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 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 webpage.

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

Faculty

Chair
R. Martin Arthur (https://engineering.wustl.edu/Profiles/Pages/Martin-Arthur.aspx)
Newton R. and Sarah Louisa Glasgow Wilson Professor of Engineering
PhD, University of Pennsylvania
Ultrasonic imaging, electrocardiography

Endowed Professors

Arye Nehorai (https://engineering.wustl.edu/Profiles/Pages/Arye-Nehorai.aspx)
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/Profiles/Pages/Joseph-O'Sullivan.aspx)
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/Profiles/Pages/Lan-Yang.aspx)
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

Shantanu Chakrabartty (https://ese.wustl.edu/faculty/Pages/default.aspx?bio=101)
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

Hiroaki Mukai (https://engineering.wustl.edu/Profiles/Pages/Hiro-Mukai.aspx)
Professor
PhD, University of California, Berkeley
Theory and computational methods for optimization, optimal control, systems theory, electric power system operations, differential games

Heinz Schaettler (https://engineering.wustl.edu/Profiles/Pages/Heinz-Schaettler.aspx)
PhD, Rutgers University
Optimal control, nonlinear systems, mathematical models in biomedicine

Associate Professors

Jr-Shin Li (https://engineering.wustl.edu/Profiles/Pages/Jr-Shin-Li.aspx)
Das Family Distinguished Career Development Associate Professor
PhD, Harvard University
Mathematical control theory, optimization, quantum control, biomedical applications

Assistant Professors

ShiNung Ching (https://engineering.wustl.edu/Profiles/Pages/ShiNung-Ching.aspx)
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

Zachary Feinstein (https://engineering.wustl.edu/Profiles/Pages/Zachary-Feinstein.aspx)
PhD, Princeton University
Financial engineering, operations research, variational analysis
Ulugbek Kamilov  
PhD, Ecole Polytechnique Fédérale de Lausanne, Switzerland  
Computational imaging, signal processing, biomedical imaging

Matthew D. Lew  
PhD, Stanford University  
Microscopy, biophotonics, computational imaging, nano-optics

Jung-Tsung Shen  
Das Family Distinguished Career Development Assistant Professor  
PhD, Massachusetts Institute of Technology  
Theoretical and numerical investigations on nanophotonics, optoelectronics, plasmonics, metamaterials

Chuan Wang  
PhD, University of Southern California  
Flexible electronics, stretchable electronics, printed electronics, nanomaterials, nanoelectronics, optoelectronics

Shen Zeng  
PhD, University of Stuttgart  
Systems and control theory, data-based analysis and control of complex dynamical systems, inverse problems, biomedical applications

Xuan "Silvia" Zhang  
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**

I. Norman Katz  
PhD, Massachusetts Institute of Technology  
Numerical analysis, differential equations, finite element methods, locational equilibrium problems, algorithms for parallel computations

Paul S. Min  
PhD, University of Michigan  
Routing and control of telecommunication networks, fault tolerance and reliability, software systems, network management

William F. Pickard  
PhD, Harvard University  
Biological transport, electrophysiology, energy engineering

Daniel L. Rode  
PhD, Case Western Reserve University  
Optoelectronics and fiber optics, semiconductor materials, light-emitting diodes (LEDs) and lasers, semiconductor processing, electronics

Ervin Y. Rodin  
PhD, University of Texas at Austin  
Optimization, differential games, artificial intelligence, mathematical modeling

Barbara A. Shrauner  
PhD, Harvard University (Radcliffe)  
Plasma processing, semiconductor transport, symmetries of nonlinear differential equations

Donald L. Snyder  
PhD, Massachusetts Institute of Technology  
Communication theory, random process theory, signal processing, biomedical engineering, image processing, radar

Barry E. Spielman  
PhD, Syracuse University  
High-frequency/high-speed devices, RF & MW integrated circuits, computational electromagnetics

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

**Professors of Practice**

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

Dennis Mell  
MS, University of Missouri-Rolla

Ed Richter  
MS, Washington University

Jason Trobaugh  
DSc, Washington University

**Senior Lecturer**

Martha Hasting  
PhD, Saint Louis University

**Lecturers**

Randall Brown  
PhD, Washington University

James Feher  
PhD, Missouri University of Science and Technology

Randall Hoven  
MS, Johns Hopkins University
Professors Emeriti

Lloyd R. Brown
DSc, Washington University
Automatic control, electronic instrumentation

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 (ESE) 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.

Degree Requirements & Timeline

Students pursuing the Doctor of Philosophy degrees in Electrical Engineering or Systems Science & Mathematics must complete a minimum of 72 credit hours 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:

• Complete at least 36 credit hours of post-baccalaureate courses.
• Pass a written qualifying examination, to be taken before the second academic year of the program.
• Pass an oral preliminary research examination, to be completed within two years of passing the written qualifying examination, and at least one year prior to completion of the dissertation.

• Satisfy the general residency requirement for PhD degrees offered by the Graduate School.
• Satisfy the general teaching requirement for PhD degrees offered by the Graduate School.
• 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.

The PhD degree should ordinarily take no more than five years to complete, for students who enter the program with a baccalaureate degree. While individual circumstances will vary, the typical timeline will be as follows:

• Year 1: Courses and written qualifying examination
• Year 2: Courses, preliminary research, research advisory committee selection
• Year 3: Courses and preliminary research examination
• Year 4: Research
• Year 5: Research, completion of dissertation, and final oral examination

Students who enter the program with a master’s degree may be able to shorten this timeline by one year or more.