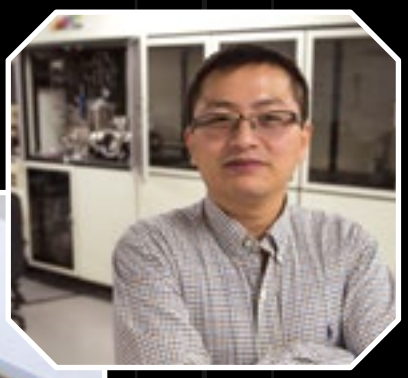
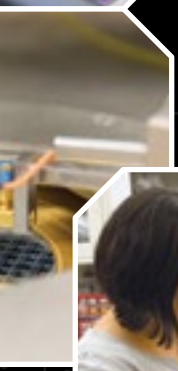
# School of **Electrical, Computer** and **Energy Engineering**

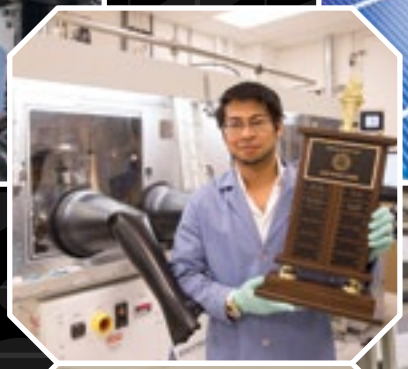
## Your future **is bright**



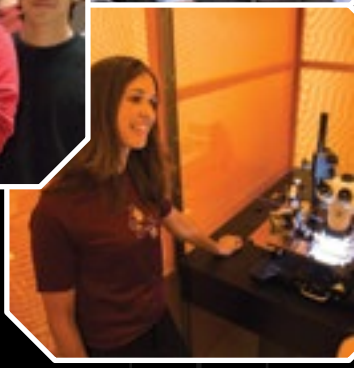












**Fall 2018 Report**

ASU Ira A. Fulton Schools of Engineering
Arizona State University

ASU
Ira A. Fulton Schools of Engineering
Arizona State University

The Ira A. Fulton Schools of Engineering at Arizona State University offers **25 undergraduate programs and 41 graduate programs in its six schools:**

- School of Biological and Health Systems Engineering
- School of Computing, Informatics, and Decision Systems Engineering
- School of Electrical, Computer and Energy Engineering
- School for Engineering of Matter, Transport and Energy
- School of Sustainable Engineering and the Built Environment
- The Polytechnic School

# In the U.S., one in 72 graduating undergraduate engineers is a Sun Devil

**$104M**
**Research expenditures**
FY2016-2017

**19**
**NSF CAREER awardees**
in the last three years

**#3 Licenses and Options**
Behind only Purdue and Carnegie Mellon

**#4 IP Disclosures**
Behind only Carnegie Mellon, Caltech and Purdue

**#4 Startups**
Behind only Purdue, Carnegie Mellon and Stanford

*Comparative data per $10 million in research expenditures, based on the Association of University Technology Managers annual report of top national engineering schools.*

**Lead institution on two and partner on two National Science Foundation Engineering Research Centers**

QESST
CBBG Center for Biomediated & Bio-inspired Geotechnics
NEWT
FREEDM SYSTEMS CENTER

**Lead institution on the Department of Homeland Security Center of Excellence**

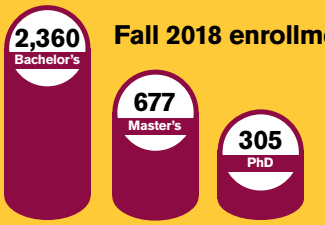
CAOE Center for Accelerating Operational Efficiency
A Department of Homeland Security Center of Excellence

# #1 in the U.S. for innovation

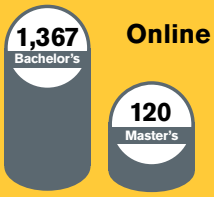
**ASU ahead of Stanford and MIT**
– U.S. News & World Report 2016, 2017, 2018 and 2019

BEST COLLEGES U.S.News & World Report MOST INNOVATIVE 2019

# Quick facts




**Fall 2018 enrollment**




**Online enrollment**

| Degrees offered: | Bachelor's | Master's | Doctoral |
|---|---|---|---|
| Electrical engineering | ✔ | ✔ | ✔ |
| Computer engineering | -- | ✔ | ✔ |

-- No degree offered.

| Degrees granted: | Bachelor's | Master's | Doctoral | Total |
|---|---|---|---|---|
| 2016-2017 | 223 | 191 | 54 | 468 |

**#32 Electrical Engineering Graduate Program Ranking, U.S. News & World Report (2019)**

**7 early career development awards in the past three years**

**$31M**
**2018 research expenditures**
$31,984,184

**16 new faculty in the past two years**

**26 IEEE Fellows**

# Continued strength

Our faculty, students and staff have redoubled their collaborative efforts to strengthen, grow and broaden the programs in the School of Electrical, Computer and Energy Engineering. The school's continued strength in research performance, new areas of research, growth in student enrollment to record levels at all levels and the development of innovative new academic programs have attracted national and international attention.

In the past few years we have grown our faculty expertise and research efforts in energy with a particular focus on photovoltaics, power systems and power electronics. Investments have also been made in terahertz circuits, networks and signal processing. These investments are often led by faculty in our major research centers described in this report.

Annual research expenditures continue at impressive levels in an environment of increasing competition for federal funds with limited growth. Our expenditures and new awards have both exceeded $30 million for the past four fiscal years. These amounts have more than tripled during the time of our current university president. This represents more than $400,000 per tenured/tenure-track faculty member. Achieving these levels of funding has been enabled by the outstanding work of our faculty and their students along with the contributions of several large research centers.

Our primary focus is the education of students, who are important contributors to our research. The majority of our research funding supports students in our program. In addition to graduate students working on sponsored project research, we engage many undergraduates and some high school students in our research labs. In addition to externally sponsored projects, we have a variety fellowships, scholarships and research stipends for all levels of students provided by gifts from generous alumni, corporations and friends. One of our undergraduates, Ngoni Mugwisi, an international student from Zimbabwe, recently earned the prestigious Rhodes Scholarship to further his studies at Oxford.

Our academic programs have grown significantly over the past few years from about 1,200 a decade ago to more than 3,300 in Fall 2018. This includes more than 300 doctoral students — or an average of more than 4 PhD students per tenured or tenure-track faculty member. This large doctoral enrollment is consistent with our strong research expenditures as well as the faculty focus on student recruiting and improving the reputation of our programs. Our graduate programs remain highly recognized with our electrical engineering graduate program ranked 32 by U.S. News and World Report and ranked in the top 20 by the National Research Council.

The online delivery of our undergraduate program has enabled an unprecedented quadrupling in undergraduate enrollment to more than 2,300 in less than a decade. This new delivery mechanism for our existing program is the first bachelor's level engineering program accredited by ABET in a 100 percent online format. This ability to use technology to enable access to our program for underserved students has clearly been successful. Of particular note is the more than 30 percent of the online enrollments are veterans or active military students. We continue to leverage technology to provide innovations in our academic programs for an improved experience for our students.

We continue to accelerate our progress through aggressive faculty hiring. The extraordinary efforts of our dedicated faculty, staff and students continue to drive the success of our school. ✤

**Stephen Phillips, PhD, P.E.**
Professor of Electrical Engineering
Director of the School of Electrical, Computer and Energy Engineering

# ECEE Fall 2018 Report

## Welcome


**3** Director's letter

**5** Key statistics


## Faculty


**6** Faculty awards

**8** New faculty

**9** Faculty spotlights

**37** Faculty expertise


## Research


**14** Wearable point-of-care sensors to offer rapid disease diagnosis

**15** ASU engineer looks to improve next-gen materials for solar cells

**16** Flexible hybrid electronics bend the rules of computing architectures

Developing a portable brain-inspired computing system

**17** Visual tech visionaries honored with Innovation Awards

Securing mobile through multiple lines of defense

**18** Engineers study radiation-caused mutations

New human mobility prediction model offers scalability, requires less data

**19** Electrical engineering photovoltaics projects lead ASU in SunShot Awards

**20** Research centers


## Innovation


**22** ASU venture Swift Coat wins big at Rice Business Competition

Electrical engineering professor among 2017 National Academy of Inventors Fellows

**23** Professor leads Google ATAP Project, teams up with former students

Boosting electromagnetic signal using artificial magnetic surfaces


## Students


**24** Doctoral students recognized for dissertation excellence

Outstanding graduates

Impact awards

**25** Palais awards

**26** USPCASE scholar collaborates on solar research, benefits Arizona and Pakistan

Quest student has the Perfect Pitch

**27** Taking the waste out of waste management

Fulton Schools teams win 12 of 20 ASU Edson Student Entrepreneur Initiative awards

NSF Graduate Research Fellowship Program

**28** Air Force veteran turned engineer lands NASA internship

**30** Doctoral students


## Alumni


**29** Electrical engineer earns Rhodes Scholarship

USPCASE draws Fulton Schools grad back to ASU, makes global impact


## Campaign ASU 2020


**34** Academic rigor, research excellence define David Ferry's legacy

**35** Gorur Family Award supports electric power and energy systems grad


## In memoriam


**48** Remembering George Karady, a power engineer


## ecee.engineering.asu.edu

**Stay in touch**

Keep up to date on news about Fulton Engineering and ECEE at our news site, Full Circle. *fullcircle.asu.edu*

**Like us on Facebook**

Find the School of Electrical, Computer and Energy Engineering to connect with our students, alumni and faculty. *facebook.com/ECEEatASU*


**Contributors**

Marco-Alexis Chaira
Monique Clement
Terry Grant
Erika Gronek
Jessica Hochreiter
Joe Kullman
Haley MacDonell
Nikai Salcido
Rose Serago
Nora Skrodenis
Erik Wirtanen
Pete Zrioka

*Stock images provided by shutterstock.com.*

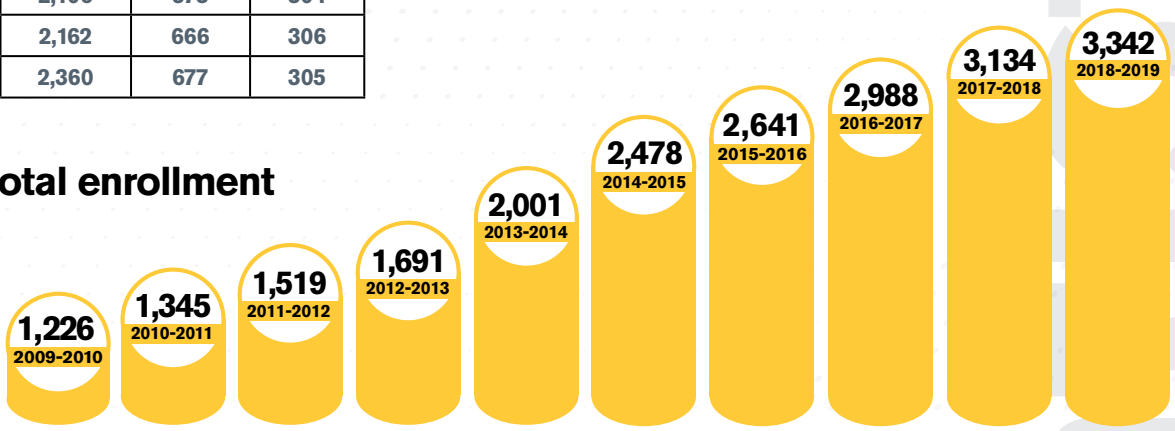
## 10-year ECEE enrollment

| Year | Bachelor's | Master's | Doctoral |
|---|---|---|---|
| 2009-2010 | 516 | 454 | 256 |
| 2010-2011 | 571 | 515 | 259 |
| 2011-2012 | 612 | 624 | 283 |
| 2012-2013 | 719 | 684 | 288 |
| 2013-2014 | 906 | 793 | 302 |
| 2014-2015 | 1,395 | 765 | 318 |
| 2015-2016 | 1,778 | 527 | 336 |
| 2016-2017 | 2,106 | 578 | 304 |
| 2017-2018 | 2,162 | 666 | 306 |
| 2018-2019 | 2,360 | 677 | 305 |

## Completed degrees

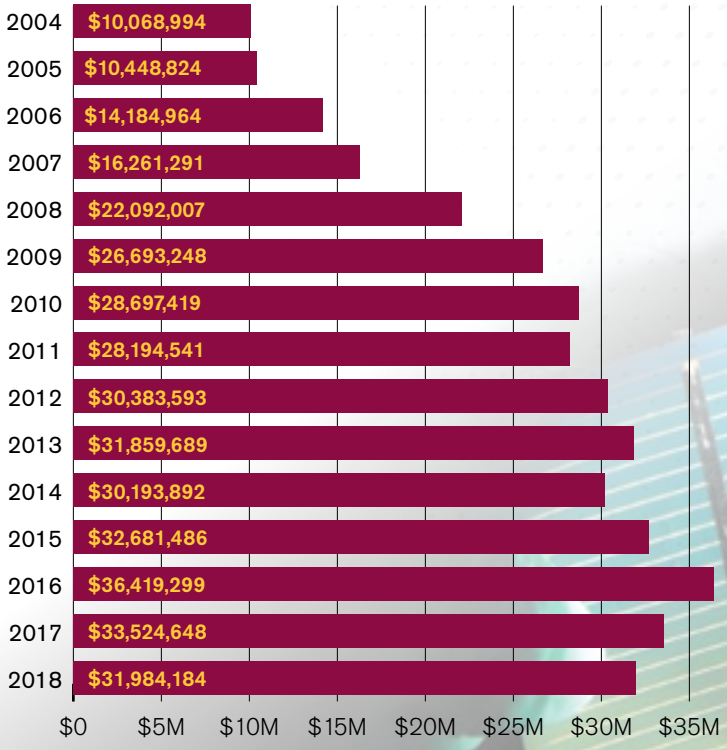
| Year | Bachelor's | Master's | Doctoral |
|---|---|---|---|
| 2012-2013 | 96 | 264 | 43 |
| 2013-2014 | 110 | 297 | 46 |
| 2014-2015 | 164 | 377 | 31 |
| 2015-2016 | 190 | 276 | 49 |
| 2016-2017 | 223 | 191 | 54 |

## 10-year total enrollment




| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| On campus | 1,138 | 1,268 | 1,445 | 1,610 | 1,852 | 1,940 | 1,774 | 1,804 | 1,841 | 1,855 |
| Online | 88 | 77 | 74 | 81 | 149 | 538 | 867 | 1,184 | 1,293 | 1,487 |

## Research expenditures FY04–FY18



## Fulton Exemplar Faculty

The Dean's Exemplar Faculty Award recognizes and rewards tenured faculty who have made exemplary contributions to the Ira A. Fulton Schools of Engineering through outstanding accomplishments and contributions in research, teaching and service.

Raja **Ayyanar**

Dan **Bliss**

Sule **Ozev**

Nongjian **Tao**

## Fulton Entrepreneurial Professors

Fulton Entrepreneurial Professors spend one to two years contributing to the Fulton Schools' culture of innovation and economic impact by translating and applying their research contributions and expertise to the entrepreneurial space.

Visar **Berisha**

Michael **Kozicki**

## Fulton Outstanding Assistant Professor

Nominated during their third year review period with the designation taking effect the following fall, the title of Fulton Outstanding Assistant Professor is awarded for two academic years to assistant professors who are contributing at high levels in all aspects of teaching, research and service.

Mariana **Bertoni**

Zachary **Holman**

Yu **Yao**

Shimeng **Yu**

Yuji **Zhao**

## Joseph Palais Distinguished Faculty Scholar Award

Professor Joseph Palais, longtime graduate program chair, and his wife Sandra established the Palais Faculty Award to recognize outstanding faculty members whose teaching stands out as exemplary, innovative, of impact and whose command of research advances the field of electrical engineering.

Mariana **Bertoni**

Zachary **Holman**

## Teaching Excellence Award

This annual award recognizes one faculty member for excellence in quality and innovative instruction. Student nominations and feedback are reviewed by a faculty committee in determining these honors.

Bertan **Bakkaloglu**

## Presidential Early Career Award for Scientists and Engineers

The Presidential Early Career Award for Scientists and Engineers (PECASE) is the highest honor bestowed by the United States government to outstanding scientists and engineers in the early stages of their independent research careers. This award identifies outstanding scientists and engineers who will broadly advance science and the missions important to participating federal agencies.

Kory **Hedman**

## DARPA Young Faculty Award

The Defense Advanced Research Projects Agency Young Faculty Award is a prestigious national honor awarded to rising stars in junior faculty positions at U.S. research institutions. Recipients of the DARPA Young Faculty Award are exposed to national security challenges in order to develop their research ideas in the context of Department of Defense needs.

Umit **Ogras**

Jennifer **Kitchen**

## NSF CAREER Award

The National Science Foundation's Faculty Early Career Development (CAREER) Program identifies the nation's most promising junior faculty members and provides them with funding to pursue outstanding research, excellence in teaching and the integration of education and research.

Jennifer **Blain Christen**

Ying-Cheng **Lai**

Umit **Ogras**

Jae-sun **Seo**

Shimeng **Yu**

## Fulbright Distinguished Chair

Fulbright Distinguished Chairs are awarded to top scholars with exemplary teaching and publication records, many of whom are in the social sciences. The position is considered one of the most prestigious Fulbright Scholar Program appointments.

Douglas **Cochran**
*(Science and Technology)*

Meng **Tao**
*(Alternative Energy Technology)*

## Recent IEEE Fellows

The distinction of IEEE Fellow is reserved for select Institute of Electrical and Electronics Engineers members whose extraordinary accomplishments in any of the IEEE fields of interest are deemed fitting of this prestigious award. Faculty selected for this award have contributed to the advancement or application of engineering, science and technology.

Hugh **Barnaby**

Dan **Bliss**

Douglas **Cochran**

Richard **King**

Yu **Cao**

## Top 5% Teaching Award

Quality and innovative instruction are top priorities of the Ira A. Fulton Schools of Engineering. We recognize excellence in instruction by awarding an annual Teaching Excellence Award and through selection to our Top 5% Teachers List. Student nominations and feedback are reviewed by a faculty committee to determine these honors.

David **Allee**

Bertan **Bakkaloglu**

Hugh **Barnaby**

Dan **Bliss**

Yu **Cao**

Junseok **Chae**

Chaitali **Chakrabarti**

Douglas **Cochran**

Stephen **Goodnick**

Michael **Goryll**

Zachary **Holman**

Jennifer **Kitchen**

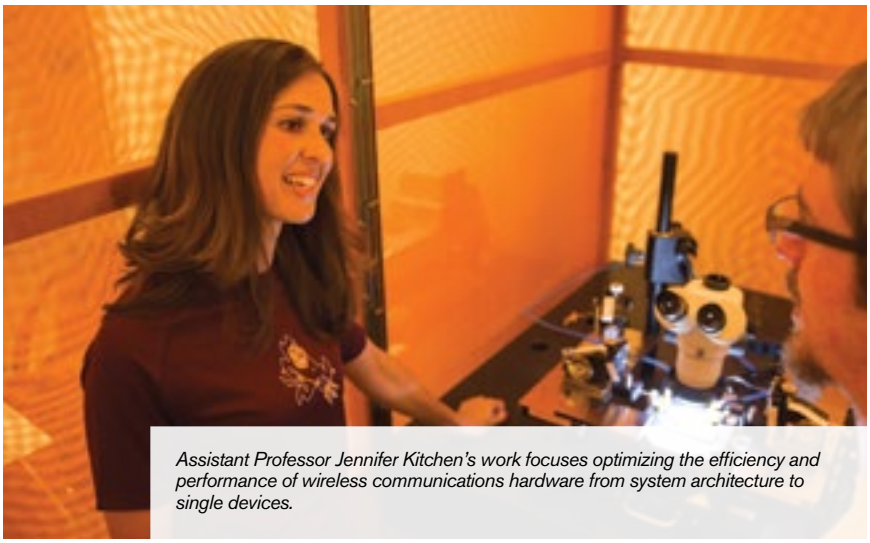
Antonia **Papandreou-Suppappola**

Brian **Skromme**

Trevor **Thornton**

*Sebastian Husein won the National Science Foundation's Perfect Pitch competition at their biennial meeting. This marks the second straight time that a QESST student from Assistant Professor Mariana Bertoni's (right) group has won.*

*Professor Michael Kozicki works with others to discover whether computing architectures that resemble the brain are not only faster, but also more durable in adverse conditions such as those found in space and warfare.*



*Assistant Professor Jennifer Kitchen's work focuses optimizing the efficiency and performance of wireless communications hardware from system architecture to single devices.*

# Our interdisciplinary leaders

Our innovative and transformative faculty define the quality, success and reputation of our school. They strive to be at the forefront of every intellectual revolution and produce research that improves quality of life for all. Over the past few years, these new faculty joined our community of esteemed engineers, entrepreneurs, scientists and teachers, who continuously push boundaries to elicit meaningful change.

Ahmed
**Alkhateeb**
focuses on wireless communications, communication theory, signal processing, machine learning and applied math. Alkhateeb is the recipient of the 2012 Microelectronics and Computer Development Fellowship from The University of Texas at Austin and the 2016 IEEE Signal Processing Society Young Author Best Paper Award for his work on hybrid precoding and channel estimation in millimeter wave communication systems.

*Assistant Professor*
*PhD, The University of Texas at Austin*

Gautam
**Dasarathy**
focuses on machine learning, signal processing, data science, information science, statistics and networked systems. He is working towards creating a rich suite of techniques that allows for taking an integrated approach to designing learning algorithms and data acquisition systems.

*Assistant Professor*
*PhD, University of Wisconsin–Madison*

Ahmed
**Emad Ewaisha**
has research interests in the areas of wireless communications and networking with a focus on developing algorithms to guarantee acceptable quality-of-service for real-time applications such as audio and video data.

*Lecturer*
*PhD, Arizona State University*

Suren
**Jayasuriya**
has research expertise in the areas of computational imaging and photography, computer vision and sensors. He has a joint appointment with the School of Arts, Media and Engineering in the Herberger Institute for Design and the Arts.

*Assistant Professor*
*PhD, Cornell University*

Mojdeh
**Khorsand**
brings expertise in power systems operations and planning, power systems restoration and cascading events, cybersecurity for electric power systems, renewable energy, transient stability studies, protection systems, power flow control technologies, stochastic optimization and electric energy markets.

*Assistant Professor*
*PhD, Arizona State University*

Richard
**King**
brings expertise in high-efficiency silicon and III-V photovoltaics, solid-state device physics, recombination at semiconductor defects and interfaces, multijunction solar cells, thin-film compound semiconductor growth and characterization.

*Professor*
*PhD, Stanford University*

Qin
**Lei**
contributes expertise in high power converters for high-voltage direct-current transmission/ medium voltage direct current transmission, medium voltage drive, grid-integration of renewable energy sources, transportation electrification/electric vehicle/ hybrid electric vehicle, power management for smart-grid/ micro-grid, wide-bandgap device application (SiC, GaN) and energy storage.

*Assistant Professor*
*PhD, Michigan State University*

Robert
**LiKamWa**
brings expertise in operating systems, computer architecture and machine learning. At the ACM/ IEEE International Symposium on Computer Architecture 2016, he presented research on RedEye, an analog ConvNet image sensor architecture for continuous mobile vision. He has a joint appointment with the ASU Herberger Institute for Design and the Arts' School of Arts, Media and Engineering.

*Assistant Professor*
*PhD, Rice University*

Angelia
**Nedich**
focuses on distributed and large-scale optimization, convex and nonsmooth optimization, game theory and variational inequalities, duality and convexity theory, stochastic approximations, dynamic systems, applications in communication networks, signal processing, machine learning and sensor networks.

*Professor*
*PhD, Moscow State University*

Anamitra
**Pal**
brings expertise in utility power systems, power transmission and smart grids and large scale system monitoring, protection and control. At Virginia Tech's Network Dynamics & Simulation Science Laboratory, he worked on two projects, analyzing cascading failures in interdependent (critical) infrastructures, and developing accurate residential energy-demand profiles using a synthetic population database.

*Assistant Professor*
*PhD, Virginia Tech*

Jiangchao
**Qin**
has research expertise in the areas of power electronics and power electronics-based power systems, high voltage direct current transmission and DC grids, WBG-based converters, grid integration of renewable energy resources, microgrids, energy storage systems, hybrid electric vehicles and transportation electrification and electric drives.

*Assistant Professor*
*PhD, Purdue University*

Christ
**Richmond**
brings research expertise in statistical, sensor and multichannel signal processing, detection and parameter estimation, information theory (and ties to estimation theory and machine learning), performance bounds and analysis, random matrix theory, radar/ sonar, communications, cooperative radar-communications, robust adaptive filtering/beamforming/ spectral analysis, interference/jammer mitigation techniques and RF emitter passive geolocation.

*Associate Professor*
*PhD, Massachusetts Institute of Technology*

Chao
**Wang**
researches novel nanostructure fabrication techniques, synthesis and fabrication of 1D and 2D nanostructures and nanomaterials, nanosensors for hazardous biomolecular sensing and disease diagnosis, micro-/nanofluidics for molecular sorting, sensing, purification, delivery and imaging, and diagnosis of cancer biomarkers by integrating nanofabrication, fluidic control, optical imaging, electrical detection and biochemical interactions.

*Assistant Professor*
*PhD, Princeton University*

Yang
**Weng**
researches power systems, machine learning and optimization. He focuses these efforts on how to optimize the integration of renewable energy resources efficiently through quantifying uncertainties, embedded physical laws and user behavior into machine learning and enabling data-driven control to create self-healing power grids.

*Assistant Professor*
*PhD, Carnegie Mellon University*

Meng (Marie)
**Wu**
brings expertise in utility power systems, power transmission and smart grids and large scale system monitoring, protection and control. At Virginia Tech's Network Dynamics & Simulation Science Laboratory, she worked on two projects, analyzing cascading failures in interdependent (critical) infrastructures, and developing accurate residential energy-demand profiles using a synthetic population database.

*Assistant Professor*
*PhD, Texas A&M University*

Saeed
**Zeinolabedinzadeh**
focuses on developing new millimeter-wave and terahertz fully integrated circuits and high-speed integrated electronics-photonics circuits for space applications for space applications.

*Assistant Professor*
*PhD, Georgia Institute of Technology*

# Umit Ogras

Umit Ogras veers easily back and forth from the pragmatic to the idealistic when he talks about his work and what he hopes it will make possible.

Ogras received a Young Faculty Award from the research arm of the U.S. Department of Defense, the Defense Advanced Research Projects Agency, commonly called DARPA.

The agency's funding will enable Ogras to concentrate more intensely on technologies that enable "wide-area sensing" using the internet of things devices to monitor, gather data and communicate within surrounding environments.

What Ogras aims to provide are low-cost, zero-maintenance "energy-harvesting" and wireless sensing and communications tools that won't require charging or replacement — made by printing tiny electrical circuits on small, physically flexible polymer platforms on which commercially available computer processing chips can be mounted.

Those technologies are being designed to enable real-time analysis of an array of situations in areas of active national defense operations.

Ogras hopes to see the impact of his contributions to that trend reach beyond enhancing defense capabilities and applying the kinds of sensors he is developing to produce assistive devices.

"My main motivation is to improve quality of life in general and empower people with physical disabilities," he says.

# Zach Holman

The U.S. Department of Energy launched the SunShot Initiative to reduce the total costs of solar energy by 75 percent and make its costs competitive with other forms of energy. Many photovoltaic modules have efficiencies of about 15 to 20 percent. Zachary Holman is using an unconventional, tandem system that raises efficiency to more than 30 percent.

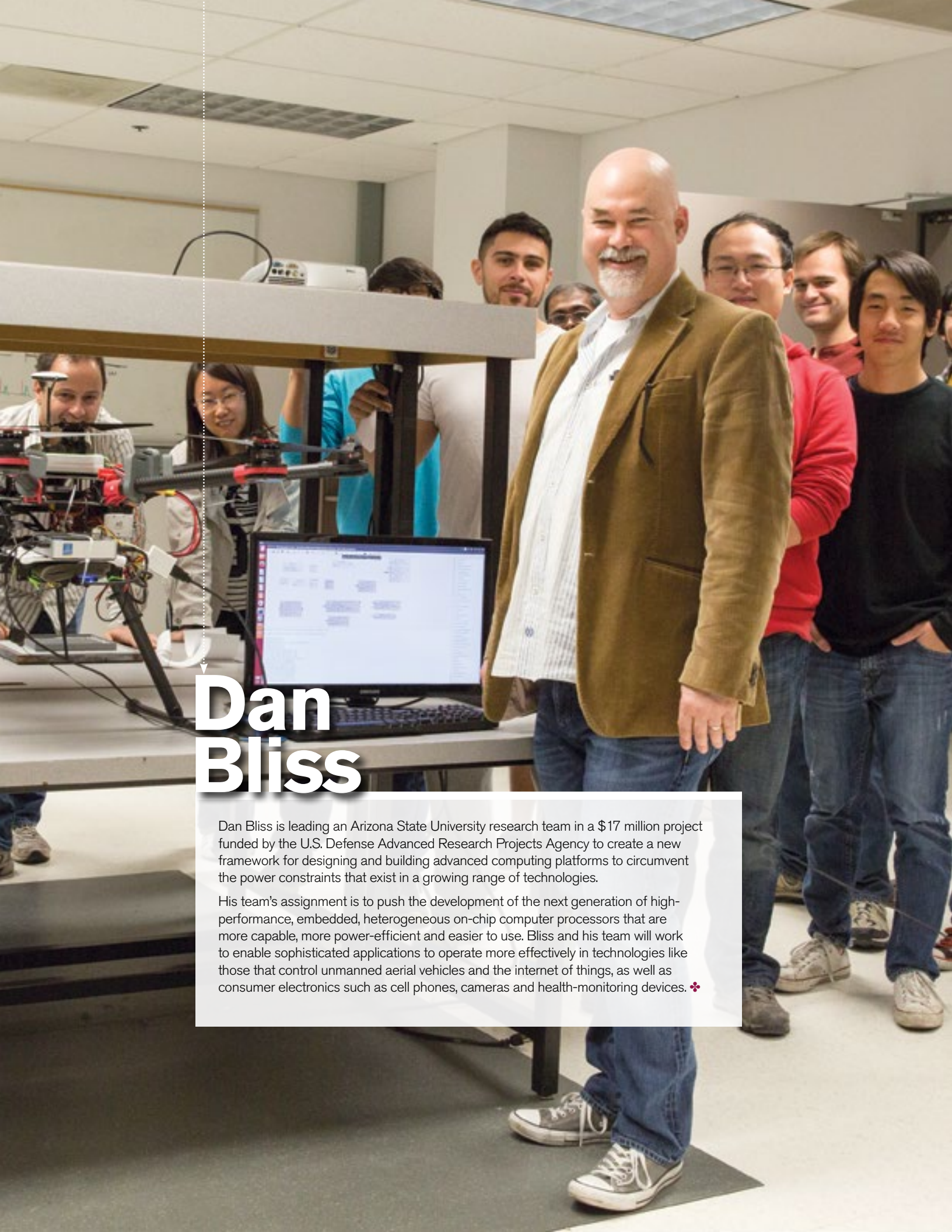
Using a silicon photovoltaic module called a "PVMirror," Holman and his team's configuration is expected to open the door to manufacturing future tandem modules and bring solar energy production costs well below the 2020 DOE SunShot goal of six cents per kilowatt hour. In fact, the tandem system could also achieve the DOE's SunShot 2030 program goal — a levelized cost of energy of three cents per kilowatt hour — which will help make solar electricity costs competitive with conventionally-generated electricity. ✣

# Anna Scaglione

Power systems are one of the most promising avenues for addressing the problem of climate change, both economically and socially. But current energy delivery systems and cyberinfrastructures that support power systems are still lacking in many respects. They are often not interoperable and do not reliably provide the necessary support to solve online, large-decision problems in real time.

Professor Anna Scaglione is motivated to solve this important problem through her research on algorithms and data analytics for networked systems and intelligent infrastructures. She aims to make energy delivery systems more secure, sustainable and reliable.

Research on new systems architectures that better leverage information and computation in critical infrastructures, such as the power grid — but also as it relates to cities, transportation, water and agriculture — will pave the path toward sustainable growth with respect to intelligent infrastructure. ✣



# Dan Bliss

Dan Bliss is leading an Arizona State University research team in a $17 million project funded by the U.S. Defense Advanced Research Projects Agency to create a new framework for designing and building advanced computing platforms to circumvent the power constraints that exist in a growing range of technologies.

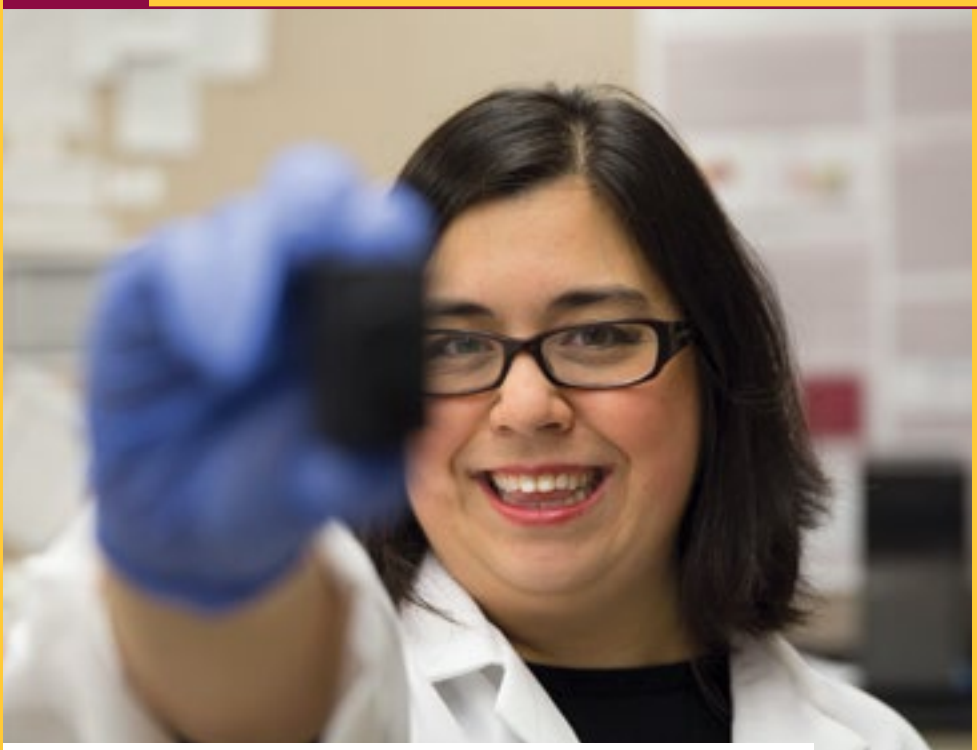
His team's assignment is to push the development of the next generation of high-performance, embedded, heterogeneous on-chip computer processors that are more capable, more power-efficient and easier to use. Bliss and his team will work to enable sophisticated applications to operate more effectively in technologies like those that control unmanned aerial vehicles and the internet of things, as well as consumer electronics such as cell phones, cameras and health-monitoring devices. ✣

# Bertan Bakkaloglu

ASU's penchant for collaborating with industry partners to explore opportunities for translatable research and economic development has led it to be named the most innovative university in the U.S. That spirit of innovation to foster growth in academic and industrial advancement will continue as Bertan Bakkaloglu was named the inaugural ON Semiconductor Professor of Engineering.

Through this five-year-long endowed professorship, Bakkaloglu — an expert in RF and mixed-signal IC design wireless and wireline communication circuits — will help push the frontiers of scholarly impact and productivity in the field of engineering as a mentor, advocate and role model. The professorship marks the latest in a long line of collaborations between ASU and ON Semiconductor stretching back to 1999.

This partnership will help both ASU and ON Semiconductor sustain the growth in resources and people needed to maintain leadership in the tech market. ✣



# Wearable point-of-care sensors to offer rapid disease diagnosis

As an electrical engineer, Associate Professor Jennifer Blain Christen has spent a good portion of her career dabbling in different fields, including health care field and biological sciences.

Blain Christen's enthusiasm for exploring new and different ways of applying electrical engineering earned her the funding to leverage her expertise to create an innovative new diagnostic tool.

The project aims to develop a disposable, point-of-care biosensor for rapid diagnosis and health monitoring, supported by a four-year, $1.8 million Smart and Connected Health award from the National Science Foundation.

Working in conjunction with Arizona State University's Flexible Display Center and Professor Karen Anderson of the Biodesign Institute, Blain Christen envisions a sweat-absorbing patch about the size of a nicotine or birth control patch with the ability to provide an immediate window into a patient's health.

A small screen within the patch, much like a miniature TV screen, will use light to examine molecules within sweat. The screen projects light through the molecules with the color of emerging light indicating the presence or absence of disease. Each pixel on the screen can look for different biomarkers, or measurable indicators to diagnose disease, and monitor for a variety of illnesses or health conditions.

"Everyone has a cell phone. In some cases, people have cell phones before indoor plumbing"

Blain Christen also wants to enable these sensors to communicate with mobile devices, leveraging the computing power of smartphones. Transmitting information through mobile devices saves times for health caregivers and opens new possibilities beyond point-of-care applications.

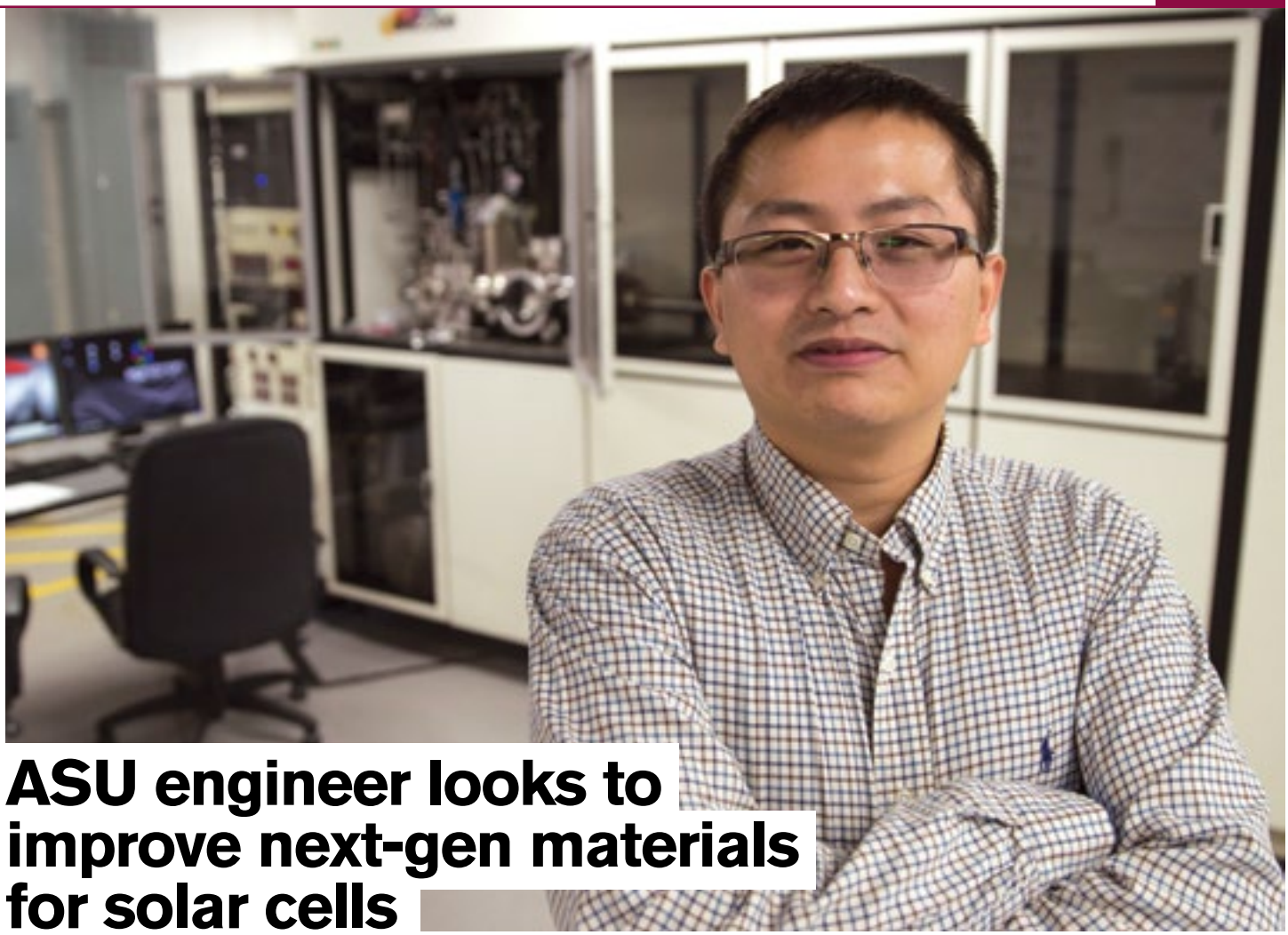
"Everyone has a cell phone. In some cases, people have cell phones before indoor plumbing," says Blain Christen, who envisions using that power to collect location data to aid in epidemiological studies. "Why not use that technology to collect the information for a centralized body? That way you empower people with information to do something about it."

Blain Christen also envisions the technology being used in developing countries with dispersed, remote populations, where it can be difficult to determine the severity and spread of illness. They can also be used as a rapid screening tool for people entering from regions affected by diseases like Zika virus, Ebola or dengue fever.

Blain Christen's work is based in electronics, but she finds its application to other areas the most rewarding.

"We have such rich availability of resources in electronics," she says. "To be able to leverage that and bring that into a new field is really exciting. It's so much fun to learn and experiment with my discipline in other fields." ✤

*Along with using her engineering expertise to develop cutting-edge diagnostic tools for use in health care, Jennifer Blain Christen is also venturing into new forms of treatment — electroceuticals.*



# ASU engineer looks to improve next-gen materials for solar cells

Gallium nitride may turn out to be superior to silicon for solar cell technologies, and the work of Yuji Zhao, an assistant professor of electrical engineering, is paving the way toward faster, more efficient and higher-powered devices of all kinds.

Zhao is exploring using gallium nitride to create a high-performance solar cell capable of operating under extremely high temperatures. Gallium nitride is a unique compound, the properties of which make it an excellent candidate for use in optoelectronics and high-power and high-frequency devices.

Zhao first began working with the material under pioneering researcher Shuji Nakamura of the University of California, Santa Barbara. Nakamura was awarded the Nobel Prize in Physics in 2014 for developing efficient blue-light-emitting diodes, which has enabled bright and energy-saving white-light LEDs.

While working toward his doctorate, Zhao focused on employing gallium nitride for use in LEDs and lasers. Now he's taken the material far beyond optoelectronics, expanding its use for solar panels, power systems and more. His exploration of the material's myriad uses earned him support from both NASA and the U.S. Department of Defense.

In 2015, Zhao was awarded an Early Career Faculty Space Tech Research Grant from NASA, a first for Fulton Schools faculty. The award supported his Applied Physics paper about high-temperature resistant solar cells.

Zhao also received a $300,000 award from the Defense Threat Reduction Agency to investigate the use of aluminum nitride in transistors that can withstand high voltage and resist radiation damage.

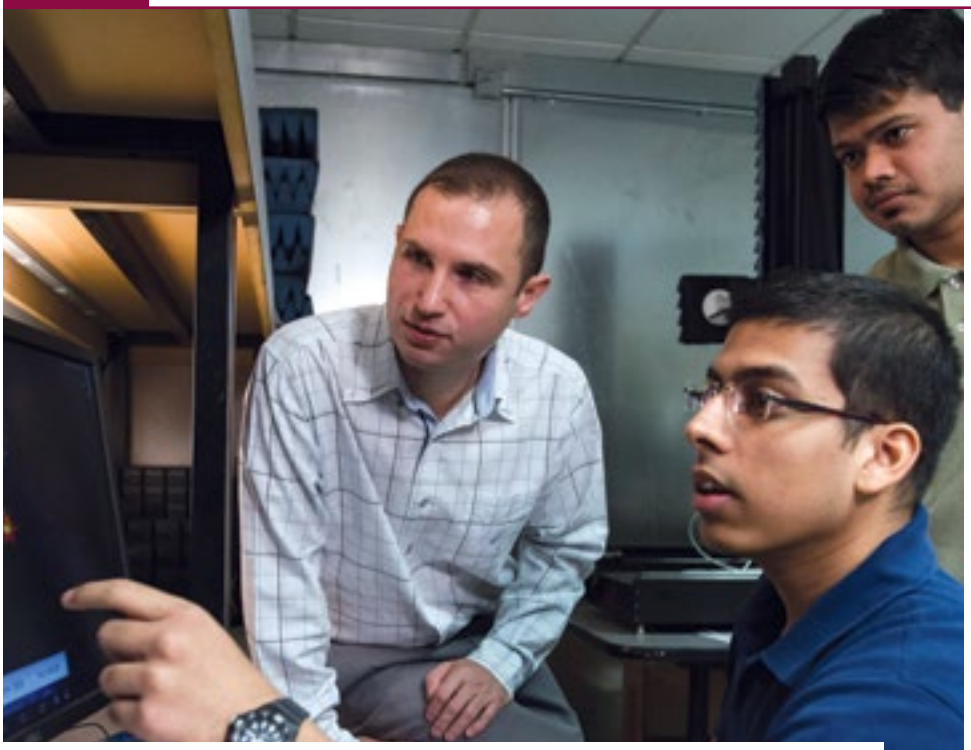
The applications are far reaching, such as more robust power electronics and communications systems, but DTRA is primarily interested in military devices that would remain operational following a radiation event, says Zhao.

"One of the key reasons I was awarded these grants was first my background with this work, but also the capability of the Metal-Organic Chemical Vapor Deposition (MOVD) lab," says Zhao. "The equipment we use is industry standard, not different from what you'd find in a major company."

The lab required an estimated investment of $800,000 to set up and became fully operational in fall 2016.

Zhao's ultimate goal mirrors that of the Nobel Prize — developing science and tech for the betterment of humanity. He has chosen refining and improving next-generation materials, such as gallium nitride, as his avenue to do so.

"The idea is to benefit as much of ASU as possible, which will hopefully extend outside of the university as well," says Zhao. ✤



# Flexible hybrid electronics bend the rules of computing architectures

## Typical computing platforms don't bend, twist and flex the ways we humans do.

Most powerful silicon architectures in use today require rigidity, but the wearable, assistive and medical computing applications of the future would be most beneficial if they were flexible.

Umit Ogras, an assistant professor of electrical and computer engineering, has been developing the methodology and tools to optimize the design of flexible hybrid electronics — architectures that combine flexible elements and rigid silicon to overcome the performance limitations of purely flexible electronics. Ogras' work is supported by a $500,000, five-year National Science Foundation CAREER Award project.

"Physical flexibility and stretchability expands the design space into an uncharted dimension, introducing intricate trade-offs with the traditional power, performance and area metrics," Ogras said. "But it can also drive the next big leap forward in form factor design, similar to the shift from desktop and laptop computers to handheld devices."

Purely rigid electronics like our smartphones boast high computing power, but lack the flexibility required for wearables. However, flexible thin-film transistors fall short on processing power.

It's up to electronic systems designers to figure out how to combine silicon and flexible printed electronics for better-performing, mostly flexible systems.

Ogras brought a new approach to the problem — constructing new tools that quantify flexibility as a metric in the design process. This will help designers find the optimal set of rigid integrated circuits and flexible/stretchable devices that implement the target functionality, Ogras said.

Flexible hybrid electronics have great potential for wearable computing, assistive technologies, the internet of things, body sensors and medical applications. He hopes in the long term, flexible hybrid electronics can "deliver the functionality of current state-of-the-art mobile platforms and more in a truly pervasive form factor." ✤

## Developing a portable brain-inspired computing system

Many of our portable devices today work with advanced voice or image features, but your personal Siri or Google Photos app can't process speech or image recognition solely using your smartphone's hardware. But what if speech and image recognition and other complex cognitive tasks could all be performed on a single portable device, without an internet connection and high-power servers behind the scenes?

Assistant Professor Jae-sun Seo's work could shatter the computing, energy and size limitations of state-of-the-art learning algorithms to fit on small-footprint devices with the help of custom-designed hardware. Seo's research in this area caught the attention of the National Science Foundation and earned Seo a five-year, nearly $473,000 CAREER Award.

"The goal of this project is to build brain-inspired intelligent computing systems using custom hardware designs that are energy-efficient and programmable for various cognitive tasks, including autonomous driving, speech and biomedical applications," Seo says.

Seo looks to the human brain to mimic its ability to selectively and adaptively learn and recognize real-world data, dispensing with the redundant computations and exhaustive searches current algorithms employ.

He is also investigating low-power, real-time on-chip learning methods; novel memory compression schemes for software and hardware design; efficient on-chip power management capable of adapting to abrupt changes in cognitive workloads; and cross-layer optimization of circuits, architectures and algorithms.

"The outcomes of this research will feature new very-large-scale integration systems that can learn and perform cognitive tasks in real-time with superior energy efficiency, opening up possibilities for ubiquitous intelligence in small-form-factor devices," Seo says.

The opportunity for Ira A. Fulton Schools of Engineering faculty to utilize the high-performance supercomputing resources available at the ASU Research Computing helped make this interdisciplinary research possible. ✤


# Visual tech visionaries honored with Innovation Awards

Visual technologies connect us in our homes, our places of work and our classrooms.

Electrical engineering professor, Lina Karam, wanted to highlight transformative technologies and media platforms, specifically, the visionaries who created them. And so, in 2016, as chair of a recent IEEE International Conference on Image Processing, Karam launched the Visual Innovation Award.

Steve Chen, co-founder of YouTube, and Ren Ng, founder of Lytro's pocket-size light-field camera, were named the first recipients of the award at the conference.

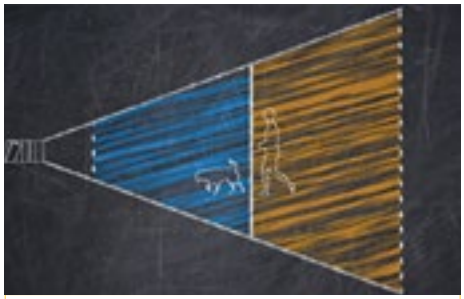
Visual Innovation Award runner-ups were notable industry professionals who were voted on by their peers: Achin Bhowmik, at the time the vice president and general manager of the Perception Computing Group at Intel Corporation and the development and deployment lead for Intel RealSense camera technology; Bill Dally, the senior vice president and chief scientist at NVIDIA and CUDA, a graphics processing platform; Reed Hastings, co-founder and chief executive officer of Netflix; Brendan Iribe, co-founder and chief executive officer of Oculus VR; and Alex Kipman, an inventor on the Microsoft Kinect program.

Karam worked with a number of industry contacts to make the award and a reality. Haohong Wang, TCL Research America general manager, served as the ICIP innovation program chair.

"He recruited the nomination committee and completely orchestrated the innovation program events, including securing top industry leaders to serve as keynote speakers," Karam said.

Wang signed on as innovation chair because he was inspired by the "wow factor" the program would bring to attendees. He regarded it as "a new platform — a new way to exchange ideas." Attendance by industry professionals rose in response.

Karam predicts the next big thing will be virtual reality with no screen within five to 10 years. "We will hold conferences at a virtual table with no video screen, and it will seem like the person on another part of the world is sitting right next to you," she said. "It's very Star Trek." ✤



*The Lytro pocket-size light-field camera earned Ren Ng the first Visual Innovation Award launched by ASU engineer Lina Karam. Photo courtesy of illum.lytro.com/learn.*

# Securing mobile through multiple lines of defense

Our growing reliance on wireless and mobile devices leaves us balancing the increased quality of life these technologies bring with the growing threat of cyberattacks.

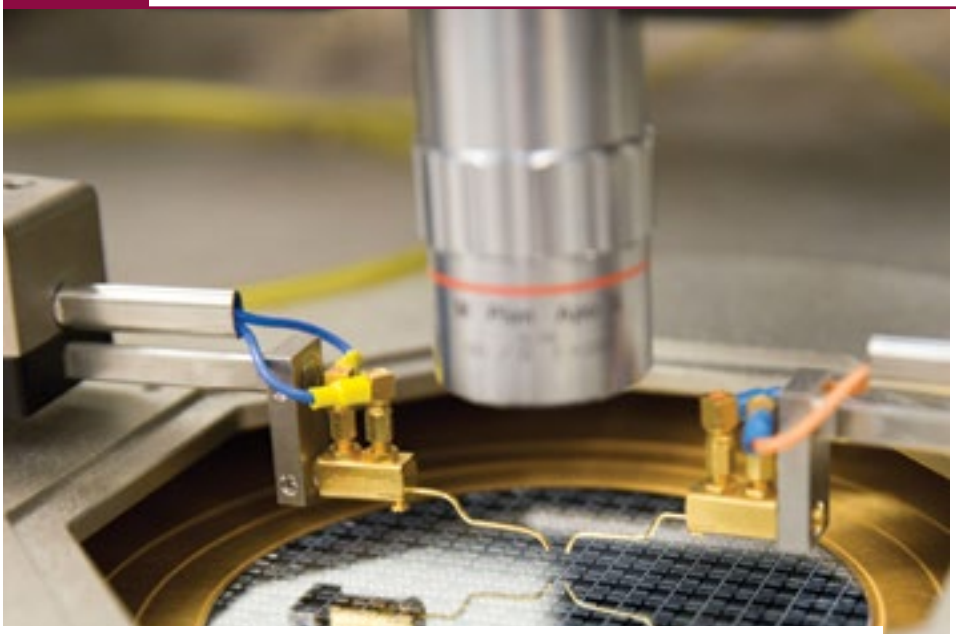
But research is underway to stem these threats. Through a $500,000 grant from the National Science Foundation, a team in the School of Electrical, Computer and Energy Engineering has worked to develop usable countermeasures against these attacks.

Yanchao Zhang, associate professor, and his doctoral students in ASU's Cyber & Network Security Group developed defenses against cyberattacks and an automated response to loss and theft. Protected devices included smartphones, tablets, laptops and Universal Software Radio Peripheral platforms.

Zhang's primary research explores security and privacy issues in computer and networked systems. Recent focus areas include emerging wireless networks, mobile crowdsourcing, the Internet of Things, social networking and computing, wireless mobile systems for people with disabilities, big data analytics, mobile wearable devices and wireless mobile health.

Zhang has served as the principal or co-investigator in several other active federal grants on cybersecurity and network security. One of his projects sought to develop spectrum sensing and sharing, which could help solve the worldwide wireless spectrum shortage.

Some of Zhang's other projects have focused on developing, prototyping and evaluating a secure and usable indoor navigation system for people who are visually impaired to use in complex physical environments, and the development of mobile authentication techniques for people with visual impairment. He's also worked on ways to defend against fake accounts on microblogging platforms such as Twitter. ✤



# Engineers study radiation-caused mutations

A team of Arizona State University researchers are among engineers revisiting neuromorphic computing to discover whether computing architectures that resemble the brain are not only faster, but also more durable in adverse conditions such as those found in space and warfare.

Hugh Barnaby, an associate professor of electrical engineering and radiation effects expert, led the team that tackled this problem in a $1.75 million project funded by the Defense Threat Reduction Agency. Working with him were Professor Michael Kozicki, Assistant Professor Shimeng Yu and Associate Professor Keith Holbert, who contributed expertise in memory, higher-level computing architectures and nuclear engineering, respectively. Together with Sandia National Laboratories' testing capabilities and facilities they set out to understand how radiation impacts these systems.

Traditional von Neumann computing architectures, found in nearly all of today's electronics, repeat a two-step computation sequence of storing and reading data in separate areas of a chip. Modern computers process this very quickly, but the read-write repetition limits their full potential. Neuromorphic computing attempts to imitate the brain's intertwined storage and processing mechanisms. Consolidating this process leads to faster processing and lower power consumption.

"The redundancy in millions of neurons and billions of synapses may tolerate the random error or fault of individual cells, which make it attractive for the harsh radiation environment that can cause the failure of individual cells," said Yu, who was awarded a National Science Foundation CAREER Award for his work in creating a self-learning microchip based on neuro-inspired computing.

The team is working to understand the basic radiation effects on neuroprocessing elements and the virtual synapses of hardware platforms to speed the development of radiation-hardened neuromorphic computing architectures. Their work has strategic and space mission applications such as machine learning, computer vision or control of nonlinear dynamic systems, and will help shorten the timeline for developing hardening techniques for neuromorphic systems. ✣

*Associate Professor Hugh Barnaby (right) and Professor Michael Kozicki (center) apply their expertise in radiation effects and memory to test next-generation neuromorphic computing architectures for use in critical applications where radiation is a likely concern.*

# New human mobility prediction model offers scalability, requires less data

However, a new method to predict human mobility — which can be used to chart the potential spread of disease or determine rush hour bottlenecks — has been developed by Ying-Cheng Lai, a professor of electrical, computer and energy engineering, and a team of researchers.

The researchers found that, based on empirical data from cell phones and GPS records, people are most inclined to travel to "attractive" locations they've visited before, and these movements are independent of the size of a region. The new mobility method uses mathematical calculations based on that data, providing insights that can be discerned regardless of size of the region being tracked.

"The new mobility prediction method is important because it works at both individual and population scales regardless of region size," Lai explained. "Until now, different models were necessary for predicting movement in large countries versus small countries or cities. You could not use the same prediction methods for countries like the U.S. or China that you'd use for Belgium or France."

Additionally, tracking at scale currently relies on measuring travel flux between locations and travel trajectories during specific time frames, requiring large amounts of private data. The new algorithm, based solely on population distribution, provides an alternative, more practical approach.

Information gathered using the new process will be valuable for a variety of prediction tasks, such as charting potential spread of disease, urban transportation planning and location planning for services and businesses like restaurants, hospitals and police and fire stations.

Lai notes that the project represents three generation of scholars working collaboratively. Co-author Xio Yong Wan was Lai's postdoctoral student at ASU, and co-author Zi-You Gao was Wan's postdoctoral student at Beijing Jiaotong University. ✣

# Electrical engineering photovoltaics projects lead ASU in SunShot Awards

In 2017, Arizona State University earned six prestigious U.S. Department of Energy SunShot Awards, totaling $4.3 million and ranking it first among recipients in the Photovoltaics Research category.

Four of those awards were awarded to researchers in the School of Electrical, Computer and Energy Engineering.

ASU's awards, which come with grants totaling $20.5 million overall for 28 projects, supports the development of new commercial photovoltaics technologies that improve product performance, reliability and manufacturability. In 2016, ASU photovoltaics researchers also received the majority of SunShot photovoltaic awards, taking six of 19 awards presented nationwide.

"For the second year in a row, our faculty won more SunShot awards than any other institution in the country, reaffirming our leadership in the research, development and advancement of photovoltaic science and technology," said Kyle Squires, dean of the Ira A. Fulton Schools of Engineering at Arizona State University. "Photovoltaics are a key component of tomorrow's energy solutions and this recognition from the Department of Energy highlights not only our faculty's research excellence and the inherent value of their ideas, but also the breadth and depth of research in the Fulton Schools of Engineering."

SunShot was launched in 2011 with a goal of making solar cost-competitive with conventional energy sources by 2020; the program is now at 90 percent of reaching its goal of $0.06 per kilowatt-hour. The program recently expanded its target to $0.03 per kilowatt-hour by 2030.

ASU's Quantum Energy and Sustainable Technologies (QESST) research center has played a key role in the photovoltaic research making strides toward the SunShot objectives.

**Mariana Bertoni** an electrical engineering assistant professor, was granted two awards. Her work looks at spalling, or the process of exfoliating a wafer from a silicon block. Bertoni's study explores a new spalling technique that relies on sound waves and low temperatures, to mitigate contamination of the wafers, while achieving industry relevant thickness and surface planarity.

Bertoni's second project is to study the correlation between electrical properties, structure and composition at the nanoscale in thin film modules of cadmium telluride and copper indium gallium selenide. The team is designing a multimodal hard x-ray microscopy approach to nondestructively probe different regions of modules under operating conditions for improved module efficiency, lower degradation rates and longer warranties.

**Stuart Bowden** an electrical engineering associate professor, is designing a novel photovoltaic cell architecture known as M-CELL. This structure is a single silicon wafer, which allows integration and interconnection of multiple cells in series to enable higher voltage and lower current than existing modules.

**Professor Meng Tao** received the school' fourth award, working on a two-layer aluminum electrode to replace its silver counterpart currently used in silicon photovoltaic cells. This could reduce processing expenses and improve device lifetime and reliability while maintaining high efficiency. ✤

## Research centers

The National Science Foundation supports the development and evolution of Industry–University Cooperative Research Centers (IUCRCs). These centers enable industrially-relevant, pre-competitive research via multi-member, sustained partnerships among industry, academia and government. School of Electrical, Computer and Energy Engineering faculty and students conduct research in many of ASU's IUCRCs.

**SenSIP:**
**Senor, Signal and Information Processing Center**

Director: Andreas Spanias

*sensip.asu.edu*

This NSF IUCRC develops a broad array of digital signal processing, imaging and communications algorithms for sensor network technologies, including those used in chemical sensors, internet of things, health monitoring, cell phones, security and radar systems.

SenSIP, NXP Semiconductor and Tecnológico de Monterrey organized SENS MACH 2016, where SenSIP students presented research on mobile health monitoring, acoustic echolocation techniques, sensor localization algorithms, mobile apps, sustainability sensor applications and machine learning methods for fault detection in sensory systems. Mike Stanley, systems manager at NXP, and Andreas Spanias, SenSIP director and professor of electrical engineering, co-organized a short course on sensor-related machine learning at the SENS MACH workshop.

**Power One IC:**
**Center for Integrated Power Management and System on a Chip**

Director: Sayfe Kiaei

Assistant Director: Bertan Bakkaloglu

*poweroneic.asu.edu*

Power management integrated circuit chips for mobile systems to automotive electronics to wireless power transfer are the core focus of this IUCRC. Power One IC develops portable, fully autonomous and integrated power management circuits and systems, and applies advanced circuit, signal processing and control methods to improve power management and energy utilization in battery-powered mobile electronics, high-frequency switching power supplies, energy storage and renewable-energy systems.

Umit Ogras, an assistant professor of electrical and computer engineering, recently earned a NSF CAREER Award for his research on flexible hybrid electronics. His work was made possible through collaborations with Power One IC and through working at ASU, a leading institution in flexible electronics.

**ASU NanoFab**

Operations Director: Kevin Hilgers

*nanofab.engineering.asu.edu*

The ASU NanoFab is a flexible nanoprocessing facility that offers state-of-the-art device processing and characterization tools for student training, university research and external company and research prototype development. Established companies and innovative startups especially benefit from NanoFab's ability to accelerate their prototype development using the facility's equipment and resources.

The center's core strengths lie in nanofabrication, unique silicon processing, molecular- and bio-electronics, micro-electro-mechanical-systems (MEMS), nanofluidics, optoelectronics and device characterization.

Former NanoFab Director and electrical engineering Professor Yong-Hang Zhang recently earned Defense University Research Instrumentation Program funding to acquire a Rapid Thermal Processing tool for the NanoFab's clean room space. This tool will help train the next generation of engineers and scientists, and allow hundreds of users to process novel electronic and optoelectronic devices that have Department of Defense and commercial applications.

## QESST: Quantum Energy and Sustainable Solar Technologies

Director: Christiana Honsberg

*qesst.org*

QESST's focus is on photovoltaic science and technology as well as transforming electricity generation to sustainably meet the growing demand for energy.

ASU won six prestigious U.S. Department of Energy SunShot Awards, totaling $4.3 million, ranking it first among recipients in the Photovoltaics Research category for 2017. This award funding supports the development of new commercial photovoltaics technologies that improve product performance, reliability and manufacturability. SunShot was launched in 2011 with a goal of making solar cost-competitive with conventional energy sources by 2020. QESST will continue to play a major role in the photovoltaics industry as SunShot moves to double the amount of national electricity demand provided by solar.

QESST scholar Sebastian Husein won the NSF's Perfect Pitch competition at their biennial meeting for his idea of deploying PV modules to places with interrupted infrastructure. This marks the second straight time that a QESST student from Assistant Professor Mariana Bertoni's group has won the $5,000 prize and brought back the Lynn Preston trophy.

Research based out of QESST also won four awards at the 43rd IEEE Photovoltaic Specialists Conference — two Best Student Paper awards and two Best Student Poster awards. At the conference, 48 Fulton Schools faculty members and students presented research that addressed the questions: How can we make solar both affordable and impactful? What are the benefits of using flexible materials? How can solar excel outside of the sunniest states?

## PSERC: Power Systems Engineering Research Center

Director: Vijay Vittal

*pserc.org*

PSERC seeks to address the diverse challenges facing the electric power industry and educating the next generation of power engineers.

The center has published reports and white papers on grand challenges and future grid initiatives, and participated in The Future Grid Initiative, a U.S. Department of Energy project on how to support high penetrations of variable sustainable energy, such as wind, solar and hydro resources.

## ASU LightWorks

Director: Gary Dirks

*asulightworks.com*

LightWorks fosters cooperation among academia, industry and government to advance innovation, facilitate technology transfer and guide energy education and policy advancement. The multidisciplinary effort pulls together ASU's strengths in renewable energy fields, including artificial photosynthesis, biofuels and next-generation photovoltaics. Research focuses on a variety of applications, including low-cost, high-efficiency solar panel technologies; renewable biofuel and biohydrogen production; fungible fuels from carbon dioxide, water and sunlight; and high-efficiency lighting, cooling and flexible display technology.

The center has made accomplishments with diffused junction, heterojunction and III-V solar cell technology improvements.

## Connection One: Communication Circuits and Systems

Director: Sayfe Kiaei

*connectionone.org*

Connection One develops integrated circuits and systems for wireless and wireline communication systems. Connection One focuses on solutions for cellular systems, Wi-Fi next-generation wireless transceivers, sensors, antennas, bioelectronics, biotelemetry and other related areas.

The center has created integrated radio ICs, integrated wireless sensors, power management circuits, MEMS speakers for digital hearing aids, integrated antennas, implantable neuron sensors and nanosensors, and advanced materials including gallium nitride and silicon carbide.

# ASU venture Swift Coat wins big at Rice Business Plan Competition

Swift Coat, an Arizona State University tech startup specializing in nanoparticle coatings, took home more than $70,000 from the prestigious Rice Business Plan Competition, ultimately finishing in fourth place overall.

The brainchild of electrical engineering Assistant Professor Zachary Holman and graduate research associate Peter Firth, Swift Coat takes its name from proprietary deposition technology, which can coat any surface with nanoparticles of varying compositions and sizes. The technology was developed through photovoltaic research in Holman's lab.

Only 42 applicants from more than 750 were selected to pitch their ideas at the competition. Swift Coat CEO Firth and doctoral student Jonathan Bryan represented the company, securing $5,000 as one of six teams to advance to the finals. They went on to win a $50,000 Department of Energy Cleantech University Prize, $15,000 in patent attorney expenses and a $1,000 High School Judging Prize, totaling $71,000 in investments.

The team made their presentation an aspirational pitch, portraying Swift Coat's potential to become a $100 million company with a vast array of products and applications.

Swift Coat's success in Houston followed their stellar performance at the inaugural ASU Innovation Open, which pitted nearly three dozen fledgling startups against one another for a grand prize of $100,000. Swift Coat advanced to the final four, winning the $5,000 Zero Mass Water Materials Award as well as the SRP Innovation Award worth an additional $10,000.

In less than a year, Swift Coat attracted more than $125,000 in funding. They found their first customers and worked to complete a third-generation nanoparticle deposition tool.

Firth credits Swift Coat's successes with ASU's strong support of entrepreneurship, noting help from the Venture Devils program, and Brent Sebold and Ken Mulligan in particular, as invaluable.

"It's been their guidance over the last year that helped a couple of guys from ASU beat out teams full of engineers and MBAs from Harvard, Stanford and MIT," says Firth. ✤

# Electrical engineering professor among 2017 National Academy of Inventors Fellows

NAI
National Academy of Inventors

A faculty member in the School of Electrical, Computer and Energy Engineering was elected to the rank of Fellow in the National Academy of Inventors.

Election to NAI Fellow status is the highest professional accolade bestowed to academic inventors. NAI Fellows are nominated by their peers for outstanding contributions to innovation in areas such as patents and licensing, innovative discovery and technology, significant impact on society, and support and enhancement of innovation.

Deirdre R. Meldrum, professor of electrical engineering, former dean of the Ira A. Fulton Schools of Engineering and director of the Biodesign Center for Biosignatures Discovery Automation, was named an NAI Fellow.

Meldrum is known for her ability to integrate multiple disciplines, including bioengineering, biomaterials, nanotechnology, electrical, chemical and computer science engineering with fields such as biology, genomics, proteomics and single cell analyses to create new paths of discovery. ✤

# Professor leads Google ATAP Project, teams up with former students

A series of grants to advance research in computer vision quickly culminated in a relocation to Google's main campus for Associate Professor David Frakes, who moved to Mountain View, California, to become a technical project leader in Google's Advanced Technology and Projects (ATAP) group.

Modeled after the Pentagon's Defense Advanced Research Projects Agency, Google ATAP specializes in bringing to market transformative technologies on a short timescale. DARPA is known for pioneering breakthrough technologies, such as the internet and GPS, for the benefit of national security. Like DARPA, Google ATAP operates in what Frakes describes as a "pressure cooker" for big ideas — meaning tangible results, including the ability to demonstrate the project can reach convincing scale, must be obtained within two years or it is shelved to make room for the next big project.

Frakes, who holds a joint appointment in the School of Electrical, Computer and Energy Engineering and the School of Biological and Health Systems Engineering, leads ATAP's Mobile Vision program. The team includes four Fulton Schools graduates. Eric Aboussouan and Christopher Workman earned graduate degrees under Frakes' tutelage. Another teammate, Vinay Venkataraman, earned his doctoral degree at the Fulton Schools, as did Rafeed Chaudhury, who works with a different team at ATAP.

"It's very gratifying not only to see your students go on and do great things, but also to have a relationship with them where they want to keep working with you professionally," says Frakes.

Frakes also received a research award from the National Science Foundation to advance the development of a first of its kind sensor to take measurements critically important in treating cardiovascular diseases. ✤

# Boosting electromagnetic signal using artificial magnetic surfaces

Pilots and others who send or receive radio communications and radar information expect those signals to be clear and recognizable. But antennas and electromagnetic-based signal transmission can encounter problems when mounted on metallic surfaces.

Artificial magnetic conductors (AMCs) — a type of surface that exhibits unique electromagnetic properties, but doesn't exist naturally — provide a way to overcome some of these antenna and electromagnetic scattering issues, says Constantine A. Balanis, Regents' Professor of electrical engineering at the Fulton Schools.

Balanis and his research team partnered with the King Abdulaziz City for Science and Technology (KACST) in Riyadh, Saudi Arabia, to develop and advance basic research in electromagnetic AMC surfaces. KACST funded the $1.05 million project.

Mikal Askarian Amiri, a graduate research assistant, explained that the group designed and fabricated novel AMCs with unique patterns that enabled efficient radiation and enhanced the total performance of the antenna elements of wireless communication systems. Checkerboards of metallic patches are placed on printed circuit boards to support and connect electronic components of the communication systems.

Electromagnetic AMC technology will help in designing futuristic ground-based and airborne radar platforms due to its increased efficiency and beneficial properties. It may also be used in commercial automotive radar for lane-change indicators and parking assistance.

The partnership with KACST contributes to the Fulton Schools' goal of global impact from its research.

"ASU has research expertise that is world-renowned in many areas such as those of this project," says Stephen Phillips, professor and director of the School of Electrical, Computer and Energy Engineering. "Part of our mission is to have a global impact, and this project led by Professor Balanis is a great example of how we can do that." ✤

# Doctoral students recognized for dissertation excellence

## The Dean's Dissertation Award recognizes graduating doctoral students who excel as researchers and leaders.

ECEE is proud to have had two doctoral students receive this award: **Weina Wang in December 2016 and Hoi-To Wai in December 2017.**

Hoi-To Wai commenced his doctoral studies in electrical engineering at the University of California, Davis, and later moved with his advisor, Professor Anna Scaglione, and her lab to the Fulton Schools in 2015.

One of the most important contributions of Hoi-To Wai's doctoral dissertation is that it makes network science research more efficient. Wai studies social networks: the internet and other platforms where people interact every day. He developed new algorithms that run on networks to solve machine learning and estimation problems.

The work provides theoretical guarantees to certain aspects of network science.

"My results can be used to learn the amount of 'trust' between you and your friends on Facebook, or they can be used to guide biologists in designing experiments for understanding the interaction between the genes in organisms — without wasting their time on performing more experiments," he explains. "It can also provide guaranteed ways to solve machine-learning problems effectively over a computer network."

"Hoi-To Wai is one of the brightest and most prolific students I have ever had the privilege to guide," says Scaglione.

Going forward, Wai will be a postdoctoral scholar at ASU, continuing his research on network science and data analytics. In spring 2019 he will join his undergraduate alma mater, Chinese University of Hong Kong, as an assistant professor.

Weina Wang grew up in the city of Changchun in northeastern China and earned a bachelor's degree in electrical engineering from Tsinghua University in Beijing. She started pursuit of a doctoral degree at Iowa State University, but later her faculty advisor, Lei Ying, joined Arizona State University.

She enrolled in the doctoral program at ASU so she could continue to work with Ying, who co-advised her with Junshan Zhang. Wang's doctoral research focused on data privacy.

"Big data analytics is a double-edged sword," she explains. "The emerging big data technology has proven its exceptional value in diverse areas, including scientific research, finance and much of what we do in our everyday lives. But the ever-improving capability of data analysis makes it possible to extract personal information that people want to remain private."

Her goal is to provide research to help devise solutions that address the conflict between the capabilities of big data technology and the problem it presents to protecting privacy. By characterizing the relationship between different notions of privacy and revealing their fundamental connections, she is laying the foundations for a novel market model for private data analytics.

Wang now has a joint postdoctoral research position with ASU and the University of Illinois at Urbana-Champaign. ✤

*Hoi-To Wai, left, pictured with Professor Anna Scaglione.*

*Weina Wang is hooded by her mentor, Professor Lei Ying.*

### Outstanding graduates

**Fall 2016**
John James "JJ" **Robertson**
Cassandra **Steeno**

**Spring 2017**
Stephanie **Yamamoto**

**Fall 2017**
Richard **Church**

**Spring 2018**
Matthew **Oman**

### Impact awards

**Fall 2016**
Kevin **Virgen**

**Spring 2017**
Ngoni **Mugwisi**

**Spring 2018**
Samuel **Perez**

**Palais Outstanding Doctoral Student Award**
*2018 — Zhengshan "Jason" Yu*

**Palais Outstanding Doctoral Student Award**
*2017 — Preston Webster*

**Palais Outstanding Doctoral Student Award**
*2016 — Zhicheng Liu*

# Palais awards

The Palais Outstanding Doctoral Students Research Award and the Joseph and Sandra Palais Senior Design Award were established with the generosity of longtime former graduate program chair and Emeritus Professor Joseph Palais and his wife, Sandra Palais. Palais' career with ASU began when he joined the engineering faculty in 1964.

Since that time he has been an ardent supporter of engineering education, especially for students pursuing doctoral degrees in electrical engineering. These awards honor excellence in research and academics.

## Palais Outstanding Doctoral Student Research Award

Since 2003, each spring Arizona State University's Ira A. Fulton Schools of Engineering has recognized an exceptional electrical engineering doctoral student with the Palais Outstanding Doctoral Student Award.

The Palais Outstanding Doctoral Student award is given to a graduating electrical engineering doctoral student who exemplifies excellence in research and academics. The award was established in 2003. Students are nominated by their doctoral advisors, must maintain at least a 3.75-grade point average and have at least one publication in a journal or at a conference to qualify. The recipient receives $1,000 and a commemorative plaque.

## The following students received the Palais Outstanding Doctoral Student Award in recent years:

**2018 — Zhengshan "Jason" Yu** earned the award for his research on record-breaking efficiency for silicon-based solar cells, an area that has the potential to make solar electricity costs more competitive in the future. His advisor was Zachary Holman.

**2017 — Preston Webster** worked on the development of new optoelectronic materials with a range of uses, from thermal imaging and tracking to solar photovoltaics as well as high-efficiency lasers and LEDs and defense applications. His advisor was Shane Johnson.

**2016 — Zhicheng Liu** earned the award for his expertise with laser physics and operation of testing equipment and optical simulation tools. He graduated with a 3.93 GPA more than 10 journal publications. His advisor was Cun-Zheng Ning.

## Joseph and Sandra Palais Senior Design Award

The Joseph and Sandra Palais Senior Design Award recognizes the best senior design project in the School of Electrical, Computer and Energy Engineering. The award is presented each semester to the team of students whose capstone design project is judged to be the semester's most promising work.

**Spring 2018**

Ammon **Johnson**

Jessica **Nelson**

Mohamed **Aden**

**Fall 2017**

Adam **Lynch**

Anthony **Nasir**

Daniyal **Ahmed**

Jusper **Qutain**

**Spring 2017**

Ahmed **Ahmed**

Arlene **Lanz**

Devan **Shivers**

Ryan **Brown**

**Fall 2016**

Stephanie **Yamamoto**

Kyle **Effinger**

Matthew **Edwards**

# USPCASE scholar collaborates on solar research, benefits Arizona and Pakistan

Balancing affordable electricity bills for customers and profits for utility companies can be tricky, but the happy medium might lie in solar energy storage.

Abdul Kashif Janjua, a fall 2016 exchange scholar from the U.S.-Pakistan Centers for Advanced Studies in Energy at the Fulton Schools, analyzed data and patterns to find a middle ground.

Janjua collaborated on a research paper entitled, "Customer Benefit Optimization for Residential PV with Energy Storage Systems" under the tutelage of George Karady, who passed away in June 2018. Karady was an Institute of Electrical and Electronics Engineers Fellow and professor of electrical engineering at the Fulton Schools.

The paper was presented at the IEEE Power Engineering Society's general meeting. IEEE acts as one of the largest forums for sharing the latest technological developments in electric power, for developing standards guiding the development and construction of equipment and systems, and for public and industry education.

For this project, various sizes of batteries were tested with several solar panels to find the right combination. The research accounted for variables like load, temperature and battery discharge rates to derive the best result for both customers and utilities.

Since the climates of Arizona and Pakistan "are quite similar, photovoltaic systems are feasible in both areas," Janjua said.

Janjua's system can be used optimize variables like the size of the photovoltaic system and various charging strategies. The algorithm developed in this research leaves the door open for computers to eventually determine the right balance of variables, possibly incorporating artificial intelligence in the future.

Janjua said that collaborating with graduate electrical engineering students Pavan Etha and Anil Chelladurai was an invaluable educational asset. And, Karady himself was supportive, helpful and encouraging.

"Karady's knowledge and experience with electrical systems can be rarely found even in the best universities of the world, and he was not reluctant to share each of his experiences related to our field," Janjua said.

The collaboration between the two countries is a hallmark of USPCASE, because it allows for progress in energy research for mutual benefit.

Following the USPCASE exchange program, Janjua went on to complete his master's degree in energy systems engineering at Pakistan's National University of Sciences and Technology. He plans to pursue a doctorate and then potentially apply his research in the commercial sector. ✣

# QESST student has the Perfect Pitch

Graduate researcher Sebastian Husein brought Fulton Schools a second consecutive win when he topped the National Science Foundation's Perfect Pitch Competition at their biennial meeting.

Husein had only 90 seconds to pitch his idea, but that was enough time to win over a panel of judges. Husein's prize included a $5,000 prize and the Lynn Preston trophy for the work he developed with Assistant Professor Mariana Bertoni's group in the Quantum Energy and Sustainable Solar Technologies (QESST) Engineering Research Center. The center is supported through NSF and the Department of Energy.

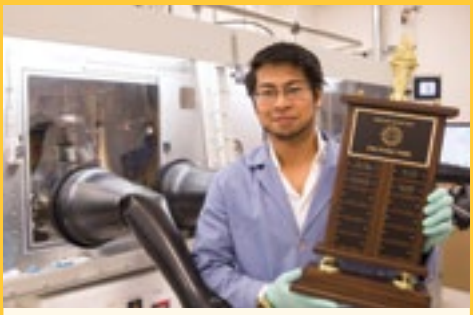
Husein's Solar Optimized Kit for Emergency Deployment is a floating platform with bifacial solar cells that produce energy, even under cloudy conditions. The energy created runs a water purification system, essential for disaster aftermath.

Husein said he was inspired by the humanitarian crises that followed the hurricanes that hit Houston, Florida and Puerto Rico.

"It was a massive humanitarian crisis, especially in Puerto Rico, and the largest needs became obvious very quickly: power and drinkable water."

Bertoni, Husein's professor and mentor, believes the skills used in pitching ideas are important for engineers.

"I strongly encourage my students to develop their communication skills and find the right balance of what to say and how to say it based on their audience," she said. ✣



*Sebastian Husein became the second consecutive student from Mariana Bertoni's group to bring home the Lynn Preston Trophy after winning the NSF's Perfect Pitch competition.*

# Taking the waste out of waste management

Electrical engineering master's graduate Saiman Shetty and Krutika Rao looked at the waste management industry and wondered, *why is it so wasteful?*

Despite millions of waste receptacles, sanitation workers and collection trucks, "it's still not uncommon to see overflowing waste bins and rising waste collection costs," Shetty says.

Their solution: technology that leverages the internet of things to gather data about the content and capacity of waste containers. Their company, Hygeia, was one of 20 student-led startups to win the Edson Student Entrepreneur Initiative for the 2016–2017 academic year.

Their proprietary device, hyTHING™, is a smart sensor that gathers data while inside a waste receptacle. An analytics engine helps optimize collection routes and collection schedules. The Hygiea vision is to improve efficiency in waste management to help prepare for the addition of one billion people to the world's population.

Shetty notes that there is "almost zero technological advent in this area." The team planned to use the Edson award to take their prototype into production and run pilot programs.

The winning team also included Parshad Patel, a robotics graduate student at Carnegie Mellon University, and Pratik Vyas, a software engineering graduate student at San Jose State University.

Hygeia has also competed in other entrepreneurial competitions, including in ASU's Changemaker Challenge, the Silicon Valley Business Competition at San Jose University, the University of California's startup accelerator LAUNCH and ASU Innovation Open, among others. ✤

**hygiea.tech**

# Fulton Schools teams win 12 of 20 ASU Edson Student Entrepreneur Initiative awards

Fulton Schools students led 12 of the 20 student startups chosen for Arizona State University's Edson Student Entrepreneur Initiative for the 2016–2017 academic year. Teams were awarded up to $20,000 each in seed funding, office space at SkySong, the ASU Scottsdale Innovation Center, and a year of mentorship and training.

**Winning teams** from the Fulton Schools were:

**BISTEG** Solar thermoelectric modules shade buildings to maximize energy efficiency while producing solar thermal energy to power them.

**Fusion Folder** A folder that attaches to the back of a laptop preventing paper document loss. *fusionfolder.wix.com/fusionfolder*

**Hygiea** A platform leveraging the Internet of Things gathers data about the content and capacity of waste containers. *hygiea.tech*

**Knoze** A note sharing and organizing platform improves the efficiency of studying for college courses. *zakhtab.wix.com/knoze*

**MyDigital Backpack** An educational platform for entrepreneurs and students to build, organize and showcase projects.

**Occupit** A company looking to capitalize on the growing virtual reality entertainment industry with the development of the first affordable motion simulator.

**Speedy Castillo** A removable rim cover for road bikes to improve acceleration and performance on bicycles.

**The Distinguished Gentleman's Club** A subscription box fashion service catering specifically to big and tall men.

**The Water Bearers** Improving the anti-icing process used in the aviation industry.

**Zero2One Diagnostics** Specializing in diagnostics, Zero2OneDiagnostics looks to stem the tide of antibiotic resistant bacterial infections.

**UnieHub** A platform for university students to be able to be in contact with their community.

**Zingfo** Providing event exhibitors with a broadcasting platform to increase leads and productivity. ✤


# NSF Graduate Research Fellowship Program

The National Science Foundation Graduate Research Fellowship Program supports outstanding graduate students master's or doctoral degree in a STEM field.

These fellows, considered potential leaders in science, technology, engineering and math, contribute to the high-impact research, teaching and innovation needed to maintain the nation's technological strength, security and economic vitality. The fellowship provides students with three years of financial support within a five-year fellowship period, and annual stipend and a cost-of-education allowance.

The following electrical engineering students were named Graduate Research Fellows during the past three academic years. ✤

**Jacob Clenney**

**Alisha Menon**

**Kevin Tyler**

**Scott Zuloaga**


# Air Force veteran turned engineer lands NASA internship

## Kristopher Maham's life as a college student is anything but traditional.

He is a U.S. Air Force veteran, husband, father of two girls and a first-time undergraduate electrical engineering student at the age of 37. Now he is further distinguishing himself through a prestigious internship with the National Aeronautics and Space Administration (NASA), where he'll spend one semester each year interning on-site at NASA's Kennedy Space Center in Cape Canaveral, Florida.

His work focuses on power production and distribution used by the various facilities at the center. He is part of the Construction of Facilities Department, which ensures that the center's facilities are capable of supporting NASA's missions, including that they are kept safe, secure, environmentally sound and operated efficiently and effectively.

"Our current projects focus on major upgrades to the safety and reliability of the center's power substations, as well as expanding an on-site solar power plant, more than doubling its current capacity," Maham said.

These projects will secure the center's energy needs as NASA continues to develop and deploy the next generation of space travel and exploration systems.

While efforts promoting space travel might be a new realm for Maham, air travel is not.

He served in the Air Force as an avionics technician on fighter aircraft for nearly 18 years until taking advantage of an early retirement program in 2014.

Originally from Minot, North Dakota, Maham was stationed at Luke Air Force Base in Glendale, Arizona, for five years and decided to return to Arizona after his retirement because it was a good location for his family.

"I enrolled at ASU because of the reputation the Pat Tillman Veterans Center has for transitioning vets back to civilian and student life," said Maham. He also knew the Fulton Schools' programs are highly rated.

Initially interested in aerospace engineering, Maham decided to pursue electrical engineering because the career choices are more in line with his interests in electronics and renewable energy systems.

"Electrical engineering seems like the best way to leverage my avionics experience from the Air Force," he added. He is also pursuing a minor in engineering management.

He also intends to pursue graduate studies at ASU. ✤


# Electrical engineer earns Rhodes Scholarship

Electrical engineering student Ngoni Mugwisi often closed his textbooks at dark because of power outages where he lived in central Zimbabwe.

Bringing reliable power to his home is his mission and, as a Rhodes Scholar who studied at University of Oxford, the recent graduate is well-positioned to accomplish his goal.

The Rhodes Scholarship is the oldest and perhaps most prestigious international graduate scholarship program in the world. It was established in 1903 by empire builder John Cecil Rhodes.

After studying at Oxford, Mugwisi plans to work at an energy company using renewables either in Europe or the U.S. He also has plans to add a master's degree in business administration or public policy to his portfolio. Then it's back to Zimbabwe to help build the nation.

Mugwisi says the transdisciplinary approach he experienced at ASU enabled him to pursue the subjects that interest him most and will assist him in the future.

While at ASU, he started a student organization with other African students called Africa Rises to promote African culture and dispel myths about the continent. He was also active in the region 6 board of the National Society of Black Engineers.

Mugwisi founded Solar Water Solutions, an initiative to extract groundwater for wells using solar energy. In 2015, he traveled home to build a well with a water wheel that used solar panels to pump water. Most community wells in Zimbabwe are powered by hand.

"Those things I would never have imagined for myself coming here as a freshman. ASU made it possible by creating an enabling environment where one can pursue their interests." ✤

# USPCASE draws Fulton Schools grad back to ASU, makes global impact


A 2005 graduate from the School of Electrical, Computer and Energy Engineering, Edward J. William Jr. reconnected with Fulton Schools when he joined the U.S.-Pakistan Centers for Advanced Energy (USPCASE) as a research advisor with the National University of Science and Technology.

William's new work venture, split between Arizona and Pakistan, involves inspiring new ideas to create innovative energy solutions at NUST.

Along with contributions to publications for IEEE and CIGRE Canada, William has also held national leadership positions in IEEE Power and Energy Society Standards committees and the National Society of Black Engineers.

The relationship between ASU and the Pakistani universities is a tremendous opportunity to share research and curriculum, William says, but also to make the world a better place by helping Pakistan solve its problems. ✤

## PhD graduates 2015–2018

| Student Name | Dissertation Title | Chair / Advisor |
|---|---|---|
| **Makram Abd El Qader** | Proximity in Hybrid Superconductor/ Ferromagnetic Structures | Nathan Newman |
| **Samet Egemen Arda** | Nonlinear Dynamic Modeling and Simulation of a Passively Cooled Small Modular Reactor | Keith Holbert |
| **Mikal Askarian Amiri** | Analysis, Design and Measurements of Flat and Curved Circularly Symmetric High Impedance Surfaces for Curvilinear Antenna Applications | Constantine Balanis |
| **Seyyed-Amir Ayati** | Full Duplex CMOS Transceiver with On-Chip Self-Interference Cancellation | Sayfe Kiaei |
| **Ebraheem Azhar** | Inorganic and Organic Photovoltaic Materials for Powering Electrochromic Systems | Sandwip Dey, Hongbin Yu |
| **Mark Bailly** | A Development of Thin Films and Laser Processes for Patterning of Textured Silicon Solar Cells | Stuart Bowden |
| **Jacob Becker** | Optimization of Monocrystalline MgxCd1-xTe/MgyCd1-yTe Double-Heterostructure Solar Cells | Yong-Hang Zhang |
| **Brahim Bensalem** | Novel Multicarrier Memory Channel Architecture Using Microwave Interconnects: Alleviating The Memory Wall | James T. Aberle |
| **Navankur Beohar** | System Identification, Diagnosis and Built-In-Self-Test of High Switching Frequency DC-DC Converters | Bertan Bakkaloglu |
| **Henry Braun** | Image Reconstruction, Classification and Tracking for Compressed Sensing Imaging and Video | Pavan Turaga |
| **Doohwwang Chang** | Monitor-Based In-Field Wearout Mitigation for CMOS RF Integrated Circuits | Sule Ozev |
| **Po-Yen Chen** | Design and Performance Analysis of Fiber Wireless Networks | Martin Reisslein |
| **Pai-Yu Chen** | Design of Resistive Synaptic Devices and Array Architectures for Neuromorphic Computing | Shimeng Yu |
| **Zhen Chen** | Diffusion in Networks: History Reconstruction and Real-Time Network Robustification | Lei Ying, Hanghang Tong |
| **Wengang Chen** | Radar Cross Section Reduction Using Electromagnetic Band-Gap Checkerboard Surfaces | Constantine Balanis |
| **Hsing Min Chen** | Designing Low Cost Error Correction Schemes for Improving Memory Reliability | Chaitali Chakrabarti |
| **Wenhao Chen** | Cu-Silica Based Programmable Metallization Cell: Fabrication, Characterization and Applications | Michael Kozicki, Hugh Barnaby |
| **Alex Chiriyath** | Fundamental Limits on Performance for Cooperative Radar-Communications Coexistence | Daniel Bliss |
| **Hugh Chung** | Low Frequency Electric Field Imaging | David Alee |
| **Sohom Datta** | Risk-Based Dynamic Security Assessment of the Electricity Grid with High Penetration of Renewable Generation | Vijay Vittal |
| **Samuel Dodge** | Tree-Based Deep Mixture of Experts with Applications to Visual Saliency Prediction and Quality Robust Visual Recognition | Lina Karam |
| **Brandon Dowd** | FDTD Simulation Techniques for Simulation of Very Large 2D and 3D Domains Applied to Radar Propagation Over the Ocean | Rodolfo Diaz |
| **Ahmad Elmoslimany** | A New Communication Scheme for Underwater Acoustic Channels: System Design, Information Theoretic Analysis and Channel Coding | Tolga Mete Duman |
| **Ahmed Ewaisha** | Optimal Power Allocation and Scheduling of Real-Time Data for Cognitive Radios | Cihan Tepedelenlioglu |
| **Fan Fan** | Fabrication and Characterization of Semiconductor Nanolasers | Cun-Zheng Ning |
| **Runchen Fang** | Defect Induced Aging and Breakdown in High-k Dielectrics | Michael Kozicki, Hugh Barnaby |
| **Lorenzo Ferrari** | Techniques for Decentralized and Dynamic Resource Allocation | Anna Scaglione |
| **Flavio Francesco Maria Sabatti** | Cellular Monte Carlo Simulation of Coupled Electron and Phonon Dynamics | Marco Saraniti |
| **David Ganger** | Enhanced Power System Operational Performance with Anticipatory Control Under Increased Penetration of Wind Energy | Junshan Zhang, Vijay Vitta |
| **Reinhard Gentz** | Wireless Sensor Data Transport, Aggregation and Security | Anna Scaglione |
| **Nikita Ghanshyam Singhal** | Enhanced Reserve Procurement Policies for Power Systems with Increasing Penetration Levels of Stochastic Resources | Kory Hedman |
| **Milind Gide** | Subjective and Objective Evaluation of Visual Attention Models | Lina Karam |
| **Seyedalireza Golestaneh** | Visual Quality Assessment and Blur Detection Based on the Transform of Gradient Magnitudes | Lina Karam |
| **Yan Guan** | Methods for Detection of Small Molecule-Protein Interactions | Nongjian Tao |
| **Da Guo** | Modeling of Copper Migration In CdTe Photovoltaic Devices | Dragica Vasileska |
| **Ujjwal Gupta** | Power-Performance Modeling and Adaptive Management of Heterogeneous Mobile Platforms | Umit Ogras |
| **Richard Gutierrez** | An Analysis of the Unmanned Aerial Systems-To-Ground Channel and Joint Sensing and Communications Systems Using Software Defined Radio | Daniel Bliss |

| Student Name | Dissertation Title | Chair / Advisor |
|---|---|---|
| **Raghuraj Hathwar** | Full-Band Monte Carlo Simulation of Nanowires and Nanowire Field Effect Transistors | Stephen Goodnick |
| **Jiahong He** | Insulator Flashover Probability Investigation Based on Numerical Electric Field Calculation and Random Walk Theory | Ravi Gorur |
| **Li He** | Source Strength Impact Analysis on Insulator Flashover Under Contaminated Conditions | Ravi Gorur |
| **Zhaoyu He** | MWIR and Visible nBn Photodetectors and their Monolithically-Integration for Two-Color Photodetector Applications | Yong-Hang Zhang |
| **Mojgan Hedayati Mehdiabadi** | Flexible Reserve Margin Optimization for Increased Wind Generation Penetration | Junshan Zhang, Kory Hedman |
| **Mojdeh Hedman** | Analytical Approaches for Identification and Representation of Critical Protection Systems in Transient Stability Studies | Vijay Vittal |
| **Chong Huang** | Data-Driven and Game-Theoretic Approaches for Privacy | Lalitha Sankar |
| **Nematollah Iri** | Universal Source Coding in the Non-Asymptotic Regime | Oliver Kosut |
| **Jae Woong Jeong** | Low-Overhead Built-In Self-Test for Advanced RF Transceiver Architectures | Sule Ozev |
| **Xiaocong Jin** | Security and Privacy in Dynamic Spectrum Access: Challenges and Solutions | Yanchao Zhang |
| **Yue Jing** | High Slew-Rate Adaptive Biasing Hybrid Envelope Tracking Supply Modulator for LTE Applications | Bertan Bakkaloglu |
| **Rakesh Joshi** | Process Control Applications in Microbial Fuel Cells | Konstantinos Tsakalis |
| **Xiaohan Kang** | Performance Analysis of Low-Complexity Resource-Allocation Algorithms in Stochastic Networks Using Fluid Models | Lei Ying |
| **Gokula Kannan Jayaram Thulasingam** | The Role of the Collisional Broadening of the States on the Low-Field Mobility in Silicon Inversion Layers | Dragica Vasileska |
| **Yeongho Kim** | Epitaxial Growth of High-Quality InAs/GaAsSb Quantum Dots for Solar Cells | Christiana Honsberg |
| **Siddharth Kulasekaran** | Soft-switching Techniques for Power Conversion System in Automotive Chargers | Raja Ayyanar |
| **Kuldeep Sharad Kulkarni** | Computer Vision from Spatial-Multiplexing Cameras at Low Measurement Rates | Pavan Turaga |
| **Jonghwan Kwon** | Performance Enhancement of Power System Operation and Planning Through Advanced Advisory Mechanisms | Kory Hedman |
| **Alvaro Latorre-Rey** | Particle-Based Modeling of Reliability for Millimeter-Wave GaN Devices for Power Amplifier Applications | Marco Saraniti |
| **James LeBeau** | Bulk Laser Material Modification: Towards a Kerfless Laser Wafering Process | Stuart Bowden |
| **Jongmin Lee** | Robust Distributed Parameter Estimation in Wireless Sensor Networks | Andreas Spanias, Cihan Tepedelenlioglu |
| **Mohammadmehdi Leilaeioun** | Fill Factor Loss Mechanisms: Analysis and Basic Understanding in Silicon Hetero-Junction Solar Cells | Stephen Goodnick, Michael Goryll |
| **Qifeng Li** | Improved Convex Optimal Decision-Making Processes in Distribution Systems: Enable Grid Integration of Photovoltaic Resources and Distributed Energy Storage | Vijay Vittal |
| **Xingpeng Li** | Reliability Enhancements for Real-Time Operations of Electric Power Systems | Kory Hedman |
| **Xiaofeng Li** | Channel Estimation in Half and Full Duplex Relays | Cihan Tepedelenlioglu |
| **Nan Li** | Let Wind Rise - Harnessing Bulk Energy Storage Under Increasing Renewable Penetration Levels | Kory Hedman |
| **Jinjin Li** | Locally Adaptive Stereo Vision Based 3D Visual Reconstruction | Lina Karam |
| **Mengbing Liang** | Molecular Electronic Transducer Based Seismic Motion Sensors Micro-Fabrication, Packaging and Validation | Hongyu Yu |
| **ChaiYong Lim** | High Performance Power Management Integrated Circuits for Portable Devices | Sayfe Kiaei |
| **Zhiyuan Lin** | Study of Minority Carrier Lifetime and Transport in InAs/InAsSb type-II Superlattices Using a Real-Time Baseline Correction Method | Yong-Hang Zhang |
| **Shi Liu** | Towards High-Efficiency Thin-Film Solar Cells: From Theoretical Analysis to Experimental Exploration | Yong-Hang Zhang |
| **Yuan Liu** | Representation of Vector-Controlled Induction Motor Drive Load in Electro-Magnetic Transient and Positive Sequence Transient Stability Simulators | Vijay Vittal |
| **Zhijian Lu** | GaN-Based Micro-LED Visible Light Communication Line-of-Sight VLC with Active Tracking and None-Line-of-Sight VLC Demonstration | Yuji Zhao |
| **Tao Luo** | Electrochemical Sensors and On-chip Optical Sensors | Jennifer Blain Christen |
| **Raveesh Magod Ramakrishna** | Ultra-low Quiescent Current NMOS Low Dropout Regulator With Fast Transient response for Always-On Internet-of-Things Applications | Bertan Bakkaloglu |
| **Debayan Mahalanabis** | Multi-Level Resistance Programming in Conductive Bridge Resistive Memory | Hugh Barnaby |
| **Adnan Mahmud** | Development of Novel Sensor Devices for Total Ionization Dose Detection | Hugh Barnaby |
| **Joseph Margetis** | RPCVD Growth of Epitaxial Si-Ge-Sn Alloys for Optoelectronics Applications | Yong-Hang Zhang |

## PhD graduates 2015–2018

| Student Name | Dissertation Title | Chair / Advisor |
|---|---|---|
| **Aymeric Maros** | Modeling, Growth and Characterization of III-V and Dilute Nitride Antimonide Materials and Solar Cells | Richard King |
| **César Antonio Martín Moreno** | A System Identification and Control Engineering Approach for Optimizing Health Behavioral Interventions Based on Social Cognitive Theory | Daniel E. Rivera |
| **Alexander Maurer** | Use of Bayesian Filtering and Adaptive Learning Methods to Improve the Detection and Estimation of Pathological and Neurological Disorders | Antonia Papandreou-Suppappola |
| **Anu Mercian** | MAC-Layer Algorithm Designs for Long-Range Hybrid Access Network supporting SDN Principles | Martin Reisslein |
| **Parag Mitra** | Load Sensitivity Studies and Contingency Analysis in Power Systems | Vijay Vittal |
| **Chenhao Nan** | Advanced High Frequency Soft-switching Converters for Automotive Applications | Raja Ayyanar |
| **Ali Nazari** | High-Speed Low-Power Analog to Digital Converter For Digital Beam Forming Systems | Hugh Barnaby |
| **Jaewon Oh** | Elimination of Potential-Induced Degradation for Crystalline Silicon Solar Cells | Govindasamy Tamizhmani, Stuart Bowden |
| **Muhlis Ozel** | An Electrical-Stimulus-Only BIST IC For Capacitive MEMS Accelerometer Sensitivity Characterization | Bertan Bakkaloglu, Sule Ozev |
| **Sivaseetharaman Pandi** | Holographic Metasurface Leaky Wave Antenna | Constantine Balanis |
| **Bryan Paul** | RF Convergence of Radar and Communications: Metrics, Bounds and Systems | Daniel Bliss |
| **Jhih-Hong Peng** | ZnTe Nanostructural Synthesis for Electronic and Optoelectronic Devices | Hongbin Yu |
| **Jennie Podlevsky** | Diagnostic and Therapeutic MEMS (Micro-Electro-Mechanical Systems) Devices for the Identification and Treatment of Human Disease | Junseok Chae |
| **Karan Puttannaiah** | A Generalized H-Infinity Mixed Sensitivity Convex Approach to Multivariable Control Design Subject to Simultaneous Output and Input Loop-Breaking Specification | Armando Rodriguez |
| **Chandarasekaran Ramamurthy** | Radiation Hardened by Design Methodologies for Soft-Error Mitigated Digital Architectures | Lawrence Clark |
| **Deepak Ramasubramanian** | Impact of Converter Interfaced Generation and Load on Grid Performance | Vijay Vittal |
| **Suhas Ranganath** | Facilitating Efficient Information Seeking in Social Media | Ying-Cheng Lai, Huan Liu |
| **Hiranmayi Ranganathan** | Deep Active Learning Explored Across Diverse Label Spaces | Sethuraman Panchanathan |
| **Shruti Dwarkanath Rao** | Exploration of a Scalable Holomorphic Embedding Method Formulation for Power System Analysis Applications | Daniel Tylavsky |
| **Hao Ren** | High Performance Microbial Fuel Cells and Supercapacitors Using Micro-Electro-Mechanical System (MEMS) Technology | Junseok Chae |
| **Jinia Roy** | High Gain DC-DC and Active Power Decoupling Techniques for Photovoltaic Inverters | Raja Ayyanar |
| **Saud Saeed** | Flexible, Reconfigurable and Wearable Antennas Integrated with Artificial Magnetic Conducting Surfaces | Constantine Balanis |
| **Khalid Saleh** | Fractional Order PID Controller Tuning by Frequency Loop-Shaping: Analysis and Applications | Konstantinos Tsakalis |
| **Mehdi Saremi** | Modeling and Simulation of the Programmable Metallization Cells (PMCs) and Diamond-Based Power Devices | Stephen Goodnick |
| **Adolph Seema** | Flexi-WVSNP-DASH: A Wireless Video Sensor Network Platform for the Internet of Things | Martin Reisslein |
| **Victoria Serrano Rodriguez** | PID Controller Tuning and Adaptation of a Buck Converter | Konstantinos Tsakalis, Bertan Bakkaloglu |
| **Maryam Shafiee Hanjani** | DFT Solutions for Automated Test and Calibration of Forthcoming RF Integrated Transceivers | Sule Ozev |
| **Md. Ashfaque Bin Shafique** | Detection, Prediction and Control of Epileptic Seizures | Konstantinos Tsakalis |
| **Dangdang Shao** | Monitoring Physiological Signals Using Camera | Nongjian Tao |
| **Shahrouz Sharifi** | On Code Design for Interference Channels | Tolga Mete Duman |
| **Jianwei Shi** | Amorphous Silicon Contacts for Silicon and Cadmium Telluride Solar Cell | Zachary Holman |
| **Huan Song** | Data-Driven Representation Learning in Multi-Modal Feature Fusion | Andreas Spanias |
| **Ganquan Song** | Development of Microfabrication Technologies on Oil-based Sealing Devices for Single Cell Metabolic Analysis | Deidre Meldrum |
| **Riqi Su** | Reconstructing and Controlling Nonlinear Complex Systems | Ying-Cheng Lai, Xiao Wang |
| **Mahesh Subedar** | Visual Quality with Focus on 3D Blur Discrimination and Texture Granularity | Lina Karam |
| **Ahmad Suhail Salim** | Transmission Strategies for Two-Way Relay Channels | Tolga Mete Duman |
| **Ming Sun** | Digital Controlled Multi-phase Buck Converter with Accurate Voltage and Current Control | Bertan Bakkaloglu |
| **Jingchao Sun** | Security and Privacy in Mobile Computing: Challenges and Solutions | Yanchao Zhang |

| Student Name | Dissertation Title | Chair / Advisor |
|---|---|---|
| **Akhilesh Thyagaturu** | Software Defined Applications in Cellular and Optical Networks | Martin Reisslein |
| **Hoi-To Wai** | New and Provable Results on Network Inference Problems and Multi-Agent Optimization Algorithms | Anna Scaglione |
| **Ran Wang** | Regenerative Surface Plasmon Resonance (SPR) Biosensor: Real-Time Measurement of Fibrinogen in Undiluted Human Serum Using the Competitive Adsorption of Proteins | Junseok Chae |
| **Xiaofeng Wang** | Topology Attacks on Power System Operations | Michael Goryll |
| **Weina Wang** | DC-DC Buck Converter Efficiency Improvement Based on Adaptive Parameter Control | Junshan Zhang, Lei Ying |
| **Lezhi Wang** | Control and Data Analysis of Complex Networks | Ying-Cheng Lai, Xiao Wang |
| **Laidong Wang** | Development of New Front Side Metallization Method of Aluminum Electroplating for Silicon Solar Cell | Meng Tao |
| **Kuo-Chen Wang** | Single Cell RT-qPCR on 3D Cell Spheroid | Deidre Meldrum |
| **Guanglei Wang** | Quantum Nonlinear Dynamics and Chaos in Photonic and Nano System | Cheng-Ying Lai |
| **Preston Webster** | Growth, Optical Properties, and Optimization of Infrared Optoelectronic Materials | Shane Johnson |
| **Trevor Werho** | Real-Time Power System Topology Monitoring Supported by Synchrophasor Measurements | Vijay Vittal |
| **Bradley West** | Correlative X-ray Microscopy Studies of CuIn1-xGaxSe2 Solar Cells | Mariana Bertoni |
| **Yinglai Xia** | High Power Density, High Efficiency Single Phase Transformer-less Photovoltaic String Inverters | Raja Ayyanar |
| **Zihan Xu** | Algorithm and Hardware Co-Design for Learning On-A-Chip | Yu Cao |
| **Hongya Xu** | Electronic, Spin and Valley Transport in Two Dimensional Dirac System | Cheng-Ying Lai |
| **Jinghua Yang** | Embedding Logic and Non-Volatile Devices in CMOS Digital Circuits for Improving Energy Efficiency | Sarma Vrudhula |
| **Tong Yao** | Robust Control of Wide Bandgap Power Electronics Device Enabled Smart Grid | Raja Ayyanar |
| **Lei Ying** | Quantum Nonlinear Dynamics in Graphene, Optomechanical, and Semiconductor Superlattice Systems | Ying-Cheng Lai |
| **Tara Yousefi** | Next Generation of Magneto-Dielectric Antennas and Optimum Flux Channels | Rodolfo Diaz |
| **Weijie Yu** | Fractal Properties and Applications of Dendritic Filaments in Programmable Metallization Cells | Michael Kozicki, Hugh Barnaby |
| **Jicheng Yu** | Hybrid AC- High Voltage DC Grid Stability and Controls | George Karady, Jiangchao Qin |
| **Zhengshan Yu** | Silicon-Based Tandem Solar Cells with Silicon Heterojunction Bottom Cells | Zachary Holman |
| **Ziwei Yu** | Dynamic Modeling, Design and Control of Power Converters for Renewable Interface and Microgrids | Raja Ayyanar |
| **Ruochen Zeng** | Dynamic Spectrum Sharing in Cognitive Radio and Device-To-Device Systems | Cihan Tepedelenlioglu |
| **Jinxue Zhang** | Secure and Privacy-Preserving Microblogging Services: Attacks and Defenses | Yanchao Zhang |
| **Chaomin Zhang** | Gallium Phosphide Integrated with Silicon Heterojunction Solar Cells | Richard King |
| **Jiazi Zhang** | Vulnerability Analysis of False Data Injection Attack on Supervisory Control and Data Acquisition and Phasor Measurement Unit | Lalitha Sankar |
| **Sai Zhang** | Consensus Algorithms and Distributed Structure Estimation in Wireless Sensor Networks | Andreas Spanias, Chihan Tepedelenlioglu |
| **Taipeng Zhang** | Nuclear Fission Weapon Yield, Type, and Neutron Spectrum Determination Using Thin Li-ion Batteries | Keith Holbert |
| **Shirong Zhao** | Developing Ohmic Contacts to GaN for High Temperature Electronics | Srabanti Chowdhury |
| **Yuan Zhao** | The Design and Demonstration of Monocrystalline CdTe/MgCdTe Double-Heterostructure Solar Cells | Yong-Hang Zhang |
| **Kai Zhu** | Information Source Detection in Networks | Lei Ying |
| **Yujia Zhu** | Improving Network Reductions for Power System Analysis | Daniel Tylavsky |

# Academic rigor, research excellence define David Ferry's legacy

David Ferry came to ASU in the early 1980s with the opportunity to play a big role in shaping the future of ASU's ambitious engineering education and research endeavors.

As he makes the transition to emeritus professor after 35 years, he will continue to support physical electronics research advances at the university with a new professorship.

Soon after he joined ASU, Ferry was appointed director of the Center for Solid State Electronics Research (originally the Microelectronics Research Center), which he built into a first-class organization respected around the world. He also chaired the electrical engineering department before taking on the associate dean for research position.

Colleagues laud Ferry in particular for being exceedingly proficient at both the experimental and theoretical aspects of his discipline and its practical applications.

He arrived at ASU at the beginning of what is now known as the field of nanotechnology and led an intellectual movement to explore what would happen to transistors when they got to nanometer-scale.

Ferry expanded his research repertoire across multiple complex explorations, mainly revolving around the quantum effects in submicron semiconductor devices and nanostructures, and the general development of quantum transport in open systems.

Ferry's accomplishments led him to be named one of the first Regents' Professors, the highest professional designation for faculty members at Arizona's state universities, and to win the prestigious Cledo Brunetti Award from the IEEE for advances in nanoelectronics.

Ferry also attained the top status of Fellow in the IEEE and other professional organizations in electrical engineering and physics, and served as the editor for major research journals in those fields.

Over his career, Ferry has authored or co-authored more than 800 research papers, written or co-written 10 textbooks, 32 chapters in science books and 16 other books he describes as "quasi-scientific."

Soon after his retirement, Ferry and his wife funded the new David and Darleen Ferry Professorship. The aim is to support the research of a faculty member in the School of Electrical, Computer and Energy Engineering with particular emphasis on those studying semiconductors, lasers, plasma electronics and endeavors in the field driven by quantum physics. ✤

# Gorur Family Award supports electric power and energy systems grad

Emeritus Professor Ravi Gorur established an award for outstanding graduates in electric power and energy systems concentrations of the electrical engineering program after more than 30 years at ASU. Its first recipient, William Bushman, was recognized in spring 2016.

Gorur joined the Electrical and Computer Engineering Department ASU in 1987 as an assistant professor, became a full professor in 1995, director of undergraduate studies in 2006 and program chair of the electrical engineering program in 2010.

"My motivation for making the award was to encourage and promote power engineering education," Gorur said. "My family, both here and in India, have always valued education and this was a way to positively project the family name. I have enjoyed my stay at ASU and this was my way of saying thank you for the experience."

Gorur credits ASU with maintaining its power program over the years.

"ASU was one of the few institutions that decided to keep the power program when it was fashionable for many universities to get rid of it 30 years back due to a temporary lull in hiring power engineers," Gorur said. "Universities must look at the long term and not simply follow the herd."

The Gorur Family Award is supporting Bushman's electrical engineering graduate studies at the Fulton Schools. After graduation, he plans to work in the electric power industry to develop solutions for the aging power industry infrastructure. ✤


We believe engineering is more than a discipline — it is a mindset, a way of looking at the world to determine how challenges can be met most efficiently, sustainably, safely and in cost-effective ways to maximize impact and benefit those we serve. As a partner in our mission, you will help support our diverse faculty and students as they find innovative and entrepreneurial solutions to pressing concerns.

To make a donation of any amount, please call David Wahls, our school's director of development, at 480-727-0827. You can also mail your gift to Ira A. Fulton Schools of Engineering Attn: David Wahls, P.O. Box 879309, Tempe, AZ 85287-9309. Please make checks payable to the "ASU Foundation" with "School of Electrical, Computer and Energy Engineering" noted in the memo line.

*Your gift is greatly appreciated. Thank you.*

# Remembering George Karady, a power engineer

George Karady, a professor of electrical engineering in the Ira A. Fulton Schools of Engineering and an expert in power, high-voltage engineering and power systems, has passed away.

Among his many contributions to the field, Karady invented a specialized type of instrumentation device — known to colleagues as a "Karady Cage" — used to measure minuscule electrical discharges even in the presence of up to a million volts.

Karady was born in Hungary and earned his BSEE and doctoral degrees in electrical engineering from the Technical University of Budapest. He later received an honorary doctorate from that university in 1996.

Surrounded by his loved ones, Karady passed away at age 87 on June 10, 2018.

After teaching at the University of Budapest, Karady's academic and industry experience took him to many places — teaching in Baghdad, Iraq, and Manchester, England, and then working at Hydro-Québec in Montreal, Canada.

Karady served as chief consulting electrical engineer, manager of electrical systems and chief engineer of computer technology with Ebasco Services, an energy infrastructure design company, which had its offices at the World Trade Center. As part of the Ebasco team, he worked as electrical task supervisor for the Tokamak Fusion Test Reactor project. After that project, Karady returned to the World Trade Center where his office was on the 96th floor.

After around 30 years of working in industry, Karady joined the Arizona State University faculty in 1986 as the Power Systems Chair. In this role, he changed the way engineering students were being educated and prepared for the workforce. He included his students as co-authors on his published research to provide them with opportunities to present papers at international conferences and gain recognition in their field before graduating.

He also architected ASU's EEE 360 course, which introduces the subject of electric power engineering to undergraduates.

Stephen Phillips, director of the School of Electrical, Computer and Energy Engineering, notes, "George was always happy to meet with students and often had a crowd in his office during office hours. His long-standing contributions to senior design project mentoring and graduate student supervision will be missed by many."

Karady was also dedicated to improving online and computer-based education. In 2011, Karady worked with Keith Holbert, associate professor of electrical engineering, to explore ways to get students more actively engaged in their education through a "computer-based classroom" model, which drew attention and recognition from their peers. Karady and Holbert's ideas are detailed in "Strategies, Challenges and Prospects for Active Learning in the Computer-Based Classroom," which won them the 2010 Transactions on Education Best Paper Award from the Education Society of the Institute of Electrical and Electronics Engineers, the world's largest professional engineering organization.

Karady was highly involved in IEEE and rose to become an IEEE Fellow, the highest distinction bestowed to members of the prestigious professional organization. He was an active member of the International Council on Large Electric Systems, or CIGRE, for many years. The international non-profit association based in Paris, France, promotes collaboration with experts to share knowledge and improve electric power systems.

"George was a genuine university citizen who deeply understood and appreciated the important impacts that faculty can have in generating ideas and knowledge, transmitting that knowledge to students and advancing his discipline both through his research and in the students who benefited from his instruction," says Kyle Squires, dean of the Ira A. Fulton Schools of Engineering and professor of mechanical and aerospace engineering. "He will indeed be sorely missed."

During his time at ASU, Karady advised 23 doctoral and 57 master's students.

He published several book chapters, 136 journal papers and 226 conference papers. He is also co-author of the book "Electrical Energy Conversion and Transport: An Interactive Computer-Based Approach" with his longtime collaborator Keith Holbert.

Karady had an adventurous side and enjoyed participating in sports, such as swimming, sailing and black diamond skiing. He even tried skateboarding once when a student brought a skateboard to class, which sent a chuckle through the room. Karady also enjoyed traveling, gourmet cooking and attending theater events. ✣

James **Aberle**
**Associate Professor**
PhD, University of Massachusetts
*Expertise: Antennas and RF systems for wireless communication modeling of complex electromagnetic phenomena.*

Ahmed **Alkhateeb***
**Assistant Professor**
PhD, The University of Texas at Austin
*Expertise: Millimeter wave and massive MIMO communication, vehicular and drone communication systems and machine learning based wireless communication.*

David **Allee**
**Professor, Associate Director**
PhD, Stanford University
*Expertise: Flexible electronics, large area sensing arrays, VLF electric and magnetic fields, fundamental and external electrical noise and nanometer scale device and nanofabrication.*

Raja **Ayyanar**
**Professor**
PhD, University of Minnesota
*Expertise: Novel topologies and new control techniques for switch-mode power conversion power system applications of power electronics.*

Bertan **Bakkaloglu**
**Professor (On Semiconductor Professor)**
PhD, Oregon State University
*Expertise: RF and mixed-signal IC design wireless and wireline communication circuits and systems broadband communication LCS and systems.*

Constantine A. **Balanis**
**Regents' Professor**
PhD, The Ohio State University
*Expertise: Computational electromagnetics, smart antennas, antennas and microwaves.*

Hugh **Barnaby**
**Professor**
PhD, Vanderbilt University
*Expertise: Semiconductors for hostile environments device physics and modeling microelectronic devices and sensor design and manufacturing.*

Visar **Berisha**
**Assistant Professor**
PhD, Arizona State University
*Expertise: Statistical signal processing, speech and audio perception and machine learning.*

Mariana **Bertoni**
**Assistant Professor**
PhD, Northwestern University
*Expertise: Defect engineering of solar cell materials, transparent conducting oxides, defects in semiconductors, synthesis, growth and deposition of semiconductors, electrical and optical characterization and X-ray microscopy and spectroscopy.*

Jennifer Blain **Christen**
**Associate Professor**
PhD, Johns Hopkins University
*Expertise: Biocompatible integration techniques for CMOS electronics, microfluidics and soft lithography, MEMS with emphasis on bio-MEMS, analog and mixed-mode VLSI for biomedical/analytical instrumentation including 3D and SOI technologies.*

Daniel **Bliss**
**Associate Professor**
PhD, University of California at San Diego
*Expertise: Information theory, estimation theory, signal processing with applications to wireless communications, remote sensing and anticipatory physiology and medicine.*

John **Brunhaver**
**Assistant Professor**
PhD, Stanford University
*Expertise: VLSI design, computer architecture, procedural hardware generation, computer vision accelerators and computer graphics hardware.*

Yu **Cao**
**Professor**
PhD, University of California, Berkeley
*Expertise: Physical modeling of nanoscale technologies, design solutions for variability and reliability and neural-inspired hardware and algorithms for learning.*

Junseok **Chae**
**Professor, Assistant Dean, Research and Innovation**
PhD, University of Michigan, Ann Arbor
*Expertise: Microdevices for bioenergy applications, implantable microdevices and electronic circuit integration with microdevices.*

Chaitali **Chakrabarti**
**Professor**
PhD, University of Maryland, College Park
*Expertise: Low power embedded system design, reliable memory design, VLSI architectures for signal processing and communications and algorithm-architecture codesign.*

Gautam **Dasarathy***
**Assistant Professor**
PhD, University of Wisconsin–Madison
*Expertise: Machine learning, statistics, signal processing, networked systems and information theory.*

Ahmed **Ewaisha***
**Lecturer**
PhD, Arizona State University
*Expertise: Wireless communication and networking*

David **Frakes**
**Associate Professor, Fulton Entrepreneurial Professor**
PhD, Georgia Institute of Technology
*Expertise: Image and video processing, fluid dynamics, computer vision and medical device design.*

Stephen **Goodnick**
**Professor**
PhD, Colorado State University
*Expertise: Transport in semiconductor devices, computational electronics, quantum and nanostructured devices and device technology.*

Michael **Goryll**
**Associate Professor**
PhD, RWTH Aachen University, Germany
*Expertise: Si and SiGe chemical vapor deposition, self-organization phenomena during semiconductor growth, surface and interface physics, strain in semiconductors and new materials in CMOS processing.*

Kory **Hedman**
**Associate Professor**
PhD, University of California, Berkeley
*Expertise: Energy systems, power system economics, mathematical programming, power systems operations and planning, transmission engineering, renewable energy, electric energy market design and pricing, cyberphysical electric power systems, smart grid, distributed energy resources and demand response.*

Keith **Holbert**
**Associate Professor**
PhD, University of Tennessee
*Expertise: Process monitoring and diagnostics, noise analysis, sensor fault detection and radiation effects.*

Zachary **Holman**
**Trustee Professor**
PhD, University of Minnesota
*Expertise: Amorphous silicon/crystalline silicon heterojunction solar cells, light management in solar cells, transparent conductive oxides, semiconductor nanoparticles, optical and electronic properties of nanoscale materials, plasma synthesis of powders and deposition of powders and thin films.*

Christiana **Honsberg**
**Professor**
PhD, University of Delaware
*Expertise: Ultra-high efficiency solar cells and silicon solar cells.*

Suren **Jayasuriya***
**Assistant Professor, Joint Appointment with School of Arts, Media and Engineering**
PhD, Cornell University
*Expertise: Computational imaging and photography, computer vision and sensors.*

Lina **Karam**
**Professor, Graduate Program Chair of Computer Engineering**
PhD, Georgia Institute of Technology
*Expertise: Image and video processing, compression, transmission, computer vision, visual quality assessment, human visual perception, multidimensional signal processing, digital filtering, source coding and biomedical imaging.*

Mojdeh **Khorsand***
**Assistant Professor**
PhD, Arizona State University
*Expertise: Power systems operations and planning, power systems restoration and cascading events, cybersecurity for electric power systems, renewable energy, transient stability studies, protection systems, power flow control technologies, stochastic optimization and electric energy markets.*

Sayfe **Kiaei**
**Motorola Chair**
PhD, Washington State University
*Expertise: Radio frequency and analog integrated circuits and integrated power management IC.*

Richard **Kiehl**
**Professor**
PhD, Purdue University
*Expertise: Self-assembly of nanoscale components by DNA scaffolding, electronic devices based on hybrid organic/inorganic nanostructures. Devices based on collective behavior in nanoparticle arrays. Information processing paradigms based on locally connected networks. Electronic devices and integrated circuits based on heterostructures, nanostructures, and molecular systems. Novel concepts for nanoscale electronic devices and circuits; fabrication by directed self-assembly techniques. Collaborative, interdisciplinary research exploring the interface between nanotechnology and biotechnology for applications in computing and signal processing and sensing.*

*** New faculty**

# Faculty expertise

Richard R. **King***
**Professor**
PhD, Stanford University
*Expertise: High-efficiency silicon and III-V photovoltaics, solid-state device physics, recombination at semiconductor defects and interfaces, multijunction solar cells, thin-film compound semiconductor growth and characterization.*

Jennifer **Kitchen**
**Assistant Professor**
PhD, Arizona State University
*Expertise: RF Integrated Transceivers on silicon and III-V processes (GaN). High-performance Power Management systems for Green Energy, specifically solar arrays, and wireless communications systems. Programmable, broadband, wireless transceivers for future generation (5G) wireless communication systems.*

Oliver **Kosut**
**Assistant Professor**
PhD, Cornell University
*Expertise: Network information theory, with a focus on security against active, malicious attackers, smart grid cybersecurity and finite blocklength information theory.*

Michael **Kozicki**
**Professor**
PhD, University of Edinburgh
*Expertise: Solid state memory and devices based on mass transport in solid electrolytes integrated/solid-state ionics low-energy nonvolatile memories.*

Ying-Cheng **Lai**
**ISS Professor**
PhD, University of Maryland
*Expertise: Nonlinear dynamics, complex networks, quantum transport in nanostructures, graphene physics, signal processing and biological physics.*

Qin **Lei***
**Assistant Professor**
PhD, Michigan State University
*Expertise: High power converters for high voltage direct current transmission/medium voltage direct current transmission, medium voltage drive, grid-integration of renewable energy sources, transportation electrification/electric vehicle/hybrid electric vehicle, power management for smart-grid/micro-grid, wide-bandgap device application (SiC, GaN), and energy storage.*

Robert **LiKamWa***
**Assistant Professor, Joint Appointment with School of Arts, Media and Engineering**
PhD, Rice University
*Expertise: Mobile operating systems; mobile computer architecture, low-power mobile systems, computational imaging systems, computer vision systems, augmented reality systems, virtual reality systems and holographic computing.*

Deirdre **Meldrum**
**Distinguished Professor**
PhD, Stanford University
*Expertise: Biosignatures, genome automation, microscale life sciences, single cell analyses and robotics.*

Angelia **Nedich***
**Professor**
PhD, Moscow State University
*Expertise: Large-scale distributed systems, sensor networks and network science, data analytics, decision and control systems and operations research.*

Cun-Zheng **Ning**
**Professor**
PhD, University of Stuttgart
*Expertise: Nanophotonics, nanowires, nanolasers, surface plasmonic enhanced light emitters and nanomaterials based solar cells.*

Umit **Ogras**
**Assistant Professor**
PhD, Carnegie Mellon University
*Expertise: Digital system design, embedded systems, flexible hybrid electronics, assistive technologies and multicore architectures.*

Sule **Ozev**
**Professor**
PhD, University of California, San Diego
*Expertise: Self-test and self-calibration for wireless transceivers, analysis and mitigation of process variations for mixed signal and digital circuits, fault-tolerant and reconfigurable heterogeneous systems and mixed signal circuit testing.*

Anamitra **Pal***
**Assistant Professor**
PhD, Virginia Tech
*Expertise: Power and energy systems, energy modeling and smart grids, wide-area monitoring, protection and control.*

Joseph **Palais**
**Professor Emeritus**
PhD, University of Michigan
*Expertise: Fiber optic communication, holography and distance learning.*

George **Pan**
**Professor**
PhD, University of Kansas
*Expertise: Computational electromagnetics, high-speed electronics packaging, magnetic-resonant imaging RF coil design and analysis, inverse scattering, rough surface scattering and millimeter-wave antenna systems.*

Antonia **Papandreou-Suppappola**
**Professor**
PhD, University of Rhode Island
*Expertise: Time-varying signal and system processing, stochastic processing with applications in adaptive sensing, radar, wireless communications, biomedicine and structural health monitoring.*

Stephen **Phillips**
**Professor, Director**
PhD, Stanford University
*Expertise: Application and integration of microsystems, MEMS and flexible electronics, system identification and adaptive control and assessment and improvement of novel delivery methods for accredited degree programs.*

Jiangchao **Qin***
**Assistant Professor**
PhD, Purdue University
*Expertise: Power electronics, power electronics-based power systems, high voltage direct current transmission and DC grids, WBG-based converters, grid integration of renewable energy resources, microgrids, energy storage systems, hybrid electric vehicles and transportation electrification and electric drives.*

Martin **Reisslein**
**Professor and Graduate Program Chair, Computer Engineering**
PhD, University of Pennsylvania
*Expertise: 5G wireless networks, access networks (cable, wireless), multimedia networking over wired and wireless networks, network coding, optical networks, software defined networking and video traffic characterization. Instructional design, K-12 students, learning, pedagogical agents, outreach, social dynamics and stereotypes.*

Christ D. **Richmond***
**Associate Professor**
PhD, Massachusetts Institute of Technology
*Expertise: Statistical, sensor, and multichannel signal processing, detection and parameter estimation, information theory (and ties to estimation theory and machine learning), performance bounds and analysis, random matrix theory, radar/sonar, communications, cooperative radar-communications, robust adaptive filtering/beamforming/spectral analysis and interference/jammer mitigation techniques and RF emitter passive geolocation.*

Armando **Rodriguez**
**Professor**
PhD, Massachusetts Institute of Technology
*Expertise: Control of nonlinear distributed parameter systems, hierarchical fault-tolerance, hypersonic vehicles and space systems, sustainability, low power electronics, sample-data control, rapid prototyping and embedded systems and visualization.*

Lalitha **Sankar**
**Associate Professor**
PhD, Rutgers University
*Expertise: Cybersecurity and privacy in the smart grid, privacy of electronic data, information-theoretic privacy measures, applications of game theory to privacy problems, finite block length source coding, distributed state estimation and optimal power flow with security and privacy guarantees in the smart grid.*

Marco **Saraniti**
**Vice Dean of Faculty Administration**
PhD, Technische Universität München, Germany
*Expertise: Computational electronics and biophysics.*

Anna **Scaglione**
**Professor**
PhD, Sapienza Università di Roma, Italy
*Expertise: Statistical signal and array processing, sensor networks and network science, communication and information theory, energy delivery and power systems.*

Jae-sun **Seo**
**Assistant Professor**
**PhD, University of Michigan**
Expertise: Digital/mixed-signal circuit design, VLSI design for neuromorphic computing and machine learning, integrated voltage regulators and high-speed on-chip transceivers.

Jennie **Si**
**Professor**
PhD, University of Notre Dame
*Expertise: Learning and approximate dynamic programming, estimation and filtering of stochastic processes, neural networks, neurophysiological basis for learning and cognitive processing and cortical neural information processing.*

Brian **Skromme**
**Professor and Assistant Dean**
PhD, University of Illinois at Urbana-Champaign
*Expertise: Compound semiconductor materials and devices, wide bandgap semiconductors and optical characterization.*

Andreas **Spanias**
**Professor and Director, SenSIP Center**
PhD, West Virginia University
*Expertise: Digital signal processing, speech and audio coding, adaptive filters, real-time processing of sensor data, DSP for arts and media applications.*

Meng **Tao**
**Professor**
PhD, University of Illinois at Urbana-Champaign
*Expertise: Semiconductor surfaces, interfaces and thin films; terawatt-scale solar photovoltaics; chemical vapor deposition; electrochemistry in solar photovoltaics; solar photovoltaic systems and applications; and two-dimensional transition metal chalcogenides.*

*** New faculty**

Nongjian **Tao**
**Professor and Director, Center for Bioelectronics and Biosensors**
PhD, Arizona State University
*Expertise: Chemical and biological sensors, molecular and nano electronics, mobile health devices and wireless sensors.*

Cihan **Tepedelenlioglu**
**Associate Professor**
PhD, University of Minnesota
*Expertise: Wireless communications, statistical signal processing and data mining for PV systems.*

Trevor **Thornton**
**Professor**
PhD, Cambridge University
*Expertise: Silicon-on-insulator MESFETs, electronics for extreme environments, electron transport in nanostructures and biomolecular sensors.*

Georgios **Trichopoulos**
**Assistant Professor**
PhD, Ohio State University
*Expertise: Millimeter wave and terahertz frequency circuits and sensors, focal plane arrays, on-chip THz antennas, imaging systems and mmW wireless communications.*

Konstantinos **Tsakalis**
**Professor and Undergraduate Program Chair, Electrical Engineering**
PhD, University of Southern California
*Expertise: Control systems, Adaptive control Process control and control of semiconductor manufacturing processes and application of feedback control in Epilepsy.*

Pavan **Turaga**
**Associate Professor, Joint Appointment with School of Arts, Media and Engineering**
PhD, University of Maryland, College Park
*Expertise: Computer vision, human activity analysis, machine learning, rehabilitation and preventive interventions.*

Daniel **Tylavsky**
**Associate Professor**
PhD, Pennsylvania State University
*Expertise: Electric power systems, numerical methods applied to large-scale system problems, parallel numerical algorithms, new educational methods and technologies, applying social optimization to power system markets and transformer thermal modeling.*

Dragica **Vasileska**
**Professor**
PhD, Arizona State University
*Expertise: Semiconductor device physics, semiconductor transport, 1D to 3D device modeling, quantum field theory and its application to real nanoscale device structures, heating effects in nanoscale devices, current collapse in GaN HEMTs and optoelectronics including modeling of solar cells and photodetectors.*

Vijay **Vittal**
**Ira A. Fulton Chair**
PhD, Iowa State University
*Expertise: Electric power, power system dynamics and controls, nonlinear systems, computer applications in power, sustainable energy and modeling and simulation of complex systems.*

Chao **Wang***
**Assistant Professor**
PhD, Princeton University
*Expertise: Nanostructures, nanoimprint lithography, nano-optics, biomolecular sensing, nanofluidics, DNA hydrodynamics and ferroelectrics.*

Yang **Weng***
**Assistant Professor**
PhD, Carnegie Mellon University
*Expertise: Power systems, machine learning, demand response, data analytics, cyberphysical systems and convex optimization.*

Meng **Wu***
**Assistant Professor**
PhD, Texas A&M University
*Expertise: Electric power systems, data analytics for power system planning and operations, modeling and stability assessment for renewable energy integration, optimization methods for smart grids and electricity markets.*

Yu **Yao**
**Assistant Professor**
PhD, Princeton University
*Expertise: Electronic transport and optic properties of semiconductor nanostructures, two dimensional materials, nanophotonic structures and their applications in advanced optoelectronics and reconfigurable optical devices; mid-infrared technology and its application for infrared sensing, medical and imaging.*

Lei **Ying**
**Professor**
PhD, University of Illinois at Urbana Champaign
*Expertise: Stochastic networks, including cloud computing, communication networks and social networks.*

Hongbin **Yu**
**Associate Professor**
PhD, University of Texas at Austin
*Expertise: Nanostructure and nanodevice fabrication and characterization; flexible, transparent and wearable electronics; wide band gap semiconductor electronic and optoelectronics, quantum size effect in metallic and semiconducting nanostructures and integrated microwave and power devices.*

Hongyu **Yu**
**Associate Professor**
PhD, University of Southern California
*Expertise: Miniature science instruments for Earth and Space exploration, such as micro seismometers for planetary geological study and sensing systems for operating in harsh environments. Micro-fabrication enabled manufacturing for newly emerging technologies, Unmanned Aerial Vehicles, wearable electronics and Cube Satellites and intelligent materials.*

Shimeng **Yu**
**Assistant Professor**
PhD, Stanford University
*Expertise: Resistive random access memory, metal-insulator-transition in oxides, memory selector/diode, 3D integration of memory, artificial neuron/synaptic devices, hardware security. Brain-inspired computing, cognitive computing, neuromorphic computing, hardware implementation of machine learning algorithm.*

Saeed **Zeinolabedinzadeh***
**Assistant Professor**
PhD, Georgia Institute of Technology
*Expertise: High-frequency millimeter-wave, and terahertz integrated circuits; integrated photonics and electronics-photonics circuits; high-speed IC design for radiation-intensive space environments and radiation hardening; IC design for robust operation over the temperature, down to cryogenic temperatures.*

Junshan **Zhang**
**Ira. A Fulton Chair Professor**
PhD, Purdue University
*Expertise: Wireless networks and information theory, network information theory and stochastic analysis.*

Yanchao **Zhang**
**Associate Professor**
PhD, University of Florida
*Expertise: Network and distributed system security, wireless networking and mobile computing.*

Yong-Hang **Zhang**
**Professor**
PhD, Max-Planck Institute for Solid States and University Stuttgart
*Expertise: Semiconductor optoelectronic devices and materials, including semiconductor lasers, photodetectors, solar cells, and their integration for various applications and molecular beam epitaxy growth of semiconductor quantum structures.*

Yuji **Zhao**
**Assistant Professor**
PhD, University of California, Santa Barbara
*Expertise: Electronics and photonics, MOCVD growth and device applications of GaN wide band gap semiconductors, including LEDs, lasers, solar cells and power transistors; nanofabrication and nanoscale characterizations; new physics and materials and devices for future solid-state electronics.*

## Emeritus faculty

**Emeritus faculty are recently retired ASU faculty members who will continue their intellectual, creative and social engagement with the university.**

Lawrence **Clark**
**Professor Emeritus**
PhD, Arizona State University

Douglas **Cochran**
**Professor**
PhD, Harvard University

Rudy **Diaz**
**Professor Emeritus**
PhD, University of California, Los Angeles

David **Ferry**
**Professor Emeritus, Regents Professor**
PhD, University of Texas, Austin

Ravi **Gorur**
**Professor Emeritus**
PhD, University of Windsor, Canada

Gerald **Heydt**
**Regents' Professor Emeritus, Professor of Advanced Technology**
PhD, Purdue University

Joseph **Hui**
**Professor Emeritus**
PhD, Massachusetts Institute of Technology

*** New faculty**

School of **Electrical, Computer** and **Energy Engineering**

P.O. Box 875706 ▪ Tempe, AZ 85287-5706
ecee.engineering.asu.edu