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SYSTEMSOLUTIONS

THE INSTITUTE FOR SYSTEMS RESEARCH
A. JAMES CLARK SCHOOL *of* ENGINEERING

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A NEWSLETTER FOR COLLEAGUES, RESEARCH PARTNERS, ALUMNI AND FRIENDS OF THE INSTITUTE FOR SYSTEMS RESEARCH, A. JAMES CLARK SCHOOL OF ENGINEERING, UNIVERSITY OF MARYLAND.

IN THIS ISSUE:

ISR alumni entrepreneurs share experiences

Rebecca Copeland

Alumni speakers Carol Teolis, Shravan Goli, Vikram Manikonda and Raj Mittu.

A packed house of more than 100 ISR alumni, industry and government professionals, faculty and students shared insights about entrepreneurship at "Entrepreneurs," the first ISR Alumni Symposium.

The event was held on April 19 at the Inn and Conference Center on campus. Four distinguished ISR alumni spoke on why and how they created and grew their companies, lessons learned from both successes and failures, and the role systems engineering plays in their operations. The alumni speakers represented a diversity of views and topics related to entrepreneurship; their experiences starting companies in different sectors of the economy both instructed and challenged the audience—especially current ISR students thinking of becoming entrepreneurs in the future.

Alumni speakers included: **Shravan Goli**, president of Dice.com; **Vikram Manikonda**, president of Intelligent Automation, Inc.; **Raj Mittu**, CEO and co-founder of ESCgov and **Carole Teolis**, CTO and chair of TRX Systems, Inc.

ISR faculty also shared their experiences in starting companies, while university officials talked about the wide range of resources available for students and faculty interested in entrepreneurship. Faculty speakers included: Professor **Carol Espy-Wilson** (ECE/ISR), founder of OmniSpeech, LLC; Professor **Neil Goldsman** (ECE and ISR affiliate), co-founder of FlexEl, LLC; and Professor **John Baras** (ECE/ISR), co-founder of AIMS, Inc.

University speakers included **Peter Sandborn**, Director, Maryland Technology Enterprise Institute; **Dean Chang**, Associate Vice President for Innovation and Entrepreneurship; and **Reuben Mezrich**, Professor, University of Maryland School of Medicine (Maryland Innovation Initiative).

The alumni speakers and audience members took time to interact with each other, discuss entrepreneurship, and recruit students for summer and permanent positions. Alumni also reconnected with their former advisors and encouraged current ISR students.

The symposium is one of many ways ISR is reaching out to its more than 1,000 alumni in the U.S. and around the world, building new opportunities to collaborate on systems research.

REZA GHODSSI

Building valuable relationships

This year at ISR we have concentrated on building relationships. I'd like to bring you up to date on how we've reached out to alumni and new friends in industry and government, and also how we're engaging the world through an extensive video project. This year has been very fruitful for everyone!

More opportunities for our alumni. ISR's more than 1,000 alumni professionals have gone on to interesting and influential careers. We know our alumni benefit from staying in touch with ISR just as we love to hear about their successes and research efforts. In this past year we started two major initiatives to reconnect with our alumni, pursue research projects of mutual benefit, and aid in recruiting and mentoring current ISR students.

First, late last summer we identified key alumni working in and around Silicon Valley and traveled to their companies to talk about future collaborations. During this trip we also sponsored a San Francisco-area reception where ISR alumni could meet up with each other, reminisce and reconnect with each other and ISR. New ideas and possibilities came out of this trip that will be beneficial for everyone. We're looking to do it again—maybe we'll come to your neck of the woods soon.

Second, this April we held our first Alumni Symposium here on campus, with the theme "entrepreneurs." Four alumni spoke about their experiences starting companies to a large audience of their fellow alums, current students and faculty. It was a great time for alumni to interact with and recruit current students, and for students to learn from those who recently were in their shoes. Look for the symposium to continue in the future; you can learn more about it in our front cover story.

A great start for our Associate Partners Program. I am proud to announce that ISR has enrolled its first 10 Associate Partners—the "Charter 10" as we are calling them. This program grants its members a level of preferred access to ISR faculty and students for research and recruiting opportunities. It also provides a natural path to specific collaboration opportunities in ISR. To find out who our "Charter 10" partners are, and learn more about the program, see our story on page 7.

ISR videos are everywhere. On the back cover of this newsletter you will find URLs and QR codes to help you explore the more than 400 videos ISR has made available on our main website, YouTube and Vimeo. We are very proud of the faculty videos we produced this spring and summer. Nearly all our faculty are starring in their own short videos, where they explain their research interests and programs. Want to know what ISR research is all about? These faculty videos will give you a good taste of what we do here.

In addition, you can see more than 100 unique videos of Maryland Robotics Center robots in action, including the famous Robo Raven video that gathered more than 200,000 views as of August 2013. We also have a number of years' worth of full-length seminar videos, given by ISR faculty and guest lecturers on just about any systems research-related topic you can think of! I invite you to check out this great assortment of videos.

Looking ahead, this fall we will begin work on ISR's next five-year strategic plan. Our Strategic Advisory Council meets in September and will provide us with valuable input. We'll continue in the fall and winter with sub-group meetings among our faculty, and put the finishing touches on the plan at a faculty retreat in spring 2014.

As always, I encourage you to contact me any time with your questions and valuable feedback on our activities and opportunities for collaboration.

Best regards,

Reza

Maryland Robotics Day is Friday, Oct. 25
Learn more at robotics.umd.edu

Krishnaprasad part of new 'information engines' MURI

Professor **P. S. Krishnaprasad** (ECE/ISR) and Professor **Christopher Jarzynski** (Chem-Biochem/IPST) are part of a new Army Research Office Multi-University Research Initiative (MURI) grant, "Information Engines: Nanoscale Control, Computing and Communication out of Equilibrium." The five-year award was recently announced by the Department of Defense.

Drawing on four distinct perspectives—computational mechanics, nonequilibrium thermodynamics, control theory, and nanoscale experiments—this project will investigate fundamental principles and algorithms for the creation of synthetic nanosystems that are able to gather, store, and manipulate information while immersed in a thermally noisy environment. Such capabilities appear to be a basis for achieving directed nanoscale flows of matter and energy. The team's research is also expected to yield insights into bio-molecular complexes with similar functionality.

The multi-university research team consists of James Crutchfield, University of California, Davis (lead institution); Gavin Crooks and Michael DeWeese, University of California, Berkeley; Henry Hess, Columbia University; and Jarzynski and Krishnaprasad from the University of Maryland.

The MURI program supports research by teams of investigators that intersect traditional science and engineering disciplines to accelerate research progress. Most of the program's efforts involve researchers from multiple academic institutions and academic departments. The highly competitive program complements other Department of Defense basic research efforts that support traditional, single-investigator university research grants. MURIs support multidisciplinary teams with larger and longer awards, in carefully chosen research topics identified for their potential for significant and sustained progress.

Pioneering 'Robo Raven' is major breakthrough for micro air vehicles

In this age of advanced technology, how hard could it be to develop a robotic bird that flies by flapping its wings? Despite the apparent simplicity of the idea, it's very hard—if you want the bird to actually fly.

And how hard could it be to make a robot bird whose wings can flap independently of each other? So hard that it's a breakthrough that's been out of reach for engineers—until now.

Professors **S.K. Gupta** (ME/ISR) and **Hugh Bruck** (ME) and their students have developed and demonstrated a new robotic bird, "Robo Raven," whose wings flap completely independently of each other, and also can be programmed to perform any desired motion, enabling the bird to perform acrobatic maneuvers. This is the first time a robotic bird with these capabilities has been built and successfully flown.

What makes building robotic birds so difficult? Not only is there a long trial and error process, but every error leads to a crash, often one that is fatal to the robot. This makes design iterations painfully slow.

Gupta has been working on flapping-wing robotic birds for the better part of a decade. He, Bruck and their graduate students first successfully demonstrated a flapping-wing bird in 2007. This bird used one motor to flap both wings together in simple motions. By 2010 the design had evolved over four successive models. The final bird in the series was able to carry a tiny video camera, could be launched from a ground robot, and could fly in winds up to 10 mph—important breakthroughs for robotic micro air vehicles that one day could be used for reconnaissance and surveillance. It even fooled local hawks, which attacked the robot in mid-flight on more than one occasion.

Rebecca Copeland

Robo Raven team (L-R): Ph.D. student Ariel Perez-Rosado, Professor Hugh Bruck (ME), Ph.D. student John Gerdes, Professor S.K. Gupta (ME/ISR), Ph.D. student Luke Roberts.

But the limitation of simultaneous wing flapping restricted how well the robotic bird could fly. So Gupta decided to tackle the much thornier problem of creating a more versatile bird with wings that operated independently, just like real birds. An unsuccessful attempt in 2008 led to the project being shelved for a while. Then, in 2012, Gupta worked with Bruck and the graduate students to try again.

"Our new robot, Robo Raven, is based on a fundamentally new design concept," Gupta says. "It uses two programmable motors that can be synchronized electronically to coordinate motion between the wings."

The challenge was that the two actuators required a bigger battery and an onboard micro controller, which initially made Robo Raven too heavy to fly.

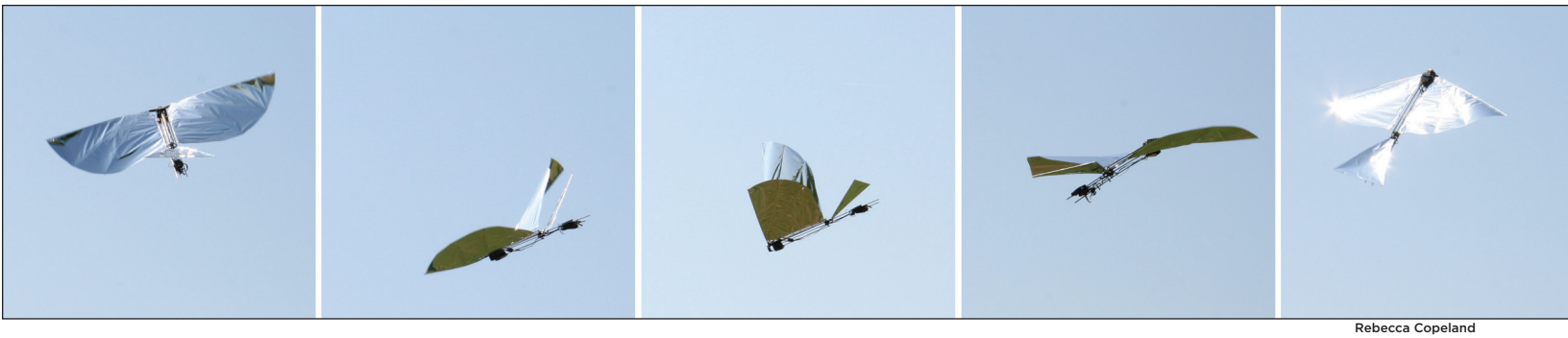
"How did we get Robo Raven to 'diet' and lose weight?" Gupta asks. "We used advanced manufacturing processes such as 3-D printing and laser cutting to create lightweight polymer parts."

But smarter manufacturing and lighter parts were only part of the solution.

So the team did three more things. They programmed motion profiles that ensured wings maintained optimal velocity while flapping to achieve the right balance between lift and thrust. They developed a way to measure aerodynamic forces generated during the flapping cycle, enabling them to evaluate a range of wing designs and quickly select the best one. Finally, the team performed system-level optimization to make sure all components worked well together and provided peak performance as an integrated system.

"We can now program any desired motion patterns for the wings," Gupta says. "This allows us to try new in-flight aerobatics—like diving and rolling—that would have not been possible before, and brings us a big step closer to faithfully reproducing the way real birds fly."

Watch the **Robo Raven YouTube video**, viewed more than 200,000 times: youtu.be/mjOWpwbnmTw.



Rebecca Copeland

Analysis of many species required to better understand the brain

Comparative study in *Science* suggests the need to revise spatial navigation models

To best understand how humans and other mammals form memories and navigate their surroundings, neuroscientists must pay attention to a broad range of animals rather than focus on a single model species, say Professor **Cynthia Moss** (Psychology/ISR) and Assistant Research Scientist **Katrina MacLeod** (Biology). Their comparative study of bats and rats in the April 19, 2013 issue of *Science* reports differences between the species that suggest the need to revise spatial navigation models.

Moss and MacLeod worked with two Boston University colleagues to report significant differences between rats' and bats' brain rhythms when certain cells were active in a part of the brain used in memory and navigation.

These cells behaved as expected in rats, which mostly move along surfaces. But in bats, which fly, the continuous brain rhythm did not appear, says Moss.

MacLeod says the finding suggests that even though mammals share a common neural representation of space in a part of the brain linked to spatial information and memory, they may have different cellular mechanisms to create or interpret the maps.

"To understand brains, including ours, we must study neural activity in a variety of animals," MacLeod says. "Common features across multiple species tell us 'Aha, this is important,' but differences can occur because of variances in the animals' ecology, behavior, or evolutionary history."

The researchers looked at a brain region containing specialized "grid cells," so named because they form a hexagonal grid of activity related to the animal's location as it navigates space. This region, the medial entorhinal cortex, sits next to the hippocampus, the place that, in humans, forms memories of events. The medial entorhinal cortex acts as a hub of neural networks for memory and navigation.

Grid cells were first noticed in rats navigating their environment, but recent work by Nachum Ulanovsky (Moss's former postdoctoral researcher) and his team at the Weizmann Institute in Rehovot, Israel, has shown these cells exist in bats as well.

In rats, grid cells fire in a pattern called a theta wave when the animals spatially navigate. Theta waves are fairly low-frequency electrical oscillations that also have been observed at the cellular level in the medial entorhinal cortex. The prominence of theta waves in rats suggested they were important. Neuroscientists, trying to understand the relationship between theta waves and grid cells, have developed models of the brain based on the assumption that theta waves are key to spatial navigation in mammals.

Jessica Nelson

A big brown bat, *Eptesicus fuscus,* flying in the Auditory Neuroethology Laboratory.

However, Moss said, "recordings from the brains of bats navigating in space contain a surprise, because the expected theta rhythms aren't continuously present as they are in the rodent."

The new *Science* study doubles down on the lack of theta in bats by reporting that theta rhythms also are not present at the cellular level. "The bat neurons don't 'ring' the way the rat neurons do," says MacLeod. "This raises a lots of questions as to whether theta rhythms are actually doing what the spatial navigation theory proposes in rats or even humans."

Read the *Science* article: *ter.ps/2w0*

ISR 2013 awards recipients

[Top left] Associate Professor **Mark Austin** (CEE/ISR), a prominent leader in systems engineering and the MSSE program, received the ISR Outstanding Faculty Award.

[Top right] M.E. Ph.D. student **Sagar Chowdhury** received the George Harhalakis Outstanding Systems Engineering Graduate Student Award. His research focuses on optical tweezers.

[Bottom left] **Mehdi Dadfarnia** received the Outstanding Systems Engineering Undergraduate Student Award. Now in the MSSE program, he also works at NIST, supporting the National Ambulance Specification project.

[Bottom right] External Relations Director **Jeff Coriale** received the Susan Frazier Outstanding Systems Engineering Staff Award. He developed and directs the Associate Partners Program and led the recent Entrepreneurs Alumni Symposium.

Rebecca Copeland

Brain's 'cocktail party effect' helps us focus in noisy environments

Paper in the journal *Neuron* details mechanisms used in this skill

"Some enchanted evening," Oscar Hammerstein wrote, "you will meet a stranger, across a crowded room." Whether they are falling in love or cutting a business deal, humans have an uncanny ability to zero in on and pay attention to just one talker in a noisy environment. We may remain aware of other sounds, but we have no problem tracking and completely understanding the speaker on whom we're focusing.

Scientists call this remarkable skill the "cocktail party effect." They have known for some time that an ability to selectively pay attention must play a role in how it works. But understanding the precise mechanisms the brain's neurons use to do this has been an elusive goal. In a study published in the journal *Neuron*, Associate Professor **Jonathan Simon** (Biology/ECE/ISR), alum **Nai Ding** (ECE Ph.D. 2012), lead author **Elana M. Zion Golumbic** of Columbia University and colleagues from universities and medical centers in New York are unlocking the mechanics, using data recorded directly from the surface of the brain.

In a crowded place, sounds from different talkers enter our ears mixed together, so our brains first must separate them using cues like when and from where the sounds are coming. But we also have the ability to then track a particular voice, which comes to dominate our attention and later, our memory. One major theory hypothesizes we can do this because our brains are able to lock onto patterns we expect to hear in speech at designated times, such as syllables and phrases in sentences. The theory predicts that in a situation with competing sounds, when we train our focus exclusively on one person, their speech will dominate our brain's information processing.

Of course, inside our brains, this focusing and processing takes the form of electrical signals racing around a complicated network of neurons in the auditory cortex.

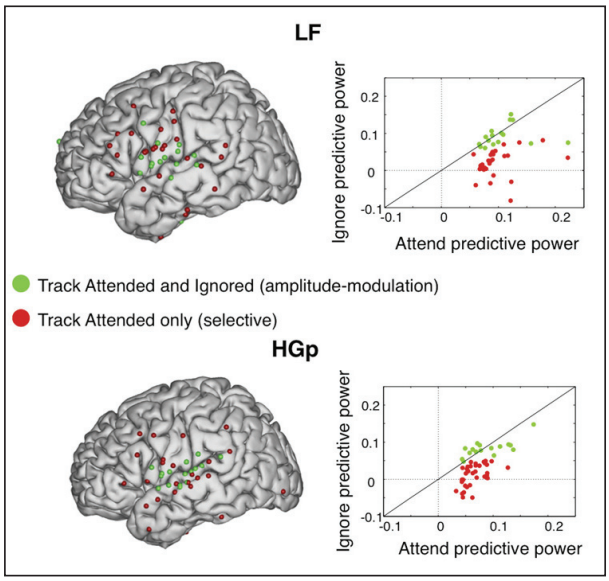
To begin to unlock how the neurons figure things out, the researchers used electrocorticography (ECoG) brain-signal recording devices. These devices, implanted directly in the cortex of the brain, are used in epilepsy surgery. They consist of about 120 electrodes arranged in an array over the brain's lateral cortex.

With the permission of the surgery patients, researchers gave them a cocktail party-like comprehension task in which they watched a brief, 9-12 second movie of two simultaneous talkers, side by side. A cue in the movie indicated to which talker the person should try to listen. The ECoG recorded what was happening in the patients' brains as they focused on what one of the talkers was saying.

The researchers learned that low-frequency "phase entrainment" signals and high-frequency "power modulations" worked together in the brain to dynamically track the chosen talker. In and near low-level auditory cortices, attention enhances the tracking of speech we're paying attention to, while ignored speech is still heard. But in higher-order regions of the cortex, we become more "selective"—there is no detectable tracking of ignored speech. This selectivity seems to sharpen as a speaker's sentence unfolds.

"This new study reaffirms what we've already seen using magnetoencephalography (MEG)," said Simon, whose lab uses MEG, a common non-invasive neuroimaging method, to record from ordinary individuals instead of neurosurgery patients. "The methods of neural data analysis developed in my lab for analyzing MEG results proved to be fantastic for analyzing these new recordings taken directly from the brain."

"We're pleased to see both the low frequency and high frequency neural responses working together," said Simon, "since our earlier MEG results were only able to detect the low frequency components."



Attentional Modulation of Speech Tracking. Sites where significant speech tracking was found for both the attended and ignored talkers ("amplitude-modulated"; green) and sites where speech tracking was significant only for the attended talker ("selective"; red). Right: Scatter plots of LF and HGp TRF predictive power for attended versus ignored talkers across all sites with significant speech tracking, color coded according to whether the predictive power was significant for both talkers (green) or only for the attended (red).

Simon's own MEG research currently is investigating what happens when the brain is no longer able to pick out a talker from a noisy background due to the effects of aging or damaged hearing.

Simon also notes that the new study's results are in good agreement with the auditory theories of Professor **Shihab Shamma** (ECE/ISR); his former student **Mounya Elhilali** (ECE Ph.D. 2004, now on faculty at Johns Hopkins University); and their colleagues, who are part of a wide-ranging, collaborative family of neuroscience researchers originating at Maryland.

The cocktail party effect raises broader questions about how people perceptually organize their noisy worlds and track speech in a realistic environment. This research brings us a large step closer to understanding this enormously important human activity.

Read the *Neuron* paper: *ter.ps/2w1*

MSSE degree provides sophisticated training

ISR's M.S. in Systems Engineering (MSSE) degree gives students systems perspective and the ability to apply powerful model-based design and analysis methodologies to complex systems and services. It provides them with exposure to essential systems engineering principles, software tools for modeling and optimization, decision and risk analysis, stochastic analysis, human factors engineering and analysis of financial and management issues associated with complex engineering systems and services.

Students are trained in systems engineering methodologies and mathematical, computational and software tools for developing engineering applications and problem solving. This includes models and simulations of complex engineering systems, algorithms and processes in system architecture development, systems design with multi-objective trade-off analysis and optimization, case studies and application to real-world industry and government problems.

Students can specialize in robotics, cybersecurity, computer and software, control, manufacturing, transportation or process systems, communications and networking, signal processing, operations research—or other areas with the agreement of their advisor.

The MSSE program's website features detailed information on the degree's features, requirements, specialization areas, and application requirements. There also are videos from students, faculty and alumni that explain the degree's many advantages.

Learn more at *www.isr.umd.edu/msse-degree*.

New graduate programs in robotics

Beginning in Fall 2013 the Institute for Systems Research and the Maryland Robotics Center will be offering two new robotics-based educational programs: the Masters of Engineering in Robotics degree and the Graduate Certificate in Engineering program in robotics.

Admission to both programs requires a bachelor's degree with a GPA of 3.0 or better in engineering; computer, electrical, from an accredited institution. In addition, mathematics courses in Calculus I, II, III, and Differential Equations are required.

The Graduate Certificate in Robotics consists of four core courses: robot modeling, robotic systems control, autonomous robot planning and autonomous robot perception. The certificate can be pursued on its own or as a gateway into the Master of Engineering program.

Master of Engineering students take the four core courses, and in consultation with their academic advisor, also choose six technical electives from computer engineering, computer science, mechanical engineering, and systems engineering to build a well-structured academic program.

For more information about these new programs, visit *ter.ps/2vq.*

Trento graduate student exchanges

Bi-directional graduate student exchanges on mutual research projects are one of the components of a broad 2011 partnership facilitated by ISR among the University System of Maryland, the State of Maryland, the Autonomous Province of Trento, the University of Trento, the Consiglio Nazionale delle Ricerche and Fondazione Bruno Kessler (FBK).

Andrew Berkovich, a Ph.D. student advised by Associate Professor **Pamela Abshire** (ECE/ISR), spent part of the summer working on the EnerVis project with **Massimo Gotardi** at FBK.

A graduate student of Professor **Raymond Phaneuf** (MSE) will travel to Trento for three months in Fall 2013 to work on a new joint project with researchers at FBK that will develop atomic layer deposited metal oxide thin films that could be used as diffusion barriers to slow the tarnishing rate for silver and bronze art and cultural heritage objects.

In addition, the University of Maryland and University of Trento (UT) have selected additional students to exchange for another project during this same time period.

The first exchange, which started in August 2012 and is ongoing, is part of "Control of Living Cells through Communication with Artificial Cells," a collaboration between Professor **William Bentley's** (BioE) Biomolecular and Metabolic Engineering Laboratories and Professor **Sheref Mansy's** research group at UT's Centre for Integrative Biology.

Last August and this February, Mansy's UT graduate student **Roberta Lentini** came to Maryland to work in Bentley's research group. She will return to Maryland for another three months this fall. Bentley's Bioengineering Ph.D. student **Jessica Terrell** spent three months working in Mansy's group this spring.

Terrell built artificial cells composed of a lipid bilayer and the cellular machinery required to transcribe and translate genes into functional proteins. The synthetic cells interact with each other and with bacteria through quorum sensing, a form of intercellular communication. Bentley's group has been exploring how manipulating this chemical language could keep bacteria from engaging in pathogenic activity, or encourage them to take a positive action.

"This groundbreaking project changes the way we can program living cells," says Bentley. "Synthetic biology is largely stuck on the single viewpoint that to modify cellular behavior, the genetic content of the cell must be changed. Our new approach transiently and safely takes over natural cells through chemical communication with artificial cells. The artificial cells will sense molecules that are secreted from natural ones, then respond by sending back chemical signals that direct natural cells' function."

The technology has far-reaching implications. "Cell-like systems capable of this sort of communication could be built to block bacterial transitions to virulent states and to guide stem cell differentiation," Bentley says. "This could lead to the treatment of infections without antibiotics and improved tissue regeneration for people with serious injuries."

—Story by Faye Levine and Rebecca Copeland

‘Charter 10’ associate partners announced

The first 10 industry and government members have joined ISR’s Associate Partners Program (APP). The APP grants members a level of preferred access to ISR faculty and students, and priority for research and recruiting opportunities. ISR seeks out and guides its associate partners toward mutually beneficial opportunities for research collaborations, provides them with up-to-date information on the institute’s activities, and actively facilitates direct relationships among associate partners, faculty and students.

Partners receive priority access to the services of the institute’s external relations director, who provides one-stop access to ISR’s research community.

Partners also receive priority consideration for teaming in research opportunities; have the opportunity to participate in short-term, bi-directional researcher exchanges; get priority and timely access to students for internships and permanent hiring; and participate in networking opportunities with other associate partners.

APP benefits also provide a natural path to specific collaborations in ISR. These are made possible through additional partnership opportunities.

The ‘Charter 10’

Intelligent Automation, Inc.

A diverse R&D think tank whose interests span range from distributed intelligent systems, sensors, signal processing, robotics, manufacturing, forensics and transportation to education, training and information technologies. IAI’s work focuses on developing and applying artificial intelligence-based techniques.

TASC

TASC provides enterprise systems engineering, integration and analytical decision-support services to the intelligence community, Department of Defense and federal government civilian agencies. Expertise includes: aviation, CBRNE, cloud architecture and engineering, geospatial intelligence, mobile apps solutions, modeling and simulation, signals intelligence and space.

ManTech International Corp.

A leader in C4ISR, cyber security, systems engineering, and global logistics, ManTech provides advanced technological services to the federal government in defense, intelligence, law enforcement, science and administration.

No Magic, Inc.

No Magic provides modeling solutions for model-driven enterprises and offers the most standards-compliant integrated business modeling, architecture and Model-Based Systems Engineering tool chain in the industry. The company is a standards-driven software provider of model-driven enterprise solutions based on Object Management Group standards.

Qualcomm

A leading provider of innovative wireless technology and services, Qualcomm’s broad research interests cover indoor positioning, mobile web applications, parallel systems, and user-centric designs.

Lockheed Martin

Lockheed Martin is a global security and aeronautics company organized around aeronautics, information systems and global solutions, missiles and fire control, mission systems and training and space systems.

Hughes Network Systems

Hughes is the world’s leading provider of satellite broadband for home and office, delivering global, innovative network technologies, managed services, and solutions for enterprises and governments.

HomeTown Sports, LLC

This technology company holds patents that incorporate modern technological advances into athletic training devices.

ST Microelectronics

ST Microelectronics is among the world’s largest semiconductor companies, a leading integrated device manufacturer serving all electronics segments and a technology innovator. Key strengths are in sensing and power, automotive and embedded processing solutions.

National Institute of Standards and Technology

NIST, an ISR federal government liaison partner, is a non-regulatory federal agency within the U.S. Department of Commerce. Its mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards and technology in ways that enhance economic security and improve the quality of life.

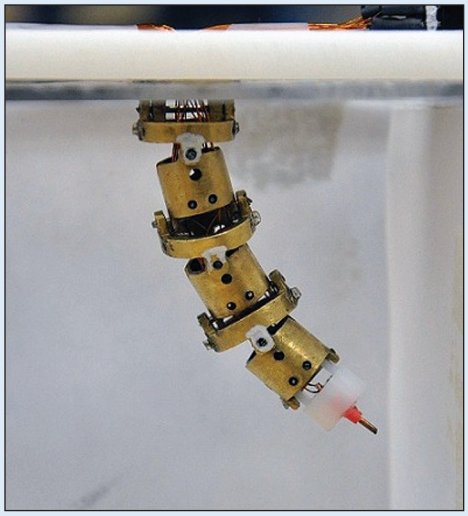
For more APP information, visit *ter.ps/2vu* or contact Jeff Coriale, 301-405-6604.

Toshiba renews partnership through 2016

ISR and Toshiba’s Corporate Manufacturing Engineering Center have renewed their 13-year partnership. During this time, ISR has hosted 17 Toshiba engineers as visiting scientists on the University of Maryland campus, typically for a year at a time. Toshiba’s partnership renewal extends through 2016, and ISR will welcome the 18th Toshiba visiting scientist in September. ISR’s Director for External Relations Jeff Coriale manages this industrial relationship. Contact him for more information at coriale@umd.edu.


Rebecca Copeland
TOMOKI UMETSU

In 2012–2013, Toshiba’s 17th visiting scientist was **Mr. Tomoki Umetsu** from Toshiba’s Corporate Manufacturing Engineering Research Center. Mr. Umetsu worked with Professor **Hugh Bruck** (ME), conducting joint research on determining the real contact area for materials using experimental and numerical techniques.



MINIR surgical robot

NIH awards $2M surgical robot grant to Desai and colleagues

ISR-affiliated Professor **Jaydev Desai** (ME) and his colleagues **Rao Gullapalli, M.D.,** and **J. Marc Simard, M.D.,** from the University of Maryland, Baltimore have been given a $2 million grant from the National Institutes of Health to continue their development of a small robot that could one day aid neurosurgeons in removing difficult-to-reach brain tumors. A "Minimally Invasive Neurosurgical Intracranial Robot" (MINIR) prototype has been developed over a number of years and its feasibility already has been demonstrated, supported in part by a previous NIH grant. Professor **S.K. Gupta** (ME/ISR) and **Jiachen Zhuo, Ph.D.** from the University of Maryland School of Medicine are co-investigators.

The NIH grant will enable the team to develop MINIR-II, a fully MRI-compatible robot, and demonstrate its safety and effectiveness under the direct control of the physician, with targeting information obtained exclusively from real-time MRI that uses active targeting methods with sensors embedded within MINIR-II.

"This technology has the potential to revolutionize the treatment and management of patients with difficult-to-reach intracranial tumors and to have a direct impact on improving their quality of life," says Desai.

Moss leads international multimodal sensing team

Professor **Cynthia Moss** (Psychology/ISR) is the principal investigator leading an international research team on "Multimodal sensing in the natural environment," a three-year research grant from the Human Frontiers Science Program.

The work focuses on four different bats; the diversity of bat species and their adaptations to different environments and behavioral tasks make them especially well-suited for this line of inquiry. The research is advancing critical insights into how animals process, represent and use multimodal sensory information from the natural environment, including how they build cognitive maps to make decisions for goal-directed actions. Through integrated field and lab studies, computer modeling and biomimetic robotics, the research contributes to a deeper understanding of multisensory integration, scene analysis and spatial navigation in natural settings.

In addition to Moss, team members are: **John Hallam** and **Annemarie Surlykke**, University of Southern Denmark, Odense; **Rachel Page**, Smithsonian Tropical Research Institute, Panama; and **Yossi Yovel**, Tel Aviv University, Israel. Their diffuse geographic locations provide access to an extraordinary array of field sites and multimedia lab facilities.

Paley is PI for AFOSR mobile sensors grant

Associate Professor **Derek Paley** (AE/ISR) is the principal investigator for a three-year, $600K grant from the Air Force Office of Scientific Research, "Optimized Routing of Intelligent, Mobile Sensors for Dynamic, Data-Driven Sampling." The research will provide a control-theoretic framework to enable intelligent, mobile systems to optimally collect sensor-based observations. The network will accurately estimate processes such as human/vehicle surveillance and airborne contaminant release. Paley will use nonlinear estimation and control methods to design coordinated sampling trajectories that measure estimated dynamical and stochastic systems.

Khaligh receives NSF grant for electric vehicles lab

Assistant Professor **Alireza Khaligh** (ECE/ISR) is a co-PI on a two-year, $199K NSF Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics grant and an award from the University of Maryland Sustainability Fund. He will develop an educational laboratory on hybrid electric and plug-in hybrid electric vehicles. The lab will educate and train students on the fundamentals of these vehicles, and expose them to their rapidly developing technology. The lab will help provide a fundamentals-based, application-oriented education that prepares students for industry and R&D-oriented careers. **Umamaheshwar Krishnamurthy** at the Illinois Institute of Technology (IIT) is the principal investigator. The project employs a strategy of first implementing a new course at IIT and then transferring it to the University of Maryland.

Maryland Industrial Partnerships funding

Professor **Benjamin Shapiro** (BioE/ISR) has been awarded a $150K grant from the Maryland Industrial Partnerships (MIPS) program to support Cordex Systems LLC's development of a new medical device for detecting and monitoring cardiovascular disease.

ISR-affiliated Assistant Professor **Ian White** (BioE) received a $135K MIPS grant to help Diagnostic anSERS Inc. (founded by BioE graduate students **Eric Hoppman** and **Sean Virgile**) advance its development of a new, highly sensitive chemical sensing device fabricated on paper using inkjet printing.

Assistant Professor **Alireza Khaligh** (ECE/ISR) and Professor **Isaak Mayergoyz** (ECE/UMIACS) have received a $155K MIPS grant to investigate, design and develop a unique silicon carbide-based battery charger for electric and plug-in hybrid electric vehicle. They will collaborate with CoolCAD Electronics, LLC, to design and develop a 7.6kW level-2 charger for next generation of these vehicles.

Part of the Maryland Technology Enterprise Institute (Mtech), MIPS pro-

vides matching grants for technology product development projects that team Maryland companies with researchers in the state's public universities. MIPS has supported projects from more than 500 companies since 1987.

Shapiro, Depireux team for hearing loss grants

Professor **Benjamin Shapiro** (BioE/ISR) and ISR Associate Research Scientist **Didier Depireux** have received several grants for delivering drug therapies to the inner ear, a new collaborative area for the two researchers. The grants are:

- A $50K, one-year University of Maryland Vice President for Research Seed Grant, "Magnetically Delivering Therapies to Inner Ear Diseases."
- A $100K, 16-month Maryland Industrial Partnerships Program (MIPS) grant, "Magnetic Therapy Injection to Treat Hearing Loss."
- A $5K, four-month I Rutel (OUHSC) sub-award, "Magnetic Injector for Targeted Delivery of Therapeutics."
- An $80K, one-year SZI-Clark Seed Funding grant to establish a collaboration with **Diego Preciado, M.D.** of Children's National Medical Center in Washington, D.C., "Magnetic Delivery of Drugs to the Middle Ear without Ear Drum Puncture."
- A $100K, one-year TEDCO Maryland Innovation Initiative grant, "Treatment of Otitis Media without Ear Drum Puncture," with Diego Preciado.

Davis awarded turbulent atmosphere optics contract

ISR-affiliated Professor **Christopher Davis** (ECE) received a five-year, $4M Multidisciplinary Research Initiatives (MRI) contract from the Joint Technology Office. "Laser Beam Propagation through the Low Atmosphere in Deep Turbulence" will develop new and improved techniques for characterizing the optical properties of the turbulent atmosphere along lengthy paths, known as "deep turbulence," close to the ground. The research will provide improved information to adaptive optics systems that project high energy laser beams at targets. Davis is working with Professor **Thomas Antonsen** (ECE/Physics/IREAP), Research Professor **Stuart Milner** (CEE), and **Ron Phillips** and **Larry Andrews** from the University of Central Florida.

Davis, Milner receive FHA traffic surveillance contract

ISR-affiliated Professor **Christopher Davis** (ECE) and Research Professor **Stuart Milner** (CEE) have been awarded a three-year, $1M Federal Highway Administration contract to provide improved cooperating camera traffic surveillance. "Cooperating Camera Platforms for Ultra High Resolution Traffic Surveillance and Autonomous Event Detection" will use cooperating high-definition cameras to monitor traffic characteristics, such as vehicle speeds and types, incidents, and traffic congestion. The new system will have the capability to recognize "events" in the highway infrastructure and relay this information to command centers in real time. The technology will also enable and feature extraction algorithms to interoperate with ultrahigh resolution surveillance hardware.

Barg receives NSF grant for polar code research

Professor **Alexander Barg** (ECE/ISR) is the principal investigator for "Ordered Metrics and Their Applications," a three-year, $472K National Science Foundation grant. Barg will conduct research into the properties and applications of polar codes for communication systems. Polar codes are a new method of coding information for transmission over noisy channels. They will realize the full potential of Shannon's theorems related to data rate and transmission reliability. Polar codes have been shown to advance a range of classical and new information-theoretic problems that rely on efficient encoding of the data. Barg's project addresses the properties of polar codes in nonbinary communication channels, the design of optimal polarizing transformations, and applications to unequal error protection, hierarchical source coding, broadcast channels, signal design, and other problems of importance for network communication.

Espy-Wilson is PI for NSF speech recognition grant

Professor **Carol Espy-Wilson** (ECE/ISR) is the principal investigator for a two-year, $600,000 National Science Foundation Collaborative Research award, "Multilingual Gestural Models for Robust Language-Independent Speech Recognition." The researchers will develop a large-vocabulary speech recognition system based on articulatory information. They will investigate the use of estimated articulatory gestures in large vocabulary automatic speech recognition. The multi-site grant includes the Stanford Research Institute (SRI), Boston University and Haskins Laboratories. Espy-Wilson's former student **Vikramjit Mitra** (EE Ph.D. 2011) is the principal investigator on the portion of the grant going to SRI.

Bergbreiter wins NRI grant for active skins

Assistant Professor **Sarah Bergbreiter** (ME/ISR) is the principal investigator for a new National Robotics Initiative grant, "Active Skins for Simplified Tactile Feedback in Robotics." The research project is one of eight selected by the National Aeronautical and Space Administration (NASA) as part of the initiative. Bergbreiter's project will support NASA's future missions in space.

Barg awarded NSF grant to develop genotyping theory

Professor **Alexander Barg** (ECE/ISR) is the principal investigator for a new NSF collaborative research grant, "A General Theory of Group Testing for Genotyping."

The three-year, $250K grant will fund the development of a comprehensive, yet analytically or computationally tractable general theory of group testing for genotyping. Barg's theory will answer the unique challenges arising in genotyping by sequencing. In addition, parts of the theory also may be used in areas as diverse as constrained multiple access channel analysis, fingerprinting and identification coding and error-control coding. Several new models will be introduced into the field of group testing, including subjects with different types and strengths, semi-quantitative testing, two-dimensional pooling, and Poisson probabilistic testing.

Chopra leads NSF nonlinear system tracking control grant

ISR-affiliated Associate Professor **Nikhil Chopra** (ME) is the principal investigator of a three-year, $325K NSF grant for "Tracking Control of Nonlinear Systems Under Sensing, Computational, and Communication Constraints." He will investigate control algorithms for resource constrained trajectory tracking in nonlinear systems used in robotic systems for manufacturing and other applications. This will lead to the development of a hybrid control framework where various resource constraints can be treated in a unified manner. The approach will provide a rigorous solution to the important problem of tracking in robotic systems under sensor constraints, significantly affecting industrial automation.

Srivastava is PI for NSF hardware security grant

Associate Professor **Ankur Srivastava** (ECE/ISR) is the principal investigator of a three-year, $500K NSF hardware security grant for "Physically Unclonable Function (PUF) Enhancements Via Lithography and Design Partnership." The grant is part of NSF's Secure & Trustworthy Cyberspace program. A silicon PUF is a supplemental circuit embedded in an IC which generates unique signatures. The signatures could be used for authentication, protection of data and secure communication. This research investigates fundamentally different approaches to PUF enhancements. It leverages quantified models for fabrication randomness that have been developed in design for manufacturability-related research endeavors. The work will enable improved silicon PUFs, increasing the possibility of their adoption. The approaches will be useful for both semiconductor manufacturing companies and fab-less design houses.

Krishnaprasad wins collective behavior testbed DURIP

Professor **P. S. Krishnaprasad** (ECE/ISR) has been awarded a DURIP 2012 grant by the Air Force Office of Scientific Research to support his work on principles and algorithms that underlie purposeful collective behavior in natural and engineered systems. The $303K award will help establish a physical testbed system for synthesis of collective behavior from fundamental building blocks. The system includes multiple mobile robots, a system of cameras for motion capture, and an enhancement of computational resources in the Intelligent Servosystems Laboratory. The testbed will support investigations in the design of distributed control strategies, generation of ground-truth for algorithms to reconstruct trajectories of natural collectives, and analysis of statistical data on the dynamics of multi-agent interactions in nature and robotics.

Khaligh receives NSF SiC battery charger grant

Assistant Professor **Alireza Khaligh** (ECE/ISR) is the principal investigator for a $96K, 18-month NSF EAGER grant, "Integrated On-Board SiC-Based Level-3 Charging for Plug-In Electric Vehicles." Khaligh will investigate, design, and develop an integrated, on-board, silicon carbide-based, level-3 battery charger, compatible with level-1 and level-2 charging, using the propulsion machine and its inverter for the next generation of plug-in vehicles. This fundamental research will achieve breakthroughs in control, modeling and design of power electronic interfaces for electric vehicles.

Fellows


CARL LANDWEHR

Former ISR Senior Research Scientist **Carl Landwehr** has been named a Fellow of the Institute of Electrical and Electronics Engineers "for contributions to cybersecurity." Landwehr is an expert in trustworthy computing: high assurance software development, understanding software flaws and vulnerabilities, token-based authentication, system evaluation and certification methods, multilevel security and architectures for intrusion-tolerant systems. He served ISR from 2003 to his retirement in 2012.


CYNTHIA MOSS

Professor **Cynthia Moss** (Psychology/ISR) has been named a Fellow of the American Association for the Advancement of Science "for distinguished research in the field of neuroethology, particularly for studies of sensory information processing, adaptive behaviors, spatial perception and memory in echolocating bats."

Outstanding paper awards

"A quadruped robot with on-board sensing and parameterized gait for stair climbing," was a runner up for the Best Paper Award at the 15th International Conference on Climbing and Walking Robots and Support Technologies for Mobile Machines. The paper was written by Professor **S.K. Gupta** (ME/ISR), his graduate student **Tom Brewer,** and his postdoctoral researcher **Krishna Kaipa**.

Associate Professor **Mark Austin** (CEE/ISR) and his Ph.D. student **Leonard Petnga** (CEE) won the Best Paper Award at the 13th Conference on Systems Engineering Research for "Ontologies of Time and Time-Based Reasoning for Model-Based Systems Engineering of Cyber-Physical Systems." Petnga is a NIST Cyber-Physical Systems Scholar.

Associate Professor **Ankur Srivastava** (ECE/ISR), his graduate student **Bing Shi,** and Professor **Avram Bar-Cohen** (ME) won the Best Paper Award at the 2012 IEEE Computer Society Annual Symposium on VLSI for "Hybrid 3D-IC Cooling System Using Micro-Fluidic Cooling and Thermal TSVs."

A paper by Assistant Professor **Alireza Khaligh** (ECE/ISR) published in *IEEE Transactions on Vehicular Technology* received the Best Vehicular Electronics Paper Award from the IEEE Vehicular Technology Society. "Advanced Integrated Bidirectional AC/DC and DC/DC Converter for Plug-In Hybrid Electric Vehicles" was co-authored by Khaligh, **Young-Joo Lee** and **Ali Emadi**.

"DETC2012-71236: Using GPUs for Realtime Prediction of Optical Forces on Microsphere Ensembles," a paper by Computer Science graduate student **Sujal Bista**, Mechanical Engineering graduate student **Sagar Chowdhury,** Professor **S.K. Gupta** (ME/ISR), and UMIACS Director **Amitabh Varshney** (CS/UMIACS), was one of two "best of conference" papers at the 2012 ASME International Design Engineering Technical Conferences. Chowdhury is advised by Professor Gupta, and Bista is advised by Professor Varshney.

Research by alumna **Rong Wang** (MSSE 2012), Professor **Michael Ball** (BGMT/ISR) and Associate Professor **David Lovell** (CEE/ISR) won the advanced modeling best paper award at the 5th International Conference on Research in Air Transportation. "Ration-by-Weight of Efficiency and Equity" discusses a new allocation method in ground delay programs for air traffic flow management that provides a compromise in efficiency and equity between what is provided by the ration-by-schedule method and the ration-by-distance method.

University of Maryland awards

ISR-affiliated Professor **Neil Goldsman** (ECE) and ECE Professor Emeritus **Martin Peckerar** received the University System of Maryland (USM) Board of Regents Entrepreneur of the Year Award. The two were honored for developing a novel, thin-film battery and starting the company FlexEl. Their batteries will make possible a number of stronger, smaller products, including wireless sensor networks, active RFID and wearable electronics and medical devices. The batteries can conform to the shape of virtually any object, and their flexibility also allows them to act as part of an electronic device's packaging.

Professor **Steve Marcus** (ECE/ISR) was the recipient of the 2013 Poole & Kent Company Teaching award, given to senior faculty in the A. James Clark School of Engineering. Marcus has been a major contributor to the Clark School's Future Faculty Program, where he has educated and provided mentorship to many graduate students who aspire to become faculty members at research universities.

ISR-affiliated Professor **Min Wu** (ECE/UMIACS) was selected as a 2013-2014 Distinguished Scholar-Teacher by the University of Maryland. The Distinguished Scholar-Teacher program recognizes faculty members who have demonstrated outstanding scholarly achievement along with equally outstanding accomplishments as teachers.

ISR-affiliated Professor **Christopher Davis** (ECE), his postdoc **John Rzasa**, and ECE students **Gerald Spessard, Leroy Chamberlain, Jr.,** and **Jakob Scharmer** were runners-up in the Physical Science Category at the 2013 Invention of the Year Awards. Their electronic home plate (EHP) is a simple, low-cost baseball home plate that contains electronic and opto-electric components. The EHP detects and indicates the presence, position, and speed of a baseball passing over it. It is designed to assist umpires in determining if a pitch is a ball or a strike in games and can be a valuable tool for both pitchers and batters in baseball training. The EHP automatically adjusts to correspond to the knee-to-chest strike zone of batters. The Invention of the Year awards are sponsored by the university's Office of Technology Commercialization.

Professor **John Baras** (ECE/ISR) was named "Principal Investigator with Greatest Impact," a significant award bestowed during the Maryland Industrial Partnerships (MIPS) 25th Anniversary event. HughesNet, which resulted from Baras' collaboration with Hughes Network Systems, also was recognized as the largest selling product developed with the help of the MIPS program. Baras created the algorithms by which the Internet is delivered over satellite worldwide.

Other awards

ISR-affiliated Associate Professor **Patrick Kanold** (Biology) won the National Organization for Hearing Research Foundation's 2013 Burt Evans Young Investigator Award. The award honors excellence, commitment and achievement in auditory research by a young scientist.

The Aerospace Division of the American Society of Mechanical Engineers (ASME) named ISR-affiliated Professor **Alison Flatau** (AE) as the 2013 recipient of its Adaptive Structures and Materials Systems Prize. The annual prize is given for significant contributions to the sciences and technologies associated with adaptive structures and/or materials systems.

Professor **Tony Ephremides** (ECE/ISR) received the IEEE Communication Society's 2012 Ad Hoc and Sensor Networks Technical Recognition Award for his pioneering contributions to the field.

ISR-affiliated Professor **Ben Shneiderman** (CS/UMIACS) won the Visualization Career Award of the IEEE Computer Society's Visualization and Graphics Technical Committee at VisWeek 2012.

ISR-affiliated Professor **Min Wu** (ECE/UMIACS) was honored as a 2012 Maryland Innovator of the Year for "A Novel Timestamp for Visual Recordings," an invention that authenticates when and in which geographic region an audio/visual recording is captured. It will allow users to determine if a recording has been tampered with or edited in any way, and if a visual track and a sound track were captured at the same time or combined after the fact. The awards are sponsored by the *Maryland Daily Record*.

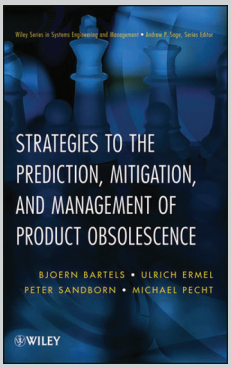
Publications of note

Micro-turbine research by ISR Director **Reza Ghodssi** (ECE/ISR) and his colleagues was the cover article of the June 2013 issue of the *Journal of Micromechanics and Microengineering*, one of the top journals in the field. "Performance of integrated retainer rings in silicon micro-turbines with thrust style micro-ball bearings" represents another advance in the longstanding research into power MEMS devices based on micro-ball bearing technology conducted in Ghodssi's MEMS Sensors and Actuators Lab. The lead author is **Robert Hergert** of the Department of Electrical and Electronic Engineering, Imperial College London. Co-authors include Ghodssi's former student, alumnus **Brendan Hanrahan** (MSE Ph.D. 2013), currently with the Army Research Laboratory; and **Andrew Holmes** of the of the Department of Electrical and Electronic Engineering, Imperial College London.

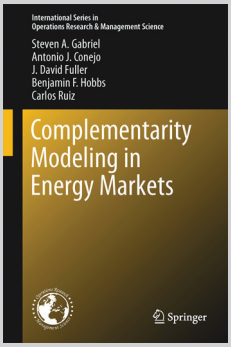
Micro-turbo-generator research by ISR Director **Reza Ghodssi** (ECE/ISR) and his colleagues was published in the June 2013 issue of the *Journal of Micro-electromechanical Systems*. "An Integrated Permanent-Magnet Microturbogenerator Supported on Microball Bearings" is the first demonstration of an integrated permanent-magnet micro-turbo-generator supported on micro-ball bearings. It is also the most complexly fabricated MEMS device the Ghodssi group has developed. The lead author is alumnus **Mustafa Beyaz** (ECE Ph.D. 2011), on the faculty of Antalya International University, Turkey, and a former student of Ghodssi's. Co-authors include Ghodssi; alumnus **Brendan Hanrahan** (MSE Ph.D. 2013), currently with the Army Research Laboratory; and Ghodssi's former undergraduate student **Jeremy Feldman** (ECE B.S. 2011), now a student in ISR's MSSE program.

Associate Professor **Jonathan Simon** (ECE/Biology/ISR) and his Ph.D. student **Nai Ding** are co-authors of a paper published in the *Proceedings of the National Academy of Sciences of the United States of America*. "Emergence of neural encoding of auditory objects while listening to competing speakers" addresses the neural underpinnings of auditory scene analysis. Their results indicate that concurrent auditory objects, even if spectrotemporally overlapping and not resolvable at the auditory periphery, are neurally encoded individually in auditory cortex and emerge as fundamental representational units for top-down attentional modulation and bottom-up neural adaptation.

Books



ISR-affiliated Professor **Peter Sandborn** (ME) is one of four authors of *Strategies to the Prediction, Mitigation, and Management of Product Obsolescence*, recently published by Wiley. Sandborn wrote the book with **Michael Pecht,** director of the University of Maryland's Center for Advance Life Cycle Engineering; **Ulrich Ermel** of the TQ-Group, Germany; and **Bjoern Bartels**, from ABSC GmbH. The book covers obsolescence forecasting methodologies, including forecasting tactics for hardware and software that enable cost-effective proactive product life-cycle management. It also describes how to implement a comprehensive obsolescence management system within diverse companies.



ISR-affiliated Professor **Steven Gabriel** (CEE) is the lead author of *Complementarity Modeling in Energy Markets,* published by Springer. The book presents mathematical, engineering, and economic models for the energy sector based on optimization and game theory collectively called "complementarity." Complementarity models are a very general and flexible modeling format that the book applies to energy markets for the first time, showing how they are well suited to situations that mix primal and dual variables. Gabriel's co-authors are **Antonio J. Conejo**, Universidad de Castilla–La Mancha; **J. David Fuller**, University of Waterloo; **Benjamin F. Hobbs**, Johns Hopkins University; and **Carlos Ruiz**, École Centrale Paris.

Patents

Alumnus **Ayan Roy-Chowdhury** (EE Ph.D. 2008) and Professor **John Baras** (ECE/ISR) have received U.S. Patent 8,397,062 for "Method and System for Source Authentication in Group Communications. The invention is an authentication system in which a central node for issuing certificates to a plurality of nodes associated with the central node in a network also is provided.

Professor **John Baras** (ECE/ISR), ECE graduate student **Kaustubh Jain,** alumnus **Kiran Somasundaram** (EE Ph.D. 2010), and alumnus **Vahid Tabatabaee** (EE Ph.D. 2003) are co-inventors of U.S. Patent 8,325,746, "Topology Selection and Broadcast Method for Rule-Based Link State Routing." This invention will optimize the link-state information broadcast in a routing domain of a communication network for QoS rule-based link-state routing.

Lectures

Associate Professor **Gang Qu** (ECE/ISR) was an invited speaker at the Circuits and Systems Society Forum on Emerging and Selected Topics (CAS-FEST) event in conjunction with ISCAS 2013 in Beijing. CAS-FEST focuses on an emerging topic for researchers to exchange state-of-the-art developments and future ideas. This year's topic was "Low-Power, Intelligent and Secure Solutions for Realization of Internet of Things (IoT)." Six speakers, including Qu, were invited. Qu talked about "Building Trusted Infrastructure for IoT," focusing on establishing trust in two critical components: circuitry and routing protocols.

ISR-affiliated Professor **Steven Gabriel** (CEE) gave the keynote address at a workshop sponsored by the Hertie School of Governance at the German Economic

Research Institute. Gabriel spoke on "Modeling for the Energy Turnaround—Modeling Approaches and Current Applications," focusing on the complex interaction of natural gas, electricity, and renewables. He also highlighted key areas of possible modeling and analysis that cut across the energy, transportation and agricultural sectors.

Associate Professor **Jonathan Simon** (ECE/Biology/ISR) was an invited speaker at the Presidential Symposium of the 36th Mid-Winter Meeting of the Association for Research in Otolaryngology, the preeminent international meeting in auditory neuroscience. He spoke on "Cortical Encoding of Auditory Objects at the Cocktail Party."

ISR Associate Research Scientist **Raj Madhavan** gave a plenary address at the 5th Robotics and Mechatronics Conference in Pretoria, South Africa. Madhavan spoke on "Smart, Flexible, and Safe Industrial Mobile Robots: Evaluation and Benchmarking of Navigation Performance in Unstructured and Dynamic Environments." Madhavan talked about his work testing and evaluating industrial mobile robots operating in warehouses and factory floors, development of test methods and performance metrics.

Professor **John Baras** (ECE/ISR) was an invited speaker and invited panel member at the London Workshop on the Control of Cyber-Physical Systems (CPS) organized by the University of Notre Dame (USA) and the Royal Institute of Technology (KTH) (Sweden). Baras spoke on "Components, Compositionality and Architectures for Networked CPS." He presented a three-layer framework for modeling networked CPS that he has developed with his research group. Baras also was an invited panelist on the workshop panel "Control of Cyber-Physical Systems: Challenges and Opportunities."

ISR Director **Reza Ghodssi** (ECE/ISR) was an invited speaker at the 38th International Conference on Micro and Nano Engineering (MNE 2012) in Toulouse, France. Ghodssi spoke on "Biofabrication: An Integrative Processing Tool for Micro/Nano/Bio Systems." Ghodssi's presentation summarized his research group's work on these two platforms and gave a general overview of the role of biomaterials in microsystem development.

Professor **Tony Ephremides** (ECE/ISR) was an invited speaker at the Workshop on Network Science organized by the Chinese University of Hong Kong and Tsinghua University of Beijing in Hong Kong. He spoke on the problem of "Scheduling in Wireless Networks."

ISR-affiliated Associate Professor **Miao Yu** (ME) was among 100 engineers under the age of 45 invited to attend the National Academy of Engineering's 2012 U.S. Frontiers of Engineering Symposium in September in Warren, Mich. The engineers met for an intensive symposium to discuss cutting-edge developments in four areas: vehicle electrification, serious games, climate engineering, and engineering materials for the biological interface. Each participant also presented aspects of their own research to their colleagues.

International service

Professor **Tony Ephremides** (ECE/ISR) has been elected as one of six external members of the 15-member Institutional Council of the National Technical University of Athens. Ephremides is an alumnus of the university, which he says is "the alma mater of most engineers of Greek descent who populate universities of the world, including our own."

Greece recently revamped its educational laws as part of its efforts to recoup from the severe crisis it has suffered in the last few years. It has established at each university a body known as the Institutional Council, which functions similarly to the board of trustees in American universities. These bodies, now in their first year of operation, are the cornerstone of a new system of governance of each university in Greece. They have substantial powers and responsibilities.

"I am happy I have the opportunity to contribute in a modest way to this effort," Ephremides says. "I consider it another way in which our own faculty can have an impact around the world."

Joint appointments

Associate Professor **Jonathan Simon**, formerly an affiliate faculty member in ISR, has been made a joint appointment in ISR as well as in the Departments of Biology and Electrical and Computer Engineering. Simon's research interests are in auditory neural computations and representations, magnetoencephalography and cortical physiology, signal processing in biological systems, and computational and theoretical neuroscience.

Promotions

Benjamin Shapiro (BioE/ISR) has been promoted to full professor. Shapiro's research is focused on all aspects of miniaturized-system control, from initial determination of the dominant physics, to model development, control problem statement and algorithm design, to experimental verification.

ISR-affiliated faculty member **Jaydev Desai** (ME) has been promoted to full professor. Desai's research interests are in cell manipulation, surgical simulation (needle insertion and soft tissue modeling), surgical robotics (breast biopsy and brain tumor) and compliant grasping. He is well known for his work developing the Minimally Invasive Neurosurgical Intracranial Robot.

ISR-affiliated faculty member **Nikhil Chopra** (ME) has been promoted to associate professor with tenure. His research interests are in developing a fundamental understanding of synchronization and control of networked dynamical systems interacting over unreliable communication networks. This work is important in practical applications such as semi-autonomous telerobotic networks, robot networks and unmanned air vehicles.

ISR-affiliated Professor **Peter Sandborn** (ME) has been named director of the Maryland Technology Enterprise Institute (Mtech). Mtech's educates the next generation of technology entrepreneurs; creates successful technology ventures; and connects Maryland companies with university resources to help them succeed. Sandborn's own research group develops life-cycle cost models and business case support for long-field-life systems including obso-

lescence forecasting algorithms, strategic design refresh planning, lifetime buy optimization and return on investment models for maintenance planning.

ISR-affiliated faculty member **Mark Shayman** (ECE) is now the associate dean for student success in the UMD Graduate School. His responsibilities include graduate outcomes assessment; oversight of initiatives related to writing for graduate students and scholarly integrity; advancement of best practices in mentoring, advising, professional development, and placement; and liaison with the Division of Research on post-doctoral fellows and associates.

Professor **Steve Marcus** (ECE/ISR) is the University of Maryland's first director of faculty leadership within the Office of Faculty Affairs. Marcus is a former director of ISR and a former chair of the Electrical and Computer Engineering Department. In this position, Marcus works across campus to create a strong sense of community and quality of life for faculty, in which everyone can excel.

New faculty

Huan Xu is a new assistant research professor in ISR and the Department of Aerospace Engineering. Xu earned her Ph.D. in Mechanical Engineering at the California Institute of Technology in 2013. Her research interests are in control and dynamical systems, optimization and formal methods, with applications in autonomy, planning and system identification for cyber-physical systems in energy, robotics, motion planning, transportation management and cybersecurity.

Daniel Winkowski has joined the ISR faculty as an assistant research scientist. Winkowski has been an ISR postdoctoral researcher since 2009, working with Professor **Shihab Shamma** (ECE/ISR). His research interests are in the neural mechanisms underlying attention, studying the role of the auditory cortex in representing acoustic stimuli and understanding how higher order processes, like attention, can modify these representations. Winkowski earned his Ph.D. at Temple University in 2003.

ISR postdoctoral research associate **Ekaterina (Katya) Pomerantseva** accepted a tenure-track faculty position in the Materials Science and Engineering Department at Drexel University in Philadelphia. She joined the faculty as an assistant professor in September. Pomerantseva was a postdoc in ISR Director **Reza Ghodssi's** (ECE/ISR) MEMS Sensors and Actuators Lab since 2010. She is the second post-doctoral associate from Ghodssi's group to join the Drexel faculty; **Matthew McCarthy** is an assistant professor in Drexel's Mechanical Engineering Department.

Domenic Forte (ECE Ph.D. 2013) accepted a tenure-track position at the University of Connecticut. He joined the school's ECE department as an assistant professor in Fall 2013. Forte was advised by Associate Professor **Ankur Srivastava** (ECE/ISR). His dissertation focuses on hardware-oriented security. He won a Best Student Paper Award at the 2011 NASA/ESA Conference on Adaptive Hardware and Systems. At UConn, Forte will continue investigating new design, fabrication, and run-time strategies for improving the efficiency, reliability and security of computing systems.

Wade Trappe (Applied Mathematics and Scientific Computing Ph.D. 2002) has been promoted to full professor in the Department of Electrical and Computer Engineering at Rutgers University. He is the associate director of the Wireless Information Network Laboratory (WINLAB). Trappe also received Rutgers' Outstanding Engineering Faculty Award in 2013. At Maryland, Trappe was affiliated with both ISR and the Electrical and Computer Engineering Department, and was advised by Professor **K.J. Ray Liu** (ECE). He has become a nationally recognized authority in wireless network security.

Alvaro A. Cárdenas (EE Ph.D. 2006), began a tenure-track position as an assistant professor in the Computer Science Department in the University of Texas at Dallas. At Maryland, Cárdenas was advised by Professor **John Baras** (ECE/ISR). Cárdenas' research focuses on network security, security of the smart grid and other cyber-physical systems, intrusion detection, trusted computing and big data analytics for security.

Arya Mazumdar (EE Ph.D. 2011) has begun a tenure-track position as assistant professor in the University of Minnesota's Electrical and Computer Engineering Department. Previously, Mazumdar was a postdoctoral researcher at the Massachusetts Institute of Technology. Mazumdar's research focuses on information theory, codes for memory and storage, signal processing, networking, discrete mathematics in communications, random processes and probabilistic methods. He was advised by Professor **Alexander Barg** (ECE/ISR).

Xiaobo Tan (EE Ph.D. 2002), an associate professor at Michigan State University, continues to develop his robotic fish. They now can glide through the water practically indefinitely, using little to no energy, while gathering valuable data that can aid in assessing the level of pollution in lakes and rivers. The fish are equipped with an array of sensors that not only allow them to travel autonomously, but also measure water temperature, quality and the presence of various contaminants. At Maryland, Tan was advised by Professor **John Baras** (ECE/ISR) and Professor **P. S. Krishnaprasad** (ECE/ISR).

Alumnus **Hamid Jafarkhani** (EE Ph.D. 1997) is a co-recipient of the IEEE Eric E. Sumner Award "for contributions to block signaling for multiple antennas." The prestigious award is presented for outstanding contributions to communications technology. Jafarkhani shares the award with Vahid Tarokh (Harvard University) and Siavash Alamouti (Vodafone, Great Britain). Jafarkhani is the Conexant-Broadcom Endowed Chair and Chancellor's Professor in the University of California Irvine's Department of Electrical Engineering and Computer Science. At Maryland, Jafarkhani was advised by former University of Maryland Provost **Nariman Farvardin** (ECE/ISR).

Ali Saleh (ECE B.S. 95; MSSE 1998) has been named president and chief executive officer of GE Healthcare in Saudi Arabia. He is responsible for the company's health-

care operations focused on Saudi Arabia. At Maryland, Saleh was advised by Associate Professor **Mark Austin** (CEE/ISR).

Matt Mosteller (MSSE 2012) received the Brian Mar Best Student Paper Award for "Platforms for Engineering Experimental Biomedical Systems" at the International Council on Systems Engineering's (INCOSE) 22nd Annual International Symposium. The paper was co-written with ISR Director **Reza Ghodssi** (ECE/ISR), Associate Professor **Mark Austin** (CEE/ISR), and ISR post-doctoral researcher **Shah-An Yang**.

Brendan Hanrahan (MSE Ph.D. 2013) won a silver medal in the 2012 summer student symposium research competition at the Army Research Laboratory (ARL). Hanrahan has been a full-time ARL employee in its Sensors and Electron Devices Directorate; Energy and Power Division since 2009.

Serban Sabau (EE Ph.D. 2011) has joined the Stevens Institute of Technology's Electrical and Computer Engineering Department as a tenure-track assistant professor. Sabau's research interests are in distributed control, sparse modeling and optimization in networked systems. At Maryland, Sabau was advised by Associate Professor **Nuno Martins** (ECE/ISR).

ISR alumni!

Do you have career news? Have you recently moved?

We want to stay in touch with you and we'd love to share your news with our readers, both in print and online.

Send your news and contact information updates to Rebecca Copeland at rebeccac@umd.edu.

ECE Ph.D. student **Young Wook Kim** has been selected as a KSEA-KUSCO Graduate Scholarship recipient by the Korean Scientists and Engineers Association. He received a cash prize and certificate at the US-Korea Conference 2013 in August. Kim, a Robert W. Deutsch Graduate Student Fellow, is advised by ISR Director **Reza Ghodssi** (ECE/ISR) and is part of the MEMS Sensors and Actuators Lab.

Eric Kim (EE and Physics B.S. 2013), has won a National Science Foundation (NSF) Graduate Research Fellowship. He was advised by Associate Professor **Nuno Martins** (ECE/ISR), and worked on research in cooperative robotics and control systems. Kim will continue his studies at the University of California, Berkeley, focusing on the interface between controls and computer science. The NSF Fellowship recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees at accredited U.S. institutions.

Mehdi Dadfarnia (EE B.S. 2012) won ISR's 2013 undergraduate research award for his work as an intern with the National Institute of Standards and Technology. Dadfarnia's research supported the National Ambulance Specification project, a joint effort of NIST and the Department of Homeland Security. He applied systems engineering approaches to analyze requirements and develop design guidance that will improve emergency medical services workers' safety while optimizing patient care. Dadfarnia was one of the first UMD students to be named a member of the select "UMD Cyber-Physical Systems Scholars at NIST" group. He is currently a graduate student in the MSSE program, where he is advised by Professor **John Baras** (ECE/ISR).

Mechanical Engineering Ph.D. student **Sagar Chowdhury** is the winner of the 2013 ISR George Harhalakis Outstanding Systems Engineering Graduate Student Award. Chowdhury is advised by Professor **S.K. Gupta** (ME/ISR). Chowdhury's research focuses on optical tweezers, a robot that uses a highly focused laser beam for precise manipulation of biological objects and dielectric beads at the micro-scale. Chowdhury also placed third in the Clark School's Dean's Doctoral Student Research Awards competition for "Planning for Automated Optical Micromanipulation of Biological Cells."

Bioengineering Ph.D. student **Aleksandar Nacev** took second place in the Clark School's Dean's Doctoral Student Research Awards competition for his paper, "Magnetic Drug Targeting: Developing the Basics." He is advised by Professor **Benjamin Shapiro** (BioE/ISR).

Six students mentored by ISR faculty are among those selected for the A. James Clark School of Engineering's 2013 Future Faculty Program. The program, launched in 2007, was created to prepare students for academic careers in top-50 engineering schools. ISR students in the 2013 program are: **Pritam Mukherjee** (ECE), advised by Professor **Sennur Ulukus** (ECE/ISR); **Levi DeVries** (AE), advised by Associate Professor **Derek Paley** (AE/ISR); **Maya Kabkab** (ECE), advised by Associate Professor **Richard La** (ECE/ISR); **Tsung-Hsueh Lee** (ECE), advised by Associate Professor **Pamela Abshire** (ECE/ISR); **Zhijian Zhang** (ME), advised by ISR-affiliated Associate Professor **Miao Yu** (ME); and **Amir Reza Kashani Pour** (ME), advised by ISR-affiliated Professor **Peter Sandborn** (ME).

Civil and Environmental Engineering Ph.D. student **James Jones** has been given a $10K research stipend by the Graduate Research Award Program on Public-Sector Aviation Issues. The award will help to fund his research on "Algorithms for Dynamic Re-sequencing of En Route Flights." Jones is a student in CEE's Civil Systems program and is affiliated with the National Center of Excellence for Aviation Operations Research (NEXTOR II). Jones, whose research interests lie in algorithms for air traffic management, is advised by Associate Professor **David Lovell** (CEE/ISR). The award is sponsored by the Federal Aviation Administration of the U.S. Department of Transportation.

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In addition, ISR's M.S. in Systems Engineering degree program website features a number of videos that explain the program, the approach of model-based systems engineering and careers for graduates. It also includes a helpful video for new grad students on how to choose a faculty advisor and make the most of graduate school.

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