

NETWORKS

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

Wearable Sensor Systems Advance Networked Health Monitoring

Taking new ideas from inception to real-world applications is a dream for many researchers, but for Subir Biswas that's exactly what he is doing. "What really makes me

excited about my job is that I can sit here at my desk and I am able to come up with an idea, and then see it developed into an application that is used by non-engineer colleagues across the MSU campus and beyond. That is truly exciting."

Biswas, an ECE associate professor, came to MSU in 2003 because he liked the department and college leadership, and saw an opportunity to build a program in wireless networking that could have real-world applications. "I worked in industry

for nine years before coming to MSU, so I am very familiar with the process of taking a new idea and developing that into an application," says Biswas, who is the founding director of the Networked Embedded and Wireless Systems (NeEWS) Laboratory and the associate chair for research in the ECE department.

"The overall objective of a wearable cyber-physical system," Biswas says, "is to develop a networked fabric of on-body computation, sensing, actuation, and communication resources that can dynamically self-reconfigure to offer the best application quality under constrained energy supplies. Remotely managed real-time health monitoring and drug delivery applications can be developed using such an intelligent on-body wearable system."

For the first few years, Biswas and his graduate students in the lab were involved in core research on developing low-power network protocols, reconfigurable computing, and embedded middleware—a kind of software that goes in between the network protocol and user applications. "Then about three years ago, I realized that we had enough of the components

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ECE graduate student Bo Dong wears a prototype of a new wearable sensor network.



Study Abroad Expands Students' Knowledge

One of many summertime options for engineering students is to study abroad. For the sixth year in a row, MSU ranked No. 1 for study abroad participation among public universities, according to the annual report of the Institute of International Education.

This past summer two ECE students took advantage of the study abroad program. They both met people of diverse backgrounds and cultures, practiced speaking a different language, and got to see the sights in a foreign country.

Scott Oliver is a junior who spent four weeks in Argentina participating in the "Globalization, Politics, and Social Capital" study abroad program. During most of the trip he lived in Buenos Aires with a host family. "None of the family spoke a word of English," says Oliver, who speaks Spanish, but chose this trip in particular to become more proficient in Spanish.

He had classes three hours a day at La Universidad del Salvador. "The first half of class focused on the political and economic history of Argentina, emphasizing the nation's industry and its role in globalization, while the remainder of the class time was devoted to social capital. There also was a field trip with a visit to an industrial plant where more than 200 businesses operated.

However, it wasn't all work and no play. Oliver had time on the weekends for trips to other parts of Argentina, including



Scott Oliver in the Andes Mountains.

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from the Chair

TIMOTHY GROTJOHN

This past year the electrical and computer engineering department reflected on the past and looked to the future as we prepared a self study of the department as part of our Academic Program Review (APR). This review is undertaken by each academic department at MSU on a seven-year interval. Our turn was this past year.

The APR report has the department answer basic questions like: Why do we have an ECE program? How good is our program? How are we going to improve the program in the future?

In this chair's message I want to look at some of the highlights of this report.

As we look to the past, the electrical engineering and computer engineering fields have been an important part of engineering and technological advances of the past century. In fact, electrical engineering and computer engineering have had a significant impact in many of the 20 greatest engineering accomplishments of the 20th century as identified by the National Academy of Engineering. These accomplishments that relied on the ECE area include electrification, the automobile, the airplane, electronics, radio and television, computers, the telephone, spacecraft, the Internet, imaging, household appliances, health technologies, laser and fiber optics, and high-performance materials.

Here in the ECE department at MSU we have graduated many students that have contributed to these accomplishments. The number of graduates is in the thousands. In fact, just over the past decade, the number of degrees awarded in ECE at MSU includes 1305 BS degrees, 415 MS degrees, and 119 PhD degrees.

As the engineering profession looks to the future, several societal goals for engineering have been outlined as the National Academy of Engineering "Grand Challenges." These challenges include: make solar energy economical, provide energy from fusion, develop carbon sequestration methods, manage the nitrogen cycle, provide access to clean water, restore and improve urban infrastructure, advance health

informatics, engineer better medicines, reverse-engineer the brain, prevent nuclear terror, secure cyberspace, enhance virtual reality, advance personalized learning, and engineer the tools of scientific discovery. The solution to these "Grand Challenges," as well as major national and world events, are influencing the direction of intellectual growth in ECE and increasing the importance of the ECE profession.

The ECE department sees the areas of energy, health, security and sustainability as central to the future direction, expansion, and focus of its educational and research programs. These areas are at the intersection of many of the National Academy of Engineering "Grand Challenges," MSU research foci, and College of Engineering research foci. With a focus on these areas of national importance, the ECE department sees itself continuing to advance its undergraduate and graduate programs and its research program.

Central to advancing the department's educational and research programs are the faculty members in the ECE department. The department now has 38 faculty members that have very strong records as indicated by one being a National Academy of Engineering member, 12 being fellows of the Institute of Electrical and Electronics Engineers, and 10 having received NSF CAREER Awards. The ECE department has established a set of goals that focuses the department on education and research/scholarship activities. The goals of the ECE department are:

(1) graduating 150 EE/CPE BS degree students

per year, who start successful careers in the global market or succeed at graduate school,

(2) graduating 20 to 30 PhD degree students per year, as well as MS degree students, who are mentored to become leaders in industry, government and academia, and

(3) growing the size and stature of the research and graduate programs with a focus on areas of national and societal benefit.

The ECE department has shown rapid progress toward these goals as indicated by a number of measures including that 94 percent of BS graduates are either employed or intending to go to graduate school at the time of graduation, the number of PhD students graduating per year has more than doubled in the past five years to 20 per year, and research expenditures are up 500 percent over the past decade to an amount of over \$10,000,000 per year. The department is also part of new major federally funded centers that have come to and are led by MSU including the NSF Science and Technology Center- BEACON (Bio/computational Evolution in Action Consortium) and the U.S. DOE Energy Frontier Research Center.

The ECE department has accomplished much in its past and by working with you, the alumni and friends of the department, we can continue to graduate students in the electrical and computer engineering profession who will make a difference in improving life for everyone.

Lastly, I would like to wish each of you success in the new year. 🌸

Study Abroad (continued from page 1)

hiking through the Andes Mountains and exploring Inca ruins.

He believes the program helped him become more independent. "Studying abroad forced me to go outside my comfort zone. I had to handle frustrating situations in a mature manner, because simple tasks like asking for directions were no longer so simple. Seeing the world from another nation's perspective has made me better rounded and will benefit me as I graduate and enter into a career. For me this trip was way more about the experience than the credits I received."

Oliver is from Algonac, Mich., and he is the son of Rex and Pattee Oliver.

Kenneth Hsu is a senior in computer engineering. He went to Kaiserslautern, Germany, this summer because he wanted to view another country from a student's perspective.

As part of this study abroad program, Hsu was involved in an independent study that focused on implementing an application capable of WiFi monitoring and managing handover.

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Wearable Sensor Systems (continued from page 1)

that could be put together for constructing domain-specific applications that could be used by researchers and practitioners in other fields. That's how we got to this point."

Biswas and his collaborators currently have major funding for three projects on wearable sensing and are working on funding for a fourth project. The project that has received a lot of publicity this fall involves the development of a new type of wearable multi-sensor system that can analyze how the human body reacts to physical activity to improve overall health. The project is in collaboration with Karin Pfeiffer of MSU Department of Kinesiology with a grant from the National Institutes of Health. Participants wear three small wireless sensors attached at the wrist, upper arm, and lower leg. During any physical activity the sensors measure not only the frequency, intensity, and time, but also the type of posture and activity, so it is possible to get more sophisticated data regarding the body's movements and positions. The data then is wirelessly transmitted to a server that can be located at a medical service provider's office.

"The software can provide a big picture of the amount of metabolic energy being expended as well as smaller details indicating an individual's postures and movements, based on the many sensor readings," says Biswas. He and Pfeiffer hope that the results of the current project will allow the team to study advanced features, such as on-body signal processing and real-time feedback to participants for better managing obesity and other health conditions.

Another project with the MSU Department of Psychology with funding from NASA uses similar technology to monitor social network formation through human interactions. The device can tell how often a person is talking, his/her body language, body movements, and physiological conditions such as heart rate and galvanic skin resistance. "You can use this information and create a social map of an individual or a group that shows how and where a person fits in socially," says Biswas. He is also working with the MSU Department of Psychology and the College of Human Medicine to obtain funding for a similar project to develop mechanisms for quantitative diagnosis and intervention for autistic children using the concept of sensor-assisted social mapping.

Biswas and his team have published numerous research articles on wearable systems in IEEE and ACM journals. They are also patenting some of the key wearable cyber-infrastructure concepts that have commercialization potential. Students, many of whom are undergraduates, working in the NeEWS lab are very enthused about the research. "They get a well-rounded exposure to what research is because they are involved in developing network protocols and applications, and at the same time they are building a real system that is being used by other researchers," says Biswas, who hopes that some of his patented research will have broad use. "I would like to see MSU take these wearable systems and software concepts to the marketplace so they have wider distribution and use." 🌟

Fast Facts about Subir Biswas



Biswas earned his PhD at the University of Cambridge, UK, and his BS and MS at Jadavpur University in Calcutta, India.

Prior to joining MSU in 2003, Biswas was with Tellium Optical Systems, where he was the principal architect of optical network restoration modeling, fault tolerant network design, network management, and advanced application development. He also worked at NEC Research Institute in Princeton, N.J., and at AT&T Research Laboratories, Cambridge, UK.

Biswas is the founding director of the Networked Embedded and Wireless Systems (NeEWS) Laboratory.

Subir is a senior member of IEEE and a fellow of the Cambridge Philosophical Society. He currently serves as associate editor of the *IEEE Transactions on Intelligent Transportation Systems*, *ACM/Springer Journal of Wireless Networks*, *Elsevier Journal of Ad Hoc Networks*, and the *International Journal of Communication Networks and Distributed Systems*.

He also serves as the associate chair for research in the ECE department. 🌟



Kenneth Hsu watches a mime in Heidelberg, Germany.

"This means that I had to make a program that utilizes an external WiFi card to have control over a laptop's connection to a specific network," says Hsu. "Whenever the program detects a network that provides a better connection to the Internet than the current one, it will perform handover in order to connect with that network."

While the research project expanded his knowledge of networks, Hsu says his most interesting experience was a one-day trip to Heidelberg. "My main objective

was to speak German for the whole trip. I had just finished a two-month German language course. Of course two months of language course would not make me speak fluently. Most of the time I just said one-liners."

Nonetheless, without any preparation beforehand, Hsu managed to travel to the city and visit all the attractions in Heidelberg by solely asking for directions and talking to other people in German. However, he admits there was a little guessing. "Computer engineering has trained me well to make valid and reasonable guesses." He said the German people including a bus driver, cashiers, booking clerk, and waitresses were enthused about helping him out—and he appreciated their patience.

Hsu was born in Ann Arbor, Mich., but grew up in Kaohsiung, Taiwan. He is the son of Ching Hsiang Hsu and Chun Wei Ou. 🌟

Alumni Networks

Alumni Service Award



Vickie and George Rock

George "Lee" Rock (BS EE '49) received the MSU Alumni Association Alumni Service Award at a ceremony held Thurs-

day, October 14, at MSU's Kellogg Hotel and Conference Center. The award is presented to MSU alumni who have demonstrated continuing, outstanding volunteer service to MSU and/or meritorious public service on a local, state, national, or international level.

After graduation, Rock first worked as an electrical engineer in Milwaukee, and then joined Dow Chemical Company in Midland, Mich., for the next 36 years, where he worked as both an engineer and as a business executive in research, patent, and business development. After retirement in 1990, he worked as a venture capitalist, partnering with MSU to identify and develop patents related to technology.

Rock has served as the president of the Midland chapter of the Instruments Society of America and later as the society's national treasurer. He has had many leadership roles with

the Rotary Club and was president of the Service Corps of Retired Executives for three years. He is co-founder of the Cadillac Area Conservancy and has been inducted into the Michigan 4-H Emerald Clover Society.

Rock and his wife, Vickie, support the MSU Electrical Engineering Design Day Humanitarian Project, which provides solar-powered computers and other equipment to schools in Tanzania.

International von Kármán Wings Award



Joanne M. Maguire (BS EE '75) is the first woman to be honored with the International von Kármán Wings Award, which has been given annually since 1985 to an aerospace

pioneer by the California Institute of Technology's Aerospace Historical Society. The award is named for Theodore von Karman, a Hungarian-American aerospace pioneer and visionary strategic planner, who, together with General Henry H. "Hap" Arnold, forged modern Air Force research and development.

Maguire is executive vice president of Lockheed Martin Space Systems Company (SSC). Under her leadership, SSC, which has approximately 18,000 employees, provides a wide spectrum of advanced technology systems for national security, as well as civil and commercial

customers. Maguire joined Lockheed Martin in 2003 and assumed her current position in 2006.

In addition to her bachelor's degree in electrical engineering from MSU, Maguire has a master's degree in engineering from the University of California at Los Angeles (UCLA), is a graduate of the executive program in management at UCLA's Anderson School of Management, and completed the Harvard University program for senior executives in national and international security. She is a fellow of the American Institute of Aeronautics and Astronautics and a member of the International Academy of Astronautics.

Zeeland Public Works Manager

Bill Cook (BS EE '77) is the new general manager of the Zeeland, Mich., Board of Public Works. "Probably the more significant issues facing the board over the next two years and beyond are definitely going to be on the electrical side of the equation," said Zeeland City Manager Tim Klunder, who has been serving as the interim general manager of the BPW since early May. "In my assessment, I would say (Cook's) strength seems to be in the electrical field. His electrical experience definitely stood out."

Cook retired from the Lansing Board of Water and Light in 2008 after almost a quarter century with the utility. For the past two years, he's been working full-time on a contract basis for the city of Owensboro, Ky., helping the utility prepare for entry into the wholesale power market. 🌱

Projects Introduce Computers in Schools in Rural Tanzania

As part of a continuing project to give schools in remote villages in Tanzania access to the educational resources and information of the Internet, students and faculty traveled to Tanzania again this past summer. The project includes student work by ECE capstone design teams. It started in 2008 with the installation of a solar-powered computer in a school located in a remote village southwest of Mount Kilimanjaro.

Each year ECE teams have expanded the project. This year one capstone team developed a time-sharing computer system with audio integration to further the educational opportunities for the students using the system. There were two schools online, and this team helped to bring a third school online during the trip to Tanzania.

Another team project focused on building a more power-efficient Internet connection for the schools. The team designed a solar-powered "connect-on-demand" satellite/radio link. With the new design in place, the system draws minimum power from the batteries while optimizing the time of its usage.

Both of the 2010 projects were supported by MSU alumni George and Vickie Rock with a matching grant from the Dow Chemical Company.

"I went for the first time this summer," says ECE Professor Lalita Udpa. She recently joined the faculty team guiding the students' work on these projects. "I was captivated by the country and the people. The people are very smart, very artistic, and friendly." She believes that it was a "life changing experience" for most of the students. 🌱



Professor Erik Goodman (second from left) and part of the team in Tanzania.

In Memoriam

Two of the department's and college's most gifted faculty and administrators died this past summer. We remember their efforts to make the department and the college better for faculty, staff, and students.

Lawrence Wayne Von Tersch, former dean of the College of Engineering and founder of the MSU Computer Laboratory, died Monday, April 19. He was 87.



Von Tersch, who served as dean from 1968 to 1989, did much to advance the stature of the college.

He joined the MSU faculty in 1956 as professor of electrical engineering and as founder and director of MSU's Computer Laboratory, a position he held until 1983. He also served as chairperson of MSU's Department of Electrical Engineering from 1957 to 1965, and as associate dean for academic programs from 1965 to 1967.

In addition to being an outstanding scholar and administrator, Von Tersch was instrumental in designing and building MSU's first computer, MISTIC (Michigan State Integral Computer), which became operational in October 1957. The vacuum tube-based computer was considered state of the art and did much to put the College of Engineering and MSU on the map. MISTIC was replaced by the CDC 3600 computer in June 1963; and in 1968, Von Tersch's first year as dean, the college received a \$1.2 million grant from the National Science Foundation for the purchase of a CDC 6500 computer. His work laid the basis for the formation of the Department of Computer Science in 1968.

"Wayne's leadership in academic computing moved Michigan State University rapidly and effectively into a new era," says MSU President Lou Anna K. Simon. "The MSU community is forever grateful for this major contribution to the history of this university; he is the epitome of a true pioneer. We extend our sympathy to his family for their loss."

"I had the privilege of meeting Wayne in early February of this year," says Satish Udpa, dean of the College of Engineering. "He talked a lot

about his time at MSU and even took the time to educate me about the pawpaw tree and its fruit. It was a wonderful meeting and my only regret is that I won't be able to do it again."

Von Tersch was born in Waverly, Iowa, on March 17, 1923. He received his BS, MS, and PhD degrees from Iowa State University, where he taught for 10 years prior to joining the MSU faculty. At Iowa State, he also served with the Institute of Atomic Research.

"We all owe a huge debt of gratitude to Wayne for all that he did for the college," says Udpa. "We wouldn't be where we are today without his energy, dedication, and drive to make the college a better place. He will be greatly missed."

Memorial contributions can be made to: L.W. Von Tersch Scholarship Fund, College of Engineering Development Office, 3536 Engineering Building, Michigan State University East Lansing, MI, 48824-1226.

Herman Koenig, MSU professor emeritus and former chairperson of the Department of Electrical and Computer Engineering, died July 31, 2010. He was 85.



Koenig's university education started while he worked on his family's farm in Illinois. He attended

Washington University and then completed his education in electrical engineering at the University of Illinois, earning a PhD in 1953. He taught and conducted research at MIT and the University of Illinois, in addition to working as a commercial design engineer, before joining the Michigan State University engineering faculty in 1956.

In 1964, at MSU, Koenig established a new undergraduate program in systems science. The systems science concepts that he helped to pioneer not only became a new major, but also were integrated into the electrical engineering curriculum. He was named chair of MSU's Department of Electrical Engineering and Systems Science in 1968, and in 1976 he was appointed director of MSU's Center for Environmental

Quality. He served as the assistant vice president for research and industry development, focusing on the development of multidisciplinary research, before retiring from MSU in 1990.

"Herman was an intellectual giant who did so much to advance science and engineering," says Satish Udpa, dean of MSU's College of Engineering. "He was one those very few individuals who could take the loftiest of ideas and distill them into engineering principles and practice. Above all, he was a wonderful human being. We will most certainly miss him."

Koenig's research organization and National Science Foundation (NSF) funding to model interdisciplinary problems mathematically and develop solutions for environmental and agricultural sustainability in the 1970s was far ahead of today's headlines. MSU's new BEACON Center for the Study of Evolution in Action—funded by the NSF and led by Erik Goodman, MSU professor of electrical and computer engineering—is a modern evolution of Koenig's multidisciplinary leadership at MSU.

Koenig won a major NSF grant in 1970 to study ecological and environmental processes under its Research Applied to National Needs (RANN) program. He hired Goodman, who had completed his PhD at the University of Michigan, as a new assistant professor to teach systems science concepts to biologists and assemble multidisciplinary research teams to address environmental problems. Says Goodman, "Herman developed novel ways of modeling and understanding circuits and other engineered systems, and he had astounding insight into the usefulness of applying these concepts to understanding the dynamics of biological organisms and their environments. Herman, and those he inspired, applied systems science from the macro and societal levels down to the level of individual cells. His legacy includes countless biologists and engineers who today see the world from a systems perspective."

In 2001, his son Roger (BS EE '76) and wife, Nancy Pierce, established the Dr. Herman E. & Ruth J. Koenig Endowed Chair. This endowed chair not only recognizes Herman's leadership achievements, but also honors both of Roger's parents for their devotion to MSU. 🌻

Faculty and Staff Networks

USA Science & Engineering Festival

Associate Professor **Xiaobo Tan** joined other researchers and scientists at the first USA Science & Engineering Festival October 23 and 24 in Washington D.C. The event was an effort to re-invigorate interest in science, technology, engineering, and math by producing and presenting the most compelling and entertaining education exhibits. There were more than 1,500 interactive exhibits and 75 stage shows, primarily held on the National Mall. Tan's exhibit, "Swimming with Robotic Fish," was among the 15 exhibits selected to represent the National Science Foundation at the event.

Tan has developed a number of highly maneuverable robotic fish, some incorporating biomimetic electroactive polymers. The robotic fish have become an important avenue for recruitment and K-12 outreach in the College of Engineering and on campus. Tan's exhibit at the Festival had a similar effect on participants. "It was great fun for us to interact with the kids, and to see the excitement the robotic fish brought to them and their parents," Tan said.

Accompanying Tan on the trip were John Thon, a teacher from Holt Junior High School, Freddie Alequin and Jianxun Wang, both PhD students of Tan's, and Cody Thon, a student from Holt High School.

National Academies Committee



Professor **Percy Pierre** has been appointed to the Committee on Science, Engineering, and Public Policy (COSEPUP), a joint unit of the National Academy of Sciences, the National Academy of

Engineering, and the Institute of Medicine. Most of its members are current or former members of the Councils of the three institutions.

COSEPUP mainly conducts studies on cross-cutting issues in science and technology policy. It was chartered by the Academies to address "the concerns and requests of the president's Science Advisor, the director of the National Science Foundation, the chair of the National Science Board, and heads of other federal research and development departments and agencies, and the Chairs of key science and technology-related committees of the Congress."

NSF RAPID Grants



Associate Professor **Xiaobo Tan** has received a Rapid Response Research (RAPID) grant from the National Science Foundation to develop robotic fish for detecting and monitoring the oil

spill in the Gulf of Mexico. RAPID is an NSF funding mechanism developed specifically to respond to natural or anthropogenic disasters and similar unanticipated events, where a timely response is essential in achieving research results.

Although the spewing of crude oil has been stopped, the oil that already leaked into the Gulf of Mexico is expected to impact the environment, ecosystem, and local economy for years to come. Monitoring and tracking the oil plume is critical for cleanup efforts, beach closure warnings, protection of sensitive areas, and understanding of the spill's environmental and ecological impacts. With the pressing need from the Gulf crisis, this RAPID project aims to provide an efficient and economical technology for detecting and tracking the oil spill by leveraging ongoing work on robotic fish development at MSU and focusing on a few key technological areas, so that robotic fish equipped with crude oil sensors can operate reliably in rough environments like the Gulf.



Assistant professor **Jian Ren** also has received a RAPID grant from the NSF. In response to the Gulf of Mexico oil spill, innovative UWB radar sensor network imaging methodologies to produce

2-D images based on 1-D signals are under development. Using these techniques, beach soil reflectivity can be measured. The differences between the reflectivity of oil spilled beach soil and that of the normal beach soil shows the dielectric property changes due to the oil spill.

In this project, models of the relations between soil reflectivity, oil content, and compression index are under development. The research crosses multiple disciplines, including sensor networks, radars, geoscience and remote sensing, civil engineering and geotechnology, signal and image processing, wireless communications, and pattern recognition.

NSF Grant



Professor **Hayder Radha**, in collaboration with Alex Liu, CSE assistant professor, and Clifford Lampe, assistant professor with the MSU Department of Telecommunications, Information Studies and

Media, have been awarded a research grant from the National Science Foundation for a multidisciplinary project titled "Signal Processing and Information Theoretic Approaches to Denoising and Demystifying Social Network Services."

The objective of this project is to develop in-depth understanding of the nature, underlying models, and dynamics of Social Network Services (SNS) with millions and even billions of users.

DURIP grant



Professor **Ning Xi** and Matt Mutka, professor and chairperson of the Department of Computer Science and Engineering, have been awarded a grant from the Army Research Office Defense

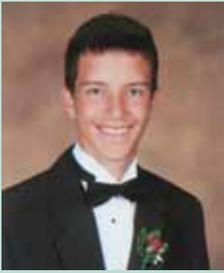
University Research Instrumentation Program (DURIP) for a project entitled "Acquisition of an All Terrain Mobile Manipulator." This project investigates coordinated control and teleoperation of multi-robot systems.

Strategic Partnership Grant

Tim Grotjohn, professor and chair of the department, has received a Strategic Partnership Grant funded by the MSU Foundation. The grant is for "Single Crystal Diamond: Substrates, Optics and Electronics." The objective of the proposal is to advance diamond deposition technology allowing creation of single crystal diamond wafers of 1-inch and fabrication of prototype high-voltage, high-power diodes. Demonstrating large diamond substrates and prototype diamond electronics will strengthen the capability of MSU to obtain expanded funding for single crystal diamond work in the future. Other ECE faculty members working on this project are **Jes Asmussen**, **Shanker Balasubramaniam**, and **Timothy Hogan**. 🌱

Student Networks

University Distinguished Scholar



ECE freshman **Grayson Wright** from Newtown, Pa., is one of 18 high school graduates from throughout the country who are Michigan State University's newest Alumni Distinguished

Scholars. These scholarships are considered to be among the most competitive in the country and cover full tuition, room and board, and books for up to eight semesters of study.

Wright says he is a math- and logic-oriented person who likes to solve problems. "And that's what engineering is about." He is a professorial assistant, working with ECE professor Erik Goodman in the BEACON Lab, where he is studying and modeling evolution and its applications in computer programs. In his spare time, Wright is working on getting in shape with the triathlon team so he can participate in races in the spring of 2011.

"I'm really excited about all the opportunities at MSU and I am looking forward to a great four years in engineering here." He is the son of Bruce and Melinda Wright.

National Defense Science and Engineering Graduate Fellowship



PhD student **Dan Dault** received a National Defense Science and Engineering Graduate Fellowship to pursue a PhD in electrical engineering at MSU.

These highly competitive fellowships are awarded to U.S. citizens and nationals who intend to pursue a doctoral degree in one of fifteen supported disciplines by the U.S. Department of Defense in an effort to increase the number and quality of the nation's scientists and engineers.

Dault received his BS EE in 2010 from MSU and is currently being mentored by Professor Shanker Balasubramaniam in his PhD research. Dault is working in the Computational Electromagnetics (CEM) laboratory, investigating methods for the rapid evaluation of electromag-

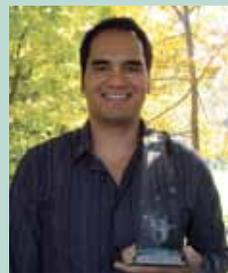
netic scattering from infinite periodic structures. "Currently, I am developing a code to model both periodic and nonperiodic structures loaded with nonlinearities, such as tuning diodes or amplifiers," says Dault. These types of problems have wide applications in many areas of microwave engineering including electronically tunable frequency selective surfaces, spatial power combiners, and nonlinear antenna feeds.

"I have always been fascinated by physics and the ability of mathematics to describe the mechanics of physical processes, especially electromagnetic phenomena. I am also interested in applying scientific knowledge to solve real-world problems. So electrical engineering, and specifically electromagnetics research, is an ideal fit for me—I get to apply the physics that underlay electrical engineering to address problems of practical utility."

Throughout his time as an undergraduate, Dault tutored Lansing-area students in science and mathematics, working with students from 5th grade up through the collegiate level. He also served as the student representative on the undergraduate studies committee during the 2009-2010 school year.

In the summer of 2009, Dault worked with Professor Tim Hogan in the thermoelectrics group and in the 2009-2010 school year in the CEM lab with Professor Balasubramaniam.

Graduate Student Leadership Award



Marcos Bolanos, a PhD student in electrical engineering, is the recipient of the 2010 Hispanic Engineering Academic Achievement Conference (HENAAC) Graduate Student

Leadership Award. As part of the award, Bolanos received an educational grant plus travel and hotel accommodations to the HENAAC Conference in Lake Buena Vista, Fla., in October.

Bolanos received his BS and MS in electrical engineering from the University of Texas at El Paso and is being advised in his PhD program by ECE associate professor Selin Aviyente. For his research project Bolanos is developing feature extraction algorithms for sensor networks using

graph theory with an application to understand the functional connectivity of the human brain. "The goal is to understand how neuronal assemblies in the brain interact and how these interactions differ among people whose brains suffer from diseases such as Alzheimer's disease and schizophrenia compared to those with healthy brains.

He has presented his research at engineering conferences in Argentina and Wales and is submitting two research papers to a conference in Prague.

Bolanos is a member of the Society of Mexican American Engineers and Scientists (MAES), the Society of Hispanic Professional Engineers, and the IEEE Engineering in Medicine and Biology Society. He also represents St. John's Student Center in serving food at local soup kitchens.

As for advice to undergraduates, Bolanos says: "If your desire is to generate imaginative, innovative ideas and if you want to share these ideas with the rest of the world all while shaping yourself into a confident and highly marketable engineer, I seriously suggest you consider graduate school as the next step in your career."

IEEE Antennas and Propagation International Symposium

ECE PhD student **Raoul Ouedraogo** won third place in the student paper competition at the IEEE Antennas and Propagation International Symposium in Toronto, Canada, in July. Two other graduate students, **Andrew Baczewski** and **Naveen Nair** were finalists, and another student, **Ozgur Tuncer**, was a runner-up. There were over 200 entrants and of those only 20 were chosen as finalists, and 20 more as runners-up.

Trustees Award

Thomas Ganley, an ECE student from Port Sanilac, Mich., was one of six students honored by the MSU Board of Trustees for academic achievements. The awards are granted at each commencement to graduating seniors having the highest cumulative grade point averages at the close of the semester prior to graduation. Galey has a 3.99 GPA. He is the son of Paul Ganley and Pamela McConnachie. 🌱

KEEPING IN TOUCH

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USA Science & Engineering Festival



Part of the team helping with the Festival in Washington D.C. included from left: Jianxun Wang, ECE PhD student; John Thon, a teacher at Holt Junior High school; Cody Thon, a high school student from Holt; and Freddie Alequin-Ramos, an ECE PhD student.



Jon Thon, a teacher from Holt Junior High School who is involved with ECE associate professor Xiaobo Tan's robotic fish project, shows one of the participants how the fish work. See story page 6.