

## Department of Electrical Engineering and Computer Science

The [Department of Electrical Engineering and Computer Science](#) (EECS) has continued to shape its role as an international leader in electrical engineering, computer engineering, and computer science through innovations in education and research. The tremendous efforts by the EECS faculty, staff, and students in developing the 2012 strategic plan have been followed by the successful implementation of several new initiatives. These initiatives will contribute to the advancement of the department's educational and research mission in the years to come.

During the past year, several members of the EECS community have been honored with major awards and recognition for research and education. Professors Shafi Goldwasser and Silvio Micali received the A.M. Turing Award for their pioneering work in the fields of cryptography and complexity theory. They are credited with “revolutionizing the science of cryptography” and developing the gold standard for enabling secure Internet transactions. Professor Tim Berners-Lee (with several colleagues) was awarded the inaugural Queen Elizabeth Prize for Engineering for inventing the World Wide Web. Tim and his colleagues were honored for “outstanding advances in engineering that have changed the world and benefited humanity.” The Queen Elizabeth Prize for Engineering is a new global engineering prize that will reward and celebrate individuals responsible for groundbreaking innovations in engineering that have been of global benefit to humanity.

The implementation of the latest initiatives described in the 2012 strategic plan is outlined below.

### SuperUROP Program

Seventy-seven juniors and seniors in EECS completed the new yearlong research program known as SuperUROP. During the spring 2012 term, EECS faculty members posted project ideas to a wide pool of EECS undergraduates (sophomores and juniors). With well over 100 projects from which to choose—in addition to the option of proposals defined by students—the selected students were accepted and supported for the inaugural year starting in fall 2012. Based on MIT's popular Undergraduate Research Opportunities Program (UROP), SuperUROP was developed and implemented to provide undergraduate students a deeper research experience as well as credit for work commensurate with graduate-level research. Over the course of two semesters, each student accepted into the program worked as a member of a research lab on campus and developed an advanced research idea. In addition, the scholars were given access to facilities (e.g., nano-fabrication) that would otherwise be open only to graduate students. SuperUROP students also participated in 6.UAR Preparation for Undergraduate Research, a course that covers subjects ranging from selection of projects and research topics in EECS to entrepreneurship and ethics in engineering.

The program is supported by the Research and Innovation Scholars Program, a named scholars program that funds students taking part in SuperUROP and provides some associated discretionary funding for the host research group. The scholars program

would not have been possible without the generous support received from corporate and individual sponsors, all of whom are committed to growing the SuperUROP program and enhancing the student experience at MIT.

Inaugural class members have enthusiastically endorsed their SuperUROP experience. One student said: “What I love about the SuperUROP program is this idea that you’re in this really special bubble, it feels like a science fair. It makes me optimistic about my future and the future of the people around me.” Another commented: “You get to meet a lot of people in different fields—from industry, graduate school, and academia. The project has given me a lot of insight into my future career choices.”

### **New Undergraduate Research Conference and Masterworks**

The Electrical Engineering and Computer Science Department also hosted a new annual research conference, EECScon, for its undergraduates, both UROP and SuperUROP students. EECScon, another initiative proposed in the 2012 EECS strategic plan, is a student-run conference specifically designed for undergraduates to present their research to a wider community of peers, faculty, and outside industry mentors. Undergraduate student organizers ran EECScon under the guidance of faculty advisor Joel Voldman. The conference was modeled after graduate-student-run conferences in the Microsystems Technology Laboratories, the Computer Science and Artificial Intelligence Laboratory, and the Laboratory for Information and Decision Systems.

Based on evaluations by a faculty panel, three top student oral presenters and four poster presenters were selected as winners. These EECScon winners were also recognized at EECS Celebrates 2013 (the annual EECS awards and recognition event). The goal of future EECScon events will be to build the attendance of both undergraduates—particularly potential UROP students—and industry members. The workshop also successfully implemented a new mentoring program designed to match undergraduate presenters with graduate student mentors.

Undergraduate research was also given a boost this year with the move of the annual EECS Masterworks to the MIT Stata Center Student Street location, leading to greater awareness of the bachelor (SM) and master of engineering (MEng) thesis work carried out in the department. Professors Tomas Palacios and Seth Teller organized Masterworks 2013 with the goal of elevating awareness and participation.

### **Undergraduate Student Advisory Group**

Fall 2012 marked the second year for the Undergraduate Student Advisory Group in EECS (USAGE). Created in 2011–2012 as part of the department’s strategic planning process, USAGE provides critical student input to the Department Leadership Group to help guide curriculum development and enhancements. One important initiative that came out of last year’s USAGE group was the new SuperUROP. The 2012–2013 USAGE group comprised more than 30 students who met regularly with department head Anantha Chandrakasan, professor Dennis Freeman (until recently EECS undergraduate officer and now dean for undergraduate education), and undergraduate administrator Anne Hunter. They also met with other members of the department leadership. The group provided input on a range of issues, including the curriculum (e.g., the

new undergraduate medical program in EECS), ways to improve response rates on course evaluations, entrepreneurship, Independent Activities Period (IAP), and the role of undergraduate students in faculty searches.

### **Rising Stars**

In fall 2012, EECS launched a program called Rising Stars to build and strengthen the academic pipeline for top recent women graduates in electrical engineering and computer science. Associate professor Polina Golland organized the new program, which evolved out of the 2012 strategic plan, in collaboration with department head Chandrakasan.

Rising Stars, held in early November, brought together nearly three dozen of the world's top young female electrical engineers and computer scientists for two days of scientific discussions and informal sessions aimed at navigating the early stages of their careers in academia. By presenting their work to each other, Rising Stars participants raised their visibility in the wide range of EECS research. The scholars became familiar with MIT and were introduced to invited high-profile women in their fields, including senior women faculty in EECS. Participants were also made aware of the possibilities for ongoing collaboration and professional support following the experience.

### **Medical Technology**

Medical technology is one of the most active and pervasive research areas in EECS. More than a third of our faculty are involved in medically or clinically related projects and the projects span the full gamut of electrical engineering and computer science concepts. For example, electromagnetics, numerics, and computer vision play a role in medical imaging research; projects focusing on wearable or implantable medical devices have involved communication, coding, circuits, and cryptography; robotics, control, and computer networking are central issues in remote surgery; and computational diagnosis leans on probability and statistics, machine learning, and computational inference.

As of last year, increasing the pool of undergraduates literate in medical technology became an EECS strategic priority and we introduced three new medically related undergraduate classes. EECS and Biological Engineering introduced a junior-level lab-based course in synthetic biology (led by professor Tim Lu and supported by the d'Arbeloff Fund for Excellence in Education); professors Alex Slocum and Charles Sodini collaborated on a joint EECS and Mechanical Engineering capstone course in medical device design; and professor Collin Stultz led a team that developed and launched 6.S02, a freshman-level medical-technology-based introduction to electrical engineering and computer science.

The 60 students who completed the spring 2013 launch of 6.S02 learned about signal processing, Fourier analysis, and machine learning by recording their personal electrocardiograms, glucose response curves, and data from their own tabletop magnetic resonance imaging (MRI) system. Student feedback confirmed that 6.S02 was a compelling introduction to the technically rich field of medical technology and highlighted opportunities for continuing the development of the course.

## Role of Course 6 in MITx/edX

MITx/edX started strong with 6.002x, a high-quality massive open online course (MOOC) produced in record time thanks to the efforts of professors Anant Agarwal, Gerry Sussman, Chris Terman, and Piotr Mitros (professor Khurram Afridi and Dr. Tania Khanna have each led reofferings of 6.002x).

The second EECS MITx/edX class, 6.00x Introduction to Computer Science, has been praised both inside and outside MIT for its focus on fundamental principles and computational thinking. For MIT students, the flexibility of 6.00x supports a diverse range of approaches to learning basic computer science. 6.00x was offered as an MITx course on edX by professors Eric Grimson and John Guttag during fall 2012 and by Dr. Larry Rudolph in spring 2013. In addition, Professors Grimson and Guttag piloted a short version of 6.00x (6.00s)—for campus use only—during IAP in 2013.

Professor John Tsitsiklis is leading the nearly complete effort to develop an MITx version of 6.041 Probabilistic Systems Analysis. 6.041x is expected to be a valuable basic reference for students in a wide range of more advanced classes. In addition, a major effort was undertaken by professor Alan Oppenheim with Dr. Tom Baran and several graduate student volunteers to use the MITx on edX platform and other online resources for the fall 2013 residential offering of the graduate subject 6.341 Discrete-Time Signal Processing.

Two additional EECS subjects made use of the MITx infrastructure. Professors Leslie Kaelbling and Tomás Lozano-Pérez developed interactive design projects and problem sets for the new 6.S064 Introduction to Machine Learning course, and professor Albert Meyer used MITx for 6.042 Discrete Mathematics.

EECS faculty also assisted in the development of MITx courses outside the department. Professor Isaac Chuang contributed to interactive electricity and magnetism simulations as a member of the team that developed the Department of Physics course 8.02x Electricity and Magnetism for MITx. These online simulations were used on campus as well, in the Concourse and Experimental Study Group sections.

## Undergraduate Program

Undergraduate enrollment in EECS averaged 1,021 during the 2012–2013 academic year, representing a 16% increase over the previous academic year. Approximately 9% of our current enrollment is in electrical science and engineering (6-1), 47% is in computer science and engineering (6-3), 38% is in electrical engineering and computer science (6-2), and 6% is in computer science and molecular biology (6-7).

The MEng program entered its 19th year with an average of 150 students.

For-credit registration in EECS classes continues to rise and is now at about 1,000 registrations per year, with total for-credit classroom registration at 8,500 in AY2011, 9,500 in AY2012, and 10,600 in AY2013. The 15 largest classes (6.00, 6.01, 6.02, 6.041, 6.042, 6.00 [2–7], 6.033, 6.034, 6.046, and 6.813) have grown as well, though less steadily, with registration at 3,200 in FY2011, 3,900 at FY2012, and 4,200 in FY2013. EECS is working

toward hiring several lecturers to maintain an appropriate student-to-instructor ratio. Finally, EECS has maintained teaching quality even as teaching loads continue to rise. For example, professor Steven Leeb won the Bose teaching award for 2013, and professor Rob Miller was selected as a MacVicar Faculty Fellow in 2013. Joe Steinmeyer, an EECS graduate student, won the Goodwin Medal for 2013.

A new common ground in mathematics is emerging between electrical engineering and computer science with respect to robotics and control (6.01, 6.003, and 6.302); networks, coding, and communication (6.02 and 6.207); computational inference and machine learning and probability (6.S080, 6.041, and 6.438); and optimization and algorithms (6.006). To support this new common ground, we are facilitating the efforts of those faculty members who are reaching across the aisle to experiment with many of the traditional course offerings. Professor Russ Tedrake led an overhaul of 6.003 (signals and systems) and refocused the course so that it involves more linear algebra, includes somewhat less signal processing material, and focuses more on control and on how to reformulate problems as canonical optimization problems. Professors Gregory Wornell, Polina Golland, and Lizhong Zheng offered a new computational inference course, 6.S080, to a small group of students and will present it again next spring. Professors Tommi Jaakkola and Regina Barzilay led a new undergraduate course in machine learning that enrolled more than 140 students, and professors Asuman Ozdaglar and Munther Dahleh again taught 6.207 Introduction to Network Science.

As the number of students enrolled in our subjects continues to increase, the need for teaching assistants (TAs) is also rising to unprecedented levels. The number of TAs that we can recruit is limited by two factors. First, the School of Engineering's budget—despite our supplementation by fellowships, MITx, other Institute funds, and departmental reserves—puts a cap on TAs. Second, the high demand for qualified graduate research assistants (RAs), with many MEng students using RAs, limits the available candidate pool. Over the years, we have hired undergraduates as TAs on an ad hoc basis. This year, we formalized an undergraduate teaching assistant (UTA) program. Unlike a regular TA, who works 20 hours per week, UTAs are limited to 10 hours a week, with a higher hourly rate than that paid to undergraduate researchers or graders. We recruited 32 UTAs to complement the 125 TAs we hired in spring 2013. The School's allocation for TAs will be increasing substantially in FY2014, which will provide additional relief for subjects with increasing enrollments.

## **Graduate Program**

The EECS graduate program offers high-quality academics with a broad range of advanced course offerings. Moreover, our graduate students make leading contributions to an extremely wide range of research activities in all areas of science: health care, energy, manufacturing, robotics, computer science, and technology. The exciting research opportunities for our graduate students continue to attract excellent applicants desiring to change the world in collaboration with their student peers and our faculty and staff supervisors.

During the 2013 admissions season, 2,790 applications were received from all parts of the world. Of those applications, 181 students originating in 27 different countries were admitted into our graduate program (approximately 6.5% of applications). This year EECS visit days occurred jointly across the department, with all of the admitted students in electrical engineering and computer science invited together to visit the campus in early March. In the fall semester, 107 applicants will join our graduate program (including joint graduate programs). Our incoming class of graduate students comprises 26% women and 14% underrepresented minorities. Fully 50% of the new students will be funded by prestigious fellowships. Of the fellowships awarded, 40% are MIT Presidential Fellowships, 25% are departmental EECS fellowships sponsored by EECS alumni, and the remainder are externally awarded fellowships. Such fellowships, while being important for financial support, also provide incoming graduate students with flexibility in selecting the appropriate research group and project to meet their interests and career goals. In 2013, all students who were admitted into our graduate program were provided financial support in the form of a fellowship, a research or teaching assistantship, or support provided by EECS.

At present, there are 635 active students in our EECS graduate student population, with 136 women (21.4% overall); 57% of these students have an international citizenship. The graduate student body is 60% electrical engineering (25% women) and 40% computer science (17% women). Our graduate student body is highly accomplished, receiving a wide assortment of fellowship awards; roughly 100 students are supported by fellowships. In addition to the fellowships awarded at the time of admission (described above), our students have received fellowships from the US government (64%), from US industry (12%), from foundations (4%), and from foreign countries (20%). Our graduate students have won a number of scholarship awards, including the prestigious Regeneron Prize, as well as five Siebel scholarships, the Simons Foundation Award, and three Dimitris N. Chorafas Foundation awards.

In AY2013, EECS graduated students in September, February, and June. Total numbers of advanced degrees awarded were as follows: 110 master of engineering degrees, 102 master of science degrees, 73 doctor of philosophy degrees, and one electrical engineering degree. EECS awarded joint master of science degrees with the Technology and Policy Program (one degree), the Leaders for Global Operations program (two degrees), and Health Sciences and Technology (two degrees). In addition, a joint doctor of philosophy degree and a joint master of science degree were awarded with the Woods Hole Oceanographic Institution. In summary 286 students obtained an advanced degree from EECS in 2013.

Along with a graduate student body that is diverse in nationality, EECS strives to achieve a graduate student community diverse in gender, ethnicity, and race. The population of admitted graduate women and underrepresented minority students increases each year. To make inroads in supporting the diversity of applicants, the graduate office staff and faculty regularly participate in MIT's Institute-wide recruiting efforts. In addition to supporting the MIT Summer Research Program, EECS supports the GEM (National Consortium for Graduate Degrees for Minorities in Engineering and Science) GRAD (Getting Ready for Advanced Degrees) Lab. Also, CONVERGE

returned in the fall semester with participation by EECS. Once applicants become part of the EECS community, networking and mentoring seminars are offered each fall (with reunions in the spring) for women as well as for individuals who may find benefit from weekly group meetings and discussions. Four different networking seminars are currently offered for various groups of incoming graduate students.

### **New Area Structure**

Areas in EECS are intended to administer several functions, including graduate admissions; tracking of PhD students in terms of qualification, SM thesis, and PhD proposal and defense; implementation of the set of requirements for SM and PhD students with respect to course work, qualification, and thesis; graduate curricular development; and building a sense of community among faculty in comparable research disciplines through frequent lunches and other events. It is evident, however, that much of the qualification and tracking of students is administered by the graduate office, with the different areas doing very little in terms of coordinating curricular development. By properly assigning these tasks, we felt that a simplified structure could perform as well, but with the advantage of removing artificial barriers imposed by the different areas. The proposed structure will have two areas. The first will be electrical engineering (or Area I), which currently comprises information systems (control, communication, signal processing, optimization), circuits, applied physics, and biomedical sciences and engineering. The second area will be computer science (or Area II), which currently comprises artificial intelligence, theoretical computer science, and computer systems and architecture. Each area will have one area chair and one admission chair, both reporting to the graduate officer. Each area can have as many organically assembled subgroups as desired, based on common interests and research. These subgroups are important in coordinating the graduate admission process.

The responsibilities of the area chair include membership on the committee on graduate students, assisting in tracking students' progress, helping students with issues and conflicts, reviewing and evaluating student petitions, and assigning faculty to doctoral research qualifying exams (RQEs). The area chair will also serve on the education and curriculum committee and take responsibility for directing curricular development. The responsibilities of the admission chair include coordinating the number of admits for the subgroups, coordinating guaranteed support, developing a list (ranked for subgroups) of candidates for fellowships, and serving on the fellowship committee. The responsibilities of the graduate officer include chairing the committee on graduate students, managing the graduate office, managing the admission and area chairs, and heading the fellowship committee.

As always, faculty can designate themselves to be electrical engineering, computer science, or electrical engineering and computer science faculty. If they select electrical engineering and computer science, they may be asked to serve on RQE committees for both electrical engineering and computer science students, teach courses related to their expertise on both sides, and supervise students on both sides. The department will also allow for a primary and secondary designation.

## Undergraduate Teaching Laboratories

The EECS undergraduate teaching laboratories serve as a pedagogical and physical focus where students across the Institute and beyond hone their craft as engineers and scientists. During the past year, the department laboratories supported existing programs and initiated new activities to bring hands-on “mind and hand” experiences to students in and of the 21st century. The laboratories sustain and nurture a culture of builders in the MIT tradition, where no project is begun without thorough analysis and where no design is complete without physical demonstration as proof.

## Engineering Design Studio

We have initiated the creation of a new prototyping studio for use by students in the EECS laboratories. With a grant from Cypress Semiconductor Corporation, we are designing and initiating construction of the Engineering Design Studio (EDS), a facility that will enable rapid prototyping and flexible manufacturing. The facility will expose students to the possibilities inherent in state-of-the-art product manufacturing technology and will support new exercises and activities in not only the department laboratories but also the EECS core undergraduate courses and Institute-wide activities such as freshman seminars.

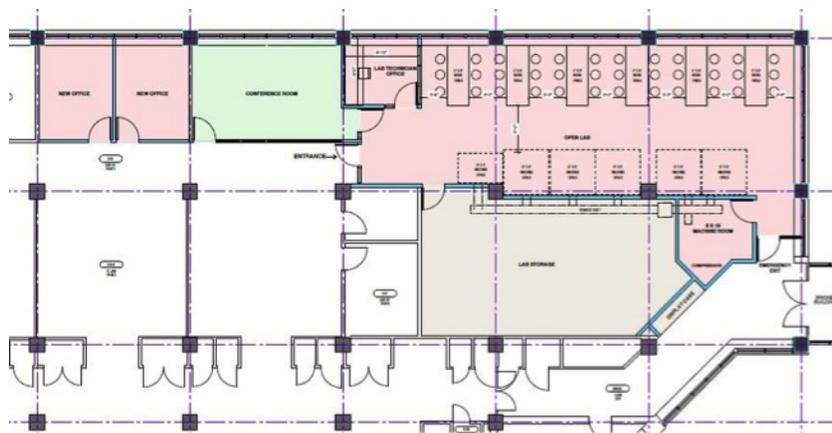


Figure 1. Engineering Design Studio in Building 38-500.

The most current architectural plan for EDS in the Building 38-500 space is shown in Figure 1, with renovations appearing in the shaded areas. This renovation planning is in progress and we expect to complete construction during the 2013 calendar year.

The department has developed and introduced a new introductory undergraduate course (6.S02) focused on medical applications of electrical engineering and computer science. This new course makes extensive use of the department’s teaching laboratories and has introduced learning modules based on hands-on activities with medical electronics technology, including activities that allow students to experiment with electrocardiogram circuits, systems for measuring blood glucose, and an amazing portable MRI system for imaging the inside of targets such as a human finger.

Over the past year, the department's teaching laboratories have supported a wide range of EECS core and laboratory subjects that offer hands-on experience and education in a substantial range of topic areas, including but not limited to energy conversion (6.007, 6.131, 6.A47, 6.A48), digital design (6.111, 6.004), embedded control (6.115), power electronics (6.131), silicon microfabrication (6.152J), analog design (6.101, 6.301, 6.302, 6.331), wireless communication (6.02, 6.102), optics and lasers (6.007, 6.161), bioelectrical engineering (6.123J), and robotics, motion, and task planning (6.01, 6.141, 6.142).



*Figure 2. Tabletop magnetic resonance imager developed for use in 6.S02 during the 2013 spring term.*



*Figure 3. Examples of the many uses of the department's teaching laboratories in AY2013.*

Students from the Sloan School of Management and from various departments (e.g., Mechanical Engineering, Aeronautics and Astronautics, Physics, Mathematics, and Earth, Atmospheric, and Planetary Sciences) benefit by working in the EECS department laboratories. The department laboratory subjects also provide training and equipment that support projects in laboratory classes in other departments. For example, activities from EECS laboratory subjects have become the centerpiece for the degree-requirement course 2.670 Mechanical Engineering Tools. These activities have also provided demonstrations for General Institute Requirement subjects such as 18.03 Differential Equations, facilities for freshman seminars, and activities for outreach programs with international extent, including the Women's Technology Program, the Center for Materials Science and Engineering educational outreach program, the Cambridge Science Festival, Campus Preview Weekend, and innumerable outreach activities for local K–12 schools, teacher organizations, and organizations such as the Boy Scouts and Girl Scouts.

The department's teaching laboratories continue to be a focal point for student competitions and interactions with industry and alumni. For example, the laboratories host the highly popular 6.270 robot competition over IAP. This competition exposes students, primarily freshmen, to robotic design, including the hardware, software, and information needed to design, build, and debug a working robot. The laboratories also host design competitions from visiting industry sponsors such as the Bose Corporation and Cypress Semiconductor, allowing students the chance to connect with "real-world" activities involving practicing engineers and alumni.

### **6-A Master of Engineering Thesis Program**

The department's 6-A Master of Engineering Thesis Program is in its 96th year. The 6-A International Internship Program is in its eighth year, with one MEng student in Beijing at Microsoft Research Asia. Thirty-six students applied to 6-A for summer 2013 positions at 10 participating companies. Fifteen students were selected as members of the incoming 6-A class. Currently, there are 14 undergraduates and 17 MEng students in the program. The program provides leading-edge technology thesis opportunities with a full calendar year of tuition support for all 6-A MEng students who are company funded by the 6-A Fellowship Program. Three students withdrew from the program during the past year, either believing that their needs were better matched with the opportunities available on campus or deciding to pursue full-time employment. However, most 6-A students continue to find the program professionally rewarding. Participating companies continue to offer challenging and well-mentored assignments. We hope that the improved thesis opportunities and funding will result in an increase in EECS student applicants to the program.

The J. Francis Reintjes Excellence in 6-A Industrial Practice Award was presented at EECS Celebrates, the spring awards ceremony, in May 2013 to two outstanding 6-A students: Joseph Colosimo (MIT Lincoln Laboratory) and Shijie (Kevin) Zheng (Analog Devices, Wilmington, MA).

There have been numerous inquiries from companies interested in the 6-A program, and we hope that we can obtain new members in the near future and increase the number of program applicants, positions, and participants.

### **International Activities**

The department is actively engaged in developing opportunities for global experiences for our students and faculty. Ongoing activities include a large number of EECS students participating in the MIT International Science and Technology Initiatives (MISTI) program, to which our department contributes support. This year 113 EECS students engaged in summer MISTI internships, up from an average of 90 in previous years. Many of these internships are with corporate research and development labs and government research labs, allowing our students to put their education into practice globally.

EECS is playing a key role in the MIT collaboration to create a new graduate university, Skoltech, outside of Moscow, Russia. Three of the five educational themes—information technology (both hardware and software), biomedical technology, and energy technology—intersect with EECS. Our faculty members are working hard to define

and pilot the new Skoltech master's degree programs and classes, including machine learning (professors Barzilay and Jaakkola) and computational methods (Professor Goldwasser and professors Jacob White and Luca Daniel). In addition, EECS faculty are leading MIT Skoltech activities related to faculty searches (professor Bruce Tidor) and postdoctoral programs (professor Marc Baldo). Multi-faculty research collaborations have been formed by EECS faculty with Skoltech and Russian faculty in a number of strategic research development projects, including power systems, machine learning, numerical methods, and electronic materials and devices.

We have pioneered a program to enable faculty from international institutions, initially in China and Hong Kong, to spend time in our department observing our teaching methods and interacting with our faculty and students to learn best practices for effective education delivery. We have added research interaction to these educational activities, giving the visitors a first-hand view of EECS education through research. Under the MIT and Masdar Institute (MI) cooperative program, several MI faculty have completed a year being hosted at MIT and will engage in continuing research collaborations. Outstanding MI faculty hosted in EECS have included professor Jerald Yoo, whose collaboration culminated in the recent publication of research on novel biomedical circuits at the premier Institute of Electrical and Electronics Engineers (IEEE) conference on solid state circuits, and professor Abe Elfael, who leads the microsystems master's degree program at MI.

### **Women's Technology Program**

2013 marks the 12th summer of the Women's Technology Program (WTP), which was founded in EECS in 2002. The WTP mission is to encourage high school girls with demonstrated math and science talent to pursue engineering and computer science by introducing them to these subjects in a hands-on, team-based format. WTP runs each year from the last week in June through the third week in July.

WTP added a second curriculum track in mechanical engineering (ME) in 2006. Although the two curriculum tracks have separate classes, staffing, and budgets, they operate as one interdepartmental program. WTP director Cynthia Skier SB '74, SM '81 (who sits in EECS), manages many administrative operations shared by the WTP-EECS and WTP-ME tracks, such as admissions, housing, dining, and a guest speaker series attended by all of the students.

For summer 2013, 60 students (40 for WTP-EECS and 20 for WTP-ME) were selected from an applicant pool of 290 female 11th-grade high school students from across the country. The WTP high school students are all top math and science performers who are not yet committed to pursuing engineering or computer science; they will all be applying to colleges in fall 2013. WTP gives them an opportunity to learn more about their aptitude for engineering, shows them some of the exciting research being done here at MIT, and allows them to explore the MIT community. The WTP-EECS students take hands-on lab-based, college-level classes introducing them to electrical engineering, computer science, and discrete mathematics, all designed and taught by a dedicated staff of MIT graduate and undergraduate women students. This also provides a unique professional development experience for the MIT women students, encouraging them to pursue academic careers.

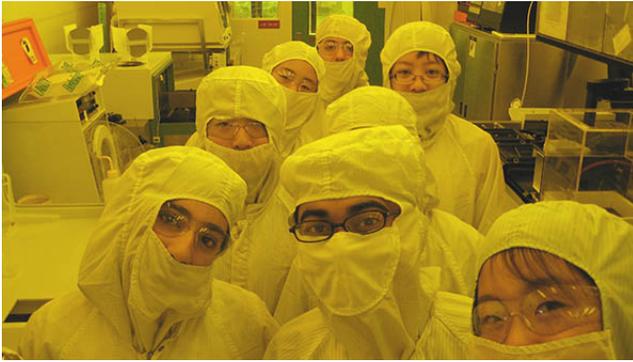


Figure 4. WTP-EECS students pose during a tour of the MTL clean lab in July 2013.

The entrance and exit surveys we administer to the WTP-EECS students demonstrate dramatic increases in their interest in further study of engineering and computer science and in their confidence at succeeding in these fields. Over 90% indicate that their attitudes and perceptions of electrical engineering and computer science were more positive after attending WTP. We also track alumnae long term, and they offer testimony to the lasting impact of WTP-EECS on their college pursuits and careers. Since 2002, more than 65% of the WTP-EECS alumnae have majored in a field of engineering or computer science (with another 20% in science or math).

Although it is not a stated goal, the WTP-EECS students also develop an interest in MIT. Of the 426 WTP-EECS alumnae since 2002, 184 (over 43%) have chosen to attend MIT; of this year's 40 summer students, 19 will enter as MIT freshmen in the fall. WTP-EECS alumnae often pursue UROP or MEng thesis projects with MIT faculty who were WTP guest speakers in the summer they attended WTP. They also return to WTP to work on the staff; this summer, five of the 12 WTP-EECS staff and two of the WTP-ME staff are alumnae who attended WTP-EECS when they were in high school. WTP alumnae at MIT as well as other colleges stay involved with mentoring programs and other STEM (science, technology, engineering, and mathematics) activities that encourage younger women to pursue engineering and computer science.

## Faculty Notes

Faculty promotions:

Associate professor without tenure:  
Konstantinos Daskalakis, Nickolai Zeldovich

Associate professor with tenure:  
Tomás Palacios, Devavrat Shah, Russell Tedrake, Mehmet Fatih Yanik

Full professor:  
Marc Baldo, Frédéric Durand, Samuel Madden, Asuman Ozdaglar

Faculty on sabbatical leave:

Elfar Adalsteinsson    Fall 2012/spring 2013

Dimitri Bertsekas     Spring 2013

Vincent Chan            Fall 2012/spring 2013

Polina Golland	Spring 2013
James Kirtley	Fall 2012
Leslie Kolodziejski	Fall 2012
Nancy Lynch	Fall 2012/spring 2013
Terry Orlando	Fall 2012
Asuman Ozdaglar	Fall 2012
Devavrat Shah	Spring 2013
Peter Szolovits	Fall 2012/spring 2013
Russell Tedrake	Spring 2013
John Wyatt	Fall 2012/spring 2013

Faculty on junior research leave:

Nickolai Zeldovich	Fall 2013
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Faculty on family release:

Polina Golland	Fall 2012
Jongyoon Han	Fall 2012
Manolis Kellis	Spring 2013
Samuel Madden	Fall 2012
Dana Moshkovitz	Spring 2013
Joel Voldman	Spring 2013

Faculty on leave:

Akintunde Akinwande  
(leave with pay, Intergovernmental Personnel Act)  
Fall 2012

David Perreault (leave with pay, 20%)  
Fall 2012/spring 2013

Charles Sodini (leave with pay, 22%)  
Spring 2013

Retired faculty:

Clifton G. Fonstad Jr.

John G. Kassakian

### New Faculty

Dirk Englund joined MIT on January 16, 2013, as an assistant professor of electrical engineering and computer science. He received his BS in physics from the California Institute of Technology and an MS in electrical engineering and PhD in applied physics

from Stanford University in 2008. His postdoctoral work at Harvard University focused on experimental and theoretical quantum optics. He was an assistant professor of electrical engineering and applied physics at Columbia University from 2010 to 2013. His research leverages semiconductor technology to develop quantum technologies for information processing and precision measurements. He has published more than 30 journal articles and several book chapters. Recent recognitions include the 2012 Defense Advanced Research Projects Agency Young Faculty Award, the 2012 IBM Faculty Award, the 2011 Presidential Early Career Award for Scientists and Engineers, and the 2011 Sloan Research Fellowship in Physics.

Daniel Sanchez joined MIT on September 1, 2012, as an assistant professor of electrical engineering and computer science, and a member of the Computer Science and Artificial Intelligence Laboratory (CSAIL). He received his BSc in electrical and computer engineering from the Technical University of Madrid, Spain, and an MS in electrical engineering and a PhD from Stanford University in 2012. His research interests are computer architecture and computer systems with an emphasis on large-scale heterogeneous multicores, scalable and efficient memory hierarchies, architectures with quality-of-service guarantees, scalable dynamic fine-grained runtimes and schedulers, and hardware support for scheduling.

The department hosted three visiting faculty this year: associate professor Khurram Afridi, associate professor Benton Calhoun, and associate professor Lawrence Wald.

## **Faculty Appointments**

### ***Career Development Chair Appointments***

Adam Chlipala was selected as the Douglas Ross (1954) career development professor of software.

Yury Polyanskiy was appointed the Robert J. Shillman (1974) career development professor of electrical engineering and computer science.

Dirk Englund was selected as the Jamieson career development professor.

Daniel Sanchez was selected as the TIBCO Founders career development professor.

### ***Faculty Chair Appointments***

Professor Srinivas Devadas was named the Edwin Sibley Webster professor of electrical engineering and computer science.

Professor James Fujimoto was selected as the Elihu Thomson professor in electrical engineering.

Professor Vladimir Bulović was awarded the Fariborz Maseeh Professorship in Emerging Technology.

Professor Gregory Wornell was awarded the Sumitomo Electric Industries Professorship of Engineering.

## Faculty Awards and Honors

Professor Dana Weinstein was selected for the Intel Early Career Award.

Professor Jesus del Alamo was honored with the Semiconductor Research Corporation 2012 Technical Excellence Award in recognition of his fabrication of nanometer-scale transistors with world-record high-frequency operation, as well as his investigation of the use of III-V compound semiconductors to enable a new generation of deeply scaled transistors for future digital applications. Professor del Alamo also received the 2012 Electron Devices Society Education Award. He was cited “for pioneering contributions to the development of online laboratories for microelectronics education on a worldwide scale.”

Professor James Fujimoto was co-recipient of the 2012 Antonio Champalimaud Vision Award for the creation and development of optical coherence tomography. In addition, Professor Fujimoto received the SPIE Britton Chance Biomedical Optics Award and was selected for the 2014 IEEE Photonics Award.

Cited for his work in developing the RSA algorithm, a method for public-key cryptography, professor Ronald Rivest was named to the National Cyber Security Hall of Fame on October 17, 2012.

Victor Zue, the Delta Electronics professor of electrical engineering and computer science at MIT and CSAIL director of international relations, was named the 2012 recipient of the Okawa Prize. He was honored for his “pioneering and outstanding contributions to speech science and conversational spoken-language systems.”

Jack Dennis, a principal investigator at CSAIL and a professor emeritus in EECS, was named the recipient of the 2013 IEEE John von Neumann Medal. He was honored “for fundamental abstractions to implement protection in operating systems and for the dataflow programming paradigm.”

The Institute of Electrical and Electronics Engineers elected EECS professors Rodney Brooks and David Perreault to IEEE Fellow status.

Research scientists David Clark and Karen Sollins were selected as recipients of the Association for Computing Machinery (ACM) Test of Time Award for their 2002 ACM SIGCOMM conference paper “Tussle in Cyberspace: Defining Tomorrow’s Internet.”

Professor Anant Agarwal was named a member of the National Academy of Engineering. Professor Agarwal and professor Andrew Lo were elected to the American Academy of Arts and Sciences.

Professor Barbara Liskov was selected as the National Academy of Inventors’ 2012 Charter Fellow.

Professor Anantha Chandrakasan received the 2013 IEEE Donald O. Pederson Award and was honored at the 60th IEEE International Solid-State Circuits Conference, for which he has been conference chair since 2010.

Professor Erik Demaine was honored with the European Association for Theoretical Computer Science Presburger Award for young scientists.

Professors Shafi Goldwasser and Silvio Micali were selected as the 2012 winners of the ACM Turing Award for their pioneering work in the fields of cryptography and complexity theory. Their work in cryptography—developing new mechanisms for how information is encrypted and secured—is widely applicable today in communications protocols, Internet transactions, and cloud computing.

Professor Tim Berners-Lee was one of the winners of the inaugural Queen Elizabeth Prize for Engineering for his work to invent the World Wide Web.

Professor Rob Miller was selected as 2013 MIT MacVicar Faculty Fellow for his outstanding undergraduate teaching, mentoring, and educational innovation.

Professor Peter Szolovits was honored with the American College of Medical Informatics' Collen Award of Excellence in biomedical informatics.

Professor Timothy K. Lu was selected as a recipient of the 2013 Office of Naval Research Young Investigator Award.

Professor Saman Amarasinghe was named the winner of the Most Influential Paper Award at the 2013 IEEE/ACM International Symposium on Code Generation and Optimization.

Professor Piotr Indyk was selected by ACM as one of the 2013 recipients of the Paris Kanellakis Theory and Practice Award. He was also selected by the Simons Foundation as a Simons Investigator.

Professor Dina Katabi was named one of the recipients of the 2013 ACM Grace Murray Hopper Award.

On the occasion of its 50th anniversary, the Design Automation Conference (DAC) recognized professor Srinivas Devasadas with several awards for being among DAC's top 10 cited authors. He won the DAC Best-Paper Hat Trick Award for winning the DAC best paper award three times, the most in DAC's 50-year history.

Professor Jacob White was also honored at the DAC 50th-anniversary event with the ACM/IEEE A. Richard Newton Technical Impact Award in Electronic Design Automation for his "seminal work on fast integral equation solvers for integrated circuit parasitic extraction."

Professor Daniela Rus was appointed by the Computing Research Association, in consultation with the National Science Foundation, as one of five new members of the Computing Community Consortium Council.

## Teaching and Service Awards

The following faculty and staff received awards at the annual EECS spring awards ceremony held in May.

Professors Polina Golland and Gregory W. Wornell were winners of the 2013 Jamieson Prize for excellence in teaching.

Professor Victor Zue was presented the Best Instructor Award by Eta Kappa Nu.

Professor Nickolai Zeldovich received the Ruth and Joel Spira Award for distinguished teaching.

Professor Dana Moshkovitz won the Jerome Saltzer Award for outstanding recitation teaching in undergraduate core subjects.

Professor Dennis Freeman was presented the Best Advisor Award by MIT's IEEE/ACM student group.

Professor Muriel Medard received the Graduate Student Association Graduate Counselor Award.

Professor Hae-Seung Lee received the department's Smullin Award.

Professor Alan Oppenheim was honored with the 2013 Capers and Marion McDonald Award for Excellence in Mentoring and Advising.

Alicia Duarte and Britton Bradley were presented the Richard J. Caloggero Award for dedicated service to the department.

Dorothy Curtis, Albert Carter, and Jessica Kraus received the Department Head Special Recognition Award.

## Student Awards

The following awards were presented to EECS students at the May spring awards ceremony.

Carlton E. Tucker Teaching Award: Katrina M. Panovich

Harold L. Hazen Teaching Award: David A. Benjamin

Frederick C. Hennie III Teaching Awards: George Chen and Ramesh Sridharan

Departmental Teaching Award (honorable mention): Vahid Montazerhodjat, Raluca Ada Popa, and Sefa Demirtas

Undergraduate Teaching Awards: Nikole P. Castle and Lars Johnson

Robert A. Fano UROP Award for Outstanding UROP in EECS: Kawin Surakitbovorn and Weihua Li

J.C.R. Licklider UROP Prize for Outstanding UROP in Networking or Human-Computer Interaction: Joseph F. Rafidi

Anna Pogosyants UROP Prize: Hayden Metsky

Morais (1986) and Rosenblum (1986) UROP Award: Akashnil Dutta and Pasin Manurangsi

2013 SuperUROP Outstanding Presentation Award: Rui Jin and Arun K. Saigal

2013 SuperUROP Outstanding Research Award: Anne E. Holladay, Avanti Shrikumar and Bonny Jain

Northern Telecom/BNR Project Award for Outstanding 6.111 Laboratory Project: Luis Fernandez and Rishi Naidu for their project "Virtual Drum Set"

George C. Newton UG Lab Prize: Rishi Patel, Pranav R. Kaundinya, and Akashnil Dutta for their project "Spatio-Temporal Video Amplification"

David A. Chanen Writing Award for the best paper in the subject 6.033: Victoria Sun

Charles & Jennifer Johnson CS MEng Thesis Prize:

First place: Timothy Kaler for "Chromatic Scheduling of Data-Graph Computations"

Second place: Owen Derby for "FlexGP: A Scalable System for Factored Learning on the Cloud"

David Adler Memorial EE MEng Thesis Prize:

First place: Shijie (Kevin) Zheng for "A Low Cost Asynchronous Eye Diagram Reconstruction System for High Speed Links"

Second place: Jonathan Mei for "Algorithm for 3D Time-of-Flight Imaging"

Morris Joseph Levin Award for Best Master Works Thesis Presentation:

Farnaz Niroui for "Electromechanical Modulation of Electrical Conduction through Organic Thin Films for Switching Applications"

Peter A. Iannucci for "Towards Rateless Wireless Networks"

J. Francis Reintjes Excellence in 6-A Industrial Practice Award:

Joseph Colosimo, Lincoln Laboratory

Shijie "Kevin" Zheng, Analog Devices

Inaugural Paul L. Penfield Student Service Award: John Sun

EECScon Oral Presentation Awards: Pratheek Nagaraj, Gustavo Goretkin, and Duanni Huang

EECScon Poster Presentation Awards: Joseph F. Rafidi, Ryan Fish, Edwin Ng, and Caelan Garrett

**Anantha P. Chandrakasan**

**Department Head**

**Joseph F. and Nancy P. Keithley Professor of Electrical Engineering**