MechSE FACTS & FACULTY 2020–21

Department of Mechanical Science and Engineering

Admal Alleyne Aluru Bahl Beaudoin Bentsman Brewster Bullard Cai Chamorro Chang

Dankowicz Downing Dullerud Dunn Elbel Ertekin Ewoldt Feng Ferreira Fischer Flachsbart

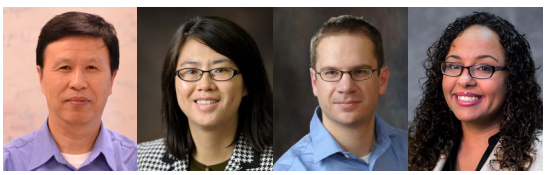
Freund Gazzola Glumac Haber He Hilgenfeldt Hovakimyan Hrnjak Hsiao-Wecksler Hutchens Jacobi

Jasiuk B. Johnson H. Johnson Juarez Kapoor Kersh Kim King Koric Krier Kurath

C. Lee T. Lee Liebenberg Matalon Matlack Mehta Mensing Mercer Miljkovic Nam Ostoja-Starzewski

Pearlstein Phillips Philpott Ramos Saif Salapaka Sehitoglu Shao Sinha Smith Socie

Sofronis Stephani Stewart Tawfick Thomas Tortorelli Tucker Vakakis van der Zande Vanka Wagoner Johnson



N. Wang S. Wang West Wissa

Grainger College of Engineering
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

OUR DEGREE PROGRAMS

Having seven top-ranked 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, next page).

Our degree programs provide students with choice in how and what they learn:

- BS, M.Eng., MS, and PhD degree programs in Mechanical Engineering (online options for M.Eng. and MS)
- BS degree program in Engineering Mechanics
- MS and PhD degree programs in Theoretical and Applied Mechanics

UNDERGRADUATE

MechSE's undergraduate programs are consistently among the top-ranked Engineering Mechanics and Mechanical Engineering programs in the world as a result of distinguished faculty, excellent undergraduate research opportunities, state-of-the-art facilities, active student societies, a collegial and collaborative environment, and exceptionally bright students from around the world. Our primary goal is to educate our students to become future leaders in engineering, science, technology, and beyond, leading the way toward improving society's quality of life.

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

Our instructional and research laboratories give students hands-on experience and provide exposure to a wide range of areas, including: biomechanics; combustion; controls systems; dynamical systems; fluid dynamics; heat transfer; machine design; manufacturing; materials testing; mechatronics; metrology; micro-nano mechanical systems; and robotics. MechSE's Innovation Studio makerspace provides students with state-of-the-art prototyping equipment and tools to realize their designs.

The Engineering Mechanics and Mechanical Engineering curricula offer a wide variety of courses, including an integrated hands-on design sequence beginning in the freshman year and culminating in Senior Capstone Design, where students develop a solution to a real-world, company-sponsored problem.

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

MechSE students gain the critical thinking skills necessary to solve even the toughest engineering problems. Upon graduation, nearly 100% of our students reporting post-graduation plans were either professionally employed or pursuing graduate school. MechSE students strongly outpace national averages on the national Fundamentals of Engineering (FE) certification exam, with a near-perfect pass rate.
mechse.illinois.edu/undergraduate

32.1
average ACT score for incoming undergraduate students

27.2
average number of AP credit hours of incoming undergraduate students

#5 ranked research-based graduate programs
#3 ranked online master's programs

GRADUATE

Our students thrive throughout their advanced studies in Mechanical Engineering or in Theoretical and Applied Mechanics due 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.

Many of MechSE's graduate research opportunities lie at the intersection of diverse areas of specialization. Our scholars are immersed in a multitude of cross-disciplinary research efforts, training our students to be among the most innovative engineers in the world.

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 actively participate in student and professional organizations, including Graduate MechSE Students (GraMS), Engineers Volunteering in Stem Education (ENVISION), the Society of Women Engineers (SWE), the National Society of Black Engineers (NSBE), and the Society of Hispanic Professional Engineers (SHPE). **mechse.illinois.edu/graduate**

All PhD students in good academic standing are guaranteed a tuition waiver for the first five years of their academic program. The majority of MS students also receive tuition waivers. The Master of Engineering program (self-funded) is a thriving coursework and experiential-learning-based program for industry-focused students.

RESEARCH CENTERS

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

- Air Conditioning and Refrigeration Center (ACRC)
- Center for Networked Intelligent Components and Environments (C-NICE)
- Center for Autonomy
- Center for Hypersonics and Entry Systems Studies (CHESS)
- Center for UAS Propulsion (CUP)
- Fracture Control Program (FCP)
- Center for Novel High-Voltage/Temperature Materials and Structures (HV/TMS)
- International Institute for Carbon-Neutral Energy Research (I^2CNER)
- Illinois Materials Research Science and Engineering Center (I-MRSEC)
- Midwest Hydrogen and Fuel Cell Coalition
- nanoMFG
- National Science Foundation Data and Informatics Graduate Intern-Traineeship: Materials at the Atomic Scale (DIGI-MAT)
- NSF PIRE (Partnerships in International Research and Education)
- Center for Power Optimization of Electro-Thermal Systems (POETS)
- Center for Wearable Intelligent Technologies (WIT)
- Center for Exascale Simulation of Plasma-Coupled Combustion (XPACC)

Campus-Level Institutes

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

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 & 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 in 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.

Read more at **mechse.illinois.edu/research**.

2020-21 FACULTY RESEARCH AT A GLANCE

To have the greatest impact on the world around us, MechSE faculty have aligned their research efforts with societal needs. The seven columns of our faculty research matrix list the 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 AND APPLIED MATH
ENERGY	Aluru, Brewster, Chamorro, Elbel, Ewoldt, Feng, Fischer, Freund, Gazzola, Haber, He, Hrnjak, Jacobi, C. Lee, Matalon, Miljkovic, Pearlstein, Smith, Vanka, S. Wang, Wissa	Admal, Aluru, Bahl, Cai, Dunn, Ertekin, Freund, Gazzola, Haber, He, Jasiuk, Johnson, Kim, Kurath, Matlack, Nam, Sehitoglu, Sofronis, Vakakis, van der Zande, Vanka	Alleyne, Bahl, Brewster, Cai, Elbel, Fischer, Glumac, Hrnjak, Jacobi, King, C. Lee, T. Lee, Liebenberg, Matalon, Miljkovic, Sinha, Smith, Stephani, van der Zande, Vanka, S. Wang	Aluru, Bahl, Cai, Ertekin, Feng, Gazzola, Jasiuk, Johnson, Kim, King, Matalon, Matlack, Miljkovic, Nam, Sehitoglu, Sinha, Smith, Stephani, Vakakis, van der Zande	Cai, Dunn, Ertekin, He, C. Lee, T. Lee, Sinha, Smith, Stephani, van der Zande	Alleyne, Bahl, Bentsman, Dankowicz, Haber, Hovakimyan, Matlack, Mehta, Salapaka, Shao, Vakakis, S. Wang, West, Wissa	Admal, Dankowicz, Ertekin, Ewoldt, Fischer, Freund, Gazzola, Haber, Jasiuk, C. Lee, Matalon, Pearlstein, Shao, Smith, Sofronis, Stephani, Vakakis, Vanka, West
ENVIRONMENT	Chamorro, Elbel, Feng, Fischer, Hrnjak, Juarez, Kapoor, C. Lee, Ostoja-Starzewski, Pearlstein, Smith, S. Wang, Wissa	Cai, Ertekin, Haber, Ostoja-Starzewski	Brewster, Cai, Chamorro, Elbel, Hrnjak, Jacobi, Kapoor, C. Lee, T. Lee, Liebenberg, Sinha, Smith, S. Wang	Cai, Ertekin, Feng, Juarez, Sinha, Smith	Cai, Ertekin, Feng, He, Kapoor, C. Lee, T. Lee, Smith	Bentsman, Haber, Hovakimyan, Shao, West	Ertekin, Feng, Fischer, Haber, Juarez, C. Lee, Ostoja-Starzewski, Pearlstein, Shao, Smith, West
HEALTH AND BIO	Aluru, Bahl, Dunn, Ewoldt, Feng, Fischer, Freund, Gazzola, Hilgenfeldt, Juarez, Pearlstein, Wissa	Aluru, Dunn, Ewoldt, Freund, Gazzola, Hilgenfeldt, Hutchens, Jasiuk, Kersh, Kim, King, Kurath, Nam, Ostoja-Starzewski, Saif, Sehitoglu, Wagoner Johnson, N. Wang	Hilgenfeldt, Ostoja-Starzewski, Sinha	Aluru, Feng, Gazzola, Hilgenfeldt, Hutchens, Jasiuk, Juarez, Liebenberg, Nam, Saif, N. Wang	Dunn, Feng, Hutchens, Nam, Pearlstein, Saif, N. Wang	Alleyne, Bentsman, Dankowicz, Hovakimyan, Hsiao-Wecksler, Ramos, Salapaka, Shao, Wissa	Aluru, Dankowicz, Ewoldt, Feng, Freund, Gazzola, Hilgenfeldt, Jasiuk, Juarez, Kersh, Ostoja-Starzewski, Salapaka, Shao, Wagoner Johnson, West
MANUFACTURING	Elbel, Ewoldt, Feng, Ferreira, Hilgenfeldt, Hrnjak, King, Miljkovic, Smith, Thomas, Tucker, Vanka	Admal, Cai, Haber, Hilgenfeldt, Hutchens, Jasiuk, Johnson, Kapoor, Kim, King, Kurath, Matlack, Nam, Saif, Tawfick, Thomas, Tortorelli, Tucker, van der Zande, Vanka, Wagoner Johnson	Cai, Elbel, Hrnjak, Jacobi, Kapoor, King, Miljkovic, Shao, Sinha, Thomas, Tucker, Vanka, S. Wang	Bahl, Cai, Dankowicz, Feng, Ferreira, Hutchens, Johnson, Kim, King, Miljkovic, Nam, Saif, Smith, Tawfick, Vakakis, van der Zande	Cai, Feng, King, Tawfick, van der Zande	Alleyne, Bentsman, Dankowicz, Ferreira, Hovakimyan, Kapoor, Ramos, Salapaka, Shao, Thomas, Tortorelli, Wagoner Johnson, Wissa	Admal, Ferreira, Haber, Hilgenfeldt, Jasiuk, Johnson, Kapoor, Shao, Smith, Thomas, Tortorelli, Tucker, Vakakis, Vanka, Wagoner Johnson, West
SECURITY AND DEFENSE	Aluru, Brewster, Elbel, Ewoldt, Freund, Gazzola, Glumac, Haber, Hilgenfeldt, Hrnjak, Jacobi, Matalon, Pearlstein, Stephani, Wissa	Aluru, Bahl, Ewoldt, Freund, Gazzola, Haber, Jasiuk, Johnson, Kim, King, Matlack, Nam, Ostoja-Starzewski, Saif, Sehitoglu, Sofronis, Tawfick, Tortorelli, Vakakis, van der Zande	Brewster, Elbel, Ewoldt, Glumac, Hrnjak, Jacobi, King, Matalon, Sinha, Stephani	Aluru, Bahl, Gazzola, Jasiuk, Johnson, King, Matlack, Nam, Sehitoglu, Sinha, Stephani, Vakakis, van der Zande	Glumac, King, Nam, Stephani, van der Zande	Alleyne, Aluru, Bahl, Bentsman, Dullerud, Hovakimyan, Matlack, Mehta, Ostoja-Starzewski, Ramos, Salapaka, Shao, Vakakis, West, Wissa	Aluru, Freund, Gazzola, Haber, Hilgenfeldt, Jasiuk, Johnson, Matalon, Pearlstein, Salapaka, Shao, Sofronis, Stephani, Tortorelli, Vakakis, West
TRANSPORTATION	Chamorro, Elbel, Fischer, Freund, Hrnjak, C. Lee, Matalon, Miljkovic, Tucker, Wissa	Cai, Ertekin, Jasiuk, Kurath, Matlack, Sehitoglu, Tawfick, Tortorelli, Vakakis, Tucker, Wissa	Cai, Elbel, Fischer, Hrnjak, Jacobi, C. Lee, Matalon, Miljkovic, Smith, Tucker, S. Wang	Cai, Ertekin, Stephani	Cai, Ertekin, Smith, Stephani	Alleyne, Dankowicz, Dullerud, Hovakimyan, Matlack, Salapaka, Shao, Vakakis, Wissa	Ertekin, Jasiuk, Shao, Smith, Stephani, Tortorelli, Tucker, West

FACULTY

Nikhil Chandra Admal: Assistant Professor / PhD, University of Minnesota, 2014. **Current research**: Solid mechanics; computational mechanics with 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.*

Andrew Alleyne: Ralph M. and Catherine V. Fisher Professor / PhD, University of California, Berkeley, 1994. **Current research**: Control of nonlinear mechanical systems; theory and application. *Developed modeling, simulation, and control approaches for dynamic thermal systems and applied them for mobile and stationary applications.*

Narayana Aluru: Richard W. Kritzer Distinguished Professor / PhD, Stanford University, 1995. **Current research**: Computational methods; multiscale modeling; MEMS, NEMS, nanofluidics. *Developed new theories for fluidic transport in nano-systems and developed physical theories and multiscale simulation tools for electrically actuated nanomechanical systems.*

Gaurav Bahl: Associate Professor and Kritzer Faculty Scholar / 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).*

Armand Beaudoin: Research Professor and Professor Emeritus / PhD, Cornell University, 1993. **Current research**: Metal plasticity; process modeling; simulation; and biomechanics.

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.*

Quinn Brewster: Professor / 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.*

Clark Bullard: Research Professor and Professor Emeritus / PhD, University of Illinois at Urbana-Champaign, 1971. Thermal systems simulation and optimization.

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 nanomaterials for renewable energy storage and conversion, catalysis and electronics. Developed nanophotonic textiles with tailored thermal radiation properties for localized thermal management of human body.*

Leonardo P. Chamorro: Associate Professor / PhD, University of Minnesota, 2010. **Current research**: Turbulence and fluid mechanics; particle dynamics; flow-structure interaction; wind and marine energy; advanced flow diagnostics; geophysical flows with focus on turbulent boundary layer processes. *Developed a framework to study the interaction between turbulence and wind farms in spectral domain, and a robust tracking algorithm for Lagrangian description of turbulence.*

Wayne Chang: Lecturer / PhD, University of California, Irvine, 2011. Atmospheric transport and chemistry; air pollution control; internal combustion engines.

Harry Dankowicz: Professor, Cannon Faculty Scholar, and Associate Dean for Graduate, Professional and Online Programs / PhD, Cornell University, 1995. **Current research**: Dynamical systems; complex networks; computational methods; robotics. *9th year as Editor-in-Chief of Applied Mechanics Reviews, the flagship review journal of the American Society of Mechanical Engineers. Oversaw the Flipped Learning Activity under the Summer 2020 Grainger Teaching Academy. Released a new version of COCO, a Matlab platform for nonlinear systems analysis and constrained design optimization, including computational geometry tools for analysis of high-dimensional surfaces.*

Stephen Downing: Senior Lecturer / PhD, University of Illinois at Urbana-Champaign, 1983. Structural failure, fatigue, fracture, data acquisition technology.

Geir Dullerud: W. Grafton and Lillian B. Wilkins Professor and Willett Faculty Scholar / PhD, Cambridge University, 1994. **Current research**: Control of complex systems, including multirate and asynchronous systems; hybrid systems; and distributed robotics. *Made significant contributions to distributed control.*

Alison C. Dunn: Assistant Professor / PhD, University of Florida, 2013. **Current research**: Tribology; contact mechanics; soft matter lubrication; wear of steel; friction of insect cuticle. *Developed repeatable microtribological methods for very low friction soft and squishy materials.*

Stefan Elbel: Research Assistant Professor / PhD, University of Illinois at Urbana-Champaign, 2007. **Current research**: Experimental and numerical research in thermodynamics, fluid mechanics, and heat transfer; energy conversion systems; heating and cooling applications with focus on HVAC&R; optimization of capacity and energy efficiency in applications using low-GWP refrigerants, including natural and synthetic working fluids; expansion work recovery, flow induced noise, heat transfer measurements, heat exchanger design and optimization, innovative cycle improvements. *Developed and optimized controllable two-phase ejector for transcritical CO_2 resulting in 20% higher energy efficiency.*

Elif Ertekin: Associate Professor, Andersen Faculty Scholar, and Director of Mechanics Programs / PhD, University of California, Berkeley, 2006. **Current research**: Computational modeling; mechanical properties at the nanoscale; energy storage and conversion; defect-property relationships; shape memory alloys. *Developed models defect-mediated phase transitions, structure/property relations and vibrational energy transport at the nanoscale. Applied computer models to design and predict new materials for novel photovoltaic, thermoelectric, and other energy conversion materials.*

Randy Ewoldt: Associate Professor and Kritzer Faculty Scholar / 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 infer molecular architecture of complex fluids.*

Jie Feng: Assistant Professor / PhD, Princeton University, 2016. **Current research**: Fluid mechanics, soft matter physics, polymer self-assembly; nanomaterials, drug delivery. *Discovered a dispersal mechanism related to bubble dynamics and developed a scalable and energy-efficient platform for multi-functional nanomaterials. Developed a versatile nanoprecipitation platform for nanoparticle-oriented bioengineering and drug delivery, and a cost-effective approach for feasible nano-therapeutics targeting infectious diseases. 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 / 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.*

Bruce Flachsbart: Teaching Assistant Professor and Director of Engineering Student Project Laboratory / PhD, University of Illinois at Urbana-Champaign, 1999. Micro-Electro-Mechanical System (MEMS) device design and fabrication.

Jonathan Freund: Donald Biggar Willett Professor and Kritzer Faculty Scholar / PhD, Stanford University, 1998. **Current research**: Fluid mechanics; bioengineering, computational/predictive science. Investigating means to tailor combustion through the novel use of plasmas; studying the flow of blood cells in the tight confines of the microcirculation; seeking means of reducing the noise of jet aircraft.

Mattia Gazzola: Assistant Professor / 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 Glumac: Shao Lee Soo Professor and 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.*

Robert Haber: Research Professor and Professor Emeritus / PhD, Cornell University, 1980. Computational mechanics with applications to dynamic fracture in quasi-brittle materials, seismology, fluid dynamics, nano and multi-scale simulation, continuum–atomistic coupling, topology optimization; high-performance computing. *Developed asynchronous spacetime discontinuous Galerkin finite element methods for high-resolution simulations involving shocks and wave-like response on high-performance computing platforms.*

Jiajun He: Teaching Assistant Professor and Faculty Director for M.Eng.ME Program / PhD, Stanford University, 2016. **Current research**: Porous materials for clean energy applications; carbon capture; fluid phase and interfacial behaviors associated with oil and gas production. *Proposed a model to describe the phase behaviors of hydrocarbon mixtures under nanopore confinement. Developed a design methodology for porous carbons to enhance methane volumetric storage capacity.*

Sascha Hilgenfeldt: Professor and 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, and Schaller Faculty Scholar / PhD, Institute of Applied Mathematics, Russian Academy of Sciences, 1992. **Current research**: Control theory and engineering, robotics, unmanned aerial systems, networked systems, machine learning, cyber-security, and applications of those across aerospace, mechanical, electrical,

agricultural, petroleum, and biomedical engineering. *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, and contributed to the foundation for development of cyber-secure autopilots.*

Predrag (Pega) Hrnjak: Stoecker Faculty Fellow, Distinguished Research Professor, and Director of ACRC / D.Sc., University of Belgrade, 1992. **Current research**: Heat transfer and fluid mechanics with end-use energy conversion applications as refrigeration, heat pumps, and air conditioning. Adiabatic two phase flow distribution in parallel flow heat exchangers including flash gas removal and articulation of pulsating flow; nonequilibrium condensation in presence of superheated vapor; periodic frosting in microchannel heat exchanges; visualization of oil-refrigerant flows in compressors and pipes; developing two phase flow, environmentally sound cycles and refrigerants including transcritical CO2; extremely low charged ammonia systems with microchannel heat exchangers; new synthetic refrigerants; novel heat exchanges.

Elizabeth T. Hsiao-Wecksler: Professor and Willett Faculty Scholar / PhD, University of California, Berkeley, 2000. **Current research**: Musculoskeletal biomechanics of locomotion; assistive device design; powered exoskeletons; medical training simulators; wearable sensors for movement analysis; advanced mobility devices. *Developed methods to better quantify gait and postural control; created portable powered ankle-foot-orthosis, automatic gear shifting manual wheelchair, and robotic simulator for performing the neurological examination.*

Shelby Hutchens: Assistant 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 Jacobi: Richard W. Kritzer Distinguished Professor and Department Head / 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 / PhD, Northwestern University, 1986. **Current research**: Mechanics of materials; micromechanics; biomechanics; 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 lightweight multifunctional bioinspired architectured materials.*

Blake Johnson: Teaching Assistant Professor and Director of Undergraduate Instruction Laboratories / PhD, University of Illinois at Urbana-Champaign, 2012. Experimental fluid mechanics; optical diagnostics; pedagogy.

Harley Johnson: Professor, Kritzer Faculty Scholar, and Associate Dean for Research / PhD, Brown University, 1999. **Current research**: Nanomechanics of electronic and photonic materials; mechanics of nanostructures; materials for photovoltaics; defects and properties of 2D materials; plasma-material interactions. *Described a new class of dislocations in layered 2D materials.*

Gabriel Juarez: Assistant Professor / PhD, Northwestern University, 2009. **Current research**: Physics of fluids and living systems, biodegradation of crude oil by bacteria, hydromechanics of coral larvae on reefs. *Developed microfluidic devices and flow visualization techniques to quantify microscale processes in heterogenous fluid environments such as bacterial growth on oil-water interfaces and larva settlement on surfaces.*

Shiv Kapoor: Professor and Grayce Wicall Gauthier Chair / PhD, University of Wisconsin-Madison, 1977. **Current research**: Micro-manufacturing; micromachining process modeling; micro-Machine Tools (mMTs) and microfactories for manufacturing of precision parts; micro-assembly and automation; sustainable manufacturing. *Developed micro-machining technology based on the use of mMTs and integration of mMTs into microfactories for manufacturing precision parts.*

Mariana Kersh: Assistant Professor / 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.*

Seok Kim: Associate Professor / PhD, Carnegie Mellon University, 2009. **Current research**: Responsive surfaces with tunable functions; transfer printing-based microassembly; microelectromechanical systems (MEMS). *Developed shape memory polymer dry adhesives; established LEGO-like microassembly processes for heterogeneous materials integration; developed MEMS vibration energy harvesters.*

William King: Professor and Ralph A. Andersen Endowed Chair / PhD, Stanford University, 2002. **Current research**: Additive manufacturing, heat exchangers, thermal energy transport, scanning probe microscopy, micro- and nano-manufacturing. *Developed measurement technologies for materials characterization and manufacturing. Led national initiative on digital design and manufacturing.*

Seid Koric: Research Associate Professor / PhD, University of Illinois at Urbana-Champaign, 2006. **Current research**: Large-scale multiphysics modeling; high-performance computing; materials processing; biomechanics; sparse direct solver technologies, confluence of numerical modeling and artificial intelligence (AI). *Developed, implemented, and tested several ground-breaking numerical methods for solving highly nonlinear multiphysics and multiphase problems on NCSA's peta-scale high-performance computing system of Blue Waters and created an effective approach towards accurate modeling of many manufacturing, materials processing, and biomechanics processes.*

Herman Krier: Research Professor and Professor Emeritus / PhD, Princeton University, 1968. Reactive gas dynamics; internal ballistics of rockets and guns; combustion physics; plasma dynamics.

Peter Kurath: Research Professor and Professor Emeritus / PhD, University of Illinois at Urbana-Champaign, 1984. Fatigue, fracture, plasticity and nonlinear deformation modeling; veterinary biomechanics; structural design.

Chia-Fon Lee: Professor / PhD, Princeton University, 1995. **Current research**: Modeling of two-phase turbulent reacting flows; internal combustion engines; liquid atomization; spray systems. *Developed and demonstrated the first successful application of two-photon nitric oxide laser-induced fluorescence measurements in a diesel engine.*

Tonghun Lee: Professor and Kritzer Faculty Scholar / 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.*

Leon Liebenberg: Teaching Associate Professor / PhD, University of Johannesburg, South Africa, 2003. **Current research**: Pedagogies of engagement and emotional learning strategies; energy, materials and the environment; human-centered design. *Co-patented a non-toxic cancer therapy based on energy restriction methods. Co-developed a novel engineering course based on the precepts of whole-mind thinking and interdisciplinary teams. Co-founded the TechnoLab technology awareness facility in South Africa, which employs learning-through-play at schools.*

Moshe Matalon: Grainger College of Engineering Caterpillar Distinguished Professor / PhD, Cornell University, 1977. **Current research**: Combustion theory; modeling and simulation of chemically reacting flows; theoretical fluid mechanics; applied mathematics; stability and bifurcation theory; asymptotic and perturbation methods. *Developed (i) the hydrodynamic theory of flame propagation in premixed combustible gases including the well-known flame speed-flame stretch relation and a coordinate-free expression for the flame stretch rate, (ii) criteria for the onset of instabilities in premixed combustion, (iii) theory for premixed turbulent flames free of ad-hoc turbulence modeling, (iv) a multi-dimensional, time-dependent theory of diffusion flames valid throughout the complete range—from complete burning to extinction, (v) first characterization of thermo-diffusive instabilities in diffusion flames (cellular and pulsating), as well as numerous contributions to droplet, solid particle combustion, edge flame dynamics, micro-scale combustion and in porous media, and flame acceleration in long narrow channels.*

Katie Matlack: Assistant Professor / PhD, Georgia Institute of Technology, 2014. **Current research**: Wave propagation in complex media; architected and phononic materials; additive manufacturing; nonlinear ultrasound. *Developed 3D-printed metamaterials for broadband and low frequency vibration absorption; showed the feasibility of using nonlinear ultrasonic techniques to monitor irradiation damage in nuclear reactor pressure vessel steels.*

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

Glennys Mensing: MNMS Lab Coordinator and Lecturer / PhD, Vanderbilt University, 1999. Microfluidics and microfabrication.

Brian Mercer: Lecturer / PhD, University of California, Berkeley, 2016. Computational and theoretical solid mechanics; molecular dynamics methods; multiscale modeling.

Nenad Miljkovic: Associate Professor and Kritzer Faculty Scholar / PhD, Massachusetts Institute of Technology, 2013. **Current research**: Phase change heat transfer (boiling, evaporation, condensation, and freezing); anti-fouling coatings, anti-corrosion coatings, anti-bacterial coatings, fluid mechanics of droplets and bubbles; micro/nanofabrication; interfacial phenomena; solar energy conversion. *Developed guidelines for the design, optimization, and fabrication of micro/nano-structured surfaces to enhance phase change heat transfer.*

SungWoo Nam: Associate Professor and Andersen Faculty Scholar / PhD, Harvard University, 2011. **Current research**: Nanoscale materials; graphene and two-dimensional materials; strain engineering; flexible electronics; bioelectronic interfaces. *Established controlled deformation (i.e. "architecturing") of atomically thin, two-dimensional (2D) materials. Developed mechanical self-assembly of folded and crumpled graphene and two-dimensional materials for strain-tolerant and flexible/stretchable forms of sensors for biotic and abiotic investigations.*

Martin Ostoja-Starzewski: Professor / PhD, McGill University, 1983. **Current research**: Mechanics and transport in random and fractal media; helices and chiral media; non-classical thermomechanics; stochastic wave propagation; traumatic brain injury. *Developed (i) models of impact waves in man-made and natural media, including human brains under concussion; (ii) micromechanically based scaling laws, random fields, and stochastic finite elements; (iii) universal elastic anisotropy index; (iv) modification of continuum mechanics accounting for spontaneous nanoscale violations of the entropy inequality; (v) mechanics of helically-wound cables; (vi) electromagnetic shielding by nanocomposites.*

Arne Pearlstein: Professor / PhD, University of California, Los Angeles, 1983. **Current research**: Computational studies of incompressible flow, with applications to stability; vortex shedding; contaminant removal, and chemically reacting systems; experimental development of transparent, immiscible, refractive index-matched systems for use as surrogates in multiphase flow. *Discovered the first, and most of the known, multi-valued stability boundaries in fluid mechanics.*

James Phillips: Professor Emeritus / PhD, Brown University, 1969. Current research: Structural testing. *Developed a load cell for measuring simultaneously the axial force and twisting moment in wire ropes.*

Michael Philpott: Lecturer and Associate Professor Emeritus / PhD, Certified Institute of Technology, 1987. Feature-based cost analysis; micro-miniature systems design for manufacture and assembly; rapid prototyping and layered manufacturing.

João Ramos: Assistant Professor / PhD, Massachusetts Institute of Technology, 2018. **Current research**: Whole-body teleoperation of humanoid robots; robot design and control for dynamic motions; human-machine interfaces; bio-inspired robotics. *Developed a bilateral feedback teleoperation strategy to synchronize the motion of a human operator and that of a humanoid robot for dynamic manipulation and agile locomotion.*

M. Taher Saif: Edward William and Jane Gutgsell Professor and Associate Head for Graduate Programs / 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 up to 80 percent of the plastic strain under macroscopically stress-free conditions; neurons in embryonic fruit flies actively maintain a rest tension, which is essential for neurotransmission.*

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 and John, Alice, and Sarah Nyquist Endowed Chair / PhD, University of Illinois at 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.*

Chenhui Shao: Assistant Professor / PhD, University of Michigan, 2016. **Current research**: Smart manufacturing; machine learning; statistics; big data analytics in manufacturing; materials joining; manufacturing systems control and automation. *Developed spatiotemporal modeling approaches for manufacturing process control. Developed and implemented an integrated monitoring and control system for ultrasonic metal welding.*

Sanjiv Sinha: Associate Professor and Associate Head for Undergraduate Programs / PhD, Stanford University, 2005. **Current research**: Thermoelectric energy conversion physics, materials, and devices; thermochemical energy storage; advanced heat exchangers; additively manufactured heat transfer devices; electronics cooling technologies; fundamental heat conduction physics; intracellular thermometry. *Developing metal-polymer heat exchangers for waste heat harvesting in a roll-to-roll process. Developed thermometer for measuring temperature inside living cells.*

Kyle C. Smith: Assistant 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.*

Darrell Socie: Lecturer and Professor Emeritus / PhD, University of Illinois at Urbana-Champaign, 1977. Fatigue of metallic machine components and structures.

Petros Sofronis: James W. Bayne Professor and Associate Head for Graduate Programs and Research / PhD, University of Illinois at 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.*

Kelly Stephani: Assistant Professor and Kritzer Faculty Fellow / PhD, University of Texas at Austin, 2012. **Current research**: Computational modeling of non-equilibrium flows; gas/plasma-surface interactions; characterization of material defects/properties. *Established the mapping between gas-phase chemical kinetics, surface energetics, and material degradation for high-temperature materials subject to oxidation. Received a 2019 Presidential Early Career Award for Scientists and Engineers (PECASE).*

D. Scott Stewart: Research Professor and Shao Lee Soo Professor Emeritus / PhD, Cornell University, 1981. **Current research**: Muliphase, multimaterial, multicomponent theory and advanced simulation applied to complex high energy density materials.

Sameh Tawfick: Associate Professor / 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.

Brian Thomas: Research Professor and C. J. Gauthier Professor Emeritus / PhD, University of British Columbia, 1985. **Current research**: Metals processing simulation; modeling of continuous casting; steel processing; numerical methods for solidification phenomena.

Daniel Tortorelli: George B. Grim Professor Emeritus / PhD, University of Illinois at Urbana-Champaign, 1988. Solid and continuum mechanics; computational mechanics; design optimization. *Applying these methodologies to design impact-resistant armor, design thermoelastic composite materials with novel properties, identify defects and crack initiation sites in solid bodies, generate representative river models for oil exploration, and design light-weight structures that are readily cast.*

Charles Tucker III: Research Professor and Alexander D. Rankin Professor Emeritus / PhD, Massachusetts Institute of Technology, 1978. **Current research**: Polymers and composite materials; quantitative modeling of processing/microstructure/property relationships; numerical methods. *Developed a model for flow-induced fiber orientation that is used in all major injection-molding software packages.*

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: Assistant Professor / 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.*

Pratap Vanka: Research Professor and Professor Emeritus / PhD, Imperial College, London, 1975. Computational fluid dynamics; multigrid methods; large eddy simulations of turbulence. *Developed innovative multigrid algorithms for Navier-Stokes equations (Vanka Smoother); applied CFD for a large number of diverse applications in single and multiphase flows, using parallel computers and GPUs; earned Freeman Scholar Award from ASME, and VAJRA Professorship from India.*

Amy Wagoner Johnson: Professor and Andersen Faculty Scholar / PhD, Brown University, 2002. **Current research**: Design, manufacture, characterization, and mechanical behavior of materials for bone replacement and repair; cell-material interactions; characterization of soft tissue for applications to preterm birth. *Demonstrated bone formation in micron-sized pores and that microporosity and an osteoinductive growth factor (BMP-s) have different, but complementary, roles in bone regeneration in CaP scaffolds with multi-scale porosity.*

Ning Wang: Leonard C. and Mary Lou Hoeft Professor / PhD, Harvard University, 1990. **Current research**: Cytoskeletal biomechanics; cellular mechanobiology; mechanotransduction; stem cell and cancer cell mechanics and biology; mechanomedicine; bio-imaging of cytoskeletal structures and stress distribution in living cells. *Developed intracellular stress tomography technology and used it to address fundamental questions about stress distribution and mechanotransduction in living cells.*

Sophie Wang: Research Assistant 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: Associate Professor / 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.*

Aimy Wissa: Assistant Professor / PhD, University of Maryland, 2014. **Current research**: Structural dynamics and control, bio-inspired design of multi-functional structures and mechanisms for mechanical and aerospace systems, experimental evaluation and flight testing of unmanned air vehicles. *Developed passive and active wing morphing systems to improve the performance of flapping and fixed wing unmanned air vehicles.*

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