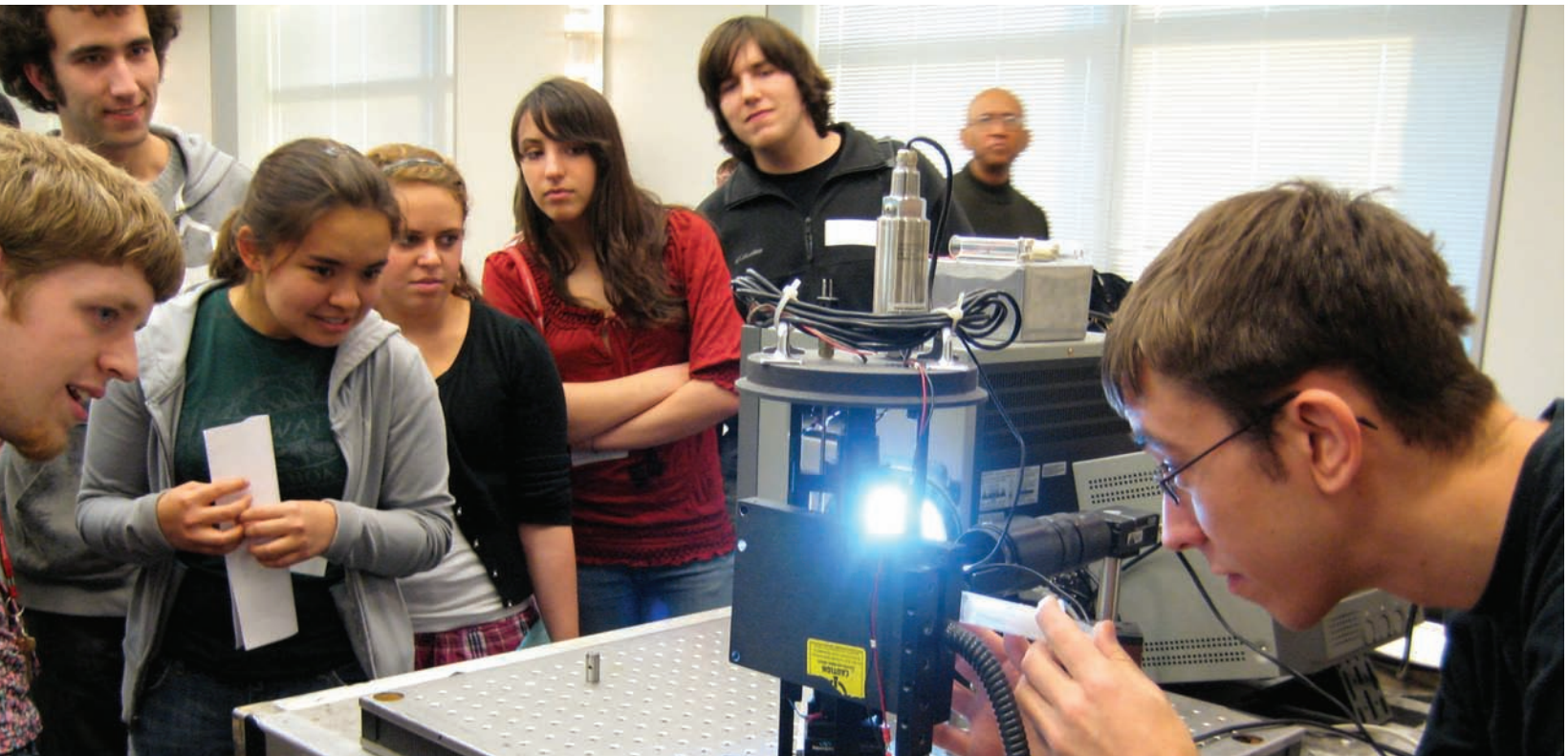
• We created an exciting new web site for the Department.

• We completely renovated the previous MFG computer lab housed in 730 Commonwealth Avenue and turned it into a suite of graduate students offices and an adjoining lounge for faculty and grad students.

• We updated the foyer and main hallway spaces in the primary ME departmental building – 110 Cummington Street.

• We had a very successful ABET review.

Mechanical Engineering Open House in November 2009.



EVENTS

Senior Project Days

Senior Project Days are a forum for Mechanical, Aerospace, and Manufacturing Engineering seniors to present their Capstone projects. With three active programs presenting on two separate days, we were treated to a full slate of presentations covering a broad range of topics. 30 April 2010 and 3 May 2010.

Department Social / Awards Ceremony

The annual ME Department Social and Awards Ceremony was held as a lunch event during the ME Senior Project Day, to celebrate the seniors and present the annual awards for Professor of the Year, GTF of the Year, and the Design Portfolio Contest winners. 3 May 2010.

Student-Alumni Dinners

Two dinners were held in which students, alumni, faculty and staff could interact in informal settings. In the fall, we had a BBQ dinner to which all department seniors were invited to mingle with alumni and faculty. The College Career Development Office co-sponsored a more formal networking alumni dinner "Networking@ME" in March in which juniors and seniors were invited to a more structured networking event. 10 November 2009 and 29 March 2010.

Mechanical Engineering Open House

Our annual Open House featured a blend of informational tables, technical demonstrations, poster presentations of undergraduate and graduate research, and exceptional baked goods from the kitchens of several faculty and staff. 20 November 2009.

Design Portfolio Workshops

This year we held two Design Portfolio Workshops: one as part of the Open House in November, and another one in March. November 2009 and March 2010.

Freshman, Sophomore, and Junior Class Meetings

The ME Chair, the undergraduate Associate Chairs, interested faculty, and the Undergraduate Coordinator meet annually in the spring with the undergraduates in all three programs to discuss issues and topics of their choosing. This year, the College introduced a "Town Meeting" for the freshmen for the same purpose, so the ME Department met only with the sophomores and juniors. We also added a "Feedback Forum" in the fall for all undergraduates in the ME department.

Senior Exit Interviews

The ME Chair and the Undergraduate Coordinator meet annually with the seniors of all three programs to get feedback on the programs and discuss issues and topics of their choosing. Three different dates in May 2010.

ABET Visit Pub Quiz

To prepare the faculty for the Fall 2009 ABET Site Visit, an "ABET Pub Quiz" was held the week before the visit. November 2009.

New Faculty Orientation

Before the start of the spring semester, the undergraduate Associate Chairs held an orientation to the undergraduate program for the new faculty members. This was deemed to be very useful and will be repeated and perhaps expanded in the future. January 2010.

Research Symposium

A research symposium was held in the fall for graduate students. Faculty presented their areas of research, and described potential projects and thesis topics. 13 November 2009.

Graduate Open House

An open house was held in the spring for students accepted into the graduate programs. 19 March 2010.

Undergraduate Program Highlights

Mechanical Engineering

The undergraduate Mechanical Engineering program has been under the process of undergoing substantial revisions, particularly in the design sequence. The notable activities related to the ME program in the Academic Year 09-10 are itemized below.

•We received very positive feedback from the ABET accreditation visit team.

• We created a "Latest Curriculum Updates" page on our web site to keep students informed of all curricular changes.

• We expanded the options for Advanced Elective courses by allowing students to take any 300 level or above Engineering course and also SMG SI 480. This gives students more flexibility to choose any concentration without taking additional courses.

• The Design Committee completed the improvements in the design sequence. As part of this, we created two new courses ME 359 Introduction to CAD and Machine Components and ME 460 Electro-Mechanical Systems Design. The senior capstone course was modified to ME 461 Mechanical Engineering Capstone Experience. We also renumbered the MFG course ME 415 Product Design to ME 360 Product Design. These four courses will become required courses in the ME curriculum for graduates in 2013 and beyond.

• We created a new 2-credit course ME 366 Probability and Statistics for Mechanical Engineers to complement the existing 2-credit EK 102 Introduction to Linear Algebra as the replacement for ME 400 Engineering Mathematics.

• A subset of the ME undergraduate committee was awarded a "Redesigning the Undergraduate Learning Experience (RULE)" grant from the University to revamp EK 301 Introduction to Engineering Mechanics. The pre-proposal is to incorporate a more active learning environment using tablet computers to facilitate interaction between the instructor and student teams.

• We improved the continuous improvement process itself through the creation of Course Review Panels which will begin meeting in the Fall of 2010.

• We phased out courses ME 311, ME 312, and ME 400.

• Prof. Wroblewski began incorporating Coherent Application Threads (CATs) throughout the curriculum. The first CAT application, wind turbines, was introduced in EK 127, EK 301, and ME 303.

• We developed a ME track in the Engineering Science minor, to be offered to non-engineering BU students.

Manufacturing Engineering

The undergraduate Manufacturing Engineering (MFG) program accepted its last freshman class in the fall of 2008. We are now in a process in which the degree program will be phased out by 2012. Students with an interest in manufacturing engineering will instead be offered the option of taking a concentration in the discipline, in which the four ME advanced electives are satisfied by four courses from the MFG curriculum, along with a required experiential component that could be satisfied by the Capstone project, undergraduate research, or an industry experience. Currently we are in a transitional period in which upperclassmen can choose the MFG major or concentration. Other notable AY 09-10 activities related to the MFG program are itemized below.

• We expanded the options for Advanced Elective courses by allowing students to take any 300 level or above Engineering course and also SMG SI 480. This gives students more flexibility to choose any concentration without taking additional courses.

• We created a "Latest Curriculum Updates" page on our web site to keep students informed of all curricular changes.

• We phased out course ME 266, which was part of the MFG curriculum but will not be retained for the concentration.

• We received very positive feedback from the ABET accreditation visit team on our termination plan.

• The Design Committee completed the improvements in the Mechanical Engineering design sequence. As part of this, the Product Design course that had been a required Manufacturing Engineering course was added to the ME required design sequence. The course was renumbered from ME 415 Product Design to ME 360 Product Design.

• The annual Manufacturing Senior Lunch was held at the home of Professors Attaway and de Winter in April 2010.

Aerospace Engineering

The undergraduate Aerospace Engineering (AE) program accepted its last freshman class in the fall of 2008. We are now in a process in which the degree program will be phased out by 2012. Students with an interest in aerospace engineering will instead be offered the option of taking a concentration in the discipline, in which the four ME advanced electives are satisfied by four courses from the AE curriculum, along with a required experiential component that could be satisfied by the Capstone project, undergraduate research, or an industry experience. Currently we are in a transitional period in which upperclassmen can choose the AE major or concentration. Other notable AY 09-10 activities related to the AE program are itemized below.

• We created a "Latest Curriculum Updates" page on our web site to keep students informed of all curricular changes.

• We expanded the options for Technical Elective courses by allowing students to take any 300 level or above Engineering course and also SMG SI 480. This gives students more flexibility to choose any concentration without taking additional courses.

• The AIAA student chapter successfully hosted the 2010 AIAA Region 1- Northeast Student Conference in April.

• We created a new course ME 321 Introduction to Aerospace Engineering, a 4 credit course to replace the two 2-credit courses ME 201 and ME 202 for the concentration.

• We phased out courses ME 201 and ME 202.

• We changed the junior math and design components to map onto the new ME requirements for graduates in 2012.

• We received very positive feedback from the ABET accreditation visit team on our termination plan.

• We had our first graduates with BS degrees in ME with the Aerospace Engineering concentration.

Professor Wroblewski's Herding CATS:

Weaving Coherent Application Threads through the ME Curriculum to Facilitate Course-to-Course Connectivity and Improve Material Retention

Coherent **A**pplication **T**hreads (CATs) are specific engineering application examples that will be woven through the fabric of the Mechanical Engineering (ME) curriculum, exposing students to the varied aspects of one application in the context of their technical courses. The idea is to improve connectivity not only among courses along a common pre-requisite path (e.g., thermal-fluids) but among dissimilar ones as well. CATs will be topics of current interest, mostly connected to department research thrust areas and concentrations. Ideally, they will follow cohorts through their 4 year curriculum. The concept of pre-requisite is backward looking, requiring students to search among the ocean of concepts learned in previous semesters to find those needed to move ahead.

Professor Wroblewski explains aerodynamics with CATs wind turbine.

The idea of Coherent Application Threads is more forward looking, providing waypoints that not only remind students where they've been, but more importantly where they're going. Though the main motivation for CATs is material retention, they also address other key pedagogical and curriculum issues, including: framing engineering topics in the larger societal context; coupling of disparate topics to expose students to the systems aspect of engineering; exposing students to the importance of lifelong learning; and engaging students through topics of current interest. Specific implementation of CATs will include: lecture modules, projects, homework problems, example problems, and laboratory experiences. These will all be integrated through a Website, that will provide a framework for the coursework, as well as a portal for independent inquiry into related topics. This project is one of two inaugural Innovative Engineering Education Faculty Fellowship, funded through the College of Engineering.

Graduate Program Highlights

The ME Department currently has the following graduate degree programs:

- MS in Mechanical Engineering
- PhD in Mechanical Engineering
- MS in Manufacturing Engineering
- MS in Global Manufacturing
- MS in Manufacturing with an MBA (dual degree program with the School of Management)

It is important to note that several ME faculty have secondary appointments in other Departments and are members of both the Division of Systems Engineering and the Division of Material Science and Engineering. These faculty advise and financially support students in both Divisions as well as students in the PhD programs in both ECE and BME. Details regarding enrollments, completed degrees, and awards related to the Graduate Programs are given elsewhere in this Report. Below is a short list of graduate program activities for FY 2010.

• We created a new Qualifying Exam that reflects the needs and scope of the newly merged Department.

• We began the process of proposing new professional Masters degrees: MEng in Mechanical Engineering, and MEng in Manufacturing Engineering.

• We continued the Distance Learning Program in MFG, and began the process of expanding that to the proposed professional MEng degrees.

• We began the process of creating new certificate programs as part of the Distance Learning Program, in topical areas related to the research strengths of the Department.

• We created a Research Symposium to better acquaint our graduate students with the research activities within the ME Department.

Faculty Awards

KAMIL EKINCI was named the 2010 **Distinguished Faculty Fellow** by the College of Engineering, BU.

J. GREGORY McDANIEL was awarded the **2010 Metcalf Cup and Prize**, Boston University's highest honor for teaching excellence. Professor McDaniel was also the recipient of the **2010 Award for Teaching Excellence** in the Department of Mechanical Engineering, conferred May 3, 2010.

ELISE MORGAN received the **NIH National Research Service Award for Senior Fellows**.

HAROLD PARK received the **2009 Richard H. Gallagher Young Investigator Award** from the United States Association for Computational Mechanics. It is awarded once every 2 years to a single recipient, and "recognizes outstanding accomplishments by researchers of 40 years or younger." He was given the Gallagher award for "groundbreaking work on computational nano mechanics and materials."

TYRONE PORTER was the recipient of the 2010 Educator Award bestowed by the Boston Chapter of the National Association of Negro Business and Professional Women's Club.

RONALD A. ROY received the Helmholtz-Rayleigh Interdisciplinary Silver Medal of the Acoustical Society of America. Professor Roy also gave the Plenary Lecture at the 2010 meeting on Advanced Metrology for Ultrasound in Medicine, London, UK.

DON WROBLEWSKI was awarded the **Innovative Engineering Education Faculty Fellowship 2009-2011**.

KATHERINE ZHANG was the winner of the **NSF CAREER Award**.

J. Gregory McDaniel Awarded the 2010 Metcalf Cup and Prize

President Robert Brown's address:

Professor J. Gregory McDaniel unites stimulating teaching with groundbreaking research. His passion is to communicate to students the excitement of mechanical engineering, in particular the wonders of mechanical vibrations and acoustics. Ever the teacher, he confesses: "Vibration is the last thing I think about before I go to sleep and the first thing that I think about when I wake up. I believe that it has the power to change the world and I believe that it has the power to change every single student who learns it."

Professor McDaniel strives to be a "student of the student," to determine the students' needs, to engage them, and then to teach, guided by the group dynamic. He weaves into his lectures stories about his research, which ranges from automotive brake squeal remediation to ocean wave energy harvesting to fundamental studies of vibration-based risk assessment by red-eyed treefrogs. A student notes that these anecdotes are frequently followed by a "cheerful bout of baritone laughter!"

His students praise him as "a dynamic and powerful communicator, able to make complex subjects understandable," and they note with gratitude "his selfless commitment to students." "It is great to have a professor who is so excited about a subject!" "Professor McDaniel is the man. There's no question," one senior concluded.

Professor McDaniel has contributed to outreach and community service, attracting under-represented students to engineering, founding the Boston University chapter of Engineers Without Borders, and helping that group to launch a successful project in Chirimoto, Peru. Most notably, he taught and mentored Peter Wal, a Sudanese refugee who survived unspeakable atrocities and went on to study engineering in college.

Inspired teacher, dedicated mentor, and champion of diversity, Professor McDaniel has enriched and changed the lives of countless students and made the field of engineering more accessible.


EXIT

FACULTY AND STAFF

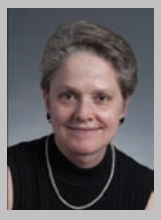
Faculty

Sean Andersson

Assistant Professor

Robotics , Control Theory, Scanning probe microscopy, Symbolic-based control

* PhD University of Maryland, College Park 2003
* Associate Editor, Conference Editorial Board, IEEE Control Systems Society and Robotics and Automation Society
* 2009 NSF CAREER Award



Stormy Attaway

Assistant Professor &
Associate Chair (MFG Undergraduate Program)

Educational methods, Computer programming for engineers

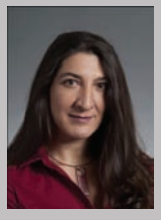
* PhD Boston University 1988
* 1995 BU College of Engineering Faculty Service Award
* 2001 BU College of Engineering Faculty Service Award

John Baillieul

Professor

Robotics, Control of mechanical systems,Mathematical system theory, Information-based control theory

* PhD Harvard University 1975
* 1992 Fellow of the IEEE, 2009 Inaugural Fellow of SIAM
* 2000 IEEE Third Millennium Medal
* 2008 Inaugural Distinguished Lecturer Series Award College of Engineering, Boston University

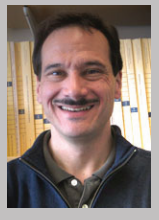


Lorena A. Barba

Assistant Professor

Fluid dynamics, Novel computer architectures, Particle methods used for fluid simulation

* PhD California Institute of Technology 2004
* 2008 Rising Star Teaching Award for the Faculty of Science, University of Bristol, UK



Paul Barbone

Associate Professor

Theoretical & computational (bio) mechanics and (bio) acoustics, Medical (ultrasound) imaging, Inverse problems, Finite element methods

* PhD Stanford University 1991
* 1995 Young Investigator Award ONR
* 2000 Fulbright Distiguished Scholar Award
* 2007 Fellow of Acoustical Society of America

Eytan Barouch

Professor

Simulation of industrial processes, Numerical analysis, Algorithm development

* PhD University of New York at Stony Brook 1969

Soumendra Basu

Professor & Associate Division Head, Division of Materials Science and Engineering

Thin films for energy, photonic, electronic, and superconducting applications; thermal barrier and environmental barrier coatings for gas turbine and fuel cell applications; environmental degradation of materials at elevated temperatures; structure and stability of interfaces

* PhD Massachusetts Institute of Technology 1989

Calin Belta

Assistant Professor

Verification and control of dynamical systems, Hybrid systems, Symbolic control, Robot motion planning and control, Gene and metabolic networks

* PhD University of Pennsylvania 2003
* 1997 Fulbright Study Award
* 2005 NSF CAREER Award
* 2008 AFOSR Young Investigator Award

James Bethune

Associate Professor

Computer-aided Design

* EdD Boston University 1991
* 1981 College of Engineering Professor of the Year
* 1994 Alumni of the Year

Thomas Bifano

Professor and Director, Photonics Center

Deformable Mirrors, Microelectromechanical Systems (MEMS) Adaptive Optics, Biphotonic Microscopy, Astronomical Telescope, Instrumentation, Laser Wavefront Control

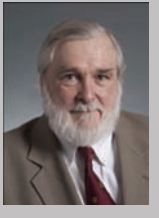
* PhD North Carolina State University 1988
* Associate Editor, Journal of Micro/Nanolithography, MEMS and MOEMS
* 2009 Bepi Colombo Prize

Michael Caramanis

Professor

Mathematical programming, control and stochastic systems

* PhD Harvard University 1976
* 2004 BU College of Engineering Service Award
* Past Editor, IIE Transactions in Design and Manufacturing
* Member of editorial board, IIE Transactions in Design and Manufacturing



William Carey

Professor

Underwater Autonomous Systems, Multiphase media, Acoustic arrays, Vibration and Acoustic Signal Processing, Sound Radiation and Scattering

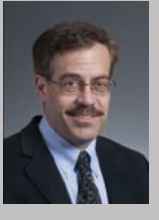
* PhD The Catholic University of America 1974
* Fellow of Acoustical Society of America and IEEE
* Past Chief Editor, IEEE Journal of Oceanic Engineering
* 2007 Silver Medal of Acoustical Society of America

Robin Cleveland

Associate Professor

Shock Wave Lithotripsy, Acoustic Imaging, Medical Ultrasonics, Sonic Boom Propagation

* PhD University of Texas at Austin 1995
* 1995 F. V. Hunt Fellow of ASA
* 2000 R. Bruce Lindsay Award of the Acoustical Society of America
* 2009 ME Department Award of Teaching Excellence



Daniel Cole

Associate Professor

Manufacturing of semiconductor devices, Electrodynamic systems, Microlithography simulation models and methods

* PhD City University of New York 1985
* Reviewer for several journals
* 2005, 2007, 2008 MFG Department Award of Teaching Excellence

On the left, faculty members of the Mechanical Engineering Department in May 2010.

Theo de Winter

Associate Professor

Superconductivity, Cryogenics, Heat transfer, Product design, Magnetic systems application

* MechE MIT 1961
* 1985, 1988, 2000, 2007 College of Engineering Professor of the Year
* 1997 College of Engineering Faculty Service Award
* 2002 BU Metcalf Award for Excellence in Teaching

Kamil Ekinci

Associate Professor

Nanomechanics, Nanofluidics, Nanophotonics, Applications of MEMS and NEMS

* PhD Brown University 1999
* 2007 NSF CAREER Award
* 2007 BU College of Engineering Dean's Catalyst Award

Caleb Farny

Lecturer

Physical acoustics, Medical therapeutic and diagnostic ultrasound applications, Cavitation detection, Transcranial ultrasound imaging

* PhD Boston University 2007

Michael Gevelber

Associate Professor

Electrospinning of nanofibers, Plasma spray, Ebeam deposition, Crystal growth, CVD

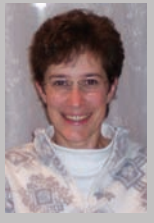
* PhD Massachusetts Institute of Technology 1988

Srikanth Gopalan

Associate Professor

Fuel cells, Chemical thermodynamics, Kinetics and transport phenomena to model the behavior of electrochemical systems

* PhD University of Utah 1997

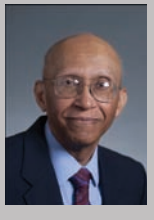


Sheryl Grace

Associate Professor

Aerodynamics, Fluid dynamics, Acoustics

* PhD University of Notre Dame 1995
* 2001 AIAA National Faculty Advisor Award
* 2002 BU College of Engineering Faculty Service Award
* 2005 AIAA Associate Fellow



William Hauser

Associate Professor of the Practice

* PhD Massachusetts Institute of Technology 1973

Yehonathan Hazony

Professor

Computer methods for industrial automation, Robotics and education

* PhD Hebrew University, Israel 1965
* 1979 American Chemical Society's Arthur K. Doolittle Award

R. Glynn Holt

Associate Professor

Physical Acoustics, Sonoluminescence, Rheology of Foam, Biomedical Acoustics and High-Intensity Focused Ultrasound

* PhD University of Mississippi 1988
* 2008 Fellow, Acoustical Society of America

Michael Howe

Professor

Fluid mechanics, Acoustics, Structural vibrations

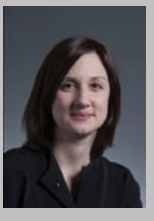
* PhD Imperial College, England 1969
* Fellow, Acoustical Society of America
* Fellow, Institute of Acoustics, UK
* 2000 Per Bruel Gold Medal of the ASME
* 2007 Rayleigh Medal of the Institute of Acoustics

Mort Isaacson

Associate Professor

Engineering education, Engineering ethics, Interdisciplinary interactions between technology and society

* PhD Massachusetts Institute of Technology 1974
* 1993 and 1998 BU College of Engineering, Faculty Service Award



Catherine Klapperich

Assistant Professor

Nanomechanics of hydrated biomaterials implants, Tissue engineering scaffold materials, Drug delivery, Bio-micro electromechanical systems (BioMEMs)

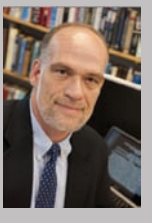
* PhD University of California, Berkeley 2000
* 1994-1997 NSF Graduate Research Fellowship

Xi Lin

Assistant Professor

Materials theory, Predictive simulation of materials electronic, optical, magnetic, and mechanical properties

* PhD Massachusetts Institute of Technology 2003



J. Gregory McDaniel

Associate Professor &
Associate Chair (ME Undergraduate Program)

Structural acoustics, Automotive brake squeal, Biological vibrations, Ocean wave energy

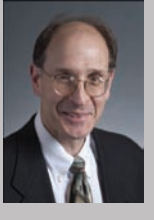
* PhD The Georgia Institute of Technology 1992
* 2000 NSF CAREER Award
* 2006 Fellow, Acoustical Society of America
* 2010 Metcalf Cup and Prize for Teaching Excellence

Elise Morgan

Associate Professor

Mechanical behavior of biological materials, Mechanical stimulation of tissue differentiation, Micromechanics of multiscale media, Damage mechanics

* PhD University of California, Berkeley 2002
* 2005 International Osteoporosis Foundation–Servier Young Investigator Research Award
* 2009 Early Career Research Excellence Award, BU COE



Ray Nagem

Associate Professor

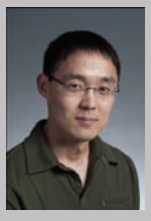
Structural dynamics, Random vibration, Wave propagation, Inverse problems

* PhD Massachusetts Institute of Technology 1988
* 1999 BU Metcalf Award for Excellence in Teaching
* 2002, 2003, 2009 BU COE Professor of the Year
* 2008 BU Department of Aerospace and Mechanical Engineering Award for Teaching Excellence

Uday Pal

Professor &
Division Head, Division of Materials Science and Engineering
Fuel cells, Chemical thermodynamics, Kinetics and transport phenomena to model the behavior of electro-chemical systems

* PhD Pennsylvania State University 1984
* Principal Editor, Journal of Materials Research
* 2010 BU COE Dean's Catalyst Award



Harold Park

Assistant Professor
Computational nanomechanics, Surface effects on the behavior and properties of nanomaterials

* PhD Northwestern University 2004
* 2007 NSF CAREER award
* 2008 DARPA Young Faculty Award
* 2009 Gallagher Young Investigator Award from the US Association for Computational Mechanics (USACM).

James R. Perkins

Associate Professor
Real-time scheduling and control of manufacturing systems' supply chain management, Resource pricing and congestion control in communications networks

* PhD University of Illinois, Urbana-Champaign 1993
* 2002-2004 Department of Manufacturing Engineering Award for Teaching Excellence

Allan Pierce

Professor
Wave propagation and scattering in heterogeneous materials, Acoustical oceanography, underwater sound, Wind turbines, Structural acoustics and vibrations

* PhD Massachusetts Institute of Technology 1962
* 1992 Rayleigh Lecturer, ASME
* 1995 Per Bruel Gold Medal, ASME
* Editor-in-Chief, Journal of the Acoustical Society of America

Tyrone Porter

Assistant Professor
Integration of ultrasound technologies with chemical and biomolecular engineered vesicles for diagnostic and therapeutic applications

* PhD University of Washington 2003
* 2003 Acoustical Society of America (ASA) Frederick V. Hunt Postdoctoral Fellowship
* 2008 ASA R. Bruce Lindsay Young Investigator Award

Ronald A. Roy

Professor & Chairman
Physical acoustics, Medical ultrasonics for imaging and therapy, Bubble dynamics, Nonlinear acoustics, Acousto optics

* PhD Yale University 1987
* 1993 Fellow of the Acoustical Society of America
* 2006-2007 65th George Eastman Distinguished Visiting Professor, University of Oxford, UK
* 2010 Helmholtz-Rayleigh Interdisciplinary Silver Medal of ASA

Vinod K. Sarin

Professor
Materials Science, Surface Modification, Physical and Chemical Vapor Deposition, Consolidation of Ceramics/Composites, Structure/Property Correlations, Transparent Optical Ceramics, Scintallator Materials

* PhD Massachusetts Institute of Technology 1971
* 1984 GTE's Leslie H. Warner Achievement Award
* Over 80 US and International Patents

Matthias Schneider

Assistant Professor
Biological physics: thermodynamics of interfaces; physics of nerves and senses; cell adaptation; Nanotechnology for life science; Surface acoustic waves; microfluidics; blood clotting

* PhD University of Munich 2003

Andre Sharon

Professor &
Director, Fraunhofer Center for Manufacturing Innovation
Electromechanical machine design, controls, automation, biotech/biomedical instrumentation, devices, rapid micro-diagnostics platforms

* PhD Massachusetts Institute of Technology 1988
* Editor-in-Chief International Journal of Robotics and Computer Integrated Manufacturing

Pirooz Vakili

Associate Professor &
Associate Division Head, Division of Systems Engineering
Monte Carlo simulation and optimization, Control and management of manufacturing and communication systems, Product development management, Computational finance, Computational biology

* PhD Harvard University 1989

Hua Wang

Associate Professor
Control of nonlinear dynamics, intelligent systems and control, complex networks, cooperative control, robotics, applications in biological, energy and aerospace systems

* PhD University of Maryland, College Park, 1993
* 2000 Cheung Kong Scholar, Ministry of Education, China and Li Ka Shing Foundation, Hong Kong, China
* 2001 Senior Member IEEE

Donald Wroblewski

Associate Professor &
Associate Chair (AERO Undergraduate Program)
Experimental fluid mechanics and heat transfer, Atmospheric turbulence, Plasma deposition

* PhD University of California, Berkeley 1990
* 2006 NRC/Air Force Senior Associateship Award
* 1999 and 2006 Aerospace and Mechanical Engineering Department Award for Teaching Excellence

Victor Yakhot

Professor
Turbulence theory, Modeling and large-scale engineering simulations, Industrial CFD, Heat transfer, Mixing and combustion, Lattice Boltzmann methods for flow computations, Non-Newtonian fluids, Nanotechnology and nanofluidics

* PhD Moscow State University, Russia 1971
* 2007 Aerospace and Mechanical Engineering Department Award for Excellence in Teaching

Katherine Yanhang Zhang

Clare Boothe Luce Assistant Professor
Mechanical behavior of soft biological tissue, Cardiovascular mechanics, Multi-scale modeling of biological composites, Micro- and nano- mechanics of thin film devices

* PhD University of Colorado at Boulder 2003
* 2006 Clare Boothe Luce Assistant Professorship
* 2007 Young Faculty Award DARPA/MTO
* 2010 NSF CAREER Award

Xin Zhang

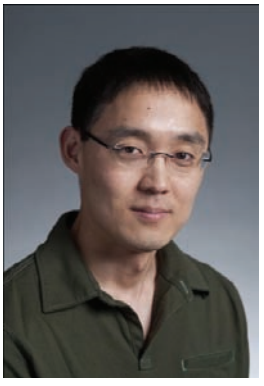
Associate Professor &
Associate Chair (Graduate Program)
Microelectromechanical Systems (MEMS)/NEMS; Specific issues related to materials science, micro/nanomechanics and micro/nanofabrication technologies motivated by practical applications in micro and nanoscale engineering

* PhD Hong Kong University of Science and Technology 1998
* 2003 NSF Faculty CAREER Award
* 2008 COE Distinguished Faculty Fellow

New Faculty

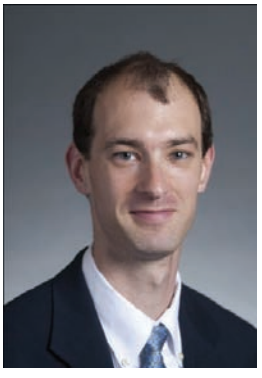
MATTHIAS SCHNEIDER

In September, 2009 Matthias Schneider joined us from Augsburg, Germany, where he was serving as an Assistant Professor of Physics. He received his PhD in Physics from the Max Planck Institute for Biophysical Chemistry and boasts a research portfolio aimed at achieving an enhanced physical understanding of biological processes. Physical concepts (thermodynamics) as well as new nanotechnologies (surface acoustic waves) are used to unravel the fundamental principles of nerve communication and blood clotting. The goal is to untangle the complexity of biological processes and find a unified explanation or law of seemingly independent phenomena in nature.



HAROLD PARK

In January 2010, the Department welcomed the arrival of Assistant Professor Harold Park, who joined us from the University of Colorado, Boulder, where he had served as an Assistant Professor of Mechanical Engineering. Professor Park received his PhD from Northwestern University. His research is focused on developing and utilizing both atomistic and multiscale modeling approaches to understand surface effects on the behavior and properties of low-dimensional nanostructures such as nanowires and graphene. Professor Park's efforts have resulted in 40 refereed journal publications. He is also the recipient of a 2007 NSF CAREER award, a 2008 DARPA Young Faculty Award, and the 2009 Gallagher Young Investigator Award from the US Association for Computational Mechanics (USACM).



CALEB FARNY

Dr. Caleb Farny joined the Department as an Instructor in January, 2010. Dr. Farny received his PhD from Boston University and has been serving on the research staff of the Focused Ultrasound Surgery Laboratory of Brigham and Women's Hospital, Harvard Medical School. His research interests center on physical acoustics, with a focus on medical applications of ultrasound. His past research has examined effects of bubble cavitation on ultrasound-induced heating in tissue, and diagnostic methods for detecting the presence and location of cavitation during sonication. Most recently he has focused on developing novel methods for imaging brain structure through the skull with ultrasound. Dr. Farny will coordinate the core Engineering Mechanics course for the College of Engineering.

WILLIAM HAUSER

Finally we are please to announce that Prof. William Hauser has been appointed the first Associate Professor of the Practice in the College of Engineering. Formerly on the MFG Department's adjunct teaching staff, Professor Hauser brings substantial industrial experience into the classroom, having served as designer of manufacturing machinery, a designer of specialized construction equipment, a supervisor of engineers performing mechanical design of telecoms equipment, a leader of design departments that spanned multiple engineering disciplines, and a leader of New Product Introduction process improvement teams that bridged the interface between product design and product manufacture. Professor Hauser received his PhD from MIT. He'll be teaching courses that reside at the intersection of engineering practice and business and taking a lead role in supervising senior capstone and independent study projects.

Secondary Faculty

ADJUNCT TEACHING FACULTY

Frank DiBella	Senior Lecturer
Jason Holmes	Lecturer
Peter Kerney	Senior Lecturer
Michael Koplow	Senior Lecturer
William J. Palm	Lecturer

AFFILIATED AND ADJUNCT FACULTY

Mary Bouxsein	Adjunct Assistant Professor
Robert Brown	Professor, University President
Hudong Chen	Adjunct Professor
Robert C. Dean Jr.	Adjunct Professor
Pierre Dupont	Adjunct Professor
Theodore Fritz	Professor
James F. Lynch	Adjunct Professor
Todd Murray	Adjunct Associate Professor
Guido Sandri	Adjunct Professor
Xiaowen Shan	Adjunct Professor

RESEARCH FACULTY

Yunze Cai	Postdoctoral Research Associate
Anirban Chatterjee	Postdoctoral Research Associate
Xu Chu Ding	Postdoctoral Research Associate
Richard B. Evans	Research Associate
Helen Fawcett	Research Assistant Professor
Gonzalo R. Feijoo	Research Assistant Professor
Minghai (Timothy) Li	Research Assistant
Robert Lund	Adjunct Professor
Nicholas Manzi	Research Assistant
James McLaughlan	Research Assistant Professor
Ashwin Sampathkumar	Postdoctoral Research Associate
Jana Tumova	Visiting Scholar
Ginu U. Unnikrishnan	Postdoctoral Research Associate
Yanli Zou	Postdoctoral Research Associate

Staff

ADMINISTRATIVE STAFF

James Langell	Director
Andrew Abrahamson	Research Assistant, DL Program
Megan Cunniff	Academic Programs Manager
Caity Fair	Undergraduate Coordinator
Ryan Flament	Administrative Assistant
Magda Hanna	Grants Administrator
Saana McDaniel	Communications Coordinator
Steve Wolk	Finance Manager

TECHNICAL STAFF

David Campbell	Laboratory Engineer
Joseph Estano	Laboratory Supervisor
Kara Mogensen	Laboratory Supervisor
Gerry Sheppard	Laboratory Supervisor
Bob Sjostrom	Senior CIMLAB Specialist

UNDERGRADUATE PROGRAMS

The Department of Mechanical Engineering offers a multidisciplinary educational experience in which accredited degrees are currently offered in three programs: Mechanical Engineering (ME), Aerospace Engineering (AE, through 2012), and Manufacturing Engineering (MFG, through 2012). Our undergraduate programs emphasize process as well as product, so that our graduates not only develop the necessary technical skills required for immediate entry into industry or graduate school, but also continue to educate themselves and to prosper in a society whose problems will require increasingly multi-disciplinary solutions.

The Department of Mechanical Engineering offers students the option of getting an accredited foundational degree in ME with optional Concentrations in Aerospace Engineering, Manufacturing Engineering, Energy Technologies and Environmental Engineering, or Nanotechnology. These students will receive the best of both worlds: a foundational degree in arguably the broadest and most marketable degree program in engineering (ME) with specialized training in the alternate discipline, without having to take any extra courses. Additionally, students have the option of obtaining minors in Biomedical, Computer, Electrical, Material Science, or Systems Engineering as well as many other fields within the University.

The eclectic portfolio of the ME Department is well suited to providing students with both classroom and laboratory exposure to a broad range of engineering activities. Technical competence and focus is established through electives and – for those who choose to pursue it – research opportunities through faculty in the Department and the College. The Department continues to maintain state-of-the-art laboratories for demonstration and projects in the various undergraduate courses.

During the year, we continued to improve all undergraduate programs, utilizing a continuous improvement process that has been strengthened by the addition of student group interviews. The curricula culminate in senior "capstone" design projects in which teams of students tackle difficult multi-faceted design projects, often stemming from the needs of faculty research or industry partners. The design thread that carries seamlessly from the sophomore through senior years was enhanced this year through the addition of required courses in Product Design and Electro-Mechanical System Design as well as a revised senior capstone sequence that will offer students more flexibility (these will be implemented for the class of 2013).

Kayla Binggeli (AE 2010)

Objectives and outcomes

Mechanical Engineering Program Objectives (Ratified by the ME Faculty March 2009)

Graduates of the program will be prepared to:

- Join a technically sophisticated workforce as successful, practicing engineers in a wide range of mechanical engineering fields.
- Continuously improve and expand their technical and professional skills through formal means as well as through informal self-study.
- Pursue advanced degrees in engineering, business, or other professional fields.
- Advance themselves professionally and personally by accepting responsibilities and pursuing leadership roles.

Mechanical Engineering Program Outcomes (Ratified by the ME Faculty November 2008)

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

(l) an ability to interpret results of analysis of physical systems, components, or processes, and utilize physical insight to check for realistic outcomes

(m) an ability to model and design in the thermal systems area

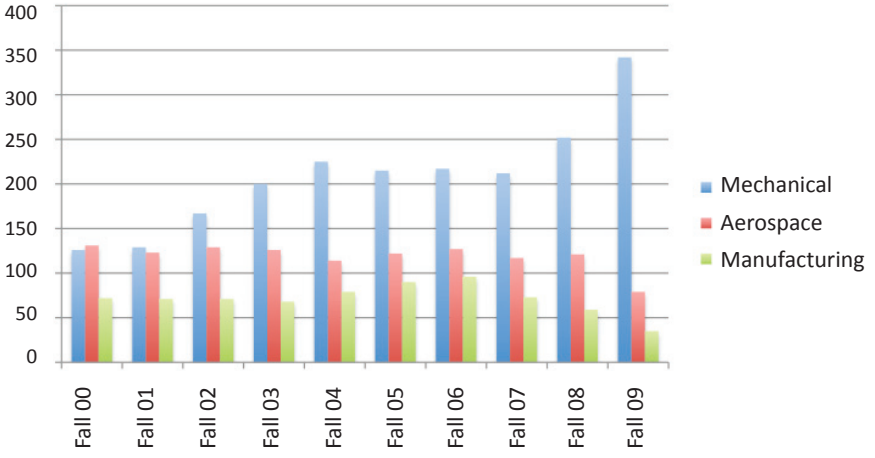
(n) an ability to model and design in the mechanical systems area

Enrollment

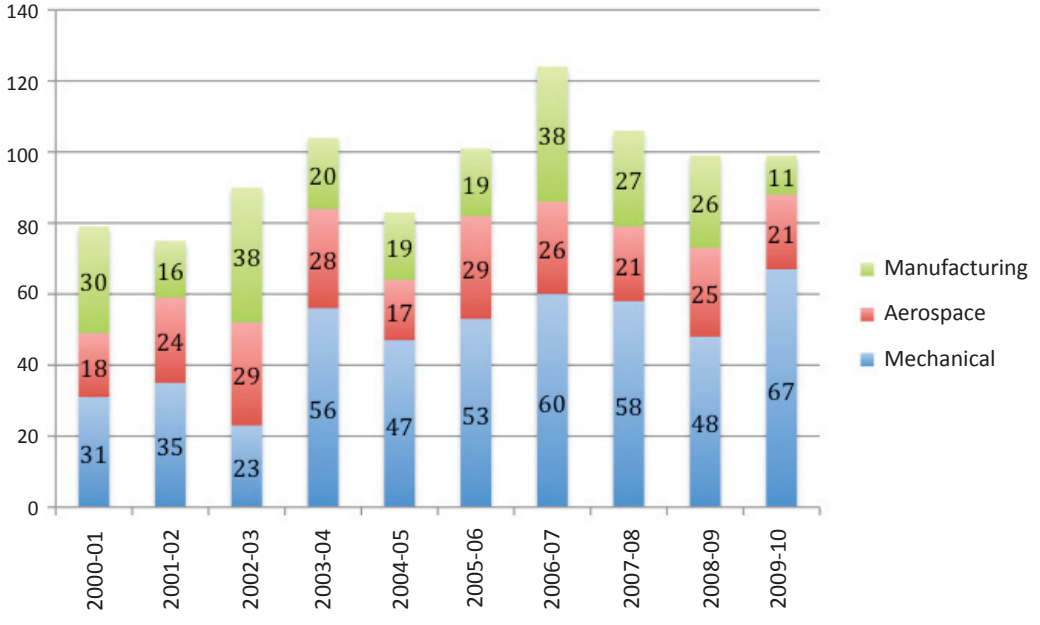
	Mechanical	Aerospace	Manufacturing	Total
Freshmen*	104	n/a**	n/a**	104
Sophomores*	75	24	6	105
Juniors	98	34	17	149
Seniors	65	21	12	98
Total	**342**	**79**	**35**	**456**

*Note: * ENG Students are not required to declare their major until their Junior year.*
*** Starting in the Fall of 2009, Aerospace and Manufacturing Engineering will no longer be available for the incoming Freshmen.*

History of Undergraduate Degree Enrollment



Undergraduate Degrees Awarded



Undergraduate Courses Offered

Course Number	Course Title	Fall 2009	Spring 2010	Summer 2010
EK 102	Introduction to Linear Algebra for Engineers	Barouch Perkins	Hauser	Attaway
EK 127	Engineering Computation	Attaway	Attaway	Attaway
EK 130/1/2	Introduction to Engineering	Bethune de Winter Sarin	Barouch Bethune de Winter Gopalan Grace	
EK 156	Design and Manufacture	de Winter	de Winter	
EK 301	Engineering Mechanics I	Barbone Kerney Wang	Farny	Nagem
EK 335	Introduction to Environmental Engineering		Pal	
EK 408	Introduction to Clean Energy Generation and Storage Technologies	Basu		
EK 409	Engineering Economy	de Winter	de Winter	de Winter
EK 546	Assessment of Sustainable Energy Technologies	Gevelber		
ME 201	Introduction to Aircraft Performance	Grace		
ME 202	Introduction to Spacecraft Performance		Nagem	
ME 266	Manufacturing Operations Management	Hauser	Hauser	
ME 302	Engineering Mechanics II	Belta Carey	Belta Nagem	Nagem
ME 303	Fluid Mechanics	Barba Porter	Schneider	
ME 304	Energy and Thermodynamics	Lin Palm	Palm	Kerney
ME 305	Mechanics of Materials	Klapperich Nagem	Pierce X.Zhang	
ME 306	Introduction to Materials Science	Sarin	Park	
ME 307	Flight Structures		Barbone	
ME 308	Statistics and Quality Engineering	Caramanis	Barouch	
ME 309	Structural Mechanics	Nagem		
ME 310	Instrumentation and Theory of Experiments	Holt	Holt	
ME 311	Engineering Design using CAD	Bethune	Bethune	
ME 312	Fundamentals of Engineering Design	Bethune	Bethune	
ME 345	Automation and Manufacturing Methods	Gevelber		
ME 400	Engineering Mathematics	Howe	Howe McDaniel	
ME 403	Atmospheric Flight Mechanics and Control	Wang		
ME 406	Dynamics of Space Vehicles	Nagem		
ME 407	Computer-Aided Design and Manufacture		Cole	de Winter
ME 409	Flight Vehicles Design I	Wroblewski		
ME 410	Flight Vehicles Design II		Wroblewski	
ME 413	Machine Design I	Isaacson DiBella Koplow		
ME 414	Machine Design II		Isaacson DiBella Koplow	

Course Number	Course Title	Fall 2009	Spring 2010	Summer 2010
ME 415	Product Design	Cole		
ME 419	Heat Transfer		Kerney K.Zhang	
ME 420	Supply Chain Engineering		Perkins	
ME 421	Aerodynamics		Yakhot	
ME 422	Fluid Mechanics II	Yakhot		
ME 425	Compressible Flow and Propulsion	Grace		
ME 430	Energy Conversion		Carey	
ME 441	Mechanical Vibrations	McDaniel		
ME 465	Materials Processing		Gopalan	
ME 495	Senior Design Capstone in Manufacturing Engineering		de Winter	
ME 501	Dynamic System Theory	Li		
ME 502	Intellectual Assets: Creation, Protection, and Commercialization	Cole		
ME 503	Kinetic Processes in Materials		Basu	
ME 505	Thermodynamics and Statistical Mechanics	Gopalan		
ME 507	Process Modeling and Control		Gevelber	
ME 510	Production Systems Analysis		Perkins	
ME 514	Simulation for Manufacturing	Vakili		
ME 515	Vibration of Complex Mechanical Systems	Pierce		
ME 516	Statistical Mechanical Concepts in Engineering		Ekinci	
ME 520	Acoustics I	Cleveland		
ME 521	Continuum Mechanics for Biomedical Engineers	Stamenovic		
ME 523	Mechanics of Biomaterials		Klapperich	
ME 525	Technology Ventures			Cole
ME 533	Energy Conversion		Carey	
ME 541	Classic Thermodynamics		Lin	
ME 542	Advanced Fluid Mechanics	Howe		
ME 543	Sustainable Power Systems		Caramanis	
ME 560	Precision Machine Design and Instrumentation	Sharon		
ME 579	Microelectronic Device Manufacturing		Cole	
ME 582	Mechanical Behavior of Materials	Ekinci		
ME 583	Product Management	Hauser		

Student Awards

NICK CHILDS	ASEE SMART Scholarship
JORDAN CUMPER	Student Leader Alumni Award College of Engineering Student Advisor Service Award
MEGHAN DAIGLE	College of Engineering Student Advisor Service Award
SEAN DeLEO	Lutchen Fellowship
SAMANTHA FISHMAN	College of Engineering Student Advisor Service Award
WARREN HUFFMAN	Winner of the Senior Award in the 5th Annual Undergraduate Design Port folio Contest, sponsored by The Merrill Ebner Fund
MATTHEW KNOLL	The Center for Space Physics under graduate Research Award
TRACEY LANTZ	College of Engineering Student Advisor Service Award
ANDREW MENARD	College of Engineering Student Advisor Service Award
BRETT MEYER	Sigma Gamma Tau Student Award
PETER MORIARTY	UROP Summer Research Award 2010
ERICA SQUILLACIOTI	College of Engineering Student Advisor Service Award
PATRICK STEIGER	College of Engineering Student Advisor Service Award
LIN YIN	Winner of the Junior Award, and the winner of the over all contest in the 5th Annual Undergraduate Design Port folio Contest, sponsored by The Merrill Ebner Fund
JEFF HAND **SETH A. MCKEEN** **TAHFIQ SALAM** **RIMAL PATEL** **JAKE WOLOSCHIN**	Outstanding Capstone Design Project in Aerospace Engineering: "Wayfarer I: Martian Unmanned Reusable ISRU Aircraft for Research and Exploration"
ANDREW LEGENDRE **ANDREW BANGERT** **RAVI HEUGLE**	Outstanding Capstone Design Project in Manufacturing Engineering: "MKS Instruments"
MATTHEW GALICA **MARTIN GOMEZ** **VICTOR LIN** **CHRISTIAN RIVERA**	Outstanding Capstone Design Project in Mechanical Engineering: " Spinal Fracture Loading Device Team"

Warren Huffman (l.) with Professor Wroblewski (r.)

Matthew Knoll (l.) with Professor Semeter (r.)

Student Organizations

AIAA – American Institute of Aeronautics and Astronautics

AIAA is the principal society for the aerospace profession, providing for the advancement and dissemination of knowledge of the theory and practice of the aeronautical and astronautical sciences. BU's chapter of the American Institute of Aeronautics and Astronautics is a small, collegiate level branch of the national chapter of AIAA. This year, they hosted the AIAA Northeast Regional Student Conference at the BU Photonics Center. A number of prominent speakers where brought in from the aerospace community and over 60 people attended the conference. Throughout the year they also hosted a number of events including industry and academic speakers, NASA mission discussion, and a GE Factory Tour. Their primary goal is to raise awareness among undergraduates about the opportunities and advances in the aerospace community.

ASME – American Society of Mechanical Engineers

This national society, with more than 100,000 regular members and 250 student sections, is dedicated to advancing the profession of mechanical engineering. Members are active at all levels of almost every segment of business, industry, education, and government. Membership in the student section brings students into contact with practicing engineers through technical meetings with guest speakers and regional and national society functions, including the regular meetings of the Boston section of ASME. This year, the executive board attended the 2009 ASME International Mechanical Engineering Congress & Exposition in Florida where the students were able to network and expand their knowledge through forums, workshops, industry tours, and a career exposition.

BU Rocket Team

The BU Rocket Team is a branch of the AIAA. The team's goal is to conduct research into hybrid rocket motor design, and is therefore more directed at the optimization of hybrid motors rather than the launching of a rocket. The team allows students to use innovation and ingenuity outside of a class environment. The team's members set their own deadlines, track their progress, report findings and encourage each other almost daily. The design process goes from chalkboard and CAD drawings to machining and assembling by testing the untapped engineering skills of each member.

BU SEDS - Students for the Exploration and Development of Space

Students for the Exploration and Development of Space are dedicated to expanding the role of human exploration and development of space. Student members participate in national conferences and host academic and industry speakers throughout the year. Specifically they attended the International Space Development Conference in Florida and New Space Conference in California.

IIE – Institute of Industrial Engineers

The student chapter of the IIE aims to promote a better environment for successful engineers by bridging the gap between school and industry. Members familiarize themselves with the intricacies of industry though plant tours, speakers, and hands-on experiences. The hands on experiences they participated in this year included a trebuchet competition and a pinewood derby race. The organization helps to provide students with insight into careers in industrial engineering.

Pi Tau Sigma Honor Society

Pi Tau Sigma is the national mechanical engineering honor society. The objectives of this society are to encourage and recognize the achievements of undergraduate students in mechanical engineering, to foster high ideals in the engineering profession, to develop leadership and citizenship, to stimulate and support departmental activities, and to honor practicing engineers for distinguished technical attainments. They hold an initiation ceremony each semester to honor their new members and award their new officers.

SAE – Society of Automotive Engineers

The SAE comprises 50,000 engineers and scientists working together to advance the field of mobility. With their diverse educational backgrounds, members are dedicated to furthering the research, development, design, manufacture, and utilization of land, sea, air, and space vehicles.

Sigma Gamma Tau Honor Society

Sigma Gamma Tau is the honor society for aerospace engineering. The objective of the society is to recognize and honor those individuals in the field of aeronautics and astronautics who have, through scholarship, integrity, and outstanding achievement, been a credit to their profession. The society seeks to foster a high standard of ethics and professional practice and to create a spirit of loyalty and fellowship, particularly among students of aerospace engineering. Each year they have an induction ceremony to welcome new members.

SME – Society of Manufacturing Engineers

This professional society stimulates research and disseminates knowledge in all phases of manufacturing engineering. Student members participate in field trips, technical seminars, and lecture series, and are upgraded automatically to regular society membership one year after graduation. They participated in the trebuchet competition with members of IIE and also raced cardboard boats against one another.

UAV Club – Unmanned Aerial Vehicles Club

The Unmanned Aerial Vehicles Club is new student organization at Boston University. This group is partnered with Aurora Flight Sciences and is devoted to researching and building unmanned aerial vehicles. Members of their executive board attended the AUVSI Programs Review Air Conference in Washington, DC. Eventually they will compete in the AUVSI Annual International Aerial Robotics Competition.

Members of the BU Rocket Team from left to right: Ryan Lacy, Kendra Toole, Lucas Bannister, Jeffrey Gereige, Nicola Ricci, Brian Serra, Monal Amin, Dane Sarcone, Joe Shifrin, and Brett Meyer.

2010 Aerospace Engineering Seniors (top), Manufacturing Engineering Seniors (bottom) and Mechanical Engineering Seniors on page 26.

Senior Design Projects

Aerospace Engineering

Project Title	Team Members
Wayfarer I: Martian Unmanned Reusable ISRU Aircraft for Research and Exploration Winning Team	Hand, McKeen, Patel, Salam, Woloschin
H.A.L.E.R.T.: High Altitude Long Endurance for Relief Telecommunications	Cumper, Kiyingi, Lyons, Miller, Valverde
Skyraider 2: Carrier-based Counter Insurgency Aircraft	Hall, Jalali, Lau, McGrath, Voorhees
NTS: Wing-in-Ground Effect Naval Transport Aircraft	Ko, Maier, Meyer, Miller, Steiger, Yen

Winning Team

Winning team in Aerospace Engineering, Wayfarer I team: Jeff Hand (l.), Rimal Patel, Seth A. McKeen, Tahfiq Salam, and Jake Woloschin (r.)

The Aerospace Engineering program culminates with a senior "capstone" design project in which teams of students tackle difficult multi-faceted design projects. The students enroll in a two-semester Flight Vehicle Design course (ME 409 & 410). During these courses each team conceives, plans, and carries out a significant aerospace vehicle design project in which each team member concentrates on a separate technical area. At the Senior Project Conference all the teams give an oral presentation of their projects. This year the winner was the **Wayfarer I team**, Jeff Hand, Seth A. McKeen, Tashfiq Salam, Rimal Patal, and Jake Woloschin.

Wayfarer I is a small, rocket-propelled UAV weighing 53 lbs (Martian Weight) that can achieve a 48.5 nautical mile flight in the thin Martian atmosphere to survey the Martian landscape. The aircraft is intended for use from a manned Martian base in the near future and is the first known plane of its kind designed to be reusable. The aircraft takes off and climbs vertically, firing its liquid oxygen liquid methane rocket engine to achieve an altitude of 12,280 ft (atmospheric density comparable to 125,000 ft on Earth!) before going into a glide segment for the remainder of the mission. Upon completion of the mission, the aircraft performs a parachute-assisted, net-arrested landing. Wayfarer I implements in-situ resource utilization (ISRU) technology, using propellants that can be harvested from Mars with simple chemical processes. This means that the propellants do not have to be transported from Earth, saving time and money, and making the aircraft much more pragmatic.

Wayfarer I models characteristics of a rocket including a Thrust Vector Control (TVC) system and a drag-minimizing, ultra-streamlined fuselage, while also including traits prevalent in high altitude glider planes such as a high lift airfoil, large wingspan, and low weight carbon fiber structural components.

Manufacturing Engineering

Project Title	Team Members
Product Development	Huffman, Minkoff, Jatia
MKS Instruments, Inc. Winning Team	Bangert, Heugle, LeGendre
Safecor	Kelly, Martin, Tworek
GreatPoint Energy	Jahn, Lee, Spergel

Winning Team

Winning team in Manufacturing Engineering, MKS Instruments: Andrew LeGendre (l.), Andrew Bangert, and Ravi Heugle (r.)

The Manufacturing Engineering program culminates with a senior capstone design project in which teams of students tackle difficult multi-faceted design projects. The students enroll in the Product Design course of ME 415 in the fall and then in the Senior Design Capstone in Manufacturing Engineering in the spring of the senior year. Each team has an industrial customer for whom they work one day a week on a typical manufacturing project. The teams are responsible for giving weekly progress reports to their industrial customers and to the supervising faculty.

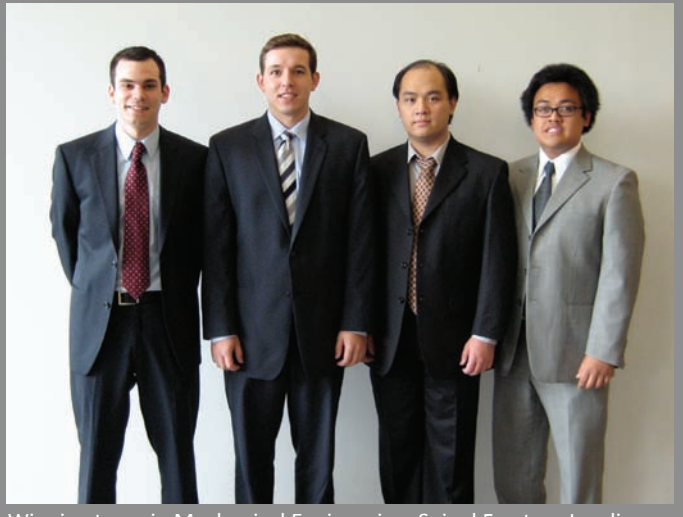
The winning team in Manufacturing Engineering was **MKS Instruments: Value Stream Mapping and Cell Capacity Analysis, Andrew LeGendre, Andrew Bangert, and Ravi Heugle.** MKS Instruments, Inc. creates devices that are used in the manufacturing of a variety of semiconductor products. Recently, MKS Instruments has experienced a large ramp up in the demand for their gas flow controllers, which is testing the capacity limits of their assembly operations.

The manufacturing senior capstone group for MKS Instruments was asked to analyze the capacity of their current operations for three major product lines and to create value stream maps of the assembly and test processes. The information in these maps was then used to identify limitations of the manufacturing line and provide suggestions for improvement.

Mechanical Engineering

Project Title	Team Members
Snow Removal System for Long Haul Trucks	Adams, Lantz, Magis-Agosta, Ozsivri, Pyun, Xiao
Snow and Ice Remover for Trucks	Anderson, Chen, Nivorozhkin, Pereira, Ramroopsingh
Test Chamber for Self-Cleaning Solar Cells	Babaniyi, Chin, Goldenbroit, Sadder, Srinivasan
Mudskipper - Human Powered Amphibious Vehicle	Dzumaga, Fu, Harris, James, Miklos
Hydro-Rover - Human Powered Amphibious Vehicle	Burriola, Foley, Friedensohn, Jimenez, Menard
Remote Coastal Camera Enclosure	Gerrior, McDowell, Miller, Worth
Deployable Electric Field Boom for Nano-Satellites	Bailey, deSouza, Knoll, Salzberg, Vizzio, Zipfel
Spinal Fracture Loading Device Winning Team	Galica, Gomez, Liu, Rivera
Mitral Valve Dynamics Simulator	Flaten, Hsu, LeValley, Martel, Ryan
Thermal Barrier Coating Test Rig	Hernandez, Jung, Marat, Martelly, Nirankari, Wong
DeBreeze Gutter Cleaner	Contois, Fleming, Nesvold, Shivers, Squillacioti
Gutter Guard Cleaner	Daigle, Fishman, Hanslon, Wang
Personal Dirt and Rock Separator	Belmonte, Bogoian, Carter, Driscoll, Vanguilder

Winning Team



Winning team in Mechanical Engineering, Spinal Fracture Loading Device Team: Martin Gomez (l.), Matthew Galica, Victor Lin, Christian Rivera (r.)

The Mechanical Engineering program also culminates with a senior "capstone" design project in which teams of students tackle difficult multi-faceted design projects, often stemming from faculty research. The students enroll in a two-semester Machine Design course (ME 413 & 414). During these courses the teams conceive, plan, and carry out a major mechanical engineering design of a multicomponent system. Each team gives an oral presentation of its project at the Senior Project Conference, where one team is declared a winner.

This year the winner was the **Spinal Fracture Loading Device Team**, Matthew Galica, Martin Gomez, Victor Lin, and Christian Rivera.

The team designed and constructed a loading device to apply a compressive load in combination with a flexion load which will simulate the bending of an individual and the resultant strain that is induced upon his or her vertebrae in order to accrue empirical data regarding spinal fracture. The loads are applied through the use of a mounted and removable gear box which allows users to simultaneously apply a pure compressive or flexion load to the spine sample being tested. The cylindrical shell surrounding the spine sample is made of a radiolucent material, which allows x-rays to penetrate. Using digital volume correlation the users are able to correlate the strain field in the disk to the spine sample.

GRADUATE PROGRAMS

The Graduate Program in Mechanical Engineering offers a variety of advanced and professional degrees. Students pursuing traditional MS and PhD degrees in Mechanical Engineering work closely with our faculty to produce foundational research having broad and profound impacts on emerging technologies in the biomedical, energy, environment, and defense spaces. This research is conducted in interactive, interdisciplinary, and well-funded research groups in acoustics and vibrations; biomechanics; computational science and engineering; dynamics, robotics, systems, and controls; thermofluid sciences, energy, and sustainability; and MEMS and nanotechnology. Students conducting research in these areas receive significant funding from internal and external sources, such as research fellowships, teaching fellowships, and scholarships.

In addition to traditional MS and PhD degrees, the department also offers advanced degrees with emphases on manufacturing and business administration. The MS in Global Engineering degree is aimed at creating a new type of "global engineer" both answering the industry demand and giving an upcoming engineer a competitive advantage in today's market place. In partnership with Boston University's School of Management, a coordinated Master of Science/Master of Business Administration program prepares recent graduates or practicing professionals who are committed to careers in industry for positions as manufacturing managers. The MS degree in Manufacturing is offered with an attractive distance learning option, in which classes are available as a synchronous and asynchronous extension of the on-campus classes. Distance learning classes allow for a broad participation of students at various career stages and allow students to participate while continuing to work outside of academia. The Late Entry Accelerated Program (LEAP) allows talented individuals and working professionals who have bachelor's degrees in non-engineering fields to earn graduate degrees in engineering.

New Matriculants 2009-2010

		Male	Female	FT	PT	GTF	RA	Fellow	DF
MS	*US*	16	5	9	12	3	3	1	0
	Intl.	2	0	2	0	1	0	0	0
PHD	*US*	6	0	6	0	4	0	0	2
	Intl.	3	3	6	0	3	0	1	2
Total		**27**	**8**	**23**	**12**	**11**	**3**	**2**	**4**

Fall 2009 Mean GRE Scores

		Verbal	%	Quantitative	%	An. Writing	%
MS	*US*	523	66	738	78	4.14	31
	Intl.	447	44	751	81	3.42	14
PHD	*US*	552	73	765	84	4.33	47
	Intl.	476	53	774	86	3.72	21
Total		**500**	**59**	**757**	**82**	**3.9**	**26**

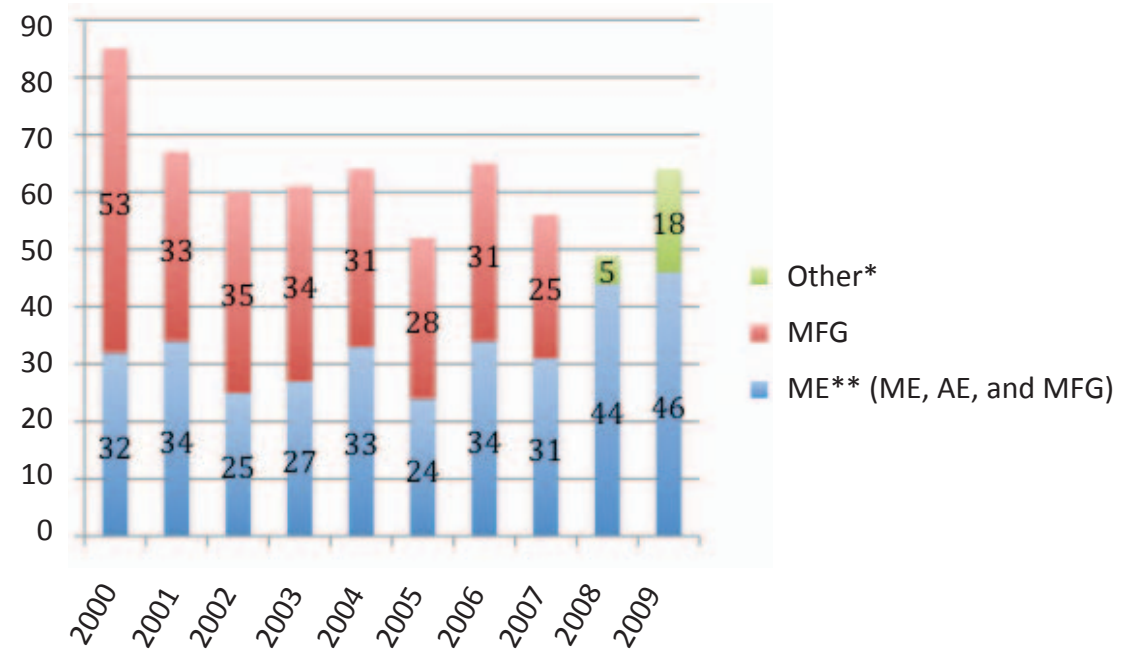
Spring 2010 Mean GRE Scores

		Verbal	%	Quantitative	%	An. Writing	%
MS	*US*	568	77	729	75	3.31	12
	Intl.	368	22	725	76	4.18	31
PHD	*US*	550	73	760	83	5.0	70
	Intl.	434	40	784	88	3.71	21
Total		**480**	**54**	**750**	**81**	**4.0**	**27**

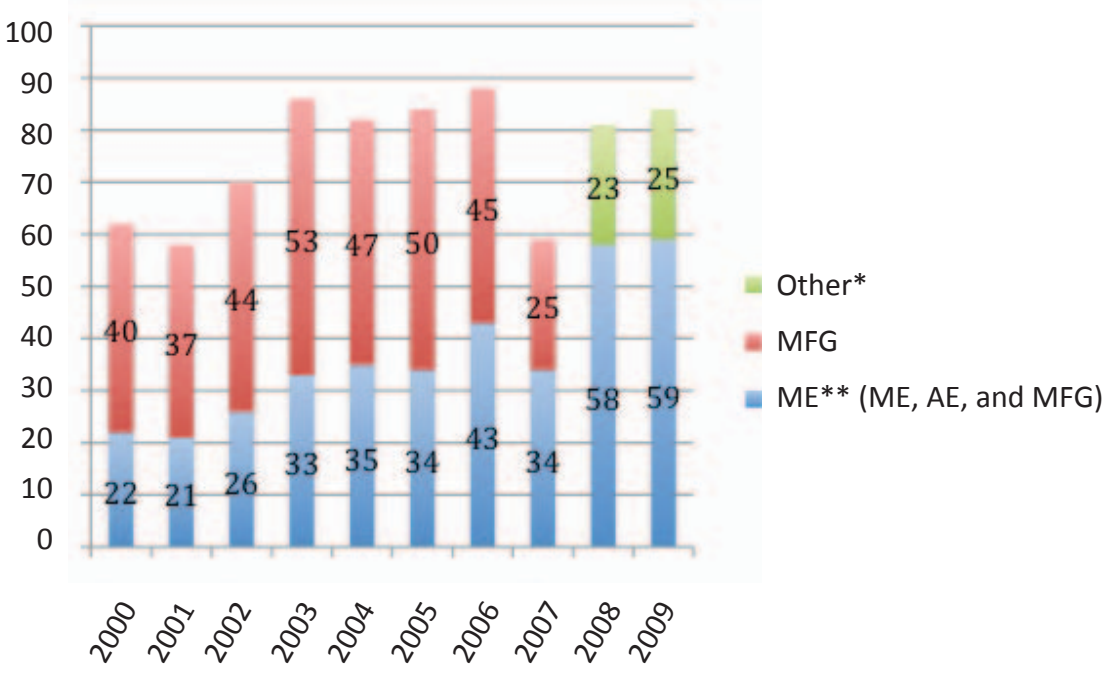
On the left, 2010 Mechanical Engineering Seniors.

Enrollment by Degree Program

History of MS Enrollment



History of PhD Enrollment



* Mechanical Engineering Professors advise and financially support students enrolled in almost every graduate degree program offered by the College of Engineering, with particular emphasis on programs offered by the Divisions of Systems Engineering and Material Science and Engineering.

** The former departments of Aerospace and Mechanical Engineering, and Manufacturing Engineering merged to form the Mechanical Engineering Department in Fall 2008.

Graduate Student Awards

KYLE BRIDGEO Outstanding Graduate Teaching Fellow Award, in the Department of Mechanical Engineering, Boston University.

MICHAEL CANNAMELA GLACIER Fellowship 2010-2011, The NSF GLALCIER (Global Change Initiative: Education & Research) program at Boston University supports fellowships and training for graduate students in science, technology, engineering, and mathematics. GLACIER fellows receive a strong interdisciplinary perspective on global change research, and have the opportunity to enhance their teaching skills by learning how to translate their research into exciting and dynamic classroom lessons for children in grades 5-8.

QINGQING CAO CIMIT Applied Healthcare Engineering Fellow.

ANDY DRAUDT "Real-Time Monitoring of High Intensity Focused Ultrasound Lesion Formation with Combined Acoustic Force Elastography and Acousto-Optic Imaging," Best Student Paper Award, 39th Annual Symposium of the Ultrasonic Industry Association, Cambridge, MA, April 2010.

KEBIN FAN Photonics Center Graduate Student Travel Award; Photonics Center Senior Research Fellowship; and Photonics Center Berman Future of Light Prize Award.

ELSE FROHLICH Draper Fellowship in Fall 2009.

AMIRA HUSSEIN BU/CIMIT Applied Healthcare Fellowship, awarded to second- or third-year graduate students researching topics that help solve health care challenges such as medical device development, creating algorithms and software for use in clinical practice, and engineering in medical environments.

BRADLEY KAANTA Nanoscience & Nanotechnology Award.

CHARLES LISSANDRELLO NSF Graduate Fellowship Award.

PUI LEONG BU/CIMIT Applied Healthcare Fellowship, awarded to second- or third-year graduate students researching topics that help solve health care challenges such as medical device development, creating algorithms and software for use in clinical practice, and engineering in medical environments.

JIM MCLAUGHLAN "Nanoparticle-Targeted Photoacoustic Cavitation for Deep Tissue Optical Imaging," Best Student Paper award, the San Antonio Acoustical Society of America meeting.

YILING QIU Photonics Center Graduate Student Travel Award.

HUSEYIN SEREN Dean's Fellowship.

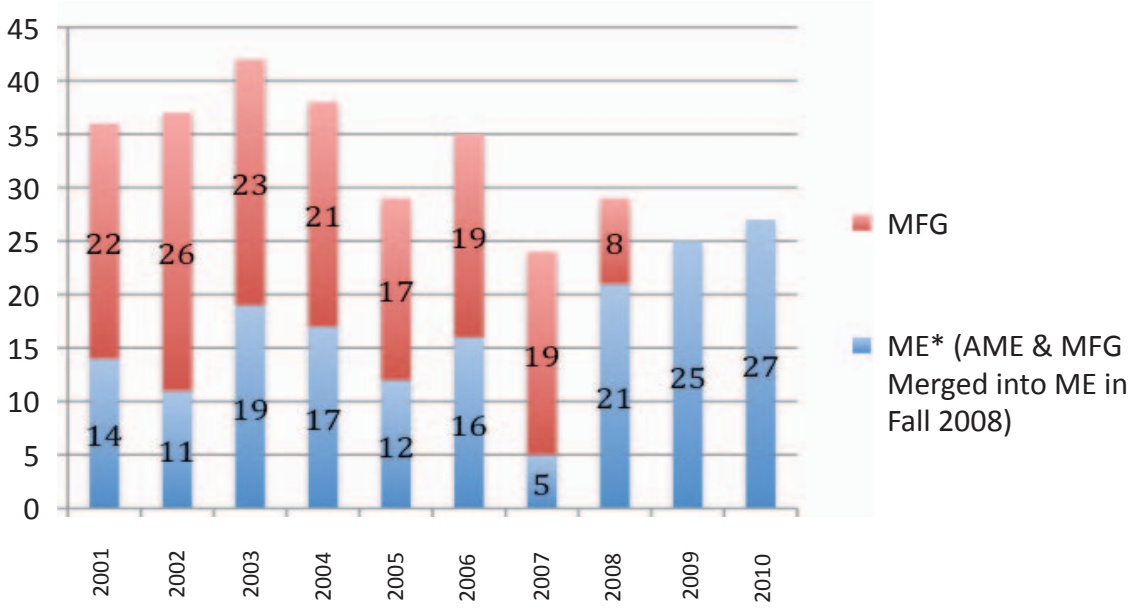
HU "TIGER" TAO received the most prestigious student award issued by the Chinese government, the National Award for Outstanding Overseas Chinese Students; OSA Foundation Graduate Student Award; and IEEE Maiman Outstanding Student Paper.

Kyle Bridgeo (l.) receives the Outstanding Graduate Teaching Fellow Award from Professor Don Wroblewski (r.)

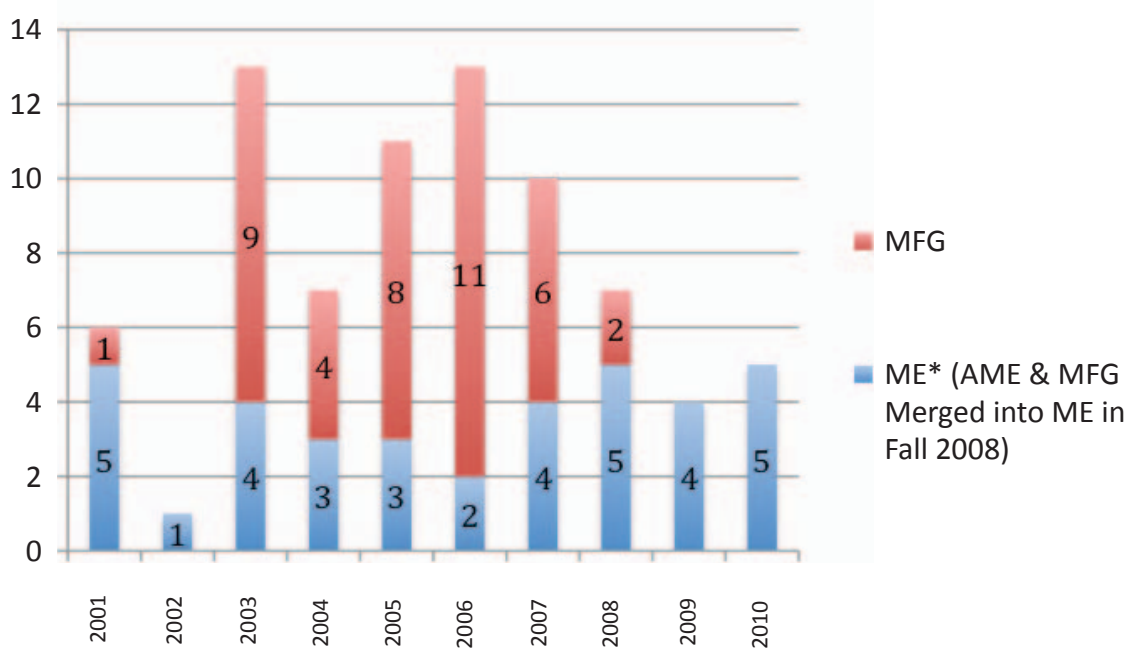
HU "TIGER" TAO **"**MEMS Enhanced Metamaterials: Towards Filling the Terahertz Gap," won the Best Dissertation Award at BU College of Engineering, May 2010.

Graduate Degrees Awarded

History of MS Degrees Awarded



History of PhD Degrees Awarded



Graduate Courses Offered

COURSE NUMBER	COURSE TITLE	FALL 2009	SPRING 2010	SUMMER 2010
EK 546	Assessment of Sustainable Energy Technologies	Gevelber		
EK 720	Biophotonic System Design and Prototyping		Bifano	
ME 501	Dynamic System Theory	Li		
ME 502	Intellectual Assets: Creation, Protection, and Commercialization	Cole		
ME 503	Kinetic Processes in Materials		Basu	
ME 505	Thermodynamics and Statistical Mechanics	Gopalan		
ME 507	Process Modeling and Control		Gevelber	
ME 510	Production Systems Analysis		Perkins	
ME 514	Simulation for Manufacturing	Vakili		
ME 515	Vibration of Complex Mechanical Systems	Pierce		
ME 516	Statistical Mechanical Concepts in Engineering		Ekinci	
ME 520	Acoustics I	Cleveland		
ME 521	Continuum Mechanics for Biomedical Engineers	Stamenovic		
ME 523	Mechanics of Biomaterials		Klapperich	
ME 525	Technology Ventures			Cole
ME 533	Energy Conversion		Carey	
ME 541	Classic Thermodynamics		Lin	
ME 542	Advanced Fluid Mechanics	Howe		
ME 543	Sustainable Power Systems		Caramanis	
ME 560	Precision Machine Design and Instrumentation	Sharon		
ME 579	Microelectronic Device Manufacturing		Cole	
ME 582	Mechanical Behavior of Materials	Ekinci		
ME 583	Product Management	Hauser		
ME 700	Advanced Topics in Mechanical Engineering		Porter	
ME 701	Optimal and Robust Control	Andersson		
ME 702	Computational Fluid Dynamics		Barba	
ME 707	Finite Element Analysis	K.Zhang		
ME 709	Turbulent Flows		Yakhot	
ME 710	Dynamic Programming and Stochastic Control		Caramanis	
ME 714	Advanced Stochastic Modeling and Simulation		Vakili	
ME 720	Acoustics II		Pierce	
ME 721	Acoustic Bubble Dynamics		Holt	
ME 723	Waves in Random Media	Carey		
ME 725	Queueing Systems	Perkins		
ME 726	Fundamentals of Biomaterials	Grinstaff		
ME 727	Principles and Applications of Tissues		Wong	
ME 733	Discrete Event and Hybrid Systems		Cassandras	
ME 740	Vision, Robotics, and Planning		Baillieul	
ME 762	Nonlinear Systems and Control		Wang	
ME 778	Micromachined Tranducers	X.Zhang		

MS Theses and PhD Dissertations

MS Theses

STUDENT NAME	DISSERTATION ADVISOR	DISSERTATION TITLE
Baggett, Keithe	Grace, Sheryl	CFD Simulation of an Acoustic Igniter
Butler, Evan	Wang, Hua	Modeling, Control, and Failure Stabilization of a Modified F-15: A Takagi-Sugeno Fuzzy Model Based Approach
Coombs, Joseph	Fritz, Theodore	Design of a Preliminary Thermal Model for Analysis of the Boston University Student-satellite for Application and Training (BUSAT)
Ho, Sharon	Howe, Michael	Low Frequency Sound Produced by a Ventilated Supercavitating Vehicle
McLean, Erin	Sharon, Andre	Development and Control of an Articulated Joint Endoscope
Speyerer, Emerson	Gevelber, Michael	Optimizing Sweep Pattern Designs for Improved Electron Beam Deposition of Optical Coatings
Wasniewski, Joseph	Cole, Daniel	An Experimental Platform for Probabilistic Robot Motion Planning and Control

PhD Dissertations

STUDENT NAME	DISSERTATION ADVISOR	DISSERTATION TITLE
Diouf, Aloune	Bifano, Thomas	Fabrication Processes for MEMS Deformable Mirrors in the Next Generation Telescope Instruments
Lai, Puxiang	Roy, Ronald	Photorefractive Crystal-Based Acousto-Optic Imaging in the Near-Infrared and its Applications
Qiu, Yiling	Zhang, Xin	Impedance Sensing for Cellular Response Studies
Tao, Hu “Tiger”	Zhang, Xin	MEMS Enhanced Metamaterials: Towards Filling the Terahertz Gap
Zagadou, Franck	Mountain, David & Barbone, Paul	An Analysis of the Micromechanics of the Organ of Corti: Significance of Microfluid Flow

Distance Learning

The Department of Mechanical Engineering offers MS degrees through a distance-learning program (DLP). The DLP has been in operation since 1992, originally in the Department of Manufacturing Engineering. This program differs from the majority of distance learning programs offered at other universities in that classes are offered live, so that distance students can hear and see the on-campus class and speak with the professor in real time. This synchronous approach is particularly helpful if class discussion or teamwork is important as distance students are integrated into the normal on-campus group of graduate students through web-based videoconferencing. This mutual participation benefits both groups: on-campus students gain perspective on the real world working environment through the experience of DLP students, and DLP students benefit by engaging with their on-campus peers and by seeing the benefits of graduate-level education. In contrast, most other distance learning programs in engineering are asynchronous, relying on recorded lectures and other web-based materials to deliver class content.

Our DL program provides Master's level classes primarily to industrial employees wishing to add to their education background, but is open to others if the format suits their needs. The DLP currently offers 20 M.S. level courses in the following areas: material science, systems engineering, product development, advanced manufacturing strategies, and high-tech areas such as micro/nanoelectronics and MEMS/NEMS.

Our DLP addresses a need identified by the department's industrial partners – many high-tech employees, including leaders in their industries, are lacking in skills needed to mass-produce high-tech products with high yield and low cost. The DLP is an excellent vehicle for providing these skills, and for serving as a convenient vehicle for life-long learning in a rapidly changing industry.

To participate in the DLP, students only require a computer, an inexpensive camera and microphone, and access to a high-speed Internet connection. This ease of entry allows students from anywhere to participate; indeed, we have had students from as far away as Taiwan, Hawaii, and Mexico (mostly company-sponsored). Since most of the interaction is meant to be in real time, a robust high-resolution videoconferencing solution is essential to the operation of the program. When combined with very high quality cameras that capture more of the classroom activity and presentation material, this technology enables us to connect with the students at individual PCs. We have also used this technology to enable a guest lecturer to provide his lecture from a distance, opening a channel for high profile guest speakers who might be unavailable due to travel times and busy schedules.

Although we still feel our synchronous approach is best for learning, we also offer recorded lectures to aid students who cannot attend live lectures because of employment commitments or time-zone differences that make it difficult to participate "live." Specifically, all class sessions are recorded and can be viewed on-line by registered students, within a few hours of the end of class. These are beneficial to students who travel, or may need to miss class due to illness or other emergencies, and many students also find them helpful when reviewing for tests. We have continually improved the quality, flexibility and reliability of these videos over the past several years and will continue to explore ways to enhance the usefulness and simplify the use of these recordings. (Note that video availability to non-DL students is at the instructor's discretion).

To facilitate web-based distribution of class material, the DLP makes an electronic whiteboard available in one of the regular DL classrooms. Anything written on the board can be saved by instructors to multipage PDF files, and easily distributed electronically or made available on-line after class, at the professor's discretion.

The DLP committee during the first half of the past academic year consisted of:

DAN COLE (chair Fall 09)

ANDREW ABRAHAMSON

WILLIAM HAUSER

DON WROBLEWSKI (chair Spring 10)

During the second semester, the group was joined by Don Wroblewski who took over the role of chair for the DLP.

We are in the process of expanding the DLP in two ways. First, we are adding new DL graduate courses in solar energy, sustainable power systems, and acoustics, and plan to add one to two DL courses each semester over the next few years. We also plan to offer certificate programs in areas with high DL enrollment and in areas with strong research expertise in the department. Each certificate will require three, 4-credit courses, which can also be used as part of an MS degree program (though enrollment in the MS program will not be a requirement for receiving a certificate). Currently, approvals are pending for certificates in engineering management, sustainable energy, and MEMS and Nanotechnology. We hope to begin offering these within in the next academic year.

Since technology is at the heart of the DLP and technology is rapidly evolving, we evaluate and adopt new technologies on an ongoing basis. Specifically, we are exploring a Niagra streaming media device that can output audio and video to a large number of clients/students at very high quality. Chat/blog media are also being explored to aid students who are not taking a course live, in order to capture their discussion points.

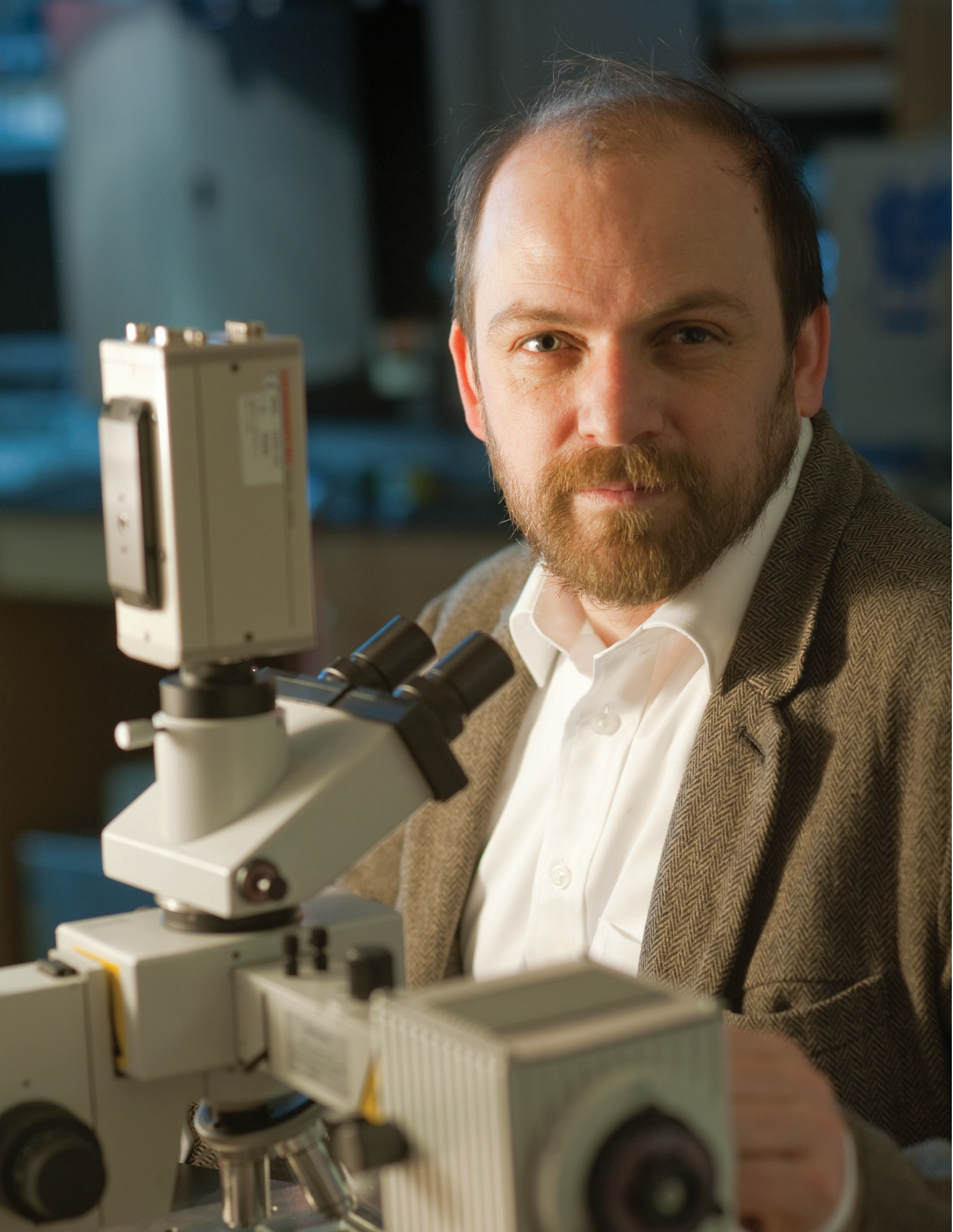
The DLP continues to play an important role in promoting the department, as it provides important industrial connections and helps to develop key future industrial leaders. Distance learning by videoconferencing or streaming video enables the department to conduct Masters degree classes concurrently on-campus and anywhere in the world accessible by a high-speed internet connection. This allows students to participate in class from a variety of locations, including at home or at a hotel when traveling. Students can access videos on-line and replay past classes if it is necessary to miss an occasional lecture. This asynchronous option is becoming increasingly popular with some DL students and may become an important aspect of our DLP in the future.

Professor Daniel Cole conducting a distance learning class.

Distance Learning Courses Offered

COURSE NUMBER	COURSE TITLE	INSTRUCTOR
ME 502	Intellectual Assets: Creation, Protection, and Commercialization	Cole
ME/MS 507	Process Modeling and Control	Gevelber
ME 510	Production Systems Analysis	Perkins
ME 517	Product Development	Hauser
ME 518	Product Quality	n/a
ME 520	Acoustics I	Cleveland
ME 525	Technology Ventures	Cole
ME/MS 526	Simulation of Physical Processes	Cole
ME/MS 534	Materials Technology for Microelectronics	Basu
ME/MS 535	Green Manufacturing	Pal
ME 543	Sustainable Power Systems	Caramanis
ME 550	Product Supply Chain Design	n/a
ME/MS 555	MEMS: Fabrication and Materials	Zhang
ME 560	Precision Machine Design and Instrumentation	Sharon
MS/EC 573	Solar Energy Systems	Mazumder
ME 579	Microelectronic Device Manufacturing	Cole
ME 583	Product Management	Hauser
ME 584	Manufacturing Strategy	Hauser
ME/SE 765	Production System Design	Caramanis
ME 778	Micro-machined Transducers	Zhang

In total, the DLP offered 10 different courses during the past academic year. A total of 42 individual DLP course enrollments were taken during this period. These enrollments permitted talented engineers to remain on the job while earning an advanced technical degree. Two M.S. DLP degrees were awarded. Most of those receiving M.S. degrees completed their studies in about three years or less. In addition, several other on-campus students used only a few DL courses to complete their degrees, to allow them to take BU courses while participating in summer internships in industry.



RESEARCH

Research Funding

Extramural Funding in 2009-2010

RECIPIENT	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD	NEW FUNDS IN 2009-2010
Andersson Belta	DynSyst Special Topics: A Formal Approach to the Control of Stochastic Dynamic Systems (REU Supplement)	NSF	9.1.09-8.31.12	$240,000
Andersson	IDBR - Simultaneous Tracking of Multiple Particles in Confocal Microscopy	NSF	9.1.09-2.28.11	$1,875
Andersson	DynSyst Special Topics: A Formal Approach to the Control of Stochastic Dynamic Systems	NSF	4.12.10-8.31.12	$7,400,000
Baillieul Castanon	Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (MURI-07)	DOD/AFSOR	12.1.09-6.30.10	$727,744
Baillieul	Student Travel Support for the 2009 IEEE Conference on Decision and Control	NSF	11.20.09-1.31.11	$15,000
Baillieul Castanon	Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (MURI-07)	DOD/AFSOR	7.1.10-11.30.10	$814,562
Barbone	Feasibility of in-vivo Determination of Absolute Elastic Tissue Properties in 3D	HHS/NIH/NCI	3.1.09-2.28.10	$13,619
Barbone	Quantitative Mechanical Imaging for Improving Breast Ultrasound Diagnostics	HHS/NIH/NCI	7.1.09-5.31.10	$59,313
Barbone	Exact Modeling of Targets in Littoral Environments (STTR)	DOD/Navy	7.15.09-6.30.10	$3,250
Belta Cassandras	MURI - Smart Adaptive Reliable Teams for Persistent Surveillance	DOD/Navy	6.1.09-8.31.012	$290,000
Belta	Specification Languages and Distributed Control Schemes for Teams of Unmanned Vehicles	DOD/Army	3.17.10-3.16.11	$75,847
Belta	Formal Verification and Synthesis of Control and Communication Strategies for Teams of Unmanned Vehicles	DOD/AFSOR	12.1.09-11.30.10	$99,999
Belta Cassandras	MURI - Smart Adaptive Reliable Teams for Persistent Surveillance	DOD/Navy	6.1.09-12.31.09	$96,000
Belta	CSR-EHCS(EHS), SM: A Formal Approach to Control of Hybrid Systems with Applications to Mobile Robotics	NSF	9.1.09-8.31.10	$99,951
Belta	CAREER: Hierarchical Abstractions for Planning and Control of Robotic Swarms	NSF	5.10.10-1.31.11	$16,500

On the left Professor Matthias Schneider

RECIPIENT	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD	NEW FUNDS IN 2009-2010
Carey	Sound Speed and Attenuation in Multiphase Media	DOD/Navy	1.1.04-3.31.11	$50,000
Carey	Sound Speed and Attenuation in Multiphase Media	DOD/Navy	1.1.04-3.31.11	$20,000
Carey	Sound Speed and Attenuation in Multiphase Media	DOD/Navy	5.1.10-4.30.11	$58,770
Cleveland	Disposable Linear Arrays for Shockwave Lithotripter Pressure Measurements	HHS/NIH/ NIDDK	2.1.10-1.31.11	$49,000
Cleveland	Tracking Kidney Stones During Shock Wave Lithotripsy	HHS/NIH/ NIDDK	4.1.10-3.31.11	$406,681
Cleveland	Strategies for Improved Shock Wave Lithotripsy	HHS/NIH/ NIDDK	7.1.09-6.30.10	$201,651
Cleveland	The Structural Basis of Kidney Stone Fragility	HHS/NIH/ NIDDK	9.1.08-8.31.10	$75,969
Cleveland	Steerable MEMS Instruments for Precise Intracardiac Surgery	HHS/NIH/ NHLBI	1.1.10-6.30.10	$58,750
Ekinci Yakhot	Tailor-Made Superhydrophobic Surfaces for MEMS and NEMS	NSF	5.1.10-4.30.13	$280,143
Ekinci	CAREER: Photonic Integration of Silicon Nanoelectromechanical Systems (REU Supplement)	NSF	5.1.08-2.28.11	$6,000
Ekinci	CAREER: Photonic Integration of Silicon Nanoelectromechanical Systems	NSF	3.1.10-2.28.11	$82,717
Gevelber	Real Time Control for Engineering Electrospun Nanofiber Diameter Distributions for Advanced Applications (REU Supplement)	NSF	6.1.09-8.31.11	$6,000
Gopalan Lin	Stable Potentiometric Sensor for Ce(III), CeI(IV) and Gd(III) Ions in Acidic Media	DOE	7.24.09-9.15.09	$30,677
Gopalan Lin	Stable Potentiometric Sensors for Ce(III), Ce(IV) and Gd(III) Ions in Acidic Media	DOE	3.29.2010-9.30.10	$70,000
Gopalan Pal, Basu Ludwig, Smith	Solid Oxide Fuel Cell Cathodes: Unraveling the Relationship Between Oxygen Reduction, Structure, and Surface Chemistry	DOE	9.1.10-3.31.10	$28,824
Gopalan Pal, Basu Ludwig, Smith	Solid Oxide Fuel Cell Cathodes: Unraveling the Relationship Between Structure, Surface Chemistry and Oxygen Reduction	DOE	4.1.10-9.30.11	$196,177
Grace	Using CFD to Guide Rotor Wake Formulation for Fan Broadband Noise Simulations	AeroAcoustics Research Consortium	6.1.09-8.31.10	$96,933
Holt	Laser Nucleation and Collapse Stability for Advanced Cavitation Power Technology	DOD/Army	2.18.08-6.28.10	$50,000
Howe	Sound Sources of Phonation	HHS/NIH/ NIDCD	12.1.09-11.30.10	$33,538

RECIPIENT	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD	NEW FUNDS IN 2009-2010
McDaniel	Estimating the Effects of Damping Treatments on the Vibration of Complex Structures	DOD/Navy	2.7.08-4.30.11	$178,536
Morgan	3-D Visualization and Prediction of Spine Fractures	HHS/NIH/ NIAMS	5.1.10-4.30.11	$313,737
Morgan Klapperich	Inducing Skeletal Repair by Mechanical Stimulation	HHS/NIH/ NIAMS	9.18.09-9.17.10	$64,152
Pal	Low-Cost, Low-Impact Magnesium Production by Solid Oxygen Membrane Electrolysis	NSF	8.1.09-12.31.09	$32,009
Park	Mechanical Loss Mechanisms in C-Axis Gallium Nitride Nanowires	NSF	7.1.09-6.30.12	$147,321
Porter	MRI-Guided Localized Delivery of Chemotherapy Using Temperature-Sensitive Lipsomes and Focused Ultrasound	Focused Ultra-sound Surgery Foundation	1.1.10-12.31.10	$50,000
Porter	BRIGE - The Role of Vaporized Perfluorocarbon Na-noemulsions in Enhanced Ultrasound-Induced Lesion Formation for Cancer Therapy	NSF	9.1.09-8.31.11	$174,783
Roy	The Utilization of the Analogic Ultrasound Imaging Engine and the Terason System 2000 in API, HIFU, and MedBED (CenSSIS Industrial Partner Program)	NSF	5.1.03-8.31.10	$35,000
Sarin	High Performance, Low Cost Scintillators for PET	DOE	7.20.09-4.19.10	$15,000
Sarin	High Performance Optical Ceramic Scintillator Through Nanotechnology	HHS/NIH/NIBIB	9.1.09-8.31.10	$44,634
Sarin	Novel Ceramic Scintillators for PET	DOE	8.15.09-8.14.10	$50,000
Zhang, K.	CAREER: Integrating Multi-Scale Mechanics and Biomaterials to Study the Translation of Mechanical Forces from Tissue to Cell	NSF	2.1.10-1.31.15	$400,000
Zhang, K.	CAREER: Integrating Multi-Scale Mechanics and Biomaterials to Study the Translation of Mechanical Forces from Tissue to Cell (REU Supplement)	NSF	6.1.07-12.31.08	$12,000
Zhang, X. Averitt	Materials and Mechanics of Metamaterial Enhanced MEMS for Terahertz Technology	DOE/Air Force	9.30.09-3.31.10	$65,000
Zhang, X.	Mechanical Behavior of Amorphous Plasma-En-hanced Chemical Vapor Deposited Silicon Oxide Films for MEMS Applications (REU Supplement)	NSF	6.1.09-5.31.11	$6,000
Zhang, X.	An Impedance-Based Assay Microsystem for Real-Time High Throughput Study of Single Cells	NSF	10.1.09-9.30.10	$86,435
Zhang, X. Averitt	Coupled Evanescent Field Micro-Resonators for Downhole Data Relay	Advanced Energy Consortium	1.1.10-12.31.10	$200,000
Zhang, X.	Collaborative Research: Elastic and Viscoelastic Characterization and Modeling of Polymer Based Structures for Biological Applications (REU Supple-ment)	NSF	6.1.10-8.31.11	$6,000
Zhang, X. Averitt	Materials and Mechanics of Metamaterial Enhanced MEMS for Terahertz Technology	DOD/Air Force	4.1.10-3.31.11	$130,000

Total New Funds: $6,742,934

Funding Administered Outside Mechanical Engineering Department for Which an ME Professor Serves as Principal Investigator of the Grant or Subcontract

RECIPIENT	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD	NEW FUNDS IN 2009-2010
Bifano	Photonics Research and Technology Insertion	DOD/Army	7.1.09-6.30.10	$34,000
Bifano	Photonics Research and Technology Insertion	DOD/Army	7.1.09-6.30.10	$60,000
Bifano	Photonics Research and Technology Insertion	DOD/Army	7.1.10-6.30.11	$401,000
Klapperich	Disposable Microfluidic Devices for Point Care Diagnostics	HHS/NIH/NIAID	7.1.09-6.30.10	$262,625
Klapperich	Microchip to Detect Influenza Infection and Type is Nasopharyngeal Swabs	HHS/NIH/NIBIB	9.1.09-8.31.11	$173,711
Klapperich	Portable Low Power Nucleic Acid Extraction Module	HHS/NIH/NIBIB	9.1.09-8.31.10	$140,343
Klapperich	A Microfluidic System for Monitoring Sepsis at the Point of Care	DOD/Army/MRAA	12.16.09-9.30.10	$140,000
Klapperich	Micro Solid Phase Extraction Module Development for EO-NAT-HIV Rapid Point-of-Care Diagnostic Device for Resource-Limited Swabs	HHS/NIH/NIAID	9.30.09-9.29.14	$627,485

Total Funding Administered Outside ME: $2,136,955

Funding Administered Outside Mechanical Engineering Department for Which an ME Professor Serves as Co-Principal Investigator of the Grant or Subcontract

RECIPIENT	TITLE OF AWARD	FUNDING AGENCY	NEW FUNDING
Andersson Porter	NUE: Undergraduate Laboratory Experiences in nanotechnology Devices and Systems (U-LENS)	NSF	$200,000
Barba	EAGER: Experimental Cluster for Fundamental Physics Center for Computational Science	NSF	$297,971
Barbone	Active Filtering in the Cochlea	HHS/NIH/NIDCD	$717,322
Grace	WIN: Women in Networks, Building Community and Gaining Voice (ADVANCE Partnerships for Adaptation, Implementation, and Dissemination Award)	NSF	$742,702
Porter	Combination of Catonic Nanoemulsion and Ultrasound for siRNA Delivery	Center for Nanoscience and Nanobiotechnology, BU	$20,000
Porter	A Nanoparticle Encapsulated Photo-sensitizer System for Targeting, Localizing, Imaging, and Treating Local and Metastatic Tumor in One Platform	Center for Nanoscience and Nanobiotechnology, BU	$20,000
Roy Barbone Cleveland	CenSSIS Program - Year 10	NSF	$314,518

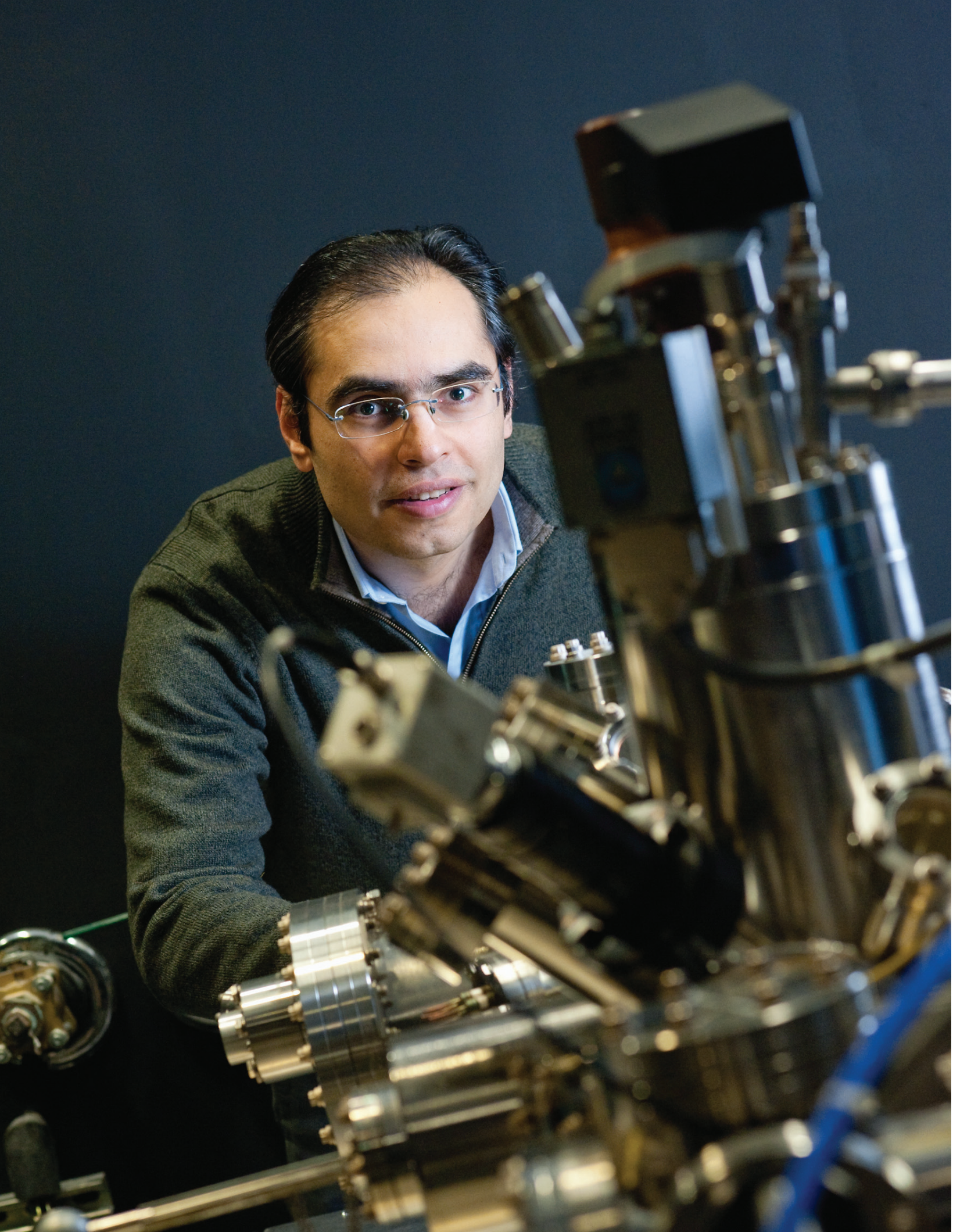
Total: $2,312,513

Current Active Awards

INVESTIGATOR	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD
Andersson	IDBR: Simultaneous Tracking of Multiple Particles in Confocal Microscopy	NSF	7.3.08-2.28.11
Andersson	CAREER: Nonlinear Control for Single Molecule Tracking	NSF	7.1.09-6.30.14
Andersson Belta	DynSyst_Special_Topics: A Formal Approach to the Control of Stochastic Dynamic Systems	NSF	9.1.09-8.31.12
Baillieul Castanon	Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (MURI-07)	DOD/Air Force	12.1.08-11.30.10
Baillieul	Student Travel Support for the 2009 IEEE Conference on Decision and Control	NSF	1.31.11-11.20.09
Barbone	Exact Modeling of Targets in Littoral Environments (STTR)	DOD/Navy	7.15.09-6.30.10
Barbone	Feasibility of in-vivo Determination of Absolute Elastic Tissue Properties in 3D	HHS/NIH/NCI	3.1.09-2.28.10
Barbone	Quantitative Mechanical Imaging for Improving Breast Ultrasound Diagnostics	HHS/NIH/NCI	7.1.09-5.31.10
Basu	EBC/TBC Coating System for Si-Based Ceramic Components for Improved Gas Turbine Performance and Lifetimes	NSF	7.1.09-12.31.10
Belta	CSR-EHCS(EHS), SM: A Formal Approach to Control of Hybrid Systems with Applications to Mobile Robotics	NSF	9.15.08-8.31.09
Belta	CAREER: Hierarchical Abstractions for Planning and Control of Robotic Swarms	NSF	2.1.09-1.31.11
Belta	Formal Verification and Synthesis of Control and Communication Strategies for Teams of Unmanned Vehicles	DOD/Air Force	3.1.09-11.30.09
Belta	Specification Languages and Distributed Control Schemes for Teams of Unmanned Vehicles	DOD/Army	3.17.09-3.16.10
Belta Cassandras	MURI - Smart Adaptive Reliable Teams for Persistent Surveillance	DOD/Navy	6.1.09-5.31.12
Carey	Acoustic Sensors and Array Processing	DOD/Navy	3.1.05-2.28.10
Carey	ONR Postdoctoral Fellowship Research Proposal for Investigation of Complex Range-Dependent Shallow Water Sound Transmission	DOD/Navy	1.1.07-12.31.09
Carey	Acoustic Sensors and Array Processing: The Autonomous Wide Aperture Cluster for Surveillance (AWACS) Project	DOD/Navy	3.1.05-2.28.10
Carey	Sound Speed and Attenuation in Multiphase Media	DOD/Navy	1.1.04-3.31.11
Carey	Sound Speed and Attenuation in Muddy Sediments	DOD/Navy	12.1.08-4.30.10
Cleveland	Ultrasonic Image Guidance for HIFU Cancer Treatment	HHS/NIH/NCI	8.1.07-7.31.09
Cleveland	CDI-Type II: Collaborative Research - Simulation of Ultrasonic-Wave Propagation with Application to Cancer Therapy	NSF	10.1.08-9.30.12
Cleveland	The Structural Basis of Kidney Stone Fragility	HHS/NIH/NIDDK	9.1.08-8.31.09
Cleveland	Disposable Linear Arrays for Shockwave Lithotripter Pressure Measurements	HHS/NIH/NIDDK	4.29.09-1.31.10
Cleveland	Strategies for Improved Shock Wave Lithotripsy	HHS/NIH/NIDDK	7.1.09-6.30.10
Cleveland	Tracking Kidney Stones During Shock Wave Lithotripsy	HHS/NIH/NIDDK	4.1.10-3.31.11
Cleveland	Steerable MEMS Instruments for Precise Intracardiac Surgery	HHS/NIH/NIDDK	1.1.10-6.30.10

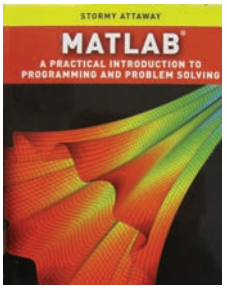
INVESTIGATOR	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD
Ekinci	CAREER: Photonic Integration of Silicon Nanoelectromechanical Systems	NSF	5.1.08-2.28.11
Ekinci Yakhot	High-Frequency Nanofluidics of Bio-NEMS: Theory and Experiments	NSF	6.15.08-5.31.11
Ekinci	National Institute of Standards and Technology	NIST	9.1.08-8.31.09
Ekinci Yakhot	Tailor-Made Superhydrophobic Surfaces for MEMS and NEMS	NSF	5.1.10-4.30.13
Gevelber	Real-Time Control for Engineering Electrospun Nanofiber Diameter Distributions for Advanced Applications	NSF	9.1.08-8.31.11
Gopalan Pal, Basu Ludwig, Smith	Solid Oxide Fuel Cell Cathodes: Unraveling the Relationship Between Oxygen Reduction, Structure, and Surface Chemistry	DOE	9.1.08-3.31.10
Gopalan Lin	Stable Potentiometric Sensor for Ce(III), Cel(IV) and Gd(III) Ions in Acidic Media	DOE	7.24.09-9.15.09
Gopalan Pal, Basu Ludwig, Smith	Solid Oxide Fuel Cell Cathodes: Unraveling the Relationship Between Structure, Surface Chemistry and Oxygen Reduction	DOE	9.1.08-3.31.10
Grace	Using CFD to Guide Rotor Wake Formulation for Fan Broadband Noise Simulations	AeroAcoustics Research Consortium	6.1.09--8.31.10
Holt	Laser Nucleation and Collapse Stability for Advanced Cavitation Power Technology	DOD/Army	2.18.08-6.28.10
Howe	Sound Sources of Phonation	HHS/NIH/NIDCD	12.1.07-11.30.09
Lin	Conjugated Polymer Solvent Affinity and Ion-Solvent Channel Design	Honda R&D Company Limited	1.1.09-3.19.10
McDaniel	Estimating the Effects of Damping Treatments on the Vibration of Complex Structures	DOD/Navy	2.7.08-4.30.11
Morgan	Collaborative Research: Micro- and Nano-scale Characterization and Modeling of Bone Tissue	NSF	9.1.08-8.31.11
Morgan	Inducing Skeletal Repair by Mechanical Stimulation	HHS/NIH/NIAMS	9.1.08-8.31.10
Morgan	3-D Visualization and Prediction of Spine Fractures	HHS/NIH/NIAMS	4.1.09-4.30.10
Pal	Solid Oxide Membrane Electrolyzer for the Production of Pure Hydrogen and Syn-Gas from a Source of Waste and Steam	Comm. of Mass./ Massachusetts Technology Transfer Center	9.1.08-8.31.09
Pal	Low-Cost, Low-Impact Magnesium Production by Solid Oxygen Membrane Electrolysis	DOE	8.1.09-12.31.09
Pal	SOM Electrolysis of Magnesium: Scale-Up Research and Engineering for Light-Weight Vehicles	NSF	4.20.10-4.19.11
Park	Mechanical Loss Mechanisms in C-Axis Gallium Nitride Nanowires	NSF	7.1.09-6.30.12
Porter	BRIGE - The Role of Vaporized Perfluorocarbon Nanoemulsions in Enhanced Ultrasound-Induced Lesion Formation for Cancer Therapy	NSF	9.1.09-8.31.11
Porter	MRI-Guided Localized Delivery of Chemotherapy Using Temperature-Sensitive Lipsomes and Focused Ultrasound	Focused Ultrasound Surgery Foundation	1.1.10-12.31.10
Porter	MRI-Guided HIFU-Mediated Heating and Lesion Formation Enhanced with Phase-Shift Nanoemulsions	HHS/NIH/NIBIB	7.1.10-6.30.11

INVESTIGATOR	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD
Roy	Detection and Identification of Buried Targets Using Time Reversal Acoustics	DOD/Navy	1.1.06-8.31.09
Roy	Center for Subsurface Sensing and Imaging Systems (CenSSIS) -- Research Thrust 1-Acoustics	NSF	9.1.08-8.31.09
Roy Cleveland Holt	R&D Mitigation of Cavitation Damage	DOE	10.5.06-9.30.09
Roy Cleveland Holt	The Utilization of the Analogic Ultrasound Imaging Engine and the Terason System 2000 in API, HIFU, and MedBED (CenSSIS Industrial Partner Program)	NSF	5.1.03-8.31.10
Sarin	Novel Ceramic Scintillators for PET (SBIR)	DOE	8.15.08-8.14.09
Sarin	High Performance, Low Cost Scintillators for PET	DOE	7.20.09-4.19.10
Sarin	High Performance Optical Ceramic Scintillator Through Nanotechnology	HHS/NIH/NIBIB	9.1.09-8.31.10
Wang	Adaptive Fuzzy Control for Modified F-15	NASA	7.17.08-12.31.09
Wroblewski	STTR Phase II: Plasma Spray Experiments in Support of Development of Sensor and Advanced Control for Plasma Spray		8.1.07-7.31.09
Zhang, K.	CAREER: Integrating Multi-Scale Mechanics and Biomaterials to Study the Translation of Mechanical Forces from Tissue to Cell	NSF	2.1.10-1.31.15
Zhang, X.	Uncooled Cantilever Microbolometer Focal Plane Arrays with MK Temperature Resolution: Engineering Mechanics for the Next Generation	DOE/Air Force	12.1.08-9.30.09
Zhang, X.	Design, Fabrication, and Characterization of an HT Micro TCD	Schlumberger Doll Research	7.1.09-12.31.10
Zhang, X.	CAREER: Creating Nanostructured Gratings on Microstructures for Residual Strain/Stress Measurement in NEMS/MEMS and Traction Force Measurement in Cells	NSF	2.13.04-8.31.09
Zhang, X.	GOALI: High Sensitivity Thermal Conductivity Sensor for Micro Gas Chromatography and Harsh Environment Chemical Detection	NSF	7.1.09-6.30.12
Zhang, X.	An Impedance-Based Assay Microsystem for Real-Time High Throughput Study of Single Cells	NSF	10.1.09-9.30.10
Zhang, X.	Mechanical Behavior of Amorphous Plasma-Enhanced Chemical Vapor Deposited Silicon Oxide Films for MEMS Applications	NSF	6.1.09-5.31.11
Zhang, X. Averitt	Materials and Mechanics of Metamaterial Enhanced MEMS for Terahertz Technology	DOE/Air Force	9.30.09-3.31.10
Zhang, X. Averitt	Coupled Evanescent Field Micro-Resonators for Downhole Data Relay	Advanced Energy Consortium	1.1.10-12.31.10
Zhang, X.	Collaborative Research: Elastic and Viscoelastic Characterization and Modeling of Polymer Based Structures for Biological Applications	NSF	6.1.10-8.31.11



Faculty Publications*

BOOKS



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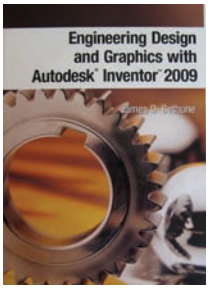

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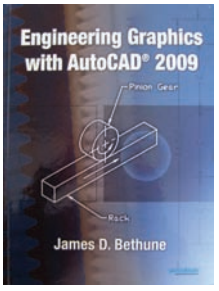

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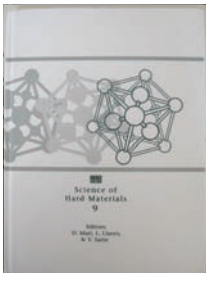

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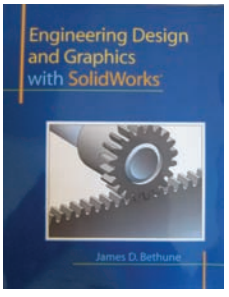

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* *Faculty Publications include all the published work by the Mechanical Engineering faculty during 1 January - 31 December 2009.*

On the left Professor Kamil Ekinci

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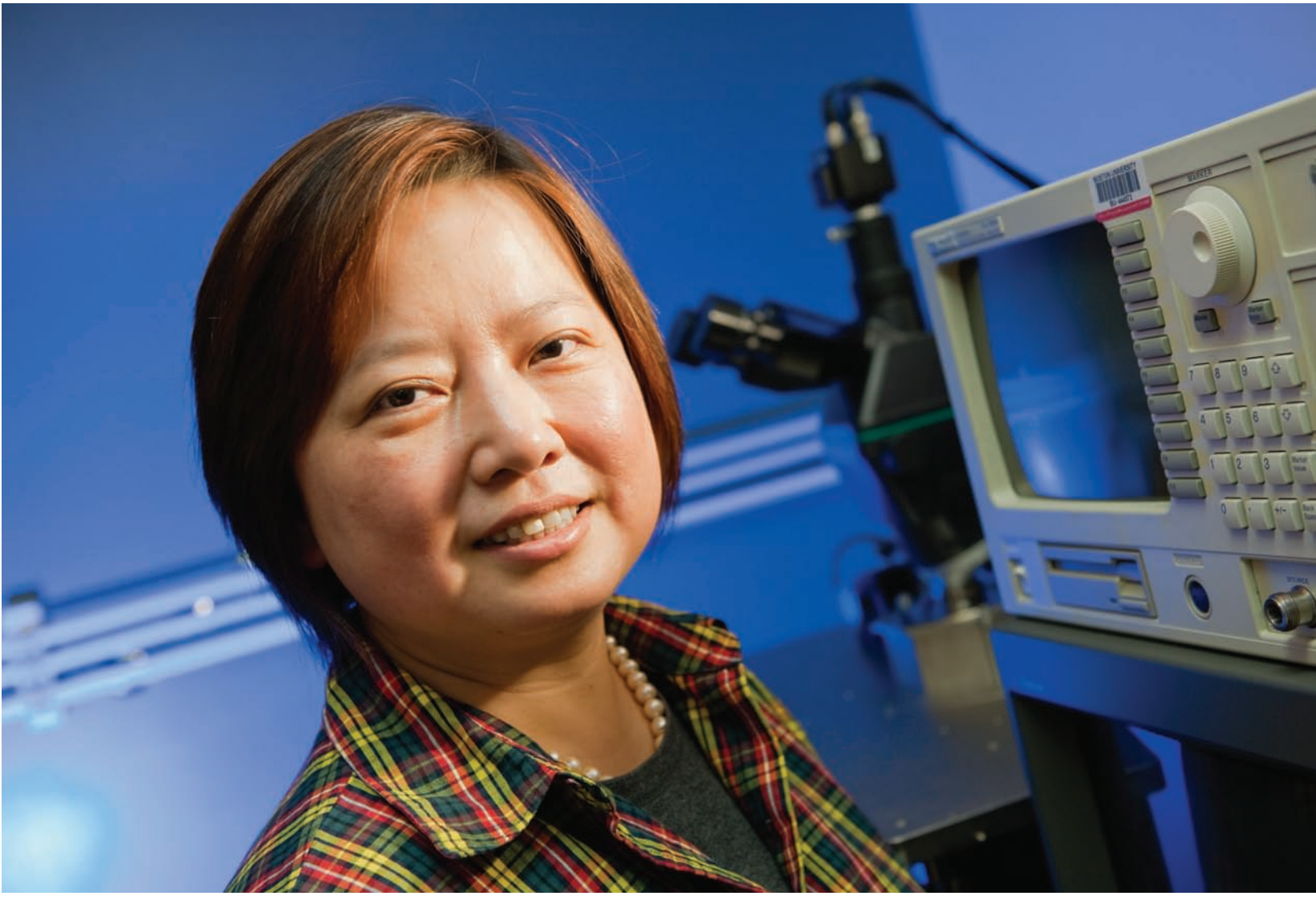

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J. Yao, **H.O. WANG** and X. Jin, "Passive Synchronization of Complex Spatio-Temporal Switching Networks with Coupling Delays," *Proceedings of the 24th IEEE International Symposium on Intelligent Control,* St. Petersburg, Russia, pp. 1605-1609, July 8-10, 2009.

H. Ohtake, K. Tanaka and **H.O. WANG**, "Fuzzy Model-Based Servo Control for Nonlinear Systems with Input Constraint," *Proceedings of the 24th IEEE International Symposium on Intelligent Control*, St. Petersburg, Russia, pp. 452-255, July 8-10, 2009.

Y.-J. Chen, H. Ohtake, W.-J. Wang, K. Tanaka and **H.O. WANG**, "Guaranteed Cost Control of T-S Fuzzy Systems Using Piecewise Lyapunov Function Based Switching Fuzzy Controller," *Proceedings of the 24th IEEE International Symposium on Intelligent Control,* St. Petersburg, Russia, pp. 440-445, July 8-10, 2009.

M. Yang, Y.-W. Wang, **H.O. WANG**, H. Ohtake and K. Tanaka, "Stabilization of Complex Switched Networks with two types of Delays via Impulsive Control," *Proceedings of the 2009 American Control Conference,* St. Louis, MO, pp. 5783-5788, June 10-12, 2009.

H. Ohtake, K. Tanaka and **H.O. WANG**, "Improved Controller Design for Switching Fuzzy Model-Based Control," *Proceedings of the 2009 American Control Conference,* St. Louis, MO, pp. 4284-4289, June 10-12, 2009.

H. Ohtake, K. Tanaka and **H.O. WANG**, "Switching Fuzzy Model Construction based on Optimal Dividing Planes," *Proceedings of the 2009 International Conference on Fuzzy Systems*, Jeju Island, Korea, August 20-24, 2009.

Y.-J. Chen, H. Ohtake, K. Tanaka, W.-J. Wang and **H.O. WANG**, "Relaxed Stabilization Conditions of T-S Fuzzy Systems Using Piecewise Lyapunov Function Based Switching Fuzzy Controller," *Proceedings of the 2009 International Conference on Fuzzy Systems*, Jeju Island, Korea, August 20-24, 2009.

Y. Higashi, K. Tanaka, H. Ohtake and **H.O. WANG**, "Improvement of Simulation Model and Development of Control Mechanism of Force Direction for a Flying Robot with Cyclogyro Wing," *Proceedings of the 2009 IEEE/RSJ International Conference on Intelligent Robots and Systems*, St. Louis, MO, October 11-15, 2009.

H. Jung, S.-H. Lee, D.H. Kim and **H.O. WANG**, "Development of the Car-like Robot with Variable Wheel Position Mechanism for Full Mobility," *Proceedings of the 2009 CACS International Automatic Control Conference*, Taipei, Taiwan, Nov. 27-29, 2009.

H. Jung, D.H. Kim, G. Ye and **H.O. WANG**, "Self-organization for Swarm Systems Based on Systematic Singular Association," *Proceedings of the 13th International Conference on Mechatronics Technology,* Cebu, Philippines, October 20-23, 2009.

O. Cote, **D. WROBLEWSKI** and J. Hacker, "Refractive Turbulence, Transient Electronic Disconnectivity, and Propagation Situational Awareness (PSA) ," *47th AIAA Aerospace Sciences Meeting,* Orlando, FL, January, 2009.

D. WROBLEWSKI, O. Ghosh, A. Lum, D. Willoughby, M. VanHout M, K. Hogstrom, **S.N. BASU** and **M. GEVELBER**, "Modeling and Parametric Analysis of Plasma Spray Particle State Distribution for Deposition Rate Control," *IMECE 2008: Heat Transfer, Fluid Flows, and Thermal Systems*, Vol. 10, pp 453-460, 2009.

Y. Zou and **Y. ZHANG**, "Time-Dependent Mechanics of Elastin Network," *Proceedings of the ASME 2009 Summer Bioengineering Conference*, Lake Tahoe, CA, 2009.

I-K Lin, **X. ZHANG** and **Y. ZHANG**, "Suppression of Inelastic Deformation in Multilayer Microcantilevers with Nanoscale Coating," *Materials Research Society Symposia Proceedings*, MRS Fall meeting, Boston, MA, 2009.

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B.C. Kaanta and **X. ZHANG**, "High Sensitivity uThermal Conductivity Detector for Gas Chromatography," *Proceeding of the 22nd IEEE International Conference on Micro Electro Mechanical Systems (MEMS '09)*, Sorrento, Italy, pp. 264–267, January 25-29, 2009.

H. Tao, K. Fan, C.M. Bingham, A.C. Strikwerda, D.V. Pilon, W.J. Padilla, R.D. Averitt and **X. ZHANG**, "Flexible Wide Angle Terahertz Resonant Absorber Based on Perfectly Impedance Matched Metamaterials," *Proceeding of the 22nd IEEE International Conference on Micro Electro Mechanical Systems (MEMS '09)*, Sorrento, Italy, pp. 108–111, January 25-29, 2009.

H. Tao, C.M. Bingham, A.C. Strikwerda, D.V. Pilon, D. Shrekenhamer, N.I. Landy, K. Fan, W.J. Padilla, **X. ZHANG** and R.D. Averitt, "Flexible Wide Angle Terahertz Resonant Absorber Based on Perfectly Impedance Matched Metamaterials," *Proceeding of the 29th Conference on Lasers and Electro-Optics / International Quantum Electronics and Laser Science Conference (CLEO/QELS '09)*, Baltimore, MD, CThFF2, May 31-June 5, 2009.

A.C. Strikwerda, K. Fan, H. Tao, D.V. Pilon, **X. ZHANG** and R.D. Averitt, "Comparison of Birefringent Metamaterials and Meanderline Structure as Quarter-Wave Plates at Terahertz Frequencies," *Proceeding of the 29th Conference on Lasers and Electro-Optics / International Quantum Electronics and Laser Science Conference (CLEO/QELS '09),* Baltimore, MD, CThFF5, May 31-June 5, 2009.

H. Tao, A.C. Strikwerda, K. Fan, C.M. Bingham, W.J. Padilla, **X. ZHANG** and R.D. Averitt, "Flexible Terahertz Metamaterials on Polyimide Substrates," *Proceeding of the 29th Conference on Lasers and Electro-Optics / International Quantum Electronics and Laser Science Conference (CLEO/QELS '09*), Baltimore, MD, CThFF1, May 31-June 5, 2009.

Y. Qiu, R. Liao and **X. ZHANG**, "Preventing Cardiomyocytes from TNF-Alpha-Induced Cell Death Based on Real-Time Monitoring Cell Adhesion through Impedance Sensors," *Proceeding of the 15th International Conference on Solid-State Sensors, Actuators and Microsystems*, Denver, CO, pp. 65–68, June 21-25, 2009.

Y. Qiu, R. Liao and **X. ZHANG**, "Intervention of Cardiomyocyte Death Based on the Impedance-Sensing Technique of Monitoring Cell Adhesion," *Proceeding of the 31st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC '09)*, Minneapolis, MN, pp. 4457–4460, September 2-6, 2009.

X. Zheng and **X. ZHANG**, "Development of a Versatile Cell Force Transducer Using Moire Mechanism," *Proceeding of the 31st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC '09)*, Minneapolis, MN, pp. 1180–1183, September 2-6, 2009.

X. Zheng and **X. ZHANG**, "Quantifying Contractility in Migrational Vascular Smooth Muscle Cells Regulated by Contractile Proteins Using a Novel Microfluidic Force Mapping Chip," *Proceeding of the 13th International Conference on Miniaturized Systems for Chemistry and Life Sciences (microTAS '09)*, Jeju, Korea, pp. 475–477, November 1-5, 2009.

I-K Lin, K-S Ou, K-S Chen and **X. ZHANG**, "Cellular Force Measurement in Cardiac Myocytes Using Polymer Micropillar Array with Viscoelastic Characterization," *Proceeding of the 13th International Conference on Miniaturized Systems for Chemistry and Life Sciences (microTAS '09)*, Jeju, Korea, pp. 269–271, November 1-5, 2009.

Y. Qiu, R. Liao and **X. ZHANG**, "Monitoring Spreading of Somatic Stem Cells Using an Impedance Sensor," *Proceeding of the 13th International Conference on Miniaturized Systems for Chemistry and Life Sciences (microTAS '09)*, Jeju, Korea, pp. 311–313, November 1-5, 2009.

P. Du, X. Li and **X. ZHANG**, "Characterization of the Correlation between Current Input and Curvature Output of Polypyrrole Trilayer Actuators," *Proceeding of the 9th International Workshop on Micro and Nanotechnology for Power Generation and Energy Conversion Applications*, Washington, DC, pp. 578–581, December 1-4, 2009.

INVITED PRESENTATIONS

S.A. ANDERSSON, "Imaging for in-cell surgery: studying single molecules through tracking," given at the LCSR/CISST Seminar Series at The Johns Hopkins University, 25 February 2009.

S.A. ANDERSSON, "Non-raster methods for high-speed AFM," given at The Workshop on Dynamics and Control of Micro/Nano Systems, IBM Zurich, 11 December 2009.

J. BAILLIEUL, "Decision-Making in the Performance of Search Tasks," One hour Colloquium Talk in the University of Washington Robotics, Controls and Mechatronics Colloquium, 15 May 2009.

J. BAILLIEUL, "The Center for Human and Robot Decision Dynamics," Briefing to D.D.R.&E., Roslyn, VA, 26 June 2009.

J. BAILLIEUL, "The Center for Human and Robot Decision Dynamics," at the 2009 AFOSR Dynamics and Control Program Review, 14 July 2009.

J. BAILLIEUL, "Exploration Behaviors and Decisions Regarding Rapid Exploration," at KTH Stockholm, Sweden, 9 September 2009.

J. BAILLIEUL, "Exploration Behaviors and Decisions Regarding Rapid Exploration," SIAM Conference on Control and Its Applications in Denver (http://www.siam.org/meetings/ct09/), 6-8 July 2009.

L.A. BARBA, "Fast summation algorithms maximizing performance on GPU architectures," at the NSF-NAIS Workshop on Intelligent Software: The Interface Between Algorithms and Machines, Edinburgh, Scotland, http://kac.maths.ed.ac.uk/NSF-NAIS/,19-21 October 2009.

L.A. BARBA, "Toward GPU-accelerated meshfree fluid simulation,"at the Initiative in Innovative Computing (IIC), School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, http://iic.harvard.edu/events/year/2009, 4 November 2009.

L.A. BARBA, "Parallel and meshfree: new frontiers of CFD," at the Center for Computational Science, Boston University, 17 April 2009.

P.E. BARBONE, "Linear and nonlinear elasticity imaging in the breast" Invited Keynote Lecture, American Institute for Ultrasound in Medicine, Annual Convention, New York, NY, 2-5 April 2009.

P.E. BARBONE, "Linking Time-reversal to Krylov Methods in Acoustic Focusing and Imaging," at Naval Undersea Warfare Center, Newport RI, 8 January 2009.

P.E. BARBONE, "Linking time-reversal to Krylov methods in acoustic focusing and imaging," presented in UU Seminar Series, Department of Mechanical Engineering, Boston University, 3 March 2009.

S.N. BASU, "Energy Technologies of the Future," at Dean's West Coast Advisory Committee meeting in San Francisco, CA, 10 June 2009.

S.N. BASU, "What Can Technology Do for Us?" presented at the panel on "The Future of Clean Energy: Opportunities and Challenges to Widespread Adoption of Sustainable Energy Technology" in San Francisco, CA, 10 June 2009.

C. BELTA, "Temporal logic motion planning and control," Harvard University, Department of Electrical Engineering, 6 February 2009.

C. BELTA, "Synthesis of Provably-Correct Control and Communication Strategies for Distributed Systems," University of Delaware, Department of Mechanical Engineering, 30 October 2009.

C. BELTA, "Synthesis of Provably-Correct Control and Communication Strategies for Distributed Systems," University of California, Los Angeles, Department of Electrical Engineering, 22 November 2009.

C. BELTA, "Temporal Logic Motion Planning and Control," Masaryk University, Department of Informatics, 27 May 2009.

C. BELTA, "Scalable algorithms for analysis and control of biochemical networks," Masaryk University, Department of Informatics, 28 May 2009.

C. BELTA, "Insights into the functional organization and robustness of genome scale metabolism," Northeastern University, Center for Complex Networks Research, Department of Physics, 2 February 2009.

C. BELTA, "Robotics Research at Boston University," Mass Technology Leadership Council Summit on the Future of Robotics, Boston, MA, 8 December 2009.

C. BELTA, "Synthesis of Provably-Correct Control and Communication Strategies for Distributed Systems," , Pasadena, CA, 23 September 2009.

C. BELTA, "Formal Approaches to Robot Motion Planning and Control," United Technology Research Center, Hartford, CO, 9 September 2009.

C. BELTA, "Automatic Deployment of Robotic Teams from Temporal Logic Specifications," AFOSR Dynamics and Control Program Review, Washington, DC, 16 July 2009.

C. BELTA, "Automatic deployment of robotic teams from rich specifications," Third Workshop on Swarming in Natural and Engineered Systems, Block Island, RI, 4 June 2009.

C. BELTA, "Automatic deployment of robotic teams from temporal logic specifications," Workshop on Formal Methods in Robotics and Automation, Kobe, Japan, 2009.

T. BIFANO, "Micro-deformable mirrors for astronomical telescopes," Bepi Colombo invited presentation, Padua Italy, 14 February 2009.

T. BIFANO, "MEMS Adaptive Optics," SPIE San Jose, CA, USA, January 2009.

M.C. CARAMANIS, "Geopolitics of Energy in Eurasia," European Studies Center, Harvard University, 31 March 2009.

M.C. CARAMANIS, "The Smart Grid: Synergies of Demand Side Management and Intermittent Clean Energy Generation," Tufts Energy Forum's 4th Annual Tufts Energy Conference, Tufts Univeristy, 28 March 2009.

M.C. CARAMANIS, "Plug in Hybrid Electric Vehicle load management," Renewable Energy National Laboratory, Denver, Colorado, 4 May 2009.

M.C. CARAMANIS, "Plug in Hybrid Electric Vehicle load management," Los Alamos National Laboratory, New Mexico, 5 May 2009.

M.C. CARAMANIS, " Is the Future Renewable?" Invited to Pardee's house seminar to talk and lead a discussion along with professor William Moomaw of Tufts University Fletcher School, Boston University, 17 November 2009.

M.C. CARAMANIS, "The Smart Grid Broadly Construed as a Cyber-Physical Electric Power System Business Platform," IEEE Demystifying the Smart Grid Symposium, MIT, 21 November 2009.

M.C. CARAMANIS, WNYC's program "Please Explain" to discuss the Electrical Power System along with Cornell University Professor Robert Thomas, 30 October 2009.

R.O. CLEVELAND, "MUSIC to Track Kidney Stones in SWL," at the 3rd Symposium International Kidney Stone Institute, Indianapolis, IN, December 2009.

R.O. CLEVELAND, "Mechanisms of stone disintegration," at the World Congress on Endourology, Munich, Germany, October 2009.

R.O. CLEVELAND, "Tutorial on Biomedical Ultrasound," at the 2009 International Symposium on Biomedical Imaging, Boston, MA, July 2009.

R.O. CLEVELAND, "Lithotripsy: A shocking blow to kidney stones," Pennsylvania State University, March 2009.

K. EKINCI, "Fluid Dynamics of NEMS," Argonne National Laboratory, CNM Users Meeting, 6 October 2009.

K. EKINCI, "Fluid Dynamics of NEMS: Fundamental, Challenges and Prospects," at the Ninth Annual Sukant Tripathy Memorial Symposium, U. Mass Lowell, 4 December 2009.

D. COLE, "Some thermodynamic process considerations at the small and large energetic scales," ME faculty seminar, Boston University, 17 March 2009.

S. GRACE, "Using CFD to Guide Rotor Wake Formulation for Fan Broadband Nose Simulations," at GE Global Research, 26 May 2009.

S. GRACE, "Using CFD to Guide Rotor Wake Formulation for Fan Broadband Nose Simulations," Ohio Aerospace Institute, Aeroacoustics Research Consortium Meeting, 3 December 2009.

M.S. HOWE, "Indirect Combustion Noise," Department of Mathematics, Keele University, England, 28 May 2009.

C.M. KLAPPERICH, "Molecular Diagnostics in Plastic Microfluidics," Brandeis University, Waltham, MA, Department of Physics Seminar Series, 16 July 2009.

C.M. KLAPPERICH, "Tiny Chips on Target to make a Big Difference in Global Health," BU Women's Council, Boston, MA, 18 March 2009.

C.M. KLAPPERICH, "Molecular Diagnostics in Plastic Microfluidics," Becton Dickinson/Biosense, Raleigh, NC, 15 June 2009.

C.M. KLAPPERICH, "Molecular Diagnostics in Plastic Microfluidics," CIMIT Forum, Boston, MA, 24 March 2009.

X. LIN, "Conductive polymer topological soliton theory," Department of Chemistry (Host: Feng Wang), Boston University, Boston, MA, 4 February 2009.

X. LIN, "Conductive polymer soliton theory revisited," Department of Physics, University of Massachusetts-Amherst, Amherst, MA, 12 February 2009.

X. LIN, "Molecular conductance: Electron-phonon coupling and fractal dimension," NSF-IGERT Nanotechnology Seminar, University of Massachusetts-Amherst, Amherst, MA, 9 April 2009.

X. LIN, "Multiscale materials modeling: Algorithms and applications," Department of Mechanical Engineering, University of Tokyo, University of Tokyo, Tokyo, Japan, 22 July 2009.

X. LIN, "History-Penalized basin filling algorithm: Transition state and global minimum search," Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian, China, 31 July 2009.

X. LIN, "Conducting polymer soliton theory," College of Chemistry and Molecular Engineering, Peking University, Beijing, China, 10 August 2009.

J.G. MCDANIEL, "Estimating the Effects of Damping Treatments on the Vibration of Complex Structures," ONR Annual Review, Carderock, Bethesda, Maryland, 20 August 2009.

J.G. MCDANIEL, "Vibrations and Frogs: Between the Devil and the Deep Blue Sea," Waves and Signs, Low-Frequency Vibration, Center for Advanced Visual Studies, Massachusetts Institute of Technology, Friday, 24 April 2009.

J.G. MCDANIEL, "Ocean Energy and Sensors," UU Seminar to Mechanical Engineering Department, Boston University, 12 February 2009.

J.G. MCDANIEL, "Ocean Wave Energy," COE Undergraduate Research Seminar entitled "Let's Concentrate," 17 November 2009.

E.F. MORGAN, "Regulating Skeletal Repair by Mechanical Stimulation," Department Seminar, Mechanical, Aerospace, and Nuclear Engineering, Rensselaer Polytechnic Institute, November, 2009.

E.F. MORGAN, "Measurement of the Local Mechanical Environment of Skeletal Tissues," Department Seminar, Bioengineering, University of Utah, February, 2009.

E.F. MORGAN, "Mechanical Regulation of Skeletal Healing," Invited Talk, Symposium on "Biomaterials: properties, variation and evolution", Annual Meeting of the Society for Integrative and Comparative Biology, Boston, January, 2009.

U.B. PAL, "Performance Analysis of Single Step Co-fired Solid Oxide Fuel Cells (SOFCs)," Solid Oxide Fuel Cells, Eleventh International Symposium (SOFC-XI), Vienna, Austria, October 2009.

U.B. PAL, "Green Technology Research at Boston University", Clean Energy Week, Boston, MA, November 2009.

U.B. PAL, "Clean Energy Research at Boston University-Fuel Cells, Fuel Processing and Green Manufacturing," US-UK Workshop, Boston, MA, November 2009.

A.D. PIERCE, "A sustained record of distinguished service to the profession," at meeting of the Acoustical Society of America in San Antonio, October 2009.

A.D. PIERCE, "Sediment shear as a perturbation in geoacoustic inversions and an explanation of the anomalous frequency dependence of the attenuation," at meeting of the Acoustical Society of America in San Antonio, October 2009.

A.D. PIERCE, "Measurement of sound transmission through mud at Dodge Pond, Connecticut," at meeting of the Acoustical Society of America in San Antonio, October 2009.

A.D. PIERCE, "Realities of publishing in a journal: Why should you submit, what should you submit, and what problems might you encounter?" Presented at meeting of the Acoustical Society of America in Portland, Oregon, May 2009.

A.D. PIERCE, "Measurement methodologies for the analysis of influence of surface panels and their vibrations on interior cabin noise," at meeting of the Acoustical Society of America in Portland, Oregon, May 2009.

A.D. PIERCE, "Intrinsic damping models and their role in predicting structural response," at meeting of the Acoustical Society of America in Portland, Oregon, May 2009.

T.M. PORTER, "Measurement of the attenuation coefficient of monodisperse populations of ultrasound contrast agent," IEEE Engineering in Medicine and Biology Society, Minneapolis, MN, 2-6 September 2009.

T.M. PORTER, "Harnessing the power of bubbles in biomedical ultrasound," Department of Physics, Ryerson University, Toronto, Ontario Canada, 19 March 2009.

T.M. PORTER, "Engineering nanoparticles for localized noninvasive cancer therapy," Department of Hematology and Oncology, Boston University, 23 April 2009.

R.A. ROY, "Utilizing light and sound for biomedical imaging," at the 34th International Symposium on Ultrasonic Imaging and Tissue Characterization, Arlington, VA, June 2009.

R.A. ROY, "Optical property measurement in diffuse media using acousto-optic pressure contrast imaging," at the 34th International Symposium on Ultrasonic Imaging and Tissue Characterization, Arlington, VA, June 2009.

R.A. ROY, "Introduction of a gas bubble layer to mitigate cavitation erosion damage to solid surfaces," at Oak Ridge National Laboratory, SNS, February 2009.

R.A. ROY, "A vertical acoustic waveguide for two-phase mercury-helium flow void fraction determination," at Oak Ridge National Laboratory, SNS, February 2009.

V. SARIN, "Advance Materials and High Temperature Coatings," IIT Mumbai, Mumbai, India, February 2009.

V. SARIN, "Laminated CVD Mullite Ceramic Composites," UPC, Barcelona, Spain, June 2009.

D. WROBLEWSKI, "Clear Air Turbulence (CAT) and Optical Turbulence (OpT) in the Upper Troposphere/Lower Stratosphere (UTLS)," Department Seminar, California Polytechnic University, 4 June 2009.

V. YAKHOT, "Turbulent mixing and beyond," International Workshop, Trieste, Italy, July 2009.

V. YAKHOT, "Nanofluidics and nanoresonators," Seminar, Brown University, Providence, RI, April 2009.

X. ZHANG, "Development of optical moiré based micro and nano biomechano sensor," at Department of Physics, Boston University, Boston, MA, 30 October 2009.

X. ZHANG, "Cellular BioMEMS: Miniaturized Biomechanosensors for Measuring Cellular Mechanical Forces in Cardiac Myocytes and Smooth Muscle Cells," at Department of Chemistry, Boston University, Boston, MA, 4 November 2009.

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PATENTS

R.G. HOLT, T.R. Murray, and J.R. Sukovich, "A method for non-contact pressure sensing using laser-induced dielectric breakdown in transparent media," filed May 15, 2009.

C.C. Coussios, M. Arora, N. Hockhan, and **R.A. ROY**, "Adaptive and spatial control of acoustic cavitation during ultrasoind exposure," UK Patent Application Number 0916634.9, filed September 2009.

C.C. Coussios, M. Gyongy, M. Arora, and **R.A. ROY**, "Mapping and characterization of cavitation activity," UK Patent Application Number 1100019454, filed November 2009.

C.C. Coussios, M. Gyongy, M. Arora, and **R.A. ROY**, "Sensing changes in temperature and in the mechanical and rheologiocal properties of tissue and other materials by acoustic cavitation noise diagnostics," UK Patent Application Number 0916635.6, filed September 2009.

CONTRIBUTED PRESENTATIONS

M. Lahijanian, **S.B. ANDERSSON**, and **C. BELTA**, "A probabilistic approach for control of a stochastic system from LTL specifications," IEEE Conference on Decision and Control, pp. 2236-2241, 2009.

Z. Shen and **S.B. ANDERSSON**, "Tracking multiple fluorescent molecules in two dimensions in a confocal microscope," IEEE Conference on Decision and Control, pp. 6052-6057, 2009.

P.I. Chang and **S.B. ANDERSSON**, "A maximum-likelihood detection scheme for rapid imaging of string-like samples in atomic force microscopy," IEEE Conference on Decision and Control, pp. 8290-8295, 2009.

P.I. Chang and **S.B. ANDERSSON**, "Theoretical bounds on a non-raster scan method for tracking string-like samples," American Control Conference, pp. 1682-1687, 2009.

Z. Shen and**S.B. ANDERSSON**, "LQG-based tracking of multiple fluorescent particles in two-dimensions in a confocal microscope," American Control Conference, pp. 2266-2271, 2009.

D. Raghunathan and **J. BAILLIEUL**, "Exploiting Information Content in Relative Motion," at the 2009 American Control Conference, St. Louis, 10-12 June, 2009.

J. BAILLIEUL, "The Standard Parts Problem and the Complexity of Control Communication," the Joint 48th IEEE Conference on Decision and Control and 28th Chinese Control Conference Shanghai, P.R. China, 16 December, 2009.

S.K. Layton, F.A. Cruz, and **L.A. BARBA**, "Parallel fast Gauss transform in a heterogeneous computing environment," 10th National Congress on Computational Mechanics USNCCM10, Columbus, Ohio, 16-19 July, 2009.

F.A. Cruz, and **L.A. BARBA**, "Parallelization of algorithms for heterogeneous computing systems with application to fast summation methods," 10th National Congress on Computational Mechanics USNCCM10, Columbus, Ohio, 16-19 July, 2009.

C. Cooper and **L.A. BARBA**, "Panel-free boundary conditions for viscous vortex methods," 19th AIAA Computational Fluid Dynamics Conference, San Antonio, Texas, 22–25 June 2009.

F.A Cruz, C. Cooper, R. Yokota, and **L.A. BARBA,** "Parallel implementation of panel-free boundary conditions for the vortex particle method," 21st International Conference on Parallel Computational Fluid Dynamics, Moffett Field, California, 18–22 May, 2009.

P.E. BARBONE, A.A. Oberai, and G.R. Feijoo, "Krylov methods in time-reversal imaging by multiple-signal-classification," Meeting of Acoust. Soc. Am., Portland, Oregon, 2009.

C.E. Rivas, **P.E. BARBONE**, and A.A. Oberai, "A stabilized forward elasticity finite element formulation yields a stable and convergent inverse elasticity solution," Meeting of Acoust. Soc. Am., Portland, Oregon, 2009.

U. Albocher, A.A. Oberai, **P.E. BARBONE**, and I. Harari, "Direct Computation of Inverse Problems of Incompressible Plane Stress Elasticity with Full Interior Data," US National Congress on Computational Mechanics, Cleveland, Ohio, July 2009.

S. Goenezen, A.A Oberai, and **P.E. BARBONE**, "Nonlinear Elasticity Imaging for Incompressible Solids," US National Congress on Computational Mechanics, Cleveland, Ohio, July 2009.

C.E. Rivas, **P.E. BARBONE**, A.A. Oberai, and O. Babaniyi, "A stabilized B-splines FEM formulation for the solution of an inverse elasticity problem arising in medical imaging," presented at the Gordon-CenSSIS NSF Site Visit, Boston, MA, April 2009.

J.M. Kracht, **P.E. BARBONE**, and **R.O. CLEVELAND**, "Kidney stone localization in vitro using multiple-signal-classification," J. Acoust. Soc. Am., 126 2213, 2009.

M. Lahijanian, M. Kloetzer, S. Itani, **C. BELTA**, and **S.B. ANDERSSON**, "Automatic deployment of autonomous cars in a robotic urban-like environment (RULE)," IEEE International Conference on Robotics and Automation, pp. 2055-2060, 2009.

T.G. BIFANO, L. Schatzberg, J. Stewart, and S. Cornelissen, "MEMS Modulated retroreflectors for secure optical communication," Proceedings of the ASME International Mechanical Engineering Congress and Exposition, Vol 13, Pts A and B, New York, Amer Soc Mechanical Engineers, 395-399, 2009.

K.K. Chu, A. Leray, **T.G. BIFANO**, and J. Mertz, "Two-photon fluorescence microscopy with differential aberration imaging," SPIE MEMS Adaptive Optics III, San Jose, CA, USA, SPIE, [7209], 720903-720905, 2009.

L. Ziph-Schatzberg, **T.G. BIFANO**, S. Cornelissen, J. Stewart, and Z. Bleier, "Secure optical communication system utilizing deformable MEMS mirrors," SPIE MEMS Adaptive Optics III, San Jose, CA, USA, SPIE, [7209], 72090C-72015, 2009.

L. Ziph-Schatzberg, **T.G. BIFANO**, S. Cornelissen, J. Stewart, and Z. Bleier, "Deformable MEMS mirrors in secure optical communication system," Micro- and Nanotechnology Sensors, Systems, and Applications, Orlando, FL, USA, SPIE, [7318], 73180T-73112, 2009.

K. Chu, **T.G. BIFANO**, and M. Jerome, "Two-Photon Differential Aberration Imaging Using a Modulating Retroreflector Mirror," Novel Techniques in Microscopy, Optical Society of America, NMD3, 2009.

K. Chu K, **T.G. BIFANO**, and J. Mertz, "Improvements in Two-Photon Fluorescence Microscopy," Frontiers in Optics, Optical Society of America, FWA2, 2009.

T.G. BIFANO, "MEMS Wavefront Correctors," Adaptive Optics: Methods, Analysis and Applications, Optical Society of America, AOThD1, 2009.

M.C. CARAMANIS, and J. Foster " Management of Electric Vehicle Charging to Mitigate Renewable Generation Intermittency and Distribution Network Congestion," 48th IEEE CDC, pp. 4717-4722, Dec, 2009.

M.C. CARAMANIS, C. Wu, and I.C. Paschalidis, "Production Planning and Quality of Service Allocation across the Supply Chain in a Dynamic Lead Time Model," 48th IEEE CDC, 7137-7144, Dec. 2009.

M.C. CARAMANIS, C. Cassandras, T. Little, and I. Paschalidis, "The Cyber-Physical (CP) Electric Power Generation-Delivery-Consumption Platform: Research Challenges for Optimal Investment Trade offs between the Platform's Cyber and Physical Components," presented at the NSF-NIST-DOE workshop on the Smart Grid, a Cyber Physical Energy System, Baltimore, 3-4 June 2009.

W.M. CAREY, J.D. Holmes, and J.F. Lynch, "The applicability of a small autonomous vehicle towed array system to ocean acoustic measurements and signal processing," Proceedings of Meetings on Acoustics, vol. 4, 070007, 2009.

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Y. Qiu, R. Liao, and **X. ZHANG**, "Monitoring Spreading of Somatic Stem Cells Using an Impedance Sensor," presented at the 13th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Jeju Island, Korea, November 1-5, 2009.

H. Tao, C.M. Bingham, K. Fan, D.V. Pilon, A.C. Strikwerda, W.J. Padilla, **X. ZHANG**, and R.D. Averitt, "Dual-Band Metamaterial Absorber in the Terahertz Regime," presented at the Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

K. Fan, A.C. Strikwerda, H. Tao, **X. ZHANG**, and R.D. Averitt, "Terahertz Magnetic Response from 3D Metamaterials," Materials Research Society Fall Meeting, Boston, MA, November 30 – December 3, 2009.

H. Tao, A.C. Strikwerda, C.M. Bingham, N.I. Landy, K. Fan, D.V. Pilon, D. Shrekenhamer, **X. ZHANG**, W.J. Padilla, and R.D. Averitt, "The Marriage of MEMS and Metamaterials at THz Frequencies," presented at the Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

P. Du, H. Lu, and **X. ZHANG**, "Measuring the Young's Relaxation Modulus of PDMS Using Stress Relaxation Nanoindentation," presented at the Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

K.-S. Ou, I.-K. Lin, P.-H. Wu, **X. ZHANG**, and K.-S. Chen, "Mechanical Characterization of Atomic Layer Deposited (ALD) Alumina for Applications in Corrosive Environments," Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

I.-K. Lin, K. Zhang, and **X. ZHANG**, "Suppression of Inelastic Deformation in Multilayer Microcantilevers with Nanoscale Coating," presented at the Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

X. Wang, S. Yerci, I.-K. Lin, L. Dal Negro, and **X. ZHANG**, "Mechanical and Optical Properties of Reactively Sputtered Silicon-Rich Silicon Nitride Films," presented at the Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

I.-K. Lin, P.-H. Wu, K.-S. Ou, K.-S. Chen, and **X. ZHANG**, "The Tunability in Mechanical Properties and Fracture Toughness of Sputtered Silicon Oxynitride Thin Films for MEMS-Based Infrared Detectors," presented at the Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

B.C. Kaanta, H. Chen, and **X. ZHANG**, "Control and Operation Schemes for Micro-Thermal Conductivity Detectors in Gas Chromatography," presented at the Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

Y. Qiu and **X. ZHANG**, "A Novel Impedance Sensing Technique for Monitoring Spreading of Somatic Stem Cells," Materials Research Society Fall Meeting, Boston, MA November 30 – December 3, 2009.

X. Zheng and **X. ZHANG**, "A Microfluidic Chip for Analysis of Mechanical Forces Generated during Cell Migration," presented at the Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

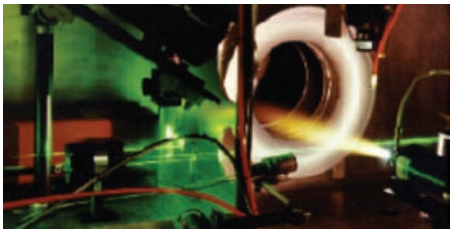
B.J. Hansen, G. Lu, I.-K. Lin, N. Kouklin, J. Chen, and **X. ZHANG**, "The Growth and Characterization of Copper (II) Oxide Nanowires with Single Nanowire Electrical, Gas Sensing, and Photoconduction Measurements," presented at the Materials Research Society Fall Meeting, Boston, MA, USA, November 30 – December 3, 2009.

P. Du, X. Lin, and **X. ZHANG**, "Characterization of the Correlation Between Current Input and Curvature Output of Polypyrrole Trilayer Actuators," presented at the 9th International Workshop on Micro and Nanotechnology for Power Generation and Energy Conversion Applications, Washington DC, USA December 1-4, 2009.

B.J. Hansen, G. Lu, I.-K. Lin, N. Kouklin, J. Chen, and **X. ZHANG**, "The Growth and Characterization of Copper (II) Oxide Nanowires with Single Nanowire Electrical, Gas Sensing, and Photoconduction Measurements," presented at the 3rd International Conference on One-Dimensional Nanomaterials, Atlanta, GA, USA, December 7-9, 2009.

Research Laboratories

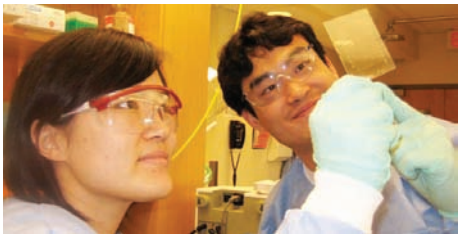
Advanced Materials Process Control Lab
MICHAEL GEVELBER



The primary research focus of the Advanced Materials Process Control Laboratory is to apply a systems-based approach to improving material processing capabilities. Research projects involve an integrated effort of physical modeling, sensor development, system design, and control development.

Current projects include work on plasma deposition for protective coatings, crystal growth for electronic applications, and chemical vapor deposition. An experimental CVD system has been developed for implementing real-time control. A microbalance is used to measure growth rates in situ, and parallel DSP boards are used for data analysis and control. Related research includes development of analysis methods for identifying fundamental process constraints, as well as development of advanced sensors and observers to infer the process state.

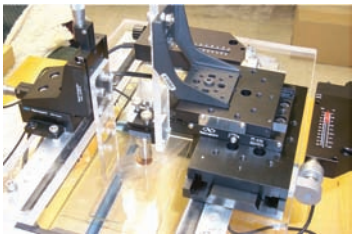
Biomedical Microdevices and Microenvironments
CATHERINE KLAPPERICH



The Biomedical Microdevices and Microenvironments laboratory is focused on materials research activities in the broad areas of tissue engineering and biomedical device design. The laboratory is equipped for polymer and hydrogel synthesis, microfluidic device rapid prototyping, fabrication of tissue engineering scaffold materials, molecular analysis, and tissue culture. It houses a dynamic mechanical analyzer for time and temperature sensitive testing of gel and polymer macroscale mechanical properties.

This facility is a fully functional laboratory for integrated mechanical, chemical, and biological testing of biomaterials. The laboratory is adjacent to the shared bio-micro/nanofabrication center. This cleanroom contains a mask aligner, AFM, DekTak Profilometer, e-beam evaporator, and a spin coater. The lab also maintains a Hysitron Triboscope Nanoindentation Instrument located in the Low Vibration Area of the Photonics Center. Laboratory projects include experiments and modeling of the contact problem for nanoscale probes on soft hydrated biomaterials, cell-biomaterial interactions in tissue engineering materials, and diagnostic microfluidic device design.

Biomedical Ultrasonics Lab
ROBIN CLEVELAND, R.GLYNN HOLT, TYRONE PORTER, RON ROY



This laboratory is equipped for wet and dry experiments supporting a broad spectrum of ultrasound research, including nonlinear acoustics, bubble-related physical and biomedical acoustics, therapeutic ultrasound, acoustic cavitation, and transduction. There are two fully instrumented ultrasonic scan tanks with computer-controlled positioners. One is for research into high-intensity-focused ultrasound for surgery and the other contains a peizo-electric array with 170 elements capable of generating intense shock waves for research in lithotripsy. The lab has a scanning acoustic microscope (SAM) that can employ ultrasound pulses with frequencies up to 150 MHz for imaging samples. The lab is well stocked with general-purpose test and measurement equipment such as function generators, multimeters, power amplifiers, preamps, analog and digital oscilloscopes. The lab is equipped with a full-size fume hood, a water purification system, and various instruments for fluid and biomaterial control, processing, and measurement.

BioRobotics Lab
PIERRE DUPONT

The BioRobotics Research Group (BRG) solves theoretical and practical problems in minimally invasive surgery. They specialize in medical robot and instrument design, development of imaging techniques for surgical guidance, modeling tool-tissue interaction; and teleoperation / automation of instrument motion. They utilize analytical tools from robotics, dynamics and control together with innovative design techniques to create successful solutions. The team members come from diverse backgrounds with degrees in mechanical / biomedical / electrical engineering and medicine. Their specialties range from biomedical robotics, clinical practice and imaging to product design and many areas in between.

Control in Nanoscale Systems
SEAN ANDERSSON

Andersson's research group uses this facility to develop and apply new techniques for the study of dynamics in nanoscale systems. They use advanced systems and control methods to design and analyze algorithms which offer extremely high spatial and temporal resolution. The target systems lie primarily in the realm of single molecules and molecular systems. The lab includes an optical microscope, a nanopositioning stage, a homebuilt confocal microscope, and laser excitation sources.

Fabrication Lab
JOE ESTANO

The Fabrication Laboratory helps support the overall research mission of the department by fabricating instrumentation and components for research use. Currently, the major machinery in the laboratory consists of 3 Sharp end mills with CNC control systems, two Sharp lathes, a band saw, some older drill presses, a table saw, a grinder and sander, and miscellaneous hand tools. The laboratory occupies 1305 sq. ft. in two adjacent rooms: ENG B02 and ENG B07 of 110 Cummington St. Its operation is under the supervision of the department's laboratory supervisor and laboratory engineer.

Green Manufacturing Lab
SRIKANTH GOPALAN

Research in Green Manufacturing Laboratory focuses on environmentally benign power generation technologies such as solid oxide fuel cells (SOFCs). They explore the material science and electrochemistry of SOFCs using tools such as impedance spectroscopy, galvanostats and potentiostats. Studies in this lab include measurement of the rates of charge transfer reactions that occur at the interfaces of solid state electrochemical devices, exploration of new materials and processes and modeling of the transport phenomena that occur in such devices. In this lab, they also conduct research on ceramic gas separation membranes for the separation of industrially important gases such as oxygen and hydrogen.

Ongoing projects conducted in close collaboration with industrial partners include the development of electrode and electrolyte materials for lower operating temperature SOFCs and the development of mixed ionic and electronic conducting materials for separation of hydrogen. The laboratory is equipped with a Perkin Elmer 263 A Potentiostat/Galvanostat used for characterization of electrochemical systems such as fuel cells, ceramic gas separation membranes, batteries and sensors, a Horiba 910 particle size analyzer capable of obtaining particle size distributions of powders in the range of 0.01 microns to 1 mm using light scattering technique, a Solartron 1255 Frequency Response Analyzer (FRA) used for AC impedance spectroscopy, high temperature furnaces that can operate up to 1700˚C, and a Spex 8000 mill capable of producing sub-micron particles for use in solid state electrodes by high-energy ball milling in a very short period of time.

High Temperature Materials Processing Lab
UDAY PAL

The High Temperature Materials Processing Laboratory is completely equipped for studying most high-temperature chemical and electrochemical processes involving metals and ceramics. It includes several high-temperature furnaces, residual gas analyzers, CO/CO2 analyzers, potentiostats, impedance analyzers, state-of-the-art thermogravimetric Cahn Balance, high precision power supplies capable of operating under constant current/voltage mode, viscometers, state-of-the-art data acquisition systems, powder processing facility, and fuel cell test stations.

The laboratory currently supports the following research programs: green electrochemical synthesis of high-energy content metals such as magnesium, titanium, calcium, and tantalum, novel materials processing for hydrogen storage, membrane technology for hydrogen production and separation, hybrid one-step processing of solid oxide fuel cells, and materials for intermediate temperature solid oxide fuel cells.

High Temperature Oxidation Lab
SOUMENDRA BASU

The research focus is to investigate high-temperature oxidation behavior of materials by exposing metal and ceramic samples to corrosive atmospheres containing oxygen and sulfur at elevated temperatures up to 1,600˚C. The laboratory is equipped with a CAHN (thermogravi-metric) balance and a Mettler microbalance for weight gain measurements, as well as an apparatus for oxidation in O–18 atmospheres, in order to determine oxidation mechanisms.

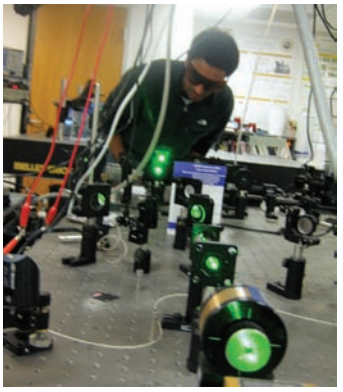
Hybrid and Networked Systems (HyNeSs) Lab
CALIN BELTA

Belta's research group is interested in phenomena that occur when continuous dynamics, described by systems of differential equations, are combined with discrete dynamics, modelled as automata or state transition graphs. Such systems are called hybrid, and examples range from man-made systems such as mobile robots, to naturally occurring systems such as biochemical networks, where the continuous dynamics of metabolic processes is regulated by the logic of gene expression. Its approach to the analysis and control of such systems combines concepts and tools from computer science and control theory. Its current application areas are networked mobile robotics, swarming, gene networks, and genome scale metabolic analysis.

Intelligent Mechatronics
JOHN BAILLIEUL

The mission of the Laboratory for Intelligent Mechatronic Systems (LIMS), formerly called the BU Robotics Lab, is to understand the design and integration of novel sensing and actuation technologies for a wide variety of control applications. The Lab is particularly interested in active materials exploiting electrostrictive and magnetostrictive effects, as well as the rapidly growing variety of silicon-based microelectromechanical (MEMs) devices. Incorporating these into actuator and sensor arrays, the LIMS studies mechatronic systems in which global dynamical effects are achieved through the aggregation of distributed parallel local actions. Control of pattern formation in multiagent systems in which band limited communication channels mediate real-time data-flow between sensor and actuator arrays is central to the research. Applications of interest include fluid structure interactions, robotic system interactions with fluids and elastic solids, microelectromechanisms, rotating shafts, and turbine dynamics.

Laser Acoustics Lab
RON ROY

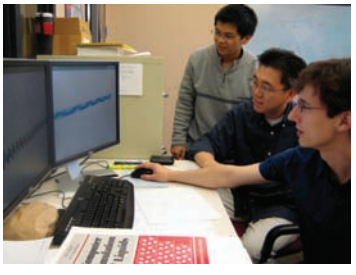


The laser acoustics lab supports research in the nondestructive characterization of conventional and biological materials. Current research projects include the development of acousto-optic imaging systems for the detection of abnormalities deep within biological tissues, the study of light and sound interaction with nanoparticles with potential applications in tissue imaging and therapy, and the development of full-field techniques for the characterization of arrays of nanostructures. The lab houses a variety of ultrasonic imaging and optical equipment.

Lab for Microsystems Technology
XIN ZHANG

The Laboratory for Microsystems Technology (LMST) is dedicated to interdisciplinary research in the design, fabrication, characterization, packaging, and operation of Microelectromechanical Systems (MEMS) and Nanoelectromechanical Systems (NEMS). They perform research on MEMS and NEMS. Specifically, they are interested in applying materials science, micro/nanomechanics, and micro/nanomanufacturing technologies to solve various engineering problems that are motivated by practical applications in MEMS/NEMS and emerging nanobiotechnologies. LMST is a Class 1000 cleanroom that provides resources for the design, fabrication, characterization, and testing of MEMS/NEMS devices. LMST is also a general biochemistry laboratory that has a strong collaboration with the Boston University School of Medicine.

Materials Theory Lab
XI LIN



The Materials Theory Group seeks to understand the property of materials via modeling and simulation. The Group makes functional materials devices following theoretical predictions in the Materials Theory Laboratory.

Medical Acoustics Lab
TYRONE PORTER

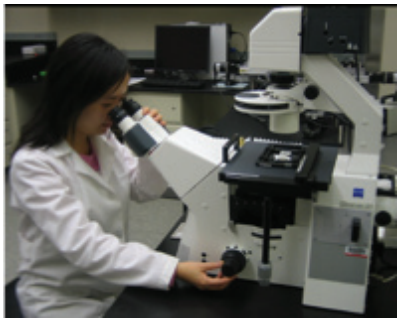
The Medical Acoustics Laboratory aims at studying the interaction between ultrasound, tissue, and biomaterials and developing new ultrasound technologies for medical applications. Research thrusts in the Medical Acoustics Lab include the development of temperature- and pressure-sensitive drug carriers, the formulation and characterization of monodisperse ultrasound contrast agents, and designing systems to monitor and control bubble-enhanced ultrasound thermal ablation of solid tumors.

Microscopy Lab
SOUMENDRA BASU

The Microscopy Laboratory is dedicated to the preparation of electron transparent specimens for observation in the Transmission Electron Microscope (TEM). The specimens have to be reduced to a thickness on the order of 100Å in order to study atomic arrangements by high resolution TEM. Equipment available for this purpose includes a GATAN dimpler and ion-mill, as well as precision grinding and polishing apparatus. The laboratory is also equipped with a darkroom, capable of processing TEM negatives and prints.

Multiscale Tissue Biomechanics Lab
KATHERINE ZHANG

In the Multiscale Tissue Biomechanics Lab, K. Zhang's research group integrates knowledge of biology, nonlinear solid mechanics, and finite element modeling, especially of complex materials and constitutive behavior. Through the research, the lab provides insights in understanding the relationship between microscopic biological processes and changes in macroscopic tissue mechanics due to diseases, and helps the development of diagnostic, therapeutic, and pharmaceutical techniques. The Multi-Scale Tissue Biomechanics Laboratory was established in 2006 and includes a fully equipped wet lab and computational facilities for characterization and modeling of the mechanical behavior of soft biological tissues and composites at multiscale.



Nanoscale Engineering Lab
KAMIL EKINCI

The Nanoscale Engineering Laboratory is used to fabricate nanometer scale semiconductor mechanical devices using electron beam lithography, plasma, and wet etching techniques. After fabrication, various state-of-the-art characterization techniques are employed to study the physical processes dominant in these nanomechanical devices. Among the fundamental phenomena studied are dissipation, fluctuations, and surface effects at the nanometer length scales. The practical aspects of this research involve the design and fabrication of ultra-high-speed nanomechanical sensors and development of surface nano-engineering techniques for improved device characteristics.

Orthopaedic and Developmental Biomechanics Lab
ELISE MORGAN

Morgan's research group uses experimental and computational methods to explore the relationships between structure and mechanical function of biological tissues at multiple length scales in the Orthopaedic and Developmental Biomechanics Lab. Current research projects include quantification of physiological loading conditions, 3-D visualization and prediction of spine fractures, and the effects of mechanical stimulation on joint and articular cartilage development.

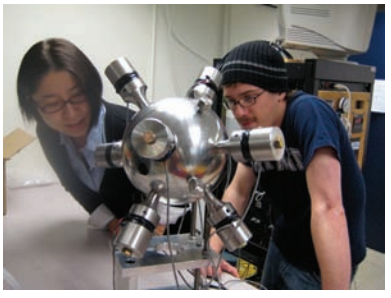
The laboratory houses a biaxial (axial-torsional) servohydraulic materials testing system with a variety of extensometers and load cells, a miniature torsional testing system, two micro-computed tomography

systems, a multi-channel signal conditional and amplification system, an X-ray cabinet, and various cutting tools including a sledge microtome and low-speed wafering saw. Additional space is dedicated to cell and tissue culture. Computational facilities include PC workstations equipped with software for image processing, finite element analysis, and general computing.

Photo-acoustics and Photo-thermal Microscopy Lab
TODD MURRAY

Research in the Photo-acoustics and Photo-thermal Microscopy lab focuses on the development of laser-based techniques for the characterization and nondestructive evaluation of small scale structures including thin films and coatings, membranes, MEMS and nanoscale devices. The laboratory includes pulsed and high frequency amplitude modulated laser sources, optical interferometers, and a variety of high speed electronic and signal processing components.

Physical Acoustics Lab
R.GLYNN HOLT



The interaction of sound with with fluids, especially those with free surfaces, is at the heart of the work in the Physical Acoustics Lab. The coupling of sound to interfacial motion leads to a variety of interesting phenomena involving free surfaces, bubbles and drops. Many of these phenomena have surprising practical applications. A few of our projects are described below.

In one externally funded project, we are investigating the collective collapse of cavitation clusters in high-static-pressure liquids. We utilize high-power pulsed laser beam arrays to control cluster nucleation and investigate the onset of collective bubble effects in high-pressure spherical resonators. Understanding the physics of collective cluster collapse will lead to applications involving high-temperature and high-pressure reactions.

In another project, in collaboration with a biomedical device company, we are using ultrasonic acoustic levitation as a technique for investigating the rheology of blood clots. The uniqueness of this non-contact method allows the determination of the intrinsic strength of clots as a function of a variety of control factors, in turn allowing medical device designers to more effectively break up clots. In two other projects we are investigating the unique properties of acoustically-driven nonlinear parametric instability waves known as Faraday waves. These waves spontaneously form patterns, and efficiently focus vibrational energy at a free surface. Our efforts are directed at investigating pattern freezing as an alternative to traditional time-consuming approaches, and towards understanding Faraday waves in periodic structures.

Powder Metallurgy & X-ray Lab
VINOD SARIN

The powder processing laboratory is equipped to batch, process, and densify a wide variety of materials. Particle size reduction and uniform mixing are essential in any powder preparation. In addition to a 500cc capacity attritor mill for processing small powder batches, an extensive selection of ball mill sizes and a variety of milling media, including silicon nitride and titanium carbide, are available. Dies and presses for powder compaction and component development have been established. Consolidation and sintering capabilities include vacuum, over pressure, and hot pressing up to 25,000 KgF and temperatures in excess of 2,400˚C. These capabilities make the powder processing laboratory uniquely equipped for developing high temperature monolithic and composite materials.

The laboratory is also equipped with a Bruker D8 Focus diffractometer with independent theta and two theta axis with copper radiation. This unit extends the laboratory's capability to perform single crystal back reflection Laue studies for crystal orientation. The standard detector is the scintillation counter, with high dynamic range and low internal background. In addition, several Debye Scherrer powder cameras are also available. This unit is equipped with all necessary components for qualitative or quantitative phase analysis, crystallite size determination, and structure determination and refinement.

Precision Engineering
TOM BIFANO

The Precision Engineering Research Laboratory (PERL) is home to an active program in Micro-electromechanical Systems (MEMS) research. In MEMS, the tools that emerged from the semiconductor manufacturing revolution are employed to design and build electronic, mechanical, and optical devices whose dimensions are measured in nanometers and micrometers. Like their microelectronic counterparts, MEMS devices can be made extremely small and in great numbers economically. The research program at PERL focuses on Optical MEMS systems—electromechanical devices to improve the performance of imaging and communication systems. One of the more successful outcomes of this research has been the design, fabrication, and testing of a new class of micromirror array that can be used to improve the resolution of microscopes, telescopes, and biomedical instruments.

Two specific types of these devices, developed at the University—MEMS deformable mirrors and MEMS spatial light modulators—have been incorporated into test-beds worldwide to exploit this new technology. The work on optical MEMS includes design, manufacturing, and testing of these devices. PERL is housed in the Photonics Center, where world-class facilities for modeling, producing, and measuring optical MEMS devices are available.

Shock Wave Lab
ROBIN CLEVELAND

The Shock Wave Laboratory houses a number of shock wave sources for research into lithotripsy (breaking of kidney stones) and shock wave therapy (the treatment of musculoskeletal pain). There are two electrohydraulic (spark based source) lithotripters: one is a research device which allows control over various aspects of the shock wave and the second is a clinical device complete with fluoroscopic imaging. The lab is also home to two shock wave therapy (SWT) devices for research into the use of shock waves to treat soft-tissue injury. Acoustical and optical cavitation detection systems are used to sense bubble activity generated by shock waves. There is a high-pressure chamber with acoustically transparent windows that is equipped with acoustic and optical ports to allow for the study of shock wave interaction with stones under pressure.

The laboratory also houses the Drop Physics Module, an acoustic levitation apparatus that flew on the Space Shuttle in the Space-lab module during the missions STS-50 (First United States Micro-gravity

Laboratory, USML-1) and STS-73 (USML-2). The apparatus enabled the study of drop dynamics and surface rheology in micro-gravity. This apparatus is currently being refurbished and will be used for studies of the dynamic rheology of foams.

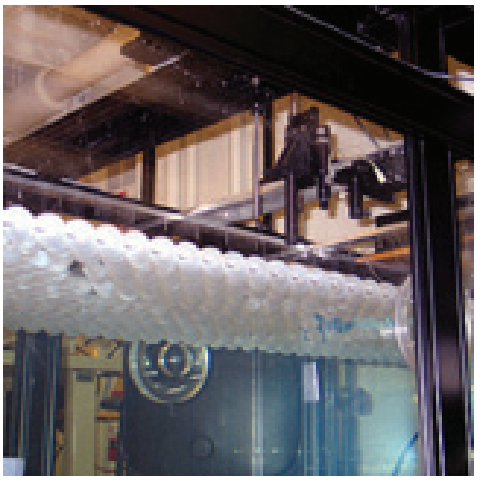
Undergraduate Machining Lab
BOB SJOSTROM

This lab is used to prototype manufacturing projects, and provides fundamental engineering research support. The lab emphasizes modern processing machinery and manufacturing aids such as computer-aided design and computer-aided manufacturing (CAD/CAM).

This lab is used for demonstration and projects in several manufacturing courses for carrying out milling, cutting, and drilling of different materials. This state-of-the-art shop is equipped with a HAAS VF2 Vertical Machining Center, 2 Sharp 1224 Vertical Machining Centers, an OKUMA LB 15 CNC 12 Station Turret Lathe, a FANUC TAPE CUT W0 Wire EDM, a HARDINGE HLV-H Toolroom Lathe, a Sharp SG618 Surface Grinder, 2 BRIDGEPORT vertical mills, a LEBLOND 16" engine lathe, 3 BRIDGEPORT Series I-CNC vertical mills w/Anilam Controls, a GROB vertical band saw, a CLAUSING-COLCHESTER 15" engine lathe, a KEARNEY TRECKER horizontal mill, and a RUEMELIN sand blaster. The lab also has 2 computer stations using Virtual Gibbs Cad Cam, Delcam's ArtCam, and Solid Works software.

Underwater Sound and Ultrasound Lab
WILLIAM CAREY, ROBIN CLEVELAND, R.GLYNN HOLT, RAYMOND NAGEM, RON ROY

The focus of this laboratory is the propagation of sound in natural bodies of water. Facilities include a wet lab testing facility as well as various instrumentation for sound generation, detection, and propagation experiments. The lab also contains 2 workstations for computational modeling. In addition to lab and computational efforts, at-sea research projects are under way through collaborations with other regional facilities.



Facilities include a large-water-filled, ultrasound scan tank (with precision positioners, supporting computers and acoustic-electronic instrumentation) for general-purpose ultrasound research and two diagnostic ultrasound scanners for biomedical imaging research. The SNS work features an acoustic resonator designed for detecting free gas bubbles in flowing mercury and a laser cavitation system for generating reproducible bubble cloud collapse near boundaries under well-controlled aqueous conditions. Cloud collapse diagnostics include high-speed photography, acoustic emission measurements, and boundary surface vibrations measured using a laser Doppler vibrometer.

Vibrations Lab
J.GREGORY McDANIEL

The laboratory offers a full suite of sensors, instrumentation, and software necessary to research the vibrations of complex structures and technologies that reduce vibration and noise. One area of current interest is the spatial mapping of energy removal by damping treatments in order to better design damping treatments for complex structures. Another area is the mitigation of automotive brake squeal.

Orthopaedic and Developmental Biomechanics Lab

Affiliated Research Centers

Center for BioDynamics (CBD)

The Center for Biodynamics (CBD) is a multidisciplinary, interdepartmental center, which strives to advance training and research between dynamical systems, biology, and engineering. The CBD trains undergraduates, graduate students, and postdoctoral fellows in leading techniques from these disciplines. The CBD emphasizes the integration of research and education, as well as the vertical integration of students and mentors at all levels within Boston University. Training is often done through involvement in cross-disciplinary collaborations and co-mentored projects.

Fraunhofer Center for Manufacturing Innovation

The Fraunhofer USA Center for Manufacturing Innovation (FHCMI) provides product development assistance and manufacturing solutions to local and international industry. They work with their clients to develop new technologies, improve current manufacturing operations and, based on our global view, benchmark against the world's best practices. Their unique ability to access a global research base and their own vast experience give our clients an unparalleled advantage.

Fraunhofer has been bridging the gap between academic research and industrial needs for more than 50 years. It is Europe's largest R&D organization spanning over fifty locations across Europe, Asia and North America; and includes an annual client base of more than three thousand corporations.

The model is very simple: Fraunhofer Institutes work with industry and universities to scale up cutting edge research into real working technologies on an industrial time table. Their engineering leads to the development of advanced machinery and processes for a variety of applications. These range from submicron precision assembly for the photonics, biotech and semiconductor industries, to high volume manufacture of consumer products.

Photonics Center

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 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 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.

Center for Subsurface Sensing and Imaging Systems (CenSSIS)

The Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems is a multi-university National Science Foundation Engineering Research Center (NSF-ERC) founded in 2000. Its mission is to develop new technologies to detect hidden objects—and to use those technologies to meet real world subsurface challenges in areas as diverse as noninvasive breast cancer detection and underground pollution assessment. The center's multidisciplinary approach combines expertise in wave physics (photonics, ultrasonics, electromagnetics), multisensor fusion, image processing, and 3D CAT-scan-like reconstruction and visualization. The Gordon Center operates with the speed and agility more typical of a results-driven private company than of an academic institution, consistent with the needs of its industrial and government partners. With its commitment to leveraging technology transfer to spur economic development, the Gordon Center is intended to be a national model for the fusion of academic research and private-sector collaboration.

Center for Information and Systems Engineering (CISE)

The Center for Information and Systems Engineering provides a home across departments for faculty and students interested in information and systems engineering methodologies and their relevance to application domains encompassing the analysis, design, and management of complex systems. Information and systems engineering research at Boston University is strong and accomplished but also spreads across departments, colleges and schools within the University. In 2002, the Trustees approved the new CISE in order to foster greater interactions among researchers speaking the same technical language across diverse application domains. Currently, there are 30 affiliated faculty from the departments of Biomedical Engineering, Computer Science, Electrical and Computer Engineering, Mathematics and Statistics, Mechanical Engineering, Operations Management and the Division of Systems Engineering. Current focal application domains include: Automation, robotics and control; Communications and networking; Computational Biology; Information Sciences; Production, Service Systems, and Supply Chains.

Center for Nanoscience and Nanobiotechnology

BOSTON UNIVERSITY
CENTER FOR NANOSCIENCE
AND NANOBIOTECHNOLOGY

Nanoscience and nanotechnology research and development are leading a revolution in basic materials science and engineering. New advancements with designed functionality are poised to enable a huge range of applications in everything from developing fundamental building blocks in the electronics, photonics, and materials sectors, to sensors, biomimetic and biocompatible platforms throughout the biomedical and health sectors.

The strength of Boston University's efforts in interdisciplinary nanoscience and nanotechnology form an axis that begins in basic materials science, surface science, physics, chemistry, and engineering, extending into molecular and cellular biology, biophysics, and the technologies of microfluidics, MEMS, and onto manufacturing. Our strengths are in developing and using nanotechnology advances in materials and platforms with our capabilities in biomedical engineering to focus on applications in understanding subcellular processes, biomolecular function and human physiology.

The new Center for Nanoscience and Nanobiotechnology was established to advance academic and technological research and development in nanoscience and nanobiotechnology. The Center serves as a hub for nanoscience researchers from the Charles River and Medical Campuses and builds activities that develop interdisciplinary research and training. The Center will connect scientists from disparate disciplines with each other in seminars, meetings, joint visitor programs and seeded projects to enhance the development of interdisciplinary nanoscale research. The Center will lead large, interdisciplinary proposal development and run funded programs for both research and training, as well as support individual researchers in their efforts by linking them with resources throughout the University and beyond. The Center will also build linkages between the research and technological commercialization resources at BU including the Photonics Center, the Technology Commercialization Institute, and Fraunhofer and with external partners and industrial affiliates.

Photonics Center at Boston University

Seminars

DATE	SPEAKER	TITLE
9.4.09	**Catherine Klapperich** Department of Mechanical Engineering Boston University	Miniaturizing Molecular Diagnostics: Engineering for Portability, Performance and Ease of Use
9.11.09	**Gretar Tryggvason** Mechanical Engineering Worcester Polytechnic Institute	Direct numerical simulations of multiphase flow
9.18.09	**Pierre Dupont** Department of Mechanical Engineering Boston University	Development of robot technology for minimally invasive surgery
9.25.09	**Clare M. Rimnac** Department of Mechanical and Aerospace Engineering Case Western Reserve University	Engineering the natural history of total joint replacements
10.2.09	**Richard Wlezien** Department of Mechanical Engineering Tufts University	Hybrid laminar flow for efficient subsonic cruise
10.9.09	**Julie Chen** Department of Mechanical Engineering University of Massachusetts Lowell	Emerging opportunities and strategies for research and partnerships in mechanical engineering
10.16.09	**Michael P. Brenner** School of Engineering and Applied Sciences Harvard University	Physics and mathematics of self assembly
10.23.09	**Kamil Ekinci** Department of Mechanical Engineering Boston University	Fluid dynamics of NEMS: Fundamentals, challenges, and prospect
10.26.09	**Semyon M. Meerkov** Electrical Engineering and Computer Science Department University of Michigan	Production Systems Engineering: Problems, Solutions, and Applications
11.6.09	**Chiang C. Mei** Department of Civil and Environmental Engineering MIT	The 2009 Felsen Lecture: Modeling of the hydrodynamics of power extraction from sea waves
11.13.09	**James F. Lynch** Applied Ocean Physics and Engineering Woods Hole Oceanographic Institution	The 2009 Munk Award Lecture: Acoustical oceanography and shallow water acoustics
12.4.09	**George G. Adams** Mechanical and Industrial Engineering Department Northeastern University	Analytical modeling and experiments in the contact of a rough microsphere with a flat solid surface
12.11.09	**Louis L. Bucciarelli** School of Engineering MIT	How many engineers does it take to design a light bulb?
1.15.10	**George Karniadakis** Applied Mathematics Department Brown University	Multiscale modeling of complex fluids, soft matter, and red blood cells
1.22.10	**Robert D. White** Mechanical Engineering Department Tufts University	Microsystems for acoustic sensing - biomimetics and engineered systems

DATE	SPEAKER	TITLE
1.27.10	**Ismail B. Celik** Mechanical and Aerospace Engineering Department West Virginia University	Application of micromachined devices to cochlear mechanics, biomedical ultrasound, and aeroacoustics
2.5.10	**Federico Capasso** School of Engineering and Applied Sciences Harvard University	Casimir-Lifshitz forces: vacuum fluctuations, quantum levitation, and the future of nanomachines
2.12.10	**Alexander Gorlov** Department of Mechanical and Industrial Engineering Northeastern University	The Gorlov Helical Turbine and its applications to the extraction of power from water currents and wind
2.19.10	**Arun Shukla** Department of Mech. Engineering and Applied Mechanics University of Rhode Island	Novel layered materials for blast mitigation and aerospace applications
2.26.10	**Jim Slinkman** IBM	Scanning Surface Photo Voltage Microscopy for characterization of stress on silicon device structure
3.19.10	**Alexander Smits** Department of Mechanical and Aerospace Engineering Princeton University	Turbulence at high Reynolds numbers
3.26.10	**Patricia Davies** School of Mechanical Engineering Purdue University	Sound quality and the assessment of aircraft noise
4.2.10	**Robin Cleveland** Department of Mechanical Engineering Boston University	Lithotripsy: a shocking blow to kidney stones
4.9.10	**Brian Storey** Olin College	Electrokinetic flow in microfluidics: problems at large voltages
4.16.10	**Jeff Mendoza** United Technologies Research Center	Silencing a diverse corporation
4.30.10	**Robert C. Dean Jr.** Synergy Innovations, Inc. and Dartmouth College	Invention, innovation and entrepreneurship

Professor Chiang C. Mei giving the 2009 Felsen Lecture: Modeling of the hydrodynamics of power extraction from sea waves.

Merril L. Ebner Fund

BACKGROUND

Since 2003, The Merrill L. Ebner Fund has been used to support a number of activities, all centered around the key aim to encourage educational activities in engineering involving creative design and commercialization. Roger and Sandra Dorf of Austin, Texas, established the financial basis of this initial fund, to which others have continued to contribute. Prof. Merrill Ebner designed the main activities and uses of the Fund, which will be discussed below. Since the Spring of 2008, when Prof. Ebner passed away, the Merrill Ebner Fund Committee has continued to organize and direct this work.

The committee for the present academic year included:

STORMY ATTAWAY Co-Chair

DAN COLE Co-Chair

RONALD ROY

J. GREGORY MCDANIEL

DONALD WROBLEWSKI

XIN ZHANG

Within the Fund are two distinct sub-funds. The "Endowed Fund" receives contributions from which the accumulated interest is available for use. Contributions to the "Current Use Fund" are available for use immediately upon receipt. The Merrill Ebner Fund Committee provides oversight for both Funds.

Activities of the Fund, which impact both the undergraduate and graduate programs, are in some cases fully financed by the Fund. In other cases the Fund leverages its alumni and corporate contributions by providing start-up funds for a project. The Fund continues to be primarily used to encourage creative design and commercialization within Mechanical Engineering, with emphasis on manufacturing operations.

FUND STATUS

The Endowed Fund has received $-0- and the Current Use Fund has received $1000 this fiscal year. As of July 1, 2010, total cumulative cash contributions (current principal) in the Endowed Fund have been $127,658. As of that date the available funds in the Endowed Fund (interest on the principal) are $14,785 and in the Current Use Fund $8039.

DESIGN PORTFOLIO CONTEST

One of the first major activities at the undergraduate level of the Endowed Fund was the establishment of an annual Undergraduate Design Portfolio Contest. The contest was started in the spring of 2005, and has been held annually since then. In the past, this design competition was open to all sophomores and juniors in the College of Engineering, with the intention of encouraging all engineering students to begin to develop their design portfolios early in their college career. This year, however, in order to increase the level of participation in the contest, it was opened up to undergraduates at all levels. Judging procedures that were established in 2005 state that every year a Portfolio Review Jury is to be designated consisting minimally of the Chair (or Co-chair) of the Ebner Fund Committee, a member of the design faculty, a senior engineering student, an engineering alumna or alumnus and the Mechanical Engineering Department Chairman or his or her designee. This year the jury consisted of:

STORMY ATTAWAY Co-Chair

DAN COLE Design Faculty

JOSEPH SHIFRIN Senior Engineering Student

CHARLIE LISSANDRELLO Engineering Alumnus

MORT ISAACSON Chair Designee

In order to encourage student participation in the contest, at least one Portfolio Workshop has also been held every year. At these workshops students and alumni exhibit their portfolios; the intention is to provide lower division engineering students with an idea of what reasonably complete portfolios look like. This year there were two different workshops. The first was held in conjunction with the Department Open House in December; this was set up as an informal table students could drop by. Subsequently, Prof. Cole held another workshop in March that was attended by approximately 20 undergraduate students. This workshop was more formally structured.

The jury decides on the contest winners. Since the contest was opened up to all undergraduates, the prize structure was revamped accordingly. It was decided that cash awards of $500 for the best senior portfolio, $400 for the best junior portfolio, $250 for the best sophomore portfolio, $100 for the best freshman portfolio, and $500 for the best overall portfolio would be awarded at the Department's end-of-year social on May 3, 2010. This year's winners were:

SAMIR AHMED (EE 2013) Freshman

YIN LIN (ME 2011) Junior

WARREN HUFFMAN (MFG 2010) Senior

Overall winner: **YIN LIN**

Note: there were no sophomore entries.

GRADUATE THESIS AWARD WITH THE GREATEST COMMERCIAL POTENTIAL

The third annual "Graduate Thesis with the Greatest Commercial Potential" award competition was held this year. Any M.S. or Ph.D. thesis produced by a student in the Department of Mechanical Engineering was eligible to be considered for this award. The total award for winning this juried competition is $3,000, paid from the Ebner Endowed Fund. The award is split evenly between the author(s) of the winning thesis and the faculty advisor for the thesis, to be used in support of the faculty advisor's laboratory.

The nomination process that was established requires that the Faculty Adviser must nominate the student/thesis to be considered by the jury. In this process, the faculty advisor writes a single-page letter of nomination for the thesis, including a discussion on the commercial potential of the thesis and any other helpful background on the thesis work to help facilitate judging. The thesis and nominating letter are then reviewed by a jury consisting of a chair and knowledgeable people chosen from the faculty and industry. In the past, the jury has included at least two faculty members, at least two people from industry, and often a BU alumni.

This year the jury ended up being smaller than usual for a number of reasons, although the number of applicants was actually higher. The make-up of the jury will need to be addressed next year. Fortunately, however, regarding the applications, the quality of the submitted theses was felt to be quite high by the jury. All had very good to excellent potential commercial applicability, combined with excellent research efforts.

The Jury for the 2010 Award consisted of three faculty members:

DAN COLE ME (Chair)
TED dE WINTER ME
DON WROBLEWSKI ME

The winning thesis, which was nominated by Prof. Vinod Sarin, was written by Tushar Kulkarni. The Ph.D. thesis was entitled, "Functionally Graded Mullite Coatings for Gas Turbines." By providing coatings on turbine blades that can withstand much higher temperatures, the efficiency of a turbine can be significantly increased.

DESIGN FELLOWSHIP

Also at the graduate level, a company-designated "Design Fellowship" has been established through the Current Use Fund. The structure of this Design Fellowship has been set up as a 16-month experience leading to a Master's degree. Design intensity is provided in the program by four elements: (1) graduate course work with special emphasis on the M.S. program option in Sensors and Instruments, (2) paid design assignments for 20-30 hours per week at the sponsoring company, (3) participation with a faculty design mentor providing an opportunity for the student to enhance the design and computation component in a senior or graduate course (referred to here as a "design practicum"), and (4) an M.S. thesis with a design thrust.

Tuition costs are shared between the College of Engineering and the sponsoring company and a book stipend is provided. All fellowship payments to Boston University on behalf of the sponsoring company are paid through the fund as the sponsor of the fellowship program. Since 2005, The Raytheon Company has been the primary supporter of Design Fellows.

Two Raytheon Fellows finished their M.S. degree and graduated in May 2009. They are: Joseph Wasniewski and Michelle Boudreau. Joseph chose to do a MS thesis with Prof. Calin Belta entitled, "An Experimental Platform for Probabilistic Robot Motion Planning and Control." This work involved the control and communication of autonomous robot networks. Michelle carried out a research project with Prof. Theodore Fritz in the CAS Astronomy Dept. on aerospace applications. Michelle's work involved design work for the Auroral Imager, which is a key subsystem of a BU satellite project.

No new Raytheon Fellows were started this year, but two more are expected to begin in a year from now.

Thus, the Merrill L. Ebner Fund continues to increase the design and commercialization emphasis in activities of interest to mechanical and manufacturing engineering. It is expected that its influence will continue to evolve and grow in future years.

The freshman winner of the Design Portfolio Contest Samir Ahmed (l.) receiving his award from Professor Wroblewski (r.)

Yin Lin, the junior and over all winner of the Design Portfolio Contest

Department of Mechanical Engineering

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