Stanford | ENGINEERING
Electrical Engineering

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Dear Electrical Engineering Alumni and Friends,

This past academic year was another very successful one for the department. We made great progress toward implementing the vision of our strategic plan (EE in the 21st Century, or EE21 for short), which I outlined in my letter to you last year. I am also proud to share some of the exciting research in the department and the significant recognitions our faculty have received.

I will first briefly describe the progress we have made toward implementing our EE21 plan.

Faculty hiring. The top priority in our strategic plan is hiring faculty with complementary vision and expertise and who enhance our faculty diversity. This past academic year, we conducted a junior faculty broad area search and participated in a School of Engineering wide search in the area of robotics. I am happy to report that Mary Wootters joined our faculty in September as an assistant professor jointly with Computer Science. Mary's research focuses on applying probability to coding theory, signal processing, and randomized algorithms. She also explores quantum information theory and complexity theory. Mary was previously an NSF postdoctoral fellow in the CS department at Carnegie Mellon University. The robotics search yielded two top candidates. I will report on the final results of this search in my next year's letter.

Reinventing the undergraduate curriculum. We continue to innovate our undergraduate curriculum, introducing two new, exciting project-oriented courses: *EE107: Embedded Networked Systems* and *EE267: Virtual Reality*. These courses have been very well received by the students and will become part of our standard curriculum.

Shared laboratory facilities. A key ingredient of the EE21 plan is the creation of new types of devices and systems to address the needs of the Internet of Things and to address major societal challenges in areas such as healthcare, energy, and the environment. With support from the School of Engineering, EE, and the faculty, we will soon be opening two new university-wide shared facilities in the Paul G. Allen Building:

- **Experimental Fabrication Facility Lab (ExFab).** This facility will provide a toolset for heterogeneous materials processing for emerging applications such as stretchable electronics, microbatteries, and 3D integration. It will be possible to prototype a wide variety of materials, from organic molecules and nanostructures to polymer and metal thin films, to semiconductors, including the integration of electronic and optoelectronic chips with other materials.
- **System Prototyping Facility (SPF).** This facility will serve as a machine shop for prototyping complex electronic systems. Students will have access to design and prototype complete systems comprising integrated circuits, printed circuit boards, and software.

In addition, we have also started an **embedded systems maker lab** (Lab64) in the Packard Electrical Engineering Building for student independent projects and inventions.

Developing architectural plans. Another key ingredient of the EE21 plan is to create modern spaces to foster collaborations within EE and other Stanford departments. Toward this goal, we have developed architectural plans to renovate and modernize instructional labs and student spaces in Packard. The schedule for the renovation has not yet been determined.

In addition to these exciting developments that collectively aim to realize the EE21 vision, I would like to highlight the following developments

- We have continued to improve our **graduate student admissions** process by increasing the number of faculty who review each application and introducing Skype interviews for the finalists to determine both the final list of admitted students and to recruit top students. These changes have had a very positive impact on the admissions yield, which was the highest ever, and on establishing closer connections between the prospective students and the faculty.
- Our website now has an **In Memoriam** page, acknowledging the faculty who are gone but not forgotten. We have also updated the **Timeline of Stanford EE History** with several new additions, including photos from the Stanford University Archives. We continue to provide the latest EE news and event information on our homepage (see ee.stanford.edu). Visit us soon!

Research Highlights

Research by Subhasish Mitra and H.-S. Philip Wong explores carbon nanotubes and their potential for boosting computing performance and capability. In a video produced by the National Science Foundation's online magazine, *Science Nation*, Subhasish and Philip describe the state of CNT research. (July 2016)

Audrey Bowden's research team designed a new urinalysis test. The new low-cost, portable device would allow patients to get consistently accurate urine test results at home, easing the workload on primary care physicians and labs. (May 2016)

Jelena Vuckovic leads research to grow optical materials from nanodiamonds. Nanodiamonds have potential for applications in energy, electronics, and molecular imaging. (May 2016)

Shanhui Fan, Jim Harris, and Mark Brongersma (Materials Science and Engineering) were awarded GCEP funding for energy research. The goal of their interdisciplinary project is to develop a high-efficiency solar device that converts waste heat into usable infrared light for the production of clean electricity. (February 2016)

Collaborative efforts of Christos Kozyrakis, Subhasish Mitra, Kunle Olukotun, Eric Pop, and H.-S. Philip Wong are creating a faster and more efficient computing architecture, described as N3XT, Nano-Engineered Computing Systems Technology. (December 2015)

Amin Arbabian and Butrus Khuri-Yakub expand their research to include technology that could potentially provide a new way to detect early stage cancers. This idea stems from research designed to detect buried plastic explosives. (November 2015)

Eric Pop and H.-S. Philip Wong describe advances in memory and data storage using graphene. Their research shows graphene's unique electrical, thermal, and atomically thin properties can be utilized to create more energy-efficient data storage. (October 2015)

Shanhui Fan and team applied their work to improve solar array performance. Their findings could improve absolute cell efficiency by over 1 percent; a significant gain in energy production. (September 2015)

Faculty Awards, Honors & Recognitions

Amin Arbabian received the Tau Beta Pi Undergrad Teaching Award

Dan Boneh was elected to the National Academy of Engineering, "for contributions to the theory and practice of cryptography and computer security."

Stephen P. Boyd received the 2016 Gores Teaching Award, Stanford's highest teaching honor. Stephen was also elevated to SIAM Fellow, "for fundamental contributions to the development, teaching, and practice of optimization in engineering."

Bill Dally received the Information Processing Society of Japan (IPSJ) Lifetime Funai Achievement Award. The award recognizes his accomplishments in computer architecture, particularly in the areas of parallel computing and Very Large Scale Integration processing.

Abbas El Gamal received the 2016 IEEE Richard W. Hamming Medal "for contributions to network multi-user information theory and for wide-ranging impact on programmable circuit architectures."

Jonathan Fan was awarded the 2016 Alfred P. Sloan Research Fellowship, acknowledging him as a distinguished member of the next generation of scientific leaders.

Patrick Hanrahan and Dawson Engler were inducted into Stanford's Invention Hall of Fame. Pat's Polaris is a data visualization technology that makes it easier for people to make decisions based on facts and data. Dawson helped invent a tool to find bugs in large software systems—preventing issues such as crashes, instability, and security vulnerabilities.

Professor Emeritus Martin Hellman and Whitfield Diffie received the 2015 ACM A.M. Turing Award (considered the Nobel Prize for computer science) for critical contributions to modern cryptography.

Butrus Khuri-Yakub was inducted into the College of Fellows, American Institute for Medical and Biological Engineering (AIMBE) for outstanding contributions to ultrasound imaging systems and devices, and particularly for pioneering work in the development of capacitive micromachined ultrasound transducers (CMUTS).

Christos Kozyrakis won the 2015 Maurice Wilkes Award, presented "for outstanding contributions to transactional memory technologies."

Nick McKeown was part of the group awarded the NEC C&C Award for SDN and OpenFlow Originators. Their citation reads, "For pioneering research in advancing networking technology and outstanding contributions promoting the development of software-defined networking."

Subhasish Mitra received the Semiconductor Research Corporation (SRC) Technical Excellence Award for his research related to Quick Error Detection (QED) technology that overcomes post-silicon validation and debug challenges.

Andrea Montanari was awarded the IEEE Information Theory Society James L. Massey Research and Teaching Award for Young Scholars. The award recognizes outstanding achievement in research and teaching by young scholars in the Information Theory community.

Professor Emeritus Calvin Quate won the 2016 Kavli Nanoscience Prize, for the invention of the atomic force microscope (AFM).

David Tse was announced as the 2017 Claude E. Shannon Award recipient. This is the highest honor from the IEEE Information Theory Society. The award recognizes consistent and profound contributions to the field of information theory.

Benjamin Van Roy was elected a Fellow of INFORMS. His citation reads, "For contributions to decision making in stochastic systems and approximate dynamic programming."

Jelena Vuckovic was elected a Fellow of the Optical Society of America (OSA). Her citation reads, "For field opening contributions to the science and engineering of photonic crystals, and in particular, for the use of 2D microcavities for the Purcell-like enhancement of the spontaneous emission rate of embedded quantum dots." She was also elected a Fellow of the American Physical Society for exceptional contributions to the physics enterprise.

Gordon Wetzstein was awarded a National Science Foundation (NSF) Faculty Early Career Development Award (CAREER) for research titled "Optimizing Computational Range and Velocity Imaging."

Howard Zebker was elected a Fellow of the American Geophysical Union (AGU). This special honor recognizes scientific eminence in the Earth and space sciences, and acknowledges Fellows for their remarkable contributions to their research fields, exceptional knowledge, and visionary leadership.

So much to be proud of, and yet there's much left to do. As EE alumni, you all are part of our storied success—past, present, and future. I'd love to hear your thoughts on our current efforts by emailing me at **chair@ee.stanford.edu**. Your ideas and support are essential to everything we do.

On behalf of my colleagues, thank you for being an integral member of the EE community. We're very excited about what's to come in 2016–17!

Best regards,

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