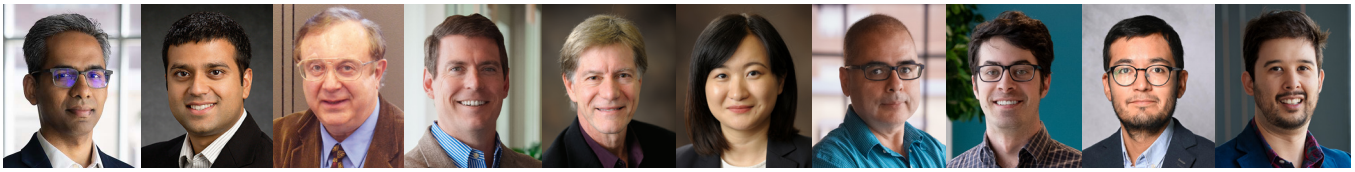
MechSE FACTS & FACULTY 2025-26

Department of Mechanical Science and Engineering
University of Illinois Urbana-Champaign



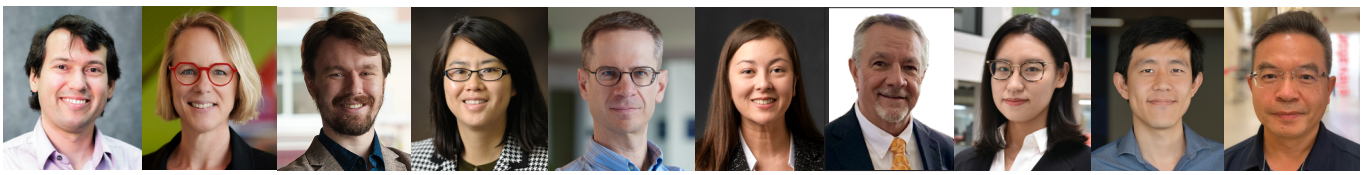
Admal | Bahl | Bentsman | Bradshaw | Brewster | Cai | Chamorro | Clemon | Constante-Amores | Correa Panesso

Ertekin | Ewoldt | Farjam | Feng | Ferreira | Fischer | Gazzola | Glumac | Golecki | Hagh

Halloran | Han | He | Hilgenfeldt | Hovakimyan | Hsiao-Wecksler | Hutchens | Jacobi | Jasiuk | B. Johnson

H. Johnson | Kersh | King | Koric | Lee | Luetkemeyer | Matlack | Mehta | Mercer | Miljkovic

Pearlstein | Saif | Salapaka | Sehitoglu | Sinha | Smith | Sofronis | Tang | Tawfick | Vakakis



van der Zande | Wagoner Johnson | Wandke | Wang | West | Wharry | Wise | Xu | Yim | Zhang

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MECHSE DEGREE PROGRAMS

Having seven exceptional degree programs in **Mechanical Engineering**, **Engineering Mechanics,** and **Theoretical and Applied Mechanics** within the same department allows our students to tailor their curricula while providing departmental resources like the unparalleled strengths of our faculty in seven fundamental research areas and six focused societal impact areas (see the matrix, back page).

Student engagement is another hallmark of MechSE programs. The department fosters a culture that is highly supportive and collegial while offering all the benefits of a large department within a world-renowned institution. Many of our students participate in professional and registered student organizations, including nationally and internationally ranked car teams, the American Society of Mechanical Engineers (ASME), Society for Engineering Mechanics (SEM), Women in MechSE (WiM), Graduate MechSE Society (GraMS), Society of Women Engineers (SWE), National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), Women in Engineering (WIE), iRobotics, Engineers Without Borders, Pi Tau Sigma (PTS) mechanical engineering honor society, Tau Beta Pi engineering honor society, and many others.

#4 undergraduate program in ME and EM

#7 research-based graduate programs

#3 online master's program in ME

2025 and 2026 U.S. News and World Report

Undergraduate Programs

MechSE's undergraduate programs are consistently among the top-ranked **Engineering Mechanics** and **Mechanical Engineering** programs in the world as a result of pedagogical innovation, state-of-the-art instructional laboratories, distinguished faculty, excellent undergraduate research opportunities, active student societies, a collegial and collaborative environment with exceptional students from around the world.

Engineering Mechanics features a chosen concentration area and is for students interested in how to research, formulate, model, analyze and engineer the way things move and deform. EM students learn the basis of all mechanical sciences with an emphasis placed on the physical principles and tools needed for modern engineering design. Thanks to the strong problem-solving abilities and advanced math, science and computing skills our graduates have, they enter into careers at the forefront of a variety of fields.

Mechanical Engineering is one of the most established and diverse of all the engineering fields and is for students who are fascinated with how machines move and work. Our program applies engineering, math and science principles to enable students to design, control and improve mechanical systems and processes.

Our undergraduate curricula offer a wide variety of courses, including an integrated hands-on design sequence beginning in the first year and culminating in a senior capstone design experience, where students develop a solution to a real-world, company-sponsored project. MechSE students gain the critical thinking skills needed to solve even the most challenging engineering problems.

Additionally, with our pre-med track, undergraduate students have an option to follow a specialized program of courses that will help them qualify for medical school.

Our instructional and research laboratories give students hands-on experience and provide exposure to a wide array of areas, including biomechanics, control systems, dynamical systems, fluid dynamics, heat transfer, machine design, manufacturing, materials testing, mechatronics, metrology, micro-nano-mechanical systems and robotics. Our newly renovated Sidney Lu Mechanical Engineering Building provides students with state-of-the-art maker spaces and laboratories to realize their designs and perform inquiry-based research.

MechSE faculty are internationally renowned for their diverse research and excellence in teaching. Many enthusiastically engage undergraduate students in their world-class research labs.

Upon graduation, nearly 100% of our students reporting post-graduation plans were either professionally employed or pursuing graduate school. MechSE students also strongly outpace national averages on the national Fundamentals of Engineering (FE) certification exam, with a near-perfect pass rate.

As a land-grant institution, Illinois is committed to providing access to quality education for high-achieving students from all backgrounds. Illinois Commitment promises free tuition and fees for up to four years for all qualified in-state undergraduate students.

Department of Mechanical Science and Engineering
The Grainger College of Engineering
Sidney Lu Mechanical Engineering Building
1206 W. Green Street, Urbana, IL 61801
mechse.illinois.edu

Graduate Programs

Our students thrive throughout their advanced studies in Mechanical Engineering and Theoretical and Applied Mechanics thanks to the excellence of our faculty, the diversity and complexity of our research opportunities, and the individualized programs of study we strive to create for each of our students. MechSE graduates go on to top positions in academia, industry and government labs, and our programs have earned a reputation as some of the best in the world.

MS / PhD

In MechSE's MS and PhD programs, discovery happens at the intersections of diverse areas of mechanics, science, and engineering. Graduate students team up with world-class faculty to push the frontiers of engineering, science, and innovation, turning ideas into solutions for energy, water, food, sustainability, health, security, manufacturing, and more. Our highly collaborative culture and cross-disciplinary partnerships accelerate the journey from breakthrough to real-world deployment. Inside and outside the lab, MechSE is supportive and collegial, offering the opportunities of a large department within a renowned research university. Through rigorous coursework, project-based learning, immersive experiences, and cutting-edge research, our students do not just learn the state of the art—they create it. Our #7 ranking further highlights our culture of excellence.

All Grainger Engineering PhD students in good academic standing are guaranteed funding (full tuition, partial fees and a stipend) for the first five years of their program. The majority of MS students can receive tuition and fee waivers through securing an advisor who offers an RA appointment.

M.Eng.ME

Our professional degree program—the **Master of Engineering in Mechanical Engineering** (M.Eng.ME)—is offered full-time, part-time, on campus and online. It launched in Fall 2015 as a coursework-based, industry-oriented way to gain advanced knowledge and experiential opportunities beyond that of a bachelor's degree. Students have the flexibility to create their own program by combining recommended courses from six existing tracks or other courses outside the tracks. Thanks to its excellent reputation in course development, student engagement and individualized student advising, program enrollment has exploded. In Fall 2025, the department welcomed a cohort of 100 students, with 55 on campus, 45 online. The online program is ranked #3 in the country and the program overall boasts high retention and graduation rates.

RESEARCH IN SERVICE TO SOCIETY

Mechanical engineering has traditionally dealt with objects and systems at macroscopic length scales. As system size has decreased to the nanoscale, the research efforts in the Department of Mechanical Science and Engineering have focused on phenomena at surfaces and length scales that have historically been the domain of physics and chemistry. At the same time, mechanical engineers use a systems approach to create new ideas and products that are far-reaching in order to meet societal needs. Research at MechSE, therefore, is pivotal, creating opportunities at the intersection of science and engineering.

MechSE faculty are engaged in six significant areas that impact society as a whole: Energy; Environment; Health and Bio; Manufacturing; Security and Defense; and Transportation.

Each area requires substantial collaboration, either among fundamental areas within engineering, or with other disciplines such as chemistry, physics, biology, or medicine. These collaborative efforts have the potential to shorten the timeline from scientific discovery to solutions that address ongoing and ever-changing global concerns.

Our faculty are developing unprecedented capabilities—in experiment and simulation—that will advance the field for years to come. Our approach is reflected in how we educate our students at all levels and in our next-generation curriculum in mechanical science and engineering.

RESEARCH CENTERS

Our science-based approach brings MechSE researchers into close contact with researchers in other departments, universities and research institutions. Our faculty are leaders or major participants in research centers at the department, college and university levels.

- Air Conditioning and Refrigeration Center (ACRC)
- Center for Autonomous Vehicles in Air Transportation Engineering (AVIATE)
- Center for Autonomy
- Center for Networked Intelligent Components and Environments (C-NICE)
- Center for Hypersonics and Entry Systems Studies (CHESS)
- Center for UAS Propulsion (CUP)
- Fracture Control Program (FCP)
- Illinois Quantum and Microelectronics Park
- International Institute for Carbon-Neutral Energy Research (I^2CNER)
- NSF Data and Informatics Graduate Intern-Traineeship: Materials at the Atomic Scale (DIGI-MAT)
- NSF Illinois Materials Research Science and Engineering Center (I-MRSEC)
- Center for Power Optimization of Electro-Thermal Systems (POETS)

Campus-Level Institutes

- Beckman Institute for Advanced Science and Technology
- Coordinated Science Laboratory (CSL)
- Carl R. Woese Institute for Genomic Biology
- Materials Research Laboratory (MRL)
- National Center for Supercomputing Applications (NCSA)
- Nick Holonyak Micro and Nanotechnology Laboratory (MNTL)

MECHSE FACULTY

Nikhil Chandra Admal: Assistant Professor / PhD, University of Minnesota, 2014. ***Current research***: Solid mechanics; computational mechanics with a focus on materials defects in crystalline systems, and interaction between atomistic and continuum domains in multiscale modeling of materials. *Developed models to study grain boundary-mediated plasticity in phenomena such as recrystallization and superplasticity in metallurgy. Developed a unified framework to link atomistic and continuum models such as classical and gradient elasticity with potential applications in multiscale modeling of materials.*

Gaurav Bahl: George B. Grim Professor / PhD, Stanford University, 2010. ***Current research***: Optical forces and optomechanics; micro-mechanical oscillators; sensors and actuators. *Demonstrated the first microfluidic device that is mechanically actuated by light, with vibrational frequencies in the GHz regime. Demonstrated that light can be used to eliminate scattering induced mechanical losses in microsystems. Received a 2019 Presidential Early Career Award for Scientists and Engineers (PECASE).*

Joseph Bentsman: Professor / PhD, Illinois Institute of Technology, 1984. ***Current research***: Control of nonlinear and distributed parameter systems; nonlinear oscillations; network control; stability; stochastic multiscale methods. *Introduced a new class of dynamical systems with active singularities that admit control actions during the singular phases of their motion.*

Craig Bradshaw: Associate Professor; Executive Director, ACRC / PhD, Purdue University, 2012. ***Current research***: Thermal systems, compressors, heat pumps, air-conditioning, refrigerant and lubricant properties, model-informed design optimization, model development, fundamentals of heat and fluid flow in thermal systems, waste-heat recovery, thermodynamics, heat transfer. *Developed a novel peristaltic compressor for HVAC&R and air applications.*

M. Quinn Brewster: Hermia G. Soo Professor; Director, M.Eng.ME Program / PhD, University of California, Berkeley, 1981. ***Current research***: Atmospheric radiation; radiation effects on cloud and mist droplet evolution; phase-change radiation. *Defined parameters that characterize radiation effect on cloud and mist droplet evolution during evaporation and condensation.*

Lili Cai: Assistant Professor / PhD, Stanford University, 2016. ***Current research***: Combustion synthesis; nanoscale materials; energy storage and conversion; smart wearables; personal thermal management; thermal radiation. *Developed rapid and scalable flame synthesis methods of nano-materials for renewable energy storage and conversion, catalysis and electronics. Developed nanophotonic textiles with tailored thermal radiation properties for localized thermal management of the human body.*

Leonardo Chamorro: Professor; Associate Head for Undergraduate Programs / PhD, University of Minnesota, 2010. ***Current research***: Turbulence and fluid mechanics, particle dynamics, flow-structure interaction, wind and marine energy, advanced flow diagnostics, and geophysical flows focusing on turbulent boundary layer processes. *Uncovered unsteady interaction between flexible structures and turbulence across scales; developed a fast, non-iterative tracking algorithm for the Lagrangian description of turbulence.*

Mickey Clemon: Teaching Assistant Professor / PhD, University of California, Berkeley, 2017; P.E. California. ***Current research:*** Additive manufacturing process scaling and optimization; mechanical design; sustainable manufacturing; impulsively loaded pressure vessels. *Development of collaborative 3D robotic printing using material extrusion.*

C. Ricardo Constante-Amores: Assistant Professor / PhD, Imperial College London, 2021. ***Current research***: Fluid mechanics related to multiphase flows, data-driven turbulence modeling from a dynamical system point of view, Koopman theory for high-dimensional systems. *Developed a modeling framework that accounts for the presence of surfactants in multiphase systems; created low-dimensional models for canonical turbulent systems such as pipe flow and plane Couette flow; studied the role of kidney stones in renal pelvis using patient-specific CFD models.*

Jorge Correa Panesso: Teaching Assistant Professor / PhD, University of Illinois Urbana-Champaign, 2017. ***Current research***: Design of high-speed and precision machinery for manufacturing automation; engineering education in design and manufacturing courses; new architectures of computer numerical control; digital manufacturing systems and AI; immersive technologies including VR/AR. *Developed software architectures for the DOE-funded Operating System for Cyber Manufacturing (OSCM). Developed cloud platforms for smart production and collaborative digital surgical planning using CAD/CAM technologies.*

Elif Ertekin: Associate Professor; Andersen Faculty Scholar; Associate Head for Graduate Programs and Research; Director of Mechanics Programs / PhD, University of California, Berkeley, 2006. ***Current research***: Computational materials physics and mechanics; AI for materials; 2D materials; energy-relevant materials. *Created AI-powered models for rapid, accurate prediction; revealed simple ways to control properties via symmetry and strain; identified candidate materials for cleaner energy; built design maps that translate simulations into real devices.*

Randy Ewoldt: Alexander Rankin Professor / PhD, Massachusetts Institute of Technology, 2009. ***Current research***: Rheology; fluid mechanics; soft matter; design. *Made the first complete measurement of weakly-nonlinear oscillatory rheology, which had been theoretically anticipated for over 50 years, and combined this with new theoretical modeling to resolve a nearly 70-year debate concerning molecular processes of nonlinear mechanics of polymeric networks.*

Nazanin Farjam: Assistant Professor / PhD, University of Michigan, 2023. ***Current research***: Process modeling and control, advanced manufacturing, printed electronics, electrohydrodynamic jet printing (EHD). Focusing on enhancing the flexibility, robustness, and efficiency of complex dynamic systems by developing modeling frameworks and intelligent control strategies to push the frontier of advanced manufacturing and optimize the behavior of systems and their components. *Developed a new paradigm in high-resolution additive and subtractive printing at the nano-to-micro scale. Developed the first high-fidelity modeling framework for a high-resolution EHD process across a range of printing conditions. Developed learning-based control strategies for complex manufacturing systems to address operational needs and optimize their performance while ensuring repeatability, robustness, and automation.*

Jie Feng: Assistant Professor / PhD, Princeton University, 2016. ***Current research***: Multiphase and interfacial dynamics oriented by bubbles and drops for energy, environment, and human health; lipid vesicle dynamics and polymer self-assembly for drug delivery. Investigating bubble-bursting aerosols at a structurally compound interface and their implications for contaminant-containing aerosol emission. Studying multi-phase flow in confined spaces related to non-Newtonian fluids and particle-laden foams for enhanced oil recovery. *Developing hybrid vesicle swimmers for efficient drug delivery. Developed a versatile nanoprecipitation platform for nanoparticle-oriented bioengineering and drug delivery. Developed a modeling framework for osmotic delivery and release of vesicles under light-triggered chemical reactions.*

Placid Ferreira: Tungchao Julia Lu Professor / PhD, Purdue University, 1987. ***Current research***: Nanomanufacturing; nanomechatronics; manufacturing automation and systems control; process planning; programmable machines. *Developed solid-state superionic stamping (S4), a process for stamping nanoscale metallic structures; high-resolution electrohydrodynamic writing for direct writing of sub-micron structures; fully functional parallel-kinematics two and three degree-of-freedom MEMS and Mesoscale nanopositioning stages.*

Paul Fischer: Professor; shared appointment with Siebel School of Computing and Data Science / PhD, Massachusetts Institute of Technology, 1989. ***Current research:*** High-order methods and scalable algorithms for computational fluid dynamics and heat transfer. *Developed the first commercial software for distributed memory parallel computers.*

Mattia Gazzola: Associate Professor; Charles Conrad Kritzer Faculty Scholar / PhD, ETH Zurich, 2013. ***Current research***: Biolocomotion; computational soft robotics; computational fluid dynamics; bio-inspired optimization. *Developed inverse design approach for optimal bio-locomotion strategies; discovered universal scaling laws of inertial swimming; designed first tissue-engineered cyborg ray.*

Nick G. Glumac: Shao Lee Soo Professor; Cannon Faculty Scholar / PhD, California Institute of Technology, 1994. ***Current research***: Spectroscopy of reacting flows and energetic materials; combustion diagnostics; metal combustion. *Produced definitive evidence that the transition away from diffusion-limited combustion in aluminum combustion occurs in the particle size range of 1 to 20 microns.*

Thomas Golecki: Teaching Assistant Professor / PhD, University of Illinois Urbana-Champaign, 2023; P.E., S.E. ***Current research***: Random vibrations in structural dynamics; structural and topology optimization considering moving loads. *Developed topology optimization approaches for bridge structures to minimize total response to random traffic excitation and for high-speed rail bridges accounting for passenger comfort through vehicle-bridge interaction.*

Varda F. Hagh: Assistant Professor / PhD, Arizona State University, 2018. ***Current research***: Computational and experimental soft matter; bio-inspired design and training of meta-materials; memory formation in matter. *Developed a systematic approach to harness the power of disorder in materials by introducing and manipulating transient learning degrees of freedom during material processing. This optimization method trains the local properties of a material to achieve the desired global behavior.*

Kellie Halloran: Teaching Assistant Professor / PhD, University of Illinois Urbana-Champaign, 2024. ***Current research***: Shoulder biomechanics during and after handcycling exercise; inverse musculoskeletal modeling; injury prevention during exercise; engineering education. *Quantified shoulder loads (moments, muscle forces) during high- and moderate-intensity prolonged handcycling exercise using subject-specific musculoskeletal models.*

Bumsoo Han: Professor; Phil & Ann Sharp Scholar in Cancer Research, Cancer Center at Illinois / PhD, University of Minneosta, 2001. ***Current research***: Biotransport of drug delivery, biomechanics at the tumor-storma interface, biophysics of cell migration and chemotaxis, microphysiological system of pancreatic cancer and brain, microfluidics and 3D printing of soft materials. *Established new mechanisms of poroelastic transport for tissue engineering and 3D printing of advanced hydrogels. Developed microfluidic tumor models of pancreatic cancer with molecular precisions using genetically engineered cells. Pioneered application of microfluidic tumor models for the discovery of drugs and drug delivery system.*

Jiajun He: Teaching Assistant Professor / PhD, Stanford University, 2016. ***Current research***: Sustainable production of materials; porous materials for clean energy applications; fluid phase and flow behaviors in porous media; carbon capture; nanopore confinement effects; life cycle assessment. *Developed a sustainable approach to convert food waste into porous carbons for CO_2 capture. Demonstrated the techno-economic and life cycle assessments for the benefits of biowaste-derived carbons for CO_2 capture. Developed a first-principle thermodynamic model for describing the rock wettability shift induced by asphaltene. Demonstrated the interfacial tension suppression in nanopore-confined systems using molecular simulations.*

Sascha Hilgenfeldt: Professor; Willett Faculty Scholar / PhD, University of Marburg, 1997. ***Current research***: Experimental and theoretical microfluidics; cell morphology and adhesion; biomechanics; structure and dynamics of tissues, foams, and other domain systems. *Elucidated fundamental properties of interfacial systems, including sonoluminescence, domain coarsening, and size-topology correlations. Developed a new, powerful method of microfluidic flow control and a structural diagnostic approach to cell and tissue mechanics.*

Naira Hovakimyan: W. Grafton and Lillian B. Wilkins Professor; University Scholar; Schaller Faculty Scholar / PhD, Institute of Applied Mathematics, Russian Academy of Sciences, 1992. ***Current research***: Autonomous systems, safe learning, air transportation engineering, certification, technology transfer. *Developed a new approach for design of robust adaptive control systems with guaranteed robustness/performance, pioneered a new approach to safe learning within the robust adaptive control architecture, explored safety of operation of aerial systems from the perspective of humans' perceived safety, contributed to the foundation for development of cyber-secure autopilots, and contributed to social engineering with applications to health analytics.*

Elizabeth T. Hsiao-Wecksler: Grayce Wicall Gauthier Professor / PhD, University of California, Berkeley, 2000. ***Current research***: Design and control of ball-based robots and wheelchairs and medical education task trainers; wearable sensors for anxiety detection; musculoskeletal biomechanics of locomotion. *Developed methods to better quantify gait and postural control; created ballbot wheelchair (PURE), portable powered ankle-foot-orthosis, automatic gear shifting manual wheelchair, and robotic task trainers for performing neurological exams and heart surgery.*

Shelby Hutchens: Associate Professor / PhD, California Institute of Technology, 2011. ***Current research***: Failure in soft solids; soft solid dynamics; large, non-linear deformation mechanics; polymers and composites; microscale materials; cellular solids. *Discovered a critical length scale in the cut-driven failure of elastomeric solids. Constructed soft, osmotically-active, plant tissue-inspired liquid/solid composites.*

Anthony M. Jacobi: Department Head; Richard W. Kritzer Distinguished Professor / PhD, Purdue University, 1989. ***Current research***: Heat transfer and fluid mechanics with end-use energy applications. *Advanced vortex-enhanced and interrupted fin designs to improve heat transfer and reduce pressure drop; developed surface microstructures for condensate management.*

Iwona Jasiuk: Professor; Richard W. Kritzer Faculty Scholar; Health Innovation Professor, Carle Illinois College of Medicine / PhD, Northwestern University, 1986. ***Current research***: Mechanics of materials; micromechanics; bio-mechanics; composite, biological, and nano materials; interfaces; elasticity. *Characterized hierarchical structure, composition, and properties of bone and developed experimentally based multi-scale models of bone. Proposed new poroelastic model of bone adaptation based on*

energy dissipation. Designed, additively manufactured, and modelled novel light-weight multifunctional bioinspired architectured materials.

Blake Johnson: Teaching Associate Professor; Director of Undergraduate Instructional Laboratories; Siebel Center for Design Affiliate / PhD, University of Illinois Urbana-Champaign, 2012. Experimental fluid mechanics, optical diagnostics, engineering education, service learning and community engagement. *Developed a course on Teaching and Leadership that is now required of the majority of graduate teaching assistants in The Grainger College of Engineering.*

Harley T. Johnson: Founder Professor; Director, NSF Illinois Materials Research Science and Engineering Center (I-MRSEC); Executive Director, Illinois Quantum and Microelectronics Park / PhD, Brown University, 1999. ***Current research***: Nanomechanics of electronic, photonic, and quantum materials; mechanics of nanostructures; strain effects and defects in topological materials; materials for photovoltaics; defects and properties of 2D materials; plasma-material interactions; multi-scale mechanical and electronic structure modeling. *Described a new class of dislocations in layered 2D materials.*

Mariana Kersh: Associate Professor; Health Innovation Professor, Carle Illinois College of Medicine / PhD, University of Wisconsin-Madison, 2010. ***Current research***: Structure-function in musculoskeletal tissues during growth and aging; imaging; finite element method. *Quantified bone strain in vivo, during locomotive tasks using coupled multi-scale musculoskeletal and finite element model.*

William P. King: Professor; Ralph A. Andersen Endowed Chair / PhD, Stanford University, 2002. ***Current research***: Computer vision and machine learning for mechanical systems, additive manufacturing, heat transfer, micro- and nanotechnology. *Developed technologies for additive manufacturing, digital design, and materials characterization that are widely used in manufacturing. Developed methods for temperature measurements used in the semiconductor and materials industries.*

Seid Koric: Research Professor; Technical Associate Director, NCSA / PhD, University of Illinois Urbana-Champaign, 2006. ***Current research***: Large-scale multiphysics modeling; high-performance computing; materials processing; biomechanics; sparse direct solver technologies, artificial intelligence (AI). *Developed several ground-breaking numerical methods now used worldwide to optimize continuous casting and other steel-making processes and minimize their defects and CO_2 footprint. Leading novel interdisciplinary research at the confluence of AI and classical numerical methods in engineering and science.*

Tonghun Lee: Bei Tse Chao and May Chao Professor / PhD, Stanford University, 2006. ***Current research***: Hypersonic and gas turbine propulsion; combustion; laser and optical diagnostics; oxidation of alternative and renewable fuels; alternative power generation. *Investigated novel chemical energy conversion phenomena in combustion systems using advanced laser diagnostics.*

Callan Luetkemeyer: Assistant Professor / PhD, University of Michigan, 2020. ***Current research***: Soft tissue mechanics, constitutive modeling (hyperelasticity and anisotropy), mechanical imaging, full-field computational inverse methods, mechanical inference. *Provided the first demonstration that microscale tissue structure can be inferred solely from mesoscale, full-field mechanical measurements, establishing a new direction for mechanics-based, non-invasive diagnostic imaging.*

Kathryn Matlack: Associate Professor; Richard W. Kritzer Faculty Scholar / PhD, Georgia Institute of Technology, 2014. ***Current research***: Wave propagation in solids; phononic materials and mechanical metamaterials; fluid-structure interaction; nonlinear acoustics and vibrations; contact acoustic nonlinearity; additive manufacturing; ultrasonic nondestructive evaluation; and fluid-metamaterials interaction. *Developed new materials and structures for novel vibration and flow control applications; developed new ultrasonic-based non-destructive evaluation techniques to probe early structural damage in metals and qualify additively manufactured materials.*

Prashant Mehta: Professor / PhD, Cornell University, 2004. ***Current research***: Dynamical systems; control theory; nonlinear estimation. *Invented the feedback particle filter algorithm for nonlinear estimation.*

Brian Mercer: Lecturer / PhD, University of California, Berkeley, 2016. Computational and theoretical solid mechanics; finite element methods; molecular dynamics methods; multiscale and multiphysics modeling; additive manufacturing; engineering education. *Developed multiscale modeling framework for predicting Kevlar polymer fiber mechanical properties as a function of atomic structure and loading conditions.*

Nenad Miljkovic: Founder Professor; Director, ACRC / PhD, Massachusetts Institute of Technology, 2013. ***Current research***: Phase change heat transfer (boiling, evaporation, condensation, melting, and freezing); thermal energy storage, electronics cooling, dynamic system modeling, anti-fouling coatings, anti-corrosion coatings, anti-bacterial coatings, fluid mechanics of droplets and bubbles; micro/nanofabrication; additive manufacturing, interfacial phenomena; renewable energy conversion. *Developed guidelines for the design, optimization, and fabrication of micro/nano-structured surfaces to enhance phase change heat transfer.*

Arne Pearlstein: Professor / PhD, University of California, Los Angeles, 1983. ***Current research***: Multiplicity and stability of three-dimensional unsteady solutions for rotating detonation rocket engines; fluid/structure interaction, including effects of aeroelastically-driven foil oscillation on heat transfer, and coupling of rotational and translational motion for falling spheres; onset and analysis of quasi-periodicity in nonlinear systems. *Discovered the first, and most of the known, multi-valued stability boundaries in fluid mechanics.*

M. Taher Saif: Edward William and Jane Marr Gutgsell Professor; NAE / PhD, Cornell University, 1993. ***Current research***: Mechanics of microelectromechanical systems (MEMS); nanoscale materials behavior; neuro-mechanics; mechanics of cancer cells and tumor microenvironment; biological machines; single cell mechanics. *Discovered a new phenomenon where plastically deformed nano crystalline metals recover plastic strain under macroscopically stress-free conditions; neurons actively maintain a rest tension, which is essential for neurotransmission. Elected to the National Academy of Engineering, 2024.*

Srinivasa Salapaka: Professor / PhD, University of California, Santa Barbara, 2002. ***Current research***: Robust control, scanning probe microscopy, precision positioning systems, combinatorial optimization, machine learning algorithms, and control of power electronics and systems. *Developing new control architectures for bottom-up power grids.*

Huseyin Sehitoglu: Professor; John, Alice, and Sarah Nyquist Chair / PhD, University of Illinois Urbana-Champaign, 1983. ***Current research***: Thermo-mechanical behavior of materials; phase transformations and shape memory. *Developed a model for determining the crystal orientation dependence of critical resolved shear stress for slip in shape memory alloys; developed an atomistic-continuum treatment to predict threshold stress intensity in fatigue in agreement with experiments.*

Sanjiv Sinha: Professor / PhD, Stanford University, 2005. ***Current research***: Thermoelectric energy conversion physics, materials, and devices; thermochemical and thermophysical energy storage; fundamen

tal heat conduction physics; intracellular thermometry. *Developed and patented roll-to-roll fabricated hybrid metal-polymer heat exchangers for waste heat harvesting; developed and patented a thermometer for measuring temperatures inside living cells; developing thermal storage energy technologies for buildings and industrial process heating.*

Kyle C. Smith: Associate Professor / PhD, Purdue University, 2012. ***Current research***: Electrochemical separations and energy storage; multi-scale computational modeling; mass, charge, heat and fluid transport in heterogeneous and porous materials; thermodynamics of electrochemical materials. *Developed and predicted strategies to desalinate water in porous electrodes using battery materials. Developing ion sorption materials with molecular recognition guided by atomistic and pore-scale modeling.*

Petros Sofronis: James W. Bayne Professor / PhD, University of Illinois Urbana-Champaign, 1987. ***Current research***: Solid mechanics; elastic-plastic fracture mechanics; materials compatibility with hydrogen; mechanics of next-generation nuclear reactor materials; finite element methods. *Rationalized and linked for the first time the effects of hydrogen at the microscale with evidence of hydrogen-induced flow localization at the macroscale.*

Ke Tang: Teaching Assistant Professor / PhD, Zhejiang University, 2005. ***Current research***: Engineering education; heat transfer and fluid mechanics with end-use energy conversion applications as refrigeration, heat pumps, and air conditioning; liquid-vapor two-phase flow visualization; electronics cooling; energy conversion systems; thermoacoustics.

Sameh Tawfick: Professor; Ralph A. Andersen Faculty Scholar / PhD, University of Michigan, 2012. ***Current research***: Material design, processing and manufacturing; mechanics of materials. *Developed synthesis and self-assembly processes to manufacture multi-functional nanocomposites.*

Alexander Vakakis: Donald Biggar Willett Professor / PhD, California Institute of Technology, 1990. ***Current research***: Nonlinear dynamics and vibrations; non-smooth dynamics; nonlinear modal analysis, reduced-order modeling and nonlinear model updating; granular acoustic metamaterials, nonreciprocal acoustics and stress wave tailoring; targeted energy transfer and vibration energy harvesting; nano- and micro-resonators; passive control of vortex-induced vibrations and aeroelastic instabilities; intentional nonlinearity in design. *Working on a new concept for intentional use of strong nonlinearity in design and nonlinear passive energy management; formulated novel nonparametric multi-scale system identification methodologies.*

Arend van der Zande: Associate Professor; shared appointment with Department of Materials Science and Engineering / PhD, Cornell University, 2011. ***Current research***: Nanomechanics, and functional devices from nanoscale materials and heterostructures; nanoelectromechanical systems (NEMS); atomically precise nanomanufacturing techniques. *Developed graphene-based NEMS. First observed atomic grain boundary structure and properties in 2D molecular membranes. Developed techniques for building functional electronic and photonic devices from 2D material heterostructures.*

Amy Wagoner Johnson: Professor; Andersen Faculty Scholar / PhD, Brown University, 2002. ***Current research***: Soft tissue mechanics (oviduct, cervix, uterus) for applications in women's reproductive health including fertility and preterm birth; soft tissue imaging (MRI, second harmonic generation) and mechanical testing (indentation, inflation, tension/compression, fracture/cutting) to understand structure-function; design of functional materials for coral propagation and restoration.

Kevin Wandke: Teaching Assistant Professor / PhD, University of Illinois Urbana-Champaign, 2024. ***Current research:*** Machine learning for solving coupled PDEs; simulation and modeling of soft robots. *Developed a method for correcting energy drift in long timescale machine learning simulations of dynamic systems.*

Sophie Wang: Research Associate Professor / PhD, Xi'an Jiaotong University, 2012. ***Current research***: Thermodynamics, heat transfer and fluid mechanics. Fundamentals of single-phase and two-phase convection, phase change and stability with applications in energy systems. Heat transfer enhancement, coefficient of performance (COP) improvement, optimization, and control for heating and cooling systems.

Matthew West: Professor; William H. Severns Faculty Scholar / PhD, California Institute of Technology, 2004. ***Current research***: Computational methods; multiscale time integration. *Developed the theory of variational time integration methods; obtained fully asynchronous integrators for computational mechanics.*

Janelle Wharry: Professor / PhD, University of Michigan, 2012. ***Current research***: structure-property-functionality relationships of materials in mechanical, irradiation, electrochemical, and corrosive extreme environments. *Developed theories explaining phase transformations in steels under mechano-irradiation extremes. Enabling code-qualification of advanced manufacturing methods for nuclear structural alloys.*

Kevin A. Wise: Adjunct Lecturer / PhD, University of Illinois Urbana-Champaign, 1987. Frequency domain analysis, optimal and adaptive control theory. *Developed guidance, navigation, and control algorithms and computer architectures for piloted and unpiloted aircraft and advanced weapon systems at The Boeing Company.*

Siyi Xu: Assistant Professor / PhD, Harvard University, 2022. ***Current research***: Soft robotics, wearable and implantable sensors, electrically responsive soft actuators, fluidic systems. *Developed biocompatible soft sensors and power-dense transducers, including actuators, valves and pumps, for the actuation and control of soft robots. Demonstrated the potential of compliant, lightweight, and compact wearable robotic systems for daily assistive and therapeutic purposes.*

Justin Yim: Assistant Professor / PhD, University of California, Berkeley, 2020. ***Current research***: Legged robot design, legged robot control, bio-inspired robotics, small robots. *Developed hopping robot control and estimation demonstrating agile, precise, and autonomous jumping in a small, one-legged robot.*

L. Winston Zhang: Adjunct Lecturer / PhD, University of Illinois Urbana-Champaign, 1996. Applied heat transfer with applications to electronics cooling and heat exchanger design. Heat pipe design and manufacturing. Numerical heat transfer.

FACULTY RESEARCH AT A GLANCE

MechSE faculty have aligned their research efforts with societal needs to have the greatest impact in the world. The seven columns of the research matrix below list our fundamental areas of the discipline, while the six rows represent critical societal needs.

FUNDAMENTAL AREAS / SOCIETAL IMPACT	FLUID MECHANICS	SOLID MECHANICS AND MATERIALS	THERMO AND HEAT TRANSFER	APPLIED PHYSICS	CHEMISTRY	DYNAMICS AND CONTROLS	COMPUTATION & APPLIED MATH
ENERGY	Bradshaw, Brewster, Chamorro, Constante-Amores, Ewoldt, Feng, Fischer, Gazzola, He, Jacobi, Miljkovic, Pearlstein, Smith, Tang, Wang	Admal, Bahl, Cai, Ertekin, Gazzola, He, Jasiuk, H. Johnson, Matlack, Sehitoglu, Sofronis, Vakakis, van der Zande, Wharry	Bahl, Bradshaw, Brewster, Cai, Fischer, Glumac, Jacobi, King, Lee, Miljkovic, Sinha, Smith, Stephani, Tang, van der Zande, Wang	Admal, Bahl, Cai, Chamorro, Constante-Amores, Ertekin, Feng, Gazzola, He, Jasiuk, H. Johnson, King, Matlack, Miljkovic, Sehitoglu, Sinha, Smith, Vakakis, van der Zande, Wharry	Bradshaw, Cai, Ertekin, He, Lee, Sinha, Smith, van der Zande	Bahl, Bentsman, Constante-Amores, Hovakimyan, Matlack, Mehta, Salapaka, Vakakis, Wang, West	Admal, Constante-Amores, Ertekin, Ewoldt, Fischer, Gazzola, He, Jasiuk, Pearlstein, Smith, Sofronis, Vakakis, West
ENVIRONMENT	Chamorro, Constante-Amores, Feng, Fischer, He, Miljkovic, Pearlstein, Smith, Wang	Cai, Clemon, Constante-Amores, Ertekin, Farjam, Hagh, He, Koric, Wagoner Johnson	Bradshaw, Brewster, Cai, Chamorro, Constante-Amores, Jacobi, Koric, Lee, Miljkovic, Sinha, Smith, Tang, Wang	Cai, Chamorro, Clemon, Constante-Amores, Farjam, Ertekin, Feng, Hagh, He, Miljkovic, Sinha, Smith	Cai, Ertekin, Feng, He, Lee, Smith	Bentsman, Constante-Amores, Farjam, Hovakimyan, West	Clemon, Constante-Amores, Ertekin, Feng, Fischer, Hagh, Pearlstein, Smith, West
HEALTH AND BIO	Bahl, Chamorro, Constante-Amores, Ewoldt, Feng, Fischer, Gazzola, Hilgenfeldt, Pearlstein	Constante-Amores, Ewoldt, Farjam, Gazzola, Hagh, Halloran, Han, Hilgenfeldt, Hutchens, Jasiuk, Kersh, King, Koric, Luetkemeyer, Saif, Sehitoglu, Wagoner Johnson, Wandke, Xu	Han, Hilgenfeldt, Koric, Sinha	Farjam, Feng, Gazzola, Hagh, Han, Hilgenfeldt, Hutchens, Jasiuk, Luetkemeyer, Saif	Feng, Hutchens, Luetkemeyer, Pearlstein, Saif	Bentsman, Farjam, Halloran, Hovakimyan, Hsiao-Wecksler, Salapaka, Xu, Yim	Ewoldt, Feng, Gazzola, Hagh, Hilgenfeldt, Jasiuk, Kersh, Koric, Luetkemeyer, Salapaka, Wagoner Johnson, Wandke, West
MANUFACTURING	Constante-Amores, Ewoldt, Feng, Ferreira, Hilgenfeldt, King, Miljkovic, Smith	Admal, Cai, Clemon, Farjam, Han, Hilgenfeldt, Hutchens, Jasiuk, H. Johnson, King, Koric, Matlack, Mercer, Saif, Tawfick, van der Zande, Wagoner Johnson, Wharry, Xu	Bradshaw, Cai, Han, Jacobi, King, Koric, Miljkovic, Sinha, Wang	Admal, Bahl, Cai, Clemon, Farjam, Feng, Ferreira, Han, Hutchens, H. Johnson, King, Mercer, Miljkovic, Saif, Smith, Tawfick, Vakakis, van der Zande, Wharry	Cai, Feng, He, King, Tawfick, van der Zande	Bentsman, Correa Panesso, Farjam, Ferreira, Hovakimyan, Salapaka, Wagoner Johnson, Xu	Admal, Clemon, Correa Panesso, Ferreira, Hilgenfeldt, Jasiuk, H. Johnson, Koric, Mercer, Smith, Vakakis, Wagoner Johnson, West
SECURITY AND DEFENSE	Brewster, Constante-Amores, Ewoldt, Gazzola, Glumac, Hilgenfeldt, Jacobi, Matlack, Pearlstein	Bahl, Clemon, Ewoldt, Gazzola, Jasiuk, H. Johnson, King, Matlack, Mercer, Saif, Sehitoglu, Sofronis, Tawfick, Vakakis, van der Zande, Wharry	Brewster, Ewoldt, Glumac, Jacobi, King, Sinha	Bahl, Clemon, Gazzola, Jasiuk, H. Johnson, King, Matlack, Mercer, Sehitoglu, Sinha, Vakakis, van der Zande, Wharry	Glumac, King, van der Zande	Bahl, Bentsman, Hovakimyan, Matlack, Mehta, Salapaka, Vakakis, West, Yim	Clemon, Gazzola, Hilgenfeldt, Jasiuk, H. Johnson, Mercer, Pearlstein, Salapaka, Sofronis, Vakakis, West
TRANSPORTATION	Chamorro, Constante-Amores, Fischer, He, Matlack, Miljkovic	Cai, Ertekin, Jasiuk, Matlack, Sehitoglu, Tawfick, Vakakis	Bradshaw, Cai, Fischer, Jacobi, Miljkovic, Smith, Tang, Wang	Cai, Ertekin	Cai, Ertekin, He, Smith	Golecki, Hovakimyan, Matlack, Salapaka, Vakakis, Yim	Ertekin, Golecki, Jasiuk, Smith, West