

## Department of Mechanical Engineering

Mechanical engineering is one of the broadest and most versatile of the engineering professions. This is reflected in the portfolio of current research and education activities in the department, one that has widened rapidly in the past decade. Today, our faculty and students are involved in projects that aim to bring engineering solutions to a spectrum of global challenges, ranging from developing alternative clean and renewable energy technologies including research in photovoltaics, wind energy, fuel cells, and carbon sequestration; developing the materials, processing, systems, and technologies that will bring clean water to the developed and developing world; developing the instrumentation, controls, and technologies required for medical treatment and biomedical exploration; designing the vehicles, acoustics, and control systems for underwater exploration and environmental monitoring; designing the structure, materials, and advanced technologies needed for better protection and security of our first responders and soldiers; exploring and decoding optimized biological designs for the engineering of new materials and devices stemming from the biomimetics of fish swimming to clam burrowing to snail locomotion to natural armor structures providing protection; developing new thermal and membrane technologies for water purification and desalination; and designing, manufacturing, and controlling precision devices and machines for competitive technologies. These projects cover the fundamental engineering science underpinnings up to the design, manufacturing, and fabrication of the new structures, devices, and technologies.

The department's mission is to be a leader in education and research. We seek to produce future leaders for industry, academia, government, and society—leaders whose vision is founded upon fundamental knowledge, analytical skills, creativity, perspective, and ethics. We seek to advance technology and science by combining basic knowledge with the innovative application of engineering and scientific principles. And we seek to enrich our educational and research programs, and ultimately society, through service.

Our educational mission is to prepare students for careers involving technological innovation and leadership. Our undergraduate educational program provides a broad base on which successful careers in engineering and a number of other fields can be founded, whereas the graduate program aims to prepare specialists, professionals, and scholars in mechanical engineering. The research mission of the department—which is to create knowledge, technologies, and ideas through fundamental research and its application—is closely intertwined with its educational mission. Our graduates go on to a vast array of careers in product design, research, management, medicine, government, teaching, public service, and entrepreneurship.

This has been a good year for the Mechanical Engineering (ME) Department, marked by many additions, changes, promotions, and honors. We maintained our ranking as the number one department in the field at both the undergraduate and graduate levels according to *U.S. News and World Report*. Our students and faculty have continued to be recognized for their originality and impact on research, education, innovation, and leadership. Our research and education programs continue to innovate and to lead the field. Below, we provide an update on faculty hiring and promotions followed by

highlights of major research initiatives, a few selected faculty research highlights, and updates on our educational programs.

### **New Faculty Appointments, Promotions, and Retirements**

We are very pleased to welcome four new faculty members to the ME Department.

Cullen Buie received his PhD in mechanical engineering from Stanford University in January 2009. Cullen's doctoral research focused on novel proton exchange membrane fuel cells and their integration with electroosmotic pumps for water removal and methanol fuel delivery. Cullen received a best student paper award from the American Society of Mechanical Engineers (ASME), and he is currently a University of California President's Postdoctoral Fellow at the University of California, Berkeley. Cullen is interested in advanced diagnostics for electrochemical systems, modeling physicochemical hydrodynamics in microchannels, and the design of micro- and nano-structured energy systems. Cullen was recently awarded a grant from the MIT Research Support Committee to study the electrokinetic properties of bacteria used in microbial fuel cells. He will join the department as an assistant professor in November 2009.

Sangbae Kim received his PhD in mechanical engineering from Stanford University in 2008. Sangbae is a designer and builder of bio-inspired robots. He will conduct research on the convergence of mechanical engineering, biology, and material science in the design of novel robot systems. He will pursue a new research field called hyperdynamic robotics for developing high-speed legged robotic systems. This new field of research will combine advances in materials and mechanical components, force and position sensing, and flexible actuation on a wide range of scales. In his graduate research at Stanford, Sangbae has created several highly innovative robots that embody his new approach to robot design, including a robotic gecko that can climb vertical glass walls using novel directional adhesives. The impact of Sangbae's contributions has been recognized by several prestigious awards, including the 2008 Best Paper award in Transactions on Robotics, the Best Student Paper Award at the 2007 IEEE International Conference on Robotics and Automation and the Best Video Award at the 2006 conference, and selection as one of *Time* Magazine's Best Innovations of 2006. Sangbae's teaching will be in the areas of robotics, design, and control.

Alexander Mitsos received his engineering diploma from the University of Karlsruhe (TH), Germany, and his PhD from MIT in 2006, both in chemical engineering. After graduation, he joined the RES Group, where he worked on numerical algorithms and software and on modeling chemical, energy, and biological systems. In 2008, he was a junior research group leader at RWTH Aachen University. He joined the department in January 2009. He has authored or coauthored 20 papers and received various awards, including the DECHEMA Gesellschaft für Chemische Technik und Biotechnologie Student Award. Only graduates who distinguish themselves by completing their studies in a particular short time and achieving outstanding results are eligible. His research interests include microscale and macroscale energy systems, including renewable energy sources, thermodynamics, and development of global optimization algorithms.

Kripa Varanasi received his PhD in mechanical engineering from MIT in 2004. Since that time, Kripa has been a lead research scientist in the energy and propulsion and nanotechnology programs at the GE Global Research Center, Niskayuna, NY, where he established research programs on nano-engineered materials and was the principal investigator for the DARPA Thermal Ground Plane program. The primary focus of his research at MIT is in the development of nano-engineered surfaces that can dramatically enhance performance in energy, water, agriculture, aviation, and electronics cooling systems. Kripa has filed more than 25 patents in this area. He was awarded first prize at the 2008 ASME Nanotechnology Symposium and won several awards at GE, including Technology Project of the Year (2005), GE Inventor Award (2005, 2008), and Best Patent Award (2006, 2008). Kripa joined MIT as d'Arbeloff assistant professor of mechanical engineering in January 2009. At MIT, he has already received an MIT Energy Initiative seed grant, a School of Engineering Reed Award, and a grant from the Deshpande Center.

In addition, two new faculty have accepted positions to join us one year from now in the areas of nonlinear dynamics and mechanics. The incoming mechanics faculty member will hold a dual appointment in the Department of Civil and Environmental Engineering (CEE), reflecting an effort initiated between ME and CEE to better bridge and highlight the synergy and excellence in mechanics activities across the two departments. An additional faculty offer is pending in the area of controls, focusing on multivehicle and multicellular control. These appointments are consistent with our strategic plan of making hires that simultaneously strengthen our mechanical engineering core and extend our research activities into exciting new areas.

Space renovations have been undertaken to accommodate the research needs of these new faculty members as well as the evolving needs of new research activities of current faculty. A 1,200-square-foot lab space renovation finalized renovation of both sides of the Pappalardo 2 Laboratory. We are grateful for a very generous endowed laboratory fund established by Neil and Jane Pappalardo this year to provide for the ongoing maintenance of these laboratory spaces. The department has also undertaken a major renovation of the Rohsenow Heat and Mass Transfer Laboratory this year, refurbishing a laboratory that originally joined the ME Department as the Heat Measurements Laboratory in 1934. The renovated lab will be equipped for studies of heat and mass transfer in nanoscale systems, thermoelectric devices, microfluidic devices, seawater desalination, and other areas; the lab will include spaces suitable for high-precision optical measurements, chemical processes, and the study of thermofluid systems of various types.

We are tremendously pleased to announce the promotions of professor Anette (Peko) Hosoi and professor Yang Shao-Horn to the rank of associate professor with tenure this year. Each brings a unique signature to the department and to the Institute in terms of their individual achievements and contributions to research, education, mentorship, and service.

Professor Anette (Peko) Hosoi is a recognized international leader in the study of the hydrodynamics of thin fluid films and in the nonlinear physical interaction of

viscous fluids and deformable interfaces. An emerging theme in her work is the fundamental study of shape, kinematic, and rheological optimization of biological fluid systems for locomotion. Her work is widely known and internationally respected by physicists, biologists, and applied mathematicians and is being used to guide the engineering design of robotic crawlers and other mechanisms. She is an exceptional and innovative teacher, an inspiring mentor for women in engineering, and an outstanding communicator of science in general. Her pedagogical contributions span several core disciplines in our undergraduate program as well as our graduate program, and she was awarded the Junior Bose award in 2006 for her teaching contributions. She is very active in service to our department as the Course 2-A coordinator, to the Institute through the Lincoln Labs Advisory Committee, and to the professional community at large as an elected member of the American Physical Society Division of Fluid Dynamics executive committee.

Professor Yang Shao-Horn is a recognized international leader in the science and engineering of electrochemical energy conversion and storage. Yang is known for confronting some of the most important and challenging problems in the field using a rigorous and pioneering approach that identifies atomistic structure connections to reaction mechanisms for innovative mechanistic-based design of new materials and catalysts in battery and fuel cell applications. Yang's research contributions have been recognized with numerous national and international awards, including the ONR Young Investigator Award, the Charles Tobias Young Investigator Award of the Electrochemical Society, and the Tajima Prize of the International Society of Electrochemistry. In addition to her contributions in teaching core undergraduate courses, Yang has introduced a new interdepartmental graduate course on electrochemistry; she has been an outstanding mentor to a talented cadre of graduate students, postdoctoral associates, and undergraduate students fostering a highly interdisciplinary mode of research. Yang has been a vibrant presence and leader in energy activities across the department, the School, and the Institute.

Four distinguished faculty members retired this year: professor Arthur (Art) Baggeroer, an international authority on underwater acoustics and geophysical signal processing, sonar technology, and a long-time intellectual resource to the US Navy; professor John B. Heywood, one of the most prominent professors worldwide in the field of internal combustion engines and, more broadly, automotive engineering; professor Henry (Hank) S. Marcus, an international expert in marine transportation; and professor James (Jim) H. Williams Jr., an international expert on the mechanics of composite materials with a focus on nondestructive evaluation inspection techniques for rigorously ensuring structural integrity of safety-critical components in aircraft. Each will remain actively engaged in research and other professional activities.

### **Research Highlights**

The department has many thriving and vibrant research programs. New major research initiatives as well as a few selected faculty research contributions are highlighted below.

A group of mechanical engineering faculty have entered into a seven-year research and educational collaboration with King Fahd University of Petroleum and Minerals

(KFUPM) in Dhahran, Saudi Arabia, leading to the creation of the Center for Clean Water and Clean Energy at MIT and KFUPM. The center's research focuses on water desalination and purification and on low-carbon energy production from both solar energy and fossil fuels. Additional research activities involve design and manufacturing, with a focus on technologies related to water and energy production. This collaboration began in fall 2008 and during the first year, a diverse group of approximately 20 MIT faculty participated in the center along with 35 MIT graduate students and 10 MIT postdocs. The center will grow further in years two and three. Funds from the center will support major space renovations in the department over the coming years. In addition, the center includes a program to bring Saudi Arabian women to MIT for research and educational activities. The center is directed by professor John H. Lienhard V and codirected by professor Kamal Youcef-Toumi.

Our Center for Ocean Engineering continues to thrive, facilitating connections among faculty from several MIT departments allowing them to come together to solve complex ocean engineering problems. At present, 32 faculty from several departments at MIT work in ocean-related problems through the center. This year, the center continued to partner with Chevron in the area of remote autonomous oil and gas production. Chevron is sponsoring significant research initiatives as well as educational activities on campus. Additionally, four ME faculty members in collaboration with eight faculty members from other departments are participating in the Singapore–MIT Alliance for Research and Technology (SMART). This five-year program provides continuous monitoring of the environment around Singapore; a major component is ocean sensing and monitoring using autonomous marine vehicles and novel sensors. Also, several faculty from the Mechanical and the Electrical Engineering Departments work to support the design of the new all-electric ship, funded by the Navy. Our ocean research efforts also increasingly focus on bringing innovation to exploring and monitoring ecosystems and the ocean environment, including, for example, the development and novel use of sonar to monitor fish schooling behavior and the development and use of autonomous underwater vehicles to study the health of deep ocean corals, which also provide important data on climate history.

One of the new initiatives in the department is aimed at developing an understanding of multicellular processes, ranging from the growth of new vascular networks (angiogenesis) to the development of cellular machines created from multiple interacting cell populations. This work began under the National Science Foundation (NSF) Emerging Frontiers in Research and Innovation program has continued through the SMART BioSystems and Micromechanics Interdisciplinary Research Group and, most recently, a proposed Science and Technology Center on Emergent Behavior in Integrated Biological Systems, which has just been selected for a site visit in the fall. In each of these programs, the vision is to understand and ultimately regulate the emergent systems-level properties of cells and cell networks interacting with their native environment and thereby establish the nascent field of engineered biological systems. These new programs include faculty from multiple departments; participating ME faculty members are professors Roger Kamm (principal investigator), Harry Asada, George Barbastathis, Linda Griffith, Matthew Lang, and Peter So.



Professor Gang Chen, Soderberg professor of power engineering, led a multidisciplinary and multiuniversity team of researchers to win a Department of Energy (DOE) Engineering Frontier Research Center entitled “Solid-State Solar-Thermal Energy Conversion Center (S<sup>3</sup>TEC Center).” At MIT, the center includes 11 faculty members from MIT’s School of Engineering (ME, Electrical Engineering and Computer Science, Materials Science and Engineering) and School of Science (Physics, Chemistry). The S<sup>3</sup>TEC Center aims to advance fundamental science and engineering by developing materials and devices to harness heat from the sun as well as from terrestrial heat sources and convert this heat into electricity via solid-state thermoelectric and thermophotovoltaic technologies. Solar thermophotovoltaics first use solar radiation to raise the temperature of a terrestrial object which then emits photons optimized to the bandgap of a photovoltaic cell to generate electricity. Solar thermoelectric energy conversion uses solar radiation to create a temperature difference across a solid-state material in order to generate electricity. These technologies have transformative potentials.

Professor Ahmed F. Ghoniem was awarded a prestigious KAUST (King Abdullah University of Science and Technology) Investigator Award. His research program focuses on high-efficiency, low-carbon energy from hydrocarbon sources as well as on the hybridization of concentrated solar thermal energy through thermochemical conversion and combustion. His group works to develop, validate, and apply multiphysics multiscale simulation techniques, from the submicron scale to the system’s scale, to engineer optimal clean low CO<sub>2</sub> energy systems based on sound fundamental understanding of the underlying mechanisms. These techniques include innovations in clean combustion for propulsion, gasification for power and biofuel production, oxy-combustion and electrothermochemical conversion in ion-transport membrane reactors, and high-temperature fuel cells for CO<sub>2</sub> capture. Simulations are supported by high-performance computer systems and state-of-the-art laboratories equipped with high-resolution optical diagnostics. In addition to the KAUST award, Ghoniem’s research programs are also supported by the DOE; the Office of Naval Research; the Air Force Office of Scientific Research; several major energy industries including BP, ENEL, Bosch, and Ford; and his participation in international collaborations with Masdar Institute and KFUPM. His programs benefit from collaborations with colleagues across the department, School, and Institute.

Professor Nicholas Makris and his group, together with collaborators from Northeastern University, the Northeast Fisheries Science Center, and the Institute of Marine Research in Norway, have observed the initiation of a massive gathering and subsequent migration of hundreds of millions of fish. Using ocean acoustic waveguide remote sensing (OAWRS), they were able to observe large images of fish schooling and living in their natural habitat—schools of up to 250 million herring covering distances more than 40 miles wide. They introduced the OAWRS method in a 2006 *Science* article; OAWRS allows the team to take images of an area some 100 kilometers (approximately 62 miles) in diameter every 75 seconds, covering much larger distances at lower frequencies than other underwater acoustic technologies. The current research, published in a March 2009 article in *Science*, “provides information essential to the conservation of marine ecosystems that vast oceanic fish shoals inhabit.” For example, the team found that once a group of fish reaches a critical population density, it triggers a kind of chain reaction

resulting in the synchronized movement of millions of individuals over a large area. This research can provide the information needed to monitor and, hopefully, conserve fish populations as well as providing an understanding of the dynamics of massive populations of animals. This research has been highlighted in local, national, and international press. Recently, the group received an NSF major research instrumentation grant for the further development of OAWRS.

Our newly revamped Mechanical Engineering Colloquium featured seminars by world renown engineers and scientists from academia and industry including distinguished alums Helen Greiner '89, cofounder of iRobot, and Michael Idelchik SM '81, vice president of advanced technologies, General Electric.

## **Education Highlights**

### **Outreach**

The summer Women's Technology Program (WTP) for high school juniors is continuing under the generous sponsorship of Brit d'Arbeloff SM '61. The program is conceived, developed, and taught by a small group of women ME graduate students under the mentorship of Dr. Barbara Hughey, a technical instructor in Mechanical Engineering. Twenty female high school students come to MIT for four weeks to take classes, work on design, and build Rube Goldberg machines. The program was intended for young women who excel in mathematics and science but are unfamiliar with engineering. The success of the program is evident: more than one-half of WTP students (ME and Electrical Engineering and Computer Science) go on to choose an engineering major in college; 14 WTP ME alumnae are currently at MIT; two of our top graduating ME seniors this year were WTP alumnae.

### **Undergraduate Program**

Our educational programs remain strong. The ME Department remains the second largest undergraduate program at MIT, and the recent trend of growing enrollment is continuing. In particular, we see continuing growth in our ground-breaking customizable Course 2-A engineering major.

The Course 2-A degree has been central to the department's undergraduate educational strategy. We use this flexible curriculum to facilitate innovative education programs for our students that in some cases are cross-disciplinary (for example, engineering management or bioengineering) and in other cases are vehicles for a deeper focus in a particular area (such as robotics and controls). In this program, students may select roughly half of their engineering subjects to develop a course of study that has particular interest to them. In 2006, the department took the step of classifying the 2-A degree as a general engineering degree for accreditation purposes so as to allow greater flexibility in the required content of the degree; in addition, during that year, a number of changes to the core requirements were made in order to strengthen the program. During our accreditation review in 2007, the Accreditation Board for Engineering and Technology summarized the resulting program as follows: "This is an exemplary program, such as described by the National Academy of Engineering in *The Engineer of 2020*." At the time of this writing, approximately one-third of ME Department sophomores are in Course 2-A.

The department's traditional mechanical engineering degree, Course 2, also continues to see strong student interest, with a 23% jump in the number of sophomores entering in fall 2008. We recently added a new required subject in computation (2.086 Numerical Computation for Mechanical Engineers) to the Course 2 degree. We have also started a major rethinking of our flagship sophomore design subject, 2.007 Design and Manufacturing I, to include more emphasis on computer-aided design and electronic control, among other goals. In the coming year, we hope to introduce options for students to take a nanotechnology subject in the senior year and to explore means of increasing the flexibility of this degree. Our traditional emphasis on design and innovation remains strong, including our senior level subject, 2.009 The Product Engineering Process, new offerings for freshmen such as 2.00B Toy Product Design, and various student design competitions, such as the de Florez awards.

The Course 2-OE degree in mechanical and ocean engineering is the focus of continuing development and discussion.

### Undergraduate Enrollment

	2004–2005	2005–2006	2006–2007	2007–2008	2008–2009
Sophomores					
2	94	105	98	93	114
2-A	32	35	29	41	51
2-OE	4	4	4	5	6
13	4	0	0	0	0
Total	134	144	131	139	171
Juniors					
2	72	91	104	99	95
2-A	31	25	22	20	44
2-OE	6	1	4	3	4
13	6	4	0	0	0
Total	115	121	130	122	143
Seniors					
2	84	69	87	99	90
2-A	21	41	31	27	26
2-OE	8	1	1	5	4
13	8	4	3	0	0
Total	121	115	122	131	120
5th Year					
2	9	6	13	12	7
2-A	4	2	1	2	5
2-OE	0	0	0	0	0
13	0	1	0	0	0
Total	13	9	14	14	12
<b>Total</b>	<b>383</b>	<b>389</b>	<b>397</b>	<b>406</b>	<b>446</b>



On the administrative side, we have successfully switched from paper evaluations to online evaluations of subjects during the past four years. Our work in this area has been at the vanguard of online assessment at MIT, and the Institute as a whole is now making a transition to online evaluations. We have upgraded our database capabilities for curriculum management, and we are now considering additional steps to replace paper office management techniques with online processes.

Our lab and shop facilities to support undergraduate teaching are also strong. We have recently hired new personnel in the ME Manufacturing Laboratory and also in support of our controls and mechatronics subjects. We plan to refurbish one of our other teaching labs to focus on robotics-related subjects. Nevertheless, space remains a considerable challenge for the undergraduate program.

Our undergraduate students have been broadly recognized, both intramurally and extramurally, for their many achievements. The 2007–2008 year recognitions included a Marshall Scholar, a Rhodes Scholar, a Fulbright Scholar, a Udall Scholar, and a Kuwamara Scholar. This past year also brought prestigious awards for scholarship, research, and leadership: senior Orian Z. Welling was named a Gates Cambridge Scholar, senior Nathaniel Sharpe was named a Marshall Scholar, and junior Natasha “Tish” Scolnik was named a Truman Scholar. In recognition of our students’ innovation, three of the 12 finalists of the National Inventors Hall of Fame Foundation’s Collegiate Inventors Competition were from the MIT ME Department, including 2008 graduate Greg Schroll, who placed first for his design of a spherical robot that uses a gyroscope to control motion up inclines and over obstacles.

The following are some of the MIT honors and prizes our undergraduates received this year for their scholarship, their innovation, and their service.

- Mary Beth DiGenova and Ethan A. Huwe: BJ and Chunhi Park Award for Outstanding Performance in Manufacturing
- Stephanie J. Chin and Charles D. Field: Society of Naval Architecture and Marine Engineering Award for Outstanding Undergraduate in the Marine Field.
- Stephanie J. Chin and Charles D. Field: Alfred A.H. Keil Ocean Engineering Development Fund Award for Excellence in Broad-Based Research in Ocean Engineering
- Jenna McKown: Wallace Prize for Scholarship in Ocean Engineering
- Justin Y. Lai and Zachary A. Trimble: Carl G. Sontheimer Prize for Creativity and Innovation in Design
- Julia C. Zimmerman: John C. and Elizabeth J. Chato Award for Excellence in Bioengineering
- Adam T. Paxson: Peter Griffith Prize for Outstanding Undergraduate Thesis
- Maia R. Bageant, John G. Boghossian, Vazrik Chiloyan, and Teerawu Wannaphahoon: AMP Inc. Award for Outstanding Performance in Course 2.002

- Shawn A. Chester and David L. Henann: Wunsch Foundation Silent Hoist and Crane Award for Outstanding Teaching Assistants in Course 2.002
- Brendan J. Englot and Brenden P. Epps: Wunsch Foundation Silent Hoist and Crane Award for Outstanding Teaching Assistants in Course 2.003
- Michael L. Stern and Fiona R. Hughes: Academic Excellence and Outstanding Senior Thesis
- Fiona R. Hughes, Adam T. Paxson, Nathaniel Sharpe, and Julia C. Zimmerman: Academic Excellence
- John M. Walton, Charles Z. Guan, Blake A. Sessions, David S. Anderson, and Benjamin J. Peters: Whitelaw Prize (for originality in 2.007 design and contest)
- Edward M. Grinnell, Pablo J. Bello, Elvine P. Pineda, and Arielle G. Fischer: International Design Competition (2.007 Contest)
- Adelaide S. Calbry-Muzyka, Joshua M. Karges, Karina N. Pikhart, Maria N. Prus, Trevor J. Shannon, Rachel E. Tatem, and Tylor J. Hess: Luis de Florez Award for Invention/Innovation, Team Project
- Adrienne Watral and Mario A. Bollini: Luis de Florez Award for Invention/Innovation, Individual Projects
- Julia C. Zimmerman: Lauren Tsai Memorial Award for Academic Excellence by a Graduating Senior
- 2.009 6DOT Team: Andrew Bishara, Adelaide Calbry-Muzyka, Kwame Hall, Joshua Karges, Michelle Lustrino, Nicole O’Keeffe, Sam Phillips, Sarah Shieh, Xiao Wei Chen, Isa Castro, Wenxian Hong, Jennifer Moore, Karina Pikhart, Rachel Tatem, and Jodie Wu: James Dyson People’s Choice Design Award

### Graduate Program

Our graduate program continues to be strong, with a total of 448 students. Of the students in the master’s program, 41% are international, 43% are women, and 13% are underrepresented minorities. Of the students in our doctoral program, 54% are international, 14% are women, and 4% are underrepresented minorities. Our students were supported by research assistantships, NSF fellowships, Department of Defense fellowships, fellowships from other sources (including Woods Hole Oceanographic Institute, Dupont, Gates, and Lemelson) as well as by several from within the department (Rohsenow, Pappalardo, Shapiro, Harrington, Martin, Cook, Lee, and Bailey) and by Institute presidential fellowships. Our graduate program attracts a very talented applicant pool where we continue to obtain a high yield even in the face of the increasingly aggressive recruitment of our competitors.

#### Graduate Enrollment ME (OE)

	2004–2005	2005–2006	2006–2007	2007–2008	2008–2009
Masters	194 (87)	174 (70)	209	208	204
Doctoral	190 (37)	200 (35)	260	236	244
Total	384 (124)	374 (105)	469	444	448
<b>Grand Total</b>	<b>508</b>	<b>479</b>	<b>469</b>	<b>444</b>	<b>448</b>

This past year, 865 students applied for admission to our graduate programs; 26% of them were offered admission, of whom 60% accepted our offer.

A review of our graduate program is currently under way to assess the various elements of the graduate program and identify any renovations and/or new elements needed to best prepare our graduates for careers in an increasingly globally cooperative and competitive environment. We will report on specific changes to the graduate program that result from this review next year.

The following honors and prizes were awarded to our graduate students.

- Kirki Kofiani and Chen-rei Wan: Meredith Kamm Memorial Award for the Outstanding ME Woman Graduate Student
- Barry M. Kudrowitz: Department Service Award for Outstanding Service to the ME Department
- Filippou Chasparis: Clement F. Burnap Award for Outstanding Master's of Science in the Marine Field
- Daniel S. Codd and Randy H. Ewoldt: Luis de Florez Award for Scholarly Innovation/Innovation Award
- Brian Chan and Amos G. Winter: Luis de Florez Award for Technology Innovation/Innovation Award
- Yi (Ellen) Chen and Irene M. Berry: Wunsch Foundation Silent Hoist and Crane Award for Academic Excellence and Outstanding Master's Thesis
- Keith V. Durand: Wunsch Foundation Silent Hoist and Crane Award for Academic Excellence and Outstanding PhD Thesis
- Gunaranjan Chaudhry: SoE Graduate Student Extraordinary Teaching and Mentoring Award
- Barry Kudrowitz: Goodwin Medal for Most Outstanding Teaching Assistantship (conferred by the MIT Office of Graduate Education)
- Husain Al-Mohssen and Ghassan Fayad: MIT 50K Arab Business Plan Competition
- Vijay Shilpiekandula: American Society for Precision Engineering 2008 R.V. Jones Memorial Scholarship for Best Paper
- Heejin Lee and Timothy Lu: National Inventors Hall of Fame Collegiate Inventors Award

### **Postdoctoral Program**

One immediate result of our ongoing graduate program review was to identify the increasingly important role of postdoctoral experience in preparing for a career in either academia or research laboratories. Most incoming junior faculty now have had one or two years of experience as a postdoctoral associate at another university or laboratory; we currently have more than 50 postdoctoral associates in the ME Department. To better

address the career development of our postdoctoral populations, we are undertaking several initiatives, including the formation of a postdoctoral cohort community, a more formal mentoring of postdoctoral associates and postdoctoral fellows in the department, and avenues for mentored teaching within the department. More details of this program will be reported on next year.

### **Faculty Notes**

Our faculty members have been recognized with the following awards and appointments.

Rohan C. Abeyaratne has accepted a three-year appointment in Singapore to serve as director of the MIT–Singapore SMART Center (having stepped down from the department head position after seven years of distinguished service).

Lallit Anand was named the Warren and Towneley Rohsenow professor of mechanical engineering.

Mary C. Boyce was appointed department head.

John G. Brisson received the Best Paper Award from the *Journal of Cryogenics*.

Cullen Buie received the Best Student Paper Award from ASME.

Tonio Buonassisi was named SMA career development assistant professor in manufacturing.

Gang Chen was named the School of Engineering Carl Richard Soderberg professor of power engineering and received the ASME Heat Transfer Memorial Award (2008).

Martin L. Culpepper was promoted to associate professor with tenure (2008).

C. Forbes Dewey was named a fellow of the Royal Academy of Engineering of the United Kingdom.

Daniel Frey was promoted to associate professor with tenure (2008), received the Joel Spiro Teaching Award, and received the Big Screw Award.

Ahmed F. Ghoniem received the KAUST Investigator Award.

Leon R. Glicksman received the ASME Heat Transfer Memorial Award (2008) and the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Distinguished Service Award (2008).

David E. Hardt was appointed graduate officer for the department.

John B. Heywood received the SAE Barry D. McNutt Award for Excellence in Automotive Policy Analysis 2008.

Neville Hogan was named the Sun Jae professor of mechanical engineering, was the ASME Rufus Oldenburger Medalist 2009, and received the ASME Henry Paynter Outstanding Investigator Award 2008.

Anette (Peko) Hosoi was promoted to associate professor with tenure (2009) and presented the Batchelor Lecture, Cambridge University.

Roger Kamm presented a talk at the Midwest Mechanics Lecture Series.

Rohit Karnik was named an Alex d'Arbeloff career development assistant professor.

Pierre Lermusiaux was named the Doherty associate professor in ocean utilization.

John H. Lienhard V was named the Samuel C. Collins professor of mechanical engineering and was appointed executive officer of the department.

Nicholas Makris was promoted to full professor (2008).

Henry S. Marcus received the William Selkirk Owen Lifetime Achievement Award of the Webb Institute Alumni Association.

Gareth H. McKinley was appointed associate head of research for the department.

Sanjay Sarma became a MacVicar Faculty Fellow.

Yang Shao-Horn was promoted to associate professor with tenure (2009), received the Charles W. Tobias Young Investigator Award of the Electrochemical Society 2008, and received the Tajima Prize of the International Society of Electrochemistry 2008.

Alexander H. Slocum received the ASME Machine Design Award 2008.

Michael S. Triantafyllou was named the William I. Koch professor of marine technology and was appointed associate head of ocean engineering of the department.

Nam P. Suh received the ASME medal.

Kripa Varanasi was named a d'Arbeloff career development assistant professor and received the ASME Nanotechnology Best Poster Award.

Evelyn N. Wang received the DARPA Young Faculty Award and was named Esther and Harold E. Edgerton career development assistant professor.

David R. Wallace was promoted to full professor (2008) and received the Jacob P. Den Hartog Distinguished Educator Award 2009.

Maria Yang was named Robert N. Noyce career development assistant professor of mechanical engineering and engineering systems.

### **Staff Awards**

Richard (Dick) Fenner received the Infinite Mile Award.

Barbara Smith received the Infinite Mile Award and the Laya W. Weisner Award.

**Mary C. Boyce**

**Department Head**

**Gail E. Kendall Professor**

*More information about the Mechanical Engineering Department can be found at <http://meche.mit.edu/>.*