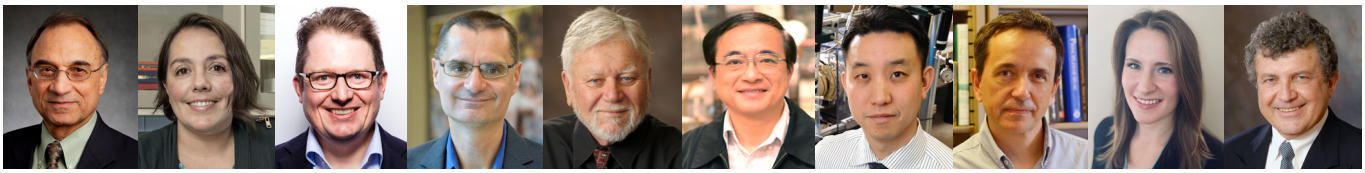
MechSE FACTS & FACULTY 2022–23

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

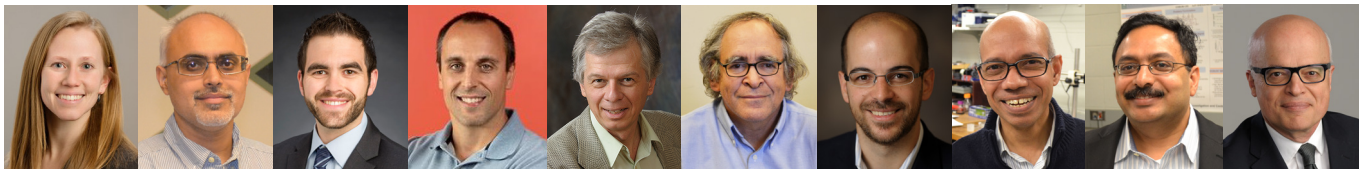
Admal Bahl Bentsman Brewster Cai Chamorro Chang Dankowicz Dullerud Dunn

Elbel Ertekin Ewoldt Feng Ferreira Fischer Flachsbart Gazzola Glumac He

Hilgenfeldt Hovakimyan Hrnjak Hsiao-Wecksler Hutchens Jacobi Jasiuk B. Johnson H. Johnson Juarez

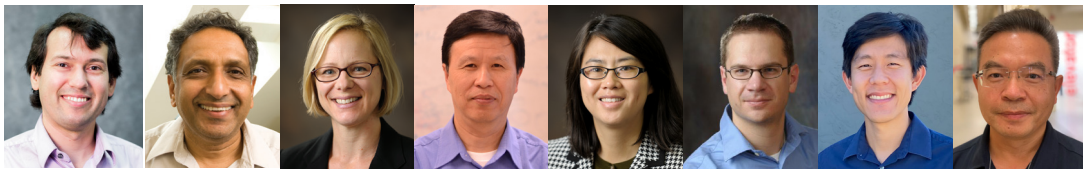


Kapoor Kersh King Koric Krier C. Lee T. Lee Liebenberg Luetkemeyer Matalon



Matlack Mehta Mercer Miljkovic Ostoja-Starzewski Pearlstein Ramos Saif Salapaka Sehitoglu

Shao Sinha Smith Sofronis Stephani Stewart Tang Tawfick Thomas Vakakis



van der Zande Vanka Wagoner Johnson N. Wang S. Wang West Yim Zhang

OUR 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).

Our degree programs include:

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

#7 ranked undergraduate programs
#4 ranked research-based graduate programs
#2 ranked online master's programs

UNDERGRADUATE

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, and exceptional 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. Our newly renovated building provides students with the newest 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 first year and culminating in Senior Capstone Design, where students develop a solution to a real-world, company-sponsored problem.

Additionally, with MechSE's pre-med track, our undergraduate students have an option to follow a specialized program of courses that will help them 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 also strongly outpace national averages on the national Fundamentals of Engineering (FE) certification exam, with a near-perfect pass rate. **mechse.illinois.edu/undergraduate**

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 students.

GRADUATE

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.

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

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.

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 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)
- International Institute for Carbon-Neutral Energy Research (I^2CNER)
- Illinois Materials Research Science and Engineering Center (I-MRSEC)
- nanoMFG
- NSF 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
- 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 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 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**.

2022-23 FACULTY RESEARCH AT A GLANCE

MechSE faculty have aligned their research efforts with societal needs to have the greatest impact on the world around us. 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	Brewster, Chamorro, Elbel, Ewoldt, Feng, Fischer, Gazzola, He, Hrnjak, Jacobi, C. Lee, Matalon, Miljkovic, Pearlstein, Smith, Vanka, S. Wang	Admal, Bahl, Cai, Dunn, Ertekin, Gazzola, He, Jasiuk, Johnson, Matlack, Sehitoglu, Sofronis, Vakakis, van der Zande, Vanka	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	Bahl, Cai, Chamorro, Ertekin, Feng, Gazzola, Jasiuk, H. Johnson, King, Liebenberg, Matalon, Matlack, Miljkovic, Sehitoglu, Sinha, Smith, Stephani, Vakakis, van der Zande	Cai, Dunn, Ertekin, He, C. Lee, T. Lee, Sinha, Smith, Stephani, van der Zande	Bahl, Bentsman, Dankowicz, Hovakimyan, Matlack, Mehta, Salapaka, Shao, Vakakis, S. Wang, West	Admal, Dankowicz, Ertekin, Ewoldt, Fischer, Gazzola, 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	Cai, Ertekin, Ostoja-Starzewski, Wagoner Johnson	Brewster, Cai, Chamorro, Elbel, Hrnjak, Jacobi, Kapoor, C. Lee, T. Lee, Liebenberg, Sinha, Smith, S. Wang	Cai, Chamorro, Ertekin, Feng, Juarez, Sinha, Smith	Cai, Ertekin, Feng, He, Kapoor, C. Lee, T. Lee, Smith	Bentsman, Hovakimyan, Shao, West	Ertekin, Feng, Fischer, Juarez, C. Lee, Ostoja-Starzewski, Pearlstein, Shao, Smith, West
HEALTH AND BIO	Bahl, Chamorro, Dunn, Ewoldt, Feng, Fischer, Gazzola, Hilgenfeldt, Juarez, Pearlstein	Dunn, Ewoldt, Gazzola, Hilgenfeldt, Hutchens, Jasiuk, Kersh, King, Luetkemeyer, Ostoja-Starzewski, Saif, Sehitoglu, Wagoner Johnson, N. Wang	Hilgenfeldt, Ostoja-Starzewski, Sinha	Feng, Gazzola, Hilgenfeldt, Hutchens, Jasiuk, Juarez, Liebenberg, Luetkemeyer, Saif, N. Wang	Dunn, Feng, Hutchens, Luetkemeyer, Pearlstein, Saif, N. Wang	Bentsman, Dankowicz, Hovakimyan, Hsiao-Wecksler, Ramos, Salapaka, Shao, Yim	Dankowicz, Ewoldt, Feng, Gazzola, Hilgenfeldt, Jasiuk, Juarez, Kersh, Luetkemeyer, Ostoja-Starzewski, Salapaka, Shao, Wagoner Johnson, West
MANUFACTURING	Elbel, Ewoldt, Feng, Ferreira, Hilgenfeldt, Hrnjak, King, Miljkovic, Smith, Thomas, Vanka	Admal, Cai, Hilgenfeldt, Hutchens, Jasiuk, H. Johnson, Kapoor, King, Matlack, Saif, Tawfick, Thomas, van der Zande, Vanka, Wagoner Johnson	Cai, Elbel, Hrnjak, Jacobi, Kapoor, King, Miljkovic, Shao, Sinha, Thomas, Vanka, S. Wang	Bahl, Cai, Dankowicz, Feng, Ferreira, Hutchens, H. Johnson, King, Miljkovic, Saif, Smith, Tawfick, Vakakis, van der Zande	Cai, Feng, King, Tawfick, van der Zande	Bentsman, Dankowicz, Ferreira, Hovakimyan, Kapoor, Ramos, Salapaka, Shao, Thomas, Wagoner Johnson	Admal, Ferreira, Hilgenfeldt, Jasiuk, H. Johnson, Kapoor, Shao, Smith, Thomas, Vakakis, Vanka, Wagoner Johnson, West
SECURITY AND DEFENSE	Brewster, Elbel, Ewoldt, Gazzola, Glumac, Hilgenfeldt, Hrnjak, Jacobi, Matalon, Pearlstein, Stephani	Bahl, Ewoldt, Gazzola, Jasiuk, H. Johnson, King, Matlack, Ostoja-Starzewski, Saif, Sehitoglu, Sofronis, Tawfick, Vakakis, van der Zande	Brewster, Elbel, Ewoldt, Glumac, Hrnjak, Jacobi, King, Matalon, Sinha, Stephani	Bahl, Gazzola, Jasiuk, H. Johnson, King, Matalon, Matlack, Sehitoglu, Sinha, Stephani, Vakakis, van der Zande	Glumac, King, Stephani, van der Zande	Bahl, Bentsman, Dullerud, Hovakimyan, Matlack, Mehta, Ostoja-Starzewski, Ramos, Salapaka, Shao, Vakakis, West, Yim	Gazzola, Hilgenfeldt, Jasiuk, H. Johnson, Matalon, Pearlstein, Salapaka, Shao, Sofronis, Stephani, Vakakis, West
TRANSPORTATION	Chamorro, Elbel, Fischer, Hrnjak, C. Lee, Matalon, Miljkovic	Cai, Ertekin, Jasiuk, Matlack, Sehitoglu, Tawfick, Vakakis	Cai, Elbel, Fischer, Hrnjak, Jacobi, C. Lee, Matalon, Miljkovic, Smith, S. Wang	Cai, Ertekin, Stephani	Cai, Ertekin, Smith, Stephani	Dankowicz, Dullerud, Hovakimyan, Matlack, Salapaka, Shao, Vakakis, Yim	Ertekin, Jasiuk, Shao, Smith, Stephani, West

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: 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).*

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: Hermia G. Soo Professor and Associate Director of 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 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, 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.*

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 / PhD, Cornell University, 1995. **Current research**: Dynamical systems; complex networks; computational methods; robotics. 10th year as Editor-in-Chief of Applied Mechanics Reviews, the flagship review journal of the American Society of Mechanical Engineers. Program Director, National Science Foundation. *Completed five-year term as Associate Dean of Graduate, Professional and Online Programs. Co-authored invited feature article in Nonlinear Dynamics on a computational tool for nonlinear systems analysis and constrained design optimization for problems with delay. Researched the purposeful design of active networks as hysteretic sensors.*

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: Associate Professor and Andersen Faculty Fellow / 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 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: 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 resolve a nearly 70-year debate concerning molecular processes of nonlinear mechanics of polymeric networks.*

Jie Feng: Assistant Professor / PhD, Princeton University, 2016. **Current research**: Fluid mechanics related bubbles and droplets, vesicle dynamics, polymer self-assembly for drug delivery. Investigating a dispersal mechanism related to bubble-driven aerosols at a compound interface. Studying multiphase flow in confined spaces related to particle-laden foams for enhanced oil recovery. *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 / 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: Senior Lecturer / PhD, University of Illinois Urbana-Champaign, 1999. Micro-Electro-Mechanical System (MEMS) device design and fabrication.

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.*

Jiajun He: Teaching Assistant Professor and Director of 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**: Autonomous systems, environmental sciences and social 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, contributed to the foundation for development of cyber-secure autopilots, explored reinforcement learning and its applications to challenges related to global warming, and contributed to social engineering with applications to health analytics.*

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, Willett Faculty Scholar, and Interim Director of the Healthcare Engineering Systems Center / 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: 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 and Health Innovation Professor, Carle Illinois College of Medicine / 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 Instructional Laboratories / PhD, University of Illinois Urbana-Champaign, 2012. Experimental fluid mechanics, optical diagnostics, engineering professional identity development, engineering education, service learning. *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 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: Associate Professor and 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 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 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.

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; sustainable energy systems; design-thinking. Fellow of the UIUC Center for Innovation in Teaching and Learning. Faculty Affiliate of the Center for Global Studies. *Founded and leads the UIUC Sustainability Competition for Undergraduates. Founded and principal investigator of the ENGagement In eNgineering Education (ENGINE) research team comprising 20 faculty.*

Callan Luetkemeyer: Assistant Professor / PhD, University of Michigan, 2020. **Current research**: Soft tissue mechanics (experiment, computation, and theory), image-based modeling, orthopedic and reproductive injuries. *Demonstrated the potential of image-based material modeling methods for medical diagnostics by inferring differences in tissue microstructure from only low-resolution mechanical deformation data.*

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) hydrodynamic theory of flame propagation in premixed combustible gases that includes the well-known flame speed-flame stretch relation and a coordinate-free expression for the flame stretch rate, (ii) comprehensive criteria for the onset of instabilities in premixed combustion, (iii) theory for premixed turbulent flames, (iv) multi-dimensional, time-dependent theory of diffusion flames that includes complete burning, partial burning and extinction, (v) first characterization of thermo-diffusive instabilities in diffusion flames (cellular and pulsating), (vi) numerous contributions to droplet and solid particle combustion, edge flame dynamics, micro-scale combustion and combustion 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; ultrasonic nondestructive evaluation. *Developed new materials and structures for advanced vibration control; developed new in situ nonlinear ultrasonic techniques to probe dislocation-based damage in metals.*

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; molecular dynamics methods; multiscale modeling.

Nenad Miljkovic: 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.*

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.*

João Ramos: Assistant Professor. *Shared Appointment with Boston Dynamics* / 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 / 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 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: Associate Professor and Director of ZJU-UIUC Institute / 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 data fusion-based learning and decision-making techniques for manufacturing process control. Developed a suite of cost-effective machine learning methods including transfer learning, federated learning, and active learning for smart manufacturing applications.*

Sanjiv Sinha: Professor and Associate Head for Undergraduate Programs / PhD, Stanford University, 2005. **Current research**: Thermoelectric energy conversion physics, materials, and devices; thermochemical and thermophysical energy storage; fundamental 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 and Associate Head for Graduate Programs and Research / 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.*

Kelly Stephani: Associate 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). Co-director of the University Consortium for Applied Hypersonics under the Joint Hypersonics Transition Office, OUSD(R&E).*

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

Ke Tang: Lecturer / PhD, Zhejiang University, 2005. 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: 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. Metals processing simulation; modeling of continuous casting; steel processing; numerical methods for solidification phenomena.

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 / 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 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 and 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.*

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

L. Winston Zhang: 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.

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