IOWA STATE UNIVERSITY Department of Electrical and Computer Engineering **alumni** newsletter fall 2012 volume 29 issue 1

ecpe connections

using bio-microfluidics to study plant disease

more inside ...

- world's largest cyber defense competition held at ecpe
- graduate student wins ieee poster contest
- alum becomes coo of skyera

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letter from the chair

s the fall semester reaches full speed, our department continues to reach new heights, break new ground, and welcome new faces.

Total enrollment for the department has risen to 1,651 students, including nearly 1,400 undergraduates. Our graduate student enrollment continues to grow, and our Ph.D. production for 2011-12 was a record 42 graduates.

Our growing ranks have brought us new challenges and new opportunities. We are in the final stages of renovating the Active Learning Complex into the Transformative Learning Area, which will include state-of-the-art equipment and an innovative setting. With an eye on the future, we are making several incremental improvements to Coover Hall that will better position it for the future.

Coover hosted the annual ECpE student cyber defense competition (page 3) in September. **Doug Jacobson**, University Professor, and **Julie Rursch**, lecturer, have built this event into the largest student competition in the world, with more than 150 participants.

Three faculty, including Associate Professors **Santosh Pandey**, **Umesh Vaidya**, and **Joseph Zambreno**, won National Science Foundation Faculty Early Career Development (CAREER) Awards. Our ranks now include 18 NSF CAREER Award winners, including 11 in the past five years. Additionally, Professor **Vikram Dalal** was awarded the 2012 IBM Faculty Award, his second straight.

Our students and alumni continue to impress. Graduate student **Subhadarshi Sarkar** was awarded first prize at the 2012 IEEE PES General Meeting Student Poster Contest in July for his presentation on optimal renewable energy. **Frankie Roohparvar** (BS CE '84) was named Chief Operating Officer at Skyera.

We will welcome assistant professor **Meng Lu** as a joint appointment between our department and Mechanical Engineering this January. Lu, a postdoctoral research associate at the Illinois Micro and Nanotechnology Laboratory, will strengthen our bioengineering research efforts. We are excited to welcome him to the department.

I look forward to another academic year and another chance to renew acquaintances. I welcome you to join us October 27 for Iowa State's 100th Homecoming Weekend.

Kind regards,

David

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

on the cover...

ECpE's Santosh Pandey is studying the effect of pathogens on plant roots,

which could one day help us grow healthier crops. (Page 6).



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research highlights now available



The 2012 Research Highlights biennial report is now available. View a copy online at www.ece.iastate.edu/research/research-highlights, or call the department at 515 294-2663 to request a hard copy. ■



iowa state hosts world's largest cyber defense competition

owa State's Department of Electrical and Computer Engineering hosted its annual student cyber defense competition on September 22, 2012. With more than 150 student participants, the event ranked as the largest cyber defense competition in the world.

Iowa State students were split into teams and were given two weeks to build their own systems on virtual machines that could stand up to cyber attacks and still function properly. Team QWERTY took first place and was comprised of captain Brian Reber along with James Kujawa, Daniel Stiner, James Care, Eric Everett, David Koster, Alex Sobek, and Curtis Ullerich. Team Creeper took second with Sony Security Team in third.

Doug Jacobson, University Professor, and **Julie Rursch**, Lecturer, organized the original cyber defense competition in 2005 and have seen it grow substantially over the last seven years.

"A bunch of us got together and talked about how we could do competitions like this," Jacboson said. "The result of that meeting planted the seed of running competitions like this."

The teams of students are identified as Blue Teams and are awarded points based on how their systems stand up to attack. Points also are awarded for detecting and fixing attacks. Blue Teams defend against attacks from the Red Team, which is comprised of cyber-security professionals from all over the Midwest. The Red Team's goal is to either plant or capture flags



Scan the code to see a photo gallery of the competition on the ECpE website or visit news. engineering.iastate.edu



within Blue Team systems. These flags are proof that the Red Team was inside of a Blue Team system.

"Planting and taking flags prevents the Red Team from just destroying the Blue Teams' computers," Jacobson said. "They're really incentivized to be stealthy."

Finally, the whole competition is overseen by the Green Team, or end users. The Green Team ensures Blue Team systems are functional and usable, in addition to being operational.

"It's a giant room full of kids on keyboards. There's a buzz of activity associated with it," Jacobson said. "It's a party atmosphere. We really try to create an environment that is fun, but still a pretty intense competition."

The impact of these ever-growing competitions is starting to be felt across the cyber-security landscape.

"Companies are starting to look for this on resumes," Jacobson said. "They will ask 'did you participate in a cyber defense completion?' It's starting to become sort of a prerequisite to getting cyber-security jobs."

ibm faculty award

ikram Dalal's solar cell research continues to turn heads. Dalal, the Thomas M. Whitney Professor in Electrical and Computer Engineering, was awarded the 2012 IBM Faculty Award, his second in as many years. Much of the \$38,000 award will go toward building a new deposition system for the solar research teams.



"This award will go a long way," Dalal says. "We'll use this year's award to build up the department's research infrastructure in this field."

The IBM Faculty Award is an annual worldwide competitive program intended to foster collaboration between researchers at leading universities and those at IBM. Faculty Awards are cash grants awarded to full-time professors at accredited universities that have an outstanding reputation for contributions in their field or show unusual promise. "You get this award based on the idea proposed and the qualifications you bring to execute the idea," Dalal says.

Dalal is researching the degradation of organic solar cells and looking at ways to improve stability. Currently, organic solar cells can be expected to degrade by around 30 percent within 100 hours of exposure to light. Since organic solar cells are not especially efficient to begin with, this rapid degradation, combined with the high installation cost of all solar cells, makes organic systems uneconomical. Dalal is working to change this.

"I realized that this was a major problem about two years ago," Dalal says. "We developed a systematic program to examine the instability of organic solar cells. We wanted to first understand the physics behind it and then come up with ideas to reduce the instability of it."



Mehran Samiee (left) and Joydeep Bhattacharya (Right) preparing organic solar cell samples inside a glove box, which is flushed with Argon to keep it free of oxygen and water vapor contamination. Several different researchers, including Dalal, make use of the department's deposition system at the Microelectronics Research Center. Currently, the system is so heavily used that researchers from ECpE, MSE, Physics and Chemistry are forced to wait in line. A crowded system promotes material contamination across projects and reduces the quality of materials and devices in experiments. Dalal's award will help remedy the situation.

"We will use a large part of this award to fund a new deposition system and a new measurement system," Dalal says. "It will increase our productivity and, more importantly, reduce cross contamination coming from other materials."

Dalal says continuing to build ECpE's solar cell research infrastructure is an important goal.

"I'll use awards like this to continuously improve our research infrastructure so we can understand the fundamental science of solar cells and improve their performance."

events

OCTOBER 11

Banquet

5:30 p.m.

Session

OCTOBER 11

OCTOBER 26

NOVEMBER 11

Ceremony

OCTOBER 5 Distinguished Lecture Series: Frank Chang 3043 ECpE Addition, 1:10 p.m.

ECpE Honors and Awards

Scheman Building, 2nd Floor,

ECpE External Advisory Board

3043 ECpE Addition, all day

Benton Auditorium, 1:30 p.m.

IEEE Distinguished Lecture, George C. Hadjipanayis 3043 ECpE Addition, 1:30 p.m.

ISUAA Honors & Awards

Fall Meeting & Graduate Poster

NOVEMBER 22-23 Thanksgiving Holiday: Offices Closed

NOVEMBER 30 Distinguished Lecture Series: T.E. Schlesinger 3043 ECpE Addition, 1:10 p.m.

DECEMBER 3-7 Senior Design Review 3043 ECpE Addition, all day

DECEMBER 15 Fall Commencement Hilton Coliseum

DECEMBER 24 - JANUARY 3 Winter Break: Offices Closed

ttp://ww

To see the full calendar of events, visit www.ece.iastate. edu/seminars-and-events/

ecpe welcomes new faculty and staff



Meng Lu will join the department as an assistant professor in January 2013. He will hold a joint appointment between ECpE and Mechanical Engineering. Lu received his bachelor's degree from the University of Science and Technology of China in 2002 and his Ph.D. in electrical engineering from the University of Illinois in 2008. Before he arrives at ISU, Lu will finish his

term as a postdoctoral research associate at the Illinois Micro and Nanotechnology Laboratory. Lu will strengthen ECpE's Bioengineering strategic research area and will focus his research on designing optical devices for biological sensing.



Karin Lawton Dunn was hired in June 2012 as the Grant Coordinator for ECpE. She acts as the department's sole point of contact with the Iowa State Office of Sponsored Programs Administration. Dunn prepares gold sheets, assists faculty with the development of budgets, reviews format requirements, and resolves questions that arise during proposal

preparation. She received her bachelor's and master's degrees from Iowa State. Previously, Dunn was director of the Des Moines Center of Upper Iowa University.



Samantha Dubert was hired in June 2012 as the Administrative Specialist for ECpE. She processes p-card transactions, releases CyBuy, handles reimbursement requests, and submits hourly payroll for the department. Dubert holds a B.S. in Finance from Iowa State University. She previously worked at CDS Global as a customer service representative from 2006-2012.



Amy Huston was hired on July 1, 2012 as a Program Assistant I for the Software Engineering Program. She assists with the overall program and the ABET evaluation reporting, serves as a resource for the program, monitors the general financial account, and manages related financial transactions associated with purchasing and expense reimbursements. Prior to joining

the Software Engineering Program, Huston was the Studio and Print Music Coordinator for West Music Piano Gallery from 2010-2012 and taught band and general music for the Burlington Community School District from 2004-2010. She holds a Bachelor's of Music Education from Drake University.



Julie Rursch joins the department as a lecturer in 2012. She received her bachelor's degree from Western Illinois in 1985, a master's in mass communication from Iowa State in 1988 and a Ph.D. in mass communication from Wisconsin in 1994. Rursch will earn a Ph.D. in computer engineering with a focus on secure computing from Iowa State in 2012.

Rursch's research includes a unique approach to critical infrastructure modeling, which can provide emergency planners and first responders with critical infrastructure information during emergencies. She also has played a critical role in the development of the IT-Adventures high school outreach program.

faculty and staff recognitions

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

- Nicola Bower was promoted to full professor.
- Chris Chu, associate professor, was elected a fellow of the Institute of Electrical and Electronics Engineers.
- Vikram Dalal, Whitney Professor of Electrical Engineering, was awarded an IBM Faculty Award, his second in as many years.
- Julie Dickerson was promoted to full professor.
- Randall L. Geiger was named the first recipient of the Doluca Professorship.
- Ahmed Kamal, professor, was elected a fellow of the Institute of Electrical and Electronics Engineers.
- **Jaeyoun Kim** was promoted to associate professor.
- **Santosh Pandey** was promoted to associate professor.
- Aditya Ramamoorthy was promoted to associate professor.
- **Umesh Vaidya** was promoted to associate professor.
- David Weiss was named the first recipient of the Nguyen Professorship.
- Joseph Zambreno was promoted to associate professor.

more online



To keep up with ECpE news, visit news.engineering. iastate.edu/category/department-news/electrical-andcomputer-engineering

ecpe announces 2012-13 speakers for distinguished lecture series



JOHN G. HARRIS - 9/21

Chair, Department of Electrical and Computer Engineering, University of Florida

"Biologically Inspired Computation Using DSP and Analog Circuit Implementations"

Abstract: There is growing interest in using biological-inspiration to improve the design of computation systems, particularly in the areas of sensory processing and pattern recognition where biological systems far outperform the best man-made devices. For instance, state-of-the- art speech and face recognition algorithms pale in comparison to human performance despite hundreds of man-years of research in these fields. We survey several examples of our work in biologically-inspired engineering designs, including research with Motorola on improving cell-phone speech quality, a new type of digital camera with much wider dynamic range, an implant for wirelessly recording neural signals for brain-machine interfaces and a general computer architecture for spike-based computation. In each case, the study of biology leads to natural and effective engineering solutions that can be implemented in DSPs or in special-purpose analog VLSI circuits.

Biography: Dr. John G. Harris earned his BS and MS degrees in Electrical Engineering from MIT in 1983 and 1986, and earned his Ph.D. from Caltech in 1991. Harris joined the Electrical and Computer Engineering Department at Florida in 1993. For his research, Harris develops biologically inspired circuits, architectures and algorithms for signal processing. Harris has published over 100 research papers and patents in these research areas. In August of 2011, Dr. Harris became the chair of the ECE department at the University of Florida.



FRANK CHANG - 10/5

Wintek Chair Professor and Chairman, Electrical Engineering, UCLA

"Next Generation Communication/ Radar/Imaging Systems-on-Chip"

Abstract: There is an increased interest in recent times to explore mm-Wave and Sub-mm-Wave (Terahertz) systems from 60-1000GHz (i.e. 1 Terahertz) for radio, radar, and imagers due to unique quasi-optical characteristics of such wave spectra. Continuous scaling has made modern CMOS with gate dimensions less than 65-40nm a potential contender with improved device speed (cut-off frequencies ft and fmax >300GHz) and superior System-on-a-Chip integration. Nevertheless, deep-scaled CMOS suffers its own disadvantages from limited linearity/dynamic range, low intrinsic gain, high process variation and excessive substrate loss. In this seminar, we will discuss various algorithms and techniques to overcome CMOS technology drawbacks in order for implementing highly integrated and portable radio/radar/imaging systems with high spectra coverage, energy efficiency and cost/size-effectiveness.

Biography: Frank Chang is the Wintek Chair Professor and Chairman of UCLA Electrical Engineering. Before joining UCLA in 1997, he was the Assistant Director and Department Manager of High Speed Electronics Laboratory at the Rockwell Science Center in Thousand Oaks, California (1983-1997). He was elected to the US National Academy of Engineering in 2008 and to Academia Sinica of Taiwan, Republic of China in 2012 for his research in advancing modern High Speed Electronics. He is an IEEE Fellow and received the IEEE David Sarnoff Award in 2006.



T.E. SCHLESINGER - 11/30

David Edward Schramm Professor and Chair, Electrical and Computer Engineering, Carnegie Mellon University

"Exploring New Paradigms in Technology"

Abstract: As the scaling of semiconductor device technology, commonly described by "Moore's Law", comes to an end, many people may be led to believe that the ability to continue to advance technology dramatically has come to an end in general. This however, is far from the case. Rather, what we are seeing is that a particular engineering paradigm is coming to an end, not technology development in general. In this presentation I will offer some "back of the envelope" arguments as to why technology has not reached any sort of limit and why orders of magnitude advances in technology are still quite possible. I will then describe two projects my colleagues and I are working on at Carnegie Mellon; one in data storage systems and the other in circuit technology. Both projects seek to exploit new technology paradigms. Finally I will discuss my reasons for great optimism in the potential of new technology paradigms and the implications of these developments.

Biography: T.E. Schlesinger is the David Edward Schramm Professor and Head of Electrical and Computer Engineering at Carnegie Mellon University. Prior to this, he was the Director of the Data Storage Systems Center, Associate Department Head in ECE, and was the founding co-director of the General Motors Collaborative Research Laboratory at CMU. He received his B.Sc. degree in Physics from the University of Toronto in 1980 and his M.S. and Ph.D. degrees in Applied Physics from the California Institute of Technology in 1982 and 1985 respectively. He is an IEEE and SPIE Fellow, is President of the ECE Department Heads' Association, and was a member of the International Advisory Panel for the A*STAR Graduate Academy. and is on the Advisory Board for the ECE Department, Georgia Tech.



ROBERT LEE - 2/22

Chair, Electrical and Computer Engineering Department, The Ohio State University "Development of New Finite Difference Time Domain Methods for Electromagnetics Based in Finite Element Concepts"

Abstract: Because of accuracy problems, researchers have worked to develop improvements to the traditional finite difference time domain (FDTD) method over the past 40 years. Although there has been some success, improvement has been slow. In my opinion, the slow progress is due to the FDTD formulation itself. The approach that we have taken is to formulate the FDTD method in terms of finite element concepts. The resulting framework allows us to use the vast capabilities developed for the finite element method to improve the FDTD method. The resulting formulation can then be translated back into the FDTD stencils and coupled directly to the rest of the grid where standard FDTD is used. This approach has allowed us to develop robust algorithms for subgridding, higher order stencils, anisotropic media modeling, and multiple time steps methods.

Biography: Robert Lee received his BSEE in 1983 from Lehigh University and his MSEE and Ph.D. in 1988 and 1990, respectively, from the University of Arizona in Tucson. From 1983 to 1984, he worked for Microwave Semiconductor Corporation in Somerset, NJ as a Microwave Engineer. Since 1990, he has been at The Ohio State University where he currently is Professor and Department Chair of Electrical and Computer Engineering. Lee teaches courses in electromagnetics, is an IEEE Fellow, and is on the ISI highly cited list.



BABAK HASSIBI - 3/8

Executive Officer of Electrical Engineering, Professor of Electrical Engineering, California Institute of Technology

"Phase Recovery for Sparse Signals"

Abstract: Abstract: Since amplitude information is not sufficient to recover signals, some form of prior information must be assumed. In this talk, we will assume that the underlying signal is sparse, a very reasonable assumption in applications in astronomy, x-ray crystallography, wireless communications, etc. We first prove that, provided the support of the unknown signal is not "periodic", it can be uniquely (up to time shifts and reflections) reconstructed from the magnitude of its Fourier transform. We then focus on practical algorithms to perform this recovery. We show that standard "lifting" methods that relax the problem to a semi-definite program (SDP) do not work. Instead, we employ a two-phase strategy: we first recover the support of the unknown signal using a combinatorial algorithm (of quadratic complexity), and then use the support information to recover the signal using an SDP.

Biography: Babak Hassibi is professor and executive officer of electrical engineering at the California Institute of Technology, where he has been since 2001. From 1998 to 2001 he was a member of the technical staff at the Mathematical Sciences Research Center at Bell Laboratories, Murray Hill, NJ, and prior to that he obtained his PhD in electrical engineering from Stanford University. His research interests span different aspects of communications, signal processing and control. Among other awards, he is a recipient of the David and Lucille Packard Foundation Fellowship, and the Presidential Early Career Award for Scientists and Engineers (PECASE).



AHMED TEWFIK - 4/12

Cockrell Family Regents Chair in Engineering and Chairman, Electrical and Computer Engineering, Univeristy of Texas

"Behavioral Networking and Decision Making"

Abstract: This talk will begin with an overview of cognitive biases. It will then describe our work on mathematical models of human decision making at the individual and group levels. In particular, we seek to study differences between human decision making and optimal decision making in a Bayesian or Neyman-Pearson framework. Cognitive biases imply that human decision making is not equivalent to an optimal Bayesian test. We hypothesize that human decision making can be modeled by a sufficient static that captures all the intrinsic information, a threshold and an additive term that depends on extrinsic and intrinsic information and past decisions. Finally, the talk considers how information should be sequenced to help groups make optimal decisions. Sequencing in this context refers to the time order in which the information is presented to each individual and when communications between individuals is encouraged or discouraged. Our recent work in a detection context (using divergence of measure analysis) shows that the average decision time in problems with a desired probability of detection can be reduced by appropriate sequencing.

Biography: Ahmed H Tewfik received his B.Sc. degree from Cairo University, Cairo Egypt, in 1982 and his M.Sc., E.E. and Sc.D. degrees from MIT, in 1984, 1985 and 1987 respectively. He is the Cockrell Family Regents Chair in Engineering and the Chairman of the Department of Electrical and Computer Engineering at the Univeristy of Texas. He was the E. F. Johnson professor of Electronic Communications with the department of Electrical Engineering at the University of Minnesota until September 2010. Dr. Tewfik worked at Alphatech, Inc. and served as a consultant to several companies. From August 1997 to August 2001, he was the President and CEO of Cognicity, Inc., an entertainment marketing software tools publisher that he co-founded, on partial leave of absence from the University of Minnesota. Tewfik is a Fellow of the IEEE. He was a Distinguished Lecturer of the IEEE Signal Processing Society in 1997-1999. He received the IEEE third Millennium award in 2000.



Teachings, interests, and skills shape **ECpE lecturer's philosophy**

ani Mina is an educator and researcher, as well as a practitioner of martial arts. He believes the three are intricately related, helping him meet the demands of teaching larger classes as well as performing research that adds value in both educational and technical fields.

The key, says Mina, who is a senior lecturer in electrical engineering, is finding a balance that keeps you focused and interested without losing sight of the bigger picture.

How does this apply in his daily work? Take the freshman course EE 185: Introduction to Electrical Engineering and Problem Solving I, which is just one of several courses he is teaching this semester. Currently, the class has around 120 students, one of its largest enrollments in history.

Seating problems notwithstanding, Mina's primary concern is being actively engaged with students.

"These students in particular are going to be going out into a very interesting, dynamic future. We want to make sure our course has an impact on them, to help them prepare," he says.

Mina adds that the course involves lots of activities, debates, and small group discussions that can make a large class more personal and engaging.

"We want to make a playing ground for them," Mina says. "Make all the mistakes you can and learn from every one of them." Another way Mina helps give a large class a more personal touch is to introduce students to activities and organizations that go on outside the classroom.

He says many of the freshman he works with get involved in groups like Critical Tinkers, which gives them an opportunity to play with technology and create interesting and challenging projects. One of the group's current projects is in collaboration with the College of Design on future designs of a high-speed lab.

Mina is also a dynamic representative of Iowa State's strong presence in education research on a national level. His National Science Foundation-funded research deals with technological literacy, and focuses on determining proper standards and tests to measure it among a general populace.

His technical research currently focuses on magneto optic switches for fiber optic communication networks.

And he practices Hapkido, a Korean martial art that emphasizes joint locking, striking dynamic pressure points, and a circular motion that maintains control of an opponent.

"Many people [who practice martial arts] are in sciences," Mina says. "It's an exercise in physical and mental focus."

Mina's martial arts practice, research in networks and education, and teaching, all work as one to demonstrate his strong ideology.

"I believe in connectivity," Mina says. "Creativity, excitement, teamwork, it's all connected."

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.

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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.

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three from ecpe win nsf

career awards

ver the past five years, researchers from ECpE have received 11 National Science Foundation Faculty Early Career Development (CAREER) Awards, the most over any five-year period in the department's history. Here is a look at three of the most recent CAREER Award winners and their contributions to the department's research portfolio.

Joseph Zambreno is researching ways to combine CPU and GPU processors into a single, hybrid chip. Traditional computer



architecture includes a CPU and a GPU handling separate tasks. Today's "fused" chips feature integrated CPU/GPU designs, which promote faster interfacing and more efficient use of processor power. However, today's model utilizes a CPU and a GPU performing the same roles they always did, just in closer proximity. Zambreno wants to combine the two chips to get the best of both.



Santosh Pandey is developing a new engineering platform to observe, sense, and modulate interactions between plant roots and pathogens. His research aims to develop effective and sustainable control strategies against plant diseases. He plans to develop a plant-in-chip system for the growth of Arabidopsis plants, realize chemical schemes

for sensing and modulating auxin in plants, and build on-chip electrical schemes for sensing root health and manipulating pathogenic interactions with roots. (See opposite page)



Umesh Vaidya's work identifies uncertainties within network systems and then proposes ways to make those systems run as efficiently as possible given the uncertainties. Vaidya is applying aspects of ergodic theory to identify critical factors that are responsible for complex changes in a network system. Vaidya finds uncertainty in network systems and determines how that uncertainty affects

the system as a whole in order to make the system run more efficiently.

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YTISAEVINU ETATE UNIVERSITY



Plant disease is not a field that is wellstudied, particularly among engineers," Santosh Pandey says. "There's this whole mystery with what goes on with the roots."

Pandey, assistant professor in Iowa State University's Department of Electrical and Computer Engineering, is studying the impact of pathogens on plant roots. He

also has a courtesy appointment in Agricultural and Biosystems Engineering Department. His research, funded by a National Science Foundation CAREER Award, involves studying the interactions of pathogens with plant roots at the microscale level. This research could potentially lead to new methods for fighting plant disease and infection.

"When crops are grown in the field, it is very hard to know when they start getting infected," Pandey says. "You don't know when a plant is infected until it's already too late. There's no way to see how pathogens penetrate the root, or even find it in the first place. There is no visual way of knowing anything related to root infection at real-time, especially in farmlands. We are making a visual, two-dimensional microscale platform to observe and characterize root infection in a laboratory setting."

Pandey is taking a model plant system – a plant whose genome is sequenced, in this case *Arabidopsis* – and growing it in microfluidic chips. These chips allow the Arabidopsis plant to grow in a transparent, controlled environment and its roots to grow along clear microchannels. The chips give researchers control over what the plants are exposed to, and allow them to visually see how roots react to pathogen invasion.

"A computer chip, for example, has a flow of electrons between selected electrodes that take data from one system module to the other," Pandey says. "In this case, rather than the flow of electrons, it is the visual flow of plant nutrients, auxin, for example, at a very small level. By utilizing microfluidic chips, we have a visual way of seeing how nutrient flow is modulated when pathogens attack the roots."

With this bio-microfluidic approach, Pandey has created a

Plant-in-a-Chip system where he can manage and control fluid flow at microscale levels. In his experiments, Pandey observes the reactions of plant roots as they are exposed to nematodes over the course of several days. The invasive organisms establish a parasite-host relationship with the live roots, resulting in a number of visual changes in root cells. With his Plant-in-a-Chip platform, Pandey is able to visually observe the root-pathogen interactions and chart how both the roots and the pathogens react to one another.

"If I have a colony of pathogens that establishes a cozy microcosm with the host roots," Pandey begins, "how can I disrupt or alter this host-pathogen relation? We will investigate chemical and electrical modulation schemes and develop the best recipe of external stimuli that will kill the pathogens and also help the plant survive this pathogenic invasion. Obviously, a high-throughput platform is needed to test multiple combinations of external stimuli."

Pandey envisions a practical use for his Plant-in-a-Chip system right away.

"If you want to develop new pesticides, you can test them first in small microfluidic chambers on a model plant system rather than dispersing them in the farmlands," he says.

He cautions, however, that his research will not provide a one-size-fits-all solution.

"Pathogens are very specific and evolving all the time," he says. "There's a lot to be done. The specificity and selectivity of pathogens are multi-faceted. The types of plant diseases we encounter in Iowa are different from those encountered in China, Africa, or South America. Above all, the success of such a multidisciplinary project requires close collaborations with Iowa State biologists. Fortunately our campus has several renowned plant and animal scientists who have helped us in this direction."

The research is still in its early phases, but Pandey doesn't hesitate to say where he wants it to end up.

"The dream would be to have a rapid diagnosis technology wherein, for a given pathogen under test, you can quickly diagnose the plant ailment and prescribe the best treatment alternatives, just as in humans."



ecpe grad student wins

ieee poster contest

Subhadarshi Sarkar, grad student in electrical engineering, was awarded first prize at the 2012 IEEE PES General Meeting Student Poster Contest in July for his presentation on optimal renewable energy.

Sarkar presented his poster to judges, professors, students, and professionals at the general meeting. The next day, he found out that he had won in the graduate category, beating out nearly 200 competitors from all over the world.

"You never think this kind of thing would happen, but it feels good," Sarkar says. "I was happy just to present my work."

Working under electrical engineering professor **Venkat Ajjarapu**, Sarkar's NSF-funded project focused on optimizing the integration of renewable wind and solar energy into the electric power grid. Sarkar's system is designed so wind and solar energy can complement one another.

Sarkar says several factors go into determining the viability of this system's use, including location.

"Wind comes mostly during the early morning and at night, and the sun peaks during the day," Sarkar says. "To make the system viable, you need good wind and sun that are complementary."

The size of the system also is an important factor, as one needs to be certain that the system can absorb enough energy to supply an adequate level of power to a grid. When location and system size have been considered, the last major challenge is ensuring the synchronicity of collecting energy from both sources.

Sarkar's work is especially relevant today. The US Department of Energy currently has a very ambitious goal of 20 percent of the nation's power coming from renewable sources by 2020. As of 2010, only 8 percent of our energy comes from renewable sources.

"Wind energy has grown very much over the last several years," Sarkar sawy. "But solar energy is still very expensive."

When Sarkar was first starting the project in 2008, he found the biggest challenge was finding a sense of direction.

"At the time, there was not a lot of prior information to go off

of," Sarkar says. "Finding precedence was a difficulty."

That problem got easier for Sarkar as time went on, and as more and more work on renewable energy was done.

"When you're working on research, you want to have an existing knowledge base, and then you want to add to it yourself," Sarkar says. "If you can do that, that is four to five years well spent."

A great deal of research has been done in wind energy and solar energy, but only a handful of pilot projects focusing on the integration of the two are being conducted. Two of the projects are in California, a state with high ambitions for increasing its use of wind and solar energy. General Electric is funding a project in Turkey and another project is getting off the ground in Costa Rica.

"If I were to tell someone 25 years ago that wind energy would be used at this level today, they wouldn't have believed me," Sarkar says. "Who knows how far this will progress in the next five to ten years?"

-by Thane Himes



Scan the code to download a copy of Subhadarshi Sarkar's award-winning poster "MW Resource Assessment Model for a Hybrid Energy Conversion System with Wind and Solar Resources."

isibor awarded microsoft technology scholarship



aisy Isibor, a junior in the Iowa State University Computer Engineering program, was awarded the Microsoft Technology Scholarship, a \$5,000 award for the 2012-13 academic year.

Isibor, a transfer from the University of Northern Iowa, spent the summer as an intern at Microsoft's Redmond, Wash. headquarters and is a member of

the Phi Eta Sigma Honor Society and the National Society of Collegiate Scholars. She was a 2007 gold medalist at the E-biko International ICT Olympiad in Turkey and participated in the 2010 International Olympiad in Informatics in Ontario, Canada. In addition, Isibor is an undergraduate research assistant for **Arun Somani**, Anson Marston Distinguished Professor in the Iowa State Department of Electrical and Computer Engineering.

"She is an amazing student," Somani says, "careful with details and thorough in her understanding of subject matter in classes and in research. It is a real treat to work with a student like her."

Microsoft awarded scholarships to students from 46 schools in the latest round of education funding. Microsoft scholarships are awarded based on a number of criteria, including merit, diversity, commitment to leadership, and a nominee's interest in a career in technology.

"Our 2012-2013 scholarship winners are a creative and talented group of aspiring technologists," said Jaime Green, University Recruiting and Diversity Program Manager at Microsoft. "They are already demonstrating the type of informed curiosity and determination we look for. I have no doubt that this group will significantly contribute to the field of technology in the years ahead."

Isibor says her experiences over the last few years have strengthened her commitment to education and to Iowa State.

"I came to Iowa State University because of the great opportunities here in the College of Engineering and throughout the university," she says. "Since my first semester here, I have been privileged to work with an exceptional research team led by Dr. Somani. This experience has really prepared me for my internship at Microsoft this summer and for my engineering career. I am very grateful for the solid foundation Iowa State is helping me build. I strive to make the best out of my cyclone life by working hard, getting involved in campus and community activities, building strong relationships, and positively impacting the lives of other students on campus in any way I can."

ecpe graduate students win memocode design contest

A team of ECpE graduate students took home the top prize at this year's MemoCODE Design Contest. The students— **Chad Nelson**, **Kevin Townsend**, and **Bhavani Rao**—devised a solution they named Shepard that was 24 times faster than the second-place solution. The team utilized the Convey HC-1 with a field-programmable gate array (FPGA) to efficiently map millions of 100 base pair DNA sequences to a reference human genome of 3.1 billion base pairs. The group was advised by ECpE's **Joseph Zambreno** and **Phillip Jones**.



Pictured: Joeseph Zambreno, Kevin Townsend, Chad Nelson, Phillip Jones

ecpe introduces 2012-13 external advisory board

ach year, the ECpE department's External Advisory Board (EAB) advises the department on ways to improve and ensure that the department's degree programs continue to excel and meet the needs of industry and academia employers. The board is comprised of industry experts and academicians, several of whom are ECpE alumni. The following individuals are on the 2012-13 EAB:

- **Bruce Trump** (BSEE '71), the board's chairperson, is a staff technologist at Texas Instruments in Tuscon, Arizona. He also serves as Texas Instruments' sponsor for Iowa State.
- **Bill Boswell** is senior director of Global Partner Marketing for Siemens PLM Software in Ames, Iowa. Boswell directs worldwide marketing and go-to market strategy for the Teamcenter software product line.
- **Rob Bowen** (BSCpE '94; MSCpE '96) is a senior engineering manager responsible for ASIC and FPGA designs related to information assurance and cryptographic products at Rockwell Collins in Cedar Rapids, Iowa.
- Mitchell Corbett (MS Systems Eng '02) is the software systems and support manager for the Engineering Field Automation group at Pioneer Hi-Bred in Johnston, Iowa. He is responsible for the development and support of software and electronic systems for the field research groups at Pioneer.

- Hamid Elahi (BSEE '77; MSEE '79) is the general manager of energy consulting at GE Energy in Schenectady, New York. Elahi is responsible for leading the GE Energy Consulting team in support of clients worldwide.
- Sam Ellis (BSComS '83) is the IBM campus relationsip manager for Iowa State and program director for InfoSphere Streams Development at IBM in Rochester, Minnesota.
- **Bob Erger** is a staff software engineer at Schneider Electric in Cedar Rapids, Iowa.
- **Ryan Hammond** (MS InfAs '94) is a new member this year. Hammond works as a software engineer focusing in cybersecurity at Boeing Research and Technology.
- Shawn Hanson is a principal test manager in the Microsoft Business Division in Fargo, North Dakota. He is responsible for leading a team of engineers testing the Dynamics AX product.
- John Kenkel (BSEE '03) is a design engineering team leader at Garmin International in Olathe, Kansas.
- David J. Lilja (BSCpE '81) is the Louis John Schnell Professor in Electrical and Computer Engineering and department head of the department of the Department of Electrical and Computer Engineering at the University of Minnesota in Minneapolis.

roohparvar named coo of skyera

owa State University alumnus **Frankie Roohparvar** (BSCpE '84) has been named Skyera's new Chief Operating Officer.

Roohparvar has nearly 30 years of professional experience and joins Skyera after 13 years at Micron, where he worked primarily with Flash memory and NAND development.

"Having been involved with NAND from the early days of its adoption in

solid-state storage, I was in a unique position to watch how NAND worked its way into the solid state field," Roohparvar said. "Seeing the huge potential for disruption that Skyera's technology is introducing, I wanted to get on the ground floor of this innovation revolution."

Skyera, a rising company located in San Jose, California, is a provider of enterprise solid-state storage systems that can enable large classes of applications with higher performance, lower power consumption, and more cost effectiveness than the enterprise storage systems on



Frankie Roohparvar

the market today. The company is working to build a new architecture of storage technology from scratch, rather than building on what already exists. With this approach, Skyera is betting on the benefits of next-generation flash memory while overcoming the limitations faced by solution vendors that build on existing systems.

Roohparvar began his career at Xicor, and went on to be one of the founders of Micron Quantum Devices, one of the first providers of NOR Flash memory. When the company was acquired by Micron, Roohparvar joined the team, holding various senior engineering and executive positions before eventually rising to the position of vice president of NAND development. As VP, Roohparvar was responsible for managing engineering organizations all over the world.

"While we come from different cultures and backgrounds, it is the engineer in all of us that is the same everywhere," Roohparvar said. "It is surprising to see how similar we all are. It is a way of thinking that seems to be programmed in our genes."

Roohparvar's technical creativity has allowed him to file

- Daniel Mineck (BSME '71) is the retired vice president of performance engineering and environment at Alliant Energy in Cedar Rapids, Iowa. Currently, he is a parttime faculty member at the University of Iowa's College of Engineering.
- Nicholas J. Multari is the senior project manager of cyber security research at the Pacific Northwest National Lab (PNNL)
- Albert (Bert) Nelson is the managing director at Zenergy Power in Burlingame, California.
- V.R. Ramanan is an executive consulting R&D scientist in the U.S. Corporate Research Center at ABB in Raleigh, North Carolina. He serves as the global project manager for amorphous distribution transformers.
- **Ren Russie** (BSEE '77) is the director of quality assurance for Boston Scientific, CRV Rhythm, in St. Paul, Minnesota.

In addition to serving on the ECpE EAB, Boswell, Ellis, and Hanson participate on the Software Engineering EAB. John Gustafson (MS applied math '80; PhD Applied Math '82), director of Intel Labs Santa Clara; Tom Miller (BSComS '72) from Microsoft Research; and Ron Wolf (BSComS '74; MSComS '76), Software Engineering Manager at Keynote, also serve on the Software Engineering EAB.

more than 300 patents through the course of his career. Dr. Radoslav Danilak, CEO of Skyera, couldn't be happier about Roohparvar joining the company.

"Piece by piece we have assembled a top-notch collection of talented individuals who will contribute their unique skill sets to the development of our revolutionary solid-state storage systems," Danilak said. "Frankie has an incredible track record in the NAND space and we welcome his extensive experience to our company."

Roohparvar is a member of the Board of Directors at Link_A_Media Devices, a leader in the designing and manufacturing of System-on-Chip solutions for peripheral data storage devices that include hard disk drives and solid-state devices. He also holds MBAs from Columbia Business School and the Walter A. Haas School of Business at the University of California, Berkeley. In addition, he holds an M.S. in Electrical Engineering from Santa Clara University on top of his BS in Computer Engineering from lowa State.

by Thane Himes

vittal receives award from ieee

ijay Vittal (PhD EE '82), former distinguished professor of electrical engineering at ECpE, has been named the 2013 recipient of the IEEE Herman Halperin Electric Transmission and Distribution Award.

Vittal's work includes a number of projects in several areas, including online dynamic security assessment, the application of a new analytical methods to analyze power system



Vijay Vittal

stability (including the method of normal forms), riskbased security assessment, the application of robust control methods to design more effective controls, and the development of a new approach to perform controlled islanding, to name a few.

"The process of coming up with solutions involved a combination of advanced analytical approaches combined with the development of efficient numerical tools," Vittal said.

The Herman Halperin Award is given to individuals or small teams for outstanding contributions to electric transmission and distribution. Award candidates are considered with an evaluation process that looks at technological importance, successful application, originality, leadership, publications, and the quality of the nomination.

"I am humbled by this recognition and acknowledge the contributions of all my past graduate students and colleagues who collaborated in the body of work that was recognized," Vittal said.

Vittal earned his Ph.D. in electrical engineering at Iowa State in 1982 and was brought on as an assistant professor shortly thereafter. Vittal remained at Iowa State for 23 years, attaining the title of Anson Marston Distinguished Professor in 2004, before accepting the Ira A. Fulton Chair Professorship in Electrical, Computer, and Energy Engineering at Arizona State in 2005. He is the Director of the Power Systems Engineering Research Center and a member of the National Academy of Engineering

Vittal's research at Iowa State began with an online dynamic security assessment project, a sustained effort supported by the Electric Power Research Institute (EPRI). The project involved the first demonstration of Vittal's analytical method at the control center of Northern States Power Co. (now known as Xcel Energy) in Minneapolis.

"I was very fortunate to have excellent mentors at ISU when I started my career," Vittal said. "Among them, Aziz Fouad, Tony Michel, and Grover Brown greatly influenced my approach to problems and in developing the ability to be persistent while tackling challenges."

by Thane Himes

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ecpe mourns loss of alum Richard Kohler (RK) Richards

ECpE lost one of its most treasured alums this summer. **Richard Kohler (RK) Richards** died Tuesday, June 26, 2012 at Mary Greeley Hospital. He was 90.

RK graduated from Iowa State with an electrical engineering degree in 1943 and, after serving in the army Signal Corps during World War II, obtained a PhD in theoretical physics from MIT in 1949. Richards worked at the IBM Central Research Facility from 1949-55 and was granted 28 different patents for his designs of vacuumtube-based business computers. He is the author of five books on computer design.

Richards served as principle

witness in the patent dispute that eventually recognized the Atanasoff-Berry computer as the first digital computer. Richards was honored with the College of Engineering's Professional Achievement Citation in Engineering (P.A.C.E.) Award in 2009 for his contributions to the mathematics of early digital computing and for bringing public recognition to the Atanasoff-Berry Computer.



RK Richards with Atanasoff-Berry Computer

Richards is survived by his wife, Virginia; his three children, Elizabeth (Joe Hardesty), of Albuquerque, N.M., Albert (Roxanne), of San Francisco, Calif., and Jane, of Boulder, Colo.; and five grandchildren, William, Lauren, Jonathan, Jay, and Jordan. He also is survived by his sister, Alberta Olson of Alliance, Neb.