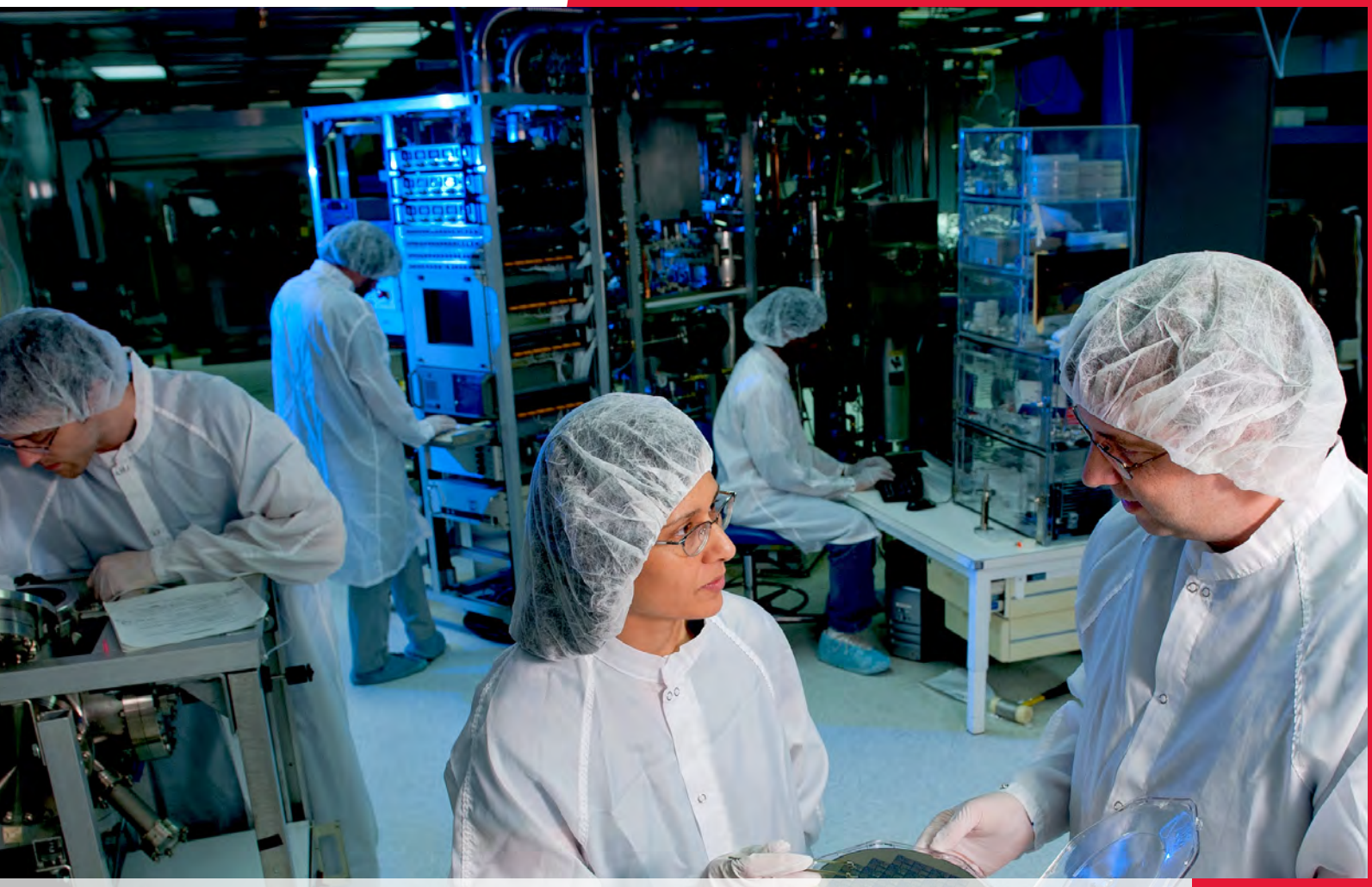
ECE NEWS *spotlight*

ELECTRICAL AND COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
NORTH CAROLINA STATE UNIVERSITY
FALL 2012



THE ASSIST CENTER

A new NSF Nanosystems Engineering Research Center led by ECE could transform health care

NC STATE UNIVERSITY

125 YEARS

IN THIS ISSUE

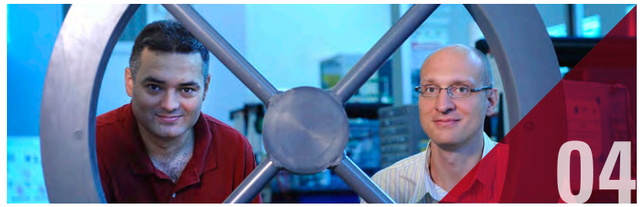
IN THE SPOTLIGHT

A GIFT TO POWER ENGINEERING
PAGE 12

ABB's $1.2 million power engineering initiative at NC State includes funds for new professorships and scholarships.

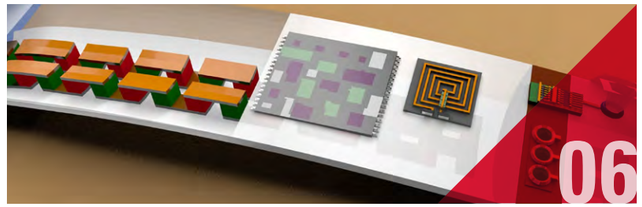
ABOUT THE COVER

Dr. Veena Misra, center left, director of the new NSF ASSIST Nanosystems Engineering Research Center led by NC State, discusses ASSIST research with Dr. John Muth, the center's deputy director. *See page 06 to learn how ASSIST could reshape health care.*



RESEARCH AND EDUCATION BRIEFS PAGE 04

Boosting computer processor performance, using neutrinos to send messages, and a first-of-its-kind master's program.



HEALTH ASSIST PAGE 06

A new NC State-led National Science Foundation Nanosystems Engineering Research Center could transform the way we think about health care.

PROJECTING ENERGY EFFICIENCY PAGE 08

New technology developed by NC State and ImagineOptix Corp. has resulted in smaller, lower cost and more efficient liquid-crystal projectors.

A MESSAGE FROM THE DEPARTMENT HEAD

Daniel Stancil

ELECTRICAL and computer engineering has traditionally been associated with technical topics spanning the space between the applied sciences and computer science. I believe one of the strengths of ECE has been that the boundaries of the discipline are blurred, and as a community we have embraced exciting new technologies and directions whether originating within our community or without.

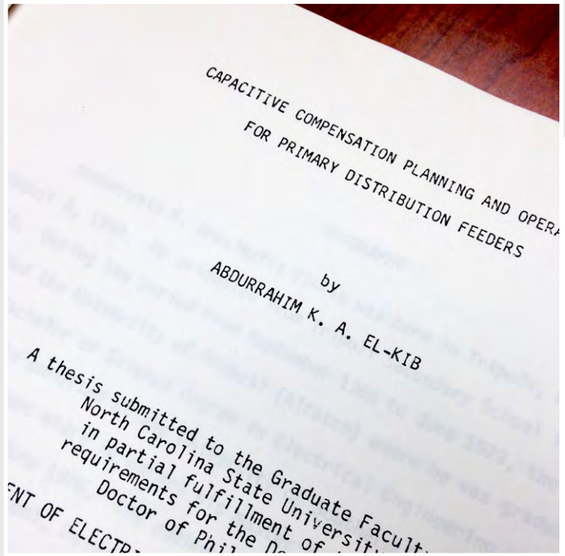
As we move forward, I believe our discipline will be defined less by a range of topics — however eclectic — and more by the way we bring a broad range of expertise to bear on critical problems facing our nation and the world. This is the vision that is shaping the strategic directions of the ECE Department at NC State.

Our first major move in this direction was the establishment of the NSF Engineering Research Center for Future Renewable Electric Energy Delivery and Management (FREEDM) Systems in 2008. Our collaborators in this center include Florida A&M, Florida State University, Missouri S&T, Arizona State University, RWTH Aachen, ETH Zurich and the University of Auckland. This center is rapidly becoming a global focal point for smart grid research.

With this newsletter we are pleased to announce a second major step toward this vision: the establishment of a second NSF Engineering Research Center — the Center for Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST). The goal of this center is to transform health informatics using nanotechnologies. Our domestic partner universities are Penn State University, the University of Virginia, and Florida International University, with contributing faculty from the University of Michigan and the University of North Carolina at Chapel Hill. International collaborators include the Tokyo Institute of Technology, the University of Adelaide, and the Korea Advanced Institute of Science and Technology.

With these two centers as catalysts, we look forward to working together with our collaborators and students on two of the major challenges of our time: energy and improved health care. We believe ECE is critical to both.

Daniel Stancil
Alcoa Distinguished Professor
ECE Department Head


CAPACITIVE COMPENSATION PLANNING AND OPERA
FOR PRIMARY DISTRIBUTION FEEDERS

by

ABDURRAHIM K. A. EL-KIB

A thesis submitted to the Graduate Faculty
North Carolina State University
in partial fulfillment of the
requirements for the De
NT OF ELECTR
Doctor of Phil

Abdurrahim El-Keib (right) received his doctorate in electrical engineering at NC State before going on to become interim prime minister of Libya. A copy of his doctoral thesis is at left.

Once a model student, now leading Libya

Dr. John Grainger, professor emeritus of electrical engineering, was listening to the radio last fall when he heard the news: One of his former graduate students at NC State was the new interim prime minister of Libya.

Grainger has fond memories of Abdurrahim El-Keib, who earned a doctorate in electrical engineering from NC State in 1984 before going on to teach at the University of Alabama. He said El-Keib came to NC State with several other students from the Middle East after completing a master's degree at the University of Southern California.

Grainger said El-Keib was soft-spoken, refined and reverent, as well as a strong student.

"He was a very mature person," Grainger recalled. "He carried himself very well."

Grainger said that El-Keib, whom he knows as "Rahim," was a devout Muslim who was troubled about not being able to return to his home country because of the ruling regime. Grainger said El-Keib would meet family members in Morocco rather than risk returning to Libya, where he had earlier done his undergraduate studies at the University of Tripoli.

"He clearly felt a great loss at not being able to go home," Grainger said. "He was quite cautious about being in Libya and being caught by the regime."

In his doctoral thesis, a copy of which sits on a bookshelf in Grainger's office on Centennial Campus, El-Keib thanked his family for their support. He also thanked Grainger for his "encouragement, patience and enthusiasm."

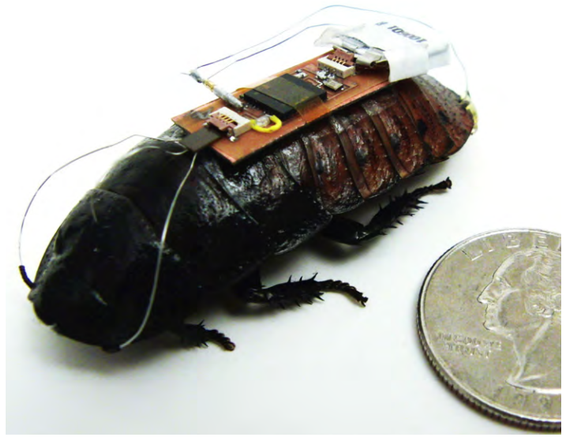
Grainger periodically ran into his former student at conferences after El-Keib became a professor at the University of Alabama. El-Keib would greet Grainger with warm and robust laughter.

"He has a strong sense of humor," Grainger said.

Grainger said he never discussed the situation in Libya with El-Keib, who was named the country's interim prime minister following Libya's liberation on Oct. 23, 2011, three days after the death of Muammar Qaddafi. But Grainger was encouraged that the Libyan leadership chose El-Keib as prime minister during the country's difficult transition.

"If a guy like him, as an outsider from politics or military things, if he was chosen for that job, then that's a wonderful, wonderful tribute to the Libyans who are now in charge," Grainger said. •

Controlling cockroaches



News organizations from all over the world — including *National Geographic, Scientific American*, CNN, Reuters and Discovery News — published stories when they learned that NC State had developed a technique that uses an electronic interface to remotely control, or steer, cockroaches.

"Our aim was to determine whether we could create a wireless biological interface with cockroaches, which are robust and able to infiltrate small spaces," said Alper Bozkurt, an assistant professor of electrical engineering and co-author of a paper on the work. "Ultimately, we think this will allow us to create a mobile web of smart sensors that uses cockroaches to collect and transmit information, such as finding survivors in a building that's been destroyed by an earthquake.

"We decided to use biobotic cockroaches in place of robots," Bozkurt said, "as designing robots at that scale is very challenging and cockroaches are experts at performing in such a hostile environment."

But you can't just put sensors on a cockroach. Researchers needed to find a cost-effective and electrically safe way to control the roaches, to ensure the roaches operate within defined parameters – such as a disaster site – and to steer the roaches to specific areas of interest.

The new technique developed by Bozkurt's team works by embedding a low-cost, light-weight, commercially-available chip with a wireless receiver and transmitter onto each roach (they used Madagascar hissing cockroaches). Weighing 0.7 grams, the cockroach backpack also contains a microcontroller that monitors the interface between the implanted electrodes and the tissue to avoid potential neural damage. The microcontroller is wired to the roach's antennae and cerci.

The cerci are sensory organs on the roach's abdomen, which are normally used to detect movement in the air that could indicate a predator is approaching – causing the roach to scurry away. But the researchers use the wires attached to the cerci to spur the roach into motion. The roach thinks something is sneaking up behind it and moves forward.

The wires attached to the antennae serve as electronic reins, injecting small charges into the roach's neural tissue. The charges trick the roach into thinking that the antennae are in contact with a physical barrier, which effectively steers them in the opposite direction.

In a recent experiment, the researchers were able to use the microcontroller to precisely steer the roaches along a line that curves in different directions. Video of the experiment can be seen at tinyurl.com/9t5tbqc.

A pair of California sixth-grade teachers wrote Bozkurt to say that their students had built prototypes of the biobots based upon a story about Bozkurt's work that ran in the *Los Angeles Times*.

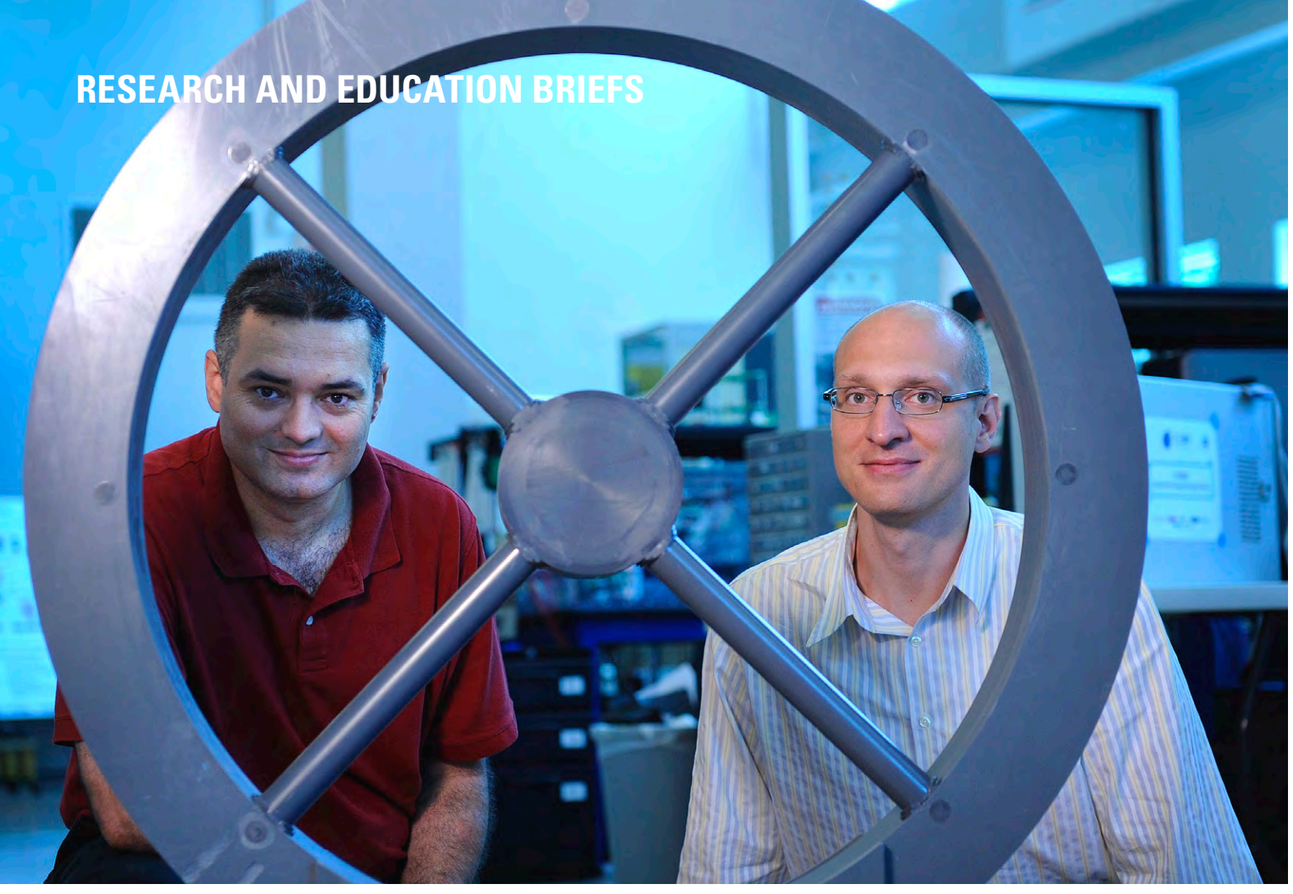
The paper, "Line Following Terrestrial Insect Biobots," was presented Aug. 28 at the 34th Annual International Conference of the IEEE Engineering in Medicine & Biology Society in San Diego, Calif. The paper was authored by Tahmid Latif, a PhD student at NC State, and co-authored by Bozkurt. Bozkurt has previously developed similar interfaces to steer moths, using implanted electronic backpacks. •

Creativity personified

Look no further than NC State for one of the South's most creative teachers. Dr. Michael Steer is just that, according to *Oxford American* magazine.

Steer, Lampe Professor of Electrical and Computer Engineering, "used his expertise in electrical engineering to develop a method of detecting the cell-phone triggers used to detonate roadside bombs," the magazine said. The work has saved hundreds of soldiers' lives in Iraq and Afghanistan.

Steer's efforts also earned him the US Army Commander's Award for Public Service in 2010. •



Dr. Srdjan Lukic (right) and PhD student Zeljko Pantic have developed a new way to fine-tune WPT receivers, work that holds promise for charging electric vehicles and other technologies.

Tuning up for wireless power transfer

Dr. Srdjan Lukic and PhD student Zeljko Pantic have developed a new way to fine-tune wireless power transfer (WPT) receivers, making the systems more efficient and functional. WPT systems hold promise for charging electric vehicles, electronic devices and other technologies.

Researchers have shown that it is possible to transmit power wirelessly by using magnetic resonance; however, even minor changes in how the transmitter or receiver is tuned can result in faulty power transmission.

A new prototype developed at NC State addresses the problem by automatically and precisely re-tuning the receivers in WPT systems. Pantic and Lukic, assistant professor of electrical and computer engineering, focused on receivers because methods already exist for precisely tuning the transmitters.

WPT systems work by transmitting magnetic waves on a specific frequency from a transmitter to a receiver. These magnetic waves interact with a coil in the receiver to induce an electric current. If the coil is tuned so that its resonant frequency matches the frequency of the magnetic waves, the current it produces is amplified.

However, if the receiver and the transmitter are out of tune, the system becomes inefficient and doesn't transfer a significant amount of power.

The researchers developed a prototype incorporating additional circuitry into the receiver that injects small amounts of reactive power into the receiver coil as needed to maintain its original resonant frequency. Also, if the transmitter's tuning changes, the prototype can read the trace amount of current being transmitted and adjust the receiver's tuning accordingly.

The next step is to try to incorporate the work into technology that can be used to wirelessly charge electric vehicles. The research was supported by the Advanced Transportation Energy Center at NC State. •

Boosting processor performance by more than 20 percent

Researchers from NC State have developed a new technique that allows graphics processing units (GPUs) and central processing units (CPUs) on a single chip to collaborate, boosting processor performance by an average of more than 20 percent.

"Chip manufacturers are now creating processors that have a 'fused architecture,' meaning that they include CPUs and GPUs on a single chip," said Dr. Huiyang Zhou, an associate professor of electrical and computer engineering who co-authored a paper on the work. "This approach decreases manufacturing costs and makes computers more energy efficient.

"However, the CPU cores and GPU cores still work almost exclusively on separate functions. They rarely collaborate to execute any given program, so they aren't as efficient as they could be."

GPUs were initially designed to execute graphics programs, and they are capable of executing many individual functions very quickly. CPUs, or the "brains" of a computer, have less computational power but are better able to perform more complex tasks.

"Our approach is to allow the GPU cores to execute computational functions, and have CPU cores pre-fetch the data the GPUs will need from off-chip main memory," Zhou said.

In preliminary testing, Zhou's team found that its new approach improved fused processor performance by an average of 21.4 percent. This approach has not been possible in the past, Zhou said, because CPUs and GPUs were located on separate chips.

The paper was co-authored by NC State PhD students Yi Yang and Ping Xiang and by Mike Mantor of Advanced Micro Devices (AMD). The National Science Foundation and AMD funded the research. •

Messaging with neutrinos

A group of researchers led in part by Dr. Dan Stancil, professor and head of the Department, and Dr. Brian Hughes, professor and associate department head, have for the first time sent a message using a beam of neutrinos, nearly massless particles that can penetrate almost everything and travel at almost the speed of light. The message was sent through 240 meters of stone and simply said "neutrino."

"Using neutrinos, it would be possible to communicate between any two points on Earth without using satellites or cables," said Stancil, lead author of a paper describing the research. "Neutrino communication systems would be much more complicated than today's systems, but may have important strategic uses."

Today, most communication is carried out by sending and receiving electromagnetic waves, but these waves don't pass easily through most types of matter. Because of their neutral electric charge and almost non-existent mass, neutrinos are not subject to electric or magnetic attractions and are not significantly affected by gravity, so they are virtually free of impediments to their motion.

The team of researchers performed their test at the Fermi National Accelerator Lab (Fermilab) outside of Chicago. At Fermilab the researchers had access to one of the world's most powerful particle accelerators and a multi-ton detector called MINERvA located 100 meters underground.

The researchers sent the message in binary code. After the neutrinos were detected, a computer on the other end translated the binary code back into English, and the word "neutrino" was successfully received. •

New degree in electric power systems engineering

A new graduate program is giving full-time students and working professionals the chance to earn a master's degree the white-hot field of electric power systems engineering.

Starting last year, students began taking courses toward a professional science master's degree in electric power systems engineering. The program — the first of its kind in the nation — was established thanks to a $3.4 million US Department of Energy grant to the Department. And it was bolstered by a gift from Siemens that established a term professorship and two graduate fellowships for students enrolled in the program.

Professional skills, interdisciplinary learning and industry exposure are the key features behind the program, which exposes students to real-world issues related to smart grid, solar and wind generation, and energy storage technologies. The NSF FREEDM Systems Center, an international smart grid center headquartered at NC State, provides lab space to students working on the capstone power systems project undertaken during the second semester of the one-calendar-year program. •

Dr. Veena Misra, center, director of the new NSF ASSIST Nanosystems Engineering Research Center led by NC State, discusses ASSIST research with Dr. John Muth, the center's deputy director.

Health ASSIST

A new NC State-led National Science Foundation Nanosystems Engineering Research Center could transform the way we think about health care.

RESEARCHERS in the Department are leading a new national nanotechnology research effort to create self-powered devices that help people monitor their health and understand how the surrounding environment affects it.

The NSF Nanosystems Engineering Research Center for Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST), headquartered on NC State's Centennial Campus, is a joint effort between NC State and partner institutions Florida International University, Pennsylvania State University and the University of Virginia. The center, announced in September and funded by an initial five-year $18.5 million grant from NSF, also includes five affiliated universities and about 30 industry partners in its global research consortium.

With the addition of ASSIST, NC State is the only university in the country currently leading two active NSF Engineering Research Centers (ERC), among the largest and most prestigious grants made by the engineering directorate of the federal agency. The FREEDM Systems Center, a smart grid ERC formed in 2008, is also headquartered at NC State.

ASSIST researchers are using the tiniest of materials to develop self-powered health monitoring sensors and devices. These devices could be worn on the chest like a patch, on the wrist like a watch, as a cap that fits over a tooth, or in other ways, depending on the biological system being monitored.

Wireless health monitoring is already a fast-growing industry, but the self-powered technology being developed by ASSIST means that changing and recharging batteries on current devices could soon be a thing of the past. By using nanomaterials and nanostructures - a nanowire is thousands of times thinner than a human hair - and thermoelectric and piezoelectric materials that use body heat and motion, respectively, as power sources, ASSIST researchers want to make devices that operate on the smallest amounts of energy.

"Currently there are many devices out there that monitor health in different ways," said Dr. Veena Misra, the center's director and a professor in the Department. "What's unique about our technologies is the fact that they are powered by the human body, so they don't require battery charging."

These devices could transform health care by improving the way doctors, patients and researchers gather and interpret important health data. Armed with uninterrupted streams of heart rate readings, respiration rates and other health indicators, as well as personalized exposure data for environmental pollutants such as ozone and carbon monoxide, sick people could better manage chronic diseases, and healthy people could make even better decisions to keep themselves fit.

On a larger scale, data gleaned from research studies employing these devices could prove invaluable to lawmakers crafting environmental policy. And if people using the devices make better decisions about where and how healthfully they live, national health care costs, which topped $2.5 trillion in 2010, could come down.

The center's headquarters are housed in the Larry K. Monteith Engineering Research Center on NC State's Centennial Campus. There, ASSIST researchers will develop thermoelectric materials that harvest body heat and new nanosensors that gather health information from the body, such as heart rates, oxygen levels and respiration data. In addition, the researchers will find ways to package the technology in wearable devices.

The center's partner institutions will also play important research roles. At Penn State, researchers will create new piezoelectric materials and energy-efficient transistors. The team from the University of Virginia will develop ways to make the systems work on very small amounts of power, while the group from Florida International University will create sensors that gather biochemical signals from the body, such as stress levels.

The results of that work, coupled with low-power radios developed by the University of Michigan, will be used to process and transmit health data gathered by the sensors to computers and consumer devices, such as cell phones, so patients, doctors and researchers can easily digest it. The University of North Carolina at Chapel Hill will provide ASSIST with medical guidance and arrange testing of the center's technology.

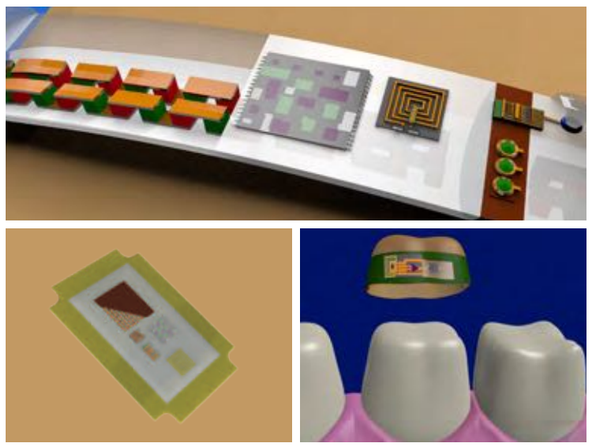
ASSIST also has foreign partnerships with the University of Adelaide, the Korea Advanced Institute of Science and Technology and the Tokyo Institute of Technology.

ASSIST will also draw on the expertise of industry partners to help guide the center's work to the marketplace. These partners include companies and agencies involved in nanomaterials, nanodevices, integrated chip manufacturing, software development, bioengineering and health care.

The center will feature a nanotechnology education program, including an undergraduate concentration and a graduate master's certificate, as well as a personalized professional-development program for graduate students.

The center will also partner with 11 middle and high schools in North Carolina, Virginia, Florida and Pennsylvania to develop outreach activities that bring nanosystems engineering into K-12 classrooms. Students in partner high schools will have the chance to be involved in ASSIST research.

The five-year NSF grant for ASSIST is renewable for an additional five years and follows a two-year selection process by the federal agency. The grant is among a new group of Engineering Research Center awards that invest in nanosystems. •



Devices developed at ASSIST could be worn on the wrist like a watch, on the chest like a patch, or as a cap that fits over a tooth.

PROJECTING ENERGY EFFICIENCY

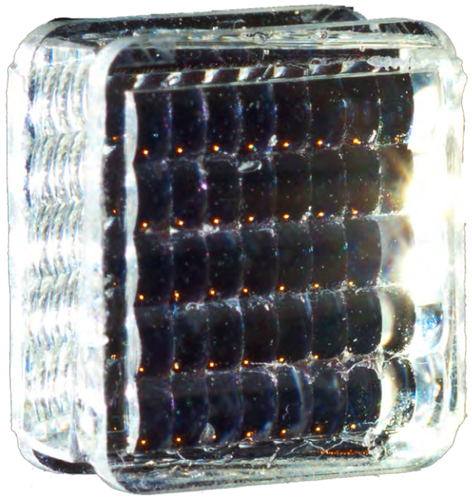
New technology developed at NC State has resulted in smaller, lower cost and more efficient liquid-crystal projectors.

RESEARCHERS from NC State and ImagineOptix Corporation have developed new technology to convert unpolarized light into polarized light, which makes projectors that use liquid crystal (LC) technology almost twice as energy efficient. The new technology has resulted in smaller, lower cost and more efficient projectors, meaning longer battery life and significantly lower levels of heat.

All LC projectors – used from classrooms to conference rooms – utilize polarized light. But efficient light sources – such as light-emitting diodes, or LEDs – produce unpolarized light. As a result, the light generated by LEDs has to be converted into polarized light before it can be used.

The most common method of polarizing light involves passing the unpolarized light through a polarizing filter. But this process wastes more than 50 percent of the originally generated light, with the bulk of the "lost" light being turned into heat – which is a major reason that projectors get hot and have noisy cooling fans.

But the new technology developed at NC State allows approximately 90 percent of the unpolarized light to be polarized and, therefore, used by the projector.



The researchers used a polarization grating-polarization conversion system (above), to create a small picoprojector (right) that could be embedded in a smartphone, tablet or other device.

The ImagineOptix-sponsored research team was also able to use the technology to create a small "picoprojector," which could be embedded in a smartphone, tablet or other device.

"This technology, which we call a polarization grating-polarization conversion system (PGPCS), will significantly improve the energy efficiency of LC projectors," said Dr. Michael Escuti, co-author of a paper describing the research and an associate professor in the Department. "The commercial implications are broad reaching. Projectors that rely on batteries will be able to run for almost twice as long. And LC projectors of all kinds can be made twice as bright but use the same amount of power that they do now. However, we can't promise that this will make classes and meetings twice as exciting."

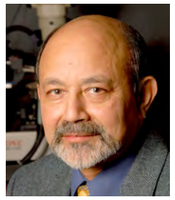
Because only approximately 10 percent of the unpolarized light is converted into heat – as opposed to the more than 50 percent light loss that stems from using conventional polarization filters – the new technology will also reduce the need for loud cooling fans and enable more compact designs.

The technology is a small single-unit assembly composed of four immobile parts. A beam of unpolarized light first passes through an array of lenses, which focus the light into a grid of spots. The light then passes through a polarization grating, which consists of a thin layer of liquid crystal material on a glass plate. The polarization grating separates the spots of light into pairs, which have opposite polarizations. The light then passes through a louvered wave plate, which is a collection of clear, patterned plates that gives the beams of light the same polarization. Finally, a second array of lenses focuses the spots of light back into a single, uniform beam of light.

The paper, "Efficient and monolithic polarization conversion system based on a polarization grating," was published July 10 in *Applied Optics*. The paper was co-authored by Drs. Jihwan Kim and Ravi Komanduri, postdoctoral researchers at NC State; Kristopher Lawler, a research associate at NC State; Jason Kekas, of ImagineOptix Corp.; and Escuti.

The research was funded by ImagineOptix, a start-up company co-founded by Escuti and Kekas. •

AWARDS & HONORS



› Dr. B. Jayant Baliga, Distinguished University Professor in the Department and founding director of the Power Semiconductor Research Center at NC State, has been selected to receive the **2012 North Carolina Award for Science**, part of a group of awards that represent the state's highest civilian honors.

The awards, administered by the North Carolina Department of Cultural Resources, recognize significant contributions to the state and nation in the fields of fine arts, literature, public service and science.

Baliga was also recognized by *India Today* as one of the top 35 thinkers produced by India since 1975. The feature was published in December 2011 in a special 35th anniversary issue of the magazine.

Baliga is internationally recognized for his groundbreaking work in electronics engineering. He invented, developed and commercialized the Insulated Gate Bipolar Transistor (IGBT), an energy-saving semiconductor switch that controls the flow of power from an electrical energy source to any application that needs energy. IGBT-enabled applications have saved the world's consumers more than $15 trillion and now help form the basis for the emerging smart grid.

The IGBT's widespread impact earned Baliga the 2010 National Medal of Technology and Innovation, the nation's highest honor for technological achievement.

› Dr. Michael Escuti was one of 78 of the nation's brightest young engineers selected to take part in the **National Academy of Engineering's (NAE) 18th annual US Frontiers of Engineering Symposium** in September.

Engineers ages 30 to 45 who are performing exceptional engineering research and technical work in a variety of disciplines came together for the event. NAE hosts the conference to help spur US innovation.

Escuti, associate professor in the Department, has earned international attention for his pioneering development of liquid crystal "polarization gratings," which consist of a thin layer of liquid crystal on a glass plate. While these look similar on the outside to the LCDs in smart phones and big-screen TVs, the hologram inside enables ultra-efficient handling of light.

› Drs. Michael Devetsikiotis, Alexandra Duel-Hallen, and Veena Misra have all been named **IEEE Fellows**.

The IEEE Grade of Fellow is conferred by the IEEE Board of Directors upon a person with an outstanding record of accomplishments in any of the IEEE fields of interest. The honor is the highest grade of IEEE membership and is recognized by the technical community as a prestigious honor and an important career achievement. The Department now has 20 IEEE Fellows.

Devetsikiotis was honored for contributions to rare-event modeling of communication networks.

Duel-Hallen was recognized for her contributions to equalization and wireless communications.

Misra received the honor for her contributions to metal electrodes and high-K dielectrics for CMOS applications.

› Drs. Greg Byrd and Keith Townsend were recently honored with significant teaching awards by the College of Engineering and NC State.

Byrd, professor in the Department, was given the **Outstanding Teacher Award** by the College of Engineering for demonstrating excellence in teaching. His research focuses on high-performance parallel systems and servers as well as computer architecture and networking.

Townsend, also a professor in the Department, was awarded the **NC State Alumni Distinguished Undergraduate Professor Award**, one of the most sought-after awards for undergraduate professors at the university. His research is in digital and wireless communication.

› Megan Leigh Matthews, a master's student in the Department, has been awarded the **Initiative for Maximizing Student Diversity (IMSD) Doctoral Research Assistantship**.

The IMSD program is an initiative at NC State that seeks to increase in a meaningful way the number of students from underrepresented groups receiving doctoral degrees and entering into the professoriate in bio-related disciplines.

› Electrical engineering PhD students Adam Wilkerson and Scott Clouse have received **Department of Defense Science, Mathematics And Research for Transformation (SMART) Scholarships**.

The SMART Scholarship for Service Program was established to support students pursuing degrees in science, technology, engineering and mathematics (STEM) disciplines.

The program aims to increase the number of civilian scientists and engineers working at DoD laboratories.

Scholarship winners are awarded full tuition, a stipend and other benefits.

› Open Hardware Makerspace, a student group in the College of Engineering, was honored with a **2012 Deborah S. Moore Service Award** for demonstrating exemplary service and outstanding volunteerism as the university's emerging non-service student organization of the year.

Among the officers of the group are Luther Blackwood and Christopher Freeze, two students from the ECE department.

› NC State's Beta Eta Chapter of the Eta Kappa Nu (HKN) ECE Honor Society won the **Outstanding Chapter Award** that recognizes excellence for its activities. Fewer than 25 of the 179 existing HKN chapters were chosen to receive the award.

BEST PAPER AWARDS

› PhD student **Xi Chen** received the Best Student Paper Award at the IEEE International Conference on Electrical Performance of Electronic Packaging and Systems (EPEPS) 2011.

The paper, "Adaptive Clock Distribution for 3D Integrated Circuits," co-authored by Chen, Dr. Rhett Davis, associate professor in the Department, and Dr. Paul Franzon, professor in the Department, presents new techniques to realize highly adaptive and reliable clock distribution with good variation tolerance for 3D ICs.

› **Dr. Huiyang Zhou** and his students were honored with a best paper award in the architecture track for "Locality Principle Revisited: A Probability-Based Quantitative Approach" at the 2012 IEEE International Parallel and Distributed Processing Symposium (IPDPS), an international forum for engineers and scientists from around the world to present their latest research findings in all aspects of parallel computation.

Zhou is an associate professor in the Department.

› A paper authored by **Dr. Brian Floyd**, associate professor in the Department, received one of the Pat Goldberg Best Paper Awards for 2011 by IBM Research.

"Organic Packages with Embedded Phased-Array Antennas for 60-GHz Wireless Chipsets" was among more than 110 papers in computer science, electrical engineering, and mathematical sciences published in refereed conference proceedings and journals in 2011 and submitted by IBM Research authors worldwide.

› Former ECE student **Sheng Yi** won the 2011 SPS Young Author Best Paper award from the International Conference on Acoustics, Speech, and Signal Processing (ICASSP). Yi recently graduated from NC State and now works at GE Research.

Yi's paper was entitled, "A Shearlet Approach to Edge Analysis and Detection." The award was presented in March at the ICASSP 2012 conference in Kyoto, Japan.

The ICASSP meeting is the world's largest and most comprehensive technical conference focused on signal processing and its applications. •

ABB gift creates $1.2 million power engineering initiative

ABB's North American headquarters has made a gift to the Department to support power engineering research and education at NC State.

The $1.2 million initiative, which includes a $632,000 commitment over five years from ABB plus state and private matching grants, aims to strengthen the organizations' cooperative research in electric power technologies and aid ABB's recruiting of top engineering professionals.

ABB executives Enrique Santacana, right, and Anders Sjoelin have continued to build the company's relationship with NC State.

"One of our biggest challenges is finding skilled engineers who are well-trained in the technical principles of this dynamic field," said Enrique Santacana, president and CEO of ABB Inc. and region manager of ABB in North America. "Not only will this initiative establish a pipeline of talented people for ABB, it combines NC State's top academic thinking and our practical business know-how for advancing this exciting and rapidly changing industry."

The gift has established an endowed professorship, a term professorship, annual scholarships, and a lecture series, all focused on power engineering, a field that deals with the generation, transmission and distribution of electric power as well as the electrical devices connected to those systems. ABB, a global power and automation technology group, is one of the world's largest power grid suppliers.

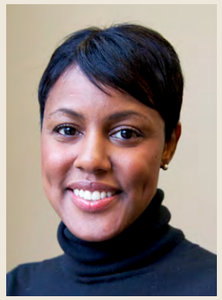
The ABB Distinguished Professorship in Electrical Engineering was designed to enable the College to retain or recruit a top power engineering faculty member and support groundbreaking research in the field. The professorship was awarded to Dr. Iqbal Husain, who came to NC State after serving as a faculty member at the University of Akron for 17 years.

The gift also established an ABB Term Professorship that was awarded to Dr. Subhashish Bhattacharya. He helped develop the FREEDM Systems Center's solid-state transformer that was named to MIT *Technology Review*'s 2011 list of the world's 10 most important emerging technologies.

The ABB Power Engineering Scholarship program created by the gift offers five awards annually to students taking power engineering classes. The $6,000 scholarships are roughly equal to in-state tuition and fees at NC State and will help attract talented students to the field.

The lecture series will feature prominent experts on topics related to recent developments in power technology and the smart grid. •

Martin joins ECE as development director



Tasha Martin is the new director of development for the Departments of Electrical and Computer Engineering and Mechanical and Aerospace Engineering. She works out of the NC State Engineering Foundation, which engages with alumni, friends and corporate partners to secure private financial support for NC State engineering students, faculty and programs.

Martin comes to NC State from the University of Florida, where she served as director of development for the Department of Industrial and Systems Engineering. In that role, she was responsible for major gift fundraising efforts and program development for the department. She also oversaw the department's student ambassador program and student giving campaign. Martin previously worked at the University of Central Florida (UCF) where she was assistant director of development. She graduated with a bachelor's degree from UCF in 1998. •

1,000 copies of this document were printed at a cost of $2,880.

Dean named Distinguished Engineering Alumnus

William H. Dean

An ECE department graduate was named an NC State Distinguished Engineering Alumnus in January by the College of Engineering.

William H. Dean, president and CEO of M.C. Dean, Inc., received his bachelor's degree in electrical engineering from NC State in 1988. The other winners for 2011 were computer science alumnus Marshall D. Brain, founder of HowStuffWorks.com; and mechanical engineering alumnus Robert R. Womack, former chairman and CEO of Zurn Industries, LLC.

The award honors alumni whose accomplishments further their field and reflect favorably on the university.

Since 1997, Dean has been president and CEO of M.C. Dean, Inc., a company founded in 1949 by his grandfather, Marion Caleb Dean. The firm has become a diversified leader in power engineering, applied electronics, information technology, controls systems, software, and systems integration for complex, mission-critical organizations.

Dean also created the M.C. Dean Foundation, which supports nonprofit organizations in their efforts to improve the communities they serve.

Dean and his company have been great allies of the College of Engineering. M.C. Dean is an active recruiter of NC State engineering graduates, a consistent participant in the NC State Engineering Career Fair and an industry member of the NSF FREEDM Systems Center.

Dean is also a member of the Dean's Circle and the NC State Engineering Foundation Board of Directors. He delivered the 2009 winter commencement address for the graduates of the Department. •

North Carolina State University
Department of Electrical and Computer Engineering
Campus Box 7911
Raleigh, NC 27695-7911

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Through generous alumni, corporate partners and friends, the Department has been able to create new education opportunities, develop new research and technologies and attract the brightest faculty and students.

To learn more about supporting the Department, contact the NC State Engineering Foundation.

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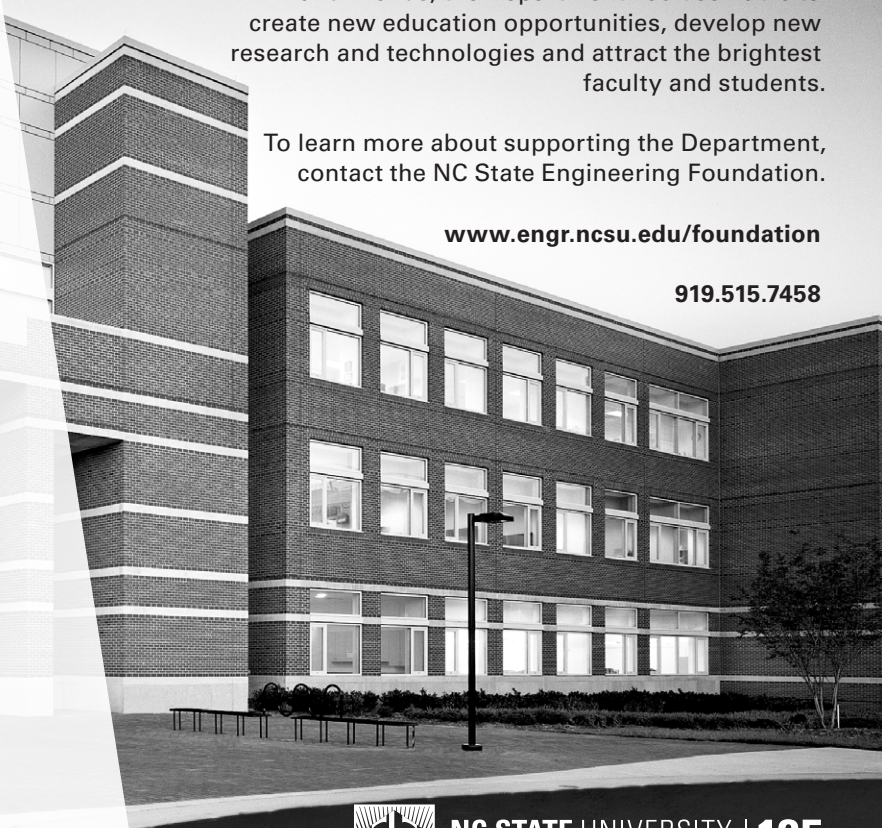

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