Department of Mechanical Engineering

The breadth, depth, and versatility of mechanical engineering has never been more relevant to the world's challenges than it is today. Within this field, MIT's Department of Mechanical Engineering (MechE) remains a leader, defining and pushing the frontiers in both education and research. Our mission to educate and mentor the next generation of leaders for industry, academia, and government remains at our core, together with the generation of knowledge and new technologies that will impact society for the better.

Every year, we attract and enroll the best and the brightest mechanical engineering students. Our undergraduate enrollment for AY2013 was just shy of 500 students; our graduate program continued to thrive as well, with almost 600 students, and our research programs incorporated a growing postdoctoral population of more than 95 fellows and associates.

The department's externally funded research portfolio is diverse, bringing innovative technical solutions to the major issues facing the 21st century, including energy, water, health, transportation, security, and the environment. Our faculty, students, and postdoctoral researchers are sharply focused on defining the next generation of engineering science and engineered processes for a productive and prosperous future.

Mechanical engineering education and research innovations are increasingly occurring at the interfaces of our disciplines. Our commitment to this interdisciplinary and multidisciplinary nature of the department is captured in seven research areas: mechanics, modeling, experimentation, and computation; design, manufacturing, and product development; control, instrumentation, and robotics; energy science and engineering; ocean science and engineering; bioengineering; and nano/micro engineering. Our societal need–focused research laboratories and centers can be found at the interfaces of these disciplinary research areas, again demonstrating our cross-disciplinary research and innovation.

Innovation and creativity are concepts that imbue everything we do in the Department of Mechanical Engineering. They are woven into every lab, every experiment, and every faculty member and graduate student. But innovation and creativity are not the same thing. Creativity is the seed for innovation and, despite popular belief, it can be learned. If creativity is the seed, then innovation is creativity aptly applied. MechE students receive the knowledge and hands-on experience necessary to transform creativity into innovation, into a product that solves a real problem or fulfills a specific need, and the business acumen to turn innovation into entrepreneurship. The department's curriculum offers a series of undergraduate and graduate product design courses for this purpose, including 2.00b Toy Lab, 2.007 Introduction to Robotics, 2.009 Product Engineering Processes, 2.013/4 Engineering Systems Design and Development, and 2.739 Product

Design and Development. It also offers programs that integrate elements of fundamental business and marketing ideas, such as the Leaders for Global Operations program in conjunction with the Sloan School of Management.

In this year's report, we provide snapshots of departmental news and contributions over the past year, including a short synopsis of faculty news (promotions, hires, and retirements); selected research highlights across the department; education highlights, with brief overviews of our undergraduate and graduate programs; and finally awards and recognition.

Faculty

New Faculty

We are very pleased to welcome two new faculty members to the Mechanical Engineering Department starting July 1, 2013: associate professor John Hart and ABS career development assistant professor Themistoklis (Themis) Sapsis.

Over the past five years at the University of Michigan, Professor Hart has established a leading research group focused on creating new manufacturing technologies for microscale and nanoscale materials and devices and for their assemblage and integration at larger scales. He is widely regarded as a young leader and rising star in the field of nanomaterials manufacturing. He has made signature innovations toward scalable manufacturing of materials incorporating aligned carbon nanotubes (CNTs). His group discovered how to engineer key characteristics of aligned CNT "forests" and pioneered nondestructive X-ray methods for rapidly and accurately measuring the diameter, alignment, and density of CNTs. His ground-breaking understanding of how CNTs can be manipulated by capillary forces led to the invention of the "capillary forming" process, which enables robust and repeatable preparation of 3D CNT microstructures for use in electronics and micromechanical devices and as a platform for the engineering of robust textured surfaces and interfaces. Moreover, working with graduate students and undergraduate design teams, Professor Hart has led the realization of several new award-winning machines and instruments, including those for efficient roll-to-roll chemical vapor deposition and high-speed manufacturing of nanocomposite thin films. His work has been recognized by two R&D 100 Awards, a CAREER Award from the National Science Foundation, and Young Investigator awards from DARPA, the Air Force, and the Navy.

Professor Sapsis graduated from the National Technical University of Athens, where he earned his diploma in naval architecture and marine engineering in 2005. He began his graduate studies at MIT in 2006 and earned his PhD in mechanical engineering in 2010 under the supervision of professors Pierre Lermusiaux and George Haller. At MIT, Themis was named the George and Marie Vergottis MIT Presidential Fellow. He has twice been the recipient of the European Union's Marie Curie Fellowship. Dr. Sapsis's research focuses on the areas of stochastic mechanics with applications to naval architecture, passive protection configurations for mechanical systems, and filtering and probabilistic prediction of nonlinear high-dimensional systems.

Faculty Promotions

We are also pleased to announce the promotion of Maria Yang from the rank of assistant professor to the rank of associate professor without tenure and the promotions of Martin Culpepper, Anette (Peko) Hosoi, and Yang Shao-Horn, each from associate professor with tenure to full professor. Each brings a unique signature to the department and to the Institute in terms of individual achievements and contributions to research, education, mentorship, and service.

Professor Yang is an emerging leader in early-stage design. In the field of engineering design, early-stage conceptual design plays a dominant role in determining the functional performance as well as the manufacturing cost of the final product. It is during early-stage design that the vision of a product is born. Historically, design process research has led to the development of numerous tools, from CAD to robust design methods, providing the ability to optimize final designs. However, understanding the factors and developing methods to guide and enhance the more ambiguous, human-centric aspects of early-stage design are just beginning to be addressed from a fundamental perspective. Professor Yang's work focuses on how informal representations (sketches, physical prototypes, models, discussions) drive early-stage design and influence the way a design team engages in the process of design. Her research has identified the important aspects of sketching (timing, quantity, frequency, engineering detail, quality) that govern successful design outcomes as well as the level and form of sketch refinement needed for effective customer feedback. Her work has also identified key attributes of physical prototyping. Success in this field has the potential to be transformative and to yield more effective and efficient design processes for greater innovation in product development. Professor Yang is recognized for her ability to educate and inspire the next generation of design engineers, educators, and researchers through her work in the classroom and numerous project-based design workshops. She has been recognized with an NSF CAREER Award as well as with the MIT Murman Award for Advising.

Professor Culpepper is a widely respected authority in the field of precision engineering. His research focuses on the design, fabrication, and testing of high-performance machine systems that make, manipulate, or measure parts and features at length scales and/or precision levels not previously possible or practical. Research from his group has produced landmark achievements in precision machine systems while also laying a foundation for both academicians and practicing designers, providing new tools to enable the design of next-generation precision systems. Professor Culpepper's HexFlex Nanopositioner is considered a signature achievement in the design and fabrication of small-scale, multi-degree-of-freedom positioning systems. He has recently developed a foundational framework regarded by many to be a breakthrough in the field for the design of multi-degree-of-freedom systems; the FACT (Freedom and Constraint Topology) framework rigorously accounts for the freedom and constraint space of the desired motion and provides families of design topologies to achieve the required degrees of motion. FACT is recognized as amongst the most significant advances in the field in recent years. Professor Culpepper is also noted for his commitment to education and mentoring of students. His courses at MIT challenge students in the rigorous design of machine elements based on engineering principles and truly embody the *mens et* *manus* MIT motto. He has brought this approach to industry as well through a series of professional education courses directly impacting the practice of precision machine design. Professor Culpepper has a long history of service to his profession and to MIT. He played an active leadership role in shaping the Laboratory for Manufacturing and Productivity and currently serves as graduate admissions officer in Mechanical Engineering. He has been recognized with several awards for his work, including the prestigious NSF PECASE award, R&D 100 Awards, and, most recently, he was named a Fellow of the American Society of Mechanical Engineers.

Professor Hosoi's research contributions lie at the juncture of nonlinear hydrodynamics, microfluidics, and bio-inspired design. She is a world leader in the study of the hydrodynamics of thin fluid films and the nonlinear physical interaction of viscous fluids and deformable interfaces. A common theme in her work is the fundamental study of shape, kinematic and rheological optimization of biological fluid systems for locomotion and their applications to the emergent field of "soft robotics." A unique mixture of experimental work, numerical simulation, and theoretical analysis characterizes her work, and it combines elements of both engineering design and mathematical optimization. Professor Hosoi's work is widely known and internationally respected by physicists, biologists, roboticists, and applied mathematicians as well as engineers, and is used to guide the engineering design of robotic swimmers, crawlers, burrowers, and other mechanisms. She is also an exceptional and innovative teacher, an inspiring mentor, and an outstanding communicator of science in general. Her pedagogical contributions have spanned several core disciplines in our undergraduate program as well as our graduate program. She has been awarded both the Junior Bose and Bose Award for her teaching excellence in the School of Engineering, she was elected a MacVicar Fellow, and most recently she won our department's coveted Den Hartog Award for Teaching Excellence. Professor Hosoi is extremely active in service to the department (as undergraduate officer), to the Institute (through the Lincoln Laboratory's Campus Interaction Committee), and to the professional community at large.

Professor Shao-Horn is widely recognized as a world-leading authority in electrochemical energy storage and conversion. Her research addresses a grand challenge in electrochemical energy: the identification and design of catalysts with enhanced activity levels to yield high-energy and efficient energy storage and conversion and enable cost-effective renewable energy. Professor Shao-Horn and her group probe and unravel the underlying molecular-level mechanisms of electrocatalytic reactions and the impact of these mechanisms on device performance. They are recognized for deep, fundamental contributions across a range of major challenges in electrochemical energy, including breakthroughs in lithium-ion batteries, lithium-air batteries, PEM fuel cells and solid oxide fuel cells. Professor Shao-Horn is admired for the creativity, innovation, vision, and leadership that she brings to the field and is also respected for her scholarly depth and precision. Recently her research has resulted in landmark achievements in understanding the fundamental atomic-level mechanisms governing the catalytic activity of transition metal oxides. Her discovery of a new oxide with catalytic performance one order of magnitude greater than the current state of the art is considered both profound and practical. Professor Shao-Horn is also recognized for her excellence in the mentoring of students and postdocs. Her ability to motivate, inspire, and nurture emerging researchers early on in their career is much admired, and she is now using these talents to spearhead professional development activities for graduate students. Her multidisciplinary course on electrochemistry has attracted students from across the School and the Institute as well as from other universities. Professor Shao-Horn serves on the advisory board of leading journals of her field. She is a highly sought-out speaker and has been recognized by her professional community with the Charles Tobias Young Investigator Award from the Electrochemical Society, the Tajima Prize from the International Society of Electrochemistry, and the 2013 Research Award by the International Battery Materials Association.

Faculty Retirements

With two SM degrees from MIT and a PhD from the Harvard Business School, professor of marine systems Henry S. Marcus is one of those rare individuals who effectively integrate management and technology. An international expert in marine transportation, he has achieved a world-renowned reputation in the marine field for his ability to analyze the interactions of advancing technology, economics, regulation, societal interests, and current maritime transportation practices. He chaired the MIT program in shipping and shipbuilding management and subsequently the graduate program in ocean systems management, programs that have educated many of the leaders in the maritime industry throughout the world. Professor Marcus was a member of the Marine Transportation System National Advisory Council and the Federal Transportation Advisory Group. He was designated a Naval Sea Systems Command professor and elected as a member of the American Bureau of Shipping. He was honored with the 2008 Webb Institute William Selkirk Owen Award, a lifetime achievement award for his service to the marine industry. He is a fellow of the Society of Naval Architects and Marine Engineers and a member of the American Society of Naval Engineers and the Marine Technology Society.

Faculty Deaths

Joseph LeConte Smith, Jr., the Samuel C. Collins professor emeritus of mechanical engineering, died on May 7, 2013, at the age of 83. Professor Smith's research spanned fundamental areas of thermodynamics, heat transfer, electromagnetics, and cryogenics, and he was able to integrate these diverse fields to advance the practice of engineering. His success in this process was perhaps best manifested in his work with professor Gerald Wilson on the development of a superconducting generator. He was the first faculty member to hold the Samuel P. Collins Senior Faculty Chair (Professor Collins founded the MIT Cryogenic Engineering Laboratory, which Professor Smith directed from 1964 until his retirement in 2008). In recognition of his many contributions to the practice of mechanical engineering, Professor Smith was elected a member of the National Academy of Engineering.

Research Highlights

Research funding continues to grow across the Department of Mechanical Engineering, with an increase of more than 50% in the past five years. Funding focuses on high-impact fundamental research programs that are increasingly collaborative and multidisciplinary. A snapshot of the varied and diverse research conducted in the department is provided below.

Energy

Gang Chen: Invisible particles could enhance thermoelectric devices. New work led by Professor Chen and Institute Professor Mildred Dresselhaus draws upon methods developed by optics researchers who have been attempting to create invisibility cloaks. The MIT team applied similar methods to embed particles that could reduce the material's thermal conductivity while keeping its electrical conductivity high. The concept that made the improvements feasible is called anti-resonance, which causes electrons at most energy levels to be blocked by the embedded particles, while those in a narrow range of energies pass through with little resistance. By tuning the size of the nanoparticles, the researchers made them invisible to the electrons but not the phonons (the virtual particles that carry heat). In addition, they found that the embedded nanoparticles actually enhanced the flow of electrons.

Yang Shao-Horn: New technique reveals lithium in action. Exactly what goes inside advanced lithium-air batteries as they charge and discharge has always been impossible to observe directly. Now, a new technique developed by a research team led by Professor Shao-Horn promises to change that, allowing study of this electrochemical activity as it happens. This new method for studying the reactions of such batteries in detail could help researchers in their quest to design better batteries. Such improvements to lithium-air batteries, according to Shao-Horn, could potentially enhance round-trip efficiency (energy retention between charge and discharge) and cycle life (the ability to charge and discharge a battery many times). This research showed that using metal oxides as an oxygen electrode could potentially enable a lithium-air battery to maintain its performance over many cycles of operation.

Alexander Slocum: Innovative storage system could enable offshore wind farms to deliver power whenever it is needed. Offshore wind could provide abundant electricity, but as with solar energy this power supply can be intermittent and unpredictable. A new approach from researchers at MIT could mitigate that problem, allowing the electricity generated by floating wind farms to be stored and then used, on demand, whenever it is needed. The key to this concept is the placement of huge concrete spheres on the seafloor under the wind turbines. These structures, weighing thousands of tons apiece, could serve both as anchors to moor the floating turbines and as a means of storing the energy they produce.

Evelyn Wang: Jumping droplets help heat transfer. On a typical, flat-plate condenser, water vapor condenses to form a liquid film on the surface, drastically reducing the condenser's ability to collect more water until gravity drains the film. Professor Wang and other researchers have focused on ways of encouraging water to bead up into droplets that then fall away from the surface, allowing more rapid water removal. Many researchers have studied ways of doing this by creating hydrophobic surfaces, but Wang and her team have now taken this a step further by making scalable surfaces with nanoscale features that barely touch the droplets. The result: droplets don't just fall from the surface but actually jump away from it, increasing the efficiency of the process.

Health and Safety

Harry Asada: Researchers engineer light-activated skeletal muscle. Many robotic designs take nature as their muse: sticking to walls like geckos, swimming through water like tuna, sprinting across terrain like cheetahs. Such designs borrow properties from nature, using engineered materials and hardware to mimic animals' behavior. Now, scientists at MIT and the University of Pennsylvania are taking more than inspiration from nature—they're taking ingredients. The group has genetically engineered muscle cells to flex in response to light and is using the light-sensitive tissue to build highly articulated robots. This "bio-integrated" approach, as they label it, may one day enable the use of robotic animals that move with the strength and flexibility of their living counterparts.

Roger Kamm: Visualizing sneaky tumor cells with a 3D assay. Professor Kamm has studied aspects of metastasis over a period of several years using a 3D microfluidic device developed in his lab, including a recent study on the effect of flow on tumor-cell migration. This time, his team used a device designed and developed by PhD candidate Ioannis Zervantonakis to look at the importance of signaling between tumor cells and macrophages, a type of white blood cell with a versatile role in the immune system. They found that when macrophages are absent, it is extremely rare for tumor cells to migrate across the cell layer that lines the blood vessels (a process called intravasation); conversely, when they are present, the rate of entry increases significantly.

John Lienhard: Water purification on the cheap. Professor Lienhard's research group focuses on a water purification technique called humidification-dehumidification desalination, an engineered version of the natural rain cycle in which brackish water is heated, evaporated, cooled, and condensed, leaving only purified water at the end of the cycle. They have conducted many years of efficiency testing that has led them to a discovery that optimizes the dehumidification component to arrive at the most efficient system: a bubbler in place of the classic fin-tube design. It is a multistage design that eliminates all of the metal fins and surface area, replacing them with freshly formed bubbles that do not have as much resistance to heat and mass transfer as steady evaporation on a plate. It works by bubbling moist air into cold water so that the moisture condenses into the cold water.

Nicolas Fang: Ferroelectric-graphene-based system could lead to improved information processing. Professor Fang and his research group have proposed a new system that combines ferroelectric materials—the kind often used for data storage—with graphene, a two-dimensional form of carbon known for its exceptional electronic and mechanical properties. The resulting hybrid technology could eventually lead to computer and data-storage chips that pack more components into a given area and are faster and less power-hungry. The new system works by controlling waves called surface plasmons. These waves are oscillations of electrons confined at interfaces between materials; in the new system, the waves operate at terahertz frequencies. Such frequencies lie between those of far-infrared light and microwave radio transmissions and are considered ideal for next-generation computing devices.

Sangbae Kim: Soft autonomous robot inches along like an earthworm. Researchers at MIT, Harvard University, and Seoul National University, led by Professor Kim, have engineered a soft autonomous robot that moves via peristalsis, crawling across surfaces by contracting segments of its body, much like an earthworm. The robot, made almost entirely of soft materials, is remarkably resilient: even when stepped upon or bludgeoned with a hammer, it is able to inch away, unscathed. The robot is named "Meshworm" for the flexible, meshlike tube that makes up its body. Researchers created "artificial muscle" from wire made of nickel and titanium, a shape-memory alloy that stretches and contracts with heat. They wound the wire around the tube, creating segments along its length, much like the segments of an earthworm. They then applied a small current to the segments of wire, squeezing the mesh tube and propelling the robot forward. Such a soft robot may be useful for navigating rough terrain or squeezing through tight spaces.

Education Highlights

Educating future leaders in mechanical engineering and preparing them to achieve the highest level of success, whether they pursue careers in industry, academia, or government, is as much a priority for our department as supporting cutting-edge, world-changing faculty research. We attract the best and brightest undergraduate and graduate students by offering them unparalleled opportunities for hands-on learning and in-depth instruction both inside and outside the classroom, along with rigorous courses of study and competitive fellowships. Courses that require students to plan, design, and fabricate tools and products are a hallmark of our programs.

A testament to the effectiveness of our educational programs is our progressively increasing enrollment numbers. Enrollment in our undergraduate program has almost doubled in the past decade, and the number of graduate applications has grown by almost 60% since 2005. We have also had a steady increase in enrollment of women as well as underrepresented minorities.

We have introduced several innovations and developments in our undergraduate curriculum recently, most notably our newly revamped 2-A flexible degree program, in which students can focus on a particular engineering-based specialty by taking a larger range of technical electives related to their specific interests. The student response and interest in this degree has been overwhelming, increasing almost tenfold since 1998 to the point where 45% of mechanical engineering majors are currently enrolled in the program, with a notable increase this past year when the revamped 2-A degree was introduced. Meanwhile, Course 2 enrollment remains steady, indicating a growing interest in mechanical engineering more broadly.

The mechanical engineering core requirements for both degree programs are exactly the same in the sophomore year, but changes start to occur in the junior year, when Course 2 students are required to take four specific courses but Course 2-A students only two, allowing them to begin honing in on an area of focus for their remaining third-year credits. From there, Course 2-A students are given the flexibility to take six 12-credit upper-level courses in a concentration area they choose in conjunction with their Course 2-A advisor. Control, instrumentation, and robotics is currently the most popular area of concentration, with more than 20% of 2-A students concentrating in robotics. Management and product development are also popular choices, with 15% to 20% of students focused in each of these areas.

This year the program increased the level of flexibility to make it even easier to concentrate on a particular mechanical engineering area. Instead of being offered six 12-credit core courses, students can now build a core from 13 different options, three of which are traditional 12-credit courses and 10 of which are six-credit course modules.

Undergraduate Enrollment, AY2009–AY2013

	AY2009	AY2010	AY2011	AY2012	AY2013
Sophomores					
2	114	76	94	78	84
2-A	51	67	64	62	98
2-OE	6	5	4	5	3
13	0	0	0	0	0
Subtotal	171	148	162	145	185
Juniors					
2	95	112	88	90	80
2-A	44	50	58	67	61
2-OE	4	6	5	3	6
13	0	0	0	0	0
Subtotal	143	168	151	160	147
Seniors					
2	90	80	104	79	87
2-A	26	49	57	64	68
2-OE	4	6	7	3	4
13	0	0	0	0	0
Subtotal	120	135	168	146	159
5th-year students					
2	7	4	5	5	8
2-A	5	5	4	10	7
2-OE	0	0	1	0	0
13	0	0	0	0	0
Subtotal	12	9	10	15	15
Total	**446**	**460**	**491**	**466**	**506**

Graduate Enrollment, AY2009–AY2013

	AY2009	AY2010	AY2011	AY2012	AY2013
Master's	151	183	212	240	232
Doctoral	244	255	268	255	299
MEng	28	20	13	17	15
MechE	1	0	2	0	0
Eng (naval)	24	31	30	30	33
Total	**448**	**489**	**525**	**542**	**579**

Graduate Course Snapshots

2.737 Mechatronics

Mechanical engineering exists at the intersection of several science and engineering fields, so it comes as no surprise that MechE courses reflect that. The 2.737 Mechatronics course, which teaches aspects of mechanical engineering, electrical engineering, and control theory, is a great example of our cross-disciplinary curriculum. Through a series of lectures and hands-on labs, students learn elements of modeling, control, instrumentation, analog electronics, digital logic, and real-time implementation. Last year, the graduate-level course (in which approximately 20% of the students were undergraduates) was updated by professor David Trumper and lecturer/lab instructor Darya Amin-Shahidi with completely new labs and an improved curriculum. The new labs are based on a unique macroscale scanned-probe imager inspired by an atomic force microscope (AFM). The AFM imager uses a novel self-sensing, self-actuating magnetic probe designed and built by Amin-Shahidi and Trumper specifically for the course. During the term, students are asked to work on various parts of the imager, such as designing motion controllers, building analog current controllers, and programming FPGA (field programmable gate array) devices. In the final two labs, they integrate everything they've worked on throughout the course to build a working imager system. This past fall, the students displayed their work during an open house for the course.

2.739 Product Design and Development

The students in 2.739 Product Design and Development experience a much more structured approach to developing new products than they did as undergraduates in MechE as they design and develop a new product throughout the semester on a team of six to eight members. Each team consists of at least one engineering student, one MIT Sloan School of Management student, and one student from the Rhode Island School of Design (RISD), which partners with MIT for the course. The benefit of bringing together students from different backgrounds—engineering, business, and industrial design—represents the students' first real-world lesson, according to course instructor Warren Seering: learning how to value and collaborate with contributors from various disciplines as they develop a successful product together. The course brings these three groups of students together twice a week at MIT for lectures presented by both MIT and RISD professors (Sloan professor Steven Eppinger and RISD professor Matt Kressy coteach the class with Professor Seering), followed by a hands-on lab. Lab time focuses on the course's main project: developing a new product, a process that must include consumer research, design, prototyping, financials, marketing, testing, and a final presentation of the manufactured prototype.

Honors and Recognition

Faculty

Professor Harry Asada and professor George Barbastathis were recently named holders of the Singapore Research Chair.

Professor John Brisson was recently named director of the MIT-SUTD Collaboration Office.

Assistant professor Cullen Buie was selected as one of 14 young research professors to receive the 2013 DuPont Young Professor Award.

Professor Gang Chen was selected to receive the 75th Anniversary Medal of the ASME Heat Transfer Division. This award recognizes outstanding service to the heat transfer community and outstanding contributions to the field of heat transfer. He was also recently named a fellow of the American Physical Society.

Professor Martin Culpepper was recently named a fellow of the American Society of Mechanical Engineers (ASME).

Associate professor Nick Fang received the 2013 Chao and Trigger Young Manufacturing Engineer Award from the ASME Division of Manufacturing in recognition of his original and fundamental contributions to nanomanufacturing.

Assistant professor John Hart was recently named a holder of the Mitsui Career Development Chair.

Professor Anette (Peko) Hosoi was recently named a fellow of the American Physical Society.

Professor Franz Hover received the Marine Technology Society's Lockheed Martin Award in Ocean Science and Engineering. He was also presented the 2013 Ruth and Joel Spira Award for Distinguished Teaching.

Assistant professor Ken Kamrin received a National Science Foundation Career Award for his proposal titled "Predicting Granular Flows: Amorphous Continuum Modeling with a Length-Scale."

Assistant professor Sangbae Kim received a Defense Advanced Research Projects Agency (DARPA) Young Investigator Award.

Assistant professor Alexie Kolpak was recently named a holder of the Rockwell International Career Development Chair.

Professor John Lienhard and his recent PhD student Prakash Narayan, along with their team, won the Water Technology Idol of the Year Award at the 2013 Global Water Summit for their humidification-dehumidification-humidification process for cleaning water.

Professor Seth Lloyd received the Quantum Communication Award for Theoretical Research at the 11th International Conference on Quantum Communication, Measurement, and Computing for his "seminal contributions to the theories of quantum communication, metrology, computation, and control."

Professor Gareth McKinley was awarded the Bingham Medal by the Society of Rheology.

Professor Anthony Patera was named an honorary member of the Societe de Mathématiques Appliquées et Industrielles. He was also awarded a chaire d'Excellence by the Fondation Sciences Mathématiques de Paris. Most recently, he was awarded the 2013 Thomas J.R. Hughes Medal by the United States Association for Computational Mechanics for his contributions to the field of fluid mechanics.

Professor emeritus Ronald F. Probstein received the 2013 Pendray Aerospace Literature Award from the American Institute of Aeronautics and Astronautics.

Assistant professor Themis Sapsis was named the first holder of the American Bureau of Shipping Career Development Chair in Mechanical Engineering, made possible by a donation from the American Bureau of Shipping.

Professor Sanjay Sarma was named director of the recently formed MIT Office of Digital Learning.

Associate professor Yang Shao-Horn received the 2013 Research Award from the International Battery Materials Association.

Professor emeritus Nam Pyo Suh was recently awarded a doctor honoris causa degree from the Universidade Nova de Lisboa.

Professor Michael Triantafyllou was recently named chairman of the council of the National Technical University of Athens.

Associate professor Kripa Varanasi received the Society of Manufacturing Engineers' 2013 Outstanding Young Manufacturing Engineer Award. He was also selected to receive the 2013 ASME Bergles-Rohsenow Young Investigator Award in Heat Transfer. Additionally, the Varanasi research group's LiquiGlide, a nontoxic, nonstick, super-slippery coating for condiment bottles, was named one of *Time* magazine's Best Inventions of 2012.

Associate professor Evelyn Wang received the Office of Naval Research's Young Investigator Award.

Assistant professor Amos Winter was recently named the Noyce Career Development Chair.

Professor Kamal Youcef-Toumi was named a fellow of the American Society of Mechanical Engineers.

Undergraduate Students

Alfred A.H. Keil Ocean Engineering Development Award (Excellence in Broad-Based Research in Ocean Engineering): Jacqueline Sly and Grace Young

AMP Inc. Award (Outstanding Performance in Course 2.002): Sean Cockey and Steven Obiajulu

Beaverworks Award (Outstanding Contributions to Courses 2.013 and 2.014): Jean Sack

Carl G. Sontheimer Prize (Creativity and Innovation in Design): Katy Gero

Department Service Award (Outstanding Service to the Department of Mechanical Engineering): Edward Burnell, Herbert Dee, Eric Del Castillo, Fernando Nunez, and Guangtao Zhang

Ernest Cravalho Award (Outstanding Performance in Thermal Fluids Engineering): Wai Hong Chan and Guangtao Zhang

John C. and Elizabeth J. Chato Award (Excellence in Bioengineering): Jiahui Liang and Shuo Wang

Lauren Tsai Memorial Award (Academic Excellence by a Graduating Senior): Lauren Kuntz

Lockheed Martin Prize (Outstanding Sophomore in Mechanical and Systems Engineering): Sterling Watson

Louis N. Tuomala Award (Outstanding Performance in Thermal Fluids Engineering): Bruce Arensen and Jordan Mizerak

Luis de Florez Award (Outstanding Ingenuity and Creativity): Kameron Chan (first place) and Jaguar Kristeller (first place)

Park Award (Outstanding Performance in Manufacturing): Angela Chu and Sean Cockey

Peter Griffith Prize (Outstanding Experimental Project): Bethany Lemanski

Robert Bruce Wallace Academic Prize: Lucille Hosford

Society of Naval Architecture and Marine Engineering Award (Outstanding Undergraduate Student in the Marine Field): Sarah Brennan

Whitelaw Prize (Originality in Course 2.007): Brian Alvarez, David Flamholz, and Xiaoyi Ren

Wunsch Foundation Silent Hoist and Crane Award: Rebecca Colby and Kirsten Lim

Graduate Students

Abkowitz Award: Maha Haji, Matthieu Leclair, George Papadopoulos, and Anna Wargula

Clement F. Burnap Award (Outstanding Masters of Science in the Marine Field): Brian Heberley

Luis de Florez Award (Outstanding Ingenuity and Creativity): Anirban Mazumdar (first place) and Federico Parietti (first place)

Meredith Kamm Memorial Award (Excellence in a Woman Graduate Student): Ambika Goel Bajpayee and Jean Chang

Rabinowicz Tribology Award (Outstanding Graduate or Undergraduate Research in Tribology): Sanha Kim

Thomas Sheridan Prize (Creativity in Man-Machine Integration): Yashraj Narang

Wunsch Foundation Silent Hoist and Crane Award: Darya Amin-Shahidi, Cristina Botero, Bryce Campbell, Hyungryul Choi, Christopher Dimitriou, Tian Gan, Jeong-gil Kim, Tapovan Lolla, Nenad Miljkovic, Kyoo Park, Adam Paxson, Adam Wahab, and Zhenlong Zhao

2013 Phi Beta Kappa Inductees: Sara Comis, Katy Gero, Laura Gilson, and Monica Isava

Leadership Change

Department head Mary C. Boyce left the Department of Mechanical Engineering effective July 1, 2013, to become the dean of Columbia University's School of Engineering and Applied Sciences. Her five years as department head were marked by remarkable innovation and growth across all aspects of the department: people, education, research, service, community, and leadership. We have the greatest respect and appreciation for Professor Boyce as both a department head and a professor and wish her the best of luck in her new position. We look forward to the start of a new chapter for the department under new leadership.

Mary Cunningham Boyce
Department Head
Ford Professor of Engineering

Gareth H. McKinley
Associate Department Head, Research
School of Engineering Professor of Teaching Innovation

David E. Hardt
Associate Department Head, Education
Ralph E. and Eloise F. Cross Professor of Mechanical Engineering