Mechanical Engineering & Materials Science

The Department of Mechanical Engineering & Materials Science offers a PhD in either Mechanical Engineering or Aerospace Engineering. The department's research strengths include biomechanics, materials, energy, fluid mechanics, and rotary-wing aerodynamics. The doctoral student, with their adviser, designs the program of study and research project. The dissertation is defended at the end of the research effort. A typical time to PhD after an undergraduate engineering degree is four to five years, but the length of program may vary, depending on the individual and the area of study.

Contact: Prof. Jessica Wagenseil  
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Website: https://mems.wustl.edu/graduate/programs

Faculty

Chair

Philip V. Bayly (https://engineering.wustl.edu/Profiles/Pages/Philip-Bayly.aspx)  
Lilyan and E. Lisle Hughes Professor of Mechanical Engineering  
PhD, Duke University  
Nonlinear dynamics, vibrations, biomechanics

Associate Chairs

Katharine M. Flores (Materials Science) (https://engineering.wustl.edu/Profiles/Pages/Kathy-Flores.aspx)  
PhD, Stanford University  
Mechanical behavior of structural materials

David A. Peters (Mechanical Engineering) (https://mems.wustl.edu/faculty/Pages/default.aspx?bio=92)  
McDonnell Douglas Professor of Engineering  
PhD, Stanford University  
Aeroelasticity, vibrations, helicopter dynamics

Endowed Professors

Ramesh K. Agarwal (https://engineering.wustl.edu/Profiles/Pages/Ramesh-Agarwal.aspx)  
William Palm Professor of Engineering  
PhD, Stanford University  
Computational fluid dynamics and computational physics

Mark J. Jakiela (https://engineering.wustl.edu/Profiles/Pages/Mark-Jakiela.aspx)  
Lee Hunter Professor of Mechanical Design  
PhD, University of Michigan  
Mechanical design, design for manufacturing, optimization, evolutionary computation

Shankar M.L. Sastry (https://engineering.wustl.edu/Profiles/Pages/Shankar-Sastry.aspx)  
Christopher I. Byrnes Professor of Engineering  
PhD, University of Toronto  
Materials science, physical metallurgy

Professor

Guy M. Genin (https://engineering.wustl.edu/Profiles/Pages/Guy-Genin.aspx)  
PhD, Harvard University  
Solid mechanics, fracture mechanics

Associate Professors

Srikanth Singamaneni (https://engineering.wustl.edu/Profiles/Pages/Srikanth-Singamaneni.aspx)  
PhD, Georgia Institute of Technology  
Microstructures of cross-linked polymers

Jessica E. Wagenseil (https://engineering.wustl.edu/Profiles/Pages/Jessica-Wagenseil.aspx)  
DSc, Washington University  
Arterial biomechanics

Assistant Professors

Damena D. Agonafer (https://mems.wustl.edu/faculty/Pages/default.aspx?bio=110)  
PhD, University of Illinois at Urbana-Champaign  
Computational fluid dynamics and computational physics

Parag Banerjee (https://engineering.wustl.edu/Profiles/Pages/Parag-Banerjee.aspx)  
PhD, University of Maryland  
Materials sciences and engineering, nanostructured materials, materials synthesis, and novel devices for storing and harvesting energy

Spencer P. Lake (https://engineering.wustl.edu/Profiles/Pages/Spencer-Lake.aspx)  
PhD, University of Pennsylvania  
Soft tissue biomechanics

J. Mark Meacham (https://engineering.wustl.edu/Profiles/Pages/Mark-Meacham.aspx)  
PhD, Georgia Institute of Technology  
Micro-/Nanotechnologies for thermal systems and the life sciences
Rohan Mishra (https://engineering.wustl.edu/Profiles/Pages/Rohan-Mishra.aspx)  
PhD, Ohio State University  
Computational materials science

Amit Pathak (https://engineering.wustl.edu/Profiles/Pages/Amit-Pathak.aspx)  
PhD, University of California, Santa Barbara  
Cellular biomechanics

Patricia B. Weisensee (https://mems.wustl.edu/faculty/Pages/default.aspx?bio=112)  
PhD, University of Illinois at Urbana-Champaign  
Thermal fluids

Professors of the Practice

Harold J. Brandon (https://mems.wustl.edu/faculty/Pages/Harold-Brandon.aspx)  
DSc, Washington University  
Energetics, thermal systems

Swami Karunamoorthy (https://mems.wustl.edu/faculty/Pages/Swami-Karunamoorthy.aspx)  
DSc, Washington University  
Helicopter dynamics, engineering education

Joint Faculty

Richard L. Axelbaum (EECE) (https://engineering.wustl.edu/Profiles/Pages/Richard-Axelbaum.aspx)  
The Stifel & Quinette Jens Professor of Environmental Engineering Science  
PhD, University of California, Davis  
Combustion, nanomaterials

Elliot L. Elson (Biochemistry and Molecular Biophysics) (http://bmbweb.wustl.edu/faculty/faculty/elliot-elson)  
Professor Emeritus of Biochemistry & Molecular Biophysics  
PhD, Stanford University  
Biochemistry and molecular biophysics

Michael D. Harris (Physical Therapy, Orthopaedic Surgery and MEMS) (https://pt.wustl.edu/faculty-staff/faculty/mike-harris-phd)  
PhD, University of Utah  
Whole body and joint-level orthopaedic biomechanics

Kenneth F. Kelton (Physics) (http://www.physics.wustl.edu/people/kelton_kenneth-f)  
Arthur Holly Compton Professor of Arts & Sciences  
PhD, Harvard University  
Study and production of titanium-based quasicrystals and related phases

MD, University of Pennsylvania School of Medicine  
Neurological surgery

Lori Setton (BME) (https://bme.wustl.edu/faculty/Pages/faculty.aspx?bio=105)  
Lucy and Stanley Lopata Distinguished Professor of Biomedical Engineering  
PhD, Columbia University  
Biomechanics for local drug delivery: tissue regenerations specific to the knee joints and spine

Matthew J. Silva (Orthopaedic Surgery) (http://www.orthoresearch.wustl.edu/content/Laboratories/2963/Matthew-Silva/Silva-Lab/Overview.aspx)  
Julia and Walter R. Peterson Orthopaedic Research Professor  
PhD, Massachusetts Institute of Technology  
Biomechanics of age-related fractures and osteoporosis

Simon Tang (Orthopaedic Surgery, BME) (http://www.orthoresearch.wustl.edu/content/Laboratories/3043/Simon-Tang/Tang-Lab/Overview.aspx)  
PhD, Rensselaer Polytechnic Institute  
Biological mechanisms

Senior Professors

Phillip L. Gould  
PhD, Northwestern University  
Structural analysis and design, shell analysis and design, biomechanical engineering

Kenneth L. Jerina  
DSc, Washington University  
Materials, design, solid mechanics, fatigue and fracture

Salvatore P. Sutera  
PhD, California Institute of Technology  
Viscous flow, bio rheology

Barna A. Szabo  
PhD, State University of New York–Buffalo  
Numerical simulation of mechanical systems, finite-element methods

Lecturers

Emily J. Boyd  
PhD, University of Texas at Austin  
Thermofluids

J. Jackson Potter  
PhD, Georgia Institute of Technology  
Senior design

H. Shaun Sellers  
PhD, Johns Hopkins University  
Mechanics and materials

Louis G. Woodhams  
BS, University of Missouri-St. Louis  
Computer-aided design
Senior Research Associate

Ruth J. Okamoto
DSc, Washington University
Biomechanics, solid mechanics

Research Assistant Professor

Anupriya Agrawal
PhD, Ohio State University
Materials science

Adjunct Instructors

Ricardo L. Actis
DSc, Washington University
Finite element analysis, numerical simulation, aircraft structures

Robert G. Becnel
MS, Washington University
FE Review

John D. Biggs
MEng, Washington University
Thermal science

Andrew W. Cary
PhD, University of Michigan
Computational fluid dynamics

Dan E. Driemeyer
PhD, University of Illinois
Thermoscience

Richard S. Dyer
PhD, Washington University
Propulsion, thermodynamics, fluids

John M. Griffith
BS, Washington University
Manufacturing

Hanford Gross
BS, Washington University
Engineering project management

Jason Hawks
MS, Washington University
Structural analysis

Richard R. Janis
MS, Washington University
Building environmental systems

Rigoberto Perez
PhD, Purdue University
Fatigue and fracture

Dale M. Pitt
DSc, Washington University
Aeroelasticity

Gary D. Renieri
PhD, Virginia Polytechnic Institute and State University
Structural applications, composite materials

Hiroshi Tada
PhD, Lehigh University
Solid mechanics

Matthew J. Watkins
MS, Washington University
Finite elements

Michael C. Wendl
DSc, Washington University
Mathematical theory and computational methods in biology and engineering

Laboratory and Design Specialist

Mary K. Malast
DSc, Washington University
Materials science

Professor Emeritus

Wallace B. Diboll Jr.
MSME, Rensselaer Polytechnic Institute
Dynamics, vibrations, engineering design

Degree Requirements

PhD in Mechanical Engineering or Aerospace Engineering

Policies & Regulations

A key objective of the doctoral program is to promote cutting-edge multidisciplinary research and education in the areas of mechanical engineering and materials science. Students are selected for admission to the program by a competitive process, and they typically start in the fall semester. On arriving at Washington University in St. Louis, the student will be advised by the temporary adviser on all procedural issues. The student will choose a permanent adviser by the end of the first year of residency in the program.

The following is a brief summary of the requirements for doctoral students:

1. Pass the qualifying exams. Qualifying exams should be taken by the end of the third semester.
2. Prepare and defend a research proposal. The research proposal should be defended by the end of the fifth semester.
3. Write and successfully defend the doctoral dissertation.
4. Complete a minimum of 36 hours of course credit, and a minimum of 24 credits of doctoral research; total of 72 credits to earn the PhD degree.
5. Satisfy the applicable teaching requirements of the Graduate School.

Degrees Offered

The Department of Mechanical Engineering & Materials Science (MEMS) offers the following doctoral degrees:

- PhD in Mechanical Engineering
- PhD in Aerospace Engineering
- DSc in Mechanical Engineering, Aerospace Engineering, or Materials Science

The Doctor of Science (DSc) has similar requirements to the PhD but without the teaching requirement. For a list of differences, please refer to the DSc and PhD Comparison (PDF) (https://mems.wustl.edu/graduate/programs/Documents/DoctoralComparisonSection.pdf).

- One may also pursue a PhD in Materials Science — through the Institute of Materials Science & Engineering (IMSE) — but work with professors from the Department of Mechanical Engineering & Materials Science. For details on this program, visit the IMSE Graduate Program (http://imse.wustl.edu/program) webpage.

For more information on MEMS PhD degrees, visit the MEMS Graduate Degree Programs (https://mems.wustl.edu/graduate/programs/Pages/default.aspx) webpage.