Founded in 1898, Northeastern is a global, experiential, research university offering undergraduate and graduate programs leading to degrees through the doctorate in nine colleges and schools, and select advanced degrees at graduate campuses in Charlotte, North Carolina, and Seattle, Washington.
Dear Friends,

This annual scholarship report reflects the exceptional academic and professional accomplishments of the mechanical and industrial engineering faculty and their students for the 2013-2014 year. With $59 million in annual research expenditures and 134 tenure and tenure track faculty members the college is expanding in both size and research abilities. As one of the five departments in the college, the mechanical and industrial engineering department is home to 44 of these faculty members; 4 new faculty members will add to the 44 strong in Fall 2014. We look forward to a new Interdisciplinary Science and Engineering Complex building in 2016, adding a 220,000 square foot space which will provide state-of-the art labs.

As of 2013 I became the chair of this research active Department of Mechanical and Industrial Engineering. The department is home to two national academy members- Professor Nadine Aubry of the National Academy of Engineering; and Professor Vinod Sahney of the National Academy of Engineering, and the National Academy of Sciences’ Institute of Medicine. Further, the department is home to three federally-funded research centers – one focused on nanomanufacturing and two focused on healthcare systems engineering.

Our scholars strive to use today’s discovery and research to make tomorrow happen. You can see some highlights of our engineering faculty members at northeastern.edu/tomorrow. We hope you enjoy this book, and look forward to sharing future accomplishments in our annual scholarship reports.

Sincerely,

Hanchen Huang
Professor and Department Chair,
Mechanical and Industrial Engineering
h.huang@neu.edu

Key Contacts

**Department Chair**
Hanchen Huang, h.huang@neu.edu

**Associate Department Chair and Program Director of Mechanical Engineering**
Andrew Gouldstone, a.gouldstone@neu.edu

**Associate Department Chair and Program Director of Industrial Engineering**
Emanuel Melachrinoudis, emelas@coe.neu.edu

**Director of Graduate Studies and Research**
Nader Jalili, N.Jalili@neu.edu

**Co-op Coordinator**
Lorraine Mountain, l.mountain@neu.edu

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@NortheasternCOE

**Join our faculty**
neu.peopleadmin.com

**Apply to our graduate program**
northeastern.edu/graduate/apply
**Quick Facts**

- **134 Faculty Members**
- **Top 50 US Engineering School**

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### Degree Programs

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<td>Bioengineering</td>
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<td>Chemical Engineering and Physics</td>
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<td>Chemical Engineering</td>
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<td>Electrical Engineering and Physics</td>
<td>Energy Systems</td>
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<td>Engineering Management</td>
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<td>Mechanical Engineering and Physics</td>
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<td>Mechanical Engineering and Physics</td>
<td>Sustainable Building Systems</td>
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<tr>
<td>Mechanical Engineering and Physics</td>
<td>Telecommunication System Management</td>
</tr>
</tbody>
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### Federally Funded Multi-Institutional Research Centers

- **ALERT**: Awareness and Localization of Explosives-Related Threats; a Department of Homeland Security Center of Excellence
- **GORDON-CenSSIS**: Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems; a National Science Foundation Engineering Research Center
- **CHN**: Center for High-rate Nanomanufacturing; a National Science Foundation Nanoscale Science and Engineering Center
- **CURENT**: Center for Ultra-wide-area Resilient Electric Energy Transmission Networks; a National Science Foundation Engineering Research Center, jointly supported by NSF and the Department of Energy and led by the University of Tennessee
- **CHOT**: Center for Health Organization Transformation; a National Science Foundation Industry-University Collaborative Research Center led by Texas A & M
- **HSyE**: CMS Innovation Center for Healthcare Systems Engineering; a Department of Health and Human Services Regional Systems Engineering Extension Center
- **PROTECT**: Puerto Rico Testsite for Exploring Contamination Threats; a National Institute of Environmental Health Sciences Superfund Research Program (SRP) Center
- **VOTERS**: Versatile Onboard Traffic Embedded Roaming Sensors; funded by National Institute of Standards and Technology (NIST) Technology Innovation Program project
MECHANICAL AND INDUSTRIAL ENGINEERING
Faculty by Scholarship Focus

Biomechanics
Gouldstone, Andrew
Mavroidis, Dinos
Muftu, Sinan
Nayeb-Hashemi, Hamid
Ruberti, Jeffrey
Shefelbine, Sandra
Vaziri, Ashkan
Wan, Kai-Tak

Energy
Busnaina, Ahmed
Cipolla, John
Huang, Hanchen
Jung, Yung Joon
Kowalski, Greg
Levendis, Yiannis
Liu, Yongmin
Livermore, Carol
Metghalchi, Hameed
Narusawa, Uichiro
Lin, Yingzi
Sahney, Vinod
Turkcan, Ayten
Sheikh, Reza
Taslim, Mohammad
Whalen, Richard

Healthcare Systems
Benneyan, James
Griffin, Jackie
Kamarthi, Sagar

Industrial Engineering/Operations Research
Benneyan, James
Cullinane, Thomas
Fard, Nasser
Griffin, Jackie
Gupta, Surendra
Kamarthi, Sagar
Lin, Yingzi
Melachrinoudis, Emanuel
Sahney, Vinod
Turkcan, Ayten
Shefelbine, Sandra
Upmanyu, Moneesh
Vaziri, Ashkan

Materials Science & Engineering
Ando, Teiichi
Busnaina, Ahmed
Erb, Randall
Gouldstone, Andrew
Huang, Hanchen
Isaacs, Jacqueline
Jung, Yung Joon
Lee, HeaYeon
Liu, Yongmin
Minus, Marilyn
Shefelbine, Sandra
Sipahi, Rifat
Vaziri, Ashkan
Wan, Kai-Tak
Zeid, Ibrahim

Mechanics
Adams, George
Chakravathy, Srinath
Gouldstone, Andrew
Hidrovo, Carlos
Jalili, Nader
Livermore, Carol
Martinez-Lorenzo, Jose
Mavroidis, Dinos
Muftu, Sinan
Nayeb-Hashemi, Hamid
Shefelbine, Sandra
Sipahi, Rifat
Vaziri, Ashkan
Wan, Kai-Tak
Zeid, Ibrahim

Mechatronics
Jalili, Nader
Lin, Yingzi
Mavroidis, Dinos
Sipahi, Rifat
Busnaina, Ahmed
Erb, Randall
Isaacs, Jacqueline
Jalili, Nader
Jung, Yung Joon
Liu, Yongmin
Livermore, Carol
Minus, Marilyn
Upmanyu, Moneesh

Nanomanufacturing
Busnaina, Ahmed
Erb, Randall
Isaacs, Jacqueline
Microchips are pervasive in today’s high-tech society, playing integral roles in the inner workings of your cell phone to your Keurig coffee machine.

A processing technology called CMOS, or complementary metal–oxide–semiconductor, made microchips economically feasible in the 1980s, said Sivasubramanian Somu, a research scientist in Northeastern’s Center for High-rate Nanomanufacturing.

A critical element in any microchip is something called an inverter — an electronic component that spits out zeros when you give it ones, and vice versa. “A transistor [the basic element in an inverter] is a simple, extremely fast switch,” Somu explained. “You can turn it on and off by electric signals.”

In the early days of computer technology, mechanical switches were used for computational operations. “You cannot achieve fast computations using mechanical switches,” Somu said. So CMOS, which used electric signals to turn the switches on and off, represented a significant advance in the field.

But despite its relative economy, a CMOS fabrication plant still costs about $50 billion, according to Somu. “We needed an alternative, cost-effective solution that still can compete with CMOS at the foundry level,” he said.

CHN’s proprietary “directed-assembly” approach is that alternative solution. Instead of requiring several fabrication steps of adding and removing material, as in the case of CMOS, directed assembly is an additive-only process that can be done at room temperature and pressure. A fabrication facility based on this technology, Somu said, could be built for as little as $25 million.

This cost savings would make nanotechnology accessible to millions of new innovators and entrepreneurs, unleashing a wave of creativity the same way the PC did for computing, said Ahmed Busnaina, the William Lincoln Smith Professor and Director of the NSF Center for High-rate Nanomanufacturing.

But creating a nanosized inverter is easier said than done, added Jun Huang, a postdoctoral research scientist in the center. Researchers have using materials like graphene and carbon nanotubes for creating inverters, but none of these has worked well on its own. Creating a nanosized inverter made up of different nanomaterials with excellent properties, Huang said, can result in excellent complimentary transistors. Using the directed-assembly process, the team created an effective complimentary inverter using Molybdenum disulfide and carbon nanotubes. “At the nanolevel,” said Huang, “molybdenum disulfide occurs in thin, nanometer-thick sheets.” At this scale, he noted, the material begins to demonstrate transistor characteristics critical to the construction of a good inverter.

The success represents a step toward CHN’s ultimate goal of enabling small- and medium-sized businesses to develop new, microchip-based technologies. The results of their research were reported in a recent article in the journal Nanotechnology.

A Small-Scale Solution With a Large-Scale Impact

Ahmed Busnaina (center) is Director of the Center for High-rate Nanomanufacturing, a National Science Foundation Nanoscale Science and Engineering Center.

See Busnaina profile, page 12
Professor James Benneyan remarked he sometimes feels like the Maytag repairman, standing by with tools that can help fix healthcare’s problems. The differences between Benneyan and “Ol’ Lonely” are that the machine he’s working on is actually broken and while he’s actively helping numerous organizations, he wishes the phone would ring more.

As founding director of Northeastern’s Healthcare Systems Engineering Institute, Benneyan is a nationally recognized expert in solving complex healthcare challenges using systems engineering methods.

Benneyan addressed a room full of senior healthcare improvement leaders at a recent Northeastern workshop, illustrating how his three centers have used these tools and approaches to address high-leverage problems also facing Boston healthcare organizations. This approach scaled nationally, he estimated, might cut the annual nearly $3 trillion healthcare budget by one-third.

“While roughly 70 percent of healthcare problems can be fixed with simple front-line improvement approaches,” said Benneyan, “maybe another 20 percent need something a bit more. But the upper tail problems are fundamentally complex and in other industries would be solved with more advanced systems engineering methods.”

Benneyan has shown this same potential in individual health systems and now has funding from the Centers for Medicare and Medicaid to scale it across an entire healthcare community, here in Boston.

Simple improvement methods include things like reorganizing storage clinical closets so the most oft-used items are readily available. However, more advanced techniques usually are required to solve macro-level problems, such as identifying the best locations for new clinics, more efficient ambulance routing patterns, or optimized treatment schedules. For these sorts of challenges, Benneyan said, engineers turn to mathematical and computational modeling.

Benneyan gave an overview of the most common systems engineering models and several healthcare examples of each in order to stimulate group brainstorming of potential applications across Boston.

“Models are artificial representations of the real world, but useful for rapidly helping design better processes and systems,” he explained. For example, his team can create simulation models that mimic such things as patient flow throughout a hospital, and then test hundreds of potential improvement ideas in order to identify the best changes to put into actual practice.

The workshop was the second in an ongoing series to introduce Boston healthcare professionals to the types of problems systems engineering can solve and the methods for doing so. After Benneyan’s lecture, he led a group brainstorming discussion session to identify similar problems they could work on locally.

See faculty page 10
Place two large, sturdy logs in a streambed, and they will help guide the water in a particular direction. But imagine if the water started mimicking the rigidity of the logs in addition to flowing along them. That’s essentially what happens in a directed assembly method developed by Marilyn Minus, an assistant professor in Northeastern’s Department of Mechanical and Industrial Engineering.

Instead of logs, Minus uses tiny carbon nanotubes and her “water” can be just about any kind of polymer solution. So far, she’s used the approach to develop a polymer composite material that is stronger than Kevlar yet much less expensive and lighter weight. In that case, the polymer not only follows the direction of the nanotube logs but also mimics their uniquely strong properties.

With funding from a new CAREER award from the National Science Foundation, Minus is now expanding this work to incorporate more polymer classes: flame retardant materials and biological molecules.

“In the case of collagen—the first biological molecule to which Minus has applied her method—Minus hopes the approach will allow the nanotubes to lend their rigidity to the system. Inside the body, collagen molecules organize themselves into a complex matrix that supports the structure of every one of our cells. But outside the body, researchers have had major challenges trying to reliably recreate this matrix.

If scientists could make collagen work outside the body the same way it does inside, it could provide an invaluable platform for testing drugs, understanding how tissues work, and even shedding light on the origins of a variety of diseases, Minus said.

Based on her prior research, she has found that the key to success in taking this approach is matching the size and geometry of the carbon nanoparticles she uses with that of the polymer in question. For instance, collagen molecules are about 300 nanometers long and 1.5 nanometers in diameter, so she’ll want to find a nanotube that roughly meets those dimensions. She’ll also want to use nanotubes for this application rather than the other carbon forms she has at her disposal: graphene, graphite, fullerenes, or even small nanocarbon particles—each of which offers a unique structure.

“We’re trying to change the entropy of the system in order to get the polymers to organize themselves around the nanomaterials,” Minus said. “Then you should be able to get this effect.”

See faculty page 45
Scholarship Focus

- Contact mechanics including adhesion, friction, and plasticity
- Modeling and analysis of microelectromechanical systems (MEMS)
- Modeling and analysis in nanomechanics

Honors and Awards

- Fellow, American Society of Mechanical Engineers
- Fellow, Society of Tribologists and Lubrication Engineers
- Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

Books and book chapters

G.G. Adams


G.G. Adams

Contacts Involving Wave Propagation, Encyclopedia of Tribology, Springer Reference, 2013, 579-583

G.G. Adams


Papers in refereed journals

H. Pan, Y.-C. Wu, G.G. Adams, G.P. Miller, N.E. McGruer


J.R. Parent, G.G. Adams

A Model of a Trapped Particle Under a Plate Adhering to a Rigid Surface, Journal of Applied Mechanics, 80, 2013, 051011

Y.-C. Wu, N.E. McGruer, G.G. Adams


Hot-Switched Lifetime and Damage Characteristics of MEMS Switch Contacts, Journal of Micromechanics and Microengineering, 23, 2013

Research Projects

Metal Contacts for High Power RF MEMS Switches
- Co-Principal Investigator, Subcontract from Defense Advanced Research Projects Agency

Dissertations Supervised

Ryan Patrick Hennessy

Exploration of Hot Switching Damage and Damage Mechanisms in MEMS Switch Contacts (see p 67)

Yu-Chiao Wu

Nanomechanics Modeling of Carbon Nanotubes Interacting with Surfaces in Various Configurations (see p 70)
SCHOLARSHIP FOCUS

- Rapid solidification processing
- Droplet-based materials processing
- Powder metallurgy
- Material processing by severe plastic deformation
- Processing-structure-property relationships in materials

HONORS AND AWARDS

- Fellow, American Society of Materials International
- Søren Buus Outstanding Research Award, College of Engineering

SELECTED RECENT PUBLICATIONS

Papers in refereed journals

D. Erdeniz, T. Ando


RESEARCH PROJECTS

Collaborative Research: Microscale Joining Using Nanoheaters

Principal Investigator, National Science Foundation

A Fundamental Investigation of the Mechanisms of Ultrasonic Powder Consolidation and its to Hard-Facing of Forging Dies

Principal Investigator, Hitachi Metals, Ltd

Metallographic Characterization of Cold Sprayed Materials

Principal Investigator, Fukuda Metal Foil

Fundamentals of Bonding in Kinetic Consolidation Processes

Co-Principal Investigator, National Science Foundation

Theoretical and Experimental Investigation of in Cold Spray

Co-Principal Investigator, Plasma Giken
Scholarship Focus
- Chaotic mixing
- Electrohydrodynamics
- Fluid dynamics
- Microfluidics
- Particle manipulation
- Self-assembly

Honors and Awards
- Member, National Academy of Engineering
- Fellow, American Association for the Advancement of Science
- Fellow, American Institute of Aeronautics and Astronautics
- Fellow, American Physical Society
- Fellow, American Society of Mechanical Engineers
- National Science Foundation Presidential Young Investigator Award
- Ralph R. Teetor Educational Award, Society of Automotive Engineers (SAE)
- Former Chair, National Academies’ U.S. National Committee for Theoretical and Applied Mechanics (USNC/TAM)
- Chair, American Physical Society Division of Fluid Dynamics

Selected Recent Publications

Papers in refereed journals

R. Chabreyrie, C. Chandre, N. Aubry
Complete Chaotic Mixing in an Electro-Osmotic Channel by Destabilization of Key Periodic Orbits, Physics of Fluids 23, 072002, 2011

M. Janjua, S. Nudurupati, P. Singh, N. Aubry
Electric Field Induced Self-Assembly of Micro- and Nanoparticles of Various Shapes at Two-Fluid Interfaces, Electrophoresis 32, 518-526, 2011
JAMES BENNEYAN
Director, Healthcare Systems Engineering Institute, College of Engineering and Health Sciences
Professor, Mechanical and Industrial Engineering, PhD, University of Massachusetts, Amherst, 1997
Joined Northeastern in 1997 | 617.373.2975 | jbenneyan@coe.neu.edu | www.hsyep.org

Scholarship Focus
- Healthcare systems engineering
- Patient safety, flow, and medical decision making
- Quality and reliability engineering
- Probabilistic design
- Simulation and mathematical statistics

Honors and Awards
- Senior Fellow, Institute for Healthcare Improvement
- Fellow, Society for Health Systems
- Lifetime Fellow, Healthcare Information and Management Systems Society
- Fellow, Institute of Industrial Engineers

Selected Recent Publications

Papers in refereed journals

A.I Topcu, J.C. Benneyan, T.P. Cullinane

C.S. Aksezer, J.C. Benneyan

J.C. Benneyan
Systems Engineering Approaches for Improving Reusable Medical Equipment Reprocessing Processes, International Journal of Innovation and Technology Management, 10, 2013

H. Musdal, B. Shiner, T.-C. Chen, M.E. Ceyhan, B.V. Watts, J. Benneyan
In-Person and Video-Based Post-Traumatic Stress Disorder Treatment for Veterans: A Location-Allocation Model, Military Medicine, 179 (2), 2014, 150-156

Generalizability of a Simple Approach for Predicting Hospital Admission From an Emergency Department, Academic Emergency Medicine, 20 (11), 2013, 1156-1163

B.V. Watts, B. Shiner, M.E. Ceyhan, H. Musdal, S. Sinangil, J.C. Benneyan

B. Chen, T. Matis, J.C. Benneyan
Computing Exact Bundle Compliance Control Charts via Probability Generating Functions, Healthcare Management Science, online, 2014

Health Systems Engineering Fellowship Curriculum and Program Development, American Journal of Medical Quality, 29 (4), 2014

Research Projects
Scalable Healthcare Systems Engineering Regional Extension, a CMS Healthcare Systems Engineering Center
   Center Director and Principal Investigator, Centers for Medicare and Medicaid Services
Center for Healthcare Organizational Transformation (CHOT)-I/UCRC
   Co-Director and Site Principal Investigator, National Science Foundation

Drug Safety Risk-Benefit Models
   Principal Investigator, National Science Foundation

New England Healthcare Engineering Partnership (VERC)
   Principal Investigator, U.S. Veterans Administration

Reducing Preventable Hospital Readmissions
   Principal Investigator, Purdue University

Dissertations Supervised
Hande Musdal
   Systems Engineering Models for Signature Injuries of Modern Military Conflicts (see p 67)
Scholarship Focus

- Development of processes and tools for fast massive directed assembly of nanoscale elements
- High-rate printing 2D and 3D nanoscale structures
- Nano-scale particle transport, deposition, adhesion and removal, contamination-free manufacturing in semiconductor processes
- Nano-scale technologies, physical modeling of semiconductor processes
- Computational fluid dynamics, turbulence modeling, transport phenomena

Honors and Awards

- Fellow, American Society of Mechanical Engineers
- Fellow, the Adhesion Society
- Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

**Papers in refereed journals**

C. Yilmaz, A.E Cetin, G. Goutzamanidis, J. Huang, S. Somu, H. Altug, D. Wei, A. Busnaina

Three-Dimensional Crystalline and Homogeneous Metallic Nanostructures Using Directed Assembly of Nanoparticles, ACS Nano, 2014, 8 (5):4547-4558


A High-Performance H2s Detection by Redox Reactions in Semiconducting Carbon Nanotube-Based Devices, Analyst, 138, December 2013, issue 23, p 7206-7211

T.-H. Kim, C. Yilmaz, S. Somu, A. Busnaina

3-D Perpendicular Assembly of SWNTs for CMOS Interconnects, Electronic Materials Letters, November 2013, vol 9, issue 6, p 763-766

J.C. Benneyan, C. Bond

Systems Engineering Approaches for Improving Reusable Medical Equipment Reprocessing Processes, International Journal of Innovation and Technology Management, 10 (3), 2013


A. Busnaina, J.Mead, J. Isaacs, S. Somu


J. Huang, S. Somu, A. Busnaina  
*Spin Coating Fabrication of Thin Film Transistors Using Enriched Semiconducting SWNT Solution*, Electronic Materials Letters, July 2013, vol 9, issue 4, p 505-507

G. Li, C. Yilmaz, X. An, S. Somu, S. Kar, Y.J. Jung, A. Busnaina, K.-T. Wan  
*Adhesion of Graphene Sheet on Nano-Patterned Substrates with Nano-Pillar Array*, Journal of Applied Physics, vol. 113, issue 24, June 2013, p 244-303

J. Shen, M. Wei, A. Busnaina, C. Barry, J. Mead  

*Phospholipase-Catalyzed Hydrolysis in an Artificial Cell Membrane in the Presence of Melittin*, Journal of Nanoscience and Nanotechnology, vol. 13, issue 1, Jan 2013, p 144-148

**Research Projects**

*NSF Nanoscale Science and Engineering Center for High-Rate Nanomanufacturing*

Principal Investigator and Director, National Science Foundation

**Dissertations Supervised**

Hanchul Cho  
*Development of High-Rate Nano-Scale Offset Printing Technology for Electric and Bio* (see p 63)

Cihan Yilmaz  
*Precise Directed Assembly of Nanoparticles for Electronic, Optical and Biomedical Applications* (see p 71)
SRINATH CHAKRAVARTHY
Assistant Professor, Mechanical and Industrial Engineering
617.373.5362 | s.chakravarthy@neu.edu | ilab.coe.neu.edu

Scholarship Focus
- Multi-scale (spatio temporal)/meso-scale numerical methods
- Development of predictive material models of micro/nanostructural features of engineering alloys
- Fracture and fatigue in metal alloys

Selected Recent Publications

Papers in refereed journals

B.A. Szajewski, S. Chakravarthy, W.A. Curtin
Operation of a 3D Frank–Read Source in a Stress Gradient and Implications for Size-Dependent Plasticity, Acta Materialia, 2013, 1469–1477

S. Olarnithinun, S. Chakravarthy W.A. Curtin

S. Chakravarthy, W.A. Curtin
Scholarship Focus

- Mathematical methods and modeling
- Thermodynamics
- Fluid dynamics
- Kinetic theory of gases
- Thermophoresis of aerosols

Honors and Awards

- Fellow, American Society of Mechanical Engineers
- Edwin F. Church Medal, American Society of Mechanical Engineers
Scholarship Focus
Analysis and design of efficient facilities focusing on inventory space control, materials handling and staffing levels.

Honors and Awards
Fellow, Institute of Industrial Engineers

Selected Recent Publications
Papers in refereed journals
A. Topcu, J. Benneyan, T. Cullinane

Research Projects
A Computer Game to Teach Sustainability in Business and Engineering
   Co-Principal Investigator, Northeastern University

Engineering Management is the art and science of planning, organizing, allocating, directing and controlling the activities and resources applicable to individuals and organizations engaged in the management of engineering activities and technology development, including: project management, economic evaluation of systems, technology transfer, management of research programs, development, design, evaluation, production, and allied activities.
Scholarship Focus

- Coherent optical detection
- Imaging in turbid media
- Multi-modal microscopy
- Medical imaging with light and sound

Selected Recent Publications

*Papers in refereed journals*

Z.R. Hoffman, C.A. DiMarzio


Z. Lai, J. Kerimo, Y. Mega, C.A. DiMarzio

*Stepwise Multi-Photon Activation Fluorescence Reveals a New Method of Melanin Detection*, Journal of Biomedical Optics, 2013

J.L. Hollmann, R. Horstmeyer, C. Yang, C.A. DiMarzio


Z. Lai, J. Kerimo, Y. Mega, C.A. DiMarzio

*Stepwise Multiphoton Activation Fluorescence Reveals a New Method of Melanin Detection*, Journal of Biomedical Optics, 18 (6), 061225–061225, 2013

J.L. Hollmann, R. Horstmeyer, C. Yang, C.A. DiMarzio

Scholarship Focus

- Structure/property relationships in composites and ceramics
- Magnetic manipulation
- Colloidal physics

Selected Recent Publications

Books and chapter books

A.R. Studart, R. Libanori, R.M. Erb


A.R. Studart, R. Libanori, R.M. Erb


Papers in refereed journals

R. Libanori, F. B. Reusch, R.M. Erb, A. R. Studart


R. Libanori, R.M. Erb, A.R. Studart


R.M. Erb, J. Sander, R. Grisch, A.R. Studart

*Self-Shaping Composites With Programmable Bioinspired Microstructures*, Nature Communications, 2013, 4, 1712


*Stretchable Heterogeneous Composites with Extreme Mechanical Gradients*, Nature Communications, 2013

R.M. Erb, J. Segmehl, M. Schaffner, A.R. Studart


A.R. Studart, R.M. Erb

*Bioinspired Materials That Self-Shape Through Programmed Microstructures*, Soft Matter, 10 (9), 2014
Scholarship Focus

- Systems reliability
- Accelerated life testing in reliability prediction
- Big data-driven decision making in spatiotemporal streaming environment
- Life data (survival data) analysis
- Robust design of experiments

Honors and Awards

- Outstanding Presentation Award from the Reliability and Maintainability Symposium
- Associate Editor, IEEE Transactions on Reliability
- Associate Editor, International Journal of Reliability, Quality and Safety Engineering
- Certified Quality Engineer by American Society for Quality

Selected Recent Publications

Papers in refereed journals

A. Motaeia, T. A. Niaki, N. Fard

A. Mendes, N. Fard
Reliability Modeling for Appliances Using the Proportional Hazard Model, Institute of Electrical and Electronics Engineers Journal, 978 (1), 4673-4711, 2013

A. Mendes, N. Fard

A. Mendes, N. Fard

Dissertations Supervised

Alexandre Mendes
Proportional Hazard Model Applications in Reliability (see p 66)
ANDREW GOULDSTONE
Associate Professor, Associate Department Chair and Program Director of Mechanical Engineering; affiliated faculty, Bioengineering, Chemical Engineering, PhD, Massachusetts Institute of Technology, 2001
Joined Northeastern in 2008 | 617.373.3699 | a.gouldstone@neu.edu | coe.neu.edu/~agouldstone

Scholarship Focus
• Contact mechanics
• Materials science and engineering
• Thick films and coatings

Honors and Awards
• College of Engineering Faculty Fellow
• National Science Foundation CAREER Award

Selected Recent Publications
Papers in refereed journals
C.T. Nguyen, H.M. Gonnermann, Y. Chen, A. Gouldstone
Film Drainage and the Lifetime of Bubbles, Geochemistry Geophysics Geosystems, vol. 14 issue: 9 p 3616-3631, September 2013
T. Hu, S. Zhalehpour, A. Gouldstone, S. Muftu, T. Ando

Research Projects
IDR/Collaborative Research: Activities in Thermal Spray Processing and Volcanology
Principal Investigator, National Science Foundation
Garde: An Interdisciplinary Approach to Accommodate Fine Motor Control Disorders
Co-Principal Investigator, National Science Foundation
Fundamentals of Bonding in Kinetic Consolidation Processes
Co-Principal Investigator, National Science Foundation

Dissertations Supervised
Parnian Boloori Zadeh
The Evaluation of Pulmonary Surfactant Mechanics Under Different Inhaled Environments via Surface Tension Studies and Light Scattering (see p 62)
Scholarship Focus

- Dynamic resource allocation models
- Real-time hospital bed management algorithms
- Patient flow simulation and optimization
- Disaster preparedness and evacuation planning

Selected Recent Publications

Books and book chapters

J.A. Griffin, P. Keskinocak, J. Swann


Papers in refereed journals

J.A. Griffin, P. Keskinocak, C. Stokes, N. O’Hara, A. Vats


J.A. Griffin, S. Xia, S. Peng, P. Keskinocak

Improving Patient Flow in an Obstetric Unit, Health Care Management Science 15: 1-14, 2012
Scholarship Focus

- Green manufacturing
- Green supply chains
- Disassembly modeling
- Remanufacturing
- Reverse logistics
- Managing end of life products
- Environmentally conscious manufacturing
- Manufacturing sustainability
- Reverse and closed-loop supply chains
- Just-in-time (JIT) manufacturing and materials management
- Operations Research: stochastic and simulation modeling

Honors and Awards

Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

Books and book chapters

S.M. Gupta


O. Ondemir, S.M. Gupta


M.A. Ilgin, S.M. Gupta


S.M. McGovern, S. M. Gupta


K. Nakashima, S.M. Gupta


O. Ondemir, S.M. Gupta

C.B. Kalayci, S.M. Gupta

C.B. Kalayci, S.M. Gupta

Papers in refereed journals
C.B. Kalayci, S.M. Gupta

C.B. Kalayci, S.M. Gupta

C.B. Kalayci, S.M. Gupta
Scholarship Focus
- Multiscale and multiphase flow and transport phenomena
- Surface tension interactions in micro/nanoengineered structures
- Electrokinetic ion transport in porous media
- Development of novel imaging and diagnostic tools
- Applications in energy storage, portable biochemical diagnostics, thermal management, and water treatment systems

Honors and Awards
- National Science Foundation CAREER Award
- Defense Advanced Research Projects Agency Young Faculty Award
- American Society of Mechanical Engineers Robert T. Knapp Award

Selected Recent Publications

Papers in refereed journals
O.N. Demirer, R.M. Naylor, C.A. Rios Perez, E. Wilkes, C. Hidrovo

O.N. Demirer, C.H. Hidrovo

A. Chhabra, R. Kanapuram, T.J. Kim, J. Geng, A. Da Silva, C. Bielawski, C.H. Hidrovo


R. Hale, R. Bonnecaze, C.H. Hidrovo

R.S. Hale, R. Ranjan, C.H. Hidrovo

Research Projects
CAREER: Inertial Two-Phase Gas-Liquid Droplet Microflows
Principal Investigator, National Science Foundation

Advanced Thermo-Adsorptive Battery Climate Control System
Co-Principal Investigator, Advanced Research Projects Agency

Capillary and Boiling Limits of Micropillared Thermal Wicks
Principal Investigator, National Science Foundation
Scholarship Focus

- Fabrication of nanorods, involving physical vapor deposition experiments, atomistic simulations, and theoretical formulations
- Mechanics and radiation damage of nanostructured materials using atomistic simulations
- Solar and nuclear energy technologies

Honors and Awards

- Fellow, American Society of Mechanical Engineers
- Member, Connecticut Academy of Sciences and Engineering
- Senior Member, Chinese Mechanical Engineering Society
- Royal Society of London KTP Visiting Professor in Hong Kong

Selected Recent Publications

Papers in refereed journals

S. P. Stagon, H. Huang
Airtight Metallic Sealing at Room Temperature Under Small Mechanical Pressure, Nature Scientific Reports 3, 3066, 2013

X. B. Niu, S.P. Stagon, H. Huang, J.K. Baldwin, A. Misra

Q. Peng, W. Ji, H. Huang, S. De

S. P. Stagon, H. Huang
Synthesis and Applications of Small Metallic Nanorods from Solution and Physical Vapor Deposition, Nanotechnology Reviews 2, 259-267, 2013

L.G. Zhou, H. Huang

B. Narayanan, I.E. Reimanis, H. Huang, C.V. Ciobanu

L. G. Zhou, H. Huang

Y. F. Zhang, L. G. Zhou, H. Huang
Research Projects

Characteristic Length Scales of Growing Nanorods
   Principal Investigator, Department of Energy Office of Basic Energy Science Core Program

Characteristic Length Scales of Growing Nanorods
   Principal Investigator, Defense Threat Reduction Agency

Collaborative Research: Atomistic Mechanisms of Stabilizing Oxide Nanoparticles in Oxide-dispersion Strengthened Structural Materials
   Principal Investigator, National Science Foundation

A New Characteristic Length Scale on Surfaces
   Principal Investigator, National Science Foundation

From Nanofabrication to Commercial Production of Solar Cells
   Principal Investigator, National Science Foundation

Collaborative Nuclear Fellowship Program Applied Research in Radiation Damage and Mitigation
   Principal Investigator, Nuclear Regulatory Commission
Scholarship Focus

• Economic-environmental assessment of alternative manufacturing and nanomanufacturing routes towards sustainable design and manufacture
• Societal implications of nanomanufacturing, with interdisciplinary collaborations in political science, philosophy, industrial hygiene and industrial engineering
• Development and assessment of educational games for engineering students

Honors and Awards

• National Science Foundation CAREER Award
• ELATE Fellow

Selected Recent Publications

Papers in refereed journals


Mapping the Biological Oxidative Damage of Engineered Nanomaterials, SMALL, Special Issue: Nanotoxicology, 9 (9-10): 1853–1865, May 27, 2013

A.A. Busnaina, J. Mead, J. Isaacs, S. Somu

Nanomanufacturing and Sustainability: Opportunities and Challenges, Journal of Nanoparticle Research, 2013

L.J. Dahlben, M.J. Eckelman, A. Hakimian, S. Somu, J.A. Isaacs


Research Projects

Ethics Education in Life Cycle Design, Engineering, and Management
Co-Principal Investigator, National Science Foundation

Research Collaborative Networks: Sustainable Energy Systems
Co-Principal Investigator, National Science Foundation

Designing and Integrating LCA Methods for Nanomanufacturing Scale-up
Principal Investigator, National Science Foundation

Shortfall! – A Computer Game to Teach Sustainability in Engineering & Business
Principal Investigator, Northeastern University

The Center for High-rate Nanomanufacturing, Research Thrust on Responsible Nanomanufacturing
Associate Director and Investigator, National Science Foundation

ADVANCE: Institutional Transformation Award
Co-Principal Investigator, National Science Foundation
NADER JALILI
Professor and Director of Graduate Studies and Research, Mechanical and Industrial Engineering; affiliated faculty, Bioengineering, PhD, University of Connecticut, 1998. Joined Northeastern in 2009
617.373.3629 | n.jalili@neu.edu | coe.neu.edu/Research/psl

Scholarship Focus
- Piezoelectric-based actuators and sensors
- Dynamic modeling and vibration control of distributed-parameters systems
- Dynamics and control of MEMS and NEMS sensors and actuators
- Control and manipulation at the nanoscale

Honors and Awards
- Fellow, American Society of Mechanical Engineers
- National Science Foundation CAREER Award
- College of Engineering Martin Essigman Outstanding Teaching Award

Selected Recent Publications

Books and book chapters
N. Jalili

N. Jalili

Papers in refereed journals
S. Faegh, N. Jalili, S. Sridhar
Ultra Sensitive Piezoelectric-Based Microcantilever Biosensor: Theory and Experiment, Published Online, IEEE/American Society of Mechanical Engineers Transactions on Mechatronics, p 1-5

S. Faegh, N. Jalili, O. Yavuzcetin, D. Nagesha, R. Kumar, S. Sridhar

S. Faegh, S. Sridhar, N. Jalili

S. Eslami, N. Jalili

S. Faegh, N. Jalili
S. Eslami, N. Jalili

Model Development and Boundary Interaction Force Control of a Piezoresistive-Based Microcantilever, Robotica, FirstView Articles, p 1-19, June, 2014

Research Projects
High Temperature and High Acceleration End-Effector Pads for Semiconductor Applications – Phase II: Carbon Nanotube (CNT)-based Surface Treatment for Improved Adhesion and Friction Properties
  Principal Investigator, Brooks Automation Inc.
High Temperature and High Acceleration End-Effector Pads for Semiconductor Applications – Phase I
  Principal Investigator, Brooks Automation Inc.
Design and Development of Nanoscale Package-Embedded Vibration Sensing and Active Isolation – Phases I-V
  Principal Investigator, Raytheon
A New Hands-on Mechatronics Course in Emerging Fields
  Co-Principal Investigator, Mathworks

Dissertations Supervised
Samira Faegh

A Novel Self-Sensing Piezoelectric Microcantilever-Based Sensor for Detection of Ultra Small Masses and Biological Species (see p 64)
YUNG JOON JUNG
Associate Professor, Mechanical and Industrial Engineering
617.373.4843 | jungy@coe.neu.edu | coe.neu.edu/research/onsi

Scholarship Focus

- Synthesis of low dimensional nanomaterials and engineering their molecular structures
- Assembly, transfer and integration of nanomaterials and nanostructured architectures and study properties and underlying fundamental science
- Nanoelectronics, flexible devices, chemical sensors and energy application

Selected Recent Publications

*Papers in refereed journals*

Liquid Metal Nanodroplet Dynamics Inside Nanocontainers, Scientific Reports, 3, 2588, 2013

X. An, F. Liu, Y.J. Jung, S. Kar
Tunable Graphene–Silicon Heterojunctions for Ultrasensitive Photodetection, Nano Letters, 13, 909, 2013

G. Li, C. Yilmaz, X. An, S. Somu, S. Kar, Y.J. Jung, A. Busnaina, K. Wan

Carbon Nanotube Core Graphitic Shell Hybrid Fiber, ACS Nano, 7, 10971, 2013

A High-Performance H2S Detection by Redox Reaction in Semiconducting Carbon Nanotube-Based Devices, Analyst, 138, 7206, 2013

Y. Kim, H. Jung, S. Park, B. Li, F. Liu, J. Hao, Y. Kwon, Y.J. Jung, S. Kar

Research Projects

Highly Organized Two and Three Dimensional Singlewalled Carbon Nanotubes- Polymer Hybrid Structures for Diverse Flexible Devices and Systems
Principal Investigator, National Science Foundation

Ultra-High Performance Carbon Nanotube “Parallel Nanotube Architectures” (PNAs) for on-Chip Gigascale Local and Global Interconnects
Principal Investigator, National Science Foundation
Controlled Synthesis of Silicon Carbide Nanowires for the Highly Effective Thermal Dissipation in Chemical Materials
   Principal Investigator, Korean Ministry of Knowledge and Economy-Materials

Nanoporous Pt Film on Silicon Wafer and Engineering Their Nanopore Structure, Korea Institute of Science & Tech.
   Principal Investigator, Korean Ministry of Knowledge and Economy-Materials

The Center for High-Rate Nanomanufacturing
   Co-Principal Investigator, National Science Foundation

Flexible Electrodes and Catalyst Support Using Nanocarbon
   Principal Investigator, Korea Institute of Science and Technology

High Performance Photoswitches Using Carbon Nanotube-Si Heterojunctions for Optoelectronic Logic Devices
   Co-Principal Investigator, National Science Foundation

Dissertations Supervised
Bo Li
   Highly Organized Single-Walled Carbon Nanotube-Polymer Hybrid Architectures (see p 66)
SAGAR KAMARTHI
Associate Professor, Mechanical and Industrial Engineering
617.373.3070 | sagar@coe.neu.edu | coe.neu.edu/~sagar

Scholarship Focus
- Industrial engineering
- Advanced manufacturing
- Personalized disease management
- Sensor based diagnostics and prognostics

Selected Recent Publications

Papers in refereed journals
G.M. Uddin, K.S. Ziemer, B. Sun, I. Zeid, S. Kamarthi

H. Abuhimd, A. Zeid, Y.-J. Jung, G.M. Uddin, S. Kamarthi

S. Radhakrishnan, Y. Lin, I. Zeid, S. Kamarthi

I. Zeid, J. Chin, C. Duggan, S. Kamarthi

Research Projects
Smart Manufacturing Performance Assurance (Mpass) Through Equipment Monitoring
Principal Investigator, National Institute of Standards and Technology

TRANSFORMing Liberal Arts Careers to Meet Demand for Advanced Manufacturing Workforce
Co-Principal Investigator, National Science Foundation

Research Frontiers in Health Care Mass Customization for Personalized Diagnostics, Care and Cure
Principal Investigator, Northeastern University
Scholarship Focus

- Energy related and calorimeter studies related to pharmaceutical developments
- Simulation of thermal effects on laser beam propagation through heated materials
- Simulating microscale heat transfer phenomena and its effects on laser beam propagation
- Simulation of laser welding processes

Honors and Awards

Fellow, American Society of Mechanical Engineers

Research Projects

Chip-Scale Nano-Calorimeter
  Principal Investigator, Draper Lab Inc.

The Master of Science degree program in energy systems (MSES) integrates the technology side of energy systems development with the financial planning needed to effectively implement them. The goal of the MSES is to create a high-level signature, interdisciplinary graduate program for the engineer or technical business major who is pursuing an industrial or public-planning-based career.
YIANNIS LEVENDIS
COE Distinguished Professor, Mechanical and Industrial Engineering
617.373.3806 | y.levendis@neu.edu | coe.neu.edu/~yal

Scholarship Focus

• Gasification and combustion of solid fuels (coal, biomass and waste-tire-derived and waste plastics derived fuels)
• Generation and containment of combustion-generated pollution
• Synthesis and characterization of combustion-generated materials
• Fire suppression – fire extinction
• Engine design and operation

Honors and Awards

• Fellow, American Society of Mechanical Engineers
• Fellow, Society of Automotive Engineers
• Søren Buus Outstanding Research Award, College of Engineering
• George Westinghouse Gold Medal, American Society of Mechanical Engineers

Selected Recent Publications

Books and book chapters

T. Zannis, R.G. Papagiannakis, Y.A. Levendis


Papers in refereed journals

Y.A. Levendis

T. Maffei, R. Khatami, S. Pierucci, T. Faravelli, E. Ranzi, Y.A. Levendis
Experimental and Modeling Study of Single Coal Particle Combustion in $O_2/N_2$ and Oxygen fuel ($O_2/CO_2$) Atmospheres, Combustion and Flame, 2013

R. Soheilian, A. Davies, S.T. Anaraki, C. Zhuo, Y.A. Levendis
Pyrolytic Gasification of Post-Consumer Polyolefins to Allow for ‘Clean’ Premixed Combustion, Energy and Fuels, 2013

F. Kazanc, Y.A. Levendis, T. Maffei
Chemical Composition of Submicron Particulate Matter Emitted from Combustion of Coals of Various Ranks in $O_2/N_2$ and $O_2/CO_2$ Environments, Energy and Fuels, 2013
J. Riaza, L. Alvarez, M.V. Gil, R. Khatami, Y.A. Levendis, J.J. Pis, C. Pevida, F. Rubiera
Ignition Behavior of Coal and Biomass Blends Under Oxy-Firing Conditions with Steam Additions,
A. Davies, R. Soheilian, C. Zhuo, Y.A. Levendis
Pyrolytic Conversion of Biomass Residues to Gaseous Fuels for Electricity Generation, Journal of

Research Projects
Temperature Measurements and Submicron Ash Formation in Oxy-Combustion of Coal
Principal Investigator, National Science Foundation
NU STEP-UP: Science, Technology, Engineering
Co-Principal Investigator, National Science Foundation

Dissertations Supervised
Feyza Kazanc
Gaseous and Particulate Emissions from Pulverized Coal and Biomass Combustion Under Different
O₂/N₂ and O₂/CO₂ Environments (see p 65)
Reza Khatami
Ignition and Combustion of Pulverized Coal and Biomass Under Different Oxy-Fuel O₂/N₂ and O₂/
CO₂ Environments (see p 65)
YINGZI LIN
Associate Professor, Mechanical and Industrial Engineering; affiliated faculty, Bioengineering
PhD, University of Saskatchewan, 2004. Joined Northeastern in 2005
617.373.8610 | yi.lin@neu.edu | coe.neu.edu/~yilin

Scholarship Focus
- Human-machine interactions, interface design and user experiences, system integration and evaluation
- Smart systems and non intrusive sensors, human friendly mechatronics, human state detection and information fusion
- Human factors in transportation and healthcare

Honors and Awards
National Science Foundation CAREER Award

Selected Recent Publications
Papers in refereed journals
S. Radhakrishnan, Y. Lin, A. Zeid, S. Kamarthi
C.J. Liu, Y. Lin, H. Teng, Z.D. Wang, W.J. Zhang

Research Projects
Integrated Individualized Modeling Towards Cognitive Control of Human-Machine Systems
Principal Investigator, National Science Foundation
Principal Investigator, National Science Foundation
Scholarship Focus

- Nano optics
- Nano plasmonics
- Transformation optics/acoustics
- Nano structured materials and devices
- Nano optomechanics
- Energy harvesting technology

Selected Recent Publications

*Papers in refereed journals*

C.L. Zhao, Y. M. Liu, Y. H. Zhao, N. Fang, T. J. Huang  
*A Reconfigurable Plasmo-fluidic Lens*, Nature Communications, 2013

Y.M. Liu, X. Zhang  

H. Cang, Y. M. Liu, Y. Wang, X. Yin, X. Zhang  

Research Projects

*Plasmonic Metamaterials: A Sustainable, Bottom-up Approach*
  - Co-Principal Investigator, Northeastern University

*Graphene Photonics for Terahertz Radiation*
  - Principal Investigator, Northeastern University
Scholarship Focus

- MEMS-enabled systems for assistive technologies, energy harvesting, and microscale vacuum systems
- Tissue engineering via MEMS-enabled cell assembly and origami folding
- Carbon nanotube-based energy storage

Honors and Awards

National Science Foundation CAREER Award

Selected Recent Publications

*Papers in refereed journals*


G. Agarwal, A. Servi, C. Livermore

*Size-Selective, Biocompatible, Manufacturable Platform for Structuring Deformable Microsystems*, Lab on a Chip, online, 2014

Research Projects

**Compact Mechanical and Ion Pumping to Achieve High Vacuum**
Principal Investigator, Defense Advanced Research Projects Agency

**High-Resolution Tactile Displays for the Visually Impaired**
Principal Investigator, Bocelli Foundation

**EFRI-ODISSEI: Origami and Assembly Techniques for Human-Tissue-Engineering (OATH)**
Principal Investigator, National Science Foundation
Scholarship Focus

- Compressive sensing and modeling using mechanical and electromagnetic waves
- Computational methods for differential and integral equations
- Physics-based signal processing, imaging and optimization
- Explosives detection: portal-based, standoff-based, and underground-based
- Multimodal breast cancer detection: x-ray and thermoacoustic-tomography
- Non-Destructive Testing (NDT) using mechanical and electromagnetic waves
- Micro-sized microwave atmospheric sounding satellites

Selected Recent Publications

Papers in refereed journals

B. Gonzalez-Valdes, J.A. Martinez-Lorenzo, C. Rappaport, A.G. Pino


An Improved SAR Based Technique for Accurate Profile Reconstruction, IEEE Transactions on Antennas and Propagation, vol. 61, no. 3, p 1490-1495, March 2013

J.A. Martínez Lorenzo, Y. Rodríguez-Vaqueiro, C. Rappaport, O. Rubinos Lopez, A. García Pino
A Compressed Sensing Approach for Detection of Explosive Threats at Standoff Distances, Using a Passive Array of Scatterers, Homeland Security Affairs, Supplement 6, Article 1, p 1-6, April, 2013


B. Gonzalez-Valdes, J.A. Martinez-Lorenzo, C. Rappaport

Research Projects
Small Business ERC Collaborative Opportunity: Advanced Deep View Signal and Image Processing Algorithms with Hardware Acceleration
Principal Investigator, National Science Foundation

Millimeter-Wave Standoff Detection of Concealed Explosives
Investigator, Department of Homeland Security (part of ALERT center of excellence)

Advanced Algorithm Development for Multiband GPR Radar Detection of Buried Mines
Co-Principal Investigator, US Army Night Vision and Electronic Sensors Directorate

Walking Robot Based Ground Penetrating Radar Sensor for Mine and IED Detection
Co-Principal Investigator, National Science Foundation

Advanced Mechanical-Electromagnetic Applications for next Generation Environmental Monitoring
Principal Investigator, National Oceanic and Atmospheric Administration

Microwave Nearfield Radar Imaging (NRI) Using Digital Breast Tomosynthesis (DBT) for Non-Invasive Breast Cancer Detection
Principal Investigator, National Science Foundation

Processing of Physiologic Optical Images and Signals for Development of an Intra-Operative Burn Surgery Diagnostic Device
Principal Investigator, Spectral MD

Multi-Modality Electromagnetic Detection and Localization of Implanted Explosives Using Ultra low Field MRI and Nuclear Quadrupole Resonance
Co-Principal Investigator, Defense Advanced Research Projects Agency (DARPA)
CONSTANTINOS MAVROIDIS

COE Distinguished Professor, Mechanical and Industrial Engineering; affiliated faculty, Bioengineering
PhD, Massachusetts Institute of Technology, 1996. Joined Northeastern in 2004
617.373.4121 | mavro@coe.neu.edu | coe.neu.edu/~mavro

Scholarship Focus
- Biomedical Mechatronics
- Medical Devices
- Rehabilitation Robotics
- Advanced Actuators

Honors and Awards
- Fellow, American Society of Mechanical Engineers
- Fellow, National Academy of Inventors
- National Science Foundation CAREER Award
- Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

Books and book chapters
C. Mavroidis, A. Ferreira

E. Brassois, C. Mavroidis

G. Sharma, Atul Dubey, C. Mavroidis
Protein-Based Nanoscale Actuation, Nanorobotics, 2013, p 425-455

M. Pietrusinski, I. Cajigas, P. Bonato, C. Mavroidis
Healthy Subject Testing with the Robotic Gait Rehabilitation (RGR) Trainer, Romansy 19 – Robot Design, Dynamics and Control CISM International Centre for Mechanical Sciences, 2013, p 341-348

Papers in refereed journals
J.E. Deutsch, M.J. Myslinski, M. Kafri, R. Ranky, M. Sivak, C. Mavroidis, J. Lewis

Research Projects
Customizable Sensors for Humans Using an Integrated Polymer: C-SHIP
- Principal Investigator, National Science Foundation

Prototype Funds to 3-SPARK LLC
- Co-Principal Investigator, Northeastern University

Commercialization of Lower Body Robotic Exoskeletons for Gait Retraining
- Principal Investigator, National Science Foundation

Compact Drive System for Planetary Rovers and Space Manipulators
- Principal Investigator, National Aeronautics and Space Administration

CPS: Breakthrough: A Cyber-Physical Framework for MRI Guided Magnetic Nano-Particles
- Principal Investigator, National Science Foundation

The Gear Bearing Drive: A Novel Compact Actuator for Robotic Joints
- Principal Investigator, National Science Foundation

Robotic Leg Advancement Device
- Principal Investigator, National Science Foundation
NICOL MCGRUER
Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering, Mechanical and
Industrial Engineering, PhD, Michigan State University, 1983. Joined Northeastern in 1987
617.373.2066 | mcgruer@ece.neu.edu

Scholarship Focus
- MEMS
- NEMS
- Micro-fabrication
- Micro-systems
- Organic semiconductor devices

Honors and Awards
Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications
Papers in refereed journals
H. Pan, Y.-C. Wu, G.G. Adams, G.P. Miller, N. McGruer
Interfacial Shear Stress Between Single-Walled Carbon Nanotubes and Gold Surfaces With and
Water Soluble Pentacene, J. Mater. Chem. C, 2013, 1, 2193-2201
Y.-C. Wu, N. McGruer, G.G. Adams
Adhesive Slip Process Between a Carbon Nanotube and a Substrate, Journal of Physics D:
Applied Physics, vol. 46, 2013, 175305
Hot-Switched Lifetime and Damage Characteristics of MEMS Switch Contacts, Journal of
Micromechanics and Microengineering, vol. 23, 2013

Papers in refereed conferences
A. Basu, R. Hennessy, G. Adams, N. McGruer
Reliability in Hot Switched Ruthenium on Ruthenium MEMS Contacts, Proceedings of the 59th
Holm Conference on Electrical Contacts (HOLM), 2013, 22-25 Sept. 2013, Pages 1-8
A. Basu, R. Hennessy, G. Adams, N. McGruer
Leading and Trailing Edge Hot Switching Damage in a Metal Contact RF MEMS Switch,
Proceedings of Transducers & Eurosensors XXVII: The 17th International Conference on Solid-

Research Projects
NSEC: The Center for High-Rate Nanomanufacturing (CHN)
Investigator, National Science Foundation
Center for RF MEMS Reliability and Design Fundamentals
Principal Investigator, Defense Advanced Research Projects Agency
EMANUEL MELACHRINOU DIS
Associate Professor, Associate Department Chair and Program Director of Industrial Engineering
PhD, University of Massachusetts, Amherst, 1980. Joined Northeastern in 1979
617.373.4850 | emelas@coe.neu.edu | coe.neu.edu/~emelas

Scholarship Focus

• Deterministic operations research and multi-criteria optimization
• Facility location
• Supply chain, transportation and logistics
• Wireless sensor network lifetime maximization with sink mobility
• Network design for maximum survivability

Selected Recent Publications

Papers in refereed journals

R. Heydari, E. Melachrinoudis

M. Mekuria, P. Furth, E. Melachrinoudis
Optimization of Spacing of Transit Stops on a Realistic Street Network, Transportation Research Record, 4, p 29-37, 2012

N. Zaarour, E. Melachrinoudis, M. Solomon, H. Min
Scholarship Focus

- Fundamentals of combustion such as Burning speed and onset of auto-ignition measurement and flame stability analysis
- Development of chemistry reduction such as Rate-controlled Constrained-Equilibrium method
- Non-equilibrium thermodynamics

Honors and Awards

- American Society of Mechanical Engineers James H. Potter Gold Medal
- American Society of Mechanical Engineers Edward Obert Award
- American Society of Mechanical Engineers Dedicated Service Award
- Editor in Chief, American Society of Mechanical Engineers Journal of Energy Resources Technology
- Fellow, American Society of Mechanical Engineers

Selected Recent Publications

Papers in refereed journals

O. Askari, M. Metghalchi, A. Moghaddas, S.K. Hannani, R. Ebrahimi
Fundamental Study of Spray and Partially Premixed Combustion Characteristics of Methane/Air Mixture, American Society of Mechanical Engineers Journal of Energy Resources Technology, June 2013, 135 (2)

M. Janbozorgi, M.R. Sheikhi, H. Metghalchi

A. Moghaddas, C. Bennett, E. Rokni, H. Metghalchi
Laminar Burning Speeds and Flame Structures of Mixtures of Difluoromethane (HFC-32) and 1,1-Difluoroethane (HCF-152a) with Air at Elevated Temperatures and Pressures, HVAC&R Research, 20, 2014, 42-50

O. Askari, H. Metghalchi, S.K. Hannani, H. Hemmati, R. Ebrahimi

G. Nicolas, M. Janbozorgi, H. Metghalchi

Research Projects

LSAMP Educational Research Project: Retention of URM Engineering Students through Practice-Oriented Experiential Education
- Principal Investigator, National Science Foundation

Investing in Tomorrow’s Engineering Leaders
- Co-Principal Investigator, National Science Foundation

Combustion Research
- Principal Investigator, Novatio Engineering
Scholarship Focus

- Process-Structure-Properties relationships in polymer-based nano-composites fibers
- Polymer/nano-carbon interfacial interactions and interphase formations
- Lightweight composite materials
- Carbon-carbon composites

Honors and Awards
National Science Foundation CAREER Award

Selected Recent Publications

Papers in refereed journals

J. Meng, Y. Zhang, K. Song, M.L. Minus

K. Song, Y. Zhang, J. Meng, E.C. Green, N. Tajaddod, H. Li, M.L. Minus
Structural Polymer-Based Carbon Nanotube Composite Fibers: Understanding the Processing-Structure-Performance Relationship, Materials, vol. 6, 2013, p 2543-2577

Y. Zhang, K. Song, J. Meng, M.L. Minus

Research Projects

Evolution of Interphase-Polyacrylonitrile (i-PAN) Structure during Carbon Fiber Processing
Principal Investigator, Defense Advanced Research Projects Agency

Studying the Dependency of Interfacial Formation with Carbon Nanotube Length for Stress Transfer in Polymer Composite Fibers
Principal Investigator, Air Force Office of Scientific Research

CAREER: Understanding Directionally Templated Interphase Processing-Structure Development and Relationships in Polymer Nano-Composite Materials
Principal Investigator, National Science Foundation
SİNAN MÜFTÜ
Professor, Mechanical and Industrial Engineering; affiliated faculty, Bioengineering, Civil and Environmental Engineering, PhD, University of Rochester, 1994. Joined Northeastern in 2000
617.373.4743 | s.muftu@neu.edu | coe.neu.edu/~smuftu

Scholarship Focus
- Mechanics and tribology of axially moving, thin materials and flexible webs
- Numerical simulation of tissue healing and bone remodeling
- High velocity impact of micron scale particles

Honors and Awards
- Fellow, American Society of Mechanical Engineers
- Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

*Papers in refereed journals*

J. Aguirrebeitia, S. Müftü, M. Abasolo, J. Vallejo

H.Y. Chou, S. Müftü
On Peri-Implant Bone Healing Due to Immediate Loading in Dental Implant Treatments, Journal of Biomechanics, 46 (5), 2013, 871-878

J. Shi, S. Müftü, A.Z. Gu, K.T. Wan

Research Projects

A Novel Biomechanical Model of Bacterial Adhesion and Aggregation
Co-Principal Investigator, National Science Foundation

Collaborative Research: Mechano-Lipidomics and Mechano-Cytosis of Drug Delivery Liposomes
Co-Principal Investigator, National Science Foundation

Theoretical and Experimental Investigation of Bonding in Cold Spray
Principal Investigator, Plasma Giken Kogyo Co

Tape Path Mechanics
Principal Investigator, International Storage Industry Consortium

Fundamentals of Bonding and Kinetic Consolidation Processes
Co-Principal Investigator, National Science Foundation

Dissertations Supervised

Qian Sheng
Tribological and Mechanical Characterization of Thin Polymer Films (see p 69)

Baran Yildirim
Mechanistic Modeling of High Velocity Micro-Particle Impacts: Application to Material Deposition by Cold Spray Process (see p 70)
SHASHI MURTHY
Associate Professor, Chemical Engineering; affiliated faculty; Bioengineering, Mechanical and Industrial Engineering, PhD, Massachusetts Institute of Technology, 2003. Joined Northeastern in 2005
617.373.4017 | smurthy@coe.neu.edu | microfluidicslab.org

Scholarship Focus

• Biomaterials
• Microfluidics

Honors and Awards

• College of Engineering Faculty Fellow
• National Science Foundation CAREER Award
• Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

Books and book chapters
B. Zhu, B.D. Plouffe, S.K. Murthy

Papers in refereed journals
B. Zhang, C. Peticone, S.K. Murthy, M. Radisic
An Improved Prototype Diffuse Fluorescence Flow Cytometer for High Sensitivity Detection of Rare Circulating Cells in Vivo, Journal of Biomedical Optics vol. 18, 2013, p 077002
N. Pestana, D. Walsh, A. Hatch, P. Hahn, G.J. Jaffe, S.K. Murthy, N. Niedre
A Dedicated Low-Cost Fluorescence Microfluidic Device Reader for Point-of-Care Ocular Diagnostics, Journal of Medical Devices, vol. 7, 2013, p 024501
B. Zhu, J. Smith, M.L. Yarmush, Y. Nahmias, B.J. Kirby, S.K. Murthy
B. Zhu, S.K. Murthy
V. Tandon, B. Zhang, M. Radisic, S.K. Murthy

Research Projects
Microfluidic Cell Separation for Tissue Engineering and Regenerative Medicine
Principal Investigator, National Institutes of Health

CAREER: Understanding the Role of Cell Surface Markers in Microfluidic Cell Separation- An Integrated Research and Education Program
Principal Investigator, National Science Foundation

Computational Fluid Dynamics Analysis of a Blood Analysis System
Principal Investigator, Constitution Medical Inc.
Scholarship Focus
Biomechanics, mechanics

Honors and Awards
Fellow, American Society of Mechanical Engineers

Selected Recent Publications

Papers in refereed journals
J. A. Renick, A. Nazarian, V. Entezarim J. Kimbaris, A. Tseng, A. Masoud, H. Nayeb-Hashemi, A. Vaziri, B. Snyder
Finite Element Analysis and Computed Tomography Based Structural Rigidity Analysis of Rat Tibia with Simulated Lytic Defects, J. of Biomechanics, 2013
A. Marzban, H. Nayeb-Hashemi, A. Vaziri
Numerical Simulation of Load-Induced Bone Structural Remodeling Using Stress-Limit Criterion, Computer Methods in Biomechanics and Biomedical Engineering, 2013
Effects of Fluid Flow Shear Rate and Surface Roughness on the Calcification of Polymeric Heart Valve Leaflet, Material Science and Engineering C 33, 2013, p 2770-2775
In-Vitro Calcification Study of Polyurethane Heart Valves, Material Science and Engineering C 35, 2013

Research Projects
Knee Injury Prevention and Osteoarthritis Risk in Obesity
Co-Principal Investigator, National Priorities Research Program

Novel Multi Functional Composite Sandwich Panel
Principal Investigator, National Priorities Research Program

High-Performance Biodegradable Composites from Qatari Date Palm Waste
Principal Investigator, National Priorities Research Program
Scholarship Focus

- Tissue engineering of load-bearing matrix (Bone, Cornea)
- Bioreactor Design
- Multi-scale Mechanobiochemistry, Statistical Mechanics, Energetics
- Microscopy, High-resolution Imaging

Honors and Awards
Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

Papers in refereed journals

H.K. Kao, Q. Li, B. Flynn, X. Qiao, J.W. Ruberti, G.F. Murphy, L. Guo

J.A. Paten, G. Tilburey, E. Molloy, R. Zareian, C. Trainor, J.W. Ruberti
Utility of an Optically-Based Micromechanical System for Printing and Testing Collagen Fibers, Biomaterials, Apr 34, 2013

B.P. Flynn, G. Tilburey, J.W. Ruberti

Research Projects
Mechanobiology of Matrix Production by Corneal Fibroblasts
Principal Investigator, National Institutes of Health

Lipid Activated Nuclear Receptors in Age-Related Macular Degeneration
Co-Investigator, National Institutes of Health

Biomimetic Bone: from Nano to Micro
Principal Investigator, National Science Foundation

Impact of Lipids on Intestinal Mucus Transport and Structural Properties
Co-Investigator, National Institutes of Health

Dissertations Supervised
Ramin Zareian
The Effect of Mechanics on Migration, Morphology and Matrix Production by Primary Human Corneal Fibroblasts: Long-Term Dynamic Observation (see p 71)
VINOD SAHNEY
University Distinguished Professor, Mechanical and Industrial Engineering
PhD, University of Wisconsin, Madison, 1970. Joined Northeastern in 2011
617.373.3831 | v.sahney@neu.edu

Scholarship Focus
• Health care initiatives
• Industrial engineering
• Operations research

Honors and Awards
• Member, Institute of Medicine, National Academy of Science
• Member, National Academy of Engineering
• Fellow, Health Care Information and Management Systems Society
• Fellow, Institute of Industrial Engineers
• Gilbreth Award for Lifetime Contribution to Industrial Engineering; Institute for Industrial and Systems Engineering
Scholarship Focus

- Multi-scale bone biomechanics – how the structure and composition of bone influences its mechanical properties
- Mechano-adaptation of bone and joint – how tissue responds to mechanical signals

Selected Recent Publications

*Papers in refereed journals*

N. Rodriguez-Florez, M. L. Oyen, S.J. Shefelbine

Age Related Changes in Mouse Bone Permeability, Journal of Biomechanics, vol. 47, issue 5 , p 1110-1116

A. Carriero, M. Doube, M. Vogt, B. Busse, J. Zustin, A. Levchuk, P. Schneider, R. Müller, S.J. Shefelbine

Altered Lacunar and Vascular Porosity in Osteogenesis Imperfecta Mouse Bone as Revealed by Synchrotron Tomography Contributes to Bone Fragility, Bone, 61:116-24, 2013

W. Macdonald, S.J. Shefelbine

Characterising Neovascularisation in Fracture Healing with Laser Doppler and Micro-CT Scanning, Medical and Biological Engineering and Computing, 2013, 51 (10):1157-65, 2013

M. Vanleene, S. J. Shefelbine

Therapeutic Impact of Low Amplitude High Frequency Whole Body Vibrations on the Osteogenesis Imperfecta Mouse Bone, Bone, 53 (2):507-14, 2013


Spontaneous Osteoarthritis In STR/ORT Mice is Unlikely Due to Greater Vulnerability to Mechanical Trauma, Osteoarthritis Cartilage, 21 (5): 756-63, 2013

N. Rodriguez, M. L. Oyen, S. J. Shefelbine

Insight into Differences in Nanoindentation Properties of Bone, Journal of the Mechanical Behavior of Biomedical Materials, 2013, 18, 90-99
Scholarship Focus

• Turbulence
• Combustion and propulsion
• Computational fluid dynamics and high performance computing

Selected Recent Publications

Papers in refereed journals

M. Janbozorgi, M.R.H. Sheikhi, H. Metghalchi

M. Safari, M.R.H. Sheikhi

Research Projects

Experimental and Computational Investigations of the Ignition and Combustion of GTL and Jet Fuel Blends
Principal Investigator, Qatar National Foundation

Large-Scale Simulation of Turbulent Flames with Detailed Chemistry
Principal Investigator, American Chemical Society

Investigation of Coal-Biomass Catalytic Gasification Using Experiments, Reaction Kinetics and Computational Fluid Dynamics
Principal Investigator, Department of Energy
Scholarship Focus
- Stability, stabilization, and control design for systems with multiple delays
- Systems-level approach to man-machine systems, security, and biomedical applications

Honors and Awards
- College of Engineering Faculty Fellow
- Defense Advanced Research Projects Agency Young Faculty Award
- Fellow, American Society of Mechanical Engineers

Selected Recent Publications

Books and book chapters
T. Vyhlidal, J.-F. Lafay, R. Sipahi (Eds.)
Delay Systems from Theory to Numerics in Applications, in Advances in Dynamics and Delays, Springer-Verlag, October 2013

Papers in refereed journals
W. Qiao, R. Sipahi

R. Sipahi, I.I. Delice
On Some Features of Core Hypersurfaces Related to Stability Switching of LTI Systems with Multiple Time Delays, IMA Mathematical Control and Information, available online, 2013

P.M. Nia, R. Sipahi

Research Projects
Interplay Between Network Topology and Stability of Control Systems with Delays
Principal Investigator, National Science Foundation

EAGER: Mechatronics Based Braille Writing Device for the Blind
Principal Investigator, National Science Foundation

A New Hands-on Mechatronics Course in Emerging Engineering Fields
Principal Investigator, Math Works

Model-Free Algorithms to Assist and Control Human-Task Missions against Dynamic Environments
Principal Investigator, Defense Advanced Research Projects Agency

GARDE: An Interdisciplinary Approach to Accommodate Fine Motor Control Disorders
Principal Investigator, National Science Foundation

Building Handheld Devices to Accommodate Essential Tremor
Principal Investigator, Center for Integration of Medicine and Innovative Technology

Dissertations Supervised
Wei Qiao
Interplay Between Stability, Delays, and Graphs of a Class of Multi-Agent LTI System with Applications
(see p 68)
MOHAMMAD TASLIM
Professor, Mechanical and Industrial Engineering
PhD, University of Arizona, 1981. Joined Northeastern in 1982
617.373.5514 | m.taslim@neu.edu | coe.neu.edu/~taslim

Scholarship Focus
- Energy
- Gas turbine cooling technology
- Droplet characterization
- Renewable energy
- Fuel cell modeling

Honors and Awards
Fellow, American Society of Mechanical Engineers

Selected Recent Publications

Papers in refereed journals

K. Elebiary, M.E. Taslim
Experimental/numerical cross-over jet impingement in an airfoil leading-edge cooling channel, J. Turbomachinery, vol. 135, no. 1, p 011037-1-12, 2013

M.E. Taslim, M.K.H. Fong
Experimental and numerical cross-over jet impingement in a rib-roughened airfoil trailing-edge cooling channel, J. Turbomachinery, vol. 135, no. 5, p 051014-1-10, 2013

M.E. Taslim, X. Huang
Scholarship Focus

- Healthcare system engineering: Appointment scheduling, chemotherapy planning and scheduling, planning of mental health services, nurse staffing
- Production and transportation systems: Predictive/reactive scheduling, train scheduling, flexible manufacturing systems,
- Methodology: Discrete optimization, multi-criteria optimization, network optimization, simulation, constraint programming

Selected Recent Publications

Books and book chapters

Papers in refereed journals
A. Turkcan, A. Zeng, M.A. Lawley

Research Projects
Improving Health Care Systems for Access to Care by Under Served Patients
Co-Principal Investigator, Patient-Centered Outcomes Research Institute

Simulation-Based Planning Model for Mental Health Care Services
Co-Principal Investigator, Department of Veterans Affairs
Scholarship Focus

- Materials science and engineering
- Computational materials science
- Kinetic phenomena in materials
- Engineering physics
- Crystalline defects and microstructures
- Interfacial phenomena
- Structure, morphology and properties of nanoscale materials
- Filamentous materials and their assemblies

Selected Recent Publications

Papers in refereed journals

H. Wang, L. A. Zepeda-Ruiz, G. H. Gilmer, M. Upmanyu

Z. Ma, D. McDowell, E. Panaitescu, A.V. Davidov, M. Upmanyu, L. Menon


C. Wang, M. Upmanyu
Shear Accommodation in Dirty Grain Boundaries, Europhysics Letters, 106 (2), 26001, 2014

Research Projects

Computational Studies of Nanocrystal Growth
Principal Investigator, National Science Foundation

Nanomaterials for Force Protection and Increased Performance of Soldiers and Vehicles
Co-Principal Investigator, Armament Research

Particle-Strengthened Interfaces
Principal Investigator, Office of Naval Research

Enhanced Stability and Mechanics of Ultra-Fine Grained Metals via Engineered Solute Segregation
Principal Investigator, US Army Research Office

Carbon Nanotube Reinforced Metal Composites
Principal Investigator, Schlumberger Foundation, Schlumberger
ASHKAN VAZIRI
Associate Professor, Mechanical and Industrial Engineering; affiliated faculty, Bioengineering
617.373.3474 | vaziri@coe.neu.edu | www.hpmsl.neu.edu

Scholarship Focus
• Solid Mechanics, materials
• Computational Methods
• Biomechanics
• Nanotechnology

Honors and Awards
• Air Force Office of Scientific Research Young Investigator Award
• National Science Foundation CAREER Award
• Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

Books and book chapters
A. Vaziri, R. Ghosh
M.W. Moon, C. Kim, A. Vaziri
Ion Beam-Induced Self-Assembled Wrinkles, Mechanical Self-Assembly: Science and Application, Springer, Edited by X. Chen, 2013

Papers in refereed journals
J.A. Rennick, A. Nazarian, V. Entezari, J. Kimbaris, A. Tseng, A. Masoudi, H. Nayeb-Hashemi, A. Vaziri, B. Snyder
Finite Element Analysis and Computed Tomography Based Structural Rigidity Analysis of Rat Tibia with Simulated Lytic Defects, Journal of Biomechanics, 2013
B. Haghpanah, R. Oftadeh, J. Papadopoulos, A. Vaziri
A. Nasto, A. Ajdari, A. Lazarus, A. Vaziri, P.M. Reis
H. Ebrahimi, A. Vaziri
R. Oftadeh, B. Haghpanah, J. Papadopoulos, A.M. S. Hamouda, H. Nayeb-Hashemi, A. Vaziri
H. Ebrahimi, A. Ajdari, D. Vella, A. Boudaoud, A. Vaziri
J. Xiong, R. Ghosh, L. Ma, A. Vaziri, Y. Wang, L. Wu
B. Haghpanah, Sh. Chiu, A. Vaziri  

B. Haghpanah, J. Papadopolous, A. Vaziri  

J. Xiong, B. Wang, L. Ma, J. Papadopoulos, A. Vaziri, L. Wu  
**Three-Dimensional Composite Lattice Structures Fabricated by Electrical Discharge Machining**, Experimental Mechanics, 2014, 54, p 405-412

**Research Projects**  
**CAREER: Functional Biomimetic Materials with Extreme Topology**  
Principal Investigator, National Science Foundation  

**Bioinspired Surfaces and Interfaces for Hybrid Multifunctional Structures**  
Principal Investigator, Air Force Office of Scientific Research  

**ALERT F4 Initiative**  
Principal Investigator, Department of Homeland Security

**Mechanics of Carbon Nanotube Surface Decontamination**  
Principal Investigator, FM Global

**Development of Novel High Friction, low Adhesion Materials**  
Co-Principal Investigator, Brooks Automation

**New Approaches for Structural Protection in Oil and Gas Industry**  
Principal Investigator, National Priorities Research Program

**Dissertations Supervised**  
Babak Haghpanah Jahromi  
**Mechanics of Regular, Chiral and Hierarchical Honeycombs** (see p 64)
Scholarship Focus

- Cellular biomechanics
- Water filtration
- Thin film adhesion and characterization
- Subsurface mechano-sensing
- Shell adhesion
- Fundamental inter-surface forces

Honors and Awards

- College of Engineering Faculty Fellow
- National Science Foundation CAREER Award

Selected Recent Publications

Papers in refereed journals

Y. Li, X. Wang, A. Onnis-Hayden, K.-T. Wan, A. Z. Gu

Universal Quantifier Derived from AFM Analysis Links Cellular Mechanic Properties and Cell Surface Integration Forces with Microbial Deposition and Transport Behavior, Environmental Science & Technology, 2013


Detecting Solid Masses in Phantom Breast Using Mechanical Indentation, Experimental Mechanics, 2013

G. Li, K.-T. Wan


J. Shi, S. Müftü, A. Gu, K.-T. Wan


X. Wang, Y. Li, A. Gu, K.-T. Wan

Predicting Macroscopic Colloidal Deposition and Transportation Based on Dimensionless Tabor’s Parameter, Nano LIFE, 2013

G. Li, C. Yilmaz, X. An, S. Somu, Swastik Kar, Y. J. Jung, A. Busnaina, K.-T. Wan


M. Robitaille, J. Shi, S. McBride, K.-T. Wan

Mechanical Performance of Hydrogel Contact Lenses with a Range of Power Under Parallel Plate Compression and Central Load, Journal of the Mechanical Behavior of Biomedical Materials, 2013

Carbon-Nanotube-Embedded Hydrogel Sheets for Engineering Cardiac Constructs and Bioactuators, ACS Nano, 2013

Research Projects

A Novel Biomechanical Model of Bacterial Adhesion and Aggregation
Principal Investigator, National Science Foundation

Mechano-Lipidomics and Mechano-Cytosis of Drug Delivery Liposomes
Principal Investigator, National Science Foundation

Development of Long-Term Adhesion Test for Photovoltaic Module Components
Principal Investigator, National Institute of Standards and Technology

Mechanical Characterization and Adhesion Measurement of Hydrogel Contact Lenses
Principal Investigator, Johnson & Johnson

Dissertations Supervised

Michael Conrad Robitaille
Multi-Scaled Adhesion Mechanics of Hydrogel Contact Lenses (see p 68)

Xin Wang
Integrated Surface and Mechanical Characterization of Freestanding Biological and Other Nano-Structures Using Atomic Force Microscopy (see p 69)
Scholarship Focus

- Mechanics
- Personalized medicine
- Simulation techniques and complex networks analysis

Honors and Awards

Fellow, American Society of Mechanical Engineers

Selected Recent Publications

*Papers in refereed journals*

J.S. Chin, I. Zeid, S. Kamarthi

*Using 3D Modeling and Neural Networks to Predict Time-To-Heal for Chronic, Nonhealing Wounds*, Journal of Medical Devices, vol. 7, 2013

G.M. Uddin, K.S. Ziemer, B. Sun, I. Zeid, S. Kamarthi


H. Abuhimd, A. Zeid, Y.-J. Jung, G.M. Uddin, S. Kamarthi


S. Radhakrishnan, Y. Lin, I. Zeid, S. Kamarthi


A. Zeid, J. Chin, S. Kamarthi


Research Projects

CAPSULE: CAP Stone Unique Learning Experience Replace

Principal Investigator, National Science Foundation

Research Frontiers in Health Care Mass Customization for Personalization of Diagnosis, Care and Cure

Co-Principal Investigator, Northeastern University

Dissertations Supervised

Jessica Selina Cho Chin

*Investigating a Systems Approach to the Predictive Modeling and Analysis of Time-Varying Wound Progression and Healing* (see p 63)
Mary Balaconis
PhD, 2014 Mechanical and Industrial Engineering
Advisor, Heather Clark | Nanoscience and Nanotechnology

The Development and Design of Fluorescent Sensors for Continuous in Vivo Glucose Monitoring

This dissertation details the design of novel fluorescent glucose-sensitive sensors for monitoring glucose levels noninvasive and continuously after initial implantation. Sensing components were selected for appropriate response at physiological concentrations and were fully characterized for dynamic range, sensitivity, and lifetime in vitro. In pre-clinical testing, glucose-sensitive sensors tracked changes in glucose levels in mice, but sensor monitoring was limited to one hour. Sensor design was further improved after these studies to prolong in vivo lifetime, increase response at hypoglycemic levels, and enhance sensor biocompatibility. These efforts resulted in vivo lifetimes greater than one hour, incorporation of more advance sensing moieties, and a biodegradable sensor platform. Future work with these sensors will involve Clark Error Grid Analysis and biodistribution studies to address clinical application requirements.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/54

Parnian Boolori Zadeh
PhD, 2013 Mechanical and Industrial Engineering
Advisor, Andrew Gouldstone | Biomechanical Engineering

The Evaluation of Pulmonary Surfactant Mechanics Under Different Inhaled Environments via Surface Tension Studies and Light Scattering

This dissertation focuses on the effects of using an indenter tip on the OCT images obtained from an excised lung (ii) the effects of oxygen on PS by confirming the results obtained from LW experiments using light scattering technique (iii) the effects of isoflurane (a commonly used sedative anesthetic) in reducing the toxic effect of oxygen on the function of PS and (iv) the effects of a single deep breath on the re-spreading process of PS. Findings from the last two studies can be very valuable in critical care and systematic utilization of isoflurane and deep breaths may be beneficial for patients in need of ventilator-based treatments.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/49
Investigating a Systems Approach to the Predictive Modeling and Analysis of Time-Varying Wound Progression and Healing

This dissertation presents three predictive statistical models, namely, multiple linear regression, non-linear regression, and neural networks, and compares their performance. These models take wound parameters such as length, width, and depth as inputs and produce the remaining time to heal as an output. These predictive models also allow us to determine the wound parameters that are most influential on wound healing. These models are developed and analyzed with insight gained from four major wound clinics around the country.

See full dissertation at iris.lib.neu.edu/ind_eng_diss/16

JESSICA SELINA CHO CHIN
PhD, 2014 Mechanical and Industrial Engineering
Advisor, Ibrahim Zeid | Molecular, Cellular, and Tissue Engineering

Development of High-Rate Nano-Scale Offset Printing Technology for Electric and Bio

This dissertation presents newly developed `damascene template,’ reusable and versatile template, for high-rate directed assembly and transfer of nanomaterials. In addition, a flexible damascene template based on a polymer substrate has been developed to apply to the roll to roll system for continuous assembly and transfer. The governing parameters for assembly and transfer were investigated to achieve the uniform assembly and high transfer yield. Our approaches demonstrate that the combination of reusable damascene template and directed assembly and transfer is significantly compatible with various nanomaterials such as polymer, silica, semiconductor nanoparticles and SWNTs by controlling the surface energy of the template, assembly and transfer parameters. This process and template will enable high-rate manufacturing of flexible devices such as a flexible transistor, display, bio and chemical sensors, energy harvesting.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/58

HANCHUL CHO
PhD, 2014 Mechanical and Industrial Engineering
Advisor, Ahmed Busnaina | Nanoscience and Nanotechnology
A Novel Self-Sensing Piezoelectric Microcantilever-Based Sensor for Detection of Ultrasmall Masses and Biological Species

This dissertation presents a unique self-sensing piezoelectric MC-based sensor for the purpose of detecting ultrasmall masses and biological species. The entire developmental process is covered and presented which includes: development of comprehensive mathematical modeling framework, numerical simulation, designing, building and testing the sensor. In the beginning chapters of this dissertation, the main focus is on analytical studies investigating modeling and simulation of piezoactive MC-based systems with diverse applications along with the relative experimental verification. Sophisticated comprehensive mathematical modeling frameworks capable of describing static and dynamic behavior of MCs are presented.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/52

BABAK HAGHPANAH JAHROMI
PhD, 2014 Mechanical and Industrial Engineering
Advisor, Ashkan Vaziri | Cellular structures

Mechanics of Regular, Chiral and Hierarchical Honeycombs

This dissertation presents approaches to obtain analytical closed-form expressions for the macroscopic elastic, plastic collapse, and buckling response of various two-dimensional cellular structures. First, it will provide analytical models to estimate the effective elastic modulus and Poisson’s ratio of hierarchical honeycombs using the concepts of mechanics of materials and compare the analytical results with finite element simulations and experiments. The work generalizes previous studies on plastic collapse analysis of lattice structures, which are limited to very simple loading conditions. Finally, the method for calculation of buckling strength is based on classical beam-column end-moment behavior expressed in a matrix form.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/55
Gaseous and Particulate Emissions from Pulverized Coal and Biomass Combustion Under Different O2/N2 and O2/CO2 Environments

This dissertation examines the gaseous (NOx, SO2 and CO) and the particulate emissions (ash) from burning of pulverized coals and biomasses under either conventional combustion in air or oxy-fuel combustion conditions. Oxy-fuel combustion is a ‘clean-coal’ process that takes place in O2/CO2 environments, which are achieved by removing nitrogen from the intake gases and recirculating large amounts of flue gases to the boiler. Removal of nitrogen from the combustion gases generates a high CO2-content, sequestration-ready gas at the boiler effluent. Flue gas recirculation moderates the high temperatures caused by the elevated oxygen partial pressure in the boiler. In this study, combustion of the fuels took place in a laboratory laminar-flow drop-tube furnace (DTF), electrically-heated to 1400 K, in environments containing various mole fractions of oxygen in either nitrogen or carbon-dioxide background gases.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/51

Ignition and Combustion of Pulverized Coal and Biomass Under Different Oxy-Fuel O2/N2 and O2/CO2 Environments

This dissertation studied the ignition and combustion of burning pulverized coals and biomasses particles under either conventional combustion in air or oxy-fuel combustion conditions. Oxy-fuel combustion is a ‘clean-coal’ process that takes place in O2/CO2 environments, which are achieved by removing nitrogen from the intake gases and recirculating large amounts of flue gases to the boiler. Removal of nitrogen from the combustion gases generates a high CO2-content, sequestration-ready gas at the boiler effluent. Flue gas recirculation moderates the high temperatures caused by the elevated oxygen partial pressure in the boiler. In this study, combustion of the fuels took place in a laboratory laminar-flow drop-tube furnace (DTF), electrically-heated to 1400 K, in environments containing various mole fractions of oxygen in either nitrogen or carbon-dioxide background gases.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/59
**Highly Organized Single-Walled Carbon Nanotube-Polymer Hybrid Architectures**

This dissertation presents highly organized two-dimensional (2D) to three-dimensional (3D) SWCNT-polymer hybrid systems have been demonstrated with an unprecedented control over growth, assembly and transfer process of SWCNTs. First, a novel strategy has been developed to control direction transport properties of SWCNT network by creating the heterogeneity within network. Second, a highly effective and CMOS friendly transfer method, wet-contact printing, has been developed to achieve large scale suspended SWCNT architectures over flexible polymeric substrates with micro to nanoscale precision. Finally, various mechanically and electrically robust 2D and 3D organized and well-aligned SWCNT networks-polymer hybrid architectures have been demonstrated with the combination of different SWCNT architectures and different transfer technologies.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/42

**Proportional Hazard Model Applications in Reliability**

This dissertation proposes two main methods as a modification of the semi-parametric Proportional Hazard Model (PHM) with innovative application for reliability testing. The first method developed uses a median of lifetime survival history for subjects with multiple occurrences to be modeled using the non-recurrent PHM method. The second method developed proposes censoring of influential observations, applying recurrent PHM theory. Both methods are validated using small electromechanical appliances with covariates identifying typical user performance as part of accelerated reliability testing... Data set arrangements for recurrent events are available in the literature; however the author reviews additional techniques to separate failure modes and properly assign categorical and continuous time-dependent covariate values when both methods are used. A complete guide to the modeling steps for the Median and Censored PHM methods proposed for reliability modeling is presented in the conclusion of this study.

See full dissertation at iris.lib.neu.edu/ind_eng_diss/18
Exploration of Hot Switching Damage and Damage Mechanisms in MEMS Switch Contacts

This dissertation explores the effect of multi-domain coupling on the behavior of an electrical contact, what makes hot switching damaging, the making of contact under bias as it compares to the breaking of contact under bias (leading versus trailing edge hot switching), and the specific mechanisms that could be responsible for hot switching damage.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/53

Systems Engineering Models for Signature Injuries of Modern Military Conflicts

This dissertation presents several systems engineering models to optimize the overall design, effectiveness, and capacity of healthcare systems for detecting and treating silent injuries, such as TBI and PTSD, as well as a general health problem that is common among veterans, sleep apnea, by addressing the following needs: (1) sequential screening processes, (2) categorical diagnostic methods, and (3) care services location-allocation (network optimization) models.

See full dissertation at iris.lib.neu.edu/ind_eng_diss/17
Interplay Between Stability, Delays, and Graphs of a Class of Multi-Agent LTI System with Applications

In this dissertation, our objective is to reveal how network structures (graphs) and delays are correlated, to develop a mathematical framework to explain the interplay between stability, topology and delays, and to reveal the rules by which the topology of a multi-agent system can be designed to be more tolerant to destabilizing effects of time delays. These results will be extremely valuable in many fields, i.e., remote surgery, synthetic biology, design of new chemical molecules and drugs, design of the Smart Grid network.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/56

Multi-Scaled Adhesion Mechanics of Hydrogel Contact Lenses

The first aim of this thesis focuses on macroscopic hydrogel lens adhesion characterization achieved via the Planar Adhesion Test (PAT). The PAT is a novel experimental technique that utilizes the lens native geometry to characterize both mechanical and adhesion properties...The second aim of this thesis focuses on characterizing hydrogel lens adhesion against more physiologically relevant samples: donated human corneas. Similar to the PAT, the lens is brought in contact with the cornea and retracted away, recording the “pull-off” force P* for each hydrogel material...The third and final aim of this thesis focuses on characterizing single cell adhesion behavior against the two hydrogel materials via Single Cell Force Spectroscopy (SCFS)...Additionally, this work contains an investigation into the mechanochemistry of native type I collagen via small angle light scattering (SALS), which is reviewed as an addendum at the end of this thesis.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/61
Integrated Surface and Mechanical Characterization of Freestanding Biological and Other Nano-Structures Using Atomic Force Microscopy

This dissertation is focused on surface and mechanical characterization of freestanding biological and other nano-structures using atomic force microscopy including two parts: cell mechanics and nano-structure mechanics. The main purpose of this work is to investigate how the nano-/micro-scale mechanical properties affect macro-scale function.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/47

Tribological and Mechanical Characterization of Thin Polymer Films

In this dissertation a toolbox of experimental techniques was developed to assess the quality of thin polymer films. These include assessment of friction, durability and interfacial adhesion. While this work is primarily focused on polytetrafluoroethylene (PTFE), assessments of perfluoroalkoxy (PFA) and poly(trivinyltrimethyl cyclotrisiloxane) (Poly(V3D3)) were also carried out.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/57

QIAN SHENG
PhD, 2013 Mechanical and Industrial Engineering
Advisor, Sinan Muftu | Tribology
sheng.q@neu.edu

XIN WANG
PhD, 2013 Mechanical and Industrial Engineering
Advisor, Kai-Tak Wan | Nanoscience and Nanotechnology
coe.neu.edu/~ktwan/Xin.html

SELECTED PhD THESES

69
Nanomechanics Modeling of Carbon Nanotubes Interacting with Surfaces in Various Configurations

This thesis models the experiments by the continuum mechanics in two distinct scenarios. In the first situation, measurements are made of CNT configurations after manipulations. Modeling is then used to determine the interfacial properties during the manipulation which led to the observed configuration after manipulations. In the second situation, modeling is used in a more traditional fashion to make theoretical predictions as to how a device will operate.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/46

Mechanistic Modeling of High Velocity Micro-Particle Impacts: Application to Material Deposition by Cold Spray Process

This dissertation investigates the mechanics of metal bonding upon high strain-rate deformation in order to improve the technological implementation of the process. The research covers a wider range of impact conditions than those directly associated with cold spray, in order to reveal the governing mechanisms of particle impact and rebound.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/45
Precise Directed Assembly of Nanoparticles for Electronic, Optical and Biomedical Applications

In this dissertation experimentally and numerically investigated the fundamental mechanism of the electrophoretic directed assembly for different sizes and types of nanoparticles. The results showed that unlike large (such as 500nm) Polysterene Latex (PSL) particles, the electrophoretic assembly of 50 nm and smaller PSL particles is significantly influenced by the Brownian diffusion. This results in random and low yield assembly for the smaller nanoparticles. In order to overcome the Brownian diffusion-limited assembly of 50 nm or smaller particles, the electrophoretic velocity of the particles must be increased. This can be accomplished by increasing the electrophoretic force, which is a function of particle surface charge and applied voltage.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/44

The Effect of Mechanics on Migration, Morphology and Matrix Production by Primary Human Corneal Fibroblasts: Long-Term Dynamic Observation

This dissertation focuses on DIC imaging, live cell fluorescent labeling, traction force microscopy and our previously designed mechanobioreactor, to locally and globally capture PHCF’s behavior under cell culture conditions for up to two weeks. It directly tracks and observes the morphology and migration of PHCFs under physiological conditions in the presence of uniaxial mechanical load directly on the microscope. The behavior of human corneal fibroblasts is observed from initial seeding through matrix production. The orientation of cells, the magnitude and direction of their velocity as well as forces exerted by PHCFs were tracked on substrates every 6 minutes. The analyzed data demonstrates that corneal fibroblasts are induced to align on loaded substrates at a relatively fixed angle to the applied force while corneal fibroblasts on unloaded substrates exhibit only local alignment.

See full dissertation at iris.lib.neu.edu/mech_eng_diss/43
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at Northeastern is a 220,000 square foot complex scheduled
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campus to the expanded area with a fly-over pedestrian
bridge. The six story building will contain wet, dry, and
computational research facilities plus interactive teaching
and learning spaces. The project was recently featured
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