



2019



Washington University in St. Louis  
**McKelvey School of Engineering**

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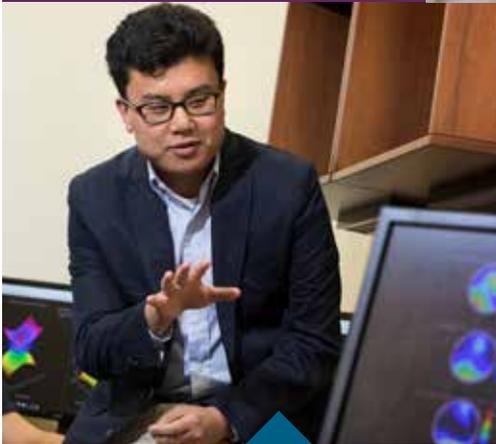
Preston M. Green Department of

# Electrical & Systems Engineering

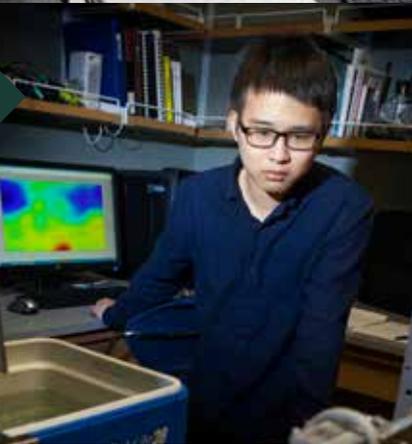


The Preston M. Green Department of Electrical & Systems Engineering is housed in Green Hall, a state-of-the-art, Gold LEED certified building.

**73%**  
of undergraduate ESE students minor, double major or have dual degrees, often in a non-engineering area



**100%**  
of PhD students are fully funded



**4:1**  
PhD students to tenured/tenure-track faculty ratio



Multiple mentor programs for undergraduate and graduate students

## WashU ESE

**25.5**

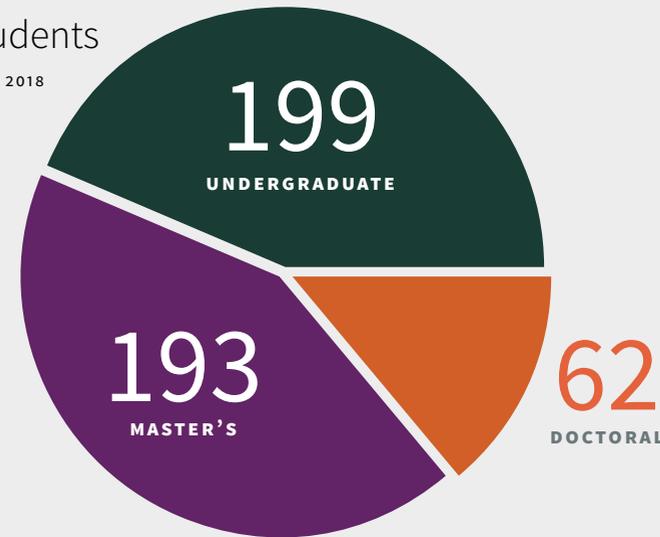
FULL-TIME FACULTY

**28%**

OF ESE STUDENTS ARE WOMEN

## Students

FALL 2018



### Undergraduate programs:

- » Applied Physics & Electrical Engineering (minor only)
- » Electrical Engineering
- » Mechatronics (minor only)
- » Robotics
- » Systems Science & Engineering
- » Financial Engineering (second major only)

### Graduate programs:

- » PhD in Electrical Engineering
- » PhD in Systems Science & Mathematics
- » DSc in Electrical Engineering
- » DSc in Systems Science & Mathematics
- » MS in Electrical Engineering
- » MS in Systems Science & Mathematics
- » MS in Data Analytics and Statistics
- » Master of Control Engineering
- » Master of Engineering in Robotics
- » Graduate Certificate in Imaging Science & Engineering

**22.4%**

INCREASE IN RESEARCH EXPENDITURES FROM FY17 TO FY18

**5,600**

ALUMNI WORLDWIDE

## Facilities

**\$275M**

invested in new and renovated Engineering space since 2000



A new academic building, Jubel Hall, features a 3,350 square-foot makerspace. McKelvey Hall, which will open in early 2021, will expand collaborative opportunities among computational researchers across the entire school.



## WashU research centers for ESE collaboration

**Center for Cyborg and Bio-robotics Research**

**Center for Quantum Sensors**

**Center for Science and Engineering of Living Systems**

**Center for Sensor Signal & Information Processing**

**Institute for Materials Science and Engineering (IMSE)**

**Siteman Cancer Center**

## New faculty



**Neal Patwari**  
*Professor*

Patwari performs research at the intersection of statistical signal processing and wireless

networking, for improving wireless sensor networking and RF sensing. He is jointly appointed in the Preston M. Green Department of Electrical & Systems Engineering and the Department of Computer Science & Engineering

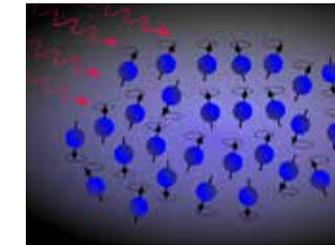


**Bruno Sinopoli**  
*Department Chair and Das Family Distinguished Professor*

Sinopoli's research focuses on robust and resilient

design of cyber-physical systems, networked and distributed control systems, distributed interference in networks, smart infrastructures, wireless sensor and actuator networks, cloud computing, adaptive video streaming applications and energy systems.

## Research news

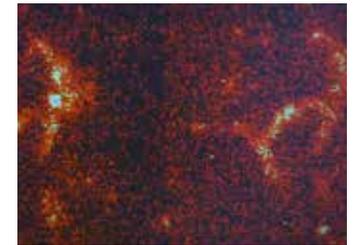


### Unlocking dynamic information in complex systems

Targeted excitation of a vast number of spin particles using radiofrequency-pulse sequences is a classical broadcast coordination task for dynamic populations, which is at the core of the principle of MRI.

With fall in full swing, our bodies naturally adjust to fewer daylight hours thanks to our circadian rhythm. Engineering researchers at Washington University in St. Louis want to determine how the brain network allows this to happen using a system-theoretic and computational approach.

Jr-Shin Li, the Das Family Career Development Distinguished Professor and an applied mathematician in the McKelvey School of Engineering, has received a four-year, \$1.6 million grant from the National Institutes of Health (NIH) to create a unified methodology that helps researchers infer dynamic topology and control spatiotemporal structures of complex networks, for example, the connectivity among the brain network that controls circadian rhythm, an important biological process that manages sleep, body temperature and digestion.



### 'Blink' and you won't miss amyloids

Tiny protein structures called amyloids are key to understanding certain devastating age-related diseases. Aggregates, or sticky clumped-up amyloids, form plaques in the brain, and are the main culprits in the progression of Alzheimer's and Huntington's diseases.

Amyloids are so tiny that they can't be visualized using conventional microscopic techniques. A team of engineers at Washington University in St. Louis has developed a new technique that uses temporary fluorescence, causing the amyloids to flash, or "blink," and allowing researchers to better spot these problematic proteins.

"It has been pretty difficult, finding a way to image them in a noninvasive way — not changing the way they come together — and also figuring out a way to image them long-term to see how they clump and form larger structures," said Matthew Lew, assistant professor in the Preston M. Green Department of Electrical & Systems Engineering at the McKelvey School of Engineering. "That was the focus of our research."

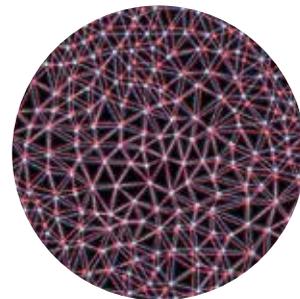
## Research areas

**Applied Physics**

**Devices & Circuits**

**Systems Science**

**Signals & Imaging**

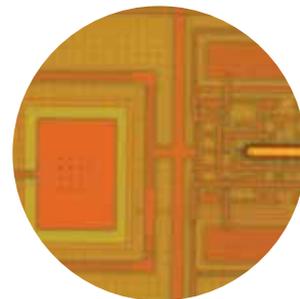


### Systems Science

- » Optimization
- » Applied Mathematics
- » Control
- » Cyber-physical Systems
- » Financial Engineering

### Signals & Imaging

- » Computational Imaging
- » Signal Processing
- » Optical Imaging
- » Data Sciences

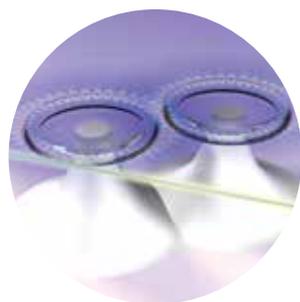


### Applied Physics

- » Nano-photonics
- » Quantum Optics
- » Engineered Materials
- » Electrodynamics

### Devices & Circuits

- » Computer Engineering
- » Integrated Circuits
- » Radiofrequency Circuits
- » Sensors



## Research news



### Using tooth sensors to detect disease

The team is developing a smart-tooth technology that could someday be used to detect early signs of certain diseases in high-risk patients by analyzing saliva or gingival crevicular fluid.

“It’s like an electronic tooth,” said Shantanu Chakrabartty, professor of electrical & systems engineering and a partner on the project, currently funded by a four-year, \$1.5 million grant from the National Institutes of Health.

That electronic tooth is actually a tiny sensor and an electronic chip, about a few millimeters-cube in volume. It is designed to be inserted inside the patient’s gum line or as part of a dental appliance, and contains bio-recognition elements that measure disease-specific peptides, which are natural or synthetic groups of amino acids. As a first attempt, the research team will work toward monitoring peptides related to bone breakdown during periodontitis, a dental disease that can lead to loosening and loss of teeth. A wireless ultrasound device would then be used to read the peptide levels and connect to the medical data-cloud.



### Diving in to how our brains process information

ShiNung Ching in the McKelvey School of Engineering, and Todd Braver, professor of psychological & brain sciences in Arts & Sciences, both at WashU, will create new models of brain function to tease apart those individual differences and create new models for them with a three-year, \$610,560 grant from the National Science Foundation (NSF). Matthew Singh, a WashU neuroscience graduate student, is another member of the research team.

The grant is one of 18 awarded by the NSF to conduct innovative research on neural and cognitive systems and will contribute to the NSF’s commitment to the National Institutes of Health’s Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative.

The research seeks to understand the mechanisms of cognitive control, or how brain functions to allow us to vary our information processing and behavior based on our current goals and the situational context, such as not eating a friend’s lunch despite being hungry.



### Building a better microscope

Ulugbek Kamilov plans to use a three-year, \$265,293 grant from the National Science Foundation to capture the information that normally gets lost and add it to the information researchers typically receive from microscopes. Ultimately, this work, along with that of his collaborator, Lei Tian at Boston University, may lead to a more precise microscope that can see objects as miniscule as 100 nanometers, such as viruses.

“The whole premise of this is built on one single fact — the way light interacts with any matter is linear,” said Kamilov, assistant professor of electrical & systems engineering and computer science & engineering. “But the reality is that the interaction is actually not linear.”

“We want to take into account this nonlinear interaction of light, objects and premises, and if we do it correctly, we can extract that information, which normally disappears in a current microscope and is treated as ‘noise,’” Kamilov said. “We want to decode the information from the noise and add it back into the resolution, and that should give us features that are smaller than the resolution limit.”



## Mentoring programs for WashU Engineers

**Mentor Collective**

**Deloitte Mentor Program**

**Regional Business Council**

**Boeing**

**WashU Engineering Mentor Program**

**Women & Engineering**

## Discovery Competition

The Discovery Competition provides engineering undergraduate students the forum to explore their entrepreneurial interests with support from mentors, to use their creativity to develop solutions for real-world problems and to compete for financial resources that could help turn their ideas into businesses.

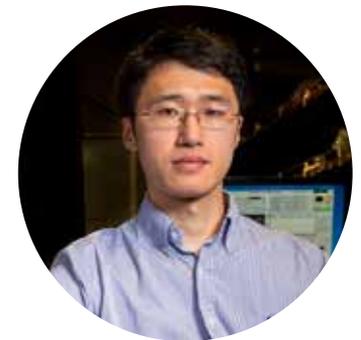
ST. LOUIS IS THE

**No. 2**

CITY FOR STARTUPS  
(Forbes)

### WashU and St. Louis resources and accelerators:

- » Arch Grants
- » Cambridge Innovation Center St. Louis
- » Cortex Innovation Community
- » Discovery Competition
- » Office of Technology Management
- » Skandalaris Center for Interdisciplinary Innovation & Entrepreneurship
- » Sling Health Network
- » T-Rex Technology Incubator
- » Venture Cafe



### Guangming Zhao

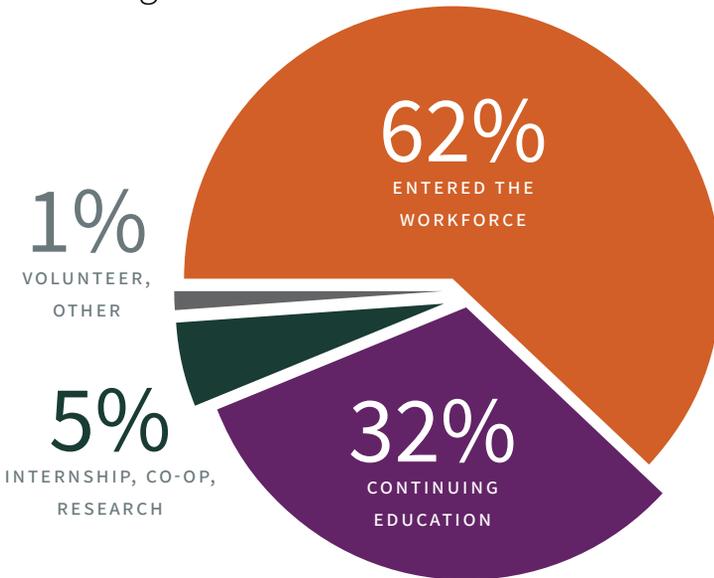
PhD candidate in electrical & systems engineering.

He holds a bachelor’s degree in physics from the University of Science and Technology of China.

“We can help people in the medical school, and maybe also help patients. Our sensor also has a low cost and high sensitivity. So we may really change the world. At first, I didn’t believe it, but now I do think we have a chance to do that. To help people.”

# WashU ESE outcomes

What do recent BS graduates do after graduation?



Average starting salary for 2018 BS graduates

**\$70K**

ELECTRICAL ENGINEERING

**\$74K**

SYSTEMS ENGINEERING

## Leadership

### Bruno Sinopoli

Department Chair and Das Family Distinguished Professor

[bsinopoli@wustl.edu](mailto:bsinopoli@wustl.edu)



#### TOP COMPANIES:

**Accenture**  
**Amazon**  
**AmeriCorps**  
**Analysis Group Inc.**  
**Anheuser-Busch**  
**AT&T**  
**Azimuth Energy**  
**Bain & Company Inc.**  
**bioMerieux**  
**Capital One**  
**Cardinal Health**  
**Cerner Corporation**  
**Citigroup**  
**Epic**  
**Evercore**  
**Garmin International**  
**Honeywell International Inc.**  
**McKinsey & Company**  
**McMaster-Carr**  
**Mitre Corp.**  
**Oracle/NetSuite**  
**Produce Pro Software**  
**Raytheon Co.**  
**Sense Corp.**  
**Two Sigma Investments**  
**ZS Associates**

#### TOP GRADUATE SCHOOLS:

**Columbia University**  
**Duke University**  
**Harvard University**  
**Johns Hopkins University**  
**Stanford University**  
**University of California, Berkeley**  
**University of California, Los Angeles**  
**University of Texas at Austin**  
**UPenn Dental**  
**Yale University**

 **Washington University in St. Louis**  
JAMES MCKELVEY SCHOOL OF ENGINEERING

Department of Electrical & Systems Engineering

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