



SYSTEMSOLUTIONS

THE INSTITUTE FOR SYSTEMS RESEARCH

A. JAMES CLARK SCHOOL of ENGINEERING

www.isr.umd.edu

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

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John T. Consoi

LEFT TO RIGHT, STUDENTS WOJCIECH BEJGEROWSKI, LESTER EHRLICH AND BRIAN RUSS DISPLAY VARIANTS OF A ROBOTIC FLAPPING-WING MICRO AIR VEHICLE IN THE ADVANCED MANUFACTURING LAB.

New initiatives: robotics, green communications, microsystems

In late 2009, ISR began three new initiatives designed to take advantage of the institute's faculty expertise and experience, its cross-disciplinary nature and systems focus, its laboratory facilities and its relationships with academia, industry and government. While each initiative has a unique focus and has progressed in its own way, all three are designed to address grand engineering challenges, take advantage of funding opportunities and position the University of Maryland as an international leader in these fields.

The three initiatives are the Maryland Robotics Center, Green Communications and Microsystems.

Maryland Robotics Center

In 2009, the University of Maryland had more than 20 faculty members working on robotics-related projects in their own labs, but there was limited external visibility, sharing of resources and interactions among students from different faculty groups. There was a realization that as robotics applications on campus continued to grow, it would be advantageous to develop a coordinating body that could bring labs together for collaboration and resource sharing. In October 2009 ISR researchers began to explore what such a body might look like. A report proposing the creation of a robotics center for the A. James Clark School of Engineering was



REZA GHODSSI

Twenty-five years of excellence

ISR is in the midst of celebrating its 25th anniversary! We were founded in 1985 as one of the original six National Science Foundation Engineering Research Centers, and were the first self-sustaining ERC to graduate from NSF funding in 1998. For the past quarter century we have been a home to interdisciplinary research and education activities in the systems sciences and systems engineering, with a focus on the communications, control and computing needed to model and design highly automated, autonomous and distributed engineering systems. We believe teams of researchers with diverse backgrounds can best address society's most challenging problems.

While many NSF ERCs discontinued operation over the years, ISR has survived, thrived and become a permanent institute of the University of Maryland.

One of the keys to our success has been evolving our research strategy through the years. Back in 1985, our main research theme and vision was the computer-aided design of complex automatic control and communication systems. We became known for research integrating intelligent control, signal processing and communication, computation and systems integration methodology. In the 1990s, ISR evolved into a "federation of centers" model which reflected our systems engineering core. Our research approaches at the time were sensor-actuator networks, media information systems, global communication systems, societal infrastructure systems and next-generation product realization systems.

ISR's strategy has been to move into new areas of research based on our faculty's interests. In the past decade our research expanded to include new applications in biology, psychology and zoology. We not only build on strengths present in the faculty, we also hire faculty in areas that are beginning to come to the fore. Some of ISR's most active research areas—for example, neuroscience and micro- and nanotechnology—started out this way.

Since I became director in Fall 2009, ISR has added three new research initiatives in microsystems, robotics and green communications that continue our practice of bringing together our own interdisciplinary faculty and other faculty from across the university. Read about them in our front-page story.

On pages 6–7 we feature news about our many systems engineering activities in both education and research. In addition, on pages 8–9 we invite you to read about three of our faculty involved in the NSF-sponsored ADVANCE Program for Inclusive Excellence that is making broad impact at the campus level.

You will also enjoy reading about ISR's commitment to and strong ties with industry (pages 16–17). We have long offered mutually beneficial partnership opportunities including an industrial affiliates program, industry-sponsored research, a unique visiting scholars program and many ways to work with our graduate students. We are always looking for new relationships with industry, academia and government, and we hope you'll consider working with us.

Last year we revitalized our Strategic Advisory Council, an industry group to which we turn for advice and recommendations. Members of this group now represent each of ISR's main research areas and are highly engaged with us.

In addition, we have a strong commitment to building community. In this newsletter you will read about our new student organization (page 4), as well as speaker series we recently have developed: the Intelligent Automation, Inc. Colloquia Series, the Techno Sciences Inc. Robotics Seminar Series, the Model-Based Systems Engineering Colloquia and the Microsystems Seminar Series. These join our existing Distinguished Lecturer Series. You're invited to attend any of these events; visit the events page on our website: www.isr.umd.edu/events/.

Speaking of the importance of community, I would like to acknowledge ISR's people, the source of our strength. We are fortunate to have dedicated faculty, staff and students who are devoted to and take pride in the Institute. Sadly, in the past year we lost our longest-serving staff member, Susan Frazier. Sue was our director of human resources and education. Her sudden passing after routine surgery last fall has left a sadness for her colleagues, and we wish her family healing and wholeness in the years ahead. We have established an endowed award to benefit graduate students in Sue's name (see back cover) and invite you to participate in it.

Best regards,
Reza

prepared, and the college agreed to form the center in January 2010. The Maryland Robotics Center was launched in March 2010.

The mission of the interdisciplinary Maryland Robotics Center is to enhance and promote collaboration among robotics researchers at the University of Maryland, to grow robotics activities by creating new initiatives and strategic partnerships, to identify new opportunities and grand challenges that can have significant societal impact and to develop educational programs focused on robotics. Professor S.K. Gupta (ME/ISR) directs the center.

The center's research includes all aspects of robotics, including component technologies development (e.g., sensors, actuators, structures and communication), novel robotic platforms and intelligence and autonomy for robotic systems. The center consists of 18 labs and 30 faculty members spanning eight academic departments: Aerospace Engineering, Civil and Environmental Engineering, Computer Science, Electrical and Computer Engineering, Mechanical Engineering, Bioengineering, Biology and Kinesiology.

Research projects are supported by the major federal funding agencies including the National Science Foundation, the Army Research Office, the Army Research Laboratory, the Office of Naval Research, the Air Force Office of Scientific Research, the National Institutes of Health, the Defense Advanced Research Projects Agency, the National Aeronautics and Space Administration and the National Institute of Standards and Technology.

Current research areas

- **Collaborative, Cooperative, Networked Robotics.** Bio-inspired robotics concepts, time-delayed robotics, robotic swarms, robotic cooperation under limited communication and distributed robotics.
- **Medical Robotics.** MRI-compatible surgical robotics, haptics-enabled AFM, exoskeletons for rehabilitation and magnetic micromanipulation for drug delivery.
- **Miniature Robotics.** Mesoscale robots; bio-inspired sensing, actuation and locomotion; optical, AFM based and micro-fluidic cell manipulation; and micro and

optical and magnetic nano manipulation.

- **Robotics for Extreme Environments.** Space robotics and autonomous deep-submergence sampling systems.
- **Unmanned Vehicles.** Micro air vehicles, unmanned sea surface vehicles, unmanned underwater vehicles and planetary surface rovers.

The center hosted Maryland Robotics Day on Sept. 10. The free, half-day event was an introduction to the Maryland Robotics Center and the University of Maryland's many robotics research projects, faculty, students and facilities. Well over 400 people attended the event on campus, including some 100 high school students, their science teachers and their parents; as well as representatives from neighboring national labs, start-up companies and defense industries. Participants heard a keynote speech by Dr. Martin Buehler, director of research at iRobot, toured labs, visited with faculty and students, and saw research in action.

A total of 16 research laboratories showcased their robotic projects for more than four hours; many staying open for visitors well past the event's 2 p.m. closing time. The open house drew reporters from television, radio and print media, including WUSA Channel 9 (Washington, D.C.), *Flight International*, *Science News* and the Voice of America. Links to the media coverage are at www.isr.umd.edu/news/news_story.php?id=5150.

The center has a comprehensive website, robotics.umd.edu, and offers a monthly seminar series sponsored by Techno-Sciences, Inc. Outreach to industry was initiated in summer 2010, and a seed grant program began in October. Collaborative grant proposals are being developed and the creation of a master's degree program in robotics is being explored.

Members of the Maryland Robotics Center include the following ISR joint appointment faculty: Associate Professor **Pamela Abshire** (ECE/ISR), Professor **John Baras** (ECE/ISR), Assistant Professor **Sarah Bergbreiter** (ME/ISR), Assistant Professor **Nikhil Chopra** (ME/ISR), Professor **Avis Cohen** (Biology/ISR), Professor **S.K. Gupta** (ME/ISR), Associate Professor **Timothy Horiuchi** (ECE/ISR), Professor **P. S. Krishnaprasad** (ECE/ISR),

Assistant Professor **Nuno Martins** (ECE/ISR), ISR Assistant Research Scientist **Raj Madhavan**, Professor **Dana Nau** (CS/ISR) and Associate Professor **Ben Shapiro** (BioE/ISR).

ISR-affiliated faculty in the center include Associate Professor **David Akin** (AE), Professor **Yiannis Aloimonos** (CS/UMIACS), Associate Professor **Jaydev Desai** (ME), Assistant Professor **Sean Humbert** (AE), Assistant Professor **Derek Paley** (AE), Associate Professor **Elisabeth Smela** (ME) and Assistant Professor **Miao Yu** (ME).

Non-ISR faculty include Professor **Bilal Ayyub** (CEE), Professor **Gilmer Blankenship** (ECE), Associate Professor **Hugh Bruck** (ME), Associate Research Scientist **Craig Carignan** (AE), Associate Professor **José Luis Contreras-Vidal** (Kinesiology), Professor **Don DeVoe** (ME), Associate Professor **Ramani Duraiswami** (CS/UMIACS), Associate Research Scientist **Cornelia Fermüller** (UMIACS), Professor **James E. Hubbard, Jr.** (AE), Professor **Miroslaw Skibniewski** (CEE), and Professor **Norman Wereley** (AE).

Green communications

ISR's initiative in green communications, led by Professor **Tony Ephremides** (ECE/ISR), aims to position ISR researchers and their future collaborators at the forefront of the grand engineering challenge to make communications and networking energy efficient. ISR researchers believe it is possible to drastically reduce the amount of energy dissipation occurring during transmission, processing, storage and device operation, and that these dramatic energy savings can be achieved in a cross-disciplinary way.

Ephremides notes that energy

consumption related to communications currently is 2 percent of global energy consumption, but is predicted to rise to 10 percent by the year 2020. Energy dissipation is especially acute in data centers and base stations.

There are multiple aspects to energy-efficiency in communications. Energy is consumed at the hardware level by material, devices, circuit lay-out, microprocessor architecture, memory management (OS, software), the amplifier and the antenna (directivity). It also is consumed at the protocol level by the physical layer (coding, signal design, transmission rate), the MAC layer (scheduling, power control), the routing layer (path length, hop length) and the application layer (partition of computation/communication tasks). Energy can be saved in each layer.

Current measures focus on preventing "leakage" current via multiple voltages, improved materials, controlled memory access, linearizing amplifiers, directive antennas, pulsed batteries, sleep schedules, multiple short hops and improving codes.

The research challenge is to go beyond these measures to the opportunities available to exploit layer interconnections such as scheduled memory access and TDMA protocol vs. random access; ultimate limits for channel capacity under "cost" criterion or distributed function computation; diverse



CLOSE TO 100 PARTICIPANTS ATTENDED THE GREEN COMMUNICATIONS WORKSHOP AT THE UNIVERSITY OF MARYLAND IN OCTOBER. THE WORKSHOP REPORT IS HELPING TO INFORM A COHERENT RESEARCH AGENDA IN THIS EMERGING FIELD.

cost criteria such as lifetime, rate, proportional fairness and “mission success”; alternative network architectures; and energy harvesting.

Ephremides believes this research challenge is well-suited for ISR because of the systems theory and engineering nature of the problem; the many faculty and student resources ISR brings to the table; and the institute’s expertise in the multiple disciplines needed to address it, including computer engineering, communications, networks, software design and VLSI.

As part of the initiative, ISR has become a member of GreenTouch, a consortium of more than 20 institutions and companies seeking a reduction in communications energy consumption by a factor of 1000.

ISR has formed a green communications focus group that includes Associate Professor **Pamela Abshire** (ECE/ISR), Professor **John Baras** (ECE/ISR), Professor **Alexander Barg** (ECE/ISR), Associate Professor **Rajeev Barua** (ECE/ISR), Professor **Tony Ephremides** (ECE/ISR), Associate Professor **Richard La** (ECE/ISR), Professor **Armand Makowski** (ECE/ISR), Professor **Prakash Narayan** (ECE/ISR), Associate Professor **Gang Qu** (ECE/ISR), Associate Professor **Ankur Srivastava** (ECE/ISR) and Associate Professor **Sennur Ulukus** (ECE/ISR).

Last October this group sponsored an international workshop on green communications at the University of Maryland that drew close to 100 academic, industry and government researchers, as well as representatives from funding agencies. The workshop included vision presentations, panel discussions and brainstorming sessions on reducing the carbon emissions footprint of communications and increasing the energy efficiency of the communications process.

The group is developing focused and concrete projects and securing funding for its ideas and efforts. Deliberations from the fall workshop are being transformed into a coherent research agenda that will be presented to funding agencies.

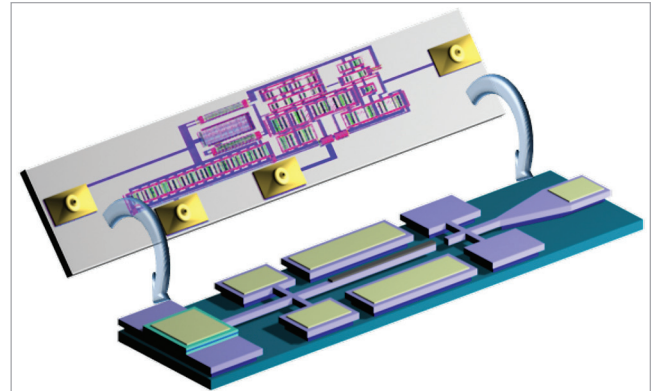
Microsystems

The University of Maryland and other organizations in the surrounding region offer both a wide expertise and rich resources in microstructures. The micro-

systems initiative at ISR is working to create a technical community that includes members from other universities, national laboratories and industry. The initiative is facilitating partnerships to develop novel microscale systems that can address important societal issues in health, security and energy. Applications include ant-size robots, bio-fabrication, point of care diagnostics, drug delivery and cell-based sensing.

ISR-affiliated Associate Professor **Elisabeth Smela** (ME), Associate Professor **Pamela Abshire** (ECE/ISR) and ISR Director **Reza Ghodssi** (ECE/ISR) are guiding the initiative, which is developing based on current faculty interests and the potential for new collaborations. The initiative aims to bring tangible benefits to its participants.

The first tasks have been focused on building a culture in which technical collaborations can thrive. Regularly held community-building sessions bring together researchers from different disciplines and help them learn to speak each other’s technical languages.



THIS III-V CHEMICAL SENSOR INCLUDES IC CONTROL CIRCUITRY, AN INP OPTICAL SOURCE, FLIP-CHIP BONDING SOLDER BUMPS, AN INP PHOTODETECTOR, AND A CANTILEVER WAVEGUIDE RESONATOR. IT IS AN EXAMPLE OF FULL SYSTEM INTEGRATION.

Courtesy Reza Ghodssi

The initiative sponsors a monthly seminar series during the academic year. There also is outreach to researchers, such as physicians, who are not currently working in the microsystems area. Common strengths and technical areas are being identified, and collaborations are already being explored to obtain proofs of concept for new ideas.

Long-term goals include increasing the visibility of the university’s microsystems strengths, enhancing student recruitment, providing a collaboration and research clearinghouse, mentoring junior faculty, creating a clean room user community, developing student peer networks, interacting more effectively with national laboratories and industry and winning major funding.

ISR STUDENT ORGANIZATION

With the exception of students earning ISR’s Master of Science in Systems Engineering degree, ISR graduate students receive their degrees from any of 14 departments within four different colleges at the university.

There has long been a need for ISR students to meet, interact and learn about each others’ disciplines, just as will be the case for them in the working world after they graduate. That’s why ISR initiated an organization for students in late 2009.

This new organization aims to provide opportunities for cross-disciplinary interaction among students. Monthly colloquia during the academic year—sponsored by Intelligent Automation, Inc.—allow students to hear research overview talks by ISR faculty members in a variety of disciplines.

This spring, ISR is renovating space in the A.V. Williams Building to provide a meeting area for the student organization.

The organization currently is led by **Konstantinos Gerasopoulos**, a Materials Science and Engineering Ph.D. student advised by ISR Director Reza Ghodssi, and **Parastoo Delgoshaei**, a Master of Science in Systems Engineering student advised by Associate Professor Mark Austin (CEE/ISR).

Gerasopoulos and Delgoshaei are active in planning events and projects for ISR students through the organization.

ISR celebrates 25th anniversary with NSF site visit, banquet, SAC meeting



ISR commemorated its 25th anniversary with a four-day series of events that assessed its past, celebrated its present and looked to its future.

NSF Site Visit

ISR hosted a site visit by the National Science Foundation from Nov. 16–18, 2010. Prior to the event, ISR faculty and staff prepared a 36-page report for NSF covering the institute's scientific achievements and impact during its 25-year history; its influence as a model for academic research; and its strategic planning, industry collaboration, technology transfer, education program, infrastructure and sustainability after graduation from the ERC program.

Talks by ISR faculty and staff included:

- "ISR Overview," ISR Director **Reza Ghodssi** (ECE/ISR)
- "ISR research and leadership from a systems research perspective: Past, present and future," Professor **John Baras** (ECE/ISR), ISR founding director 1985–1991
- "ISR education since ERC graduation," Associate Professor **Mark Austin** (CEE/ISR), director of the MS Systems Engineering program
- "Building communities of researchers," Professor **Gary Rubloff** (MSE/ISR), ISR director 1996–2001
- "ISR External Relations since ERC graduation," **Jeffrey Coriale**, ISR external relations director
- "Maryland Robotics Center," Professor **S.K. Gupta** (ME/ISR), Maryland Robotics Center director
- "Microsystems," ISR-affiliated Associate Professor **Elisabeth Smela** (ME)
- "Green Communications," Professor **Tony Ephremides** (ECE/ISR)

After the presentations, the site visit team viewed an extensive poster session featuring the work of close to 60 ISR faculty. Each poster illustrated the faculty member's most important research during their time at ISR. The team also met

privately with ISR joint-appointment faculty, department chairs and Dean **Darryll Pines** of the A. James Clark School of Engineering. At the end of the visit the NSF reviewers prepared a report and suggestions for ISR's future directions.

ISR 25th Anniversary Reception and Dinner

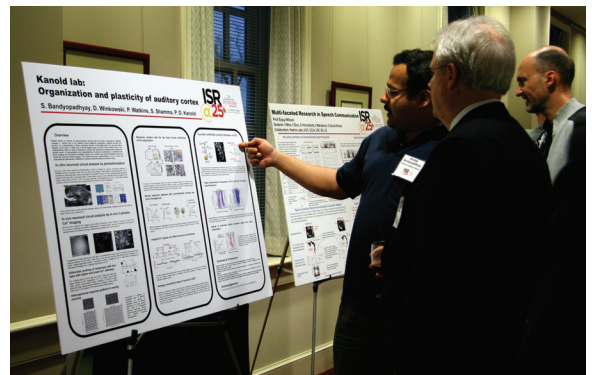
The NSF Site Visit was followed by a gala 25th anniversary dinner attended by well over 100 ISR faculty, university dignitaries, staff, the NSF review team and the ISR Strategic Advisory Council. After-dinner talks included:

- "National Science Foundation ADVANCE Program for Inclusive Excellence at the University of Maryland," Professor **Avis Cohen** (Biology/ISR)
- Keynote talk: "Flight and Targeting Characteristics of Echolocating Bats," Professor **Cynthia Moss** (Psychology/ISR)

The keynote talk was followed by a panel discussion featuring Moss; Professor **P. S. Krishnaprasad** (ECE/ISR); and Associate Professor **Timothy Horiuchi** (ECE/ISR).

Strategic Advisory Council Meeting

ISR's Strategic Advisory Council (SAC) met with ISR joint faculty and staff on the morning of Nov. 19, giving their impressions of the information presented in the NSF Site Visit and poster session. The SAC is made up of industry and academic representatives who convene on a regular basis to advise ISR on future directions. Specific advice for ISR was offered and discussed at this meeting.



TOP TO BOTTOM: NSF SITE VISIT, POSTER SESSION, 25TH ANNIVERSARY BANQUET

All photos: Rebecca Copeland

US Army RDECOM and University of Maryland sign CRADA Agreement

The University of Maryland and the U.S. Army Research, Development and Engineering Command (RDECOM) officially joined forces to expand research, development and engineering efforts by signing a Cooperative Research and Development Agreement (CRADA) on Sept. 28. The CRADA builds upon already existing working relationships with the university while increasing understanding of the transforming missions and functions of Aberdeen Proving Ground, where RDECOM is headquartered. The ceremony took place in the rotunda of the Jeong H. Kim Engineering Building.

RDECOM's vision is to be the Army's primary source for integrated research, development and engineering capabilities. Army officials said Aberdeen Proving Ground has the potential to become one of the leading science and technology centers in the nation; however, educational institutions are needed as partners working toward a mutually beneficial future.

The first statement of work, "Research and Development of Systems Engineering Models, Methods, Practices and Principles," emphasizes various types of systems that



Rebecca Copeland

Army scientists and engineers deal with, such as real-time, non-real-time, deeply embedded, stand alone and networked. Within the university, the Institute for Systems Research has a 25-year track record of cross-disciplinary research committed to developing basic solution methodologies and tools for systems problems, making it the ideal partner in this endeavor.

Dr. Darryll Pines, dean of the A. James Clark School of Engineering, was the master of ceremonies. University of Maryland Provost Nariman Farvardin gave remarks; as did RDECOM Commanding General, Major General Nick Justice; and Mr. Christian Johansson, Secretary of Maryland's Department of Business and Economic Development.

Farvardin and Justice signed the CRADA agreement, while the accompanying Statement of Work document was signed by Dr. Norma Allewell, Acting Vice President of Research, University of Maryland; and Mr. Gary Blohm, Director, Communications Electronics Research, Development, and Engineering Center. The University of Maryland Reserve Officer Training Corps served as official color guard during the ceremony.

Others in attendance included:

- Ms. Asuntha Chiang-Smith, Executive

Director of the Governor's Cabinet on BRAC;

- Dr. James Lyons, Maryland Secretary of Higher Education and Dr. John Stephenson, the Higher Education BRAC Coordinator;
- From the U.S. Army Research Laboratory, Mr. John Pellegrino, Director of the Sensors and Electron Devices Directorate; and Dr. Jay Gowens, a long-time friend of the university and Director of the Computational and Information Sciences Directorate;
- From CERDEC (the U.S. Army Communications-Electronics Research, Development, and Engineering Center) Mr. David Jimenez, the Associate Director for Systems Engineering; and Mr. Walter Lucchesi, CERDEC's Principal Investigator on the CRADA agreement;
- Dr. John Baras, the University of Maryland's Principal Investigator on the CRADA agreement;
- Dr. Reza Ghodssi, director of the Institute for Systems Research; and
- The president of the Army Alliance at the Aberdeen Proving Ground, Mr. Bernard Michel.



RDECOM COMMANDING GENERAL, MAJOR GENERAL NICK JUSTICE ADDRESSES THE AUDIENCE.

Rebecca Copeland

MSSE degree prepares students for 'best job in America'

In 2009, *Money* magazine declared systems engineer was the "Best Job in America." *Money* conducted a survey of 35,000 people about what makes a great job, and found intellectual challenge, a passion for the work, flexibility and security were the top desirables. Systems engineer, with a median salary for experienced engineers of \$87,100, top pay of \$130,000, and a forecasted job growth of 45 percent over the next 10 years, was ranked the top job.

Money said, "They're the 'big think' managers on large, complex projects, from major transportation networks to military defense programs. They figure out the technical specifications required and coordinate the efforts of lower-level engineers working on specific aspects of the project. Demand is soaring for systems engineers, as what was once a niche job in the aerospace and defense industries becomes commonplace among a diverse and expanding universe of employers, from medical device makers to corporations like Xerox and BMW. Pay can easily hit six figures for top performers, and there's ample opportunity for advancement."

ISR's Master of Science in Systems Engineering degree exposes students to a wide range of systems engineering principles and software tools tailored to support visual modeling of systems, requirements engineering, system-level modeling, optimization and trade-off analysis and human factors engineering.

Students become familiar with the financial and management issues associated with complex engineering systems while acquiring a deep understanding of one particular application area. The degree was designed with substantial industry input.

Learn more about the MSSE degree at www.isr.umd.edu/students/MSSE.htm.

ISR represents Maryland in Systems Engineering Research Center

ISR is the lead unit for the University of Maryland as a collaborator and partner in the University Affiliated Research Center (UARC) Systems Engineering Research Center (SERC).

SERC is a consortium of 20 universities, funded by the U.S. Assistant Secretary of Defense for Research and Engineering. The University of Maryland became a SERC partner and collaborator in March 2010. Professor **John Baras** (ECE/ISR) is the principal investigator for Maryland. Stevens Institute of Technology is the lead institution.

SERC leverages the research and expertise of senior researchers from collaborator universities and not-for-profit research organizations throughout the United States. SERC is unprecedented in the depth and breadth of its reach, leadership and citizenship in systems engineering.

SERC provides a critical mass of systems engineering researchers who have worked with a wide variety of domains and industries, and so are able to bring views and ideas from beyond the traditional defense industrial base. Establishing such a

community of focused researchers promises results well beyond what any one university could accomplish.

SERC provides opportunities to create new funded projects on various aspects of systems science and engineering. A good example is the current systems engineering pilot capstone course for undergraduate engineering students now being offered at 14 SERC member universities, including through ISR at the University of Maryland.

Professors Baras and **Mark Austin** (CEE/ISR), supported by a \$200,000 grant from the U.S. Assistant Secretary of Defense for Research and Engineering through SERC, recently developed the capstone pilot course ENES 489P: Hands-on Systems Engineering Projects (see box).

Last November, the University of Maryland and the Fraunhofer Institute hosted the Second Annual SERC Research Review (ASRR) at the University of Maryland. The ASRR is an annual opportunity for the SERC community to assemble, share the previous year's research activities and results, propose new research ideas and strengthen collaborative ties.

ENES 489P: HANDS-ON SYSTEMS ENGINEERING PROJECTS

This hands-on design projects course, developed with SERC funding, exposes senior-level undergraduate and graduate-level students from all areas of engineering to exciting career opportunities in the systems engineering field.

Students are introduced to the technical aspects of systems engineering through a team-based, systematic, step-by-step procedure for product development. Students work with a real-world customer to define operations concepts, requirements gathering and organization, synthesis of models of system behavior and system structure, functional allocation to create system design alternatives, formal assessment of design alternatives through trade-off analysis, and established approaches to testing and validation/verification.

The course was first offered in Fall 2010. Three product development projects were provided by the Army Research

Laboratory and Aberdeen Proving Ground:

Product 1: Black box for army transport vehicles

Product 2: Integrated security of wireless sensor networks

Product 3: Integrated vehicle bus architected for army transport vehicles

More information about the capstone course is available at www.isr.umd.edu/-austin/enes489p.html.



ISR's Cohen, Moss, Espy-Wilson key to university's new ADVANCE program

Trio also notable for research advances, honors in past year

Professors **Avis Cohen** (Biology/ISR), **Cynthia Moss** (Psychology/ISR) and **Carol Espy-Wilson** (ECE/ISR), three women professors who enjoy widespread recognition in their academic fields, are key participants in the new National Science Foundation (NSF) ADVANCE Program for Inclusive Excellence at the University of Maryland. The ADVANCE Program aims to transform the institutional culture of the University of Maryland by facilitating networks, offering individual mentoring and support, and offering information and strategic opportunities for women faculty in all areas of academia. Here's a profile of the recent accomplishments of these outstanding ISR faculty members.

Avis Cohen

In November Avis Cohen became the project director for the ADVANCE program, which is funded by a five-year, \$3.2 million NSF grant.

Cohen's systems research spans both neural and genomic systems. She concentrates on lampreys, particularly spinal cord regeneration. Cohen uses mathematical, physiological, behavioral and biomechanical studies to understand how neural output is integrated with the properties and forces of muscle, body and water to generate realistic swimming movement. One of the applications of Cohen's research is

faculty members who have demonstrated outstanding scholarly achievement and equally outstanding teaching accomplishments. Cohen is one of only four University of Maryland professors to receive the honor this year. Nominees are selected by their peers and winners are chosen by a panel of previous Scholar-Teachers. Those selected bring a passion for learning to their colleagues and students, and serve as models for faculty at a research university. Previous ISR Scholar-Teachers include Professor **K.J. Ray Liu** (ECE) 2007; Professor **Michael Fu** (Robert H. Smith School of Business/ISR), 2004; Professor **Steven Marcus** (ECE/ISR), 2000; and Professor Emeritus **Thomas McAvooy** (ChBE/BioE/ISR), 1997.

Last June, Cohen and ISR-affiliated Professor **Ralph Etienne-Cummings** (Johns Hopkins University) were featured in a segment of the CNN International television series *Earth's Frontiers*. The researchers were interviewed about their longstanding collaboration on the computer chip for

paraplegics. The chip is modeled on the lamprey spinal cord, contains a silicon analog of spinal circuits and currently is able to control a walking robot. You can view the CNN video at edition.cnn.com/video/#/video/international/2010/06/25/earths.frontiers.c.biomimicry.cnn.

In November, an article by Cohen and her colleagues Eric D. Tytell, Chia-Yu Hsub, Thelma L. Williams and Lisa J. Fauci was published in the *Proceedings of the National Academy of Sciences of the United States of America*. "Interactions Between Internal Forces, Body Stiffness, and Fluid Environment in a Neuromechanical Model of Lamprey Swimming" examined the roles of body stiffness, muscle activation and fluid environment for swimming animals, and developed a computational model of a lamprey. The research holds significant promise for the development of prosthetics that could aid people with spinal cord injuries and also has applications for robotics. Read the article online at www.pnas.org/content/early/2010/10/27/1011564107.abstract.



AVIS COHEN

a biologically inspired computer chip that could help restore leg motion to paraplegics.

In February, the university selected Cohen as a 2011–2012 Distinguished Scholar-Teacher. This program recognizes

ABOUT THE ADVANCE PROGRAM

The ADVANCE project is expanding the University of Maryland's reputation as a campus that cultivates the professional growth of women faculty members and is serving as a model for other institutions that endeavor to address similar challenges.

The program will provide new funding opportunities for women faculty members in all disciplines, create greater transparency about how career advancement decisions are made, increase the awareness and use of benefits designed to help faculty members balance work and family lives, and address the under-representation of women of color and their specific professional growth concerns.

One of the program's goals is to increase the university's representation of women faculty members in science, technology, engineering and mathematics (STEM) fields. An additional investment of funds from the university's deans and vice president for research broadens the impact beyond the STEM disciplines. The University of Maryland senior vice president for academic affairs and provost is the principal investigator for the grant. Darryll Pines, dean of the A. James Clark School of Engineering; and Kerry Ann O'Meara, associate professor of higher education in the Department of Education Leadership, Higher Education and International Education are co-PIs along with Cohen.

"This will truly be an institutional transformation," Cohen says. "We're thrilled that we'll be able to have an impact on all parts of the university with the support that we have received, and that we'll be changing the culture to make this a great institution for the excellent young women and men of today and the future."

Learn more about the ADVANCE program at www.advance.umd.edu.

Cynthia Moss

In February Professor Cynthia Moss was announced as the ADVANCE professor for the College of Behavioral and Social Sciences. Her research with echolocating bats deals with auditory information processing, spatial perception and memory; somatosensory signaling, flight control, sensorimotor integration and adaptive behaviors; and acoustical, psychophysical, perceptual, computational and neurophysiological studies that advance knowledge in systems neuroscience.

Last March, Moss won a Regents' Faculty Award for Research, Scholarship and Creative Activities. These prestigious awards are granted by the University System of Maryland's Office of Academic Affairs



CYNTHIA MOSS

to publicly recognize faculty distinguished performance. The award is the highest honor presented by the Board of Regents to faculty members throughout the entire University System of Maryland. A maximum of four awards for research, scholarship

and creative activities are given each year. Learn more about the awards at www.usmd.edu/usm/academicaffairs/regfac.txt.

Also last March, Moss won a \$200K Defense University Research Instrumentation Program award from the Air Force Office of Scientific Research to purchase a Vicon real-time optical tracking system and multichannel acquisition processor system (MAP) for studying the role of bat wing hairs in fluttering flight control. The MAP system allows Moss and her research team to follow single neurons over time, before and after epilation of the wing membrane, and also to study somatosensory signaling. The Vicon system is helping Moss collect and analyze data 100 times faster than her previous video system. It ensures that complete data sets from every trial

are available for analysis and enables more sophisticated kinematic analysis.

In October, Moss was part of a team led by ISR postdoctoral researcher **Chen Chiu** that published an article examining competition among bats in the prestigious *Journal of Experimental Biology*. The article, "Effects of competitive prey capture on flight behavior and sonar beam pattern in paired big brown bats, *Eptesicus fuscus*," explored the strategies bats use to track and catch prey—and to track each other—when they are competing with other bats. In addition to Moss and Chiu, the team included Puduru Viswanadha Reddy from Tilburg University in the Netherlands, Auditory Neuroethology Laboratory Research Assistant Wei Xian, and Professor **P. S. Krishnaprasad** (ECE/ISR). Chiu won the 2010 *Journal of Experimental Biology* Outstanding Paper Prize as the lead author of this article. Editor-in-Chief Hans Hoppeler noted, "This study is exceptional for its use of cutting-edge technology and data analysis to study a behaviorally complex situation." Download the full article at: www.usmd.edu/usm/academicaffairs/regfac.txt.

Carol Espy-Wilson

In February, Professor Carol Espy-Wilson was named the ADVANCE Professor for Women Faculty of Color in Science, Technology, Engineering, and Mathematics (STEM). Espy-Wilson's research integrates engineering, linguistics and speech science in speech communication; speech recognition based on phonetic features that addresses the limitations of present recognizers; speech production; and speech enhancement.

Espy-Wilson and her Ph.D. student Srikanth Vishnubhotla received many accolades in 2010 for the invention, "Multi-Pitch Tracking in Adverse Environments." This invention addresses background noise, a problem familiar to anyone who has used a cell phone in a public place. The novel algorithm "cleans up" speech by separating the voices of primary speakers from their noisy environments. The technology also can be used to improve sound quality in hearing aids, for military identification purposes, and in conferencing.

In April, this invention won the University of Maryland "Invention of the

Year" award in the Information Science category. In October, Espy-Wilson was honored as a 2010 Maryland Innovator of the Year by the *Maryland Daily Record*. This awards program recognizes Maryland residents and companies who have introduced innovations that have had a positive effect on their business, industry or community. Espy-Wilson was one of 25 honorees statewide.

Espy-Wilson is developing the technology as chief technology officer of her start-up company,

OmniSpeech LLC, which she founded in 2003. Last May, OmniSpeech, Espy-Wilson and Electrical and Computer Engineering Research Associate **Tarun Pruthi** won the "High Technology Category" of the Maryland Technology Enterprise Institute's 2010 University of Maryland \$75K Business Plan Competition. OmniSpeech LLC also won the grand prize in the Rockville Economic Development Inc. (REDI) StartRight! Women's Business Plan Competition in July and the 2010 \$50,000 SAIC-VentureAccelerator Competition in August.

In December, Espy-Wilson was appointed to the National Advisory Board on Medical Rehabilitation Research, which advises the National Center for Medical Rehabilitation Research, part of the Eunice Kennedy Shriver National Institute of Child Health and Human Development at the National Institutes of Health.

The center fosters the development of scientific knowledge needed to enhance the health, productivity, independence and quality of life of people with disabilities. It supports research on enhancing the functioning of people with disabilities in daily life. Learn more about the National Center for Medical Rehabilitation Research at www.nichd.nih.gov/about/org/ncmrr/.



CAROL ESPY-WILSON

John T. Consoli

Horiuchi, Humbert, Baras part of two MURIs

Three ISR faculty members are conducting research in two Multi-University Research Initiatives (MURIs) announced by the Department of Defense.

Associate Professor **Timothy Horiuchi** (ECE/ISR) and ISR-affiliated Assistant Professor **Sean Humbert** (AE) are participating in an Office of Naval Research MURI, "Animal Inspired Robust Flight with Outer and Inner Loop Strategies." Maryland's portion of the grant is \$1.48M. The lead institution for this MURI is the University of Washington, and the principal investigator is Kristi Morgansen. Besides Maryland, other institutions involved include Boston University and the University of North Carolina.

Humbert and Horiuchi's research will combine experimental biological analysis with a mathematical framework and control algorithms to develop a single-chip sonar for autonomous unmanned aircraft systems. The team is investigating the sensing, actuation and robust flight kinematics of insects. They will develop a mathematical framework for echolocation and visual motion for robust environment perception, along with control algorithms based on a multimodal sensory processing framework.

Horiuchi and Humbert will use neuromorphic VLSI techniques to develop a new single-chip sonar that will improve detection resolution in both range and azimuth.

Professor **John Baras** (ECE/ISR) is participating in an Air Force Office of Scientific Research (AFOSR) MURI, "Multi-Layers and Multi-Resolution Networks of Interacting Agents in Adversarial Environments." Maryland's portion of this grant is \$700K. The lead institution for this MURI is the University of Illinois, Urbana-Champaign, and the principal investigator is Tamer Basar. In addition to Maryland, other institutions involved include Stanford University and the University of California, Berkeley.

Baras's portion of the grant is to develop systematic methods for multi-agent and networked control, which will further the idea of rapidly-mobile, multi-vehicle, unmanned aerial vehicle networks that can provide situational awareness on both tactical and strategic scales. The research will provide a more sophisticated view of agent interactions and the information available to agents. In particular, the research will use multi-layer, multi-resolution game and team theory, as well as experimental game theory, to address fundamental issues that arise in networked heterogeneous agents.

Aloimonos awarded NSF grant for robot vision

ISR-affiliated Professor **Yiannis Aloimonos** has been awarded a three-year, \$550K NSF Cyber-Physical Systems Methods and Tools grant for "Robots with Vision that Find Objects." This research will develop methods and software that allow robots to detect and localize objects using active vision and to develop descriptions of their visual appearance in terms of shape primitives. The approach is bio-inspired. The robot will actively search using an attention mechanism with filters tuned to the appearance of objects. Then the robot will use an anthropomorphic segmentation mechanism to fixate at a point within the attended area and segment the surface, using contours and depth information from motion and stereo. Finally, a description of the segmented

object will be developed, using the contours of its visible surfaces and a qualitative description of its 3D shape.

The approach defines, for the first time, the meeting point where perception happens. Adding top-down attention and segmentation capabilities to robots that can navigate and manipulate will enable many technologies. Some of these include household robots or assistive robots to help care for the elderly, or robots in manufacturing, space exploration and education.

Ulukus is PI for two NSF wireless networks grants

Associate Professor **Sennur Ulukus** (ECE/ISR) is the principal investigator for "Interactive Security," a four-year, \$1.1 million National Science Foundation (NSF) grant for wireless security research. This is a joint grant with Aylin Yener of Penn State University and Kannan Ramchandran of the University of California, Berkeley.

The research aims to secure wireless communication channels in the physical layer using techniques from information theory, communication theory and signal processing. Conventional approaches to information security are designed for wired networks with assumptions that lead to a disassociation from the physical medium in which communication takes place.

This research will develop a new way for wireless networks to deliver provable, unconditional security. The investigators account for untapped and rich resources naturally provided by wireless systems, including sources with correlated observations or application content, channels that provide spatial and temporal diversity, network nodes that are helpers or relays providing interaction, and broadcast and bidirectional features that enable communication with feedback.

Ulukus also has been awarded a National Science Foundation (NSF) grant for "Rechargeable Networks." The four-year, \$900,000 award is a joint grant with Roy Yates of Rutgers University and Aylin Yener of Penn State University. The project examines wireless communication networks whose nodes have batteries that recharge

ISR HIGHLIGHTED IN E@M, RESEARCH@MARYLAND

ISR was featured in the October 2010 issue of *Research@Maryland*, published by the University of Maryland's Office of the Vice President for Research. The front-page story talks about ISR's 25-year history of cutting-edge systems research, the November visit by the National Science Foundation, and the research directions ISR is pursuing in the future. View a PDF version of *Research@Maryland* at www.isr.umd.edu/news/misc_pubs/researchOct2010.pdf.

ISR and robotics research are featured in the spring 2011 issue of *E@M* magazine, published by the A. James Clark School of Engineering. For a copy of *E@M*, contact Rebecca Copeland at rebeccac@umd.edu.

by harvesting energy from the environment. It applies analytical models for battery recharging to evaluate fundamental multiple access, broadcast and relay network models composed of rechargeable nodes. This will result in an enhanced understanding of the analytic fundamentals of rechargeable networks, and will contribute to developing and deploying ecologically-friendly rechargeable networks.

Krishnaprasad collaborating on collective behavior grant

A new four-year collaborative project, devoted to the investigation of principles and algorithms that underlie purposeful collective behavior in natural and engineered systems, was initiated in 2010. It is an AFOSR-supported joint effort involving **P. S. Krishnaprasad** (ECE/ISR) and Andrea Cavagna of the Institute for Complex Systems of the Italian National Research Council.

Building on their separate prior contributions, Krishnaprasad and Cavagna have launched an intense program of research in natural flocks and swarms of birds and insects. The research is aimed at discerning the underlying principles and working out models and algorithms to create quantitative support for them. The goal is to design, implement and verify robust, distributed, cooperative, survivable control systems for swarms of autonomous robots.

A variety of tools from geometric and optimal control theory, statistical physics, graph theory and large-scale data analysis coupled with empirical observations, are being used.

Baras is co-PI on NSF Cyber-Physical Systems grant

Professor **John Baras** (ECE/ISR) is a co-PI on a National Science Foundation (NSF) grant award from the Cyber-Physical-Systems (CPS) program in the large category, "Science of Integration for Cyber-Physical Systems." The five year, \$4.99M grant is a collaborative effort among Vanderbilt University (lead institution), the University of Notre Dame

and the University of Maryland. In addition, General Motors Corp. is a partner and direct participant. The University of Maryland portion of the grant is \$1.2M. Professor Janos Sztipanovits of Vanderbilt University is the principal investigator. Along with Baras, co-PIs include Panos Antsaklis (Notre Dame), Xenofon Koutsoukos (Vanderbilt) and Shige Wang (General Motors).

The project will develop a new Science of Integration for Cyber Physical Systems (CPS). This new science re-examines the fundamentals of composition in heterogeneous systems, develops foundations and tools for system integration and validates the results in experiments using automotive and avionics system-of-systems experimental platforms. The proposed new integration science represents a major departure from the current discipline-oriented, compartmentalized systems design. Building on a rigorous theory, it will develop foundations, methods and tools for achieving constructivity and predictability in CPS integration.

Shamma, Baras awarded MIPS grants

Two ISR faculty members are working with local companies on projects through the Maryland Industrial Partnerships (MIPS) grants competition. The funding is part of Round 47 of MIPS awards, which total \$3.7 million divided among 16 teams of Maryland companies and faculty developing commercially promising technology products. Funding supports research in the laboratories of participating university faculty, who work closely with partner companies to advance their products. MIPS is an initiative of the Maryland Technology Enterprise Institute (Mtech) at the University of Maryland.

Professor **John Baras** (ECE/ISR) is working with Frederick, Md.-based Ceron Networks on research funded by a \$268,600 MIPS grant. The team will develop a broadband Internet-via-satellite system with two-way performance that approaches terrestrial Internet connections. The system will cut costs for providers and can be retrofitted to existing systems. Baras and Ceron

also worked together on a MIPS grant in Round 46 of the awards.

Professor **Shihab Shamma** (ECE/ISR) is working with College Park-based OmniSpeech LLC on research funded by a \$135,000 MIPS grant. The research will improve the performance of software that separates speech from background noise for clear cellular and other communications.

Moss, Horiuchi receive NSF CRCN Adaptive perceptual-motor feedback grant

Professor **Cynthia Moss** (Psych/ISR) is the principal investigator and Associate Professor **Timothy Horiuchi** (ECE/ISR) is the co-PI for a new National Science Foundation Collaborative Research in Computational Neuroscience grant, "Adaptive perceptual-motor feedback for the analysis of complex scenes."

The five-year, \$1.5 million grant will fund research to understand the processes that support perception and action in complex settings. The research will focus on spatial perception and navigation in the echolocating bat, an auditory specialist that produces high frequency sonar calls and listens to echo returns to determine the location of objects in its environment. The echolocating bat modifies its sonar calls in response to echo information from targets (insect prey) and obstacles. Quantitative analyses of this animal's adaptive vocal behavior will be used to infer its perception of a changing environment.

Qu, Wu win AFOSR grant for information hiding

Associate Professor **Gang Qu** (ECE/ISR) and ISR-affiliated Associate Professor **Min Wu** (ECE/UMIACS) have received a grant from the Air Force Office of Scientific Research for information hiding based trusted computing system design. Qu is principal investigator and Wu is co-PI for this 3-year, \$450K effort that aims at enhancing the trust in systems designed and implemented by untrusted parties.

Fellows



BEN SHNEIDERMAN

ISR-affiliated Professor **Ben Shneiderman** (CS/UMIACS) was recently inducted into the National Academy of Engineering (NAE). Shneiderman was selected for his research, software development and scholarly texts on human-computer

interaction and information visualization. The NAE has more than 2,000 peer-elected members and foreign associates. These are senior professionals in business, academia and government who are among the world's most accomplished engineers. They provide leadership and expertise for numerous academy projects focused on the interconnection of engineering, technology and quality of life.



MIN WU

ISR-affiliated Associate Professor **Min Wu** (ECE/UMIACS) has been elected a fellow of the Institute of Electrical & Electronic Engineers. She was recognized for "significant contributions to multimedia security and forensics."

Invention of the Year

Professor **Gary Rubloff** (MSE/ISR) won the Physical Science category of the University of Maryland's 2010 Invention of the Year awards, along with Associate Professor **Sang Bok Lee** (ChBi) and Rubloff's Ph.D. student **Parag Banerjee**. The winning invention is "Nano Arrays for Energy Storage," a high-density energy storage solution for vehicle and electronic device batteries. The arrays have a capacity 10 times higher than available products

and can be produced using inexpensive materials. Rubloff and Lee plan to start a company to bring the nano arrays to market. In 2007, Rubloff was a finalist in this same category for "Lateral Two-Terminal Nanotube Device and Method for their Formation." The invention enhances the efficiency of energy capture, storage and delivery.

Professor **Carol Espy-Wilson** (ECE/ISR) won the information science category for her invention, "Multi-Pitch Tracking in Adverse Environments" (see page 9).

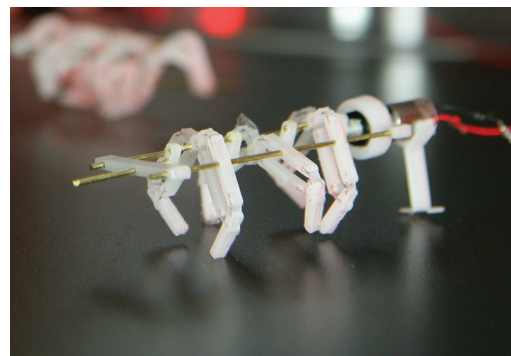
In addition, ISR-affiliated Assistant Professor **Miao Yu** (ME), **Hyungdae Bae** and **Xuming Zhang** were finalists for "Surface Mountable Ultra-Miniature Fiber-Optic Pressure Sensor." This is a unique fiber-optic fabrication technique for the production of smaller, more sensitive pressure sensors. Such sensors are used for space-constrained medical diagnostics and for acoustic sensing.

The awards are presented annually by the University of Maryland Office of Technology Commercialization to honor outstanding inventions and inventors from the previous year. Each year a panel of University of Maryland and industry judges selects a winner in each of three categories: life science, information science and physical science. Winners are chosen based on the creativity, novelty and potential benefit to society of each of the inventions.

Early career awards

Assistant Professor **Sarah Bergbreiter** (ME/ISR) is the recipient of a 2011 National Science Foundation Faculty Early Career Development (CAREER) Award for "Microrobot Legs for Fast Locomotion over Rough Terrain." Bergbreiter will create legs that will enable microrobots to walk and run over rough terrain. She will model viscoelastic microrobot legs in a dynamic simulation environment and experimentally validate the models using a new microfabrication process that includes viscoelastic materials.

This work will lead to the first sub-centimeter robots that can move quickly over complex surfaces, in addition to a wealth of data that will enhance understanding of insect locomotion. Microrobots that move through real-world environments



THE "CRAB-BOT" IS AN EARLY MICROROBOT WITH LEGS DEVELOPED IN BERGBREITER'S LAB.

John T. Consoli

at insect-like speeds can search through small cracks in rubble after natural disasters, provide low-cost sensor deployment over civil infrastructure and engage in stealth surveillance. In addition, robust, viscoelastic mechanisms similar to these legs can provide breakthroughs in applications such as minimally invasive surgery and micromanufacturing.

ISR-affiliated Assistant Professor **Derek Paley** (AE) won a 2010 NSF CAREER Award for "Dynamics and Control of Motion Coordination for Information Transmission in Groups." Paley is studying information transmission in biological groups (like schools of fish) and applying the same principles to design motion coordination strategies for autonomous vehicles.

The NSF CAREER program fosters the career development of outstanding junior faculty, combining research support and education of the highest quality and in the broadest sense.

The Alfred P. Sloan Foundation named ISR-affiliated Assistant Professor **Patrick Kanold** (Biology) a Sloan Research Fellow in 2010. He was the only person in Maryland to be so honored. The Sloan Research Fellowships stimulate fundamental research by early-career scientists and scholars of outstanding promise. The two-year fellowships are awarded annually to 118 researchers in recognition of distinguished performance and a unique potential to make substantial contributions to their field.

The Alfred P. Sloan Foundation is a philanthropic, not-for-profit grantmaking institution based in New York City.

Established in 1934 by Alfred Pritchard Sloan Jr., then-president and chief executive officer of General Motors, the foundation makes grants in support of original research and education in science, technology, engineering, mathematics and economic performance.

Outstanding paper awards

Professor **S. Raghavan** (BGMT/ISR) was awarded the 2010 Management Science Strategic Innovation Prize by the European Association of Operational Research Societies (EURO). The award was for a paper jointly authored with his former student **Ioannis Gamvros** (now at IBM), "Multi-Period Traffic Routing in Satellite Networks." It was presented at EURO's annual conference in Lisbon, Portugal, in July. This is one of EURO's major awards. The paper deals with a strategic multi-period demand routing problem in satellite networks that has strong implications for revenue management.

Assistant Professor **Nuno Martins** (ECE/ISR) won the 2010 George Axelby Outstanding Paper Award from the IEEE Control Systems Society. Martins shares this award with Munther Dahleh of MIT for their jointly authored paper, "Feedback Control in the Presence of Noisy Channels: Bode-Like Fundamental Limitations of Performance." This prestigious award is given annually to the best paper published in *IEEE Transactions on Automatic Control*. The award was presented at the 49th IEEE Conference on Decision and Control in December.

"Integrated Silicon-PDMS Process for Microrobot Mechanisms," a paper written by Assistant Professor **Sarah Bergbreiter** (ME/ISR) and her students **Aaron P. Gerratt** and **Ivan Penskiy**, won the Best Conference Paper Award at the 2010 IEEE International Conference on Robotics and Automation in Anchorage, Alaska.

Professor **S.K. Gupta** (ME/ISR) and four of his colleagues won the Best Paper Award in the compliant mechanism category at the 34th ASME Mechanism and Robotics Conference. "Design and Fabrication of a Multi-Material Compliant Flapping Wing Drive Mechanism for Miniature Air Vehicles" details design and fabrication methods for creating a multi-material compliant mechanism to realize a micro air vehicle (MAV) drive. Gupta's co-authors are his Ph.D. student **Wojciech Bejgerowski**; his former student and recent M.S. graduate **John Gerdes** (now at the Army Research Laboratory); Professor **Hugh Bruck** (ME); and **Stephen Wilkerson** of the Army Research Laboratory. The mechanism described in the paper was implemented in a successfully flying MAV prototype, and the methods described by the paper are applicable to any light-weight, load-bearing compliant mechanism manufactured using multi-material injection molding.

facultyNEWS

Publications of note

ISR neuroscience researchers had two articles published in *Nature Neuroscience* in 2010.

Professor **Shihab Shamma** (ECE/ISR), ISR-affiliated Assistant Professor **Patrick Kanold** (Biology) and ISR Assistant Research Scientist **Sharba Bandyopadhyay** published a complex picture of auditory cortex neuronal activity in the Jan. 31, 2010 edition of *Nature Neuroscience*. Their findings are the first study of the auditory cortex conducted using the advanced imaging technique, "in vivo 2-photon calcium imaging." The technique provides an unprecedented amount of detail about the way hearing occurs, and the findings suggest that the brain is far more adaptable than previously thought. "These results may rewrite our classical views of how cortical circuits are organized and what functions they serve," Shamma

says. View the full article at the *Nature Neuroscience* website: www.nature.com/neuro/journal/vaop/ncurrent/full/nn.2490.html.

ISR Associate Research Scientist **Jonathan Fritz** was the lead author of an article on adaptive, behaviorally-gated, persistent encoding of task-relevant auditory information in the frontal cortex, published in *Nature Neuroscience*'s July 11, 2010 issue. Fritz's co-authors are Professor **Shihab Shamma** (ECE/ISR), **Stephen David**, **Susanna Radtke-Schuller** and **Pingbo Yin**. David and Yin are ISR postdoctoral researchers, while Radtke-Schuller is a German neuroanatomist at the Ludwig-Maximilians University, Munich. The researchers found the frontal cortex exerts dynamic and selective control over sensory filters in the primary auditory cortex of the brain during auditory behavior. This corroborates the view that the primary frontal cortex is the source of top-down modulatory influence on other brain areas, particularly sensory cortices, in enabling behavioral goals. View the full article at

www.nature.com/neuro/journal/vaop/ncurrent/full/nn.2598.html.

A team led by ISR postdoctoral researcher **Chen Chiu** published an article examining competition among bats in the October 2010 issue of the prestigious *Journal of Experimental Biology*. "Effects of competitive prey capture on flight behavior and sonar beam pattern in paired big brown bats, *Eptesicus fuscus*" explores the strategies bats use to track and catch prey—and to track each other—when they are competing with other bats. Surprisingly, one of the findings was that as bats chase each other and perform maneuvers to gain advantage, a bat trailing another actually has the competitive advantage in capturing the prey. In addition to the lead author Chiu, the team included **Puduru Viswanadha Reddy** from the Department of Econometrics and Operations Research at Tilburg University in the Netherlands, Auditory Neuroethology Laboratory Research Assistant **Wei Xian**, Professor **P. S.**

Krishnaprasad (ECE/ISR) and Professor **Cynthia Moss** (Psych/ISR).

Chiu and the article later won the journal's 2010 Outstanding Paper Prize, given to encourage young scientists. The prize is awarded to the young scientist who made the greatest contribution to the winning paper. *JEB* Editor-in-Chief Hans Hoppeler noted, "This study is exceptional for its use of cutting-edge technology and data analysis to study a behaviorally complex situation."

Download the article at the *Journal of Experimental Biology* website: jeb.biologists.org/cgi/reprint/213/19/ii.

Books



The Control Handbook, a reference set edited by ISR-affiliated Professor **William Levine** (ECE), is now available in a three-volume second edition. The handbook covers control system fundamentals, applications and advanced methods. Published by CRC Press, the book's first edition was the Association of American Publishers' best engineering handbook of 1996. Levine has updated, reorganized and expanded the comprehensive resource. Learn more at: www.crcpress.com/product/isbn/9781420073607;jsessionid=d4PVmiVdkz3MLkFH0hEdJQ**.

The new *MEMS Materials and Processes Handbook* has just been released. The comprehensive and practical volume

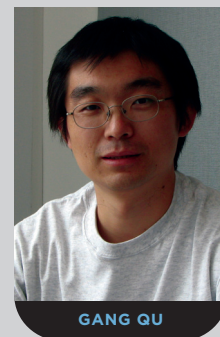
is co-edited by ISR Director **Reza Ghodssi** (ECE/ISR) and **Pinyen Lin**, Chief Technologist and Vice President of Business Development, Touch Micro-System Technology Corp., Taiwan. Micro-electromechanical Systems (MEMS) is a diverse and multidisciplinary area of research that offers a vast set of challenges relative to typical integrated circuit fabrication and design. This comprehensive MEMS-focused reference book is an important asset for current and future research scientists and engineers. It provides the reader with the basics of MEMS materials and processes, and also gives practical insight into the workings and standard procedures carried out in research labs and production facilities on a daily basis. It is the sixth book in the Springer MEMS Reference Shelf series devoted to MEMS and nanotechnology. Learn more at www.springer.com/978-0-387-47316-1.

Professor **John S. Baras** (ECE/ISR) and alumnus **George Theodorakopoulos** (ECE/ISR), a senior researcher at the École Polytechnique Fédérale de Lausanne (EPFL), have written the monograph *Path Problems in Networks*. It provides a modern view on the algebraic path problem, which is a generalization of the shortest path problem in graphs. This book will help current and future researchers add this powerful tool to their arsenal. It is part of Morgan & Claypool's Synthesis Lectures on Communication Networks, an ongoing series of publications on topics related to the design, implementation and management of communication networks. Learn more at: www.amazon.com/Problems-Networks-Synthesis-Lectures-Communication/dp/1598299239/ref=sr_1_3?ie=UTF8&s=b00ks&qid=1273541020&sr=1-3.

Baras also is co-editor, along with Tansu Alpcan and Levente Buttyán, of Springer's *Decision and Game Theory for Security*, part of its Lecture Notes in Computer Science/Security and Cryptology Series. The book gathers the refereed proceedings of the First International Conference on Decision and Game Theory for Security (2010). The papers focus on analytical models based on game, information, communication, optimization, decision and control theories that are applied to diverse security topics. The book

is organized into sections on security investments and planning, privacy and anonymity, adversarial and robust control, network security and botnets, authorization and authentication, and theory and algorithms for security. Learn more at www.springerlink.com/content/2523105t4nj6knrg/.

New faculty



aided synthesis and sensor networks.

Associate Professor **Gang Qu** (ECE/ISR) is a new ISR joint appointment faculty member interested in VLSI intellectual property reuse and protection, low power system design, applied cryptography, computer-



Raj Madhavan has been appointed to the ISR faculty as an Assistant Research Scientist. Madhavan also is a guest researcher with the Intelligent Systems Division of the Manufacturing Engineering

Laboratory at the National Institute of Standards and Technology (NIST). Madhavan's research interests are in unmanned ground vehicle navigation in unstructured and dynamic environments; performance evaluation, benchmarking, standardization issues and standards-defining activities in mobile robotics navigation and mapping. Over the last decade, he has contributed to various topics in field robotics, systems and control theory.



Associate Professor **Jaydev Desai** (ME) has joined ISR as an affiliate faculty member. His research interests are in medical robotics, haptic interfaces for robot-assisted surgery, surgical simulation, model-based teleoperation and cellular

surgery. Along with S.K. Gupta and others, Desai invented the minimally invasive neurosurgical intracranial robot, which won the University of Maryland's Invention of the Year award in 2007. Desai is part of the Maryland Robotics Center within ISR.



SEAN HUMBERT

Assistant Professor **Sean Humbert** (AE) also has joined ISR as an affiliate faculty member. Humbert has research interests in flight dynamics and control, bio-inspired sensing, estimation, locomotion and autonomous robotics. Humbert is the director of the Autonomous Vehicle Laboratory, which develops biologically inspired autonomous robotic vehicles. He is part of the Maryland Robotics Center.



BRUCE JACOB

Associate Professor **Bruce Jacob** (ECE) is an affiliate faculty member interested in memory systems, embedded systems, circuit integrity and memory management. Recently Jacob has been in the news for his COIL electric guitar. The guitar's

unique electronics—pickups, circuit boards and switch configurations—expand the range of sounds the instrument can produce without time-consuming rewiring.



DEREK PALEY

Assistant Professor **Derek Paley** (AE) has joined ISR as an affiliate faculty member. He conducts research into nonlinear dynamics and controls, cooperative control of autonomous vehicles, autonomous underwater vehicles

and modeling of animal aggregations. His Synthetic Collective Unmanned Underwater Laboratory project is a modeling, simulation and prototyped framework

for cooperative unmanned underwater vehicle behavior. Paley is part of the new Maryland Robotics Center.



John T. Consoli

ELISABETH SMELA

organic materials (from polymers to cells) in microsystems to realize microactuators, cell-based sensors and CMOS/MEMS integrated systems. In recent years she has frequently collaborated with ISR faculty members Pamela Abshire and Ben Shapiro in these areas. Smela heads the Laboratory for Microtechnologies. She is one of the leaders of ISR's microsystems initiative and part of the new Maryland Robotics Center.

Patents

Associate Professor **Mark Austin** (CEE/ISR); former ISR Faculty Research Assistant **Natalya Shmunis**; ISR alumnus **Vimal Mayank** (MSSE 2003), now at Wachovia Corp.; and **David Everett**, a senior system engineer at NASA Goddard Space Flight Center; are co-inventors of U.S. Patent 7,877,737, "tree-to-graph folding procedure for systems engineering requirements." The patent was issued on Jan. 25, 2011, and is a method for generating a graph data representation with a plurality of nodes corresponding to respective systems engineering requirements.

Professor **John Baras** (ECE/ISR) and his former student **Xiaoming Zhou** (ECE Ph.D. 2004) are co-inventors of U.S. Patent 7,827,459, "Communications Protocol." The patent was issued on Nov. 2, 2010. The invention is an improved telecommunications protocol for networks having relatively long propagation times. The protocol increases the efficiency of transmission in return channels on a multi-channel slotted Aloha system by incorporating advanced error correction algorithms, selec-

tive retransmission protocols and the use of reserved channels to satisfy the retransmission requests.

ISR-affiliated Associate Professor **Min Wu** (ECE/UMIACS), **Ashwin Swaminathan** and **Yinian Mao** are co-inventors of U.S. Patent 7,840,789, "Data Hiding in Compiled Program Binaries for Supplementing Computer Functionality." The patent was issued on Nov. 23, 2010. In the invention, bit reductions in program instructions are achieved by determining the set of bit patterns in bit locations of the instructions. If only a subset of bit patterns is present in the instructions, they may be represented by an index value having a smaller number of bits.

You can view information on ISR patents on our online patents page: www.isr.umd.edu/research/patents.htm.

NEW ONLINE FROM ISR

ISR's video site allows you to watch videos of colloquia, distinguished lectures, robotics and microsystems seminars and more. We have uploaded close to 150 videos of ISR faculty and guest lecturers from the past decade at vimeo.com/isr/videos/. Stop by, browse the many topics and watch or listen to the talks!

You can follow ISR on Facebook and Twitter. We post notices of most ISR news stories to these social media outlets. To friend us on Facebook, go to www.facebook.com/ISRUMD. Follow us on Twitter at [#Inst4SystemsRes](https://twitter.com/Inst4SystemsRes).

ISR's Maryland Robotics Center has an informative web site that details the University of Maryland's robotics faculty, research projects and laboratories. It also contains exciting videos of robots in action. Visit robotics.umd.edu.

Find out what ISR alumni are up to on our alumni news page, www.isr.umd.edu/news/news_search_alumni.php.

Access 25 years of ISR Technical Reports at drum.lib.umd.edu/handle/1903/4375.

Read back issues of the **Systems Solutions** newsletter at www.isr.umd.edu/news/newsletter.htm.

IAI, Techno-Sciences sponsor colloquia and seminar series

Two ISR industrial partners are sponsoring monthly colloquia and seminar series at ISR.



INTELLIGENT AUTOMATION INC. PRESIDENT VIKRAM MANIKONDA (LEFT FOREGROUND) ATTENDS THE FIRST IAI COLLOQUIA OF THE SPRING 2011 SEMESTER. TO HIS RIGHT IS PROFESSOR P. S. KRISHNAPRASAD (ECE/ISR), WHO WAS MANIKONDA'S PH.D. ADVISOR.

Intelligent Automation, Inc. (IAI) is providing financial sponsorship for ISR's monthly colloquia series, the "Intelligent Automation, Inc. Colloquia Series at the Institute for Systems Research."

Vikram Manikonda

is IAI's president and a member of the ISR Strategic Advisory Council. He earned a Ph.D. in Electrical Engineering at the University of Maryland in 1997, advised by Professor **P. S. Krishnaprasad** (ECE/ISR). ISR thanks Manikonda and IAI for this generous sponsorship, which makes the continuation of our community-building colloquia series possible.



TECHNO-SCIENCES' JEAN-LUC ABAZIOU TALKS ABOUT HIS COMPANY AND ITS INTEREST IN ROBOTICS AT THE FIRST TECHNO-SCIENCES INC. ROBOTICS SEMINAR OF 2011.

Techno-Sciences, Inc. is providing financial sponsorship for the Maryland Robotics Center's seminar series, the "Techno-Sciences, Inc. Robotics Seminar Series." This series

showcases the latest advances in robotics and also familiarizes visiting robotics experts with the center's activities and capabilities. **Jean-Luc Abaziou** of Techno-Sciences was on hand for the first seminar of the semester on January 28. The Maryland Robotics Center thanks Techno-Sciences for this generous sponsorship, which makes the continuation of this community-building colloquia series possible.

ISR's international collaborations

ISR has formal agreements and collaborates with a range of international research organizations. Projects include a bidirectional exchange of researchers, co-writing technical papers, teaming for joint research funding, bidirectional lecture and workshop visits and jointly organized workshops. Additional international collaborations are in development at this time. The current list of partners is available at: www.isr.umd.edu/industry/international.htm.

INTERNATIONAL RESEARCH PARTNERS

- Institute of Information Transmission Problems, Russian Academy of Sciences
- Centre for Wireless Communications, University of Oulu, Finland
- University of South Australia, Australia
- IMEC, Belgium (nanoelectronics)
- School of Computer and Communication Sciences, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland
- Verimag Laboratory, France (embedded systems)
- Politecnico di Milano (University of Milan), Italy
- The Royal Institute of Technology, Stockholm (KTH), Sweden
- Institute of Computer Science, FORTH (Foundation of Research & Technology, Hellas), Greece
- École Supérieure d'Électricité (Supélec), France (electric energy and information science)
- Baghdad University, Iraq
- Alexandria University, Egypt

OPPORTUNITIES FOR WORKING WITH ISR

ISR offers a one-stop gateway for working with the University of Maryland and mutually beneficial partnership opportunities. Some of these include:

Strategic partners. ISR's industrial affiliates program with three levels of membership.

Research collaborations. Visiting scientists program, industry-sponsored research, intellectual property licensing, teaming to win agency-sponsored programs, Maryland Industrial Partnerships for local, small and start-up companies.

ISR students and postdocs. Permanent hires, internships, graduate student fellowships, postdoctoral researcher sponsorship.

Gifts to ISR. Endowments of chairs, fellowships, scholarships; gifts of cash, hardware and software; lab sponsorships.

Other opportunities. Systems engineering courses, workshops and events, international research agreements.

To learn more, contact Jeff Coriale, ISR director of external relations, 301-405-6604, coriale@umd.edu. Download our partnership opportunities brochure at: www.isr.umd.edu/industry/industry_brochure.pdf.



ISR's Visiting Scientist Program

Ryuichi Teramoto, a researcher at Toshiba Corp.'s Corporate Manufacturing Engineering Center in Yokohama, Japan, was ISR's most recent Visiting Scientist, spending a year with us from September 2009 to September 2010. While here, Teramoto conducted research on accelerated stress testing of electronics with Professor Abhijit Dasgupta (ME).



ISR's friend and former Visiting Scientist **Takeo "Tax" Yokoyama**, in the motor sports development division of Honda R&D Co. in Saitama, Japan, writes:

"More than seven years have passed since I was in Maryland and during these seven years I've been in the motorcycle racing industry, in which I've been required to communicate in English with professional riders, mechanics, engineers, guests and many other people. I don't believe I could have achieved the same level without learning English and Western culture in Maryland.

"In world class racing, it's so important to understand the variety of cultures, working styles and thought because you're working with the best skilled people from all over the world. The biggest contribution of the Visiting Scientist Program is to invest and

educate engineers into those capable of doing so. Here is a picture of how I've been working in the racing. It is from the podium of MotoGP in the Italian Grand Prix. This year I will once again travel all over the world for MotoGP races and two of them will be in the US: Laguna Seca, Calif. in July, and Indianapolis in August."

About ISR's Visiting Scientist Program

Visiting scientists and their companies directly benefit from education, training and research opportunities at ISR. They are integrated into ISR research teams, developing their knowledge and skills, which brings them to the forefront of technology and research. The program provides a natural vehicle for:

- Close collaboration with ISR faculty and students
- Education in systems engineering, allied sciences and business practices
- Knowledge transfer between systems methodologies and applications
- Training in state-of-the-art tools, including those based on ISR research

Learn more about the program at ISR's website: www.isr.umd.edu/industry/VSP.htm.

Sikorsky renews as strategic partner for third year

Sikorsky Aircraft Corporation has renewed its membership in ISR's Strategic Partners Program for a third year. Sikorsky is a world leader in the design, manufacture and service of military and commercial helicopters; fixed-wing aircraft; spare parts and maintenance, repair and overhaul services for helicopters and fixed-wing aircraft; and civil helicopter operations. Sikorsky collaborates with Professor **André Tits** (ECE/ISR) to research advanced algorithms for rotorcraft control. Alumnus **Vineet Sahasrabudhe** (Aerospace Engineering Ph.D. 1996), who was co-advised by Dr. Tits and Professor Roberto Celi (AE), is Sikorsky's technical lead. "I have enjoyed collaborating with Sikorsky on a problem of mutual interest, and believe we are developing a solution which will be of significant value to Sikorsky," Dr. Tits said.

Strategic Advisory Council provides guidance to ISR

ISR's Strategic Advisory Council (SAC) provides us with evaluation and guidance on our research directions, educational programs and management. This valuable group helps ISR deliver strategic benefits to our external partners in industry, government and academia.

The SAC brings a unique external perspective that provides ISR with guidance and constructive criticism. It also brings to ISR's attention current and future systems engineering challenges faced by industry, government and society.

The SAC is composed of talented international leaders from industry, academia and government labs who have expertise in ISR's specific research fields. The SAC advises ISR throughout the year on specific topics and gathers for an annual meeting.

ISR STRATEGIC COUNCIL MEMBERS

Dr. Frances Ligler, Naval Research Laboratory

Dr. Paul Houpt, GE Global Research

Dr. Herc Neves, IMEC, Belgium

Dr. Albert Benveniste, IRISA/INRIA, France

Dr. Randall Smith, Northrop Grumman Undersea Systems

Dr. Rajiv Laroia, QUALCOMM Flarion Technologies

Dr. Peter Hartwell, Hewlett-Packard Labs

Dr. Vijay Srinivasan, National Institute of Standards and Technology

Mr. Satoshi Sumida, Toshiba, Japan

Dr. Vikram Manikonda, Intelligent Automation, Inc.

Dr. Arnie Greenland, IBM Global Business Services

Dr. Juan Garay, AT&T Labs

Dr. Sanford Friedenthal, Lockheed Martin

Dr. Lennart Ljung, Linköping University, Sweden

Ion Matei (2010 EE Ph.D.) has begun a postdoctoral fellowship with the National Institute of Standards and Technology (NIST) in Gaithersburg, Md. He is working in the newly created system engineering group in NIST's Engineering Laboratory, focusing on applying model-based systems engineering techniques in manufacturing. Matei was advised by Professor John Baras (ECE/ISR). Matei's postdoctoral fellowship is funded through the NIST American Recovery and Reinvestment Act Measurement Science and Engineering Fellowship Program. The program is managed by Institute for Research in Electronics and Applied Physics Director Daniel Lathrop, and Robert Briber, chair of the Materials Science and Engineering Department.

Hamid Jafarkhani (1997 EE Ph.D.) was recently elected as a fellow of the American Association for the Advancement of Science in the Section on Information, Computing, and Communication. He also was recently named the Conexant-Broadcom Endowed Chair at the University of California, Irvine, where he has been on the faculty since 2001. He recently was named director of the Center for Pervasive Communications and Computing, after serving as deputy director for several years. At Maryland, Jafarkhani was advised by former University of Maryland Provost Nariman Farvardin (ECE/ISR).

Xiaobo Tan (2002 EE Ph.D.) received Michigan State University's Teacher-Scholar Award. The university-wide award is given to faculty who early in their careers have earned the respect of students and colleagues for their devotion to and skill in teaching and who have shown scholarly promise. Tan was one of only six faculty at MSU to receive the award in 2010. Tan's advisors at Maryland were Professor John Baras (ECE/ISR) and Professor P. S. Krishnaprasad (ECE/ISR). Tan also was promoted to Associate Professor with tenure in 2010. He has been a faculty member in MSU's Department of Electrical and Computer Engineering since 2004.

Weifeng Su, an assistant professor of electrical engineering at the State University

of New York, Buffalo and a former postdoctoral researcher in Professor K. J. Ray Liu's (ECE) research group, won a best paper award from the IEEE International Conference on Communications. "The Outage Probability and Optimum Power Assignment for Differential Amplify-and-Forward Relaying" was co-written by SUNY-Buffalo researchers Fuyu Chen and Dimitris A. Pados, and John D. Matyas of the Air Force Research Laboratory.

Zhu Han (2003 EE Ph.D.), Assistant Professor of Electrical and Computer Engineering at the University of Houston, has won an NSF CAREER Award for "Mutual Benefit in Cognitive Radio Networks: A Coalitional Game Framework." Cognitive radio is a revolutionary wireless communication paradigm in which cognitive (secondary) users are able to observe, learn, optimize and intelligently adapt for spectrum utilization without interfering with traditionally licensed (primary) users. Han will improve cognitive radio network performance through a game theory perspective. Han was advised by Professor K.J. Ray Liu.

Yan Lindsay Sun (2004 EE Ph.D.), received the Best Paper Award at the IEEE International Conference on Social Computing for "Anomaly detection in feedback-based reputation systems through temporal and correlation analysis." Her co-author was Yuhong Liu. Sun was recently promoted to Associate Professor with tenure at the University of Rhode Island, where she has been a faculty member in the Electrical, Computer, and Biomedical Engineering Department since 2006. Sun was advised by Professor K.J. Ray Liu.

Fumin Zhang (2004 EE Ph.D.) won a Young Investigator Program (YIP) grant from the Office of Naval Research, one of only 17 awarded nationwide in 2010. The YIP invests in academic scientists and engineers who show exceptional promise for creative study. Zhang was advised by Professor P. S. Krishnaprasad (ECE/ISR). Zhang's research is "Generic Environment Models for Agile Marine Autonomy." He will establish a fundamental research program to lay out the theoretical foundation for agile marine autonomy, the capability of unmanned systems to quickly respond

to changes in a marine environment. Since 2007 Zhang has been an assistant professor of systems and controls in the School of Electrical and Computer Engineering at the Georgia Institute of Technology.

Richard Stamper (1997 ME Ph.D.) has been appointed interim associate dean for professional experiences at the Rose-Hulman Institute of Technology in Terre Haute, Ind. Stamper has served as head of the Department of Engineering Management at Rose-Hulman since 2008. He joined the faculty in 1998 and is an associate professor of mechanical engineering. He received the Rose-Hulman Dean's Outstanding Teacher Award in 2006, and the Board of Trustees Outstanding Scholar Award in 2004. Stamper's advisor was the late Professor Lung-Wen Tsai (ME/ISR).

Wade Trappe (2002 Applied Math and Scientific Computing Ph.D.), associate director of the Wireless Information Network Laboratory (WINLAB) at Rutgers University, received a best paper award at the Association for Computing Machinery 8th Annual International Conference on Mobile Systems, Applications and Services. His research group's "ParkNet: Drive-By Sensing of Road-Side Parking Statistics," represents a new direction for signal processing, suggesting a way technology can relieve traffic congestion and help drivers find available parking spaces by making detailed parking data widely available via Web-based maps and navigation systems. Trappe was advised by Professor K. J. Ray Liu.

Xiao-Jiang (James) Du, (2003 EE Ph.D.), has been promoted to Associate Professor with tenure at Temple University, where he has been on the faculty of the Department of Computer and Information Sciences since 2009. Du was advised by Professor Mark Shayman (ECE).

Victor De Oliveira (1997 Math Ph.D.) has been awarded the Distinguished Achievement Award of the Section on Statistics and the Environment of the American Statistical Association. De Oliveira is an associate professor in the Department of Management Science and Statistics in the College of Business at the University of Texas at San Antonio. He

was advised by ISR-affiliated Professor Benjamin Kedem (Math). De Oliveira's research interests are in Bayesian methods, environmental statistics, geostatistics, Markov random fields, spatial prediction and space-time modeling.

Radha Poovendran (1999 EE Ph.D.), has been promoted to full professor by the University of Washington's Electrical Engineering Department, where he is the founding director of the Network Security Lab. Poovendran's research interests focus on communications, network security, and cryptography. Poovendran's Ph.D. advisor was Professor John Baras (ECE/ISR).

Amnon Lotem (2000 CS Ph.D.) has been appointed chief technology officer by Skybox Security. Lotem has more than 20 years of experience in artificial intelligence (AI), modeling and simulation techniques. He was advised by Professor Dana Nau (CS/ISR). Skybox Security specializes in automated security risk and compliance management.

ISR alumni, do you have career news?
We'd love to share it with our readers, both in print and online. Send your news to Rebecca Copeland at rebec-cac@umd.edu.

studentNEWS

Ph.D. student **Yongqiang Wang** won "Best OR/MS-focused Paper" at the 2010 Winter Simulation Conference, the premier international forum for the field of system simulation. "Model-based Evolutionary Optimization," presents a new framework for solving global optimization problems by establishing a connection between evolutionary game theory and model-based optimization algorithms. Wang wrote the paper with his advisors Professor Michael Fu (BGMT/ISR) and Professor Steve Marcus (ECE/ISR). Wang also won the INFORMS Computing Society (ICS) 2010 Student Paper Award for "A New Stochastic Derivative Estimator for Discontinuous Payoff Functions with Application to Financial Derivatives." His award was presented during the INFORMS Annual Meeting.

William Herring is a Ph.D. student in the Applied Mathematics & Statistics, and Scientific Computation program, working with Associate Professor Jeffrey Herrmann (ME/ISR). He won the graduate paper prize in the 2010 Society for Health Systems Student Paper Competition for "A Stochastic Dynamic Program for the Single-Day Surgery Scheduling Problem."

Daniel Garcia-Romero, a Ph.D. student of Professor Carol Espy-Wilson (ECE/ISR), won the Speech Communication Best Student Paper Award at the Joint 159th Acoustical Society of America Meeting and Noise-Con 2010. Garcia-Romero was honored for his work, "Speech Forensics: Automatic Acquisition Device Identification."

The Materials Research Society's May 2010 *MRS Bulletin* included a story on research completed by MSE Ph.D. student **Parag Banerjee** during an internship at the University of Pennsylvania. Banerjee's advisor is Maryland NanoCenter Director Gary Rubloff (MSE/ISR). The paper, "Plasmon-Induced Electrical Conduction in Molecular Devices," demonstrates the ability of surface plasmons to alter the electrical properties of a molecular junction by coupling gold nanoparticle arrays with highly conjugated, chromophoric wires. It appeared in the American Chemical Society's *ACS Nano* journal. Banerjee's co-authors are Dawn A. Bonnell, David Conklin, Sanjini Nanayakkara and Tae-Hong Park of the University of Pennsylvania; and Michael J. Therien of Duke University.

Beiyu Rong won the Best Student Paper Award at the prestigious 8th International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt). The paper, "Stable Throughput, Rate Control, and Delay in Multi-Access Channels," represents an important step in linking information theoretic and networking concepts and points to new possibilities for a stronger coupling between the two fields. Beiyu co-wrote the paper with her Ph.D. advisor Tony Ephremides (ECE/ISR). Rong is now a postdoctoral fellow in a special joint program between the University of Texas at Austin and Texas A&M University.

Arya Mazumdar, an ECE Ph.D. student, won the Information Theory Society Student Paper Award for "Codes in Permutations and Error Correction for Rank Modulation." The paper was co-written with his advisor, Professor Alexander Barg (ECE/ISR). This major award recognizes outstanding papers presented by students at the IEEE International Symposium on Information Theory, the largest conference in information and coding theory. Dr. Barg notes that the prize "arguably represents some of the best student work in the field of information theory worldwide during the last year." Mazumdar was one of five ECE/ISR students who were among the 44 finalists worldwide. The other four were:

- **Ersen Ekrem** (joint work with Sennur Ulukus)
- **Punarbasi Purkayastha** (joint work with Alexander Barg)
- **Himanshu Tyagi** (joint work with Piyush Gupta and Prakash Narayan)
- **Sirin Nitinawarat** (sole-authored work; he is advised by Prakash Narayan)

Nathan Siwak won an Advancing Science in America Scholar Award at a ceremony sponsored by the Achievement Rewards for College Scientists (ARCS) Foundation. The foundation provides scholarships to academically outstanding students pursuing degrees in science, medicine and engineering. Siwak is a Ph.D. advisee of ISR Director Reza Ghodssi (ECE/ISR). His research focuses on homeland security chemical sensing applications using indium phosphide MEMS (micro-electromechanical systems) optical switches. It was his second ARCS award.

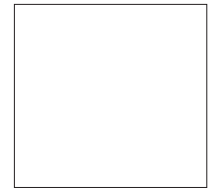
Shanshan Zheng, Shalabh Jain and Johnny Ta, three graduate students advised by Professor John Baras (ISR/ECE), won scholarships to attend the 5th European Trusted Infrastructure Summer School (ETISS 2010). The Information Security Group is one of the largest academic security groups in the world. The three students work on research topics involving physical layer security of wireless devices and networks.



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ADDRESS SERVICE REQUESTED



inMEMORIAM



Rebecca Copeland

ISR DIRECTOR REZA GHODSSI PRESENTS SUE FRAZIER WITH THE OUTSTANDING STAFF AWARD IN MAY 2010.

With great sadness we share with you the news that longtime ISR Director of Human Resources and Education **Sue Frazier** passed away on Saturday, Oct. 23, 2010, from complications following routine surgery.

Sue served the University of Maryland for more than 35 years and was part of ISR when it started in 1985. Sue was regarded by her colleagues and friends as a role model for professionalism and passion for excellence in higher education, and was the face of ISR to students, faculty and staff alike.

Sue received the President's Distinguished Service Award in 1997 for exceptional performance, leadership and service. She also twice received ISR's Outstanding Staff Award, in 1989 and

2010. Sue's impact reaches beyond the University of Maryland campus to alumni, collaborators and former colleagues.

The Susan Frazier Memorial Graduate Education Award is an endowed award that benefits the financial needs of ISR graduate students. There are two ways to contribute:
Online via credit card at www.foundation.umd.edu/giving/searchResults.php?searchterm=susan+frazier&x=0&y=0.
By check, payable to "University of Maryland College Park Foundation." Make a notation on the memo line that the donation is for the Susan Frazier Memorial Graduate Education Award. Checks should be sent to Jason Strahan, 2167 A.V. Williams Building, University of Maryland, College Park, MD 20742.

ISR Collaborators

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American Hearing Research Foundation
BAE Systems
BBN Technologies
Cobham Analytic Solutions
CoolCAD Electronics, LLC
CPU Technology, Inc.
Elsevier
Energetics Technology Center
Fujitsu Laboratories
General Dynamics
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Innovative Biosensors, Inc.
Intelligent Automation, Inc.
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ISR is a permanent state-supported institute of the University of Maryland within the A. James Clark School of Engineering. ISR is a National Science Foundation Engineering Research Center.

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