2004 SUMMARY OF ENGINEERING RESEARCH

A Report of Activities during 2003

This .pdf is part of the larger 2004 Summary of Engineering Research, available on the Web at www.engr.uiuc.edu/research and on CD-ROM. The Summary of Engineering Research represents the extensive engineering research program conducted in 2003 at the University of Illinois at Urbana-Champaign. Detailed statistics about research in the College of Engineering are included in the Directory of Engineering and Engineering Technology Programs and Research, published by the American Society for Engineering Education, Washington, D.C.

How to Use the Summary of Engineering Research: Research projects are listed by title, followed by the names of the investigators and the sponsoring agencies. Projects are sorted by major topic areas. Project descriptions are brief. Additional information on each project may be obtained from the investigator in charge (denoted by an asterisk). Mailing addresses are provided on the introductory page.

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Bill Mischo: Engineering Librarian, Grainger Engineering Library Information Center

Please send queries and comments about the 2004 Summary of Engineering Research to the Engineering Communications Office, 303 Engineering Hall, MC-266, 1308 West Green Street, Urbana, IL 61801 USA, or email research@engr.uiuc.edu.
Faculty and Their Research Interests

Aerospace Engineering

Robert A. Beddini
Fluid dynamics, computational aerothermochemistry, propulsion, solid rockets

Lawrence A. Bergman
Structural dynamics and control, stochastic dynamics, system identification, smart structures

Michael B. Bragg
Aerodynamics, flight mechanics, aircraft icing, unsteady aerodynamics

John D. Buckmaster
Fluid mechanics, applied mathematics, combustion

Rodney L. Burton
Electric and advanced chemical rocket propulsion, hypersonic flows, hypervelocity accelerators

Bruce A. Conway
Celestial mechanics, optimal control

Victoria Coverstone
Aerospace system design, robotics, spacecraft control

Emilio Frazzoli
Design, development, and operation of autonomous aerospace system; impact of information technology on performance, safety, and reliability of highly automated systems

Philippe Geubelle
Theoretical and computational solid mechanics, fracture mechanics, constitutive behaviors of solids

Harry H. Hilton, Emeritus
Solid mechanics, viscoelasticity, composites, structures, dynamics, numerical analysis, computer-aided engineering

John Lambros
Static and dynamic fracture mechanics

Ki D. Lee
Computational fluid dynamics, aerodynamics, transonic flows, design optimization

Eric Loth
Two-phase flow and compressible flow, fluid mechanics

N. Sri Namachchivaya
Nonlinear dynamical systems, including bifurcation theory, stability analysis, stochastic processes, structural dynamics

Natasha Neogi
Aerospace software, hazard elimination using backwards reachability techniques in discrete and hybrid models

John E. Prussing
Orbital mechanics, spacecraft trajectories, optimal control systems

Michael S. Selig
Computational and experimental aerodynamics; airfoil design and analysis; wind energy systems; aircraft design, performance, stability, and control

Lee H. Sentman, Emeritus
Chemical lasers, nonequilibrium flow modeling, molecular energy transfer, kinetic theory and statistical mechanics, fluid dynamics, space environmental effects on satellite motion

Kenneth R. Sivier, Emeritus
Experimental and applied aerodynamics, aircraft flight mechanics, aircraft design education, system design and engineering

Wayne C. Solomon, Emeritus
Gas-phase kinetics, space systems, high-energy lasers

Petros G. Voulgaris
Robust control of time-varying and nonlinear systems, general systems theory, estimation and identification of complex systems, emphases on aerospace applications

Scott R. White
Manufacturing of composites, solid mechanics, composite materials, smart structures and materials

S. M. Yen, Emeritus
Rarefied gas dynamics, computational fluid dynamics, hypersonic aerodynamics

Adam R. Zak, Emeritus
Structures, dynamics, solid mechanics
Agricultural and Biological Engineering

Robert A. Aherin
Agricultural safety and health, safety behavior analysis, confined space safety, using sensors in safety systems

Loren E. Bode
Chemical application system, spray nozzle design, spray drift reduction

Douglas L. Bosworth
Product development processes, product safety, engineering design

Philip Buriak
Technical systems management, learning theory, implications to college teaching

Leslie L. Christianson
New product development; engineering design; agricultural buildings; heating, ventilation, and air-conditioning; air quality; swine facilities

Richard A. Cooke
Subsurface drainage, vadose zone water and contaminant transport, modeling of watershed-scale drainage systems

Steven R. Eckhoff
Corn fractionation, wet milling, dry milling, ethanol production, hybrid specific processing

Ted L. Funk
Livestock confinement structures, indoor climate control systems for livestock, manure management systems, residential housing structures, indoor air quality

Tony E. Grift
Sensors and controls in biosystems automation, machine vision systems, electronic sensor development and agricultural data acquisition systems, mathematical modeling and control

Alan C. Hansen
Biofuels for diesel engines, simulation modeling of material handling systems, off-road machinery systems, precision agriculture

Joe G. Harper
Technical systems management

Michael C. Hirschi
Water quality, erosion and sediment control

Prasanta K. Kalita
Hydrology, watershed-water quality modeling, pathogen transport, erosion and sediment control

Bruce Elliott-Litchfield
Food engineering

Marvin R. Paulsen
Food and bioprocess applications, grain quality measurements, near-infrared and FT-NIR spectroscopy

Roscoe L. Pershing
Computer simulation, undergraduate education

Kent D. Rausch
Recovery of nutrients from bioprocesses, corn quality effect on co-product value, variability of co-product quality, co-product quality for human and animal consumption

Vijay Singh
Engineering economic analysis and modeling of bioprocesses, design of processes for corn fractionation, recovery and concentration of nutraceuticals and biobased products

Lei Tian
Sensors and information systems for precision agriculture, applied machine vision, remote sensing, variable-rate technology

Xinlei Wang
Heating, ventilation, and air-conditioning controls; indoor air quality; waste management; environmental engineering

Yuanhui Zhang
Indoor air quality; effect of indoor air quality on occupants; sensor technology for bioenvironmental systems; heating, ventilation, and air-conditioning control; waste treatment

Qin Zhang
Off-road vehicle mechatronics, machinery systems for bioproduction, electrohydraulic systems control, computer-integrated agricultural systems, sensors and instrumentation
Bioengineering

Narayan R. Aluru
Bioengineering, computational science and engineering, engineering mechanics, fluid dynamics, nano-, micro-, and meso-technology

Thomas J. Anastasio
Computational neuroscience

Philip M. Best
Ion channels

Stephen Boppart
Optical biomedical imaging, molecular imaging, lasers in medicine and biology, optical coherence tomography, image-guided surgery, medical engineering, optical diagnostics of cancer

Richard D. Braatz
Multiscale systems and control

Yoram Bresler
Biomedical imaging systems; statistical signal and image processing; inverse problems; statistical pattern recognition; sensor-array processing

Bertram C. Bruce
Science education

Sahraoui Chaïeb
Biological mechanics, experimental fluid mechanics, experimental solid mechanics, microfluidics, micromechanics, multiphase flows, particulate flows, phase transitions, smart materials

John C. Chato, Emeritus
Bioengineering, energy systems and thermodynamics, heat transfer

Leslie L. Christianson
Indoor air quality

Robert B. Clarkson
Imaging and magnetic resonance

Robert Clegg
Experimental biophysics, including nucleic acid (DNA/RNA) structures and conformational changes

Edward R. Damiano
Bioengineering, computational science and engineering, fluid dynamics

M. Joan Dawson
NMR spectroscopy and spectroscopic imaging

Howard S. Ducoff, Emeritus
Radiation biophysics

Albert S. Feng
Sound information processing

Leon A. Frizzell
Ultrasonic biophysics, ultrasonic bioengineering

John G. Georgiadis
Bioengineering, computational science and engineering, energy systems and thermodynamics, fluid dynamics, heat transfer

William T. Greenough
Neuronal pattern analysis

David R. Gross
Cardiovascular physiology, physiological fluid mechanics

Bruce M. Hannon
Biological modeling

Sandy I. Helman
Electrophysiology of epithelia, membrane transport

Elizabeth Hsiao-Wecksler
Bioengineering, control systems, dynamic systems, engineering mechanics

Eric G. Jakobsson
Biomolecular and biophysical theory and computation

Russell Jamison
Biomaterials, tissue engineering scaffolds, bioactive polymers and ceramics, bone and cartilage replacements

Ann L. Johnson
Orthopedic surgery

Neil L. Kelleher
Bioanalytical chemistry, mass spectrometry

Kyekyoon (Kevin) Kim
Growth of GaN-based compound semiconductors and fabrication of optoelectronic and electronic devices using plasma-assisted MBE; plasma-arc-driven electromagnetic railgun for fueling of plasma devices; charged liquid cluster beam generation and application to thin film deposition, micropattern generation, and nanoparticle
fabrication; generation of solid and hollow, charged and neutral, monodisperse, micro- and nanospheres for biomedical and other applications; plasma display panels; development of novel thin film deposition techniques using plasmas, charged particles, electrostatic spraying, and their combinations with other techniques; MEMS and sensors; ionized source (cluster) beam deposition for low-temperature growth of high-quality films; inertial confinement fusion targets

**Paul C. Lauterbur**  
Chemical origin of life

**Deborah E. Leckband**  
Bioengineering and biophysics

**Zhi-Pei Liang**  
Magnetic resonance imaging, pattern recognition, statistical learning, bioinformatics

**Norman R. Miller**  
Control systems, design methodology and tribology, dynamic systems, nano-, micro-, and meso-technology

**Manssour H. Moeinzadeh**  
Biomechanics, dynamic modeling, experimental mechanics

**Mark E. Nelson**  
Computational neuroscience

**Burks Oakley II**  
Applications of computer-aided learning in the undergraduate engineering curriculum

**William D. O’Brien, Jr.**  
Ultrasonic biophysics and bioeffects, acoustic microscopy, ultrasonic bioengineering, ultrasonic dosimetry, ultrasonic tissue characterization, acoustic imaging techniques

**Margery Osborne**  
Integrated learning environments

**Daniel W. Pack**  
Biotechnology and gene therapy

**Marvin R. Paulsen**  
Food and bioprocess applications, grain quality measurements, near-infrared and FT-NIR spectroscopy

**Adrienne L. Perlman**  
Normal and disordered deglutition

**Gerald J. Pijanowski**  
Orthopedic biomechanics

**Nikolaos V. Sahinidis**  
Optimization and process systems engineering

**Mark A. Shannon**  
Bioengineering, computational science and engineering, heat transfer, materials processing, nano-, micro-, and meso-technology

**Jonathan V. Sweedler**  
Neurotransmitter distribution and release

**Alexander F. Vakakis**  
Dynamic systems

**Andrew Webb**  
RF coil design, functional imaging agents, magnetic resonance microcoils, thermal mapping using MRI, functional magnetic resonance imaging

**Bruce C. Wheeler**  
Analysis of multichannel neural signals, microminiature sensors for neural recording, algorithms for enhanced hearing aids, patterned growth of neurons

**Matthew B. Wheeler**  
Tissue engineering, microfluidics, nanometer-scale integrated systems, biology of single mammalian embryos and embryonic stem cells, remote sensing of embryonic metabolism and embryonic health, NMR imaging, microcalorimetry and MEMS actuators

**Gerard C. L. Wong**  
Biopolymers, biomolecular materials, biological and biomimetic self-assembly, gene therapy, synchrotron x-ray probes

**James F. Zachary**  
Ultrasound-induced bioeffects, contrast-agent induced bioeffects, and acoustic imaging of tumors

**Xudong Zhang**  
Bioengineering, computational science and engineering, human factors and ergonomics

**Yuanhui Zhang**  
Indoor air quality; effect of indoor air quality on occupants; sensor technology for bioenvironmental systems; heating, ventilation, and air-conditioning control; waste treatment
Huimin Zhao  
Biomolecular engineering

Charles F. Zukoski  
Colloid and interfacial science

Chemical and Biomolecular Engineering

Richard C. Alkire  
Electrochemical engineering

Richard D. Braatz  
Multiscale systems and control

Vinay K. Gupta  
Interfacial phenomena: structure and dynamics

Thomas J. Hanratty, Emeritus  
Fluid dynamics

Jonathan J. L. Higdon  
Fluid mechanics and computational algorithms

Paul J. A. Kenis  
Microfuel cells, microreactors, microfluidic tools, and microfabrication

Deborah E. Leckband  
Bioengineering and biophysics

Richard I. Masel  
Kinetics, catalysis, microfuel cells, and microchemical systems

Walter G. May, Emeritus  
Separation processes

Anthony J. McHugh, Emeritus  
Polymer science and engineering

Daniel W. Pack  
Biotechnology and gene therapy

Nikolaos V. Sahinidis  
Optimization and process systems engineering

Edmund G. Seebauer  
Microelectronics processing and nanotechnology

Michael S. Strano  
Carbon nanotechnology, 1-D charge transfer, nanobiotechnology, nanoparticle separations

James W. Westwater, Emeritus  
Heat transfer in boiling and condensation

Huimin Zhao  
Biomolecular engineering

Charles F. Zukoski  
Colloid and interfacial science

Civil and Environmental Engineering

Daniel P. Abrams  
Reinforced concrete, masonry, earthquake engineering

Christopher P. L. Barkan  
Transportation safety and risk analysis, with particular emphasis on topics related to railroad train accidents, tank cars, and hazardous materials; railroad transportation energy efficiency and environmental impact; railway signaling, traffic control systems, and capacity

Rahim Benekohal  
Traffic flow modeling and simulation, traffic flow theory and control, capacity analysis, traffic safety

Tami Bond  
Aerosol chemistry, physics, and optics that govern the environmental impacts of particles from combustion

Scott A. Burns  
Engineering design optimization, structural engineering, numerical methods

William G. Buttlar  
Mechanics of transportation facilities and materials, micromechanical simulation of creep and fracture in particulate composites, asphaltic materials

Samuel H. Carpenter  
Bituminous materials, pavement evaluation, climatic factors

Mark M. Clark  
Membrane, colloid, and interfacial science; flocculation and mixing
Barry J. Dempsey
Climatic effects on pavements and materials, drainage, geosynthetic materials

Robert H. Dodds, Jr.
Fracture mechanics, computational solid mechanics, structural analysis

Amr Elnashai
Testing, analysis, and field observations and study of the effects of earthquakes on complex multiphysics civil engineering systems

Khaled El-Rayes
Optimization and information technology in construction, including optimal construction planning and control, multiobjective optimization, distributed computing, optimal lighting design for nighttime construction, impact of weather on construction, object-oriented modeling, artificial intelligence in construction

Douglas A. Foutch
Dynamic characteristics of full-scale structures, analysis and design of earthquake-resistant bridge and steel buildings, wind effects

William L. Gamble, Emeritus
Structural concrete, prestressed concrete bridges, creep and shrinkage of concrete, reinforced concrete slabs, fire-resistant structures

Jamshid Ghaboussi
Structural and geomechanical computational mechanics, earthquake engineering, computational intelligence and soft computing, information technology in civil engineering

German R. Gurfinkel, Emeritus
Structural design, failure investigations and retrofitting of wood, reinforced concrete, prestressed concrete and steel structures including silos, tanks, tall buildings

William J. Hall, Emeritus
Structural engineering, structural dynamics, earthquake engineering

Yousef Hashash
Numerical modeling, static and dynamic soil-structure interaction, deep excavations and tunnels, underground structures, geotechnical engineering, visualization and virtual reality

Neil M. Hawkins, Emeritus
Reinforced, prestressed, and composite steel and concrete structures, fracture mechanics

Edwin E. Herricks
Aquatic ecology, ecosystem management, water quality management standards and legislation

Keith D. Hjelmstad
Structural mechanics, nondestructive evaluation of large structures, fluid/structure interaction

Nicholas P. Jones
Structural dynamics, flow-induced vibration, and wind engineering

Clyde E. Kesler, Emeritus
Concrete

Praveen Kumar
Hydroclimatology, hydrogeomorphology, hydrologic information systems, knowledge discovery in databases, ecohydrology

James M. LaFave
Reinforced concrete building and bridge structures, light-frame construction, innovative structural framing systems

David A. Lange
Construction materials, microstructure and properties of cement and concrete

Susan M. Larson
Air quality monitoring and modeling, aerosol physics

Jon C. Liebman, Emeritus
Water resource and water quality systems, solid waste management and disposal

Liang Y. Liu
Construction project controls, productivity analysis and improvements, information technology, sensors and field data collection, construction modeling and simulation

W. H. C. Maxwell, Emeritus
Hydromechanics, hydraulic engineering

Gholamreza Mesri
Engineering properties, construction problems, and ground modification technology in relation to soft clays and silts, stiff clays and soft rocks, expansive soils and swelling shales, as well as granular materials
Barbara S. Minsker
Environmental systems analysis and management, groundwater remediation and monitoring design, interactive and collaborative environmental management using machine learning

Eberhard Morgenroth
Influence of dynamic reactor operation on the performance of biological treatment processes, biofilms

Stanley L. Paul, Emeritus
Experimental and analytical studies of reinforced concrete

David A. Pecknold, Emeritus
Structural mechanics and dynamics, shell structures, composite materials, neural network material modeling

John S. Popovics
Nondestructive evaluation and sensing for civil engineering materials and structures; corrosion; dynamic properties of concrete

Shaoying (Shawn) Qi
Water and wastewater treatment: PAC/GAC adsorption theories and applications for organic removal; packed-bed filtration/ultrafiltration for particle removal; chemical and biological reactions related to water quality control

Lutgarde Raskin
Biological treatment of water and wastewater, molecular microbial ecology, environmental microbiology

Chris R. Rehmann
Environmental fluid mechanics, turbulence in stratified fluids; double diffusion, zebra mussel transport in rivers, environmental multiphase flows

Arthur R. Robinson, Emeritus
Structural mechanics, dynamic elasticity, numerical methods applied to nonlinear structural problems

Jeffrey Roesler
Concrete pavement analysis, design, and large-scale testing; fatigue and fracture of concrete materials; concrete slab curling; fiber reinforced concrete materials; continuously reinforced concrete pavements

Mark J. Rood
Environmental air quality: aerosol chemistry and physics, development of methods to separate and remove contaminants from gas streams, development of aerosol sampling instrumentation

A. R. Schmidt
Surface-water hydraulics and hydrology; hydrology and hydraulics related to urban stormwater drainage systems, including best management practices, risk-based design and real-time control; and reliability-analysis applications for in water-resources and environmental engineering

Vernon L. Snoeyink
Environmental chemistry, drinking water treatment, water reclamation

Lucio Soibelman
Construction management, civil engineering information systems, distributed artificial intelligence, data mining, design rationale, KDD, lean construction, text mining, image reasoning

B. F. Spencer, Jr.
Smart structures, pseudo-dynamic substructure testing, structural health monitoring, vibration testing and theory, fatigue and fracture reliability, stochastic and robust structural control and system identification, earthquake engineering, deterministic and stochastic structural dynamics, computational probabilistic methods, structural reliability.

Timothy D. Stark
Foundation engineering, static and seismic stability of natural and constructed slopes, soil liquefaction, geosynthetics

Timothy J. Strathmann
Environmental chemistry, catalysis of contaminant degradation, sorption and speciation at mineral-water interfaces, metal microbe interactions, photocatalysis

Leslie J. Struble
Materials, chemical, microstructural and physical properties of cement and concrete, rheology of fresh cement and concrete

Marshall R. Thompson, Emeritus
Flexible pavements, transportation, railroad track structure analysis and design, soil stabilization, paving materials, subgrade soils

Erol Tutumluer
Pavement materials, aggregates and soils, flexible pavements, mechanistic based pavement design, image analysis, geosynthetics, artificial neural networks, stabilization and recycling
Albert J. Valocchi
Transport processes in porous media, groundwater contamination, numerical methods

William H. Walker, Emeritus
Structural mechanics, structural dynamics, highway bridge dynamics, fatigue and fracture

Y. K. Wen
Vulnerability functions, systematic treatment of uncertainty, effect of redundancy in buildings under seismic loads, Hilbert Spectral Representation and simulation of nonstationary random processes, optimal seismic design based on lifecycle cost consideration

Charles J. Werth
Transport and fate of organic chemicals in soils, sediments, and groundwater, sorption, mass transfer, soil and sediment characterization

Kam W. Wong, Emeritus
Surveying, photogrammetry, computer vision metrology

Jian Zhang
Seismic analysis and design of bridges and reinforced concrete structures, soil-structure interaction, earthquake engineering, structural dynamics and seismic protective devices

Computer Science

Vikram Adve
Compilers, software reliability, performance analysis, computer architecture

Sarita Adve
Computer architecture, low-power design, adaptive systems, real-time and network processing, performance evaluation methods, parallel computing

Gul A. Agha
Developing new abstractions for building open distributed systems and reasoning about their behavior, parallelism, coordination, real-time behavior

Brian P. Bailey
User interface tools that better support early design tasks, systems and environments that help users maintain information awareness, tools for multimedia authoring and design, interfaces that foster social interaction, human–computer interaction

Geneva G. Belford, Emeritus
Databases and information systems, distributed systems

Marco Caccamo
Real-time operating systems, real-time scheduling and resource management, wireless sensor networks, quality of service control in next-generation digital infrastructures

Roy H. Campbell
Security, distributed operating systems, ubiquitous computing

C. C. Kevin Chang
Databases, Internet information access, and digital libraries, with focuses on information integration of heterogeneous sources, Internet query processing, Web databases, and ranked top-k query processing

Gerald DeJong
Artificial intelligence

AnHai Doan
Databases, data integration and sharing, data mining, information discovery on the Web, efficient use and maintenance of meta-data, schema matching, machine learning

Jeffrey G. Erickson
Algorithms, data structures, and lower bounds; computational and discrete geometry

Michael Garland
Computer graphics, geometric modeling, human–computer interaction, visualization

Jiawei Han
Database systems, data mining, data warehousing, stream data mining, Web mining, spatiotemporal data mining, bio-data mining

Mehdi T. Harandi
Artificial intelligence, information systems, HCI, software engineering

Sariel Har-Peled
Algorithms, data structures, computational geometry, clustering, learning, computer graphics

John C. Hart
Computer graphics, computational topology

Michael T. Heath
Scientific computing, parallel computing
Jennifer C. J. Hou
Multicast routing and multicast, protocol design and implementation for Quality-of-Service (QoS) control, wireless QoS, network modeling and simulation, distributed systems and applications, real-time computing

Laxmikant V. Kale
Numerical, parallel, and scientific computing, operating systems

Samuel N. Kamin
Programming languages, software components, functional programming applied to scientific computation, denotational semantics, program specification and verification, domain-specific languages

Thomas Kerkhoven
Numerical and scientific computing

Robin H. Kravets
Mobile computing and communication, location management, power management, transport protocols, ad hoc networks, personal area networks

Steven M. LaValle
Robotics, motion planning, computational geometry, artificial intelligence, computational biology, computer vision, computer graphics, control theory

Jose Meseguer
Formal executable specification and verification; software composition, reflection, and metaprogramming; object-oriented specification and software architecture; concurrent, distributed, and mobile computing; logical frameworks and formal interoperability; logical and semantic foundations

M. Dennis Mickunas
Operating systems, parallel computing, programming languages

Saburo Muroga, Emeritus
Computer-aided design of digital systems

Klara Nahrstedt
Quality-of-Service (QoS) management, integration of guaranteed and best effort services for audio/video/DATA traffic, QoS-aware resource management, QoS routing, multimedia security, soft real-time scheduling, middleware support for distributed multimedia applications

David A. Padua
Computer architecture and systems, parallel computing, compilers

Lenny Pitt
Artificial intelligence, theoretical computing

Jean A. Ponce
Computer vision, robotics, computer graphics

Edgar A. Ramos
Computational geometry: randomized algorithms and derandomization, optimization and approximation algorithms, triangulation and mesh generation, topological methods and algorithms, parallel algorithms

Daniel A. Reed
Terascale and petascale computing, scalable parallel systems, performance analysis, smart environments, parallel input/output, real-time adaptive systems, scalability analysis, I/O characterization and optimization

Larry Rendell
Artificial intelligence

Grigore Rosu
Software and software related aspects; design, semantics, and implementation of programming and specification languages; automated software engineering and formal methods, especially “push-button” techniques for certification, monitoring, synthesis, and modularization; automated reasoning about computer systems, applications of logics, theorem proving; algorithms, (co)algebra, category theory

Dan Roth
Artificial intelligence, theoretical computing

Lui Sha
Distributed real-time computing systems, dynamic real-time architecture, Quality-of-Service (QoS) driven resource management, security and fault tolerance in networked embedded systems

Robert D. Skeel
Numerical analysis and scientific computing, computational methods for biomolecular simulation

Marc Snir
Large-scale parallel and distributed systems, parallel computer architecture, grid computing, parallel programming
Eric de Sturler
Iterative methods, eigenvalue problems, large-scale optimization

Josep Torrellas
Parallel and sequential computer architecture, processor-memory integration, thread-level speculation, low power design, reliability

Mahesh Viswanathan
Analysis and validation of software systems, including design of efficient algorithms, characterization of computational limitations, development of formal models for system specification, and implementation of software tools for program analysis

Marianne S. Winslett
Databases, security, parallel computation

Yizhou Yu
Appearance modeling, animation, computer graphics and vision, image and video processing

ChengXiang Zhai
Text processing and management, statistical natural language processing, machine learning, bioinformatics

Yuanyuan Zhou
Operating systems, file and storage systems, architecture, distributed systems, parallel systems, system support for database

Craig Zilles
Computer architecture, dynamic optimization, compiler construction, simulation methodologies, software engineering

Electrical and Computer Engineering

Ilesanmi Adesida
Electronic and transport properties of ultra-low dimensional semiconductor structures, advanced processing methods for electronic devices, high-speed optoelectronic devices and integrated circuits, radiation effects

Narendra Ahuja
Computer vision, robotics, image processing, sensors, pattern recognition, virtual environments, intelligent interfaces

Tamer Basar
Information technology research; control over wired and wireless networks; robust identification and control; dynamic games and stochastic teams; nonlinear and adaptive robust control; decentralized detection and estimation; routing, pricing, and congestion control; modeling and control of communication networks; mobile computing; incentive mechanisms through pricing; neural networks-based identification and control; applications of control and game theory in economics

Tangul Basar
Optimum transmitter-receiver design in communication systems, spread spectrum communication systems, jamming problems in information transmission, minima stochastic optimization problems with applications in communication systems, mobile radio systems

James Beauchamp, Emeritus
Use of computers for music synthesis, determination of sound synthesis models based on analysis of musical instruments, detection of musical pitch from acoustic recordings

Jennifer Bernhard
Reconfigurable active and passive antennas, phased array antennas, wireless sensor systems

Stephen G. Bishop
Optical and electrical characterization of crystalline and amorphous semiconductors and semiconductor nanostructures, compound semiconductors: GaAs, InP, AlGaAs, ZnSe, SiC, defects in semiconductors, isoelectronic defects, rare earth-doped chalcogenide glasses and GaN. Experimental techniques: photoluminescence, nuclear magnetic resonance, electron spin resonance, magneto-optics, photoemission, infrared spectroscopy

Richard Blahut
Communications, signal processing, information theory, optical recording

Stephen Boppart
Optical and biomedical imaging, molecular imaging, lasers in medicine and biology, optical coherence tomography, image-guided surgery, medical engineering, optical diagnostics of cancer

Yoram Bresler
Biomedical imaging systems; statistical signal and image processing; inverse problems; statistical pattern recognition; sensor-array processing
Donna J. Brown
Asynchronous learning technologies and environments; WWW-based education; VLSI placement and routing; parallel and distributed algorithms and architectures; analysis and design of algorithms, with a particular interest in approximation algorithms; graph theory

Marie-Christine Brunet
Numerical algorithms, parallel computing

Andreas Cangellaris
Numerical techniques for electromagnetic modeling and simulation, microwave circuit design, speed VLSI interconnects, electronic packaging, electromagnetic computer-aided design for high-speed digital and RF/microwave electronics, antenna modeling, optoelectronic interconnects, electromagnetic modeling for nonlinear optics

Scott Carney
Optical physics, including imaging, near-field microscopy, classical and quantum coherence theory, beam propagation, fundamental issues of energy conservation, mathematical methods in inverse scattering and the propagation of light

Nicholas Carter
Architectures that combine programmable processors and reconfigurable logic, computing using nanotech devices, design techniques to integrate computation and sensing

Patrick Chapman
Power electronics, electric drives, vibrations in electromechanical systems, monolithic integrated power circuits, numerical magnetic modeling, biomechanical energy conversion

Keh-Yung Cheng
Molecular beam epitaxy technology, optoelectronic integrated circuits, high speed devices, in situ fabrication of nanostructures, quantum wire lasers, vertical cavity surface emitting lasers, Sb-based IR detectors and electronic devices

Weng Cho Chew
Electromagnetics: wave propagation in inhomogeneous media, microwave integrated circuits, microstrip antennas, and fast algorithms for radar scattering, low frequency electromagnetics, and layered media; parallelization of fast algorithms; inverse scattering, imaging, and physics-based signal processing

Hyungsoo Choi
Precursors for nanoscale materials synthesis, including syntheses and development of tailored organometallic, inorganic, and polymeric precursors; thin film and nanoparticle fabrication, including thin films, micro- and nanoparticles, and nanowires/tubes via sol-gel processing, charged liquid cluster beam (CLCB) deposition, chemical vapor deposition (CVD), chemical solution deposition (CSD), and precision particle fabrication (PPF) technology; electronic and optical materials, including fabrication of electronic, optical, and magnetic materials for various devices involving thin films, micro- and nanoparticles, nanowires/tubes of metals, metal nitrides and oxides utilizing their electronic, optical, optoelectronic, and magnetic properties; bimaterials, including fabrication of micro- and nanospheres/capsules of biodegradable/compatible materials for advances drug delivery and tissue engineering

Kent Choquette
Vertical cavity surface emitting lasers (VCSELs), micro- and nanocavity lasers, optoelectronic devices, selective oxidation of compound semiconductors, hybrid heterogenous integration, nanoprocessing fabrication, photonic crystal materials, Si-based optoelectronics

Shun Lien Chuang
Optoelectronics, semiconductor lasers, modulators, photodetectors, photonics systems, quantum electronics, fiber optical sensors, electromagnetics

James J. Coleman
Semiconductor lasers, optoelectronics, epitaxial growth

Minh Do
Image and multidimensional signal processing, wavelets, multiscale geometric analysis, visual information representation

J. Gary Eden
Ultraviolet and visible lasers and laser spectroscopy, short wavelength photophysics, ultrafast laser spectroscopy, microdischarge and microresonator devices, laser magnetometry

Milton Feng
High-speed devices and ICs for wireless and light emitting transistors for optoelectronics (optoelectronic IC), monolithic microwave and millimeter-wave IC, digital IC, high field transport properties, RF-MEMS for wireless communications, advanced Si-CMOS device physics
Patricia Franke
Atmospheric dynamics, including the dynamics and thermodynamics of the upper atmosphere through data analysis of radar and lidar data and through the numerical simulations of different types of flow; radar and optical remote sensing of the upper atmosphere; computational electromagnetics, application of finite difference time domain techniques to the problems of radar backscatter from turbulent regions of the neutral atmosphere and the ionosphere and application of different numerical methods and parallel computing for computationally demanding problems; computational fluid dynamics

Steven J. Franke
Development and application of radar and signal processing techniques for remote sensing in the middle and upper atmosphere; application of tomographic imaging to the middle and upper atmosphere using arrays of ground-based sensors and low-earth orbit satellites; low-power wireless RF communications; high efficiency linear power amplifiers for RF communications and radar applications

Leon A. Frizzell
Ultrasonic biophysics, ultrasonic bioengineering

Chester S. Gardner
Optical communication, laser altimetry, laser remote sensing and ranging, laser guide stars, adaptive optics

George Gross
Electricity planning and analysis, power system operations, competitive electricity markets and auction mechanisms, transmission services and pricing, ancillary services, congestions management, reliability and security, energy policy and economics, restructuring of the electricity business

Christoforos Hadjicostis
Systems and control; error control coding; fault diagnosis and tolerance in dynamic systems; testing and verification; discrete event systems; algebraic systems; coding and graph theory

Bruce E. Hajek
Communication networks information theory, computer networks stochastic analysis, optimization wireless communication

Mark Hasegawa-Johnson
Acoustic phonetics, audio signal processing and speech recognition, speech and auditory physiology

Karl Hess
Hot carriers in semiconductors, electronic transport in heterojunction structures and superlattices, numerical simulation of semiconductor devices (supercomputing applications), quantum transport in mesoscopic systems, laser diode simulation, molecular and electron nanostructures, theory and simulation, deuterium processing and MOS reliability, quantum computing, theorem of Bell

Nick Holonyak, Jr.
Semiconductors, semiconductor device physics, semiconductor crystal growth and junction formation, diffused Si devices, SCRs, TRIACs, double injection, luminescence, light emitting diodes (LEDs), heterojunctions, lasers, tunnel diodes, compound semiconductors, quantum well heterostructures, superlattices, quantum well lasers, impurity-induced layer disordering, Al-based III-V native oxides and their use in heterostructures devices

Kuang C. Hsieh
Semiconductor materials/devices processing and characterization

Thomas S. Huang
Image processing, image compression, computer vision, human computer interaction, image and video databases

Seth Hutchinson
Robotics, computer vision, artificial intelligence

Wen-Mei Hwu
Architecture, compilation and microarchitecture of high performance parallel computer systems

Ravishankar K. Iyer
Design and evaluation of reliable and secure networks and systems, computer measurement and modeling, dependability and security validation and benchmarking

Jianming Jin
Computational electromagnetics, finite element methods, electromagnetic analysis and design in magnetic resonance imaging, wave scattering and propagation, electromagnetic interference and compatibility, microwave and millimeter wave circuits, antennas and electromagnetic theory

Douglas L. Jones
Digital signal processing, time-varying and time-frequency analysis, signal processing for communications, binaural hearing aids, signal processing for MEMS
Farzad Kamalabadi
Remote sensing and imaging, multidimensional signal and image processing, signal reconstruction and tomography, ionospheric and space physics

Kyekyoon (Kevin) Kim
Growth of GaN-based compound semiconductors and fabrication of optoelectronic and electronic devices using plasma-assisted MBE; plasma-arc-driven electromagnetic railgun for fueling of plasma devices; charged liquid cluster beam generation and application to thin film deposition, micropattern generation, and nanoparticle fabrication; generation of solid and hollow, charged and neutral, monodisperse, micro- and nanospheres for biomedical and other applications; plasma display panels; development of novel thin film deposition techniques using plasmas, charged particles, electrostatic spraying, and their combinations with other techniques; MEMS and sensors; ionized source (cluster) beam deposition for low-temperature growth of high-quality films; inertial confinement fusion targets

Ralf Koetter
Practical and theoretical aspects of coding theory, complexity, algorithms, communication systems, networks

Philip T. Krein
Power electronics, electric machinery and electromechanics, electric and hybrid vehicle systems

Erhan Kudeki
Radar remote sensing; atmospheric winds, waves, and turbulence; ionospheric plasma instabilities; incoherent scatter electric field measurements; midlatitude field aligned irregularities and meteor trails

P. R. Kumar
Wireless networks, sensor networks, convergence of control, communication and computation, semiconductor manufacturing, manufacturing systems, machine learning, adaptive systems, control, stochastic systems

Mark J. Kushner
Gaseous electronics, plasma processing of semiconductor materials, laser physics, pulse power, plasma diagnostics, plasma computer simulation, amorphous thin films, microelectronic feature evolution, plasma remediation of toxic gases, incoherent lighting sources, biocompatible films, polymer processing, microplasmas

Jean-Pierre Leburton
Theory of semiconductor devices, modeling and simulation of nanostructures, electronic and optical properties of heterostructures and low dimensional systems, transport in quantum structures, electronic properties, charging effects in quantum dots and nanocrystals, spin effects in nanostructures, quantum computation and quantum information processing

Stephen Levinson
Speech processing, language acquisition, natural language understanding, speech synthesis

Zhi-Pei Liang
Magnetic resonance imaging, pattern recognition, statistical learning, bioinformatics

Daniel Liberzon
Nonlinear control theory, analysis and synthesis of hybrid dynamical systems, systems with imprecise measurements and/or modeling uncertainty, stochastic differential equations and control

Chang Liu
MEMS, microsensors, microintegrated fluidics systems, MEMS for nanotechnology, wireless interface for sensors, sensitive skin

Michael C. Loui
Computational complexity theory, parallel and distributed computation, software reliability, ethics in engineering and computing

Steven Lumetta
Optical network architecture, computer architecture, cluster computing, parallel computing, user-level communication, validation and reliability

Joseph W. Lyding
Scanning tunneling microscopy and spectroscopy, STM-based nanolithography and nanofabrication, silicon-based molecular electronics, carbon nanotubes and carbon-based nanotechnology merged with silicon, growth of 3-D silicon nanostructures, deuterium processing and hot electron degradation in semiconductor devices, atomically precise dopant mapping, cross-sectional STM of semiconductor heterostructures, oxide silicon interface mapping, carbon nanotube purification

Yi Ma
Computer vision, including multiple view geometry, structure from motion, dynamic vision, real-time tracking, and active vision; systems theory, including geometric nonlinear control, hybrid systems, vision-based robotic control and navigation
Amit Mehrotra
Radio frequency (RF), analog, and mixed signal circuit design for mobile communication systems; simulation techniques for RF and mixed signal circuits and systems; interconnect performance and modeling issues in VLSI and novel circuits; physical design issues for high performance VLSI designs

Sean Meyn
Optimal control, Markov processes (with or without control), stochastic approximation and adaptive control, reinforcement learning and simulation, spectral theory and large deviations, information theory, stochastic networks

Eric Michielssen
Computational electromagnetics, fast integral equation-based solvers algorithms in both the frequency and time domains, and robust design paradigms; analysis and design of electromagnetic and optical systems (antennas, filters, interconnects, platform, terrain, plasmonic devices, and so forth)

Pierre Moulin
Image and video processing, compression, statistical signal processing, information hiding

David Nicol
Cyber-security, modeling and analysis of computer and communications systems, high performance simulation, parallel processing

Burks Oakley II
Applications of computer-aided learning in the undergraduate engineering curriculum

William D. O’Brien, Jr.
Ultrasonic biophysics and bioeffects, acoustic microscopy, ultrasonic bioengineering, ultrasonic dosimetry, ultrasonic tissue characterization, acoustic imaging techniques

Thomas Overbye
Power systems operation and control, power system stability, power system analysis by computer methods, power system visualization

Mangalore A. Pai
Power system stability, dynamic security of power systems, model reduction in power systems, iterative solver techniques in power system computations, voltage stability, robust stability, power system computation, impact of distributed generation in power systems

Sanjay Patel
Computer architecture, microarchitecture, high-performance and reliable computer systems, the implications of future generation applications and implementation technologies on systems design

Janak H. Patel
VLSI testing and testability, VLSI design automation

William R. Perkins
Control systems, system theory, sensitivity theory and robust control, large-scale dynamic systems

Constantine D. Polychronopoulos
Parallelizing/optimizing compilers for multithreaded architectures, program restructuring and optimization; code generation and optimization for superscalar processors; parallel programming languages; environments for parallel programming; partitioning, scheduling, and run-time environments for parallel computers; multiprocessor operating systems with multithreading support; parallel computer architectures; performance evaluation of parallel architectures

N. Narayana Rao
Ionospheric propagation, radiolocation

Umberto Ravaioli
Monte Carlo simulation of high speed electronic devices; numerical methods for semiconductor device simulation; quantum devices; supercomputation and visualization; reliability of MOS devices; micro- and nano-electromechanical systems (MEMS and NEMS); charge transport in biological systems (ionic channels); properties of carbon nanotubes

Elyse Rosenbaum
Design of ESD-protected RFICs, modeling and simulation of ESD protection circuits, analysis of substrate noise coupling, silicon-on-insulator, ESD protection for very high speed I/Os, gate oxide reliability

William Sanders
Dependability, security, and performance evaluation; intrusion- and fault-tolerant systems; reliable/secure distributed systems

Dilip V. Sarwate
Communications, coding theory, spread-spectrum communications, design of algorithms
<table>
<thead>
<tr>
<th>Name</th>
<th>Research Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peter W. Sauer</td>
<td>Electric machinery modeling, analysis and control, power system dynamic modeling and simulation, power system stability</td>
</tr>
<tr>
<td>Jose Schutt-Aine</td>
<td>Electronic packaging, microwave theory and measurements, and digital circuit modeling, including integration of modeling and simulation tools, high-performance computation for simulation of packages, applications of V-shaped transmission lines</td>
</tr>
<tr>
<td>Naresh Shanbhag</td>
<td>Design and VLSI implementation of low-power, high-performance multimedia digital signal processing and communications systems, noise-tolerant deep submicron VLSI systems, fundamental bounds on efficiency of VLSI information processing systems, power-aware reconfigurable DSP systems, low-power DSP and circuits, DSP and communication system design, digital ASIC design</td>
</tr>
<tr>
<td>Yoshihisa Shinagawa</td>
<td>Computer graphics, vision, and its applications</td>
</tr>
<tr>
<td>Andrew Singer</td>
<td>Statistical signal processing, communications, machine learning, data compression, sonar/lidar/optical signal processing</td>
</tr>
<tr>
<td>Gary Swenson</td>
<td>Remote sensing of the atmosphere from ground-based, aircraft, and spacecraft using optical methods; space environment issues with a particular emphasis on spacecraft glows</td>
</tr>
<tr>
<td>Gregory Timp</td>
<td>Fabrication, development, and characterization of the performance of silicon MOS nanotransistors to discover the fundamental limitations of the silicon MOSFET; atomic physics and light pressure forces on single atoms for lithography applications; mesoscopic and nanostructure physics, including measurement of the low temperature transport characteristics of high electron mobility transistors that resemble electron waveguides Hopping (thermally-assisted tunneling) conductivity of localized electrons in a two dimensional impurity band formed in the inversion layer of a silicon metal-oxide-semiconductor field effect transistor (MOSFET); the effect of superlattices on lattice-dynamical properties of graphite intercalation compounds using Raman scattering, extremely high field magnetoresentors, Schubinkov-deHaas effect (using high resolution microscopy), high resolution x-ray scattering; nanometer-scale lithography to probe biological function</td>
</tr>
<tr>
<td>Timothy N. Trick</td>
<td>Computer-aided analysis and design of circuits, computer-based education</td>
</tr>
<tr>
<td>John Tucker</td>
<td>Center for Silicon Quantum Computers (Director), metal silicide source/drain MOS transistors at ~10nm gate length, atom-scale electron devices made by STM patterning of donors in silicon</td>
</tr>
<tr>
<td>Ricardo Uribe</td>
<td>Digital systems, cybernetics</td>
</tr>
<tr>
<td>Nitin Vaidya</td>
<td>Wireless networking, mobile computing, fault-tolerant computing</td>
</tr>
<tr>
<td>Venu Veeravalli</td>
<td>Distributed wireless sensor systems, wireless packet data networks, channel modeling for wideband multiantenna wireless systems, information theory for wireless communications, wireless code division multiple access (CDMA) systems, radio resource management for wireless networks, decentralized dynamic decision making, sequential multihypothesis testing and change-point detection</td>
</tr>
<tr>
<td>Pramod Viswanath</td>
<td>Communication theory, wireless communication, information theory, communication networks</td>
</tr>
<tr>
<td>Benjamin W. Wah</td>
<td>Nonlinear optimization, parallel processing, distributed processing, artificial intelligence, computer networks, multimedia signal processing</td>
</tr>
<tr>
<td>Andrew Webb</td>
<td>RF coil design, functional imaging agents, magnetic resonance microcoils, thermal mapping using MRI, functional magnetic resonance imaging</td>
</tr>
<tr>
<td>Bruce C. Wheeler</td>
<td>Analysis of multichannel neural signals, microminiature sensors for neural recording, algorithms for enhanced hearing aids, patterned growth of neurons</td>
</tr>
<tr>
<td>Martin Wong</td>
<td>Computer-aided design of VLSI, field-programmable systems, design and analysis of algorithms, combinatorial optimization</td>
</tr>
</tbody>
</table>
Jianhua (David) Zhang  
Lasers and laser spectroscopy, electromagnetics, plasma diagnostics, optics, cryogenics, electric and electronic circuits

General Engineering

Carolyn L. Beck  
Control systems, modeling and model reduction for the purposes of control, systems theory

Francesco Bullo  
Nonlinear controls, autonomous vehicles

Scott A. Burns  
Engineering design optimization, structural analysis

James V. Carnahan  
Probabilistic methods, applied statistics, simulation

Thomas F. Conry  
Tribology, mechanical design, mechanical systems

Wayne J. Davis  
Hierarchical systems and programming for planning and control, advanced simulation of manufacturing systems

David E. Goldberg  
Genetic algorithms and evolutionary computation in search, optimization and machine learning, innovation

W. Brent Hall  
Reliability engineering, conditional reliability and decision making, structural optimization, cold-formed steel design

Juraj V. Medanic  
Systems theory, control systems, systems analysis

Manssour H. Moeinzadeh  
Biomechanics, dynamic modeling, experimental mechanics

Raymond L. Price  
Engineering management, time to market, business and technology strategy

Henrique L. M. dos Reis  
Nondestructive testing and evaluation, structural analysis and design, composite materials

Ikhlaoq Sidhu  
Technology management, with a focus on the technology areas of networking, image processing, hardware development, software development, and communications

Mark W. Spong  
Control theory, robotics, mechatronics

R. S. Sreenivas  
Discrete-event systems, automatic control simulation

Deborah L. Thurston  
Multiattribute decision making under uncertainty and risk, environmentally conscious design and manufacturing

Louis Wozniak  
Control theory, systems identification and simulation, speed control, power systems

Ali Yassine  
Product development models, design theory and methodology, concurrent engineering, project management

Materials Science and Engineering

John R. Abelson  
Plasma-assisted deposition of semiconductor, dielectric, and conductive thin-films for electronic applications; the physics and chemistry of film growth; fabrication of photovoltaic cells and thin-film transistors for macroelectronics

Leslie H. Allen  
Thin-film physics, microelectronic processing, interfaces, nanoscale, size-dependent material properties, nanocalorimetry

Carl J. Altstetter, Emeritus  
Hydrogen in metals and hydrogen embrittlement, stress corrosion cracking, nanophase metal processing and properties

Robert S. Averback  
Ion beam modifications of materials, ion beam analysis, radiation damage, nanophase materials

Pascal Bellon  
Far from equilibrium materials, simulations and modeling of materials processing (energetic beams, plastic deformation), electron microscopy
Clifton G. Bergeron, Emeritus
Glass, crystallization kinetics, ceramic coatings

Howard K. Birnbaum, Emeritus
Hydrogen effects in solids, hydrogen embrittlement, grain boundaries and interfaces, dislocation effects in deformation and fracture of solids

Robert W. Bohl, Emeritus
Nuclear materials, physical metallurgy, mechanical properties, failure mechanisms

Paul V. Braun
Materials chemistry, polymers, biomaterials, organic and inorganic self-assembly, electronic materials and photonics

David Cahill
Epitaxial growth, scanning tunneling microscopy, ion-surface interactions, thermal properties of thin films, strained layer heterostructures

James Economy
Synthesis and characterization of advanced composites thermosets and high surface area adsorption systems

Gert Ehrlich, Emeritus
Surface studies including crystal growth on the atomic level, atomic interactions and clusters

Richard J. Gaylord, Emeritus
Nontraditional programming languages for scientific computing, computer simulation, cellular automata studies

Phillip H. Geil
Processing–morphology–property relationships in polymers, blends, and composites

Steve Granick
Polymers and biopolymers, nanorheology/tribology, surface spectroscopies

Joseph Greene, Emeritus
Thin-film physics, surface science, crystal growth, electronic properties

Russell Jamison
Biomaterials, tissue engineering scaffolds, bioactive polymers and ceramics, bone and cartilage replacements

Duane D. Johnson
Materials theory and computation materials science to calculate physical properties and processes in materials, especially those tied directly to characterization experiments

Waltraud M. Kriven
Phase transformations in oxide ceramics (TEM, high-temp XRD and synchrotron), processing-microstructure-property relations in structural ceramics and composites, synthesis of oxide fibers, bioceramics, electron microscopy

Jennifer A. Lewis
Colloidal assembly, phase behavior of complex fluids, direct-write assembly, rheology, drying, film formation

Erik Luijten
Theoretical and computational statistical mechanics and thermodynamics of materials, phase behavior of complex fluids (polymers, ionic liquids, colloidal systems), development of computational methods

David A. Payne
Electrical ceramics, dielectric materials, microstructure-property relations, processing, characterization, ferroics, crystal growth, materials chemistry, sol-gel, magneto resistance

Ian M. Robertson
Radiation effects in materials, micromechanics and micromechanisms of fracture in aggressive and nonaggressive environments, electron microscopy

Angus A. Rockett
IV, III–V, and chalcogenide semiconductors, materials for solar cells, theory of crystal growth, defects in semiconductors, contact metallurgies, solid phase reaction kinetics, surface science, microelectromechanical systems

John A. Rogers
Electroactive polymers, plastic electronics, microfluidics, elastomers, soft lithography

T. J. Rowland, Emeritus
Experimental physics of solids, nuclear magnetic resonance, electronic structure of matter

Kenneth S. Schweizer
Statistical mechanical theories of structure, self-assembly, thermodynamics, phase transitions, rheology and dynamical phenomena in macromolecular solutions, melts and alloys, colloidal and nanoparticle suspensions, and other complex fluids and soft materials

Jian-Ku Shang
Solid interfaces, composite materials adhesion, structural ceramics, layered materials
Moonsub Shim
Nanoscale materials, chemistry and physics of low-dimensional systems, nanomaterial/biomolecule interfaces and hybrid structures, semiconductor nanocrystals, carbon nanotubes

Yong-Qian Sun
Mechanical properties, high-temperature alloys, dislocations and crystal defects, phase transformations, intermetallic alloys, defect formation under wear-failure stresses

C. Marvin Wayman, Emeritus
Phase transformations, martensitic transformations, shape memory alloys, electron microscopy

John H. Weaver
Nanostructured materials; surface and interface phenomena for metals, semiconductors, superconductors, and insulators; ordered and disordered solids; clusters and fullerene-based systems

Gerald P. Wirtz, Emeritus
Electrical ceramics, catalysts, structure of oxides, high-temperature fuel cells and electrolyzers

Gerard C. L. Wong
Biopolymers, biomolecular materials, biological and biomimetic self-assembly, gene therapy, synchrotron x-ray probes

J. Francis Young, Emeritus
Chemistry and microstructure of cements and concretes, chemically bonded ceramics, solidification and immobilization of hazardous wastes

Jian-min Zuo
Direct observation of chemical bonds in crystals; surface, interface structures and bonding and their effects on the mechanic and electronic properties of advanced materials; charge states, charge fluctuations and low-dimensional charged phases in complex oxides; advanced electron microscopy and nanocrystallography

Mechanical and Industrial Engineering

Andrew G. Alleyne
Automotive systems, control systems

Narayan R. Aluru
Bioengineering, computational science and engineering, engineering mechanics, fluid dynamics, nano-, micro-, and meso-technology

Armand J. Beaudoin
Bioengineering, materials behavior, materials processing

Joseph Bentsman
Control systems, dynamic systems

Lawrence A. Bergman
Dynamic systems

M. Quinn Brewster
Combustion and propulsion, heat transfer

Richard O. Buckius
Combustion and propulsion, fluid dynamics, heat transfer

Clark W. Bullard, Emeritus
Energy systems and thermodynamics, environmental engineering, heat transfer

Bei Tse Chao, Emeritus
Heat transfer, fluid dynamics

John C. Chato, Emeritus
Bioengineering, energy systems and thermodynamics, heat transfer

Thomas F. Conry
Nano-, micro-, and meso-technology

J. Craig Dutton
Combustion and propulsion, energy systems and thermodynamics, fluid dynamics, heat transfer

Edward R. Damiano
Bioengineering, computational science and engineering, fluid dynamics

Jonathan A. Dantzig
Computational science and engineering, engineering mechanics, fluid dynamics, heat transfer, materials behavior, materials processing
Richard E. DeVor, Research Professor
Engineering statistics and quality control, environmental engineering, manufacturing systems, nano-, micro-, and meso-technology

Geir E. Dullerud
Control systems, dynamic systems

William E. Dunn
Computational science and engineering, control systems, energy systems and thermodynamics, fluid dynamics, heat transfer

Placid M. Ferreira
Design methodology and tribology, manufacturing systems, production management

John G. Georgiadis
Bioengineering, computational science and engineering, energy systems and thermodynamics, fluid dynamics, heat transfer

Nick G. Glumac
Combustion and propulsion, energy systems and thermodynamics, materials processing

Elizabeth Hsiao-Wecksler
Bioengineering, control systems, dynamic systems, engineering mechanics

Yonggang Y. Huang
Computational science and engineering, engineering mechanics, materials behavior, nano-, micro-, and meso-technology

Anthony M. Jacobi
Energy systems and thermodynamics, fluid dynamics, heat transfer, nano-, micro-, and meso-technology

Sheldon H. Jacobson
Operations research

Harley Johnson
Computational science and engineering, engineering mechanics, materials behavior, nano-, micro-, and meso-technology

Shiv G. Kapoor
Engineering statistics and quality control, environmental engineering, manufacturing systems, nano-, micro-, and meso-technology

Scott D. Kelly
Computational science and engineering, control systems, dynamic systems, engineering mechanics

Diego Klabjan
Computational science and engineering, operations research, production management

Helmut H. Korst, Emeritus
Fluid dynamics, combustion and propulsion

Herman Krier
Combustion and propulsion, fluid dynamics, heat transfer, energy systems and thermodynamics

Mark J. Kushner
Energy systems and thermodynamics

Dimitrios Kyritsis
Automotive systems, combustion and propulsion, energy systems and thermodynamics, heat transfer

Carl S. Larson, Emeritus
Design methodology and tribology

Chia-Fon Lee
Automotive systems, combustion and propulsion, computational science and engineering, energy systems and thermodynamics, environmental engineering, fluid dynamics, heat transfer

Judith S. Liebman, Emeritus
Operations research

Chang Liu
Microfabrication, microfluidics, MEMS for nanotechnology (M4N), nano-, micro-, and meso-technology, sensors, wireless networks

Thomas J. Mackin
Bioengineering, design methodology and tribology, engineering mechanics, materials behavior, nano-, micro-, and meso-technology, operations research

Norman R. Miller
Control systems, design methodology and tribology, dynamic systems, nano-, micro-, and meso-technology

Ty A. Newell
Energy systems and thermodynamics, environmental engineering, fluid dynamics, heat transfer
Udatta S. Palekar  
Engineering statistics and quality control, operations research, production management

Arne J. Pearlstein  
Computational science and engineering, fluid dynamics, materials processing

Curtis O. Pedersen, Emeritus  
Energy systems and thermodynamics

Michael L. Philpott  
Design methodology and tribology, manufacturing systems, nano-, micro-, and meso-technology

Leslie M. Phinney  
Energy systems and thermodynamics, heat transfer, nano-, micro-, and meso-technology

Andreas A. Polycarpou  
Design methodology and tribology, dynamic systems, materials behavior, nano-, micro-, and meso-technology

M. Taher A. Saif  
Bioengineering, engineering mechanics, materials behavior, nano-, micro-, and meso-technology

Huseyin Sehitoglu  
Engineering mechanics, materials behavior

Peter Seiler  
Computational science and engineering, control systems, dynamic systems

Mark A. Shannon  
Bioengineering, computational science and engineering, heat transfer, materials processing, nano-, micro-, and meso-technology

Darrell F. Socie  
Design methodology and tribology, materials behavior

Wilbert F. Stoecker, Emeritus  
Energy systems and thermodynamics

James A. Stori  
Manufacturing systems, operations research

Daniel A. Tortorelli  
Computational science and engineering, design methodology and tribology, engineering mechanics

Charles L. Tucker  
Computational science and engineering, engineering mechanics, fluid dynamics, heat transfer, materials behavior, materials processing

Alexander F. Vakakis  
Dynamic systems

S. Pratap Vanka  
Combustion and propulsion, computational science and engineering, energy systems and thermodynamics, fluid dynamics, heat transfer, materials processing, nano-, micro-, and meso-technology

John S. Walker  
Fluid dynamics, materials processing

Robert A. White, Emeritus  
Fluid mechanics, automotive systems

Xudong Zhang  
Bioengineering, computational science and engineering, human factors and ergonomics

Nuclear, Plasma, and Radiological Engineering

Roy A. Axford  
Application of the Lie Theory of Local Transformation Groups to the solution of linear and nonlinear systems of differential equations that arise in engineering science, theoretical physics, applied mathematics, computational physics of nuclear energy systems

Brent J. Heuser  
Hydrogen/metal systems, defects in materials, thin-film structures, numerical simulations of spallation source systems, neutron scattering techniques

Barclay G. Jones  
Thermal-hydraulics, reactor safety, multiphase flow, boiling heat transfer, turbulence measurement and modeling, flow-induced vibrations and hydroacoustics, human-machine interfaces for reactor control and simulation, food irradiation-safety
George H. Miley
Fusion systems, plasma engineering, reactor kinetics and control, nuclear pumped lasers, direct energy conversion, hydrogen energy production and fuel cells, low-energy nuclear reactions in solids

Magdi Ragheb
Computational methods, reactor theory, Monte Carlo methods, radiation protection and shielding, probabilistic risk assessment, applied artificial intelligence, supercomputing

David N. Ruzic
Experimental fusion research, modeling of edge plasma atomic physics, atomic properties of potential first-wall materials, plasma-material interaction, plasma processing of semiconductors, extreme ultraviolet (EUV) sources for lithography, physical and chemical vapor deposition

Clifford E. Singer
Energy economics, energy and security, advanced propulsion systems, nuclear proliferation, South and Northeast Asia nuclear programs

James F. Stubbins
Development, analysis, and application of materials, primarily for energy-related applications; nuclear systems design and analysis; nuclear materials, irradiation damage and effects, mechanical properties, high temperature corrosion, electron microscopy

Rizwan Uddin
Nuclear reactor theory, homogenization techniques, computational methods, reactor thermal hydraulics, virtual nuclear systems, nonlinear dynamical systems, computational biology

Alexey Bezryadin
Experimental condensed matter, nanometer-scale mesoscopic physics, molecular electronics, quantum phase transitions in one-dimensional superconductors, DNA electronics

David M. Ceperely
Helium, computational condensed matter physics, electronic structure, quantum statistical mechanics, Monte Carlo methods, low-temperature physics, high-pressure physics

Yia-Chung Chang
Theoretical condensed matter physics, electronic properties of semiconductors, theoretical solid state physics

Tai-Chang Chiang
Experimental condensed matter physics, surface science

Robert Clegg
Experimental biophysics, including nucleic acid (DNA/RNA) structures and conformational changes

S. Lance Cooper
Experimental condensed matter physics, optical effects in solids, Raman scattering, spectroscopic studies of low carrier density magnetic systems, spectroscopic studies of the magnetic oxides

Karin Dahmen
Condensed matter physics, nonequilibrium dynamical systems, including pattern formation in homogeneous systems and inhomogeneous systems with quenched disorder

Paul T. Debevec
Experimental nuclear physics, muon physics, fundamental interactions and properties of elementary particles

James N. Eckstein
Experimental condensed matter physics, electronic and quantum electronic properties of complex oxide materials; thin-film-based devices using heterostructures of different complex oxide phases; II-V semiconductor materials grown by MBE; electro-optic devices incorporated into integrated optic circuits

Bob I. Eisenstein, Emeritus
Experimental high-energy physics, weak interactions of B mesons

Physics

Gordon A. Baym
Condensed matter, theoretical nuclear physics, theoretical astrophysics

Douglas H. Beck
Medium and high energy nuclear physics, in particular, the structure of and electroweak interactions with the nucleon and few-nucleon systems; fundamental symmetries in particles, nuclei, and atoms; laser physics
Aida X. El-Khadra
Theory and phenomenology of fundamental particle interactions, including QCD, weak interactions, lattice field theory, heavy quark physics, standard model parameters

Steven M. Errede
Experimental high-energy physics, collider physics, electroweak interactions, strong interactions fundamental forces

C. Peter Flynn
Experimental condensed matter physics, materials physics; defects and diffusion; magnetism; low-energy electron microscopy; crystal growth

Eduardo Fradkin
Theoretical condensed matter physics, field theoretic problems of condensed matter systems; statistical mechanics of frustrated and disordered systems; electronic properties of disordered systems; phase transitions in 2-D systems; high temperature superconductors, strongly correlated systems, fractional quantum Hall effect

Hans Frauenfelder, Emeritus
Biological physics

Charles Gammie
Theoretical astrophysics, including theory of star and planet formation, accretion disks and related phenomena, galactic structure, astrophysical fluid dynamics, computational astrophysics

Russell W. Giannetta
Experimental condensed matter physics, including superconductivity, low temperature physics, mesoscopic physics

Gary E. Gladding
Experimental high-energy physics, mixing of charmed mesons, physics education research

Paul Goldbart
Theoretical condensed matter physics, random systems, mesoscopic physics, superconductivity and superfluidity

Nigel Goldenfeld
Theoretical condensed matter physics, pattern formation in spatially extended systems, high-temperature superconductivity, biocomplexity, statistical mechanics, polymers, liquid crystals, disordered systems, pattern formation in nonlinear systems far from equilibrium, high temperature superconductivity

George Gollin
Experimental high-energy physics, interactions of the electroweak gauge bosons

Andrew V. Granato, Emeritus
Experimental condensed matter physics, properties of simple liquids and glasses, amorphous materials

Enrico Gratton
Experimental biological physics, fast relaxation in enzymes, fluorescence properties, hydration of proteins, ir spectroscopy of biological substances

Laura H. Greene
Experimental condensed matter physics, highly correlated electron systems, high-temperature superconductivity, novel materials

Taekjip Ha
Experimental biological physics, DNA-protein, protein-protein interactions, protein and RNA folding, membrane biophysics, fluorescence microscopy of biological systems, single-molecule spectroscopy and manipulations

David Hertzog
Experimental nuclear physics, precision muon physics

Lillian Hoddeson
History of 20th-century science and technology, including electronics, atomic weapons, modern physics, big science, oral history

Leland E. Holloway, Emeritus
Experimental high-energy physics

Alfred Hübner
Nonlinear and complex dynamics, control of chaos, pattern formation, information flows, science education

Icko Iben, Jr., Emeritus
Structure and evolution of stars, comparisons between theoretical models of stars and observed properties of stars

E. A. Jackson, Emeritus
Dynamic lessons from nature’s evolutionary processes, human creativity

Thomas Junk
Experimental high-energy physics, search for the Higgs boson
Sheldon Katz  
Theoretical high-energy physics, algebraic geometry and its interaction with theoretical physics, especially string theories and supersymmetric field theories

Miles V. Klein, Emeritus  
Experimental condensed matter physics; optical effects in solids; electronic, vibrational, and magnetic excitations in solids

John Kogut  
Theoretical high-energy physics, lattice gauge theory, deep inelastic phenomena

Paul G. Kwiat  
Experimental atomic, molecular, and optical physics; foundations of quantum mechanics, especially tests of nonlocality, interaction-free measurements, generation of entangled states, and the principle of complementarity (including demonstrations of quantum erasers); quantum information physics

Frederick K. Lamb  
Theoretical high-energy and relativistic astrophysics; properties of strong gravitational fields and ultradense matter; neutron stars, pulsars, and black holes; X-ray and gamma-ray stars; gravitational radiation; gas and magnetofluid dynamics, electromagnetic radiation processes, and radiation transport; nuclear and space weapons, missile defense, arms control, space policy

Susan A. Lamb  
Theoretical astrophysics; galaxy collisions and star formation

Anthony J. Leggett  
Theoretical condensed matter physics, macroscopic manifestations of quantum mechanics, foundations of QM, superfluid \(^3\)He, thermal and acoustic properties of glass, high-temperature superconductivity, Bose-condensed alkali gases, formation of topological defects in quenching

Robert G. Leigh  
Theoretical high-energy physics, quantum field theory, supersymmetric gauge theory, superstring theory

Tony M. Liss  
Experimental high-energy physics, proton–antiproton collisions, top quark physics

Naomi C. R. Makins  
Experimental nuclear physics, hadronic structure, origin of spin in the proton and neutron, nucleon structure

Richard M. Martin  
Theoretical condensed matter physics, the electronic structure of condensed matter

Telemachos Mouschovias  
Theoretical astrophysics, interstellar gas dynamics, theory of star formation in the presence of magnetic fields

Alan M. Nathan  
Experimental nuclear physics, physics of sports

Munir H. Nayfeh  
Experimental and theoretical atomic physics, laser atomic spectroscopy, silicon nanotechnology

Yoshitsugu Oono  
Theoretical statistical physics in the broadest sense (nonequilibrium, including biological, hydrodynamical, and dynamical systems), applied mathematics

Vijay R. Pandharipande  
Theoretical nuclear physics, many-body theory, neutron star matter

Jen-Chieh Peng  
Experimental nuclear physics, heavy ion physics, parton structures of the nucleons and nuclei, including production and decays of charm and beauty mesons

Matthias Grosse Perdekamp  
Experimental high-energy nuclear physics, nucleon structure, spin-dependent structure of the proton, quark transversity distribution in the proton, spin dependent quark fragmentation functions

Philip W. Phillips  
Theoretical condensed matter physics, quantum critical phenomena, quantum magnetism, strongly correlated electrons

David Pines, Emeritus  
Theoretical condensed matter physics, liquid helium, astrophysics, plasma physics

Kevin T. Pitts  
Experimental high-energy physics, CP violation in bottom quark decays

Ian K. Robinson  
Experimental condensed matter physics, x-ray diffraction, surfaces, interfaces
Myron B. Salamon  
Experimental condensed matter physics, phase transitions, superconductivity, magnetic behavior of oxides and nanophase materials

Klaus Schulten  
Theoretical biological physics, statistical physics, computational physics

Mats Selen  
Experimental high-energy physics, production and decays of heavy “b” and “c” quarks

Paul Selvin  
Experimental biological physics, new forms of resonance energy transfer techniques, structure and dynamics of biological macromolecules

Stuart L. Shapiro  
Theoretical astrophysics, general relativity, physics of black holes and neutron stars, gravitation, dynamics of large N-body dynamical systems; computational physics and astrophysics; numerical relativity

Ralph O. Simmons, Emeritus  
Experimental condensed matter physics

Charles P. Slichter, Emeritus  
Experimental condensed physics, nuclear magnetic resonance, NMR studies of high-temperature superconductors

John D. Stack  
Theoretical high-energy physics, quantum field theory, lattice field theory, QCD

Michael Stone  
Theoretical condensed matter physics, statistical physics, mathematical physics, quantum field theory

Jeremiah D. Sullivan  
Nuclear nonproliferation, arms control and international security, science policy

Jon J. Thaler  
Experimental high-energy physics, properties of bottom and charmed quarks and the tau lepton

Dale J. Van Harlingen  
Experimental condensed matter physics, superconductivity, microfabrication of superconductor devices, scanning probe microscopy, mesoscopic systems

Benjamin D. Wandelt  
Theoretical cosmology, cosmic microwave background, structure formation, dark matter, early universe

William D. Watson, Emeritus  
Theoretical astrophysics, interstellar medium, atomic and molecular processes

Albert Wattenberg, Emeritus  
History of physics

Michael Weissman  
Experimental condensed matter physics, 1/f; noise, spin-glasses, amorphous materials, inhomogeneous phase transitions

Scott Willenbrock  
Theoretical high-energy physics, including strong, weak and electromagnetic interactions, Higgs phenomenon

James E. Wiss  
Experimental high-energy physics, photoproduction of charmed mesons, precision study of the B meson

James P. Wolfe  
Experimental condensed matter physics, optical properties of semiconductors, phonon imaging

Ali Yazdani  
Experimental condensed matter physics, physics of nanostructures, scanning probe microscopy, atomic manipulation, tunneling spectroscopy, properties of correlated and low dimensional electron systems, mesoscopic physics

Theoretical and Applied Mechanics

Ronald J. Adrian  
Turbulent boundary layers, turbulent thermal convection, experimental fluid mechanics, geophysical fluid dynamics, microfluidics, turbulence physics

S. Balachandar  
Computational fluid dynamics, convection, flow instability, geophysical fluid dynamics, multiphase flows, particulate flows, turbulence physics, vortex dynamics

Donald E. Carlson  
Continuum thermomechanics, elasticity
Sahraoui Chaïeb
Biological mechanics, experimental fluid mechanics, experimental solid mechanics, microfluidics, micromechanics, multiphase flows, particulate flows, phase transitions, smart materials

Jonathan B. Freund
Acoustics, atomistic models, compressible flow, computational fluid dynamics, nonlinear waves, numerical methods, turbulence physics

Eliot Fried
Biological mechanics, constitutive theory, experimental fluid mechanics, granular materials, particulate flows, phase transitions, smart materials

Gustavo Gioia
Biological mechanics, boundary layers, constitutive theory, continuum mechanics, foams, granular materials, phase transitions, turbulence physics

Robert B. Haber
Atomistic models, computational fluid dynamics, computational solid mechanics, continuum mechanics, elasticity, fracture, materials processing, numerical methods

Kimberly M. Hill
Experimental fluid mechanics, granular materials, multiphase flows, particulate flows

K. Jimmy Hsia
Experimental solid mechanics, fracture, micromechanics, plasticity

Richard D. Keane
Experimental fluid mechanics

Robert D. Moser, Jr.
Chaos, compressible flow, computational fluid dynamics, numerical methods, turbulence physics, vortex dynamics

James W. Phillips
Experimental solid mechanics

William R. C. Phillips
Biological mechanics, boundary layers, environmental effects, flow instability, geophysical fluid dynamics, nonlinear waves, turbulence physics, vortex dynamics

Daniel N. Riahi
Boundary layers, convection, flow instability, geophysical fluid dynamics, materials processing, multiphase flows, nonlinear waves, turbulence physics

D. Scott Stewart
Combustion, compressible flow, computational fluid dynamics, continuum mechanics, detonation and shock physics, multiphase flows, nonlinear waves, numerical methods, phase transitions

Mark Short
Combustion, compressible flow, detonation and shock physics, nonlinear waves

Petros Sofronis
Atomistic models, computational solid mechanics, continuum mechanics, elasticity, plasticity, environmental effects, fracture, granular materials, materials processing, micromechanics, plasticity, smart materials

Nancy R. Sottos
Experimental solid mechanics, micro- and nano-mechanics, self-healing materials, composite materials, thin film reliability

Richard L. Weaver
Ultrasonics, stochastic waves, structural acoustics, disordered and complex structures, quantitative nondestructive evaluation