FALL 2004 | Vol.11, No.2

CONNECTIONS

ELECTRICAL AND COMPUTER ENGINEERING

A newsletter of the Department of Electrical and Computer Engineering

INSIDE

Min Wu among world's top young innovators on 'TR100' list

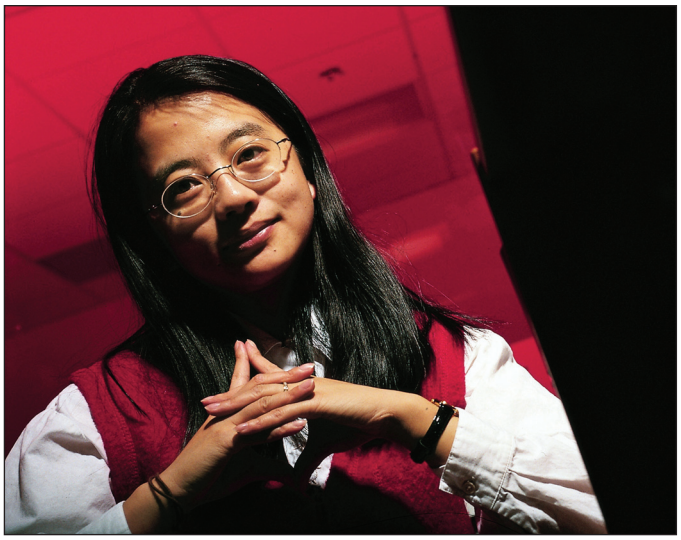


Photo by John T. Consoli

Assistant professor Min Wu is among the world's 100 top young innovators according to Massachusetts Institute of Technology's *Technology Review* magazine, which named her to its "TR100" list this fall. The list names 100 individuals under age 35 whose innovative work has made a profound impact on the world.

The nominees were recognized for transforming biotechnology, medicine, computing and nanotechnology.

Wu is developing novel solutions to multimedia security and content protection problems such as fraud prevention of binary documents and forensic tracking of classified multimedia content. She is a signal processing expert on security in multimedia applications and on hiding information in digital images. Her research has applications from the Department of Defense to the Hollywood film industry.

Wu holds U.S. Patent No. 6,285,775 for technology that adds a digital signature to a black-and-white image by subtly altering individual pixels on the edges of letters and other symbols. If widely adopted, this technology could make it virtually impossible to forge or alter an electronic image or document. Wu also holds three other patents on digital watermarking and multimedia. In 2003 she co-authored *Multimedia Data Hiding* with Bede Liu of Princeton University. She won an NSF CAREER Award for "Signal Processing Approaches for Multimedia Security and Information Protection" in 2001.

Originally from Beijing, Wu received her Ph.D. in electrical engineering from Princeton in 2001. She joined Maryland in 2001 with a joint appointment in ECE and the Institute of Advanced Computer Studies. She is also affiliated with the Institute for Systems Research.

Technology Review began the TR100 list five years ago to recognize the world's top innovators under age 35. Inclusion among the TR100 has become one of the most prestigious awards for young innovators around the world.

Message from the Chair

We have some very exciting news to report to you in this issue. The most recent *US News & World Report's* "America's Best Graduate Schools" issue ranks our department 14th (8th among public schools) and computer engineering 16th (9th among public schools) in the nation. As a whole, the Clark School ranked 16th (10th among public universities), tied with Princeton and the University of California, Los Angeles. In engineering specialties, of the Clark School's seven programs, an unprecedented six have been ranked among the top 25. In all cases, these departmental rankings are the highest the college has ever had. We take great pride in this news.

Our cover story in this issue honors Assistant Professor **Min Wu,** who has been chosen by MIT's *Technology Review* magazine as among the top young innovators in the world. Congratulations, Min!

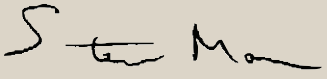
Another faculty member, **Timothy Horiuchi,** is receiving significant attention by the medical, military and science communities for his research on bats and how they detect and use sound. He has received funding from such organizations as NIH, NSF and the Air Force. We are excited to profile "Timmer" and his research on page 4.

Speaking of cutting-edge research, we talk with of our alums, **Naomi Leonard,** about her work in underwater robotics on page 6. Leonard received her Ph.D in 1994 and was a student of **P.S. Krishnaprasad.** She is now a professor at Princeton.

This fall we welcome Assistant Professor **Peter Petrov.** Peter recently completed his Ph.D. at the University of California in San Diego. His research focuses on embedded systems and processors. Read about him on page 9.

We are excited to announce the establishment of a new endowed scholarship in honor of alumnus **Raymond Tate.** The Raymond T. Tate Endowed Scholarship will support undergraduate and master's engineering students performing research in electromagnetism, electrophysics or a related field. The scholarship was established in honor of Mr. Tate's 80th birthday by family and friends. We are grateful for the gift and for what it will mean to those students who will benefit from it.

As the fall semester begins we welcome students back to campus and celebrate our recent graduates. Among these is **Jennifer Roberts,** who is going on to graduate studies at MIT. During her time here, Jennifer truly made a difference, not only as a successful and gifted student but as an advocate for mental health issues. She also is a talented singer and ballroom dancer. Jennifer is an example of a student who has made the university a better place for having been here. I'm sure you will enjoy reading her profile on page 11. We want to wish her and our other graduates the best of luck as they begin their new endeavors, whether it be continuing their education or joining the professional ranks. We watch their future progress with great anticipation.



Major awards to ECE faculty

Shihab Shamma receives $1.25 million NIH grant

Professor **Shihab Shamma** is the principal investigator for a new five-year, $1.25 million grant from NIH. "Spectro-Temporal Plasticity in Primary Auditory Cortex" is sponsored by NIH's National Institute on Deafness and other Communication Disorders. The co-PI is **Jonathan Fritz,** a post-doctoral researcher at ISR.

"Auditory experience can cause significant and continuous reorganization and receptive field plasticity in the primary auditory cortex (AI)," says Shamma. "The exact form of this plasticity depends on the details of the behavioral context, and of the spectral and temporal cues in the acoustic stimuli."

Recent findings indicate that neuronal responses in AI of awake behaving animals reflect motor, attention and reward dimensions, rather than simply encoding the acoustic features of the stimuli. According to Shamma, this is "consistent with findings in other neural systems and supports the hypothesis that auditory cortical cells may undergo rapid, short-term, and context-dependent changes of their receptive field properties when an animal is engaged in different auditory behavioral tasks."

Shamma's research will explore the hypothesis that plasticity would likely involve a selective functional reconfiguring of the underlying cortical circuitry to sculpt the most effective receptive field for accomplishing the auditory task.

Reza Ghodssi receives NSF grant for InP-based MEMS-tunable optical filters and switches

Assistant Professor **Reza Ghodssi** is the principal investigator for a new three-

year, $210,000 NSF grant for InP-based MEMS-tunable optical filters and switches. **Madhumita Datta,** research associate in the MEMS Sensor and Actuators Lab, is the co-principal investigator. The project will develop and test wavelength-selective widely tunable (1250-1650 nm) resonant microcavity filters and switches by on-chip electrostatic micro-electro-mechanical actuation of indium phosphide (InP) waveguides and highly reflective monolithic horizontal mirrors, for broadband optical networks.

Rama Chellappa and Reza Ghodssi part of $3 million MURI grant

ECE faculty members **Rama Chellappa** and **Reza Ghodssi** are part of a new three-year (with option for two more), $3 million Multidisciplinary University Research Initiative (MURI) award from the Department of Defense. Chellappa and Ghodssi will be working on "Micro Hovering Air Vehicles: Revolutionary Concepts and Navigation Advancements."

This award focuses on the development of revolutionary concepts and navigation advancements in the emerging research area of micro hovering air vehicles. The principal investigator is **Inderjit Chopra** of the Department of Aerospace Engineering.

Four ECE faculty on team for a new $1.3 million NSF/NIH Biosonar grant

Assistant Professor **Timothy Horiuchi,** Professor **P.S. Krishnaprasad,** Professor **Shihab Shamma** and Assistant Professor **Jonathan Simon** are co-PIs for a new four-year, $1.3 million NSF/NIH grant, "Innovative Technologies Inspired by Biosonar." Professor **Cynthia Moss** (Psychology/ISR) is the principal investigator. The project aims to advance understanding of the transformation of sensory information to motor commands for adaptive behaviors such as tracking, reaching, grasping and steering around obstacles in the natural environment.

A more complete understanding of the computations supporting these vital functions of the nervous system will facilitate treatment and rehabilitation when they fail to develop normally or break down through disease. The echolocating bat will be used as a model system because it exhibits rich but well-defined adaptive motor patterns that indicate changing behavioral states. This interdisciplinary project brings together biology, neural recording telemetry, and control systems in novel and important ways.

This grant in the NSF/NIH Collaborative Research in Computational Neuroscience (CRCNS) program is funded by the National Institute of Biomedical Imaging and Bioengineering.

Goldsman, Tretter, Liu and Dagenais receive MIPS awards

Four ECE professors recently received contract awards from the Maryland Industrial Partnerships program (MIPS).

Professor **Steven Tretter** is working with TeleContinuity, Inc., of Rockville, Md. to create a seamless, low-cost, network-level solution to quickly restore telephone service to users after a catastrophic event, PBX failure, fiber cut, fire, flood, or similar circumstance. The solution will integrate Voice over IP (VoIP) with Public Switched Telephone Network technology to create a "hot" standby telephone service.

Professor **Neil Goldsman** is working with TRX Systems, Inc., of Lanham, Md., on indoor location and emergency alerting. He will design and develop technology to wirelessly track the location of firefighters, police and other public personnel inside buildings and structures.

Professor **K.J. Ray Liu** continues his work with InTank, Inc., of Laurel, Md., on the project, "Ultrasonic Nondestructive Inspection of Tanks." This project is developing an effective and efficient ultrasonic testing system for use in robots that inspect commercial storage tanks such as gasoline, fuel oil, and chemicals.

Liu also is working with Maryland Semiconductor, Inc., Clarksburg, Md., on "Wireless USB Broadband Connectivity," a new project that will develop high-speed, wireless universal serial bus (USB) hardware and software to interconnect office devices at data rates of 55 to 480 megabits per second.

Professor **Mario Dagenais** is working with Maxion Technologies, Inc., of Hyattsville, Md. on semiconductor laser technology for chemical sensors. The project is titled "Tunable Diode Laser for Chemical Sensors."

The MIPS program provides matching funding for university-based research projects that help companies develop new products. MIPS projects must deal with innovative technological or scientific concepts and have direct commercial applications.

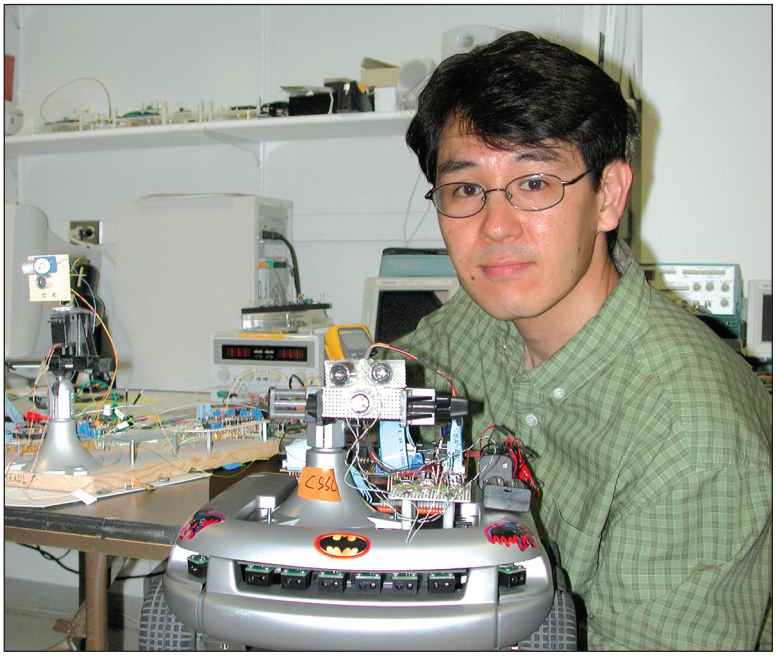
Other recent contracts

Professor **Christopher Davis** received a $291,047 DURIP (Defense University Research Instrumentation Program) for "Optical and Radio Frequency Communications Testbed for Scalable Networks."

ECE Chair **Steve Marcus** and Professor **Michael Fu** (Business/ISR) received a three-year, $622,947 grant from the Air Force for "Integrated Risk-Sensitive, Simulation-based and Graphical Methodologies for Estimation and Control."

Professor **Neil Goldsman** and **Joy Bernstein** (MSE) received a three-year, $458,805 grant from the Office of Naval Research for "Reliability, Analysis and Design of Wide Bandgap Power Semiconductor Devices."

Horiuchi's research focuses on how bats detect and use sound



Horiuchi with the "Batmobile," a robotic vehicle that incorporates technology based on his research.

As a child, Timothy Horiuchi was fascinated by the mysteries of the animal world. He would often imagine himself as one of them.

"I knew that at night some animals could see better than we could, and I would wonder what it would be like to be an owl, or that other animals, like elephants, could hear at a different frequency range than we could," he recalls. "I would wonder what it would be like to be an elephant and hear those low frequency noises from long distances away."

Today, Horiuchi is an ECE assistant professor also affiliated with the Institute for Systems Research and the Neuroscience and Cognitive Sciences program. He is converting his childhood fascination into cutting-edge research by studying another favorite, the bat.

Horiuchi is trying to get an understanding of how biological systems operate so power efficiently and how adaptation and learning are integrated into the brains of so many successful animals.

Although bats seem very different from humans, their brains are characteristically mammalian, and they detect and analyze sounds in much the same way humans do. The differences in auditory behavior between bats and humans are often reflected in brain structures, giving us a clue about how brains process sound.

From an electrical engineering perspective, says Horiuchi, this knowledge could help open the door to all kinds of possibilities, including artificial devices that "hear" and navigate by sound and assist humans; autonomous robots; and other devices that can extend our perception of our everyday world.

Horiuchi and his research group in the Computational Sensorimotor Systems Laboratory are focusing on three main areas: bat echolocation modeling; very-large-scale-integration (VLSI) implementation; and neural recording combined with radio telemetry.

Horiuchi and Professor Cynthia Moss (Psychology/ISR) are designing electronic implementations of neural systems for real-time robotic systems to explore neurally-inspired algorithms in real environments. Both physical models and software simulation are employed to understand the flow and processing of echolocation information to drive behavior.

The group also is interested in developing low-power sensory and motor systems that could benefit robotics. They are currently developing VLSI models of the bat cochlea, the echo-direction sensitive cells of the lateral superior olive, the echo delay-tuned cells of the inferior colliculus, and the sensorimotor cells of the superior colliculus. The group also studies their roles in controlling behavior.

In another collaborative effort with Moss and her Auditory Neuroethology Lab, Horiuchi is developing telemetry devices to measure sonar vocalizations, extracellular neural responses, and EMG potentials in flight. These will be transmitted via radio signals to a video-synchronized multi-channel data acquisition system.

The bat research crosses many disciplinary boundaries, bringing a systems view to how bats detect and use sound to understand their world. This has not gone unnoticed by the science, health and military communities.

Horiuchi and Moss recently received a $1.6 million grant from NIH for their work in "Dynamic Sensorimotor Control for Spatial Orientation." The grant was issued by NIH's Division of Neuroscience and Basic Behavioral Science, part of the National Institute of Mental Health.

Horiuchi says, "In this project we're trying to help expand understanding of how mammals process and integrate auditory information with their motor pro-

grams, adapting as they move spatially in their environments."

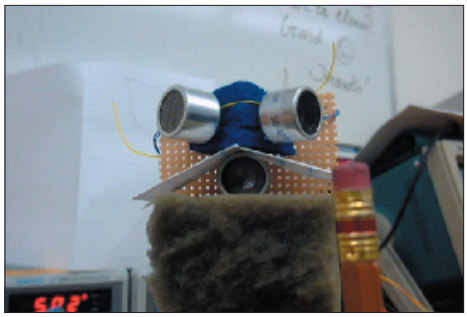
Being able to navigate within the environment is central to healthy human functioning. An enhanced understanding of sensorimotor integration may lead to better treatment and rehabilitation for people in whom this fails to develop normally or for whom it has broken down through disease.

Horiuchi is the recent recipient of an NSF CAREER Award for his work on "Adaptive Neuromorphic VLSI for Improving Accuracy and Precision: Modeling Attention for Bat Echolocation."

Horiuchi's research designs adaptive circuits that mimic brain function to both understand the brain and to build new computational devices

NSF developed the CAREER Award to foster the career development of promising junior faculty.

Horiuchi also has received a grant



Narrowband test system (40 kHz)

Wideband system (10 kHz to 100 kHz)

from the Air Force Office of Scientific Research for "Neuromorphic VLSI-Based Bat Echolocation for Micro- Aerial Vehicle Guidance." The grant funds research in VLSI implementation of neural processing found in the brainstem and midbrain of the echolocating bat. Professor **P.S. Krishnaprasad** is the co-PI for this project.

"Bats seem to be using sound very much the way we use vision to navigate," Horiuchi says. "They are not moving slowly. They are flying an average of two meters a second. They can move very quickly through forests and complex three-dimensional environments using sound alone."

Horiuchi with Professor Cindy Moss (Psychology), his partner in several research awards, including a new $1.6 million NIH grant.

The chips developed based on this research will provide real-time, low-power sensing and will be tested on flying micro-aerial vehicles for collision avoidance and maintaining elevation in forest-like environments,.

Horiuchi, who grew up in the Los Angeles area, was also intrigued early on by the "world I couldn't see or hear. It started with electricity and walkie-talkies and extended to thinking about invisible light and inaudible sound."

As he considered college, "electrical engineering seemed like the way to go," he says. However, he began studying neurobiology along with electrical engineering and "was completely hooked. Combine this with building robots, and I am a very happy person."

Horiuchi earned his bachelor's degree in electrical engineering in 1989 and his Ph.D. in computation and neural systems in 1997, both from the California Institute of Technology. His Ph.D. work focused on the design of analog VLSI circuits that mimic the neural circuit underlying saccadic (rapid) eye movements in primates.

It included designing visual processing chips, auditory localization chips, non-volatile on-chip analog memories, motor control and attention processing.

After completing his postdoctoral work at the Zanvyl Mind/Brain Institute at Johns Hopkins University, Horiuchi joined the ECE Department in 1999. He was drawn to the University of Maryland because of faculty who were working on problems in the neuroscience area as well as the breadth of the department, the interdisciplinary Institute for Systems Research, and the strength and excitement of the Neuroscience and Cognitive Sciences program."

It's a good fit for Horiuchi: "I like the challenge of studying cutting-edge neuroscience and at the same time trying to push the boundaries of electronic design."

Alum Naomi Leonard named MacArthur Fellow for underwater robotic research

The moment was perfect. Riding out on a small boat from California's Monterey Bay late last summer, **Naomi Leonard** could observe for the first time the performance of the marine gliders for which she and her research team had designed control laws. The gliders submerged and resurfaced, gathering important data from the depths of the ocean.

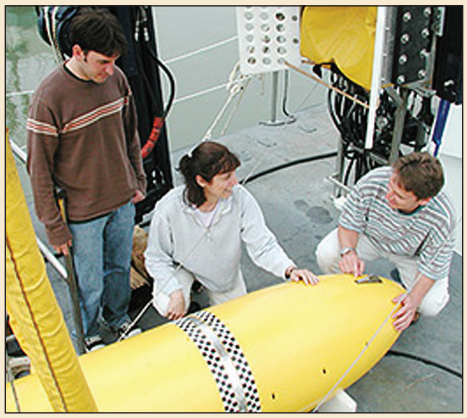
"Then about 100 dolphins surrounded us, jumping out of the water and coming up to the boat. We spotted a blue whale," she recalls. "I remember thinking to myself, 'Wow, I picked the right job.'"

Leonard, who earned her ECE Ph.D. in 1994, now has another reason to celebrate. She has been named one of 23 MacArthur Fellows for 2004 by the John D. and Catherine T. MacArthur Foundation. The award is a $500,000, "no-strings-attached" grant given to recipients selected for originality, creativity, and the potential to do more in the future in fields ranging from science to literature to humanitarian work. It is sometimes referred to as "the genius grant."

Leonard is a professor in the Department of Mechanical and Aerospace Engineering at Princeton University, where she specializes in underwater robotics research. Her 2003 trip to Monterey Bay was part of the Autonomous Ocean Sampling Network project, which brings together sophisticated new robotic vehicles with advanced ocean models to improve the ability to observe and predict the ocean. It relies on a team of researchers from several universities and institutions.

Leonard and her research team, supported by funding from the Office of Naval Research (ONR), worked with a fleet of autonomous underwater vehicles (AUVs) in the Pacific Ocean to test their ability to move in formation through the water while mapping ocean currents and tracking marine microorganisms.

The 15-glider fleet covered an area between the shore and 150 kilometers offshore and dove to depths of 200 to 400 meters. The team ran experiments with groups of gliders to demonstrate tracking and reconfiguring (contracting) formations, and with gliders coordinated with other sensor platforms, such as a towed sensor array from a ship and a propeller-driven AUV, "for evaluating the ability of the group to estimate gradients in things like temperature and salinity," says Leonard.



Leonard and team members inspect one of the gliders before its release into the Monterey Bay.

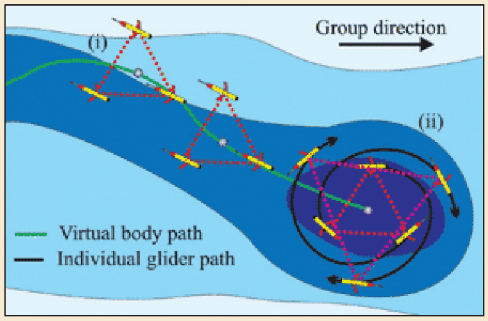
The gliders were almost perfectly reliable and stayed in the water for weeks at a time. Leonard says, "It was an amazing demonstration of the power of feedback control to see the really autonomous behavior of the gliders, especially when you compared it to the demands on person time to keep other parts of the experiment functioning: the airplanes flying, the towed arrays moving, even the propeller-driven AUV going, which needed to be launched and recovered frequently."

The gliders proved to be "amazing vehicles with unbelievable endurance… always collecting data and sending it back."

The gliders' success came after months of planning and design. "It was exciting to be able to go from algorithms we designed through to the whole phase of making them applicable to the ocean environment with operational constraints," she says. The research was "intellectually rewarding… with its depth of mathematics and science as well as biology."

The glider system is modeled after animal groups. In the wild, animals do much better in groups for activities like foraging for food, much as the gliders forage for information. "We can learn a lot from biologists about the way natural systems move around together and why," Leonard says.

Leonard began the path to her current work as a graduate student. She had originally received her bachelor's degree from Princeton in mechanical engineering. After graduating, she went to work for a small engineering company in Washington, D.C. "But, I wanted to go back to school and I



Adaptive sampling. Gradient climbing (i) by the vehicle group on the sampled field and data-driven group rotations, expansions and contractions focus the mobile sensor array on sub-regions of greatest scientific interest.

was interested in control theory," she says.

She learned about the electrical engineering program and the Institute for Systems Research at the University of Maryland. "I went over and talked to some faculty members, and it seemed like a great place, which it turned out to be," she says. "I didn't apply anywhere else."

Leonard did not come to the program planning on staying for a Ph.D., "but I had an inspiring mentor who loved his job and it was infectious," she says of Professor **P.S. Krishnaprasad**. Leonard recently hired another of Krishnaprasad's students as a post-doc. "Maryland engineering students keep getting better and better."

Leonard first became interested in motion control problems and how to systematically control systems or vehicles while working on her dissertation. After graduation, she joined the faculty at Princeton. At an IEEE conference she met researchers involved with autonomous underwater vehicles. "It was a fascinating area with lots of possibilities," she says.

Leonard, who has won both an NSF CAREER Award and an ONR Young Investigator Award, is preparing for the next phase of her underwater robotics research—the Adaptive Sampling and Prediction project. The project is being supported by the Office of Naval Research under the Multi-Disciplinary University Research Initiative (MURI) program with $1 million a year for up to five years. "We will be doing a much more comprehensive study of adaptive sampling," she says of the experiments that will take place in 2006 at Monterey Bay. "This time we want to take every mobile sensor and control it in a way that optimizes the samples and produces the best data set."

Leonard eagerly awaits the challenges ahead. "There's so much to discover in the ocean depths."

Alumni achievements

Ramesh Rao, who received his master's degree 1982 and Ph.D. in 1984, has been appointed the first holder of the QUALCOMM Endowed Chair in Telecommunications and Information Technologies. This is an endowed chair in the Department of Electrical and Computer Engineering at the University of California, San Diego. Rao is professor and directs the San Diego division of the California Institute for Telecommunications and Information Technology or Cal-(IT)2. He is a specialist in network protocols, performance analysis and energy-efficient communications.

A number of ECE Ph.D. graduates have accepted academic positions.

Nitin Chandrachoodan, a student of **K. J. Ray Liu** and **Shuvra Bhattacharyya,** is an assistant professor at IIT – Madras.

Petru Andrei, a student of **Isaak Mayergoyz,** is an assistant professor in the ECE Department at Florida State University.

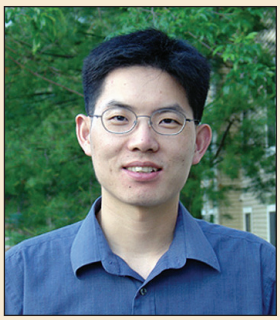
William Byrne, a former student of **Shihab Shamma,** has recently joined the faculty of Cambridge University in the United Kingdom.

Yan Sun, a student of K. J. Ray Liu, is an NSF advance assistant professor at the University of Rhode Island.

Xiaojiang Du, a student of **Mark Shayman,** has joined North Dakota State University as an assistant professor.

Mohamed Zahran, a student of **Manoj Franklin,** joined CUNY (New York) as an assistant professor.

Z. Jane Wang, a postdoc with **K. J. Ray Liu,** is an assistant professor at the University of British Columbia.

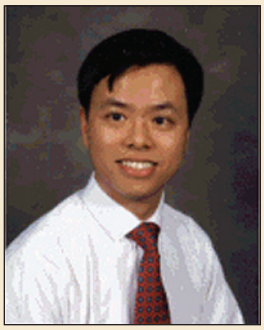


Xiaobo Tan, whose advisor was **John Baras** and co-advisor **P. S. Krishnaprasad,** has joined Michigan State at East Lansing as an assistant professor of electrical and computer engineering.

Pat Mead, a former student of **Christopher Davis,** has recently joined the faculty of Norfolk State University as full professor.

Shaoxiong Hua, a student of **Gang Qu,** joined the faculty of the ECE Department at the University of Alabama as an assistant professor.

Tamer Abu-elfadl, who received his Ph.D. under **Victor Granatstein** in 2002, is on the faculty of Cairo University as a senior lecturer.



Jie Chen, who received his Ph.D. in 1998 and is now an assistant professor with Brown University's Department of Electrical Sciences and Computer Engineering, has been named a Distinguished Lecturer by IEEE's Circuits and Systems Society.

alumniNEWS

Alum Art Wall wins NARTE award

This summer the National Association of Radio and Television Engineers (NARTE) presented its National Service Award to 1970 ECE alum **Art Wall** for his contributions to telecommunications during his career at the Federal Communications Commission. Wall was instrumental in developing Mutual Recognition Agreements (MRA) with the European Union (EU), APAC and South America, which benefited U.S. test labs and manufacturers. He also was a primary developer of the Telecommunications Certified Body (TCB) program, which privatized the telecommunication terminal and radio certification procedures.

ECE chair Steve Marcus with Reji Kartholy, the ECE undergrad who is the recipient of the scholarship.

As part of the award, the recipient designates a college or university of choice to receive at $1,000 scholarship. The ECE Department is the beneficiary of Art's scholarship.

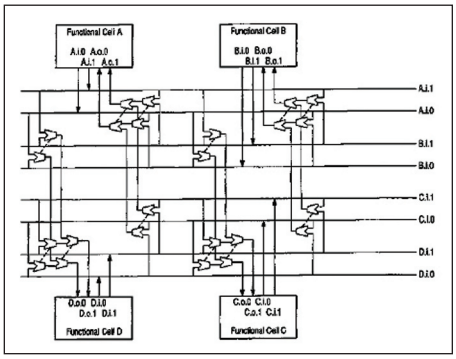
Reji Kartholy was chosen to receive the award. Thanks to Art for selecting ECE to receive the scholarship!

facultyNEWS

Horiuchi wins NSF CAREER Award

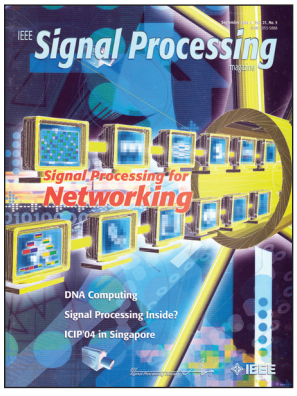
Assistant Professor **Timothy Horiuchi** has won a National Science Foundation Faculty Early Career Development (CAREER) Award for his work on "Adaptive Neuromorphic VLSI for Improving Accuracy and Precision: Modeling Attention for Bat Echolocation." The NSF CAREER program fosters the career development of outstanding junior faculty, combining the support of research and education of the highest quality and in the broadest sense. We profile Horiuchi on pages 4-5 of this issue.

Patent for Vishkin and Nuzman



Professor **Uzi Vishkin** and his former student **Joseph Nuzman** (MS 2003) have been issued U.S. patent 6,768,336 for "Circuit Architecture for Reduced-Synchrony On-Chip Interconnect." This is the third patent to be issued in connection with Vishkin's "PRAM On Chip" research project.

Liu's *IEEE Signal Processing Magazine* No. 1 in citation impact



Professor **K.J. Ray Liu** is editor-in-chief of *IEEE Signal Processing Magazine,* which is now ranked first among 205 electrical and electronics journals in terms of citation impact. The magazine, which was ranked second last year, is also the most-read journal in the signal processing community, with more than 25,000 subscribers.

Liu wins EURASIP award

Professor **Liu** also won the 2004 EURASIP Meritorious Service Award for leadership in establishing the *EURASIP Journal on Applied Signal Processing* as a leading journal in the field. EURASIP is the European Association for Signal, Speech and Image Processing.

Murphy wins Oak Ridge junior faculty award

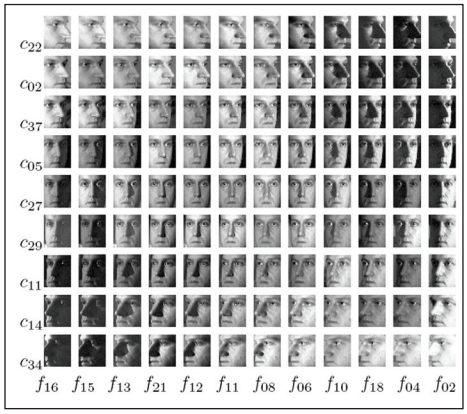
Assistant Professor **Thomas Murphy** has won the Oak Ridge Associated Universities Ralph E. Powe Junior Faculty Enhancement Award. The award is intended to enrich the research and professional growth of young faculty and result in new funding opportunities. Murphy's primary research interest is in optical communication systems.

Two ECE finalists for 'Invention of the Year'

Murphy and Professor **Rama Chellappa**, along with their students, were finalists in the University of Maryland's 17th annual Invention of the Year Awards. The competition is sponsored by the university's Office of Technology Commercialization to honor outstanding inventions and inventors.

Murphy and his student **Reza Salem** were finalists for their work in "Technique for Performing Polarization-Independent Optical Cross-Correlations." They developed a polarization-independent form of

optical cross-correlation—two-photon absorption (TPA)—which is simple, inexpensive, sensitive and ultra fast. The technology has broad applications in optical signal processing. Near-term applications include optical clock recovery, high-speed optical sampling and optical mixing.



Examples of face images under actual illumination settings and poses for recognition in Chellappa and Zhou's invention.

Chellappa and his student **Shaohua Zhou** were finalists for their invention, "Probabilistic Face Recognition from Video." This technology uses a time-series model to simultaneously resolve the tasks of tracking appropriate forms and of performing recognition analysis. Their model employs a probabilistic framework that allows for immediate recognition decisions without using still frames. It takes advantage of the temporarily encoded series of images which video inputs provide.

Ramahi and students featured in *Interference Technology* magazine

ECE-affiliated professor **Omar Ramahi,** director of the Electromagnetic Compatibility and Propagation Laboratory, along with ECE graduate students **Shahrooz Shahparnia** and **Baharak Mohajer-Irvani,** have published an article on electromagnetic band-gap material in *Interference Technology,* a publication for the engineering community involved in eliminating or controlling electromagnetic interference (EMI) and achieving electromagnetic compatibility (EMC).

The article details the novel concept of using electromagnetic bandgap (EBG) structures for the suppression of electromagnetic noise in a variety of applications. By placing EBG structures within power planes, dramatic suppression of switching noises can be realized over a very wide band of frequencies.

The University of Maryland's Office of Technology Commercialization is pursuing a patent for this technology.

Gligor appointed to IEEE editorial board

Professor **Virgil Gligor** has been appointed to the editorial board of the new *IEEE Transactions on Dependable and Secure Computing*. This follows his 10 years on the board of the *Journal of Computer Security* and current membership on the board of *ACM Transactions on Information Systems Security.*

Barua receives TEDCO funding

Assistant Professor **Rajeev Barua** has received a research funding award of $50K for "A Dynamic Memory Allocator for Embedded Systems with Scratch-Pad Memory" from the Maryland Technology Development Corporation (TEDCO). The award is given for new technologies that have significant commercial potential.

Gomez to chair 2006 INTERMAG Conference

Associate Professor **Romel Gomez** has been appointed the general chair of the 2006 International Magnetics Conference (INTERMAG), the annual flagship conference of the IEEE Magnetics Society.

Peter Petrov joins ECE faculty

Research focuses on embedded systems and processors

Peter Petrov, who recently received his Ph.D. in computer engineering from the University of California in San Diego (UCSD), is a new ECE assistant professor. Petrov researches embedded systems and processors, with an emphasis on designing and implementing next-generation, customizable application-specific embedded processors.

Petrov hopes to define a new embedded processor architecture capable of incorporating and utilizing application knowledge within the processor microarchitecture to achieve significant power and performance improvements. His research brings fundamental issues from compilers, computer architecture, operating systems and VLSI design into a unified framework.

Originally from Bulgaria, Petrov received his bachelor's and master's degrees in computer science from Sofia University in 1996 and 1998. He graduated first in his class. His Ph.D. thesis was on "Application-Specific Embedded Processor Customizations for High Performance and Low Power." While at UCSD, he received the Cal-(IT)2 Fellowship and the IBM Graduate Fellowship. While a Ph.D. student, Petrov worked as a design engineer for several companies.

Petrov chose Maryland because "the ECE Department has an established reputation for being one of the nation's top research institutions."

"I firmly believe I can initiate strong collaborative work with a number of faculty members who specialize and focus on computer engineering," Petrov says.

ECE entries win University of Maryland Business Plan Competition

ECE's two entries in the University of Maryland's Business Plan Competition won their categories.

Maryland Data Recovery wins alumni category

The Maryland Data Recovery (MDR) team won the alumni category. This team includes **Chun Tse,** ECE Ph.D. 2003; ECE Professor **Isaak Mayergoyz;** and Senior Engineer **Charles Krafft,** Laboratory for Physical Sciences.

This company specializes in hard disk data recovery and computer forensics. By using a patent-pending spin-stand imaging technology and intersymbol interference removal technology, MDR will seek to provide customers with advanced data recovery solutions to the most challenging data-loss scenarios. MDR also has developed a sophisticated data reconstruction algorithm that allows the retrieval of overwritten computer data. The vision of MDR is to provide customers with data recovery solutions that set the standard in the industry for quality, turn-around time, and cost.

MacroPhage wins graduate student category

The MacroPhage Networks team won the graduate student category. This team consists of **Mehdi Kalantari,** an ECE Ph.D. candidate; **Mehdi Alasti,** a 2001 ECE Ph.D.; and Professor **Mark Shayman,** who is CTO and interim CEO.

The company offers a novel technology to identify and eliminate distributed denial of service (DDoS) attacks, serious threats to current and next generation networks. MacroPhage will provide a distributed immunity system for the Internet, composed of cells installed at vulnerable points such as edge routers and firewalls. The cells monitor traffic through the network and perform a test that detects the attack flows.

Photo by Eric Schurr

ECE Ph.D. candidate Mehdi Kalantari presents the MacroPhage Networks plan.

The test algorithm is based on "Code division multiple access Aggregate Perturbation method" (CAP), a patented technology. This state-of-the-art algorithm detects attack traffic almost immediately (about 30 seconds after start of an attack) and provides an opportunity for the ISP to suppress the illegal flows proactively, before the attack traffic turns into a flood that causes congestion or denial of service. The MacroPhage immunity system is an evolutionary approach that does not require changes in architecture, hardware, software or network protocols. It can be deployed incrementally to provide safety and security for Internet servers and hosts.

Student achievements

For the fourth year in a row the **Electrical and Computer Engineering Graduate Student Association** (ECEGSA) has won the University of Maryland's annual Golden Geese Awards competition. The award is given to acknowledge the work of student groups on campus, honoring those student associations that help and give help to others, embodying shared leadership and teamwork.

Brian Morgan, a graduate student in the MEMS Sensors and Actuators Laboratory, is the recipient of a 2004-2005 Achievement Rewards for College Scientists (ARCS) Scholarship. Morgan's research focuses on novel three-dimensional silicon MEMS microfabrication technology. The award is sponsored by the Metropolitan Washington Chapter of the ARCS Foundation, Inc. Morgan is advised by Assistant Professor **Reza Ghodssi.**

Congratulations to **Kiyong Kim,** who won the 2004 Marshall N. Rosenbluth Outstanding Doctoral Thesis Award in Plasma Physics. The award is given by the American Physical Society. His dissertation detailed the development of ultrafast optical diagnostics and their application to measurement of ultrafast dynamics in the interaction of intense laser pulses with gases, atomic and molecular clusters, and plasmas, including plasma waveguides.

Kim's Ph.D. advisor was Professor **Howard Milchberg.** He is the second of Dr. Milchberg's students to win the award; **Tom Clark** won it in 1999. No other research group in plasma physics has won the award more than once.

Kim received his Physics Ph. D. in 2003. He is now a postdoctoral fellow at Los Alamos National Laboratory, pursuing the study of coherent terahertz radiation from intense laser-produced plasmas.

MERIT Fair winners

Maryland Engineering Research Internship Teams (MERIT) is an 11-week summer research program for undergraduates administered by ECE and supported by the National Science Foundation and the Army Research Laboratory. This year, 34 students from colleges and universities across the country participated.

MERIT combines cutting-edge team research with technical and educational seminars, visits to industry and government, and meetings with leaders in the field. The technical focuses are Power and Energy Electronics Research (PEER) and Research Internships in Telecommunications Engineering (RITE).

At the end, a MERIT Fair is held to showcase of the research conducted during the summer. Winners are determined in each technical focus area.

RITE program—Marshall Miller, University of Maryland; and **Guarav Singal**, Columbia University; for their project "Multi-Echo Integration for Sonar-Based Vehicle Navigation." They were mentored by **Timothy Horiuchi**.

Runners up were **Amir Ali Ahmadi** and **Elric Von Eden** from the University of Maryland for their project "Adjustable Time Delays for Optical Clock Recovery Systems." They were mentored by **Thomas Murphy**.

PEER program—Christopher **Lombardo,** University of Maryland, for "Electro-Mechanical Analysis of AIN Micro-Mechanical Beam Resonators." He was mentored by **R.D. Vispute** and Dr. Alma Wickenden of the Army Research Laboratory.

Recent grad is engineer, advocate and performer

For **Jennifer Roberts,** engineering alone just isn't enough.

Roberts, who majored in both electrical engineering and computer science, accomplished much in her five years in the ECE Department. She graduated summa cum laude this spring with departmental honors and a University Honors citation. She is a recipient of both the NSF Graduate Research Fellowship Award and the John and Fannie Hertz Foundation Award for her graduate engineering study at MIT.

But there are other aspects to her life that are an important part of who she is and who she hopes to become. "I find that I can't just concentrate on engineering alone," Roberts says. "I need something else to balance things out."

She has found that balance in being a mental health advocate, a student of classical voice and a participant in competitive ballroom dancing. The singing and dancing she admits she does for herself. The work as a mental health advocate she does for others.

"My grandfather was bipolar and suffered from chronic depression," she says. "I grew up being aware of how painful it was for my mother and grandmother. He passed away when I was in 11th grade. Perhaps if he had lived longer, I would have reached an age where I could have become more involved with him."

Roberts is particularly concerned with the stigma that comes with mental illness. "There are people who need help and won't get it because they don't want to be judged by others," she says. "I wanted to do something to change that."

Not only was Roberts a member of the Gemstone Mental Health Education and Awareness Team, she founded Active Minds at Maryland, a student mental health advocacy group on campus. "I wanted to make a difference," says Roberts, who also worked with the mental health advocacy organization, On Our Own of Maryland, while at the university.

The Gemstone group researched the effects and nature of stigma toward people with mental illness on campus and presented a 180-page thesis before a panel of experts. Then Roberts wrote an

continued on page 12...

Jennifer Roberts

...continued from page 11

additional proposal describing ways to include mental health education in the Maryland curricula. She was named a professional writing contest nominee for the proposal.

Roberts wanted to do more. Through Active Minds at Maryland, anti-stigma health education has been added to freshman seminars. The group is also working to use peer outreach to reduce stigma and increase awareness about mental health issues as well as to inform students of available resources and encourage them to seek help. Roberts has made a lasting impression on the university.

Roberts discovered engineering at the open house before her freshman year. "I remember everything they talked about seemed to fit me," she recalls. "I knew engineering would be something I would enjoy. I grew up with puzzles and games and enjoyed math and science."

As an undergraduate student, Roberts, a member of the Eta Kappa Nu Honor Society, eagerly embraced the curriculum and opportunities both inside and outside of the classroom. She worked as a research assistant in the Neural Systems Laboratory; as a technical aide for Johns Hopkins University's Applied Physics Lab; and as an electrical engineer at the U.S. Naval Research Laboratory.

These experiences were valuable. "I was exposed to topics before I saw them in class, and so I was ahead of the game. Internships let you apply head knowledge in a real-world setting. You understand why what you learned is so relevant."

Roberts was especially intrigued by signal processing, but isn't quite sure what she will pursue at MIT. "I'm eager to meet with different professors there and talk about my options," she says.

One thing is certain, she will continue her focus on "giving back," as she puts it. The Hertz Foundation Award is oriented towards students who are interested in applied research that will help humanity within the next 50 years. "The foundation is interested in students who are public service minded and want to give back to the community," says Roberts. She was one of only 19 students nationwide to win.

Roberts has always loved to dance and sing. She took classical voice at Maryland and is excited that ballroom dancing is big at MIT.

"It's a good sport for engineers, because learning the steps and figuring out how they work is so technical," Roberts says. "I've already met people from the MIT engineering program during dance competitions."

Now Roberts will join them, bringing her many talents, interests and convictions.

Connections is published twice yearly for alumni and friends of the Department of Electrical and Computer Engineering at the University of Maryland.

Alumni news and comments are welcome. Please send them to: Editor, Department of Electrical and Computer Engineering, A.V. Williams Building, College Park, MD, 20742.

Phone: 301.405.3683
Fax: 301.314.9281
Visit our Web site at www.ece.umd.edu

Department Chair: Steve Marcus
Connections writing: Lisa Gregory
Editing, photography and production: Rebecca Copeland

A. JAMES CLARK
SCHOOL OF ENGINEERING

Department of Electrical and Computer Engineering
University of Maryland
College Park, MD 20742-2111

Nonprofit Org.
U.S. Postage
PAID
Permit No. 10
College Park, MD