

# Electrical & Systems Engineering

The Department of Electrical & Systems Engineering offers PhD degrees in Electrical Engineering and in Systems Science & Mathematics. Research activity in the department is focused in the following three areas:

- Applied mathematics, systems & control
- Electronics & optics
- Signal processing, imaging & communications

Students working in any of these areas will enjoy the benefits of programs that balance fundamental theoretical concepts with modern applications. In our department, students find ample opportunities for close interactions with faculty members working on cutting-edge research and technology development.

Prospective PhD students with previous degrees in engineering who are interested in PhD studies and research in mathematics or statistics are encouraged to apply for PhD studies in Mathematics and Statistics. For more details, visit the Graduate Programs in Mathematics and Statistics (<http://wumath.wustl.edu/graduate/>) webpage.

**Phone:** 314-935-7520  
**Website:** <http://ese.wustl.edu>

## Faculty

### Chair

**Bruno Sinopoli** (<https://engineering.wustl.edu/Profiles/Pages/Bruno-Sinopoli.aspx>)

Das Family Distinguished Professor  
PhD, University of California, Berkeley  
Cyberphysical systems, analysis and design of networked embedded control systems, with applications to sensor actuators networks

### Endowed Professors

**Shantanu Chakrabartty** (<https://engineering.wustl.edu/faculty/Shantanu-Chakrabartty.html>)

Clifford W. Murphy Professor  
PhD, Johns Hopkins University  
New frontiers in unconventional analog computing techniques using silicon and hybrid substrates, fundamental limits of energy efficiency, sensing and resolution by exploiting computational and adaptation primitives inherent in the physics of devices

**Arye Nehorai** (<https://engineering.wustl.edu/faculty/Arye-Nehorai.html>)

Eugene and Martha Lohman Professor of Electrical Engineering  
PhD, Stanford University  
Statistical signal processing, machine learning, imaging, biomedicine

**Joseph A. O'Sullivan** (<https://engineering.wustl.edu/faculty/Joseph-OSullivan.html>)

Samuel C. Sachs Professor of Electrical Engineering  
Dean, UMSL/WashU Joint Undergraduate Engineering Program  
PhD, Notre Dame University  
Information theory, statistical signal processing, imaging science with applications in medicine and security, and recognition theory and systems

**Lan Yang** (<https://engineering.wustl.edu/faculty/Lan-Yang.html>)

Edward H. & Florence G. Skinner Professor of Engineering  
PhD, California Institute of Technology  
Nano/micro photonics, ultra high-quality optical microcavities, ultra-low-threshold microlasers, nano/micro fabrication, optical sensing, single nanoparticle detection, photonic molecules, photonic materials

## Professors

**Jr-Shin Li** (<https://engineering.wustl.edu/faculty/Jr-Shin-Li.html>)

Professor  
PhD, Harvard University  
Mathematical control theory, optimization, quantum control, biomedical applications

**Neal Patwari** (<https://engineering.wustl.edu/faculty/Neal-Patwari.html>)

Professor  
PhD, University of Michigan  
Intersection of statistical signal processing and wireless networking for improving wireless sensor networking and radiofrequency sensing

## Associate Professors

**ShiNung Ching** (<https://engineering.wustl.edu/faculty/ShiNung-Ching.html>)

Das Family Distinguished Career Development Assistant Professor  
PhD, University of Michigan  
Systems and control in neural medicine, nonlinear and constrained control, physiologic network dynamics, stochastic control

**Jung-Tsung Shen (<https://engineering.wustl.edu/faculty/Jung-Tsung-Shen.html>)**

Das Family Distinguished Career Development Assistant Professor

PhD, Massachusetts Institute of Technology

Theoretical and numerical investigations on nanophotonics, optoelectronics, plasmonics, metamaterials

## Assistant Professors

**Ulugbek Kamilov (<https://engineering.wustl.edu/faculty/Ulugbek-Kamilov.html>)**

PhD, École Polytechnique Fédérale de Lausanne, Switzerland  
Computational imaging, signal processing, biomedical imaging

**Mark Lawrence**

PhD, University of Birmingham

Nanophotonics, nonlinear optics, metasurfaces

**Matthew D. Lew (<https://engineering.wustl.edu/faculty/Matthew-Lew.html>)**

PhD, Stanford University

Microscopy, biophotonics, computational imaging, nano-optics

**Chuan Wang (<https://engineering.wustl.edu/faculty/Chuan-Wang.html>)**

PhD, University of Southern California

Flexible electronics, stretchable electronics, printed electronics, nanomaterials, nanoelectronics, optoelectronics

**Yong Wang (<https://engineering.wustl.edu/faculty/Yong-Wang.html>)**

PhD, Washington University in St. Louis

Biomedical engineering, life science, human physiology, magnetic resonance imaging, electrocardiographic imaging

**Shen Zeng (<https://engineering.wustl.edu/faculty/Shen-Zeng.html>)**

PhD, University of Stuttgart

Systems and control theory, data-based analysis and control of complex dynamical systems, inverse problems, biomedical applications

**Xuan "Silvia" Zhang (<https://engineering.wustl.edu/faculty/Xuan-Silvia-Zhang.html>)**

PhD, Cornell University

Robotics, cyber-physical systems, hardware security, ubiquitous computing, embedded systems, computer architecture, VLSI, electronic design automation, control optimization, and biomedical devices and instrumentation

## Senior Professors

**Paul S. Min (<https://engineering.wustl.edu/faculty/Paul-Min.html>)**

PhD, University of Michigan

Routing and control of telecommunication networks, fault tolerance and reliability, software systems, network management

**Robert E. Morley Jr. (<https://engineering.wustl.edu/faculty/Robert-Morley.html>)**

DSc, Washington University in St. Louis

Computer engineering, lower-power VLSI design, computer architecture, signal processing, microprocessors systems design

**Hiro Mukai (<https://engineering.wustl.edu/faculty/Hiro-Mukai.html>)**

PhD, University of California, Berkeley

Theory and computational methods for optimization, optimal control, systems theory, electric power system operations, differential games

**William F. Pickard (<https://engineering.wustl.edu/faculty/William-Pickard.html>)**

PhD, Harvard University

Biological transport, electrobiology, energy engineering

**Daniel L. Rode (<https://engineering.wustl.edu/faculty/Daniel-Rode.html>)**

PhD, Case Western Reserve University

Optoelectronics and fiber optics, semiconductor materials, light-emitting diodes and lasers, semiconductor processing, electronics

**Ervin Y. Rodin (<https://engineering.wustl.edu/faculty/Ervin-Rodin.html>)**

PhD, University of Texas at Austin

Optimization, differential games, artificial intelligence, mathematical modeling

**Heinz Schaettler (<https://engineering.wustl.edu/faculty/Heinz-Schaettler.html>)**

PhD, Rutgers University

Optimal control, nonlinear systems, mathematical models in biomedicine

**Barbara A. Shrauner (<https://engineering.wustl.edu/faculty/Barbara-Shrauner.html>)**

PhD, Harvard University (Radcliffe)

Plasma processing, semiconductor transport, symmetries of nonlinear differential equations

**Donald L. Snyder (<https://engineering.wustl.edu/faculty/Donald-Snyder.html>)**

PhD, Massachusetts Institute of Technology

Communication theory, random process theory, signal processing, biomedical engineering, image processing, radar

**Barry E. Spielman (<https://engineering.wustl.edu/faculty/Barry-Spielman.html>)**

PhD, Syracuse University

High-frequency/high-speed devices, radiofrequency and microwave integrated circuits, computational electromagnetics

**Tzyh Jong Tarn (<https://engineering.wustl.edu/faculty/TJ-Tarn.html>)**

DSc, Washington University  
Quantum mechanical systems, bilinear and nonlinear systems, robotics and automation, life science automation

## Professors of Practice

**Dedric Carter (<https://engineering.wustl.edu/faculty/Dedric-Carter.html>)**

PhD, Nova Southeastern University  
MBA, MIT Sloan School of Management

**Dennis Mell (<https://engineering.wustl.edu/faculty/Dennis-Mell.html>)**

MS, University of Missouri-Rolla  
Industrial automation, robotics and mechatronics, product design and development with design-for-manufacturability emphasis, prototyping, manufacturing

**Ed Richter (<https://engineering.wustl.edu/faculty/Ed-Richter.html>)**

MS, Washington University  
Signal processing applications implemented on a variety of platforms, including ASIC, FPGA, DSP, microcontroller and desktop computers

**Jason Trobaugh (<https://engineering.wustl.edu/faculty/Jason-Trobaugh.html>)**

DSc, Washington University  
Ultrasound imaging, diffuse optical tomography, image-guided therapy, ultrasonic temperature imaging

## Teaching Professor

**James Feher (<https://engineering.wustl.edu/faculty/James-Feher.html>)**

PhD, Missouri University of Science and Technology  
Electrical engineering, computer science, mathematics and physics

## Senior Lecturers

**Martha Hasting (<https://engineering.wustl.edu/faculty/Martha-Hasting.html>)**

PhD, Saint Louis University  
Mathematics education

**Vladimir Kurenok (<https://engineering.wustl.edu/faculty/Vladimir-Kurenok.html>)**

PhD, Belarus State University (Minsk, Belarus)  
Probability and stochastic processes, stochastic ordinary and partial differential equations, financial mathematics

**Jinsong Zhang (<https://engineering.wustl.edu/faculty/Jinsong-Zhang.html>)**

PhD, University of Miami  
Modeling and performance analysis of wireless sensor networks, multi-source information fusion, ambiguous and incomplete information processing

## Lecturers

**Tsitsi Madziwa-Nussinov (<https://engineering.wustl.edu/faculty/Tsitsi-Nussinov.html>)**

PhD, University of California, Los Angeles

**Dorothy Wang (<https://engineering.wustl.edu/faculty/Yunjing-Dorothy-Wang.html>)**

PhD, Virginia Tech  
Fiber optic sensing and practical experience in sensor implementation and field test

## Professors Emeriti

**R. Martin Arthur (<https://engineering.wustl.edu/faculty/Martin-Arthur.html>)**

Newton R. and Sarah Louisa Glasgow Wilson Professor of Engineering  
PhD, University of Pennsylvania  
Ultrasonic imaging, electrocardiography

**David L. Elliott**

PhD, University of California, Los Angeles  
Mathematical theory of systems, nonlinear difference, differential equations

## Degree Requirements

### PhD in Electrical Engineering or Systems Science & Mathematics

The Department of Electrical & Systems Engineering at Washington University in St. Louis offers two PhD programs. Both the PhD in Electrical Engineering and the PhD in Systems Science & Mathematics are academic doctoral degrees designed mainly for full-time students interested in an academic, laboratory and/or industrial research and development career in a specialization within electrical engineering, systems, control or applied mathematics.

Students pursuing the Doctor of Philosophy degrees in Electrical Engineering or Systems Science & Mathematics must complete a minimum of 72 credit units of post-baccalaureate study consistent with the residency and other applicable requirements of Washington University and the Graduate School. These 72 units must consist of at least 36 course units and at least 24 units of research and may include work done to satisfy the requirements of a master's degree in a related discipline. Up to 24 units may be transferred to Washington University from another institution.

Each candidate for the PhD degree in Electrical Engineering and the PhD degree in Systems Science & Mathematics must do the following:

- Complete at least 36 credit units of post-baccalaureate courses.
- Complete the qualifying process (which includes a qualifying examination) and match with a research mentor before the second academic year of the program.
- Pass an oral preliminary research examination, to be completed within two academic years of completing the qualifying process.
- Satisfy the general teaching requirement as specified for the department.
- Write a doctoral dissertation that describes the results of original and creative research in a specialization within electrical engineering or systems science and mathematics.
- Pass a final oral examination in defense of the dissertation research.
- Take ESE 590 Electrical & Systems Engineering Graduate Seminar each semester.