UCONN ENGINEERING
INDUSTRY
OPEN HOUSE
FRIDAY, NOVEMBER 1, 2013 8:30AM TO NOON | UNIVERSITY OF CONNECTICUT, STORRS, CT

UCONN SCHOOL OF ENGINEERING

CO-SPONSORS:
CONNECTICUT INNOVATIONS, INSTITUTE OF MATERIALS SCIENCE, UCONN OFFICE OF THE VICE PRESIDENT FOR ECONOMIC DEVELOPMENT, UCONN OFFICE OF THE VICE PRESIDENT FOR RESEARCH
Welcome!

Thank you for participating in UConn Engineering’s first-ever Annual Industry Open House.

We are excited to showcase a selection of our innovation-driven faculty research and to meet with you one-on-one to discover, together, pathways toward collaboration that will energize and enhance your business.

As you stroll through the exhibit hall, you will see more than 70 posters summarizing a fraction of the research and commercialization activities underway at UConn that can help you innovate, lower production and materials costs, improve plant efficiency, explore new technologies, license UConn-developed IP and improve your operation.

Be sure to visit the Education & Economic Development posters and speak with their representatives as well.

UConn Engineering currently collaborates with more than 100 companies on different areas of research innovation, SBIR ventures, and sponsored capstone Senior Design projects that allow our students to gain invaluable hands-on design and development experience. There are many avenues that we can explore together with your company.

One-on-One Meetings

For those who reserved one-on-one “speed dates” with our innovators, please consult the Faculty Find Legend and ballroom floorplan contained in this program to locate your meeting table(s).

If you didn’t book a reservation for a one-on-one meeting, there may still be times available. Don’t hesitate to ask a faculty member whether they can accommodate an unscheduled “speed date” during today’s Open House.

Before leaving today, we would appreciate your feedback on the event: simply complete the enclosed Comments slip and hand it to one of our staff posted at the ballroom entryway. We hope to see you again!

Cordially,

Kazem Kazerounian
Interim Dean, School of Engineering and Professor, Mechanical Engineering
<table>
<thead>
<tr>
<th>Area/Faculty Member</th>
<th>Poster #</th>
<th>Speed Date Table #</th>
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<td>Pinar Zorlutuna</td>
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<td><strong>High Performance Computing, Cybersecurity, Big Data</strong></td>
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<td>Mohammad Tehranipoor</td>
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**Environment**

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**Imaging & Visualization**

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**Materials (Bio, Energy, Mfg.)**

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**Nanotechnology**

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**Process Modeling, Systems Optimization & Control**

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### Faculty Find Legend

**Industry Open House November 1, 2013**

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</table>
ALEXANDER G. AGRIOS
CIVIL & ENVIRONMENTAL ENGINEERING

Phone: (860) 486-1350
E-mail: agrios@engr.uconn.edu
Website: http://agrios.engr.uconn.edu

Keywords:
Nanomaterials; Composites; Catalysis; Photovoltaics; Dye-sensitized solar cells; Environmental photocatalysis

Summary:
Composite nanoscale semiconductors: Two metal oxides with different compositions and morphologies are combined, with each material playing a distinct role: one (the active layer) forms the high-surface area interface at which optoelectronic of photoelectrochemical processes occur; the other (the transport layer) rapidly relays charge from the active layer to the underlying conducting substrate.

Molecularly tethered nanocatalysts: Platinum nanoparticles (< 2 nm) are chemically attached to a semiconductor surface via a bifunctional molecule capable of binding to both the semiconductor and the metal while providing electronic coupling between the two. Applications include photovoltaics, solar fuels, sensing, and displays.
MARK AINDOW
MATERIALS SCIENCE & ENGINEERING

Phone: (860) 486-2644
E-mail: m.aindow@uconn.edu
Website:
http://www.ims.uconn.edu/~aindow/

Keywords:
Electron microscopy, microstructural development, defects, interfaces, alloys, thin films, composites, catalytic nanostructures

Summary:
Dr. Aindow is the Associate Director of the Institute of Materials Science. The emphasis of Dr. Aindow’s current programs is on microstructural development in a variety of engineering materials. The main approach is the use of advanced electron microscopy techniques to reveal the microstructural details that dictate the behavior of materials. These projects include: conductive oxide coatings for solid oxide fuel cell interconnects (NSF/United Technologies Research Center); metals and alloys for electrical circuit breaker applications (GE); electroplated cobalt-phosphorus coatings as replacements for hard chrome (US Chrome); novel high-strength aluminum-based alloys for aerospace applications (Pratt and Whitney/DARPA).
RED A. AMMAR
COMPUTER SCIENCE & ENGINEERING

Phone: (860) 486-5285
E-mail: reda.ammar@uconn.edu
Website: http://www.engr.uconn.edu/~reda/

Keywords:

Summary:
Hierarchical performance modeling to design efficient application: Techniques to evaluate sequential and distributed systems have been investigated. Results were integrated in Hierarchical Performance Modeling System (HPMS) to provide a general-purpose methodology to support the development of the performance-oriented software applications including distributed objects and real-time systems. It provides quantitative performance assessment of an entire system comprising of hardware, software and communication. It assists the system developers to incorporate performance metrics very early in the design process. Techniques are used to evaluate and optimize developing efficient parallel and distributed applications via restructuring, partitioning, allocation and scheduling.

Efficient Deployment Algorithms for Wireless and Underwater Sensor Networks: Techniques to efficiently determine the number and locations of sensors for wireless and underwater networks. It includes routing algorithms and scheduling approaches for different settings. We assume static setting and dynamic setting. In the later one, we employed adaptive power control to handle mobile networks. We also design, implement and evaluate an adaptive power controlled routing scheme for different network applications.
EMMANOUIL ANAGNOSTOU
CIVIL & ENVIRONMENTAL ENGINEERING

Phone: (860) 486-2298
E-mail: manos@engr.uconn.edu
Website: www.engr.uconn.edu/environ

Keywords:
Global precipitation measurement from remote sensing; Hydro-meteorological modeling for the prediction of floods; Underwater passive aquatic listening for marine application; Numerical weather prediction and data assimilation; Damage modeling for electric distribution networks

Summary:
Intelligent Ambient Noise Sensors for Monitoring the Oceanic Environment: The sustainable protection and management of the oceans requires a comprehensive understanding of the processes and conditions that affect the state of the marine environment. To support this need, we are developing remote sensing techniques for smart detection and categorization of the ambient sounds into multiple sources, such as, environmental (rainfall and wind speed), anthropogenic (ships, drillings), biological (e.g. marine mammals) and geological (seismic activities, volcanic eruptions, landslides), and the quantification of the abovementioned classified sources.

Weather-Based Damage Prediction on Electric Distribution Network: New England is a densely forested region of the US, frequently affected by severe winds and precipitation that often leads to power outages. Our team is developing a weather-based power outage prediction system tailored for the Northeast Utilities service territories. The prediction framework utilizes forecasted values of meteorological parameters from a state-of-the-art numerical weather prediction model combined with infrastructure data and vegetation parameters to provide operational estimates of the number and spatial distribution of power outages over the region for an approaching weather event.
Keywords:
Aerosol-cloud-radiation interactions, regional and global scale atmospheric modeling, anthropogenic and natural aerosol influence to extreme weather events

Summary:
Dust storm episodes have multiple effects on aircraft flight operations with consequences on the flight safety (erosion, corrosion, engine performance) as well as financial implications. State-of-the-art atmospheric modeling systems are capable of simulating the desert dust particles emission, transport, deposition and concentration, including detailed information on the particle characteristics (mass and size) and location. The knowledge of the aforementioned dust fields and meteorological conditions will reproduce the flow field around a complex structure (aircraft) that would facilitate the estimation of the potential damages from the dust particle intrusion. The combined use of modeling techniques and atmospheric measurements is designed to benefit flight operations, maintenance procedures and engine protection in areas affected by frequent dust particle intrusions.
JOHN BAU
CENTER FOR CAREER DEVELOPMENT

Phone: (860) 486-6666
E-mail: john.bau@.uconn.edu
Website:
http://www.career.uconn.edu
http://www.linkedin.com/in/johnbau

Keywords:
Career Fairs, Job and Internship Postings, Experiential Learning Collaborations, Company Information Sessions, On-Campus Interviewing, Campus Brand-Building Opportunities, On-Campus Recruiting, Networking

Summary:
Mr. Bau serves as the embedded Career Consultant for the School Engineering from the UConn Center for Career Development. With nearly 20 years of experience in technology staffing and higher education, John seeks to build bridges between industry partners and UConn students in ways that can benefit both. John coaches students in communication-oriented skills to complement their technical classroom experiences to help prepare them for the workplace. Networking is a specific interest, and he is an avid proponent for professional use of social media, such as LinkedIn, in the job search. He can assist employers in developing campus branding and recruiting strategies to help them reach the right students at the right time to meet their staffing goals – in both engineering and non-technical roles.
Keywords:
Electric Motor Drives, Motor Control, Power Electronics, Electro-mechanics, Renewable Energy Systems

Summary:
Intelligent Control of Electric Drives: This area focuses on both offline design and real-time or online control of electric drives aiming at enhancing efficiency and reliability at minimal incremental cost. Induction machines have been the main focus of this area, but servo motors and synchronous machines (wound rotors and permanent magnet rotors) are of interest too. Experimental prototyping is used to verify efficiency and reliability enhancement by design. Also, real-time algorithms enhance efficiency through minimizing power losses, while reliability is enhanced through sensed and sensorless fault diagnosis and recovery. Applications range from basic drives for elevators and pumps, to advanced drives in electric traction, marine, and aerospace applications.

Distributed Energy Aggregation into Larger Systems: This area focuses on the modeling and energy conversion of various distributed generation resources ranging from small-scale applications (e.g., energy harvesting for sensors), to medium-scale applications (e.g., motor drives and stand-alone renewable energy systems), and large-scale applications (e.g., solar photovoltaic farms). Models that can be used in simulation platforms and hardware-in-the-loop applications are of main interest, in addition to the design and testing of the energy conversion stages and test-beds with integrated control algorithms.
GEORGE M. BOLLAS
CHEMICAL & BIOMOLECULAR ENGINEERING

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Keywords:

Summary:
Dr. Bollas’ work focuses on process modeling, dynamic simulation, optimization and control of energy related processes. Currently, his research focuses on chemical-looping combustion, biomass catalytic pyrolysis, coal and biomass to liquids conversion, Fischer-Tropsch synthesis, and catalyst deactivation in catalytic cracking applications. He is the recipient of the prestigious NSF CAREER Award and the ACS PRF Doctoral New Investigator Award. In his research he tries to close the gap between simulation and experimentation, by using modeling for the design of experimental reactors (eg, a conical spouted bed biomass catalytic reactor), to optimally design experiments for kinetics parameter estimation (eg, optimal experimental design for parameter estimation for reduction reactions of NiO chemical-looping), and to design model-predictive control structures of dynamic processes (eg, optimal control of a fluid catalytic cracker).
KEVIN BROWN  
BIOMEDICAL ENGINEERING

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Keywords:  
Complex Systems, Networks, Inverse Problems, Mathematical Modeling, Systems Biology, Bayesian and Nonparametric Statisticsial media mining, Mining of Web logs and software defect reports, System performance and dependability analysis

Summary:
Multimodal Data Fusion: Combining multiple data sets with complementary spatial and temporal resolution in order to obtain an integrated view of a process of interest is a difficult problem that arises in many disparate contexts. Two examples are (i) combining satellite measurements with ground-based sensors in earth science, and (ii) fusing simultaneous electroencephalographic and functional magnetic resonance measurements of human brain activity. I have developed BICAR, a new algorithm to extract paired sources of interest from two sets of sensor data with vastly different degrees of sensor coverage and sampling rate. BICAR is objective, flexible, extensible, specific, and symmetric.

Sloppy Models: Modeling complex systems presents several challenges: (i) uncertain parameters and model structure, (ii) the necessity of using simplified dynamics, and (iii) limited data availability. I designate problems with these challenges sloppy models. Sloppiness is ubiquitous, and sloppy models are a well-defined class of problem that arises in nonlinear systems with weak parameter constraints, and the resulting model space geometry has implications for understanding these systems. By using ensemble methods, I can generate confidence intervals on model predictions and yield robust, falsifiable models. These kinds of calculations can also be directly extended to both model selection and optimal experimental design.
CHENGYU CAO
MECHANICAL ENGINEERING

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Keywords:
Control theory and applications, system identification, modeling, parameter estimation, unmanned vehicles, robotics

Summary:
Parameter Estimation and System Modeling: Parameter estimation is widely used in both off-line system identification and on-line diagnostic. In structural health monitoring, nominal parameterized models are constructed for on-line performance monitoring. Component failure or performance degeneration will be manifested by the parameter shift and further detected by the on-line parameter estimation algorithm. We invented a novel polynomial adaptive estimator which can estimate nonlinear parameters instead of linear ones. It could be used in the modeling and structural health monitoring of non-linearly parameterized dynamic systems.

Advanced Adaptive Control: We developed a novel L1 adaptive controller and applied it to various applications. L1 adaptive control could handle time-varying uncertainties and improve transient performance by using fast and robust adaption. It has already been successfully tested on the NASA Airstar, UTAS air management system and so on. It enables the control system to deal with large time-varying uncertainties while maintaining desired performance.
BAKI M. CETEGEN  
MECHANICAL ENGINEERING

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Keywords:  

Summary:  
Experimental research is being conducted in reacting turbulent flows with the goal of understanding turbulent flow-flame interactions in technologically important reacting flows in high intensity combustion systems such as gas turbine combustors. Fundamental flame experiments are being conducted in canonical flame configurations to unveil the details of the combustion process with particular emphasis on flame extinction and blowout. Detailed planar laser diagnostic imaging of velocity and chemical species allows better understanding of these complex processes and provide valuable experimental data for model validation.

Thermodynamic analyses of a new type of propulsion system based on rotating detonation waves are being conducted to determine the salient features of this process that may enable simpler and more efficient propulsion devices. Detailed computational analyses are utilized to extract simpler thermodynamic models that can be used for parametric studies for evaluations of performance.
Keywords:
Heat and mass transfer, energy materials

Summary:
Materials used in energy storage and conversion (e.g. fuel cells, batteries, electrolyzers, CO2 separation membranes) all consist of heterogeneous functional materials that exhibit functional behavior in a manner that controls their collective performance as an energy system. There is a critical need to understand the role of a material’s structure, morphology, and composition on system performance. This seminar presents a non-destructive approach to image and characterize energy materials using synchrotron-based transmission x-ray microscopy. Three-dimensional structures within the sample volume are imaged and tomographically reconstructed at up to 17 nm spatial resolution. Several theoretical approaches including numerical methods (lattice Boltzmann, finite element) and analytical methods (electrochemical fin theory) are used to analyze mass transfer, heat transfer, ionic/electronic charge transfer, and chemical / electrochemical reaction rates. To demonstrate this approach, solid oxide fuel cell and in Li-ion battery electrodes are examined to provide fundamental insight into the origins of microstructured-induced transport losses during operation.
RICHARD E. CHRISTENSON
CIVIL & ENVIRONMENTAL ENGINEERING

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Keywords:
Structural vibrations, shake table testing, vibration monitoring

Summary:
Rich Christenson’s research interests are in structural engineering, particularly in the areas of structural dynamics and experimental research. His current research is in the areas of smart damping technologies for buildings and bridges, bridge monitoring, and real-time hybrid testing methodologies. Laboratory testing facilities of interest include a single axis and six degree-of-freedom (6DOF) shake table with associated sensor and data acquisition technologies. Field testing capabilities include a portable wireless monitoring system including up to 20 channels of acceleration and strain measurements to measure structural response, deterioration and existing conditions useful in the physical evaluation of structural performance.
JUN-HONG (JUNE) CUI
COMPUTER SCIENCE & ENGINEERING

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Keywords:
ROBERT DAY
SCHOOL OF BUSINESS

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Keywords: 703425
Operations research, spectrum markets, hospital management, scheduling, grid computing

Summary:
With a Ph.D. in Applied Mathematics and Operations Research from the University of Maryland, Professor Day is a world-leader in auction design research, with several billions of dollars in revenue generated for government consulting clients in telecommunications regulation. His work emphasizes the synthesis of cutting-edge ideas from Computer Science, Economics, and Operations Research. With additional research in Hospital Management, Scheduling, and Grid Computing, his work has been recognized with the Dantzig Dissertation Award, the INFORMS Computing Society Prize, and most recently, an Innovation in Teaching Award for his undergraduate course on Project Management.
AVINASH M. DONGARE
MATERIALS SCIENCE & ENGINEERING

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Keywords:
Computational materials science, nanostructured materials, structural materials, multi-scale modeling, materials in extreme environments, interfaces

Summary:
Research focuses on the investigation of the atomic scale processes related to deformation and failure of materials (metallic alloys, ceramics, composites, etc.). The aim of the research is to enable an atomic scale design (structure, chemistry) of interfaces/surfaces that result in stronger materials, improved lifetimes for various applications as well as improved performance in extreme environments.
ENGINEERING AMBASSADORS
ENGINEERING DIVERSITY AND OUTREACH

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Keywords:
Diversity, Classroom Enrichment, Professional Presentation, Community Engagement, K-12 STEM Education, Communication, Leadership, Company Information Session, Networking, Collaboration, Internship

Summary:
UConn Engineering Ambassadors are a select group of the most talented engineering student leaders on campus! The Ambassadors have diverse academic and extracurricular backgrounds and are highly trained in effective communication and leadership skills. Engineering Ambassadors routinely give presentations to varied audiences and are extremely adept at handling complex communication situations and working effectively in a variety of teams. The outstanding engineering education at the University of Connecticut, unique internship opportunities with corporate partners, and the experiences provided through being an Engineering Ambassador position and prepare Ambassadors to be immediate leaders and contributors to the companies that they choose for employment.
**Monty A. Escabi**  
**Electrical & Computer Engineering**  
**Biomedical Engineering**

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**Keywords:**  
Central Auditory Physiology, Biologically Inspired Speech and Sound Recognition Systems, Auditory Prosthetics

**Summary:**  
Dr. Escabi’s research focuses on understanding how sounds are encoded in the brains of humans and animal, both at the single cell and network level. Findings from this basic research are being applied to new clinical applications for the hearing impaired and development of biologically inspired sound processing / recognition systems. Work is under way to develop and test signal-processing strategies for cochlear and auditory midbrain implants that attempt to replicate normal brain activity using optimization and closed-loop cortical feedback. He is also applying findings to the design of auditory neuron networks for sound recognition that incorporate biologically realistic spiking neurons and network architectures.
Keywords:

Summary:
Dr. Fan’s current research focuses on theoretical investigations of fluid mechanics and multiphase transport phenomena of complex fluids. Examples of these fluids are dispersions of nanoparticles, bubbles, proteins, lipid assemblies, and polymer mixtures, which have broad applications in manufacturing, energy, pharmaceutical, food, and life sciences. Understanding the fluid properties and flow behaviors of these dispersed materials is critical for tuning the stability and fluidicity in storage, manufacture, delivery, and relevant chemical processes.
AFSHIN GHIAEI
CONTINUING & DISTANT ENGINEERING EDUCATION

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Keywords:
Continuing education, online courses, distance education, customized programs, master of engineering, certificates

Summary:
The Continuing & Distance Engineering Education (CDEE) program at the UConn’s School of Engineering gives working engineers the ability to improve their skills in cutting-edge subject areas or to develop in-depth knowhow in areas tailored to their needs or the needs of their employers. The CDEE program also delivers coursework required by graduate students toward completion of their degrees; courses of interest to students who wish to expand their knowledge of specific subjects, either for credit or not for credit; and courses for practitioners and students who are interested in advancing their knowledge of specific subjects in a non-degree path.

In summary, the CDEE program offers:
- Master of Engineering (MENG)
- Advance Engineering Certificate (AEC)
- Graduate Courses (Non-degree)
- Corporate Education (Customized Training & Development)
KRYSTyna GIELO-PercZAK  
BIOMEDICAL ENGINEERING

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Keywords:  
Medical & Surgical devices; Prosthesis design; Musculo-skeletal modeling; Human-factors engineering; biomechanics; biomedical engineering related human body

Summary:  
My primary research focus is on the musculoskeletal system. My current research interests include:  
(i) Biomechanics of the Human Body  
(ii) Neuroengineering and Rehabilitation  
(iii) Orthotic Biomechanics  
(iv) Human Centered Design  
(v) Wearable Sensors Technology  
(vi) Prosthetic Biomechanics  
(vii) Robot–Aided Mobility  
Currently, my research projects are focused on biomechanical simulation, biomechanics of shoulder, balance control, development of medical and surgical devices, ergonomics, human factors engineering and biomechanical modeling.
SWAPNA S. GOKHALE
COMPUTER SCIENCE & ENGINEERING

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Keywords:
Social media mining, Mining of Web logs and software defect reports, System performance and dependability analysis

Summary:
Data Mining and Analysis: Mining of social media feeds to understand customers’ needs and opinions. Development of industry-specific frameworks, that can be applied to utilities, transportation, health care. Performance and Dependability Assessment: Sensitivity and tradeoffs in system performance and dependability based on system architecture.
Keywords:
Thermoelectricity, semiconductors, phase change memory, nano-scale, electrical characterization, finite element simulations, electronic transport

Summary:
Nanoelectronics Laboratory at UConn is equipped with electrical characterization tools for semiconductor characterization. We perform temperature dependent measurements on thin films and nano-scale devices using conventional and custom made tools. We also perform electro-thermal and semiconductor device simulations using COMSOL multi-physics and Synopsys Sensaurus.

Our main focus has been the electro-thermal processes at small scales and extreme conditions (e.g. thermal gradients in the order of 1-50 K/nm). Our work spans from fundamental understanding of physical processes to materials characterization and device modeling. We currently have a significant effort in phase change memory and actively collaborate with IBM Watson Research Center. Our research portfolio is supported by DOE Office of Basic Energy Sciences and NSF. The below publication is a highlight of our work on the electro-thermal processes in semiconductors:

http://www.nature.com/srep/2013/130923/srep02724/full/srep02724.html
SHALABH GUPTA
ELECTRICAL & COMPUTER ENGINEERING

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Keywords:

Summary:
Dr. Gupta’s research interests are directed towards cyber-physical systems with focus on two key areas: Big Data Analytics and Networked-control systems. Modern day human-engineered systems (e.g., aerospace systems, unmanned vehicles, and smart grid) are required to perform with either limited or no human supervision where complexity arises due to large-order dynamics, intricate component interconnections, and gradual growth of anomalies. Dr. Gupta’s research efforts include supervisory control as well as diagnostics & prognostics of such complex systems via developing new mathematical tools of data reduction, real-time robust pattern discovery, information fusion, and adaptive decision-making under uncertainty using multidisciplinary concepts derived from Formal Languages & Automata Theory, Symbolic Dynamics, and Statistical Mechanics. Application areas include aerospace systems, sensor networks, distributed robotics, unmanned vehicles, smart grid, and manufacturing systems.
Keywords:
Metallurgy, rapid solidification, phase transformations, additive manufacturing, steels, titanium alloys

Summary:
Rapid solidification processing (RSP) has over the last three decades greatly extended the range of commercial alloys. The deviations from equilibrium during RSP can induce novel phases or microstructures and hence contribute to alloys with improved properties. During additive manufacturing of metallic components cooling rates reach $10^4$ K/s locally and are therefore similar to cooling rates in traditional RSP. The fundamental knowledge of RSP is applied to additive manufacturing in order to modify compositions of existing commercial alloys or to develop new alloys, for example metallic glass alloys.
BRYAN D. HUEY  
MATERIALS SCIENCE & ENGINEERING

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Keywords:  
Nanotechnology, Materials Characterization, AFM, Ceramics, Semiconductors, Photovoltaics, Ferroelectrics, Tribology, Data Storage, Batteries, Biomechanics

Summary:  
The nmLabs features the fastest Atomic Force Microscope in the United States, providing novel insight into tribology at the nanoscale relevant to a range of industrial applications sensitive to friction and/or wear.

More generally, the nmLabs is constantly advancing the state of the art for nanoscale measurements particularly of mechanical and/or electronic properties. Recent and ongoing projects have uniquely mapped and/or manipulated mechanical compliance, piezoactuation, ferroelectricity, conductivity, photovoltaic efficiency, LED outputs, and battery performance.
HOREA ILIES
MECHANICAL ENGINEERING
COMPUTER SCIENCE & ENGINEERING

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Keywords:

Summary:
We are developing tools to automate the understanding of 3D scenes observed with 3D cameras. These developments can unlock incredible levels of expression and productivity in all activities that rely on semantic understanding of 3D environments, from engineering design, manufacturing and inspection, to autonomous navigation, assistive devices for visually impaired, surveillance, real-time task allocation and decision making for complex systems, computer aided surgery, and gaming. Our work in virtual reality on natural hand gesture-based interfaces and haptics assisted interaction have immediate applications in a number of industrial and consumer applications including CAD modeling, rational drug design, virtual assembly and inspection, teleoperation and game design.
INSTITUTE OF MATERIALS SCIENCE
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Research Instrumentation and Facilities
The Institute houses a wide range of advanced research instruments and facilities. These include:

- atomic force microscopy
- electron microscopy (SEM & TEM)
- high field characterization
- laser spectroscopy
- optical microscopy
- thermal analysis
- X-ray diffraction & spectroscopy
- Electrical Insulation Research Center
- computational modeling
- gas chromatography
- IR, Raman and UV spectroscopy
- NMR spectrometry
- polymer rheology
- surface analysis (AES & XPS)
- Clean Room

Graduate Programs
Materials Science; Materials Science & Engineering; Polymer Science

Degrees Offered
M.S., MEng., Ph.D. >150 graduate students perform research in IMS

Research Funding FY13
$8.3M in research expenditures

Publications
>227 journal papers in 2012/13

Industrial Associates
Projects include:
(a) Small one-off projects where industry needs scientific/technical support beyond that available in commercial service laboratories
(b) A subscription-based program of approximately 30 companies having an ongoing working relationship with IMS
(c) Large collaborative projects, often involving major federal support
FAQUIR JAIN
ELECTRICAL & COMPUTER ENGINEERING

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Keywords:
Biomaterials, tissue engineering, organic/inorganic composites, scaffold fabrication, ceramic coatings, in vitro and in vivo tests, 3D bio-imaging

Summary:
Miniaturized wireless biosensors, that can be subcutaneously inserted using a syringe, are being developed to continuously monitor glucose and other analyte levels to manage diabetes.

Quantum dot superlattice (QDSL) structures for electronics (novel 2-bit FETs, SRAM and flash memories) and high efficiency solar cells.
BAHRAM JAVIDI
ELECTRICAL & COMPUTER ENGINEERING

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Keywords:
3D Imaging, 3D Displays, Image recognition, image encryption, security, and authentication, object and hardware security

Summary:
The Optical Imaging and 3D Visualization Laboratory is focused on the state of the art research to design, assembly, implementation, and test optical and digital imaging systems, including three dimensional imaging, nano-scale imaging, low light level imaging, 3D integral imaging systems, 3D holographic display, stereo displays, 3D passive and active sensing and visualization, holographic microscopy, coherent imaging, incoherent imaging, optical measurements, multi spectral imaging, polarimetric imaging, compressive imaging, photon counting imaging, interferometric imaging, and bio-medical imaging.
ERIC JORDAN
MECHANICAL ENGINEERING

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Keywords:
Plasma spray, solution precursor plasma spray (LPPS), thermal barrier coatings, constitutive modeling, high temperature materials, life prediction

Summary:
Dr. Jordan has 9 funded projects, including 4 sponsored by industry. One active area is the fabrication of coatings by plasma spray primarily thermal barrier coatings for gas turbines although one very successful coating project was a nano wear coating for the Navy that saved $25 million. In plasma spray he and colleges developed a new version of plasma spray LPPS that plays a key role in his coatings work. In addition to coating fabrications, turbine projects include finite element modeling of coatings with nonlinear materials models, life predictions of coatings and non-destructive assessment of coatings with optical and x-ray tomography methods.
MOHAMMAD MAIFI HASAN KHAN
COMPUTER SCIENCE & ENGINEERING

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Keywords:
Distributed systems, mobile computing for preventative healthcare, cloud computing, performance modeling

Summary:
Troubleshooting of large scale distributed systems: Mohammad Khan is currently investigating reliability of large scale distributed systems, with an emphasis on cloud platform for real-time cyber-physical systems. Analyzing and understanding complex, large scale distributed systems such as data centers, computing clusters and wireless sensor networks from an empirical perspective is the primary focus of this research. He is applying key insights from data mining literature to come up with automated solutions that may help identify the complex distributed interactions that cause the systems to fail or perform poorly. The ultimate goals of this research are, first, to provide a rich collection of tools and techniques for troubleshooting large scale systems such as clusters and data centers, and second and more importantly, to provide a comprehensive understanding of the different failure modes and reliability challenges towards better and more reliable systems.

Leveraging cloud infrastructure for real-time integration of heterogeneous sensor streams: Mohammad Khan is investigating the possibilities of leveraging cloud infrastructure for real-time integration of heterogeneous sensor streams. This platform can be leveraged by different application domains such as remote patient monitoring, battlefield monitoring or smartgrid monitoring. The objective of the proposed research is to develop automated solutions that address the increasingly difficult challenge of performance troubleshooting and tuning of cloud based applications by synergistically exploiting techniques from hierarchical performance modeling, on-demand execution tracing, and discriminative sequence mining.
OMER KHAN
ELECTRICAL & COMPUTER ENGINEERING

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Keywords:
Nanotechnology, Materials Characterization, AFM, Ceramics, Semiconductors, Photovoltaics, Ferroelectrics, Tribology, Data Storage, Batteries, Biomechanics

Summary:
Professor Khan's research focuses on architecture methods to improve the performance, power, resiliency, and security of future microprocessors, including shared-memory multicores. For more details, see Professor Khan’s website, listed above.
KARTHIK C. KONDURI
CIVIL & ENVIRONMENTAL ENGINEERING

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Keywords:
Activity-based travel behavior, time use analysis, travel demand modeling and forecasting, transportation planning and policy analysis, integrated models of land-use and transport, econometric and statistical modeling methodologies

Summary:
Dr. Konduri’s primary research interest is in the field of transportation systems with an emphasis on microsimulation-based approaches to model and analyze travel behavior. In microsimulation approaches to travel demand modeling, activity-based approaches and tour-based approaches have widely been adopted. In both these approaches there are common themes, namely, the representation of individual’s time use i.e. what activities, where, how, and with whom are activities pursued and travel behavior i.e. what trips are entailed, and by what mode in pursuing activities. Dr. Konduri’s research involves the exploration of different dimensions of time use and travel behavior including examination of activity engagement patterns, intra-household interactions and their role in the formation of household activity schedules, household vehicle fleet composition and usage, and the development of utility/value metrics to measure individual activity-travel engagement decisions.

Dr. Konduri has also actively contributed to the state of practice by designing and developing open-source transportation planning software. He led the design and development of two transportation planning software including, PopGen (Population Generator) – an open-source synthetic population generator for microsimulation-based land use and transport models, and OpenAMOS (Open-source Activity Mobility Simulator) – an open-source activity-based travel demand model system during his tenure at Arizona State University as a Graduate Research Associate and then as a Postdoctoral Researcher. PopGen has gained interest from the transportation planning community in the United States and around the world. PopGen has also been adopted into model systems of land-use and transport both in the fields of research and practice. OpenAMOS software is currently undergoing testing and will be released to public in the near future. He continues to be actively involved in the development efforts of these and other transportation planning software.
**LEILA LADANI**  
**MECHANICAL ENGINEERING**

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**Keywords:**  

**Summary:**  
Dr. Ladani has extensive research experience with additive manufacturing, particularly in the area of electron beam melting and selective laser sintering. She has had several research projects with NASA, industry and NSF on manufacturing of metallic parts fabricated using these techniques. The projects focused on understanding the mechanical and fatigue behavior of parts, geometrical variations and process modeling and simulation. Dr. Ladani has extensive background on quality and reliability. In particular she has worked on process optimization, design of experiment and defects reduction in different manufacturing processes.

She is also interested in advanced materials and processes. In her recent project with NSF, she is fabricating carbon nanotubes as through silicon via (TSV) interconnects for microelectronic industry. She is also conducting multiscale/multiphysics modeling of the system using finite element simulation and molecular dynamics modeling. Dr. Ladani is the chair of Electronic Materials Division of ASME and has more than 60 peer reviewed publications in the areas of materials, manufacturing and mechanics.
Yu Lei
Chemical & Biomolecular Engineering

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Keywords:
Chemical Sensor, Biosensor, Bionanotechnology, Harsh Environmental Sensor; Environmental Biotechnology

Summary:
We patented a new sensing material for the detection of explosives by naked eyes under a handheld UV light. The sensing materials can be directly delivered to the surface for the detection of buried explosives (or landmine) or be used as a possible add-on device to an existing short range sensor platform for explosives detection.

Recently we also patented a sensing technology for strong reducing gas, including CO and C₃H₈, at high temperature 800 °C. The sensing device is simply, easy fabricated and cost-effective, and has a simple configuration, good stability, high sensitivity and selectivity toward CO and C₃H₈.
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CIVIL & ENVIRONMENTAL ENGINEERING  

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**Keywords:**  
Wastewater Treatment, Underwater energy harvest, microbial fuel cells  

**Summary:**  
Wastewater Treatment: efficient wastewater treatment, convert wastewater to electricity, achieve self-sustainable wastewater treatment processes.  

Bioenergy production in microbial fuel cells (MFCs): harvest bioenergy from wastewater and underwater environment. Provide sustainable low-cost electricity to various customers and sensors.
Nicholas E. Lownes
Civil & Environmental Engineering

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Keywords:
Transportation, transit, networks, optimization, modeling, data, equity, t-HUB, transport, systems

Summary:
Dr. Lownes’ recent research efforts have focused on data management and analytics for public transit operators and planners. These efforts have led to the establishment of t-HUB, a multi-disciplinary collaborative effort between civil engineering, computer science and geography creating a single-stop web-accessible database tool for public transit data and system evaluation. Demographic data, socio-economic data, performance data and system configuration data are all housed within t-HUB. Next steps include the integration of real-time feeds from transit systems as their tracking systems come online. Methodological improvements in transit system performance measurement are also incorporated in the new t-HUB technology.
TIANFENG LU
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Keywords:
Combustion, Computational fluid dynamics, Numerical simulations, Chemical kinetics, Fuels and energy

Summary:
Lu’s primary research interest is in combustion and computational fluid dynamics with special interests in chemical kinetics and computational flame diagnostics. He develops theories and systematic numerical methods to simplify complex chemical kinetics amenable for industrial CFD simulations of chemically reacting flows, e.g. those in combustors. His reduced mechanisms and reduction methods have been adopted in major commercial CFD codes, e.g. ANSYS Fluent, Star-CCM+, and Converge. Lu also develops numerical methods to efficiently solve chemically stiff problems.
**PETER B. LUH**  
**ELECTRICAL & COMPUTER ENGINEERING**

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**Keywords:**  
Smart and Green Buildings and Eco Communities – optimized energy management, HVAC fault detection and diagnosis, emergency crowd guidance, and eco communities; Smart Power Systems – smart grid, auction methods for electricity markets, robust renewable (wind and solar) integration to the grid, electricity load and price forecasting, and micro grid

**Summary:**  
Buildings account for nearly 40% of global energy consumption, and the consumption can be significantly reduced by optimized control of HVAC and lighting, and through early fault detection and diagnosis. The issues, however, are difficult since HVAC systems are large in scale, building and equipment dependent and operating under uncertain conditions, and inherent problem complexity. We have been working on model-based and data-driven methods for building energy optimization and HVAC fault detection problems with excellent results. On the smart grid size, we have been working on robust and optimized renewable (wind and solar) integration to the grid.
W.K. Anson Ma
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Keywords:
Rheology, nanotechnology, inkjet printing flexible electronics, 3D printing, polymer composites

Summary:
Our research group focuses on understanding the flow behavior, or rheology, of complex fluids (e.g., suspensions, foams, and emulsions), thereby developing novel, scalable techniques for processing these fluids into multifunctional, high performance articles (e.g., films, fibers, and polymer composites). Current projects include how to exploit the size and shape of particles to: (1) create ultra-stable emulsions/foams (NSF award #1253613) and (2) improve anticancer drug delivery (NSF award #1250661). We are also developing new techniques to improve the reliability and push the existing resolution limit of inkjet and 3D printing technology.
**RAMESH B. MALLA**  
**CIVIL & ENVIRONMENTAL ENGINEERING**

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**Keywords:**  
Structural mechanics, Dynamics & vibrations of structures, Finite element modeling, Space structures, Lunar structures, Structural failure, Highway and railroad bridges, Truss/frame structures, Infrastructures, Percussive drilling mechanisms, Granular materials, Energy harvesting systems

**Summary:**  
Dr. Ramesh B. Malla’s research expertise is in the areas of applied and theoretical structural mechanics, finite element analysis, and dynamics and vibration of structures. Some of his current and recent past research topics include analytical and finite element modeling of percussive drilling devices for planetary exploration, innovative energy harvesting systems, dynamics response of railroad bridges under high speed trains, highway bridge expansion joint sealant and monitoring, subgrade soil resilient modulus, infrastructures monitoring and highway vehicle weigh-in-motion technology, studies of granular material beds for space life support systems, dynamic response of structures during progressive failure, and analysis of structures in orbit/space and on the Moon. His research work has been supported by several federal and state agencies and industry, including National Science Foundation (NSF); National Aeronautics and Space Administration (NASA); NCHRP-IDEA program of the FHWA/National Academy of Sciences; U.S. Army; New England Transportation Consortium; Connecticut Innovation Inc.; NASA/Connecticut Space Grant Consortium; GM2 Associates, Inc.; eGen LLC; Bentley Systems, Inc.; Hamilton Sundstrand Space Systems International, Inc.; and Honeybee Robotics Spacecraft Mechanism Corporation.
Summary:
The shortage of energy and water resources is a grand challenge facing humanity in the 21st century. Engineered osmosis (EO) technologies have been increasingly investigated as an alternative means of sustainable water and energy production. These membrane technologies exploit the gradient of osmotic pressure between solutions of differing salinity as a driving force for water treatment/desalination (forward osmosis) and electricity generation (pressure retarded osmosis). However, EO development has been hindered by the lack of appropriately-designed membranes that exhibit high water flux, superior selectivity, chemical stability and adequate mechanical strength. At UConn, we develop new membrane platforms for forward and pressure retarded osmosis and can apply those designs to other membrane separations processes.
Keywords: Fuel Cells, Batteries, Electrochemistry, Catalysts

Summary: Controlling Microstructure and Surface Chemistry of Carbon: In this project, our group uses silicate templating to precisely control the pore structure of carbon. We also use the reaction precursor and conditions control the carbon microcrystallinity and to purposefully incorporate adatoms into the carbon structure (i.e. N, S, P, B). These adatoms give the carbon unique properties and provide charge centers for strong catalyst-support bonding while not building in intrinsic instability.

Lithium Batteries: Our group specializes in the electrochemical and physical characterization of Li-ion electrodes. This includes capacity retention and rate-capability testing. We are also adept with the CPR method, which allows us to calculate the diffusivity of Li in the electrode structure. Recently, we have developed a new method for in-situ TEM to investigate the structural changes that occur in carbon and non-carbon electrode materials during testing.
SERGE NAKHMANSON
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Keywords:
Electroactive materials by computational design, Mesoscale and atomic-scale simulations of materials properties

Summary:
Successful growth of the energy, medical and high-tech sectors of our economy is critically dependent on an expanding stream of new smart materials with improved useful properties and advanced functionalities. Electroactive (ferroic) compounds are crucial for a wide range of state-of-the-art applications that include energy harvesting, conversion and storage, sensing and actuating, low-power microelectronics and nonvolatile memories, pyroelectric arrays, and acoustic and nonlinear optical devices. However, materials with technological-grade qualities are still relatively rare, as it is currently unclear how to control the strength of, as well as the coupling among, their functional properties by manipulating their structure, chemical composition and geometry. With the rising demand for these smart, nano-engineered compounds, their computer assisted discovery, design and characterization are becoming increasingly more relevant. This is due not only to the obtained valuable insights into the nature of these intricate materials, but also to high throughput and efficiency that such investigations provide.
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Keywords:  
Nano-structural Characterizations, Biomaterials, Polymeric Materials, Nanoparticles, Surfactants, Phospholipids, Theragnostic Nanocarriers, Drug Delivery, Self-Assemblies

Summary:  
Our laboratory has successfully developed a unique strategy to manufacture uniform soft nanoparticles (30 ~ 100nm), which can carry either hydrophobic or hydrophilic molecules, in aqueous solutions. The platform can be easily adopted by an industrial setting for mass production over a short span.

We can help our industrial partners characterize the global structures of materials using scattering technology (with light, X-ray neutron). The attainable range of nano-sized morphologies varies from micron to Å and their uniformity can also be obtained. The examined materials can be solid, gel, liquid or thin film. In-situ studies are generally possible.
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Keywords:
Technology Transfer, Commercialization, Business Development, Technology Incubation, Industry partnerships, Patents, Small Business Counseling, UConn Technology Park

Summary:
The Office of Economic Development (OED) capitalizes on Connecticut’s investment in world-class facilities, research and people to support companies and jobs including the development of partnerships relating to the UConn Technology Park. The office manages the commercial application of innovations developed at UConn, helps existing companies seeking assistance with technology-related issues and assists entrepreneurs developing new tech-related products. OED hosts the Connecticut Small Business Center, which assists existing and start-up businesses in all business sectors. There are numerous programs at UConn to help build entrepreneurial companies and OED serves as the portal to help firms locate assistance within the UConn community.
Keywords:
Automatic Control, Computer logic, Controls, Stability, High-speed systems. Chatter, Time-Delayed Dynamics, Vibration control

Summary:
Time-Delayed Systems (TDS) are ubiquitous in many advanced technologies. They represent infinite dimensional dynamics. As such, they offer mathematically very challenging stability and control problems, which have kept many system specialists occupied in the past 6+ decades. The pillar of our research results is a recent mathematical paradigm called the ‘Cluster Treatment of Characteristic Roots (CTCR)’. This paradigm starts with some earlier-unrecognized features of the Time-Delayed Systems, and proposes a unique resolution to the stability assessment of TDS via a substantially different perspective than the competing methodologies. It results in a paradoxical finding that states the stability of systems may be improved by artificially increasing the existing delays. Most critically it declares such stability pockets non-conservatively and exhaustively. This feature leads to some completely new stabilizing control concepts which we named “Delay Scheduling (DS)” and “Sign Inverting Control (SIC)”.
End product of this treatment has already yielded broad practical implications, a few of which are listed below.

a) Delayed Resonator© actively-tuned vibration absorber (see the CNN strip at the above URL).
b) Real time control using Delay Scheduling and Sign Inverting concepts,
c) Optimized metal machining free from regenerative chatter,
d) New techniques in controlling multi-agent swarms under delayed communication exchanges.
e) Design and control of combustors without Thermo-acoustic Instability (TAI)
Keywords:
Smart energy and power conversion, microgrid, smart building power network, renewable integration, power conditioning system, grid-connected-inverter, battery energy conversion and management systems, building power quality

Summary:
Dr. Park’ recent research efforts have focused on smart energy and power conversion systems in the distributed power network and renewable energy grid integration applications. Dr. Park seeks the way of full utilization of power conditioning systems so that:

1. The power quality of distributed power network will be enhanced
2. The benefit from renewable energy and its power conditioning systems will be maximized
3. The energy source or storage will last longer

The power conditioning system is the core part of renewable integration, electric vehicle power conversion, and battery energy storage systems. It will play important roles in the microgrid and smart grid applications.
KRISHNA R. PATTIPATI
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Keywords:
Systems theory and optimization, Diagnosis & Prognosis, Big Data Analytics, Machine Learning, Information Fusion, Dynamic Resource Management, Decision making, Model-based Systems Engineering

Summary:
Dr. Pattipati is the UTC Professor in Systems Engineering and Director of the Systems Optimization Laboratory. He has over 30 years of experience in supervising and performing research on a variety of problems including fault diagnosis and prognosis in cyber-physical systems; adaptive algorithms for Li-ion batteries in mobile applications; performance evaluation of large-scale computer and manufacturing systems; large-scale mixed-integer optimization; big data analytics and machine learning; team decision making; and agile planning and adaptive organizations for dynamic and uncertain environments. His research has been funded by federal government agencies and industrial sponsors, including ONR, NSF, NASA, DARPA, Aptima, Fairchild Semiconductor, Comcast, NPS, GM, Toyota and others. He is a Co-founder of Qualtech Systems (www.teamqsi.com), and serves on the board of Aptima (www.aptima.com). He is a Fellow of the IEEE.
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Keywords:  
Computer Graphics, Scientific Visualization, Computational Topology, Big Data

Summary:  
I am interested in preservation of topology during computer animation, both for the motion picture industry and for visualization of the big data generated by exascale simulations.
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Keywords:  
Big Data Analytics, High Performance and Parallel Computing, Bioinformatics  

Summary:  
Big Data Analytics: We live in an era of data explosion in any branch of science and technology. This is especially true for the industry. For instance, transactional data can be used to study the behavior of individuals, to identify dissatisfied customers and take measures, to locate frauds, etc. in many companies. Analyses of this kind have to be done quickly to remain competitive in the market place. As a result, we need effective algorithms for Big Data Analytics. I have 10+ years of experience in this area. I have been funded by NSF, NIH, DARPA, etc. for my works on Big Data. I have invented numerous novel algorithms many of which are the best-known for the respective problems. Given the amount of data, sequential algorithms may not be adequate. In such cases parallelism is vital. I have 25+ years of experience in the development of parallel algorithms.  
Bioinformatics: In this area I have worked on several problems including motif search, sequence assembly, fundamental data structures, string matching, primer selection, etc. For instance, I have developed a web system for motif search called Minimotif Miner that is widely used by biologists all over the globe. The best-known algorithms for $(l, d)$-motif search are from my Lab. My work on motif search is currently funded by NIH with an R01.
Keywords:

Summary:
Determining and controlling dielectric response and breakdown of insulators for electrical and electronic applications. Design of cheap, high-performance, low-temperature catalysts. High-throughput computing, exploring vast chemical spaces, and navigation of the Periodic Table. Learning from data (machine learning), and recognition & discovery of materials property correlations and trends.
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Keywords:
Optical measurements, laser diagnostics, combustion, laser ablation, surface contaminant identification

Summary:
Prof. Renfro develops optical and laser techniques for measuring gas and surface properties in harsh environments. One application is the measurement of velocity, temperature, and chemical composition in reacting flows including combustion and fuel cell systems. This work has impact on identifying flame stabilization mechanisms and providing data for computational model development. A second application is the measurement and/or removal of contamination from delicate surfaces including coated gas turbine components. This work has impact on non-destructive evaluation of coatings and on identification of chemical composition in surface deposits.
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Keywords:
Actuators, sensors, transducers, capacitors, dielectrics, piezoelectrics, pyroelectrics, ferroelectrics, ceramics, thin films

Summary:
Dr. Rossetti’s research focuses on electroactive materials and devices. He manages the Active Materials Property Laboratory (AMPL) which houses facilities for processing monolithic and thin film materials, for the measurement of electrical, electromechanical and thermophysical properties, and for computational and experimental investigations of structural phase transformations in polar dielectrics. Current research topics include compositional design of electromechanical transducers, constitutive modeling of electrocaloric cooling devices, dielectric behavior of nanocomposite films for pulsed power capacitors, thermal stability and transport properties of ultra-high strain piezoelectric single crystals, control of property tolerances in piezoelectric ceramics, and development of phase transforming energy harvesting devices.
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Keywords:
Small business, technology, commercialization, entrepreneur,
technology assessment, business partnerships, federal grants, state
grants, grant-writing, small business internships, manufacturing grants,
small business mentoring

Summary:
Deb is the Director of the Small Business Innovation (SBI) Group at
Connecticut Innovations, a quasi-state organization that provides
equity and risk capital investments, debt financing, and business
connections, counseling, and support. SBI supports collaborative
partnerships among state government, industry, and academia, and
facilitates SBIR federal funding through the Partner with a Professor
program for applied university research. Other programs award
matching grants to small businesses, help companies locate resources,
and provide mentoring support to entrepreneurs on emerging and
innovative technologies. Their diverse offerings support small, high
tech. companies throughout the business lifecycle.
ZHIJIE JERRY SHI  
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Keywords:  
Computer security, computer architecture, embedded system, sensor networks security, underwater sensor networks.

Summary:  
Dr. Shi is interested in efficient and secure computing, including optimization of algorithms on a variety of platforms, hardware mechanisms for secure and reliable computing, side-channel attacks and countermeasures. The examples of the work done by his research group are optimized implementations of orthogonal frequency-division multiplexing (OFDM) based acoustic communication algorithms and elliptic curve cryptography (ECC) algorithms, architectural mechanisms for protecting program code integrity and tracking data flow in processors, new techniques in power analysis, fault analysis, and algebraic side-channel attacks.

Dr. Shi is also interested in improving the efficiency, reliability and security in underwater acoustic communications. In addition to the real-time and low-power implementation of acoustic communication algorithms, his group studies routing protocols in underwater sensor networks, denial of service attacks and countermeasures for acoustic communications.
STEVEN L. SUIB
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CHEMICAL & BIOMOLECULAR ENGINEERING

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Keywords:
Catalysis, Spectroscopy, Energy, Materials, Green Synthesis, Ceramics, Semiconductors, Surfaces and Interfaces, Photochemistry and Photocatalysis, Plasmas

Summary:
One area of research involves activation of molecules with heat, light, ultrasound, microwaves, solar, and other forms of energy. These catalytic processes involve development of catalysts, characterization with a multitude of characterization methods (many are in situ or in operando) like XRD, FTIR, Raman, UV-Vis, MAS-NMR, EPR, magnetic susceptibility, thermal methods, and synthesis techniques like CVD, CVI, sol-gel, hydrothermal, high temperature, ALD, thin film methods, glove box, and high pressure methods. Some of the catalytic reactions of interest are selective oxidations, total oxidations, biomass conversion, reductions, water gas shift, Fischer Tropsch, activation of CO₂, generation of H₂, water splitting, and degradation of dyes and hazardous chemicals.

Another area of interest involves ceramic fiber composites, their generation, characterization and applications. Tensile strength, hardness, and related physical properties as well as chemical properties like corrosion resistance are being studied. The same characterization methods as above as well as surface analytical methods like scanning Auger microscopy (SAM) and X-ray photoelectron spectroscopy (XPS) are being used. Some other systems studied involve battery materials, sensors, semiconductors, luminescent materials and control of color, environmentally friendly systems, coatings, and thin films.
LUYI SUN
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Keywords:
Polymeric materials, polymer composites and nanocomposites, nanostructured hybrids, layered materials, green science and engineering, coatings, biomass; Structural and functional applications, packaging application, energy conversion and storage

Summary:
Nanocoatings: We have developed a facile and economical nanocoating technology, which provides excellent performance, but meanwhile can be easily processed using commercial processing equipment. The thin coating is composed of a nanostructured organic/inorganic hybrid, in which the inorganic nanosheets are well oriented and packed within the organic matrix. The nanocoating offers superior mechanical properties (Young’s modulus > 50 GPa), barrier properties (oxygen barrier <0.1 cc/m2-da), and flame retardancy. This coating can be easily processed in an aqueous system, which brings extra benefits in terms of cost, health, and environment.

Valuable Materials from Rice Husk Biomass: Rice husk (RH) biomass is a massive byproduct from rice milling. Applications of RHs have been very limited. Current disposal of RHs needs extra cost and may bring pollutions. Therefore, RHs are often considered as a biowaste. RHs are mainly composed of lignocellulose (ca. 72-85 wt%) and silica (ca. 15-28 wt%). We have developed an approach for comprehensive utilization of RHs to obtain both lignocellulose and high quality porous silica nanoparticles from RHs. As such, we are able to convert a biowaste to two valuable materials which have found widespread application in industry.
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Keywords:
Combustion, flame, fuel, chemistry, diagnostics, modeling, ignition, extinction, stabilization, emissions

Summary:
Dr. Sung’s research goal is to establish a fundamental understanding of flame dynamics and fuel chemistry to enable development of next-generation, fuel-flexible, ultra-low emissions, and high-efficiency engines and combustors using conventional and alternative fuels. Recent work has focused on developing:

1. Novel experimental platforms and databases for chemical kinetics, transport processes, and combustion characteristics through advanced ex-situ and in-situ diagnostic methods
2. A suite of predictive combustion modeling capabilities to understand and optimize the design and utilization of non-petroleum derived, carbon-neutral fuels in advanced engines/combustors.

These efforts will enable CFD simulations to better predict the performance and emissions profiles.
JIONG TANG
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Keywords:
Structural Dynamics, System Dynamics, Rotor Dynamics, Vibration Analysis and Suppression, Sensing and Monitoring, Automatic and Robust Control, Modeling and Computational Analysis of Complex Engineering Systems

Summary:
My research interests are in the areas of Dynamics and Control. I have extensive project experience working with industries. My representative research thrusts include the following:

1. Modeling, analysis, and robust design of complex engineering systems combining physical principles (e.g., finite element method) and sensor measurements
2. Vibration reduction and mitigation using passive/active/hybrid approaches
3. Hardware-oriented precision control
4. Sensing and monitoring of structural systems and machinery systems based on new sensor hardware and signal analysis tools
5. Smart structures development using functional materials such as piezoelectric material and electrical circuitry synthesis
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Keywords:
Computer-aided design and test for CMOS VLSI designs, hardware security and trust, counterfeit IC detection and prevention, and reliable systems design at nanoscale.

Summary:
Counterfeit Detection and Prevention: We develop tools, methodologies, and experimental analysis flows for detection of counterfeit electronic components. We also develop innovative anti-counterfeit structures for integrated circuits.

Hardware Trojan Detection and Prevention: We develop tools and methodologies for detection of hardware Trojans in integrated circuits.
**TIMOTHY M. VADAS**  
**CIVIL & ENVIRONMENTAL ENGINEERING**

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**Keywords:**  
Water quality, storm water, sorbents, metals, organic matter, ecology

**Summary:**  
Dr. Vadas’ recent research efforts have focused on water treatment of emerging contaminants using novel, high surface area sorbents. The focus is on the development of a chemical surface modification scheme for nanofibrous materials due to the difficulty in functionalization using traditional methods without losing significant mass or strength. In addition, we explore novel functional groups that can enhance the selectivity and sorption capacity for emerging or low concentration contaminants such as Hg, As, or pharmaceutical compounds. This technology could also be used for resource recovery or bio-based product purification.
IOULIA (JULIA) VALLA
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Keywords:
Hierarchical pore structure zeolites, clean fuel production, biomass catalytic pyrolysis, refinery processes

Summary:
Dr. Valla’s research have focused on the modification of zeolites structure for advanced catalytic and adsorption processes. Our objective is to minimize the diffusion limitations in the micropores of zeolites making them accessible to heavier, complex molecules. Our objective is also to improve the selectivity of zeolites towards targeted reactions, by incorporating in their structure guest-molecules which can act as actives-sites. Industrial applications include:

1. Sulfur compounds removal from hydrocarbon streams via chemisorption
2. Biomass catalytic pyrolysis for BTX production
3. Catalytic removal of PAH from syngas derived from biomass gasification
4. Fluid Catalytic Cracking of heavy gas oils to fuels
**DIANE VAN SCOTER**  
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**Keywords:**  
Industrial Engineering, Process Improvement, the Impact of Contextual Factors and STEM Education

**Summary:**  
Dr. Van Scoter’s industry experience spans more than twenty years, ranging from Manufacturing at Boeing Commercial, space optics, survivability, and technology transfer for the DoD, to management consulting for Deloitte including working for the South African Government, and SA Airways, to quality for an international logistics company. Since arriving at UCONN she has been updating the MEM program to better serve the students, industry, and the university. Another focus has been to raise the awareness of both students and industry to the MEM program itself, and the advantages it offers for these two groups.
GUILING WANG
CIVIL & ENVIRONMENTAL ENGINEERING

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Keywords:
Climate variability, climate change, climate impact, extreme events, floods, modeling, prediction, vulnerability, risk, security

Summary:
Dr. Wang’s recent research efforts have focused on regional climate extremes and their impact on water resources and flooding risks in the U.S. Northeast. A comprehensive database has been developed for future predicted changes of climate extremes over the Northeast, based on downscaling and bias correction of climate projections from 10 climate models. The impact of past observed increase of extreme events on hydrological processes has been assessed, with strong increase in flooding risk. Also assessed is the impact of projected future climate changes. Further research interest includes the potential impact of extreme events on power and civil infrastructure and climate impact on human health.
Keywords:
Biomaterials, tissue engineering, organic/inorganic composites, scaffold fabrication, ceramic coatings, in vitro and in vivo tests, 3D bio-imaging

Summary:
Dr. Wei’s research has been focused on biomaterials, tissue engineering, organic and inorganic composites, ceramic coatings, biomaterial-cell interactions, and in vivo performances of biomaterials. Her main research falls into the following areas: (1) Fabrication of novel tissue engineering scaffolds for bone, cartilage and other tissue repair and regeneration; (2) Application of bioactive coatings on metallic implant surfaces for enhanced implant-host integration; (3) Fabrication of biodegradable ceramic-polymer fiber composites to be used as load-bearing bone fixation devices; (4) Syntheses of magnetic, biocompatible and biodegradable nanoparticles to be used in bioimaging, cancer treatment and drug delivery.
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Keywords:
Machining mechanics and processes, integrated additive/subtractive manufacturing, precision manufacturing, modeling of machining processes and systems

Summary:
Dr. Zhang's recent research efforts have focused on integrated additive/subtractive manufacturing, in which both additive manufacturing (e.g., EBM and SLM) and subtractive machining are designed and integrated as a whole. Sophisticated parts can be efficiently manufactured with low cost and high quality (e.g., material integrity, surface finish, and dimensional tolerances). These parts may otherwise be difficult and even impossible to manufacture with the conventional techniques. Dr. Zhang's primary accomplishments lie in research on precision machining of advanced materials (including nanostructured ceramics and WC, aerospace alloys) and design for precision manufacturing.
LIANG ZHANG
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Keywords:
Manufacturing systems, production control and management, battery systems.

Summary:
Production Systems Engineering: The goal of this research is to develop first-principle-based methods for modeling, analysis, continuous improvement, lean design, real-time control, and energy-efficient operations of manufacturing and service systems. Applications of the research has been carried out in numerous companies such as General Motors, Ford, Chrysler, Toyota, Generac, MillerCoors, Kraft Foods, Kroger, Lexmark, Subzero, Cree Lighting, and HellermannTyton.

System-theoretic Analysis of Battery systems: The goal of this research is to develop system-level mathematical and computer models for battery systems that can be used for performance prediction, active control, and optimal parameter selection without experimenting with physical systems.
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Keywords:
Power system, resilience, reliability, optimization, control, microgrid, simulation, photovoltaics, wind power, ocean energy harvesting

Summary:
Dr. Zhang’s recent research efforts have focused on power system resilience and efficiency as well as cyber-physical systems. These recent efforts have led to the launch of University of Connecticut’s Depot Campus Microgrid, UConn’s first solar photovoltaic array, a successful study for hardening Northeast Utilities’ power infrastructure against extreme weather events such as wind storms, a Department of Energy project for wide area monitoring and control, and a Building Innovator Program award from the Department of Energy. The next step is to develop unique, advanced tools for controlling and managing microgrid and active distribution systems, and to create smart grid technologies for enhancing power systems resilience and robustly integrating more electric vehicles, storages and renewable resources while improving power supply reliability and reducing costs for customers. Dr. Zhang is also actively working on ocean energy harvesting systems for various applications.
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Keywords: Biomedical Engineering; Biomedical Devices; Biomedical Imaging; Biophotonics; Optical tomography for breast cancer detection and diagnosis; Photoacoustic and ultrasound imaging for ovarian cancer detection and diagnosis

Summary:
Project 1: Optical tomography imager as an add-on unit to commercial ultrasound scanners for detection and diagnosis of breast cancers and for predicting treatment response of advanced breast cancers: Under the support of NIH/NIBIB R01 projects (July 2002- Oct 2017), the UCONN group has developed the US-guided optical tomography technique and conducted clinical trials at the Hartford Hospital and the UConn Health Center. Promising results have obtained from more than 300 patients. Currently, we are looking for commercial partner to bring this technology to market.

Project 2: Photoacoustic and ultrasound imaging for ovarian cancer detection and diagnosis: Under the support of NIH/NCI R01 Project, the UCONN group is developing transvaginal co-registered Photoacoustic and ultrasound imaging device for ovarian cancer detection and diagnosis. Currently, we are optimizing the device for Phase I clinical trial at UConn Health Center. We will look for commercial partner soon after we complete the phase I study.
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Summary:
Dr. Pinar Zorlutuna’s lab explores designing biomimetic environments for understanding and controlling cell behavior, and cell-cell and cell-environment interactions using tissue engineering, genetic engineering and micro- and nanofabrication approaches, mostly focused on applications towards cardiovascular research. One of the main focus areas is developing disease models for investigating heart diseases. Towards this end, hydrogel-based tissue engineering approaches are combined with microfabrication and microfluidics techniques to design and fabricate myocardial tissue models comprise of human induced pluripotent stem cell-derived endothelial cells and cardiomyocytes, and a photocross-linkable hydrogel material which can impose control over the tissue organization.