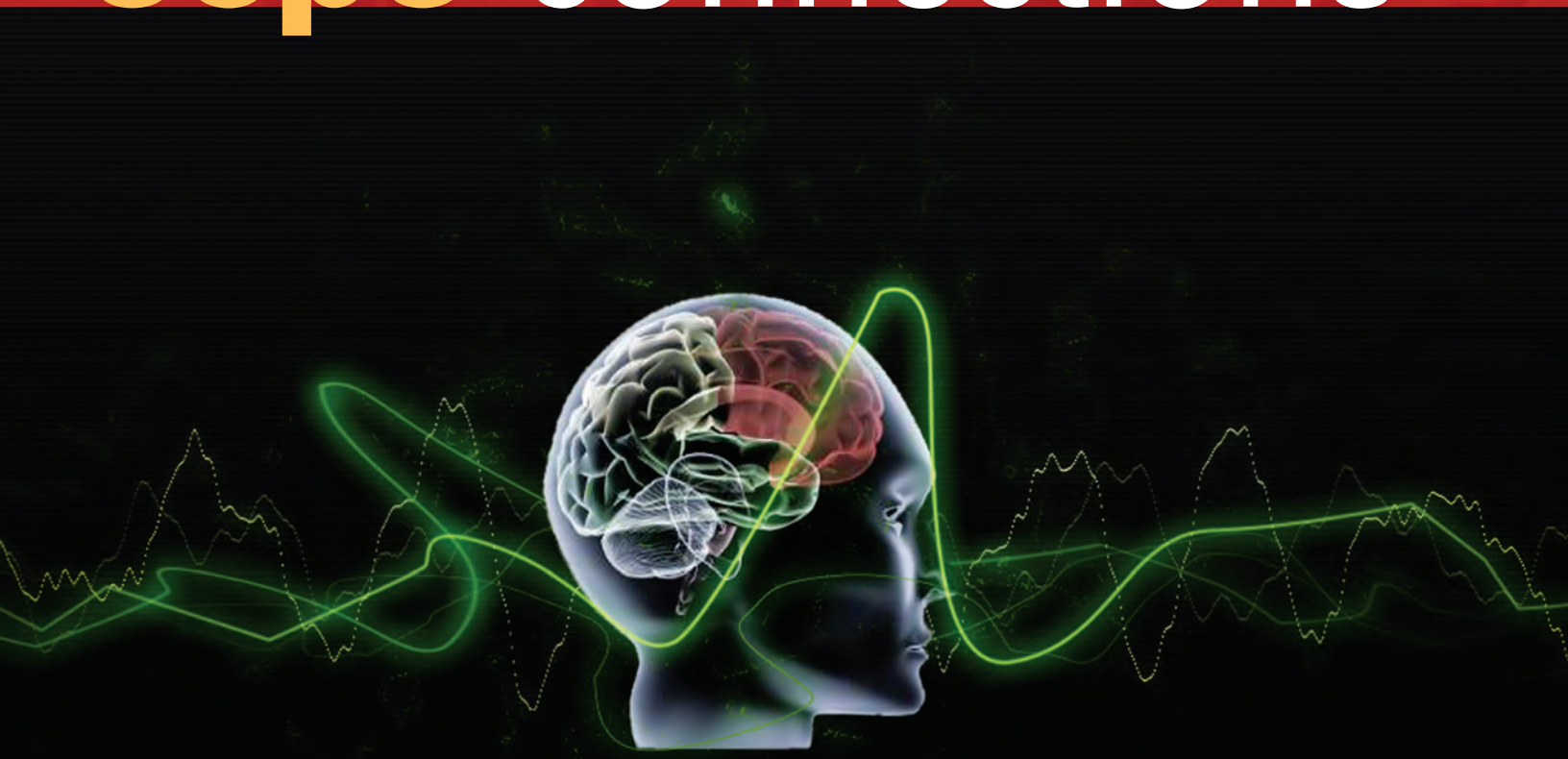
IOWA STATE UNIVERSITY
Department of Electrical and Computer Engineering

alumni newsletter
spring 2012
volume 28
issue 2

ecpe connections



iowa state, steptoe group
treating brain disorders

more inside ...

- **sculpting** more powerful electric motors
- **detecting malware** on android phones
- **digital women** on the rise

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letter from the chair

As we wind down another academic year at ECpE, I look back at this past semester with satisfaction. We have accomplished much in these months, from creating tools that help us build better electric motors (page 11), to research on Transcranial Magnetic Stimulation (Page 6).

Our success in research is matched by our success in the classroom. We are educating a new generation of engineers; one that is more connected,than any before. We have committed ourselves to meeting the needs of this new generation in the classroom and identifying new challenges that arise every day (page 13).

Our department continues to grow, both in size and in stature. The College of Engineering is the fastest-growing college on campus and ECpE is one of the largest departments in the college. Are total student numbers are nearly 1,600. This unprecedented growth affords us a wealth of opportunities and serves as motivation for our faculty and staff.

Additionally, I am pleased to report that several of our faculty and alumni have been honored recently for their research and other career achievements. Three of our faculty, **Chris Chu**, **Ahmed Kamal** and **Vikram Dalal**, became fellows of their professional associations (pages 3 and 4) and **Aditya Ramamoorthy** was awarded a National Science Foundation (NSF) CAREER Award. **Suraj Kothari** was awarded a large DARPA grant to develop malware detection systems on Android phones and **Srikanta Tirthapura** will travel to the Principles of Database Systems (PODS) conference this May with three papers topresent, more than any other researcher at the conference.

Our alums continue to make us proud long after they leave campus. **Richard Stanley**, who has been a vital supporter of ISU for many years, will receive the Distinguished Alumni Award this April (page 14), while the U.S. Department of Energy has appointed **Anjan Bose** as a senior advisor in charge of coordinating research on electric power grid technologies (page 15).

I take great pleasure in the merits of this department. The success of our research, our students, faculty and staff, and our alumni speaks for itself. We are proud of our accomplishments in the Department of Electrical and Computer Engineering and continually seek to have a positive impact on the lives of others.

Best regards,

David Jiles

David C. Jiles
Palmer Department Chair in Electrical and Computer Engineering
Anson Marston Distinguished Professor

on the cover...

Iowa State researchers are improving the process of Transcranial Magnetic Stimulation to treat brain disorders (Page 6).

in this issue

about this issue

Spring 2012 • Volume 28 • Issue 2

Department Chair: David C. Jiles
Newsletter Editor: Brock Ascher

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To give a gift to the ECpE department, visit *www.foundation.iastate.edu* or call the ISU Foundation at 515 294-4883.

two ecpe faculty
elected ieee fellows

Based on their excellent contributions to electrical and computer engineering research, two Iowa State Electrical and Computer Engineering (ECpE) professors have been named 2012 Fellows of the Institute of Electrical and Electronics Engineers (IEEE).

Chris Chu, associate professor, and **Ahmed Kamal**, professor, officially joined the ranks of IEEE Fellows in January 2012.

The IEEE Fellow Program, established in 1912, recognizes members who have remarkable accomplishments throughout their careers. Each year the total number of Fellows selected does not exceed one-tenth of one percent of the total membership.

chu's innovative algorithms

Chu was selected for his "contributions to physical design of integrated circuits." He has developed two notable algorithms, along with other contributions in the physical design field, that have led to design circuits with better performance, lower costs, and lower energy consumption.

One of his research areas includes very-large scale integration (VLSI) placement, which involves determining the locations of millions of modules in an integrated circuit. Through years of research, Chu created the algorithm "FastPlace" that has significantly reduced the time it takes for a computer to place modules on an integrated circuit. In fact, the time reduction FastPlace offered was so astonishing, the technical program committee for the Association for Computing Machinery (ACM) International Symposium on Physical Design in 2004 almost rejected his paper submission thinking that such remarkable improvements were impossible.

After using Chu's program to verify the information, the paper was accepted and received the best paper award at the conference. His algorithm is being used today for placement of many modern integrated circuits and has even been implemented by companies such as IBM and Xilinx.

Chu also has conducted various research projects on routing to find the best paths for connecting modules. "FLUTE" is an algorithm Chu devised for rectilinear Steiner minimal tree (RSMT) construction, a process in VLSI design that can be used to estimate wire load, routing congestion, interconnect delay, and the routing topology of each net.

Chu's algorithm for RSMT construction provides a more efficient way of routing between circuit modules on an integrated circuit. His method is based on pre-computing and storing RSMT solutions in a lookup table. The striking improvement FLUTE has provided in terms of solution quality and run time over other RSMT algorithms has led ten companies, including Intel, IBM, and Magma, to adopt or show significant interest in adopting FLUTE as a part of their design tools.

In addition to research in VLSI, Chu also teaches courses on VLSI design and algorithms in computer engineering at Iowa State.

more online

For more information on the three fellow awardees and their career achievements, visit *www.ece.iastate.edu/news/honors-and-awards*.

Chu also has been on a number of technical program committees for various IEEE conferences, including the IEEE/ACM Design Automation Conference in 2010, and as the chair of routing and detailed physical design area for the IEEE/ACM International Conference on Computer-Aided Design in 2010.

He has received several awards and honors for his research and papers. In 2008, he received the Young Engineering Faculty Research Award from Iowa State. In that same year, he received an IBM Faculty Award, which he was selected to receive again in 2009 and 2010.

In addition to his best paper award for his publication about FastPlace, Chu has received two other best paper awards for, "A Quadratic Programming Approach to Simultaneous Buffer Insertion/Sizing and Wire Sizing," in 1999, and "FLUTE: Fast Lookup Table Based Rectilinear Steiner Minimal Tree Algorithm for VLSI Design," in 2010.

kamal's networking advancements

Kamal was selected as a 2012 IEEE Fellow for "contributions to optical networks provisioning for multipoint traffic."

"My research in optical networks concentrates on network planning, and operation, in order to accommodate the maximum number of connections between communicating parties, while guaranteeing connection requirements such as bandwidth," explained Kamal. He has spent the last 15 years focused on provisioning multi-point connections, such as TV broadcasting and e-Science applications, in optical networks so that the cost of provisioning these connections is minimal, users are satisfied with the quality of service, and the network can operate in a non-stop fashion, even in the presence of equipment failures. Kamal has received a U.S. patent for some of his methods.

He also has studied wireless sensor networks. More recently, he has started to examine cognitive radio networks, dealing primarily with competition for wireless bandwidth, for example, in Wi-Fi connections. Bandwidth can often be difficult to obtain from the original source in cognitive radio networks, but unused licensed bandwidth from places such as idle TV channels or idle wireless microphones may be able to be allocated to different devices.

continued on page 4 ▸

dalal elected

aaas fellow

Vikram Dalal, Thomas M. Whitney Professor in Electrical Engineering, is part of this year's class of 539 new American Association for the Advancement of Science (AAAS) Fellows.

Dalal, who also is director of Iowa State's Microelectronics Research Center and an associate of the Ames Laboratory, was recognized "for distinguished contributions to research in solar energy conversion materials and devices and for invention of industrially important photovoltaic devices."

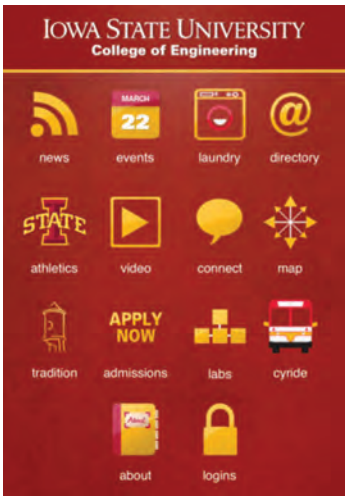
Dalal was presented a certificate and gold and blue (representing science and engineering) rosette pins on February 18 at the annual meeting of the AAAS in Vancouver, British Columbia, Canada. •

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

college of engineering mobile app

now available

The Iowa State College of Engineering mobile app is now available for the iOS platform and is coming soon for Android. The college is continuing its focus on two-way digital communication with students, alums, and others close to the college by developing OS-native mobile applications.



The app includes news and events, the entire ISU directory, and a tradition tab that includes the full history of the college. In addition, the app tells users how many computers are available in CoE computer labs, lets students know track their laundry's progress in department of residence laundry rooms and is the only officially sanctioned CyRide app available. Get the app by following the above QR code to the college's apps site. •

continued from page 3

"I am currently trying to come up with algorithms and techniques to make efficient use of all the available bandwidth," Kamal explained. "The first step is determining when and how to detect available bandwidth, and then to develop efficient ways to share that bandwidth." His research in cognitive radio networks also concentrates on multi-point connections.

Kamal founded the Laboratory for Advanced Networks (LAN) at Iowa State in order to further his research in both optical and wireless networks.

Outside of research, Kamal teaches several computer networking and digital logic design courses, both at the undergraduate and graduate levels, and dedicates his time to PhD students. Additionally, he makes it a priority to volunteer for IEEE. His involvement with the organization began early in the 1980s as a graduate student assisting with paper reviews for journals and upcoming conferences. From there, he got involved in organizing IEEE conferences and has served as a conference chair for a number of conferences, as well as serving as an editor for IEEE and other leading journals in electrical and computer engineering.

Kamal currently is a program evaluator for the Accreditation Board for Engineering and Technology, Inc. (ABET), which accredits college degree programs in engineering, computing, technology, and applied sciences. Kamal hopes to continue volunteering for programs like this within IEEE to give back to an organization he has been a part of for almost 30 years.

The dedication these Iowa State professors have shown to advancing their fields led to their selection as 2012 IEEE Fellows, and both Chu and Kamal are equally honored for being chosen for such an outstanding recognition. • *by Kelsey Schirm*

calendar of

events

APRIL 5
Department Seminar: Jonathan Cohen
3043 ECpE Addition, 1:10 p.m.

APRIL 6
Distinguished Lecture: Kunle Olukotun
3043 ECpE Addition, 1:10 p.m.

APRIL 12
ECpE External Advisory Board Spring Meeting & Graduate Poster Session
3043 ECpE Addition

APRIL 13
Department Seminar: Akbar Sayeed
3043 ECpE Addition, 1:10 p.m.

APRIL 16-22
VEISHEA
Event times and locations vary; *www.veishea.iastate.edu*

APRIL 18
ECpE Scholarship, Honors, and Awards Banquet
Scheman Building, 5:30 p.m.

APRIL 19
Department Seminar: Robi Polikar
3043 ECpE Addition, 1:10 p.m.

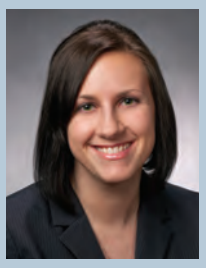
APRIL 20
Department Seminar: Ari Arapostathis
3043 ECpE Addition, 10 a.m.

MAY 4
Master's and PhD Commencement Ceremony
Hilton Coliseum, 8 p.m.

MAY 5
Undergraduate Commencement Ceremony
Hilton Coliseum, 3:00 p.m.

MAY 18
Department Seminar: George C. Hadjipanayis
3043 ECpE Addition, 1:10 p.m.

new
faculty and staff



Laurel Kelch was hired in October 2011 as the Fiscal Officer for ECpE. She develops and manages the budgets for the department, including state, federal, contract, grant and Foundation funds. Kelch holds a B.S. in Business Management from Iowa State University and has gained an extensive background in University operations throughout her career. She has worked at Ames Laboratory, the ISU Purchasing Department, and the former Center for Transportation Research and Education (now the Institute for Transportation). She has experience in fiscal management, research coordination, and financial auditing.

Brock Ascher was hired in January 2012 as the Communications Specialist for ECpE. He directs the department's communications efforts, serves as webmaster of the ECpE website, and is Editor of both *Connections* and the forthcoming *Research Highlights*. He holds a B.A. in Communications from the University of Northern Iowa. Prior to joining ECpE, Ascher was Assistant Director for Athletic Communications at Drake University from 2009-12 and served as the Seasonal Assistant for the Kansas City Chiefs public relations department during the 2008 NFL season. •

jiles named
honorary fellow

David C. Jiles, distinguished professor and Palmer Department Chair of Electrical and Computer Engineering, traveled to Chennai, India, to receive recognition as the 2011 Honorary Fellow of the Indian Society for Non-Destructive Testing (ISNT).

Jiles was elected for his work on magnetic methods for non-destructive evaluation (NDE). Over the last ten years, he has collaborated on research projects with NDE professionals in India including Dr. Amitava Mitra of the National Metallurgical Laboratory in Jamshedpur; Dr. Anil Prabhakar, professor at the Indian Institute of Technology in Chennai; and Dr. T. Jayakumar of the Indira Gandhi Center for Atomic Research (IGCAR) at Kalpakkam.

Led by Baldev Raj, former director of IGCAR and Advisor to the Prime Minister of India, ISNT is an international organization geared toward coordinating and informing professionals in NDE. As this year's elected Honorary Fellow, Jiles will be attending regular ISNT meetings to collaborate with NDE experts in India.

"It was a great pleasure to go to Chennai to receive this recognition from ISNT," Jiles said. "It was also a rather humbling experience," he added when referring to taking his place as the next in a long line of distinguished ISNT honorary fellows. •

by Kristene Dontje

faculty and staff
recognitions

Congratulations to the following faculty and staff on their recent professional awards and honors:

- **Vikram Dalal**, Whitney Professor in Electrical Engineering and director of the Microelectronics Research Center, was elected as an AAAS Fellow (Page 4).
- **Chris Chu**, associate professor, and **Ahmed Kamal**, professor, were named IEEE Fellows (Page 3)
- **David C. Jiles**, Palmer Department Chair and Anson Marston Distinguished Professor, was elected as an Honorary Fellow of the Indian Society for Non-Destructive Testing.
- **Degang Chen**, professor, was awarded a second place outstanding paper award during the 2011 EIT conference.
- **Liang Dong**, Harpole-Pentair Assistant Professor, received the McGee Wagner Interdisciplinary Research Fund Award.
- **Doug Jacobson,** university professor, was a recipient of Information Security Magazine's Security 7 Award, awarded to the top seven individuals in the cyber security field.
- **Julie Rursch**, postdoctoral research associate, received the IEEE Education Society Best *Transactions on Education* Paper Award. •

more online

For more details on faculty and staff recognitions, visit *www.ece.iastate.edu/news/honors-and-awards.*

iowa state, steptoe group

partner to treat brain disorders

Last fall, Iowa State University Palmer Department Chair in Electrical and Computer Engineering and Anson Marston Distinguished Professor **David C. Jiles** announced a groundbreaking research and development partnership between Iowa State University and the Steptoe Group, LLC. The partnership focuses on bioengineering of new diagnostic and treatment interventions in several brain disorders. The joint R&D efforts will initially target Deep Brain Transcranial Magnetic Stimulation (TMS) and Transcranial Ultrasound Stimulation in Traumatic Brain Injury, Post Traumatic Stress Disorder (PTSD), and Depression.

As of 2008, more than two million soldiers had served in Iraq and Afghanistan. Of those two million soldiers, more than 320,000 have some degree of Traumatic Brain Injury and over 300,000 have PTSD.

"Traumatic brain injury can occur when improvised explosive devices (IEDs), or roadside bombs, go off. The IEDs radiate shock waves that can travel through the brain, causing skull movement and the loss of brain function," Steptoe says. "Traumatic brain injury can speed up the development of disorders, such as PTSD, depression, Parkinson's Disease, vascular dementia, stroke, and more."

The Steptoe Group, LLC, based in Ellicott City, Maryland, was founded in 2008 as a Service Disabled Veteran Owned Business whose objective is to create sustainable partnerships with government agencies and private organizations in order to improve access and delivery of quality health, science, and education services to military veteran and servicemen families.

what is transcranial magnetic stimulation?

Transcranial Magnetic Stimulation (TMS) employs a rapidly changing magnetic field designed to induce electric currents in the brain using electromagnetic induction. The currents trigger activity in targeted areas of the brain, allowing researchers to study the functions of the brain's different regions. Over time, and with repeated treatments, TMS could be used to treat a number of different brain conditions.

According to **Ron Steptoe**, CEO of the Steptoe Group, their research focuses on individualized patient care. "Our major issue is that what works for some people doesn't work for everyone. We are looking to find new ways, and developing a training program, to look at patients based on characteristics such as their age, gender, ethnicity, work, environment and more."

Currently, the company is working to increase awareness of the growing and detrimental impact mental health and behavioral mental health conditions are having on the military and veteran communities, as well as deliver unique technologies to improve injury recuperation.

"What we're doing is developing transcranial magnetic stimulation (TMS) for deep brain stimulation—a non-invasive, non-surgical method for examining and treating the brain with minimal associated risk," Jiles explains. "It is very promising because it enables you to treat someone's brain without doing any surgery. It is not going to solve every problem that is out there, but our objective is to find out what it works for and to improve technology to treat brain disorders."

We are looking to find new ways, and developing a training program, to look at patients based on characteristics such as their age, gender, ethnicity, work, environment and more

Jiles' research on TMS began about three years ago at Cardiff University. "I was interested in finding out how magnetics could be used in the biomedical field, and an opportunity came up when Magstim, a company that provides instrumentation, got a TMS device and needed some help to improve it," Jiles says. "The device was relatively new and wasn't doing quite what they wanted, so Magstim came to me and set up a research program to look at things like coil development, my area of expertise."

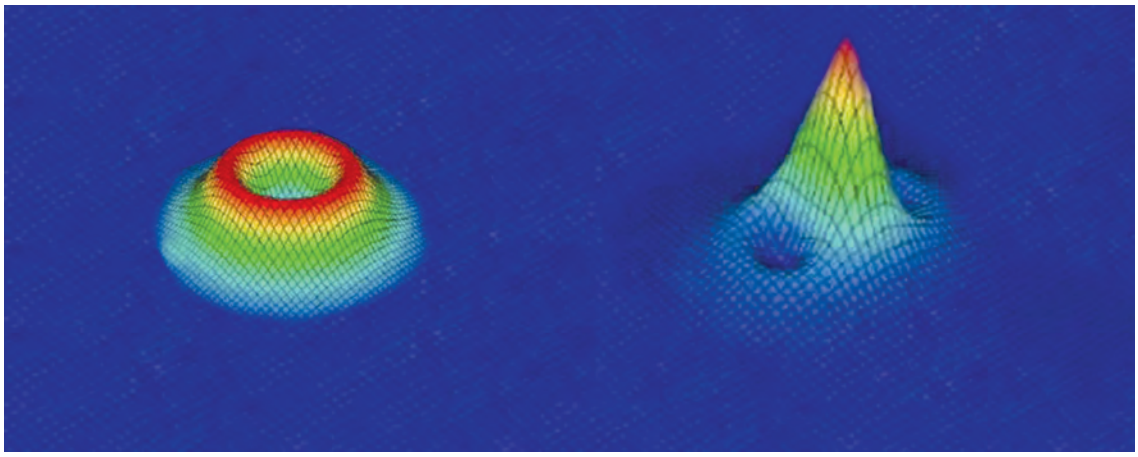
According to Jiles, the coils, which are put on the patient's head to stimulate the outer part of the brain, were working, but overstimulated the surface when they tried to get deep brain stimulation. This was not only painful, but caused more effects on the outer part of the brain than they wanted and did little to stimulate the inside.

After two years, Jiles and team members **Lawrence Crowther**, graduate student in electrical engineering; **Ravi Hadimani**, postdoctoral research associate; and **Paul Williams** of Cardiff University, came up with a coil design and published their findings. While they found that the field penetrated very differently than they initially expected, they were able to rework their coil designs to reach inside the brain, increasing the field strength by a factor of four at 70 mm.

When the coils were tested on a number of patients suffering from several different brain disorders, the results showed some interesting effects. "By stimulating the brain, you can cause invol-

untary movement in the limbs, which is beneficial for stroke rehabilitation," Jiles explains. "When paralysis occurs, muscle tone deteriorates. You can stimulate muscles using TMS to recover some of the muscle toning."

In an ischemic stroke, the blood supply to the brain is cut off. If the individual survives, the blood supply is restored but the victim will suffer from brain damage. "TMS can be used to treat this because it 'bathes' the entire brain in a magnetic field, which stimulates the entire brain and not just the outer region," Jiles says.

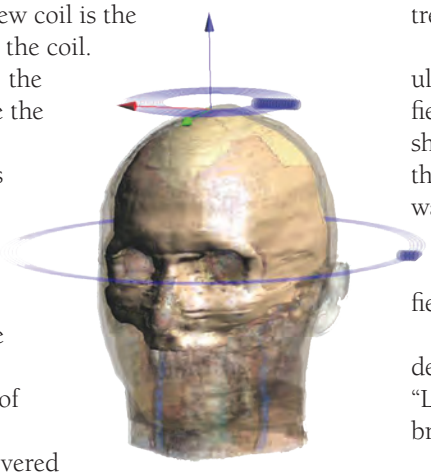


The induced electric field profiles of single and double coils differ widely because of their geometry. The induced electric field of a circular coil (left) is zero directly under its centre and reaches maximum approximately under the mean diameter. In the case of double coils (right) it is at a maximum directly under the middle of the two coils and has two smaller peaks on either side near the outer part of the conductor.

Preliminary results also suggest that TMS could be used as an alternative or even a possible replacement for electroconvulsive therapy (ECT), a method for treating severe depression. Tests done in hospitals showed that TMS worked just as well as ECT, but seemed to cause fewer side effects, which can include confusion and memory loss.

In addition, they found that stimulating certain parts of the brain can cause interruptions in individuals' speech, while stimulation of other regions significantly improves individuals' ability to perform simple mathematics on a temporary basis.

More recently, Jiles and his team have developed a new coil that has not yet been tested—the larger "Halo coil". "The difference between the old and new coil is the distance between the field and the coil. When you stimulate the brain, the most stimulation occurs where the field is largest," Jiles says. "On the old coil, the field decreases quickly as it goes into the brain, but the configuration of the new coil enables the magnetic field to penetrate even deeper into the brain. We were able to increase the field strength at 70 mm by a factor of four."



A standard coil (top) augmented with the larger "Halo Coil."

While the group has uncovered several useful findings and continues to make new discoveries, Jiles says that the interaction between the field and the brain is only crudely understood. "A lot of interesting things go on there that are not fully understood. The stimulation causes a voltage in the brain that causes polarization. Some of the neurons go right from the brain, and the voltage goes down the neuron," Jiles explains. "It is also interesting that the head provides almost no hindrance to the passage of the field, which is very different from almost any other kind of technology."

Other Iowa State faculty members working on the project include **Anumantha Kanthasamy**, a distinguished professor of biomedical sciences and the W. Eugene and Linda R. Lloyd Endowed Chair in Neurotoxicology at the Iowa State University College of Veterinary Medicine, and **Timothy Bigelow**, assistant professor in electrical and computer engineering.

Kanthasamy, an expert on animal diseases—specifically Parkinson's Disease and other neurodegenerative disorders — will aid in the research by testing the efficacy of the non-invasive magnetic field in an animal model of Parkinson's Disease, while Bigelow will investigate transcranial ultrasound stimulation in the treatment of traumatic brain injury.

"We will determine the ultrasound thresholds for brain stimulation both with and without an accompanying electromagnetic field," Bigelow says. "While considerable work has been done showing that it is possible to stimulate neurons with ultrasound, the thresholds have not been explored when a magnetic field was also applied. Therefore, we will systematically explore the ultrasound parameters necessary for brain stimulation in both in vitro and in vivo models both with and without a magnetic field."

Jiles adds that the potential benefits of the research and development partnership with the Steptoe Group are enormous. "Let's find out what we can do non-invasively, optimize that, and bring it to its best capabilities," Jiles says.

While the partnership is still in its early stages, the team members are already hard at work pursuing additional funding sources, including the U.S. Department of Defense, National Institutes of Health (NIH), National Science Foundation (NSF), and Roy J. Carver Charitable Trust, among others. •

by Kenzie Brennan

more online

For more news on transcranial magnetic stimulation, visit *www.ece.iastate.edu/news*

kothari to develop malware detection for
android phones

Suraj Kothari, professor, is leading a research project that will increase the security of Android phones. Funded by a $4.1 million, 3.5-year grant from the Defense Advanced Research Projects Agency (DARPA), the project's objective is to develop a tool to detect malware placed unknowingly within applications on the mobile devices.

According to Kothari, malware apps silently leak sensitive information without revealing themselves. Mobile malware presents several sophistications that need special attention. "We are looking at malicious software that leaves a scattered footprint and that exhibits behaviors that blend with legitimate functionalities of a given application," he said.

The tool Kothari and his team are designing also includes a framework that gathers important information about an app as it scans code for malware. This data is presented in a digestible form that can be analyzed by a human, allowing for more accurate assessments about an app's intentions than systems currently in place.

"Detecting malware on mobile devices using a completely automated process hasn't been successful in producing consistent, valuable results," said Kothari. "We needed a solution that included human interaction, but we also needed to ensure the person analyzing the results could do so without having to parse enormous amounts of information."

Kothari has partnered with **Xuxian Jiang**, assistant professor of computer science at North Carolina State University, and Jeremias Sauceda, chief technology officer at EnSoft Corp., on the project.

The team is currently designing, programming, and testing the tool, and is also creating a "cookbook" of properties the tool will use to identify malware-like code. Once implemented, the tool will be flexible enough to be refined and extended to address future malware attacks. •

Contributed by Engineering College Relations

ecpe faculty
career award

Assistant Professor **Aditya Ramamoorthy** was awarded a National Science Foundation (NSF) CAREER Award for his project, "Joint Topographic Imaging and Characterization Using Atomic Force Microscopy (AFM) – A Systems Approach."

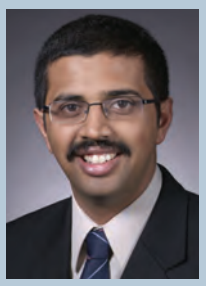
AFM uses a thin cantilever to examine materials at high resolutions. As the cantilever interacts with the medium, it deflects based on atomic-level forces. AFM operates in several different modes, depending on the material being investigated. With soft or fragile materals, observers use what is called tapping mode.

This mode involves oscilating the cantilever at a certain frequency and observing the effects of oscillation without damaging the medium. Ramamoorthy's research involves the use of signal processing algorithms to characterize and image soft materials in a fraction of the time taken when conventional methods are used.

The NSF CAREER Award is a five-year, $400,000 grant awarded to faculty members on tenure track at universities nationwide.

"It will certainly help facilitate my research," Ramamoorthy said. "I can go through things much faster now."

tirthapura heading to
pods 2012



The annual Association for Computing Machinery (ACM) SIGMOD/PODS conference, held May 20-24 in Scottsdale, Ariz., will feature three papers by Srikanta Tirthapura, associate professor. Tirthapura's three entries represent the most of any researcher invited to this year's conference.

Tirthapura's papers propose new methods for processing queries over subsampled data streams, find the optimal clustering number for space-filling curves in data structures, and give new algorithms for organizing databases of rectangle streams to answer standard queries.

Of special note, his paper, "On Optimality of Clustering Through a Space Filling Curve," proved that the Hilbert curve was optimal for the class of queries of a constant size.

The ACM's Special Interest Group on Management of Data (SIGMOD) holds its symposium on Principles of Database Systems (PODS) every year. The SIGMOD/PODS conference is a leading international forum for database researchers, practitioners, developers and users to explore cutting-edge ideas and results and to exchange techniques, tools and experiences.

Tirthapura's three accepted submissions give him four PODS-accepted papers to his credit. His previous work, "Time-Decaying Aggregates in Out-of-order Streams," was accepted to PODS in 2008.

keep in touch!

We want to hear about your career moves and personal news for future issues of *ECpE Connections*! Please fill out the form below or online at *www.ece.iastate.edu/alumni* (click Alumni News Form) to share your news.

Name: _____ Graduation year(s) and degree(s): _____

Address: _____ City: _____

State: _____ Zip code: _____

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Home phone: _____ Business phone: _____

News I'd like to share: _____

support the department

The ECpE department relies heavily on the support of our alumni and friends to ensure that students have access to scholarships and the latest lab facilities and classroom spaces, that faculty can continue to support graduate students and conduct state-of-the-art research, that department facilities remain updated for staff to do their jobs efficiently, and that student organizations and department events can continue to thrive.

If you would like to help the department continue to be one of the best in the country, you can support the department through several funds. Additional opportunities are available to support endowments and building space. Please check the appropriate box below if you want to offer your support today, or visit *www.foundation.iastate.edu*. For more information about the funds, contact the ISU Foundation's Adam Laug at 515 294-4883 or alaug@iastate.edu.

I'd like to support the:

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Thank You!

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Mailing Instructions: Detach this form along the perforated edge. Fold the form in thirds so that the ECpE address shows on the outside. Tape the form closed and place your stamp in the labeled box. If you're mailing a check, remember to completely seal the edges of the form or send the form along with your check in a standard envelope.

ecpe postdoctoral research associates'

research in brief

Seven postdoctoral research associates work in the ECpE department and contribute to the department's research efforts. Below are highlights of three postdocs and their recent research. For research highlights from ECpE's other postdoctoral research associates, see the Fall 2011 issue of *ECpE Connections*.

Siddhartha Khaitan is developing new algorithms on serial and parallel platforms for enabling very fast and online time domain simulations for power systems. These algorithms are intended to boost computational speed to allow dynamic simulations of the power grid for operational purposes; a task very few of the world's control centers are able to perform. Dynamic simulations are a powerful tool for system operators and would be useful in preventing large-scale blackouts. Khaitan also is involved with research projects dealing with integration of renewable (solar, wind, etc.) energy into the power grid.

Additionally, Khaitan is the developer of the only public-domain cross-platform power system simulator capable of large-system steady state and dynamic simulations. His software outperforms commercial software and will soon be extended to include long-term dynamic simulations with the development of modules for economic dispatch, optimal power flow and automatic generation control.

His research is funded by a grant from the United States Department of Energy. **James McCalley**, Harpole Professor in Electrical and Computer Engineering, is his advisor.

Ravi Hadimani is one of the researchers working on transcranial magnetic stimulation (TMS). Hadimani is aiding in the development of a new coil that can generate a magnetic field which can penetrate deeper into the brain. With the new coil design, the team can stimulate any part of the brain, not just the outer region, and use TMS for treating a host of different brain diseases non-invasively. The team is researching the effect of magnetic fields on nematodes as a first step toward testing on complex organisms.

Additionally, Hadimani is investigating new rare-earth magnetoelastic and magnetocaloric materials. These materials show unique effects in the presence of magnetic fields and can be used as high efficiency refrigerators or sensors and actuator materials.

David C. Jiles, Palmer Department Chair and Anson Marston Distinguished Professor, is Hadimani's advisor.

Lucien Ouedraogo is developing methods for the performance analysis of communication protocols used for networked embedded control applications in automotive and aerospace systems. His research will be useful for synthesizing communication for fault-tolerant and time-critical systems.

In a distributed real-time application, it is important to ensure that messages exchanged on the communication bus meet deadlines. For such systems, the challenge is to find an optimal system configuration with respect to bandwidth and latency so that the real-time requirements and performance criteria are achieved without message loss due to buffer overload. Ouedraogo's work addresses this need through the development of formal analysis techniques capable of determining the worst-case behavior applications under a given scheduling policy.

Ratnesh Kumar, professor, is Ouedraogo's advisor. •

aliprantis wants to "sculpt"

more powerful electric motors

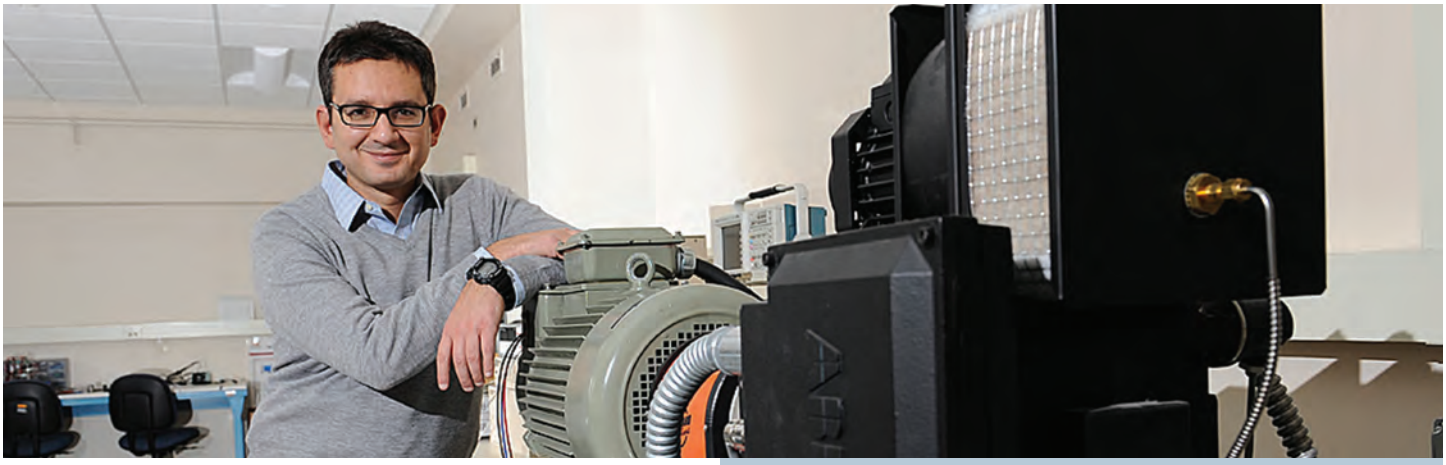

Photo by Bob Elbert

Dionysios Aliprantis took up an imaginary hammer and chisel and pounded away at the air.

"Think of the ancient Greeks and their sculptures," said the Iowa State University assistant professor of electrical and computer engineering.

Now apply the idea of a sculptor precisely chipping away at stone to the electric motors that run our machines and generate our electricity. Aliprantis is working to develop computer modeling technology that will show engineers how to chip away at the surfaces of electric motors to create new designs and shapes that can increase power generation.

"The goal is to get more power out of the same size motor," he said. "Or, that could mean getting the same power with a smaller motor."

Aliprantis is quick to say he's not looking for a huge improvement in a motor's performance.

"I'm looking for a little bit of increase, maybe 5 percent or 1 percent," he said. "But multiply that number by the number of hybrid cars, let's say, and you could get savings in the billions of dollars. The potential here could be huge."

Aliprantis' project is supported by a five-year, $400,000 grant from the National Science Foundation's Faculty Early Career Development Program. The grants support junior faculty identified as teacher-scholars through outstanding research, excellent education, and the integration of education and research.

Assisting with the motor design project is Yanni Li, a doctoral student in electrical and computer engineering.

Aliprantis and Li want to take advantage of the fact that most electric motors and generators operate in just one direction - in most applications there's no real need for them to go into reverse. The motors, however, have long been designed to offer equal performance no matter which way they're rotating.

And so the engineers are exploring how electric motors can be improved by optimizing performance in a preferred direction of rotation. To do that, they've written a computer modeling program that incrementally changes the design of the motors - just like a sculptor chipping away - and calculates when the surface shape is just right.

The teeth that hold coils of wire within an electric motor, for example, have typically been built with a symmetrical shape that maintains performance in either direction. By making the teeth asymmetrical, the engineers hope the motor can pick up some power when rotating in the preferred direction.

"We are trying to develop a systematic way of getting to the right shape," Aliprantis said. "This idea is very simple, but motors are still being designed using techniques that are essentially one hundred years old."

Because electric motors are all around us – in vehicles, wind turbines, power plants and all kinds of machinery – Aliprantis said finding new ways to improve their performance can make a real difference in the development of sustainable energy resources. •

Contributed by Engineering College Relations

aliprantis is keeping busy...

- Another of his projects is improving the models used to predict the dynamic performance of electric motors as engineers experiment with different power electronics and control technologies. The idea is to develop more sophisticated control systems that capture more of a motor's performance characteristics. The project is supported by the ECpE department and includes **Yuanzhen Xu**, master's student in electrical and computer engineering.

- Aliprantis also is collecting data on how much solar energy is available throughout a day. The idea is to improve power forecasts by developing better models of cloud cover. That would help utilities make better estimates of the power they can expect from solar panels on a given day. **Chengrui Cai**, a doctoral student in electrical and computer engineering, is assisting with the project.

- Aliprantis is part of an Iowa State faculty team that is developing a new, multidisciplinary doctoral program in Wind Energy Science, Engineering, and Policy. He also is using a National Science Foundation grant to work with Purdue University faculty to improve undergraduate education in power electronics and motor drives by modernizing student lab equipment and course content.

student profile:

allison sapienza

why did you want to study electrical engineering?

I came to Iowa State interested in computer architecture and I started out as a computer engineer. I realized as I went through the program that I wanted to go through the actual board design process. So I looked into more electrical engineering classes. I was just really interested in the actual circuits themselves as opposed to the programming side of how different computer chips work.

tell us about digital women.

We work as a support group for women who are in technical fields, not only computer software and electrical engineering, but also computer science. We come up with different activities for these women to get to know each other so they're comfortable around one another and can work together on homework assignments or projects. It's also a kind of way of relieving stress. We work with a lot of the other organizations – IEEE, HKN, COMMSCI club, so we're not out on an island.

what kinds of projects do you want to work on after iowa state?

I think it would be really cool to work on the layout of different kinds of circuit boards. I'm taking a class right now, EE 330, that talks about layouts of different circuit boards. We have software that we're using to look down at the micron level on how you can design different transistors, and I think it would be really cool to work on the layouts of these different boards and figure out how they all interact with each other. I think that would be a really interesting field to go into. That's VLSI.

what are your career plans after iowa state?

I really like circuit boards. I love it when we get to design. I like the actual application of what we've been learning. We go into the lab and we've been talking about transistors since the beginning of the semester, and now we're like 'we're going to design one, this is all the different layers.' So I like the application, but I also like to learn the physical electronic parts. •

quick bits

Major: Electrical Engineering
Year: Senior
Hometown: Minnetonka, Minn.
Activities: President of Digital Women, member of CyTronics, member of Cantamus Choir, mentor for EE 186 and EE 187.

Digital Women
digitalwomen.ece.iastate.edu
digitalwomen.president@gmail.com

Supporting women in CprE, EE, SE and ComS

student
honor roll

Congratulations to the following student award winners:

- **Lei Ke** (BSEE '11) and **Jinbo Duan** (BSEE '11), graduate students in electrical engineering, and **Xi Chen** (BSCprE '11) and **Mohammad Saleh** (BSCprE '11), graduate students in computer engineering, earned ISU Research Excellence Awards.
- **Xin Zhao** (CprE), computer engineering graduate student, and **William Burkland** (EE), graduate student in electrical engineering, were honored with ISU Teaching Excellence Awards.
- **Shibing Zhao** (EE) and **Benjamin Jusufovic** (EE) were awarded the annual International Engineering Consortium's William L. Everitt Award of Excellence for 2010-11.
- **Daniel Montgomery** (BSEE '11), and **Adam Literski** (EE) were awarded the IEEE Power and Energy Society scholarship from the society's Scholarship Plus Initiative.

more online

For more on student awards and honors, visit *www.ece.iastate.edu*

sitting down with

digital women

Being a woman in a male-dominated industry like electrical and computer engineering can have its challenges. Fortunately, organizations like Digital Women support female students in ECpE.

Kristen Muehlenthaler and **Allison Sapienza** have had very different experiences at ECpE. Muehlenthaler, a senior in computer engineering, was one of the creators and later president of Digital Women, a group dedicated to female ECpE students. Allison Sapienza, a senior in electrical engineering, is Muehlenthaler's current successor.

Muehlenthaler knew she wanted to be a computer engineer after taking programming classes in high school, as well as receiving her first insulin pump.

"I liked the aspect that I could create software that could save someone's life," Muehlenthaler said.

Sapienza came into Iowa State to study engineering, but it wasn't until the spring of her freshman year that she joined ECpE.

"I didn't actually know whether I wanted to pursue computer or electrical engineering," Sapienza said. "But I was very interested in computer hardware."

As a woman in a typically male-dominated field, Muehlenthaler had to find a way to fit in. She admits it was difficult at first.

"I had a professor ask me the first day of class, 'Are you sure you are in the right class?'" Muehlenthaler said. "I worked harder than anyone else to prove to everyone I was just as good, if not better, at the technical aspects of computer engineering."

Sapienza, meanwhile, had a different experience.

"I've always stood out in my classes because I'm one of the very few females and I've learned that in both good and bad ways I'm always memorable," Sapienza said. "I found it really strange how much I was noticed at first, but I've become accustomed to it over the years, and I still find it amusing."

Sapienza said that joining the Digital Women group was helpful to hear other women's experiences.

"I believe that the existence of Digital Women helps women to have more confidence because they aren't completely isolated and there are other women who have similar experiences," Sapienza said. "It really helps that it's now sort of trendy for women to be interested in science and technology."

Sapienza also thinks that a recent trend for women to be interested in her field has helped female students feel more welcome.

"It lowers the social stigma that women aren't capable of thinking critically," Sapienza said. "There are a lot more women in our department now and hopefully there will be fewer cases [like Muehlenthaler's] now that we're not as much of a rarity."

"I do believe that having a more diverse workforce, whether the ratio is from men to women or people from different places, creates more ideas from different perspectives," Sapienza said. "How can technology suffer from new ideas? By bringing in people with different life experiences and other ways of thinking, we can only become more successful." •

By Thane Himes

ecpe lecturer on the state of engineering

education

The future of engineering education is a moving target. As trends ebb and flow, as generations change and new ideas are brought forth, the way we educate students must be flexible, but must continue to impart the foundations of the craft. Engineering education now exists in a different form, with new technology and new research, than it did even five years ago. Dr. **Mani Mina**, senior lecturer, is at the forefront of Iowa State's commitment to remain among the top engineering education schools in the nation.

what has changed in engineering education compared to five years ago?

"We've increased the technological competency that we ask our students to have, and we've reduced the number of credits that students take. In general, we're adding courses that are not in the core of engineering. Is it wrong? No, I don't think so. I think it's the future."

what problems do you see in engineering education?

"Many engineering schools are seeing a strange trend. Students go through courses – and they're good courses – but the students don't have a long-term memory of them. Historically, what we used to do, is we used to drill them. Really drill them. Some of our alums probably remember that. It turns out that with the new generation, if you look at all the data, that doesn't work for them. One of the things we're working on is: How do we make a long-term memory commitment to the concepts and subjects in a way that is creative for them to learn for the future and to create new knowledge? One of the things we ask of our students is to do things that we have not been able to do. So they actually have to challenge the knowledge and bring new knowledge."

what's the biggest challenge facing engineering educators?

"The challenge of the educator is: How do you get students engaged in a meaningful way? Not only do we want them to repeat the tests and formulas for us, but we want them to become independent thinkers. We want them to think about what we say and keep it with them on the long term. Sometimes when you talk to engineering undergrads, they will tell you that their life as an engineering and science student was to memorize as much as they could and repeat it at the test. The goal of the educator is to teach them the basics; teach them how to learn so they can grow and expand their knowledge base." •

ecpe alum to receive

distinguished alumni award

On April 20th, 2012, **Richard H. Stanley** (BSME, BSEE '55) will be one of five Iowa State University alumni to receive the Distinguished Alumni Award.

A native of Muscatine, Iowa, Stanley has made tremendous contributions to Iowa State over the years. During his time as a student, he served as president of the student body. He has served as an ISU Foundation governor, and has been a member of and continues to serve the Memorial Union student board. He has served as member of the engineering college advisory council for 25 years, including two as president. His honors from Iowa State also include the Anson Marston Medal and the Professional Achievement Citation from the College of Engineering.

Stanley owns his company, Stanley Consultants, which provides engineering and construction services around the world. He has served as president of the Iowa Engineering Society, the National Construction Industry Council, and the American Council of Engineering Companies. He is a member of a IEEE, ASEE, ASCE, ASME, and NSPE. He has received numerous honors and awards, including the Distinguished Award of Merit and the Community Service Award of the American Council of Engineering Companies, the Diamond Jubilee Award from the American Society of Mechanical Engineers, the Harry S. Truman Distinguished Service Award from the American Association of Community Colleges, the Herbert Hoover Centennial and the Distinguished Service Awards from the Iowa Engineering Society, the Award for Citizen Diplomacy from the National Council for International Visitors, the Distinguished Alumni Achievement Award from the University of Iowa Alumni Association, and the Herbert Hoover Centennial and the Distinguished Service Awards from the Iowa Engineering Society.

Of all his contributions to engineering and education, Stanley has been most active concerning many humanitarian causes. Stanley has often chaired, presented, and participated in conferences on world affairs and global issues. He also is the Chair of the Stanley Foundation, a private, non-profit foundation that began simply as an experiment to integrate global education into the schools of his hometown of Muscatine. The Stanley Foundation has since expanded, working towards achieving sustainable world peace with freedom and justice.

Stanley and his wife, Mary Jo, have two daughters and one son. Stanley and his wife continue to fund a variety of projects at Iowa State, including the Stanley Chair in Interdisciplinary Engineering and the Richard and Mary Jo Stanley International Fund in the College of Engineering. •

By Thane Himes

a successful, charitable

businessman

- **following in his father's footsteps**
  Stanley's company, Stanley Consultants, was first founded by his father, C. Maxwell Stanley, in 1913, which Stanley later took over. Stanley now serves as a Chair Emeritus of the company. The Stanley Foundation was founded by his father in 1956, which Stanley later took over leadership, continuing its work toward sustainable world peace.

- **success in business**
  Stanley was on the Board of Directors of the HNI Corporation, the second-largest office furniture manufacturer in the world and the nation's leading manufacturer of gas- and wood-burning fireplaces. In 2008, the corporation was recognized as one of America's Most Admired Companies by *Fortune* magazine. Stanley has served as the Director Emeritus of HNI's Board of Directors since 2005.

- **giving back to his hometown**
  Stanley has made many contributions to his hometown of Muscatine. He was the founding Chair of Unity Health Care, the town's first vertically integrated hospital in Muscatine. Stanley also has served as the first President of the Board of Eastern Iowa Community College, past President of the Muscatine Chamber of Commerce, past Chair of the Board of Directors of the Northeast-Midwest Institute, as well as President of the Muscatine Health Support Foundation. •

celebrating
alumni awards

• **Richard E. Horton** (PhDEE '62) was honored with the Alumni Medal by the ISU Alumni Association. The Alumni Medal recognizes Iowa State alumni for long, loyal service to the university through alumni-related activities and is the premier award given to alumni by the ISU Alumni Association.

Horton is a trustee of the Stanton Memorial Carillon Foundation and was presented with the ISU Memorial Union Service Medallion in 1995. He is a retired ECpE professor and earned the Iowa Board of Regents' Faculty Excellence Award in 1998 and ECpE's Mervin S. Coover Distinguished Service Award in 2003.

• **Tracy Summers** (BSEE '94) was presented with the ISU Alumni Association Outstanding Young Alumni Award. This award is presented annually to ISU alumni 40 and under who have excelled in their professions and provided service to their community.

Summers currently is a senior program manager for Medtronic and oversees Cardiac Rhythm Disease Management Brady Product Development. She previously has been honored with the College of Engineering Professional Progress in Engineering Award (2003) and the ECpE Impact Award (2009).

• **David Miller** (BSEE '75) was awarded an ISU Alumni Association Impact Award for his leadership during the 2010 Ames flood. The Impact Award was established in 2000 to recognize individuals, businesses, organizations or units whose programs or accomplishments brought broad recognition to the university.

Miller currently serves as associate vice president for Facilities Planning and Management at Iowa State. He is active with the Ames Morning Rotary, the Story County Board of Adjustments, and the Northcrest Inc. board. He was previously honored with the ISU Alumni Association's Award for Superior Service to Alumni in 2003.

• **Thomas J. Bluth** (BSEE '89) and **Leo (Lee) Edward Ott** (BSEE '64; MSEE '68; PhDEE '71) were honored with the Professional Achievement Citation in Engineering (PACE) by the ISU College of Engineering. The award was originally established in 1968 to recognize superior technical or professional accomplishments in research, development, administration and education, and recognizes eminently known alumni for their professional competence and creativity.

Bluth (bottom left) is a vice president of Caterpillar, Inc., and oversees the earthmoving division. He was Senior Class President and received the Wallace E. Barron All-University Senior Award at Iowa State.

Ott (right) serves as chief scientist at Fugro and was a pioneer in the development of GPS technology. He is an active charity organizer and has organized events that regularly bring in upwards of $300,000 per year. He previously was awarded the ECpE Impact Award in 2010. •

ecpe alum tapped to coordinate
power grid research

Photo courtesy of Washington State University

The U.S. Department of Energy has appointed **Anjan Bose** (PhDEE '74) as a senior advisor in charge of coordinating research on electric power grid technologies. Bose's task will be to oversee ongoing research and establish new directions for power grid exploration.

Bose currently serves as the Regents Professor at Washington State University School of Electrical Engineering and Computer Science. He has 40 years of experience working on the electric power grid, dating back to his time as a graduate student and teaching assistant at Iowa State from 1970-74.

Bose received the Professional Achievement Citation in Engineering (PACE) Award from Iowa State in 1995. In addition, he is an IEEE Fellow and was honored with the Third Millennium Medal and the Herman Halperin Electric Transmission and Distribution Award by IEEE. He also was named a distinguished alumnus of the Indian Institute of Technology, Kharagpur.

Bose's year-long assignment at the DOE will focus on smart grid research and finding new methods for including renewable energy sources in the existing power grid. •

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ecpe alum receives

joint appointment at rowan university

Shreekanth Mandayam (MSEE '93; PhDEE '96) has received two new appointments with Rowan University. Mandayam is now executive director of the South Jersey Technology Park (SJTP) and associate provost for research.

"As executive director, I manage SJTP, which is a collaborative effort between the state of New Jersey and Rowan University to revive the economy of southern New Jersey through an integrated strategy of technology transfer initiatives," Mandayam said.

SJTP is home to many of Rowan's research initiatives, including research laboratories, the Imaging and Virtual Reality Lab, and the Rohrer College of Business Incubator. Sponsors for the research at SJTP include the National Science Foundation, NASA, U.S. Navy, U.S. Department of Commerce—Economic Development Administration, U.S. Department of Energy, American Cancer Society, and ExxonMobil.

Mandayam received his bachelor's degree in electronics engineering from Bangalore University in India, and then completed his master's in electrical engineering in 1993 and his PhD in electrical engineering, focusing on signal processing in communications, in 1996 from Iowa State University. During his time at Iowa State, Mandayam served as a research associate at Iowa State, a research consultant for GE-Global Research, a research associate for the National Academies at NASA's Stennis Space Center.

Mandayam joined Rowan in 1997, where he has served as professor of electrical and computer engineering as well as chair of the department from 2006 to 2011. Mandayam says that in his new roles, his goals will shift from conducting his own research to promoting SJTP and Rowan to high-tech companies.

"I intend to showcase Rowan University as the technology transfer hub in the region, advocate for the technical expertise of our faculty, and foster the establishment of businesses that can hire our graduates and contribute to the economic development of south Jersey," Mandayam said. • *– Innovate Online*

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