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 first annual scholarship report reflects the exceptional academic and professional accomplishments of the electrical and computer engineering faculty and PhD candidates for the 2013-2014 year. With $59 million in annual research expenditures, and 134 faculty members (51 in electrical and computer engineering) the college is expanding in both size and research abilities. We look forward to a new infrastructure in 2016, adding a 220,000 square foot interdisciplinary science and engineering building which will provide state-of-the-art labs.

As of 2013 I became the new Electrical and Computer Engineering department Chair. With strong partnerships between students, faculty, alumni, industry and government, I look forward to taking this department to even greater levels in research and education. We are dedicated to growing our faculty which corresponds with our increasing undergraduate and graduate student body.

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 we look forward to sharing our future accomplishments in our annual scholarship reports.

Sincerely,

Sheila S. Hemami
Chair of Electrical and Computer Engineering
hemami@ece.neu.edu

Key Contacts

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Business Manager
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neu.peopleadmin.com

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### Degree Programs

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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; a National Institute of Standards and Technology (NIST) Technology Innovation Program project
# Electrical and Computer Engineering Quick Facts

## Faculty by Scholarship Focus

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To us, it may not seem like a big deal: CNN’s website is taking too long to load. The day’s most popular YouTube video won’t stop buffering. “Twitter is over capacity.” While these little hiccups in usability may frustrate end users, they merely scratch the surface of the enormous technical challenge that’s confronting the backend.

Northwestern assistant professor of electrical and computer engineering Ningfang Mi recently learned she was one of 42 early-career researchers to win a Young Investigator Award from the Air Force Office of Scientific Research. They will receive the grants over a three-year period.

She plans to use award to figure out a better way to manage the vast amount of information sharing that takes place online—and push that massive technical challenge even further into the background for end users.

These days most of the data we request online is stored in the so-called “cloud”—a series of virtual computers distributed on physical servers around the world. For instance, Google has 12 data centers across four continents. The 20,000 emails sitting in my Gmail inbox aren’t actually stored on my computer—they’re stored in Google’s cloud, which exists on all those remote servers. Every time I look at one of my emails, I am requesting access to it from one of those servers.

Now consider YouTube. Its billions of hours of video aren’t all sitting on the same physical server; rather, they are stored remotely in the cloud. In this case, I am just one of millions of users requesting the same video in a given moment. And that, Mi explained, is where things get challenging.

Her research is focused on modeling performance in different scenarios and figuring out the best ways to manage resources based on the outcomes of those models. This will give her a sense of the workloads and number of traffic requests that remote servers are likely to have to handle.

“Based on this kind of information,” she said, “how can I find the best configuration for the platform in order to provide the highest quality of service?”

There are two options: She can either move information around on a single server or move information between servers. The best choice will depend on the situation at hand.

“Before predictions were based more on average load or traffic, but now we know that in reality the workload changes,” Mi said. “The term I use here is ‘burstiness’ or ‘spikes.’”

Indeed, it all depends on the burstiness of human behavior. Some online phenomena are predictable, Mi said. For instance, you’re likely to see a burst in email activity on the East Coast every weekday at around 9 a.m. EST. Similarly, the Internet is likely to be all-a-flurry across a range of websites on election night as people world over discuss the race on Twitter, stream acceptance speeches on NBC, and read about the results in The New York Times.

But what about when a celebrity unexpectedly passes away or makes a comment that goes viral? Or when a boy in a balloon suddenly becomes one of the biggest news stories on the Internet? No one can predict events like that, so no amount of resource management preparation could ready YouTube for the associated activity spikes.

Mi, for her part, is developing models that will help detect those bursts with more immediacy—and in some cases even predict them a couple hours in advance. So while we may not know when the next media hoax will drive traffic from millions of curious viewers, at least our computers will be able to handle it better.

See faculty page 46
To watch a ballerina move is to observe, perhaps, the pinnacle of coordination, to experience precise and exquisite elegance. But now imagine a rhythmic gymnast, who must not only move with the articulated grace of a dancer but must simultaneously manipulate a ball, hoop, or ribbon with extreme control.

“She extends her movements toward the object. She is one with the object,” said Dagmar Sternad, professor of biology, electrical and computer engineering, and physics at Northeastern.

On Tuesday afternoon, Sternad received the 50th annual Robert D. Klein University Lecturer Award and delivered her university lecture, titled “The wonder of human movement: How the brain controls the body.” She displayed images of gymnasts and dancers to highlight their incredible level of physical control.

On the flip side, she said, are individuals who suffer from disorders and ailments such as Parkinson’s disease, cerebral palsy, or stroke. Damage to the neural system of the brain robs these patients of control over their limbs and movements. “We have no cure,” Sternad said. “We have ways to ameliorate the symptoms, but no cure.”

The Robert D. Klein University Lecturer Award, established in 1964 upon the recommendation of the Faculty Senate, Honors and Awards a member of the faculty who has contributed with distinction to his or her own field of study. In 1979, it was renamed in tribute to the late Klein, a revered professor of mathematics and a leader in the Faculty Senate.

Stephen W. Director, provost and senior vice president for academic affairs, presented the award to Sternad. Director characterized her as “a brilliant educator, a remarkable speaker, a leader, and an impassioned researcher.”

Sternad, who directs the Action Lab at Northeastern, is an internationally known authority in the field of experimental and computational motor neuroscience. Her diverse academic career has spanned the disciplines of movement science, English linguistics and literature, experimental psychology, neuroscience, and kinesiology. Her studies of human motor control and learning have shed light on neurological defects in Parkinson patients, children with dystonia, and individuals who have suffered strokes.

In her lecture, Sternad elaborated on the complexity of the human brain, which consists of between 10 billion and 100 billion neurons, each making thousands of connections with all the others. “This is an unfathomable network with 100 trillion connections,” she explained. How does this infinitely complex structure turn information into physical movements? And how can we use that process to help patients who cannot control their movements?

In a first step to answering these questions, developing appropriate interventions for patients, and understanding how ballerinas and gymnasts achieve such remarkable control over their movements, Sternad’s team works backwards. Instead of starting with the neurons that cause the movement, they start with the behavior.

“We start by picking a task that is interesting,” Sternad said. This may be carrying a cup of coffee or bouncing a ball. They then work to understand the physics of the task in order to render it in a virtual environment, where they can experimentally probe a human’s performance. Based on what they learn, they can design interventions to help people modify their movements.

“It is unlikely that humans control their movements by learning the precise muscles that are controlling a given task,” Sternad explained. Instead, we gather extrinsic information about it, such as performance feedback in a game. “We then find solutions in the task that make our variability less detrimental.”

Her research has shown that though we may not understand the mathematical calculations that go into a task, we learn and respond to its physics the more we practice it. For instance, in the game table skittles, in which a player must skillfully launch a tethered ball in order to knock down a small pin, there are areas on the ball’s elliptical trajectory where releasing it will be more likely to result in success. Though we may not know this, as we perform the game over and over we begin to release the ball just inside that sweet spot, she said.

Her work has shown that people with Parkinson’s disease have control over their trajectory but not over the timing of their release of the ball. “We can [use] that insight to focus our interventions,” she explained.

Still, even the most highly trained and skilled athletes can crack under pressure. In order to simulate the sense of competition threat that may be present during, say, the Olympics or the World Series, Sternad has partnered with Northeastern University psychology professor Stephen Hanks to develop experiments in which participants must play the game either with or without additional information about their likelihood of success. “We tell them there are gender differences,” she said. Indeed, invoking threat causes that nuanced communication between brain and body to degrade. “So mind matters,” Sternad said.

See faculty page 62
Twenty-five years ago, an engineer at CERN, the European Organization for Nuclear Research in Geneva Switzerland, had an idea that would change the world. Tim Berners Lee sent a memo to his colleagues at the world’s largest particle physics laboratory proposing a way for all of its computers—and eventually all the computers in the world—to talk to each other. This memo marks the birth of the World Wide Web.

Since then, the Internet has become increasingly essential to human activity—from reading the news and buying stocks to communicating and researching flu symptoms. But it still has some problems—namely, its plumbing, according to Edmund Yeh, an associate professor of electrical and computer engineering at Northeastern University.

Yeh is a principal investigator on a multi-university $7.9 million research project to unclog the Internet’s plumbing and fix this problem. The Internet’s basic architecture is highly inefficient, he said, because new connections to each piece of content must be created whenever a user wants access to the material.

“If you’ve got a lot of demand for a particular data type, it’s like water building up,” Yeh explained. That water, he said, can be managed in two ways—one is by getting it to its destination drain (i.e., the data server), the other is to drill a new drain somewhere along its journey (i.e., a caching point that temporarily stores the data).

Yeh’s research team is building what it calls the Named Data Network—one of four projects funded by the federal government’s Future Internet Program. NDN maintains a network of caching points, or “drains,” that are strategically located around the core of the Internet as well as its periphery.

Content distribution networks such as Akamai are taking a similar approach, Yeh said, but their operations work only at the edge of the Internet and provide service only to large content providers such as CNN. “This,” Yeh said, “is due to the inability of the current Internet architecture to handle caching.”

With NDN, user requests would be directed to caching points located closer to them in the Internet, regardless of the type of content they’re trying to access.

Still, a challenge remains: where to place the drains and how to best direct the “water” toward them. In collaboration with researchers at the California Institute of Technology, Yeh’s lab at Northeastern recently released a paper on arXiv in which the team presents an algorithm called the VIP Algorithm. It simultaneously performs both processes—both the drilling of drains and the directing of water. The processes work in a coordinated manner, Yeh said, with each relying on the other and both dynamically adapting to the prevailing demand for content.

Incidentally, the global network of high-energy physics researchers attempting to access particle physics data from the Large Hadron Collider at CERN—where the World Wide Web was born all those years ago—also has a similar plumbing problem. But physics researchers based at the California Institute of Technology believe Yeh’s algorithms could help them unclog their network pipes. So the two groups have teamed up to test it out.

Indeed, Yeh’s approach is a promising candidate for any scientific network in which a global community of users is requesting access to a vast body of data.

“We could make an impact first in these scientific big-data applications,” he said. “That’s a good testing ground for the broader Internet.”

See faculty page 71
Scholarship Focus

- Power system state estimation
- Visualization of power system operation
- Fault identification in transmission and distribution networks

Honors and Awards and Awards

Fellow, Institute of Electrical and Electronics Engineers

Selected Recent Publications

Papers in refereed journals

M. Korkali, A. Abur

Robust Fault-Location Using Least-Absolute-Value Estimator, Institute of Electrical and Electronics Engineers (IEEE) Transactions on Power Systems, Nov. 2013, vol. 28, no. 4, p 4384-4392

L. Zhang, A. Abur


M. Göl, A. Abur


R. Emami, A. Abur


M. Korkali, A. Abur


L. Zhang, A. Abur


Papers in refereed conferences

M. Göl, A. Abur


A. Rouhani, A. Abur


M. Göl, A. Abur

Rapid Tracking of Bus Voltages Using Synchro-Phasor Assisted State Estimation, Proceedings of the ISGT 2013-Europe, Copenhagen, Denmark, Oct. 7-9, 2013
M. Göll, A. Abur

A. Rouhani, A. Abur

Research Projects

New Methods of Fault Simulation and Location for Smart Grids Based on Synchronized Measurements
Principal Investigator, National Science Foundation

Exploiting Emerging Data for Enhanced Load Modeling
Co-Principal Investigator, National Science Foundation

Transmission Topology Control for Infrastructure Resilience to the Integration of Renewable Generation
Co-Principal Investigator, Advanced Research Projects Agency

Engineering Research Center for Ultra-wide Area Resilient Electric Energy Transmission Network
Co-Principal Investigator, National Science Foundation

Entergy’s Response to Smart Grid Investment Grant Program
Principal Investigator, DOE/Entergy Corporation

Scalable and Flat Controls for Reliable Power Grid Operation with High Renewable Penetration
Co-Principal Investigator, Global Climate and Energy Project/Stanford University

Completed Dissertations Supervised

Mert Korkali
Robust and Systemwide Fault Location in Power Networks via Optimal Deployment of Synchronized Measurements (see p 79)
Scholarship Focus

- Mobile networks and wireless communications systems
- Wireless sensor networking (underwater and terrestrial)
- Design and implementation of network protocols

Selected Recent Publications

Books and book chapters

S. Basagni, M. Conti, S. Giordano, I. Stojmenovic

S. Basagni, M. Y. Naderi, C. Petrioli, D. Spenza

Papers in refereed conferences

S. Basagni, L. Boloni, L. C. Petrioli, C. A. Phillips, D. Turgut

L. Boloni, D. Turgut, S. Basagni, C. Petrioli

L. Chen, S. Cool, H. Ba, W. Heinzelman, I. Demirkol, U. Muncuk, K. R. Chowdhury, S. Basagni

K. Kaushik, D. Mishra, S. De, S. Basagni, W. Heinzelman, K.R. Chowdhury, S. Jana

Research Projects

Co-Principal Investigator, National Science Foundation

GENIUS: Green Sensor Networks for Air Quality Support
Co-Principal Investigator, National Science Foundation
Scholarship Focus
- Biomedical signal processing
- Medical imaging
- Inverse problems
- Dynamics and manifolds in biomedical imaging
- Electrocardiography
- Diffuse and fluorescence optical tomography
- Magnetic resonance imaging
- Fresh tissue microscopy image analysis
- Machine learning for biomedical imaging and image analysis
- Open source software for biomedical imaging
- Modeling and optimization of transcranial neuromodulation

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

Selected Recent Publications

Papers in refereed journals

A.F. Frangi, D.R. Hose, P.J. Hunter, N. Ayache, D. Brooks
Guest Editorial Special Issue on Medical Imaging and Image Computing in Computational Physiology, IEEE Transactions on Medical Imaging, vol. 32, issue 1, Jan 2013, p 1-7

V. Pera, E. Zettergren, D.H. Brooks, M. Niedre

M. Milanic, V. Jazbinšek, R.S. MacLeod, D.H. Brooks, Rok Hren

V. Pera, D.H. Brooks, M. Niedre


B. Erem, P. van Dam, D.H. Brooks
Identifying Model Inaccuracies and Solution Uncertainties in Non-Invasive Activation-Based Imaging of Cardiac Excitation Using Convex Relaxation, IEEE Transactions on Medical Imaging, 33:4, April 2014, p 902-912
J. Sourati, D. Erdogmus, J.G. Dy, D.H. Brooks
   Accelerated Learning-Based Interactive Image Segmentation using Pairwise Constraints, IEEE
   Transactions on Image Processing, 23:7, July 2014, p 3057-3070

   Kopans, K-T. Wan
   Detecting Solid Masses in Phantom Breast Using Mechanical Indentation, Experimental Mechanics,
   4:6 Jul. 2014

Research Projects
Center for Integrative Biomedical Computing
   Investigator, National Institutes of Health
High Resolution Multiplexed Fluorescence Tomography
   Co-Investigator, National Institutes of Health
Precise Characterization of Conformational Ensembles
   Co-Principal Investigator, National Science Foundation
Finding Underlying Manifolds of Large-Scale Complex Biological Signals
   Co-Principal Investigator, Northeastern University
Brain-Computer Interface for Signaling Changes in Psychological States
   Co-Principal Investigator, Northeastern University
Precise Characterization of Conformational Ensembles
   Co-Investigator, National Science Foundation

Completed Dissertations Supervised
Fatemeh Noushin Golabchi
   Graphical Model Based Segmentation of Massive Numbers of Irregular Small Objects in Images,
   with Application to Axon Characterization in Histological Sections (see p 78)

Burak Erem
   Differential Geometric Models and Optimization Methods for Dynamic Analysis of Electrocardiographic
   Signals and the Inverse Problem of Electrocardiography (see p 75)
OCTAVIA CAMPS
Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering
617.373.4663 | camps@ece.neu.edu

Scholarship Focus
• Communications and signal processing
• Robust computer vision
• Image processing
• Machine learning

Selected Recent Publications
Books and book chapters
A. Vasile, O. Camps
Hierarchical Image Geo-Location on a World-Wide Scale, Advances in Visual Computing, 2013, in Lecture Notes in Computer Science (8034), Springer-Verlag, 2013, p 266-277

Papers in refereed journals
S. Markovic, B. Li, V. Pera, M. Sznaier, O. Camps, M. Niedre

Papers in refereed conferences
C. Dicle, O. Camps, M. Sznaier
The Way They Move: Tracking Multiple Targets with Similar Appearance, IEEE Int. Conf. on Computer Vision (ICCV), Sydney, Australia, Dec. 2013
M. Ayazoglu, B. Yilmaz, M. Sznaier, O. Camps
Finding Causal Interactions in Video Sequences, IEEE Int. Conf. on Computer Vision (ICCV), Sydney, Australia, Dec. 2013
F. Xiong, Y. Cheng, O. Camps, M. Sznaier, C. Lagoa

Research Projects
Real Time Video Surveillance: Dynamic Research Model Based Anomaly Partnership Detection and Resource Allocation
Principal Investigator, Northeastern University
ALERT DHS HS-STEM Career Development Program at Northeastern University
Co-Principal Investigator, Department of Homeland Security
Compressive Information Extraction: A Dynamical Systems Approach
Co-Principal Investigator, Air Force Office of Scientific Research
Robust Identification of a Class of Structured Systems with High Dimensional Outputs and Applications
Co-Principal Investigator, National Science Foundation
Dynamic Invariants for Video Scenes Understanding
Principal Investigator, National Science Foundation
R3B-Millimeter-Wave Standoff Detection of Concealed Explosives
Investigator, Department of Homeland Security

Completed Dissertations Supervised
Binglong Li
Dynamics-Based Invariants for Video Analytics (see p 80)
Scholarship Focus
• Wireless cognitive radio networks
• Ad hoc and sensor networks
• Experimentation and protocol design for communication systems
• Applications of wireless technology in multimedia delivery and health care

Honors and Awards
• Vice President IEEE Technical Committee on Simulation
• Fellow, National Science Foundation of China

Selected Recent Publications

Papers in refereed journals
K.R. Chowdhury, M.D. Felice, L. Bononi
A. Al-Ali, K.R. Chowdhury
K.R. Chowdhury, M. D. Felice, I. F. Akyildiz
P. Nintanavongsa, R. Doost-Mohammady, M.D. Felice, K.R. Chowdhury
G. Schirner, D. Erdogmus, K.R. Chowdhury, T. Padir

Papers in refereed conferences
K. Kaushik, D. Mishra, S. De, S. Basagni, W. Heinzelman, K.R. Chowdhury, S. Jana
P. Nintanavongsa, M. Y. Naderi, K. R. Chowdhury
   Medium Access Control Protocol Design for Sensors Powered by Wireless Energy Transfer, IEEE INFOCOM, Turin, Italy, April 2013
A. Al-Ali, K. R. Chowdhury, M. DiFelice, J. Paavola
   Querying Spectrum Databases and Improved Sensing for Vehicular Cognitive Radio Networks, IEEE ICC, Sydney, Australia, June 2014

Research Projects
GENIUS: Green Sensor Networks for Air Quality Support
   Principal Investigator, National Science Foundation
CPS: Medium: Collaborative Research: Holistic Design Methodology for Automated Implementation of Human-in-the-Loop Cyber-Physical Systems
   Co-Principal Investigator, National Science Foundation
Link Layer Design and Implementation for Software Defined Radios
   Principal Investigator, Mathworks
CDRIVE: Cognitive Radio Enabled Spectrum Aware Intelligent Vehicular Networks
   Principal Investigator, National Science Foundation
A Flexible and Extensible Solution to Incorporating new RF Devices and Capabilities into EWI ISR Networks
   Principal Investigator, Defense Advanced Research Projects Agency
ANTHONY DEVANEY
Distinguished Professor, Electrical and Computer Engineering
PhD, University of Rochester, 1971. Joined Northeastern in 1989
617.373.5284 | devaney@ece.neu.edu | ece.neu.edu/faculty/devaney

Scholarship Focus
• Communications and signal processing
• Electromagnetic wave propagation
• Inverse scattering
• Tomography
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. DiMarzio


Z. Lai, Josef 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


L. Zhenhua, 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


Completed Dissertations Supervised

Yair Mega

*Using Second Harmonic Generation Microscopy to Study the Three-Dimensional Structure of Collagen and its Degradation Mechanism* (see p. 83)
JENNIFER DY
Associate Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering
PhD, Purdue University, 2001. Joined Northeastern in 2002
617.373.3062 | jdy@ece.neu.edu | ece.neu.edu/faculty/jdy

Scholarship Focus
• Machine learning
• Data mining
• Statistical pattern recognition
• Computer vision

Selected Recent Publications

Papers in refereed journals
D. Niu, J. Dy, M.I. Jordan
Iterative Discovery of Multiple Alternate Clustering Views, IEEE Transactions on Pattern Analysis and Machine Intelligence, 2013
Y. Yan, R. Rosales, G. Fung, R. Subramanian, J. Dy
Learning From Multiple Annotators with Varying Expertise, Machine Learning, 1-37, 2013
P. Castaldi, J. Dy, J. Ross, Y. Chang, G. Washko, (COPDGene Study team), E. Silverman, M. Cho
Cluster Analysis in the COPDGene Study Identifies Subtypes of Smokers with Distinct Patterns of Airway Disease and Emphysema, Thorax, 2014
F. Azmandian, A. Yilmazer, J. Dy, J.A. Aslam, D.R. Kaeli

Papers in refereed conferences
J. Ross, J. Dy
J. Sourati, K. Kose, M. Rajadhyaksha, J. Dy, D. Erdoganmus, Dana H. Brooks
Automated Localization of Wrinkles and the Dermo-Epidermal Junction in Obliquely-Oriented Reflectance Confocal Microscopic Images of Human Skin, SPIE BIOS, 2013
M. Moghadamfalahi, A. Satpute, M. Akcakaya, D. Brooks, J. Dy, D.Erdogmus, L. Barrett
Are Affective Responses in fMRI Independent of Previous Affect-Inducing Stimuli?, Organization for Human Brain Mapng (OHBM), 2013
K. Kose, C. Alessi-Fox, J. Dy, D. Brooks, M. Rajadhyaksha
J. Ross, P. Castaldi, M. Cho, J. Dy
Dual Beta Process Priors for Latent Cluster Discovery in Chronic Obstructive Pulmonary Disease, ACM SIGKDD Knowledge Discovery and Data Mining, 2014

Research Projects
III:Small: Exploring Data in Multiple Clustering Views
Principal Investigator, National Science Foundation
Genetic Epidemiology of COPD
Principal Investigator, National Institutes of Health
Automated Classification of Retinopathy of Prematurity Using Machine Learning
Investigator, National Institutes of Health
DENIZ ERDOGMUS
Associate Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering
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Scholarship Focus
• Statistical signal processing and machine learning
• Brain computer interfaces
• Information theory
• Differential geometry

Honors and Awards and Awards
• National Science Foundation CAREER Award
• Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

Papers in refereed journals
Noninvasive Brain Computer Interfaces for Augmentative and Alternative Communication, IEEE
Reviews in Biomedical Engineering, Dec 2013
Brain-Computer Interface with Language Model-EEG Fusion for Locked-in Syndrome,
Neuro-Rehabilitation and Neural Repair, Dec 2013
U. Orhan, D. Erdogmus, B. Roark, B. Oken, M. Fried-Oken
Offline Analysis of Context Contribution to ERP-based Typing BCI Performance, Journal of Neural
Engineering, vol. 10, no. 6, Oct 2013
Plus Disease Diagnosis in Retinopathy of Prematurity: Vascular Tortuosity as a Function of Distance
from Optic Disc, Retina, vol. 33, no. 8, p 1700-1707, 2013
M. Higger, M. Akcakaya, D. Erdogmus
A. Cansizoglu, E. Bas, J. Kalpathy-Cramer, G.C. Sharp, D. Erdogmus
Contour-Based Shape Representation Using Principal Curves, Pattern Recognition, vol. 46, no. 4,
p 1140-1150, April 2013
O. Kyrgyzov, D. Erdogmus
Nonnegative Nonredundant Tensor Decomposition, Frontiers of Mathematics in China, vol. 8, no. 1,
p 41-61, Feb 2013
M. Simundic, B. Drasler, V. Sustar, J. Zupanc, R. Stukelj, D. Makovec, D. Erdogmus, H. Hagerstrand,
D. Drobone, V. Kralj-Iglic
Effect of Engineered TiO2 and ZnO Nano and Microparticles on Washed Erythrocytes, Platelet Rich
Plasma and Giant Unilamelar Phospholipid Vesicles, BMC Veterinary Research, vol. 9, no. 7, 2013
G. Schirner, D. Erdogmus, K. Chowdhury, T. Padir

Papers in refereed conferences
Initial Assessment of Artifact Filtering for RSVP Keyboard TM, SPMB 2013, p 1-5, Brooklyn, NY, 2013
A. Ahani, H. Wahbeh, H. Nezamfar, M. Miller, D. Erdogmus, B. Oken
Change in Physiological Signals During Mindfulness Meditation, Neural Engineering, Nov. 6-8 201
A. Fowler, B. Roark, U. Orhan, D. Erdogmus, M. Fried-Oken
Improved Inference and Autotyping in EEG-based BCI Typing Systems, ASSETS 2013, Bellevue,
DENIZ ERDOGMUS continued

WA, Oct 2013

N. Ghadar, X. Zhang, K. Li, D. Erdogmus, G. Thibault, A. Bayesteh, I. Shafran, K. Coleman, K.A. Grant
Visual Hull Reconstruction for Automated Primate Behavior Observation, Proc MLSP 2013, p 1-6, Sep 2013

M. Higger, M. Akcakaya, U. Orhan, D. Erdogmus

M. Fried-Oken, U. Orhan, B. Roark, D. Erdogmus, A. Fowler, M. Miller, A. Mooney, B. Oken, B. Peters

S. You, M. Massey, N. Shapiro, D. Erdogmus

J. Sourati, M. Rajadhyaksha, J.G. Dy, D. Erdogmus, D.H. Brooks
Automated Localization of Wrinkles and the Dermo-Epidermal Junction in Obliquely-Oriented Reflectance Confocal Microscopic Images of Human Skin, SPIE Optical Imaging 2013, Jan 2013

Research Projects

Flexible, Adaptive, and Synergistic Training
Co-Investigator, Intelligence Advanced Research Projects Agency

Automated Classification of Retinopathy of Prematurity using Machine Learning
Investigator, National Institutes of Health

Automated Segmentation of Vessel Network Structures in Large Image Stack Sets
Principal Investigator, Massachusetts Green High-Performance Computing Center

Adaptive Brain Computer Interfaces Sub Award to CSL at NU
Principal Investigator, National Science Foundation

Precise Characterization of Conformational Ensembles
Co-Principal Investigator, National Science Foundation

CAREER: Signal Models, Channel Capacity, and Information Rate for Noninvasive Brain Interfaces
Principal Investigator, National Science Foundation

SHB-Small: Robustly Detecting Clinical Laboratory Errors
Co-Principal Investigator, National Science Foundation

Signal Processing Support for Oken-National Institutes of Health-K24 Mid-Career Development Grant
Principal Investigator, National Institutes of Health

Collaborative Research: Holistic Design Methodology for Automated Implementation of Human-in-the-Loop Cyber-Physical Systems
Co-Principal Investigator, National Science Foundation

CDI-Type I: Computational Models for the Automatic Recognition of Non-Human Primate Social Behaviors
Principal Investigator, National Science Foundation

Translational Refinement of an Adaptive Communication System for Locked-in Patients
Co-Investigator, National Institutes of Health

Completed Dissertations Supervised

Umut Orhan
RSVP Keyboard: An EGG Based BCI Typing System with Context Information Fusion (see p 85)
Scholarship Focus
- Computer architecture
- Embedded systems
- Hardware-oriented security
- Design automation
- Mobile computing
- Underwater sensor networks

Honors and Awards
National Science Foundation CAREER Award

Selected Recent Publications
Papers in refereed journals
J. Martinez-Santos, Y. Fei

Papers in refereed conferences
T. Hu, Y. Fei
“An Adaptive Routing Protocol Based on Connectivity Prediction for Underwater Disruption Tolerant Networks”, in IEEE Global Communications Conference (GlobeCom), 2013
T. Hu, Y. Fei
“DSH-MAC: Medium Access Control Based on Decoupled and Suppressed Handshaking for Long-Delay Underwater Acoustic Sensor Networks”, in IEEE Conf. Local Computer Networks (LCN), 2013
J. Martinez Santos, Y. Fei
B. Jiang, Y. Fei

Research Projects
MRI: Development of a Testbed for Side-Channel Analysis and Security Evaluation-TeSCASE
Principal Investigator, National Science Foundation
Principal Investigator, National Science Foundation
CAREER: Architectural Enhancement and Design Methodologies for Secure Processing in Embedded Systems
Principal Investigator, National Science Foundation
ARTS: Adaptive, Robust, and Sustainable Networking for Undersea Distributed Sensor Systems
Principal Investigator, Office of Naval Research

Completed Dissertations Supervised
Juan Carlos Martinez Santos
Architectural Support for Software Security (see p 82)
YUN RAYMOND FU
Assistant Professor, Electrical and Computer Engineering; jointly appointed, Computer and Information Science, PhD, University of Illinois, 2008. Joined Northeastern in 2012
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Scholarship Focus
- Machine learning and computational intelligence
- Big data and social media analytics
- Computer vision and pattern recognition
- Cyber-physical systems

Honors and Awards
- Army Research Office Young Investigator Award
- Office of Naval Research Young Investigator Award
- International Neural Network Society’s Young Investigator Award

Selected Recent Publications

Books and book chapters
Y. Fu
- Human-Centered Social Media Analytics, Springer, VIII, 208 p 97, 2013
Y. Fu, Y. Ma
- Graph Embedding for Pattern Classification, Springer, VIII, 260 p 91, 2013

Papers in refereed journals
X. Zhao, X. Li, Z. Wu, Y. Fu, Y. Liu
- Multiple Subcategories Parts-Based Representation for One Sample Face Identification, IEEE Transactions on Information Forensics and Security (T-IFS), Volume: 8, Issue: 10, p 1654-1664, 2013
Y. Kong, Y. Jia, Y. Fu
- Interactive Phrases: Semantic Descriptions for Human Interaction Recognition, IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI), 2014
K. Li, Y. Fu
- Prediction of Human Activity by Discovering Temporal Sequence Patterns, IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI), 2014
M. Shao, D. Kit, Y. Fu
Y. Yao, Y. Fu
L. Li, S. Li, Y. Fu
- Learning Low-Rank and Discriminative Dictionary for Image Classification, Image and Vision Computing (IVC), 2014
W.W. Xu, L. Li, M.A. Stefanone, Y. Fu

Y. Su, S. Li, S. Wang, Y. Fu
Submanifold Decomposition, IEEE Transactions on Circuits and Systems for Video Technology (T-CSVT), 2014

Research Projects
Manifold Learning for 3D Shape Description and Classification
Principal Investigator, Army Research Office

Self-Learning Engine for Anomaly Detection in Crowd Behavior
Principal Investigator, Northeastern University

Unconstrained Face Recognition through Low-Rank Learning
Principal Investigator, Samsung

Finding Underlying Manifolds of Large-Scale Complex Biosignal Dynamics
Principal Investigator, Northeastern University

Medium: Quantitative Visual Sensing of Dynamic Behaviors for Home-based Progressive Rehabilitation
Principal Investigator, National Science Foundation

Stabilized Manifold Learning Based on Low-Rank Matrix Recovery for Visual Representation
Principal Investigator, Office of Naval Research

Socio-Cultural Media Sharing as Conversations: Sensing and Modeling Behavior in Response to Environmental Changes
Principal Investigator, Air Force Office of Scientific Research

Geolocation on Motion Imagery with Alternative Socio-Behavioral Context
Principal Investigator, Central Intelligence Agency

Social Computing: Occupation Recognition by Heterogeneous Context Fusion
Principal Investigator, Google

Deep Structures Boosted Self-Organized Behavior Pattern Learning for Anomaly Detection
Principal Investigator, Office of Naval Research

Intention Sensing Through Video-Based Imminent Activity Prediction
Principal Investigator, Army Research Office

Three-Dimensional Data Acquisition Platform for Human Activity Understanding
Principal Investigator, Department of Defense
VINCENT HARRIS
University Distinguished Professor, William Lincoln Smith Professor, Electrical and Computer Engineering; affiliated faculty, Chemical Engineering, PhD, Northeastern University, 1990. Joined Northeastern in 2003
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Scholarship Focus
• Design and processing of advance magnetic materials with emphasis on materials for high frequency applications
• Understanding the structure, processing and magnetism relationship of materials
• Synchrotron radiation characterization of materials with emphasis on extended x-ray absorption fine structure

Honors and Awards
• Fellow, Institute of Electrical and Electronics Engineers
• Fellow, American Physical Society
• Fellow, Institute of Physics
• Fellow, Institute of Engineering and Technology
• Institute of Metal Research’s Lee Hsun Lecture Award
• Fulbright Sensor Scientist Award
• Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

Books and Book Chapters
Y. Chen, V. Harris
Impact of Structural and Magnetic Anisotropies on Microwave Ferrites, Chapter 9 in Recent Advances in Magnetic Insulators - From Spintronics to Microwave Applications, Solid State Physics, vol. 64, Elsevier Inc., p 331-347, 2013

Papers in refereed journals
Z. Wang, Y. Li, R.Viswan, B. Hu, V. Harris, J. Li, D. Viehland
Engineered Magnetic Shape Anisotropy in BiFeO₃–CoFe₂O₄ Self-Assembled Thin Films, ACS Nano, 7, 3447-3456, 2013
Z. Su, Y. Chen, B. Hu, A. Sokolov, S. Bennett, L. Burns, X. Xing, V. Harris
Crystallographically Textured Self-Biased W-Type Hexaferrites for X Band Microwave Applications, Journal of Applied Physics, 113 (17), 17B305-17B305-3, 2013
V.G. Harris, Y. Chen, Z. Chen, A.L. Geiler
Research Projects

Design and Development of Multifunctional Electromechanical Ceramics
  Co-Principal Investigator, Army Research Office

Carbide Based Permanent Magnet Materials as Replacements for Rare Earth Based Permanent Magnets
  Co-Principal Investigator, Advanced Research Projects Agency

Rare Earth Free Permanent Magnet Materials for Alternative Energy Technologies
  Co-Principal Investigator, Advanced Research Projects Agency

Broadband Metamaterial Integrated Circulator/Antenna
  Co-Principal Investigator, Office of Naval Research

Realizing Room Temperature Magnetoelectric Materials
  Co-Principal Investigator, National Science Foundation

Completed Dissertations Supervised

Scott M. Gillette
  Highly Sensitive Tube-Topology Magnetoelectric Magnetic Sensors (see p 77)

Trifon Fitchorov
  Electric Field-Driven Tuning of Multiferroic Transducers and Antennas Through Changes in Field Strength and Material Morphology (see p 77)

Steven Bennett
  The Realization of a New Band Gap Engineered Photoferroelectric Photovoltaic Device with High Photocurrent (see p 73)
Scholarship Focus

- Multimedia signal processing
- Image and video compression and transmission
- Visual psychophysics

Honors and Awards

Fellow, Institute of Electrical and Electronics Engineers

Selected Recent Publications

Papers in refereed journals

F.M. Ciaramello, S.S. Hemami

A Computational Intelligibility Model for Assessment and Compression of American Sign Language Video, IEEE Transactions on Image Processing, November 2011

D.M. Rouse, S.S. Hemami, R. Pépion, P.-L. Callet


Papers in refereed conferences

A. Wang, S.S. Hemami, A. Molnar


G.O. Pinto, S.S. Hemami

Image Quality Assessment in the Low Quality Regime, Human Vision and Electronic Imaging, San Francisco, CA, January 2012


Comparing User Experiences in 2D and 3D Videoconferencing, IEEE International Conference on Image Processing, Orlando, FL, October 2012

L. McLaughlin, S.S. Hemami

Reduced-Reference Video Quality Assessment with Scalable Overhead, IEEE International Conference on Image Processing, September 2013
Scholarship Focus

- Signal and image processing
- Statistical analysis
- Hyperspectral signal processing

Selected Recent Publications

Papers in refereed journals

R. Herrero, V. Ingle

S. Niu, S. Golowich, V. Ingle, D. Manolakis

S. Niu, S. Golowich, V. Ingle, D. Manolakis

Papers in refereed conferences

R. Herrero, V. Ingle
Analytical and Comparative Analysis of Lossy Ultraspectral Image Compression, SPIE DSS Conference, May 18, 2013

S. Niu, S. Golowich, V. Ingle, D.G. Manolakis

C. Brett, R. DiPietro, D. Manolakis, V. Ingle

Research Projects

Hyperspectral Detection Algorithms with False Alarm Mitigation
Principal Investigator, Massachusetts Institute of Technology

Implementation of MF Detectors Using GPGPUs
Principal Investigator, Massachusetts Institute of Technology

Integrating an Active Learning Platform into the ECE Curriculum
Senior Investigator, Analog Devices

Completed Dissertations Supervised

Sidi Niu
Quantification of Chemical Gaseous Plumes on Hyperspectral Imagery (see p 84)
Scholarship Focus
• Parallel computer architectures
• Cybersecurity
• Hardware and software reliability
• Big data analytics

Honors and Awards
• National Science Foundation CAREER Award
• Søren Buus Outstanding Research Award, College of Engineering
• Fellow, Institute of Electrical and Electronics Engineers

Selected Recent Publications

Books and book chapters
B. Gaster, L. Howes, D. Kaeli, P. Mistry, D. Schaa

J. Cavazos, X. Gong, D. Kaeli

Papers in refereed conferences
Z. Chen, D. Kaeli, N. Rubin

Y. Ukidave, A. Ziabari, P. Mistry, D. Kaeli

P. Mistry, Y. Ukidave, D. Schaa, D. Kaeli
A Framework for Profiling and Performance Monitoring of Heterogeneous Applications, 6th Workshop on Programmability Issues for Heterogeneous Multicores (MULTIPROG’13), 2013

P. Mistry, Y. Ukidave, D. Schaa, D. Kaeli
Valar: A Benchmark Suite to Study the Dynamic Behavior of Heterogeneous Systems, GPGPU-6, March, 2013

R. Whelan, T. Leek, D. Kaeli

R. Wang, N. Kandasamy, C. Nwankpa, D.Kaeli
Datacenters as Controllable Load Resources in the Electricity Mark, Proceedings of the 33rd IEEE International Conference on Distributed Computing Systems, July 2013, p 176-185

A. Ymazer, D. Kaeli
HQL: A Scalable Synchronization Mechanism for GPUs, Proceedings of the 27th IEEE International Symposium on Parallel and Distributed Processing, May 2013, p 475-486

Puerto Rico Testsite for Exploring Contamination Threats (PROTECT): An Innovative Approach to
Assessing and Addressing Pre-Term Birth in Puerto Rico, 6th International Conference on Health Promoting Universities, San Juan, PR, March 2013

R. Dominguez, D. Kaeli
Unstructured Control Flow in GPGPU, Programming and Applications for Multi-Core Processors and GPUs: IPDPSW ‘13 Proceedings of the 2013 IEEE 27th International Symposium on Parallel and Distributed Processing Workshops, May 2013, p 1194-1202

Y. Ukidave, D. Kaeli

D. Kaeli, T. Leek, R. Whelan

Research Projects

AMD GPU Research Gift
Principal Investigator, AMD Corporation

Puerto Rico Testsite for Exploring Environmental Contamination Threats (PROTECT)
Co-Principal Investigator, National Institutes of Health

Multi-Disciplinary Preparation of Next Generation Information Assurance Practitioners- Phase II
Co-Principal Investigator, National Science Foundation

CRS: Small: Power Efficient Emerging Heterogeneous Platforms
Co-Principal Investigator, National Science Foundation

MRI: Development of a Testbed for Side-Channel Analysis and Security Evaluation
Co-Principal Investigator, National Science Foundation

SHF: Small: The Cross Layer Reliability Stack
Principal Investigator, National Science Foundation

A System Model for Effective Anomaly Analysis and Detection
Principal Investigator, Northeastern University

Project A: Reducing Uncertainties in SBRT for Pancreatic Cancer
Principal Investigator, Massachusetts General Hospital

Lightweight Hypervisor-Based Instrumentation and Machine Learning to Provide Timely Malware Detection
Principal Investigator, Air Force Small Business Innovation Research

A Disk-Subsystem Interposer Using a Lightweight Virtual Machine Monitor
Principal Investigator, Massachusetts Institute of Technology Lincoln Laboratory

A Biomedical Imaging Acceleration Testbed
Principal Investigator, National Science Foundation

Analogic CenSSIS Corporate Membership to Fund GPU Research
Principal Investigator, Analogic

Analogic Grant to Fund GPU Ultrasound Research
Principal Investigator, Analogic

Samsung-GPU-Modeling
Principal Investigator, Analog Devices
YONG-BIN KIM
Associate Professor, Electrical and Computer Engineering
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Scholarship Focus

- High speed digital/analog integrated circuit design
- Clocking scheme for high performance VLSI systems including on-chip skew analysis and clock distribution
- High speed integrated circuit signal integrity and physical CAD tool development
- High speed system integration for signal processing and communication applications
- Innovative circuits and system applications

Selected Recent Publications

Books and book chapters
Y.B. Kim, K. Kim

Papers in refereed journals
J. Yang, Y.B. Kim
H. Chauhan, Y. Choi, M. Onabajo, I. Jung, Y.-B. Kim
Inseok Jung, Yong-Bin Kim, and Kyung Ki Kim

Papers in refereed conferences
W. Li, Y.-B. Kim
A High Performance Modulo 2^n+1 Squarer Design Based on Carbon Nanotube Technology, IEEE International Midwest Symposium on Circuits and Systems(MWCAS), Aug.4-7, 2013, Columbus, OH, p 429-432
I. Jung, M. Onabajo, Y.-B. Kim
A 10-bit 64MS/s SARADC Using Variable Clock Period Method, IEEE International Midwest Symposium on Circuits and Systems (MWCAS), Aug. 4-7, 2013, Columbus OH, p 1144-1147
H. Lee, Y.-B. Kim
Low Power Null Convention Logic Circuit Design Based on DCVSL, 2013 IEEE International Midwest Symposium on Circuits and Systems(MWCAS), Aug.4-7, 2013, Columbus OH, p 29-32
Y. Choi, H. Jeon, Y.-B. Kim
J. Lu, J. Yang, Y.-B. Kim, K. Kim
Implementation of CMOS Neuron for Robot Motion Control Unit, 2013 IEEE International SoC Conference (ISOCC), Nov. 17-19, 2013, Busan South Korea, p 9-12

J. Wu, H. Qin, Y. Shi, M. Choi, H. J. Lee, K. Kim, Y.-B. Kim

Jung, Y.-B. Kim

H. Chauhan, Y. Choi, C. Hsiang, Y.-B. Kim, M. Onabajo
On-Chip Amplifier Linearity Calibration with the Fast Fourier Transform, 2013 IEEE North Atlantic Test Workshop (NATW), May 8-10, 2013, Wakefield, MA

Research Projects

VLSI Chip Fabrication for Low Power Integrated Circuits Design
Principal Investigator, Techwin Corporation and Dongbu Electronics

Low Power DC-DC Converter Design for Power Management
Principal Investigator, Techwin Corporation

Multi-Ferroic Materials for RF Applications
Principal Investigator, Defense Advanced Research Projects Agency

Collaborative Research: Cyberplasm - An Autonomous Micro-Robot Constructed Using Synthetic
Co-Principal Investigator, National Science Foundation

Software Grant for VLSI Design and Verification Software Grant
Principal Investigator, MyCAD

CAD Tool Grant
Principal Investigator, Cadence
ENGIN KIRDA
Professor, Electrical and Computer Engineering; jointly appointed, Computer and Information Science
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Scholarship Focus
• Security issues with the potential to affect a large number of people
• Web security, malware and vulnerability analysis, intrusion detection, and other computer security issues

Selected Recent Publications

Papers in refereed journals
M. Egele, A. Moser, C. Kruegel, E. Kirda

T. Scholte, D. Balzarotti, E. Kirda

M. Egele, T. Scholte, E. Kirda, C. Kruegel

Papers in refereed conferences
T. Lauinger, K. Onarlioglu, A. Chaabane, E. Kirda, W. Robertson
Mohamed Ali Kaafar, Holiday Pictures or Blockbuster Movies? Insights into Copyright Infringement in User Uploads to One-Click File Hosters, The 16th International Symposium on Research on Attacks, Intrusions and Defenses (RAID 2013), St. Lucia, October 2013

K. Onarlioglu, M. Battal, W. Robertson, E. Kirda
Securing Legacy Firefox Extensions with SENTINEL, 10th Conference on Detection of Intrusions and Malware and Vulnerability Assessment (DIMVA), Berlin, Germany, July 2013

K. Onarlioglu, C. Mulliner, W. Robertson, E. Kirda

A. Cassola, W. Robertson, E. Kirda, G. Noubir

T. Lauinger, M. Szydlowski, K. Onarlioglu, G. Wondracek, E. Kirda, C. Kruegel
Clickonomics: Determining the Effect of Anti-Piracy Measures for One-Click Hosting, 20th Annual Network and Distributed System Security Symposium, 12 (NDSS 2013), San Diego, CA, February 2013
MIECZYSŁAW KOKAR
Professor, Electrical and Computer Engineering
617.373.4849 | mkokar@ece.neu.edu | ece.neu.edu/faculty/kokar

Scholarship Focus

- Information fusion – situation awareness
- Cognitive radio – awareness of itself and environment
- Software engineering – self-adaptive software
- Ontology based computing and modeling

Selected Recent Publications

Papers in refereed journals

L. Lechowicz, M. Kokar

Papers in refereed conferences

B. Ulicny, J. Moskal, M. Kokar

D. Suresh, M. Kokar, J. Moskal

L. Lechowicz, M. Kokar

IEEE DySPAN 1900.5 Efforts To Support Spectrum Access Standardization, 2013 IEEE Military Communications Conference (MILCOM 2013), San Diego, 2013

Research Projects

Information Salience

Principal Investigator, Office of Naval Research
MIRIAM LEESER
Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering
617.373.3814 | mel@ece.neu.edu | coe.neu.edu/Research/rcl/members/MEL

Scholarship Focus
- Computer engineering
- Reconfigurable and GPU computing
- Embedded computing
- Computer arithmetic

Selected Recent Publications

Books and book chapters
V. Ross, M. Leeser

Papers in refereed conferences
P. Grossmann, M. Leeser, M. Onabajo

N. Moore, M. Leeser, L. S. King
Kernel Specialization for Improved Adaptability and Performance on Graphics Processing Units (GPUs), in Parallel & Distributed Processing (IPDPS), 2013 IEEE 27th International Symposium on p 1037-1048, May 2013

D. Kusinsky, M. Leeser

X. Fang, M. Leeser
Vendor Agnostic, High Performance, Double Precision Floating Point Division for FPGAs, in High Performance Extreme Computing Conference (HPEC), IEEE, p 1-5, 2013

Research Projects
MRI: Development of a Testbed for Side Channel Analysis and Security Evaluation (TeSCASE)
Co-Principal Investigator, National Science Foundation

Ensuring Reliability and Portability of Scientific Software for Heterogeneous Architectures
Co-Principal Investigator, National Science Foundation

Modeling Manycore Architectures in Matlab
Principal Investigator, Mathworks

Mathworks System Modelling and Radio Technology Lab (SMART)
Principal Investigator, Mathworks

Completed Dissertations Supervised
Peter Grossmann
Design and Analysis of Minimum Energy FPGAs (see p 78)
Scholarship Focus

- Power electronics
- DC-DC converters
- Non-linear dynamics/control

Selected Recent Publications

**Papers in refereed journals**

S. Chen, P. Li, D. Brady, B. Lehman


Y. Zhao, J. de Palma, J. Mosesian, R. Lyons, B. Lehman


**Papers in refereed conferences**

W. Huang, B. Lehman


S. Sheng, L. Peng, B. Lehman

*Parallel Operation of Digital Controlled Modified Sine Wave Inverters*, in Energy Conversion Congress and Exposition, 2013 IEEE, p 3440-3447

C. Hsu, P. Li, S. Sheng, B. Lehman


Y. Zhao, B. Lehman, R. Ball, J.F. de Palma

*Graph-Based Semi-Supervised Learning for Fault Detection and Classification in Solar Photovoltaic Arrays*, in Energy Conversion Congress and Exposition, 2013 IEEE, p 1628-1634

Q. Sun, S. Patil, N. Sun, B. Lehman

*Inductive Magnetic Harvester with Resonant Capacitive Rectifier Based on Synchronized Switch Harvesting Technique*, in Energy Conversion Congress and Exposition, 2013 IEEE, p 4940-4947

Q. Sun, S. Patil, N. Sun, B. Lehman

*Modeling and Optimization of an Inductive Magnetic Harvester Considering Nonlinear Effects*, in Control and Modeling for Power Electronics (COMPEL), 2013 IEEE 14th Workshop on, p 1-6

S.W. Qian, B. Lehman

*A Simple Formula for Estimating the Optimum Tilt Angles of Photovoltaic Panels*, in Control and Modeling for Power Electronics, 2013 IEEE 14th Workshop on, p 1-8
J.H. Huang, Y. Zhao, B. Lehman, D. Nguyen
Fast Switching Reconfigurable Photovoltaic Modules Integrated within DC-DC Converters, in Control and Modeling for Power Electronics, 2013 IEEE 14th Workshop on, p 1-7

S. Sheng, C. Hsu, P. Li, B. Lehman
Energy Management for Solar Battery Charging Station, in Control and Modeling for Power Electronics (COMPEL), 2013 IEEE 14th Workshop on, p 1-8

Y. Zhao, B. Lehman, R. Ball, J. Mosesian, J.F. de Palma

S. Chen, P. Li, B. Lehman, R. Ball, J.F. de Palma,

Research Projects
Fault Detection and Protection for Solar PV Systems
Principal Investigator, Mersen

GOALI: Adaptive Self Healing Solar Arrays
Principal Investigator, National Science Foundation

Partnerships for Innovation: Accelerating Innovation Research
Principal Investigator, National Science Foundation

BOS and Grid Tie Option
Principal Investigator, Power Film

Watt-Sun: Solar Forecasting
Principal Investigator, IBM

Completed Dissertations Supervised
Song Chen
A Non-Superconducting Fault Current Limiter (NSFCL) (see p 74)
Scholarship Focus
- Statistical and adaptive signal processing
- Networked dynamic state estimation
- Signal processing techniques for power delivery systems

Honors and Awards
Fellow, Institute of Electrical and Electronics Engineers

Selected Recent Publications

Papers in refereed conferences
P. Argyropoulos, H. Lev-Ari
Customized Wavelets for Improved Fault Location Quality in Power Systems, IEEE Power and Energy Conference at Illinois (PECI), Champaign, IL, Feb 2013
P. Argyropoulos, H. Lev-Ari, A.M. Stankovic
L. Peng. H. Lev-Ari

Research Projects
Cyber-Physical Models for Estimation, Control and Fault Management in Naval Energy Systems
Principal Investigator, Office of Naval Research

Scalable and Flat Controls for Reliable Power Grid Operation with High Renewable Penetration
Principal Investigator, GCEP Stanford

ERC for Ultra-wide Area Resilient Electric Energy Transmission Network
Co-Principal Investigator, National Science Foundation

New Methods of Fault Simulation and Location for Smart Grids Based on Synchronized Measurements
Co-Principal Investigator, National Science Foundation
YONGMIN LIU
Assistant Professor, Mechanical and Industrial Engineering; jointly appointed, Electrical and Computer Engineering, PhD, University of California, Berkeley, 2009. Joined Northeastern in 2012
617.373.4457 | y.liu@neu.edu | northeastern.edu/liulab

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 Plasmofluidic Lens, Nature Communications, 2013

Y.M. Liu, X. Zhang

H. Cang, Y. M. Liu, Y. Wang, X. Yin, X. Zhang
Giant Suppression of Photo-Bleaching for Single Molecule Detection via the Purcell Effect, Nano Letters, 2013

Research Projects

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

Graphene Photonics for Terahertz Radiation
Principal Investigator, Northeastern University
FABRIZIO LOMBARDI
ITC Professor, Electrical and Computer Engineering
617.373.4854 | lombardi@ece.neu.edu

Scholarship Focus
• Testing and design of digital systems
• Quantum and nano computing
• Advanced memory and storage design
• Emerging technologies for computing
• Defect tolerance

Honors and Awards
• Fellow, Institute of Electrical and Electronics Engineers
• Søren Buus Outstanding Research Award, College of Engineering

Selected Publications
Books and book chapters
A. Ottavi, A. Salsano, S. Pontarelli, F. Lombardi
P. Junsangsri, F. Lombardi

Papers in refereed journals
K. Namba, W. Wei, F. Lombardi
J. Han, J. Liang, F. Lombardi
J. Han, J. Liang, F. Lombardi
H. Feng, A.F. Almurib, T. Nandha Kumar, F. Lombardi
G. Cho, F. Lombardi
A.F. Almurib, T Nandha Kumar, F. Lombardi
W. Wei, J. Han, F. Lombardi

P. Junsangsri, F. Lombardi

T. Nandha Kumar, F. Lombardi

Papers in refereed conferences

S. Pontarelli and M. Ottavi, F. Lombardi

K. Namba, F. Lombardi

J. Han, H. Wu, F. Lombardi

G. Cho, F. Lombardi

J. Han, F. Lombardi

K. Chen, J. Han, F. Lombardi
Design and Evaluation of Two MTJ-Based Content Addressable Non-Volatile Memory Cells, Proc. IEEE Int. Symp on Nanotechnology, p 707-712, Beijing, August 2013

A.F. Almurib, T. Nandha Kumar, F. Lombardi
On the Operational Features and Performance of a Memristor-Based Cell for a LUT of an FPGA, Proc. IEEE Int. Symp on Nanotechnology, p 71-76, Beijing, August 2013

P. Junsangsri, J. Han, F. Lombardi
Scholarship Focus
Novel methods for data and signal processing of biophysical data; x-ray scattering for studies of proteins and tissues.

Selected Recent Publications

Papers in refereed journals
D. Minh, L. Makowski

Wide-Angle X-Ray Solution Scattering for Protein-Ligand Binding: Multivariate Curve Resolution with Bayesian Confidence Intervals, Biophys. J. 104, p 873-884, Feb 10, 2013

R.E. Iacob, D. Houde, G.M. Bou-Assaf, L. Makowski, J.R. Engen, S.A. Berkowitz

Understanding Monoclonal Antibody Aggregation by Comparing the Higher-Order Structure of Solution-Free Monomers to Aggregate Dimers, J. Pharmaceutical Sciences 102, 4315-4329, 2013


J. Badger, J. Lal, R. Harder, H. Inouye, S.C. Gleber, S. Vogt, I. Robinson, L. Makowski

Three-Dimensional Imaging of Crystalline Inclusions Embedded in Intact Maize Stalks, Scientific Reports 3, 2843, 2013

Research Projects

MADMAX: Precise Measurement of Conformational Changes in Proteins
Principal Investigator, National Institutes of Health

Center for Direct Catalytic Conversion of Biomass to BioFuels (C3Bio)
Co-Investigator, Basic Energy Sciences

Conformational Flexibility in Activation of Scr-Kinase
Subcontract Lead, National Institutes of Health

Precise Characterization of Conformational Ensembles
Principal Investigator, National Science Foundation
Scholarship Focus

- Physics-based signal processing and imaging
- Electromagnetic information theory

Honors and Awards

National Science Foundation CAREER Award

Selected Recent Publications

Papers in refereed journals

E. A. Marengo


E.A. Marengo, F.K. Gruber


E.A. Marengo


E.A. Marengo, P. Berestesky


E.A. Marengo


Papers in refereed conferences

E.A. Marengo


E.A. Marengo


Research Projects

Wave-Based Algorithms and Bounds for Target Support Estimation

Principal Investigator, Air Force Office of Scientific Research
JOSE MARTINEZ LORENZO
Assistant Professor, Mechanical and Industrial Engineering; jointly appointed, Electrical and Computer Engineering, PhD, University of Vigo, 2005. Joined Northeastern in 2013
617.373.6835 | j.martinez-lorenzo@neu.edu | coe.neu.edu/~jmartinez

Scholarship Focus

• Compressive sensing and modeling using mechanical and electromagnetic waves
• Computational methods for differential and integral equations
• Explosives detection: portal-based, standoff-based, and underground-based
• Physics-based signal processing, imaging and optimization
• 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. Martinez Lorenzo, Y. Rodriguez-Vaqueiro, C. Rappaport, O. Rubinos Lopez, A. Garcia 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, SpectralMD

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)
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

Water Soluble Pentacene, J. Mater. Chem. C, 2013, 1, 2193-2201

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


Papers in refereed conferences
A. Basu, R. Hennessy, G. Adams, N. McGruer

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-State Sensors, Actuators and Micro-systems (Transducers & Eurosensors XXVII), p 16-20, 2013

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

Completed Dissertations Supervised
Anirban Basu
An Experimental Investigation of Hot Switching Contact Damage in RF MEMS Switches (see p 72)

Huiyan Pan
Determination of Shear Stress Between Single-Walled Carbon Nanotubes and Substrates Using NEMS Devices (see p 85)

Anup Kumar Singh
Organic Photovoltaics Using Novel Pentacene Derivatives (see p 86)
STEPHEN MCKNIGHT
Professor, Electrical and Computer Engineering
PhD, University of Maryland, 1976. Joined Northeastern in 1980
617.373.2060 | mcknight@ece.neu.edu

Scholarship Focus

- Sub-millimeter devices and materials
- Optical and infrared materials and systems
- Sensing and imaging
Scholarship Focus

- Combinatorial optimization
- Algorithm design and analysis
- Scheduling
- Machine learning
- Parallel computing
- Online platforms for behavioral experimentation

Selected Recent Publications

*Papers in refereed journals*


Detecting Solid Masses in Phantom Breast Using Mechanical Indentation, Experimental Mechanics, March 27, 2013

Research Projects

Online Laboratory to Study Large Group Network Performance
Co-Principal Investigator, Army Research Office

Completed Dissertations Supervised

Curtis Watson

Signal Detection and Digital Modulation Classification-Based Spectrum Sensing for Cognitive Radio
(see p 88)
NINGFANG MI
Assistant Professor, Electrical and Computer Engineering
PhD, College of William and Mary, 2009. Joined Northeastern in 2009
617.373.3028 | ningfang@ece.neu.edu | ece.neu.edu/~ningfang

Scholarship Focus

• Performance evaluation
• Resource management
• Capacity planning
• Cloud computing
• Storage systems
• System modeling
• Simulation
• Data analysis

Honors and Awards

• IBM Faculty Award
• Air Force Office of Scientific Research Young Investigator Award

Selected Recent Publications

Papers in refereed conferences

Y. Yao, J. Wang, B. Sheng, N. Mi

Deng Liu, Jianzhe Tai, Jack Lo, Ningfang Mi and Xiaoyun Zhu,
vFRM: Flash Resource Manager in VMware ESX Server, the IFIP/IEEE Network Operations and Management Symposium (NOMS’14), Krakow, Poland, May 2014

Yi Yao, Jiayin Wang, Bo Sheng, Jason Lin, and Ningfang Mi,
HASTE: Hadoop YARN Scheduling Based on Task-Dependency and Resource-Demand, the IEEE International Conference on Cloud Computing (Cloud’14), Alaska, USA, June 2014

Research Projects

CSR: EAGER: An Integrated Framework for Performance and Reliability in Large-Scaled Computing Systems
Principal Investigator, National Science Foundation
HOSSEIN MOSALLAIEI
Associate Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering
PhD, University of California, Los Angeles, 2001. Joined Northeastern in 2005
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Scholarship Focus
- Metamaterials and devices
- GHz-THz front-ends
- Photonic and quantum systems
- Computational electromagnetics and physics

Selected Recent Publications

Books and book chapters

Papers in refereed journals
J. Cheng, W. L. Wang, H. Mosallaei, E. Kaxiras


M. Farmahini-Farahani, J. Cheng, H. Mosallaei

B. Memarzadeh, H. Mosallaei

M. Farmahini-Farahani, H. Mosallaei

S. Saadat, H. Mosallaei, E. Afshari

S. Saadat, M. Adnan, H. Mosallaei, E. Afshari

M. Farmahini Farahani, H. Mosallaei

M. Rostami, D. Ansari O.B., H. Mosallaei
Dispersion Diagram Analysis of Arrays of Multishell Multimaterial Nanospheres, PIERB, 48, p 77-98, 2013
A. Rashidi, H. Mosallaei, R. Mittra


Papers in refereed conferences

H. Mosallaei


D. Ansari O.B., H. Mosallaei


M. Farmahini Farahani, H. Mosallaei


J. Cheng, W. L. Wang, H. Mosallaei, E. Kaxiras

Graphene Metamaterial with Organic Molecular Patterning, Materials Research Society, Fall Meeting, Boston, MA, Dec. 1-6, 2013

Research Projects

3D Optical Metamaterials with Tunability and Low Loss

Co-Principal Investigator, Office of Naval Research

Dielectric and Plasmonic Particles Enabling Nanoscale Energy Engineering

Principal Investigator, Air Force Office of Scientific Research

Transformative Parameters Extreme Antennas: Active, Nonlinear, and Patterned Metamaterials Investigation

Principal Investigator, Office of Naval Research

Completed Dissertations Supervised

Babak Memarzadeh Isfahani

Plasmonic Metasurfaces with Tailored Linear and Nonlinear Building Blocks (see p 83)
Scholarship Focus

- Biomedical optics and non-invasive imaging
- Rare cell detection and tracking in the body
- Ultrafast time-domain diffuse optical imaging
- Image reconstruction and biomedical signal processing

Honors and Awards
Massachusetts Life Sciences Center New Investigator Award

Selected Recent Publications

Papers in refereed journals

S. Markovic, B. Li, V. Pera, O. Camps, M. Sznaier, M. Niedre

V. Pera, E. Zettergren, D.H. Brooks, M. Niedre


Y. Mu, N. Valim, M. Niedre

N. Pestana, D. Walsh, A. Hatch, P. Hahn, G.J. Jaffe, S.K. Murthy, M. Niedre

N. Valim, J. Brock, M. Leeser, M. Niedre
The Effect of Temporal Impulse Response on Experimental Reduction of Photon Scatter in Time-Resolved Diffuse Optical Tomography, Physics in Medicine and Biology, 58 (2): 335-349, 2013

Research Projects
Ultra-Fast Time-Domain Multiplexed Fluorescence Tomography
Principal Investigator, National Institutes of Health

Completed Dissertations Supervised
Niksa Valim
Instrumentation and Methods for Time-Resolved Diffuse Fluorescence Imaging (see p 87)
Scholarship Focus

- Design of analog, radio frequency and mixed-signal integrated circuits
- Built-in test and calibration techniques for systems-on-a-chip
- On-chip temperatures sensors for thermal monitoring and built-in testing

Selected Recent Publications

Papers in refereed journals

C.H. Chang, M. Onabajo

C.H. Chang, M. Onabajo

C.-J. Park, M. Onabajo, J. Silva-Martinez

Y. Ni, M. Onabajo

Papers in refereed conferences

I.S. Jung, M. Onabajo, Y.B. Kim

C.H. Chang, M. Onabajo

C.J. Park, H. M. Geddada, A. I. Karsilayan, J. Silva-Martinez, M. Onabajo

P. Grossmann, M. Leeser, M. Onabajo

Research Projects

Integrated Self-Calibrated Analog Front-End for Biopotential and Bloimpedance Measurements
Principal Investigator, National Science Foundation

RF Power Amplifier Linearization with Digital Predistortion
Principal Investigator, Analog Devices, Inc. (Lyric Labs)

Compact & Power Efficient Integrated Voltage Tunable RF Inductors & Transformers with Wide Tunable Inductance Range
Principal Investigator, Northeastern Subcontract from Winchester Technologies, LLC (SBIR, National Science Foundation)
Scholarship Focus

- Antenna design
- Wave propagation in complex media
- Biomedical microwaves device design and analysis
- Subsurface sensing system design and integration
- Concealed object detection for security applications

Honors and Awards

- Fellow, Institute of Electrical and Electronics Engineers
- Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

**Papers in refereed journals**


*An Improved SAR Based Technique for Accurate Profile Reconstruction*, IEEE Transactions on Antennas and Propagation (TAP), vol. 61, No. 3, p 1490 – 1495, March 2013

J.A. Martinez Lorenzo, Y. Rodriguez-Vaqueiro, C. Rappaport, O. Rubinos Lopez, O., G. Pino


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


Y. Rodríguez-Vaqueiro, Y. Álvarez, B. Gonzalez-Valdes, J.A. Martínez-Lorenzo, F. Las-Heras, C. Rappaport

*On the Use of Compressed Sensing Techniques for Improving Multistatic Three-dimensional Millimeter-Wave Portal-Based Personnel Screening*, IEEE (TAP), vol. 62, no. 1, p 494 - 499


Y. Álvarez, Y. Rodríguez-Vaqueiro, B. Gonzalez-Valdes, J.A. Martínez-Lorenzo, F. Las-Heras, C. Rappaport


**Papers in refereed conferences**

S. Mantzavinos, B. Gonzalez Valdes, D. Busuioc, M. Nickerson, R. Miller, J.A. Martinez-Lorenzo, C. Rappaport

*Low-Cost, Fused Millimeter-Wave and 3D Point Cloud Imaging for Concealed Threat Detection*, Gordon Research Conference: Detecting Illicit Substances, Drugs and Explosives, May 2013

C. Rappaport, A. Morgenthaler

*A Simple and Accurate Means of Predicting the Locus of Constant Travel Time of an Underground...*
M. Hines, C. Rappaport
Localization of Anti-Personnel Landmines using Computationally Modeled Data for Bistatic Ground-Coupled Ground Penetrating Radar, (IGARSS), July 2013, p 4070 - 4073
M. Tajdini, C. Rappaport
Analytic Analysis of Ground Penetrating Radar Wave Scattering of Reinforced Concrete Bridge Decks, (IGARSS), July 2013, p 4066 - 4069
A. Morgenthaler, C. Rappaport
Fast GPR Underground Shape Anomaly Detection Using the Semi-Analytic Mode Matching Algorithm, (IGARSS)
M. Tajdini, C. Rappaport
An Efficient Forward Model of Ground Penetrating Radar for Sensing Deteriorated Bridge Decks, IEEE International Antennas and Propagation Symposium, July 2013, p 1022 - 1023
J.A. Martinez-Lorenzo, R. Obermeier, F. Quivira, C. Rappaport, R. Moore, D. Kopans
J.A. Martinez-Lorenzo, A. Basukoski, F. Quivira, C. Rappaport, R. Moore, D. Kopans
Composite Models for Microwave Dielectric Constant Characterization of Breast Tissues, IEEE International Antennas and Propagation Symposium, July 2013, p 2036 - 2037
S. Mantzavinos, B. Gonzalez-Valdes, D. Busuioc, R. Miller, J.A. Martinez-Lorenzo, C. Rappaport
Low-Cost, Fused Millimeter-Wave and 3D Point Cloud Imaging for Concealed Threat Detection, IEEE International Antennas and Propagation Symposium, July 2013, p 1014 - 1015
A. García Pino, B. Gonzalez-Valdes, J.A. Martinez-Lorenzo, C. Rappaport
Scanned Blade Beam Reflector Antenna for Nearfield Imaging, IEEE IAPS, July 2013, p 950 - 951
Y. Rodríguez-Vaqueiro, B. Gonzalez-Valdes, J.A. Martinez-Lorenzo, C. Rappaport, Y. Álvarez, F. Las-Heras
Compressed Sensing Techniques for Multistatic Three-dimensional Millimeter-Wave Personnel Screening, IEEE International Antennas and Propagation Symposium, July 2013, p 534-535
Y. Álvarez, F. Las-Heras, B. Gonzalez-Valdes, J.A. Martinez-Lorenzo, C. Rappaport
Low Permittivity Dielectric Object on Conductor Characterization, IEEE IAPS, July 2013, p 822 - 823
Y. Álvarez, F. Las-Heras, B. Gonzalez-Valdes, J.A. Martinez-Lorenzo, C. Rappaport
Accurate Profile Reconstruction Using An Improved SAR Based Technique, IEEE International Antennas and Propagation Symposium (IAPS), July 2013, p 818 - 819
B. Gonzalez-Valdes, J.A. Martinez-Lorenzo, C. Rappaport
Dual Band SAR Processing for Low Dielectric Contrast Buried IED Detection, IEEE IAPS, p 1080
C. Rappaport, B. Gonzalez-Valdes, G. Allan, J.A. Martinez-Lorenzo
Optimizing Element Positioning in Sparse Arrays for Nearfield Mm-Wave Imaging, IEEE Phased Array Conference, October 13-16, 2013, p 333-335
Y. Álvarez, F. Las-Heras, B. Gonzalez-Valdes, J.A. Martinez-Lorenzo, C. Rappaport

Research Projects
Awareness and Localization of Explosive-Related Threats (ALERT)
Co-Principal Investigator, Department of Homeland Security
Walking Robot Based Ground Penetrating Radar Sensor for Mine and IED Detection,
Principal Investigator, National Science Foundation
Microwave Nearfield Radar Imaging (NRI) Using Digital Breast Tomosynthesis (DBT) for Non-Invasive Breast Cancer Detection,
52 Co-Principal Investigator, National Science Foundation
Scholarship Focus
- Remote sensing
- Wave propagation and scattering in random media and multi-path environments
- Temporal and spatial signal processing
- Statistical inference theory
- Acoustical oceanography
- Fisheries and marine mammal acoustics
- Nonlinear scattering theory

Honors and Awards
- Presidential Early Career Award for Scientists and Engineers
- Office of Naval Research Young Investigator Award

Selected Recent Publications

Papers in refereed journals
Z. Gong, D. Tran, P. Ratilal
Z. Gong, T. Chen, P. Ratilal, N. Makris
A. Jain, A. Ignisc
D. Tran, W. Huang, A. Bohn, D. Wang, Z. Gong, N. Makris, P. Ratilal

Research Projects
Development of a Lightweight Towed Array Receiver (LTAR) for Wide-Area Ocean Monitoring and Imaging
Principal Investigator, National Science Foundation
Suplemental Funding Request: Sea Test and Design of Vibration Isolation Module of National Science Foundation-MRI funded Lightweight Towed Receiver Array (LTAR)
Principal Investigator, National Science Foundation
Enhancing Long Range Sonar Performance in Range-Dependent Fluctuating Ocean Waveguides by Mitigating Biological Clutter and Environmental Reverberation
Principal Investigator, Department of Defense
Instantaneous Passive And Active Detection, Localization, Monitoring And Classification Of Marine Mammals Over Long Ranges With High-Resolution Towed Array Measurements
Principal Investigator, National Science Foundation
Unified Four-Dimensional Multi-Resolution Oceanographic, Acoustic and Atmospheric Modeling and Dynamics
Collaborator, Office of Naval Research
MATTEO RINALDI
Assistant Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering
617.373.2751 | rinaldi@ece.neu.edu | northeastern.edu/nemslab

Scholarship Focus
• Micro/nano electromechanical systems (MEMS/NEMS)
• Chemical, physical and biological sensors
• Radio frequency wireless communication devices
• Piezoelectric materials
• Nano-materials and nano-structures

Honors and Awards
• National Science Foundation CAREER Award
• Defense Advanced Research Projects Agency Young Faculty Award

Selected Recent Publications

Papers in refereed journals
T. Nan, Y. Hui, M. Rinaldi, N. Sun

Y. Hui, M. Rinaldi

Y. Hui, T. Nan, N. Sun, M. Rinaldi

Papers in refereed conferences
Z. Qian, Y. Hui, F. Liu, S. Kar, M. Rinaldi

Y. Hui, T. X. Nan, N. X. Sun, M. Rinaldi

G. Hummel, Y. Hui, Z. Qian, M. Rinaldi

Y. Hui, Z. Qian, G. Hummel, M. Rinaldi

Research Projects
Un-Cooled Nanomechanical Infrared/THz Detectors Based on Piezoelectric Resonant Nano Plates
Principal Investigator, Defense Advanced Research Projects Agency (Young Faculty Award)

Nano Electro Mechanical Resonant Sensing Platform for Chip Scale, High Resolution and Ultra-Fast Terahertz Spectroscopy and Imaging
Principal Investigator, National Science Foundation (CAREER Award)

Intrinsically Switchable and Programmable MEMS Filter Array
Principal Investigator, Defense Advanced Research Projects Agency
Scholarship Focus

- Security and privacy of operating systems, mobile and embedded devices, and web applications
- Malware and vulnerability analysis
- Anomaly and intrusion detection

Selected Recent Publications

*Papers in refereed conferences*

A. Cassola, W. Robertson, E. Kirda, G. Noubir

*A Practical, Targeted, and Stealthy Attack Against WPA Enterprise Authentication*, in Proceedings of the Network and Distributed System Security Symposium (NDSS), San Diego, CA USA, February 2013

K. Onarlioglu, C. Mulliner, W. Robertson, E. Kirda


K. Onarlioglu, M. Battal, W. Robertson, E. Kirda

*Securing Legacy Firefox Extensions with Sentinel*, in Proceedings of the International Conference on Detection of Intrusions and Malware and Vulnerability Assessment (DIMVA), Berlin, July 2013

T. Lauinger, K. Onarlioglu, A. Chaabane, E. Kirda, W. Robertson, M. Kaafar

*Holiday Pictures or Blockbuster Movies? Insights into Copyright Infringement in User Uploads to One-Click File Hosters*, in Proceedings of the International Symposium on Research in Attacks, Intrusions, and Defenses (RAID), St. Lucia, LC, October 2013

T.-F. Yen, A. Oprea, K. Onarlioglu, T. Leetham, W. Robertson, A. Juels, E. Kirda

*Beehive: Large-Scale Log Analysis for Detecting Suspicious Activity in Enterprise Networks*, in Proceedings of the Annual Computer Security Applications Conference (ACSAC), New Orleans, LA USA, December 2013

C. Mulliner, J. Oberheide, W. Robertson, E. Kirda


C. Mulliner, W. Robertson, E. Kirda

*Hidden GEMs: Automated Discovery of Access Control Vulnerabilities in Graphical User Interfaces*, in Proceedings of the IEEE Symposium on Security and Privacy (Oakland), San Jose, CA USA, May 2014

A. Kharraz, E. Kirda, W. Robertson, D. Balzarotti, A. Francillon

*Optical Delusions: A Study of Malicious QR Codes in the Wild*, in Proceedings of the IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), Atlanta, GA USA, June 2014

C. Mulliner, W. Robertson, E. Kirda

MASOUD SALEHI
Associate Professor, Electrical and Computer Engineering
PhD, Stanford University, 1979. Joined Northeastern in 1989
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Scholarship Focus
• Information theory
• Coding
• Digital communications

Selected Recent Publications

Books and book chapters
J.G. Proakis, M. Salehi

Papers in refereed conferences
K. Firouzbakht, G. Noubir, M. Salehi

O. Vahabzadeh, M. Salehi
A Novel Two-User Cooperation Scheme for Cooperative Communications Based on Protograph-Based Low-Density Parity-Check (LDPC) Codes, Proceedings of the 47th annual conference on Information Sciences and Systems, March 20-22, 2013, Baltimore, MD

K.L. Huang, V. Gaudet, M. Salehi
A Scaling Method for Stochastic LDPC Decoders with Binary Symmetric Channel, Proceedings of the 47th annual conference on Information Sciences and Systems, 2013, Baltimore, MD

Kuo-Lun Huang, Vincent Gaudet, Masoud Salehi

Completed Dissertations Supervised
Yuegian Li
Code Design for SISO and MIMO Block-Fading Channels (see p 80)

Osso Vahabzadeh
Efficient Low-Density Parity-Check Codes for Cooperative Communication (see p 86)
Scholarship Focus

- Design of embedded computer systems
- System-level design automation, hardware / software co-design
- Architectures and technology solutions for embedded vision
- Design of cyber-physical systems

Selected Recent Publications

Books and Book Chapters
G. Schirner, M. Götz, A. Rettberg, M. Zanella, F. J. Rammig

R. Birken, J. Zhang, G. Schirner
System Level Design of a Roaming Multi-Modal Multi-Sensor System, in Sensor Technologies for Civil Infrastructures: Performance Assessment and Health Monitoring, Ming L. Wang; Jerome P. Lynch, and Hoon Sohn (Editors), April 2014

Papers in refereed journals
G. Schirner, D. Erdogmus, K. Chowdhury, T. Padir

H. Tabkhi, R. Bushey and G. Schirner

Papers in refereed conferences
H. Tabkhi, R. Bushey, G. Schirner

R. Bushey, H. Tabkhi, G. Schirner

J. Zhang, G. Schirner
Joint Algorithm Developing and System-Level Design: Case Study on Video Encoding, Proceedings of the International Embedded Systems Symposium (IESS), June 2013

Y. Ukidave, A. Ziabari, P. Mistry, G. Schirner, D. Kaeli

H. Tabkhi, R. Bushey, G. Schirner
Function-Level Processor (FLP): Raising Efficiency by Operating at Function Granularity for Market-Oriented MPSoCs, IEEE International Conference on Application-specific Systems, Architectures and Processors (ASAP), Zurich, Switzerland, 2014
C. Zhang, H. Tabkhi, G. Schirner
   A GPU-based Algorithm-specific Optimization for High-performance Background Subtraction,
   International Conference on Parallel Processing, Minneapolis, MN, 2014

J. Zhang and G. Schirner
   Automatic Specification Granularity Tuning for Design Space Exploration, Proceedings of the ACM/
   IEEE Conference on Design, Automation & Test in Europe (DATE), Dresden, Germany, 03/2014

J. Zhang, H. Qiu, S. Shamsabadi Shamsabadi, R. Birken and G. Schirner
   SIROM - A Scalable Intelligent ROaming Multi-Modal Multi-Sensor Framework, Computer Software and
   Applications Conference (COMPSAC), 07/2014

Research Projects

CPS: Medium: Collaborative Research: Holistic Design Methodology for Automated Implementation of
   Human-in-the-Loop Cyber-Physical Systems
   Principal Investigator, National Science Foundation

SHF: Small: Power Efficient Emerging Heterogeneous Platforms
   Principal Investigator, National Science Foundation

Versatile Onboard Traffic Embedded Roaming Sensors (VOTERS)
   Technical Lead for System Integration, National Institute of Standards and Technology

Designing Green Software for High-Performance Computing Clusters
   Sole Principal Investigator, Massachusetts Green High Performance Computing Center

System-Level Estimation for MPSoC Design
   Sole Principal Investigator, Analog Devices Inc

Simplifying BSP Integration Through Simulink Abstract Devices
   Sole Principal Investigator, Mathworks

Bringing Model-based HW/SW Co-Design into the ECE Experience
   Sole Principal Investigator, Mathworks

Integrating an Active Learning Platform into the ECE Curriculum
   Co-Principal Investigator, Analog Devices Inc

Integrating the Personal Active Learning Platform: Advancing the Department of Electrical and Computer
   Engineering through Curriculum Innovation
   Principal Investigator, David House Foundation
Scholarship Focus

- Electromagnetics
- Nonlinear optics
- Microwaves
- Remote sensing
- Electrodynamics of random media
- Plasma turbulence
- Ionospheric scintillations
- Gaseous lasers
BAHRAM SHAFAI
Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering
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Scholarship Focus
• Control systems and signal processing
• Robust and optimal control
• Stability and control of time delay systems, positive systems, multi-agent systems

Honors and Awards
• Associate Editor of IEEE Transactions on Systems
• Senior Member, Institute of Electrical and Electronics Engineers

Selected Recent Publications
Papers in refereed journals
R. Ghadami, B. Shafai

Papers in refereed conferences
B. Shafai, R. Ghadami
P.M. Nia, R. Sipahi, B. Shafai
A.B. Farjadian, M.J. Yazdanpanah, B. Shafai
M. Alavi, M. Saif, B. Shafai
State Estimation in Discrete-Time Nonlinear Stochastic Systems Subject to Random Data Loss, Proceeding of 2013 Asian Control Conference, Istanbul, Turkey, p 1-5, 2013
K. Bekiroglu, M. Sznaier, C. Lagoa, B. Shafai
B. Shafai, R. Ghadami, A. Oghbaee

Completed Dissertations Supervised
Pascal Maurice Brunet
Nonlinear System Modeling and Identification of Loudspeakers (see p 74)
Robert D. Black Professor, COE Distinguished Professor, Electrical and Computer Engineering; affiliated faculty, Civil and Environmental Engineering, PhD, Northeastern University, 1971. Joined Northeastern in 1972
617.373.3033 | m.silevitch@neu.edu | northeastern.edu/alert

Scholarship Focus
• Subsurface sensing and imaging
• Medical and security screening systems
• Multi-partner large center development

Honors and Awards
Life Fellow, Institute of Electrical and Electronics Engineers

Research Projects
Awareness and Localization of Explosives Related Threats (ALERT), a Department of Homeland Security Center of Excellence. ALERT seeks to conduct transformational research, technology and educational development for effective characterization, detection, mitigation and response to the explosives-related threats facing the country and the world
  Director and Principal Investigator, Department of Homeland Security
Puerto Rico Testsite to Explore Contaminant Threats (PROTECT), a National Institute of Environmental Health Sciences Superfund Research Center. PROTECT investigates the relationship between environmental contamination and preterm birth
  Research Translation Core co-Leader, National Institutes of Health
The Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems, A Graduated NSF Engineering Research Center. Gordon-CenSSIS was created to develop new technologies to detect hidden objects, and to use those technologies to meet real-world subsurface challenges in areas as diverse as noninvasive breast cancer detection and underground pollution assessment
  Director and Principal Investigator, National Science Foundation
Research and Development of Reconstruction Advances in CT Based Object Detection Systems
  Principal Investigator, Department of Homeland Security
DAGMAR STERNAD
Professor, Biology; jointly appointed: Electrical and Computer Engineering, Physics; affiliated faculty, Bioengineering, PhD, University of Connecticut, 1995. Joined Northeastern in 2008
617.373.5093 | dagmar@neu.edu | northeastern.edu/actionlab

Scholarship Focus
- Control and coordination of goal-directed human behavior
- Single and multi joint human movements including upper limb manipulation tasks and locomotion examined in virtual environments

Selected Recent Publications

Papers in refereed journals
S.-W. Park, T. Dijkstra, D. Sternad

D. Sternad, H. Marino, M. Duarte, L. Dipietro, S. Charles, N. Hogan
Transitions Between Discrete and Rhythmic Primitives in a Unimanual Task, Frontiers in Computational Neuroscience, 7:90, 2013

N. Hogan, D. Sternad
Dynamic Primitives in the Control of Locomotion, Frontiers in Computational Neuroscience, 7:71, 2013

M.O. Abe, D. Sternad
Directionality in Distribution and Temporal Structure of Variability in Skill Acquisition, Frontiers in Human Neuroscience, 7:225, 2013

W.T.V. Chu, D. Sternad, T.D. Sanger
Healthy and Dystonic Children Compensate for Changes in Motor Variability, Journal of Neurophysiology, 109, 8, 2169-2178, 2013

Papers in refereed conferences
M.E. Huber, M. Leeser, D. Sternad

Research Projects
Variability and Stability in Skill Acquisition
Principal Investigator, National Institutes of Health

PRISM: Attracting Students to Mathematics, Physics and Biology Through Interdisciplinary Research and Discovery
Co-Principal Investigator, National Science Foundation

Multi-Joint Intelligent Prosthesis Based on EMG Control
Co-Investigator, University of Beijing

Development of an Adaptive Clinician-Friendly Virtual Rehabilitation System and its Evaluation in Post-Operative Shoulder Therapy
Principal Investigator, Northeastern University

Prosody in Congenital and Acquired Dysarthria
Co-Investigator, National Institutes of Health

Training Dual-Task Walking After Stroke: Effects on Attentional and Locomotor Control
Co-Investigator, American Heart Association
Scholarship Focus
- Communications
- Signal processing
- Wireless networks

Honors and Awards
Fellow, Institute of Electrical and Electronics Engineers

Selected Recent Publications

Papers in refereed journals
E. Zorita, M. Stojanovic
Space-Frequency Block Coding for Underwater Acoustic Communications, IEEE Journal of Oceanic Engineering, Special Issue on Underwater Communications

P. Qarabaqi, M. Stojanovic


C. Murphy, J. Walls, T. Schneider, R. Eustice, M. Stojanovic, H. Singh

F. Fazel, M. Fazel, M. Stojanovic
Random Access Compressed Sensing over Fading and Noisy Communication Channels, IEEE Transactions on Wireless Communications, vol.12, No.5, May 2013, p 2114-2125

K. Tu, T. Duman, M. Stojanovic, J. Proakis

D. Lucani, M. Medard, M. Stojanovic

W.Y. Shin, D. Lucani, M. Medard, M. Stojanovic, V. Tarokh

Papers in refereed conferences
B. Reed, J. Leighton, M. Stojanovic, F. Hover
P. Ponnavaikkoy, K. Yassiny, S.K. Wilsoiy, M. Stojanovicz, J. Holliday

K. Kerse, F. Fazel, M. Stojanovic

D. Parker, M. Stojanovic, C. Yu

P. Qarabaqi, Y. Aval, M. Stojanovic

R. Ahmed, M. Stojanovic

Y. Aval, M. Stojanovic

F. Fazel, M. Stojanovic

Research Projects
Intelligent Coordination and Adaptive Classification for Naval Autonomous Systems
Principal Investigator, Office of Naval Research

MURI: Underwater Acoustic Propagation and Communications: A Coupled Research Program
Principal Investigator, Office of Naval Research

NeTS: Large: Collaborative Research: Exploration and Exploitation in Actuated Communication
Principal Investigator, National Science Foundation
Scholarship Focus
- Magnetic, ferroelectric and magnetoelectric materials
- RF/microwave magnetic and magnetoelectric devices design, fabrication and testing
- Materials properties at RF/microwave frequency range
- Self-assembly of magnetic nanostructure

Honors and Awards
- Fellow, Institute of Physics
- Fellow, Institute of Engineering and Technology
- Office of Naval Research Young Investigator Award
- National Science Foundation CAREER Award
- Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications

Books and book chapters
X. Xing, N. Sun

Papers in refereed journals
  Quantification of Charge Mediated Magnetoelectric Coupling Strength in Magnetic/Dielectric Thin Film Heterostructures, Applied Physics Letters, 103, 232906, 2013
- G. Wu, T. Nan, R. Zhang, N. Zhang, S. Li, N. Sun
  Challenges and Opportunities for Multi-Functional Oxide Thin Films for Voltage Tunable RF/Microwave Components, Journal of Applied Physics, 114, 191301, 2013
  Compact and Low Loss Phase Shifter With Low Bias Field Using Partially Magnetized Ferrite, IEEE Trans. Mag., 2013
- G.M. Yang, J. Wu, J. Lou, M. Liu, N. Sun
- F.R. Liu, N. Bai, J.J. Zhao, X.X. Han, W. P. Zhou, X. Lin, N.X. Sun
  An Explanation of the Crystallization of Amorphous Ge2Sb2Te5 Films Induced by a Short Gaussian Laser Pulse, Applied Physics Letters, 103, 051905, 2013
- T. Nan, Y. Hui, M. Rinaldi, N. Sun
M. Liu, B. Howe, L. Grazulis, K.Y. Mahalingam, T. Nan, N. Sun, G. Brown


S. Li, M. Liu, W. Shao, J. Xu, S. Chen, Z. Zhou, T. Nan, N. Sun, J.G. Duh
Large E-Field Tunability of Microwave Ferromagnetic Properties in Fe50co50-Hf/Lead Zinc Niobate-Lead Titanate Multiferroic Laminates, J. Appl. Phys.113, 17C727, 2013


Li, M. Liu, J. Lou, X. Xing, J. Qiu, J. Lin, Z. Cai, F. Xu, N.X, Sun, J.G. Duh
Microwave Frequency Performance and High Magnetic Anisotropy of Nanocrystalline Fe70Co30-B Films Prepared by Composition Gradient Sputtering, Journal of Nanoscience and Nanotechnology 2013

X. Yang, J. Wu, S. Beguhn, T. Nan, Y. Gao, Z. Zhou, N. X. Sun

S. Li, M. Liu, J. Lou, X. Xing, J. Qiu, J. Lin, Z. Cai, F. Xu, N.X. Sun, J.G. Duh
Tunable Microwave Frequency Performance of Nanocomposite Co2MnSi/PZN-PT Magnetoelectric Coupling Structure, Journal of Nanoscience and Nanotechnology, 13, 1182, 2013

X. Xing, N. X. Sun, B. Chen

M. liu, Z. Zhou, T. Nan, B. Howe, G.J. Brown, N. X. Sun

Papers in refereed conferences
Q. Sun, S. Patil, N.X. Sun, B. Lehman
Inductive Magnetic Harvester with Resonant Capacitive Rectifier Based on Synchronized Switch Harvesting Technique, Energy Conversion Congress and Exposition (ECCE), 2013 IEEE, 4940-4947

Shawn Beguhn, X. Yang, N. Sun
Design of a Magnetization Gradient Ferrite Substrate Integrated Waveguide Isolator to Mitigate Higher Order Mode Effects, International Microwave Symposium (IMS), June 2~6, 2013, Seattle, WA, USA

Road Profile Estimation of City Roads Using DTPS, Proc. SPIE 8692, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems, 86923C, April 19, 2013

Y. Hui, T. Nan, N. Sun, M. Rinald
MARIO SZNAIER
Dennis Picard Trustee Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering
PhD, University of Washington, 1989 Joined Northeastern in 2006
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Scholarship Focus
- Robust control
- Identification and model (In) validation
- Information extraction from high volume data streams
- Vision based control
- Applications of dynamical systems theory to imaging and video processing

Honors and Awards
IEEE Control Systems Society Distinguished Member Award

Selected Recent Publications

Papers in refereed journals
S. Markovic, B. Li, V. Pera, M. Sznaier, O. Camps, M. Niedre, M. Cytometry

F. Dabbene, M. Sznaier, R. Tempo

M. Sznaier, M. Ayazoglu, T. Inanc

N. Ozay, M. Sznaier, C. Lagoa

Papers in refereed conferences
K. Bekiroglu, M. Sznaier, C. Lagoa, B. Shafai

M. Ayazoglu, B. Yilmaz, M. Sznaier, O. Camps

C. Dicle, O. Camps, M. Sznaier
The Way They Move: Tracking Multiple Targets with Similar Appearance, IEEE Int. Conf. on Computer Vision, Sydney, Australia, Dec. 2013

Y. Cheng, Y. Wang, M. Sznaier

B. Yilmaz, C. Lagoa, M. Sznaier
F. Xiong, Y. Cheng, O. Camps, M. Sznaier, C. Lagoa

Y. Wang, M. Sznaier, F. Dabbene

J. Lopez, Y. Wang, M. Sznaier

Research Projects
Compressive Information Extraction: A Dynamical Systems Approach
Principal Investigator, AFOSR

Robust Identification of a Class of Structured Systems with High Dimensional Outputs and Applications
Principal Investigator, National Science Foundation

Dynamic Invariants for Video Scenes Understanding
Co-Principal Investigator, National Science Foundation

ALERT DHS HS-STEM Career Development Program at Northeastern University
Participant, Department of Homeland Security
GILEAD TADMOR
Professor, Electrical and Computer Engineering; affiliated faculty, Bioengineering
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Scholarship Focus

- Robust and nonlinear control
- Reduced order models
- Fluid flow control
- Applications of dynamics in imaging
- Real time video analysis
- Information extraction from massive data systems

Selected Recent Publications

Papers in refereed journals

L. Mirkin, T. Shima, G. Tadmor

K. Aleksic’-Roeßner, R. King, O. Lehmann, G. Tadmor, M. Morzyn´ski

Papers in refereed conferences

L. Mirkin, T. Shima, G. Tadmor
Analog Loop Shifting in H2 Optimization of Input-Delay Sampled-Data Systems, 52nd IEEE Conf. on Decision and Control, December 2013
CARMINE VITTORIA
COE Distinguished Professor, Electrical and Computer Engineering
PhD, Yale University, 1970. Joined Northeastern in 1985
617.373.2061 | vittoria@ece.neu.edu | ece.neu.edu/faculty/vittoria.html

Scholarship Focus
- Development of new microwave materials
- Ferrites
- Ferroelectrics
- Superconductors
- Magneto-dielectrics
- Composite electrical and magnetic materials
- Magnetic super lattices
- Nano particles and sub-micron planar devices
- Fundamental excitations in magnet-dielectric materials

Honors and Awards
- Fellow, Institute of Electrical and Electronics Engineers
- Søren Buus Outstanding Research Award, College of Engineering

Selected Recent Publications
Papers in refereed journals
M. Mohebbi, K. Ebnabbasi, C. Vittoria
M. Mohebbi, C. Vittoria,
M. Mohebbi, K. Ebnabbasi, C. Vittoria
First Observation of Magnetoelectric Effect In M-Type Hexaferrite Thin Films, J. Appl. Phys. 113, 17C710, 2013
K. Ebnabbasi, M. Mohebbi, C. Vittoria
Strong Magnetoelectric Coupling in Hexaferrites at Room Temperature, J. Appl. Phys. 113, 17C707, 2013
K. Ebnabbasi, M. Mohebbi, C. Vittoria
K. Ebnabbasi, M. Mohebbi, C. Vittoria
Coaxial Line Technique to Measure Constitutive Parameters in Magnetoelectric Ferrite Materials, Microwave and Optical Components Letters, vol. 23, No. 9, 2013

Completed Dissertations Supervised
Marjan Mohebbi
Magnetoelectric Hexaferrite Thin Films Growth for Next Generation Device Applications (see p 84)
EDMUND YEH
Associate Professor, Electrical and Computer Engineering
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Scholarship Focus
- Data-centric network architectures
- Network science
- Network information theory and coding
- Control and optimization of wireless networks
- Network economics
- Smart power grids

Honors and Awards
- Army Research Office Young Investigator Program Award
- IEEE Smart Grid Activities Liaison Officer, IEEE Information Theory Society
- Senior Member of the Institute of Electrical and Electronics Engineers
- Secretary, IEEE Information Theory Society

Selected Recent Publications
Papers in refereed journals
E. Sasoglu, E. Telatar, E.M. Yeh
Polar Codes for the Two-user Multiple-access Channel, IEEE Transactions on Information Theory, vol. 59, no.10, October 2013, p 6583-6592

Papers in refereed conferences
Y. Cui, E. Yeh

Y. Cui, E.M. Yeh
Delay Optimal Control and Its Connection to the Dynamic Backpressure Algorithm, Proceedings of the International Symposium on Information Theory (ISIT), Honolulu, HI, June 29 - July 4, 2014

Y. Xu, E.M. Yeh, M. Medard
Approaching Gaussian Relay Network Capacity in the High SNR Regime: End-to-End Lattice Codes, Proceedings of the IEEE Wireless Communications and Networking Conference (WCNC), Istanbul, Turkey, April 6-9, 2014

Research Projects
FIA: Collaborative Research: Named Data Networking
Principal Investigator, National Science Foundation

NeTS: Small: Collaborative Research: Large Scale Networks and Information Flow: From Emergent Behavior to Algorithm Design
Principal Investigator, National Science Foundation

Modeling, Analysis and Control for Robust Interdependent Networks
Co-Principal Investigator, Defense Threat Reduction Agency

Joint Forwarding and Caching Algorithms for Named Data Networking
Principal Investigator, Cisco Systems Inc.
Hypothesis Margin Based Weighting for Feature Selection Using Boosting: Theory, Algorithms and Applications

This dissertation presents work focused on Boosting based feature selection techniques for imbalanced and noisy training data. Feature selection allows one to deal with high dimensions, retaining only the features that are most important for the classification task. Traditional feature selection methods, however, fail to account for a sample data value distribution and the existing of outliers, leading to poor predictions for minority class examples. This thesis proposes a new feature selection based on the hypothesis-margins induced by Boosting. It considers Boosting decision stumps and the effect that individual features have on the margin distribution associated with the weighted linear combination that Boosting produces. Experiments on imbalanced noisy data sets taken from a range of application domains demonstrate the effectiveness of the proposed method in selecting informative features.

See full dissertation at iris.lib.neu.edu/comp_eng_diss/22

An Experimental Investigation of Hot Switching Contact Damage in Rf Mems Switches

This dissertation presents work focused on contact damage in Ruthenium-on-Ruthenium micro-contacts has been investigated under hot switching conditions. Using an AFM based test setup, developed at Northeastern University for the purpose of contact testing, a large number of experiments were performed to observe and understand the mechanisms that lead to micro-contact damage and ultimately its failure. The structure used was a clamped-clamped beam structure with a contact bump at its center. A flat topped mating pillar formed the other end of the contact and this pillar was mounted on a piezoactuator whose expansion and contraction, leading to contacts closing and opening, replicated switching cycles.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/81
Substrate Integrated Waveguide Isolators Utilizing Magnetic Materials

This dissertation presents work focused on a series of SIW isolators using tunable, non-reciprocal magnetic materials are presented. A 20 mil thick SIW with micro strip transition elements was designed utilizing Rogers TMM-3 and 4003 substrate material using both standard PCB fabrication as well as a cheaper and faster milled circuit approach not previously demonstrated. Incorporating the non-reciprocal effects of magnetic materials a nominal, magnetization gradient and wideband isolator is demonstrated. The nominal isolator utilizes a single ferrite as a proof-of-concept device, as well as being the first ferrite isolator to be implemented in SIW. The magnetization gradient isolator utilizes a stack of ferrites to form a novel saturation magnetization gradient used to mitigate high order mode effects. The wideband isolator also uses a stacked ferrite configuration to create a tunable wideband response through tailored shape demagnetization terms. In addition to these three devices a fourth isolator with more efficient tapered ferrite transitions was studied for high-power effects and compared to the nominal configuration.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/76

The Realization of a New Band Gap Engineered Photoferroelectric Photovoltaic Device with High Photocurrent

This dissertation presents work focused on incorporating a bandgap engineered, discontinuous nano-granular thin film ferrite, \((\text{CdxMn}(1-x)\text{Fe2O4})\) [CMFO], with BFO in a heteroepitaxial structure. The result is a photovoltaic device that has a spontaneous electric polarization and high photocurrent without the need for a p-n junction. An order of magnitude increase and record photocurrent was measured by incorporation of this discontinuous CMFO layer. The giant photocurrent enhancement can be explained by the overall increase in photo-induced charge carriers originating from the added narrow bandgap CMFO. Furthermore, the magnetic characteristics of both layers could lend to the possibility of tuning the absorption of the device by use of an external applied magnetic field.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/91
A Non-Superconducting Fault Current Limiter (NSFCL)

This dissertation presents work focused on studying and reviewing the various topologies of the emerging FCL technology, compare their advantages and limitations, and propose a Non-Superconducting Fault Current Limiter (NSFCL) topology. The NSFCL is optimized to protect against short transients and to work in conjunction with existing protection devices, hence it is simple, low-cost, and more compact than prior art. We analyze the operation of the proposed NSFCL topology under normal condition and different fault conditions, and validate the concept with simulations and experiments of a prototype on a 3-phase 600V system in a UL-certified high power lab. In the tests, the NSFCL successfully protects the system from 100kA potential fault current, by limiting the fault current to a pre-determined level of 50A. Additionally, it analyzes the stresses of the critical components under fault conditions, and specifies guidelines for part sizing and parameter design for the NSFCL. Moreover, this dissertation discusses design optimizations of the proposed topology to make the NSFCL more efficient under normal conditions and smaller in size.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/89
Dynamic Translation of Runtime Environments for Heterogeneous Computing

This dissertation presents work focused on the design of Caracal, a dynamic compiler that can translate between runtime environments used in heterogeneous computing. A major challenge of developing such a translation system is the inherent difference in both the underlying instruction set architecture, as well as the runtime system. One of the more challenging questions across different runtime environments is the handling of program control flow by the compiler and the hardware. Some implementations can support unstructured control flow based on branches and labels, while others are based on structured control flow relying solely on if-then and while constructs. Also explored in this dissertation is the difference between heterogeneous parallel processors architectures that will impact the design of a translator when attempting to optimize code. Two specific compiler optimizations that are highly sensitive to the underlying architecture are vectorization and loop unrolling. The experiments show that by tuning these two optimizations in the translation system, execution time can be reduced by 90%.

See full dissertation at iris.lib.neu.edu/comp_eng_diss/23

Differential Geometric Models and Optimization Methods for Dynamic Analysis of Electrocardiographic Signals and the Inverse Problem of Electrocardiography

This dissertation presents work focused on algorithmic approaches that exploit the dynamical properties in the ECG signals, and to a lesser extent EEG as well. This thesis leverages ideas from differential geometry and optimization theory to model the signals as lying on trajectories confined by their biophysical origins to a subset of the space in which the measured signals reside. These trajectories can be characterized by the spatio-temporal properties of the signals. First, characterizing these geometric subsets as smooth manifolds, we apply Laplacian eigenmaps—an established manifold learning method from the machine learning literature—to these data, along with several extensions which we have developed expressly to relate the learned low-dimensional dynamic structure to the underlying physiological behavior without specifying an explicit dynamical model. We concentrate primarily on ECG signals, but also present examples of the methods applied to EEG data containing frequent episodes of interictal epileptic spiking.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/74
Understanding Neurodegeneration with Multi-Scale Images - an Integrated Neural Image Analysis System

This dissertation presents work focused on a system approach designed for large-scale mechanism studies and drug development by analyzing multi-scale neuron images of synaptic structures, including dendritic spines, synaptic vesicles, and neurites. These three structures are the most important components in synapse functions including synaptic information transmission and storage. We propose curvilinear structure detector based dendritic spine detection strategy and employ a novel level set method to segment the spines. A pipeline based on multi-scale variance stabilizing transform followed by region based adaptive thresholding is proposed to accurately segment and quantify synaptic vesicles in an automated manner. To illustrate how the system can be used in large-scale screenings, an example of screening more than one thousand small molecules to identify inhibitors of neurite loss induced by A peptide is provided using proposed neurite image processing module. The screening results are further analyzed as potential treatment for Alzheimer’s. With the proposed system, scientists and biologists could employ it to large-scale study on responses of a population of neural cells under different chemical, genetics, or radiation perturbations without manual labeling and quantification to promote the neurodegenerative disease research and treatment development.

See full dissertation at iris.lib.neu.edu/comp_eng_diss/27

Electrode Architectures for Efficient Ionic and Electronic Transport Pathways in High-Power Lithium Ion Batteries

This dissertation focuses on developing electrode architectures that enhance electronic and ionic transport pathways in large and small area lithium ion electrodes. These architectures will utilize the unique electronic and mechanical properties of carbon nanotubes to create robust electrode scaffolding that improves electrochemical charge transfer. Using extensive physical and electrochemical characterization, the second aim is to investigate the effect of electrode parameters on electrochemical performance and evaluate the performance against standard commercial electrodes. These parameters include surface morphology, electrode composition, electrode density, and operating temperature. Finally, the third aim is to investigate commercial viability of the electrode architecture. This will be accomplished by developing pouch cell prototypes using a high-rate and low cost scale-up process. Through this work, we aim to realize a commercially viable high-power electrode technology.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/95
Electric Field-Driven Tuning of Multiferroic Transducers and Antennas Through Changes in Field Strength and Material Morphology

This investigation demonstrates experimentally and theoretically that tuning of magnetic properties of the heterostructures can be controlled through applied electric field. Significant CME effect is found in all three heterostructures: FeCoV/PZN-PT (31 Oe cm kV-1), Metglas/PMN-PT (23 Oe cm kV-1), and FeGa/PMN-PT (12.5 Oe cm kV-1). The tunabilities of remanence (Mr), coercivity (Hc), and squareness (SQ = Mr / Ms) are demonstrated. A sensitive dependence of CME effect on the magnitude of the applied electric field is discovered in the time and frequency domains, especially near the electric coercive field, and an alternative path to magnetization reversal is identified. The change in sign of magnetization is shown in the vicinity of magnetic coercivity. Tuning of induced magnetic fringe field (4.5 Oe cm kV-1) is shown for the FeGa/PMN-PT heterostructure, which could be used as a magnetic field generator. Results of low temperature characteristics of magnetization and magnetostriction of a novel terbium-doped FeGa alloy show this material can be applied to actuators and sensors requiring operability in wide temperature ranges. Indirect electric-field tuning can also be applied to patch antennas with a dielectric substrate.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/82

Dynamic Translation of Runtime Environments for Heterogeneous Computing

This dissertation focuses on development and characterization of tube-topology ME composites as magnetic field sensors. The novel topology is most notable for demonstrating high zero-external-bias sensitivity, low noise floor, low-frequency bandwidth, and self-powered, stable room temperature operation. Numerous characterization studies are included in this work where several devices are analyzed as a function of test-field, DC-bias field, geometry, material choice, and more. The overall conclusions drawn upon these results indicate strongly that the tube-topology ME magnetic field sensor holds promise to compete with existing hall-effect and flux-gate magnetometers. ME composites are at the tipping point of commercialization for use in magnetometry applications and are emerging as a valuable technology for use in numerous creative ways.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/83
Graphical Model Based Segmentation of Massive Numbers of Irregular Small Objects in Images, with Application to Axon Characterization in Histological Sections

This dissertation focuses on the particular problem of automated identification and characterization of very large numbers of small objects of interest, where the objects have similar but variable structure, are embedded in a complex cluttered background, and may have low contrast and other imaging aberrations. The motivating application is the analysis of microscopy images of stained histological sections of brain or spinal cord tissue, where quantitative measurements from closely packed axons are useful to elucidate possible physiological mechanisms underlying contrast in diffusion-weighted magnetic resonance (DW-MR) images.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/80

Design and Analysis of Minimum Energy Fpgas

This dissertation presents work focused on multiple steps forward in the design and analysis of FPGAs targeting minimum energy operation. A fabricated FPGA test chip capable of single-supply subthreshold operation is presented, with measurement results demonstrating FPGA programming and operation as low as 260 mV. The capability to minimize energy per clock cycle at subthreshold supply voltages for a high activity factor test case is also shown, indicating that the flexible nature of FPGAs does not inherently prevent their energy minimum occurring below threshold. A simulation flow for performing pre-fabrication chip-level minimum energy analysis for FPGAs has also been developed in this work. By combining industry-standard integrated circuit design verification software with academic FPGA software and custom scripts, the minimum energy point sensitivity of an FPGA to its programming was investigated. The FPGA was programmed with 21 different ISCAS ‘85 benchmarks, and a minimum energy supply voltage was estimated for each with a nominal input activity factor. The benchmarks had minimum energy points ranging from 0.42-0.54 V, or slightly above threshold. The minimum energy point was not a strong function of benchmark circuit size or input count, suggesting that the topology of the benchmark circuit influenced the FPGA minimum energy point.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/73
Robust and Systemwide Fault Location in Large-Scale Power Networks via Optimal Deployment of Synchronized Measurements

This dissertation addresses a novel method for fault location in power systems, while providing a new vision for the deployment of wide-area measurement systems and the application of robust estimation techniques in an effort to achieve system wide, cost-effective, and resilient fault-location capability in large-scale power systems.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/83

Engineering Highly Organized and Aligned Single Walled Carbon Nanotube Networks for Electronic Device Applications: Interconnects, Chemical Sensor, and Optoelectronics

This dissertation presents work focused on single walled carbon nanotubes (SWNTs). They offer the potential to serve as building blocks for future electronic devices such as field effect transistors (FETs), electromechanical devices, and various sensors. In order to realize these applications, it is crucial to develop a simple, scalable, and reliable nanomanufacturing process that controllably places aligned SWNTs in desired locations, orientations, and dimensions. Also electronic properties (semiconducting/metallic) of SWNTs and their organized networks must be controlled for the desired performance of devices and systems. These fundamental challenges are significantly limiting the use of SWNTs for future electronic device applications. Here, we demonstrate a strategy to fabricate highly controlled micro/nanoscale SWNT network structures and present the related assembly mechanism to engineer the SWNT network topology and its electrical transport properties. A method designed to evaluate the electrical reliability of such nano- and microscale SWNT networks is also presented.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/71
SELECTED PhD THESES

YUEQIAN LI
PhD, 2013 Electrical and Computer Engineering
Advisor, Masoud Salehi | Digital Communications and Networking

Code Design for SISO and MIMO Block-Fading Channels

This dissertation focuses on the diversity order and the coding gain. At high signal to noise ratios, the diversity order determines the slope of the codeword error probability curve, while the coding gain shifts the curve horizontally. Therefore, the diversity order is the determining factor in code design. The optimal diversity order achievable by coding scheme is upper bounded by the Singleton bound, which establishes the fundamental tradeoff between coding rate and diversity order. The family of codes which can achieve the optimal diversity order are referred as blockwise maximum distance separable (MDS) codes. The general approach for code construction on block-fading channels is to design MDS codes with large coding gain.

See full dissertation at iris.lib.neu.edu/comp_eng_diss/24

BINLONG LI
PhD, 2014 Electrical and Computer Engineering
Advisor, Octavia Camps | Systems and Communications

Dynamics-Based Invariants for Video Analytics

In this thesis exploiting dynamics-based invariants as an information encapsulating paradigm is explored. The approach is inspired by the fundamental fact that visual data comes in streams: videos are temporal sequences of frames, images are ordered sequences of rows of pixels and contours are chained sequences of edges. We make this ordering explicit by treating the data streams as outputs of dynamic systems that have associated quantities which are invariant to affine transformations, initial conditions, and viewpoint changes. These invariants provide compact representations of the dynamic information in the data, yet they can be efficiently extracted while avoiding identifying the underlying models. The power of the proposed framework is illustrated by applying it to several problems in dynamic scene understanding: activity recognition, shape representation, and multi-camera tracking.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/77
Robust and Systemwide Fault Location in Large-Scale Power Networks via Optimal Deployment of Synchronized Measurements

This dissertation focuses on the study and development on a number of planar antennas that have been manufactured with low-cost printed circuit board (PCB) technology. It also presents a brief methodology for the design process in order to frame the context and boundary conditions of the antenna problem, and to satisfy the regulatory specifications such as FCC compliance.

The antenna dispersion problem is also summarized and clarified in detail with theoretical analysis, simulation models and experimental characterization to aid the UWB antenna development for impulsive GPR system.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/92

Design, Fabrication and Assembly of Multiple Biomarker in-Vivo Biosensor

In this thesis, a design for highly sensitive micron scale in-vivo sensor platform device for simultaneous detection of multiple disease biomarkers is presented. The biosensor microchip is 0.25mm in diameter, based on SU-8 polymeric platform fabricated incorporating four active isolated areas as small as 70µm x 70µm. Conventional micro and nanofabrication processes were used for fabrication of these biocompatible microchips to enable large-scale production of such biosensors at lower manufacturing cost.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/70
Classification of Malware Persistence Mechanisms Using Low-Artifact Disk Instrumentation

This dissertation focuses on DIONE, a flexible rule-based disk I/O monitoring and analysis infrastructure. DIONE interposes between a system-under-analysis and its hard disk, intercepting disk accesses and reconstructing high-level file system and registry changes as they occur. We evaluate the accuracy and performance of DIONE, and show that it can achieve 100% accuracy in reconstructing file system operations, with a performance penalty less than 2% in many cases.

See full dissertation at iris.lib.neu.edu/comp_eng_diss/28

Architectural Support for Software Security

This dissertation investigates a series of hardware/software co-design techniques that advance the state-of-the-art in low-overhead security architectural design: leveraging speculative architectures for run-time program control-flow validation; adding compile-support to reduce the overhead of dynamic information flow tracking (DIFT); micro-architectural support to ensure consistency between data processing and metadata processing in multi-core DIFT; integrating architectural support, compiler, and operating system for thread isolation to avoid memory corruption and information disclosing in multi-threaded applications.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/78
Using Second Harmonic Generation Microscopy to Study the Three Dimensional Structure of Collagen and its Degradation Mechanism

This dissertation investigates a new model, intended to be used together with second harmonic generation (SHG) microscopy, to thoroughly investigate collagen-based tissues. In this dissertation the use of the SHG model reveals information in real time from enzymatic biochemical processes. Also a novel method used to measure quantitatively the direction of the fibers within the tissue, from SHG images is presented. Using this method, the ability to reconstruct an angular map of the orientation of collagen fibers from multiple sections across the entire area of a human cornea. The structure we obtained demonstrates the criss-crossing structure of the human cornea, previously suggested in the literature. In addition is reported work on a unique step-wise three-photon fluorescence excitation discovered in melanin.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/69

Plasmonic Metasurfaces With Tailored Linear and Nonlinear Building Blocks

This dissertation investigates applications for plasmonic metasurfaces. In the first chapter there is brief review of metamaterials and plasmonic metasurfaces. In the second chapter we present the concept of transmitarray concentrator implemented in optics. Planar concentric loop antennas are used as the elements for a 21 × 21 array to concentrate the incident plane wave at a desired distance... Third chapter investigates the concept of multi-layered tripod frequency selective surfaces in infrared. A full wave analysis based on finite difference time domain technique is applied to comprehensively characterize the structure and obtain the performance for both normal and oblique waves (for TE and TM polarizations). The layered tripod structure can be envisioned as a mean to realize cascaded LC circuit configurations achieving desired filter performance. A wide stop-band IR nano-filter which is almost independent of incident angle and polarization is demonstrated. Chapter 4 is concentrated on a functional metasurface building block which is multi-material loops. Plasmonic nano loops has been shown to be a capable candidate for creating building blocks of metasurfaces to manipulate the light in desired ways... The effects of coupling between the plasmonic loops on the bistability curve are studied and the trade-off between the required intensity for switching and the extinction ratio of the two states of the switch is explored systematically. The dissertation is finished by a number of recommendations for the future directions for this research.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/98
Quantification of Chemical Gaseous Plumes on Hyperspectral Imagery

This dissertation focuses on evaluating and investigating the advantages and limitations of a number of quantification algorithms that span a variety of such assumptions. With these in-depth insights we gain, a new quantification algorithm is proposed for single gas quantification which is superior to all state-of-the-art algorithms in almost every aspect including applicability, accuracy, and efficiency.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/84

SIDI NIU
PhD, 2014 Electrical and Computer Engineering
Advisors, Vinay Ingle, Dimitris Manolakis | Chemical Plume Quantification

Magnetoelectric Hexaferrite Thin Films Growth for Next Generation Device Applications

This dissertation focuses on alternating target laser ablation deposition (ATLAD) is used for in-situ deposition of M-type and Y-type hexaferrites. There have been considerable reports on epitaxial growth of M-type hexaferrite but not on Y-types, since it is very difficult and challenging to produce them. One of the main problems is the need of substrate temperatures in excess of 1150°C which requires additional expensive high temperature equipment. Our developed process can be done at lower temperatures by PLD equipment and can form unique crystal structures which cannot be achieved by other techniques.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/88

MARJAN MOHEBBI
PhD, 2014 Electrical and Computer Engineering
Advisor, Carmine Vittoria | Electromagnetics and Photonics
RSVP keyboard: An EEG Based BCI Typing System with Context Information Fusion

This dissertation focuses on the design of an EEG based letter-by-letter BCI typing system, RSVP KeyboardTM, which utilizes rapid serial visual presentation (RSVP). Differently from the commonly used visual BCI presentation schemes, RSVP aims to be accessible to the population with limited eye gaze control by presenting sequences of symbols on a screen over time at a fixed focal area and in rapid succession. As a response to the infrequent novel target stimulus (oddball paradigm), brain generates P300, an event related potential which is a positive deflection in the scalp voltage mainly in the centro-parietal areas with an average latency just over 300 ms. This natural novelty response allows us to design interfaces by detecting the intent using EEG.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/85

HUIYAN PAN
PhD, 2014 Electrical and Computer Engineering
Advisors, Nicol McGruer, George G. Adams | Nanotechnology Fabrication
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Determination of Shear Stress Between Single-Walled Carbon Nanotubes and Substrates Using NEMS Devices

This dissertation focuses on a novel and easily controllable technique based on a NEMS device, a ZYVEX nanomanipulator, and a scanning electron microscope (SEM) along with a theoretical model is developed to study the shear stress between SWNTs and substrates. A small SWNT bundle is assembled across two cantilevers by dielectrophoresis, with one cantilever much more flexible than the other. The flexible cantilever is then pushed away from the stiffer cantilever in order to produce slip between the SWNTs and the cantilever surface. When the cantilever returns to its initial position, axial slack is observed in the SWNTs. A theoretical model has been developed to calculate the shear stress between the SWNT bundle and the cantilever surface, based on the measured axial slack. This new technique overcomes some disadvantages of the AFM-based methods and gives the first determination of the shear stress between dielectrophoretically assembled SWNTs and substrates.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/79
Efficient Low-Density Parity-Check Codes for Cooperative Communication

This dissertation focuses on addressing code design problem for cooperative communication over different channel models with emphasis on low complexity designs and structured codes that are attractive for practical implementation. Starting with the problem of designing efficient codes for the relay node in Gaussian relay channels. For a class of capacity approaching codes for this channel model, called bilayer lengthened LDPC (BL-LDPC) codes, we calculate a measure of decoding complexity as a function of the number of decoding iterations and propose a technique to design complexity-optimized BL-LDPC codes by minimizing the complexity measure of these codes...Next, we study the achievable rates for the decode-and-forward (DF) relaying strategy for the Rayleigh fading relay channel where the links have independent normalized Rayleigh fading coefficients and the channel side information is perfectly known at the corresponding receivers but not at the transmitters...Finally, we introduce rate-compatible protograph-based root LDPC (RCPB-R-LDPC) codes for cooperative communication over block fading channels and propose two methods to construct these codes.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/99
Instrumentation and Methods for Time-Resolved Diffuse Fluorescence Imaging

This dissertation focuses on the development of a novel instrument that allows simultaneous collection of spectral and temporal data sets. Chemometric analysis of joint temporal and spectral data sets allowed us to separate, quantify, and image up to five fluorochromes concurrently with 93% accuracy. This significantly outperformed more conventional methods, where only spectral or temporal information was used independently.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/90

Pavement Assessment Using Dynamic Pressure Sensor System

This dissertation presents a non-destructive and non-contact acoustic sensing approach for fast inspection of road and bridge deck conditions with vehicles running at normal speed without stopping traffic. This approach, which uses an instantaneous and real-time dynamic tire pressure sensor (DTPS), possesses the capability to inspect pavement conditions from a moving vehicle. In this dissertation, verifications of the DTPS concept of sensing pressure inside the tire have been carried out. By measuring dynamic pressure changes (the pressure variation rather than static pressure) inside the tire, useful signals from tire/road interaction can be amplified and isolated from environmental noise. Comparisons between the DTPS, ground-mounted accelerometer, and directional microphone are made. In addition, the DTPS can also measure dynamic response of the tire-road interaction and reduce the cost of currently used road profile measuring systems with vehicle body-mounted profilers and axle-mounted accelerometers. A prototypes of the real-time DTPS with both wired and wireless systems together with an alternative rotating energy harvester design have been developed and demonstrated on a testing van at speeds from 5 to 80 mph.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/68
Compact, Lightweight and Power Efficient Voltage Tunable Multiferroic Rf/Microwave Components

In this dissertation, a method of measuring the complex permeability using a CPW and a network analyzer is presented. The permeability spectra under varied magnetic field is discussed. The measured permeability spectra show a negative region which prohibits the wave propagation. Therefore, the energy of the RF source dissipated in the material, and the attenuation depends on the magnitude of the negative value. In addition, a resonator was fabricated on the ferrite substrate. The device showed an absorption band gap under a magnetic field from 200 Oe to 600 Oe, which was in good agreement with the measured permeability spectra.

See full dissertation at iris.lib.neu.edu/elec_eng_diss/75

Signal Detection and Digital Modulation Classification-Based Spectrum Sensing for Cognitive Radio

In this dissertation, we describe a spectrum sensing architecture that characterizes the carrier frequency and bandwidth of all narrowband signals present in the spectrum, along with the modulation type of those signals that are located within a licensed portion of the spectrum. From this radio identification, a cognitive radio can better determine an opportunity to access the spectrum while avoiding primary users.

See full dissertation at iris.lib.neu.edu/comp_eng_diss/26

XI YANG
PhD, 2013 Electrical and Computer Engineering
Advisor, Nian-Xiang Sun | Electromagnetics and Photonics

CURTIS WATSON
PhD, 2014 Electrical and Computer Engineering
Advisor, Waleed Meleis | Digital Communications and Networking
**Robust Design Techniques for Emerging Technologies of Computing**

This dissertation focuses on the reliability issues in crossbar nano-architectures, as an example of alternative implementation, as well as reversible logic, as an example of alternative computational technology. Two approaches are studied, namely logic mapping and architectural techniques, to incorporate variation and defect tolerance in crossbar nano-architectures.

See full dissertation at iris.lib.neu.edu/comp_eng_diss/21

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**Micro-Architectural Support for Improving Synchronization and Efficiency of SIMD Execution on GPUs**

This dissertation presents a new approach to enhance the efficiency and scalability of GPU synchronization. The proposed scheme can enable applications that work on shared data to effectively communicate at finer levels of granularity. To achieve this ambitious goal, a new synchronization approach called Hierarchical Queuing Locks (HQL) is proposed. HQL is a novel hardware-based synchronization mechanism which provides efficient use of resources through execution blocking and hierarchical queuing.

See full dissertation at iris.lib.neu.edu/comp_eng_diss/29

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**SELECTED PhD THESIS**

**AYSE YILMAZER**

PhD, 2014 Electrical and Computer Engineering
Advisor, David Kaeli | Computer Engineering
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**MASOUD ZAMANI**

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The Interdisciplinary Science and Engineering Complex (ISEC)
at Northeastern is a 220,000 square foot complex scheduled
to open in 2016. This facility will help grow Northeastern’s research by providing state of the art infrastructure, and increasing the capacity to attract top students, faculty and academic leaders. The ISEC will connect the main 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 in ASCE’s Civil Engineering Magazine (bit.ly/NU_ASCE). Learn more at northeastern.edu/isec.