Dear Electrical Engineering Alumni and Friends,

As you may already know, I will be stepping down as chair at the end of December and Stephen Boyd will take over as chair starting January 1, 2018. The department will be in very good hands under Stephen’s leadership. He is one of the most accomplished faculty in Stanford. His work has revolutionized the way mathematical optimization is taught and applied in engineering and the applied sciences. His courses, books, articles, lectures, and open source software have shaped the content and style of optimization courses in engineering throughout the world, educating a world-wide audience of students, researchers, and practicing engineers on contemporary advances in optimization and their applications. For his contributions, Stephen has won many prestigious awards and honors, most recently the IEEE Mulligan Education Medal and the Walter Gores Award, Stanford’s highest award for excellence in teaching.

In the remainder of this letter, I will briefly highlight the progress we have made this past year toward implementing our EE21 plan. I will also share some of the exciting research by our faculty and the honors and recognitions awarded to our faculty, students, and staff. Finally, I will look back at what we have been able to accomplish and the challenges we have faced during my five years as chair.

First, I will briefly describe the progress we have made this year.

**Faculty hiring.** We continue to advance our top priority of hiring faculty with the vision and expertise that complements our department and faculty. I am very happy to report that this fall, Dorsa Sadigh will join us as an assistant professor joint with CS. Dorsa’s research is on autonomous systems. Her PhD research at Berkeley has explored the interactions between autonomous and human driven vehicles. In fall 2018, we will welcome another rising star, Priyanka Raina. Priyanka’s expertise lies in low power digital system design. This is an area of great need in the department as system architecture becomes more application driven and low power VLSI is needed for many embedded system implementations. We look forward to Dorsa and Priyanka joining our faculty, and contributing to our EE21 goals.

**Energizing our undergraduate curriculum.** ‘EE42: Introduction to Electromagnetics and Its Applications’ welcomed its first students in winter quarter 2016-17. In spring quarter 2018-19, we plan to introduce ‘EE104: Introduction to Machine Learning.’ We continue to refine our undergraduate courses and BS program, equipping students with relevant, foundational knowledge for EE in the 21st Century.

**Maker lab64, celebrating one year.** Our embedded systems maker lab continues to flourish. Over 200 students from many parts of the university have attended weekly workshops and several projects have been successfully completed. Palo Alto Code:ART Festival 2017 included an installation created using
lab64 resources. Details on our site at, ee.stanford.edu/news/lab64-code-art. The lab will be used this fall for the class, ‘EE285: Embedded Systems Workshop.’ The lab space also continues to be a popular gathering spot for student organizations, such as the VR and robotics student clubs. We are developing plans to increase the lab’s visibility among the students and to facilitate industry involvement.

**Shared laboratory facilities.** Launched last year, the two university-wide shared facilities in the Paul G. Allen Building are thriving:

- **Experimental Fabrication Facility Lab (ExFab).** There are more than 26 tools installed for rapid and flexible materials processing. This facility has already seen over 5,000 hours of use by 70 faculty from 18 departments and has been used to offer a new class, ‘Engr. 241: Advanced Micro and Nano Fabrication.’
- **System Prototyping Facility (SPF).** This facility, which is jointly operated by SLAC, offers a spectrum of options for building research-grade electronic systems—from turnkey to assisted projects. This facility has active projects from several departments and the School of Medicine.

**Space renovations.** One of the key elements of our EE21 plan is to create modern student and collaboration spaces. Toward this end, we have created a student hub on the second floor of AllenX with over 35 students sharing office and interaction spaces. We have several other projects underway (which may be complete by the time you read this letter):

- We are renovating the rest of the student and shared spaces on the first floor of the Allen building. Together with the renovation already completed last year as part of the SPF and ExFab facilities, the first floor will have seen its first complete redo since the building opened in the early 1980s.
- The 3rd floor of Gates is being renovated to provide better collaboration spaces and more visibility.
- We are in the process of renovating the AllenX Auditorium.

**Increasing faculty and student diversity has been an underlying goal of our faculty hiring and graduate admissions.** We have added three outstanding women faculty in the past two years. This fall we are delighted to welcome the most diverse PhD class in the history of the department. We are also holding the annual Rising Stars in EECS: An academic career workshop for women at Stanford this year. Through a rigorous review process 70 out of 373 senior PhD and postdoc women applicants from top EE and CS universities were selected to attend this workshop.

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

- Launch of the Knight-Hennessy Scholars (KHS) program. KHS is designed to build a multidisciplinary community of Stanford graduate students dedicated to finding creative solutions to the world’s greatest challenges. The program awards up to 100 high-achieving students every year with full funding to pursue a graduate education at Stanford, including the M.S. and Ph.D. in Electrical Engineering.
  - Details online at Knight-Hennessy.Stanford.edu
- Quarterly newsletter summary for alumni and friends.
  - Available at ee.stanford.edu/about/chair-letters-newsletters
Research Highlights

Shanhui Fan continues to improve radiative panels that could be the future of lower-energy air conditioning and refrigeration. He has also developed a way to wirelessly deliver electricity to moving objects, potentially leading to electric cars being charged while driving on a highway. (October, June 2017)

Jim Harris's research has made a significant improvement to the efficiency of solar energy through a texturing process. Applying the texturing process to LiDAR also greatly improves collision-avoidance technology. (October 2017 and November 2016)

Eric Pop's research continues to identify atomically thin materials that could enable future electronic devices to be transparent, flexible and more energy-efficient. (August and March 2017)

Gordon Wetzstein has created a 4D camera that expands on light field photography research introduced by Marc Levoy and Pat Hanrahan in 1996. (July 2017)

Roger Howe, Subhasish Mitra, Krishna Saraswat, and H.-S. Philip Wong create high-rise chips using non-silicon nanomaterials for both logic and memory, and stack the computation and storage layers vertically. (July 2017)

Jelena Vuckovic is developing materials that can trap a single, isolated electron. Working with collaborators worldwide, she has tested three different approaches to the problem, one of which can operate at room temperature—a critical step if quantum computing is going to become a practical tool. Jelena’s team is also investigating if a modified nanoscale laser can be used to efficiently generate quantum light for fully protected quantum communication. (May 2017)

Kwabena Boahen is researching how to build neuromorphic computers. They are more efficient than conventional digital computers and will be useful in embedded systems, such as neural implants or autonomous drones. (March 2017)

Krishna Shenoy and neurosurgeon Jaimie Henderson demonstrated that a brain-to-computer hookup can enable people with paralysis to type via direct brain control at the highest speeds and accuracy levels reported to date. (March 2017 and September 2016)

H.-S. Philip Wong’s Nanoelectronics Lab found that bolstering copper with graphene can alleviate electron migration. (February 2017)

Ada Poon and H. Tom Soh, along with courtesy faculty, Adam de la Zerda and James Zou have been invited to participate in a collaborative life science initiative with Chan Zuckerberg Biohub (CZ Biohub). (February 2017)

Sachin Katti and team have developed a miniature, ultra-low-energy wireless radio and processor. It has a range of up to 50 meters and can transmit up to 300 kilobits per second. (November 2016)
Andrea Goldsmith’s research on chemical messaging could advance nanotechnology. Her team’s demonstration of chemical-based data exchange could be self-powered, traveling throughout the body harmlessly—and undetectable by outside devices. (November 2016)

Nick McKeown and Sachin Katti’s technology allows users to choose which home or mobile traffic should get preferential delivery, while putting network and content providers on a level playing field. This could be a very practical tool for regulators, helping them to design simple and clear policies, then audit how well providers adhere to them. (September 2016)

Shanhui Fan has developed a fabric that allows for the dissipation of infrared radiation, and evaporative cooling. When compared with cotton, the new fabric allowed the skin surface to be 3.6F cooler. (September 2016)

Shan Wang has developed a mobile device that can detect multiple substances in saliva using magnetic nanotechnology (GMR). Previously used as a cancer screen, it could be the first practical roadside test for marijuana intoxication. (September 2016)

Faculty Awards, Honors & Recognitions

Dan Boneh and Christos Kozyrakis named as ACM 2016 Fellows, recognized for major contributions in areas including artificial intelligence, cryptography, computer architecture, high performance computing and programming languages.

Stephen Boyd selected to receive the 2017 IEEE James H. Mulligan, Jr. Education Medal for a career of outstanding contributions to education in the fields of interest of IEEE. Stephen was also named as 2016 INFORMS Fellow, and was presented with an honorary doctorate from the Institute of Statistics, Biostatistics and Actuarial Sciences of the Catholic University of Louvain for his achievements in the field of data sciences.

John Duchi selected as a 2017 Alfred P. Sloan Research Fellow in Mathematics.

Jonathan Fan was awarded the Presidential Early Career Awards for Scientists and Engineers (PECASE). This is the highest honor bestowed by the United States Government on science and engineering professionals in the early stages of their independent research careers. Jonathan was also awarded the 2016 Packard Fellowship for Science and Engineering.

Shanhui Fan received the Vannevar Bush Faculty Fellowship, “for top-tier researchers to conduct revolutionary research of strategic importance.”

Andrea Goldsmith was elected to the National Academy of Engineering. Her citation reads, “For contributions to adaptive and multiantenna wireless communications.” She was also elected to American Academy of Arts and Sciences, one of the country’s oldest and most prestigious honorary learned societies.

President Emeritus John L. Hennessy has been elected to the Royal Academy of Engineering. He is also appointed as the inaugural James F. Gibbons Professor in the School of Engineering.
Lambertus Hesselink received IEEE SciVis Inaugural Test-of-Time (ToT) Award. The coauthored paper describes work on mathematical topology related to data analysis and lossless compression and visualization of tensor and vector data sets.

Mark Horowitz featured in IEEE Solid-State Circuits Magazine, a testament to decades of contributions, covering his journey from childhood, his contributions to computer architecture and industry, and his guidance of Stanford PhD candidates who continue to become influential researchers.

Professor Emeritus Thomas Kailath received The Marconi Society Lifetime Achievement Award, recognizing his many transformative contributions to information and system science over six decades as well as his sustained mentoring and development of new generations of scientists. Tom also received an Honorary Degree from National Technical University of Athens, and was selected as an Eminent Member of IEEE-Eta Kappa Nu (IEEE-HKN).

Mendel Rosenblum has been appointed as the inaugural DRC Professor in the School of Engineering.

Krishna Shenoy has been appointed as the inaugural Hong Seh and Vivian W. M. Lim Professor in the School of Engineering.

Olav Solgaard elevated to IEEE Fellow.

Fouad Tobagi awarded SIGMOBILE Inaugural Test-of-Time (ToT) Award.

David Tse has been appointed to the Thomas Kailath and Guanghan Xu Professorship in the School of Engineering.

Student Awards, Honors & Recognitions
Dinesh Bharadia (PhD '16) received the Marconi Society Paul Baran Young Scholar Award. (October 2016 article)

PhD candidates Isha Datye and Alexander Gabourie received best poster award at the Device Research Conference (DRC). (March 2017 article)

Alex Gabourie and Saurabh Suryavanshi (co-authors) won the best presentation award at the IEEE NANO conference. (July 2017 article)

Mingyu Gao’s (PhD candidate) paper was selected as one of 2016’s top papers in computer architecture at ISCA 2016. (February 2017 article)

PhD candidates Yanjun Han and Jiantao Jiao were awarded the ISITA 2016 Student Paper Award. (November 2016 article)

Darren Hau, Min Cheol Kim, Chayakorn Pongsiri, Peter Franklin Satterthwaite, Nick John Sovich, and Vivian Wang received the 2017 Frederick Emmons Terman Engineering Award for Scholastic Achievement. This is one of the most selective academic awards at Stanford. (April 2017 article)
Co-authors Yuanfang Li (MS candidate) and postdoc Ardavan Pedram received the Best Paper Award at the 28th annual IEEE International Conference on Application-specific Systems, Architectures and Processors. (July 2017 article)

Dianmin Lin (PhD ‘16) was co-awarded the 2017 Quantum Electronics and Photonics (QEP) Doctoral Research Prize, recognizing her exceptional work in the field. (June 2017 article)

PhD candidates Connor McClellan and Fiona Ching-Hua Wang received the best in session award at TechCon 2017. (October 2017 article)

Eshan Singh (PhD candidate) and David H. Lin (PhD ‘16) received IEEE ITC Best Paper Award. (October 2016 article)

Kirby Smithe (PhD candidate) received the Early Career Scientist Award at the EDISON20 conference. (July 2017 article)

Ning Wang (PhD candidate) received best paper and best poster awards at TECHCON 2016. (March 2017 article)

Vivian Wang (BS ’17) wins 2017 Churchill Scholarship. (March 2017 article)

**Staff Awards, Honors & Recognitions**

*Steven Clark*, Instructional Labs Manager was awarded the Chair’s Award for Outstanding Contributions to Undergraduate Education.

*Lisa Sickorez*, Financial Officer received the School of Engineering Leadership Award.

**Looking back**

When I started out as chair, I set the following priorities for the department based on many conversations with the faculty:

1. Improve department organization and operation.
2. Improve communication and create a stronger sense of community in the department.
3. Improve the PhD qualifying examination and graduate admissions.
4. Focus on faculty hiring.
5. Support new strategic initiatives from the school of engineering and university.
6. Revamp undergraduate curriculum.
7. Improve department physical infrastructure.

Through the dedicated efforts of many faculty and staff, we have been able to make great progress on the first three priorities. Most notably, we have improved our (infamous) qualifying exam process, significantly increased the vetting and recruiting efforts in admissions, created both internal and external online presence, and implemented many of the recommendations of the Student Life Committee. To tackle the last four priorities, we created the EE21 plan and have made great strides toward implementing it. Most notably,

- We hired 10 outstanding new faculty;
• We doubled the undergraduate enrollment by revamping the curriculum and having more of our best teachers teach the introductory courses;
• We started three new shared maker-space facilities;
• We reinvented our research-oriented affiliates program (CIS), launching the SystemX Alliance with 30 member companies from diverse industries; and
• We renovated and modernized some of our outdated spaces.

Clearly, we have made tremendous progress that we are all proud of. However, here are a few challenges that I would like to briefly mention:

• **Physical infrastructure.** As I mentioned we have made several improvements to our labs, and student and common areas in the Allen and Gates buildings. We spent two years working with architects on a plan to modernize and improve our instructional labs and student spaces in the Packard building. Unfortunately, this plan is currently on hold.

• **Faculty hiring.** Unfortunately, it has become increasingly difficult to hire faculty over the last several years. Since 2012, only half of the offers we extended were accepted, which is low by Stanford standards. Although the reasons for turning our offers down were different in each case, the overriding reason was the cost of living in the Bay Area, which includes but is not limited to the cost of housing. Our offers have been competitive with those from our peer institutions, but not when the cost of living is factored in. The university is aware of this issue and has been taking steps to try to mitigate it.

I know that Stephen and future department chairs will strive to continue to make informed decisions that elevate the future of the department, our students, and the field of electrical engineering.

We have so much to be proud of—and with your support—our future possibilities are boundless. 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 and future efforts, please email 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 2017-18 and beyond!

Best regards,

Abbas El Gamal
Fortinet Founders Chair of the Department of Electrical Engineering
Hitachi America Professor in the School of Engineering