

CURRENT TRANSMISSIONS

Electrical and Computer Engineering | Missouri S&T | Spring 2020

EXCEEDING ALL EXPECTATIONS

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THANK YOU, ALUMNI

The \$110,000 renovation of our 600-square-foot Advanced Embedded Systems Laboratory was funded entirely by the generosity of our electrical and computer engineering graduates.

The lab gives upper-level computer engineering students a chance to conduct cutting-edge research and gain hands-on experience working with real-time systems like smart grids; adaptive neural networks; fuzzy and artificial intelligence; detection, isolation and accommodation of digital faults; and micro and nano robotics.

And way more than that.

This is where our students and researchers are developing embedded hardware and the control and networking algorithms to implement on it.

And they couldn't do it without your support. Thank you!



DEAR ALUMNI, COLLEAGUES AND FRIENDS,

One of my jobs as ECE chair is to talk about the awesome things happening in our department. I love this role, because I've got a LOT to brag about! This newsletter only scratches the surface.

We don't get an opportunity to speak much about our alumni here, but I couldn't be prouder of their accomplishments and of the impact they are making on the world.

I feel this pride the strongest when I visit alumni during the ECE Academy meeting. Its members have made substantial technical contributions to their industries as engineers, presidents or vice presidents, entrepreneurs, inventors, and more.

Despite being extraordinarily busy, these alumni spend two days in Rolla each year helping the department chart a path for the future, and often take an extra evening to meet students and give them advice about how to handle their classes, land their dream job and navigate their future careers.

The achievements of S&T's alumni would make any department chair proud, but their desire to help the next generation of engineers achieve similar success really intensifies my pride. This desire is one of the



reasons I became a faculty member, and it is wonderful to see it in our alumni as well.

On the following pages, you'll also see lots of reasons why I'm so proud of our department.

Our faculty are among the best teachers in the country, as shown by Kelvin Erickson's win of the Governor's Award for Excellence in Teaching. They are among the best at developing new knowledge and technical innovations, as shown by Rui Bo's win of the DARPA Young Faculty award, or Chulsoon Hwang and his students' win of (yet another) Best Paper award. Our students are overcoming amazing hurdles to become some of the best engineers in the field. And so much more.

As always, we'd love to see you if you're ever near Rolla. You're always welcome at S&T!

Daryl Beetner, Ph.D.
Chair, Electrical and
Computer Engineering



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FAN'S RESEARCH IS FINALIST FOR BEST PAPER

Researchers in the Electromagnetic Compatibility Laboratory proposed a new method to reduce radio-frequency interference in electronics through a new circuit board design. Their approach, which could result in cost savings, is described in a paper that was a finalist for the Best Paper Award at DesignCon 2019, the U.S.'s largest event for chip, board and systems engineers.

In their paper, the researchers studied a popular consumer electronic device and its multiple digital sub-systems, including a central processing unit, a double data rate (DDR) memory chip and Wi-Fi antennas. They proposed a way to reduce radio-frequency interference, or RFI, in the device without impeding signal integrity.

"The board with the new design shows clear RFI reduction," says **Jun Fan**, the Cynthia Tang Missouri Distinguished Professor of Computer Engineering at S&T and one of the paper's authors. Fan is also director of the EMC Lab at Missouri S&T.

Fan adds that shielding — or blocking an electromagnetic field with barriers made of conductive or magnetic materials — is the approach commonly used to reduce RFI in electronic products. But the S&T researchers' proposed layout changes, based on the analysis using a "dipole moment" method, could eliminate the need for shielding in some electronic products.



AARON HARMON: LEARNING BY LEADING

Missouri S&T students leave the university with more than a degree. They gain invaluable experience in leadership by bringing people together to solve issues on campus.

Aaron Harmon, CpE'18, president of Spectrum — a campus organization for LGBTQ students and their allies — and a Ph.D. student in computer engineering, was one S&T student organization leader *Missouri S&T Magazine* featured in a Fall/Winter Q&A about leadership.

"As an organization that represents a broad group of marginalized identities, we are often affected by outside events related to experiences unique to these identities," Harmon said. "Because of this, I most often find myself working with the group to foster an inclusive and supportive community, within the organization and throughout our campus."

Harmon believes one characteristic every leader should possess is compassion. "Compassion lets us accept an individual's shortcomings and cherish their strengths," he said. "Through compassion and understanding, a leader can start to unpack why things are not going well and readjust the plan moving forward, keeping the team in mind."

He says his personal experiences at S&T have made him into a good leader.

"I have learned how to foster leadership in others and better embrace aspects of other philosophies that differ from mine."

GRADUATION DOESN'T MEAN GOODBYE

It's easy to stay in touch with your department. Just say hello when a student representative calls during phonathon, or drop us a note at ece@mst.edu. Tell us what you're doing with your degree in electrical and computer engineering so we can feature your accomplishments among our alumni achievement stories.

With your support, there's no limit to what we can achieve!

WELCOME NEW FACULTY

Three new faculty members joined ECE this past fall.



Ahmad Alsharoa is an assistant professor from Virginia State University, where he worked as an assistant professor of engineering and computer science. His research

focuses on computer security, machine learning and wireless networks. Alsharoa earned a Ph.D. in computer engineering and electrical engineering from Iowa State University in 2017.



Mina Esmaeelpour is an assistant professor from the radiology department at Stanford School of Medicine, where she worked as a postdoctoral research fellow.

Esmaeelpour earned a Ph.D. in physics from Lehigh University in 2016. Her research interests include fiber optics, photonic crystal waveguides and fibers, and positron emission tomography (PET) imaging.



Dong-Hyun Kim is an assistant professor who came to S&T in 2018 as a visiting assistant research professor. He earned his Ph.D. in electrical engineering from

the Korea Advanced Institute of Science and Technology in 2018. Kim's research interests include signal integrity, electromagnetic compatibility and semiconductor devices.

FACULTY AND STAFF NEWS

PROMOTIONS

- » **Kristin Donnell** was promoted to associate professor; **Theresa Odun-Ayo** was promoted to associate teaching professor, and **Pourya Shamsi** was promoted to associate professor.

SERVICE

- » **Steve Watkins**, EE'83, MS EE'85, was elected 2019-20 vice president of educational activities and awards for IEEE.

AWARDS

- » **Rui Bo** received a Young Faculty Award from the Defense Advanced Research Projects Agency (DARPA), one of the Department of Defense's most competitive awards.
- » **Kelvin Erickson**, EE'78, MS EE'79, received the 2019 Governor's Award for Excellence in Teaching and was named a fellow of the International Society of Automation.
- » **Mehdi Ferdowsi**, **Jie Huang**, **Jagannathan Sarangapani** and **Pourya Shamsi** were honored by the College of Engineering and Computing for receiving patents during the past year.

- » **Kevin Hasner**, senior electronics technician, received the Rookie of the Year Award during a College of Engineering and Computing awards ceremony.

- » **Chulsoon Hwang** received a Faculty Research Award.

- » **Jie Huang** received the 2019 Faculty Excellence Award and the IEEE St. Louis Section Outstanding Researcher award.

- » **Amardeep Kaur** was named Outstanding Educator by Region 5 of IEEE and received the IEEE St. Louis Section Outstanding Member award.

- » **Victor Khilkevich** received a Faculty Achievement Award.

- » **Jagannathan Sarangapani** received the IEEE Control System Society's Transition to Practice Award.

- » **Robert Woodley** received a \$5,000 grant from the Center for Advancing Faculty Excellence at S&T to redesign Computer Engineering 2210, Introduction to Digital Logic.

- » **Donald Wunsch**, was invited to attend the Global Grand Challenges Summit in London in September and received the 2019 Ada Lovelace Service Award from the International Neural Network Society.



GRAINGER AWARD RECIPIENTS

Ten recent electrical engineering graduates received a \$6,000 Grainger Power Engineering Award as a reward for academic excellence.

The Power Engineering Awards are funded by a \$1.3 million endowment from The Grainger Foundation of Chicago. Missouri S&T is recognized by Grainger for its ability to attract top students and educate quality engineers and is one of only six universities in the nation chosen to receive such funding.

Each spring, the Grainger Power Engineering Award is presented to up to 12 electrical engineering graduate and undergraduate students who plan to pursue careers in power engineering. Selection is based on academic performance, exhibited interest in power engineering and extra-curricular activities.

The 2019 recipients of the Power Engineering Awards are:

Kyle Anders, Michaela Dickerson, Matthew Goebel, Gideon Hallman, Nicholas Hausladen, Kevin McPherson, Jordan Nowak, Jared Raffel, Gabe Sheffield and Lane Sprunger.

SCHEPERS HONORED FOR PROFESSIONAL ACHIEVEMENT

David J. Schepers, EE'75, received an Award of Professional Distinction during the December 2018 commencement ceremonies at S&T. The award recognizes outstanding alumni for professional achievement.

Schepers began his career with Anheuser-Busch Companies and in 1976, joined Union Electric Co. He served in positions of increasing responsibility until 2003, when he was named vice president of energy delivery technical services for Ameren Corp. He also served as vice president of special projects and of crisis management before retiring in 2014.

Schepers was vice chair of the AEIC Power Delivery Committee, chair of the Edison Electric Institute Distribution and Metering Committee, a senior member of IEEE, and co-founder and past president of the St. Louis professional chapter of Engineers Without Borders. He is past president of the Electrical Board of Missouri and Illinois, a current member of the board of directors for Ranken Technical College and board president of the Central Institute for the Deaf.

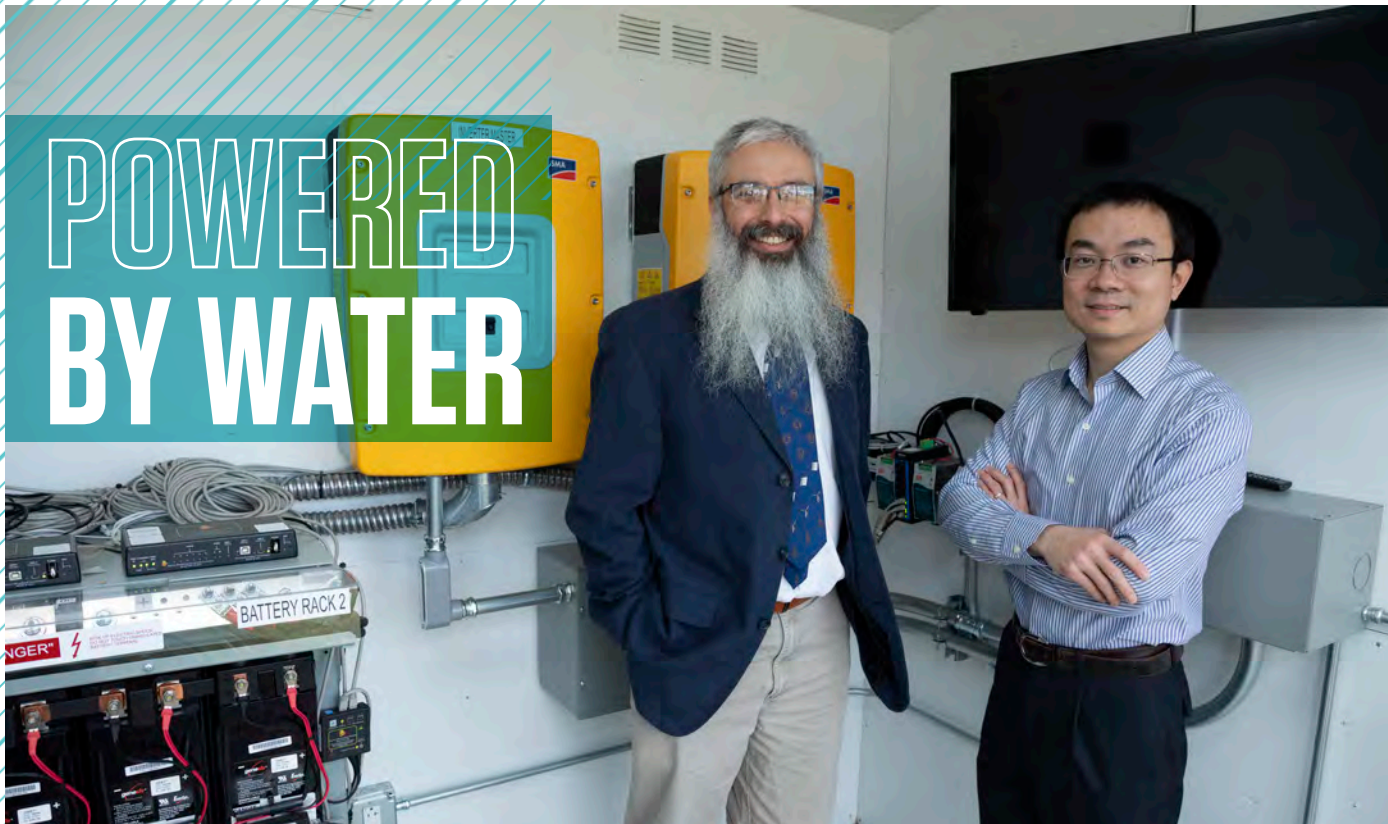
He is a member of the Order of the Golden Shillelagh and the Academy of Electrical and Computer Engineering.



STUDENT NEWS

- **Pamela Petterchak**, sophomore in computer engineering and computer science, was selected 2019-20 Venturing president for Boy Scouts of America.
- Ph.D. student **Yin Sun**, her advisor, **Chulsoon Hwang**, and former S&T postdoctoral associate **Jingook Kim** received the Best Signal and Power Integrity Symposium Paper Award for "Jitter-Aware Target Impedance," which was presented at the 2019 IEEE EMC Symposium. The paper was selected out of roughly 200 presented.
- **Abhishek Patnaik, Shubhankar Marathe** and **Shun Liu**, and faculty advisors **David Pommerenke** and **Daryl Beetner**, received honorable mention for the Richard B. Schulz award for the best paper published in the *IEEE Transactions on Electromagnetic Compatibility* in 2018 for "A Transient Event Sensor for Efficient System Level ESD Testing," published in Vol. 60, No. 5.
- The IEEE Student Branch was chosen as the Outstanding Branch by the IEEE St. Louis section.
- The Gamma Theta chapter of IEEE-HKN won an Outstanding Chapter Award for the 14th time in a row. They have been recognized a total of 42 times.
- **Evan Fitzgerald** won the IEEE St. Louis Section black box competition.
- **Aimee Dietiker** received a \$2,000 scholarship from the IEEE Power Engineering Society.
- Ph.D. student **Shubhankar Marathe** received the Best EMC Symposium Student Paper Award for "ESD Generator Tip Current Reconstruction using a Current Probe Measurement at the Ground Strap" at the 2019 IEEE EMC Symposium. He shares the award with **Javad Meiguni** and his advisor **David Pommerenke**.

POWERED BY WATER



Rui Bo, pictured above (right) with fellow ECE researcher Jonathan Kimball, on site at one of the Solar Village's battery control buildings.

About 10% of electricity in the U.S. is created by moving water or hydropower, according to a Hydropower Vision report from the U.S. Department of Energy (DOE). But the report found great potential in improving hydropower to meet more U.S. energy needs.

Missouri S&T has won almost \$1 million dollars in grant funding from the DOE to improve and evaluate better models for pumped storage hydropower (PSH) — a subset of hydropower that uses water storage in reservoirs to generate energy.

Rui Bo, the principal investigator (PI) on the grant and an assistant professor in electrical and computer engineering at S&T, is leading a team of system operators, research institutions and industry leaders to test new PSH models in real-world conditions.

“A pumped storage hydro plant is a special plant that can both generate electricity and consume electricity,” says Bo.

PSH is a type of hydroelectric energy storage that uses two water reservoirs at different elevations to generate power as the water moves down through a turbine. The moving water drives a generator, which then produces electricity. In order to generate energy continuously, the plant pumps water from the lower reservoir to the upper reservoir and the cycle starts again.

“It may sound odd to use energy to pump the water up and then you’re using the water to generate energy again,” says Bo. “But they serve different purposes at different times, working like a battery. You want to generate power when the system is in need of more energy and the price is higher. When you pump, you choose the time when the energy demand or load is low and the price is low.”

Bo says when operated efficiently, the cycle makes sense economically.

“We will use real data to generate real benefits to consumers. If this project is successful, it has the potential to be applied in energy markets across the U.S.,” says Bo.

Bo’s other projects this year include serving as co-PI on a \$1 million grant from NSF to develop stronger safeguards for cyber-physical systems, which are used in everything from computer systems and electric grids to self-driving cars. Bo is a co-PI on a \$2.9 million DOE grant to develop ultra-fast electric vehicle charging stations to make their charging time about the same as filling up a gas tank in a conventional car. He was also awarded a DARPA Young Faculty award in 2018.



EXCEEDING ALL EXPECTATIONS

As a child, **Tamar Makharashvili** was curious about computers. She wanted to understand their parts and how they worked. But her interest in technology wasn't encouraged at home or at school in her home country of Georgia.

During her talk at Missouri S&T's third TEDx event in spring 2019, Makharashvili told the audience what it was like growing up in Georgia as a young woman interested in science, technology, engineering and math (STEM).

"When you are told that there is a difference in how men and women think and how differently their brains are wired, you just accept it," says Makharashvili. "Girls are convinced they cannot succeed in technical fields."

That discouragement didn't deter her from earning a bachelor's degree in electrical engineering at Tbilisi State University in

Georgia's capital city of Tbilisi. In 2014, her electrical engineering study led her to Missouri and the S&T Electromagnetic Compatibility Laboratory (EMC).

"The Electromagnetic Compatibility Lab is famous in my field," says Makharashvili. "I contacted my S&T professors, talked about research and ended up in Rolla after earning my bachelor's."

During her five years at S&T, she adapted and excelled. One of her dissertation

topics focused on reducing emissions in vehicles by evaluating the behavior of electrical components in the design stage to potentially mitigate radiated emission issues for the system.

"My research in the EMC Lab helped me to improve my critical thinking skills, to develop an idea, to investigate and to analyze," says Makharashvili. "Internship programs at Missouri S&T made it possible for me to practice my skills on practical work in industry."

After graduation, she accepted an offer in California to work as a design engineer at Google. She works with printed circuit boards to evaluate their performance, make modifications and improve the product.

She says that S&T gave her the essential tools and skills to build a strong foundation for her engineering career.

"I had a great opportunity to work with and learn from amazing, smart engineers and professors during my studies at school," says Makharashvili. "I am excited and prepared for my next step in my career after graduation."



To watch the video of Makharashvili's talk or any of the other TEDxMissouriS&T events, visit tedxmst.com.

WELCOME TO THE ACADEMY

During an April 2019 ceremony, eight ECE engineers with ties to S&T were inducted into the Academy of Electrical and Computer Engineering.

The new members were recognized for their service and leadership in the field. Please welcome:



Geoffrey A. Akers, EE'96, associate professor of engineering at the College of the Ozarks, retired from the Air Force as a lieutenant in special programs in Arlington, Va. At College of the Ozarks, he supervises the Acoustics Services Workstation and advises the Engineering Club.



Martin O. Penning, EE'80, vice president of commercial operations for Empire District Electric Co., has held positions of leadership in system protection and planning; corporate planning; engineering; and commercial operations for both the Eastern Division and the Western Division. He is an S&T alumni admissions ambassador.



F. Scott Aschinger, EE'88, president of Aschinger Communications and an adjunct instructor at Jefferson College, is also a project engineer for Aschinger Electric. He is a registered communications distribution designer, a certified installation contractor, and is photovoltaic certified.



Christopher A. Philipp, EE'82, MS EMgt'89, senior electrical engineer for Ross and Baruzzini, held positions at Stone and Webster, Booker Engineering, Sverdrup Corp. and Sachs Electric Co. before moving to Ross and Baruzzini in 2017.



Sharon Beermann-Curtin, EE'87, senior advisor to the director of the Strategic Capabilities Office for the Office of the Undersecretary of Defense for Research and Engineering, held leadership positions in Sea Warfare and Weapons and Strategic Capabilities before taking her current position in 2018.



David R. Saunders, EE'83, senior systems engineer for Viasat Inc., began his career at McDonnell Douglas Aircraft, then worked at Motorola Inc. before taking his current position at Viasat Inc. in 2006.



Nancy A. Pendleton, EE'88, vice president of engineering mission systems for Boeing Defense, worked at Boeing Phantom Works and Boeing Research and Technology before taking her current position. She is a systems engineering mentor at S&T and a mentor for women in engineering at Washington University in St. Louis.



H. Ward Silver, EE'78, owner of RBR Engineering and Aetherworks Publishing, held positions with Environmental Measurements, Wesmar Electronics and Physio-Control/Medtronics and served as an adjunct faculty member. Since 1984, Silver has owned RBR Engineering and Aetherworks Publishing.

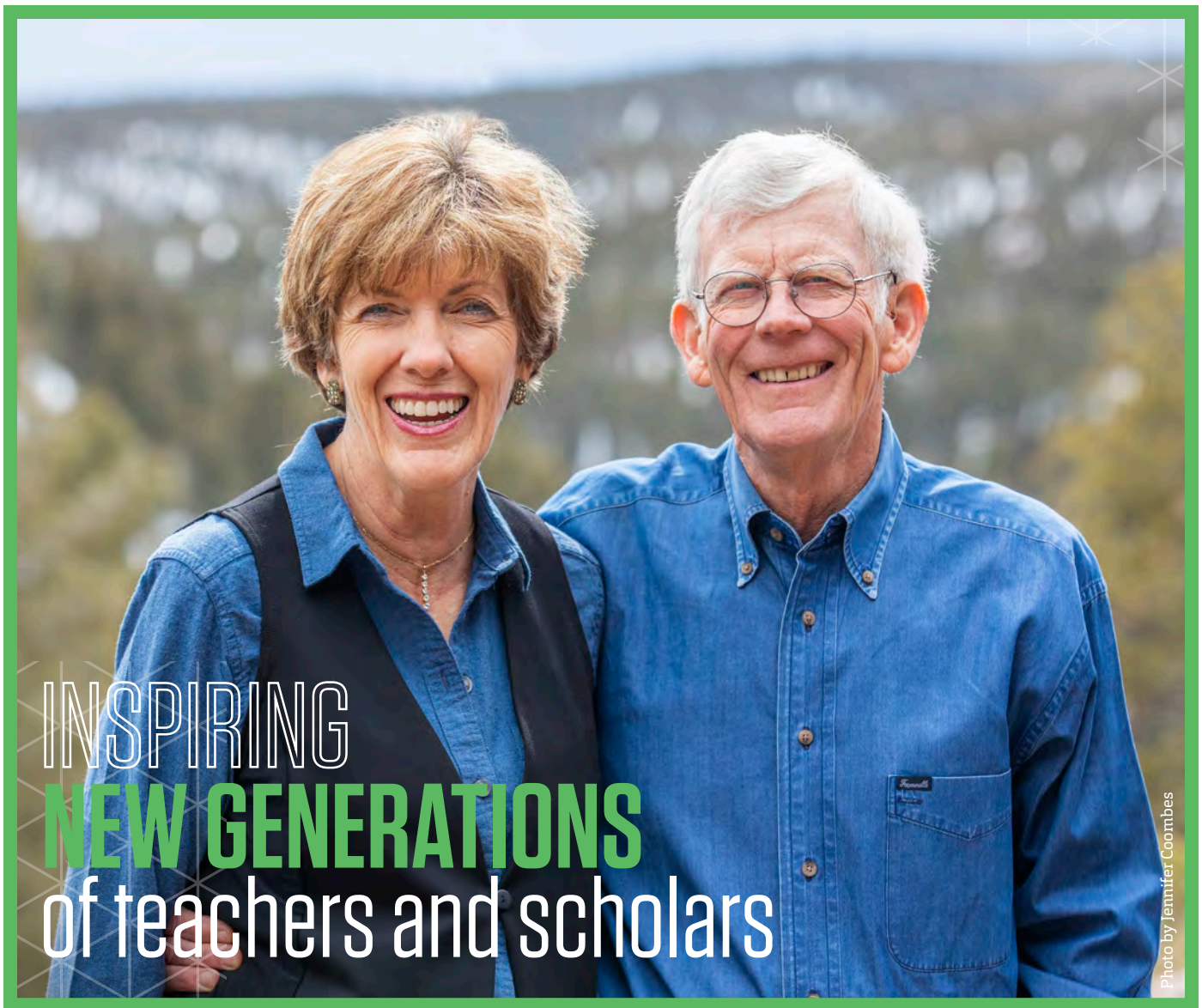


Photo by Jennifer Coombes

INSPIRING NEW GENERATIONS of teachers and scholars

When **Joan Woodard, Math'73**, was in high school, there wasn't much exposure to engineering. But that changed when she got to Rolla.

"I had many friends studying engineering," she says. "I knew that's what I ultimately wanted to do."

After graduation, Woodard joined Sandia National Laboratories. Nearly 40 years later, she retired as executive vice president and deputy director.

Now Woodard and her husband, **James Woodard Jr.**, have established a \$1 million faculty endowment in electrical and

computer engineering. The Woodard Associate Professorship for Excellence will support a mid-career faculty member on the path to full professor by providing research funding and other resources.

"I started at Sandia as a member of the technical staff," says Woodard. "The work was exciting and cutting edge."

Woodard's first project was in energy research, developing a solar thermal electric

power generation system. During the assignment, she met a Ph.D. graduate of MIT, her future husband.

"We were working on a \$110 million federal investment in the 1970s, so there was a lot of pressure," says Woodard. "Using our research, the government built a plant to test advanced concepts in power generation." Woodard is a member of the S&T Board of Trustees and the Academy of Computer Science. She was recognized among the university's Alumni of Influence in 2011. The Woodards have two sons who are both Miners, **Thomas, EE'06**, and **Mark, PhD CpE'17**.

"The professorship will support excellent faculty members who teach because they love students, do research because it keeps them at the frontier of their fields, and serve because they are leaders," she says. "And hopefully the endowment will encourage all faculty on that path."



POURYA SHAMSI FIRST TO FILL WOODARD PROFESSORSHIP

ECE associate professor **Pourya Shamsi** has been named the inaugural Woodard Associate Professor.

The Woodard Associate Professorship was established through a \$1 million endowment from Joan Woodard, Math'73, and her husband, James Woodard Jr.

Shamsi, who joined the ECE faculty in 2013, studies smart grids, stability assessment in microgrids, energy management, switching power converters and VHF/UHV dc-dc converters as part of the power research group. The power group is designed to provide graduates with general knowledge as well as specifics to start out in industry already a productive engineer. The strong base of fundamental skills power engineering students leave S&T with can form the basis for an industrial career or launch an academic career.

Shamsi's recent research projects include providing expertise in high-power and medium-voltage converter design for a project ECE professor Jonathan Kimball leads to develop fast-charging stations for electric cars and working as part of Missouri S&T's Microgrid Industrial Consortium to use lead acid batteries to store and distribute energy for S&T's Solar Village.



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IN MEMORIAM

1. Professor emeritus **David Ray Cunningham** died July 24, 2019. He joined the S&T faculty in 1969 and taught for 30 years, earned numerous faculty teaching awards and was advisor to Eta Kappa Nu. He co-authored a textbook, *Circuit Analysis*, now in its second edition, which continues to be used in the United States and internationally. He previously worked for General Electric, at the Hanford Nuclear Reservation and in Syracuse, N.Y., and was instrumental in developing the first imaging machine, which led to the development of Xerox copiers. Early in his university career he worked during summer breaks for Conoco.
2. Professor emeritus and former Schlumberger Professor **William Tranter** died May 5, 2019. In 1969, he joined the S&T faculty, serving as an assistant and associate dean of engineering from 1980 to 1985. In 1997, he joined the Virginia Tech faculty as the Bradley Professor of Electrical and Computer Engineering. He was a program director in the National Science Foundation Computer and Information Science and Engineering Directorate and was an IEEE Life Fellow. He was editor-in-chief of the Journal on Selected Areas in Communications for 11 years and received an IEEE Centennial Medal and a Millennium Medal, among other awards.
3. **E. Keith Stanek**, professor emeritus of electrical and computer engineering and S&T's First Finley Distinguished Professor in ECE, died Sept. 30, 2019. He began his career on the electrical engineering faculty at his alma mater, the Illinois Institute of Technology, then held faculty positions at West Virginia University and the Michigan Technological University before joining the S&T faculty in 1990. He served as chair of electrical and computer engineering from 1995 to 2002 and retired in 2006. He was inducted into the Academy of Electrical and Computer Engineering in 2003. Among many honors, Stanek was an IEEE Fellow, and a member of the National Society of Professional Engineers, where he served on the board of directors of its educational foundation.

PAUL NAUERT: OUTSTANDING ENGINEER



Paul Nauert, EE'78, a lecturer for S&T Global-St. Louis, received the Outstanding Professional Engineer in Education award from the Missouri Society of Professional Engineers.

Nauert earned a master's degree in electrical engineering from Purdue University in 1980. He is a registered professional engineer in Illinois and Missouri. In 2015, he retired from Ameren following a 35-year career. He now teaches power systems classes at S&T.

Nauert is a senior member of the Institute of Electrical and Electronics Engineers (IEEE), former vice chair of the Power and Energy Society St. Louis chapter, and a member of the Academy of Electrical and Computer Engineering.



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150 YEARS

LET'S CELEBRATE MISSOURI S&T'S STORY

From our founding in 1870 as a pioneering technical school to our 21st century standing as a national technological university, Missouri S&T's story spans a century and a half of remarkable change.

GET SET TO CELEBRATE 150 YEARS OF MINER PRIDE!

A year of special events kicks off with MinerFest 150 in October 2020 and concludes with the Alumni of Influence celebration in November 2021. In between, mark your calendar in green for our biggest best ever festival — or “Bestival” — over St. Pat's Weekend in March 2021.

Watch for the publication launch in October 2020 of a commemorative book by Curators' Distinguished Teaching Professor emeritus Larry Gragg. His history of the university spans 150 years of Miner milestones, memories and mischief.

Visit 150.mst.edu for more information.