Fall 2010

The Circuit, Fall 2010

Department of Electrical and Computer Engineering, Michigan Technological University

The Circuit

Electrical and Computer Engineering

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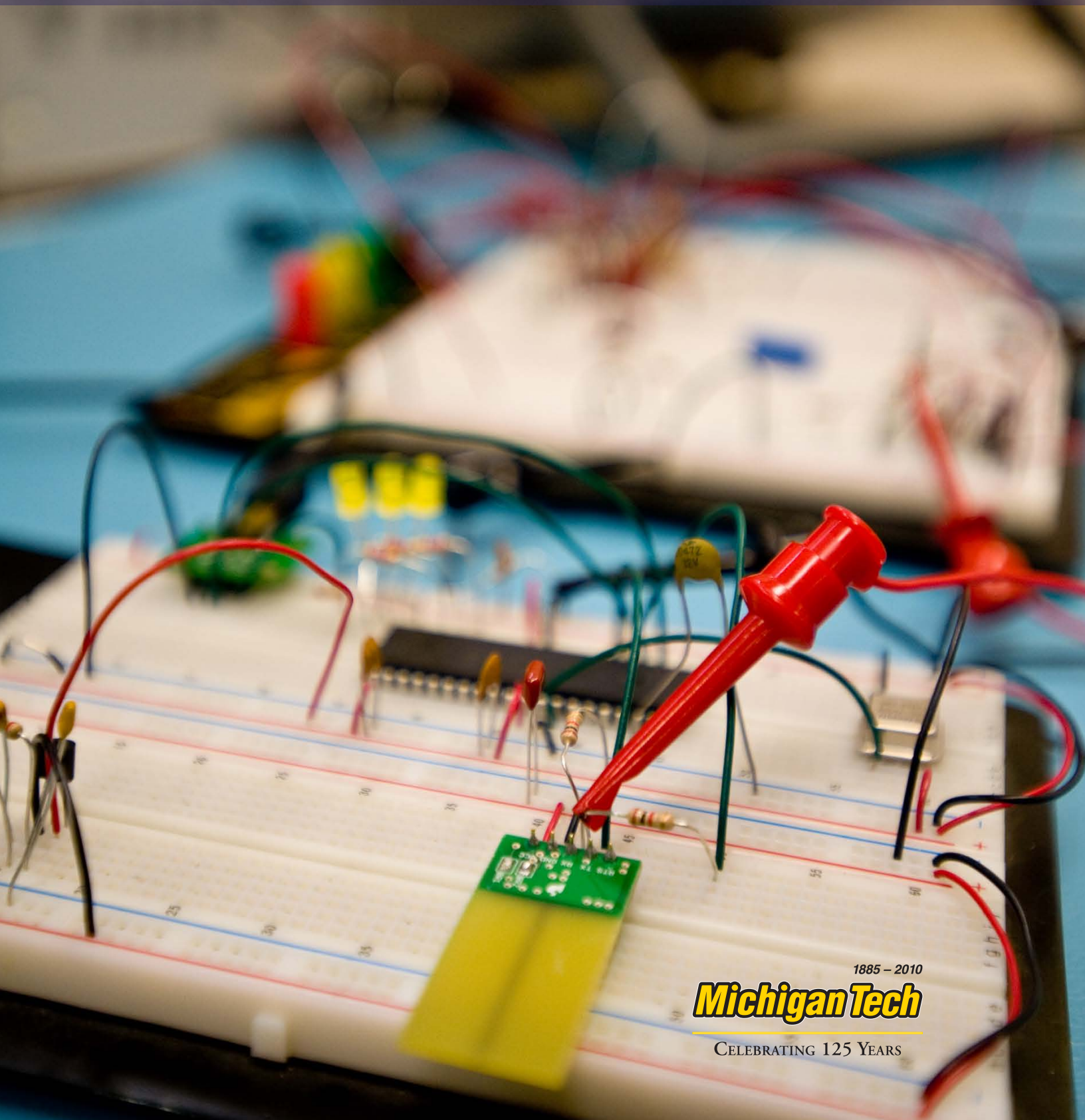


1885 – 2010

Michigan Tech

Celebrating 125 Years

From the Chair

Dan Fuhrmann, Chair
Department of Electrical and Computer Engineering

Greetings from Michigan's beautiful Upper Peninsula, and best wishes from the faculty, staff, and students in the Department of Electrical and Computer Engineering.

I am delighted to bring you this latest, and my first, edition of *The Circuit.* I arrived at Michigan Tech in fall 2008, ready and eager to take on the role of leading this wonderful department in its transformation in both size and character. I haven't been disappointed; in fact, I'm having the time of my life. I have learned that Michigan Tech is a singular sort of place, fashioned by its history and connection with the Copper Country mining industry, now looking forward to the new technologies and challenges of the twenty-first century. My family and I have quickly grown to love the Houghton/Hancock area. We've taken up cross-country skiing on the Tech Trails, downhill skiing on Mont Ripley, camping in McLain State Park and the Porkies, bicycling all over Houghton County, rowing on Portage Lake—I've even taken up curling in the Calumet Drill House! All of this is, of course, enhanced by the good company of our new friends and neighbors in Houghton.

There has been quite a bit happening in the ECE department, and I hope that we can convey some sense of that in these pages. To begin with, we have experienced significant growth in our faculty, from twenty-one to twenty-six tenured and tenure-track faculty members in just two years. Three new faculty members (Shiyan Hu, Elena Semouchkina, and Zhuo Feng) are profiled here, and we'll highlight the others in a later issue.

We have also experienced remarkable growth in our PhD program. Just five years ago, we had thirty-six PhD students; this fall we have sixty-five. Ultimately, we would like to graduate twelve doctoral students per year, consistent with the long-term strategic goals of the College of Engineering.

A strong graduate education and research program will serve to strengthen our undergraduate educational efforts by bringing the latest and greatest ideas of our faculty into the classroom and into our state-of-the-art Senior Design and Enterprise programs. The growth in our faculty means that they will have ample opportunity to balance their research and teaching obligations. I am happy to report that the BSEE and BSCpE programs are as strong as ever and are in very good hands.

The recent news that has everyone in the department buzzing involves a big shake-up in space in the EERC. In July, the Michigan Tech Board of Control approved a bond issue which paves the way for the Seaman Mineral Museum to move to a new location on Sharon Avenue. The renovated space on the fifth floor, formerly occupied by the museum, will house a multidisciplinary Center for Computer Systems Research, which will involve a number of faculty members in the ECE and computer science departments, particularly those with interests in real-time high-performance computing and novel application-specific computer architectures.

Please enjoy reading about everything that is happening here in the department. We would like to hear about what is happening with you as well. I hope you will respond to calls for updates from the Michigan Tech Alumni Office, or if you prefer, contact the department at eceinfo@mtu.edu or me directly at fuhrmann@mtu.edu. In future issues of *The Circuit* we will include more information about our alumni. In the meantime, have a wonderful autumn and holiday season.

An Invitation to Give Back

The Department of Electrical and Computer Engineering is making steady progress toward our goal of being among top ECE departments in the country. Departments that attain this goal all share two qualities: a dedicated and ambitious faculty and a strong foundation of support from alumni and friends. I assure you we are committed to this vision, and, with the continued assistance of our alumni and friends, we will continue on our path of growth and success. Many of our recent accomplishments and initiatives, such as the renovation plan for the EERC, would not have been possible without the support of generous alumni and friends like you.

I invite you to think back on what you have gained through your relationship with Michigan Tech and to think about what makes this institution special. We invite all of our alumni and friends to be part of our continued growth through contributions that support department activity. We have targeted gifting areas in endowed professorships, graduate fellowships, undergraduate scholarships, Senior Design and Enterprise, and space renovation, and of course we always welcome unrestricted gifts. We also welcome your involvement in other ways: service on external committees, participation in local alumni activities, promotion of Michigan Tech within industry and government organizations, or simply good ideas and constructive criticism. I would be delighted to hear from you anytime. Please visit our website at www.mtu.edu/ece for more information on how you can be a part of the life of the department.

Strategic Faculty Hiring Initiatives at Michigan Tech

Michigan Tech is redefining its graduate and undergraduate education through interdisciplinary programs. These programs will be strengthened by the creation of several new faculty positions each year through an effort called the Strategic Faculty Hiring Initiative, or SFHI. In 2007 the theme was sustainability, and in 2008 it was computational discovery and innovation. For 2009 and 2010, two themes have emerged: health—including basic sciences, technologies, and medical informatics—and next-generation energy systems.

The computational discovery and innovation phase resulted in two new faculty members joining the ECE department: Zhuo Feng, who specializes in modeling and simulation for large-scale electronic systems carried out on graphical processing units (GPUs); and Saeid Nooshabadi, an international leader in large-scale VLSI system design.

The ECE department will participate in the upcoming next-generation energy systems phase, as well. The goal: to recruit faculty who can help strategically bridge existing strengths and enable expanded research in several key areas. For more information, check out the SFHI website at www.mtu.edu/sfhi.

SFHI: Next-Generation Energy Systems

- Smart transmission and distribution systems, cyber-security
- Generation and integration of renewables, including wind and solar
- Improved combustion and conversion technologies with CO_2 capture and sequestration, including biomass and waste streams
- Development of distributed power generation with cogeneration and energy systems for buildings
- Energy harvesting in multi-scale systems, including waste thermal, mechanical, and chemical energies
- Advanced materials for photovoltaic and battery technologies
- Distributed energy storage systems, management, and interconnection, including micro-grids and plug-in hybrid electric vehicles
- Biomimetic systems for energy conversion, including photo-biological processes
- Regulatory, policy, legal, social, environmental, and economic aspects of energy generation, transmission, and consumption

Tech Receives $3 Million to Develop EV Education Programs

Michigan Tech will receive nearly $3 million from the US Department of Energy to train engineers and technicians to build the next generation of hybrid electric vehicles.

"This is great news for Michigan Tech," said Carl Anderson, associate dean for research and graduate programs in the College of Engineering and the program's principal investigator. "We have had a strength in liquid-fueled vehicles for a long time. Now we can take advantage of a broader array of our strengths and establish a similar leadership role in the development of a new generation of electric-powered vehicles."

Wayne Weaver, an assistant professor of electrical and computer engineering, will bring his expertise in power electronics and electric motors to develop the course work, including undergraduate and graduate curricula and a certificate program. "The grant is based on all the technologies that converge around electric propulsion, and the curricula can actually apply to any vehicle that relies on electricity for power, including hybrids, hydrogen fuel cells, and electric vehicles," he said.

In addition to teaching advanced vehicle technologies, the curricula will also look at the big picture: societal energy use. "If all these electric cars are someday going to be plugged in at night, that could have a huge effect on our electrical grid," Weaver said. So huge, in fact, that it could require the construction of new power plants, potentially wiping out whatever green benefits electric vehicles bring to the table.

To solve the problem, employers might let workers plug in their cars at the job site. "It wouldn't be a great loss to the employer, and they might even be able to sell some stored energy from the cars back to the utility during times of peak demand," Weaver said.

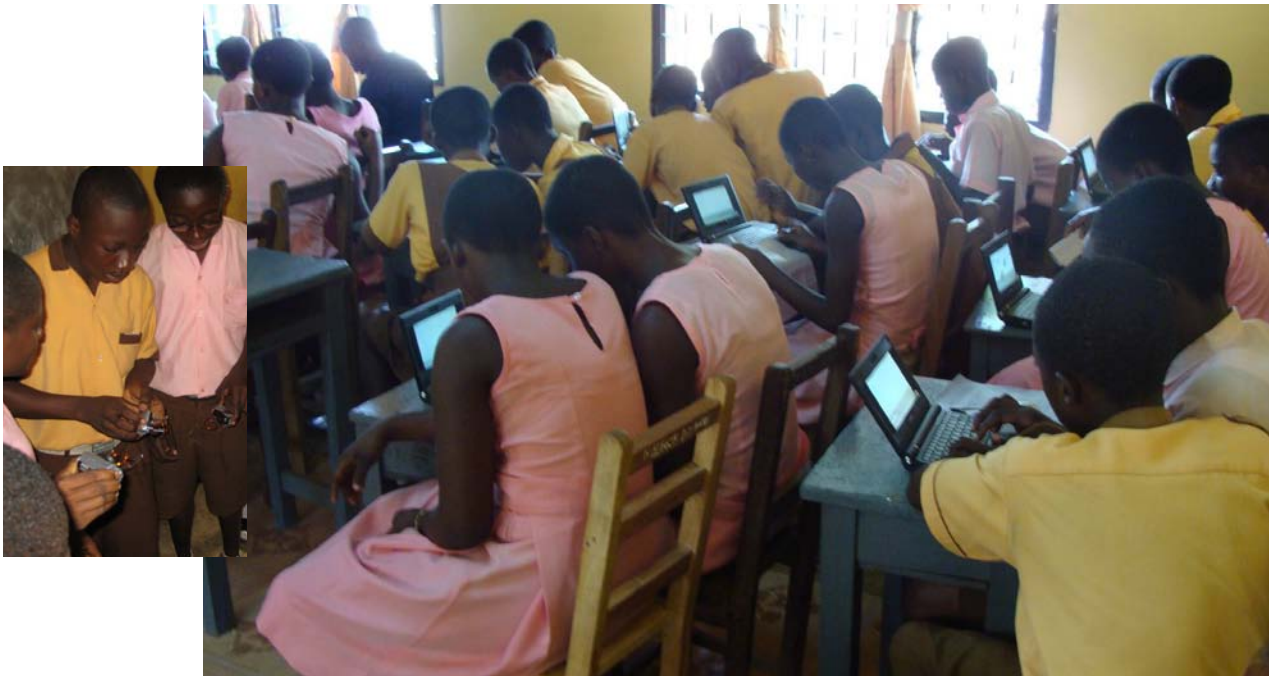
"These technologies will require a lot of intelligent planning and design," he added. "This will be more than a car class."

The project also offers a plus for the researchers. "We are taking a very interdisciplinary approach and breaking down walls between our departments," said Weaver. "This is a wonderful opportunity to bring faculty in all the engineering disciplines together."

"We'll be training and retraining the next generation of engineers to produce vehicles that reduce fuel consumption and emissions," said Jeff Naber, lead faculty member of the multidisciplinary program.

The electric hybrid curriculum will be modeled after the groundbreaking course in advanced propulsion for hybrid vehicles that Michigan Tech taught in Detroit for displaced automotive engineers last spring. Partners in the effort are Argonne National Laboratory and companies AVL, General Motors, Eaton, Horiba, MathWorks, Schweitzer Engineering Laboratories, and Woodward.

ECE Student Brings Laptops to Ghana



ECE department senior Roger Matias traveled to Ghana last summer with Michigan Tech's Pavlis Institute for Global Technological Leadership. Born in Cuba, Matias attended high school at Grand Rapids Technical School before coming to Michigan Tech to study electrical engineering.

Matias visited two villages in Ghana, Kranka and Sunyani, along with seven other Pavlis Institute students. They divided into three teams, each focusing on a community development project. Matias was a member of the laptop team.

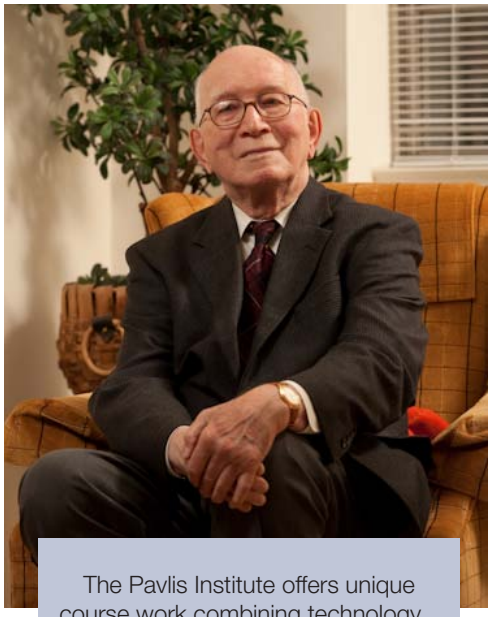
"In Africa, a continent-wide program requires students to be computer literate upon completion of secondary schooling," he says. "By 2012, this requirement will expand to students completing primary schooling. Unfortunately, numerous villages are poverty-stricken and cannot afford to purchase their own computers. The majority of the people in villages such as these have never seen a computer."

In the months leading up to the journey, the Pavlis students raised several thousand dollars from industry donors, friends, and family to purchase twenty-three laptop computers to bring to Ghana. Each laptop came with a wireless router, a mouse, and a flash drive. "We chose low-cost, extremely portable laptops with nearly every capability of a normal computer," Matias explains. "Each weighed roughly 800 grams (less than two pounds) and had a seven-inch, high-resolution LCD screen."

The trio carried the laptops on the plane to Ghana and then delivered them in person, meeting with six classes in three days. While there, it didn't take long for Matias to notice the lack of hands-on experiments in the classroom. Using inexpensive materials purchased at a local shop, he showed the class how to use a 1.5-volt battery, two paper clips, a magnet, and some insulated wire to make a small electric motor. "This showed the relationship between current and magnetic field and how these principles can be applied to create a temporary magnet, an electric motor, and electricity."

On the day of the experiment in Kranka, the class was divided into three teams of about fourteen students. Enough materials were given to each team to create four electric motors. "Each team would start cheering when one of their teammates would get the motor to work," he recalls. "It didn't take long before the class became a shouting battle." Matias selected the fastest motor from each team, and, after carefully observing each one, declared a winner. He hopes that enthusiasm, as well as the computers, will linger after they are long gone.

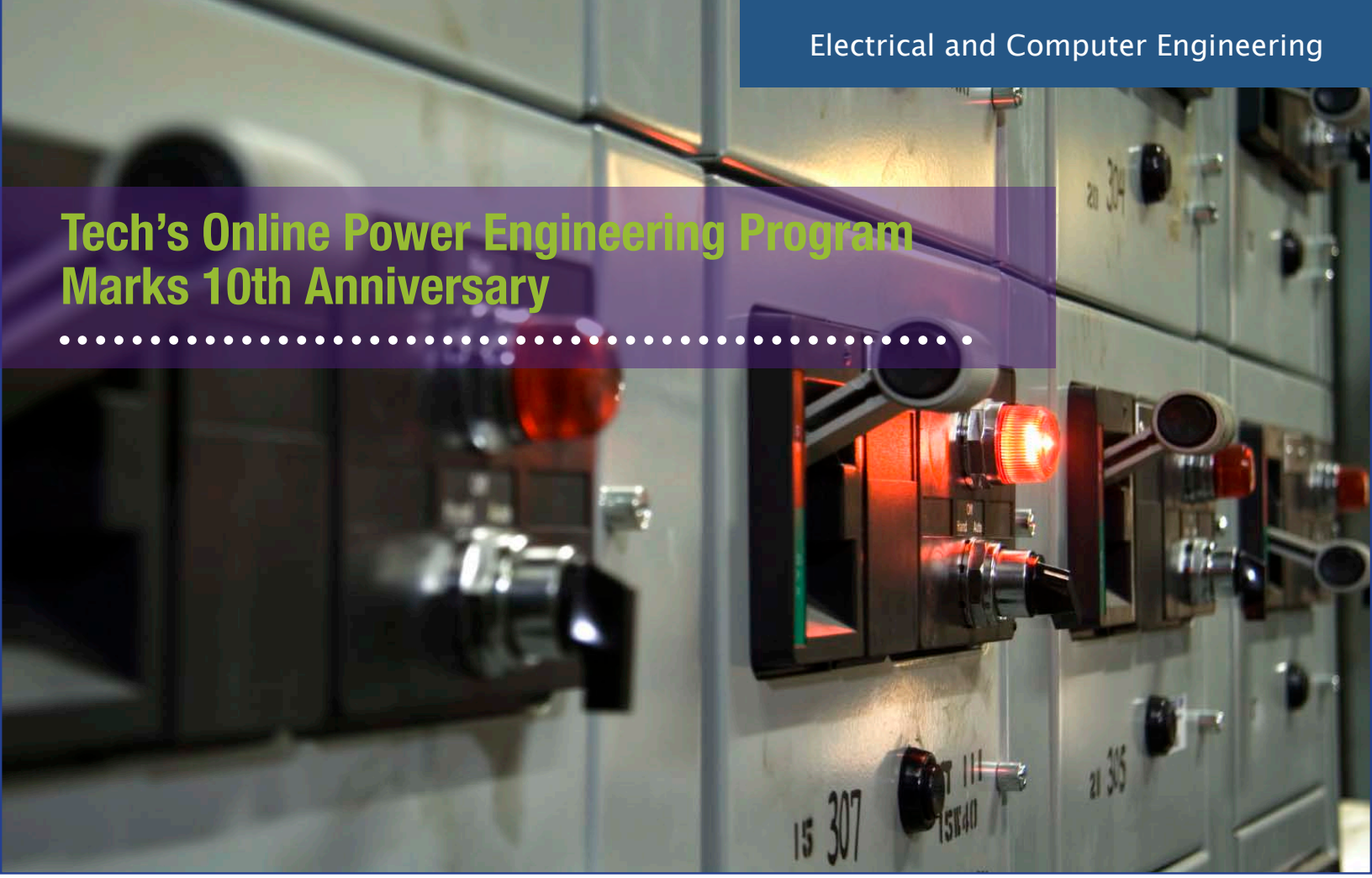
"One of our goals was to leave knowing that the information that we taught would be passed on to future generations."



The Pavlis Institute offers unique course work combining technology, business, communications, and global understanding. It is modeled on the experiences and skills of Michigan Tech alumnus Frank Pavlis, who devoted his career to managing innovation worldwide.

While in Ghana, Matias and his fellow students got front-row seats to President Barack Obama's appearance in the capital city of Accra. Check out their blog at http://pavlistravelblog.blogspot.com.

Tech's Online Power Engineering Program Marks 10th Anniversary



Over a decade ago, a handful of Michigan Tech faculty got together with representatives from Cooper Power, a major supplier of equipment for the power industry. The company suggested a partnership: would Tech offer a distance-learning graduate program that could give its engineers greater technological capabilities in power generation, transmission, and distribution?

So began Michigan Tech's distance learning MS in Electrical Engineering with a concentration in power systems. From the original four Cooper engineers, the program now enrolls nearly thirty students from all over the US and is the only one of its kind in Michigan.

An additional twenty-five are earning one of its two certificates in power systems engineering, one for undergraduates and the other for graduate students, also offered online. When undergraduates come to Tech to complete their lab component, they enjoy the benefits of state-of-the art facilities, made possible by nearly half a million dollars from corporate partners.

The classes are available 24/7 on streaming video, "so our students can go on a business trip and catch up on the weekend," says Associate Dean of Engineering Leonard Bohmann, an architect of the online effort. The program's strength reflects a renewed awareness of the importance of electrical power, says Bruce Mork, a professor of electrical and computer engineering and director of Michigan Tech's Power and Energy Research Center.

"Energy has become a national security issue," he says. "It's more important than ever to have infrastructure that is robust and reliable."

"We saw a need for something like this way back when we started the program," Professor Dennis Wiitanen remembers. "But we didn't realize it was going to be so big. Energy is becoming popular again, and we were almost accidentally well positioned for it." The power industry is undergoing a technological revival, which has accelerated demand for power engineers. "We had about twelve years of Enron-type priorities, when focus was on energy marketing rather than the actual engineering and new technologies," Mork said. "In hindsight, we could raise an eyebrow at that. It was assumed the infrastructure was mature and developed, and all we had to do was maintain it.

"The US is now playing catchup in R&D," he said. "The power industry is scrambling to adopt smart grid technologies that conserve energy and provide wide-area protection and control to improve grid reliability, plus adding new, renewable energy sources to the power-generation mix.

"Companies need competent engineers to design these systems, especially with the smart grid technologies that are coming along," says Mork. "Our graduates have those core competencies; they know how to design and apply those technologies."

The program opens doors for its graduates. Tom Ernst, a supervising engineer with Minnesota Power in Duluth, Minnesota, enrolled to fill in some technical gaps in his education. Having finished his MS in 2008, he now plans to use his degree in the classroom. "It has opened up more opportunities, especially at the community college level," he says.

"It's a great program," Ernst adds. "It provides an opportunity for people who want to continue their education in this field, and not all universities offer power engineering." It took Ernst several years to complete his MS while he worked full time. Students now have other options, including just taking a class or two or pursuing a certificate.

The new certificates in power systems were developed in cooperation with American Electric Power, which provides electricity to 11 million customers in five states. "Like the MS, they grew out of workforce needs of our industry partners," Mork said. "It was a natural step for us."

For more information on Tech's online programs in power systems engineering, contact Mork at bamork@mtu.edu.

"Michigan Tech can't be a top 25 engineering university without a strong EE department."

Dave House: Why Research Is Key to the Future of Tech and to ECE

By virtue of its location, for Michigan Tech to survive in the long term it has no choice but to become one of the top-ranked national research universities. That requires growing its graduate and research programs, says electrical engineering alumnus Dave House '65, who chairs the University's Generations of Discovery Capital Campaign.

"The number of universities in the three-state region offering bachelor's degrees in engineering has skyrocketed since I graduated—and the number continues to grow," says House, who recently made a $10 million pledge to the University, the largest single gift in Michigan Tech's history. "Soon almost anyone will be able to get an engineering education close to home. Data show that the top students travel to nationally recognized universities; the others generally attend universities closer to home. Because of Michigan Tech's location, it needs to draw students from hundreds of miles away. Therefore, we will have to become nationally recognized to attract students to our campus."

"Because of the increasing complexity of all technologies, there's a growing demand for graduates with advanced degrees," says House. "Michigan Tech needs to grow its graduate programs to meet that market requirement."

A listing of the top national universities shows that they all have strong graduate and research programs. To support these programs they need the very best faculty.

"It's critical that Michigan Tech be a highly rated research university," says House. "That requires that we attract the best research-oriented faculty members. The best way to attract great faculty is through endowed chairs and professorships, which is why they are the focus of the capital campaign."

Endowed professorships and chairs are permanently supported by invested funds. Earnings from those funds underwrite the work of the selected faculty members.

To broaden Tech's research base, the House Family Foundation provided funding in 2004 for the University to purchase the research group that would become the Michigan Tech Research Institute. The Ann Arbor–based facility is a leader in sensors and signal processing research, especially in the earth sciences.

House believes the ECE department must play a leading role in driving Tech to the summit. "Michigan Tech can not be a top national research university without a top-ranked College of Engineering, and that would be almost impossible without a top-ranked program in electrical and computer engineering. On a worldwide basis, there are more electrical engineers than any other kind," House says. "Michigan Tech can't be a top twenty-five engineering university without a strong ECE department."

To attract and retain top faculty within the department, the House Family Foundation has funded two endowed professorships. House is now pursuing a different kind of investment, the new Center for Computer Systems Research.

"What we are creating is a center focusing on all aspects of information technology," he says. "It's being done in recognition of the fact that it's difficult to tell the difference between electrical engineering and computer engineering and between computer engineering and computer science. It's a continuum of capabilities; each field doesn't fit in a single silo. It's important that our students function across that continuum, and this facility will allow them to do that."

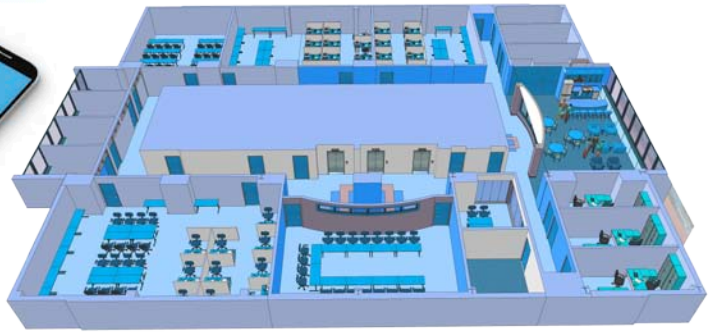
"To deliver the highest quality of education to future generations, it's important to have the right kinds of facilities," he adds. "Often there aren't the funds to make those available. I thought it was an important initiative on behalf of the department."

House is the retired president of Nortel Networks, former CEO of Bay Networks, and a longtime Intel executive. He is chairman of Brocade Communication Systems of San Jose, California, and has a winery in the Santa Cruz Mountains. Without Michigan Tech, his story might have been different. He gives out of gratitude and encourages other alumni to do the same.

"Any success they've had is at least partially due to the education they got at Michigan Tech," he says. "I think it's only appropriate that they give back to an important source of their wealth."

Alumni Gifts Fund New Center for Computer Systems Research

"The fact that this is made possible completely by alumni donations is phenomenal."



Computer engineering and computer science are both key to advancing knowledge of computing. The engineers focus on design and integrating software and hardware, while the scientists concentrate on analysis and the fundamental nature of computing.

Now, with the enthusiastic support of the Department of Computer Science, the Department of Electrical and Computer Engineering is creating a space where Michigan Tech's computer engineers and scientists can put their heads together.

The new Center for Computer Systems Research will occupy the entire fifth floor of the Electrical Energy Resources Center (EERC). The Seaman Mineral Museum, a longtime tenant of the area, will be moving to a new building in the Advanced Technology Development Complex. Construction on the center is slated to begin December 1, with the opening expected in April 2011.

"We're excited about working with the computer science department on this," said Dan Fuhrmann, chair of electrical and computer engineering. "We'll be looking at experimental architectures, new applications, new ways of doing computing."

Steven Carr, interim chair of computer science, is equally enthusiastic. "It's a really neat opportunity for Computer Science and Computer Engineering to finally collaborate in a much more defined way," he said. "We have always worked well together, and there are faculty in both departments who have the potential to cooperate closely on large projects. The center will play a big role in making that happen."

The half-million-dollar renovation is funded in part by two $150,000 gifts, one from the James Fugere Foundation and the other from the Dave House Family Foundation. The remaining $200,000 is being underwritten by numerous smaller donations given to the department over the last several years.

"The fact that this is made possible completely by alumni donations is phenomenal," said Fuhrmann.

Brainstorming for the new center began over a year ago, when Michigan Tech launched a strategic initiative to hire faculty in the area of computational discovery and innovation. Through the initiative, the department has gained two new computer engineering faculty, Zhuo Feng and Saeid Nooshabadi.

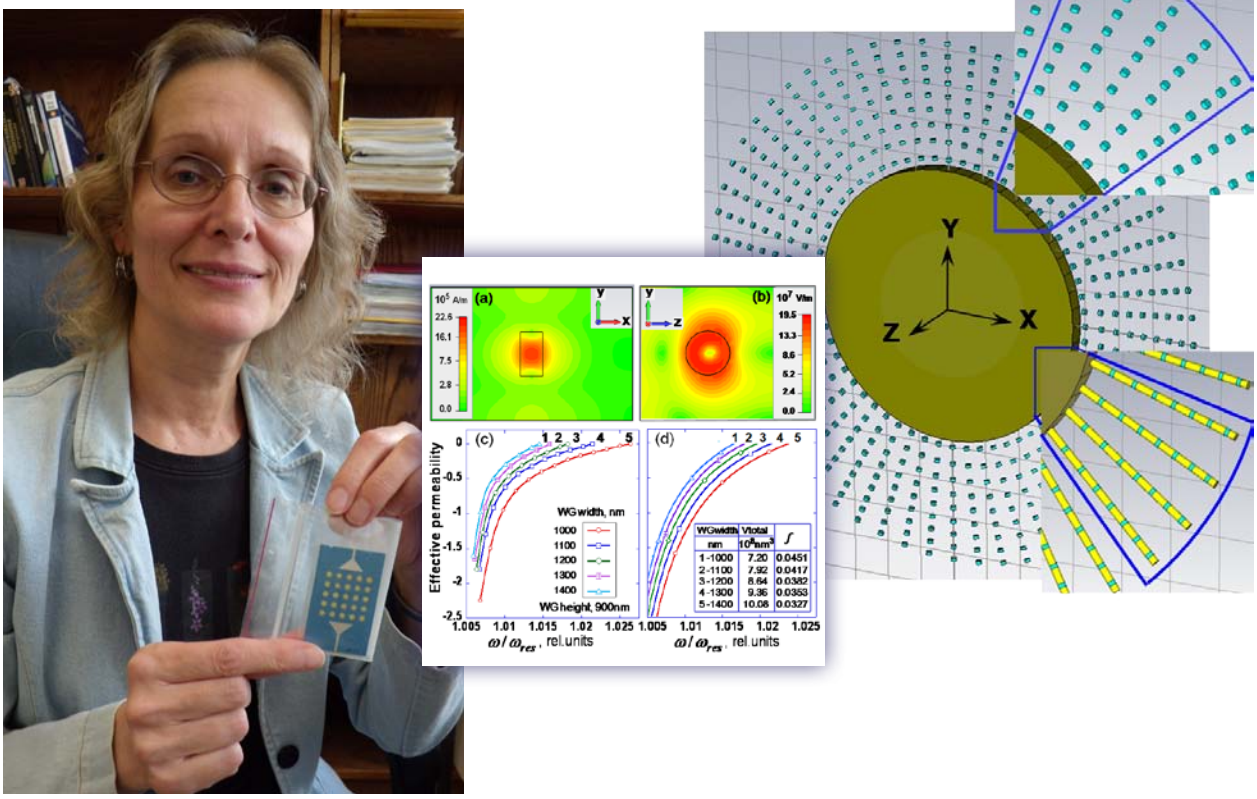
"We started thinking about what we could do to reinforce the hiring initiative and our relationship with the computer science department," Fuhrmann said. In addition, the computer engineering program was growing; with new master's and PhD degrees, it needed more space.

The Center for Computer Systems Research addresses all three issues. The new faculty are expected to be heavily engaged; Nooshabadi in particular will play a leadership role, since his research crosses the disciplines of electrical engineering and computer science. Preliminary plans include offices that can be used by faculty from both departments, informal meeting rooms, laboratory space, a conference room, space for graduate students, a seminar room, and even a kitchen. A department committee chaired by Senior Lecturer Glen Archer provided guidance to OHM Engineering Services in Houghton, which drew up the plans.

The center represents a huge step forward for the department, and it wouldn't be happening without support from alumni, Fuhrmann stressed. "I'd like to thank all of you who have contributed to the department over the years," he said. "Your generosity has made this possible. We literally couldn't have done it without you."

Now You See It, Now You Don't

An Invisibility Cloak Made of Glass



From Tolkien's ring of power in *The Lord of the Rings* to *Star Trek*'s Romulans, who could make their warships disappear from view, from Harry Potter's magical cloak to the garment that makes players vanish in the video game classic "Dungeons and Dragons," the power to turn someone or something invisible fascinates mankind. But who ever thought that a scientist at Michigan Tech would be serious about building an invisibility cloak?

That's exactly what Elena Semouchkina, an associate professor of electrical and computer engineering, is doing. She has found ways to use magnetic resonance to capture rays of visible light and route them around objects, rendering those objects invisible to the human eye.

Semouchkina and colleagues at Pennsylvania State University, where she is also an adjunct professor, recently reported on their research in the journal *Applied Physics Letters,* published by the American Institute of Physics. Her coauthors were Douglas Werner and Carlo Pantano of Penn State and George Semouchkin, who works at Michigan Tech and Penn State.

They describe developing a nonmetallic cloak that uses identical glass resonators made of chalcogenide glass, a type of dielectric material (one that does not conduct electricity). In computer simulations, the cloak made objects hit by infrared waves—approximately one micron, or one-millionth of a meter long—disappear from view.

Earlier attempts by other researchers used metal rings and wires. "Ours is the first to do the cloaking of cylindrical objects with glass," Semouchkina said.

Her invisibility cloak uses metamaterials, which are artificial materials having properties that do not exist in nature, made of tiny glass resonators arranged in a concentric pattern in the shape of a cylinder. The "spokes" of the concentric configuration produce the magnetic resonance required to bend light waves around an object, making it invisible.

Metamaterials, which use small resonators instead of atoms or molecules of natural materials, straddle the boundary between materials science and electrical engineering. They were named one of the top three physics discoveries of the decade by the American Physical Society.

Semouchkina and her team now are testing an invisibility cloak rescaled to work at microwave frequencies and made of ceramic resonators. They're using the anechoic chamber, a cave-like compartment in a lab lined with highly absorbent charcoal-gray foam cones. There, antennas transmit and receive microwaves, whose wavelengths are much longer than those of infrared light, up to several centimeters long. They have cloaked metal cylinders two to three inches in diameter and three to four inches high.

ECE Laboratories

STAND OUT

Glen Archer, senior lecturer, teaches the electrical engineering course for students from other engineering disciplines, and he oversees all eleven of the undergraduate laboratories that support hundreds of students in the department.

Those duties put what he calls his "fingerprints" on a lot of engineering students at Tech. "They all come through either our labs or our service course," he says. "It's an enormous privilege and responsibility that I take very seriously."

Archer has a bachelor's in electrical engineering from Texas Tech and a master's in information systems management from Webster University. He was the commandant of Tech's Air Force ROTC program from 1999 to 2001. That assignment concluded a twenty-nine-year career in the military; ever since he has worked in the ECE department.

"I love working with the teachers," he says, "and I love working with the students. They're inspiring in many ways. The energy, the resourcefulness, and the creativity that they bring to solve the problems that we pose for them—it's really exciting."

He says the ECE laboratories stand out. He has traveled extensively to other institutions, including the elite, and says of Tech's labs: "We're better than most of them and as good as any of them."

He says Tech students have a reputation for "hitting the ground running" on their first jobs. A major reason for that: the laboratory regimen. "Our students understand how to operate the equipment and software that they will deal with in the real world. They confront daily the difference between theory and reality."

Archer also is the advisor for the Blue Marble Security Enterprise, which is hosted by the department and has students working directly with design engineers in industry. "They develop technical skills and soft skills," he says.

He concludes, "Many students who come to Michigan Tech for an engineering degree have to drive by a half dozen perfectly fine engineering schools. The Enterprise Program, in my mind, is one reason that's a good idea."

An Interview with Professor Anand Kulkarni

Professor Anand Kulkarni retires in December after thirty-two years in the ECE department.

"As professors, we are competing to be known for our research. But I enjoy teaching, as well. You need both—an educational institution can't survive with only one strength," he says. Kulkarni spent about ten years researching indium tin oxide. "Interesting stuff," he says. "It behaves like a metal, but still allows light to pass through." More recently he has delved into photovoltaics, researching quantum dots and their potential use in solar cells. "They are particularly effective at converting sunlight into electrical energy."

Inspired by Keats, Frost, Yeats, Shelley, Shakespeare, Wordsworth, and others, Kulkarni writes poetry in addition to conducting research and teaching. "I write to entertain my students," he says.

Q: When did you come to Michigan Tech?

A: I came in December 1978. The winter of 1978–79 broke all the previous records of total snowfall. We got close to 400 inches of snow. When I came here in early December, I thought I had landed on the Himalayan Mountains. I was working on my PhD when I joined Michigan Tech's EE department as a new faculty member. I completed my PhD in December 1979 and went on tenure track in September 1980.

Q: When will you retire?

A: I plan to retire in December 2010. It was a difficult decision and will be a good one if the stock market doesn't crash as it did in March 2009.

Q: What makes you think it is the right time?

A: There is no right or wrong time for retirement. I will keep active doing research and may teach once in a while somewhere.

Q: What do you look forward to most about retirement?

A: I look forward to travel as much as I can afford. Publish a book or two of my poetry. It helps me to think out of the box anyway. Play more tennis to keep healthy, spend more time on my investments to remain wealthy, and play cards until cows come home.

Q: What will you miss the most about the department and/or the University?

A:

I will miss the bliss of working in my office.
The books, the journals and my handwritten notes.
The magnificent view of Portage Lake blue waters,
All the boats that pass through and those unperturbed,
Uneven, green hills.

I will miss the thrill of teaching
The students and their confused thinking.
My enthusiasm to share what I know,
Challenge my students on what they do know!

I will miss my distinguished colleagues,
Their wonderful friendship and association.
The electrophysics group and those unfathomable seminars,
Unknown theories and well-known practical stupidities!

The snow statues not shivering in cold winds,
Diwali night and its delight!

Q: Do you have a favorite highlight or memory from your years of teaching and research?

A: I have a couple of stories to share. Soon after I started teaching, I was having dinner at the Ambassador with friends one night. The waitress brought a bottle of beer and told me that one of my students had sent it to me. I was very surprised and equally pleased that a student has appreciated my teaching. Then I came to know that the student had gotten his first D grade in my class. I think he had only F grades till that time. We were definitely a tough school in the woods those days.

The most comforting moment in my teaching came when I won the department's Professor of the Year award in 2000. I had struggled to teach my EMAG class after my wife's sudden death. More than the award, what brought me joyful tears was a sympathy card signed by all my forty-two students in the class.

The most exciting aspect of my research was the fabrication of diamond thin films on silicon substrates. Looked under a microscope when I saw the tiny crystals of shining diamonds for the first time, my heart spoke:

Twinkle twinkle little crystals
Formed by methane and
Hydrogen miracles!
Using a hot tungsten filament
Under controlled vacuum environment!

Thirty-two years in the Department of Electrical and Computer Engineering at Michigan Tech

New Faculty



From left: New electrical and computer engineering faculty members Elena Semouchkina, Zhuo Feng, and Shiyan Hu

Elena Semouchkina

Associate Professor Elena Semouchkina comes to Michigan Tech from Penn State, where she continues to serve as an adjunct professor. She holds three advanced degrees: an MS in Electrical Engineering and a PhD in Physics and Mathematics, both from Tomsk State University in Siberia, Russia, and a second PhD in Materials from Penn State. Semouchkina has extensive research experience in electromagnetics, computational modeling and design, electronic and photonic devices, and materials. She will conduct graduate-level classes on emerging topics at the boundary of those different disciplines. Her work integrates the fundamental study of electromagnetic wave interaction with nonuniform media. One recent project involved magnetic resonance imaging. "Currently with MRI, the alternating of magnetic fields is usually done with metallic coils. We tried replacing those cords with nonconducting ceramic materials, with success."

At Penn State, Semouchkina was a senior research associate with the interdisciplinary Materials Research Institute and the Computational Electromagnetics and Antennas Research Laboratory, the latter within Department of Electrical Engineering. She was also associate professor in two additional departments—engineering science and mechanics, and materials science and engineering.

Semouchkina received the Best PhD Thesis Award from Penn State in 2001 and was a 2004 recipient of the National Science Foundation's Fellows Award in the ADVANCE Program: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers. She is an associate editor of *Antenna and Wireless Propagation Letters.* She is also co-organizer of the first-ever Women in Electromagnetics (WiEM), an annual international workshop, sponsored by the IEEE Antenna and Propagation Society.

Her previous research at Tomsk State University, the Ioffe Physics-Technical Institute of the Russian Academy of Science, and St. Petersburg State Polytechnic University included the investigation and development of solid-state devices, in particular, novel infrared MOS photodetectors.

Currently, Semouchkina is working on the creation of an "invisibility cloak" (see the story on page 8).

Zhuo Feng

Assistant Professor Zhuo Feng comes to Michigan Tech from Texas A&M University, where he received a PhD in Electrical and Computer Engineering in 2009. He earned a Master of Engineering in Electrical Engineering from the National University of Singapore in 2005 and a BS in Information Engineering from X'ian Jiaotong University, Xi'an, China, in 2003. Feng will explore the emerging parallel computing platforms and methodologies that are becoming increasingly important in integrated circuit computer-aided design. During the past few summers, he worked as a summer intern, first at Mentor Graphics Inc. in Wilsonville, Oregon, where he concentrated on the development of a statistical design-dependent interconnect corner extraction program. Next, at Magma Design Automation in Austin, Texas, Feng focused on hardware acceleration of circuit simulations—using and developing some very new techniques for integrated circuit simulation algorithm development.

His goal is to attack the problem of large-scale circuit simulation using emerging power-efficient parallel computing platforms. His general research interest involves VLSI computer-aided design, or VLSI CAD. One of his recent research projects includes the development of efficient CAD methodologies specifically for three-dimensional integrated circuit (3D-IC) designs. These methodologies target power and thermal verifications, a key step in 3D-IC design.

Feng is teaching a new graduate-level course on VLSI simulation and modeling. His goal is to help students better understand and use today's VLSI CAD techniques. Students will also learn about GPUs—specialized processors that offload 3-D graphics renderings from the microprocessor. Feng will teach students how to accelerate existing algorithms on GPUs. "Their massively parallel computing capability makes them more attractive for a range of computationally intensive applications," he says.

Shiyan Hu

Assistant Professor Shiyan Hu comes to Michigan Tech from Texas A&M University, where he earned a PhD in Computer Engineering in 2008. In 2007, he spent seven months at the IBM Austin Research Lab working on the company's chip physical layout design flow. Some of his work, such as slew buffering, has been used in IBM chip design flow. Hu will continue his collaboration with IBM while at Michigan Tech.

Hu seeks to address difficult design automation problems. "As VLSI technology enters the nanoscale regime, chip design becomes increasingly difficult," he says. "Progress in this area faces several limiting factors: the fundamental interconnect limit, variational effect, and lithography-related manufacturability. These emerging issues for next-generation integrated circuit designs require ultrafast and high-quality solutions. Advanced algorithms for large-scale optimizations need to be used and invented." Hu adds, "Right now I am more or less a mathematician working with combinational optimization theory. But there's always an element of engineering. There's got to be a balance between the practical and the pioneering aspects of the work. I am continually looking for the potential applications of profound theory."

Hu has published over forty journal and conference papers, including those in *IEEE Transactions on CAD* and *IEEE Transactions on VLSI, DAC and ICCAD.* His research has been cited by other ECE research groups, including the University of Michigan, University of Texas at Austin, Northwestern University, University of California–San Diego, University of Wisconsin–Madison, the University of Waterloo, and ETH Zurich—as well as leading chip-makers IBM and Intel.

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Doctoral Student Chao Zou Wins 2009 Matt Wolfe Award

Doctoral student Chao Zou has won the 2009 Matt Wolfe Award. For the honor, he received a plaque and $500.

"Chao distinguishes himself as an outstanding PhD student researcher, not only by the quality and productivity of his research, but also by his truth-seeking spirit," says his advisor, Associate Professor Chunxia (Tricia) Chigan. "He often initiates constructive discussions among his lab mates. He sets the goals high and then reaches those goals with a hardworking and truth-seeking attitude."

The National Science Foundation recently gave a "competitive" ranking to a research proposal based mainly on Zou's research. "Chao has developed a software simulator for cognitive radio networks that will be released to the research community shortly," Chigan explains. "As the first simulator of its kind, we expect it will help promote Michigan Tech's reputation."

Zou obtained his bachelor's and master's degrees at Shanghai Jiaotong University, in China. Now completing his doctoral studies in electrical engineering, Zou has published several articles in top journals such as the *Journal of Computer Networks* and the *Journal of Computer Communications,* and he has submitted articles to the *IEEE Transactions on Wireless Communications* and the *IEEE Transactions on Vehicular Technology.* In addition, Zou has published a conference paper and a book chapter about cognitive radio networks.

As a result of his publication record, Zou has been invited to review journal articles and conference papers—something extraordinary for a doctoral student.

Research in Zou's area is sparse, so there is often little to go by. "Many directions have to be tried to see whether or not they are feasible," Zou explains. "Sometimes, after a long time exploring one possible solution, it is proven not able to solve the problem. That is the most challenging aspect of the work."

The award is in memory of Matt Wolfe, a 1992 BSEE graduate and master's candidate, who was killed in an automobile accident during his second year of graduate study.