

SIGNALS

Department of Electrical and Computer Engineering
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U of MN awarded \$28 million to lead development of next generation microelectronics



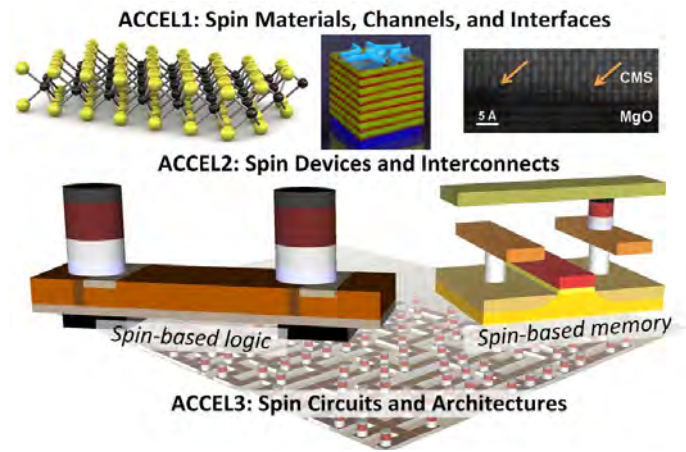
Prof. Jian-Ping Wang

The University of Minnesota has been awarded \$28 million over five years to lead a new national research center focused on developing the next generation of microelectronics. About one-third of the grant will support research in Minnesota.

The grant was awarded by the Semiconductor Research Corporation, a global research collaboration of private companies, universities and government agencies, and the Defense Advanced Research Projects Agency (DARPA). Minnesota is one of only six lead universities to receive funding through the Semiconductor Technology Advanced Research Network (STARnet) initiative aimed at supporting continued growth and leadership of the U.S. semiconductor industry.

The new Center for Spintronic Materials, Interfaces, and Novel Architectures (C-SPIN) at the University of Minnesota will bring together top researchers from across the nation to develop technologies for spin-based computing and memory systems. Unlike today's computers, which function on the basis of electrical charges moving across wires, the emerging spin-based computing systems will process and store information through spin, a fundamental property of electrons.

"The incredible ability to scale semiconductor technology, an electron-charge-based technology, has led to the information revolution of the past half-century," said C-SPIN's director Dr. Jian-Ping Wang, an electrical and computer engineering professor in the University's College of Science and Engineering. "However, today's semiconductor technology is reaching its fundamental limits in terms of density and power consumption. Spin-based logic and memory based on the hybridization of magnetic materials and semiconductors have the po-



tential to create computers that are smaller, faster, and more energy-efficient than conventional charge-based systems."

The research also will have an impact beyond the world of computer science and engineering resulting in advances in nanotechnology, materials science, physics, chemistry, circuit design, and many other fields, Wang said.

"This new center is just one example of how research at the University of Minnesota can help boost the economy locally and globally," said University of Minnesota President Eric Kaler. "This center will bring together the nation's best minds in spintronics to push the boundaries of research and to develop new discoveries that will benefit all of us."

C-SPIN is headquartered at the University of Minnesota-Twin Cities and will fund research for 31 leading experts from 14 universities working in six scientific disciplines. C-SPIN also will fund research from more than 60 doctoral and post-doctoral students and host industry researchers-in-residence.

In addition to the University of Minnesota-Twin Cities, the 13 other universities involved are Carnegie Mellon University; Cornell University; Johns Hopkins University; Massachusetts Institute of Technology; Pennsylvania State University; Purdue University; University of Alabama; University of California, Riverside; University of California, Santa Barbara; University of Iowa; University of Michigan; University of Nebraska; and University of Wisconsin-Madison. Industry partners include Applied Materials, GLOBAL-FOUNDRIES, IBM, Intel Corporation, Micron Technology, Raytheon, Texas Instruments, and United Technologies.

For more information about C-SPIN, visit cspin.umn.edu.

In this issue

• Prof. Steve Koester's research in biomedical detection and microelectronic computing.....	2
• Undergrad Kenneth Condon interns at SpaceX.....	3
• Control Data and the Career of Robert M. Price.....	4
• Three professors join ECE Faculty (Cho, Dhople, Mazumdar).....	5
• Envision Fund enhances student experience by encouraging innovation.....	5
• U of MN team makes Disney 22nd ImagiNations Competition finals.....	6

• ECE News Briefs	
Faculty.....	6
Students.....	7
In Memoriam (Erwin Tomash-EE'43; Roger Swanson-EE'53).....	7
• ECE Individual Donors.....	8-9
• ECE Corporate and Foundation Donors.....	9
• Alumni Check In with Anoosh Mostowfi (MSEE'82).....	10-11
• Envision Fund Projects Accepted March 2013.....	11

Seeking biomedical detection and microelectronic computing breakthroughs



Finding uses for the one-atom thick substance called Graphene

Prof. Steven Koester, who joined the University's ECE faculty in 2011, is working on a variety of research projects that are stretching the limits in a number of computing and biomedical areas using the nanofabricated one-atom-thick carbon substance called graphene.

Koester and his research team's projects involve: 1) graphene quantum capacitance varactors for wireless biosensing applications, 2) fabrication and characterization of graphene nanoribbon and nanomesh transistors, 3) graphene-based photonic devices, 4) all-spin logic, and 5) tunneling field-effect transistors for ultra-low-power logic applications.

Koester is creating glucose monitoring sensor to help diabetics

Since early 2012, Koester has been working with Mayo Clinic researchers Yogish Kudva, M.B.B.S., and Ananda Basu, M.B.B.S., M.D. Through their combined efforts and sponsor funding by Minnesota Partnership—A Decade of Discovery, the team hopes to deliver an entirely new diabetes management tool.

Managing diabetes is a demanding and difficult daily task. Diabetes presents as either Type I or Type II. Type I is caused by an autoimmune response disorder that damages the pancreas leaving it unable to produce insulin. In Type II, insulin is produced but the body's cell functions do not respond correctly to the insulin.

"What I am seeking to create is a universal bio-sensing platform, in this case, a glucose sensor—small enough to place within an artery to accomplish real time, close-loop feedback," Koester says. Koester's sensor would read blood glucose levels and send messages to an insulin pump which in turn would send the proper dosage of insulin into the person's body.

Koester's sensors are made of graphene (proven to be a good biomedical sensor) with added wire receptors.

The current sensors used in research are not as sensitive as doctors would like. In addition, the current sensor must be replaced frequently. It takes up a lot of space in the body because of its size—about two postage stamps wide—requiring placement on either side of the abdomen under the skin. Koester's proposed glucose sensor would help manage these problems.

Mayo researchers have begun calling the project the "artificial pancreas." It is hoped the entire system will be able to deliver insulin when needed; to measure the body's reaction when insulin is delivered; to continuously measure the sugar in the blood; and to coordinate all the components. This is a complicated task but greatly needed. In Minnesota alone, there are more than 300,000 people diagnosed with diabetes.

Koester working toward computing and memory breakthroughs with spin-based technology

As associate director of the newly established Center for Spintronic Materials, Interfaces, and Novel Architectures (C-SPIN), Koester is working with Prof. Jian-Ping Wang (Center Director) and others to develop spin-based computing and memory systems with the potential to create computers that are smaller, faster, and more energy-efficient than conventional charge-based systems. Funded by the Nanoelectronics Research Initiative (NRI/SRC), the C-SPIN Center will be incorporating spintronics which uses magnets to accomplish the computing rather than the current electric charge-based method. (For more about the C-SPIN Center, refer to page 1).

"A lot of energy is wasted due to the inefficiency of the electron model in use today," says Koester. "Devices lose power when not in use and during use. (We've all been victim to a dying or dead cell phone.) Trying to counteract this energy waste on current electrical-based devices has proven counterproductive—the result is slower computation speed.

"My team is working with graphene as a spin interconnect—essentially creating a way that these magnets can talk to each other—while trying to control spin polarization."

In addition, Koester will head efforts to coordinate industry's interaction on the project by ensuring that the research is meeting industry's needs and is incorporating industry's input.

Koester seeks other uses of graphene for computing and biodevices

Koester and his research team also are working on a novel electronics switch—another technique to save energy in computation. "We are trying to find a switch that operates on the tunneling field effect transistors." This research is funded by National Science Foundation.

Collaborating with ECE Prof. Mo Li, Koester is applying graphene as an optoelectronic material that would use its characteristics of tunable absorption of light to produce high speed computations with low power modulation.

Koester also has been working on using a biosensor for monitoring cancer therapy. Collaborating with Dr. Bruce Gerby and Dr. Margaret Reynolds of Department of Therapeutic Radiology – Radiation Oncology, the team hopes to make ultra-small *in vivo* radiation sensors to monitor dosimeter readings during actual cancer radiation treatments. Funding has been provided by the U of MN's Institute of Engineering in Medicine (IEM).

Prized opportunity awarded to undergraduate Kenneth Condon: A fall internship at SpaceX, and another to follow this summer



Kenneth Condon
Junior, ECE

Having just completed his sophomore year in the Electrical and Computer Engineering program, Kenneth Condon received a phone call with the news that he had been awarded a design engineering internship at SpaceX—one of the hottest companies in the country. Condon deferred his fall semester, made his travel plans, and arrived in Hawthorne, Calif. assigned to work on the Dragon Avionics project.

“When I arrived, I was only one of ten undergraduate interns,” he said. “The rest were graduate students and the SpaceX employees. The staff consisted of two distinct groups of professionals: the younger group who had done really well in school and now were super energetic engineers and the older group who had worked at NASA and Northrop and had experience from the most technical clearing grounds in the world.”

Condon was assigned to the team designing electrical hardware for the Dragon 4 (that went into space in early March 2013) and Dragon 5 (that will be in space the summer of 2014). “We worked on power systems, telemetry, and fiber optics. It’s the ground support equipment—testing and launch pad,” says Condon.

“SpaceX has a dedicated staff that works 50 hours per week minimum. Everyone, including the interns, is on-call 24/7. When we were into the manufacturing stage of specific components, we could expect a call if instructions or tolerances were in question. I even received a call at 3 a.m. They were depending on you and your project—it made you know your work was important.”

SpaceX provided apartments for the interns in Venice Beach. “All my friends asked me about California,” he says. “All I could say was that SpaceX’s lab is really cool. We didn’t get outside much.”

Prior to his internship with SpaceX, Condon had participated in two internships with Minnesota companies. His first was at Minnesota Health Solutions where he worked on a government research grant to fine tune automatic braking for wheelchairs by creating traction and orientation realignment controls. His second internship was at Ingersoll Rand where he worked on creating algorithms for lower power sensors.

On campus, Condon is involved in student organizations including Tesla Works, IEEE Student Group, ULSI Rocket Builders, and Triangle Fraternity, where he served as president. In addition, he has served as a mentor and an inspector for First Robotics.

When it came time for his interviews with SpaceX, he was ready with a wealth of interning and hands-on experiences, in addition to his University of Minnesota classroom- and lab-acquired knowledge. “Without that background, I would not have made the first cut. The interview process was thorough,” he says.

“The most valuable things I learned from my internships are:

- The internet is your friend.
- Don’t be afraid to ask questions from the people around you.
- Keep busy during your internship.

“Just because the project you are working on is done, continue to stay busy,” he says. “Work on something else to get as much experience as you can. Focus and dedication take a lot of planning so that there are no gaps in your work time. Stay busy.”

Condon will be returning to SpaceX this summer; he has been invited back. He hopes to attend graduate school and eventually start his own company in the area of low power industrial sensors. “I want to be busy with a lot of projects. I like to work on new things while I am working on current projects,” he says.

This semester, Condon is providing freshmen who are new to electronics with an in-depth experiential opportunity in which they will be making audio amplifiers (Class A and Plus AB).

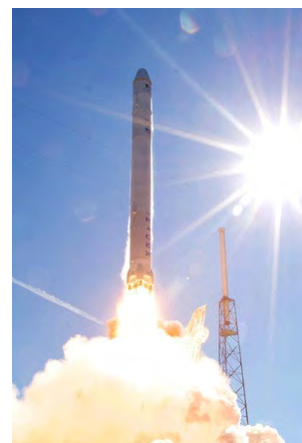
“I’m sharing information about electronics design, amplifiers, transistors, and frequency domain of circuits,” he says. “Then we’re going to spend a lot of time on parts selection. There are billions of parts out there and there may be 130,000 catalog items that look like they are all the same but they’re not. I’m going to show the students how to differentiate the specs and to choose quickly. When these students have completed our project, they will be ready for an entry-level internship in electronics.”

Condon advises students, “Get involved in University of Minnesota student groups that actually build something. Join groups like Tesla Works, Triangle Fraternity, Formula SAE. It’s not real if you don’t do some building. If you don’t get frustrated, you are not working hard enough.”

SpaceX gained worldwide attention for a series of historic milestones:

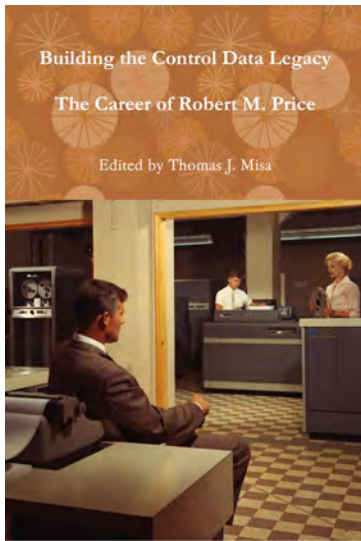
- Only private company ever to return a spacecraft from low-Earth orbit (Dec. ‘10)
- The company’s Dragon spacecraft attached to the International Space Station, exchanged cargo payloads, and returned safely to Earth (May ‘12)
- Dragon again successfully delivered cargo to and from the space station, in the first official cargo resupply mission for NASA (Oct. ‘12)

from the SpaceX Web site
<http://www.spacex.com/company.php>



Building the Control Data Legacy: The Career of Robert M. Price

By Prof. Thomas J. Misa



We don't ordinarily transform our oral history transcripts into 400-page books, profusely illustrated, professionally published, and publicly available on Amazon.com. But then the oral history with Bob Price, who rose through the ranks to succeed Bill Norris as Chairman and CEO of the Control Data Corporation, is not an ordinary one.

Partly by design, and partly by luck, *Building the Control Data Legacy* (CBI 2012) is the best source available to understand this leading 20th century computer company.

We met and discussed the prospects after one of my public talks on "Minnesota's Hidden History in Computing," Bob and I agreed to begin a set of interviews that would start with a rough overall plan to cover his entire career, from his early experiences programming the first generation of stored-program computers in California, though his 29 years at Control Data, and onto his more recent activities including teaching at Duke's management school and advising start-up companies. We even touched on Control Data's initiatives in what became known as corporate social responsibility. It seemed a promising plan.

We had several unusual resources upon which to draw. First was the recorded set of several dozen Control Data executive and manager oral histories, many of which are available on CBI's online oral history database <http://www.cbi.umn.edu/oh/index.html>.

A second unusual resource was having the entire Control Data Corporation archives available to us. When we did segments on Control Data's international operations, I was able to bring to our interview specific documents from the time. Bob often offered insights that were valuable in interpreting the business and financial strategies that shaped the documents themselves.

And then there were Bob's personal papers, with his own detailed memos and correspondence, astonishing "to do" lists from his days in international operations and as sales manager, and unvarnished "first drafts" of documents that later became part of the official company records.

About two-thirds of the way through what turned out to be 20 hours of recorded interviews, it occurred to me that this was not a normal oral history. We typically do a careful editing process and post a clean PDF on the oral history database. This set of inter-

views was much more, and I proposed that we create a book from these rich materials. During this time, I had been finding wonderful period photographs of the Control Data people, facilities around the world, and the company's notable products. I selected 80 of the best photographs and assembled them with the finished transcript into a 400-page book.

The book includes a far more complex and compelling story about Control Data than anything else I know. The first chapter of Bob Price's own book, *The Eye for Innovation: Recognizing Possibilities and Managing the Creative Enterprise* (Yale 2005), is probably the best introduction to Control Data's diverse history. Many people also read the biography by James Worthy, *William C. Norris: Portrait of a Maverick* (Ballinger 1987).

Bob made a number of trenchant comments on Worthy's perspective and interpretations, giving a more rounded view of Norris and his inimitable leadership style. We took particular care to document the early California-based programming activities, of which Bob was a part, and its link to computer services that was a main theme of his career.

Bob connected me with Fred Laccabue, Hewlett-Packard's "oldest employee" (before his retirement) and one of the Control Data engineers who had managed a complex and controversial project for the U.S. Air Force. CBI's associate director Jeffrey Yost conducted an oral history with him. Laccabue was the lead manager on this massive Control Data contract.

Drawing on this and other research on the history of the Air Force's Advanced Logistics System, Yost published a paper for the IFIP World Computer Conference in Brisbane, Australia.

While Control Data is, to this day, best known for Seymour Cray's stunning line of "supercomputers," the oral history indicates that the company's efforts in mass manufacturing of computer peripherals as well as its prescient effort in computer and information services were key parts of the company's activities and financial picture.

For more information about the CBI Archives go to <http://www.cbi.umn.edu/collections/index.html>



Prof. Thomas J. Misa, Director of the Charles Babbage Institute, is a faculty member in the ECE department, and teaches in the Program for History of Science, Technology, and Medicine.

Three faculty join ECE Department



Jeong-Hyun Cho received a B.S. degree in control and instrument engineering from Hoseo University, South Korea, in 2001. He received his M.S. degree in engineering and his Ph.D. in engineering science from Washington State University, Pullman, in 2004 and 2007, respectively.

As a postdoctoral researcher in the Department of Chemical and Biomolecular Engineering at The Johns Hopkins University from 2008 to 2010, Cho devised a nanoscale self-assembly process and developed three-dimensional (3D) surface-patterned nanoparticles that self-assembled from 2D nanoparticles with precise, lithographically-defined features. Most recently, he served as a postdoctoral fellow in The Center for Integrated Nanotechnologies at the Los Alamos National Laboratory where he was developing advanced materials and multifunctional nanostructures for electrical energy storage and power generation using a self-assembly strategy.

Cho has received several awards including the “Outstanding Researcher Award” in the School of Mechanical and Materials Engineering at Washington State University in 2006, the “Outstanding Poster Award,” and the “Achievement Award” at the Los Alamos National Laboratory in 2011.



Sairaj Dhople received his Ph.D. in 2012 from the University of Illinois at Urbana-Champaign (UIUC), in Urbana, Ill., in the Electrical and Computer Engineering department. He received his B.S. and M.S. degrees in Electrical Engineering from UIUC in 2007 and 2009, respectively.

Dhople’s research interests include modeling, simulation, and control of renewable electric power systems with emphasis on photovoltaic and wind energy conversion systems.

Dhople was the electrical engineering lead of UIUC’s 2009 Solar Decathlon team. He was a recipient of the Sargent and Lundy fellowship in 2010 for contributions to research in the area of Power and Energy systems, and was awarded the M. E. Van Valkenburg graduate research award in 2012 for contributions to research in the areas of circuits and systems.



Arya Mazumdar received his Ph.D. in Electrical and Computer Engineering in 2011 from the University of Maryland–College Park.

His research interests include information theory, error-correcting codes, codes for memory and storage, discrete mathematics in communications, networking, signal processing and security, random processes and probabilistic methods.

Mazumdar received the Distinguished Dissertation Fellowship Award in 2011 from the University of Maryland and the Best Student Paper Award at the IEEE International Symposium of Information Theory in 2010.

For updates and research web sites from these new faculty members, visit our web site at <http://www.ece.umn.edu/facultyECE/index.htm>

New Fund

ECE Envision Fund enhances student experience by encouraging innovation

The U of MN Department of Electrical Engineering announces the launch of the Envision Fund created to offer all College of Science and Engineering students an opportunity to pursue an extra curricular project idea that includes electrical and/or computer engineering content. Awards up to \$500 are anticipated for each funded effort.

“We’re encouraging innovation and creativity among students who wish to pursue extracurricular projects,” says Prof. David Lilja, ECE Department Head. “Thanks to our Envision Fund Sponsors—Barr Engineering, Digikey, Emerson, IEEE-Minnesota Chapter, and ExxonMobil—we can support this exciting opportunity.”

“Individuals and teams are welcome and freshmen and sophomores are encouraged to join in,” says ECE Director of Undergraduate Studies James Leger. “If students need assistance organizing a team or finding a team to join, help is available at the ECE Rice Student Advising Center by contacting Kyle Dukart (kdukart@umn.edu).”



Our Envision Fund Sponsors

Applications are accepted throughout the year, and will be reviewed during the third week of each regular semester for subsequent funding. It is expected that as many as twenty proposals could be funded each year. Interested students are asked to submit a project proposal online at z.umn.edu/eceenvision

To see which projects have been funded this semester, go to page 11.

U of MN students make Disney 22nd ImagiNations Competition finals



(l to r) Made Arya Adiartha,
Lucas Kaeding, Mickey
Mouse, Isaiah Bergstrom,
James Cospser

From the tours of the Disney Imagineering studios where Disney Magic is created to the “Twilight Zone” and “Toy Story Mania” attractions at Disneyland, U of MN students Lucas Kaeding (team leader), Isaiah Bergstrom, Made Arya Adiartha, and James Cospser created amazing memories as finalists in Disney’s 22nd ImagiNations Competition. Although they did not finish as the grand prize winners during their all-expenses-paid trip to California, they acquired a variety of skills and confidence that will last a lifetime.

This year’s contest was to “pick one city anywhere in the world and design an entertainment/recreational experience for its citizens and tourists.” The U of MN team’s entry was “Cores Brasileiras” at Rio de Janeiro, Brazil, a multimedia attraction designed to celebrate the beauty of Brazil. Combining the atmosphere of Rio’s enthusiastic culture with its love of established Disney characters, the team incorporated multidisciplinary skills of electrical and mechanical engineering, design graphics, and architectural design.

The team’s inspiration came from a variety of places: Cospser—Sci Fi, “Ducktails” cartoons, Disney’s influences of adventure and magic; Bergstrom—the culture and people of Rio; Adiartha—video games, role playing games, maps and terrains, and landscaping; Kaeding—life-long enjoyment of anything Disney and his desire to someday work in the entertainment industry.

The team agreed early on that they would not be driven by the mechanical aspects but rather by the story. “The more we worked on our project, the more important that aspect became,” Bergstrom, a mechanical engineering senior, says. “It helped us stay focused.”

Collaboration, the team agreed, was the most valuable skill they acquired. “Translating ideas, brainstorming, having discussions, and gaining different perspectives all gave me new insight that often wasn’t available when I was working on individual projects in my own department,” says Cospser, a College of Design MFA graduate student.

“Collaboration requires communicating well,” adds Kaeding, electrical engineering senior. “With all our different disciplines, we don’t use the same vernacular. And, for me as team leader, I had to learn to motivate others.”

“Working as a team was eye-opening and inspiring,” says Adiartha, a sustainable design graduate student. “I enjoyed seeing the passion in others. I also learned where I lacked in a skill, one of my colleagues could help.”

“It’s hard to ask for help because you think you should be able to do it all,” Cospser adds. “But, asking for help saves time.”

“Although we practiced our presentation many times, presenting to the Disney Imagineers (from both California and Florida) who actually do this work for a living was nerve-wracking,” Kaeding says. “But, we were able to observe the passion of the people working at Disney in an entertainment industry that creates magic.”

ECE New Briefs

Faculty



Prof. Massoud Amin was interviewed on CNBC on “What the Indian Power Blackout Revealed.” Prof. Amin also was a major information source during the Eastern U.S. power outages as a result of Hurricane Sandy in October 2012 and the 2013 Superbowl Power Outage. He was on NPR, Forbes, KARE11, Associate Press, *National Geographic*, *Wall Street Journal*, *Pacific Standard*, *Huffington Post*, *Government Computer News*, CNN, *Minneapolis Star Tribune*, *Intelligent Utility*, and NBC News, among others. In addition, Prof. Amin has been named one of *Government Technology’s* “Top 25 Doers, Dreamers and Drivers for 2013” as one who sets the standard for using innovative technology to solve public sector challenges and improve the performance of critical government programs.



Asst. Prof. Mo Li has been awarded the 2013 McKnight Land-Grant Professorship of the University of Minnesota. This award is designed to advance the careers of the most promising junior faculty of the university at a crucial period in their professional lives. Dr. Li’s research focuses on nanoscale photonic devices and mechanical systems for next-generation communication, computation and sensing, as well as for probing fundamental physics phenomena. Dr. Li joined the ECE department in 2010 from Yale University, where he was a postdoctoral associate. He received his Ph.D. degree from Caltech in 2007. In 2012, he received the AFOSR Young Investigator Award.



Prof. Ned Mohan, in collaboration with the University of Central Florida and the Petroleum Institute, organized an NSF-sponsored workshop in Abu Dhabi during Nov. 25-28, 2012, on the topic “Energy Education and Research: Addressing the need of Industry.” Attendees included representatives from U.S. academia and industry and from UAE, Jordan, Saudi Arabia, and Qatar. In addition, Prof. Mohan and his colleagues conducted a workshop on Electric Energy Education in Napa, Cal. Feb 7-10. It was attended by 165 university faculty, industry and various government agency representatives.



Prof. Gerald Sobelman has been named as a Distinguished Lecturer of the IEEE Circuits and Systems Society for calendar years 2013-2014.



Prof. Joseph Talghader and his research team received an Office of Naval Research/ Joint Technology Office Multidisciplinary Research Initiative (MRI) Grant for \$3.3 million for “Particulate and Contamination-Induced Breakdown in Large Area Optics.” The University of Minnesota lab is the lead organization and working with the Naval Postgraduate School, University of Notre Dame, Pennsylvania State University, Anasys, and Advanced Thin Films.



Prof. Nikos Sidiropoulos and Carnegie Mellon University Profs. Christos Faloutsos and Tom Mitchell received funding (\$866,846) to develop algorithms and associated software that can identify the core relations that exist among the different tensor modes, and scale to extremely large datasets.

Students



Ph.D. candidate Mohamed Almekkawy received an ECE travel grant to attend the BMES 2012 Annual Meeting in Atlanta to present his poster “Thermal Lesion Formation in Atheromatous Plaques Using High Intensity Focused Ultrasound (HIFU).” (Prof. Emad Ebbini, advisor)



Ph.D. student Andrew Casper won the Best Paper competition at the International Ultrasonics Symposium 2012 in Dresden. (Prof. Emad Ebbini, advisor)



Ph.D. candidate Sohini Roychowdhury received an ECE travel grant to attend the Asilomar Conference on Signals, Systems, and Computers held Nov. 4-7 in Pacific Grove, Cal. She presented her paper titled “Screening Fundus Images for Diabetic Retinopathy.” (Prof. Keshab Parhi, advisor)



Ph.D. student Eric Severson received a conference student travel award to attend the 12th Joint MMM/Intermag Conference in Chicago scheduled for January 14-18, 2013. He presented his paper titled “Experimental Results and 3D Finite Element Analysis of the AC Homopolar Motor.” (Prof. Ned Mohan, advisor)

Alumni



ECE alumnus Prof. Naresh R. Shanbhag (Ph.D. '93) was invested as the first Jack S. Kilby Professor of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign on Oct. 31, 2012.

The same day, just hours before the investiture ceremony, he learned that the proposal he led for establishing the SONIC (Systems on Nanoscale Information fabriCs) Center under the new STARnet program was selected for funding. The STARnet program is funded by DARPA and the U.S. semiconductor and supplier companies, and administered by SRC. Its goal is to maintain U.S. leadership in semiconductor technology vital to U.S. prosperity, security and intelligence. SONIC (www.sonic-center.org) will receive \$30 million over the next five years to investigate the design of robust, energy efficient, and intelligent computing platforms using emerging nanoscale devices, inspired by the information processing principles found in communication and biological systems. (Prof. Keshab Parhi, former advisor)



ECE alumnus Prof. John Pierre (M.S. '89 & Ph.D. '91) has been elevated to Fellow standing by the IEEE with the following citation: “for development of signal processing methods for estimation of power-system stability.” The total number selected in any one year cannot exceed one-tenth of one percent of the total voting membership. Dr. Pierre is a professor at the University of Wyoming. (Prof. Mos Kaveh, former advisor)

In Memoriam

Erwin Tomash (EE'43)

University of Minnesota, Department of Electrical and Computer Engineering alumnus Erwin Tomash (EE'43) passed away on Dec. 10, 2012, at the age of 91.

He served in the Army Signal Corps during World War II. After the war he worked at Engineering Research Associates (ERA), where he was responsible for the central control system of the 1103 computer designed for the Navy. He graduated in 1950 with his Master of Science from the University of Maryland.

In 1956, Tomash led Telemeter Magnetics, one of the first companies involved in the core memory industry, in the creation of affordable data storage for business. Three years later, Tomash took this company public.

In 1962, Tomash founded Dataproducts Corporation, which became the world's largest letter-quality, high-speed printer manufacturer. Dataproducts grew to be a Fortune 500 company, and created the subsidiaries Informatics and Data Card. He also established Tomash Publishers to reprint classic computer-related books, and initiated an oral history collection project to record industry pioneers' and scientists' recollections.

In 1979, he and his wife, Adelle, established The Adelle and Erwin Tomash Fellowship in the History of Information Technology. In 1979, Thomash established the Charles Babbage Institute dedicated to preserving and researching the history of computing. It was eventually housed at the University of Minnesota and became the world's most extensive collection of rare books chronicling the science, math, thinking and invention of the computer.

Roger B. Swanson (EE'53)

University of Minnesota, Department of Electrical and Computer Engineering alumnus Roger Swanson (EE'53) passed away on Dec. 25, 2012, at the age of 81.

He owned and founded a number of manufacturing business in rural Minnesota including Erskine Manufacturing (snowblowers) in Erskine, RC Industries (tractor cabs and agricultural devices) in Sherburn, Innovar Industries (snowmobiles) and Glasstite Company (fiberglass pickup toppers), both in Dunnell.

Swanson graduated from St. Paul Central High School in 1948 and from the University of Minnesota in 1953, and served three years in the Navy assigned to the destroyer USS Henley. Returning to Minnesota, he moved to his family farm in Dunnell, Minn., which became his permanent home.

Swanson, an avid sailor whose accomplishments included sailing more than 217,000 total miles in his lifetime, circled the world three times. In 1982, Swanson, his sons, and four friends sailed around the world in his 57-foot sailboat Cloud Nine. On Cloud Nine, Swanson sailed from Antarctica through the infamous 600-mile Drake Passage to South America. After two unsuccessful attempts (1994 and 2005), Swanson, in 2007, was the first American sailboat captain to cross the Northwest Passage from east to west in a single year. Among his sailing medals were The Blue Water Medal from the Cruising Club of America, The Tilman Medal from the Royal Cruising Club of England, and the Cruising World Medal from *Cruising World Magazine*.

ECE Individual Donors January-December 2012

"Thank you to all who give to ensure that our programs and labs offer the best educational experience for our students."

David J. Lilja, ECE Department Head

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Mostowfi is streamlining automation and the work process in the health service sector



(l to r) Anoosh Mostowfi (MSEE'82), Tara Nader, and Carmen

Creativity can be expressed in many ways. Anoosh Mostowfi (MSEE '82) and his wife, Tara Nader, chose to create a new business and business model: Qualium Corp. – Bay Sleep Clinics in 2002. Tara, a mechanical and industrial engineer, chose to follow her interests in medicine – sleep diagnostics; Anoosh wanted to add efficiency to patient management workflow processes through advanced technology and to improve the way people work by creating software that allowed medical professionals to collaborate over patient management across diverse locations and long distances.

Starting with one clinic, they now manage more than 18 clinics in the San Francisco Bay area that serve more than 6,500 patients per year, and employ more than 60 staff. “In 2002, when we began the sleep clinics, it was rare to set up a medical diagnostics business that was not connected to a hospital,” he says. “But my wife had been observing the market and thought it was the right time to try it. I was doing well as an engineering vice president at EBay,” says Anoosh. “So I told her she should be free to pursue her dream and start a business.” She enrolled in a four-month sleep technician training at Stanford Sleep Clinic (the hub of sleep research from the inception of this field), and set up the first clinic.”

During this time, the media increasingly covered the topics of sleep deprivation and sleep apnea; *Time Magazine* did an in depth article about sleep one month after the first clinic opened. “We could not have asked for better timing,” Anoosh says. “People began seeking answers, correct diagnoses, and ways they could control or improve their sleeping hours, energy, and wellness.”

Tara’s passion for this field and marketing savvy helped grow the business and a year later Anoosh joined in. “As an EE with signal and image processing background, it was natural for me to get interested – EEGs measure brain waves. With my background in software development, I also had a growing interest in the technical operations side of business,” he says.

“Our list of independent physicians increased and our patient satisfaction surveys reported positive outcomes,” he says. “We expanded to a wider distribution of locations. In addition, we were amassing a huge quantity of data that we wanted to be able to share with our physicians. I wrote a cloud based custom patient management application software that allowed our diverse locations and

distributed staff to collaborate effectively to provide the patient diagnostics in the shortest time possible and with the highest quality. Referring physicians are able for the first time to get the patient results on-line as soon as it is available, shortening the diagnostic cycle. Automated feedback cycle between physicians and technicians and other staff allows for continuous process and quality improvements. Although on-line access to patient data is now becoming more common in larger hospitals, we were able to offer the same efficiencies to more than 1,100 independent physicians’ offices that use our services.”

With the patient data available from remote sites, physicians, and clinicians had online access to critical information for data analysis 24/7. Diagnostics were fast, often allowing reports to patients the next morning. Anoosh wrote the software package that streamlined the business side and allowed staff to work from home and to use flexible hours to accomplish their work tasks. “I set out to build a new work style,” he says. “President Obama has launched a \$20 million incentive program to increase efficiencies in the medical care system. Our work models exemplify the successes that can be achieved in this area,” he says.

Efficiencies and flexibility of work attracted the best physicians and staff to the business. Tara and Anoosh even were approached to offer franchises, but they declined. “We didn’t want to become the McDonald’s of sleep clinics,” Anoosh says. “Our one-on-one relationships with our physicians were most important to us, so we decided that the size of our footprint was large enough. It has allowed us to learn more about the application needs for automation in the health services sector.”

Graduate school at the University of Minnesota

Anoosh reminisced about his graduate studies at the University. “I think that might be where I found the value of being a lifelong learner,” he says. “While I was in graduate school, image processing was a relatively new subject and I wanted to learn more about it. When Prof. Harry Wechsler learned of my interest just before the Christmas break, he handed me the Image Processing book by Gonzales from the bookshelf in his office and said, ‘Read it, maybe you can be my TA next semester. I read the book during the break and applied for the job on January 2. After I graduated in 1982, a recession year when jobs were scarce, I got my first job at Honeywell Systems and Research Center Image Processing lab right after school due to this and the recommendation by my professor.’”

“Graduate school built in me an extreme sense of urgency,” he says. “You have to internalize the ‘urgency to explore.’ When I began working on my thesis, Prof. Larry Kinney, my advisor, encouraged me to work with a group building a bit-slice multi-processor. They already had been working on it for four or five months. I gave myself one month to accomplish my part because I had a job waiting for me at Honeywell. I finished the memory module design and implementation, wrote my thesis about it, and completed my degree. I remember working day and night, living on coffee and donuts at the EE department lab. After one continuous three-day stretch, when I left the building, so much snow had fallen I could not find my car and I had to borrow a shovel to clear a path out of the parking lot.”

Anoosh says he wished someone had explained to him how intense graduate school would be. “One learns to work independently and

in research groups,” he says. “There is a huge amount of competitiveness. My daughter Roza, who is in graduate school now, law school, has taken to it more easily. She is off and running.”

Career Path

Anoosh’s career reflects his graduate school skills: being flexible, being a life-long learner, and working hard.

When Anoosh graduated from the University with his Master’s degree in electrical engineering, he took jobs at Honeywell and 3M. “I feel very lucky to have been exposed to a lot of firsts throughout my career,” he says. “I learned to keep my antennae out there to learn where the market is, where the demand is, and how things worked.”

Anoosh kept moving and learning. He spent time in the graphics and animation software division at Symbolics, a spin off of an MIT Media Lab Project, producing systems and software for creating the first animated movies and commercials. “I got into creating physical modeling software using Lisp because I observed the increasing demand for object based software development skills.”

Anoosh spent time at AutoDesk, Xerox and CommerceOne rising to the vice president of engineering position. By the time he was working as vice president of engineering at EBay, he had several hundred engineers reporting to him and no time to dig into software. “That’s when I realized I wanted to do more of the creative work,” he says. “When writing software, one can explore new things. Today you can develop an application for an iPhone in a few months that tens of thousands of people download and use. This type of creativity and reach is rarely possible in other fields.”

“I ended up in the business area of the clinics because it was logical for me at the time to be there. I leveraged what I was interested in. A lot of people told me to raise millions of dollars in venture capital and then hire many more people to make our new business run efficiently. Instead, I spent the time building my own skill set to meet the business’s demands.”

“Writing software is an art and creative process – just like painting or writing a novel,” he says. “Lots of people enjoy what you have done and use it. I want as my legacy to build software that helps make people efficient at their work so there is more time for the rest of their lives. I want to build products that extend and enable their chosen lifestyles.”

Advice to ECE students

“One needs to be flexible because technology moves so fast,” Anoosh says. “Define yourself around an area not the other way around and be ready to change and to reinvent yourself every few years.

“Keep your antennae out for interesting things to explore. Be very picky about how you spend your time. I’ve been known to fire myself from projects. You have to discern between hobbies and working to make a living.

“A lot of smart people are out there who think just by applying their intelligence they will be successful. It also takes hard work to be successful. Brilliant shortcuts don’t always work and at best, odds for success are low. Today it seems many want the short cut to wealth and they forget the pleasure of work and creativity.”

Continued from page 5

Envision Fund Projects accepted this semester

Raspberry Pi Graphing Calculator - Scott Sievert, EE, sophomore

“The Raspberry Pi is a small credit-card-sized computer that includes HDMI ports, audio ports, and USB ports. From this, I plan to make a graphing calculator, with a small 3.5” display and a small USB keyboard. My calculator will run Sage (Sagemath.org.), a free and open source alternative to Matlab and Mathematica. The feature to graph also is included in this project.”

Runner’s GPS - Dan Taylor, CE, junior

“I’d like to build a GPS system for runners, doing things like displaying current time, speed, distance traveled, location on map, etc. Data and maps would be saved to/loaded from an SD card, and displayed on a small LCD.”

Obstacle Detection and Avoidance - Bryan Stadick, EE (junior); David Haugen, CompE (senior); Email Alwis, EE (junior); Max Veit, Phys and CSci (junior); Nick Hammes, CSci (sophomore); Ryan Kotval, CSci (sophomore)

“We are working on a system that will detect objects using vision processing then determine the distance to the object. The output will be a two dimensional matrix of objects, their size, and their location relative to the sensors. The map will contain a 360-degree view. The ultimate goal is to make this a low-cost solution that is adaptable to multiple situations.”

USLI Rocket Team - Kenneth Condon, EE (junior); Mark Abotos-saway, AE, (senior); Amir Ener, AE (senior); Devin Volmer, AE (senior); Gregory Zeien, ME (freshman); Hannah Weiher, AE (junior); Binh Bui, AE (senior); Kendall Schneider, AE (senior); Matthew Donohue, AE (junior); Monique Hladun, AE (graduate student); Nathan Kluegel, AE (senior); Vishnuu Mallik, AE (junior); Samuel Coley, AE (junior); Tim Chau, AE (junior)

“Our team is made up of 15 engineering students who are working on building a competitive rocket for the USLI competition in April 2013. The competition is a national contest to design, to build, and to launch a high-powered rocket with an on board engineering payload. Our rocket will travel to one mile in altitude, safely return all of its components, and release the rover payload.”

Multicopter Build - Mark Gilbertson, ME (junior); Kevin Zoch, ME (sophomore); Connor Lewis, ME (sophomore); Jordan Gustafson, EE (sophomore); Michael D’Agostino, EE (sophomore)

“Our project would be a multi-rotor copter. The number of rotors would depend on the funding, a hexcopter being the preferred. “

Virtual Cycling - Kyle Bergemann, CompE (junior); Jialun Jiang, CompE (freshman - Honors Program)

“A bike trainer is used to mount your road bike on during the winter months, and enable you to train indoors. This has one large drawback, however, it gets very boring. I would like to design an integrated system that uses a video from actual outside riding, and takes into account the speed of your bike to adjust the playback speed of the video. This will integrate with the ANT+ standard that Garmin uses for their speedometer bike options. With this integration, the rider will have a realistic experience, seeing that his speed actually corresponds to something.”

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Time: 2:00 - 4:30 p.m.

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