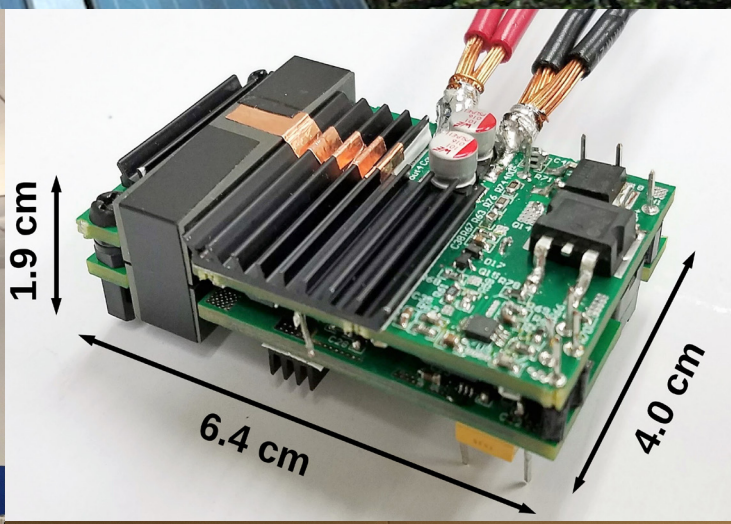
CONNECTIONS

DEPARTMENT of ELECTRICAL & COMPUTER ENGINEERING

A. JAMES CLARK SCHOOL *of* ENGINEERING



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Safe, Light, and Utilitarian Electric Bikes

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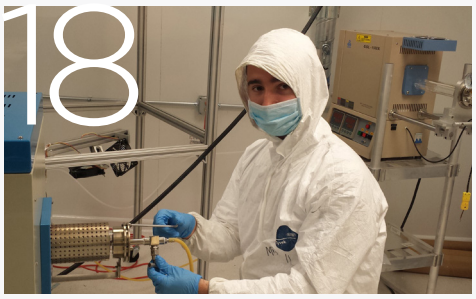

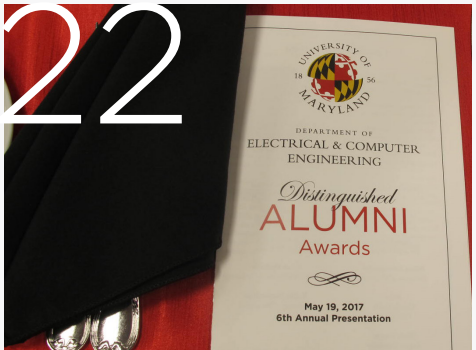

message from the chair

Electrical and computer engineering is at the heart of everything! From your smart phone and computer, to the car you drive, to the plane you fly in, to utilities and medicine, it is hard to come across something the fields of electrical and computer engineering have not touched. For this issue of *Connections* we really wanted to emphasize how the Department of Electrical and Computer Engineering (ECE) touches not only the other departments and institutes of the A. James Clark School of Engineering, but other schools and majors at The University of Maryland, College Park. Thanks to the comprehensive range of joint and affiliate appointments held by our faculty and students in other academic departments, research institutes, and research centers, ECE is really Connected to Everything. ECE stands at the heart of the technology industry, from the development of robotic systems to nanoelectronics. Our close affiliations with a number of research institutes such as the Institute for Systems Research (ISR), the Institute for Advanced Computer Studies (UMIACS), the Institute for Research in Electronics and Applied Physics (IREAP), the Institute for Physical Science and Technology (IPST), the Maryland Energy Research Center (UMERC), the Maryland Cybersecurity Center (MC2), and the Maryland Nanocenter, results in cutting-edge, cross-disciplinary, and team-oriented research projects and contributions to the field.

I've had the pleasure of seeing the department grow, and this past year was no exception. I am so thrilled and proud to share with you in this issue the significant achievements of ECE over the last year and our plans for this coming school year. This includes the start of two new faculty members, Professor Kevin Daniels and Professor Yasser Shoukry. Prof. Daniel's research is in the area of microelectronics, and Prof. Shoukry's research is in the field of cyber-physical systems. In addition, six faculty members of ECE were promoted in 2017: Professors Pamela Abshire (ECE/ISR), Nuno Martins (ECE/ISR), Edo Waks (ECE/IREAP), and Donald Yeung (ECE/CS) were promoted to the rank of full professor, and Professors Mohammad Hafezi (ECE/IREAP/JQI) and Jeremy Munday (ECE/IREAP) have been promoted to the rank of associate professor with tenure. This is a major achievement for our wonderful colleagues. Their promotions show the impact they have on their respective fields and the lives of the future generation of engineers.

This past year, ECE faculty members have won many prestigious awards and honors, including Professor Ed Ott's Richardson Medal and Moser Award, Professor Michael Rotkowitz's PECASE, Professor John Baras' Simon Ramo Medal and AACC Richard Bellman Control Heritage Award, and Professor Howard Milchberg's Senior Faculty Outstanding Research Award and Professor Alireza Khaligh's Junior Faculty Outstanding Research Award from the A. James Clark School of Engineering. Professor Thomas Antonsen has been named a University of Maryland Distinguished University Professor.

In addition to our wonderful faculty, the other thing I am most proud of is ECE's commitment to undergraduate education. While the number of students choosing electrical or computer engineering as a major has gone up, we have emphasized hands-on education and put resources into our labs. This fall we will be unveiling the newly designed ENEE428 Communications Design Lab thanks to a generous sponsorship by Hughes Network Systems. ENEE428 is a senior-level elective course taught by Emeritus Professor Steve Tretter in which students implement the theoretical concepts presented in Communications Systems (ENEE420) and Digital Signal Processing (ENEE425) on actual hardware in real time. Hughes has been a longtime friend and partner of ECE and the A. James Clark School of Engineering. I thank ECE alumnus and Hughes Executive Vice President and General Manager, North America, Paul Gaske, for securing the donation from Hughes for the lab and ECE alumnus and Hughes Vice President for Engineering, Charles Barnette for being involved with the design of the lab. I also thank the staff of Technical Operations Unit led by Mr. Bryan Quinn for building the lab.

In the coming year, I hope to see ECE grow even more. I would love to hear from you and hope I can count on your continued support. It is my sincerest hope that you will take the opportunity to help ECE in whatever way is most meaningful to you—anything from supporting current research to lab improvements to education to extracurricular activities. The time, expertise, and financial support of our alumni, whether personal or through industry sponsorship, are crucial to the success of our program. To learn more about our department or to discuss any of the subjects outlined in *Connections*, please contact our Director of External Relations, Amanda Stein, at steina@umd.edu.

With heartfelt, sincerest thanks, we appreciate your support of ECE.

Rama Chellappa

Rama Chellappa

DISTINGUISHED UNIVERSITY PROFESSOR
MINTA MARTIN PROFESSOR OF ENGINEERING AND CHAIR

CONNECTIONS is published for alumni and friends of the Department of Electrical and Computer Engineering at the A. James Clark School of Engineering, University of Maryland, College Park. Your alumni news and comments are welcome. Please send them to: Kara Stamets, Marketing Communications Coordinator in ECE, 2455 A.V. Williams Building, College Park, MD, 20742 or stametsk@umd.edu. Visit our website at: **www.ece.umd.edu**

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the 2016-2017 graduating class

DATA ON THE GRADUATING CLASS IN FALL 2016 & SPRING 2017:

202
B.S. Degrees were awarded
59 in the fall
143 in the spring

86
Students (56%) were in either College Park Scholars or University Honors

10
Students studied abroad in Spring '17

Computer Engineering

91% employed or attending graduate school (86% employed, 5% grad school)

Top Employers for CE:

- Booz Allen Hamilton
- Google
- JHU Applied Physics Lab
- Lockheed Martin
- Northrop Grumman

Electrical Engineering

86% employed or attending graduate school (72% employed, 14% grad school)

Top Employers for EE:

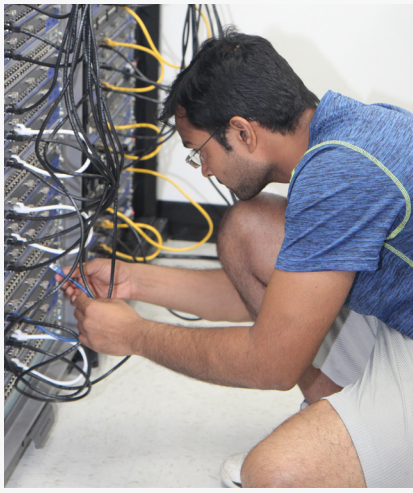
- Facebook
- Hughes Network Systems
- Texas Instruments
- National Security Agency
- Northrop Grumman

The Master's In Telecommunications Program (ENTS)

The Master's in Telecommunications Program (ENTS) is a joint program offered by the Electrical and Computer Engineering Department in the A. James Clark School of Engineering and the Robert H. Smith School of Business. ENTS students earn a master's of science (M.S.) degree while studying both technical and business aspects of the modern telecommunications industry. On the technical side, students have access to a wide range of courses that examine the most current major telecom areas. Courses focus on such subjects as advanced wireless systems, cloud computing, the internet of things (IoT), computer and information security, software defined networks, and satellite and terrestrial communications. On the business side, students take a minimum of four MBA level classes to learn the basics of marketing, management, and economics. They also may elect to take courses in business topics like entrepreneurship, which is an active focus of the university.

Unlike other master's degree programs, where research is the primary focus, ENTS provides students with practical and essential skills for launching successful careers in the telecommunications industry. This difference is evident in many aspects of the program, including summer employment: while another program's students may be encouraged to find a lab position, ENTS encourages its students to obtain experience off campus, such as through an internship with a major telecommunications company.

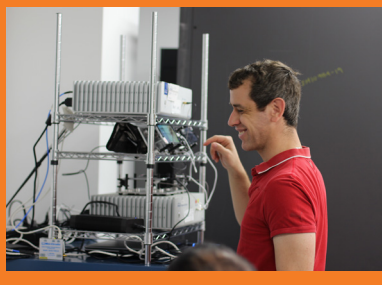
ENTS underlines its commitment to real-world immersion by drawing most of its faculty from local companies. These instructors form a majority of the teaching corps; in addition to their adjunct status, they hold lead technical and managerial positions at local companies. This is a great advantage for the students, as these instructors bring up-to-the-minute and first-hand knowledge of current industrial problems into the classroom, providing exposure to the issues and circumstances deemed most critically important by industry leaders. These experiences allow graduates to leave the program well prepared to commence a successful career in the telecommunications marketplace. But the effects of the program don't end with the first job: the ENTS faculty often remind their students that the knowledge they gain is not just to get a job - it's also to help them get promoted. ■



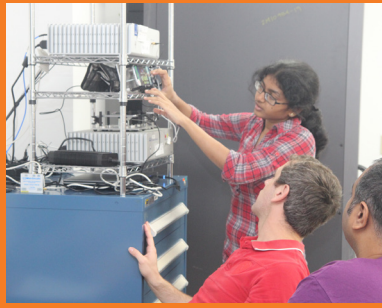
Spirent Communications Partners with the ENTS Program

In fall 2016, **Spirent Communications,** a multinational telecommunications testing company headquartered in San Jose, California, partnered with The A. James Clark School of Engineering's Master's in Telecommunications Program (ENTS) to provide students with Spirent equipment and mentorship. This was the first year of the partnership. Highlights of the partnership included the development of a new course (ENTS 699L) that leveraged tools, technical expertise, and support from Spirent, and, the creation of the WIT-Wireless Innovation Team Club. In addition, Spirent held a Wireless Technology Seminar at the beginning of the fall semester with attendance exceeding the venue's capacity.

Michael Dellomo and **Alejandra Mercado**, associate directors of the ENTS program, designed the new course, *ENTS 699L Independent Studies: LTE Network Protocols Testing Equipment Lab* to provide students with the opportunity to learn how to perform device-to-device mobile testing using the Spirent Wireless Test Station, WTS 122. Students also learned how to use Spirent's Elevate Test Framework and the ProLab Testing Suite. The course is being offered again in the fall 2017 semester. The WIT-Wireless Innovation Team Club consisted of six students currently enrolled in the ENTS program. The team used Spirent-provided tools for their activities and used mentorship, support, and projects provided by Spirent to hone their skills in the field of wireless telecommunications.

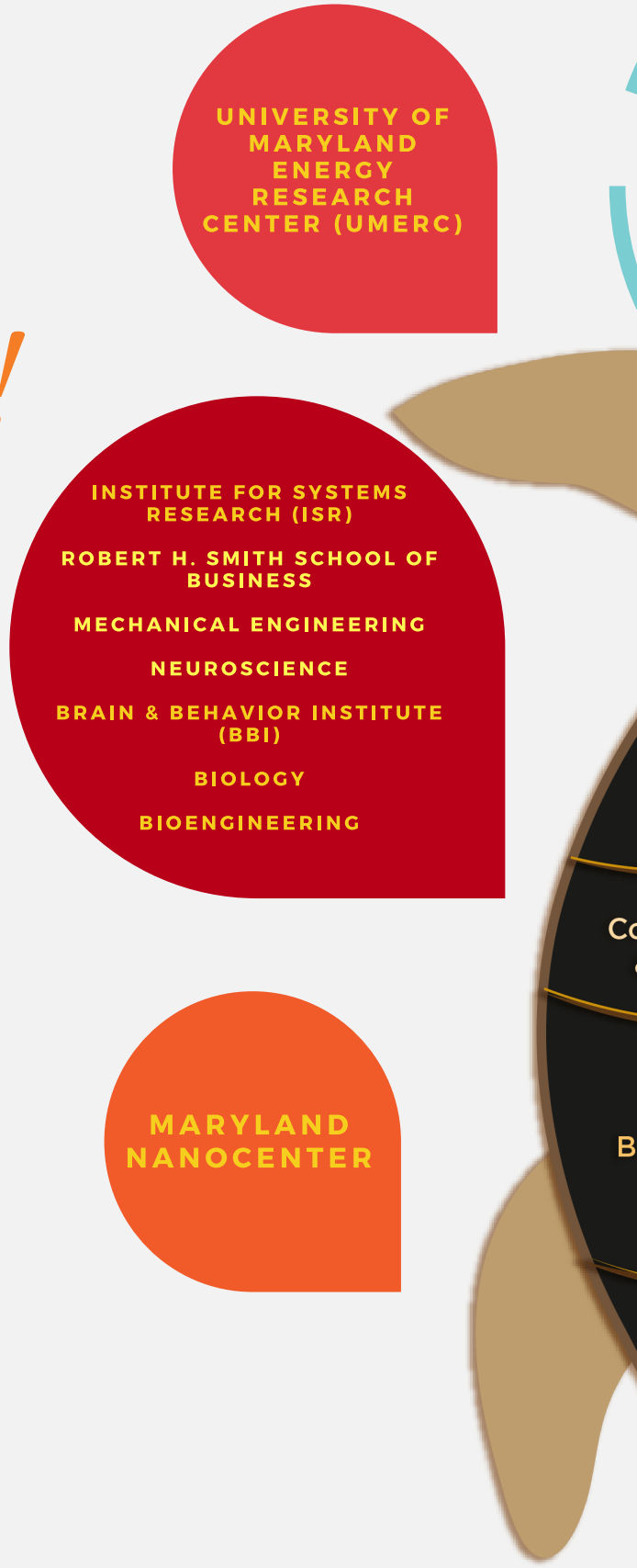


Of the partnership, Spirent's Senior Director of Systems Engineering **Charlie Mera** says, "The program is off to a great start, realizing benefits to the students, the University and Spirent. Students gain practical experience in testing new and upcoming wireless services while also increasing their marketable skills. The university benefits from providing access to state of the art tools to help reinforce the Telecom curriculum, and Spirent enjoys the opportunity to directly connect with our future Telecom professionals. We're excited about expanding the collaboration and complementing UMD's ENTS program."



Future collaboration between Spirent and ENTS will include additional Spirent tools to further enhance the teaching and learning experience in the new course and for the WIT Club. The company is also recruiting new members to the WIT Club to backfill vacancies left by graduating members. ■

ECE is Connected to *Everything!*



The innovative research conducted by the faculty and students in the Electrical and Computer Engineering (ECE) Department at the University of Maryland's (UMD) A. James Clark School of Engineering has an extremely broad range. This breadth is driven by the comprehensive range of joint and affiliate appointments held by ECE faculty in other academic departments, research institutes, and research centers.

These connections spread far beyond ECE to include not only our sister departments in the A. James Clark School of Engineering, but also those in the basic physical, computer, mathematical and biological sciences housed in UMD's College of Computer, Mathematical, and Natural Sciences (CMNS). ECE researchers and professors have also worked closely with those from the Robert H. Smith School of Business, the College of Behavioral and Social Sciences, and the College of Arts and Humanities at UMD. The research conducted within ECE often goes beyond UMD to create partnerships between other universities (both national and international) and industry, and these networks provide our students and researchers an array of opportunities for team-oriented, cross-disciplinary research aimed at helping government and industry solve some of the most pressing global challenges.

Being an extensive and profound department, ECE's 59 faculty members, more than 1,000 undergraduate students, and nearly 600 graduate students focus their research on the following areas:

- Computer Engineering
- Signal Processing
- Controls and Dynamical Systems
- Communications and Networking
- Bioelectronics and Systems
- Quantum Research, Photonics and Quantum Optics
- Applied Electromagnetics
- Circuits and Systems, Electronic Materials and Devices

Trending Research Areas
Cybersecurity
Machine Learning
Virtual & Experimental Reality
Energy & Sustainability
Quantum Engineering

COLLEGE OF COMPUTER, MATHEMATICAL, AND NATURAL SCIENCES (CMNS)

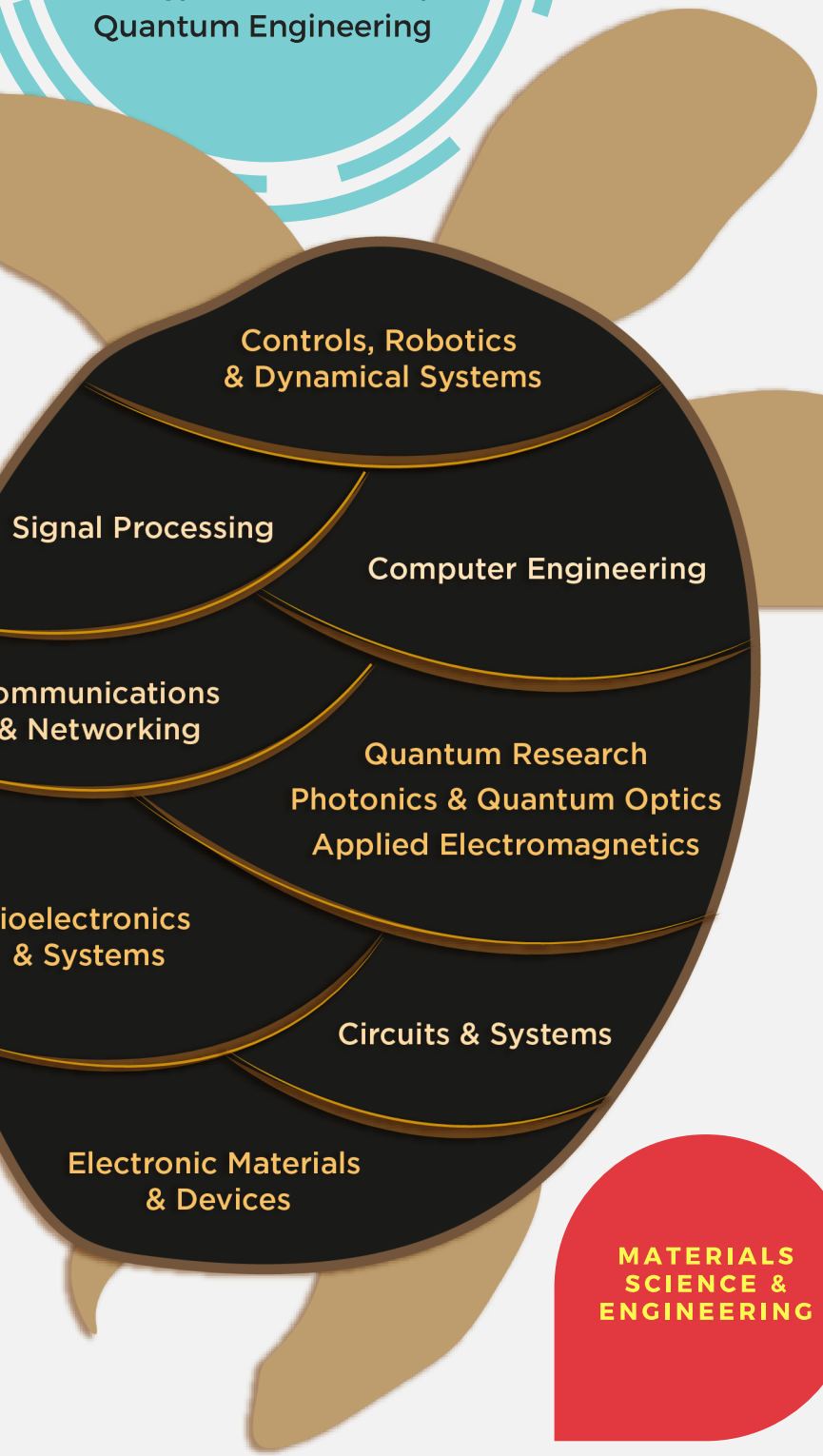
COMPUTER SCIENCE

CYBERSECURITY CENTER

UMD INSTITUTE FOR ADVANCED COMPUTER STUDIES (UMIACS)

LABORATORY FOR TELECOMMUNICATION SCIENCES (LTS)

APPLIED MATHEMATICS



THE INSTITUTE FOR RESEARCH IN ELECTRONICS AND APPLIED PHYSICS (IREAP)

PHYSICS

LABORATORY FOR PHYSICAL SCIENCES (LPS)

JOINT QUANTUM INSTITUTE (JQI)

MATERIALS SCIENCE & ENGINEERING

From these main research areas of the department, here is a small sampling of how ECE's faculty and students are connected to other disciplines, centers, and institutes:

Computer Engineering

Over the last forty years, the discipline of electrical engineering has evolved to include further study in computer hardware and computing, thus leading to the development of the computer engineering discipline to focus on the intersection of electrical computing components and software. In the fall of 1997, the Computer Engineering degree program was added to the Electrical Engineering Department at UMD, and a minor in Computer Engineering for those studying Electrical Engineering was added to the department's curriculum in 2015. The computer engineering major is offered in conjunction with the Department of Computer Science.

COMPUTER SCIENCE
UNIVERSITY OF MARYLAND

Computer engineering has been growing as a research area for ECE, with six new faculty members added in the last five years alone. Computer engineering students and researchers share a strong cross collaboration with their colleagues in the Department of Computer Science within the College of Computer, Math and Natural Science (CMNS). Many of the faculty and students in ECE who work in this area have joint appointments within the University of Maryland Institute for Advanced Computer Studies (UMIACS) and the Maryland Cybersecurity Center (MC2). UMIACS, housed in CMNS, focuses on the intersection of traditional computer science and electrical engineering with economics, social sciences, human-computer interaction, and other areas of computing. UMIACS researchers are pioneers in computational science involving computer vision, graphics and visualization, AI, machine learning, precision medicine, cybersecurity, language, culture, and much more.

UMIACS University of Maryland Institute for Advanced Computer Studies

MARYLAND CYBERSECURITY CENTER

MC2 is a unique multidisciplinary computing organization that addresses many of today's most pressing scientific and societal challenges. It is a joint effort of the A. James Clark School of Engineering and CMNS to study the pressing issues related to cybersecurity. The ECE faculty and students associated with MC2's research efforts lie primarily in cryptography, programming-language, software, and system-level security. The work of UMIACS and MC2 researchers will be vital as the cybersecurity discipline continues to expand.

Signal Processing, Controls and Dynamical Systems

Some of the strongest areas of ECE are related to the study of signal processing and controls and dynamical systems. This field has changed significantly over the years to aid the growing needs of society in the areas of cyber-physical systems, linear and nonlinear control systems, neural networks, and much more. It will continue to evolve as the need for autonomous systems grows, with ECE researchers serving at the forefront of revolutionary technologies. Part of this success is attributed to ECE's involvement with the Institute for Systems Research (ISR). Since its founding in 1985, ISR, a major research institute component of the Clark School, has been at the international forefront of interdisciplinary research and education in system sciences and systems engineering. ISR is home to nearly 80 faculty and other researchers from 14 departments and 4 colleges across the University of Maryland. Many ECE's faculty members have joint appointments with ISR. Under the umbrella of ISR is the Maryland Robotics Center, which aims to advance robotic systems, underlying component technologies, and applications of robotics through interdisciplinary and systems approached-based research and educational programs. In addition to its several ECE faculty, the researchers of the Maryland Robotic Center belong to the following departments: Aerospace, Bioengineering, Biology, Computer Science, Kinesiology, and Mechanical Engineering.

The Institute for Systems Research

Communications and Networking

The research being done in ECE regarding communications and networking is at the heart of the program. As more connected devices hit the market and the Internet of Things evolves, the research surrounding communications and networks will become even more critical and cross disciplinary in nature. ECE has a unique program for master's degree students that stretches beyond the traditional electrical engineering degree. As revealed on page 5, the master's degree in telecommunications (ENTS) is run in conjunction with the Robert H. Smith School of Business at the University of Maryland. The program combines rigorous technical education with invaluable business insight and entrepreneurial skill building. Technical courses focus on wireless communications, computer networking, and cybersecurity. The business courses cover the areas of economics, marketing, management, finance, and entrepreneurship. The business component sets ENTS apart from most M.S. programs, and it allows students to become strong project managers and leaders in their organizations.

MASTER'S IN TELECOMMUNICATIONS PROGRAM

Bioelectronics & Systems

As interest in the workings of the human body has come to the forefront, research that investigates the body as an electrical system has become a focus for several of ECE's faculty members. From understanding the brain to developing new medical devices, the faculty and students of ECE are working on applying their technical understandings to the human body. In this respect, ECE works closely with the Fischell Department of Bioengineering and

the Robert E. Fischell Institute for Biomedical Devices, part of the Clark School of Engineering; several ECE faculty members also have joint appointments in that department with UMD's Brain and Behavior Institute (BBI). BBI's unique mission is to understand the complex behaviors produced by the human brain and to develop novel approaches to address related problems. ECE professors are involved with research to understand neural circuits, sensation, perception, communications, and mental health. BBI interfaces not only with Bioengineering and ECE, but with faculty in the Computer Science, Psychology, and Performance Art departments.

Quantum Research, Photonics and Quantum Optics, and Applied Electromagnetics

In recent years, there has been a strong push in academic and research communities for new breakthroughs in the area of quantum research, specifically related to computing. As technology advances, there will be a continued push to explore quantum physics in the context of information science and technology. The Joint Quantum Institute (JQI) was created by the Clark School of Engineering and CMNS, along with two government entities: the Laboratory for Physical Sciences (LPS) and the National Institute of Standards and Technologies (NIST). Researchers at JQI come from several academic departments, including ECE, Mechanical Engineering, Computer Science, and Physics. JQI focuses on experimental and theoretical physics to exploit and control quantum systems to create the next generation of breakthrough technologies. It is a truly unique interdisciplinary center for the interchange of ideas among atomic physics, condensed matter and quantum information scientists.

At the intersection of electrical engineering and physics is the study of electromagnetics and the devices that go along with it. Many ECE faculty conducting research in this area also have appointments in the Department of Physics within CMNS. Related to this are two major institutes of UMD that are joint endeavours between the Clark School of Engineering and CMNS: the Maryland NanoCenter and the Institute for Research in Electronics and Applied Physics (IREAP). As a research entity, IREAP aims to advances modern science through research and educational programs that are interdisciplinary between physical science and engineering. Additionally, for building and experimenting with devices, many ECE faculty members turn to the Maryland NanoCenter to promote nano- and micro-scale research. With open lab space and a state-of-the-art clean room, research groups from different departments, including ECE, Physics, Materials Science Engineering, and Bioengineering work together to seek, generate, and exploit microsystems. Their hope is to alter available technologies and bring transformational change to important industries such as biomedicine, security, defense, manufacturing, and consumer lifestyles.

Electronic Materials and Devices

Faculty members working on electronic materials and devices are studying new ways to generate, use, and store energy. ECE faculty members partner with the University of Maryland Energy Research Center (UMERC) and the Maryland Energy Innovation Institute to advance energy science and technology related to energy storage, clean energy creation, and efficiency. Along with faculty members from ECE, Materials Science Engineering, and Mechanical Engineering researchers work on power electronics, smart grid, and next-generation battery development.

Future Areas of Interest

The ECE Department offers a wide variety of courses and research opportunities across numerous disciplines for both undergraduate and graduate students. In addition, ECE master's students and Ph.D. candidates often receive advisors or co-advisors hailing from different departments within the A. James Clark School of Engineering and CMNS to further enhance their studies. ECE faculty members and students collaborate with industry, government entities, and other universities to develop cutting edge research and create the best possible educational opportunities. As the electrical and computer engineering discipline continues to progress, the major areas to watch for include:

- Quantum Engineering
- Energy and Sustainability
- Virtual and Experimental Reality
- Machine Learning
- Cybersecurity
- Autonomy
- Biodevices

ECE faculty and students are already pioneering research in these dynamic and fascinating areas in cooperation with their colleagues in fellow UMD departments other research institutes and centers, industry, and outside universities. We look forward to their continued success and discoveries in the field.

ECE is truly connected to everything. ■

ECE Promotions

Four ECE Professors have been promoted to Full Professorships with Tenure, and two have been promoted to Associate Professorships with Tenure.

Professors Pamela Abshire (ECE/ISR), Nuno Martins (ECE/ISR), Edo Waks (ECE/IREAP), and Donald Yeung (ECE/CS) have been promoted to full professorships in the Electrical and Computer Engineering (ECE) Department.

Prior to joining the UMD faculty in 2001, **Pamela Abshire** received her B.S. degree in physics, with honors, from the California Institute of Technology in 1992 In 1995, she began her graduate education in the Department of Electrical and Computer Engineering at The Johns Hopkins University and earned her M.S. degree in 1997 and her Ph.D. degree in 2001. She has won many awards throughout her career, most recently receiving the Clark School of Engineering E. Robert Kent Junior Faculty Teaching Award in 2011 for excellence in teaching. Her areas of specialty are in the fields of VLSI circuit design and bioengineering. Her research focuses on understanding the tradeoffs between performance and resources in natural and engineered systems. ■

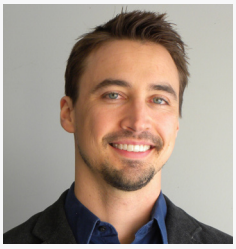
Nuno Martins received "Licenciado" and M.Sc. degrees in electrical engineering and computer science from The Technical University of Lisbon, Portugal, in 1994 and 1996, respectively. He earned a Ph.D. in electrical engineering and computer science and a minor in mathematics from the Massachusetts Institute of Technology (MIT) in 2004. He was director of the Maryland Robotics Center from 2012 until 2014. He received the 2006 American Automatic Control Council O. Hugo Schuck Award, the National Science Foundation CAREER Award in 2007, the 2008 IEEE CSS Axelby Award for the best paper in the IEEE Transactions on Automatic Control, the 2010 Outstanding ISR Faculty Award, and the 2010 George Corcoran Award from the ECE Department and UMD. He was also an UMD/ADVANCE leadership fellow in 2013. His research interests are in distributed control, team decision, optimization, networked control, and communications. ■

Edo Waks received his B.S. and M.S. in electrical engineering from The Johns Hopkins University, and he earned his Ph.D. in electrical engineering from Stanford University in 2003. He joined the ECE Department in 2006. Waks oversees the Nanophotonics and Quantum Information Research Group and is a fellow of the Joint Quantum Institute. He won the Army Research Officer Young Investigator Award in 2007, the National Science Foundation CAREER award in 2009, the Presidential Early Career Award for Scientists and Engineers (PECASE) in 2010, and the DARPA Young Faculty Award in 2011. ■

Donald Yeung received his B.S. from Stanford University in 1990, and his M.S. and Ph.D. from The Massachusetts Institute of Technology (MIT) in 1993 and 1998, respectively. Yeung joined the ECE Department in 1998. He co-directs the University of Maryland's Systems and Computer Architecture Laboratory. His research interests lie in the areas of computer architecture, performance evaluation of computer systems, and the interaction of architectures, compilers, and applications. Yeung received the 2000 George Corcoran Memorial Teaching Award from the ECE Department/UMD, the 2001 NSF CAREER Award, and the 2005 IBM Shared University Research Award. ■

Mohammad Hafezi (ECE/IREAP/JQI) and Jeremy N. Munday (ECE/IREAP) have been promoted to tenured associate professorships in the ECE Department.

Mohammad Hafezi studied for two years at Sharif University before completing his undergraduate degree in physics at Ecole Polytechnique. He received his Ph.D. in physics from Harvard University in 2009. He was a senior research associate at the Joint Quantum Institute before joining the ECE faculty in 2014, and is currently a JQI fellow. His research interests include the theoretical and experimental investigation of strongly correlated systems and topological physics, nanophotonics and optomechanics, and hybrid quantum systems. In 2015, he won a Sloan Research Fellowship and an Office of Naval Research (ONR) Young Investigator Award in support of his research in "Quantum Transport of Photons in Nanostructures." ■



Jeremy Munday received his B.S. in physics from Middle Tennessee State University in 2003 and his Ph.D. in physics from Harvard University in 2008. He was a postdoctoral scholar at Caltech until 2011, when he came to the University of Maryland. His research endeavors range from near field optics, photonics, plasmonics, and solar energy to quantum electromechanical phenomena (such as the Casimir effect) for actuating mirco- and nano-mechanical devices. He has received a number of recognitions, including the 2012 NASA Early Career Faculty Space Technology Research Award, the 2014 George Corcoran Award for Faculty (ECE Department, University of Maryland), the 2014 SPIE Early Career Achievement Award, the 2015 IEEE Young Investigators Award, the 2015 Optical Society of America Alfred Lomb Medal, the 2016 ONR YIP Award, and a 2016 NSF CAREER Award. ■

Q&A with ECE's New Faculty

This Fall, ECE weclomed two new faculty members to the department: Professors Kevin M. Daniels (ECE/IREAP) and Yasser Shoukry (ECE).

Kevin M. Daniels joins ECE as an assistant professor this fall. He has also been given a joint appointment in IREAP. Born and raised in South Carolina, and the youngest of three children, Daniels received his B.S., M.E., and Ph.D. in electrical engineering from the University of South Carolina in 2009, 2012, and 2014, respectively. From 2014 through his start at UMD, Daniels served as a resident National Research Council postdoctoral fellow at the U.S. Naval Research Laboratory in Washington, DC. In this role, he investigated the growth of wide bandgap materials (such as silicon carbide [SiC]), for power electronics and two-dimensional epitaxial graphene for high-speed communications and sensors. His research interests include the growth of various metallic, semiconducting, and insulating two-dimensional materials, particularly transition metal oxides and dichalcogenides, for environmental and biological sensors, batteries, and fuel cells.

What is one of your most memorable professional highlights?
My most memorable highlight happens to be the most impactful in my career, the beginning as an undergraduate researcher at the University of South Carolina. Starting as a freshman, working with Professor Tangali Sudarshan, was where I developed a passion for research and an interest in growth of semiconductors and fabrication of devices. I do not think my career would have taken this wonderful path without this experience and the mentorship and guidance I received from Prof. Sudarshan.

What interested you in teaching at the University of Maryland?
Definitely the students! I have had the pleasure of interacting with quite a few students and alumni from UMD during my tenure at NRL, establishing amazing collaborations resulting in impactful contributions to the field. I think, in no small part, was the education they received at UMD. I am looking forward to teaching, mentoring and working with the passionate students.

How do you plan on continuing your research at UMD?
My research focus is the growth of 2D semiconductors materials towards the development of sensors, batteries and fuel cells. The vast facilities at UMD, from the clean room for device fabrication to the numerous characterization tools available, as well as the proximity to the many national laboratories and universities, enables and facilitates research of all kinds and fosters the collaborations necessary to produce great research.

What class are you teaching this fall? I will be teaching ENEE 313, Introduction to Solid State Devices this Fall. Many of the technological luxuries in computing, communication, renewable energy, etc. are possible due to the advancement in solid state, or semiconductor materials and devices in the last 50 years. I am looking forward to taking students through the devices that filled up rooms to the devices that fit in our pocket. ■

Yasser Shoukry joins ECE as an assistant professor this fall. He received his Ph.D. in electrical engineering from the University of California, Los Angeles, in 2015, where he was affiliated with both the Cyber-Physical Systems Lab and the Networked and Embedded Systems Lab. He received B.Sc. and M.Sc. degrees in computer and systems engineering from Ain Shams University, Cairo, Egypt in 2007 and 2010, respectively. Prior to joining ECE, Yasser was a joint postdoctoral associate at the University of California, Berkeley, UCLA and the University of Pennsylvania. Before pursuing his Ph.D. at UCLA, he spent four years as an R&D engineer in the industry of automotive-embedded systems. Shoukry's research areas include cyber-physical systems and Internet of Things (IoT) security.

What is one of your most memorable professional highlights?
In 2015, the National Science Foundation (NSF) held a research competition between Early-Career Investigators (ECI) in the domain of cyber-physical systems and Internet-of-Things. In this competition, groups of researchers are asked to present new research ideas, in a shark-tank setting, in the domain of smart cities. The team I led was one of the two winning teams and we represented the NSF-ECI in the Global City Teams Challenge held in June 2015.

What interested you in teaching at the University of Maryland?
I am very excited about the general teaching philosophy at UMD in which students experience both hands-on experience along with rigorous theoretical and mathematical classes. This teaching philosophy matches my own one and I believe it is a necessity to develop and inspire the next generation of engineers.

How do you plan on continuing your research at UMD?
The rapidly increasing dependence on CPS and IoT in building critical infrastructures—in the context of self-driving cars, smart cities, power systems, and medical devices—will open the gates to increasingly sophisticated and harmful attacks with major societal implications. My research focuses on designing and deploying "resilient" CPS and IoT that can withstand such attacks. This research area is interdisciplinary and requires expertise from several disciplines. I am confident that the collaborative climate at UMD will allow me to foster many opportunities to build such interdisciplinary research.

What class are you teaching this fall? This Fall, I am introducing a new undergraduate course entitled "Introduction to Cyber-Physical Systems" which I am very excited about. The course will focus on the interplay between cyber components (software and communication) and physical processes (e.g., self-driving cars). The course is accompanied by a set of labs and projects to give hands-on experience to students. ■

Awards and Honors for ECE Faculty

Ott Receives Richardson Medal (EGU) and Moser Award (SIAM)

Professor **Ed Ott** (ECE/Physics/IREAP) has been selected to receive prestigious awards from two different professional societies in recognition of his decades-long career in nonlinear science and chaos theory.

The Richardson Medal, awarded by the European Geosciences Union, is named in honor of Lewis Fry Richardson, a mathematician and physicist who pioneered the science of fractal theory and weather forecasting. For this award, Ott is being recognized for seminal work in nonlinear science and data assimilation, which is now widely used for weather prediction. His influence is widespread and evident; every time a meteorologist discusses "computer models," they are referring to models that use methods conceived and published by Ott as recently as 15 years ago to predict weather worldwide. The award was presented to Ott at the annual European Geosciences Meeting in April 2017 in Vienna, Austria where he gave an address.

The Jürgen Moser Award is conferred biennially by the Society of Industrial and Applied Mathematics. Ott was recognized this year for his distinguished and sustained contributions to the field of nonlinear science. The award was presented at the May 2017 SIAM Meeting on Dynamical Systems, where Ott delivered a plenary lecture. ■

Milchberg and Khaligh Receive 2016 Junior and Senior Faculty Outstanding Research Awards from the Clark School

Professor **Alireza Khaligh** (ECE/ISR) received the 2016 Junior Faculty Outstanding Research Award. This recognition represents one of the highest honors that the Clark School bestows upon its junior faculty. Khaligh has established an impressive program in power electronics at the University of Maryland. His research has pioneered high-impact research on ultra-compact, integrated; and highly efficient power electronic systems for electric vehicles; more electric aircrafts; energy harvesting systems; and micro robotics. He has authored/co-authored 2 books, 4 book-chapters, 50 journal papers, and 89 conference papers. His publications have been cited over 4,400 times (according to Google Scholar), resulting in an H-index of 30. Besides his extraordinary scholastic record, Khaligh has been at the forefront of major events in power electronics. He was the general chair of the 2016 IEEE Applied Power Electronics Conference and Exposition (APEC), the Premier Event in Applied Power Electronics™. He was also the general chair of the 2013 IEEE Transportation Electrification Conference and Expo (ITEC).

Other recognitions received by Khaligh include the 2015 Inaugural ISR Junior Faculty Fellowship from the Institute for Systems Research, the 2010 Ralph R. Teetor Educational Award from the Society of Automotive Engineers, the 2013 George Corcoran Memorial Award from the ECE Department, and three prize transaction paper awards. He is a distinguished lecturer of the IEEE Industry Application Society and the IEEE Vehicular Technology Society.

Dr. Darryll Pines, dean of the Clark School said to Alireza, "I am so pleased that you decided to join our college a few years ago. You have been a wonderful colleague and an outstanding researcher."■

Professor **Howard Milchberg** (ECE/PHY/IREAP) has been named the recipient of the 2016 Senior Faculty Outstanding Research Award. The award is given to a senior faculty member in recognition of exceptionally influential research accomplishments. Milchberg's research interests include nonlinear optics; laser and optical physics; interaction of intense electromagnetic fields with atoms, solids, and plasmas; and generation and application of coherent and incoherent short wavelength radiation.

In very recent work, his lab discovered a new type of optical structure with many potential future applications: a toroidal optical vortex that accommodates phase discontinuities in high-intensity, self-focusing laser light pulses. The resulting toroids form energy swirls in the light pulses, which, Milchberg said, resemble optical "smoke rings."

"All experiments at universities rely heavily on grad students," said Milchberg. "I'm thrilled that my group at Maryland has some of the best students anywhere."

Milchberg has received numerous awards and honors during his career, including being named fellow of the Optical Society of America and the American Physical Society, winning the American Physical Society (APS) Excellence in Plasma Physics Award in 2005, and being named a distinguished scholar-teacher in 2005-2006, which recognizes senior faculty of outstanding scholarly accomplishment and excellence in teaching. He said that he is most proud of his graduate students, three of whom have won the American Physical Society Dissertation Award in plasma physics, a record for a single advisor. ■

Former President Obama Names Michael Rotkowitz a PECASE Recipient

On January 9, 2017, before the end of his time in office, President Barack Obama named Assistant Professor **Michael Rotkowitz** (ECE/ISR) as 1 of the 102 recipients of the Presidential Early Career Award for Scientists and Engineers (PECASE).

This is the highest honor bestowed by the federal government on science and engineering professionals in the early stages of their independent research careers. Rotkowitz was among the 19 professionals nominated by the National Science Foundation (NSF).

Radhakisan Baheti, program director of the NSF Directorate for Engineering, said, "Michael Rotkowitz has made pioneering contributions in the decentralized implementable control of massively interconnected systems. His work has been cited by over 1,200 researchers and has led to new insights and several important results. Michael has also contributed to the education of undergraduate and high school students using innovative engineering test-beds." ■

Abshire, Goldsman, and Newcomb Participate in ISCAS 2017

Approximately 1,200 research scientists, engineers, and industry partners from around the world attended the 50th edition of the IEEE International Symposium on Circuits and Systems (ISCAS), held May 28-31, 2017, in Baltimore, Maryland. Among the participants were three Electrical and Computer Engineering Department professors, **Pamela Abshire** (ECE/ISR), **Neil Goldsman** (ECE), and **Robert Newcomb** (ECE). IEEE ISCAS is a premier annual conference that reflects on the diversity, creativity, and significance of circuits and systems as a field, as well as the technological applications and knowledge economy that are based on the field's fundamentals. This was the first time in many years that the conference was held in the United States.

Throughout the conference, current research findings, ideas, and applications in circuits and systems were presented in workshops and tutorials, plenary sessions, industrial panels, demonstrations, industrial innovation sessions, and social activities.

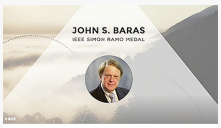
Two sessions were held highlighting Pioneers of CAS, which honored distinguished delegates from the first years of ISCAS as they shared their perspectives on important technical achievements over the past 50 years and their vision of ISCAS's future. Abshire, who served as General Co-Chair of ISCAS, introduced Newcomb, the director of the Microsystems Laboratory at UMD, during the Pioneers of CAS Session on May 29, 2017. Newcomb was recognized as a true pioneer in the industry and spoke about his experience in the IEEE Circuits and Systems (CAS) Society and his participation in the first conference in 1967. Newcomb and other Pioneers of CAS were in agreement that the future of CAS will focus on advances in the medical industry and achieving a greater understanding of the human body.

The Present Your Startup session at ISCAS aimed to promote industry participation and entrepreneurship by showcasing new ventures resulting from research in the CAS community session. Goldsman presented his startup company, CoolCAD Electronics, LLC, a CAD and custom electronics design firm, which he co-founded in 2009. Goldsman won the Innovation Award at the close of the session. This prize is chosen by a special jury and awards the new ventures that showcase the best overall innovations.

The event was sponsored by the IEEE, with the Institute for Systems Research (ISR) and the Electrical and Computer Engineering (ECE) Department serving as promotional sponsors of the event. In addition, Professor Timothy K. Horiuchi (ECE) served as a tutorial co-chair, and ECE Ph.D. student Andrew Berkovich served as volunteer coordinator at ISCAS. ■

Baras Wins Simon Ramo Medal and AACC Richard E. Bellman Control Heritage Award

Professor and Lockheed Martin Chair in Systems Engineering **John Baras** (ECE/ISR) received the Institute of Electrical and Electronics Engineers 2017 Simon Ramo Medal. This award recognizes exceptional achievement in technical leadership in major innovative engineering projects related to systems engineering and systems science. Baras accepted the medal at the 2017 IEEE Honors Ceremony Gala, part of the IEEE Vision Innovation Challenges Summit event in San Francisco on May 25, 2017. The award consists of a gold medal, bronze replica, certificate, and an honorarium of $20,000. The medal citation for Baras reads, "For exceptional contributions to the conception and commercialization of Internet-over-satellite systems, and for leadership in model-based engineering, systems science and engineering research."



Baras has also received the American Automatic Control Council's (AACC) 2017 Richard E. Bellman Control Heritage Award. He accepted this award at the 2017 American Control Conference (ACC) Awards Ceremony in Seattle on May 25, 2017. The Bellman Award is given for distinguished career contributions to the theory or application of automatic control. It is the highest AACC recognition of professional achievement for U.S. control systems engineers and scientists. The recipient must have spent a significant part of his/her career in the United States. The award consists of plaque and an honorarium of $10,000. The citation for Dr. Baras' award reads, "For innovative contributions to control theory, stochastic systems, and networks and academic leadership in systems and control."■

Yeung Wins National Science Foundation Award

Professor **Donald Yeung** (ECE/CS) is the principal investigator for a new National Science Foundation award for a project entitled, "Parallelization and Memory System Techniques for Effectively Utilizing Heterogeneous Microprocessors." The three-year, $400K grant is being funded through the National Science Foundation's Software and Hardware Foundations (SHF) program within the Division of Computing and Communication Foundations (CCF). ■

Murphy Reappointed as Director of IREAP

Professor **Thomas E. Murphy** has been reappointed as the director of the Institute for Research in Electronics and Applied Physics (IREAP) for a three-year term.

Murphy joined the faculty at the University of Maryland in 2002, where he now serves as a professor in the Department of Electrical and Computer Engineering and IREAP. He served as interim IREAP director for six months before assuming his current role as IREAP director in July 2012. ■

Liu Wins IEEE Signal Processing Society Meritorious Service Award

Christine Kim Eminent Professor of Information Technology **K.J. Ray Liu** (ECE) was selected to receive the 2016 Institute of Electrical and Electronics Engineers (IEEE) Signal Processing Society Meritorious Service Award for exemplary service to and leadership in the Signal Processing Society. Liu also delivered a plenary keynote at the 42nd IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP 2017) in New Orleans, Louisiana, on March 7. ICASSP is the premier international conference on signal processing and has an attendance of about 2,500. Liu's speech was titled, "Smart Radios for Smart Life." ■

Papamanthou Wins NSF CAREER Award

Professor **Charalampos (Babis) Papamanthou** (ECE/MC2/UMIACS), has received an NSF CAREER Award, which is expected to total $450,000 over five years. The funding supports efforts for designing new frameworks and protocols that can provide security, availability, and privacy to common classes of cloud applications, which in turn can lead to improved performance for everyday users of cloud applications.

"Working with a group of talented graduate students and postdocs at the Maryland Cybersecurity Center, we have built provably-secure systems that scale to gigabytes of data—something I believed was closer to science fiction as recently as a few years ago," says Papamanthou. ■

Chellappa Named Inaugural Recipient of IEEE Biometrics Council Leadership Award

Distinguished University Professor **Rama Chellappa,** chair of the Department of Electrical and Computer Engineering and UMIACS appointee, was recognized as the inaugural recipient of the IEEE Biometrics Council Leadership Award on September 6, 2016, in Buffalo, New York, at the IEEE Eighth International Conference on Biometrics: Theory, Applications, and Systems (BTAS 2016).

The award honors exceptional leadership from IEEE members involved in biometrics, the measurement and statistical analysis of people's physical and behavioral characteristics. This includes voice, fingerprint, iris, face, handwriting, gait, and other modalities, as well as multi-modal biometrics and new biometrics based on novel sensing.■

ANTONSEN NAMED DISTINGUISHED UNIVERSITY PROFESSOR

Professor **Thomas M. Antonsen** (ECE/IREAP/Physics) has been named a University of Maryland distinguished university professor, the most prestigious internal honor on campus. The award is given to a limited number of the university's most accomplished professors. Antonsen is one of three faculty members who will be honored at the convention in the fall of 2017, and this honor comes from his fundamental contributions to the related fields of plasma physics, charged particle beam research, and nonlinear dynamics.

Antonsen has received numerous other honors during his career. In 1999, he was a co-recipient of the Robert L. Woods Award for Excellence in Vacuum Electronics Technology, and in 2003, he received the IEEE Plasma Science and Applications Award. In 2004, he received the Outstanding Faculty Research Award of the Clark School of Engineering, and in 2016, he was awarded the John R. Pierce Award for Excellence in Vacuum Electronics.

"Professor Antonsen is an internationally recognized researcher in plasma physics and non-linear dynamics. He is also an inspiring teacher and helps the department in various ways. His technical contributions and scholarship has been recognized by numerous prestigious awards," says Rama Chellappa, chair of the Department of Electrical and Computer Engineering and Minta Martin professor of engineering. "With this recognition, Professor Antonsen joins a select group of distinguished faculty members on campus. I wholeheartedly congratulate Tom on this very deserving recognition and appointment." ■

Hafezi Wins Faculty Award for Significant Contributions to Electrical and Computer Engineering Education

Mohammad Hafezi (ECE/IREAP/JQI), the recipient of ECE's George Corcoran Award for Teaching, has been honored for his outstanding contributions to engineering education and teaching at the University of Maryland. The award is given for significant contributions to electrical or computer engineering through excellence in teaching and the advancement of the profession. ■

Ramirez Wins ECE Staff Service Award and UMD's Provost's Professional Academic Advisor of the Year

Electrical and Computer Engineering Director of Undergraduate Studies **Neruh Ramirez** has received ECE's 2017 Corcoran Staff Service Award. The award was given in recognition of his level of dedication, excellence in performance, and commitment to service to the department this year. His work in support of ECE has allowed others to turn their full attention toward their primary responsibilities, be they teaching, learning, or working behind the scenes.

Ramirez was also selected as the 2016-2017 Provost's Professional Academic Advisor of the Year within the University. Each year, the provost presents three awards for excellence in academic advising, with one each to faculty, staff, and a graduate student. The award was presented to Ramirez at the Annual Undergraduate Studies Advising Conference, held on August 15, 2017. He was selected from a very cometitive pool of cadidates and was nominated by students and colleagues in the ECE Department.

A letter written in support of Ramirez's nomination said, "His enthusiasm inspires me to strive to be better, more knowledgeable, and more supportive to students. [He goes] above and beyond within his role and gives generously of his time. Thank you for your contributions to advising and for the mentorship offered to so many advisors on campus." ■

Zhang Wins ECE Graduate Teaching Assistant Award

Zeyu Zhang received this year's George Corcoran award for graduate teaching assistants (TAs). This award is given to students who show excellent leadership skills and commitment to education in their teaching assistant positions. ■

Krayer Wins ECE Graduate Student Service Award

Lisa Krayer is the recipient of this year's George Corcoran award for Graduate Student Service. This award is given to nominees who demonstrate a firm commitment to the welfare of the department and of the students studying within it.

A recommendation written on behalf of Krayer said, "Lisa Krayer is an exemplary student-scholar who has made significant advances in the lab, while simultaneously serving to advance the Department, the College, and the University." ■

Khaligh Wins ECE Jimmy H.C. Lin Invention Competition Award

Alireza Khaligh (ECE/ISR) Won ECE's Lin Innovation Award for his patent: "ZVS DC/DC Converter for Converting Voltage between a Battery and a DC link in a Hybrid Energy Storage System."

The Lin Innovation award is given to promote innovation among ECE students, staff and faculty by stimulating, encouraging and rewarding the invention and patenting process, and to help students, staff and faculty move their ideas forward through the complicated and often expensive patenting process. ■

Chellappa, Milchberg, Sprangle and Waks Participate in Different Department of Defense MURI Projects

Electrical and Computer Engineering (ECE) faculty members will be conducting research in three recently announced Multidisciplinary University Research Initiatives (MURI), which are administered by the U.S. Department of Defense (DoD). The highly competitive MURI program complements other DoD basic research efforts (which that involvesupport traditional, single-investigator university research grants). MURI grants use larger and longer awards to support multidisciplinary teams investigating with larger and longer awards in carefully chosen research topics with identified for their potential for significant and sustained progress in security and military capabilities.

Professors **Edo Waks** (ECE/IREAP/JQI), **Chris Monroe** (Physics/JQI), and **Yi Kai Lu** (UMIACS/Staff Scientist/NIST) have been named as members of the Air Force Office of Scientific Research (AFOSR) MURI, "Scalable Certification of Quantum Computing Devices and Networks." The project will contribute to the understanding of the Foundations of Interactive Protocols for Quantum Computation and Communications. The lead institution for this MURI is the California Institute of Technology, and the principal investigator is Professor Thomas Vidick. Additional team members are from UC Berkeley and the University of Southern California.

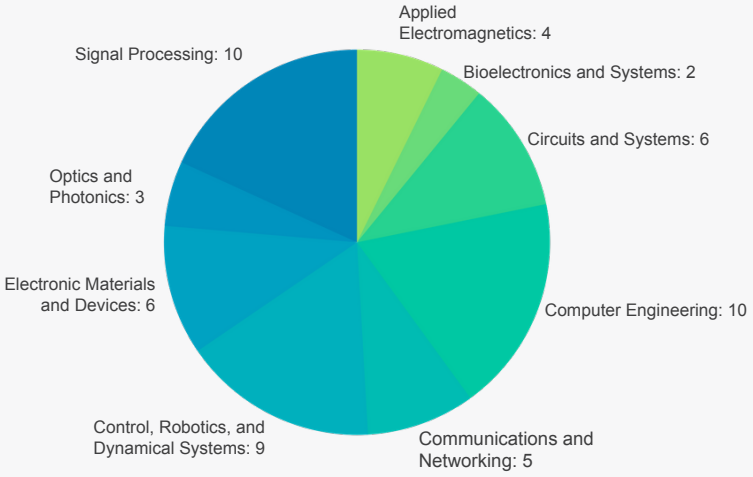
The ECE department chair, Professor **Rama Chellappa** (ECE/UMIACS), has been named a member of the MURI team that will explore the characterization of information content in data for multimodal analysis. The MURI, "Semantic Information Pursuit for Multimodal Data Analysis," is sponsored by the Army Research Office (ARO) and is led by Professor Rene Vidal of The Johns Hopkins University. Additional team members are from Stanford, UC Berkeley, UCLA, and the University of Southern California. This MURI award also has a U.K. component, with partners drawn from Oxford University, Imperial College, the University of Surrey, and the University College, London.

Profesors. **Howard Milchberg** (ECE/IREAP/Physics), **Kiyong Kim** (IREAP/Physics), and **Phil Sprangle** (ECE/IREAP/Physics) have been named to an Office of Naval Research (ONR)–funded MURI team led by Professor Chandrashekhar Joshi of UCLA entitled, "Fundamental Studies of Nonlinear Optics and Laser-Plasma Phenomena in Gases and Solids Using High-Power LWIR Lasers." Their research will explore the use of high-power lasers in long-wave infrared to better understand plasma phenomena for future DoD applications. Additional team members are from the University of Michigan, the University of Arizona, the University of Central Florida, and the State University of New York, Stony Brook. ■

GRADUATE STUDENTS AREA OF FUNDING

Approximately 56 new graduate students joined the Department of Electrical and Computer Engineering this fall. Students attending our programs are from the USA, India, China, Nepal. Taiwan, Greece, Iran, Bangladesh, and Sri Lanka.

Our 17 new Masters students and 39 Ph.D. students have chosen to specialize in the following research areas:



ULUKUS IS PI FOR NEW NSF GRANT

Professor **Sennur Ulukus** (ECE/ISR) has been named the principal investigator for a three year, $500,000 NSF Communication and Information Foundations grant: "Alignment for Secrecy: One-Time-Pads in the Air without Keys." The goal of this research is to advance information-theoretic physical layer security in order to address practical issues arising from user misbehavior, conflicting user interests, lack of complete network state information and to devise practically implementable codes. ■

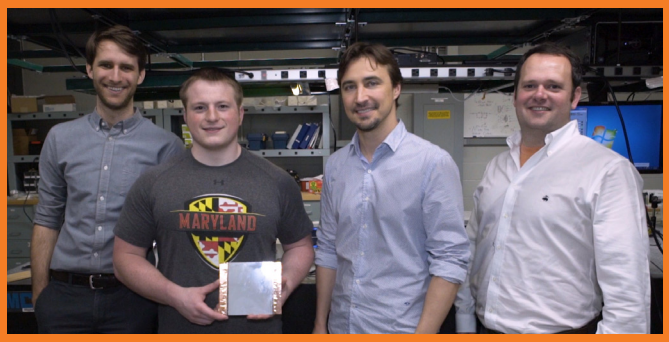
HAFEZI RECEIVES DURIP GRANT

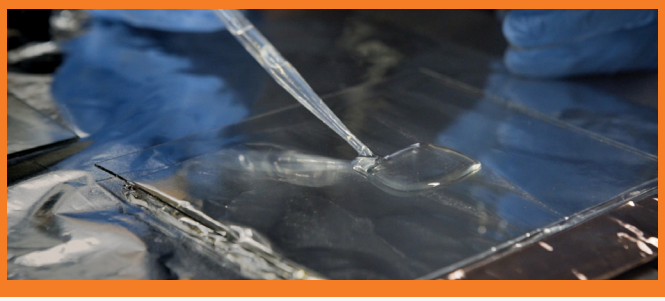
Professor **Mohammad Hafezi** (ECE/IREAP/JQI) has been awarded the highly competitive Defense University Research Instrumentation Program (DURIP) grant by the Department of Defense.

DURIP supports the acquisition of high-tech equipment and innovative research to foster advances in science and technology. Only 160 researchers from 84 institutions all over the country received DURIP grants this year. Awards are administered through a merit competition jointly conducted by the Army Research Office, the Office of Naval Research, and the Air Force Office of Scientific Research. Hafezi's award will support a project on a cryogenic system for quantum optical measurement. ■

Solar Smart Windows of the Future

UMD researchers, led by Professor **Jeremy Munday,** have designed a window that uses solar energy to power devices, allow or block light, and make your home more sustainable. Liquid crystals in the window adjust to allow light to pass through the window, and a thin semiconductor converts solar energy into electricity. By harnessing solar energy, these windows help reduce a building's carbon footprint. ■





DACHMAN-SOLED RECEIVES GRANT TO CONTINUE RESEARCH ON POST-QUANTUM CRYPTOSYSTEMS AT CISCO

Professor **Dana Dachman-Soled** (ECE/MC2/UMIACS) has received a grant from Cisco Systems, Inc., titled, "Analyzing the Side-Channel Resistance of Lattice-Based Key Exchange." The $75,525 award will support her research on "post-quantum" cryptosystems.

Companies such as Google are beginning to experiment with the implementation of post-quantum cryptosystems, which will remain secure even in the presence of a universal quantum computer. This is unlike traditional cryptosystems (such as RSA and Diffie-Hellman based systems), which can be entirely broken by quantum computers. One promising candidate for secure, post-quantum key exchange is known as the "New Hope" algorithm, which is based on the conjectured quantum-hardness of finding the shortest non-zero vector in certain types of lattices. The goal of this project is to determine, mathematically as well as empirically, the robustness of candidate lattice-based key exchange schemes, such as New Hope and others, to side-channel attacks.

"I am very excited to continue my collaboration with the crypto and hardware security teams at Cisco," said Dachman-Soled. "As it is anticipated that post-quantum cryptosystems will be standardized within the next few years, my research will help determine the suitability of various candidates for large-scale use." ■

SRIVASTAVA IS PI; JACOB CO-PI FOR NSF "UNIFIED FRAMEWORK FOR 3D CPU CO-SIMULATION" GRANT

Professor **Ankur Srivastava** (ECE/ISR) is the principal investigator for a new National Science Foundation SI2-SSE 3DSIM grant, "A Unified Framework for 3D CPU Co-Simulation." Professor **Bruce Jacob** (ECE) is the co-principal investigator. The three-year, $500K grant will allow Srivastava and Jacob to develop a full-system simulator for 3D CPUs that accounts for the architectural and physical interactions between the cores and memory components. This will allow the co-simulation of power, performance, and reliability characteristics. The project will address chip design issues that have come to the forefront in recent years. Performance enhancements and increased energy efficiency that previously could be obtained by reducing the dimensions of transistors are becoming more difficult to achieve.

This project seeks to develop this simulation framework and make it available to the computer architecture design community. The researchers' framework will support a wide array of 3D CPU configurations, including intricate specifications of cores, core counts, network on chip protocols, on-chip/off-chip caches, main memory, and off-chip secondary storage (built using diverse set of devices including SRAM, DRAM, non volatile devices). The project is a substantial addition to the repertoire of 3D integrated circuit design and simulation frameworks and will play a vital role in future innovations in 3D CPU architectures. ■

Spotlight on Faculty Start-Ups

COOLCAD ELECTRONICS, LLC. was started by Professor **Neil Goldsman** (ECE) and ECE graduate and current research professor Akin Akturk. UMD graduates Dr. Zeynep Dilli, Mitchell Gross, and Dr. Siddharth Potbhare round out the management team. The CoolCAD staff also includes other UMD alumni, while numerous UMD interns have also benefitted from hands-on employment with the company.

CoolCAD produces electronic devices and integrated circuits (chips) fabricated from Silicon Carbide (SiC), a new revolutionary semiconductor. In contrast to silicon-based electronics, SiC circuits can withstand very high voltages, can operate at very high temperatures, and are able to optically sense ultraviolet light. Their robust qualities make processing and chip manufacturing from SiC very difficult. CoolCAD is one of a small group of elite companies that has developed the capability of fabricating devices and chips from SiC, which makes the company attractive to entities like NASA through fabricating high-temperature electronics for space missions (such as the exploration of Venus), imaging of stars in the visible and ultraviolet spectrums, and monitoring Earth's environment and especially its delicate ozone layer. In addition to work for NASA, markets for CoolCAD's high temperature electronics include the automobile industry, energy generators, geothermal developers, and industrial furnace controllers. For their SiC ultraviolet optoelectronics, CoolCAD's main application is the provision of water purification monitoring with ultraviolet light, which overrides the need for chemical additives such as chlorine. Its ability to hold off high voltage also gives SiC many applications in the power electronics industry. CoolCAD's mission is to satisfy these new, highly lucrative opportunities and to provide opportunities for UMD graduates. ■

ORIGIN WIRELESS® (Origin) was founded January 2013 by ECE Professor **K. J. Ray Liu** and his students. The company aims to deliver "smart radios for smart life" by developing advanced wireless technologies for the future.

Indoor positioning has been a key technical problem for over three decades, tackled by the world research community and industry but never solved. Origin solved the problem by using fundamental time-reversal physics combined with signal and information science. The company's offering was selected the best paper from among 2,600 paper submissions to the premier IEEE International Conference on Acoustic, Speech, and Signal Processing in 2016.

Origin can achieve one to two centimeter locationing accuracy under non-line-of-sight conditions with only a single smart radio device, the first ever such device that can achieve this result and can track in real-time using WiFi or LTE devices. This is an achievement that cannot be reproduced with any other existing techniques.

Origin has also worked to find a solution to a problem regarding the estimation of speed of an object with lower speed and many multipaths. Origin discovered that the time-reversal focusing ball is a result of the sum of a large number of coherent multipths. Its energy distribution exhibits a stationary behavior that can be used to accurately estimate speed under the condition of severe indoor multipaths. Consequently, Origin technology can track someone indoors with a smartphone without any infrastructure.

The company's "Time Reversal Machine" offers a revolutionary platform for IoT and 5G. It enables the creation of many vertical IoT applications that have been envisioned for a long time. The Time Reversal MachineTM offers many outlets for application, including the world's first-ever centimeter accuracy indoor positioning/tracking, wellness monitoring, home/office security, radio human biometrics, health care, wireless charging, and 5G communications. Origin's Waveforming® technology takes advantage of unavoidable but rich multipaths in signal propagation and the physics of time reversal that resonate with the environment to focus signal energy to specific positions.

Origin has obtained and filed over 50 patent applications through its intensive research and development. Origin's product lines cover applications ranging from positioning/tracking, home/office security, health care, smart cars, and communications. In addition, Origin offers a horizontal platform to enable many vertical IoT applications for joint ventures or IP licensing. ■

The Maryland Development Center (MDC) was founded in 2015 by five physicians at the University of Maryland's Medical School with two entrepreneurs, including ECE Professor **Gil Blankenship**. MDC was created to commercialize technology from the medical school and other research institutions. The company licenses intellectual property from universities and works with inventors to develop prototypes and viable products supported by startup companies. MDC also produces its own inventions and builds companies based on those ideas.

MDC's initial focus has been on medical devices, especially those with a short path to regulatory approval and a short time to market. The company is currently working on the following technologies: wearable systems to monitor and improve sleep health, digital information technology for vaccine compliance and use, a thermal imager for laparoscopic surgery, EO2 (a device for emergency resuscitation), SONOSA (ultrasound imaging for detection and characterization of obstructive sleep apnea), FA2 (a device for the placement of arterial catheters to support hemorrhage control), the dura repair kit (a toolkit to repair tears in the dura mater), and AnkleBot (a device to help stroke victims learn to walk again).

To date, MDC has created five startup companies. MDC offices are in a historic building in Baltimore, near the University of Maryland Medical Center, where MDC partners and clients practice, teach, and research state-of-the-art medicine. ■

Alumni Awards and Honors

Forte Wins ARO Young Investigator Award

Alumnus **Domenic Forte** (C.E. Ph.D. 2013), who was advised during his Ph.D. studies by Professor Ankur Srivastava (ECE/ISR), received a prestigious 2016 Army Research Office (ARO) Young Investigator Award to investigate "game-changing approaches in human-to-device authentication that explicitly tie electronic system operation to certain individuals by combining biometrics with hardware obfuscation" said Forte. The three-year award is worth 150k.

Forte is an Assistant Professor in the ECE Department at the University of Florida. He received his Ph.D. in Electrical and Computer Engineering from the University of Maryland in 2013. His current research focuses on Counterfeit Detection and Avoidance, Hardware Security Primitives, Hardware Trojan Detection and Prevention, Nanoscale Integration Challenges, Reverse Engineering and Anti-reverse engineering, Design tools, metrics, and rules for hardware security; and Biometrics.

The ARO Young Investigator Program recognizes young faculty less than five years out of doctoral studies who show exceptional promise for creative research. The objectives of this program are to attract outstanding faculty members to the army research program, support innovative research and encourage teaching and research careers. ■

Briskman Wins IAF Hall of Fame & IEEE/AESS Judith A. Resnik Space Awards

Alumnus **Robert D. Briskman** (M.S. E.E.'61), co-founder of Sirius XM Radio, received the 2017 International Astronautical Federation (IAF) Hall of Fame Award for his outstanding contribution during the course of his career to the progress of Astronautics within the framework of the IAF activities. He received a certificate for his award during the closing ceremony at this year's 68th International Astronautical Congress, held in Adelaide, Australia September 25-29, 2017.

Briskman also received the 2017 IEEE/AESS Judith A. Resnik Space Award for his dedication and success in the development of civilian satellite communication and broadcast systems. The award is an annual AESS award that recognize candidates who have provided outstanding contributions to space engineering in the AESS fields of interest.

Since 1965, Briskman has been responsible for launching over 30 successful satellites, including the first commercial communications satellite, "Early Bird" (later renamed INTELSAT 1). In 1975, he designed the 6/4 GHz satellite radio communications frequency plan, which incorporated dual polarization. It was approved by the FCC and is still used today in North America, Asia, and Europe. For the past two decades, SiriusXM Radio has implemented a satellite radio broadcast system that currently serves over 35 million subscribers in North America.

Briskman's award was presented at the Awards Luncheon at the IEEE/AIAA 2017 Digital Avionics Systems Conference (DASC) on Thursday, September 21, in St. Petersburg, Florida. ■

Ahmadi Wins Alfred P. Sloan Foundation Fellowship

Alumnus **Amir Ali Ahmadi** (B.S. E.E./ Mathematics '06), assistant professor in the Department of Operations Research and Financial Engineering at Princeton University, was selected this year as 1 of only 126 individuals in the nation to win an Alfred P. Sloan Foundation Fellowship. These two-year, $60,000 fellowships are awarded yearly to individuals in recognition of distinguished performance and unique potential to make substantial contributions within their fields.

Ahmadi received a dual B.S. in electrical engineering and mathematics from the University of Maryland in 2006. Ahmadi was an undergraduate researcher in ECE under the supervision of Professor Thomas E. Murphy and Dr. Reza Salem (for his work in photonics) and Professors Thomas Antonsen and Edward Ott (for his work on chaotic properties of fluid mixings).

Regarding his experience at Maryland, Ahmadi wrote, "I have amazing memories from my time at UMD - it was my first home after immigrating to the U.S., and I truly believe my education there set the foundation on which my current research is built. My decision to pursue graduate work in optimization was very much a result of taking two ECE courses from Professor Andre Tits (Signals and Systems, and Optimal Control). At Maryland, I was so fortunate to receive amazing mentorship from several top-notch researchers such as Thomas Antonsen, Thomas Murphy, Edward Ott, Reza Salem, Andre Tits, and James Yorke."

At Princeton University, Ahmadi develops new algorithms and new understanding of optimization problems. He has won the NSF CAREER Award, the Google Faculty Award, the Young Investigator Program Award of the AFOSR, and several best paper and teaching awards. ■

ECE Alumni Win NSF CAREER Awards

Five alumni of the Electrical and Computer Engineering Department have received a 2017 National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award. The NSF CAREER Program fosters the career development of outstanding junior faculty, combining the support of research and education of the highest quality and in the broadest sense.

Domenic Forte (Ph.D. 2013) received a CAREER Award for "Transformative Approaches for Hardware Obfuscation Protection, Attacks, and Assessment." The five-year, $400,000 grant will advance the state-of-the-art in hardware obfuscation for IP protection. Forte is now an assistant professor in the Department of Electrical and Computer Engineering at the University of Florida in Gainesville, Florida.

Serban Sabau (Ph.D. '11) received an NSF CAREER Award for "Novel Representations for Distributed Control of String Networks in Vehicle Platooning and Supply Chain Management." The five-year, $500K award funds research to develop a novel mathematical description of dynamical networks capable of capturing simultaneously both the dynamics and the topology of a given network. Since 2013, Sabau has been an assistant professor in the department of electrical and computer engineering at the Stevens Institute of Technology in Hoboken, New Jersey.

Aswin Sankaranarayanan (M.S. '07, Ph.D. '09) received a CAREER Award for "Plenoptic Signal Processing: A Framework for Sampling, Detection, and Estimation Using Plenoptic Functions." The five-year award is worth $532,000. Sankaranarayanan is now an assistant professor in the department of electrical and computer engineering at Carnegie Mellon University in Pittsburgh, Pennsylvania.

Ravi Tandon (E.E. Ph.D. 2010) received a CAREER Award for "Communication-Efficient Distributed Computation: Information-Theoretic Foundations and Algorithms." The five-year, $500,000 award funds research to design scheduling, data movement, and data-shuffling algorithms for efficient data processing among multiple processors in big-data applications such as healthcare analytics, cybersecurity, and scientific computing. Tandon is now an assistant professor of electrical and computer engineering at the University of Arizona.

Ashok Veeraraghavan (M.S. '04, Ph.D. '08) received a CAREER Award for "A Signal Processing Framework for Computational Imaging: From Theory to Applications." The five-year, $549,000 award funds research aimed at developing novel imaging systems that can break through the barriers of size, spatial resolution, temporal resolution, field of view, weight, and cost by leveraging on the co-design of optics and signal processing. Since 2011, Veeraraghavan has been an assistant professor of electrical and computer engineering at Rice University in Houston, Texas. ■

Hagan Receives Advocating Women in Engineering Award from The SWE

This past fall, **Natalie Hagan** (B.S. E.E. '01) won the Advocating Women in Engineering Award from the Society of Women Engineers (SWE) for "sustained excellence in software reverse engineering and cybersecurity, and for inspiring and empowering other women engineers with engaged leadership on diversity and inclusion." This award honors individuals who have demonstrated professional excellence in their chosen STEM fields and have proven to be advocates of both women in engineering and SWE's objectives. Only five women worldwide receive this award each year.

Hagan is an electrical engineer in the wireless cyber capabilities group in applied physics at The Johns Hopkins University (JHU/APL), where she performs reverse engineering and driver development on classified projects and high-level language development. She received her B.S. in electrical engineering from the University of Maryland, College Park, in 2001, and her M.S. in electrical engineering from the Whiting School of Engineering at Johns Hopkins.

Hagan's support for women in engineering has both established her as a role model for aspiring women engineers and resulted in substantial workplace changes at JHU/APL. She has championed changes to improve the recruitment and retention of a diverse staff, and she has initiated a series of outreach inclusion events to develop women's leadership skills and to advocate for women engineers to senior management. Hagan's efforts toward inclusion ensure that lab projects include the talents, perspectives, and contributions of all the people working there. ■

Alumni Promotions

Veeraraghavan Promoted to Associate Professor at Rice University

Alumnus **Ashok Veeraraghavan** (M.S. '04, Ph.D. '08) has been promoted to associate professor in the Department of Electrical and Computer Engineering at Rice University.

Veeraraghavan earned his M.S. and Ph.D. in ECE from the University of Maryland in 2004 and 2008, respectively. As a student at Maryland, he was advised by Distinguished University Professor and Chair of Electrical and Computer Engineering Rama Chellappa. Since joining the Rice faculty in 2010, Veeraraghavan's lab has developed mobileVision, a simple device to monitor eye health, and FlatCam, a lens-less camera platform project developed with engineering colleague Richard Baraniuk. ■

Zhang Promoted to Full Professor at Georgia Tech

Alumnus **Fumin Zhang** (Ph.D., EE 2004) has been promoted to full professor in the School of Electrical and Computer Engineering at the Georgia Institute of Technology.

As a student at Maryland, Zhang was advised by Professor P.S. Krishnaprasad (ECE/ISR). Zhang joined Georgia Tech in 2007, after completing a postdoctoral appointment in the Department of Mechanical and Aerospace Engineering at Princeton University with another alum, Professor Naomi Leonard (Ph.D., EE 1994).

Zhang's research program balances theory and applications. His interests are in the design and control of marine robots and mobile sensor networks and in cyber-physical systems theory, with a focus on feasibility of control tasks on networked and embedded computing devices with limited power. His work on mobile sensor networks aims to solve the problem of monitoring large areas in the ocean and atmosphere with limited sensing resources and limited power. His work also investigates cyber-physical systems that integrate control theory, embedded systems, and distributed sensing algorithms with real world applications constrained by environmental disturbances and limited power. His theoretical contributions are implemented on actual robots and sensor networks as distributed control and sensing algorithms.

Zhang was the recipient of an ONR Young Investigator Program award for "Generic Environment Models (GEMs) for Agile Marine Autonomy" in 2010 and an NSF CAREER Award for "Feasibility of Control Tasks: Towards Control-Computing-Power Co-Design" in 2009. ■

Qiu Promoted to Associate Professor at Georgia Tech

Alumnus **Peng Qiu** (Ph.D. EE, 2007), has received tenure as an Associate Professor at the Georgia Institute of Technology, where he teaches in the Coulter Department of Biomedical Engineering. He joined the Georgia Tech faculty in 2013 after holding a faculty position at the University of Texas MD Anderson Cancer Center for three years. His research interests are in bioinformatics and computational biology, focusing on machine learning, visualization, signal processing, systems modeling and network analysis. Qiu won a 2016 NSF CAREER Award for "Experimental Design and Model Reduction in Systems Biology."

He was advised by Christine Kim Eminent Professor of Information Technology K.J. Ray Liu at the University of Maryland. Qiu graduated with a Ph.D. from the Department of Electrical and Computer Engineering, in 2007.

"Looking back on my journey, I'd like to thank Dr. Liu for introducing me to my current research direction, and I thank him for his excellent mentoring and training," said Qiu. "The four years at the University of Maryland has been one of the biggest contributing factors that has allowed me to reach where I am right now, and I am very grateful for that." ■

Turaga Promoted to Associate Professor with Tenure at ASU

Alumnus **Pavan Turaga** (M.S. '07, Ph.D. '09) has been promoted to associate professor at Arizona State University where he teaches in the departments of Arts, Media and Engineering and Electrical Engineering (ECEE). His research interests are in computer vision, machine learning, and live experimental systems, with methodologies drawn from statistics, optimization, geometry, and topology.

Turaga obtained his Ph.D. in 2009 from the Electrical and Computer Engineering Department at the University of Maryland under the guidance of Distinguished University Professor and Chair of Electrical and Computer Engineering Rama Chellappa. After spending two years as a research associate at the Center for Automation Research at the University of Maryland, he joined the ASU faculty in 2011.

Turaga was named the IBM Emerging Leader in Multimedia in 2008. He won the University of Maryland Distinguished Dissertation award in 2009, was named IEEE Senior Member in 2014, and won a 2015 NSF CAREER Award for the "Role of Geometry in Dynamical Modeling of Human Movement: Applications to Activity Quality Assessment Across Euclidean, Non-Euclidean, and Function Spaces." ■

ECE Inducts Four New Distinguished Alumni

This spring, at the sixth annual ECE Distinguished Alumni Award presentation, The Electrical and Computer Engineering Department honored four alumni for their leadership, their meritorious contributions to the field of engineering, their humanitarian efforts, and their application of the principles of an engineering education to other disciplines. This year's ECE distinguished alumni are Can E. Korman, Mingyan Liu, Ray Upton, and S. Kevin Zhou. The four honorees were recognized at a ceremony and luncheon on May 19, 2017 at the University of Maryland.

Can E. Korman (B.S. '85, M.S. '87, Ph.D. '90) obtained his M.Sc. degree under the supervision of Professor Robert Harger and his Ph.D. degree under the supervision of Professor **Isaak Mayergoyz**, who nominated him for this award. After completing his Ph.D. at UMD, Korman joined The George Washington University (GWU) in 1991 as an assistant professor, and now holds the rank of professor in the Department of Electrical and Computer Engineering. He served as chair of that department from 2005 to 2009, and he is currently serving as the associate dean for research and graduate studies in the School of Engineering and Applied Science. He is also the co-director of the Institute for MEMS and VLSI Technologies at GWU.

As associate dean, Korman is responsible for planning the growth of the research programs within the school, recruiting and funding graduate students, and overseeing graduate career services. He led the School of Engineering and Applied Science in the planning and design of GWU's new Science and Engineering Hall, the flagship research building of the university. His professional expertise is in the areas of micro-nano-electronics, micro-electro-mechanical systems (MEMS), sensors, semiconductor noise, magnetic recording, and hysteresis.

He won the Eta Kappa Nu Association's Teacher of the Year Award in 1994 and the Engineer's Council Faculty of the Year Award in 1995 at GWU. He has authored or co-authored over 100 refereed journal papers and conference presentations.

Of his award, Korman says, "It is my distinct honor to receive the Sixth Annual ECE Distinguished Alumni Award from the Electrical and Computer Engineering Department. I owe my career success to the intellectually fostering environment at the department and to the caring mentorship of my advisors and professors. I would like to thank the department for this recognition and my Ph.D. advisor Professor Isaak Mayergoyz for nominating me. My best wishes to the continued growth and academic excellence of the ECE Department at the University of Maryland."

Mingyan Liu (M.S. '97, Ph.D. '00) received her Ph.D. in electrical engineering from the University of Maryland, College Park in 2000, under the supervision of Professor **John Baras,** who nominated her for this award. She joined the University of Michigan, Ann Arbor, in 2000 in the Department of Electrical Engineering and Computer Science and currently holds the rank ofprofessor.

Her research interests are in optimal resource allocation, incentive design, and performance modeling and analysis, all within the context of communication networks. Her most recent research activities involve online learning, modeling, and mining of large-scale Internet measurement data concerning cyber security, and incentive mechanisms for interdependent security games.

She was the recipient of a 2002 NSF CAREER Award, the University of Michigan's Elizabeth C. Crosby Research Award in 2003 and 2014, the 2010 EECS Department Outstanding Achievement Award, the 2015 College of Engineering Excellence in Education Award, and the 2017 College of Engineering Excellence in Service Award. She holds best paper awards from the International Conference on Information Processing in Sensor Networks (IPSN) in 2012 and the IEEE/ACM International

Conference on Data Science and Advanced Analytics (DSAA) in 2014. She has served on the editorial board of IEEE/ACM Trans. Networking, IEEE Trans. Mobile Computing, and ACM Trans. Sensor Networks. She is a fellow of the IEEE and a member of the ACM.

Liu is also a successful entrepreneur, having co-founded a cybersecurity startup in 2014 called QuadMetrics, Inc. The company, licensed from the University of Michigan in 2015, leverages Internet measurement techniques and predictive analytics to produce a global security ratings/scoring system for enterprises. This security score helps security professionals address gaps and reveals a firm's security risk; it also helps insurance underwriters construct risk-informed cyber insurance policies. In 2016, QuadMetrics was acquired by FICO, the company associated with providing consumer-credit scores.

"I am extremely honored to be selected for this alumni award. University of Maryland was the landing place for me when I first arrived in the U.S. as a graduate student 22 years ago, and it still feels like home to me. This is where I formed many life-long friendships and professional connections. I am enormously grateful for the education I received in ECE and the advice from many professors. I am particularly grateful for my two mentors, Professor Andre Tits, who recruited me to Maryland, and Professor John Baras, who convinced me to complete a Ph.D. degree, and later on, to pursue an academic career. None of what I have accomplished would have been possible without them and without ECE," said Liu.

Ray Upton (B.S. E.E. '95) was nominated for the 2017 ECE Distinguished Alumni Award by Professor **R.D. (Mel) Gomez.** After receiving his degree from the University of Maryland in 1995, Upton joined Texas Instruments (TI), where he currently holds the position of vice president and general manager of the Connected Microcontroller Business Unit. Along with his team, Upton is responsible for definition, innovation, development, and marketing of the world's most connected and complete wired and wireless portfolio of microcontrollers, all of which are making the Internet of things possible. Upton has held wide-ranging positions at TI in multiple locations in his 22-year career at TI, including roles in sales, operations, and product line and business unit management.

In addition, for more than five years, he has used his passion for the development of personnel to sponsor and advise one of TI's Diversity Initiatives, which promotes the professional development of Latino and Hispanic employees at TI. Upton also played a key role in establishing TI's support for the ENEE 101 class and lab in AV Williams, which allows freshmen students to gain hands-on work experience with the intent of igniting a passion for innovation.

Of his nomination, Upton said, "Through college, I worked closely with a couple of UMD professors, which afforded me great flexibility to work independently. Because they provided me with flexibility, I wanted to do a good job in return. Through this engagement and work, I was practically exposed to semiconductors quite early, which has prepared me for where I am today."

S. Kevin Zhou (Ph.D. '04) obtained his Ph.D. degree in electrical engineering from the University of Maryland and was advised and nominated by Professor **Rama Chellappa.** He is currently a principal key expert at Siemens Healthineers Technology Center, which is dedicated to researching and developing innovative solutions for medical and industrial imaging products. His research interests lie in computer vision and machine learning and their applications to medical image analysis and face recognition and modeling.

Zhou has published more than 170 book chapters and peer-reviewed journal and conference papers, has registered more than 250 patents and inventions, and has written 2 research monographs. He has also edited three books, including Medical Image Recognition, Segmentation and Parsing: Machine Learning and Multiple Object Approaches (single editor) and Deep Learning for Medical Image Analysis (jointly with H. Greenspan and D. Shen). In addition, he has actively served the community as the associate editor for Medical Image Analysis and IEEE Trans. Medical Imaging and as the area chair and a program committee member for premier computer vision and medical imaging conferences, which has involved giving tutorial talks and organizing workshops.

Zhou has won multiple awards that honor his publications, patents, and products, including best paper awards, the Thomas Alva Edison Patent Award from NJ R&D Council, the Johnson & Johnson Supplier Enable Innovation (SEI) Award, the R&D 100 Award, and the Siemens Inventor of the Year. He is a fellow of American Institute of Medical and Biological Engineering (AIMBE).

Of his nomination, Zhou said, "This award means a lot to me. When I started my Ph.D. in 2000, I came to the USA for the first time in my life, leaving my parents and home country behind. I developed a habit of working hard and staying confident and focused, even when my paper submissions were rejected. I became curious and challenged many research problems, which lead to publishing over a dozen papers during my time as a student. After graduation, I moved to New Jersey and joined Siemens. I have generated hundreds of inventions, including my best invention ever --- my son. I thank the department and everyone for giving me the great honor of receiving the Distinguished Alumni Award." ■

ECE Students Attend Practice Sessions Leading up to the 2017 Indianapolis Time Trials

On May 18, 2017, Electrical and Computer Engineering (ECE) students **Michael Dipalo**, **Konrad Anderson**, and **Sean Stanley** and Mechanical Engineering (ME) student **Benjamin Strobel** of the University of Maryland (UMD) Terps Racing Formula Team traveled to Speedway, Indiana, to attend the practice sessions held just a few days prior to the Indianapolis time trials. These sessions lead up to the annual Indianapolis 500.

The trip was organized by John Barnes, a longtime racing enthusiast and a former Indy team manager of Panther Racing, and Captain Leonard J. Hamilton, who serves as an associate professor in the Mechanical Engineering Department at the United States Naval Academy, a UMD adjunct associate professor in the Mechanical Engineering Department, and the Terps Racing Formula Team faculty advisor. The host, Schmidt Peterson Motorsports, an auto racing team in the Verizon Indy Car Series, took the students for a behind-the-scenes look at the practice sessions held before the ime trials. The students were given garage access and plenty of time to speak with mechanics, and they were plugged into the radio of James Hinchcliffe's team (#5 at Schmidt Peterson) during the practice. They also spoke with the Front-End Mechanic of the #7 car about efficiency and time management. They expressed their excitement about the opportunity to employ some of the Indy team's techniques to their own team, hoping to see the same great results.

"It was an incredibly unique experience to see what we do as a hobby here at Maryland as a profession, and to see how these engineers approach problems on their team," said Stanley.

In addition, **Booz Allen Hamilton**, longtime corporate affiliate of the Electrical and Computer Engineering Department at UMD, is now supporting Terps Racing. Booz Allen Hamilton has teamed up with Terps Racing students to create a Formula SAE driver feedback system. This system is meant to improve the performance of the FSAE vehicle and to provide a nicer driver experience through the presentation of the vehicle instrumentation. **Bill Olsen,** principal at Booz Allen Hamilton and ECE UMD Advisory Board member, was instrumental in forming and fostering the relationship between John Barnes, Schmidt Peterson, the Terps Racing Formula Team, and Booz Allen Hamilton Staff.

Terps Racing is an organization of students who design, build, test, and race Formula SAE and Baja SAE racecars. Team Formula is a student-led team that works in and out of class to design, construct, test, and race a formula race car in national FSAE events. The Baja team represents UMD in the Society of Automotive Engineers Baja Collegiate Design Series.

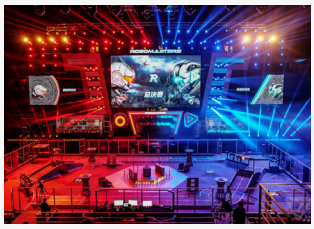
"Racing on the collegiate level is an incredibly valuable educational experience. When opportunities like these present themselves for professional development and networking in the field of racing, you begin to recognize the value of your experience," said Stanley.

The Terps Racing Formula Team as a whole said that they had been incredibly motivated by this experience, which helped them recognize the importance and relevance of their work and how it is used in a professional level. They said they they are excited to continue pursuing their racing endeavors and will, as always, strive to go faster. ■

Booz | Allen | Hamilton

Mandl, Todd, and UMD Teammates Aim to Compete in Robomasters 2018

This summer, seniors **Jenny Mandl** (ECE) and **Noah Todd** (ME), 2 of the 20 students on the UMD RoboMasters Team, traveled to Seattle to visit the first American team to compete in RoboMasters at University of Washington. RoboMasters is an annual robotics competition for teams of aspiring engineers to design and build next-generation robots that complete difficult tasks and engage in hand-to-hand combat. The competition is hosted by DJI, a leader in the consumer drone market and maker of the Phantom Drone. Each team competes in this competition, the most sophisticated of its type in the world, with three robots: a base, a drone, and an attack robot. Each robot shoots pellets and golf balls at pressure-sensitive plates on opponents in order to earn a victory. American engineering schools currently competing include the University of Washington, Virginia Tech, the University of Arizona, and Worcester Polytechnic Institute.

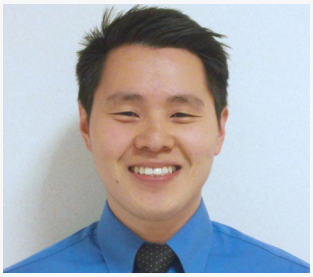


DJI plans to bring a regional competition to the United States next year to make the competition more internationally focused.

Mandl and Todd were able to discuss designs and challenges with members of the American team in Seattle. On the designs side, the UMD team has a working computer vision algorithm to detect opponent bots and basic functioning robots that move in all directions and shoot pellets. They also discussed their challenges, including how to self-fund and fundraise effectively for 2018. They also sought advice on attending the competition and on how to obtain quality translations of the Chinese-language specs sent with the parts from DJI. Conversations about the latter have led the team to actively recruit bilingual English-Mandarin Chinese engineers for the team. ■

Danny Kim, MWC/ARCS Lockheed Martin Scholar, will continue Malware Mitigation Technology Research

Danny Kim, a Ph.D. student in computer engineering advised by Professor **Rajeev Barua** (ECE/ISR), has been selected as a Metropolitan Washington Chapter of Achievement Reward for College Scientists (MWC/ARCS) Lockheed Martin Scholar for 2017-2018. This is the third year that Kim has won this award. Kim, along with fellow ARCS Scholars, will be recognized during the Scholar Awards Reception on October 12, 2017 at the National Academy of Sciences Building in Washington, DC.



As an ARCS scholar, Kim is working toward discovering new fundamental behaviors of malicious software, better known as malware, in order to better detect it and stop it before damage is caused. This research has allowed him to produce an initial prototype of a tool capable of identifying and analyzing critical malware properties through the presence of obfuscation. Kim has further enhanced the tool by using machine learning to increase accuracy and decrease false positives. The tool has demonstrated its potential to create to safer computer systems, which would have significant economic, strategic, and privacy-related benefits to society.

Over the past few years, Kim has been recognized numerous times for his exceptional engineering work. His awards include, in addition to his three-year tenure as an ARCS scholar, AFCEA Bethesda Scholarship, a Jeong H. Kim Scholarship, an A. James Clark Engineering Scholarship, and a Dean's Scholarship from The University of Maryland. Kim graduated from UMD with a B.S. in electrical engineering in 2014. He previously served as vice president of the ECE Graduate Student Association in 2016 and is an active volunteer within his church.

After his graduation, expected in spring 2018, he plans to lead the malware analysis industry using innovative techniques to detect even the most difficult malware. Once an expert in the field, he hopes to reduce the negative impact malware has on the world.

The ARCS Foundation advances science and technology in the United States by providing financial awards to academically outstanding students working toward graduate degrees in science, engineering, and medical research. Since its founding in 1958 in Los Angeles, ARCS has grown to a national organization of 17 chapters that have collectively provided more than 14,000 scholar awards (totaling nearly $83 million) at 54 leading universities. ■

Four ECE Students Receive Outstanding Graduate Assistant Award from UMD Graduate School

ECE graduate students **Sangwook Chu, Dipankkar Maity, Sayyed Sina Miran,** and **Yupeng Zhang** are 4 of approximately 80 winners of the University of Maryland Graduate School's 2016-2017 Outstanding Graduate Assistant Award. The award recognizes the outstanding contributions that graduate assistants provide to students, faculty, departments, administrative units, and the university as a whole. Recipients of the award are among the top 2 percent of GAs on campus in a given year. The awards were given at the annual Fellowship and Award Celebration on May 11, 2017.

THE GRADUATE SCHOOL

Chu is advised by Professor **Reza Ghodssi** (ECE/ISR), the ISR director, and is a member of the MEMS Sensors and Actuators Laboratory. His research focuses on the integration of biological nanomaterials such as genetically engineered tobacco mosaic virus (TMV), with three-dimensional microsystems components for the development of advanced bioelectronics.

Maity is advised by Professor **John Baras** (ECE/ISR). His research interests are in controls, robotics, and networked cyber-physical-systems. He has focused on the intersection of control and formal verification engineering for complex cyber-physical systems. He is a member of the Autonomy Robotics Cognition (ARC) lab, where he works on implementing these algorithms to robotics.

Miran is advised by Professor **Behtash Babadi** (ECE/ISR). His research is in computational neuroscience. He applies tools from statistical signal processing, compressed sensing, and machine learning to neuroscience-related problems in order to develop mathematical models to explain the neural data for the purpose of information extraction.

Zhang is advised by Professor **Charalampos (Babis) Papamanthou** (ECE/UMIACS/MC2) and Professor **Jonathan Katz** and is a member of the Maryland Cybersecurity Center (MC2). His research focuses on computer security, privacy, and cryptography. Zhang also won a 2017 Google Ph.D. Fellowship for his work to improve security for cloud computing by developing new schemes with better privacy and integrity guarantees. ■

Capstone Design Course on Electric Bikes *Sprints Ahead*

This spring, the Electrical and Computer Engineering Department at the University of Maryland offered a unique capstone course led by Professor and Associate Chair for Undergraduate Studies **R.D. (Mel) Gomez** (ECE). Students worked on the design of safe, light, and utilitarian electric bicycles for personal transportation.

The course utilized a combination of off-the-shelf and custom-made components in order to develop a prototype of a bicycle that met one of several design challenges: an urban bike with extended range and fast charge capability, a mountain bike with superb terrain climbing ability, or a self-driving tricycle for autonomous transport. The vehicles were required to contain myriad sensors for safety and convenience, including GPS systems, on-board diagnostics, and theft deterrent systems. The vehicles also needed to be operable under different road conditions, at all hours, and in inclement weather.

In result, a team designed and prototyped the 408R-URB bike, which can travel 50 miles in a single charge (roughly two round trips from College Park to the Washington Monument) and can be charged to 80 percent capacity in less than two hours. A second team designed and prototyped the 408R E-Mountain Bike, which can climb the steps of UMD's Xfinity Center. The range of this bike is about 17.5 miles, which is enough to effortlessly explore most back trails.

408R E-Mountain Bike

408R E-URB Bike

"Designing projects that offer practical solutions to real world needs, and better than available on the market, are challenging but very gratifying," said Gomez. "Our students designed products that can be used as an alternative for cars in urban areas or to explore off the beaten path. The course teaches students how to incorporate real world constraints such as safety, reliability, cost, and manufacturability into their design thinking. In the future, the bar will be set higher: 125-mile range, using energy from renewable sources, energy regeneration, added sensors and actuators for safety and environment monitoring, self-driving bikes, and use of new materials for construction."

About The Bikes

The bikes incorporate several subsystems: power-propulsion, charging, sensing, and a user interface. For safety and legal reasons, the top speeds of the bikes are limited to 25 mph. The 408R-URB bike weighs 30 pounds, and the 408R E-Mountain bike weighs 28 pounds. Each bike has undergone extensive laboratory and test rides, and so far, neither has failed in testing. The urban bike uses an airless tire that cannot go flat. While many e-bikes are commercially available, these bikes offer superior range, torque, convenience, and cost. If bikes like these were to be commercially made, the cost would be around $1,600. ■

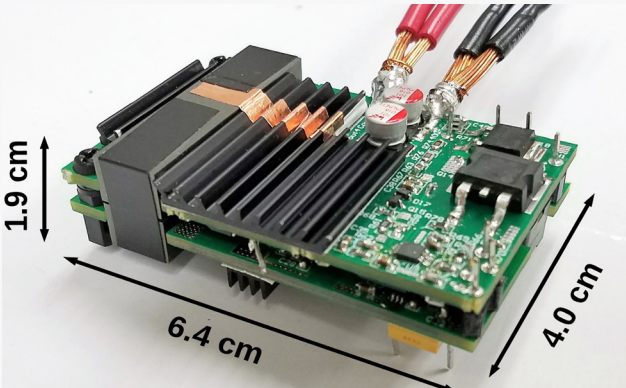
Khaligh-led Student Team Wins Award at IEEE IFEC Competition

A student team led by Professor **Alireza Khaligh** (ECE/ISR) won the Best Presentation Award at the 2017 IEEE International Future Energy Challenge (IFEC), which was held July 24-25 at Virginia Tech in Blacksburg, Virginia.

Besides Khaligh, team members included ECE undergraduate students **Gary Cooke, Samira Nikpour, Alexander Massimo Fiore,** and **Alexander Beall**, as well as graduate students **Peiwen He** and **Ayan Mallik.** This is the first year the University of Maryland participated in the competition.

The 2017 challenge was to build a high-efficiency, high-density isolated DC-DC converter. The demand for these types of converters has grown rapidly in recent years, especially for computer, telecommunications, data center, battery charger, industrial, and aerospace applications. Collectively, these products consume more than 10 percent of all electric power, and even a 1 percent efficiency improvement in this sector represents tremendous energy savings. Moreover, with the increase of cloud computing and big data, it is expected that data centers alone will consume 10 percent of electricity generated by 2020, less than three years from now.

IFEC is an international undergraduate competition that fosters innovation, conservation, and effective use of electrical energy. It is, open to college and university student teams from recognized engineering programs in any location. Each team is required to have a minimum of three undergraduate students and up to two graduate students; the latter's participation is limited to technical assistants. IFEC is sponsored by the Institute of Electrical and Electronics Engineers (IEEE) Power Electronics Society (PELS), the Power & Energy Society (PES), the Industry Application Society (IAS), and the Power Sources Manufacturers Association (PSMA). ■



ECE Students Dive Into the Communications Design Course With a New Lab Sponsored by Hughes Network Systems

This fall, students in the Department of Electrical and Computer Engineering will, thanks to **Hughes Network Systems**, set foot into a newly designed laboratory for the Communications Design Course, ENEE428. The beautifully designed lab, located on the first floor of the A.V. Williams Building across from the ECE Undergraduate Student Lounge, boasts crisp blue walls, a spotless grey floor, and computers at two semicircular, high-top table stations, perfect for fostering collaboration in pairs. ENEE428 is a senior-level elective course in which students implement the theoretical concepts presented in Communications Systems (ENEE420) and Digital Signal Processing (ENEE425) on actual hardware in real time. This process allows students to gain experience using equipment common to the industry, such as oscilloscopes, spectrum analyzers, error rate test sets, channel simulators, digital signal processors, analog-to-digital and digital-to-analog converters, and signal generators.

Professor **Steve Tretter**, who has been the instructor for ENEE428 for many years, said of the lab, "The Communications Design Laboratory is one of my favorite classes to teach. I am so thrilled with the new design of the lab, and thankful to Hughes for this sponsorship. It will be wonderful to work with the students in the new, state-of-the-art space and collaborate with Hughes on examples of problems facing the communications industry." Lectures will be held for 50 minutes once a week and labs will be held in two sections twice a week for three hours on Wednesdays and Fridays. Once an experiment is completed, students will use a workstation to demonstrate that the implementation is working correctly, and they will then be assessed on completed individual written lab reports.

Hughes Network Systems is the world's leading provider of satellite broadband for home and office, and the company is a longtime corporate affiliate of the ECE Department. Hughes is also a top employer of recent ECE graduates, ECE-sourced interns, and ECE alumni. **Paul Gaske**, ECE alumnus and Hughes's executive vice president and general manager, North America, was instrumental in securing the donation from Hughes for this lab.

"On behalf of Hughes, we are very proud to support the design and construction of the new Communications Design Lab at the Department of Electrical and Computer Engineering, and to play a role in educating the next generation of communications engineers who will help companies like ours stay in the forefront of technology and innovation," said Gaske. "Every day, the many ECE alumni at Hughes are working to improve and extend communications access for communities around the globe. With this lab, and through our collaboration, we hope to inspire even more students to take up these and other challenges that our industry will face in the years ahead."

This is the third lab renovation of an ECE undergraduate lab in as many years. The gift for ENEE428 included funds for the construction of the redesigned space and an endowment to secure the most current equipment and upkeep for the lab. Professor **Rama Chellappa,** chairman of the ECE Department, said of this gift, "Paul and Hughes have been longtime friends and partners of ECE and the Clark School. The new Communications Design Lab sponsored by Hughes solidifies their place as a top partner....Hughes has also done a great service for current students and future students who will take this course. The redesign of this lab shows the commitment the department and its sponsors have to educating future engineers." ■

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WE NEED YOUR HELP!

To learn how you can make a charitable contribution and have a measurable impact on the future of the Electrical and Computer Engineering Department, or to explore other options, contact Amanda Stein, ECE Director of External Relations.
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