Points of Pride

$19.5 million Ohio State ECE research expenditures in the 2017-2018 academic year

19 Number of faculty members who are IEEE Fellows

58 Tenure-track faculty members

7 Research-track faculty members

5 Clinical-track faculty members

11,000+ Ohio State ECE alumni worldwide

Ohio State's ECE department ranks 25th among graduate programs listed in *U.S. News and World Report* (2018).

Degrees conferred

44	Ph.D.
155	Master's
218	Bachelor's

Summer 2017-Summer 2018

Graduate enrollment

	Ph.D.	MS
Total Number of Graduate Students (AU2018)	242	193
New Applicants	300	858
Number Admitted	46 (15.3%)	131 (15.3%)
Number Enrolled	35	98
Average GRE (quantitative)	164 (89 percentile)	165 (88 percentile)

ECE graduate program acceptance rates are less than 20%. Students in our Ph.D. program averaged 87th percentile GRE quantitative scores.

Total graduate students

2014	465
2015	525
2016	454
2017	420
2018	435

Undergraduate students

2014	358	548	906
2015	368	551	919
2016	412	588	1,000
2017	351	624	975
2018	299	578	877

Pre-majors | Declared majors

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Department of Electrical & Computer Engineering

2018 Annual Report

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

From the Chair

Professor Hesham El Gamal

It is a privilege to assume my new role as chair of the Department of Electrical and Computer Engineering after serving in the faculty ranks for almost 18 years. Building on our recent successes, I am a firm believer the department is poised to reach new heights. We are embarking on a journey to further foster our collaborative, cross disciplinary, diverse, and inclusive educational culture.

Under the leadership of Prof. **Joel Johnson**, the department grew to 51 tenure-track faculty, seven research-track faculty, five clinical-track faculty, 887 undergraduate students, and 435 graduate students. The quality they represent is witnessed by the outstanding number of research awards, the widespread impact of our scholarly work, and the impressive accomplishments of our alumni. Such success is the main reason we continue to attract top talents to our student and faculty body. For example, last year we welcomed Prof. **Kiryung Lee**, Prof. **Shamsul Arafin**, and Prof. **Tawfiq Musah**, who extend our collective passion for next-generation power efficiency, communications, photonics, and signal processing, in addition to their solid scholarly contributions, our faculty are heavily engaged in technology development and entrepreneurship. Such efforts are recognized by university-wide innovation awards, set to yield remarkable outcomes in terms of licensing intellectual property and spin-off start-ups in the next few years. More importantly, we believe the entrepreneurial spirit of our faculty is important toward mentoring our students and delivering the world class education and skill sets necessary for their success in an ever-changing technological landscape. While we formulate our strategic plan for the next five years and engage in new research and education initiatives, ranging from cyber security to artificial intelligence and quantum information sciences (among others), we realize collaboration is imperative for success. This focus will also enhance our ability to attract industrial and federal funding to deliver on our ambitious research agenda.

As a proud member of our bustling university, the department's commitment to the economic development of the State of Ohio remains unwavering.

More importantly, recruiting and nurturing faculty and students from underrepresented minorities is a top priority. These colleagues and students bring invaluable strengths, and our collegiate and inclusive culture will always be a source of pride for all of us.

With the utmost gratitude to Dean Williams for guidance and support, Prof. Johnson for his effective leadership, as well as our dedicated faculty and staff, our engaged alumni, plus our bright and motivated students for their eagerness to learn, I am excited about the journey ahead and the future of our department.

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Faculty

New Appointments, 2018

Mariana Pereira Costa Pulcherio, joined ECE as a Lecturer in 2018. She previously earned her Ph.D. in electrical engineering at Ohio State with a focus on microgrid systems.

Saeedeh Ziaeefard joined as a Lecturer in 2018. She earned her Ph.D. in Mechanical Engineering in 2018 from Michigan Technological University.

Shamsul Arafin, joined ECE as an Assistant Professor in 2018. His research interests include III-V compound semiconductor technology for materials and devices: molecular beam epitaxial growth and characterization of materials, as well as realization of photonic devices.

Keith Redmill became a Research Associate Professor in 2018, after serving six years as an Assistant Professor of Practice and 13 years as a Research Scientist at Ohio State. His focus includes sensing, control, and coordination for autonomous robotic and embedded systems, with emphasis on automated driving and advanced vehicle safety systems.

Kiryung Lee joined as an Assistant Professor in 2018. His research interests include inverse problems and optimization in signal processing and statistics, as well as applications in engineering, neuroscience, and psychology.

Haskell "Jac" Fought, joined Ohio State ECE as an Assistant Professor of Practice in 2018. With more than 20 years of industry experience at Battelle working on advanced sensors and robotic vehicles, he now oversees the undergraduate Capstone Design program.

TJ Ronningen joined ECE as a Research Scientist in 2018, after gaining 12 years industry experience at Battelle. His research incorporates infrared sensing, spectroscopy, data analysis and systems development.

Selection of ECE awards and honors

Faculty

- Faculty **Julia Zhang**, **Longya Xu**, **Jin Wang**, **Mahesh Illindala**, **Anant Argawal** and **Mike Benzakein** received $4.1 million from the Ohio Federal Research Network for the proposal "Brushless doubly-fed machine and drive for aviation application."
- Professors **Sanjay Krishna**, **Waleed Khalil** and **Earl Fuller** of SK Infrared won $428,000 in 2018 from the DARPA WIRED program for the proposal, "Open Circuit Voltage Photodetector (VocP) Infrared Imager."
- Professor **Aleix Martinez** won Best Paper at the 2018 European Conference on Computer Vision.
- Professor **Philip Schniter** won the 2018 Qualcomm Faculty Award.
- Assistant Professor **Liang Guo** won the inaugural 2018 Nano Research Young Innovators (NR45) in nanobiotechnology.
- Assistant Professor **Abhishek Gupta** won two NSF grants from the Computer and Network Systems Division for his work in cyber security.
- ECE Professors **Walter Burnside** and **Inder Gupta** won the prestigious 2018 John Kraus Antenna Award from the IEEE Antennas and Propagation Society for their industry contributions.
- Research by Professor **Benjamin Coifman** and Ph.D. student **Lizhe Li** won the Transportation Research Board Committee on Traffic Flow Theory and Characteristics 2018 Greenshields Prize.
- Professors **Longya Xu**, **Jin Wang** and **Julia Zhang** earned $750,000 in funding from Power America for the development, demonstration and commercialization of a SiC based 1 MW medium voltage motor drive system.

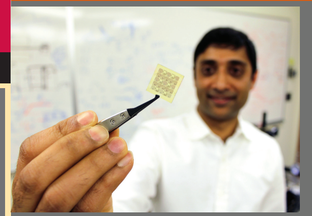
Students

- **Altug Karakurt** won the Best Paper Award at the 2018 International Symposium on Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt).
- **Alex Brothers** earned First Place at Ohio State's ninth annual Undergraduate Research Forum for his project "A High Efficiency High Power Density Bidirectional DC-DC Converter for Battery Energy Storage."
- Ph.D. student **Jack Blauert** won the IEEE Antennas and Propagation Society Doctoral Research Award, under the guidance of Assistant Professor **Asimina Kiourti**.
- **Peimeng Guan, Emma Hoying, Kerri Loyd, Dominic Mikrut, Hussein Abdi, Affiq Ruslin** and **Yazan Aldeneh** won Harold P. Mathis Memorial Scholarships in 2018.
- Undergraduate alumnus **Raman Vilkhu** won the national 2018 Alton B. Zerby and Carl T. Koerner Outstanding Electrical and Computer Engineering Award.
- Undergraduates **Alex Brothers**, **Jeff Hensal**, **Matthew Foster** and graduate student advisor **Boxue Hu** won the "Outstanding Presentation Award" at the 2018 International Future Energy Challenge.
- **Trevor Dean**, **Roman Fragasse** and **Teressa Specht** won AFRL/ Dayton Area Graduate Studies Institute (DAGSI) Ohio Student-Faculty Research Fellowships.
- Ph.D. student **Feiran Lei** won Best Student Paper at the IEEE 60th International Midwest Symposium on Circuits and Systems at Tufts University

Research and Outreach

New ElectroScience Laboratory director, Richard Ridgway

At the core of every engineer is a person trying to better understand the world, trying to solve problems facing society, or exploring a passion for the details in life through science and mathematics. As the newly appointed director for Ohio State's ElectroScience Laboratory (ESL), **Richard W. Ridgway** has built a career at that intersection of joy and discipline.
From better understanding the impact of global warming, advancing circuits and antennas, improving GPS capabilities and reducing the complexities of radar toward the future of autonomous vehicles, Ridgway said the work at ESL is important.
"ESL is one of the nation's premier electromagnetic centers of excellence, trying to solve some of the most challenging of our nation's problems," he said.
This semester, Ridgway said, ESL welcomes a total of 29 faculty and researchers, nine post-doctoral students and visiting scholars, 87 Ph.D. and master's degree students, and 12 undergraduates. Read more in our interview with Ridgway: **https://go.osu.edu/esl-ridgway**



Ohio State DREaM-ing up the future IoT

From autonomous cars and medical devices, to real-time traffic detection and augmented reality – the future of technology is destined to become increasingly complex and interconnected. Add to that equation millions of people accessing this data simultaneously and the Internet-of-Things (IoT) could get messy.
While some scientists are working to redesign devices to improve bandwidth and efficiency, others are rethinking the actual materials used to create them. At the forefront of this research is Ohio State professor **Siddharth Rajan** who was recently awarded over $5 million toward two new projects for the Defense Advanced Research Projects Agency (DARPA) and its new Dynamic Range-enhanced Electronics and Materials (DREaM) program.
Rajan's research marries scientific disciplines between Materials Science Engineering (MSE) and Electrical and Computer Engineering (ECE). The two projects he's working on exemplify the newest realms in microelectronics research to date. Read more: **https://go.osu.edu/dream**

CubeRRT: The little satellite that could

The debut data from The Ohio State University's first satellite transmitted back from orbit, and the results look promising for future scientists studying the Earth.
Joel Johnson, an electrical and computer engineering professor at Ohio State, said the CubeSat Radiometer Radio Frequency Interference Technology Validation satellite, or CubeRRT, contains advanced sensors for observing Earth's environment from space. While the team demonstrated the concept in pre-launch lab tests, would it prove successful in orbit?
"The data we received on Sept. 5 confirmed successful real-time on-board removal of RFI from CubeRRT's measurements," Johnson said. "This was the primary goal of the mission, so it was a great feeling to know we had reached this important milestone and that our little satellite was making big accomplishments up in space."
Read more about the results: **https://go.osu.edu/qbertdata**

Ohio State engineers trying to reverse suicide rates through technology

With suicides increasing at alarming rates in America, scientists at Ohio State are trying to reverse the trend through collaboration across scientific boundaries.
Ohio State Electrical and Computer Engineering Ph.D. scholar **Hugo Gonzalez Villasanti** recently won the highest honor given by the university to a student – a Presidential Fellowship. He is developing a framework for technology-assisted neural and sensory stimulation therapies using virtual and augmented reality. Specifically, he is trying to find ways to treat depressive and bipolar disorders, which are dangerously pervasive worldwide.
"It's so prevalent. It is costing society over $1 trillion worldwide per year. Think about $1 trillion per year, how many lives are lost to suicide. A multi-disciplinary perspective is needed to analyze this challenge," he said.
Read the full story online: **https://go.osu.edu/hugoVR**
Watch a short video: **https://go.osu.edu/hugovid**

At first blush, you look happy - or sad, or angry

Human faces broadcast feelings in living color - even when they don't move a muscle.
That's the conclusion of a groundbreaking study into human expressions of emotion, which found people are able to correctly identify other people's feelings up to 75 percent of the time-based solely on subtle shifts in blood flow color around the nose, eyebrows, cheeks or chin. The study, published in the Proceedings of the National Academy of Sciences, demonstrates a first-ever connection between the central nervous system and emotional expression in the face. It also enabled researchers to construct computer algorithms that correctly recognize human emotion via face color up to 90 percent of the time.
"We identified patterns of facial coloring that are unique to every emotion we studied," said **Aleix Martinez**, a cognitive scientist and professor of electrical and computer engineering at Ohio State. "Not only do we perceive these changes in facial color, but we use them to correctly identify how other people are feeling, whether we do it consciously or not."
Read more online: **http://go.osu.edu/blushm**

Looking up: CHPPE 2018 review

The efficiency and environmental benefits of electrification are already propelling vehicles on the ground and sea, but next-generation engineers are looking to the skies for the next major breakthrough.
The Ohio State University's Center for High Performance Power Electronics (CHPPE) held its annual review for industry leaders Oct. 14 and 15 to discuss just such a topic.
CHPPE Co-Director **Jin Wang** said the event showcases new realms of power electronics research for industry leaders, but the goal this year was to highlight the future of hybrid aviation. "The reason is that we now have several major projects sponsored by NASA and the Ohio Federal Research Network on the propulsion of future hybrid electric aircrafts," said Wang, a professor in electrical and computer engineering (ECE).
He said keynote speakers held throughout the event came from NASA, Boeing, GE Aviation, Safran, and more.
"There is a great need for a technological push and a new generation of engineers to meet the grand challenge of aviation electrification," Wang said. "CHPPE is right at the center of the nation's effort."
The CHPPE review also serves as a platform for undergraduate and graduate research. Power electronics students presented numerous projects related to hybrid aviation and propulsion.
CHPPE Program Director and ECE Professor **Longya Xu** said national and international experts identified the need for advancements in hybrid propulsion in aviation as due for an essential technological breakthrough over the next 15 to 20 years.
Read more: **https://go.osu.edu/chppe18**

Alumni and Innovation

From student to entrepreneur, alumna Jessie Zhao

For engineering students, the pathway to entrepreneurship and innovation is full of unknowns. The Ohio State University may provide the foundation, but success requires the desire to look beyond the classroom.
Electrical and Computer Engineering alumna **Jessie Zhao** knows this well. After graduation, she followed the path toward business as lead developer for the startup Soliton Reach. The company makes small, wireless, motion-tracking sensors for healthcare and rehabilitation applications.
Originally from China, Zhao earned both her undergraduate and master's degree in ECE as a Buckeye.
"During my time at Ohio State, I worked on various projects with my advisor and research team, such as networking, embedded systems, analog and digital hardware," Zhao said.
Soliton Reach, she said, came about through word of mouth.
"Therapists at Nationwide Children's Hospital heard about us working on therapy-related games. They came to us and said they are having a problem tracking motions on young babies," Zhao said.
Their solutions were not working to their satisfaction, she said, so they asked for some technology help to address the issue.
"Our research group came together and figured we might give it a try," she said. "We came up with a design and eventually it became a business."
Find the full story online: **https://go.osu.edu/zhaostory-vid**

ECE Weekly

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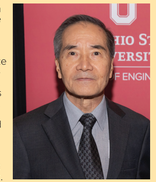
http://ece.osu.edu/ece-weekly-newsletter

Alumnus wins 2018 Future Science Prize



Known as the "father of immersion lithography," an alumnus of The Ohio State University received the highest honor in China for his pioneering lifelong work in semiconductor technology.
Electrical and Computer Engineering graduate, **Burn J. Lin**, received the 2018 Future Science Prize in the category of Mathematics and Computer Science. It remains the biggest science achievement award in China. Award organizers said Lin remains "a hero of the semiconductor industry" to this day.
Now 60 years since integrated circuits (IC) were invented, semiconductor technology has powered the biggest industrial and social revolution in the history of mankind.
"It is appropriate and compelling to bestow the (award) to an exceptionally accomplished scientist and inventor," organizers wrote in their nomination.
Lin's pioneering work in immersion lithography, as well as continuously scaled nano-metric integrated circuit fabrication, revived and extended Moore's law for multiple generations.
According to IEEE's recent statistics, at least 80% of all transistors in the world are now made with immersion lithography.
Although the concept of immersion lithography was proposed in the early 1980s, it was not a realizable approach, until Lin created critical performance metrics and derived scaling equations for the immersion lithography systems to be fully characterized and optimized, which mapped out scaling laws for the intended super-high-resolution 3D immersion optics.
Read more: **http://go.osu.edu/linfsp**

Front cover photograph: *Research Assistant Professor Çağlar Yardim and P.h.D. student Luyao Xu prepare a drone for flight. Stay tuned to future ECE Weekly editions for their story.*