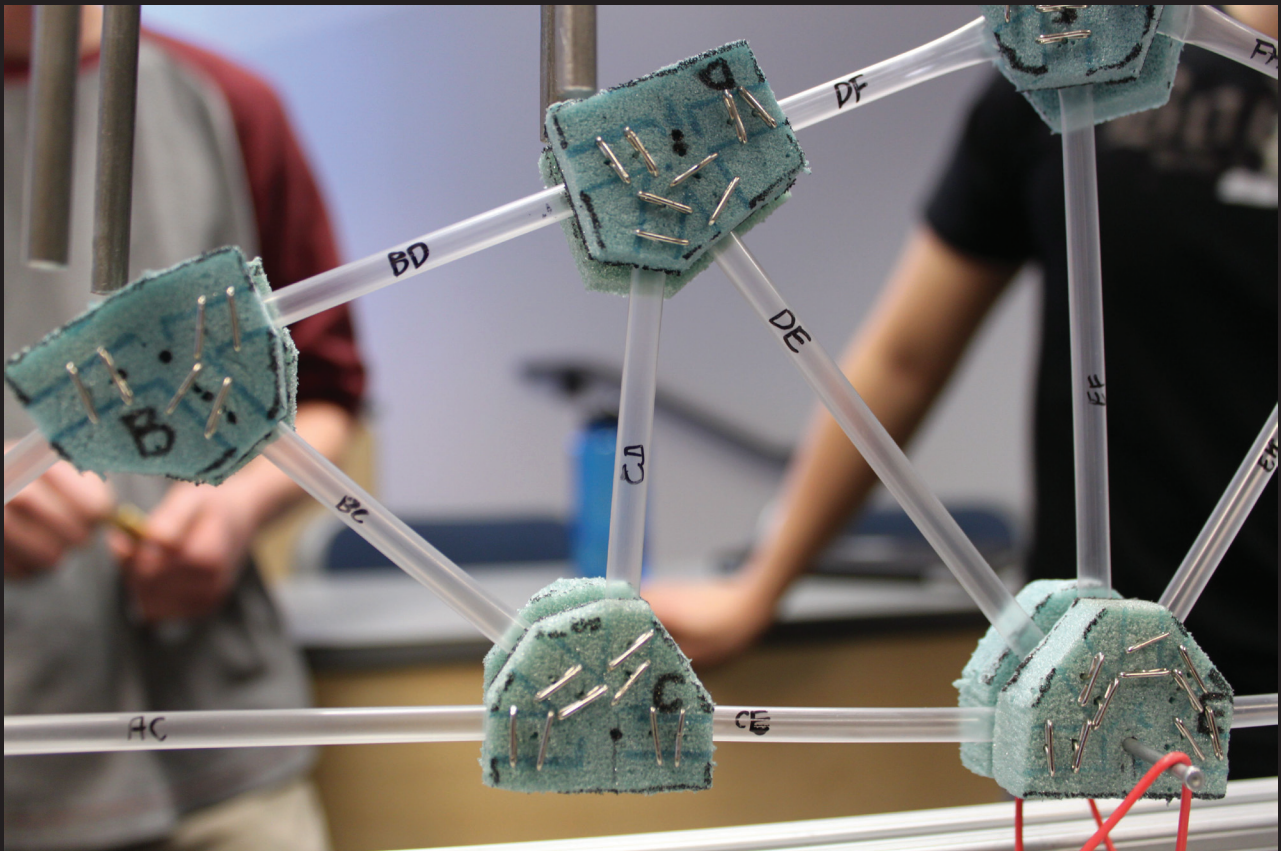


College of Engineering

# Annual Report 2011-2012

Department of Mechanical Engineering



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## MESSAGE FROM THE CHAIR



I am pleased to share with you the 2011-2012 edition of the Boston University Department of Mechanical Engineering Annual Report. We have successfully concluded the phased restructuring of our undergraduate programs, a process that began in 2008 when the former Manufacturing Engineering and Aerospace and Mechanical Engineering departments merged to form a single unit with over 40 full time faculty dedicated to quality instruction and active in a multiplicity of research topics ranging from acoustic levitation to bone mechanics. Many ME faculty have joint appointments in other Departments and are participating faculty in the BU Division of Material Science and Engineering and Division of Systems Engineering. Add approximately \$6M in new extramural research funding in FY2012 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 within the Department include, but are not limited to, acoustics and vibrations, automated manufacturing, biomaterials and biomedical applications of mechanical engineering, thermo-fluid sciences, materials engineering and mechanics, MEMS & NEMS, nanobiotechnology, robotics & controls, photonics, and systems engineering.

For students who matriculated prior to September 2008, the Department offered accredited BS degrees in mechanical, aerospace, and manufacturing engineering. Fiscal Year 2012 was final year of a 4-year process in which we “sunset” our BS degree programs in aerospace and manufacturing engineering and replaced them with an accredited degree in mechanical engineering with concentrations in aerospace and manufacturing. 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 either aerospace or manufacturing engineering. The College has also created two new concentrations accessible to ME students, one in “Energy Technologies” and one in “Nanotechnology.” The new ME program is designed with flexibility in mind.

At the graduate level, the Department offers the PhD in mechanical engineering as well as MS degrees in both mechanical and manufacturing engineering. The MS degree programs are targeted to students focused on industrial or academic research. In addition, the department recently launched two new engineering masters degree programs, the MEng in mechanical engineering and manufacturing engineering. The MEng caters to the advanced student who aspires to work in industry and features a suite of courses, taught by both engineering professors and faculty from the School of Management,

that reside in the intersection of engineering and management. Interested students can choose to pursue either the MEng or the MS in manufacturing engineering 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 2011-2012 academic year we made several new additions to the ranks of full-time faculty. Assistant Professor Jacy Bird received his PhD from Harvard University in 2010. His research is broadly based in fluid dynamics, with a specific focus on the capillary dynamics of drops and bubbles. Assistant Professor Chuanhua Duan, who received his PhD from the University of California, Berkeley in 2009, studies enhanced ion/molecule transport using ordered micro/nanostructures, for both fundamental understanding and practical applications in energy conversion/storage and biomolecular sensing/separation. Assistant Professor Emily Ryan received her PhD from Carnegie Mellon University in 2009. She conducts research in the area of computational modeling of energy systems. Finally, Assistant Professor Mac Schwager, who received his PhD from MIT in 2009, studies group behaviors in robots and animals using tools from control theory, optimization, and statistical inference.

Several ME faculty members received well-deserved awards. Lorena Barba was named the CUDA Fellow from NVIDIA Corporation. Caleb Farny received the 2012 ME Department Award for Excellence in Teaching. Hua Wang was the recipient of the 2012 BU College of Engineering Service Award, and Don Wroblewski was appointed the Inaugural College of Engineering Associate Dean for Educational Initiatives. I am also pleased to announce that Profs. Andersson, Park, Porter, and Katherine Zhang all received tenure and promotion to the rank of Associate Professor, and Profs. Cleveland and Xin Zhang were promoted to full professor.

In AY2011-2012, the Department featured a total undergraduate enrollment of 453 and conferred 123 BS degrees in three active programs. Several students won significant awards including approximately 75% of the awards conferred by the College. The graduate program hosted approximately 134 MEng/MS/PhD students, with 54 degrees conferred in three programs. Several graduate students won best paper awards and extramural fellowships (NSF, Clare Boothe Luce). It is important to stress that the ME faculty research portfolio is extremely diverse and crosscutting. Mechanical engineering professors serve as PI on grants administered by numerous College departments and research centers, as well as the BU Medical Center. Indeed, almost 50% of the PhD students supported by ME faculty are earning degrees in programs outside of mechanical engineering, mostly in BME, ECE, or one of the Division programs.

It is both an honor and a challenge to lead the BU Department of Mechanical Engineering into the future. The next few years will witness additional 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

A handwritten signature in black ink, appearing to read "Ronald A. Roy".

Ronald A. Roy  
Professor and Chair  
Department of Mechanical Engineering

# OVERVIEW

## HIGHLIGHTS

Fiscal Year 2012 was a very active year that saw many accomplishments on all fronts. Our main focus areas were the expansion of the graduate programs and the implementation of the new design sequence in the undergraduate curriculum. 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

- As a result of successful faculty searches, we welcomed four new hires in January.
- We were successful in gaining tenure and promotions to Associate Professor for all four Assistant Professors who went up for tenure.
- We enrolled our first cohorts for two new professional Masters degrees: a Master of Engineering (MEng) in Mechanical Engineering, and a Master of Engineering (MEng) in Manufacturing Engineering.
- We expanded the Distance Learning Program with the addition of several new DL courses in ME.
- The graduate committee handled a record number of applicants to our graduate programs.
- We successfully launched a pilot of an Active Learning-based section of EK 301 Introduction to Engineering Mechanics, as part of the “Redesigning the Undergraduate Learning Experience (RULE)” grant from the University.
- We relocated and upgraded research laboratory facilities for several faculty members, and built a new Multi Robot Control Lab for a new hire.
- We participated in an extensive, detailed design process for a new College-wide Engineering Production Innovation Center (EPIC), and successfully recruited a director for EPIC, who will join the ME faculty in 2012.
- We provided staff support for the College’s new Imagineering Lab; ME staff also provided training sessions for students in the Imagineering Lab.
- We sponsored the creation of a new student group, the Design and Engineering group.
- We had live video streaming of the Senior Capstone Presentations for all majors, enabling alumni and others to participate via live chats.

### EVENTS

#### New Graduate Student Orientation

Before the start of the fall semester, the Department held an orientation for all new graduate students. 2 September 2011.

#### New Graduate Student Welcome Lunch

The Department held a pizza luncheon for all faculty and graduate students to welcome the new graduate students. 7 October 2011.

#### Undergraduate Town Hall Meetings

The ME Chair, the undergraduate Associate Chairs, interested faculty, and the Undergraduate Coordinator have met annual-

ly in the spring with the undergraduates in all three programs to discuss issues and topics of their choosing. Again this year the College held a “Town Hall Meeting” for the freshmen for the same purpose, so the ME Department met only with the sophomores and juniors in the spring. Due to the enthusiastic response of the students, this year we expanded the program and held Town Meetings in the fall, also, for the juniors and the seniors in ME, and separate meetings for the seniors in Aerospace and Manufacturing Engineering. 18 October 2011, 20 October 2011, 18 November 2011, 26 March 2012, and 30 March 2012.

### Student-Alumni Dinners

Two dinner events were held, one each semester, in which the Department juniors and seniors could mingle with alumni and faculty. The College Career Development Office co-sponsored these “Networking@ME” events, which were a huge success. 15 November 2011 and 10 April 2012.

### Mechanical Engineering Open House ME@BU

Our annual Open House “ME@BU Day” 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. 2 December 2011.

### Design Portfolio Workshops

This year we held two Design Portfolio Workshops: one as part of the Open House in December, and another one in February. 2 December 2011 and 15 February 2012.

### Graduate MEng Town Hall Meeting

The Department held a “Town Hall Meeting” with the ME MEng students to gather feedback on the new degree programs. 27 January 2012.

### Graduate Open House

An open house was held in the spring for students accepted into the graduate programs. 2 and 3 March 2012.

### Undergraduate Open Houses

We held three Undergraduate Open Houses for the prospective new undergraduate students who got to explore different aspects of the Department of Mechanical Engineering. 6, 13, 20 April 2012.

### 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. 3 May 2012 and 4 May 2012.

### Awards Ceremony

A Mechanical Engineering Social/Awards Ceremony featured a luncheon for the entire departmental community during the ME Senior Project Day, as well as an awards ceremony. The awards for the two contests sponsored by the Merrill Ebner Fund were presented, including the Design Portfolio Contest and the Graduate Thesis with the Greatest Commercial Potential. The awards for the Graduate Teaching Fellow of the Year, Outstanding ME Ph.D. Thesis, and the ME Professor of the Year were also announced. 4 May 2012.

### 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. 7 & 8 May 2012.

Below, Fly-by-wire competition during Open House in April 2012.



## UNDERGRADUATE PROGRAM HIGHLIGHTS

### Mechanical Engineering

The undergraduate Mechanical Engineering program continues to undergo substantial improvement, particularly in the design sequence. The notable activities related to the ME program in the Academic Year 11-12 are itemized below.

- The Design Committee continued the process of refining the improvements in the design sequence; in particular, the two courses that will become required courses in the ME curriculum for graduates in 2013 and beyond: ME 460 Electro-Mechanical Systems Design, and ME 461 Mechanical Engineering Capstone Experience. Also, the two new junior-level courses, ME 359 Introduction to CAD and Machine Components and ME 360 Product Design, were taught for the first time this year.

- The teaching format for one of the core undergraduate engineering courses, Engineering Mechanics I (EK301), was revised as part of a “Redesigning the Undergraduate Learning Experience” (RULE) grant made possible from the Office of the Provost and the Center for Excellence and Innovation in Teaching. The new format involves a studio style lecture, where students break into small groups throughout the lecture period to work on example problems in new concept areas. The group work is documented on networked tablets, allowing the work to be instantly shared with the course faculty. The faculty provide feedback during the group work and facilitate a class-wide discussion based on the students’ work, giving students real-time criticism on new concepts. The revised course was piloted in the Spring 2012 semester in one section of EK 301 and will be implemented across the entire course in the Fall 2012 semester. A comparison of student performance between the new and traditional lecture-style format in the two section in the spring clearly demonstrated that the group work measurably improves comprehension of the course material.

- The Course Review Panels in the areas of Mechanical Systems, Thermal Systems, Design, and Engineering Mathematics collected and reviewed course materials for the purpose of recommending improvements both for individual courses and for course streams (this will take place in conjunction with the Undergraduate Committee in the next year).

- We ratified new Student Outcomes for the ME program.

- We held a total of nine Town Hall Meetings and Senior Exit Interviews to get feedback from students on improving the undergraduate curricula and the overall undergraduate experience. We are pleased that these events have been very well attended; it is obvious that the students understand that we are listening and are genuinely interested in working with them.

### Aerospace and Manufacturing Engineering

#### Majors

The undergraduate programs in Aerospace Engineering and Manufacturing Engineering accepted their last freshman classes in the fall of 2008. At that time, the Department began the process of phasing out those programs by 2012, and replacing them by concentrations in aerospace and manufacturing (see below). During the transitional period through May 2012, students have been able to complete either the major or concentration in these fields. Although the degree programs in those majors were accredited through 2013, we were pleased that all students in the Aerospace and Manufacturing Engineering degree programs successfully completed their degrees in May 2012.

#### Concentrations

Mechanical engineering students with an interest in Aerospace engineering or Manufacturing engineering now have the option of completing a concentration in the chosen discipline. Additionally, all engineering students have the option of taking concentrations in the areas of Nanotechnology or Energy Technologies and Environmental Engineering. For all of these concentrations, the four ME advanced electives are satisfied by four courses from the appropriate list, along with a required experiential component that could be satisfied by the Capstone project, undergraduate research, or an industry experience.

Graduate students at the pizza social in September 2011.



## GRADUATE PROGRAM HIGHLIGHTS

The ME Department currently has the following graduate degree programs:

- MS in Mechanical Engineering
- MEng in Mechanical Engineering (launched Fall 2011)
- 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)
- MEng in Manufacturing Engineering (launched Fall 2011)

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 2011.

- We welcomed our first cohorts to the new professional Masters degree programs: MEng in Mechanical Engineering, and MEng in Manufacturing Engineering; 15 students graduated with MEng degrees.
- We held a Town Hall Meeting with the MEng students to solicit feedback for the improvement of these new programs.

- We appointed four faculty members as dedicated MEng advisors, in recognition of the unique needs of the MEng students.

- We expanded the Distance Learning Program within the Department, adding new courses in ME.

- We held two welcoming events in the fall for incoming graduate students.

### LEAP Program

The College-wide Late Entry Accelerated Program (LEAP) allows talented individuals who have bachelor's degrees in fields other than engineering to enter our graduate degree programs in engineering. Phase I LEAP students take an intense version of the undergraduate curriculum in order to be prepared to enter a master's degree program. The Department admits students into the LEAP program in both Mechanical and Manufacturing Engineering. The LEAP program has been growing in the last few years, and as a result within the ME Department there were several activities during the year.

- We increased the number of LEAP advisors from two to three, to handle the increased load.

- We modified the LEAP Phase I requirements for both ME and MFG, to be better aligned with the new undergraduate curriculum in Mechanical Engineering, particularly in the design sequence.



## “Flipped Classroom” Energizes Computational Fluid Dynamics Class

“Two . . . one . . . zero. Change!”

Clutching an iPhone, Assistant Professor Lorena Barba (ME) works a brightly lit computer lab at the Photonics Center like a Hollywood movie director, cueing her ENG ME 702 – Computational Fluid Dynamics (CFD) students to take their places on the set of what she calls the “Navier-Stokes Speed Dating Game.” As the action unfolds, five of the 10 graduate students and seniors in attendance—selected at random by an app on Barba’s iPhone—remain at their workstations and display their software solutions to a physics problem using the classic equations that describe fluid motion. The other five pair off with a succession of three-minute “dates” at each workstation, compare notes, and select the date with the most impressive solution. The winning programmer then projects his code and graphical results on a whiteboard at the front of the room, sparking a lively discussion about its merits.

The scene departs dramatically from what took place in last spring’s version of the course, when Barba delivered a lecture on the same topic, deriving equations on the whiteboard as students mainly listened and took notes. That’s because this year she decided to “flip the class,” posting videos of lectures online for home study and using class time to guide highly interactive, collaborative problem-solving sessions that clarify concepts presented in the lecture—i.e., the “homework.” Rather than deliver information from on high, she meanders through the room, offering an occasional leading question to help a student get unstuck, or facilitating a conversation about the relative advantages of different approaches to the problem at hand.

### From Lecture to Workshop

“Creating an active and engaged learning environment is automatic when flipping a class, and with today’s technology for creating multimedia learning materials, it can be done without losing any of the content,” maintains Barba, who made the switch by editing 40 hours of lecture videos that she had already recorded and posted on iTunes U for students in previous incarnations of the CFD course. “In fact, it is the perfect use of technology for education.”

It takes more than technology, however, to implement a flipped classroom successfully, she observes.

“The challenge of the flipped model, I have found, is designing the class activities by which the students are led to discover the important concepts, and explain them to each other. During these activities, the instructor can walk among the students giving them personalized attention, sometimes giving a tip or asking a question.”

While the flipped classroom strategy has been around for more than five years, the widespread availability of online video technology has recently accelerated its adoption in schools and colleges across the globe. Also driving its use is a growing body of empirical studies that underscore the ineffectiveness of the traditional lecture. Informed by these studies, a recent President’s Council of Advisors on Science and Technology report concluded that flipping the classroom, active learning and other more dynamic teaching methods are essential to producing sufficient numbers of science, technology, engineering



and mathematics (STEM) graduates to maintain U.S. preeminence in STEM fields.

### Upgrading the Learning Experience

For Barba's students, the flipped classroom has not only captivated their attention, but also deepened their command of the subject matter.

"Class meetings are active, engaging, and encourage cooperative learning," said Brad Garner, a LEAP student pursuing an MEng degree in mechanical engineering. "Watching condensed versions of traditional lectures at home allows me to reinforce the concepts demonstrated in class without sacrificing the ability to ask questions of Professor Barba or my classmates."

"The biggest upside to the 'flipped classroom' concept is that it provides a structured platform for peer-to-peer learning; every class is like a study group," added Andrew Wixom, a first-year PhD student in mechanical engineering. "In our class, everyone helps out and the coding projects feel almost like a collaborative effort."

Barba credits the approach for improving student performance.

"Last time, students usually had a bug or more in their code during their final presentations and never fixed them afterwards," she recalls. "This time, nearly all are discovering and correcting their errors way before their presentations. Nearly everyone's code works, leading to much more relaxed, creative presentations."

### A Rising Tide of Innovative Education at ENG

The flipped CFD course is one of a growing number of College of Engineering courses in which innovative educators are transforming the classroom into a center for active learning. Also underway are more formal initiatives, such as the University-wide Redesigning the Undergraduate Learning Experience (RULE) program, that are replacing the traditional lecture hall in courses such as EK301: Engineering Mechanics I with a learning studio where students collaborate at round tables to solve problems under the guidance of faculty and graduate teaching fellows.

"One of the greatest benefit of 'flipping' and other active learning approaches is the rapid feedback that students receive at a time when the ideas are still fresh in their mind," noted Professor Donald Wroblewski (ME), Associate Dean for Educational Initiatives, who began flipping the aerospace senior design course in 2009. "Students leave class with a level of clarity and a sense of accomplishment that are hard to achieve in traditional lecture formats."

After one round of the "Navier-Stokes Speed Dating Game," the most popular date describes the underlying physics behind his solution on the communal whiteboard. Soon another student joins him at the board, challenging his interpretation, and in no time more than half the class weighs in from their workstations. The room is abuzz with the kind of spontaneous intellectual exchange that would appear out of place during a traditional lecture. Though Barba guides the discussion, the class practically runs itself, decisively turning the old paradigm on its head.

*By Mark Dwortzan*



# 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



### Calin Belta

#### Associate 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



### Stormy Attaway

#### Assistant Professor & Faculty Coordinator of Special Programs

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



### 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



### 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  
 \* 2011 IEEE Bode Prize



### James Bird

#### Assistant Professor

Interfacial fluid dynamics, Fluid-solid interactions, Microfluidics, Electrohydrodynamics, Drops and bubbles  
 \* PhD Harvard University 2010  
 \* 2003 Fulbright Study Award



### Lorena A. Barba

#### Assistant Professor

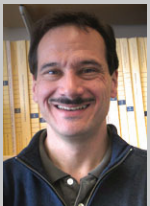
Fluid dynamics, Novel computer architectures, Particle methods used for fluid simulation  
 \* PhD California Institute of Technology 2004  
 \* 2008 Rising Star Teaching Award for the Faculty of Science, University of Bristol, UK  
 \* 2011 CUDA Fellow  
 \* 2012 NSF CAREER Award



### 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



### 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 Distinguished Scholar Award  
 \* 2007 Fellow of Acoustical Society of America



### William Carey

#### Professor

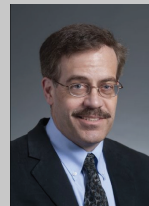
Underwater Autonomous Systems, Multiphase media, Acoustic arrays, Vibration and Acoustic Signal Processing, Sound Radiation and Scattering  
 \* PhD The Catholic University of America 1974  
 \* Fellow of Acoustical Society of America and IEEE  
 \* Past Chief Editor, IEEE Journal of Oceanic Engineering  
 \* 2007 Silver Medal of Acoustical Society of America



### Eytan Barouch

#### Professor

Simulation of industrial processes, Numerical analysis, Algorithm development  
 \* PhD University of New York at Stony Brook 1969



### Daniel Cole

#### Associate Professor

Manufacturing of semiconductor devices, Electrodynamic systems, Microlithography simulation models and methods  
 \* PhD City University of New York 1985  
 \* 2005, 2007, 2008 MFG Department Award of Teaching Excellence



### 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  
 \* PhD Massachusetts Institute of Technology 1989  
 \* 2011 BU College of Engineering Service Award



### 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 BU College of Engineering Faculty Service Award  
 \* 2002 BU Metcalf Award for Excellence in Teaching



## Chuanhua Duan

### Assistant Professor

Energy conversion and storage, Micro/nanofluidics, Phase change heat transfer

- \* PhD University of California, Berkeley 2009

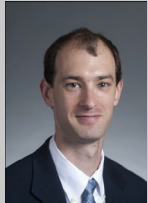


## Kamil Ekinci

### 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
- \* 2012 ME Department Award for Teaching Excellence



## 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

Product development, Manufacturing strategy, Product remanufacturing

- \* PhD Massachusetts Institute of Technology 1973



## R. Glynn Holt

### Associate Professor

### Associate Chair (Graduate Program)

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



## 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

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
- \* 2006 BU College of Engineering Professor of the Year
- \* 2010 BU 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,

- \* PhD University of California, Berkeley 2002
- \* 2005 International Osteoporosis Foundation-Servier Young Investigator Research Award
- \* 2009 BU College of Engineering Early Career Research Excellence Award



## Ray Nagem

### Associate Professor &

### Associate Chair (ME Undergraduate Program)

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

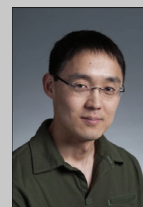


## Uday Pal

### Professor

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 Emeritus*

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



## Emily Ryan

*Assistant Professor*

Heat transfer, Thermodynamics, Fluid mechanics, Reactive transport, Fuel cells, Electrochemistry, Energy systems, Competitive adsorption, Pore-scale phenomena, Porous media, Computational and multi-scale modeling, Engineering educational outreach

- \* PhD Carnegie Mellon University 2009

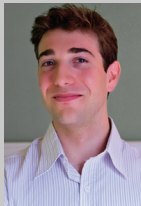


## Vinod K. Sarin

*Professor*

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

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



## Aaron Schmidt

*Assistant Professor*

Nanoscale energy transport, ultrafast laser metrology, and laser-material interaction

- \* PhD Massachusetts Institute of Technology 2008



## 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



## Mac Schwager

*Assistant Professor*

Distributed controllers for the deployment of mobile sensor networks, Inferring dynamical models of biological group phenomena from data, Aggressive multi-robot control over multi-hop networks with time delays, Persistent monitoring and persistent environmental sampling with robots

- \* PhD Massachusetts Institute of Technology 2009



## 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*

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 &*

*Associate Division Head, Division of Systems Engineering*

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
- \* 2001 Senior Member IEEE
- \* 2012 BU College of Engineering Service Award



## Donald Wroblewski

*Associate Professor &*

*Associate Dean for Educational Initiatives*

Experimental fluid mechanics and heat transfer, Atmospheric turbulence, Plasma deposition

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



## 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

*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

*Professor*

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

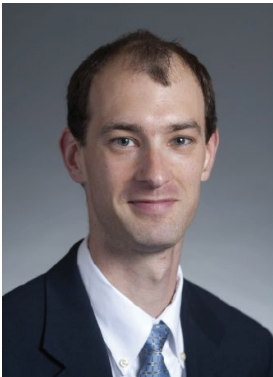
- \* PhD Hong Kong University of Science and Technology 1998
- \* 2003 NSF Faculty CAREER Award
- \* 2008 COE Distinguished Faculty Fellow

# FACULTY AWARDS AND APPOINTMENTS



## LORENA A. BARBA

Assistant Professor Lorena A. Barba was named a **CUDA Fellow by NVIDIA Corporation**. She joins an elite group of leaders in GPU computing, while also being the first female appointee. She has demonstrated a passion and commitment to using CUDA and the power of GPU computing to help solve the most challenging computational problems. Professor Barba was also awarded the prestigious **CAREER Award of the National Science Foundation** for her research and educational endeavors in scientific computing and applications in fluid mechanics and computational biology. The award will fund Prof. Barba's research in scalable algorithms for extreme computing on heterogeneous systems.



## CALEB FARNY

Caleb Farny received the **Mechanical Engineering Department Award for Excellence in Teaching 2012**. The award is decided by the Mechanical Engineering seniors who vote on the professors. This was quite an accomplishment for a relatively new faculty member who has taken control of EK 301: Engineering Mechanics and ME 310: Instrumentation and Theory of Experiments. He can be found actively engaged with the undergraduate students in the wind tunnel lab all through the week.



## HUA WANG

Associate Professor Hua Wang was a recipient of the **BU College of Engineering Service Award 2012** that recognized Professor Wang's valuable contributions and continuing service to the Division of Systems Engineering, Department of Mechanical Engineering and the College of Engineering. Professor Wang is the Associate Division Head for the Division of Systems Engineering. In addition, he has served on the College of Engineering Graduate Committee, and the Department of Mechanical Engineering Graduate Committee.



## DONALD WROBLEWSKI

Associate Professor Don Wroblewski was appointed the new **Associate Dean for Educational Initiatives** to oversee, implement, catalyze and design new and existing College-wide and cross-college educational initiatives that involve innovation in curriculum design or course delivery.

# NEW FACULTY

In January 2011, the Department welcomed the arrival of four new tenure-track Assistant Professors who were recruited following nation-wide faculty searches that attracted several hundred qualified applicants. These searches were part of the Department's ongoing effort to expand its strength and competence in the areas of thermo-fluid sciences, energy, robotics and controls.



## JAMES BIRD

Assistant Prof. Jacy Bird received his PhD in Engineering Science from Harvard University in 2010, after which he served as an NSF Postdoctoral Fellow at MIT, working on the mathematical modeling of free viscous sheets with curved geometry. Professor Bird's current research is broadly based in fluid dynamics with a specific focus on the capillary dynamics of drops and bubbles; combining both experiments and theory, he investigates problems such as how drops spread on surfaces and how bubbles pop. His research, which will be carried out in a new state-of-the-art laboratory, is motivated by problems in a variety of fields, including healthcare (e.g. virus transfer via droplets), energy (e.g. boiling and condensation), and materials (e.g. foams). All told, his work to date has resulted in 12 journal articles and 3 conference proceedings papers. His papers include two Nature articles, two Physical Review Letters papers, and two papers in the Proc. of the National Academy of Sciences.



## CHUANHUA DUAN

Assistant Prof. Chuanhua Duan earned his PhD in Mechanical Engineering in 2009 from the University of California, Berkeley, where he studied under Arun Majumdar. This was followed by a postdoctoral position at the Lawrence Berkeley National Lab, where he continued his work in transport phenomena in nanochannels and micro/nano-structured materials, work that has resulted in 11 journal articles and 15 conference proceedings papers, including papers in Nature Nanotechnology and the Proc. of the National Academy of Sciences. At BU, Prof. Duan is in the process of setting up a new lab aimed at studying enhanced ion/molecule transport using ordered micro/nanostructures, with the intent of fueling fundamental understanding and exploring practical applications in energy conversion/storage and biomolecular sensing/separation. Current research interests include: anomalous transport phenomenon in 1-D or 2-D confined nanochannels and enhancing ion/molecule transport in batteries.



## EMILY RYAN

After earning her PhD in Mechanical Engineering from Carnegie Mellon University in December, 2009, Assistant Prof. Emily Ryan served as a postdoctoral fellow and as a computational scientist at the Pacific Northwest National Lab. Her work in computational modeling of energy systems has resulted in 9 journal articles and 12 conference proceedings papers. With increasing energy costs and concerns about the environment, cleaner, more efficient energy systems are needed. Professor Ryan's research focuses on developing computational models of reactive transport, fluid mechanics, heat transfer and electrochemistry in energy systems and on advanced computational models to study energy technologies, such as fuel cells and batteries. A primary thrust of her research involves reactive transport in porous media, which is central to many energy-related technologies such as fuel cells, battery technologies and subsurface transport.



## MAC SCHWAGER

Assistant Prof. Mac Schwager earned his PhD in Mechanical Engineering from MIT in September 2009, after which he served as a postdoc at the Univ. of Pennsylvania's General Robotics, Automation, Sensing, and Perception Lab. He works on adaptive multi-robot control. The robots of the future will be numerous and pervasive, and they will change the way we interact with the natural world. Professor Schwager develops practical control algorithms for multi-robot systems to accomplish global tasks in a decentralized manner. He envisions his work leading to a sophisticated theory of multi-robot systems, with decentralized control algorithms enabling large groups of robots to seamlessly monitor and interact with the natural world. He has set up a new lab that is outfitted to accommodate both flying (quad rotor) and ground based robots, and his work to date in this area has led to 8 journal articles, 26 conference proceedings papers, and 19 invited presentations at workshops and symposia.

## RETIRED FACULTY



### MORT ISAACSON

Professor Mort Isaacson, a Mechanical Engineering professor at Boston University, retired at the end of the spring semester 2012 after a 30-year career.

Professor Isaacson earned his PhD in Mechanical Engineering from Massachusetts Institute of Technology in 1974. After graduation, he worked at Northeastern University and California Institute of Technology before starting his career at Boston University in the Department of Aerospace and Mechanical Engineering in 1982.

The undergraduate program was dear to the heart of this exceptional educator. Professor Isaacson served as the Associate Chair for the Mechanical Engineering undergraduate program from 1996 to 2008. He taught a number of undergraduate courses: Instrumentation and Theory of Experiments, Energy Conversion Heat Transfer, Engineering Mechanics 1, Technology and Society, Introduction to Engineering: Engineering and Environment, Machine Design I and Machine Design II. Not only was he dedicated in the classroom, but he also found the time to be the Faculty Advisor to Tau Beta Pi, Pi Tau Sigma, and ASME student organizations.

Professor Isaacson received the College of Engineering Distinguished Faculty Service Award in 1993 and 1998.

During his retirement years, Professor Isaacson is looking forward to spending more time with his wife Erica, bird watching and travelling.

## IN MEMORIAM



### WILLIAM CAREY

Professor William Carey, 69, a Mechanical Engineering professor at Boston University since 1999, passed away on July 11, 2012 after a long illness.

A leading researcher in underwater acoustics, Professor Carey focused on the design and performance of underwater acoustic antennae known as arrays, which have been used in tracking enemy submarines and exploring the marine environment.

He was also a leading expert on ocean ambient noise, conducting extensive studies of noise from breaking waves and the signal-to-noise ratio that towed and other arrays sense in the real ocean environment. In recent years he measured the ambient noise produced by micro-bubbles and bubble clouds resulting from sea surface activity, and helped determine that these clouds can optimally radiate and scatter low frequency sound. In 2011, he co-authored a book with Richard B. Evans, *Ocean Ambient Noise: Measurement and Theory*.

In 2007 the Acoustical Society of America awarded Carey the Pioneer of Underwater Acoustics Silver Medal for his contributions to understanding ocean ambient noise and defining the limits of acoustic array performance in the ocean.

Professor Carey was a member of the Cosmos Club and Sigma Xi; a Fellow of the Acoustical Society of America and the Institute of Electrical and Electronics Engineers; recipient of the IEEE Oceanic Engineering Society's Distinguished Technical Achievement, Third Millennium and Distinguished Service awards; and editor emeritus of the Journal of Oceanic Engineering and an associate editor of the Journal of the Acoustical Society. Carey was also an adjunct professor of applied mathematics at the Rensselaer Polytechnic Institute and an adjunct scientist in applied ocean physics and engineering at the Woods Hole Oceanographic Institution. He will be missed by his students and colleagues.

# COMMITTEES

## Department Committees

### Executive

**R. Roy**  
S. Attaway  
G. Holt  
J. Langell  
R. Nagem

### Graduate

**G. Holt**  
C. Belta  
M. Cunniff  
S. Gopalan  
E. Morgan  
H. Park  
A. Schmidt  
M. Schneider  
P. Vakili  
H. Wang  
K. Zhang

### Website

**S. Grace**  
S. Andersson  
L. Barba  
S. McDaniel  
T. Porter

### Course Review Panel: Mechanical Systems

**C. Farny**  
P. Barbone  
K. Ekinci  
R. Nagem  
H. Park  
V. Sarin  
P. Zink

### Course Review Panel: Manufacturing

**S. Attaway**  
T. Bifano  
D. Cole  
T. de Winter  
M. Gevelber  
J. Perkins

### Faculty Search - Acoustics

**P. Barbone**  
G. Holt  
T. Porter  
J. McDaniel  
E. Morgan  
R. Roy (Ex Officio)  
X. Zhang

### Undergraduate

**R. Nagem**  
**S. Attaway**  
W. Hauser  
C. Farny  
M. Levy (fall 2011)  
J. Carter (spring 2012)

### Ebner Fund

**S. Attaway**  
**D. Cole**  
W. Hauser  
G. Holt  
R. Nagem  
R. Roy

### Course Review Panel: Thermal Systems

**M. Schneider**  
L. Barba  
C. Farny  
X. Lin  
A. Schmidt  
K. Zhang

### Course Review Panel: Energy

**S. Attaway**  
S. Basu  
M. Caramanis  
M. Gevelber  
U. Pal

### Faculty Search - Design

**D. Wroblewski**  
D. Cole  
T. de Winter  
W. Hauser  
A. Sharon  
R. Roy (Ex Officio)

### Laboratory

**C. Farny**  
D. Campbell  
J. Estano  
M. Gevelber  
K. Ekinci  
M. Isaacson  
K. Morgensen  
V. Sarin  
G. Sheppard  
R. Sjostrom  
K. Zhang

### Seminars

**E. Morgan**  
S. Basu  
J. Baillieul  
X. Zhang

### Course Review Panel: Design

**W. Hauser**  
D. Campbell  
D. Cole  
T. de Winter  
J. Estano  
M. Isaacson  
A. Sharon  
R. Sjostrom  
D. Wroblewski

### Course Review Panel: Aerospace

**S. Attaway**  
S. Grace  
R. Nagem  
V. Yakhot  
H. Wang  
D. Wroblewski

### Qualifying Exams

**P. Barbone**  
M. Caramanis  
S. Gopalan  
G. Holt (Ex Officio)  
M. Howe  
R. Nagem  
V. Yakhot

### Course Scheduling

**J. Perkins**  
S. Attaway  
J. Carter (spring 2012)  
M. Cunniff  
G. Holt  
J. Langell  
M. Levy (fall 2011)  
R. Mason  
R. Nagem  
R. Roy (Ex Officio)

### Space

**J. Langell**  
S. Andersson  
C. Farny  
U. Pal

### Course Review Panel: Engineering Math

**P. Vakili**  
E. Barouch  
C. Belta  
J. McDaniel

### Concentrations

**S. Attaway** (MFG liaison)  
S. Andersson (Nano liaison)  
S. Grace (Aero liaison)  
U. Pal (Energy/Environ. liaison)

### Undergraduate Lab Safety

#### J. Langell

S. Attaway (Ex Officio)  
D. Campbell  
J. Estano  
K. Mogensen  
R. Nagem (Ex Officio)  
G. Shephard  
R. Sjostrom

### Distance Learning

#### D. Wroblewski

A. Abrahamson (fall 2011)  
D. Cole  
W. Hauser  
C. Lynch (spring 2012)

## College Committees

#### Dean's Research Advisory

S. Basu  
T. Bifano  
E. Morgan  
X. Zhang

#### Associate Dean for Educational Initiatives

D. Wroblewski

#### COE LEAP

D. Cole

#### Faculty Search: ECE Chair

T. Bifano

#### COE Executive

R. Roy  
D. Wroblewski

#### COE Director of Curricular Assessment and Improvem.

S. Attaway

#### MSE Division Leadership

S. Basu

#### COE Graduate

S. Basu  
H. Wang  
G. Holt

#### Conduct

V. Sarin

#### SE Division Leadership

H. Wang

#### COE Undergraduate

S. Attaway  
R. Nagem  
D. Wroblewski

#### Bell Scholar

S. Attaway

#### CNN Associate Director

T. Porter

## University Committees

#### PROSTARS Internal Advisory Board

R. Roy

#### WISE

S. Grace

#### Responsible Conduct of Research

S. Andersson  
M. Gevelber  
E. Ryan  
V. Sarin

#### PHO Academic Advisory Board

R. Roy

#### University Marshall

T. de Winter

#### Provost's Faculty Advising on Distance Learning

D. Cole

#### BU Energy Working Group Board

**M. Gevelber**

#### Athletic Advisory Board

T. de Winter

#### Fulbright/DAAD Evaluation

P. Barbone

#### BU Sustainability

M. Gevelber

#### Faculty Rep to NCAA

T. de Winter

#### CEESI

**M. Caramanis**  
M. Gevelber  
U. Pal

# SECONDARY FACULTY

## Adjunct Teaching Faculty

<b>Frank DiBella</b>	Senior Lecturer
<b>Jason Holmes</b>	Lecturer
<b>Peter Kerney</b>	Senior Lecturer
<b>Guy Thompson</b>	Lecturer
<b>John Voccio</b>	Lecturer
<b>Peter Zink</b>	Lecturer

## Affiliated and Adjunct Faculty

<b>Robert Brown</b>	Professor, University President
<b>Hudong Chen</b>	Adjunct Professor
<b>Robin Cleveland</b>	Adjunct Professor
<b>Robert C. Dean Jr.</b>	Adjunct Professor
<b>Pierre Dupont</b>	Adjunct Professor
<b>Theodore Fritz</b>	Professor
<b>Catherine Klapperich</b>	Assoc. Professor, 2d Appointment
<b>Theodore Morse</b>	Professor, 2d Appointment
<b>Todd Murray</b>	Adjunct Associate Professor
<b>Guido Sandri</b>	Adjunct Professor
<b>Xiaowen Shan</b>	Adjunct Professor

## Research Faculty

<b>Yunze Cai</b>	Postdoctoral Research Associate
<b>Anirban Chatterjee</b>	Postdoctoral Research Associate
<b>Xu Chu Ding</b>	Postdoctoral Research Associate
<b>Jian Dong</b>	Visiting Scholar
<b>Richard B. Evans</b>	Research Associate
<b>Helen Fawcett</b>	Research Assistant Professor
<b>Gonzalo R. Feijoo</b>	Research Assistant Professor
<b>Christian Fillafer</b>	Postdoctoral Associate
<b>Jon Kopechek</b>	Postdoctoral Associate
<b>Robert Lund</b>	Adjunct Research Professor
<b>Nicholas Manzi</b>	Research Assistant
<b>James McLaughlan</b>	Research Assistant Professor
<b>Sudesna Roy</b>	Postdoctoral Research Associate
<b>Pablo Ruiz</b>	Visiting Scholar
<b>Ashwin Sampathkumar</b>	Postdoctoral Research Associate
<b>Kenn Sebesta</b>	Postdoctoral Associate
<b>Jana Tumova</b>	Visiting Scholar
<b>Genu U. Unnikrishnan</b>	Postdoctoral Research Associate
<b>Conshung Wang</b>	Postdoctoral Associate
<b>Shahrokh Zeinali-Davarani</b>	Postdoctoral Associate
<b>Yanli Zou</b>	Postdoctoral Research Associate

# STAFF

## Administrative Staff

<b>James Langell</b>	Director
<b>Andrew Abrahamson</b>	Research Assistant, DL Program (2011)
<b>Jasmine Carter</b>	Undergraduate Coordinator (2012)
<b>Megan Cunniff</b>	Academic Programs Manager
<b>Magda Hanna</b>	Grants Administrator
<b>Emily Howieson</b>	Administrative Assistant
<b>Mor Levy</b>	Undergraduate Coordinator (2011)
<b>Natasha Lewin</b>	Finance Manager
<b>Christopher Lynch</b>	Research Assistant, DL Program (2012)
<b>Saana McDaniel</b>	Communications Coordinator

## Technical Staff

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



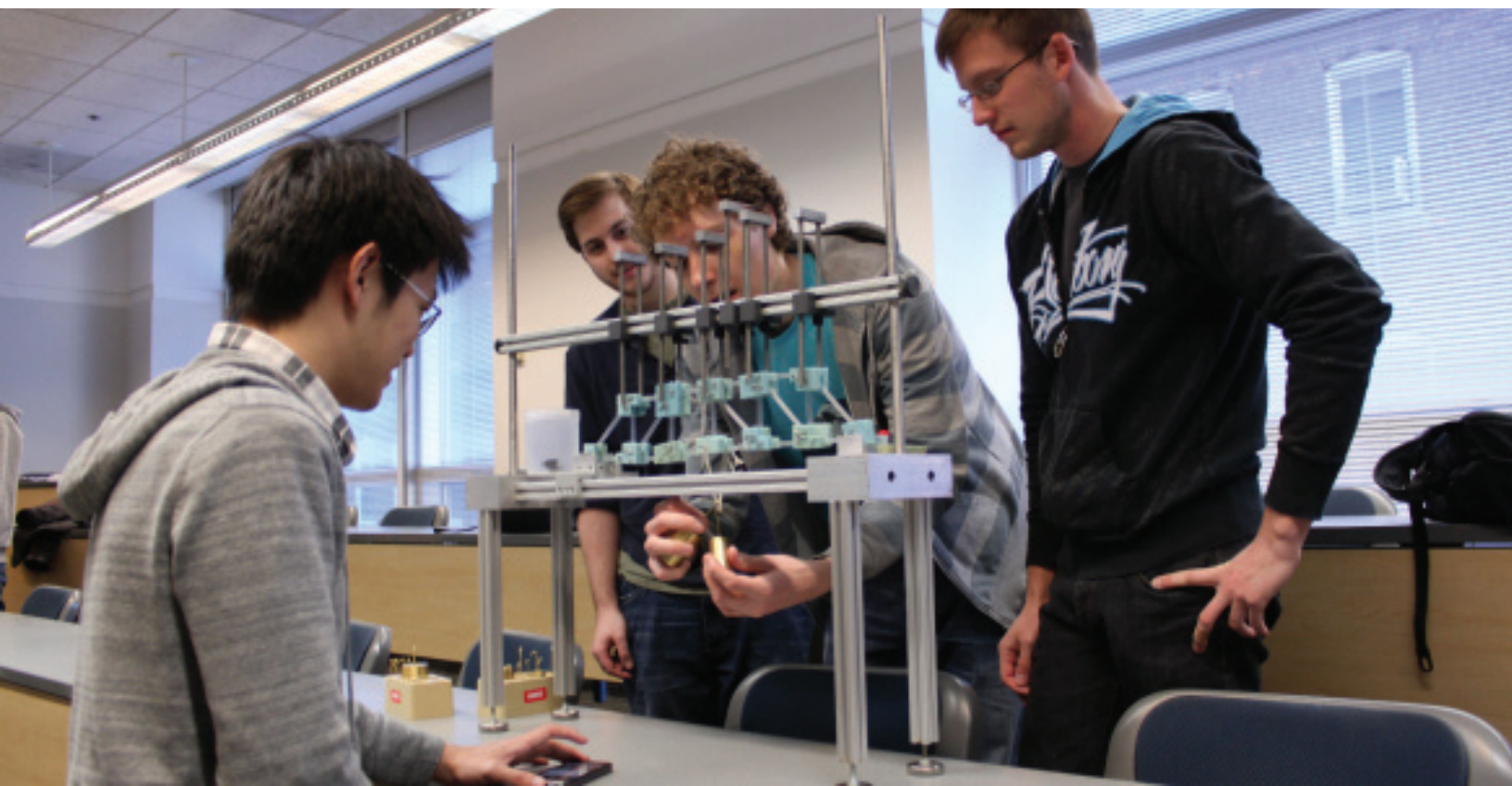
# UNDERGRADUATE PROGRAMS

The Department of Mechanical Engineering offers a multidisciplinary educational experience in which accredited degrees were 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 accredited degrees in Aerospace and Manufacturing will be replaced after May 2012 by the highly successful concentrations in these fields which have been in place for several years.

The Department of Mechanical Engineering offers students the option of getting an accredited degree in ME with optional Concentrations in Aerospace Engineering, Manufacturing Engineering, Energy Technologies and Environmental Engineering, or Nanotechnology. Students who take a concentration 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 focused 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 Course Review Panels. 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 CAD & Machine Components and Product Design. Next year, the revised curriculum in the senior year will feature a new course on Electro-Mechanical System Design as well as a senior capstone course that will offer students the flexibility to work on a project at Boston University or industry, or to conduct extensive research.



# 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 Student Outcomes (Ratified by the ME Faculty April 2012)**

(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

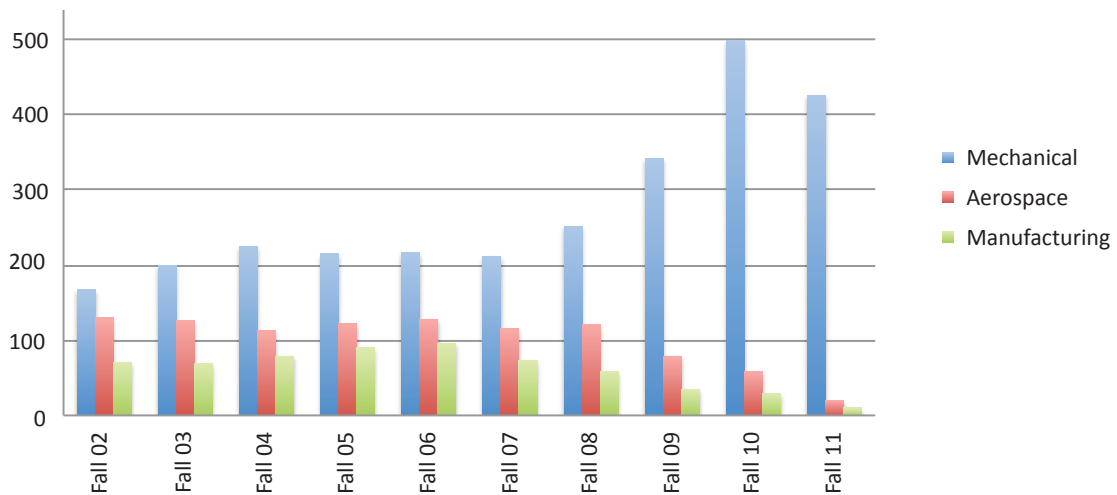
## Enrollment

	Mechanical	Aerospace	Manufacturing	Total
Freshmen*	90	n/a**	n/a**	90
Sophomores*	128	n/a**	n/a**	128
Juniors	112	n/a**	n/a**	112
Seniors	93	20	10	123
<b>Total</b>	<b>423</b>	<b>20</b>	<b>10</b>	<b>453</b>

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

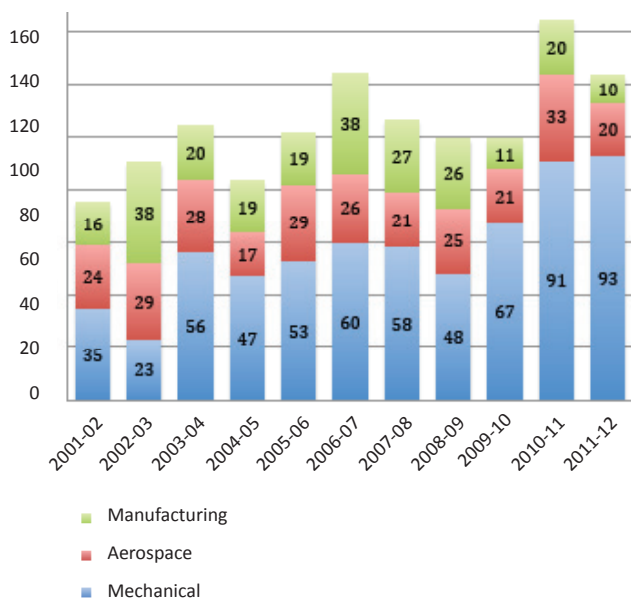
\*\* Since the Fall of 2009, Aerospace and Manufacturing Engineering have no longer been available for the incoming Freshmen.

## History of Undergraduate Degree Enrollment

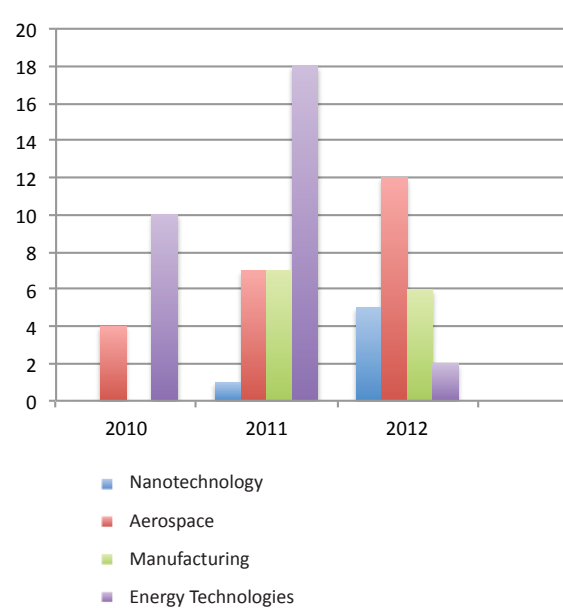


## Undergraduate Degrees and Concentrations Awarded

### History of Undergraduate Degrees Awarded



### History of Concentrations Awarded



## Courses Offered to Undergraduate Students

Course Number	Course Title	Fall 2011	Spring 2012	Summer 2012
EK 102	Introduction to Linear Algebra for Engineers	Carey Vakili	Belta	Attaway
EK 127	Engineering Computation	Attaway	Attaway	Attaway
EK 130/1/2	Introduction to Engineering	Barba de Winter Sarin	de Winter Gopalan Holt Sarin	
EK 156	Design and Manufacture	de Winter	de Winter	
EK 280	Technology, Society and Policy		Isaacson	
EK 301	Engineering Mechanics I	Barbone Farny Porter Yakhot	Farny Andersson	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 302	Engineering Mechanics II	Ekinci Voccio	Ekinci	Nagem
ME 303	Fluid Mechanics	Grace Schneider	Porter	
ME 304	Energy and Thermodynamics	Lin	Bird	DiBella
ME 305	Mechanics of Materials	Nagem Zink	Nagem X.Zhang	
ME 306	Introduction to Materials Science	Sarin	Park Zink	
ME 309	Structural Mechanics		Nagem	
ME 310	Instrumentation and Theory of Experiments	Farny	Farny	
ME 345	Automation and Manufacturing Methods	Gevelber		
ME 359	Introduction to CAD and Machine Components	Thompson Cole	Thompson	
ME 360	Product Design	Cole	Cole Zink	
ME 366	Probability and Statistics for Mechanical Engineers	McDaniel	Barouch Perkins	McDaniel
ME 403	Atmospheric Flight Mechanics and Control	Wang		
ME 404	Dynamics and Control of Mechanical Systems		Andersson	
ME 406	Dynamics of Space Vehicles	Nagem		
ME 407	Computer-Aided Design and Manufacture			de Winter
ME 409	Flight Vehicles Design I	Wroblewski		
ME 410	Flight Vehicles Design II		Wroblewski	
ME 413	Machine Design I	DiBella Hauser Isaacson		
ME 414	Machine Design II		DiBella Hauser Isaacson	

Course Number	Course Title	Fall 2011	Spring 2012	Summer 2012
ME 419	Heat Transfer	Schmidt	Duan Schmidt K.Zhang	
ME 420	Supply Chain Engineering		Perkins	
ME 422	Fluid Mechanics II		Yakhot	
ME 425	Compressible Flow and Propulsion	Grace		
ME 441	Mechanical Vibrations	McDaniel		
ME 465	Materials Processing		Gopalan	
ME 495	Senior Design Capstone in Manufacturing Engineering		de Winter	
ME 500*	Special Topics: Principles of Biological Physics		Schneider	
ME 500*	Special Topics: Computational Nanomechanics		Park	
ME 502*	Intellectual Assets: Creation, Protection, and Commercialization	Cole		Cole
ME 503*	Kinetic Processes in Materials		Basu	
ME 504*	Polymers and Soft Materials		Klapperich	
ME 505*	Thermodynamics and Statistical Mechanics	Pal		
ME 507*	Process Modeling and Control		Gewelber	
ME 510*	Production Systems Analysis	Perkins		
ME 514*	Simulation for Manufacturing		Vakili	
ME 515*	Vibration of Complex Mechanical Systems		McDaniel	
ME 520*	Acoustics I	Holt		
ME 521*	Continuum Mechanics for Biomedical Engineers	Barbone		
ME 524*	Skeletal Tissue Mechanics	Morgan		
ME 526*	Simulation of Physical Processes		Cole	
ME 527*	Transport Phenomena in Materials Processing	Gopalan		
ME 533*	Energy Conversion		Carey	
ME 540*	Advanced Aerodynamics		Grace	
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 566*	Advanced Engineering Mathematics	Howe		
ME 579*	Microelectronic Device Manufacturing			Cole
ME 580*	Theory of Elasticity		Barbone	
ME 582*	Mechanical Behavior of Materials	Morgan		
ME 583*	Product Management	Hauser		
ME 584*	Manufacturing Strategy		Hauser	

\* Graduate courses open to undergraduate enrollment.





2012 Aerospace Engineering Seniors (top), Manufacturing Engineering Seniors (bottom) and Mechanical Engineering Seniors on the left.

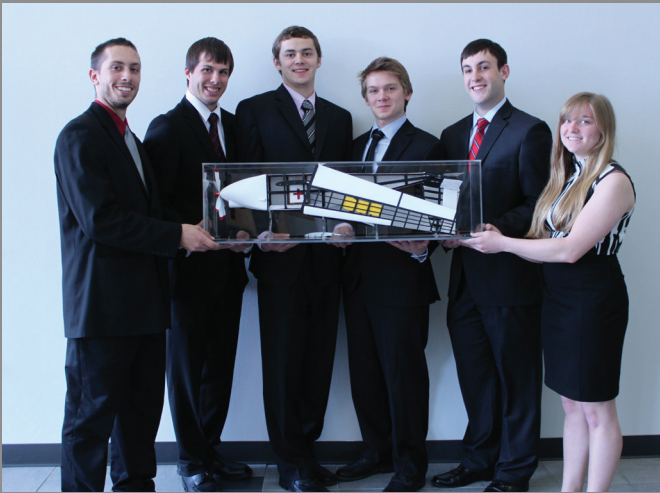


# Senior Design Projects

## Aerospace Engineering

Project Title	Team Members
Eye-Sky Falcon: Vertical Takeoff and Landing Surveillance Aircraft	Brandenburg, Carrozzi, Hoffman, Kipping-Ruane, and Womer
Aethia: Dual Mode, Submersible Unmanned Aerial Vehicle	Binggeli, Kazanjian, King, Luo, and Wagner
Arctic Dragon: Polar Ice Cap Measurement Aircraft	Cayuelo-Calvo, Hagen, Jimenez, Kempf, and Kruper
HERO: Extremely Short Take-Off & Landing, Transportable Humanitarian Aid UAV <i>Winning Team</i>	Appleman, Buehrer, Holmes, Munsell, Senouci-Bereksi, and Waldman
AquaFlyer: 50-Passenger, Amphibious Turboprop	Bennett, Harris, Kvartek, Lally, and Rakowski

### Winning Team - Aerospace Engineering



Winning team in Aerospace Engineering, HERO: Extremely Short Take-Off & Landing, Transportable humanitarian Aid UAV -- Preston Buehrer (l.), Eric Munsell, Tom Waldman, Alonso Holmes, Matt Appleman, and Anissa Senouci-Bereksi (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 winning team was **HERO: Extremely Short Take-Off & Landing, Transportable Humanitarian Aid UAV**, Matt Appleman, Preston Buehrer, Alonso Holmes, Eric Munsell, Anissa Senouci-Bereksi, and Tom Waldman.

HERO is an unmanned aircraft designed to provide humanitarian aid to disaster-stricken areas. HERO is able to take off and land in 500 ft from unprepared surfaces, and is able to fold up and be transported in the cargo hold of a C-130 cargo transport aircraft. HERO carries two standard-sized cargo pallets, is able to autonomously unload cargo, and can be remotely reloaded by untrained personnel.

## Manufacturing Engineering

Project Title	Team Members
Saint-Gobain Abrasives Winning Team	El Attal, Hernandez Hilado, and Tineo Raga
New Balance	Guevremont, Manning, and Nelson
Boston Centerless	Burak Ficioglu, Soedarsono, and Yeh
Globe Composite Solutions	Belna and Garnier Ventura

### Winning Team - Manufacturing Engineering



Winning team in Manufacturing Engineering, Saint-Gobain Abrasives: Jose Tineo Raga (l.), Seif El Attal and Ricardo Hernandez Hilado (r.)

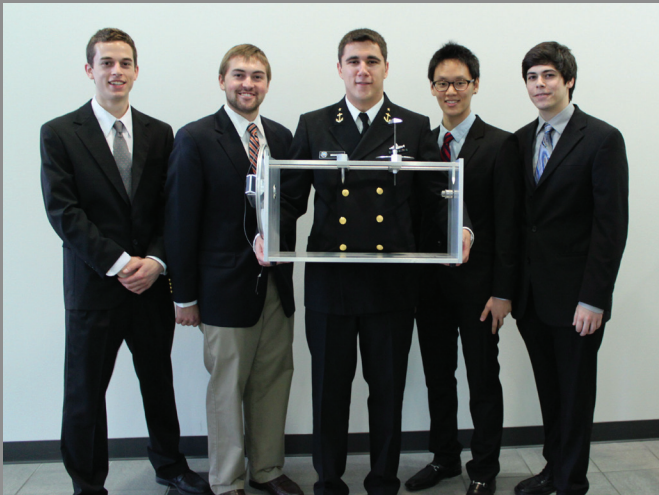
The Manufacturing Engineering program culminates with a senior capstone design project in which teams of students tackle difficult multi-faceted design projects. The students enroll in the Product Design course of ME 415 in the fall and then in the Senior Design Capstone in Manufacturing Engineering 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 **Saint-Gobain Abrasives** with Seif El Attal, Ricardo Hernandez Hilado, and Jose Tineo Raga. Sait-Gobain Abrasives team's project had two main goals: (1) to improve the utilization of presses to produce diamond based abrasives, and (2) to find a faster and more efficient way to cool the molds for the abrasives. Press utilization was improved by categorizing the press molds and scheduling three back-to-back eight hour shifts. An adjustable cooling deck was designed to speed the cooling of the hot mold plates.

## Mechanical Engineering

Project Title	Team Members
The Next Step	DiFilippo, Kim, Kostadinov, Mansfield, Tagliabue, Valsamis
Team N-Able	Thalakotur, and Gill
Level Head Design	Guan, Kiely, Lopez, and Snobar
Team 4Gate	Cheng, De Sa, Wook Lim, and Yoo
Hub Rocketry	Ashur, Lacy, Shomberg, Tommila, and Zagorski
BatWing	Kardelis, Mueller, Schein, and Tabacow
Hookshot Engineering	Beck, Ehrlicher, Johnson, and Malloy
Team CKC	Bernard, Silver, and Mace
Team LeafJet	Stone, Walsh, Taylor, Chhabra, and Schon
DES	Chang, Govani, Gutmann, and Jelavich
Sjostrom Dynamics	Cataldo, George, Going, and Yanez
GigaPed	Basu, Atefi, Sadri, Venegas, and Vishwanathan
Robust Revisionaries	Taddonio, DiTullio, Brooks, Sylvia, and Lee
Team JITHH	Doherty, Hall, Kane, Nguyen, and Reiter
Boston Powder Pharmaceuticals	Girouard, Kostopoulos, Hatem, and Ichihara
Team LSD	Lin, Ukpebor, Zeidan, and Ziade
QSQI	Nehme, Dhukka, Maranan, and Ouk
Oiler's Method	Koningswood, Chisholm, Kokoshi, Rock, and Widanka
Tempest Controls	Alrashed, He, Sehn, and Tennyson

### Winning Team - Mechanical Engineering



Winning team in Mechanical Engineering, Robust Revisionaries: Paul DiTullio (l.), Michael Sylvia, Matthew Brooks, Clarence Chiho Lee, and Mark Taddonio (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.

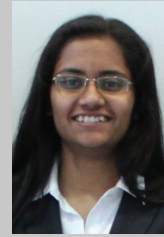
This year the winner was the **Robust Revisionaries** team: Matthew Brooks, Clarence Chiho Lee, Paul DiTullio, Michael Sylvia, and Mark Taddonio. It is commonly accepted among both students and professors that the laboratory experiments performed in the *Mechanics of Materials* (ME 305) are both tedious and lacking in direct student involvement. Robust Revisionaries attacked this problem by creating a new lab apparatus that measures bending deflections in cantilever and 3-point bending tests and measures angular deflection for samples subject to torsion. This apparatus will get students directly involved in the experiments through implementation of both smaller group sizes and more hand on experiments. Another key improvement is the incorporation of clearly visible deflections with increased loading. This visualization allows students to better conceptualize the effects of different loading conditions on the specimens.

## Undergraduate Student Awards

<b>YASMIN ATEFI</b>	Student Advisor Service Award
<b>ADITI BASU</b>	Student Advisor Service Award
<b>LOUISA GOING</b>	Student Advisor Service Award
<b>OLIVER KEMPF</b>	Engineering Alumni Association Student Leader Award
<b>IVA KOKOSHI</b>	Student Advisor Service Award
<b>WILLIAM LALLY</b>	Dean's Host Award, and Student Advisor Service Award
<b>CHAS MANNING</b>	Anita Cuadrado Memorial Award, and Dean's Host Award
<b>KONSTANTINOS OIKOMOPOULOUS</b>	Ebner Design Portfolio Contest Sophomore Winner
<b>IAN SCHON</b>	Ebner Design Portfolio Contest Senior Winner and Overall Winner
<b>ADRIAN TANNER</b>	Ebner Design Portfolio Contest Freshman Winner
<b>CAROLINE TENNYSON</b>	Student Advisor Service Award
<b>OBEHI UKPEBOR</b>	Engineering Alumni Association Student Leader Award, and Student Advisor Award
<b>PREETIKA VISHWANATHAN</b>	Ging S. Lee Community Service Award
<b>ERIC WOMER</b>	Ging S. Lee Community Service Award
<b>KEVIN ZAGORSKI</b>	Engineering Alumni Association Student Leader Award
<b>MATT APPELMAN PRESTON BUEHRER ALONSO HOLMES ERIC MUNSELL ANISSA SENOUCI-BEREKSI TOM WALDMAN</b>	Outstanding Capstone Design Project in Aerospace Engineering: "HERO: Extremely Short Take-Off & Landing, Transportable Humanitarian Aid UAV"
<b>SEIF EL ATTAL RICARDO HERNANDEZ HILADO</b>	Outstanding Capstone Design Project in Manufacturing Engineering: "Saint-Gobain Abrasives"
<b>JOSE TINEO RAGA</b>	
<b>MATTHEW BROOKS CLARENCE CHIHO LEE PAUL DiTULLIO MICHAEL SYLVIA MARK TADDONIO</b>	Outstanding Capstone Design Project in Mechanical Engineering: "Robust Revisionaries"



Yasmin Atefi



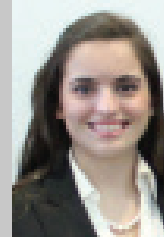
Aditi Basu



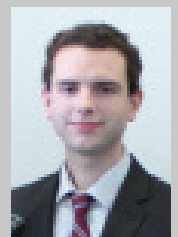
Louisa Going



Oliver Kempf



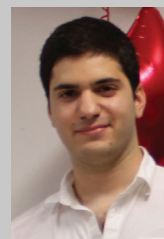
Iva Kokoshi



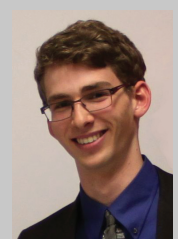
William Lally



Chas Manning



Konstantinos Oikomopoulos



Ian Schon



Adrian Tanner



Caroline Tennyson



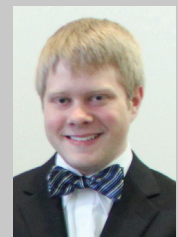
Obahi Ukpabor



Preetika Vishwanathan



Eric Womer



Kevin Zagorski

## Student Organizations

### American Institute of Aeronautics and Astronautics - AIAA



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. AIAA hosts industry and academic speakers, contests and general meetings catered towards the aerospace and aeronautical fields. This year, they welcomed a speaker (with SEDS) Steve Isakowitz, CTO of Virgin Galactic. Their primary goal is to raise awareness among undergraduates about the opportunities and advances in the aerospace community. They ended their year by attending the International Space Development Conference (ISDC)

### American Society of Mechanical Engineers - ASME



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, field trips to local industries, and regional and national society functions, including the regular meetings of the Boston section of ASME. Upon graduation, student members can become associate members of the society. This year the group hosted the ASME SLS Student Leadership Seminar, the Wine in the Sky Paper Tower Contest, the Kinex Roller Coaster Competition, and visited GE Aviation.

### Society of Manufacturing Engineers - SME

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. In Summer 2012, several representatives of SME were able to attend the SME Annual Conference in Atlanta. The conference was both an extremely informative event as well as an excellent networking opportunity for the students.

### BU Rocket Team



The BU Rocket Team is a branch of the AIAA. This group is focused heavily on student participation in developing a repeatable testing procedure for hybrid rocket

engines. In 2011-2012, the team had a breakout year, moving from a paper design and some pre-development hardware to a fully functional hybrid fuel rocket engine. The team has fired the engine six times, testing everything from a world class data acquisition system to thrust vector control vanes. The BU Rocket Team hopes to fly a hybrid rocket to space, and the goals for next year are to build a flight-ready rocket capable of achieving altitudes twice that of a commercial airliner and returning safely to Earth.

### 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.

### Society of Automotive Engineers - SAE

The Society of Automotive Engineers 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. Last year the the group focused on bringing some of their older go-karts into working order.

### Students for the Exploration and Development of Space

Students for the Exploration and Development of Space is a second year student group at Boston University. This group is 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. In October, two students attended the Space Vision Conference in Colorado. In May of 2012, 9 students from BU SEDS were able to attend the International Space Development Conference (ISDC) in Washington D.C., which was a great networking opportunity and educational experience.

### BU UAV Team



The BU UAV Team is devoted to researching and building unmanned aerial vehicles (UAVs). Their main goals for the 2011-2012 academic year were to build a model airplane, a

quad-copter and a weather balloon, moving from a 3-D model to a fully built and working model.

### BU Design and Engineering - BU D&E

In this group's first year, BU Design and Engineering has set its sights very high by having nearly weekly workshops or hosting guest speakers from industry. Workshops this year included a lathe instructional meeting, advanced milling, a Solidworks workshop and a 3-D printer workshop among many others. Utilizing the newly built Imagineering Lab, the BU D&E group had an excellent attendance record for its workshops and guest speakers, making it a highly interactive and informative group with a very successful first year.

### 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.

## A New Student Group: Design and Engineering

Design and Engineering arose from a desire to expand beyond the perimeter normally established by engineering curricula as engineering is best augmented, cultivated, and exercised by regularly incorporating other disciplines into engineering practices. This philosophy, along with a penchant for hands-on, project based work, prompted the formation of a group aimed at offering content and resources unavailable anywhere else at BU.

By assembling resources and motivated individuals, BU Design and Engineering facilitates and catalyzes the engineering process in a way that hones technical knowledge while constantly incorporating peripheral skills such as machining, graphic and information design, sketching, photography, and others. While many groups utilize students to complete a specific project, students can utilize BU D&E as a platform for development and execution of new ideas.

BU D&E initiates conversations and workshops with speakers from the design and engineering industries, as well as unrelated disciplines such as communication, art, and business. By fusing disciplines, broadening perspectives, and offering hands-on experience, BU D&E fosters innovation and seeds creativity.

d&E presents

# MACHINIST LUNCH

JOIN DESIGN AND ENGINEERING AS WE TALK TO BOB SJOSTROM AND JOE ESTANO ABOUT MACHINING BEST PRACTICES

MONDAY OCTOBER 1ST, 2PM, 110 CUMMINGTON ST. ROOM 245

# 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 and professional degrees with emphases on industry, manufacturing, and business administration. The professional MEng degree programs in Mechanical Engineer-

ing and Manufacturing Engineering are geared towards a career in industry. 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 marketplace. 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 2011-2012

		Male	Female	Fulltime	Parttime	GTF*	Research Assistanship	Dean's Fellowship
<b>MEng</b>	<i>US</i>	19	4	14	9	0	0	0
	<i>Intl.</i>	9	1	10	0	0	0	0
<b>MS</b>	<i>US</i>	9	2	9	2	0	0	0
	<i>Intl.</i>	2	0	2	0	0	0	0
<b>PhD</b>	<i>US</i>	4	1	5	0	2	2	1
	<i>Intl.</i>	7	4	11	0	8	1	2
<b>Total</b>		<b>50</b>	<b>12</b>	<b>51</b>	<b>11</b>	<b>10</b>	<b>3</b>	<b>3</b>

## Fall 2011 Mean GRE Scores

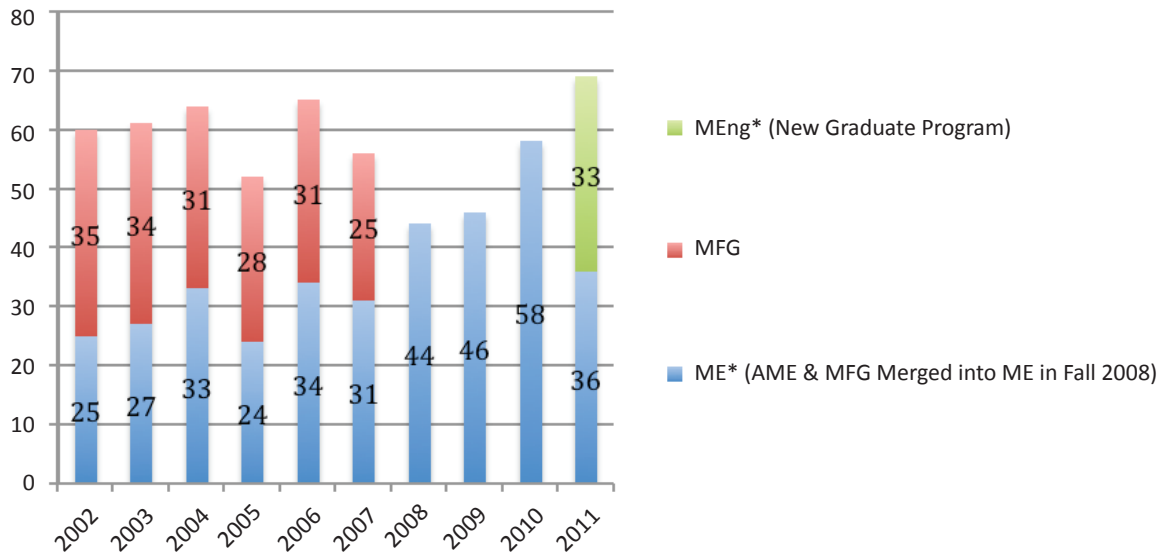
		Verbal	Percentile	Quantitative	Percentile	An. Writing	Percentile
<b>MEng</b>	<i>US</i>	523	65	735	79	4.00	45
	<i>Intl.</i>	468	52	778	89	3.20	17
<b>MS</b>	<i>US</i>	598	82	774	88	4.50	65
	<i>Intl.</i>	515	66	785	90	3.00	10
<b>PhD</b>	<i>US</i>	622	86	736	79	3.70	31
	<i>Intl.</i>	437	45	777	89	3.33	23
<b>Total</b>		<b>512</b>	<b>62</b>	<b>760</b>	<b>85</b>	<b>3.70</b>	<b>35</b>

## Spring 2012 Mean GRE Scores

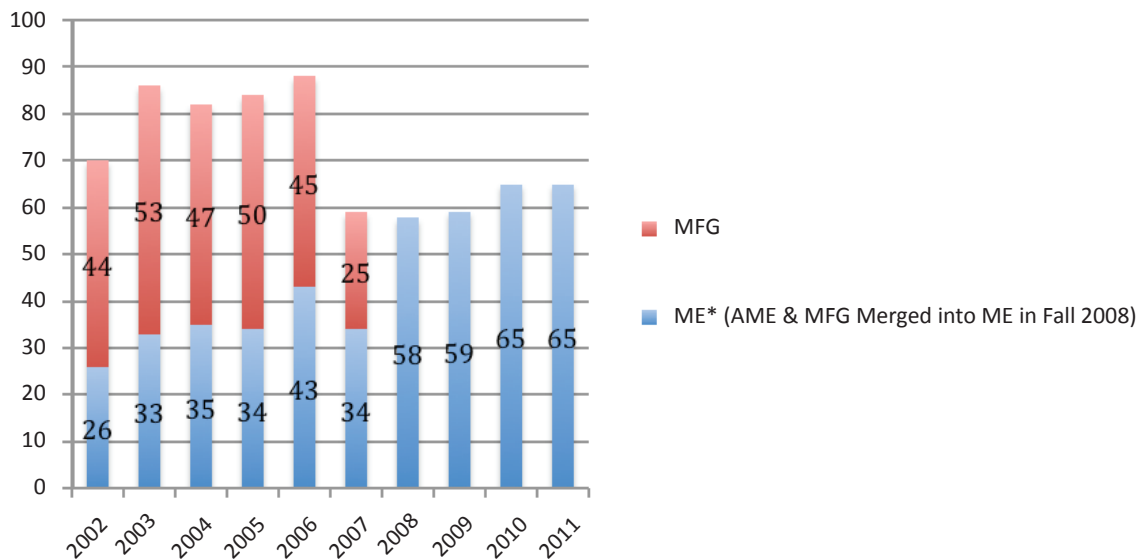
		Verbal	Percentile	Quantitative	Percentile	An. Writing	Percentile
<b>MEng</b>	<i>US</i>	565	75	700	70	3.80	38
		154*	64*	158*	79*		
	<i>Intl.</i>	620	89	800	94	3.00	10
<b>MS</b>	<i>US</i>	625	90	760	85	4.75	76
	<i>Intl.</i>	0	0	0	0	0	0
<b>PhD</b>	<i>US</i>	0	0	0	0	0	0
	<i>Intl.</i>	0	0	0	0	0	0
<b>Mean</b>		600	84	744	81	<b>4.00</b>	<b>46</b>
		154*	64*	158*	79*		

\* Scores reflect changes to new GRE scoring scale on all exams taken after August 2011.

## History of MS and MEng 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



**ELSE FROHLICH**

Winner of the **President's Award**, the top prize at Boston University's annual Science and Engineering Research Symposium, April 2012, "*The Use of Controlled Surface Topography and Flow-induced Shear Stress to Influence Renal Epithelial Cell Function.*"

In her research, Else developed a microfluidic tissue modeling device (MTMD) to mimic a kidney tubule microenvironment through simultaneous and independent control of both topography and FSS. "Else has exhibited excellent performance in her research, due to her excellent intellectual ability, strong creativity in problem solving, ability to understand both large scale goals and scientific detail, and her absolutely outstanding work ethic," said advisors Joseph Charrest of Draper Laboratory and Professor Xin Zhang.



**KEBIN FAN**

Recipient of the **Best PhD Thesis in the Department of Mechanical Engineering Award**, May 2012, "*Three Dimensional and Nonlinear Metamaterials at Terahertz Frequencies.*" The motivation for Kebin's thesis was based on the immense technological potential of terahertz radiation as a safe non-invasive diagnostic with the potential for chemical detection and imaging of embedded objects embedded.

There was a need to push the development of detectors to realize robust imaging systems that could routinely operate in real-world environments at a reasonable cost. Kebin's approach combined the unique electromagnetic response of the metamaterials and the terahertz nonlinearity in naturally occurring materials to achieve a sensitive field-based detection scheme. The successful demonstration of such technique is competitive with existing systems for safety, security, and non-invasive diagnostic



**TREVOR ASHLEY**

Recipient of the **Outstanding Graduate Teaching Fellow Award**, the Department of Mechanical Engineering, Boston University. Trevor was the Teaching Fellow for the ME 403/4 class "Dynamics and Control of Mechanical Systems" The voting undergraduate students made the following comments:

"Phenomenal TF, very helpful and personable." "Wouldn't have gotten through ME403 without him, extremely helpful and accessible." "Fantastic TA, really helped with understanding the material. I learned a lot about controls in the class and a large part of this was due to the guidance he provided in conjunction with the professor. Trevor was available pretty much whenever we had a question for him. He would guide us enough to determine the correct method or answer but never giving it out, which allowed us to become more proficient in using available resources to accomplish my tasks. His advice extended past just the class I had him for."

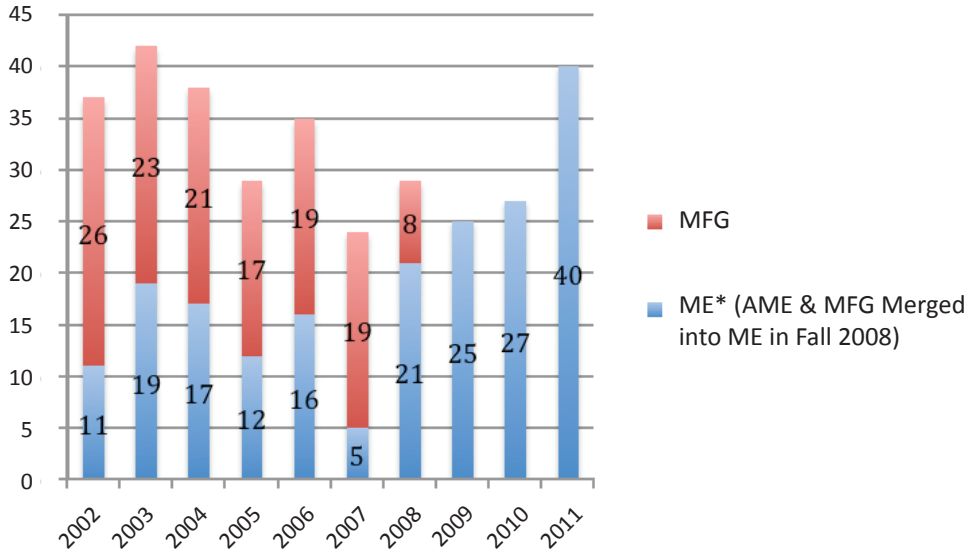


**SYLVANUS LEE**

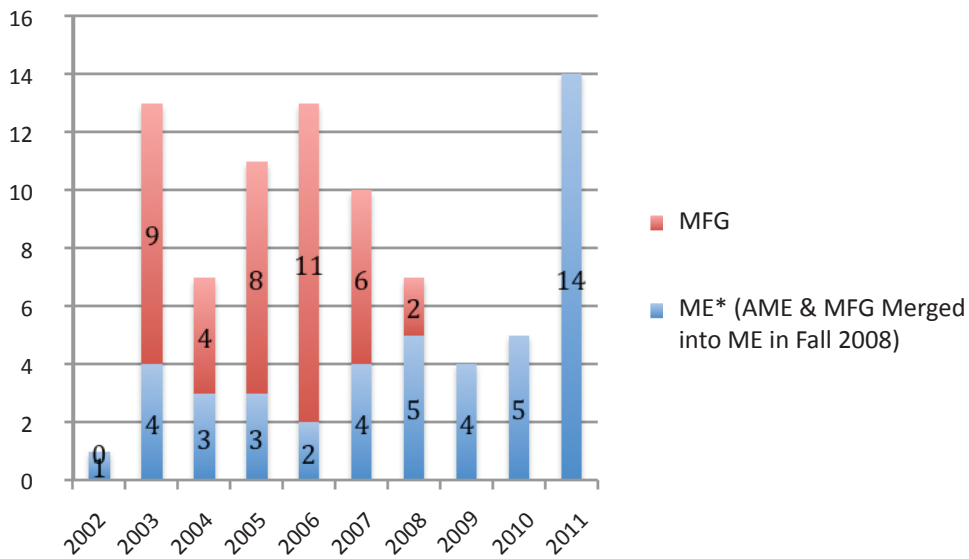
Winner of the **Emil Wolf Outstanding Students Paper Competition Award** for his paper "Isotropic Structural Color of Nanostructured Metal Surfaces" at the Optical Society of America (OSA) Frontiers in Optics/Laser Science conference in San Jose, CA in October 2011. Sylvanus has been working with his advisor Professor Luca Dal Negro (ECE) on nanofabrication research on how to control the color response of metal surfaces on nanostructures in ways that aren't possible with traditional techniques. He found that pinwheel nanoparticle arrays can allow for intense coloration enhanced by plasmonic resonance. This finding can be applied to many other research areas such as energy, optical technology and security. Dal Negro said: "Sylvanus is a highly motivated PhD student who is constantly pushing the limits of nanofabrication."

# Graduate Degrees Awarded

## History of MS Degrees Awarded



## History of PhD Degrees Awarded



## Graduate Courses Offered

Course Number	Course Title	Fall 2011	Spring 2012	Summer 2012
EK 546	Assessment of Sustainable Energy Technologies		Gevelber	
ME 500	Special Topics: Principles of Biological Physics		Schneider	
ME 500	Special Topics: Computational Nanomechanics		Park	
ME 501	Dynamic Systems Theory	Baillieul		
ME 502	Intellectual Assets	Cole		Cole
ME 503	Kinetic Process in Materials		Basu	
ME 504	Polymers and Soft Materials		Klapperich	
ME 505	Thermodynamics and Statistical Mechanics of Materials	Pal		
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		McDaniel	
ME 520	Acoustics I	Holt		
ME 521	Continuum Mechanics	Barbone		
ME 523	Mechanics of Biomaterials for Biomedical Engineers	Klapperich		
ME 524	Skeletal Tissue Mechanics	Morgan		
ME 526	Simulation of Physical Processes		Cole	
ME 527	Transport Phenomena in Materials Processing	Gopalan		
ME 533	Energy Conversion		Carey	
ME 540	Advanced Aerodynamics		Grace	
ME 541	Classic Thermodynamics		Lin	
ME 542	Advanced Fluid Mechanics	Howe		
ME 543	Sustainable Power Systems		Caramanis	
ME 544	Networking the Physical World	Little		
ME 560	Precision Machine Design and Instrumentation	Sharon		
ME 566	Advanced Engineering Mathematics	Howe		
ME 579	Microelectronic Device Manufacturing			Cole
ME 580	Theory of Elasticity		Barbone	
ME 582	Mechanical Behavior of Materials	Morgan		
ME 583	Product Management	Hauser		
ME 584	Manufacturing Strategy		Hauser	
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		Howe	
ME 724	Advanced Optimization Theory and Methods		Paschalidis	
ME 725	Queuing Systems	Perkins		
ME 726	Biomaterials and Tissue Engineering I	Grinstaff		
ME 727	Biomaterials and Tissue Engineering II		Wong	
ME 740	Vision, Robotics, and Planning		Baillieul	
ME 762	Non-Linear Control of Mechanical Systems		Wang	
ME 765	Production System Design	Caramanis		
ME 778	Micromachined Transducers	X.Zhang		
ME 781	Electroceramics	Gopalan		

## MS Theses and PhD Dissertations

### MS Theses

Student Name	Thesis Advisor	Dissertation Title
Ozcimder, Hasan Kayhan	Baillieul, John	Control Communication Complexity And Communication Protocols For Dance
Trueb, Jacob	Klapperich, Catherine	A Portable, Powerless System for Nucleic Acid Purification

### PhD Dissertations

Student Name	Dissertation Advisor	Dissertation Title
Cannamela, Michael	Gevelber, Michael & Wroblewski, Donald	Development of a Fluid Model for DC Arc Plasma Torches and its Integration with Downstream Models of Atmospheric Plasma Spray Particle Plumes
Cao, Qingqing	Klapperich, Catherine	Microfluidic Platform For Continuous Flow Polymerase Chain Reactions Based Nucleic Acid Diagnostic
Chang, Peter	Andersson, Sean	High-speed Atomic Force Microscopy through Local Raster Scanning
Du, Ping	Zhang, Xin	Viscoelastic Characterization And Modeling Of PDMS Micropillars For Cellular Force Measurement Applications
Fan, Kebin	Zhang, Xin	Three Dimensional and Nonlinear Metamaterials at Terahertz Frequencies
Gong, Yanjun	Porter, Tyrone	Acoustic Characterization of Ultrasound Contrast Agents with Lipid-coated Monodisperse Microbubbles
Kracht, Jonathan	Cleveland, Robin	Tracking Kidney Stones with Sound During Shock Wave Lithotripsy
Lahijanian, Morteza	Andersson, Sean & Belta, Calin	Formal Verification and Control of Stochastic Systems
Lee, Yuk Kwan Sylvanus	Dal Negro, Luca	Engineering Aperiodic Nanostructured Surfaces For Scattering-Based Optical Devices
Wang, Qi	Cleveland, Robin	Electromagnetic Acoustic Source (EMAS) for Generating Shock Waves and Cavitation in Mercury

## Distance Learning

The Department of Mechanical Engineering offers both individual courses and full MEng degrees through its Distance-Learning Program (DLP). Our DL program provides Master's level classes primarily to industrial employees wishing to add to their education background, but it is open to others if the format suits their needs. It differs from the majority of offerings at other universities in that our classes are offered as live extensions of the on-campus classroom. Remote students can hear and see the on-campus class and communicate with the professor in real time. They can participate in class from a variety of locations, including work, home, hotel, and they are welcome to come to class on campus if their schedule permits it. In contrast, most other distance learning programs in engineering are exclusively asynchronous, relying on recorded lectures and other web-based materials to deliver class content. Since our students can also access videos on-line and replay past classes whenever they have the need we can offer students the best of both worlds.

The committee for the present academic year included:

**DONALD WROBLEWSKI** Chair

**ANDREW ABRAHAMSON** (fall 2011)

**DANIEL COLE** (fall 2011)

**WILLIAM HAUSER** (fall 2011)

**CHRISTOPHEHR LYNCH** (spring 2012)

**KIRSTIE MILLER**

The oversight and administration of DLP underwent a change in September, 2011. Kirstie Miller, in her role as Director of Professional Education & Corporate Relations, took on full administrative responsibility for DLP, along with the Masters of Engineering and Late Entry Accelerated Program, reporting to Don Wroblewski in his new role as Associate Dean of Educa-



tional Initiatives. Chris Lynch joined the DLP in January, 2012, taking over the day-to-day operation of the program. The traditional DLP committee meetings were replaced with weekly meetings among the three above-mentioned individuals.

The DLP currently offers 25 different masters level courses with 17 of those available during the past academic year.

EMB 105 continues to be the flagship room for the DLP, with its state-of-the-art multi-camera capabilities. The room's sophisticated cameras and camera controls allow DL instructors to teach freely in their most natural mode, be that handwriting on the whiteboard, computer-based presentation or a combination of the two.

We continue to use Adobe Connect for the delivery and recording platform for all DL courses. The ease of use and university-level support have made it a boon to the quality and reliability of class delivery. We are researching a switch to Echo 360, which will provide enhanced archiving capabilities and content protection.

The mobile DL cart was upgraded with new hardware for use in PHO 206, the large auditorium. The changes will allow connection to the room's built-in AV to bring the class experience to DL students and to enhance the in-class viewing of class demonstrations. This upgrade will help to meet the original objective of the mobile cart, by expanding the type of room that can be used for DL courses.



The combination of Adobe Connect and our new mobile cart enabled us to support the streaming and recording of a number of events for ME, COE and CDO this year. Most of the CDO workshops and their popular etiquette dinner were streamed and archived using the DLP mobile cart. We also fulfilled requests for live streaming and recording of the new MEng Speaker series, both in the Faculty Lounge in the Student Union and the Photonics Colloquium room. This further demonstrates our ability to provide services in almost any type of room. We provided a live stream and chat connection for the LEAP and MEng open houses. Both Open Houses had significant online audiences during the events and the recording of the events have been watched online hundreds of times since.

Live streaming and recording of all the senior project presentations for ME, Aero, and MFG seniors was our largest single

effort on behalf of the ME department outside of DL classes. This allowed seniors' friends and families to join them for their final presentations from locations all over the world. The online discussion was quite lively and the presentations were recorded and posted online so they would be available for those who couldn't sign in during the presentation time. The feedback from students and parents was exuberant and we look forward to supporting it again in the coming year.

Although we still feel our synchronous approach is preferable, we are looking into the possibilities of providing more asynchronous options in order to broaden the windows of time available for students to participate in classes. This asynchronous option is becoming increasingly popular with some DL students and may become an important aspect of our DLP in the future.

## Distance Learning Courses Offered

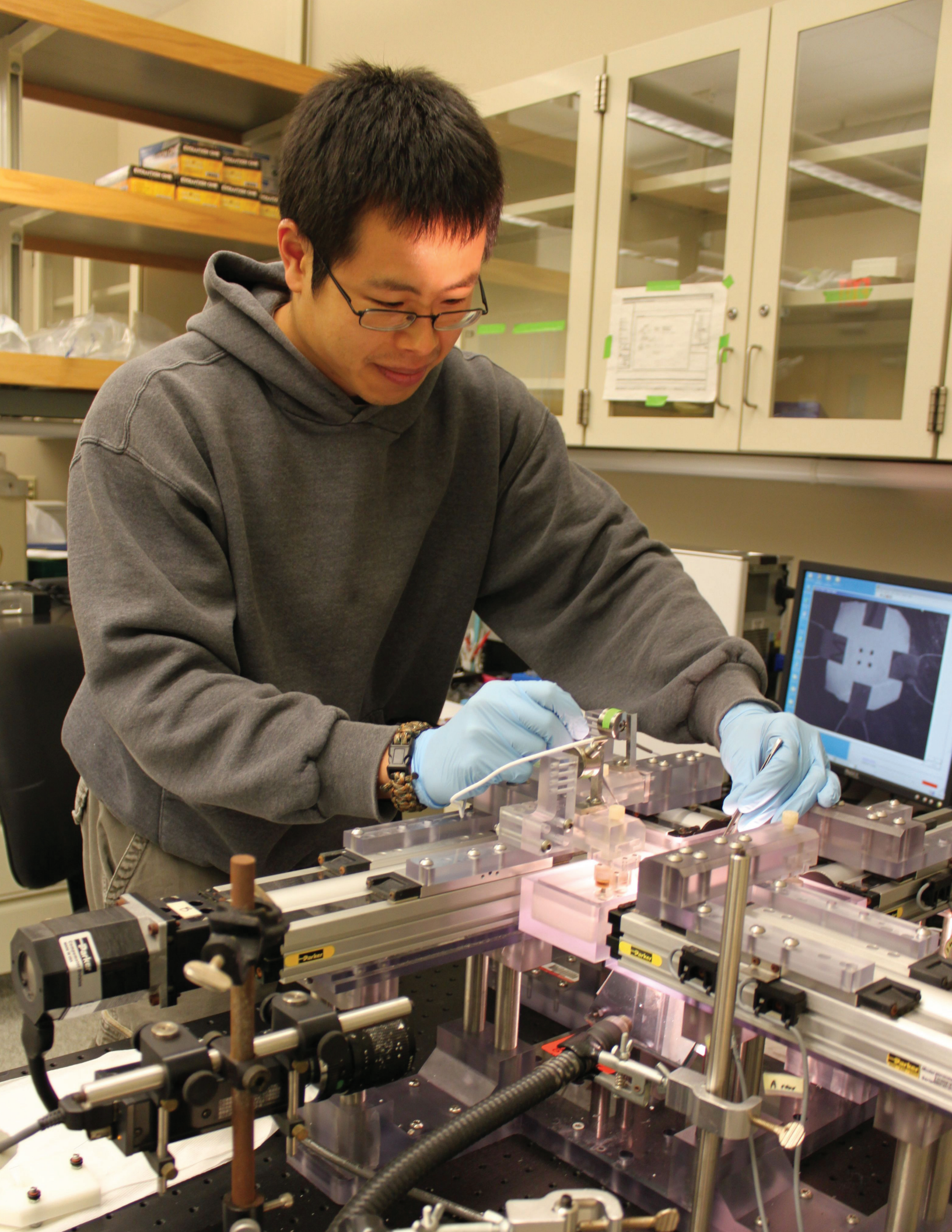
COURSE NUMBER	COURSE TITLE	INSTRUCTOR
EK 546	Assessment of Sustainable Energy Technologies	Gevelber
ME 502	Intellectual Assets: Creation, Protection, and Commercialization	Cole
ME 507	Process Modeling and Control	Gevelber
ME 510	Production Systems Analysis	Perkins
ME 515	Vibration of Complex Mechanical Systems	McDaniel
ME 520	Acoustics I	Cleveland
ME 526	Simulation of Physical Processes	Cole
ME 542	Advanced Fluid Mechanics	Howe
ME 543	Sustainable Power Systems	Caramanis
ME 560	Precision Machine Design and Instrumentation	Sharon
ME 583	Product Management	Hauser
ME 584	Manufacturing Strategy	Hauser
ME 720	Acoustics II	Howe
ME 762	Non-Linear Control of Mechanical Systems	Wang
ME 765	Production System Design	Caramanis
ME 778	Micromachined Tranducers	X.Zhang

In total the DLP offered 17 different courses during the past academic year. Four of these courses were offered for the first time in the DL format: ME 515 Vibration of Complex Mechanical Systems, ME 542 Advanced Fluid Mechanics, EK 546 Assessment of Sustainable Energy Technologies, and ME 720 Acoustics II. In addition, several other on-campus students used only a few DL courses to complete their degrees, allowing

them to take courses that would otherwise be unavailable to them due to work, internship, or other schedule restrictions.

For more information:

<http://www.bu.edu/me/academics/graduate/masters/distance-learning/courses/>



# RESEARCH

## RESEARCH FUNDING

### Extramural New Funding in 2011-2012

RECIPIENT	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD	NEW FUNDS IN 2011-2012
Andersson	DYNSYST Special Topics: A Formal Approach to the Control of Stochastic IC Dynamic Systems	NSF	9.1.09-8.31.12	\$5,000
Andersson	A Novel SFM-Based Method for Studying Single Molecule Dynamics	HHS/NIH/NCRR	9.15.10-8.31.13	\$170,924
Baillieul Belta	AIRFOILS: Animal Inspired Robust Flight with Outer and Inner Loop Strategies (MURI)	DOD/ONR	8.1.10-3.31.13	\$602,502
Baillieul Castañón	Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (MURI-07)	DOD/AFSOF	5.1.07-6.30.12	\$674,216
Barba	Post-PASI Workshop-Solidifying networks and staying current in parallel computing; Seattle, Washington; November 12-18, 2011	NSF	9.1.11-8.31.12	\$9,416
Barba	Participant Support, Post-PASI Workshop-Solidifying networks and staying current in parallel computing; Seattle, Washington; November 12-18, 2011	NSF	9.1.11-8.31.12	\$22,297
Barba	Multiplying Algorithmic and Hardware Speed-Up: Fast Multipole Boundary Element Method on GPU Applied to Biomolecular Electrostatics, Years 2 and 3	DOD/ONR	2.1.11-12.31.13	\$31,753
Barba	CAREER: Scalable Algorithms for Extreme Computing on Heterogeneous Hardware, with Applications in Fluids and Biology	NSF	3.1.12-2.28.17	\$550,627
Barbone	Quantitative Mechanical Imaging for Improving Breast Ultrasound Diagnostics	HHS/NIH/NCI	7.1.09-5.31.12	\$58,549
Belta	Collaborative Research: The Dynamics of the Innate Immune Systems: A Study of the Toll-Like Receptors (TLR) Network	NSF	12.1.11-11.30.13	\$142,512
Belta	Smart Adaptive Reliable Teams for Persistent Surveillance	DOD/ONR	6.1.09-5.31.12	\$192,000
Belta Baillieul	Instrumentation to Support Research on Formal Verification and Control of Unmanned Vehicles (DURIP), (non fabrication)	DOD/AFOSR	9.30.11-9.29.12	\$21,189
Belta Baillieul	Instrumentation to Support Research on Formal Verification and Control of Unmanned Vehicles (DURIP), fabricated	DOD/AFOSR	9.30.11-9.29.12	\$72,500
Collins Belta	Utilizing Synthetic Biology to Create Programmable Micro-Bio-Robots	DOD/ONR	3.1.09-2.29.12	\$30,399
Bifano	Scalable, Cost-Effective, High-Actuator-Count Deformable Mirrors for Astronomical Adaptive Optics	NSF	7.1.11-6.30.14	\$783,346

RECIPIENT	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD	NEW FUNDS IN 2011-2012
Gevelber	Analysis of Process Dynamics and Sensing for Development of Robust Electrospinning Process Control	DOD/Army	9.12.11-9.11.14	\$85,793
Gopalan	PFI: Partnerships for Innovation in Thermally Sprayed Functional Oxides: Enabling New Applications Through Advanced Processing	NSF	7.1.11-6.30.14	\$50,000
Gopalan Ludwig, Smith Basu, Pal	Solid Oxide Fuel Cell Cathodes: Unraveling the Relationship Between Structure, Surface Chemistry and Oxygen Reduction	DOE	9.1.08-3.31.13	\$200,000
Holt	Development of Inexpensive Acoustic Recording Hardware and Software for NEFSC Passive Acoustic Research Needs	DOC/NOAA	9.2.11-8.31.12	\$27,000
Howe	The Self-Noise from Ventilated Supercavities, Year 2	DOD/ONR	1.1.11-12.31.13	\$77,738
Howe	Sound Sources of Phonation	NIH/NIDC	12.1.07-11.30.12	\$36,275
McDaniel	Global Optimization of Damped Structures	DOD/ONR	4.1.12-5.31.15	\$177,731
Pal	Efficient One-Step Electrolytic Recycling of Low-Grade and Post-Consumer Magnesium Scrap	DOE	9.1.10-12.31.11	\$25,007
Pal Basu	EAGER: Feasibility of the Solid Oxide Membrane-Based Electrolysis Process for Solar Grade Si Production	NSF	2.1.12-1.31.13	\$100,000
Pal Gopalan	Anode Development and Modeling of Solid Oxide Membrane (SOM) Electrolysis of Magnesium: Vehicle Technology Program	MOXST, Inc.	4.1.12-3.31.13	\$96,054
Porter	Collaborative Research: Engineering Monodisperse Lipid-Coated Microbubbles with Distinct Scattering Spectra for Ultrasound Molecular Imaging Applications	NSF	9.1.11-8.31.14	\$225,000
Ryan	Degradation Modeling in SOFC Electrodes	Battelle Memorial Inst/Pacific Northwest	4.26.12-9.30.12	\$70,000
Ryan	Validation of CFD Models for Solid Sorbent Carbon Capture Systems	Battelle Memorial Inst/Pacific Northwest	4.13.12-1.31.13	\$82,000
Sarin	Development of a HP/HIP Process for LSO	ALEM Associates, Inc.	9.1.11-8.31.12	\$40,000
Sarin	Scintillators for X-Ray Imaging Applications	XRADIA Corp.	12.1.11-11.30.12	\$50,062
Schneider	Max Kade Postdoctoral Research Exchange Grant - Christian Fillafer	Max Kade Foundation, Inc.	4.1.11-3.31.12	\$29,100
Zhang, K.	An Integrative Multi-Scale Model of Extracellular Matrix Mechanics in Vascular Remodeling	NIH/NHLBI	12.15.10-11.30.14	\$257,644
Zhang, K.	An Integrative Multi-Scale Model of Extracellular Matrix Mechanics in Vascular Remodeling	NIH/NHLBI	12.15.10-11.30.14	\$28,627
Zhang, X.	Mercury Sensor Development for Application in the Oil and Gas Industry	Schlumberger-Doll Research Center	7.1.11-6.30.12	\$56,752
Zhang, X.	Draper Laboratory Fellow: Else Frohlich	Charles Stark Draper Laboratory, Inc.	9.1.11-8.31.12	\$39,761
Zhang, X.	Draper Laboratory Fellow: Aleksander Jonca	Draper Laboratory, Inc.	9.1.11-5.31.12	\$29,820
Zhang, X. Averitt	Materials and Mechanics of Metamaterial Enhanced MEMS for Terahertz Technology	DOD/AFOSR	9.30.09-9.30.13	\$130,000
Zhang, X. Averitt	Active Metamaterial Based Terahertz Polarimeter for Spectroscopic Detection of Chemical and Biological Hazards	DTRA	7.1.06-6.30.13	\$201,766

RECIPIENT	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD	NEW FUNDS IN 2011-2012
Zhang, X.	Coupled Evanscent Field Micro-Resonators for Down-hole Data Relay	Advanced Energy Consortium (AEC)	1.1.10-12.31.12	\$208,209
Zink Pal	Sr--B <sup>2+</sup> - Alumina Surrogate Potentiometric Sensor	DOE	4.27.11-2.29.12	\$15,000

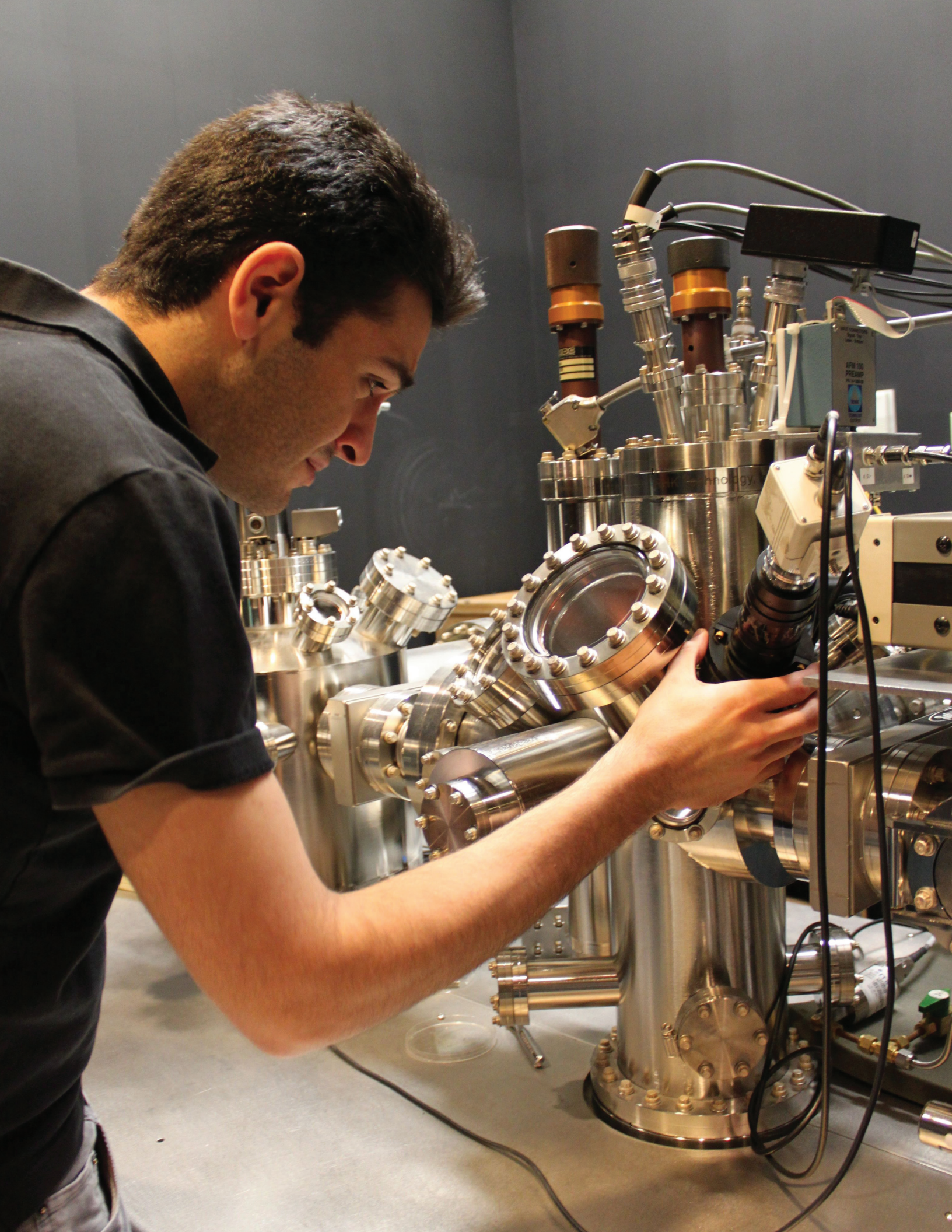
Total New Funds: **\$5,923,798**

## Current Active Awards

INVESTIGATOR	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD
Andersson	IDBR: Simultaneous Tracking of Multiple Particles in Confocal Microscopy	NSF	9.1.07-2.28.12
Andersson	IDBR: Simultaneous Tracking of Multiple Particles in Confocal Microscopy (REU Supplement)	NSF	9.1.07-2.28.12
Andersson	CAREER: Nonlinear Control for Single Molecule Tracking	NSF	7.1.09-6.30.14
Andersson	CAREER: Nonlinear Control for Single Molecule Tracking (REU Supplement)	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
Andersson Belta	DynSyst_Special_Topics: A Formal Approach to the Control of Stochastic Dynamic Systems (REU Supplement)	NSF	9.1.09-8.31.12
Andersson	A Novel SFM-Based Method for Studying Single Molecule Dynamics	HHS/NIH/NCRR	9.15.10-8.31.13
Baillieul Castañón	Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (MURI-07)	DOD/Air Force	9.15.10-8.31.11
Baillieul Belta	AIRFOILS: Animal Inspired Robust Flight with Outer and Inner Loop Strategies	DOD	8.1.10-3.31.12
Barba	Scientific Computing in the Americas: The Challenge of Massive Parallelism; Valparaiso, Chile	NSF	9.15.10-8.31.11
Barba	Multiplying Algorithmic and Hardware Speed-Up: Fast Multipole Boundary Element Method on GPU Applied to Biomolecular Electrostatics	DOD/ONR	2.1.11-12.31.13
Barbone	Quantitative Mechanical Imaging for Improving Breast Ultrasonic Diagnostics	NIH/Nat'l Cancer Institute	7.1.09-5.31.12
Belta	CAREER: Hierarchical Abstractions for Planning and Control of Robotic Swarms	NSF	7.1.05-1.31.12
Belta	CSR-EHCS(EHS), SM: A Formal Approach to Control of Hybrid Systems with Applications to Mobile Robotics	NSF	9.15.08-8.31.12
Belta Cassandras	MURI - Smart Adaptive Reliable Teams for Persistent Surveillance	DOD/Navy	6.1.09-5.31.12
Belta	CPS: Medium: Collaborative Research: Efficient Control Synthesis and Learning in Distributed Cyber-Physical Systems	NSF	9.15.10-8.31.13
Belta	Specification Languages and Distributed Control Schemes for Teams of Unmanned Vehicles	DOD/Army	3.17.09-3.16.12
Belta	Formal Verification and Synthesis of Control and Communication Strategies for Teams of Unmanned Vehicles	DOD/Air Force	3.1.09-2.29.12

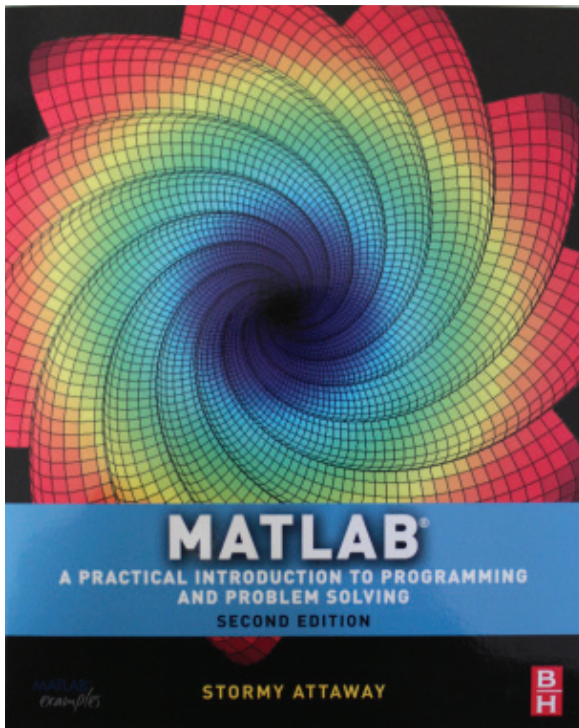
INVESTIGATOR	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD
Bifano	Optical Propagation Through Impenetrable Materials Using MEMS	NSF	5.3.11-6.30.12
Caramanis Baillieul	EFRI-SEED Framework for Advanced Sustainable Building Design	NSF	8.15.10-7.31.14
Carey	Sonic Properties of Multiphase Media	DOD/ONR	1.1.04-12.31.13
Carey Porter	Sound Speed and Attenuation in Muddy Sediments	DOD/ONR	2.22.07-4.30.12
Cleveland	Strategies for Improved Shock Wave Lithography	Indiana University	7.1.09-9.30.11
Cleveland	Tracking Kidney Stones during Shock Wave Lithotripsy		
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/NI-DDK	9.1.08-8.31.11
Cleveland	Steerable MEMS Instruments for Precise Intracardiac Surgery	Children's Hospital, Boston	1.1.10-12.31.11
Ekinci	CAREER: Photonic Integration of Silicon Nanoelectromechanical Systems	NSF	3.1.07-2.28.13
Ekinci	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	9.1.08-8.31.12
Gevelber Wroblewski	Development of Software System Prototype for Optimized Commissioning and Adaptive Control of Building HVAC	Comm. of MA/ Massachusetts Technology	5.15.11-6.30.12
Gopalan Pal, Basu Ludwig, Smith	Solid Oxide Fuel Cell Cathodes: Unraveling the Relationship Between Oxygen Reduction, Structure, and Surface Chemistry	DOE	9.1.08-3.31.13
Gopalan Lin	Stable Potentiometric Sensor for Ce(III), Ce(IV) and Gd(III) Ions in Acidic Media	Battelle Energy Alliance, LLC	3.29.10-1.31.12
Grace	Further Investigation into Fan Broadband Noise Simulations	Ohio Aerospace Institute	5.1.11-6.30.12
Howe	Sound Sources of Phonation	HHS/NIH/NI-DCD	12.1.07-11.30.12
Howe	The Self Noise from Ventilated Supercavities	DOD/ONR	1.1.11-12.31.13
McDaniel	Estimating the Effects of Damping Treatments on the Vibration of Complex Structures	DOD/Navv	2.7.08-4.30.12
Morgan	Collaborative Research: Micro- and Nano-scale Characterization and Modeling of Bone Tissue	NSF	9.1.08-8.31.11
Morgan	Micro-Computed Tomography Assessment of TRUFIT	Smith & Nephew, Inc.	12.1.10-12.1.12
Morgan	3-D Visualization and Prediction of Spine Fractures	NIH/NIAMS	4.8.08-4.30.13
Pal	Efficient One-Step Electrolytic Recycling of Low-Grade and Post-Consumer Magnesium Scrap	DOE	9.1.10-12.31.11
Pal	Low-Cost, Low-Impact Magnesium Production by Solid Oxide Membrane Electrolysis (SBIR Phase II)	DOE	5.1.11-4.30.12
Pal	Characterization of Multivalent Metal Oxide Electrolysis Using Solid-Oxygen-Ion Diffusion	DOE	1.14.11-9.30.11
Park	Mechanical Loss Mechanisms in C-Axis Gallium Nitride Nanowires	NSF	7.1.09-6.30.12
Park	CAREER: Multiscale Design of the Coupled Optomechanical Properties of Silicon Nanowires	NSF	2.12.10-7.31.12
Porter	BRIGE - The Role of Vaporized Perfluorocarbon Nanoemulsions in Enhanced Ultrasound-Induced Lesion Formation for Cancer Therapy	NSF	9.1.09-8.31.11

INVESTIGATOR	TITLE OF AWARD	FUNDING AGENCY	GRANT PERIOD
Porter	MRI-Guided Localized Delivery of Chemotherapy Using Temperature-Sensitive Liposomes and Focused Ultrasound	Focused Ultrasound Surgery Foundation	1.1.10-8.31.11
Porter	MRI-Guided HIFU-Mediated Heating and Lesion Formation Enhanced with Phase-Shift Nanoemulsions	NIH/NIBIB	7.1.10-6.30.13
Roy	Shock Wave Source and Cavitation Detection for the Spallation Neutron Source	DOE	10.5.06-12.31.11
Roy	Center for Subsurface Sensing and Imaging Systems (CenSSIS) -- Research Thrust 1-Acoustics	NSF	9.1.08-8.31.12
Roy Cleveland, Holt	R&D Mitigation of Cavitation Damage	DOE	10.5.06-12.31.11
Roy Cleveland	The Utilization of the Analogic Ultrasound Imaging Engine and the Terason System 2000 in API, HIFU, and MedBED (CenSSIS Industrial Partner Program)	NSF	5.1.03-8.31.12
Sarin	Novel Ceramic Scintillators for PET (SBIR)	DOE	8.15.08-7.31.11
Sarin	High Performance Optical Ceramic Scintillator Through Nanotechnology	NIH/NIBIB	9.1.09-7.31.12
Schneider	Max Kade Postdoctoral Research Exchange Grant - Christian Fillafer	Max Kade Foundation, Inc.	4.1.11-3.31.12
Sharon	Bacterial Drug Susceptibility Identification by Surface Enhanced Raman Microscopy	NIH RO1	7.1.10-6.30.15
Wroblewski	Sensor and Control Development for Thermal Spray	Cyber Materials, LLC	5.15.11-5.31.12
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, K.	An Integrative Multi-Scale Model of Extracellular Matrix Mechanics in Vascular Remodeling	NIH/NHLBI	12.15.10-11.30.14
Zhang, K. Ziegler	Effects of Immediate Biochemical Environments on the Structure and Function of Aortic Elastin	NSF	5.1.11-4.30.14
Zhang, X.	Draper Laboratory Fellows	Charles Stark Draper Laboratory, Inc.	9.1.10-8.31.11
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	10.1.09-9.30.12
Zhang, X.	Mechanical Behavior of Amorphous Plasma-Enhanced Chemical Vapor Deposited Silicon Oxide Films for MEMS Applications	NSF	6.1.07-8.31.11
Zhang, X. Averitt	Materials and Mechanics of Metamaterial Enhanced MEMS for Terahertz Technology	DOE/Air Force	9.30.09-9.30.13
Zhang, X. Averitt	Coupled Evanescent Field Micro-Resonators for Downhole Data Relay	Advanced Energy Consortium	1.1.10-6.30.12
Zhang, X.	Collaborative Research: Elastic and Viscoelastic Characterization and Modeling of Polymer Based Structures for Biological Applications (REU Supplement)	NSF	9.1.08-8.31.12
Zhang, X. Averitt	Development of Novel Optomechanical Uncooled Metamaterial Enhanced Active Terahertz Detection Imager	NSF	7.1.08-6.30.12
Zhang, X.	Structures for biological applications (REU supplement)	NSF	9.1.08-8.31.12
Zink, Peter	Sr--B <sup>2+</sup> - Alumina Surrogate Potentiometric Sensor	DOE	4.27.11-2.29.12

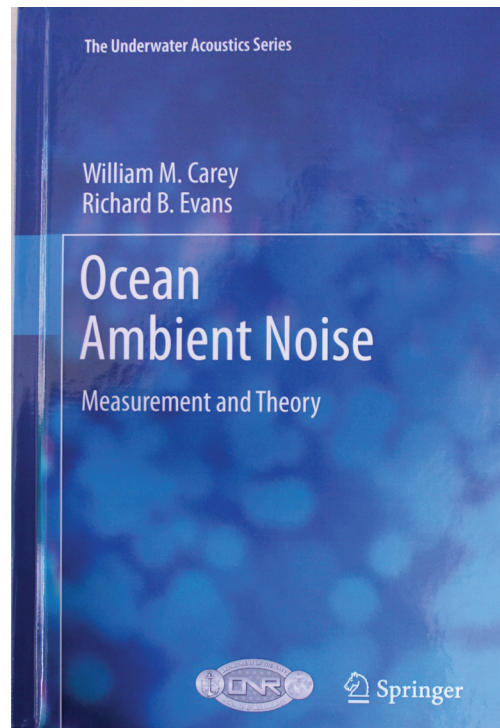


# FACULTY PUBLICATIONS\*

## Books



**STORMY ATTAWAY**, *MATLAB: A Practical Introduction to Programming and Problem Solving*, Second Edition, pp.512+x, Burlington, MA, Elsevier Inc., 2011.



**WILLIAM M. CAREY**, and Richard B. Evans, *Ocean Ambient Noise: Measurement and Theory*, pp.263, New York, NY, Springer, 2011.

## Book Chapters

P.I. Chang and **S.B. ANDERSSON**, "Non-raster scanning in atomic force microscopy for high-speed imaging of biopolymers," in *Control Technologies for Emerging Micro and Nanoscale Systems*, E. Eleftheriou and S.O.R. Moheimani, Eds., ser. Lecture Notes in Control and Information Sciences, Springer, pp.101-117, 2011.

Y. Chen, X. C. Ding, A. Stefanescu, and **C. BELTA**, A Formal Approach to Deployment of Robotic Teams in an Urban-Like Environment, *Springer Tracts in Advanced Robotics*, Springer-Verlag, Berlin, 2011.

T. Sibai, **E.F. MORGAN**, and T.A. Einhorn, "Effect of Anabolic Agents on Bone Quality," In: Boskey, A and Donnelly, E, editors. *Bone Quality: From Bench to Bedside. Clinical Orthopaedics and Related Research*, 469(8):2215-2224, 2011.

## Journal Articles

P.I. Chang, P. Huang, J. Maeng, and **S.B. ANDERSSON**, "Local raster scanning for high speed imaging of biopolymers in atomic force microscopy," *Review of Scientific Instruments*, 82(6): 063703, 2011.

Z.Shen and **S.B. ANDERSSON**, "Bias and precision of the fluoroBancroft algorithm for single particle localization in fluorescence microscopy," *IEEE Transactions on Signal Processing*, 59(8): 4041-4046, 2011.

**S.B. ANDERSSON**, "A nonlinear controller for three-dimensional tracking of a fluorescent particle in a confocal microscope," *Applied Physics B: Lasers and Optics*, 104(1): 161-173, 2011.

Z. Shen and **S.B. ANDERSSON**, "Tracking nanometer-scale fluorescent particles in two-dimensions with a confocal microscope," *IEEE Transactions on Control Systems Technology*, 19(5): 1269-1278, 2011.

\* Faculty Publications include all the published work by the Mechanical Engineering faculty during 1 January - 31 December 2011.

- J. BAILLIEUL, and D. Baronov, "A Motion Description Language for Robotic Reconnaissance of Unknown Fields," *European J. Control*, 17(5-6): 512-525. doi:10.3166/EJC.17.512-525, Sept-Dec 2011.
- R. Yokota, L.A. BARBA, "Comparing the treecode with FMM on GPUs for vortex particle simulations of a leapfrogging vortex ring," *Computers & Fluids*, 45(1):155-161, doi:10.1016/j.compfluid.2010.11.029, 2011.
- R. Yokota, J.P. Bardhan, M.G. Knepley, L.A. BARBA, and T. Hamada, "Biomolecular electrostatics using a fast multipole BEM on up to 512 GPUs and a billion unknowns," *Comput. Phys. Commun.*, 182(6):1271-1283 doi:10.1016/j.cpc.2011.02.013, 2011.
- F.A. Cruz, S.K. Layton, and L.A. BARBA, "How to obtain efficient GPU kernels: an illustration using FMM & FGT," *Comput. Phys. Commun.*, 182(10):2084-2098, doi:10.1016/j.cpc.2011.05.002, 2011.
- T.J. Hall, P.E. BARBONE, A.A. Oberai, J. Jiang, J.-F. Dord, S. Goenezen, and T.G. Fisher, "Recent Results in Nonlinear Strain and Modulus Imaging," *Current Medical Imaging Reviews*, 7(4): 313-327, Nov. 2011.
- S.W. Shore, P.E. BARBONE, A.A. Oberai, and E.F. MORGAN, "Transversely Isotropic Elasticity Imaging of Cancellous Bone," *Journal of Biomechanical Engineering - Transactions of the ASME*, 133(6), Jun 2011.
- S. Goenezen, P.E. BARBONE, and A.A. Oberai, "Solution of the nonlinear elasticity imaging inverse problem: The incompressible case," *Computer Methods in Applied Mechanics and Engineering*, 200(13-16): 1406-1420, 2011.
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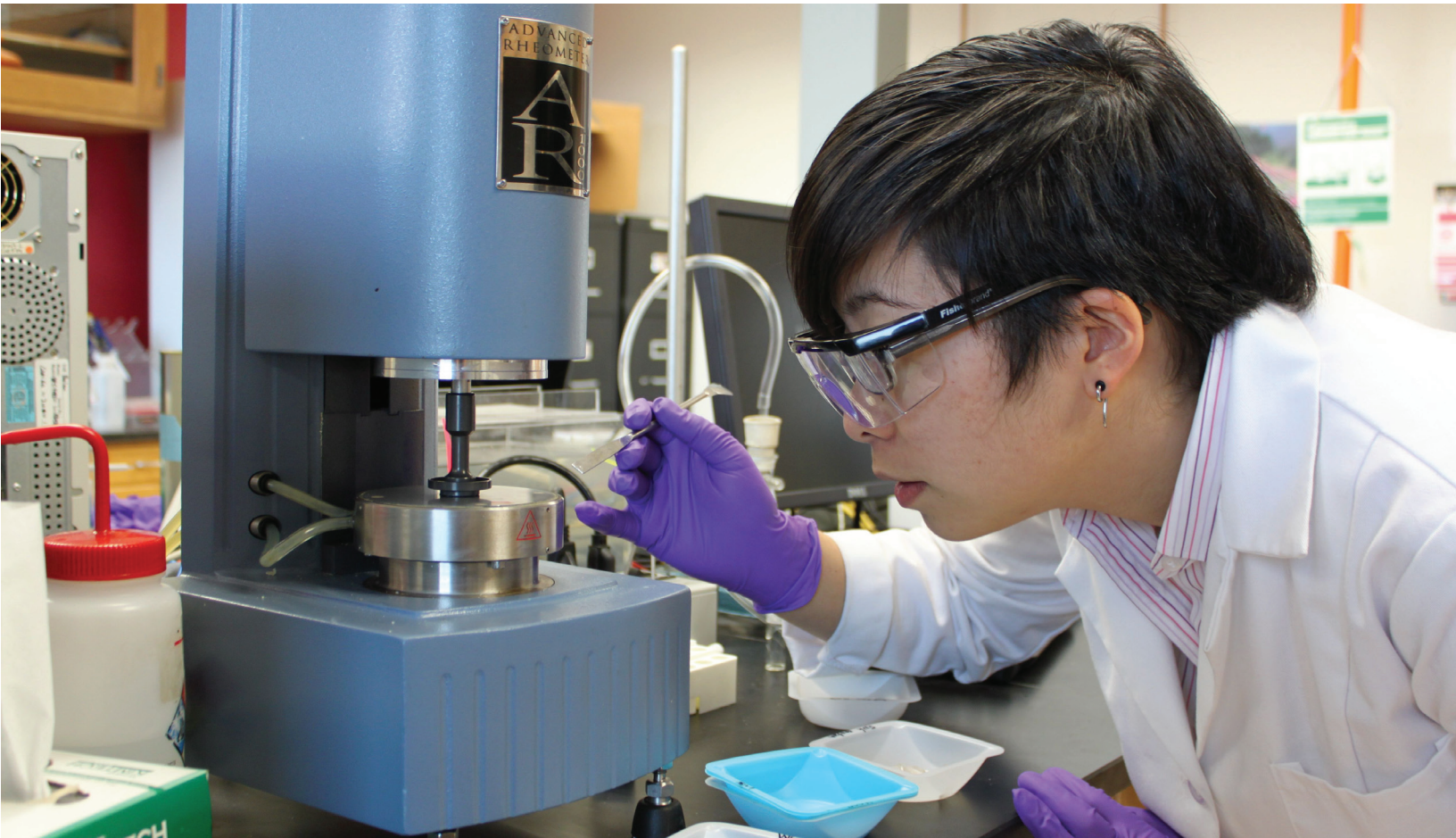
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- W.M. CAREY** and **A.D. PIERCE**, "Sonic speed estimates for muddy sediments with plausible microbubble distributions," 161st Meeting Acoustical Society of America, Seattle, Washington, 23 - 27 May 2011, Session 1aUW: Underwater Acoustics, paper 1aUW6, doi: 10.1121/1.3684895, *Proceedings of Meetings on Acoustics*, Vol. 12, 070005, 2012.
- O.B. Onur, S. Bramhavar, and **K.L. EKINCI**, "Near-field optical transducer for nanomechanical resonators," *IEEE Conference: 16th International Conference on Optical MEMS and Nanophotonics (OMN)*, Istanbul, Turkey, 8–11 Aug 2011.
- J.N. Davis, L. Miara, L. Saraf, T.C. Kaspar, **S. GOPALAN**, **U.B. PAL**, K.F. Ludwig, and **S.N. BASU**, "Direct Measurement of Oxygen Tracer

- Diffusion of Heteroepitaxial La<sub>0.8</sub>Sr<sub>0.2</sub>MnO<sub>3</sub> Cathode Material," *The Electrochemical Society*, Montreal, Canada, 2011.
- J. Maunus, **S. GRACE**, and D. Sondak, "Effect of CFD Wake Prediction in a Hybrid Simulation of Fan Broadband Interaction Noise," *17th AIAA/CEAS Aeroacoustics*, AIAA Paper No. 2011-2875, Portland, OR, Jun 2011.
- J. Maunus, **S. GRACE**, D. Sondak, and **V. YAKHOT**, "Investigation of Calculated Turbulence Parameters for use in Hybrid Broadband Fan Noise Calculations," *ASME IGTI 2011*, GT2010-45906, Vancouver, Canada, Jun 2011.
- P.R. Murray and **M.S. HOWE**, "Thermo-acoustic instabilities of a generic Rijke burner," *Proceedings: 18th International Congress on Sound and Vibration (ICSV18)*, Rio de Janeiro, Brazil, 10–14 Jul 2011.
- P. Du, **X. LIN**, and X. Zhang, "Dielectric constants of PDMS nanocomposites by conducting polymer nanowires," *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems*, pp. 645–648, 2011.
- P. Du, **X. LIN**, and X. Zhang, "Electromechanical coupling of polypyrrole trilayer actuators," *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems*, pp. 478–481, 2011.
- P. Du, **X. LIN**, and X. Zhang, "Effect of loading rates on polymer micro-pillar-based force transducers," *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems*, pp. 1432–1435, 2011.
- Y. Lu, Y. Cao, **J.G. McDANIEL**, and M.L. Wang, "Tire Noise in pavement debonding identification using HHT," *Symposium of Subsurface Imaging, Feature Identification and Damage Detection*, Engineering Mechanics Conference (EMI2011), Jun 2011.
- Y. Cao, Y. Zhang, Y. Lu, **J.G. McDANIEL**, and M.L. Wang, "Air-coupled SASW in pavement profile detection," *Symposium of Subsurface Imaging, Feature Identification and Damage Detection*, Engineering Mechanics Conference (EMI2011), Jun 2011.
- Y. Cao, Y. Lu, Y. Zhang, **J.G. McDANIEL**, and M.L. Wang, "A new fast inversion analysis algorithm for the spectral analysis of surface wave (SASW) method," *SPIE2011 Conference SSN09*, San Diego, CA, Mar 2011.
- Y. Lu, Y.H. Cao, **J.G. McDANIEL**, and M.L. Wang, "Wave Number Estimation Based Method on In Situ Pavement Ground Truth with Near Source-Receiver Sensing," *SPIE2011 Conference SSN09*, San Diego, CA, Mar 2011.
- C.M.J. De Bakker, L.N.M. Hayward, L.C. Gerstenfeld, M.W. Grinstaff, and **E.F. MORGAN**, "Contrast-enhanced computed tomography for non-destructive, quantitative assessment of the early stages of fracture healing," *ASME Summer Bioengineering Conference*, 2011.
- M.M. Sperry, L.N.M. Hayward, G.J. Miller, and **E.F. MORGAN**, "Characterization of the poroelastic material properties of skeletal repair tissues using microindentation," *ASME Summer Bioengineering Conference*, 2011.
- G.J. Miller, P.G. Patel, and **E.F. MORGAN**, "Correlation of local mechanical environment to mechanically induced tissue phenotype during altered bone fracture healing," *ASME Summer Bioengineering Conference*, 2011.
- E. Gratz, S. Pati, J. Milhstein, A. Powell, and **U.B. PAL**, "Efficiency and Stability of Solid Oxide Membrane Electrolyzers for Magnesium Production," *Magnesium Technology*, pp. 39–42, 2011.
- H.S. PARK** and X.H. Qian, "Strain Effects on the Optical Properties of Metallic Nanostructures," *NSF CMMI, Grantees Conference Proceedings*, 2011.
- J. McLaughlan, T.W. Murray, and **R.A. ROY**, "The use of optically activated nanoparticles to enhance controlled lesion formation from high intensity focused ultrasound exposures," *IEEE International Ultrasonics Symposium Proceedings*, 2011.
- C.A. Boteroa, E. Jimenez-Piqué, T. Kulkarnic, G. Fargas, **V.K. SARIN**, and L. Llanes, "Nanoindentation and Nanoscratch of Compositionally Graded Mullite Films," *Proceedings of the 38th International Conference on Metallurgical Coatings and Thin Films (ICMCTF)*, 2011.
- F. Liu, Z.-H. Guan, **H.O. WANG**, and G. Zhu, "Stability and control of bifurcation in XCP networks," *Proceedings of the 30th Chinese Control Conference*, pp. 5991–5994, 22–24 Jul 2011.
- T. Seo, H. Ohtake, K. Tanaka, Y.-J. Chen, and **H.O. WANG**, "A Polynomial Observer Design for a Wider Class of Polynomial Fuzzy Systems," *Proceedings of the 2011 IEEE International Conference on Fuzzy Systems*, pp.1305-1311, Taipei, Jun 2011.
- Y. Cai, **H.O. WANG**, K. Tanaka and X. Xu, "Robust Filtering for Networked Systems with Random Transmission Delays and Packet Dropouts," *Proceedings of the 2011 American Control Conference*, pp. 1813-1818, San Francisco, CA, USA, 29 Jun –1 Jul 2011.
- K. Tanaka, H. Ohtake, T. Seo and **H.O. WANG**, "An SOS-based Observer Design for Polynomial Fuzzy Systems," *Proceedings of the 2011 American Control Conference*, pp. 4953-4958, San Francisco, CA, USA, 29 Jun–1 Jul 2011.
- H. Ohtake, K. Tanaka and **H.O. WANG**, "An Improved Approach to Fuzzy Model Construction and Servo Control with Constraints based on Error Dynamics," *Proceedings of the 2011 American Control Conference*, pp. 4959-4963, San Francisco, CA, USA, 29 Jun–1 Jul 2011.
- H. Ohtake, K. Tanaka, and **H.O. WANG**, "Fuzzy Model-based Servo Control for Discrete-Time Nonlinear Systems with Constraints," *Proceedings of the 18th World Congress of International Federation of Automatic Control (IFAC)*, pp. 9029–9034, Milano, Italy, Aug 2011.
- Y. Cai, **H.O. WANG**, and X. Xu, "The Kalman Filtering for a class of Local Strongly Coupled Systems," *Proceedings of the 2011 Chinese Control and Decision Conference (CCDC)*, pp. 1962–1966, Mianyang, China, 23-25 May 2011.
- H. Jung, Y.-G. Kim, D. H. Kim, and **H.O. WANG**, "Remote Robot Control Learning Powered by Bluetooth Communication," *Proceedings of the IASTED International Conference Technology for Education and Learning (TEL 2011)*, Beijing, China, 24–25 Oct 2011.
- D. WROBLEWSKI**, "Herding CATs: Weaving Coherent Application Threads through a Mechanical Engineering Curriculum to Facilitate Course-to-Course Connectivity and Improve Material Retention," *Proceedings of the 2011 ASEE Annual Conference*, Vancouver, Canada, 2011.

C. Lissandrello, **V. YAKHOT**, and **K.L. EKINCI**, “Confinement Effects in Oscillating Nanoscale Flows,” *Bulletin of the American Physical Society*, 56, 2011.

K. Fan, A.C. Strikwerda, H. Tao, R.D. Averitt, and **X. ZHANG**, “Broadband Tunable 3D Metamaterials at Terahertz Frequencies,” *Proceeding of the 24th IEEE International Conference on Micro Electro Mechanical Systems (MEMS '11)*, pp. 680-683, Cancun, Mexico, 23–27 Jan 2011.

K. Fan, A.C. Strikwerda, **X. ZHANG**, and R.D. Averitt, “Tunable Terahertz 3D Metamaterials,” *Proceeding of the 31st Conference on Lasers and Electro-Optics (CLEO '11)*, CWA1, Baltimore, MD, 1–6 May 2011.

E. Ekmekci, A.C. Strikwerda, K. Fan, G.R. Keiser, **X. ZHANG**, G. Turhan-Sayan, and R.D. Averitt, “Frequency Tunable Metamaterial Designs Using Near-Field Coupled SRR Structures in the Terahertz Region,” *Proceeding of the 31st Conference on Lasers and Electro-Optics (CLEO '11)*, JTU35, Baltimore, MD, 1–6 May 2011.

A.C. Strikwerda, H. Tao, E.A. Kadlec, K. Fan, W.J. Padilla, R.D. Averitt, E.A. Shaner, and **X. ZHANG**, “Metamaterial Based Terahertz Detector,” *Proceeding of the 31st Conference on Lasers and Electro-Optics (CLEO '11)*, QTuD6, Baltimore, MD, 1–6 May 2011.

B.C. Kaanta, A. Jonca, H. Chen, and **X. ZHANG**, “Effect of Knudsen Number on Maximum Response of a Thermal Conductivity Detector,” *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers '11)*, pp. 88–91, Beijing, China, 5–9 Jun 2011.

B.C. Kaanta, H. Chen, and **X. ZHANG**, “Flow Insensitive Thermal Conductivity Detector for Micro Gas Chromatography,” *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers '11)*, pp. 2074-2077, Beijing, China, 5–9 Jun 2011.

X. Wang, S.W. Anderson, and **X. ZHANG**, “Microengineered Iron and Iron-Oxide Contrast Agent Particles for Tunable Multispectral Magnetic Resonance Imaging,” *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers '11)*, pp. 2152–2155, Beijing, China, 5–9 Jun 2011.

P. Du, X. Zheng, I.-K. Lin, H. Lu, and **X. ZHANG**, “Effect of Loading Rates on Polymer Micropillar-Based Force Transducers,” *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers '11)*, pp. 1432–1435, Beijing, China, 5–9 Jun 2011.

X. Zheng and **X. ZHANG**, “Polymer Opto-Mechanical Transducer for Abnormal Cell Contraction Diagnostics,” *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers '11)*, pp. 2243–2246, Beijing, China, 5–9 Jun 2011.

P. Du, X. Lin, and **X. ZHANG**, “Electromechanical Coupling of Polypyrrole Trilayer Actuators,” *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers '11)*, pp. 478–481, Beijing, China, 5–9 Jun 2011.

K. Fan, A.C. Strikwerda, R.D. Averitt, and **X. ZHANG**, “Bottom-Up Three Dimensional Metamaterials at Terahertz Frequencies,” *Proceeding of the 16th International Conference on Solid-State Sensors,*

*Actuators and Microsystems (Transducers '11)*, pp. 2662–2665, Beijing, China, 5–9 Jun 2011.

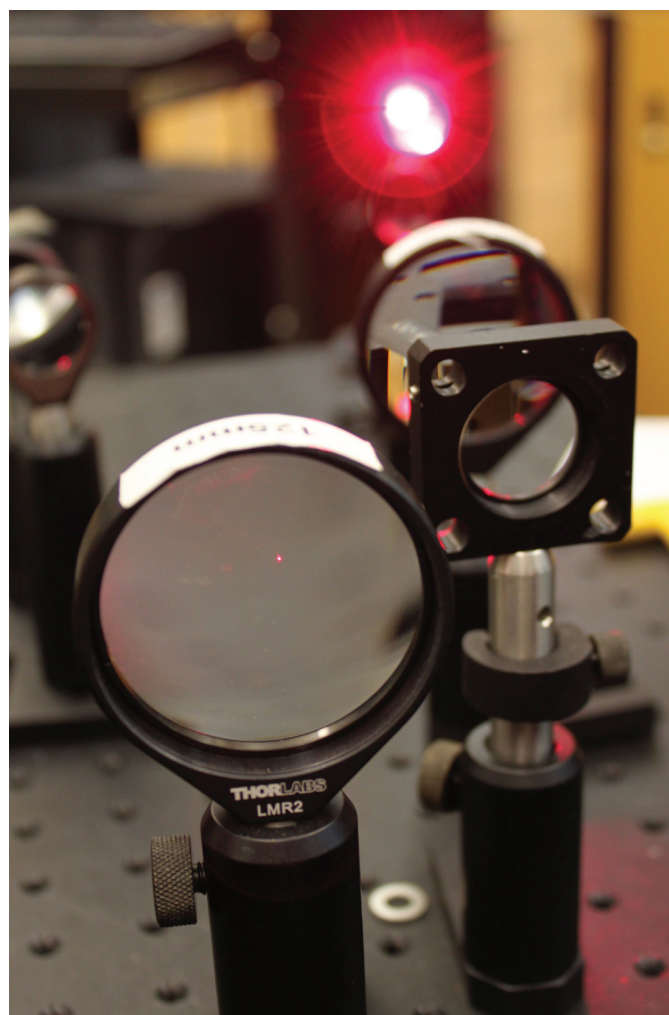
P. Du, X. Lin, and **X. ZHANG**, “Dielectric Constants of PDMS Nanocomposites by Conducting Polymer Nanowires,” *Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers '11)*, pp. 645–648, Beijing, China, 5–9 Jun 2011.

C. Wang, X. Wang, S.W. Anderson, and **X. ZHANG**, “Iodinated Hydrogel Microparticles as X-Ray Computed Tomography Contrast Agents,” *Proceeding of the 15th International Conference on Miniaturized Systems for Chemistry and Life Sciences (microTAS '11)*, W20H, Seattle, WA, 2–6 Oct 2011.

Y. Zou, and **Y. ZHANG**, “Changes in the Mechanical Behavior of Arterial Elastin due to Glycation,” *ASME International Mechanical Engineering Congress and Exposition*, Denver, CO, 11–17 Nov 2011.

M.-J. Chow, and **Y. ZHANG**, “Quantifying the structural and mechanical changes in elastase degraded arteries,” *ASME International Mechanical Engineering Congress and Exposition*, Denver, CO, 11–17 Nov 2011.

**Y. ZHANG**, “An integrative Multi-Scale Model of Extracellular Matrix Mechanics in Vascular Remodeling,” *NIH Multiscale Modeling (MSM) Consortium Meeting*, Rockville, MD, 4–5 Oct 2011.



## Invited Presentations

**S.B. ANDERSSON**, “From no-go to go in three tries,” the National Science Foundation CAREER workshop, 4 Apr 2011.

**S.B. ANDERSSON**, “Motion control in an uncertain world,” Cornell University, Department of Mechanical and Aerospace Engineering, 29 Aug 2011.

**S.B. ANDERSSON**, “Studying dynamics in nanometer-scale systems through tracking,” Cornell University, Applied and Engineering Physics, 30 Aug 2011.

**S.B. ANDERSSON**, “Studying dynamics in nanometer-scale systems through tracking,” Agilent Technologies, 26 Sep 2011.

**J. BAILLIEUL**, “IEEE PUBLISHING from its dawn to the present,” IEEE Region 1 Student Conference held at Boston University, Photonics Center, 26 Mar 2011.

**J. BAILLIEUL**, Plenary Lecture: “Information Based Control and Control Communication Complexity,” the Asian Control Conference, Kaohsiung, Taiwan, 17 May 2011.

**J. BAILLIEUL**, “Brockett-Heisenberg Systems and Geometric Aspects of Control Communication Complexity,” workshop on “Decision, Dynamics and Control in MultiAgent Systems,” University of California at Santa Barbara, 24 Jun 2011.

**J. BAILLIEUL**, “Information Gradients and Topology in Random Fields,” Applied Algebraic Topology Conference, ETH Zurich, 6 Jul 2011.

**J. BAILLIEUL**, “Brockett-Heisenberg Systems and Geometric Aspects of Control Communication Complexity,” Lecture at the Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany, workshop on Applied Dynamics and Geometric Mechanics, 14–20 Aug 2011.

**J. BAILLIEUL**, “Information Based Control and Control Communication Complexity,” Kolloquium Technische Kybernetik, Institut fuer Systemtheorie und Regelungstechnik, University of Stuttgart, 22 Aug 2011.

**J. BAILLIEUL**, “Teaching Robots to Dance: Information Based Control and Control Communication Complexity,” Colloquium at Harvard University Electrical Engineering Seminar, 14 Oct 2011.

**J. BAILLIEUL**, “The Standard Parts Optimal Control Problem,” the IEEE Conference on Decision and Control Workshop entitled: “The Work of Peter Crouch,” 11 Dec 2011.

**J. BAILLIEUL**, The 23rd Hendrik W. Bode Lecture: “Fifty Years of Information Based Control Theory,” delivered at the 50th IEEE Conference on Decision and Control, Orlando FL, 15 Dec 2011.

**L.A. BARBA**, “The basis and perspectives of an exascale algorithm: our ExaFMM project,” Workshop on Manycore and Accelerator-based High-performance Scientific Computing, International Center for Computational Science (ICCS), UC Berkeley, 26–28 Jan 2011.

**L.A. BARBA**, “The basis and perspectives of an exascale algorithm: our ExaFMM project,” IMA workshop on High-performance Computing and Emerging Architectures, University of Minnesota, 10–14 Jan 2011.

**L.A. BARBA**, “Fast algorithms for global approximation methods,” Scientific Computing Group, UMass Dartmouth, 13 Apr 2011.

**L.A. BARBA**, “Dare to think about exascale CFD: a research agenda,” ParCFD’11, 23rd International Conference on Parallel Computational Fluid Dynamics, Barcelona, Spain, 16–20 May 2011.

**L.A. BARBA**, “A tuned and scalable fast multipole method as a pre-eminent algorithm for the exascale,” Daresbury Laboratory (UK), Computational Science and Engineering Department, 1 June 2011.

**L.A. BARBA**, “40 years and counting: AWM’s celebration of women in mathematics,” AWM Anniversary Conference at the new Institute for Computational and Experimental Research in Mathematics, ICERM, Brown University. Special session: Recent Advances in Numerical Methods and Scientific Computing, 17–18 Sep 2011.

C.E. Rivas Aroni, **P. BARBONE**, A.A. Oberai, “Improved inverse problem solutions using improved forward solvers,” Applied Inverse Problems Conference, Texas A&M University, College Station, TX, 23–27 May 2011.

A. Oberai, U. Albocher, I. Harari, Y. Zhang and **P. BARBONE**, “Direct computation of inverse problems of incompressible elasticity,” Applied Inverse Problems Conference, Texas A&M University, College Station, TX, 23–27 May 2011.

**P. BARBONE**, B. Chu, A.A. Oberai, “Estimating uncertainty in inverse elasticity with application to quantitative elastography,” 162nd Meeting of the Acoustical Society of America, San Diego, CA, 31 Oct–4 Nov 2011.

M.S. Richards, **P. BARBONE**, and A.A. Oberai, “Image Registration for Tissue Biomechanics Imaging,” 2nd International Conference on Mathematical and Computational Biomedical Engineering - CMBE2011, Washington D.C., 30 Mar–1 Apr 2011.

**P. BARBONE**, “Biomechanical imaging: elastography beyond young’s modulus,” International Tissue Elasticity Conference, Arlington, TX, 12–15 Oct 2011.

**P. BARBONE**, “Computational formulations for inverse elasticity problems with application to breast cancer imaging,” Mathematics Department Seminar, Rochester Institute of Technology, Rochester, NY, 26 Apr 2011.

C.E. Rivas Aroni, **P. BARBONE**, A.A. Oberai, “Two steps forward and one step back: Improved inverse problem solutions using improved forward solvers,” Inverse Problems and Optimal Control for PDEs, Warwick, UK, 23–27 May 2011.

**C. BELTA**, and T.U Delft, “Verification and Control of Piecewise Affine Systems with Applications to Synthetic Biological Networks,” De-

partment of Mechanical, Maritime, and Materials Engineering, Delft, Netherlands, 17 Nov 2011.

**C. BELTA**, and T.U. Eindhoven, "Verification and Control of Piecewise Affine Systems with Applications to Synthetic Biological Networks," Department of Electrical Engineering, Eindhoven, Netherlands, 16 Nov 2011.

**C. BELTA**, "Verification and Control of Piecewise Affine Systems with Applications to Synthetic Biological Networks," ETH, Automatic Control Laboratory, Zurich, Switzerland, 9 Nov 2011.

**C. BELTA**, "Formal Verification and Control of Piecewise Affine Systems with Applications to Biological Networks," Universite Joseph Fourier and Laboratoire Jean Kuntzmann, Grenoble, France, 18 Oct 2011.

**C. BELTA**, "Formal Approaches to Motion Planning and Control," Groupe de Recherche Modelisation, Analyse et Conduite des Systemes Dynamiques, Paris, France, 13 Oct 2011.

**C. BELTA**, "Formal Verification and Control of Piecewise Affine Systems with Applications to Biological Networks," INRIA, Rocquencourt, France, 10 Oct 2011.

**C. BELTA**, "Formal Verification and Synthesis of Discrete-Time Piecewise Affine Systems," Carnegie Mellon University, School of Computer Science, 6 Mar 2011.

**C. BELTA**, "Formal Synthesis Approaches to Robot Motion Planning and Control," Georgia Institute of Technology, Decision and Control Laboratory, Atlanta, GA, 25 Feb 2011.

**T. BIFANO**, "Polymorphic optical zoom with MEMS DMs," MEMS Adaptive Optics V, San Francisco, CA, SPIE, Jan 2011.

**T. BIFANO**, Plenary Talk: Shaping Light, Int'l. Conference on Optical MEMS & Nanophotonics, Istanbul, Turkey, Aug 2011.

**M.C. CARAMANIS**, "Intermittent Renewable Generation, Distributed Resources and Demand Response: Are Smart Grid Enabled Market Solutions Viable?" Northeastern University, ECE Department, 11 Feb 2011.

**M.C. CARAMANIS**, "Intermittent Renewable Generation, Distributed Resources and Demand Response: Are Smart Grid Enabled Market Solutions Viable?" Yale University, E&CS Department, New Haven, CT, 18 Feb 2011.

**M.C. CARAMANIS**, "Market Based Demand Response in Smart Grid Supported Power Markets: Power System Requirements and Computational Method Implications," MIT, Cambridge, MA, 29 Sept 2011.

**M.C. CARAMANIS**, "Flexible Demand Response in Smart Grid Supported Power Markets," the 25th Annual CCW, Smart Grid Session, Hyannis MA, 10 Oct 2011.

**M.C. CARAMANIS**, "Market Based Demand Response and efficiency gain opportunities in Smart Grid Supported Electric Power Systems," United Kingdom Consulate General, UK/US Innovations in Smart Grids Workshop, Boston, MA, 31 Oct 2011.

**D. COLE**, "Carbon nanotubes: making use of their amazing properties in novel nanoelectronic devices," Students for the Advancement for Nanotechnology (S.A.N.T.), Boston, MA, 11 Nov 2011.

**K. EKINCI**, "Nanoscale Mechanical Resonators for Probing Physical Phenomena: Fluid Dynamics of High-frequency Flows," American Physical Society, March Meeting, Session J2: Force Probes of Materials' Structure and Function, 22 Mar 2011.

**K. EKINCI**, "Nanoscale Mechanical Resonators for Probing Physical Phenomena: Fluid Dynamics of High-frequency Flows," Virginia Tech, Mechanical Engineering Graduate Student Seminar Series, 15 Apr 2011.

**K. EKINCI**, "Nanoscale Mechanical Resonators for Probing Physical Phenomena: Fluid Dynamics and Beyond," Physics Colloquium, U. Mass. Lowell, Lowell, MA, 21 Sep 2011.

**R.G. HOLT**, "Alligator Mississippiensis and Faraday Waves: How I Spent my Spring Break Watching the Mating Displays of Alligators," Physics Department Colloquium, University of Mississippi, Apr 2011.

**R.G. HOLT**, P.A. Anderson, A. Sampathkumar, Jonathan R. Sukovich and D.F. Gaitan, "Shock-controlled bubble cloud dynamics and light emission," the 161st meeting of the Acoustical Society of America, Seattle, WA, 2011.

D.F. Gaitan, Y. Pischalnikov, T.J. Matula, C.C. Church, J. Gutierrez, C. Scott, **R.G. HOLT**, T. Matula, L.A. Crum, "Transient Cavitation in High-Quality Factor Resonators at High Static Pressures," the 161st meeting of the Acoustical Society of America, Seattle, WA, 2011.

Y.A. Pischalnikov, D. Felipe Gaitan, M.S. Einert, **R.G. HOLT**, C.C. Church and L.A. Crum, "Simultaneous measurements of shock waves, sonoluminescence flashes, and high-speed video of cavitation in high-quality factor resonators at high static pressures," the 161st meeting of the Acoustical Society of America, Seattle, WA, 2011.

**M.S. HOWE**, "The thermo-acoustic Fant equation," Department of Mathematics, Keele University, UK, 9 Aug 2011.

**X. LIN**, "Unified model Hamiltonian for conducting polymers," University of Pennsylvania, Philadelphia, PA, Jul 2011.

**E.F. MORGAN**, "Measurement, Regulation, and Consequences of the Local Mechanical Environment in Skeletal Healing," Sun Valley Workshop on Musculoskeletal Biology, Session on "Fracture Healing and Non-Union," Aug 2011.

**E.F. MORGAN**, "Identification of Local Mechanical Stimuli that Regulate Skeletal Healing," Biomethods Boston Conference, Session on "Methods and Advances in Mechanobiology," Boston, MA, Jul 2011.

**E.F. MORGAN**, "Digital Volume Correlation fo Study of the Mechanics of Whole Bones," Department Seminar, Faculty of Medicine Lyon-Est, University of Lyon, Lyon, France, Jul 2011.

**E.F. MORGAN**, "Measurement of the Local Mechanical Environment of Skeletal Tissues," Department Seminar, Mechanical and Aerospace Engineering, University of California San Diego, May 2011.

- E.F. MORGAN**, "Alterations to Bone Microstructure with Age and Disease," Boston Older Adults Independence Claude D. Pepper Center, Boston Medical Center, Mar 2011.
- E.F. MORGAN**, "Full-Field Measurement of Tissue Motion, Deformation, and Failure," Department Seminar, Orthopaedic Surgery, University of California San Diego, CA, Feb 2011.
- E.F. MORGAN**, "Regulation of Skeletal Healing by Mechanical Factors," Rheumatology, Allergy, and Immunology Seminar Series (RAISS), University of California San Diego, Jan 2011.
- U.B. PAL**, "Novel Large Scale Rapid Response Energy Storage System for Addressing Intermittency in Electric Power Generation and Use," ARPA-E, Washington, DC, Mar 2011.
- H.S. PARK**, "Computational Modeling of Surface Effects on Mechanical and Electromechanical Phenomena in Nanomaterials," Massachusetts Institute of Technology, Cambridge, MA, Oct 2011.
- H.S. PARK**, "Mechanics of Crystalline Nanowires," Notre Dame University, Dec 2011.
- H.S. PARK**, "Multiscale, Finite Element Modeling of Surface Effects on Nanomaterials," 6th MIT Conference on Computational Mechanics, Cambridge, MA, Jun 2011.
- H.S. PARK** and M. Devel, "A Multiscale Formulation for the Electromechanical Behavior of Nanomaterials," 6th MIT Conference on Computational Mechanics, Cambridge, MA, Jun 2011.
- H.S. PARK** and M. Devel, "A Multiscale Formulation for the Electromechanical Behavior of Nanomaterials," USNCCM, Minneapolis, Jul 2011.
- H.S. PARK**, G. Yun, P. Cao, J.A. Zimmerman, and T.J. Delph, "Nonlocal Instability Analysis of FCC Bulk and (100) Surfaces Under Uniaxial Stretching," SES 2011, Evanston, IL, Oct 2011.
- H.S. PARK** and M. Devel, "A Multiscale Formulation for the Electromechanical Behavior of Nanomaterials," SES 2011, Evanston, IL, Oct 2011.
- H.S. PARK**, Z. Suo, J. Zhou and P.A. Klein, "A Dynamic Finite Element Formulation for the Inhomogeneous Deformation of Dielectric Elastomers," ASME IMECE, Denver, Nov 2011.
- H.S. PARK** and M. Devel, "A Multiscale Formulation for the Electromechanical Behavior of Nanomaterials," ASME IMECE, Denver, CO, Nov 2011.
- H.S. PARK**, P. Cao, G. Yun, J.A. Zimmerman and T.J. Delph, "Nonlocal Instability Analysis of FCC Bulk and Surfaces Under Uniaxial Stretching," ASME IMECE, Denver, CO, Nov 2011.
- T.J. Delph, J.A. Zimmerman, **H.S. PARK** and P. Cao, "Time and Rate-Dependence of Defect Nucleation in Crystalline Solids: the Transition State Theory Approach," USNCCM 2011, Minneapolis, MN, Jul 2011.
- T. PORTER**, "Harnessing the power of bubbles in biomedical ultrasound," Department of Mechanical Engineering, University of Texas at Austin, 23 Sep 2011.
- T. PORTER**, "Biomedical Acoustics: Making a Quantum Leap in Medicine," Annual Meeting of the National Society of Black Physicists/National Society of Hispanic Physicists, Austin, TX, 22 Sep 2011.
- T. PORTER**, "Biomedical Acoustics: Making a Quantum Leap in Medicine," 161st meeting of the Acoustical Society of America, Seattle, WA, 23–27 May 2011.
- T. PORTER**, "Stimuli-responsive colloidal particles for diagnostic and therapeutic applications," Department of Bioengineering, University of Washington, Seattle, WA, 26 May 2011.
- T. PORTER**, "Coating microbubbles with lipids: Introducing nonlinearity into a linear system," Department of Physics, Harvard University, 19 Jan 2011.
- T. PORTER**, "Acoustic stimulation of nanoparticles for image-guided therapeutic applications," Department of Pharmaceutical Sciences, Northeastern University, Boston, MA, 4 Nov 2011.
- T.W. Murray, H. Ju, J.R. McLaughlan, and **R.A. ROY**, "Nanoparticle targeted laser ultrasonic cavitation for imaging and therapy," the International Conference on Photoacoustic and Photothermal Phenomena, Merida, Mexico, Nov 2011.
- R.A. ROY** "ASA Tutorial Lecture: The physics of biomedical imaging and therapy by interacting light and sound," Interdisciplinary Tutorial Lecture presented at the 161st Meeting of the Acoustical Society of America, Seattle, WA, 23–27 May 2011.
- R.A. ROY**, P. Lai, J.R. McLaughlan, A.B. Draudt, R.O. Cleveland. R.O., and T.W. Murray, "Imaging and monitoring non-cavitating focused ultrasound lesions using light and sound," the 161st Meeting of the Acoustical Society of America, Seattle, WA, 23–27 May 2011.
- R.A. ROY**, R.O. Cleveland, R.G. Holt, P.V. Chitnis, N.J. Manzi, C.E. Ormonde, Q. Wang, M. Wendel, and B. Riemer, "Cavitation inception and damage in liquid mercury exposed to a high-energy pulsed proton beam," the 161st Meeting of the Acoustical Society of America, Seattle, WA, 23–27 May 2011.
- R.A. ROY**, J.R. McLaughlan, and T.W. Murray, "Enhancing targeted focused ultrasound therapy using light, sound, and nanoparticles," the 161st Meeting of the Acoustical Society of America, Seattle, WA, 23–27 May 2011.
- R.A. ROY**, "Augmenting biomedical imaging using the interaction of light and sound," Physics Colloquium, University of Maine, Orono, ME, Mar 2011.
- V.K. SARIN**, "CVD - Nano Structures," UTC Seminar Series, Barcelona, Spain, Jun 2011.
- V.K. SARIN**, "Use of CVD in Modern Technology," seminar IITB, Mumbai, India, Jan 2011.
- A.J. SCHMIDT**, "Limits of Thermorefectance for Thermal Measurement," American Society of Mechanical Engineers IMECE2011-65840, Denver, CO, 15 Nov 2011.
- M.F. SCHNEIDER**, "From Physical State to Biological Function," Transitions at the Soft Interface and its Potential to Regulate Biology, München, Germany, Apr 2011.

**M.F. SCHNEIDER**, "From State to Function, Microfluidics, the Physics of blood and transitions in soft interfaces Bayreuth," Germany Jun 2011.

**M.F. SCHNEIDER**, "Microfluidics, the Physics of blood and transitions in soft interfaces," Zweibruecken, Germany, Jun 2011.

**M.F. SCHNEIDER**, "Einstein at the interface: How biological function arises from the second law," Weimar, Germany, Jul 2011.

**M.F. SCHNEIDER**, "Einstein at the Interface: Flat Microfluidics, Blood Clotting and How the Physical State Regulates Biological Function," Basel, Switzerland, Jun 2011.

**P. VAKILI**, "Variance Reduction for Monte Carlo via Information Storage and Reuse," Department of Mathematics, Boston University, Nov 2011.

**V. YAKHOT**, "Short-time behavior of turbulence models," EXA Corp, Burlington, MA, May 2011.



Above PhD student Chris Stockbridge in Precision Engineering Laboratory.

**X. ZHANG**, "MEMS and Metamaterials: A Perfect Marriage at Terahertz Frequencies," Department of Physics and Astronomy, University of Texas at San Antonio, 8 Apr 2011.

**X. ZHANG**, "Spying on Cells: Polymeric Micro/Nanosystem for Cellular Force Measurement," Department of Biomedical Engineering, Syracuse University, 21 Oct 2011.

**X. ZHANG**, "Metamaterial Enhanced MEMS for Terahertz Technology," Department of Mechanical Engineering, University of Toronto, 18 Nov 2011.

**X. ZHANG**, "Opto-Mechanical Platforms for Cell Force Study," MRS Fall Meeting, Boston, MA, 29 Nov 2011.

**Y. ZHANG**, "Mechanobiological Study of Extracellular Matrix Mechanics," Department of Mechanical Engineering, University of Arizona, Mar 2011.

**Y. ZHANG**, "Mechanobiological Study of Extracellular Matrix Mechanics," Department of Mechanical Engineering, University of Illinois – Urbana Champaign, Mar 2011.

**Y. ZHANG**, "Mechanobiological Study of Extracellular Matrix Mechanics," Department of Mechanical and Industrial Engineering, Northeastern University, Mar 2011.

**Y. ZHANG**, "The Importance of Elastin to the Mechanics of Artery," Department of Mechanical Engineering, University of Washington, Apr 2011.

**Y. ZHANG**, "The Importance of Elastin to the Mechanics of Artery," Department of Materials Science and Engineering, Massachusetts Institute of Technology, Apr 2011.

**Y. ZHANG**, "The Importance of Elastin to the Mechanics of Artery," School of Engineering, Solid Mechanics Seminar, Brown University, May 2011.

**Y. ZHANG**, "Mechanobiological Study of Extracellular Matrix Mechanics," Department of Environmental Health, Harvard School of Public Health, May 2011.

**Y. ZHANG**, "An Integrative Multi-Scale Model of Extracellular Matrix Mechanics in Vascular Remodeling," NIH Multiscale Modeling (MSM) Consortium Meeting, Oct 2011.

## Contributed Presentations

P. Huang and **S.B. ANDERSSON**, "Generating images from non-raster data," American Control Conference, pp. 2246–2251, 30 Jun 2011.

M. Lahijanjan, **S.B. ANDERSSON**, and **C. BELTA**, "Controlling an MDP from a PCTL specification," American Control Conference, pp. 311–316, 29 Jun 2011.

A.I. Medina Ayala, **S.B. ANDERSSON**, and **C. BELTA**, "Temporal Logic Control in Dynamic Environments with Probabilistic Satisfaction Guarantees," IROS, San Francisco, 2011.

M. Lahijanjan, **S.B. ANDERSSON**, and **C. BELTA**, "Control of Markov Decision Processes from PCTL specifications," American Control Conference (ACC), San Francisco, CA, 2011.

A.M. Ayala, **S.B. ANDERSSON**, and **C. BELTA**, "Temporal logic control in dynamic environments with probabilistic satisfaction guarantees," IEEE/RSJ International Conference on Intelligent Robots and Systems, pp. 3108–3113, 28 Sep 2011.

P.I. Chang and **S.B. ANDERSSON**, "Probabilistic bounds for complete scanning in non-raster atomic force microscopy," IEEE Conference on Decision and Control, pp. 6278–6283, 2011.

Z. Shen and **S.B. ANDERSSON**, "3-D tracking of fluorescent nanoparticles in a confocal microscope," IEEE Conference on Decision and Control, pp. 5856–5861, 2011, 14 Dec 2011.

R. Yokota and **L.A. BARBA**, "Parameter tuning of a hybrid treecode-FMM on GPUs",. In CACHES'11: Characterizing Applications for Heterogeneous Exascale Systems, at the 25th International Conference on Supercomputing (ACM/SIGARCH), Tucson, Arizona, 31 May – 4 Jun 2011.

R. Yokota, and **L.A. BARBA**, "Fast multipole method vs. spectral methods for the simulation of isotropic turbulence on GPUs," 23rd International Conference on Parallel Computational Fluid Dynamics, ParCFD'11, Barcelona, Spain, 16–20 May 2011.

S.K Layton, A. Krishnan, and **L.A. BARBA**, "culBM—A GPU accelerated immersed boundary method", 23rd International Conference on Parallel Computational Fluid Dynamics, ParCFD'11, Barcelona, Spain, 16–20 May 2011.

J.F. Dord, **P.E. BARBONE**, and A.A. Oberai, "Contrast preserving regularizations for biomechanical images," Applied Inverse Problems Conference, Texas A&M University, College Station, 23–27 May 2011.

**P.E. BARBONE**, G.R. Feij'oo, and A.A. Oberai, "Krylov methods in inverse scattering and imaging," 162nd Meeting of the Acoustical Society of America, San Diego, California, 31 Oct–4 Nov 2011.

S.W. Shore, **P.E. BARBONE**, and **E.F. MORGAN**, "Load and boundary requirements for transversely isotropic elasticity imaging," Summer Bioengineering Conference SBC 2011 Farmington, Pennsylvania, 22–25 Jun 2011.

A.A. Oberai, **P.E. BARBONE**, R. Leiderman, S. Goenezen, and J. Dord, "Biomechanical Imaging: Inferring Tissue Microstructure and Pathology," 2nd International Conference on Mathematical and Computational Biomedical Engineering - CMBE2011, Washington D.C., USA, 30 Mar–1 Apr 2011.

S. Goenezen, J. Dord, **P.E. BARBONE**, and A.A. Oberai, "Quantitative Nonlinear Elasticity Imaging in Three Dimensions," IEEE International Ultrasonics Symposium 2011 (IUS 2011), Caribe Royale, Orlando, Florida, 18–21 Oct 2011.

Y. Zhang, A.A. Oberai, **P.E. BARBONE**, and I. Harari, "A direct variational algorithm for solution of the time-harmonic viscoelastic inverse problem," International Tissue Elasticity Conference, Arlington, Texas, 12–15 Oct 2011.

E. Rodrigues Ferreira, U. Albocher, I Harari, A.A. Oberai, **P.E. BARBONE**, "Data requirements for linear and nonlinear elastic modulus reconstruction in two and three dimensions," International Tissue Elasticity Conference, Arlington, Texas, 12–15 Oct 2011.

E Rodrigues Ferreira, S. Goenezen, **P.E. BARBONE**, A.A. Oberai, "Development of a new microstructure-based constitutive model for healthy and cancerous tissue," International Tissue Elasticity Conference, Arlington, Texas, 12–15 Oct 2011.

A.I. Hussein, **P.E. BARBONE**, and **E.F. MORGAN**, "Digital volume correlation for study of the mechanics of whole bones," IUTAM, IUTAM Symposium on Full-field Measurements and Identification in Solid Mechanics, Cachan, France, 4–8 Jul 2011.

S. Goenezen, A.A. Oberai, J. Dord, Z. Sink, and **P.E. BARBONE**, "Nonlinear Elasticity Imaging," 2011 IEEE 37th Annual Northeast Bioengineering Conference (NEBEC), RPI, Troy, NY, 1–3 Apr 2011.

**S.N. BASU**, "Direct Measurement of Oxygen Tracer Diffusion of Heteroepitaxial La<sub>0.8</sub>Sr<sub>0.2</sub>MnO<sub>3</sub> Cathode Material," The Electrochemical Society Meeting, Montreal, Canada, 2 May 2011.

**S.N. BASU**, "Hard X-Ray Fluorescence Measurements of heteroepitaxial solid oxide fuel cell cathode materials," The Electrochemical Society Meeting, Boston, MA, 11 Oct 2011.

**S.N. BASU**, "Hard X-Ray Fluorescence Measurements of heteroepitaxial solid oxide fuel cell cathode materials," presented at the Materials Research Society Meeting, Boston, MA, 28 Nov 2011.

**S.N. BASU**, "Study of an Innovative Energy Storage and Recovery System based on the W/WO<sub>3</sub> Oxidoreduction Reaction," The Electrochemical Society Meeting, Boston, MA, 11 Oct 2011.

**S.N. BASU**, "Comparison of Mechanism of Oxygen Reduction Kinetics of La<sub>0.85</sub>Ca<sub>0.15</sub>MnO<sub>3</sub> and La<sub>0.6</sub>Sr<sub>0.4</sub>Co<sub>0.2</sub>Fe<sub>0.8</sub>O<sub>3</sub> Cathodes," The Electrochemical Society Meeting, Boston, MA, 11 Oct 2011.

**S.N. BASU**, "Solid Oxide Membrane Process for Solar Grade Silicon Production Directly from Silicon Dioxide", The Electrochemical Society Meeting, Boston, MA, 11 Oct 2011.

- S.N. BASU**, "Plasma spray control design for achieving TBC production and coating quality objectives", The ITSC 2011 International Thermal Spray Conference, Hamburg, Germany, 27–29 Sep 2011.
- M. Kloetzer, X.C. Ding, and **C. BELTA**, "Multi-robot deployment from LTL specifications with reduced communication," CDC 2011, Orlando, FL, 2011.
- R.M. Estanjini, X.C. Ding, M. Lahijanian, **C. BELTA**, and I. Paschalidis, "Least Squares Temporal Difference Actor-Critic Methods with Applications to Robot Motion Control," CDC 2011, Orlando, FL, 2011.
- N. Cooper, **C. BELTA**, and A. Julius, "Genetic Regulatory Network Identification Using Multivariate Monotone Functions," CDC 2011, Orlando, FL, 2011.
- X.C. Ding, S.L. Smith, **C. BELTA**, and D. Rus, "MDP Optimal Control under Temporal Logic Constraints," CDC 2011, Orlando, FL, 2011.
- B. Yordanov and **C. BELTA**, "A Formal Verification Approach to the Design of Synthetic Gene Networks, CDC 2011, Orlando, FL, 2011.
- G. Richard, H.J. Chang, I. Cizelj, **C. BELTA**, A. Julius, and S. Amar, "Integration of large-scale metabolic, signaling, and gene regulatory networks with application to infection responses," CDC 2011, Orlando, FL, 2011.
- Y. Chen, X.C. Ding, and **C. BELTA**, "Synthesis of Distributed Control and Communication Schemes from Global LTL Specifications," CDC 2011, Orlando, FL, 2011.
- A. Ulusoy, S.L. Smith, X.C. Ding, **C. BELTA**, and D. Rus, "Optimal Multi-Robot Path Planning with Temporal Logic Constraints," IROS, San Francisco, 2011.
- H.J. Chang, G. Richard, A. Julius, **C. BELTA**, and S. Amar, "An Application of Monotone Functions Decomposition to the Reconstruction of Gene Regulatory Networks," 33rd Annual International IEEE EMBS Conference, Boston, MA, 2011.
- A. Julius and **C. BELTA**, "Genetic Regulatory Network Identification Using Monotone Functions Decomposition," 18th IFAC World Congress, Milan, Italy, 2011.
- I. Cizelj, X.C. Ding, M. Lahijanian, A. Pinto, and **C. BELTA**, "Probabilistically Safe Vehicle Control in a Hostile Environment," 18th IFAC World Congress, Milan, Italy, 2011.
- X.C. Ding, S.L. Smith, **C. BELTA**, and D. Rus, "LTL Control in Uncertain Environments with Probabilistic Satisfaction Guarantees," 18th IFAC World Congress, Milan, Italy, 2011.
- Y. Zhou, **T. BIFANO**, and C. Lin, "Adaptive optics two-photon scanning laser fluorescence microscopy," MEMS Adaptive Optics V, San Francisco, CA, SPIE, [7931], H1-8, 2011.
- Y. Lu, S.M. Hoffman, C.R. Stockbridge, A.P. LeGendre, J.B. Stewart, and **T. BIFANO**, "Polymorphic optical zoom with MEMS DMs," MEMS adaptive Optics V, San Francisco, CA, SPIE, 7931, D1-7, 2011.
- M.N. Horenstein, R. Sumner, P. Miller, **T. BIFANO**, J. Stewart, and S. Cornelissen, "Ultra-low-power multiplexed electronic driver for high resolution deformable mirror systems," NOEMS and Minaturized Systems X, San Francisco, CA, SPIE, [7930], M1-8, 2011.
- P.A. Ruiz, J.M. Foster, A. Rudkevich, and **M.C. CARAMANIS**, "On Fast Transmission Topology Control Heuristics", Proceedings, of the 2011 IEEE PES General Meeting, Detroit, Michigan, 26–29 July 2011.
- M.C. CARAMANIS** and J.M. Foster, "Uniform and Complex Bids for Demand Response and Wind Generation Scheduling in Multi-Period Linked Transmission and Distribution Markets," the Proceedings of the 50th CDC, December 2011.
- Y.C. Paschalidis, B. Li, and **M.C. CARAMANIS**, "Market-Based Mechanism for Providing Demand-Side Regulation Service Reserves" the Proceedings of the 50th CDC, December 2011.
- J.M. Foster, P.A. Ruiz, A. Rudkevich and **M.C. CARAMANIS**, "Economic and Corrective Applications of Tractable Transmission Topology Control," Proceedings, 49th annual Allerton Conference on Communication, Control and Computing, 27–30 Sep 2011.
- W.M. CAREY** and **A.D. PIERCE**, "Sonic speed estimates for muddy sediments with plausible microbubble distributions," 162st Meeting of the Acoustical Society of America, Session UWA5: Underwater Acoustics, Paper 49UWa5. Acoustical Society of America, doi: 10.1121/1.3693533, San Diego, California, 3 Nov 2011.
- W.M. CAREY** and **A.D. PIERCE**, "Sonic speed estimates for muddy sediments with plausible microbubble distributions," 161st Meeting Acoustical Society of America, Seattle, Washington, Session 1aUW: Underwater Acoustics, paper 1aUW6, doi: 10.1121/1.3684895, Proceedings of Meetings on Acoustics, Vol. 12, 070005, 23–27 May 2011.
- O. Basarir, S. Bramhavar, and **K.L. EKINCI**, "Near-field optical transducer for nanomechanical resonators," IEEE Conference: 16th International Conference on Optical MEMS and Nanophotonics (OMN), Istanbul, Turkey, 8–11 Aug 2011.
- M. GEVELBER**, M. Cannamela, S. DeLeo, **D. WROBLEWSKI**, **S. BASU**, M. Tuttle, and D. Radgowski, "Plasma spray control design for achieving TBC production and coating quality objectives," International Thermal Spray Conference 2011, Hamburg, Germany, 27–29 Sep 2011.
- M. GEVELBER** and X. Yan, "Process Dynamics and Control Analysis for Electrospinning Nanofibers," 2011 ESA Annual Meeting on Electrostatics, Case Western Reserve University, Cleveland OH, 14–16 Jun 2011.
- M. GEVELBER**, "Opportunities for Achieving Significant Energy Reduction in Existing University Buildings: developing efficient HVAC operations," Association for the Advancement of Sustainability in Higher Education, 2011 Annual Conference: Creating Sustainable Campuses and Communities, Pittsburgh, PA, 9–12-Oct 2011.
- M. GEVELBER**, "When Do Variable Flow Fume Hoods Save Energy? implications for lab design and behavior modification," presented at Association for the Advancement of Sustainability in Higher Education, 2011 Annual Conference: Creating Sustainable Campuses and Communities, Pittsburgh, PA, 9–12 Oct 2011.
- M. Cannamela, M. Tuttle, D. Radgowski, S. DeLeo, **M. GEVELBER**, and **D. WROBLEWSKI**, "Assessment of particle sensor performance in the plasma spray process," International Thermal Spray Conference 2011, Hamburg, Germany, 27–29 Sep 2011.

- J.N. Davis, L. Miara, L. Saraf, T. C. Kaspar, **S. GOPALAN**, **U.B. PAL**, J. C. Woicik, K. F. Ludwig, and **S.N. BASU**, "Hard X-Ray Fluorescence Measurements of Heteroepitaxial Solid Oxide Fuel Cell Cathode Material", accepted for publication in ECS Transactions, 2011.
- L. Miara, **S. BASU**, U.B. Pal, and **S. GOPALAN**, "Comparison of Mechanism of Oxygen Reduction Kinetics of La<sub>0.85</sub>Ca<sub>0.15</sub>MnO<sub>3</sub> and La<sub>0.6</sub>Sr<sub>0.4</sub>Co<sub>0.2</sub>Fe<sub>0.8</sub>O<sub>3</sub> Cathodes", Meet. Abstr. - Electrochem. Soc. 1102 310, 2011.
- S. Pati, U.B. Pal, and **S. GOPALAN**, "Electrolyzer for Waste to Energy Conversion", Meet. Abstr. - Electrochem. Soc. 1102 469, 2011.
- L. Miara, U. Pal, and **S. GOPALAN**, "Mechanistic Interpretation of the Oxygen Reduction Kinetics of La<sub>0.85</sub>Sr<sub>0.15</sub>MnO<sub>3</sub> Cathode", Meet. Abstr. - Electrochem. Soc. 1101 844, 2011.
- J. Maunus, **S. GRACE**, and D. Sondak, "Effect of CFD Wake Prediction in a Hybrid Simulation of Fan Broadband Interaction Noise," AIAA Paper No. 2011-2875, Jun 2011.
- J. Maunus, **S. GRACE**, D. Sondak, and **V. YAKHOT**, "Investigation of Calculated Turbulence Parameters for use in Hybrid Broadband Fan Noise Calculations," GT2010-45906, Jun 2011.
- P. Moriarty and **R.G. HOLT**, "Faraday waves produced by periodic substrates: Mimicking the alligator water dance," presented at the 161st meeting of the Acoustical Society of America, Seattle, WA, 2011.
- R.D. Valtierra, S.M. Van Parijs, and **R.G. HOLT**, "A simple autocorrelation method for multipath localization techniques," presented at the 161st meeting of the Acoustical Society of America, Seattle, WA, 2011.
- J.R. Sukovich, A. Sampathkumar, **R.G. HOLT** and D.F. Gaitan, "Spatially and temporally resolved sonoluminescence from compact bubble clouds," presented at the 161st meeting of the Acoustical Society of America, Seattle, WA, 2011.
- P. Anderson, A. Sampathkumar and **R.G. HOLT**, "Shock-driven growth of bubble clouds," presented at the 161st meeting of the Acoustical Society of America, Seattle, WA, 2011.
- A. Sampathkumar, C. M. Klapperich, J. R. Saylor and **R.G. HOLT**, "Optical freezing of Faraday waves for precise pore distributions in tissue scaffolds," presented at the 161st meeting of the Acoustical Society of America, Seattle, WA, 2011.
- P.R. Murray and **M.S. HOWE**, "Thermo-acoustic instabilities of a generic Rijke burner," presented at the 18th International Congress on Sound and Vibration, ICSV18, Rio de Janeiro, 10–14 Jul 2011.
- P. Du, **X. LIN**, and X. Zhang, "Dielectric constants of PDMS nanocomposites by conducting polymer nanowires," Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, 645-648, 2011.
- P. Du, **X. LIN**, and X. Zhang, "Electromechanical coupling of polypyrrole trilayer actuators," Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, 478–481, 2011.
- P. Du, **X. LIN**, and X. Zhang, "Effect of loading rates on polymer micropillar-based force transducers," Proceeding of the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, 1432–1435, 2011.
- A.L. Botelho and **X. LIN**, "A unified model Hamiltonian for polythiophene, polypyrrole, polyfuran, free base porphyrin, and polyaniline: Accuracy, transferability, and computational efficiency," APS National Meeting, Dallas, TX, Mar 2011.
- Q. Lu, M. Li, A. Kushima, and **X. LIN**, "Finding lowest saddle point," APS National Meeting, Dallas, TX, Mar 2011.
- Y. Shin and **X. LIN**, "Adapted Su-Schrieffer-Heeger Hamiltonian for PPV, PPP, and polyacenes," APS National Meeting, Dallas, TX, Mar 2011.
- X. LIN**, M.H. Li, A.L. Botelho, and Y.W. Shin, "Unified model Hamiltonian for pi-conjugated systems," Electronic Structure 2011, Philadelphia, PA, Jun 2011.
- Y. Lu, Y. Cao, **J.G. McDANIEL**, and M. L. Wang, "Tire Noise in pavement debonding identification using HHT," Symposium of Subsurface Imaging, Feature Identification and Damage Detection, Engineering Mechanics Conference (EMI2011), Jun 2011.
- Y. Cao, Y. Zhang, Y. Lu, **J.G. McDANIEL**, and M.L. Wang, "Air-coupled SASW in pavement profile detection," Symposium of Subsurface Imaging, Feature Identification and Damage Detection, Engineering Mechanics Conference (EMI2011), Jun 2011.
- Y. Cao, Y. Lu, Y. Zhang, **J.G. McDANIEL**, and M.L. Wang, "A new fast inversion analysis algorithm for the spectral analysis of surface wave (SASW) method," SPIE2011 Conference SSN09, San Diego, CA, Mar 2011.
- Y. Lu, Y. Cao, **J.G. McDANIEL**, and M.L. Wang, "Wave Number Estimation Based Method on In Situ Pavement Ground Truth with Near Source-Receiver Sensing," SPIE2011 Conference SSN09, San Diego, CA, Mar 2011.
- J.G. McDANIEL**, "Modular Ocean Wave Energy Collectors," Fourth Annual Global Marine Renewable Energy Conference, Washington, D.C., 28–29 Apr 2011
- C.M.J De Bakker, L.N.M. Hayward, L.C. Gerstenfeld, M.W. Grinstaff, and **E.F. MORGAN**, "Contrast-enhanced computed tomography for non-destructive, quantitative assessment of the early stages of fracture healing," ASME Summer Bioengineering Conference, 2011.
- M.M. Sperry, L.N.M. Hayward, G.J. Miller, and **E.F. MORGAN**, "Characterization of the poroelastic material properties of skeletal repair tissues using microindentation," ASME Summer Bioengineering Conference, 2011.
- G.J. Miller, P.G. Patel, and **E.F. MORGAN**, "Correlation of local mechanical environment to mechanically induced tissue phenotype during altered bone fracture healing," ASME Summer Bioengineering Conference, 2011.
- E.F. MORGAN** "Digital Volume Correlation for Study of the Mechanics of Whole Bones", Symposium on "Full-field measurement and

identification in solid mechanics”, International Union of Theoretical and Applied Mechanics (IUTAM), Cachan, France, Jul 2011.

L. Miara, **U.B. PAL**, and **S. GOPALAN**, “Mechanistic Interpretation of the Oxygen Reduction Kinetics of La<sub>0.85</sub>Ca<sub>0.15</sub>MnO<sub>3</sub> Cathode”, ECS Trans. 35 (1), 2119, 2011.

E. Gratz, S. Pati, J. Milhstein, A. Powell, and **U. PAL**, “Efficiency and Stability of Solid Oxide Membrane Electrolyzers for Magnesium Production,” Magnesium Technology, pp. 39–42, 2011.

**H.S. PARK** and X.H. Qian, “Strain Effects on the Optical Properties of Metallic Nanostructures,” NSF CMMI 2011 Grantees Conference Proceedings, 2011.

**T. PORTER**, “pH/Thermosensitive liposomes modified with poly(N-isopropylacrylamide-co-propylacrylic acid) copolymers for cancer therapy,” National Cancer Institute Alliance for Nanotechnology in Cancer Annual Principal Investigator’s meeting, Boston, MA, Oct 2011.

**T. PORTER**, “pH/Thermosensitive liposomes modified with poly(N-isopropylacrylamide-co-propylacrylic acid) copolymers for focused-ultrasound-triggered release of doxorubicin,” Gordon Research Conference: Nanotechnology in Cancer, Waterville, ME, Jul 2011.

**T. PORTER**, Annual meeting of the Biomedical Engineering Society, Hartford, CT, 12 Oct 2011.

**T. PORTER**, “The application of phase-shift nanoemulsion in high-intensity focused ultrasound-mediated heating and its potential in monitoring lesion formation,” 10th US-Japan Symposium on Drug Delivery Systems, Lahaina, HI, Dec 2011.

**T. PORTER**, 161st Meeting of the Acoustical Society of America, Seattle, WA, 23–27 May 2011.

**T. PORTER**, Gordon Research Conference: Nanotechnology in Cancer, Waterville, ME, Jul 2011.

J. McLaughlan, T.W. Murray, and **R.A. ROY**, “The use of optically activated nanoparticles to enhance controlled lesion formation from high intensity focused ultrasound exposures,” IEEE International Ultrasonics Symposium Proceedings, 2011.

**R.A. ROY**, “Bubbles: Foreward to the special issue on the acoustics of bubbles and cavitation,” J. Acoust. Soc. Am. 130(5), Pt. 2, 3183, 2011.

C.A. Boteroa, E. Jimenez-Piqué, T. Kulkarnic, G. Fargas, **V.K. SARIN**, and L. Llanes, “Nanoindentation and Nanoscratch of Compositionally Graded Mullite Films”, Proceedings of the 38th International Conference on Metallurgical Coatings and Thin Films (ICMCTF), 2011.

F. Liu, Z.H. Guan, **H.O. WANG**, and G. Zhu, “Stability and control of bifurcation in XCP networks, Proceedings of the 30th Chinese Control Conference,” pp. 5991-5994, 22–24 Jul 2011.

T. Seo, H. Ohtake, K. Tanaka, Y.J. Chen, and **H.O. WANG**, “A Polynomial Observer Design for a Wider Class of Polynomial Fuzzy Systems,” Proceedings of the 2011 IEEE International Conference on Fuzzy Systems, pp.1305–1311, Taipei, Jun 2011.

Y. Cai, **H.O. WANG**, K. Tanaka, and X. Xu, “Robust Filtering for Networked Systems with Random Transmission Delays and Packet Dropouts, Proceedings of the 2011 American Control Conference,” pp. 1813-1818, San Francisco, California, USA, 29 Jun– 1 Jul 2011.

K. Tanaka, H. Ohtake, T. Seo, and **H.O. WANG**, “An SOS-based Observer Design for Polynomial Fuzzy Systems, Proceedings of the 2011 American Control Conference,” pp. 4953-4958, San Francisco, California, USA, 29 Jun– 1 Jul 2011.

H. Ohtake, K. Tanaka, and **H.O. WANG**, “An Improved Approach to Fuzzy Model Construction and Servo Control with Constraints based on Error Dynamics,” Proceedings of the 2011 American Control Conference, pp. 4959-4963, San Francisco, California, USA, 29 Jun– 1 Jul 2011.

H. Ohtake, K. Tanaka, and **H.O. WANG**, “Fuzzy Model-based Servo Control for Discrete-Time Nonlinear Systems with Constraints,” Proceedings of the 18th World Congress of International Federation of Automatic Control (IFAC), pp. 9029-9034, Milano, Italy, Aug 2011.

Y. Cai, **H.O. WANG**, and X. Xu, “The Kalman Filtering for a class of Local Strongly Coupled Systems,” Proceedings of the 2011 Chinese Control and Decision Conference (CCDC), pp. 1962-1966, Mianyang, China, 23–25 May 2011.

H. Jung, Y.G. Kim, D.H. Kim, and **H.O. WANG**, “Remote Robot Control Learning Powered by Bluetooth Communication,” Proceedings of the IASTED International Conference Technology for Education and Learning (TEL 2011), Beijing, China, 24–25 Oct 2011.

**D. WROBLESKI**, “Herding CATs: Weaving Coherent Application Threads through a Mechanical Engineering Curriculum to Facilitate Course-to-Course Connectivity and Improve Material Retention,” Proceedings of the 2011 ASEE Annual Conference, Vancouver, Canada, 2011.

C. Lissandrello, **V. YAKHOT**, and **K.L. EKINCI**, “Confinement Effects in Oscillating Nanoscale Flows,” Bulletin of the American Physical Society 56, Baltimore, MD, 20–22 Nov 2011.

C. Lissandrello, **V. YAKHOT**, and **K.L. EKINCI**, “Drag Measurements in Laminar Flows over Superhydrophobic Porous Membranes,” Bulletin of the American Physical Society 56, Baltimore, MD, 20–22 Nov 2011.

**X. ZHANG**, “Elastic and Viscoelastic Characterization and Modeling of Polymer Based Structures for Biological Applications,” the NSF Design, Service and Manufacturing Grantees and Research Conference, Atlanta, GA, 4–7 Jan 2011.

K. Fan, A. Strikwerda, H. Tao, R. Averitt, and **X. ZHANG**, “Broadband Tunable 3D Metamaterials at Terahertz Frequencies,” the 24th IEEE International Conference on Micro Electro Mechanical Systems, Cancun, Mexico, 23–27 Jan 2011.

K. Fan, A. Strikwerda, H. Tao, **X. ZHANG**, and R. Averitt, “A Tunable 3D Terahertz Metamaterial,” the International Workshop on Optical Terahertz Science and Technology, Santa Barbara, CA, 13–17 Mar 2011.

A. Strikwerda, K. Fan, G. Metcalfe, M. Wraback, **X. ZHANG**, and R. Averitt, “Electromagnetic Composite-Based Reflecting Terahertz

Waveplates,” Presented at the International Workshop on Optical Terahertz Science and Technology, Santa Barbara, CA, 13–17 Mar 2011.

K. Iwaszczuk, K. Fan, A. Strikwerda, **X. ZHANG**, R. Averitt, and P.U.. Jepsen, “Stealth Metamaterial Objects Characterized in the Far Field by Radar Cross Section Measurements,” the International Workshop on Optical Terahertz Science and Technology, Santa Barbara, CA, 13–17 Mar 2011.

K. Fan, A. Strikwerda, H. Tao, R. Averitt, and **X. ZHANG**, “Tunable Terahertz 3D Metamaterials,” the 31st Conference on Lasers and Electro-Optics, Baltimore, MD, 1–6 May 2011.

E. Ekmekci, A. Strikwerda, K. Fan, G. Keiser, **X. ZHANG**, G. Turhan-Sayan, and R. Averitt, “Frequency Tunable Metamaterial Designs Using Near-Field Coupled SRR Structures in the Terahertz Region,” the 31st Conference on Lasers and Electro-Optics, Baltimore, MD, 1–6 May 2011.

A. Strikwerda, H. Tao, E. Kadlec, K. Fan, E. Padilla, R. Averitt, E. Shaner, and **X. ZHANG**, “Metamaterial Based Terahertz Detector,” the 31st Conference on Lasers and Electro-Optics, Baltimore, MD, 1–6 May 2011.

A. Strikwerda, H. Tao, E. Kadlec, K. Fan, W. Padilla, R. Averitt, E. Shaner, and **X. ZHANG**, “Metamaterial Based Terahertz Detector,” the 5th International Conference on Surface Plasmon Photonics, Busan, Korea, 15–20 May 2011.

K. Fan, A. Strikwerda, **X. ZHANG**, and R. Averitt, “A Broadband Tunable Three Dimensional Metamaterial at Terahertz Frequencies,” the 5th International Conference on Surface Plasmon Photonics, Busan, Korea, 15–20 May 2011.

**X. ZHANG**, “Coupled Evanescent Field Micro-Resonators for Down-hole Data Relay,” AEC “All Project Review,” Boston, MA, 1–3 June 2011.

B. Kaanta, A. Jonca, H. Chen, and **X. ZHANG**, “Effect of Knudsen Number on Maximum Response of a Thermal Conductivity Detector,” the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, Beijing, China, 5–9 Jun 2011.

B. Kaanta, H. Chen, and **X. ZHANG**, “Flow Insensitive Thermal Conductivity Detector for Micro Gas Chromatography,” the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, Beijing, China, 5–9 Jun 2011.

X. Wang, S. Anderson, and **X. ZHANG**, “Microengineered Iron and Iron-Oxide Contrast Agent Particles for Tunable Multispectral Magnetic Resonance Imaging,” the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, Beijing, China, 5–9 Jun 2011.

P. Du, X. Zheng, I. Lin, H. Lu, and **X. ZHANG**, “Effect of Loading Rates on Polymer Micropillar-Based Force Transducers,” the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, Beijing, China, 5–9 Jun 2011.

X. Zheng and **X. ZHANG**, “Polymer Opto-Mechanical Transducer for Abnormal Cell Contraction Diagnostics,” the 16th International Con-

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P. Du, X. Lin, and **X. ZHANG**, “Electromechanical Coupling of Polypyrrole Trilayer Actuators,” the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, Beijing, China, 5–9 Jun 2011.

K. Fan, A. Strikwerda, R. Averitt, and **X. ZHANG**, “Bottom-Up Three Dimensional Metamaterials at Terahertz Frequencies,” the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, Beijing, China, 5–9 Jun 2011.

P. Du, X. Lin, and **X. ZHANG**, “Dielectric Constants of PDMS Nanocomposites by Conducting Polymer Nanowires,” the 16th International Conference on Solid-State Sensors, Actuators and Microsystems, Beijing, China, 5–9 Jun 2011.

**X. ZHANG**, “Materials and Mechanics of Metamaterial Enhanced MEMS for Terahertz Technology,” AFOSR Annual Grantees/Contractors’ Meeting for Mechanics of Multifunctional Materials & Microsystems, Arlington, VA, 1–5 Aug 2011.

C. Wang, X. Wang, S. Anderson, and **X. ZHANG**, “Iodinated Hydrogel Microparticles as X-Ray Computed Tomography Contrast Agents,” the 15th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Seattle, WA, USA, 2–6 Oct 2011.

E. Ekmekci, A. Strikwerda, K. Fan, G. Keiser, **X. ZHANG**, G. Turhan-Sayan, and R. Averitt, “Frequency Tunable Metamaterial Designs Using Near Field Coupled SRR Structures in the Terahertz Region,” the 36th International Conference on Infrared, Millimeter, and Terahertz Waves, Houston, TX, 2–7 Oct, 2011.

A. Strikwerda, H. Tao, E. Kadlec, K. Fan, W. Padilla, R. Averitt, E. Shaner, and **X. ZHANG**, “Metamaterial Based Terahertz Detector,” the 36th International Conference on Infrared, Millimeter, and Terahertz Waves, Houston, TX, USA, 2–7 Oct, 2011.

K. Fan, A. Strikwerda, H. Tao, **X. ZHANG**, and R. Averitt, “A Tunable 3D Terahertz Metamaterial,” the 36th International Conference on Infrared, Millimeter, and Terahertz Waves, Houston, TX, 2–7 Oct, 2011.

N. Kumar, A. Strikwerda, K. Fan, **X. ZHANG**, R. Averitt, P. Planken, and A. Adam, “Direct Measurement of the THz Near-Magnetic Field of Metamaterials,” the 36th International Conference on Infrared, Millimeter, and Terahertz Waves, Houston, TX, 2–7 Oct, 2011.

**X. ZHANG**, “Opto-Mechanical Platforms for Cell Force Study,” BioMEMS-Materials and Devices, Materials Research Society Fall Meeting, Boston, MA, 28 Nov–2 Dec 2011.

E. Frohlich, **X. ZHANG**, and J. Charest, “The Use of Controlled Surface Topography and Flow-Induced Shear Stress to Influence Renal Epithelial Cell Function,” BioMEMS-Materials and Devices, Materials Research Society Fall Meeting, Boston, MA, 28 Nov–2 Dec 2011.

J. Tan and **X. ZHANG**, “Planar Impedance Sensing Device for Cellular Response Studies,” BioMEMS-Materials and Devices, Materials Research Society Fall Meeting, Boston, MA, 28 Nov–2 Dec 2011.

P. Du, C. Cheng, H. Lu, and **X. ZHANG**, "Complex Modulus Study of PDMS by Dynamic Nanoindentation," BiMEMS-Materials and Devices, Materials Research Society Fall Meeting, Boston, MA, 28 Nov–2 Dec 2011.

C. Wang, X. Wang, S. Anderson, and **X. ZHANG**, "Nanofabricated Biocompatible Hollow Cylinders as Contrast Agents for Magnetic Resonance Imaging," Micro- and Nanoscale Processing of Biomedical Materials, Materials Research Society Fall Meeting, Boston, MA, 28 Nov–2 Dec 2011.

X. Wang, C. Wang, S. Anderson, and **X. ZHANG**, "Characterization and Application of Reactively Sputtered Iron Oxide Thin Films," Microelectromechanical Systems--Materials and Devices V, Materials Research Society Fall Meeting, Boston, MA, 28 Nov–2 Dec 2011.

**X. ZHANG**, "Coupled Evanescent Field Micro-Resonators for Down-hole Data Relay," Presented at AEC "All Project Review", Boston, MA, USA, 7–8 Dec 2011.

Y. Zou and **Y. ZHANG**, 2011, "Changes in the Mechanical Behavior of Arterial Elastin due to Glycation," ASME International Mechanical Engineering Congress and Exposition, Denver, CO, 11–17 Nov 2011.

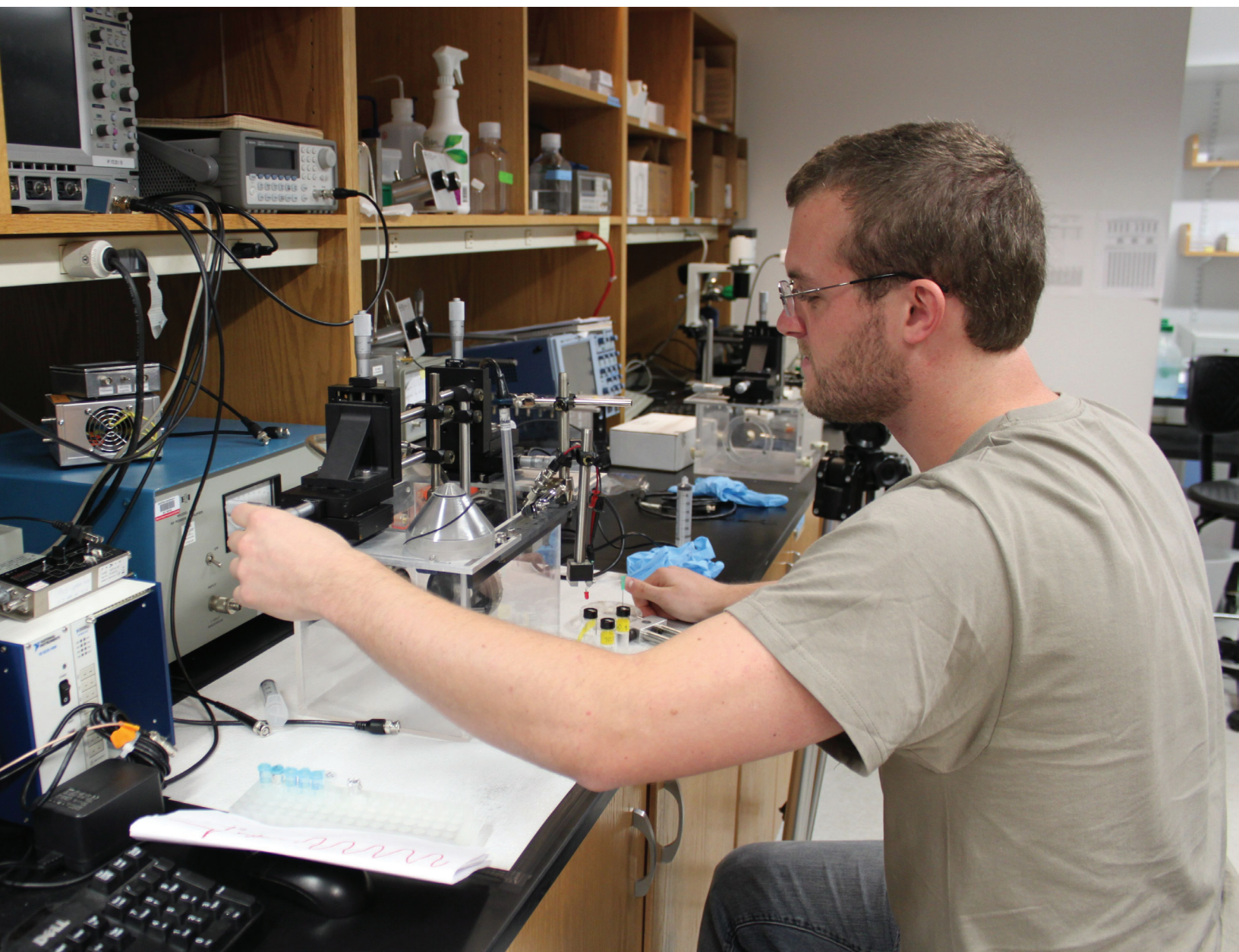
M.J. Chow and **Y. ZHANG**, "Quantifying the structural and mechanical changes in elastase degraded arteries," ASME International Mechanical Engineering Congress and Exposition, Denver, CO, 11–17 Nov 2011.

B. Xu and **Y. ZHANG**, "Hydration and crosslinking effects on the elastic and viscoelastic properties of collagen scaffolds," Proceedings of the ASME 2011 Summer Bioengineering Conference, Farmington, PA, 22–25 Jun 2011.

M.J. Chow and **Y. ZHANG**, "Quantifying the structural and mechanical changes in elastase degraded arteries as an in vitro model of aortic aneurysm," Proceedings of the ASME 2011 Summer Bioengineering Conference, Farmington, PA, 22–25 Jun 2011.

Y. Zou and **Y. ZHANG**, "Mechanical behavior of arterial elastin with glycation effect," Engineering Mechanics Conference (EMI 2011), Boston, MA, 2–4 Jun 2011.

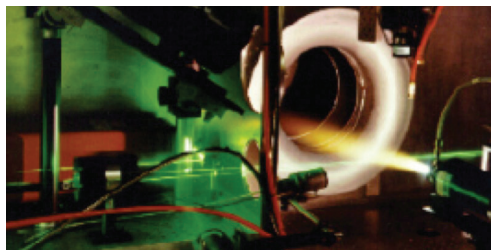
Below PhD student Mark Burgess in the Nanomedicine and Medical Acoustics Laboratory.



# 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



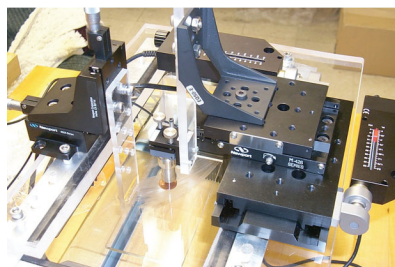
The Biomedical Microdevices and Microenvironments laboratory is focused on materials research activities in the broad areas of tissue engineering and

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 Tribo-scope 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

R.GLYNN HOLT, TYRONE PORTER, RON ROY

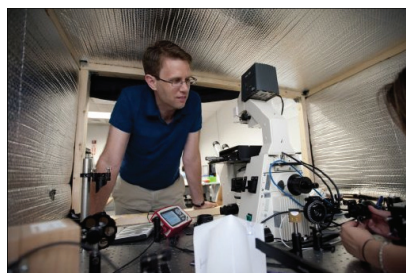


This laboratory is equipped for wet and dry experiments supporting a broad spectrum of ultrasound research, including nonlinear acoustics, bubble-related physical and biomedical acoustics, therapeutic ultrasound, acoustic cavitation, and

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.

## 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. Advanced systems and control methods are used 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.

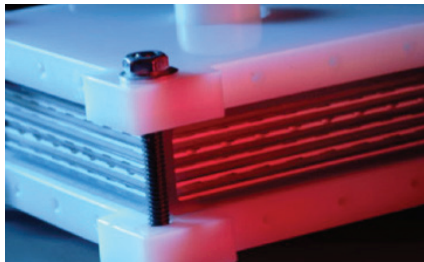
## Fabrication Lab

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, drill presses, a table saw, a grinder and sander, and miscellaneous hand tools. The laboratory occupies 1305 sq. ft. in two adjacent rooms. Its operation is under the supervision of the department's laboratory supervisor and laboratory engineer.

## Green Manufacturing Laboratory

**SRIKANTH GOPALAN**



Research in the 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, research is also conducted 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 Laboratory

**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/CO<sub>2</sub> 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 Laboratory

**SOU MENDRA 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 (thermogravimetric) 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) Laboratory

**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. The approach to the analysis and control of such systems combines concepts and tools from computer science and control theory. The 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 applica-

tions. The Lab is particularly interested in active materials exploiting electrostrictive and magnetostrictive effects, as well as the rapidly growing variety of silicon-based microelectro-mechanical (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.

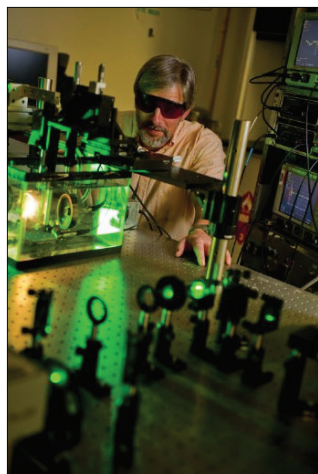
## Interfacial Fluid Dynamics Laboratory

JAMES BIRD

Bird's research group, located in the Interfacial Fluid Dynamics Laboratory, investigates a variety of phenomena that are dominated by interfacial forces, such as surface tension. These projects range from measuring the drainage and rupture of bubbles to modeling how oil flows through porous rock. Because these phenomena are often counter-intuitive, the group's approach is to combine carefully controlled bench-top experiments with theoretical modeling. Experimental techniques include interferometry, microfluidics, and high-speed photography. The new physical insights gained from these projects can be applied to problems in manufacturing (e.g. controlling the degassing of bubbles in molten glass), energy (e.g. determining how best to extract oil from porous reservoirs), and the environment (e.g. reducing uncertainty in climate models by better characterizing marine aerosol production).

## Laser Acoustics Laboratory

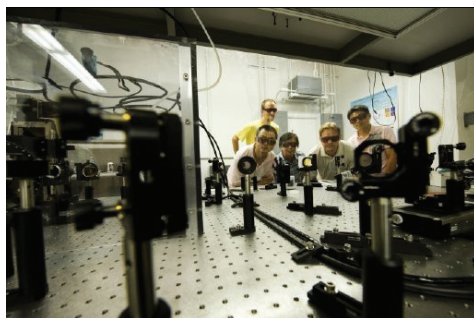
RONALD A. ROY



Professor Ronald A. Roy's Laser Acoustics Laboratory 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 laboratory houses a variety of ultrasonic imaging and optical equipment.

## Lab for Microsystems Technology

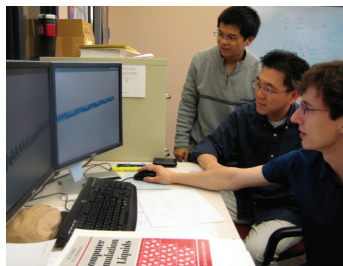
XIN ZHANG



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, the group is 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 Laboratory

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.

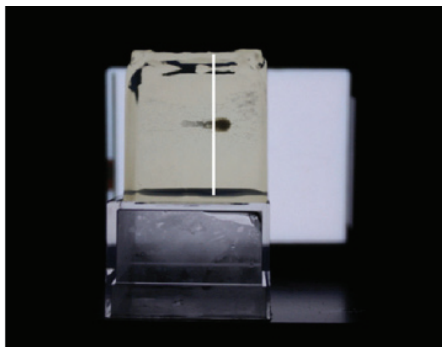
## Multi-robot Systems Laboratory

MAC SCHWAGER

The Multi-robot Systems Lab (MSL) studies strategies for controlling groups of robots to accomplish useful tasks in a distributed fashion. Some examples include controlling a team of autonomous helicopters to provide surveillance of an environment, or deploying a group of autonomous rescue vehicles to locate and retrieve survivors in a collapsed building. The key difficulty in controlling such systems is the lack of a centralized coordinating station; the robots must determine their actions in a distributed fashion using the limited information available to them. The lab uses mathematical tools from control theory, optimization, and information theory to design and analyze algorithms for multi-robot systems to perform coordinated control, sensing, and learning tasks. To test its algorithms, the lab relies on mathematical proof, verification in computer simulations, and hardware experiments with robotic platforms. Ultimately, the Multi-robot Systems Lab seeks to emulate examples of distributed phenomena that pervade the natural world, such as birds flying in a flock, colonies of termites building a complex nest structure, or groups of cells cooperating to make an organism.

## Nanomedicine and Medical Acoustics Laboratory

TYRONE PORTER



The Nanomedicine and 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 Nanomedicine and

Medical Acoustics Lab include the development of temperature- and pressure-sensitive drug carriers, the formulation and characterization of monodisperse ultrasound contrast agents, and the design of systems to monitor and control bubble-enhanced ultrasound thermal ablation of solid tumors.

## Nanoscale Energy-Fluids Transport Laboratory

CHUANHUA DUAN

The Nanoscale Energy-Fluids Transport (NEFT) laboratory led by Prof. Chuanhua Duan focuses on the experimental study of energy and fluids transport in and around nanometer-sized objects with at least one characteristic dimension below 100 nm. Transport at this nanoscale benefits from three unique features, including large surface-to-volume ratio, strong interplay between various surface or interfacial forces and the relevant length scale comparable to the size of single biomolecules. These features give rise to unique transport phenomena that are not accessible at the bigger length scale. The NEFT lab designs, fabricates and/or synthesizes various confined nanostructure/devices, including nanopores, nanotubes/nanowires, nanochannels and mesoporous materials to study these transport phenomena and explore their novel applications in both bio- and energy-related fields. The current investigations include: i) exploring anomalous transport phenomena in 1-D or 2-D confined nanochannels; ii) enhancing ion/molecule transport in batteries and fuel cells using nanostructured materials; iii) Improving phase-change heat transfer based on patterned micro/nanostructures; iv) developing new nanofluidic devices for biomolecule sensing and separation.

## Microscopy Laboratory

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 Laboratory

KATHERINE YANGHANG 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 Multiscale 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 multi-scale.

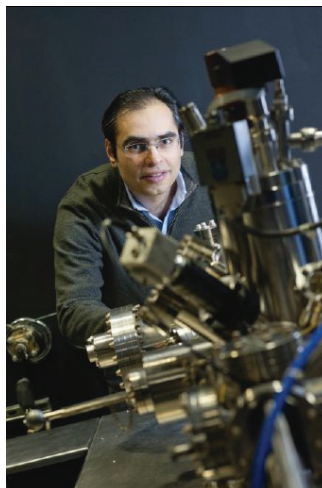
## Nano Heat Transfer Laboratory

AARON SCHMIDT

The Nano Heat Transfer Lab is focused on nanoscale heat transfer, ultrafast thermal measurements, and laser-material interaction. The focus is on the development and application of optical instruments to study and manipulate energy in solids and liquids from the atomic scale up to the macroscale. Applications include development of new materials, solid-state energy conversion, thermal management, new imaging technologies, and furthering the fundamental understanding of nanoscale transport phenomena.

## Nanoscale Engineering Laboratory

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 nano-

mechanical sensors and development of surface nano-engineering techniques for improved device characteristics.

## Orthopaedic and Developmental Biomechanics Laboratory

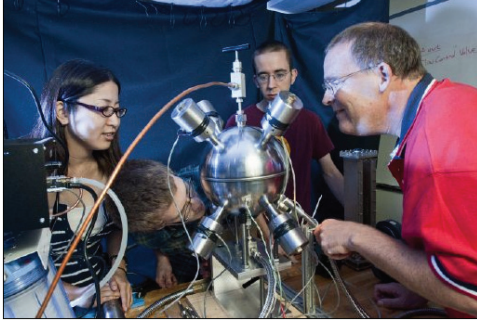
ELISE MORGAN



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.

## Physical Acoustics Laboratory

R. GLYNN HOLT



The interaction of sound 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.

In one externally funded project, the group is investigating the collective collapse of cavitation clusters in high-static-pressure liquids. High-power pulsed laser beam arrays are utilized 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, ultrasonic acoustic levitation is being used 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. Two other projects 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. 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 Laboratory

VINOD SARIN

The Powder Metallurgy & X-ray 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 available.

## Precision Engineering Laboratory

TOM BIFANO



The Precision Engineering Research Laboratory (PERL) is home to an active program in Microelectromechanical 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.

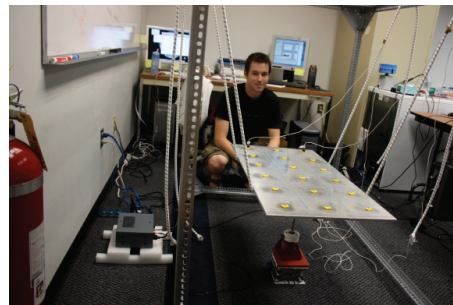
## Undergraduate Machining Laboratory

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.

## Vibrations Laboratory

J.GREGORY McDANIEL



The Vibrations 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.

# 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 (FHCCI) 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 their global view, benchmark against the world's best practices. Their unique ability to access a global research base and their own vast experience give their 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 numerous 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 NANOBIO TECHNOLOGY

Nanoscience and  
nanotechnology re-  
search and develop-

ment 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. The 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 connects 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 leads large, interdisciplinary proposal development and runs funded programs for both research and training, as well as supporting individual researchers in their efforts by linking them with resources throughout the University and beyond. The Center also builds linkages between the research and technological commercialization resources at BU including the Photonics Center, the Technology Commercialization Institute, and the Fraunhofer Center for Manufacturing Innovation and with external partners and industrial affiliates.

Photonics Center at Boston University



# SEMINARS

DATE	SPEAKER	TITLE
9.23.11	Katia Bertoldi School of Engineering and Applied Sciences Harvard University	Soft materials: Functionality through instabilities and deformations
9.30.11	Hanchen Huang Department of Mechanical Engineering University of Connecticut	Fabrication and mechanics of nanowires/nanorods
10.7.11	David Clarke School of Engineering and Applied Sciences Harvard University	Thermal barrier coatings and how they fail
10.14.11	Rina Tannenbaum Department of Mechanical Engineering Boston University	Nanoengineering: Tailoring materials properties by interfacial design
10.21.11	Jonathan Rothstein Mechanical & Industrial Engineering University of Massachusetts, Amherst	Drag reduction in laminar and turbulent flows past superhydrophobic surfaces
10.28.11	Kenn Sebesta Department of Mechanical Engineering Boston University	Flying with the greatest of ease: They can do it, why can't we?
11.4.11	Jason Fleischer Department of Electrical Engineering Princeton University	Fluid dynamics of light
11.11.11	David Green Department of Chemical Engineering University of Virginia	New ways to reinforce polymer nanocomposites through the stretching of graft polymers
11.18.11	Virginia Ferguson Department of Mechanical Engineering University of Colorado at Boulder	Grading of tissue mechanical properties, microstructure, and composition facilitate effective function of the bone-cartilage interface
12.2.11	Yi Zhao Department of Biomedical Engineering The Ohio State University	Electrospun/electrosprayed constructs for microscale cell/tissue engineering
12.9.11	Junhong Chen Department of Mechanical Engineering University of Wisconsin-Milwaukee	Nanocarbon-based hybrid structures for sensing and energy applications
1.20.12	Robert J. Hunnemann Gordon Institute Tufts University	Retooling our energy ecosystem – challenges and opportunities
2.3.12	James Bird Department of Mechanical Engineering Boston University	The folding and wrinkling of bursting bubbles
2.10.12	Tatiana Khokhlova Applied Physics Laboratory University of Washington	Light and sound for biomedical diagnostics and therapy
2.21.12	Megan S. Ballard Applied Research Laboratories University of Texas at Austin	Acoustic propagation modeling and remote sensing in three-dimensional environments
2.24.12	Michael Pomfret Naval Research Laboratory	Optical studies of fuel cell systems

DATE	SPEAKER	TITLE
2.27.12	Kevin J. Haworth Image-Guided Ultrasound Therapeutics Laboratory University of Cincinnati	Ultrasound-mediated microbubble bioeffects: Production, induction, and optimization
3.1.12	Nicholas Boechler Department of Mechanical Engineering Massachusetts Institute of Technology	Granular crystals: Controlling mechanical energy with nonlinearity and discreteness
3.2.12	J. Scott Bunch Department of Mechanical Engineering University of Colorado at Boulder	Ultrastrong adhesion, semipermeable atomic membranes, and other graphene mechanical wonders
3.5.12	Song Hu Department of Biomedical Engineering Washington University in St. Louis	Multi-contrast photoacoustic microscopy: listening to anatomy, function, metabolism, and biomarkers in vivo
3.30.12	Andrew Hull Naval Underwater Warfare Center	Elastic modeling of spatially periodic structures
4.13.12	Ben Dzikowicz Naval Research Laboratory	Spiral wave front navigation and other projects in physical acoustics at the Naval Research Laboratory
4.20.12	Kevin L. Wasson Corning Inc.	Engineering an electric guitar
4.27.12	Alexis Sauer-Budge Fraunhofer Inc.	Innovations at the intersection of mechanical engineering and life sciences



Seminar Speaker Kenn Sebesta(l.) flying the Batcopter with Prof. John Baillieul (m.) and Prof. Thomas Kunz (r.)

# MERRILL 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

**DANIEL COLE** Co-Chair

**WILLIAM HAUSER**

**R. GYNN HOLT**

**BRUCE JORDAN**

**RAY NAGEM**

**RONALD ROY**

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 Ebner Current Use Fund received \$2,500 this fiscal year. As of July 1, 2012, total cumulative cash contributions (current principal) in the Endowed Fund is \$127,958. It will generate \$5,555 in annual income; this will be added to the Current Use Fund, which had \$3,639 in balance, for a total of \$9,194 in anticipated total usable income.

## 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. Since 2010, the contest has been open to all undergraduate engineering majors, with the intention of encouraging all engineering students to develop their design portfolios early in their college career. Judging procedures that were established in 2005 state that every year a Portfolio Review Jury is to be designated, consisting of the Chair (or Co-chair) of the Ebner Fund Committee, a member of the design faculty, an engineering student and/or 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 of Ebner Fund Committee

**DANIEL COLE** Design Faculty and Co-Chair

**JIM CONNORS** BU Engineering Alumnus and Industry Representative

**CHARLIE LISSANDRELLO** BU Engineering Alumnus

**GUY THOMPSON** 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, Prof. Cole held two different workshops. The first was held in conjunction with the Department Open House in December 2011; this was set up as an informal set of displays that students could drop by, hopefully pique their interest, and ask questions. A more structured workshop with speakers, demonstrations, and Q&A, was then held in February 2012. This workshop was held in the College’s new Imagineering Lab.

The jury decides on the contest winners. The prizes given were of the following amounts: \$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; these were awarded during the Department’s end-of-year luncheon with students on May 4, 2012. This year’s winners were:

Best Senior: **IAN SCHON** ME 12

Best Junior: **SAMIR AHMED** EE 13

Best Sophomore: **KONSTANTINOS OIKONOMOPOULOS** ME 14

Best Freshman: **ADRIAN TANNER** ME 15

Best Overall: **IAN SCHON** ME 12

## Graduate Thesis Award with the Greatest Commercial Potential

The fifth 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 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 alumnus.

The Jury for the 2012 Award consisted of three faculty members from BU and one person from outside of BU:

**DAN COLE** Associate Professor at BU in ME Dept., Chair

**TOM BIFANO** Professor at BU in ME Dept.

**TED de WINTER** Associate Professor at BU in ME Dept.

**TUSHAR KULKARNI** PhD from BU, now at Lam Research, and winner of this award in 2010

Professor Cole formed the above jury, accumulated the theses, and with the jury made the selection.

The winning thesis, which was nominated by his thesis adviser Prof. Vinod Sarin, was written by **STEPHEN TOPPING**. The title of his thesis was “Vapor Deposited Europium Doped Lutetium Oxide for X-Ray Imaging Applications.”

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.



Prof. Stormy Attaway (l.) and Prof. Daniel Cole (m.) with Ian Schon (r.), the senior and overall winner of the Design and Portfolio Contest.





 Department of Mechanical Engineering

Boston University  
Department of Mechanical Engineering

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