

Philip Bayly

Research areas

Applications of Imaging in Science & Engineering

Biomechanics & Mechanobiology

Biomedical & Biological Imaging

Biomedical, Bio-inspired, and Bio-derived Materials

Neural Engineering

Neuroimaging

Quantitative Imaging

Women's Health Technologies

Expertise

Develops imaging methods to study biomechanics from cell motility to traumatic brain injury

Focus

Mechanics of cells and soft tissues; nonlinear dynamics; waves and oscillations

Research

Professor Bayly studies impact, vibration, wave motion, and instability in mechanical and biomedical systems. He uses magnetic resonance imaging (MRI) to investigate the mechanics of brain injury and brain development. He also studies the nonlinear dynamic phenomena that underlie the oscillatory movements of cells and microorganisms.

Ramesh Agarwal

Research areas

Advanced Materials

Applied Physics

Cardiovascular Engineering

Computational Methodologies

Energy

Environmental Engineering

Machine Learning & Artificial Intelligence

Materials for Energy and Environmental Technologies

Parallel Computing Technology

Thermal-Fluids in Energy, Aerospace and Biomedicine

Expertise

Applies computational fluid dynamics to solve problems in mechanical and aerospace engineering

Research

Ramesh Agarwal's current research interests include ground effect aerodynamics, flow control, rarefied gas dynamics and hypersonic flow, bio-fluid dynamics, wind energy, energy efficiency of buildings, chemical looping combustion and geological carbon sequestration

Chiama Asinugo

Expertise

Studies machine elements & design

Biography

Chiamaka Asinugo previously worked as a design engineer for Global Surgical Corporation and joined WashU in full capacity in 2016 to run courses in material science, vibrations, and design. She is currently the Associate Director of the Spartan Light Metal Products Makerspace. Chiamaka also works as an adjunct instructor for the UMSL/WashU Joint Undergraduate Engineering Program and runs a College Prep summer course for the WashU's Institute for School Partnership.

Kashif Masud Awan

Expertise

Makes super tiny stuff with applications in biosensors, quantum computers, optical communication and more

Research

Kashif Masud Awan completed his BS in engineering from NUST (Pakistan) in 2009, followed by serving the national space agency, SUPARCO for a couple of years. He then pursued his master's under the Erasmus Mundus scholarship at St. Andrew's University (UK) and Royal Institute of Technology (Sweden). He then served as a lecturer at Iqra University (Pakistan) for one year, before pursuing PhD at University of Ottawa, under the Canada Excellence Research Chair doctoral fellowship.

Awan completed his PhD in electrical engineering in 2018 focused on the fabrication of III-V semiconductor devices for nonlinear optics. Following his doctorate he joined University of British Columbia as a research associate leading micro and nanofabrication of optical devices at the Quantum Matter institute for applications in bio sensing, optical communication and quantum computing.

Sang-Hoon Bae

Research areas

Advanced Materials

Biomedical & Biological Imaging

Biomedical, Bio-inspired, and Bio-derived Materials

Devices & Circuits

Materials for Energy and Environmental Technologies

Quantum and Photonic Materials and Devices

Expertise

Discovers new physical phenomena by developing new material platforms

Research

The Bae research group focuses on tackling the challenges in materials science with thermodynamics, kinetics and solid-state physics.

The core question in his research is: "How can we bring material innovation in 2D atomic layers and 3D thin films towards ubiquitous electronics?" A future hardware will entail ubiquitous electronics requires higher performance, mechanically lower stiffness and self-power. His recent studies have revealed unique and universal methodologies to produce large-scale, freestanding and single-crystalline exotic materials, which satisfy the aforementioned requirement. Based on the discoveries, his team mainly focuses on three directions; i) developing material building blocks, freestanding 3D films and 2D atomic layers, and discovering new 3D/2D physical coupling phenomena and functional architectures, ii) developing advanced solar cells with the study of solid-state photovoltaic physics and iii) heterogeneous integration for self-powered ubiquitous electronics with AI cognitive function.

Matthew Bersi

Research areas

Biomechanics & Mechanobiology

Cardiovascular Engineering

Cell & Molecular Bioengineering

Women's Health Technologies

Expertise

Studies the relationship between biomechanics and inflammation in soft tissues

Research

Professor Bersi's research interests are centered on the development of experimental and computational approaches to better understand the relationship between biomechanics and inflammation in soft tissues. His group has focused on the role of the immune system in hypertension, cardiac fibrosis and vascular injury and has developed various tools and systems for the mechanical characterization of biological samples ranging from local mechanical properties of geometrically complex tissues to biophysical properties of single cells. While focused primarily on cardiovascular disease, this multiscale approach has applicability to understanding biomechanical regulation of injury and disease processes in multiple tissues and organ systems.

Emily Boyd

Expertise

Teaches thermal fluids sciences and lab experimentation

Biography

Emily Boyd joined Washington University in St. Louis in 2015. She specializes in thermofluids sciences, teaching courses in fluid dynamics and heat transfer. She also coordinates the Washington University Summer Engineering Fellowship program, which provides research experience for undergraduate students.

Boyd has researched methods for increasing the efficiency of gas turbine engines, focusing on film cooling. She conducted proprietary experimental research for gas turbine engine manufacturers such as Pratt & Whitney, G.E. Energy, G.E. Aviation, and Siemens.

Christopher Cooper

Research areas

Advanced Materials

Biomedical, Bio-inspired, and Bio-derived Materials

Chemical Engineering

Energy

Materials for Energy and Environmental Technologies

Expertise

Responsive, soft materials for applications in energy storage, environmental sustainability and human health

Research

Christopher Cooper's prior research focused on synthesizing and characterizing dynamic polymers with distinct molecular designs and reversible bonds to create novel stretchable materials that integrate into wearable or implantable electronic devices. Cooper has published more than 15 peer-reviewed journal articles and given numerous conference presentations and invited talks. His research at WashU will focus on using these dynamic polymers to create responsive, soft materials for applications in energy storage, environmental sustainability and human health.

Katharine Flores

Expertise

Designs metallic alloys for structural applications

Focus

Design of metallic glasses and other structural alloys, micromechanical characterization methods, and novel manufacturing techniques including additive manufacturing

Research

Kathy Flores' primary research interest is the mechanical behavior of high performance structural materials, with particular emphasis on understanding structure-processing-property relationships in bulk metallic glasses and their composites.

She leads research projects on topics ranging from investigations of the structural origins of deformation in metallic glasses to the development of efficient strategies for the design of new glasses with desirable properties. She is particularly interested in the development of new manufacturing techniques suited to the unique processing capabilities of these alloys, in an effort to accelerate their incorporation in mainstream and high performance applications.

Prof. Flores's research focuses on structural materials, with particular emphasis on understanding structure-processing-property relationships in compositionally or structurally complex metallic alloys. Her current research projects include developing and applying high-throughput computational and experimental methods to alloy design and using micromechanical experimental methods to investigate the rheology of geological materials.

Guy Genin

Research areas

Advanced Materials

Biomechanics & Mechanobiology

Biomedical, Bio-inspired, and Bio-derived Materials

Cell & Molecular Bioengineering

Machine Learning in Image Science

Orthopedic Engineering

Quantitative Imaging

Expertise

Studies interfaces & adhesion in physiology & nature

Focus

Mechanobiology, biomechanics, quantitative image analysis, interfaces and adhesion

Research

Guy Genin studies interfaces and adhesion in nature, physiology, and engineering. His current research focuses on interfaces between tissues at the attachment of tendon to bone, between cells in cardiac fibrosis, and between protein structures at the periphery of plant and animal cells.

Guy Genin studies the mechanobiology of interfaces and adhesion in nature, physiology, and engineering. His research aims to understand and harness the role of force in living systems. Through these efforts, Genin and his group are working to advance path-breaking solutions, including engineered scaffolds for tissue repair and regeneration, improved reconstructive surgery, therapy for tissue inflammation and fibrosis, and hardier crops that require fewer resources.

Jianjun Guan

Expertise

Develops functional biomaterials, stem cell and drug delivery systems for tissue repair and regeneration

Research

Professor Guan's research interests are in functional biomaterials and microenvironments for cell and drug delivery; oxygen sensitive biomaterials for non-invasively and real time imaging and detecting tissue oxygen during vascularization therapy; and cardiovascular, skin, and musculoskeletal tissue regeneration. His research covers regenerative medicine, polymer, drug delivery, nanomedicine, stem cell, biomechanics, surgery and biomedical imaging fields.

Sharniece Holland

Expertise

Teaches courses in mechanics and materials science, manufacturing processes and quantitative materials science and engineering

Mark Jakielia

Expertise

Engineering design, optimization, computer-aided design, assembly and manufacturing

Research

Professor Jakielia conducts research related to engineering design and design optimization. He has specialized in the application of evolutionary computation to problems in design and manufacturing. Together with associated researchers, he has developed systems that perform structural topology optimization, shape pattern nesting, finite element mesh generation, antenna design, and the optimal arrangement of piezoelectric actuators on aerodynamic surfaces. More recently, he has investigated computer-based systems that allow engineering design and product development to be done by web-based user communities, as well as comprehensive cost models for remanufacturing processes.

He has had collaborative research projects with many industry partners, including Ford, Nissan, Hitachi, and Boeing. More recently, he has developed new courses in mechanical fabrication and Computer-aided engineering for mechanical design.

Swami Karunamoorthy

Expertise

Leads the ABET accreditation process for the undergraduate engineering programs

Research

Swami Karunamoorthy's research areas include Helicopter Dynamics, Applied Aerodynamics, Mechanics of Solids, Composites, Kinematics, Engineering Education, Assessment methods for program continuous improvement. He is the author of several publications in these areas.

Jeff Krampf

Expertise

Teaches engineering design, modeling and practical applications

Research

Jeff studies fluid mechanics in biological systems, focusing on modeling blood flow in hemodialysis access circuits. He uses computational fluid dynamics (CFD) and magnetic resonance angiography (MRA) to investigate the effects of fluid properties and access construction on access development and dysfunction.

Spencer Lake

Research areas

Biomechanics & Mechanobiology

Biomedical, Bio-inspired, and Bio-derived Materials

Imaging Science in Medicine

Orthopedic Engineering

Regenerative Engineering in Medicine

Expertise

Aims to enhance fundamental understanding of orthopaedic soft tissues

Focus

Musculoskeletal Soft Tissue Mechanics

Research

Spencer Lake's research focuses on soft tissue biomechanics, with an emphasis on orthopaedic tissues, such as tendon and ligament. His research uses a multiscale experimental and computational approach to evaluate the *in vivo* loading environment, tissue properties, and microstructural structure-function relationships of tissues that function in complex physiologic environments.

Studies conducted by Lake's research group in the Musculoskeletal Soft Tissue Laboratory aim to enhance fundamental understanding of healthy tissue properties, elucidate changes that occur in (and mechanisms responsible for) injury/disease, and provide guidelines for improved treatment/replacement strategies. While focused primarily on tendon and ligament of the upper extremity (i.e., shoulder and elbow), these studies also have broad applicability towards understanding properties and relationships of many different native and engineered soft tissues.

Xianglin Li

Research areas

Thermal-Fluids in Energy, Aerospace and Biomedicine

Expertise

Advances energy storage and conversion systems (fuel cells and batteries) through regulating multiphase mass and heat transfer

Research

Li's research interests are in batteries and fuel cells, including direct methanol fuel cells, lithium-oxygen batteries and battery thermal management; transport phenomena in porous media; greenhouse gas emissions and full fuel cycle analysis of fossil fuels; and life cycle assessment and economic analysis of advanced energy techniques, among others. Li has co-written more than 50 peer-reviewed journal articles, multiple U.S. Department of Energy and National Laboratory reports.

Mark Meacham

Research areas

Biomechanics & Mechanobiology

Biomedical, Bio-inspired, and Bio-derived Materials

Energy

Thermal-Fluids in Energy, Aerospace and Biomedicine

Expertise

Studies microfluidics, micro-electromechanical systems and associated transport phenomena

Focus

Acoustic microfluidics; biomedical microdevices; multiphase transport phenomena; control and observation of physical, chemical, and biological processes at the microscale

Research

Mark Meacham's research interests include microfluidics, micro-electromechanical systems (MEMS) and associated transport phenomena, with application to design, development and testing of novel energy systems and life sciences tools, from scalable micro-/nanotechnologies for improved heat and mass exchangers to MEMS-based tools for manipulation and investigation of cellular processes. He is also interested in the behavior of jets and/or droplets of complex fluids during ejection from microscopic orifices, which is critical to applications as disparate as biological sample preparation and additive manufacturing.

Rohan Mishra

Research areas

Advanced Materials

Applications of Imaging in Science & Engineering

Applied Physics

Artificial Intelligence in Materials Discovery and Design

Chemical Engineering

Energy

Environmental Engineering

Image Formation and Reconstruction

Machine Learning in Image Science

Materials for Energy and Environmental Technologies

Quantitative Imaging

Quantum and Photonic Materials and Devices

Expertise

Designs new materials for energy applications starting from the atomic scale

Focus

Rational design of materials for energy applications, atomic-scale modeling, electronic structure calculations, electron microscopy

Research

Rohan Mishra's research interest is to develop quantitative structure-property correlations in materials starting from the atomic scale. To develop such correlations, his group synergistically combines electronic structure calculations with atomic-resolution electron microscope imaging and spectroscopy. The end goal is the rational design of materials with properties tailored for electronic, optical, magnetic and energy applications. Current research topics include perovskite materials for photovoltaic and optoelectronic applications, novel electrocatalysts, oxidizers and wide-bandgap semiconductors.

Hong Niu

Expertise

Creates novel drug delivery systems using multi-functional biomaterials and investigate the pathways of the treatments for cardiovascular diseases

Research

Hong Niu has a long-standing interest in new biomaterials and drug delivery, stem cell transplantation for tissue regeneration, and biomaterials-driven immunomodulation. She has over ten years of experience in polymeric biomaterials related techniques.

Ruth Okamoto

Ruth Okamoto has served as a design engineer at Digital Equipment Corporation in Shrewsbury, MA, (1987-1989), an engineering software specialist at Digital Equipment Corporation in St. Louis, MO, (1989-1993), and an assistant professor at Washington University in St. Louis. (1997-2008).

Amit Pathak

Research areas

Biomechanics & Mechanobiology

Biomedical, Bio-inspired, and Bio-derived Materials

Cell & Molecular Bioengineering

Expertise

Studies mechanobiology of cancer metastasis and epithelial cell behaviors in complex environments

Focus

Cell migration, micro-fabrication and hydrogel synthesis, tumor microenvironment, cancer mechanobiology, and computational modeling of cell-matrix interactions

Research

Amit Pathak's research interests include biomechanics, biomaterials, mechanobiology of the cell, and interactions between cells and extracellular matrices. In particular, his research aims to understand how mechanical properties of three-dimensional matrices affect cell behavior through various sub-cellular mechanisms. His lab tackles this multi-variable problem through a multidisciplinary approach that includes fabrication of new matrix platforms, development of advanced measurement tools in cell biology, and construction of predictive computational models.

David Peters

Expertise

Studies aeroelasticity

Focus

Dynamics, Vibration, Aeroelasticity, Applied Aerodynamics, Rotary-Wing Systems

Research

Professor Peters's research projects in rotor wake modeling seek to correctly model the dynamic motions that profoundly influence vehicle dynamics of airplane propellers, helicopters and tilt rotors.

His other research interests include aeroelastic modeling of helicopter rotors and wind turbines with unsteady aerodynamics and nonlinear structural deformations and response to stalling.

Jackson Potter

Expertise

Applies theoretical and practical engineering knowledge to the design of mechanical devices

James Jackson Potter joined Washington University in St. Louis in 2017 to teach mechanical engineering design and dynamics. His broad design background has included projects ranging from pure software to pure hardware, hardware-in-the-loop and human-in-the-loop experiments, many mechatronics projects, and experience in industry as a product design engineer.

Srikanth Singamaneni

Research areas

Advanced Materials

Biomedical & Biological Imaging

Biomedical, Bio-inspired, and Bio-derived Materials

Neural Engineering

Neuroimaging

Quantum and Photonic Materials and Devices

Expertise

Develops new nanomaterials for biology & medicine

Focus

Plasmonic nanostructures for chemical and biological sensors and nanomedicine

Research

Professor Singamaneni's research interests include Plasmonic engineering in nanomedicine (in vitro biosensing for point-of-care diagnostics, molecular bioimaging, nanotherapeutics), photovoltaics (plasmonically enhanced photovoltaic devices), surface enhanced Raman scattering (SERS) based chemical sensors with particular emphasis on the design and fabrication of unconventional and highly efficient SERS substrates, hierarchical organic/inorganic nanohybrids as multifunctional materials, bioinspired structural and functional materials, polymer surfaces and interfaces, responsive and adaptive materials and scanning probe microscopy and surface force spectroscopy of soft and biological materials.

Jessica Wagenseil

Research areas

Biomechanics & Mechanobiology

Biomedical & Biological Imaging

Biomedical, Bio-inspired, and Bio-derived Materials

Cardiovascular Engineering

Expertise

Studies vascular biomechanics and mechanobiology in development and disease

Research

Jessica Wagenseil studies cardiovascular mechanics, specifically focusing on cardiovascular development, extracellular matrix proteins, and microstructurally-based constitutive modeling. Her work is important for testing clinical interventions for elastin-related diseases and for designing better protocols for building tissue-engineered blood vessels.

Patricia Weisensee

Research areas

Advanced Materials

Thermal-Fluids in Energy, Aerospace and Biomedicine

Expertise

Studies heat transfer and fluid dynamics in multiphase systems for energy and manufacturing applications

Focus

Experimental thermo-fluid dynamics using high speed imaging, including phase change heat transfer, droplet impact, wetting, and capillary transport in porous media.

Research

Weisensee's work focuses on understanding the interplay of fluid dynamics, heat transfer and liquid-solid interactions of droplets and other multi-phase systems. Practical applications of interest are phase change heat transfer for thermal management, thermal storage, and water harvesting, metallic additive manufacturing, and droplet interactions with biological and natural systems.

Louis Woodhams

Expertise

Uses computational methods to study and model the mechanics and dynamics of cells and cell appendages