



FALL 2009

CONNECTIONS

DEPARTMENT of ELECTRICAL & COMPUTER ENGINEERING

A. JAMES CLARK SCHOOL of ENGINEERING

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MEET ECE'S GUITAR HERO

Prof. Bruce Jacob has designed his own line of guitars that expand sound range and control, and he has also introduced a new course on guitar design for undergrads.

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mEessage from the chair



RESEARCH REVIEW DAY WILL SHOWCASE INNOVATION, ENTREPRENEURSHIP

We use the terms “entrepreneur” and “entrepreneurship” in conjunction with education, research and emerging technology, but we are rarely offered a clear definition of these terms.

In my opinion, an entrepreneur is a person who establishes sustainable enterprises of any sort.

PATRICK O'SHEA

A measure of our success will be the real-world, long-term impact of our education, service and research programs, through the problems we solve and the lives we improve. We must do sustainable good for society, and therefore, we must establish sustainable enterprises based on our education and research.

It is entrepreneurial explorers who will lead us to a bright future.

Entrepreneur \en' tre • pre • neur\ , noun
Defn: someone who organizes a sustainable enterprise and assumes the risks for it

An entrepreneur must be willing to accept risk. We rarely can predict which of the horses is going to win the race. Years may pass before we back a winner. Therefore, we must place our bets far and wide. In the years to come, I hope to see a whole spectrum of students and faculty who take diverse approaches to technology development.

We must ask ourselves: “If I succeed, will anybody care?” In order to be truly great, we must make a solemn commitment to solve some of the great challenges of humanity, and not simply to do research on them.

In this spirit, the Department of Electrical and Computer Engineering (ECE) will hold a special ECE Research Review Day on Friday, October 9 from 9:00 am - 3:00 pm in the Jeong H. Kim Engineering Building on the University of Maryland's College Park campus. We will present research in key areas impacting the nation and global community: Communications and Networks; Advanced Information Systems; Energy and Sustainability; Biomedical Technology; Security; and Robotics and Automation. After the morning talks and mid-day poster sessions, we will host a Faculty Venture Fair competition to highlight entrepreneurial research. Faculty will present their emerging technologies to a panel of venture capitalists and entrepreneurs, focusing on the commercial market for their recent inventions. The winner will receive a special award and plaque for presenting the technology with the most promising commercial—or entrepreneurial—potential.

For more information about Research Review Day, and to register online, visit: www.ece.umd.edu/rrd. We hope to see you on Oct. 9.

ECE PROGRAMS HIGHLY RANKED IN LATEST SURVEYS

The *U.S. News & World Report's* 2010 Best Colleges and Best Graduate Schools surveys ranked the University of Maryland's Department of Electrical and Computer Engineering (ECE) undergraduate and graduate programs among the top 20 in the nation. Computer Engineering was ranked 16th among undergraduate programs and 17th among graduate programs. Electrical Engineering was ranked 17th among undergraduate programs and 15th among graduate programs.

UNIVERSITY OF MARYLAND NAMED ENERGY FRONTIER RESEARCH CENTER

The U.S. Department of Energy (DOE) named the University of Maryland an Energy Frontier Research Center (EFRC) as part of a major new program. EFRCs are a means to enlist the talents and skills of the very best American scientists and engineers to address current fundamental scientific roadblocks to U.S. energy security.

The University of Maryland EFRC will address the “Science of Precision Multifunctional Nanostructures for Electrical Energy Storage.” Its objective is to understand how nanostructures formed from multiple materials behave and their potential for a new generation of electrical energy storage technology.

The Maryland team includes researchers from the University of Maryland Energy Research Center (UMERC) and the Maryland NanoCenter. Both research centers are comprised of faculty from three colleges – the Clark School of Engineering, Chemical and Life Sciences, and Computer, Math and Physical Sciences. The effort will be led by Professor **Gary Rubloff**, Director of the NanoCenter.

Maryland is joined by university and federal laboratory partners at the University of California, Irvine, Sandia National Laboratory, the University of Florida, Los Alamos National Laboratory and Yale University. 

University Establishes New Center for Applied Electromagnetics

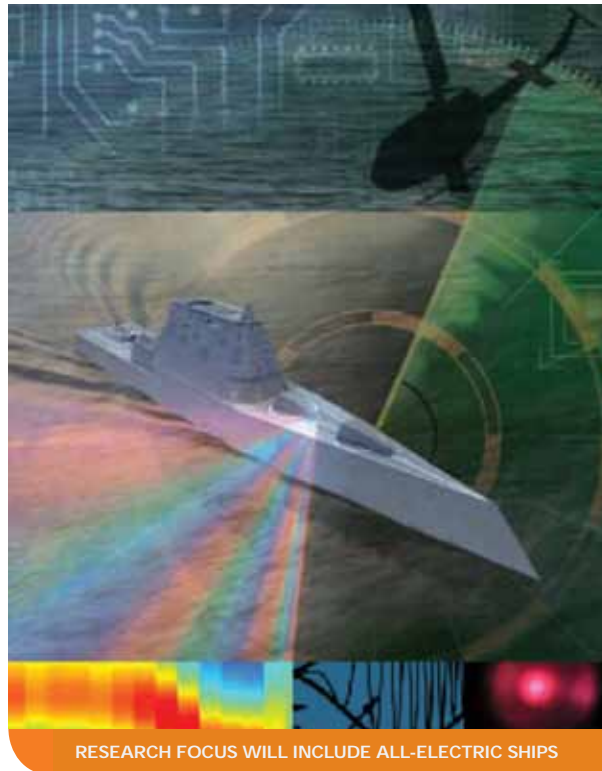
New research center will contribute valuable technology innovations to Navy and Department of Defense future systems

The university recently established a new, multi-million dollar Center for Applied Electromagnetics (AppEl) with funding from the Office of Naval Research (ONR).

Dr. **Patrick O'Shea**, Professor and Chairman of the Department of Electrical and Computer Engineering (ECE), will serve as executive director of the new center. AppEl will be the "focal point for basic research on topics that promise to lead to significant improvement and valuable new concepts in Navy and Department of Defense (DoD) future systems," said O'Shea.

The Center's research will focus on electromagnetic phenomena in the spectral range from microwaves to visible light. The research will form a basis for all-electric ships, speed-of-light weapons and advanced communication technologies for the U.S. Navy.

Victor Granatstein, a professor with ECE, will be the research director of the center, which will include approximately



19 faculty researchers from seven academic departments and research institutes across campus. These include the Department of Electrical and Computer Engineering,

the Department of Physics, the Department of Materials Science and Engineering, the Department of Aerospace Engineering, the Institute for Research in Electronics and Applied Physics, the Institute for Physical Science and Technology, the Institute for Systems Research and the Institute for Advanced Computer Studies. The center will also be working with other institutions, such as the Naval Postgraduate School and Boise State University; among others.

The opportunity for the center came when Rear Admiral **William E. "Bill" Landay III**, chief of naval research, was the featured speaker at a Division of Research-sponsored research seminar last February. During Landay's remarks, he spoke about the Navy's interest in dominating the electromagnetic spectrum and fighting at the speed of light. "The admiral's vision intersected with the concept I had in mind for the Center," said O'Shea. C

Story by Lisa Gregory, Graphic by Jennifer Paul

NSA Designates Maryland as 'National Center of Academic Excellence'

The National Security Agency (NSA) has designated the University of Maryland as a National Center of Academic Excellence in Information Assurance Research. The university received the formal award at the 13th Colloquium for Information Systems Security Education.

"This award is a recognition of the critical role that University of Maryland research is playing in the protection of the information and communications resources essential to 21st century life," said **Gerry Sneeringer**, Director of Information Technology Security in the University of Maryland Office of Information Technology.

ECE faculty members provided ideas and material for the proposal, including

Professor **John Baras**, Associate Professor **Sennur Ulukus**, and Associate Professor **Min Wu**.

NSA and the Department of Homeland Security (DHS) jointly sponsor the National Centers of Academic Excellence Programs and began the Information Assurance (IA) Research program in 2007 to promote robust information assurance technology, policy, and practices that will enable the United States to effectively prevent and respond to catastrophic events. The program recognizes schools that foster an IA research focus in curriculum as well as labs. The vision for this program is to establish

a process that will present opportunities for IA research centers to drill deeper into much needed solutions to securing the global information grid and provide NSA, DHS, and other federal agencies with insight into academic IA programs that can support advanced academic research and development capabilities.

Universities designated as Centers of Academic Excellence in Information Assurance Education and Centers of Academic Excellence in IA Research are eligible to apply for scholarships and grants through both the Federal and Department of Defense Information Assurance Scholarship Programs. C

ECE Professor Introduces New Guitar Technology

Electrical and Computer Engineering (ECE) Professor **Bruce Jacob** pried open his new electric guitar and wondered why he couldn't get more sounds out of it.

It was the first guitar Jacob had purchased since he was a teenager, but he found that the instrument's tones were more limited than the guitars he grew up playing. The engineer in him sought an answer.

"I decided to catalog every cool sound a guitar could naturally make," said Jacob, a Clark School Keystone Professor and Director of the Computer Engineering program. "But the problem was, as every engineer knows, when you investigate how things work, you begin to realize what is possible."

In 2006 Jacob launched Coil LLC to make his ideal guitar. Jacob also created a new course at the University of Maryland that covers the physics and circuit details behind electric guitars, titled ENEE 159b: Electric Guitar Design.

Five ECE students who studied under Jacob joined Coil: **Justin Ahmanson** and **Tim Babich**, now both alumni, current graduate student **Joseph Gross** and undergraduates **Franklin DeHart** and **Christopher Monaghan**. Together they developed patent-pending electronics to give them all of the sounds

they wanted from a guitar. Jacob then designed the guitars to put them in. In July, the Coil team officially launched

red, intense red, pale red. But basically everything you could do with it is red. As soon as you can throw in blue, well, you can make red and blue -- and purple. Throw in yellow, you get green and orange and all sorts of stuff."

Jacob wanted every available option from his guitar's pickups. Rather than rewiring them, as many guitarists do, he connected each pickup to a circuit board in the back of the guitar. That circuit board is



JACOB'S NEW GUITARS OFFER A WIDE RANGE FOR MUSICIANS | PHOTO BY BENJAMIN SOLOMON

sales of their dream guitars at www.coil-guitars.com.

What makes Coil guitars unique? An electric guitar's distinct sounds come from its pickups, magnets wrapped in copper wire that "pick up" the vibrations of a guitar's strings, convert them into electrical currents and send them to an amplifier, speaker or recording device. Guitarists can select different pickups through a switch on the guitar to produce different sounds. How those pickups are configured—for instance, if they are wired to one another or not —also determines the sounds any one guitar can make.

"If you have a bunch of paints, you can create any paint you want from the three or four fundamental colors. With guitars, it's the exact same thing," said Jacob. "But most guitars have just one color. You could have deep red, light

equipped with small jumpers or pegs that can be set into different slots to configure the pickups to almost any combination to produce various sounds.

"**Paul Reed Smith** was one of the first guys to come up with a custom switch to give you all the permutations available," said **Paul Schein**, guitar guru for Chuck Levin's Washington Music Center. "What [Jacob] has done is take it to the next level. Here is how you get these two coils in parallel, these in series. These are the five or so I want. That's a cool thing because it allows people to go in and configure the guitar."

Each of Coil's pickup switches offers a different circuit board and switch configuration. The Tonefly™ E/P switch offers seven different sounds, with five available through a five-way switch when playing the guitar. The CustomWire™

model also uses a five-way switch, but can be customized to more than 50 wildly different tones. The Jacob's Ladder™ model gives musicians 22 unique sounds, but combines a three-way switch with a five-way switch to make 15 of the 22 tones available at play time.

For guitarists, this means they don't have to rewire a guitar to get the sounds they want. It also means they may need to carry fewer guitars with them to performances, since they can get more sounds out of one guitar.

"Last night I dragged four guitars,

"Last night I dragged four guitars to a recording session. Reducing that number by having a guitar that is more versatile would make life easier when going to gigs or to record."

including a Telecaster, a Gibson, and an old sixties model that does something a little different, to a recording session," said **Ron Haney**, a music producer and a guitarist for **Alicia Keys** who has also played with **Bono**, **Gwen Stefani** and **Sheryl Crow**. "Reducing that number by having a guitar that is more versatile would make life easier when going to gigs or to record."

Jacob's next invention, called **LevelHeaded™**, makes it easier to combine different pickup combinations. For instance, when guitarists switch from a crunchy humbucker sound to a clean, crisp, single coil, the volume drops, making it difficult to play live. **LevelHeaded™** gives each switch setting its own volume, so single coils come out as loud as humbuckers.

"We put the volume adjustment after the switch," says Jacob. "No one has done that before."

The Coil team next turned to the tone knob. "Most people don't use it," Jacob

says. "It is a low-pass filter, cutting off high frequencies and sapping some of your signal. We were wondering how to make a tone knob that really changes the guitar's resonant frequency."

Enter **Qtone™** (one knob) and **Qfreq™** (two knob), tone controls that revive and enhance one of the most effective technologies that has ever appeared in electric guitars, according to Jacob: the passive parametric EQ filter, which allows you to change central frequency and filter bandwidth ("the Q"). Coil's tone knobs, developed by DeHart and Monaghan,

can make a guitar sound rich and full, bright and chimey, nasal and funky, and everything in between.

Coil is sponsoring further audio electronics development at the University of Maryland through a \$135,000 Maryland Industrial Partnerships (MIPS) project. The company is located in the new TERP Startup Lab, a technology incubation program for university faculty, students, and regional entrepreneurs. Coil has donated electronics, circuit components, guitars and recording equipment to the university for use in its instructional facilities.

Jacob's new guitars were featured in *The Chronicle of Higher Education*, *The Washington Post*, the *IEEE Spectrum*, and NPR's *All Things Considered*. Visit www.coil-guitars.com to see the company's guitars, videos of musicians playing them, and interactive demonstrations of how its electronics work. **C**

Story by Eric Schurr, Mtech

New Battery, Security Key Technology Wins Invention of the Year

ECE researchers won in two of three categories at the University of Maryland's 22nd annual Invention of the Year Awards, organized by the university's Office of Technology Commercialization.

In the Physical Science category, Prof. **Martin Peckerar** and Prof. **Neil Goldsman** won for their invention, titled "World's Highest Energy Density Thin-Film Battery." Their millimeter-thick, rechargeable batteries offer more capacity than any other thin-film battery in the world. The batteries are comprised entirely of environmentally friendly materials, and can be manufactured using a cost-effective printing process. Remotely rechargeable, the batteries gather energy from environmental sources, such as solar energy, vibrations and radio waves. They can even be recharged simply by pointing a cell phone at them. They are well suited to power ultra-small electronics, including implantable medical devices and wireless sensor networks, and can outlast many of these devices. **Yves Ngu**, **Zeynep Dilli** and **George Metze** from the National Security Agency also worked on this project. Peckerar and Goldsman formed a start-up company, FlexEl LLC, to commercialize the battery. The FlexEl team was the winner of \$20K in the information technology division of the University of Maryland's \$75K Business Plan Competition, held on May 8.

In the Information Science category, Prof. **John Baras** was recognized for his work with the Army Research Laboratory on a key exchange system to secure Internet transactions, titled "Efficient Key Exchange for Symmetric Cryptosystems." Baras and his fellow researchers discovered a method of efficiently updating and exchanging secret keys that exploits the randomness of Markov models in selecting a new key. This new method eliminates the need for third-party key management, public key infrastructure, and large amounts of storage space. His invention is of interest for national defense systems and major banking companies. **Paul Yu** and **Brian Sadler** also worked on this project. **C**

Ghodssi, Researchers Introduce New Era of Miniaturization with Micro-Machines Technology

The modern-day soldier carries a heavy load. Try to imagine running hard in a desert environment toting some 100 pounds of weapons, body armor, simple medical supplies, food and water, and an array of digital communications and computing devices. Every pound matters, including the 20 pounds of lithium ion and other batteries that power those digital devices.

A team of researchers at the A. James Clark School of Engineering, led by Herbert Rabin Distinguished Professor of Engineering **Reza Ghodssi** and funded by the U.S. Army Research Laboratory and U.S. Army Research Office, has recently succeeded in manufacturing micromachines—tiny pumps, motors, and turbines that, integrated in a microscale liquid-fuel power generation system, could significantly reduce a soldier's battery load. The engineers' advances also hold promise in technologies for health care (micropumps for implantable medical devices) and first responders (bio-chemical sensors).

The Clark School researchers have successfully miniaturized ball bearing support mechanisms with microballs as wide as a few human hairs and nearly invisible to the naked eye. Using these components, they have built tiny silicon pumps, motors, and turbines demonstrating rotational speeds of up to 87,000 rpm, comparable to the speed of large-scale machinery.

"Traditional actuators built for micro systems are restrained to linear motion or small-angle rotation," adds Dr. **Rajinder P. Khosla**, program director in the Division of Electrical, Communications, and Cyber Systems of the National Science Foundation's Directorate for Engineering. "In Dr.

Ghodssi's lab, microball bearings have been implemented in electrically-actuated rotary platforms for controlled angular positioning as well as high-speed turbomachinery for microscale fuel pumps. The successful development of these devices will lead

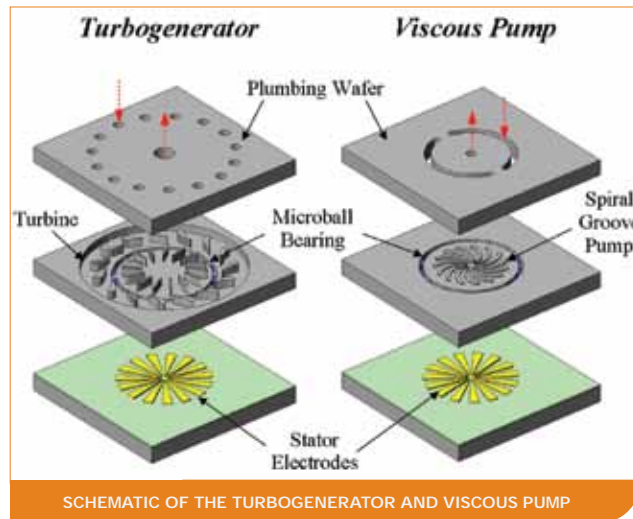
power the vehicles' electrical systems without weighing them down.

To create their machines, Ghodssi and his team first had to conquer the science of microscale "tribology" or the friction, wear, and lubrication of tiny rolling components. They then applied this knowledge in building different types of micromachines using conventional manufacturing processes, and finally in integrating these devices into tiny systems that can reliably accomplish a task such as power generation over a reasonable period of time, and not simply burn up.

Prof. Ghodssi and his fellow researchers recently received a three-year, \$330,000 NSF grant for research on microball bearing systems with an emphasis on material interfaces for MicroElectroMechanical Systems (MEMS)

applications. Ghodssi is the principal investigator (PI) for the research project, titled "Tribologically-Enhanced Encapsulated Microball Bearings for Reduced Friction and Wear in High-Performance Rotary Microactuators and PowerMEMS Devices." The objective of this work is to develop high-performance rotary ball bearings for MEMS using special, tribologically-enhanced thin-film coatings.

"We focused on feasibility—building pumps and motors that are fast enough to do the jobs required, reliable enough to last, and easy enough to manufacture in the real world," said Ghodssi. "As in the miniaturization of electronics, we expect to achieve successive generations of higher and higher efficiency and refinement in micromachine systems, and to see the creation not only of new defense and medical products, but of entirely new technologies no one has yet imagined." **C**



directly to the realization of small-scale power generators and high-performance directional sensors systems."

"The Army needs small-scale, liquid-fueled power generators that can provide higher energy, at lighter weight and lower cost, than current fielded power sources," said **Bruce Geil**, Acting Branch Chief for the Power Components Branch of the U.S. Army Research Laboratory. "Dr. Ghodssi's team is developing key fuel delivery and electrical generator components to meet our requirements."

Micromachine systems also will help power land or air-based "micro vehicles" (also under development at the Clark School in partnership with government agencies) that will venture into risk-filled environments ahead of soldiers or first responders and send back information. Microgenerators fabricated completely in silicon and supported on microball bearings could

New Research Grants for ECE Faculty

BIOMEDICAL

ESPY-WILSON RECEIVES NIH GRANT TO HELP TONGUE CANCER PATIENTS' SPEECH

Prof. **Carol Espy-Wilson**'s research has been funded by a new grant from the National Cancer Institute's Division of Cancer Control and Population Sciences (DCCPS), part of the U.S. National Institutes of Health (NIH). Espy-Wilson is co-principal investigator (Co-PI) for the new grant, titled "Predictors of Speech Quality after Tongue Cancer Surgery." The PI for the grant is Dr. **Maureen Stone** of the University of Maryland Dental School, and Dr. **Jerry Prince** of Johns Hopkins University is the other Co-PI. The five-year grant is worth a total of \$2,760,296. Espy-Wilson's portion of the grant is worth \$422,761. The researchers will try to improve the speech outcome of tongue cancer surgery by minimizing the impact of tongue reconstruction, so patients can communicate more clearly and confidently. Espy-Wilson's role will be to develop 3-D vocal tract models based on cine-MRI data to perform acoustic analysis of the patients' speech signals in order to understand the effects of tongue surgery on speech quality.

COMPUTING

BARUA WINS DARPA FUNDING FOR AESOP PROJECT

Prof. **Rajeev Barua** is the University of Maryland's principal investigator (PI) for a large research grant recently acquired through the Defense Advanced Research Projects Agency (DARPA). This research program, known as AESOP, or Adaptive Environment for Supercompiling with Optimized Parallelism, represents a major multi-institution collaboration to develop a state-of-the-art compiler that can compile serial programs automatically into parallel programs to a wide variety of platforms. Maryland will collaborate with BAE Systems

and Princeton University on this four-year, \$11.5M DARPA-sponsored program, with Maryland's share consisting of \$2.53M. Rajeev Barua is the lead UMD PI; **Alan Sussman** and **Rance Cleaveland** are co-PIs. Reflecting the belief that serial programs will continue to represent the vast majority of programs in the world, the goal of the AESOP project is to compile serial programs automatically into parallel programs. The AESOP project will use an aggressive suite of existing methods and new techniques that the researchers have developed to extract large-amounts of scalable parallelism, even from seemingly serial irregular programs. This will enable software to exploit the full potential of the hardware in the modern multi-core era. Further, the compiler will accurately characterize and compile to a wide variety of computer systems without any manual effort.

MARCUS PART OF FIVE-YEAR, \$10M 'EXPEDITIONS IN COMPUTING' GRANT

Prof. **Steve Marcus** is co-principal investigator (co-PI) for the University of Maryland's portion of a major new National Science Foundation collaborative research grant, "Next-Generation Model Checking and Abstract Interpretation with a Focus on Embedded Control and Systems Biology." The five-year, \$10M project is part of NSF's "Expeditions in Computing" initiative. Maryland's part of the project is worth \$1.8M.

Along with Marcus, Prof. **Rance Cleaveland** is the principal investigator (PI) for the project, and Prof. **Tongtong Wu** is a co-PI.

The consortium will develop new computational tools to help scientists and engineers analyze and understand the behavior of the complex models they develop for application domains ranging from systems biology to embedded control. Building on the success of model checking and abstract interpretation (MCAI), two well-established methods for automatically verifying properties of digital circuit designs

and embedded software, this research project will extend the MCAI paradigm to systems with complex continuous dynamics and probabilistic behaviors.

The research will include: understanding the precursors and course of pancreatic cancer; predicting the onset of atrial fibrillation; and obtaining deep design-time insights into the behavior of automotive and aerospace control systems. Ultimately, the project is expected to provide vital tools that will enable health care researchers to discover better treatments for disease and will allow engineers to build safer aircraft and other complex systems.

The researchers hope to develop revolutionary techniques for automatically analyzing and predicting the behavior of biological and control systems. Using the new techniques, scientists and engineers will be able to greatly accelerate the pace of their discoveries by automating tasks that currently must be performed manually.

The work is intrinsically multidisciplinary. Cleaveland works on embedded software. Marcus studies control and systems theories and will develop mathematical models that take into account uncertainties. Wu, whose research interests include computational statistics and statistical genetics, will focus on cancer classification and the genetic determination of diseases.

Carnegie Mellon University is the lead institution for the program. In addition to the University of Maryland, other collaborating institutions are the City University of New York, New York University, SUNY Stony Brook, Cornell University and NASA's Jet Propulsion Laboratory.

VISHKIN RECEIVES NSF GRANT FOR ASYNCHRONY IN DESKTOP SUPERCOMPUTER TECHNOLOGY

Prof. **Uzi Vishkin** is co-Principal Investigator (PI) for a National Science Foundation (NSF) grant that will support his research,



New Research Grants for ECE Faculty *(cont.)*

(Continued from p. 7)

titled “Design and Tools for Easy-to-Program Massively Parallel On-Chip Systems: Deriving Scalability through Asynchrony.” The grant, worth nearly \$1 million, was one of only two large-scale team proposals awarded by NSF in the “Design Automation for Micro and Nano Systems” area for its Computing Processes and Artifacts program. The research is being conducted jointly with Prof. **Steven Nowick** of Columbia University, an expert in asynchronous computing. The researchers are engaged in new parallel processing technology aimed at improving scalability and power consumption in the next generation of computers.

SRIVASTAVA, NARAYAN RECEIVE NSF GRANT FOR THERMAL MANAGEMENT ON MULTI-CORE PROCESSORS

Prof. **Ankur Srivastava** and Prof. **Prakash Narayan** have been awarded a new, three-year National Science Foundation (NSF) grant worth \$450,000 for a research project titled “Information Theoretic Multi-Core Processor Thermal Profile Estimation.” Srivastava is principal investigator (PI) for the research grant while Narayan is Co-PI. The researchers seek to improve the performance and reliability of multicore processors through thermal management research.

ENERGY

GHODSSI RECEIVES GRANTS FOR NOVEL NANOFABRICATION FOR ENERGY APPLICATIONS

Prof. **Reza Ghodssi** received a new three-year grant from the National Science Foundation worth \$401,712 for research on novel, biological nanofabrication processes for the development of small-scale energy storage devices utilizing the Tobacco mosaic virus (TMV). Ghodssi is the principal investigator (PI) for the research project, titled “Nanofabrication Using Viral Biotemplates for

MicroElectroMechanical Systems (MEMS) Applications.” Prof. **James Culver** from the University of Maryland Biotechnology Institute is Co-PI. The objective of the research is to make use of the self-assembly and metal-binding properties of a biological nanostructure, the TMV, in the development of novel functional materials and fabrication processes for energy microsystems applications. The researchers also received a \$250,000 FY2009 Maryland Nanobiotechnology Research and Industry Competition Grant for this research, awarded by the Maryland Technology Development Corporation (TEDCO) and the Maryland Biotechnology Center.

NETWORKS AND WIRELESS COMMUNICATIONS

MILNER, DAVIS AWARDED \$1 MILLION AFOSR GRANT

Prof. **Christopher Davis** and Prof. **Stuart Milner** have been awarded a three-year grant worth \$1,048,279 from the Air Force Office of Scientific Research (AFOSR). The grant will support their research proposal, titled “Quantifying and Assuring Information Transfer in Dynamic Heterogeneous Wireless Networks.” Milner will serve as Principal Investigator (PI) while Davis will serve as Co-PI. The Maryland researchers, along with fellow researchers at Cornell University and University of Illinois, will conduct a theoretical investigation of next generation, complex, heterogeneous, wireless networks aimed at quantifying, controlling and managing information transfer for theater, tactical and strategic support.

EPHREMIDES RECEIVES NSF GRANT FOR COOPERATIVE NETWORKING

Prof. **Anthony Ephremides** is the principal investigator (PI) on a new National Science Foundation (NSF) research grant on “Cooperative Networking Across the Layers.” The three-year grant is part of a larger

collaborative project with researchers at the Northwestern University and the University of Texas, Austin. Maryland’s portion of the grant is worth \$371,166. This research initiative goes beyond the physical layer in defining and analyzing cooperative techniques for wireless networks. By incorporating higher layer properties, such as traffic dynamics and access control, Ephremides and his fellow researchers will develop a new theoretical framework for analyzing and designing cooperative networking algorithms across the layers.

WU RECEIVES GRANT FOR CROSS-LAYER SECURE COMMUNICATIONS

Prof. **Min Wu** is the principal investigator for a 3-year, \$300K National Science Foundation grant. This effort focuses on “Addressing Physical-Layer Challenges via CLAWS: Cross-Layer Approaches to Wireless Secure Communications.” The research will investigate the role of physical-layer properties and systematic engineering modeling in designing secure communications systems, and jointly optimize overall system performance to provide secure communications for current and future generation networks.

LA RECEIVES NSF GRANT FOR NETWORK PRICING MECHANISMS

Prof. **Richard La** has received a National Science Foundation Theoretical Foundations grant for “Network pricing with uncertainty: risk aversion and incomplete information.” The three-year, \$300K grant will identify suitable frameworks for designing efficient and fair network pricing mechanisms.

SECURITY

HORIUCHI, HUMBERT DEVELOPING BIO-INSPIRED NAVIGATION FOR MICRO AIR VEHICLES

Prof. **Timothy Horiuchi** and Prof. **J. Sean Humbert** are collaborating with Aurora

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(Continued from p. 8)

Flight Sciences and the U.S. Air Force to develop a sonar and vision-based micro air vehicle (MAV) navigation guidance system. The project is titled “Panoramic Avoidance and Navigation using OPTics Integrated with Sonar” (PANOPTIS). PANOPTIS is being developed for a new generation of autonomous MAVs designed to operate in cluttered urban environments. The lightweight guidance system will enable “swallow-like” flight by using a combination of optical and sonar navigation sensors inspired by insects and bats. Horiuchi’s work will provide bat-based echolocating sensors while Humbert’s research results in optic flow sensors that mimic the vision of insects.

LIU AND WU AWARDED AFOSR GRANT FOR MEDIA FORENSICS

Prof. **K. J. Ray Liu** is the principal investigator (PI), and Prof. **Min Wu** is the co-PI for a grant from the Air Force Office of Scientific Research (AFOSR). This 3-year effort will investigate theories and algorithms to perform non-intrusive forensic analysis on multimedia devices and digital content.

ECE FACULTY WIN MURI AWARDS

Several ECE faculty members were awarded Multidisciplinary University Research Initiatives (MURIs) by the U.S. Department of Defense:

John Baras, Nuno Martins and **Eyad Abed** are involved in a MURI awarded to Georgia Tech and the Air Force Office of Scientific Research on “Distributed Learning and Information Dynamics in Networked Autonomous Systems.”

Shihab Shamma is working with Johns Hopkins and the Office of Naval Research on “Figure-Ground Processing, Saliency and Guided Attention for Analysis of Large Natural Scenes.”

Rama Chellappa is working with fellow faculty researchers **Larry Davis** and **John Benedetto** on a MURI awarded to Rice University and the Army Research Office, “Opportunistic Sensing for Object & Activity Recognition.”

Liu Selected for IEEE Panel on World Changing Technologies

The Institute of Electrical and Electronics Engineers (IEEE), the world’s largest technical professional society, featured ECE Professor **K.J. Ray Liu** and his research at an event marking the organization’s 125th anniversary on March 10. Liu was selected as one of seven panelists offering “world changing” technologies that will change the way humans interact with machines, the world, and each other.

The panel of technology experts, moderated by *The New York Times* senior editor and technology reporter **Steve Lohr**, discussed emerging technologies in fields ranging from biometrics, computing, wireless power, and cancer research, that they believe have the potential to change the world.

“For 125 years, IEEE and its members have influenced the creation of nearly all the technologies we now cannot imagine life without,” said 2008 IEEE President **Lewis M. Terman** at the event. “Today we take a glimpse into the future with some of those who are driving the



K. J. RAY LIU

development of some of the emerging innovations and technological advancements for the betterment of humanity.”

Using signal processing, Dr. Liu has developed a theoretical model called “ensemble dependence” for how studying the behavior of DNA can help predict early cancer development. Dr. Liu and his research team have developed a model that, by testing the interaction between

an individual’s genomic and proteomic signaling through a simple blood test, can determine if the patient is in the transition stage to developing cancer, and identify the type. This information will offer the earliest possible prediction of whether an individual is in danger for developing cancer and allow for preventative treatment.

“Our method has yielded very promising performance so far,” Liu said. “Investigations of mathematical patterns related to the proposed method have allowed us to pinpoint the transition in between cancer and normal gene patterns.” C

ECE FACULTY WIN DOD AWARDS

Three ECE faculty members have been awarded Department of Defense (DoD) University Research Instrumentation Program (DURIP) Awards. **Rama Chellappa** received an award for “Multi-sensor Remote Biometrics System.” **Edo Waks** received an award for “Superconducting Magnet for Quantum Information Processing with Spin States.” **Thomas Murphy** received an award for “Complexity-Based Optical Sensor Networks.”

SIMULATION AND CONTROL

FU, MARCUS AWARDED NSF GRANT

Prof. **Michael Fu** is principal investigator and Prof. **Steven Marcus** is co-PI for a new National Science Foundation grant, “Combining Gradient and Adaptive Search in Simulation Optimization.” The three-year, \$350K grant aims to make significant theoretical and practical advances in simulation optimization. C

Significant Honors and Awards for ECE Faculty

O'SHEA NAMED DISTINGUISHED SCHOLAR-TEACHER

Professor and ECE Chairman **Patrick O'Shea** was selected as a 2009-2010 Distinguished Scholar-Teacher by the University of Maryland. The Distinguished Scholar-Teacher program recognizes faculty members who have demonstrated outstanding scholarly achievement along with equally outstanding accomplishments as teachers. Prof. O'Shea will give a Distinguished Scholar-Teacher Lecture in October.

CHELLAPPA NAMED FELLOW OF OSA, ELECTED PRESIDENT OF IEEE BIOMETRICS COUNCIL

Minta Martin
Professor of
Engineering **Rama Chellappa** was recently named a Fellow of the Optical Society of America (OSA). In their last meeting on October



RAMA CHELLAPPA

20, the OSA Board of Directors elected Prof. Chellappa to the rank of Fellow of the Society. Chellappa was recognized for pioneering contributions in image and video-based pattern recognition and computer vision. Prof. Chellappa was also elected President of the newly formed Institute of Electrical and Electronics Engineers (IEEE) Biometrics Council, a new entity that will coordinate all biometrics related activities sponsored by the IEEE.

Prof. Chellappa was also selected to receive the Outstanding Gemstone Mentor Award. Prof. Chellappa was nominated for the award by the Gemstone students he advised. The Gemstone Program at the University of Maryland is a unique multidisciplinary

four-year research program for selected undergraduate honors students of all majors. Under guidance of faculty mentors and Gemstone staff, teams of students design, direct and conduct significant research, exploring the interdependence of science and technology with society.

LIU RECEIVES OUTSTANDING RESEARCH AWARD, ELECTED PRESIDENT-ELECT OF IEEE SPS, FELLOW OF AAAS

Prof. **K. J. Ray Liu**, ECE Associate Chair for Graduate Studies and Research, received the Clark School's Faculty Outstanding Research Award. The award was given to Dr. Liu in recognition of his pioneering work in the research areas of information forensics and security, wireless communications, and bioinformatics. Prof. Liu is the only Clark School faculty member who has received both the Faculty Outstanding Research Award and the Poole and Kent Outstanding Teaching Award for Senior Faculty.

Prof. Liu was elected President-Elect of the Institute of Electrical and Electronics Engineers (IEEE) Signal Processing Society (SPS). The IEEE SPS has more than 15,000 members worldwide. He will assume the position of President for 2012-2013. Prof. Liu was also elected Fellow of the American Association for the Advancement of Science (AAAS). Liu is one of a select group of new fellows recognized as leaders whose contributions toward the advancement of science and technology are deemed scientifically or socially distinguished.

PETER PETROV WINS ATANASOFF AWARD

Prof. **Peter Petrov** was presented with the 2008 John Atanasoff Award for achievement in the development of

computer and information technology. Bulgarian President **Georgi Parvanov** personally presented the award at an official ceremony held at the Presidential building in Sofia. The Atanasoff Award is named after **John Atanasoff**, a renowned American scientist and electrical engineer of Bulgarian descent, and inventor of the world's first automatic electronic digital computer. Each year, one young Bulgarian is recognized with the award for his or her significant contribution to the development of computer and information technology. Prof. Petrov has been an ECE faculty member since 2004. His research interests focus on application-specific processors and embedded systems.

EDO WAKS EARNS NSF CAREER AWARD

Prof. **Edo Waks** was the recipient of a 2009 National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award for "Coherent Interactions Between Photons and Quantum Dots Using Photonic Crystals."



EDO WAKS

The five-year grant is worth \$400,000. The research will help develop new fundamental concepts in the control of semiconductor nanostructures at the quantum level, as well as coherent light-matter interactions.

U.S. DEPARTMENT OF COMMERCE TAPS PAMELA ABSHIRE FOR ADVISORY COMMITTEE

The U.S. Department of Commerce has appointed Prof. **Pamela Abshire** to its new Emerging Technology and Research Advisory Committee. The committee will advise the department on the application of export controls to cutting-edge research and

(Continued on p. 11)





(Continued from p. 10)

innovation, and on identifying emerging technologies and research and development activities that may be of interest from a dual-use perspective.

GHOSSSI PROMOTED TO FULL PROFESSOR

Herbert Rabin Distinguished Associate Professor **Reza Ghodssi** was promoted to the rank of full professor, effective July 1, 2009. Ghodssi is the Herbert Rabin



REZA GHODSSI

Distinguished Professor and Director of the MEMS Sensors and Actuators Lab. His research interests include the design and development of microfabrication technologies and their applications to micro/nano devices and systems for chemical and biological sensing, small-scale energy conversion and harvesting.

Prof. Ghodssi is the organizing committee chair for the 9th International Workshop on Micro and Nanotechnology for Power Generation and Energy Conversion Applications (PowerMEMS 2009). The conference will be held Dec. 1-4, 2009 at the American Film Institute Silver Theatre and Cultural Center in Silver Spring, Md.

SRIVASTAVA RECEIVES TENURE, NAMED ASSOCIATE EDITOR OF IEEE TRANSACTIONS ON VLSI

Prof. **Ankur Srivastava** was promoted to the rank of Associate Professor with tenure. Srivastava's research areas include VLSI design automation



A. SRIVASTAVA

techniques and algorithms for low power and high performance integrated systems. His primary focus is on fabrication variability and manufacturability concerns in VLSI.

Prof. Srivastava has been invited to become associate editor for the Institute of Electrical and Electronics Engineers (IEEE) *Transactions on Very-Large-Scale Integration* (VLSI), the top journal in the VLSI field. Srivastava was also named associate editor of *Integration*, the VLSI Journal.

MARCUS ELECTED SIAM FELLOW

Prof. **Steven I. Marcus** was elected a Fellow of the Society for Industrial and Applied Mathematics (SIAM). Consisting of over 12,000 members, SIAM fosters the development of applied mathematical



STEVE MARCUS

and computational methodologies needed in academic, manufacturing, research and development, government, and military organizations worldwide. Marcus was in the inaugural class of SIAM Fellows. Marcus was also honored in April at a symposium at the University of Maryland titled "Advances in Discrete Event, Nonlinear and Stochastic Systems Modeling and Control."

ESPY-WILSON INCLUDED IN "SOUL OF TECHNOLOGY" EXHIBIT

Prof. **Carol Espy-Wilson** was included in an exhibit in Palo Alto, California, titled "Soul of Technology," which showcased the 50 most important African Americans in technology. Espy-Wilson is named among 16 "Educators" on the list, and was recognized for her research and

scholarly work in speech recognition and speech science.

MIN WU ELECTED VP FOR FINANCE OF THE IEEE SIGNAL PROCESSING SOCIETY

Prof. **Min Wu** has been elected Vice President for Finance of the Institute of Electrical and Electronics Engineers (IEEE) Signal Processing Society (SPS), for



MIN WU

a three-year term of 2010-2012. As Vice President-Finance, Prof. Wu will be a voting member of the SPS's Board of Governors, Executive Committee, Conference Board and Publications Board, and will lead financial planning and management efforts related to major SPS activities and policies.

SHIHAB SHAMMA NAMED TO NIH STUDY SECTION

The National Institutes of Health have appointed Professor **Shihab Shamma** to serve as a member of the Auditory System Study Section of the Center for Scientific Review. His four-year term runs through June 2012. Prof. Shamma was selected for his achievements in the discipline of auditory systems.

BHATTACHARYYA SELECTED FOR FULBRIGHT GRANT

Professor **Shuvra Bhattacharyya** has been selected for a Fulbright Senior Specialists Grant at the Salzburg University of Applied Sciences in Austria. The grant will provide support for Prof. Bhattacharyya to offer advice on a new Masters Program that the university is developing in Embedded Signal Processing. C

EYAD ABED TO JOIN UNITED ARAB EMIRATES UNIVERSITY

Institute for Systems Research (ISR) Director and ECE Professor **Eyad Abed** will become the dean of the College of Information Technology (CIT) at United Arab Emirates University (UAEU) in the fall. Abed intends to maintain formal ties to the University of Maryland by taking extended leave. He also plans to work toward establishing a research partnership between the two universities in information technology and related areas.

A faculty member of ECE and ISR since 1983, and director of ISR for the past seven years, Dr. Abed has expertise in system and control theory; electric power system dynamics and control; aerospace control systems; and the analysis and design of complex networks.

"Dr. Abed has had an extraordinarily successful career at Maryland," said ECE Chairman **Patrick O'Shea**. "We wish him every success as Dean of the College of Information Technology at UAEU, and look forward to extensive collaborations with CIT and other colleges at UAEU."



EYAD ABED

NEW BOOKS BY FACULTY:

LIU CO-AUTHORS NEW BOOK ON "COOPERATIVE COMMUNICATIONS AND NETWORKING"

ECE Professor and Associate Chair for Graduate Studies and Research **K. J. Ray Liu** is the co-author of a new book titled "Cooperative Communications and Networking." The book, published by Cambridge University Press, offers a holistic approach to cooperative communications and networking, giving equal consideration to the concepts of space, time, frequency diversity and MIMO.

MAYERGOYZ CO-AUTHORS NEW BOOK

Prof. **Isaak Mayergoyz** co-authored a new book titled "Nonlinear Magnetization Dynamics in Nanosystems." The book, published by Elsevier Science, deals with the analytical study of nonlinear magnetization dynamics in nanomagnetic devices and structures. The topics discussed in the book are of interest to the broad audience of electrical engineers, material scientists, physicists, applied mathematicians, and numerical analysts involved in the development of novel magnetic storage technology and novel nanomagnetic devices.

NEW EDITION OF DAVIS' EXPERIMENTAL RESEARCH GUIDE BOOK RELEASED

A new edition of a book co-authored by Professor **Christopher Davis** has been published by Cambridge University Press. The book, titled "Building Scientific Apparatus," was originally published in 1983, and was co-authored by Davis, **John H. Moore**, and **Michael A. Caplan**. Now in its fourth edition, the book serves as a valuable guide to teach scientists and engineers how to perform experiments.

LEVINE'S HANDBOOK OF NETWORKED AND EMBEDDED CONTROL SYSTEMS MOST POPULAR DOWNLOAD

The Handbook of Networked and Embedded Control Systems, co-edited by Prof. **William Levine** and **Dimitris Hristu-Varsekalis**, had the largest number of downloaded chapters of any book in the Springer Engineering E-book collection in 2008. So far, it is ranked second highest in 2009. C

OLIVIA GOETZ RETIRES AFTER 43 YEARS OF SERVICE AT MARYLAND

ECE staff member **Olivia Goetz** was honored at a retirement celebration on June 22. Friends, family, and co-workers gathered to



OLIVIA GOETZ

pay tribute to Olivia's warmth, professionalism, and outstanding service to the ECE Department. Olivia was also recognized for 43 years of service to the University of Maryland at the Clark School's 2009 Staff Appreciation Event on May 13. ECE Chairman **Patrick O'Shea** was on hand to recognize her at both events. C

ECE FACULTY IN THE NEWS

GHODSSI FEATURED IN MECHANICAL ENGINEERING MAGAZINE COVER STORY

HERBERT RABIN DISTINGUISHED PROFESSOR REZA GHODSSI WAS FEATURED IN A COVER STORY IN THE APRIL 2009 ISSUE OF MECHANICAL ENGINEERING MAGAZINE. THE PIECE FOCUSED ON GHODSSI'S RESEARCH ON MICROSCALE BALL BEARINGS FOR USE IN MICROMACHINES AND MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS) DEVICES.

BHATTACHARYYA INTERVIEWED IN VISION SYSTEMS DESIGN MAGAZINE

AN INTERVIEW WITH PROFESSOR SHUVRA BHATTACHARYYA WAS PUBLISHED IN THE APRIL 2009 ISSUE OF THE MAGAZINE VISION SYSTEMS DESIGN. HE WAS INTERVIEWED FOR THE MAGAZINE'S LEADING EDGE VIEWS FEATURE ON THE SUBJECT OF SIGNAL ARCHITECTURE. C

IN MEMORIAM

Professor and Innovator Hung C. Lin Dies at 89

The ECE Department lost one of its most distinguished professors and dearest friends last March. Professor Emeritus **Hung C. (“Jimmy”) Lin** passed away on March 5. He was 89.

A dedicated and popular instructor who only missed one class in his years of teaching in College Park, Dr. Lin joined the University of Maryland as Professor of Electrical Engineering in 1969. He retired in 1990, and has since served as Professor Emeritus. Well known to his colleagues for his abundant energy, his career has spanned more than half a century and has been punctuated with many patent rights, honors, and awards.

“Professor Lin was not only a brilliant and distinguished professor and accomplished inventor, but he was also a warm and caring person, and a dear member of our ECE family,” said ECE Department Chair **Patrick O’Shea**. “He cared passionately about making sure that engineering research resulted in better lives for everyone. He touched so many people, and his vibrancy and friendship will be sorely missed.”

Dr. Lin was inducted into the Clark School of Engineering Innovation Hall of Fame in May 1990 in recognition of his significant inventions and contributions in semiconductor devices and integrated circuits. The holder of 57 U.S. patents, he is



PROF. HUNG C. “JIMMY” LIN

known in particular for the invention of the quasi-complementary amplifier used in most commercial audio amplifiers and for the lateral transistor used in most linear integrated circuits. He is the author or co-author of 170 technical papers, author of the book “Integrated Electronics,” and co-author of three other books: “Selected Semiconductor Circuits Handbook,” “Semiconductor Electronics Education Committee Notes 1,” and “Electronics Designers Handbook.” In 1978, IEEE presented him with the J.J. Ebers Award. He was elected a Fellow of the Institute of Electrical and Electronics Engineers for contributions to semiconductor electronics and circuits and pioneering of integrated circuits. He received the B.S. in Electrical Engineering in 1941 from Chiao Tung University in

Shanghai, China, the M.S. degree in 1948 from the University of Michigan, and the Doctor of Electrical Engineering in 1956 from the Polytechnic Institute of Brooklyn. He was an avid tennis player, and made his way through college on a tennis scholarship.

A campus memorial service was held in memory of Prof. Lin on March 25 in the University Chapel. Dr. Lin is survived by his wife, **Anchen**, two sons, **Robert** and **Daniel**, and three grandchildren, **Ming, Huei, and Adrian**.

Last year, Dr. Lin endowed the Jimmy Lin Fund for Innovation and Invention within the Department of Electrical and Computer Engineering. The goal of the gift was to promote innovation among ECE students, staff and faculty by stimulating, encouraging and rewarding the invention and patenting process.

Donations can be made in memory of Prof. Lin to the Jimmy Lin Fund for Innovation and Invention. Checks should be made out to “UMCPF” (University of Maryland College Park Foundation) with “Jimmy Lin Fund for Innovation and Invention” written in the memo area of the check, and sent to:

Jimmy Lin Fund for Innovation & Invention
Electrical & Computer Engineering Dept.
2457 A.V. Williams Bldg.
College Park, MD 20742



ECE Staff Member India Tiller Dies Unexpectedly at 49

The ECE community lost a staff member and a dear friend last February. **India Tiller** passed away unexpectedly on February 24. She was 49. Since 2004, India had served as program management specialist in the ECE Undergraduate Studies office.

“India was the smiling face of the undergraduate office, the first person that every student met,” said ECE Chairman **Patrick O’Shea**. “She was always good humored and helpful to all.”

India attended high school in Detroit at Osborn High School. She went on to attend college at Capital University in Columbus, Ohio, receiving a B.A. in Speech Science and Communication. She also received an A.A. from the Psychology Center in Catonsville, Md., and later enrolled in the University of



INDIA TILLER

member in the University of Maryland’s Department of Business Services from 2000 - 2004. India was an enthusiastic animal lover and had two dogs: Pepper, a Shih Tzu, and Sammy, a Basenji.

Maryland University College Master of Science in Management program. Before joining the ECE Department, India worked as a staff

The Department organized a memorial service in India’s honor on March 3rd at the University of Maryland’s Main Memorial Chapel. **Rebecca Copeland** of the Institute for Systems Research led the service, while **Patrick O’Shea, Christopher Davis, Judi Bell, Steve Norton, and Robert Newcomb** offered remarks and reflections.

The ECE Department is collecting funds for a memorial for India. Those interested in contributing should send a check made out to “UMCPF” (University of Maryland College Park Foundation) with “In Memory of India Tiller” written in the memo area of the check, and sent to:

Teresa Moore
Electrical & Computer Engineering Dept.
2457 A.V. Williams Bldg.
College Park, MD 20742



ECE ALUMNI HONORED AT "TOP NAVY SCIENTIST AND ENGINEER OF THE YEAR" AWARDS

ECE alumni **George Stimak** (MS '76, MBA '83), **Jonathan Neumann** (Ph.D. '05), **Richard Fischer** (B.S. '84, M.S. '86), and **Kevin A. Boulais** (Ph.D., '96) received honors at the "Top Navy Scientist and Engineer of the Year" awards. They were among 34 scientists and engineers recognized at the third annual Dr. Delores M. Etter Top Scientists and Engineers of the Year awards ceremony at the Pentagon on May 19.

Stimak, a program officer at the Office of Naval Research (ONR), was honored for breakthrough research that yielded the world's first-ever ship degaussing system to use high temperature superconducting (HTS) materials. Degaussing is the process of making a steel ship's hull nonmagnetic by producing an opposing magnetic field, protecting it from magnetically activated mines.

Neumann was advised by ECE Chairman **Patrick O'Shea**. Fischer currently serves as a research scientist and engineer in the Laser Physics Section at the Naval Research Laboratory.

ALUMNUS GOODMAN SELECTED TO SERVE ON MARYLAND CLEAN ENERGY BOARD

Dan Goodman (B.S.E.E., '87), a Clark School of Engineering alumnus and Smith School of Business senior fellow for renewable energy, was confirmed recently by the Maryland Senate as one of nine Board members of the Maryland Clean Energy Center.

Goodman was appointed to the Board by Gov. Martin O'Malley. He serves as the Board's Treasurer and Chair of the Finance Committee.



DAN GOODMAN

ALUMNUS SIDIROPOULOS ELECTED IEEE FELLOW

ECE Alumnus **Nikos Sidiropoulos** was elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for "contributions to signal processing for communications." Sidiropoulos is a professor in the Telecommunications Division of the Technical University of Crete. He earned his Ph.D. in Electrical Engineering in 1992 as a student of Professor **John Baras**. After graduation, Sidiropoulos was an Institute for Systems Research (ISR) postdoctoral researcher and later an ISR assistant research scientist and an adjunct professor for the ECE Department.

KIM RECEIVES LIFETIME ACHIEVEMENT AWARD, NAMED ONE OF "MOST CREATIVE MINDS"

The Chinese Institute of Engineers has selected alumnus and ECE Professor of Practice **Jeong Kim** (Ph.D. '91, reliability engineering), president of Alcatel-Lucent Bell Labs, as the recipient of its 2009 Distinguished Lifetime Achievement Award. The award recognizes Asian-American engineering professionals with a record of significant personal achievements, contributions to academia, public service and industry. Previous honorees have included Nobel Prize winners, leading professors and corporate leaders. Kim was also named one of the "12 Most Creative Minds of 2008" by Fast Company Magazine.

ECE ALUMNA RECEIVES BLACK ENGINEER OF THE YEAR HONORS

ECE alumna **Muluwork Geremew** (M.S. '06) was named a 2009 Most Promising Engineer by Career Communications Group. She was honored on the national stage at the 23rd Annual Black Engineer of the Year Awards Conference in Baltimore, MD, February 19-22, 2009 at the Baltimore Convention Center. Muluwork currently works at Corning, Inc. in the Modeling and Simulation Directorate as a Process Simulation Scientist. She was advised by Prof. **Joseph Jaja** during her time as an M.S. student in the Electrical and Computer Engineering Department. **C**

CLARK SCHOOL STARTUP LED BY ECE ALUMNA WINS \$500K GLOBAL SECURITY CHALLENGE

TRX Systems, a company founded by ECE Professor and Associate Chair for External Affairs **Gil Blankenship** and led by ECE alumna and Chief Executive Officer (CEO) **Carole Teolis**, won first place in the third annual Global Security Challenge (GSC) international competition.

Teolis and TRX Chief Operating Officer **Karina Drees** presented TRX's Sentinel™ first responder tracking and monitoring technology at the final competition held in London last November. TRX Systems beat out five other semi-finalists to win the "Most Promising Security Start-up 2008" award, for which TRX received a \$500,000 federal contract from the Technical Support Working Group, the U.S. national forum that coordinates interagency and international research for combating terrorism.

Based in Greenbelt, Md., TRX Systems recently graduated from the Technology Advancement Program, the incubator facility for startups that is part of the Clark School's Maryland Technology Enterprise Institute (Mtech). Before winning the GSC competition, the company was named the Maryland Incubator Company of the Year for Homeland Security. TRX employs 17 people—seven full-time, seven part-time, and three consultants. All but three are University of Maryland alumni.

TRX's system can effectively track individuals inside multi-story buildings with no special instrumentation or preparation of the incident site required. The system provides accurate, reliable locations in 3-dimensions, indoors and outside regardless of the local environment, weather conditions, availability of GPS, etc. The system's precision location and health information for deployed personnel allows a dramatic improvement in rescue time for distressed or downed firefighters.

"Interaction with firefighters from the start has been critical to the development of a system that firefighters will use and that meets their requirements," said TRX CEO Teolis. "The involvement of the Maryland Fire and Rescue Institute has been vital in the development of the TRX system."

Teolis, a 1994 Ph.D. graduate in electrical engineering, was advised by Professor **John Baras**. Teolis also holds a B.S. and M.S. in electrical engineering from Maryland. **C**

NEW FACULTY POSITIONS AND PROMOTIONS, ACADEMIC ACCOMPLISHMENTS AND AWARDS FOR ECE ALUMNI

ALUMNA ELHILALI WINS NSF CAREER AWARD

Alumna **Mounya Elhilali** received a National Science Foundation (NSF) CAREER Award for Cognitive Auditory Systems for Processing of Complex Acoustic Scenes. The five-year, \$550K award will support her research in developing an architecture for sound processing based on cognitive and adaptive processes. Elhilali earned her Ph.D. in Electrical Engineering in 2004. She was advised by Prof. **Shihab Shamma**. Currently she is an assistant professor of electrical and computer engineering at Johns Hopkins University, where she also is active in the Center for Language and Speech Processing.

ALUMNUS SEAN ANDERSSON RECEIVES NSF CAREER AWARD

Alumnus **Sean Andersson**, assistant professor of mechanical engineering at Boston University, has received a National Science Foundation CAREER Award for “Nonlinear Control for Single Molecule Tracking.” The five-year, \$430K award will establish a rigorous theoretical and experimental foundation for tracking single nanometer-scale particles and for tracking multiple particles simultaneously. Andersson earned his Ph.D. in Electrical Engineering in 2003. He was advised by Prof. **P.S. Krishnaprasad**.

ALUMNUS BLACK JOINS AMERICAN UNIVERSITY FACULTY

ECE alumnus **Michael Black** (Ph.D., '07) joined the faculty of the Department of Computer Science at American University in Washington, DC. He currently serves as assistant professor. Black's research and teaching focus is in the areas of computer architecture and parallel computing. During

his time at the University of Maryland, Michael was advised by Professor **Manoj Franklin**. As a student, he served on the board of the ECE Graduate Student Association (ECEGSA).

ALUMNUS ANDRES KWASINSKI JOINS RIT FACULTY

ECE alumnus **Andres Kwasinski** (Ph.D., '04) joined the faculty of the Department of Computer Engineering at the Rochester Institute of Technology. Dr. Kwasinski's research and teaching focus

is in the areas of digital signal processing and networking/communications. Kwasinski was advised by Prof. **K.J. Ray Liu** during his time studying in the ECE Department and Institute for Systems Research (ISR), and served as a postdoc within ISR after graduating.

SEDDIK JOINS EE FACULTY AT ALEXANDRIA UNIVERSITY

Karim Seddik, a 2008 ECE Ph.D. graduate, accepted a position as assistant professor of electrical engineering at Alexandria University, Egypt. Karim was advised by Associate Chair for Graduate Studies and Research and Professor **K. J. Ray Liu**. Karim's research interests include sensor networks, cooperative communications, source-channel diversity over relay channels, and blind channel estimation in OFDM and MIMO-OFDM systems.

ALUMNUS PRIYA RANJAN TO JOIN IIT KANPUR FACULTY

ECE alumnus **Priya Ranjan** will join the Indian Institute of Technology Kanpur as

an assistant professor in the Department of Electrical Engineering in Fall 2009. Ranjan received his Ph.D. in Electrical Engineering in 2003. He was advised by Institute for Systems Research Director **Eyad Abed** and Associate Professor **Richard La**. Ranjan served as a senior research scientist at Intelligent Automation, Inc., in Rockville, Md., and also is a former ISR research associate.

ALUMNUS SOYSAL JOINS FACULTY OF TURKEY'S BAĞÇEĐEHİR UNIVERSITY

ECE alumnus **Alkan Soysal** (Ph.D., '08) joined the faculty of Bağçeşehir University, Istanbul, Turkey. He is currently serving as assistant professor in the Department of Electrical and Electronics Engineering. Soysal received his M.S. and Ph.D. degrees in electrical and computer engineering from the University of Maryland in 2006 and 2008, respectively. He was advised by **Sennur Ulukus**. Soysal's research interests are in wireless communication theory, information theory and signal processing for wireless communications with particular focus on MIMO networks.

ALUMNA ZHENG EARNS TENURE AT UC-SANTA BARBARA

ECE alumna **Heather (Haitao) Zheng** (M.S., '98, Ph.D., '99) was promoted to the position of associate professor with tenure in the Department of Computer Science at the University of California, Santa Barbara. She was advised by Associate Chair for Graduate Studies and Research and Professor **K. J. Ray Liu**.



ALUMNUS NARASINGARAO SREENATH PROMOTED TO FULL PROFESSOR AT CASE WESTERN RESERVE

Narasingarao “Sree” Sreenath (ECE, Ph.D., '87) has been promoted to full professor in the Electrical Engineering and Computer Science Department at Case Western Reserve University in Cleveland. He is a former student of Professor **P.S. Krishnaprasad**. Sreenath is the director of the Complex Systems Biology Center and also the Director of Case Systems Biology Initiative (Case SBI). In addition, he co-directs the UNESCO Global Issues Education Network Initiative (GENIE). He is a recipient of NIH-National Cancer Institute (NCI) Research Career Award in 2004.

ALUMNUS BILL BYRNE PROMOTED TO READER AT CAMBRIDGE

Alumnus **Bill Byrne** (ECE, Ph.D., 1993) was recently promoted to a Readership in Information Engineering in the Department of Engineering at the University of Cambridge in the United Kingdom. He was previously a Lecturer in Speech Processing. He is also a Fellow of Clare College, Cambridge. **C**



BILL BYRNE

ECE ALUMNUS PAUL TRAN RECEIVES MINORITY BUSINESS LEADER AWARD

Alumnus **Paul Tran** (B.S. '95, EE), President and CEO of Elucid Solutions, was honored by the Washington Business Journal with the prestigious Minority Business Leader Award in April. Born in Vietnam, Tran came to the U.S. and earned a degree in Electrical Engineering from Maryland in 1995. He later started his own company, Elucid Solutions, which he modeled after a culture devoted to client service, rewarding employee loyalty, and incorporating charitable giving and community service. **C**

ECE ALUMNI ADVANCE IN INDUSTRY

MANIKONDA NAMED PRESIDENT OF INTELLIGENT AUTOMATION, INC.

Alumnus **Vikram Manikonda** (ECE, Ph.D., '97) was appointed president of Intelligent Automation, Inc., based in Rockville, Md. He is a former advisee of Prof. **P.S. Krishnaprasad**. His research over the last decade has spanned nonlinear and geometric control, motion description languages, robotics, and the application of multi-agent systems agents to simulation, distributed control, and air traffic control and management. During his time at Maryland, Manikonda helped develop DLe, a motion control language for robotics, and was manager of the Intelligent Servosystems Laboratory (ISL).

ECE ALUMNUS HERSHEY PROMOTED TO FELLOW AT RAYTHEON

Paul C. Hershey (ECE, M.S., '84; Ph.D., '94) was promoted to the position of Engineering Fellow at Raytheon. Hershey was one of only nine individuals to receive this honor, given to Raytheon professionals who have distinguished themselves through technical achievements and expertise in the application of advanced technologies.

IN MEMORIAM

Linda Lea Overman Bright (B.S., E.E., '77), 58, passed away after a long illness on Nov. 25, 2008 in Glen Burnie, Md. Bright worked for the National Security Agency before leaving to devote time to her family. A long-time birthing instructor in the Bradley Method, she was very active in her church and in community service, opening her home to teens in trouble and homeless animals.

George W. Cooper (M.S., E.E., '86), 55, died Aug. 20, 2008 after running in a race. Cooper had served as a National Security Agency engineer since 1990. Prior to NSA, he worked for Voice of America and Ralph M. Parsons engineering and construction. He received B.S. and M.S. degrees in civil engineering from the University of Michigan. He received his M.S. degree in electrical engineering from the University of Maryland in 1986. He did volunteer work for Habitat for Humanity and was a member of the Institute of Electrical and Electronics Engineers.

Louis Costrell (M.S., E.E., '49), 93, died of prostate cancer on June 8, 2009 in Rockville, Md. In 1946, Costrell joined what is now the National Institute of Standards and Technology, where he worked in the radiation-detection field. He retired in 1982 as chief of the radiation measurement technology section but stayed on until his death as an engineer. In 1964, Mr. Costrell wrote a reference manual that became the authoritative textbook on the standardized electrical specifications for radiation-measuring components. It is still used in laboratories worldwide today.

Clarence “Buzz” Pearl Jones, Jr. (B.S., E.E., '64), passed away on March 26, 2009. A D.C. native, Jones joined the Navy and served as an electronics technician. He was a reservist for 23 years, retiring as a Commander. After active duty, he completed his B.S. degree at Maryland. After graduation, he worked at the Naval Ordnance Laboratory (N.O.L.) in White Oak, Md. In 1970, he transferred to Keyport where he became the senior technical liaison between Keyport and N.O.L.

Nicholas C. Paleologos (B.S., E.E., '60), 70, died March 31, 2009, at his home in Savannah, Ga., following an extended fight with cancer. He graduated from Maryland with a B.S. in electrical engineering and as captain of the varsity swimming team. He joined the Navy where he served for 20 years, mostly at sea and in the Pacific. His last tour was as commanding officer of a destroyer stationed out of Pearl Harbor. Following the Navy, he had a second career in the nuclear electric generation industry at the Institute of Nuclear Power Operations.

Dr. Alan J. Simmons (Ph.D., E.E., '57), 84, died Feb. 9, 2009 of complications of Parkinson's disease at his home in Center Sandwich, N.H. He received a B.S. degree in Chemistry at Harvard University. After Pearl Harbor was attacked, Simmons joined the U.S. Navy and developed a fascination with communications technology, leading to his work on the first U.S. satellites. Simmons earned his M.S. degree from MIT in 1948 and a Ph.D. in electrical engineering from Maryland in 1957. He was a group leader at MIT's Lincoln Lab for 17 years.

Robert L. Terrell Jr. (B.S., E.E., '53), 78, died of pneumonia Nov. 27, 2008. Terrell, a native Washingtonian, graduated from Maryland with a B.S. in 1953. He served in the Navy from 1955 to 1958 aboard the aircraft carrier USS Antietam. He returned to the D.C. area and started his company, G.T. Associates, an electronics sales firm which he owned and operated in Silver Spring for more than 20 years. Terrell moved to Hendersonville, N.C., where he owned a parcel-packing store for 15 years. He moved to Michigan in 2006.

Sukij Yongpiyakul (B.S., E.E., '88) passed away in October 2008. In addition to his B.S. in electrical engineering from Maryland, he also had a B.S. in mathematics from Columbia Union College. He was awarded the 1992 Outstanding Invention of the Year for “The Connect Family of Innovative Voice Response Applications” from the University of Maryland Graduate Research Office of Technology Liaison. As a University of Maryland employee, he provided engineering and technical expertise in the support of complex voice and data communication systems. His contributions included planning, design, engineering and project management support for the installation of the campus-wide telecommunications system. **C**

Charles Tobin Receives Peoples Fellowship with DOE's Fermilab

ECE 2009 Ph.D. graduate **J. Charles Tobin** received the prestigious Peoples Fellowship from the U.S. Department of Energy's (DOE) Fermi National Accelerator Laboratory (Fermilab), a national lab located in Chicago that focuses on research at the frontiers of high energy physics. The three-year, tenure-track fellowship will focus on next-generation colliders and high intensity proton source research.

The Peoples Fellowship was created at Fermilab with the goal of attracting outstanding accelerator scientists early in their careers who have the potential to be leaders of the field. Peoples Fellows are provided with significant research support and have extraordinary latitude in choosing their research activities. The position is equivalent to an assistant professor at a university.

An advisee of ECE Chairman **Patrick**



J. CHARLES TOBIN

O'Shea, Charles earned his Ph.D. in May 2009, studying space-charge dominated electron beams. Charles expressed gratitude to Prof. O'Shea, as well as Prof. **Rami**

Kishek, Prof. **Martin Reiser** and Dr. **Don Feldman** for their guidance and support. He also cited his participation in the Clark School's Future Faculty Fellows program, as well as his training at the International Accelerator School for Linear Colliders in Erice, Italy, as significant factors in helping him qualify

and prepare for the Peoples Fellowship opportunity at Fermilab.

Charles' primary areas of research include next-generation particle accelerators and photoinjectors. As a graduate student under O'Shea, he worked on the University of Maryland Electron Ring project. This fall, he will start work on the A0 photoinjector and Project X at Fermilab. C

Soujanya Kedilaya Selected as 2009 Texas Instruments Scholar

ECE M.S. student **Soujanya Kedilaya** was selected as a 2009 Texas Instruments (TI) Scholar. Kedilaya is an advisee of Prof. **Shuvra Bhattacharyya**.

The TI Scholars program was made possible by a gift from Texas Instruments through the ECE Corporate Affiliates program. Each year, Texas Instruments supports two talented graduate students in electrical and computer engineering with a tuition grant, stipend, and benefits through the TI Scholars program. TI Scholars work on selected research topics related to communications and signal processing.

Since joining the University of Maryland as a Masters student in Fall 2008, Soujanya has been a member of the Digital

Signal Processing Computer-Aided Design (DSPCAD) Research Group led by Prof. Bhattacharyya. Soujanya's research interests



SOUJANYA KEDILAYA

include embedded software and very-large-scale integration (VLSI) architectures for signal processing applications. Recently, she was a recipient of the Marshall Plan Scholarship

that promotes academic exchange between American and Austrian universities, offering her the opportunity to visit the Salzburg University of Applied Sciences in Austria. C

Students Celebrate Third Annual ECE International Day

Undergraduates, graduate students, friends, faculty, and staff from the Electrical and Computer Engineering (ECE) Department joined together to share their different cultures at the third annual ECE International Day on Tuesday, April 14, 2009, in the A.V. Williams Building.

Over 250 students, faculty, and staff attended the event, representing over 36 different countries. The popular event, which showcases the department's broad diversity each year, was sponsored by ECE Graduate Student Association, Women in ECE, and the ECE Undergraduate Student Council.

Costumes and music organized by graduate student **Marcos Vasconcelos** entertained the crowds and a medley of foods from the different countries satisfied the appetites of those who filled the room. Students, faculty, and staff dressed up in traditional costumes and brought in a variety of homemade dishes for fellow students and colleagues to sample their nation's culture.

Mahsa Domajafi, graduate student and president of Women in ECE, looks forward to ECE International Day each year.

"It is a chance for faculty and students to meet each other outside the classrooms in a different atmosphere while learning about each others' cultures," said Mahsa.

Filiz Yesilkoy, graduate student and vice president of Women in ECE, recalled her enlightening encounter with a cheese tray brought in by Research Scientist, **Quirino Balzano**, who represented Italy.

"[Quirino] brought in a delicious cheese tray and told us how it was made, how old it was, and how to age cheese," said Filiz.

The different cultures represented at ECE International Day included Brazil, Chile, China, Denmark, England, Ethiopia, India, Iran, Ireland, Italy, Jamaica, Japan, Korea, Lebanon, Philippines, Poland, Taiwan, and Turkey. C

Fresh off Last Year's Win, Robotics@Maryland Places 8th at Autonomous Underwater Vehicle Competition

This year, the Robotics@Maryland team hoped to repeat their victory at the Association for Unmanned Vehicle Systems International (AUVSI) and Office of Naval Research 12th Annual International Autonomous Underwater Vehicle Competition in San Diego, Calif., held in August. Last year, the Maryland team edged out 25 other teams from across the U.S., India, Canada and Japan to win the competition in only their second year participating. This year, they finished 8th out of 30 teams, still an impressive showing.

The Robotics@Maryland team is comprised of students across a variety of different majors, including many in electrical and computer engineering. The team has been advised by Prof.

Dave Akin and Prof. **Nuno Martins**. Robotics@Maryland is sponsored by the Electrical and



THE ROBOTICS@MARYLAND TEAM WON THE 2008 AUVSI COMPETITION

Computer Engineering Dept., the Aerospace Engineering Dept., the Institute for Systems Research, the Clark School of Engineering, and the UM Office of the Vice President for Research,

and also receives corporate support from BAE Systems, Lockheed Martin, Northrop Grumman, MEMSense, and Apple.

The Robotics@Maryland team has benefited from a particularly useful and unique facility at the Clark School's Neutral Buoyancy Research Facility in the Space Systems Laboratory on the University of Maryland campus—the only such university-based facility in the country. The 50-foot diameter, 25-foot deep water

tank is used to simulate the microgravity environment of space, and proved a valuable environment for practicing the robot's maneuvering capabilities. C

Maryland To Host Second Annual Robotic Speedway Competition

The Robotics@Maryland ground team placed second in the first annual Autonomous Robot Speedway Competition hosted by the University



THE AUTONOMOUS ROBOT SPEEDWAY COMPETITION, OCT. 24

of Maryland in October, 2008. The Robotics@Maryland team took home a \$250 prize. The event was conceived and organized by the Washington, DC Chapter of the Institute of Electrical and Electronic Engineers Robotics and Automation Society (IEEE-RAS) in

conjunction with members of Robotics@Maryland, and Maryland's Department of Electrical and Computer Engineering (ECE). The competition

was sponsored by Robotic Research.

The 2009 Autonomous Robot Speedway Competition will be held Saturday, October 24 in the open parking lot located next to the Computer Science Instructional Facility on the College Park campus. C

TERPS RACING EXCELS IN RECENT INTERNATIONAL BAJA, SAE COMPETITIONS

The University of Maryland Terps Racing teams continue to impress at international racing competitions.

Maryland's Baja team, which consists of many Clark School students, placed third overall against an international field of 100 teams at the Baja SAE Alabama 2009 competition at Auburn University, April 16-19.

Last year, the Terps Racing team won the Formula SAE West, held at California Speedway, placing first overall out of 83 teams from all over the world. Five ECE undergraduate students participated on the Formula SAE racing team, plus ECE grad student **Mike Stanley**, together with 20 other engineering undergrads. This year, the Formula SAE team placed fourth in the same competition. C

AVINASH VARNA RECEIVES LITTON FELLOWSHIP

Avinash Varna, an ECE Ph.D. student advised by Prof. **Min Wu**, was selected as winner of the Clark School Litton Industries Fellowship. The award, worth



AVINASH VARNA

\$11,075, was established by Litton Industries to support outstanding full-time graduate students in pursuit of a doctorate degree in either Electrical or Mechanical Engineering who are committed to a teaching career in engineering education. Avinash's research interests are in the broad area of signal and image processing, information forensics and security.

ENLU ZHOU TO JOIN FACULTY AT UNIV. OF ILLINOIS

ECE graduate student **Enlu Zhou** will join the Department of Industrial & Enterprise Systems Engineering (IESE) at the University of Illinois at Urbana-Champaign, as an Assistant Professor this



ENLU ZHOU

coming fall. Enlu Zhou received a B.S. degree with highest honors in electrical engineering from Zhejiang University, China, in 2004, and will receive a Ph.D. degree in electrical engineering from the University of Maryland, College Park, in August 2009. She has been advised by Prof. **Steve Marcus** and Prof. **Michael Fu**. She was a recipient of the NSF award for Cyberinfrastructure Experiences for Graduate Students in 2007, the Future Faculty Fellowship from A. James Clark

School of Engineering in 2007-2009, and the ECE Distinguished Dissertation Fellowship in 2009.

ECE UNDERGRADS HONORED WITH AWARDS

Eight ECE undergraduate students were presented with awards at the Clark School Honors and Awards Ceremony on April 29, 2009. The ECE Department's Outstanding Academic Performance Award, awarded to juniors for academic excellence, was presented to **Elizabeth Kenyon**, an Electrical Engineering major. **Jason Callender** received the ECE Department's Service Award. Recognized for their outstanding academic performance as seniors, **Ali Faghih**, **Ameer Abutaleb**, **Anqi Fu**, **David Crawford**, and **Renfei Luo** all received the ECE Department's Chair's Award. The recipients of the International Engineering Consortium's William L. Everitt Student Award were **Phil Luo** and **Anqi Fu**.

ECE GRAD STUDENT SIWAK AWARDED ARCS FELLOWSHIP

Nathan Siwak, a graduate student advised by Prof. **Reza Ghodssi**, won a 2009 Achievement Rewards for College Scientists (ARCS) Fellowship worth \$15K. Nathan conducts research in the MEMS (micro-electro-mechanical systems) Sensors and Actuators Laboratory. His research activities are currently focused on creating cantilever microsystems that can detect various gases, vapors, aerosols, or other analytes of interest.

STEPHAN KOEV WINS MEMS ALLIANCE AWARD, SYSTEMS ENGINEERING AWARD

Stephan Koev, a Ph.D. student of Professor **Reza Ghodssi**, won the Best Student Poster Award at the 2008 MEMS Alliance Symposium, held at the Johns Hopkins Applied Physics Lab on Nov. 24. The poster described Koev's research on optical

SATINDER PAL SINGH NAMED NEW PRESIDENT OF ECEGSA

ECE PH.D. STUDENT **SATINDER PAL SINGH** WAS NAMED THE NEW PRESIDENT OF THE AWARD-WINNING ELECTRICAL AND COMPUTER ENGINEERING GRADUATE STUDENT ASSOCIATION (ECEGSA), SUCCEEDING **EDUARDO ARVELO**. SINGH IS ADVISED BY PROF. **MARK SHAYMAN**. HIS CURRENT RESEARCH FOCUS IS IPGEOLOCATION, WHICH INVOLVES ESTIMATING THE GEOGRAPHICAL LOCATION OF AN IP ADDRESS IN A METROPOLITAN AREA. C



microantilever sensors for liquid samples being conducted in the MEMS Sensors and Actuators Laboratory and the Center for Biosystems Research at the University of Maryland Biotechnology Institute. Stephan was the recipient of this year's George Harhalakis Outstanding Systems Engineering Graduate Student Award. He also won a university-wide graduate student research contest and was featured in the February 2009 issue of Research@Maryland.

ECE-MENTORED HIGH SCHOOL STUDENT CREATES INNOVATIVE PROSTHETIC DEVICE

A local area high school student spent time on campus to develop a new device to help soldier amputees returning from Iraq and Afghanistan. North Point High School student **Katherine Bomkamp**, 17, created a therapeutic prosthetic device to relieve pain and discomfort for amputees with the assistance of Prof. **Gilmer Blankenship**, ECE Engineer **Jay Renner**, and students in the BAE Systems Controls Instructional Laboratory. Bomkamp demonstrated her handiwork at Maryland Day, and also at the 50th Annual Charles County Science Fair, earning a grand prize, and advanced to the Intel Science Fair in Nevada. C