Inquiry, Discovery in Engineering and Science

College of Engineering and Science

Fall 2011

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Above: Generated from physics professor Emil Alexov's research on a molecular handshake known as electrostatic force, this image illustrates the potential distribution in a system made of a dielectric plate, a protein and a tip of an atomic force microscope.

On the cover: Students traveled abroad with professor Delphine Dean for a hands-on experience to put what they've learned into action and to see how their work will impact others around the world.
From the Dean

The 2011-12 academic year marks the beginning of an exciting journey for our University and college. The Clemson 2020 Road Map is a 10-year strategic plan that calls for investments in faculty hires, student engagement, upgraded facilities and technology, and faculty and staff compensation. Fulfilling Clemson’s responsibility to students and South Carolina means

• generating talent for the new economy by recruiting and retaining outstanding students and faculty,
• providing an exceptional educational experience grounded in engagement,
• driving innovation — through research and service — that stimulates economic growth and solves problems,
• serving the public good by focusing on emphasis areas that address some of the great challenges of the 21st century — national priorities such as health, energy, transportation and sustainable environment.

The College of Engineering and Science (CES) is in a unique position to contribute to this plan. We like to think of ourselves as the “driving force” of Clemson’s 2020 Road Map, and this edition of IDEaS explains why.

Our cover story speaks to two of the national priorities mentioned above — energy and sustainable environment.

The Clemson University Wind Turbine Drivetrain Test Facility (CU-DTF) is currently under construction and will make significant contributions to this evolving industry while providing a number of positive outcomes for the state and the nation.

This edition also describes our new master’s program in sustainable and resilient infrastructure. The new degree is an interdisciplinary program that blends civil engineering (including environmental issues), business, policy and architecture to provide a holistic perspective of the nation’s infrastructure throughout its life.

Our “Clemson Couple” feature relates to the work being done by a married faculty-pair working in a joint bioengineering program of Clemson University and the Medical University of South Carolina. These two are seeking ways to improve health and well-being through the development of novel biomedical materials and scaffolds, biomedical device design, fabrication and testing, drug delivery, cellular/tissue engineering and stem cell biology.

Yet another feature describes the molecular electrostatic work of one of our biophysicists whose research is sponsored by a five-year, $2.2 million grant from the National Institute of General Medical Sciences, a part of the National Institutes of Health.

We are indeed on an exciting journey, and I’m looking forward to the ride.

Sincerely,

Esin Gulari, Dean
College of Engineering and Science
Clemson University
Molecular Handshakes

By Tom Hallman

Considering your body right now are billions of molecules, all going about their business and interacting with one another to make you — well, your biological system — work right. Every now and then, one of those little interactions goes awry, and the resulting confusion can lead to big problems — including severe disease. To get to the bottom of it all, scientists first need to understand more about the way these molecules interact. One such way is a kind of molecular handshake known as electrostatic force.

*Electrostatics is the major force between molecules,* says Clemson biophysicist Emil Alexov, one of the scientists studying these interactions. *With that, you can understand how they function in the cell and how disease affects their functionality.*

Molecules naturally carry tiny electrical charges, and scientists have been testing the effects of these charges ever since physicist J.J. Thomson discovered the electron in his work on cathode rays in 1897.

Applying these rules to the molecules in your body is more dicey, mainly because there are so many charged particles at work — and they’re all moving targets.

*The living cell is a very complicated system comprised of biological macromolecules such as DNA, RNA and proteins,* Alexov says. *They constantly interact with each other to maintain the function of the cell, and the driving force is the electrostatics.*

*Each of these atoms has a charge, and they’re all in water — not a homogeneous medium — so you’re working with millions of atoms whose positions are not defined,* he says. *Because of that, accurate calculations of electrostatic fields and energies are crucial for successful modeling of virtually all biological processes and many other phenomena occurring in nanosystems and nanodevices.*

The software for Alexov’s project, called DelPhi, was developed specifically to handle the math of the Poisson–Boltzmann equation.
To determine how all these charged particles will behave requires some complicated math. Based on nearly century-old mathematical theories, the Poisson-Boltzmann equation — a differential equation that describes electrostatic interactions — serves as the basis for Alexov’s work. It allows scientists to calculate the corresponding energies for molecules and geometrical objects immersed in water or other solutions.

But to make that equation function on a scale necessary to study living organisms, where the stakes are high and the variables nearly infinite, you need a really big computer and some top-flight software.

Luckily for Alexov, the computer is right on campus and is known as Clemson’s Palmetto Cluster. It’s ranked among the top 100 supercomputers in the world, and Alexov’s research team is one of its largest users.

The software for his project, called DelPhi, was developed specifically to handle the math of the Poisson-Boltzmann equation. Alexov served for five years as senior researcher in the lab of its creator, Barry Honig of Columbia University. At Clemson, part of Alexov’s work is to improve the software’s speed and accuracy, continuously adapting the program so that scientists around the world may apply it to the rapidly changing array of computational biophysics and bioinformatics.

“DelPhi is highly specialized, but in this field of research, he says, ‘It’s the only way to get the job done.’

“You couldn’t achieve this with laboratory experiments,” Alexov says. “If you had to do this experimentally in a lab, it would cost you a billion dollars. Modeling is much faster, much cheaper.”

It has other benefits as well.

“With proper mathematical modeling, studies can be performed on a large number of cases so it will have more validity,” according to Alexov. “In an experiment, the results are specific to the case you are making, but we can apply this model to numerous cases to provide more reliable data.”

An indication of the importance that scientists put on his work is the support Alexov has garnered. His research is sponsored by a five-year, $2.2 million grant from the National Institute of General Medical Sciences.

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As the same time, they work closely with scientists engaged in laboratory experiments so they may better understand the molecular mechanisms of biological systems. Portions of Alexov’s work are devoted to estimating pKa values of amino acids, which play an important role in defining the characteristics of proteins, and probing disease-causing and mismatch mutations, which can keep proteins from functioning.

“Modeling is a very efficient and fast approach to deliver important biological information,” Alexov says. “Computers can calculate the electronics of atoms and the corresponding energies and carry detailed analyses of the structure-function relationships in a relatively short period of time. As this ability develops, it will help us shorten the time for developing new treatments for human diseases.”

Ultimately Alexov’s team, which includes several Clemson graduate and undergraduate students, will develop new capabilities in the DelPhi software to allow scientists to study areas previously inaccessible to them.
This cross-disciplinary approach to learning gives SMP students the chance to experience different specialty fields of study.
THERE’S a lucrative breeze blowing over South Carolina.

With some of the most powerful offshore gusts in the United States, South Carolina is becoming a top resource for wind-produced electric power.

According to the U.S. Department of Energy (DOE), wind power is poised to become a major contributor to America’s electricity supply within the next 20 years. To make sure the concept comes to fruition, President Obama issued a challenge to derive at least 20 percent of the nation’s energy from wind power by 2030. The Sustainable and Resilient Infrastructure Thesis Research Projects

- Pavements and Urban Heat Island Effect
  David Duncan
- Robust Structural Health Monitoring
  Sarah Sudan
- Liquefaction Hazard Mapping and Planning
  Lawrence Sonneveld
- Pile Foundation Centrifuge Testing
  Brian Machmer
- Bridge Collapse Risk Analysis
  Caitlyn Davis-McClain
- Levee Scour Protection
  Earnest Johnson
- Greywater Treatment Options
  David Christopher
- Net-Zero Energy Buildings
  Mt. Vernon
- Concrete with Industrial By-Products
  David Lowe

infrastructure throughout its life — from the planning stages, design and construction, through operation, maintenance and rehabilitation,” says Ron Andrus, an associate professor of civil engineering and principal investigator on the project. This cross-disciplinary approach to learning gives SMP students the chance to experience different specialty fields of study. Nadim M. Aziz, professor and chair of civil engineering and director of the resilient infrastructure focus area of Clemson’s Restoration Institute, believes this freedom and the opportunity to rub shoulders with industry professionals are the key differentiators for the program’s advantage. “They’re interacting with their industry role models while we’re filling a niche for students seeking a broader perspective.”

According to assistant professor Leidy Klotz, this innovative program is also transforming Clemson University for the better. “With sustainability and resilience at the core of this program, we’re putting Clemson on the national radar of prospective graduate students,” he says. Graduates of the program will be well-prepared leaders and true renaissance thinkers who are ready to help the nation pull up the grade on its infrastructure and beyond.

One of the NSF SMP fellows, Earnest Johnson (pictured at left), spent a portion of his spring and summer working as an intern with the U.S. Army Corps of Engineers (USACE) in Vicksburg, Miss. With the historic spring flooding on the Mississippi River, the timing of Johnson’s internship proved to be serendipitous — he had the opportunity to inspect levees just when their capacities were mightily tested.

Johnson spent considerable time with Don Ward, a USACE engineer who works on levees and coastal protection services. He also spent some time at the USACE Coastal and Hydraulics Lab (CHL), where he conducted research involving longshore and multigrain sediment transport.

“This experience has been invaluable,” observes Johnson. “It’s like reading about Santa Claus as a kid, and then one day you actually intern in the North Pole and see how it all happens in person. I was able to see how what I’m studying applies to real-life situations.”

Left: Clemson graduate student Earnest Johnson (from left) and intern Thuy Thi Vu inspect a Vicksburg levee with CHL scientists David King, Susan Morang, Irene Watts and Andrew Morang.

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Windfall

With some of the most powerful offshore gusts in the United States, South Carolina is becoming a top resource for wind-produced electric power.

According to the U.S. Department of Energy (DOE), wind power is poised to become a major contributor to America’s electricity supply within the next 20 years. And to make sure the concept comes to fruition, President Obama issued a challenge to derive at least 20 percent of the nation’s energy from wind power by 2030.
Recognizing the Palmetto State’s central location, a uniquely talented research presence and a highly skilled workforce, the DOE has granted funding for a state-of-the-art wind turbine testing facility in Charleston. Spearheaded by the Clemson University Restoration Institute with major leadership provided by principal investigator Imtiaz Haque, the Clemson University Wind Turbine Drivetrain Test Facility (CU-DTF) is specifically being established to initiate and nurture the clean energy effort for South Carolina.

Haque, who is chair of Clemson’s automotive engineering department, describes the impact of this facility on the surrounding region. “As the wind-energy market evolves along the East Coast, South Carolina provides the geography and environment to serve as a hub for the wind-energy manufacturing cluster in the Southeast.” CU-DTF takes Clemson’s strengths of research and education and combines them with the University’s belief in maintaining long-term partnerships with industry leaders.

The Charleston facility will use Highly Accelerated Life Testing methodology to test the reliability and limits of the drivetrains intended for use with wind turbines using two test rigs. One for 15 MW turbines and the other for 7.5 MW turbines, the rigs are used to simulate the environment and actual forces that the wind-turbine drivetrain would encounter in the field. Knowing how the drivetrains will perform in various weather conditions is essential because they are the mechanisms that convert the rotation of the turbine blades into electrical energy.

Haque believes the research information provided by these tests is vital for developing windтурbine technology. He explains, “Our objective is to accelerate the development of advanced drivetrains by gaining a more in-depth understanding of gearbox/generator assemblies. The data gathered from these tests will generate new knowledge and lead to improved design for a more efficient and durable wind turbine.”

Testing in a controlled environment — like that of CU-DTF — instead of outdoors on an actual wind turbine offers numerous advantages and will ultimately reduce wind turbine costs and increase the quality of manufactured units and foster the ubiquity of wind turbines in the global marketplace.

The facility is designed to be international in scope, accommodating drivetrains from anywhere in the world. CU-DTF will also boast the distinction of being the world’s only facility equipped to test the large drivetrains of the most recent and cutting-edge wind turbines. Haque says, “The CU-DTF design is especially unique in that it will be able to test large-scale wind turbine drivetrains up to 15 MW. No comparable facility exists.”

Located at the former U.S. Naval Complex in North Charleston, CU-DTF has access to a unique industrial and academic environment due to its proximity to a deepwater port, railway infrastructure and interstates.

CU-DTF represents a $45 million investment from the DOE and $53 million of matching funds from partners including the Charleston Naval Complex Redevelopment Authority, the S.C. Department of Commerce, the state of South Carolina, the city of North Charleston, the Savannah River National Laboratory, Fluor Corp., S.C. Electric and Gas Co., EcoEnergy and other private donors.

In addition to advancing wind turbine technology, the facility will also bring direct economic benefits to South Carolina. It is expected to generate more than 800 jobs and stimulate economic activity in the surrounding area. The DOE estimates that South Carolina could gain 10,000 to 20,000 new jobs related to the wind power industry over the next 20 years.

Haque states, “It’s difficult to overstate what this facility represents for South Carolina. From an economic development standpoint, the testing facility will bring benefits statewide.” He continues, “Clemson, together with the industry that will grow around the testing facility, will drive wind energy research nationally.”

CU-DTF takes Clemson’s strengths of research and education and combines them with the University’s belief in maintaining long-term partnerships with industry leaders.
Hand-in-Hand

By Greg Wilson

T

here is a long history of chemistry between two

of the nation’s top research bioengineers at

Clemson University.

Xuejun Wen, Hansjörg Wyss Endowed

Chair and a professor in the Clemson-MUSC

bioengineering program, and his wife, Ning Zhang,

associate professor of bioengineering at Clemson, share

a lifelong love of research that began for each in their

middle school chemistry labs.

“Science was my role model,” says Wen, who is a
/native of China. “I found in middle school that I liked

mixing things up in the chemistry lab, making new stuff.

Making polymers — as I do today — is quite similar to

what I did then.”

Zhang, the 2011 recipient of a National Science

Foundation (NSF) CAREER award, found her path to

the chemistry lab was more direct — both of her parents

were university chemistry professors.

“I was raised labs and got interested in mixing

things together to produce new things,” Zhang says. “I

know even then, when I was young, that I wanted to

become a researcher.”

Today, the couple works together in Charleston

through a joint bioengineering program between

Clemson University and the Medical University of South

Carolina. Their research focuses on a wide variety of

novel biomedical materials and scaffolds, biomedical

device design, fabrication and testing, drug delivery,
cellular/tissue engineering, stem cell biology and

regenerative medicine.

Wen says the ultimate goal of his research is

developing new strategies for organ repair and tissue

regeneration — in addition to enhancing the principles

and techniques of regenerative medicine — all with

the goals of easing suffering and enhancing human health.

A medical doctor, Wen sees finding ways to ease pain

and suffering is the greatest reward of his research.

“I have several technologies that have already been

tested in animals for the treatment of Parkinson’s and

spinal cord injuries, which could eventually help many

people,” Wen says. “I love basic science, but by the time I

retire, I want to be a physician who has used some of the

technologies I developed to help my patients.”

Zhang agrees the potential application of their

research is what drives her in the lab.

“Knowing the materials we produce, the strategies we

develop will eventually alleviate or improve the treatment

of disease or injury — this is the most energizing part

of my research,” she says. Her recent NSF CAREER

award funds research on regenerating brain tissue after

stroke. Zhang proposed the development of an injectable

hydrogel-based delivery system to manipulate neural

stem cells for structural regeneration at brain lesion sites.

She expects her work to have an impact in the fields of

biomaterials, tissue engineering, neuroscience, stem cell

biology and engineering, and regenerative medicine.

As a couple, Wen and Zhang bring different

educational backgrounds, approaches and strengths to

the research process due to the different paths each took

to work in the field of bioengineering research.

Wen’s initial academic interests were dentistry and

facial cranial surgery — fields that are combined in a

single program in China. But, despite having the top

score on the entrance exam, he was passed over for the

By Greg Wilson

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Clemson University’s College of Engineering and Science Clemson Family

13

Clemson University’s College of Engineering and Science Clemson Family
Clemson is the pioneer in bioengineering — one of the first in the world, Wen says. “Everyone in the world knows Clemson, and it’s an honor to come here and work.”

“Clemson is the pioneer in bioengineering — one of the first in the world, Wen says. “Everyone in the world knows Clemson, and it’s an honor to come here and work.”

In addition to the accolades listed above, Zhang has resulted in eye impressive results. The laboratory has produced investigations into stem cell genetic engineering, brain-tissue regeneration to brain lesion sites. She expects the work to have an impact in the fields of tissue engineering, stem cell biology, and engineering neuroscience and regenerative medicine.

Student service project in Haiti wins top award

A project to bring fresh water to the people of the earthquake-impacted nation of Haiti has earned Clemson Engineers for Developing Countries the S.C. Commission on Higher Education Service Learning Project of the Year award.

The team of civil engineering students traveled to Haiti in 2010 to design and build water delivery systems in rural areas — an assignment they had begun to study even before the magnitude 7.0 earthquake. About 30 students were actively involved in designing, building, testing, and fundraising efforts for the project.

The S.C. Commission on Higher Education Service Learning Award honors college programs that address community issues, evaluates them on the degree to which they enhance the students’ learning and how they are integrated into the academic program.

Beshah Ayalew, an assistant professor in the civil engineering department in the College of Engineering and Science, encourages her students to be innovators and to contribute to motivation such as expectations, values, goals, attitudes, cognition and academic performance. Understanding these relationships will address the greatest challenges facing engineering educators, which are increasing enrollment in engineering, creating a more diverse engineering workforce and preparing students for a future of rapid technological change and globalization.

Today, many critical electronic devices, such as wireless sensors, pacemakers, implantable artificial organs are becoming smaller and more energy efficient by requiring only minute amounts of power to function. Assistant professor of mechanical engineering Mohammed Daqaq is looking at ways to turn these electronic devices into self-powered units by developing scalable microsensor generators that can scavenge mechanical energy from the surrounding environment and transform it into electricity via different electrical coupling mechanisms. The ambient energy can generally result from mechanical stimuli similar to the vibrations of structures, the strain in a vehicle’s tire, ocean waves, warm or human motion, muscle stretching or even buoyant fluids. Self-powered electronic devices will facilitate detection of structural damage to avoid sudden catastrophic failures of structures and will undoubtedly improve the quality of life for many patients living with implantable appliances.

Leila Khet, an assistant professor of civil engineering, is exploring ways to help engineers make better decisions in building design. At stake is a potentially vast amount of the nation’s primary energy consumption. The U.S. Department of Energy estimates that buildings represent 40 percent of the nation’s primary energy consumption.

Khet focuses specifically on how designers choose the techniques they employ in energy-efficient design. His research centers around “natural design,” meaning buildings that make use of renewable energy sources because of improved energy efficiency combined with the use of energy-saving renewable energy. And because his research relies on psychological concepts like choice architecture, cognitive biases and irrelevance, he often collaborates with undergraduate students from Clemson’s psychology department in addition to his engineering colleagues in several engineering research projects.

Pamela Malmgren, a professor of nursing at Clemson University, has received a five-year nursing grant from the Department of Education’s Nurse Faculty Program (NFP) to support the professional development of 40 full-time nurses in South Carolina. The NFP is a competitive grant program that recognizes faculty members who have completed a master’s degree in nursing and who plan to teach nursing students. Malmgren said she will use the funds to provide faculty development training for the nurse faculty members at Clemson University and the University of South Carolina. She also plans to use some of the funds to support the professional development of the program’s current students.

The project, which is expected to begin next fall, will focus on improving the quality of education for nursing students by providing them with a better understanding of the nursing profession and the challenges they may face in the workplace. Malmgren said she hopes to increase the number of nurses in South Carolina by providing them with the skills they need to succeed in their chosen field.

The grant is administered by the National Council of State Boards of Nursing and is funded by the U.S. Department of Education. The NFP is a competitive grant program that recognizes faculty members who have completed a master’s degree in nursing and who plan to teach nursing students. Malmgren said she will use the funds to provide faculty development training for the nurse faculty members at Clemson University and the University of South Carolina. She also plans to use some of the funds to support the professional development of the program’s current students.

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Chowdhury named Mays Professor of Transportation Engineering

Ronnie Chowdhury, associate professor of civil engineering, has been named the Eugene Douglas Mays Professor of Transportation Engineering.

Chowdhury is an expert in intelligent transportation systems, a field that uses information technology in conjunction with roads and vehicles to address problems like traffic congestion, safety and fuel consumption. His research also includes vehicle-infrastructure integration, security and energy, with sponsorships from the NSF, the U.S. Department of Transportation, state departments of transportation and national transportation centers.

Gilbert named Fellow of science association

Juan E. Gilbert, a professor and chairman of the human-centered computing division in the School of Computing, has been named a Fellow of the American Association for the Advancement of Science.

The world’s largest general scientific society and publisher of the journal Science, the association bestows the honor on individuals for “distinguished efforts to advance science or its applications.”

It cited Gilbert for “communicating and interpreting technology to the public, innovations in the field of human-centered computing and leadership in broadening participation in computing.”

At Clemson, Gilbert’s division seeks to develop computer solutions to real-world problems and to understand how computer technologies affect society. His research interests include applications such as voice texting and electronic voting.

Burg elected president of scientific society

Bioengineering professor Karen Burg has been elected president of the Society For Biomaterials, a professional society for scientists and engineers who study cells, tissues and organs and their interactions with natural and synthetic materials, including implanted prosthetic devices.

Burg, who holds the Hunter Endowed Chair in Bioengineering, is director of the Institute for Biological Interfaces of Engineering and interim vice provost for research and innovation at Clemson.

With a focus on reconstruction of breast tissue following cancer surgery, Burg’s research into tissue engineering, biofabrication and absorbable polymers has led to 11 issued or pending U.S. patents. Her work is funded by the NSF and the Department of Defense, among others.

Clemson students receive NSF Graduate Research Fellowships

Eight Clemson students have received NSF graduate research fellowships and nine others earned honorable mentions in the national fellowship competition.

Fellows receive three years of support for their graduate studies: an annual stipend of $30,000, a $10,500 allowance for tuition and fees, and opportunities for international research and professional development. The program recognizes and supports outstanding students who are pursuing research-based master’s and doctoral degrees in NSF-supported science, technology, engineering and mathematics disciplines.

Clemson’s 2011 awardees are
• Toni Bloodworth, a computer science graduate student from Anderson;
• Michael Esposito, a civil engineering senior from Prospect, Ky.;
• James Grayson, a civil engineering graduate student from Okatie;
• Jennifer Ann Johnson, a civil engineering senior from Hilton Head Island;
• Kristina Kesel, a biochemistry senior from Charlotte, NC;
• Laila Roudsari, a bioengineering senior from Charleston;
• Kemper Talley, a physics senior from Easley;
• Daniella Triebwasser, a plant and environmental sciences graduate student from Fort Mill.

Clemson University inaugurates Canada Center

Canada’s ambassador to the United States, Gary Doer, visited Clemson recently to help launch the University’s new Canada Center. The center will support and coordinate Clemson’s collaborations with Canadian institutions and provide a framework for developing more extensive ties to America’s largest trading partner and closest ally.

“The links between Canada and South Carolina — our trade, investment, tourism and friendships — are growing,” Doer says. “Closer bilateral relations make our nations stronger and more competitive in today’s globalized economy. The launch of the new Canada Center at Clemson University and the academic and research ties that are being nurtured by this institution will play an important role in advancing this strong partnership.”
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On the cover: The latest CES graduate degree responds to President Obama’s challenge to bring the nation’s infrastructure up to par. Turn to page 6 to read more about professors, such as Prasada Rangaraju (pictured), who are answering the call.

Right: Wind energy is a major part of our energy future. Flip to page 9 to find out more about Clemson’s new $98 million role in converting this sustainable natural resource into power.

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Highlights from our departments

Inquiry, Discovery in Engineering and Science
FALL 2011
IDEA is produced biannually for the College of Engineering and Science at Clemson University by the Office of Creative Services.

On the cover: The latest CES graduate degree responds to President Obama’s challenge to bring the nation’s infrastructure up to par. Turn to page 6 to read more about professors, such as Prasada Rangaraju (pictured), who are answering the call.

Right: Wind energy is a major part of our energy future. Flip to page 9 to find out more about Clemson’s new $98 million role in converting this sustainable natural resource into power.

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Highlights from our departments
College Structure Is Key to Collaboration

The College of Engineering and Science is made up of 14 separate schools and departments, but the unique structure of combining engineering and science programs within one college has led to an uncommon ability to provide a team-based, integrated approach to teaching and research. Scientists and engineers working together to find more efficient solutions is the structure of Clemson University’s College of Engineering and Science.
Faculty Highlights

Bashbak Arar, assistant professor of automotive engineering, has received the NSF CAREER Award for his proposal entitled “Control of Processes Actuated with Mobile Radiant Sources.” He is the second faculty member to receive this prestigious award in the department.

The project targets energy efficient radiant drying and curing processes for largescale manufacturing lines and will potentially play a transformative role in reducing total energy use and carbon dioxide emissions from manufacturing lines. It addresses the fundamental problem of controlling radiant reactor in situ or at impact other processes such as robotic welding and spray forming. Other potential applications are pollution mitigation and medical radiotheraphy. This project includes strong educational and outreach components built around the theme of control for energy efficiency. Planned activities include new course development, graduate research opportunities, utilization of Clemson’s Creative Inquiry program to involve undergraduates — including minorities and women — in the research, and summer science teacher workshops and success camps.

Ayalew joined Clemson in 2006 as a developer of the M.S. and Ph.D. programs in automotive engineering. He teaches courses in modeling and control of automotive systems, and his research interests lie in the general area of vehicular electronics, manufacturing, vehicle design and development.

Presented annually, the Towser award encourages young faculty to develop new concepts in teaching, writing in research programs and participate in local partnerships with industry. Mears is the third Clemson faculty member to win the Towser award since it was established in 1985. Seeking to “create an atmosphere where teachers can meet and exchange views with practicing engineers,” the award includes a trip to Detroit for the SAE World Congress plus a tour, a series of meetings and alternative-vehicle tours at the GM Research facility.

Mears joined Clemson in 2005 as one of the developers of the M.S. and Ph.D. programs in automotive engineering. He teaches modeling and analysis of automotive manufacturing processes, automotive manufacturing quality control and automation integration in manufacturing. His research is in manufacturing process control, equipment diagnostics and intelligent machining systems.

Mohammad Omar was promoted to associate professor, received early tenure and was honored with the college’s Outstanding faculty for Excellence in Teaching. He joined Clemson in 2000 as a developer of the M.S. and Ph.D. programs in automotive engineering. He teaches courses in modeling and control of automotive systems, and his research interests lie in the general area of dynamic systems modeling and advanced robust control, including manufacturing process control, final power and electric-mechanical systems, vehicle dynamics, vehicle running systems and hydraulic/electric hybrid drivetrains.

Laine Mears, assistant professor of automotive engineering, was honored with two prestigious awards this spring. He received the Ralph R. Bower Award — the top educational award of the Society of Automotive Engineers (SAE) — and the 2011 Graduate Young Researcher Award for Excellence in Scientific Research.

The student worked with technicians at each hospital for the design of the final product. The entire experience has shaped the rest of my time here at Clemson and my future.”

The American Heart Association Predoctoral Fellowships were awarded to Vinca Breckle, Naivoo Li and Erin Pardue. All are doctoral students in the CU-MUSC joint bioengineering program.
Faculty Highlights
Mark Thies and Amod Ogale co-authored CARBON 2010, the Annual World Conference on Carbon, at Clemson University. The international conference is held once every four years. Carbon research is essential in the United States, it is held in Asia and Europe during the other two years. About 400 delegates from more than 40 countries presented more than 550 papers. The international conference was organized by the Center for Advanced Engineering Fibers and Films and was cosponsored by the American Carbon Society. Thies presented to 13 companies.
Scott Hussin and Chris Kitchens received a three-year NSF grant to run a summer research experience for undergraduates (REU) program for a talented and diverse group of undergraduates from across the nation. The intellectual focus of this REU site is advanced functional nanomaterials. The program will engage promising young students in research aimed at providing nanomaterials-based solutions to grand societal challenges, such as improving the quality and cost of health care, producing a cleaner and safer environment, and improving materials for energy conversion and storage.
David Bruce and Mark Thies have been working with the TECHSUL LLC, a startup company in Charleston, to develop a process for the recovery and purification of lignin, which can then be used as a fuel source. The project addresses the opportunity of increasing biomass feedstocks to electric-power generating furnaces with the goal of reducing greenhouse gases. The team has recently been awarded a Phase II SBIR grant from the Department of Energy totaling $1 million.
Anthony Guigné-Elke is a keynote presenter last spring at the 2011 International Conference on Frontiers of Characterization and Metrology for Nanoscale Science held at the MINATEC campus in Grenoble, France. He will talk on entitled “Frontiers of More than Moore in Biosciences and the Required Metrology Needs.” He has also been named to the Board of Directors of the Council for Frontiers of Knowledge.
Scott Hussin received a grant from the National Institute of General Medical Sciences to develop high-performance monomers for chromatography-based protein purifications. The rapidly growing public demand for protein therapeutics promises require new, higher productivity, higher resolution methods for their recovery and purification. Development of these materials is essential to the production of lesser cost therapeutic products for improved public health. Hussin’s group has demonstrated in earlier work that nanomaterials chromatography fulfills these requirements. They have developed strategies to overcome historically low protein-binding capacities by grafting high-capacity polymer nanofibers from base monomer supports. A goal of the work is to understand the role of nanofiber structure, numerous pore structures and interactions with the protein in binding with major objectives of accelerating the use of monomeric chromatography in initial protein capture steps.
Student Achievements
At spring commencement, Clemson University’s Norris Medal was awarded to TE hm senior Jennifer L. Norris. The Sparklingnative also received the prestigious Barry M. Goldwater Scholarship and the EasteA Award for Excellence in Chemical Engineering. Moffitt conducted undergraduate research entitled “Phase Behavior of Cellulose Nanocrystal Dispersions” with professor Christopher Kitchens and earned Calhoun College Honors.
Moffitt has accepted a position in the research and development department at Eastman Chemical Co. and plans to pursue a Ph.D. in chemical engineering while working. The Norris Medal was established under the terms of the will of D.K. Norris, a life trustee of Clemson University. The medal is given each year to a graduating student who is deemed to be the best alumnus by Clemson’s scholarships and awards committee.
This year’s Clemson University Robert E. Rutland Institute for Ethics held the 10th Annual J. Barton Jr. Ethics Essay Scholarship Competition focused on the BP oil spill in the Gulf of Mexico. CBE senior Allison Foreman received third prize for her essay entitled “What ethical obligations did BP have to protect workers like Ed when they were hired?”
Clemson’s National Scholars Program (NSP) provides a full scholarship to about a dozen top undergraduates annually. CBE graduated three seniors last spring who were members of that prestigious group — Allison Foreman, Jennifer Thiel and Ray Smith. Each year, the NSP invites seniors to present their research entitled “Phase Behavior of Cellulose Nanocrystal Dispersions” with professor Christopher Kitchens and earned Calhoun College Honors.
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Faculty Highlights
Leidy Klotz, assistant professor of civil engineering, received an NSF CAREER grant to study resilience of designers to design by computer science, engineering and mathematics disciples. The outcomes will affect how the study decisions are made at this design and planning stage. The project will bridge emerging and established science to advance understanding of how irrationalities influence design decisions. The project's research and educational components support the department's focus on sustainable and resilient infrastructure. Klotz is an expert on sustainability and has received research funding from the U.S. Department of Energy and the NSF. Ronnie Choudhury, associate professor of civil engineering, aims to study transportation, Choudhury is an expert in intelligent transportation systems. He also conducts research in solid-surface integration, security and energy. His research is funded by the NSF, the U.S. Department of Transportation, state departments of transportation and national transportation centers. Professor C. Hsein Juang is chairing the organizing committee for GeoRisk 2011. A program made possible by the Department of Transportation, the AICHE CAREER Program will allow participants to learn more about explicitly considering risk and uncertainty in order to improve the value and scope of their service to the public. The Clemson Engineers for Developing Countries (CEDC) Water Symposium Design for Cargo, Haiti, project involves a group of students advised by Lance Bell and has recently earned the S.C. Commission on Higher Education Service Learning Project of the Year award. The Clemson group took a team of civil engineering students to Haiti in 2010 to design and build non-durable systems in rural areas -- an assignment that they had begun to study even before the magnitude 7.0 earthquake struck the country. About 30 students were actively involved in design, logistics, training and fundraising efforts for the project. CEDC was lauded in our fall 2010 issue.

Student Achievement
Three civil engineering students received NSF Graduate Research Fellowships, and two others received honorable mention in the national competition. Fellows receive three years of support for their graduate studies, including an annual stipend of $30,000, a $10,500 allowance for tuition and fees, and opportunities for international research and professional development. The program recognizes and supports Outstanding Students who are pursuing research-based doctoral degrees in NSF-specified science, technology, engineering and mathematics disciplines. Two civil engineering students received NSF Fellowships in the civil engineering department to study for the 2011 academic year. The awards are given “in recognition of the recipients’ influence for good, excellence in maintaining high ideals of life and genuine and disinterested service to others.” The award, named in honor of the first president of the New York Society of Engineers, was established by an agreement between the society and Clemson University. John Johnson has received several scholarships and fellowships, including the Federal Highway Administration Dwight D. Eisenhower Transportation Graduate Fellowship, the Heritage Classic Foundation Scholarship, the American Public Transportation Association’s Louis T. Klauder Scholarship and the Society of Women Engineers Adi I. Pinnock Memorial Scholarship. She was recognized by the civil engineering department at both outstanding junior and outstanding senior. Her efforts were twice recognized by the University’s Best General Education Award, and she received the Till McClure Student Award for Outstanding Service from the President’s Commission on the Status of Women. Clemson’s ACEE student chapter earned the first place trophy at the Carolina Conference for 2011. Annual competition was held at North Carolina State University. Eight schools, including The Citadel, University of South Carolina, Duke University, University of North Carolina-Chapel Hill, North Carolina State University, North Carolina A&T, and the Georgia Institute of Technology competed in 16 events. The Carolina Conference Chair was Clemson student David Duncan. Professor Stephen Courter is the chapter advisor, and professors Scott Schiff and Brad Patton advised the Steel Bridge and the Concrete Canoe teams respectively.

School of Computing
Faculty Highlights
Juan E. Gilbert, a professor and chairman of the human-centered computing division within the School of Computing, has been named a Fellow of the American Association for the Advancement of Science. The world’s largest general scientific society and publisher of the journal Science, the association honors the leader in individuals for "disting- uished efforts to advance science or its applications." Robert Gaytins delivered the keynote address in computer graphics at the International Symposium on Visual Computing this past summer.

Student Achievement
Ph.D. student Toni Bloodworth received an NSF Graduate Fellowship Award. The fellowship program recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering and mathematics disciplines who are pursuing research-based master’s and doctoral degrees in the United States and abroad. Ph.D. students Jamie Lyke and Jonica Jones received the 2011 Illinois Science, Mathematics and Research for Transformation scholarship. The scholarship provides recipients and their universities with full tuition and education-related fees, a health insurance reimbursement allowance for up to $1,200 and a book allowance of $1,000 per academic year. Recipi- ents complete summer internships at Department of Defense (DOD) facilities nationwide and are guaranteed employment at a DoD facility after graduation.

Ph.D. student Dennis Lingelberg received an IBM Ph.D. Fellowship award. IBM received several hundred applications and selected fewer than 100 recipients. The award “covers a $20,000 stipend as well as a $10,000 tuition allowance.” Lingelberg’s focus for the 2011-12 academic year will be I/O system specialization, specializing in GPU utilization within the context of IBM’s Virtual Computing Initiative.

Gabriel Paul Fair, a junior computer science major, received the 2011 Dr. Martin Luther King, Jr. Excellence in Service Award from the University for his work with Students for Environmental Action.

The following students were recognized at the 2011 School of Computing Awards Ceremony: Aubrey Lawson and Patrick O’Dell, Outstanding Sophomores in Computer Science; Christopher Mallen and Zachary Welch, Outstanding Juniors in Computer Science; Ian Wood, Outstanding Senior in Computer Science; Matthew Clay, the Callister Software Scholarship for Outstanding Senior in Computer Information Systems; Christopher Corti and Aunsu Hao, the DuPont Best Undergraduate Project in Computing; Lim Li, Outstanding Graduate Teaching Assistant; Manan Gupta, Outstanding Master’s Student in Computer Science; and Heather Horton and Aqeshia Martin, Outstanding Ph.D. Students in Computer Science.
Faculty

ECI graduate students and research programs include a spectrum of activity reflecting the intensity and expertise of the faculty. Particularly noteworthy is the breadth of education across the faculty, the balance between experience and youth, the record of recent publications and the research funding obtained in recent years. More than 40 faculty members are known nationally and internationally and teach and perform research in a broad range of topics in electrical and computer engineering.

Among them are IEEE Fellows, two endowed chairs, seven named professors and several young faculty members who have won prestigious national and international awards and grants.

Faculty Highlights

Professor Liang Dong and John Ballato have recently received major grants from the Air Force Office of Scientific Research (AFOSR) and the Missile Defense Agency (MDA) to investigate the use of advanced optical fibers for high-power laser beams. Fiber-based lasers typically require less power and are more compact and lightweight than chemical, gas and other types of lasers; hence, these lasers can be used in a wide variety of applications and platforms and bring tremendous benefits to a variety of military operations. This technology can also be used for many other applications including precision machining, optical communications, medical applications and spectroscopy.

As part of the AFOSR High-Energy Laser (HEL) Multidisciplinary Research Initiative (MDRI) program, principal investigator (PI) Dong and Co-PI Ballato will receive approximately $8.4 million over the next three years. If the project is successful, a potential two-year, $1.1 million extension will be made available for a total of $2.5 million funding.

Zhang's grant is part of the Graduate Foundation's fourth funding round of Grand Challenge Explorations, an initiative to help scientists around the world explore new and largely unproven ways to improve health in developing countries. From almost 2,700 proposals, just 78 grants were awarded to scientists in 18 countries on six continents.

Student Achievement

Michael Juang, a Ph.D. electrical engineering student, was awarded a 2010 National Defense Science and Engineering Graduate (NDSEG) Fellowship, from a field of more than 2,900 submitted applications. Juang is investigating adaptive transmission protocols for wireless communications systems and has already published one conference paper on the subject and is preparing another. The NDSEG Fellowship is sponsored and funded by the DoD.

Chunrong Song was awarded the 2011 Chinese Government Award for Outstanding Self-financed Students Abroad. The award was established in 2003 by the Ministry of Education and the China Scholarship Council to encourage outstanding excellence and to recognize the achievement in all fields among Chinese students abroad. Song is currently a Ph.D. student in electrical engineering with an emphasis in radio-frequency and micro-electro-mechanical systems design.
Tanja Karanfil, Ph.D.
Department Chair
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Faculty Overview
Tanja Karanfil received an NSF grant for her proposal entitled “Formation of Halomethanes and Nitromethanes during Ozonation in Drinking Water.” In addition, Arch Chemicals Inc. made a gift award to the University to support Karanfil’s research on formation of disinfection by-products in ozone treated water.

David Freedman also received a grant from the NSF-SBIR program. He is working on Bioconcentration Consulting Inc. in Waterloo, Mass., on a project entitled “Development and Characterization of a Bioconcentration Device to Konadu Chelated Ethane in Low pH Ground Water.” Freedman also is working on a project sponsored by Ocean Corp., entitled “Laboratory Evaluation of Bioconcentration for Groundwater at the Lake Charlie Site.”

Brian Powell and Nathan Smith received funding from the project “Lithic, Rutil and Stremite Geochemistry in Wolof and Subsaharan Sahara.” This project is sponsored by Savannah River Nuclear Solutions through the S.C. Universities Research and Education Foundation and focuses on understanding burial and surface controls of rhenium-rich rhenite fines and transport.

The 19th Annual Clemson’s David S. Stripes Geochemistry Symposium was held at Clemson last spring. This year’s event attracted more than 100 attendees from around the Southeast. The theme session covered innovative techniques for groundwater and soil remediation using oxidation technologies, CO2 sequestration, contaminated wetland treatment systems, well and stream monitoring networks, and chemical processes and Clemson’s geology graduate undergraduates Creative Inquiry projects.

Adam Mangel was, as in the past years, the main organizer and coordinator of this event. Professor Larry Mundish gave a talk on hydrochemistry. Shelley Miller discussed life cycle analysis, and Rian Feha and Jim Carter gave presentations related to carbon dioxide sequestration. Graduate student editing and presentation included Dao Huu, Ricki Hall, Dan Matt, Soo Shannan, Shannon Thompson, Carrie Gehard, Jim Chamberlain, Xiaolin Liu, Fei Chen, Vigni Santhar, Adam Mangel and Zhao. Nine papers were presented.

Professor Larry Mundish was elected chair of the Board of Directors of the Consortium of Universities for the Advancement of Hydrologic Science Inc. (CAHSS) in 2006. CAHSS is an NSF-funded consortium of 126 universities with research programs in hydrology and water science.

John Wagner received the S.C. Science Council’s highest award for a science educator, the Corner Award for Educational Excellence.

Louis Grady was the recipient of the 2010 Industrial Water Users’ Lodging Achievement Award from the Water Environment Federation.

Brian Powell was selected to receive the prestigious 2010 Outstanding Young Investigator Award for the Clemson University chapter of Sigma Xi.

Dan Drumm gave a talk at Andros Island in the Bahamas. Andros is famous among geologists as a watershed location for studies on bromine and radon and the third-longest barrier reef in the world.

Jia He’s doctoral dissertation “Exploring Formation and Distribution of Halogen-containing in Drinking Waters” was selected as one of the best doctoral dissertations completed in 2010 by the American Water Works Association. Her research adviser, Tanja Karanfil, was recognized with a plaque at the ceremony.

Peng Lao, a Ph.D. candidate, was selected to receive a 2010/2011 Roy G. Port Foundation Graduate Student Scholarship in the amount of $5,000.

Daniel Louis, an M.S. student, received the Blue Ridge Research Doctoral Scholarship from the Blue Ridge Quality Life Institute. District Chair of the S.C. American Water Works Association and the Water Environment Association of South Carolina.

Vinh Dao and Ting Yang were the recipients of Clemson Student Awards from the Division of Environmental Chemistry of the American Chemical Society. Each year, the division recognizes up to 25 graduate students nationwide.

Scott Warnn

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Department Overview
The industrial engineering program is accredited to award B.S., M.S., M.Eng. and Ph.D. degrees in industrial engineering.

The department promotes excellence in scholarship, research and industrial engineering education, broadly focused in supply chain, optimization and logistics, human factor and safety, and sustainable care and in technology and complex environment, education, and learning systems.

The department has sound programmatic initiatives that have resulted in significant growth, garnering awards on both national and international levels. These include the online M.Eng. in industrial engineering and the SmartState Endowed Chair in Supply Chain. In addition, the department is home to two institutes, the Clemson Institute of Supply Chain, Optimization and Logistics and the Human Factors and Ergonomics Institute. The department is also home to an NSF-sponsored Industry and University Cooperative Research (UCRC) program center in engineering logistics and distribution and the Center for Excellence in Quality.

Finally, to engage undergraduate students in research, the faculty is implementing a new Creative Inquiry paradigm to enrich the undergraduate experience. Clemson has become a leader through its international research and collaboration, and the industrial engineering department has played a significant role in bringing the world’s talent to our doorstep.

Faculty Highlights
William G. Garrett has been elected a Fellow of the Institute of Industrial Engineers. During his time at Clemson, Garrett has focused his research activities toward applying rigorous approaches to real supply chain logistics problems in industry and the world outside of academia. This has led to establish the Clemson Institute for Supply Chain Optimization and Logistics that serves as a liaison between Clemson’s wealth of expertise and the needs of S.C. industry. To expand this ef- fort, he founded and directs Clemson’s Center for Excellence in Logistics and Distribution, an NSF UCRC. All research within the center is funded by industry or government contracted with Clemson.

Finally, the industrial engineering education and other research and innovation solutions for difficult, real-world logistics problems. Two of Ferrichi’s recent projects include developing a model that determines the optimum core outbound logistics solu- tion for a distribution center and building a decision support system to assist green bullets in selecting and implementing appropriate I-Sign tools for problems they encounter.

Student Achievement
Paul L. Gorthal graduated from Clemson last spring with a Ph.D. in industrial engineering. In the span of the 30 months it took to earn the degree, 12 of his papers were published in archival journals, and six were published in national conference proceedings. Seven additional journal papers currently remain in various stages of revision or review.

For his accomplishments, he was selected the depart- ment’s, the college’s and the University’s Best Researcher of the Year award. Gorthal also saw her early opportunity to shine in matters ranging from nanotechnology to supply chain and distribution.

The industrial engineering department has played a significant role in bringing the world’s talent to our doorstep.

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Faculty Highlights

Marion Kennedy and Julie Troncoso, assistant professors of engineering and science education, received an NSF award to run the Research Experience for Undergraduates (REU) site at Clemson University. The summer REU site will be run by the School of Materials Science and Engineering until 2013. This program brings 13 undergraduate students from across the nation to engage in research projects with Clemson Faculty. These programs are highly competitive, and the grant was awarded to the school for both its cutting-edge research and facility commitment to undergraduate mentoring. The research and program outcomes of the REU site are designed to give participants positive research and social experiences and to encourage them to pursue graduate studies and research careers.

This past summer, Jian Lu’s research group participated in a Multidisciplinary University Research Initiative (MURI) program entitled “Tailoring of Atomic-scale Interfacial Complexes for Metamaterials/Infrared Devices.” This five-year, $15 million MURI project is funded by the U.S. Office of Naval Research and will be led by Lehigh University (Martin Harmer, PI), with participation from Clemson University, Carnegie-Mellon University, University of Illinois at Urbana-Champaign and Kutztown University of Pennsylvania. The results of this MURI project and the methodology developed will have a broad impact with the potential to create “designer” materials with unique property sets and/or vastly improved specific properties and performance such as enhanced optical, corrosion and impact resistance, as well as improved energy generation and storage systems. As a major participant of this project, Lu’s group at Clemson is expected to receive $1.25 million of research support and will lead several research thrusts, including thermodynamic modeling and computational materials for advanced, lightweight, self-cooling protective ceramics (structural alloys) and ceramics (solid-oxide fuel-cell theory development, as well as experimental studies of metals (structural alloys) and ceramics (solidoxide fuel-cell materials). John Ballato and chemistry professor Joe Kolis received an extension for their project “Fire-Safe Polycrystalline Lazes,” which is funded by the DOD Joint Technology Office. The focus of the project is transparent ceramic and single crystal glasses, thin films, and polycrystalline materials (Y2O3, Sc2O3, and Lu2O3) as the enabling materials in high-lighting, solid-state laser optics. These materials are of interest because they have enhanced thermal conductivity over incumbent materials such as yttrium aluminum garnet.

Ksenia Kosten and Igor Luzinov received funding from the Air Force Research Laboratory to investigate approaches to creating self-cooling gradient shell for body armor. This work arose at developing novel, nanomaterials for advanced, lightweight, self-cooling protective clothing by creating a laminated structure with a prescribed thermal gradient.

John Ballato has become a Fellow of the International Society for Optics and Photonics (SPIE). The society was founded in 1981 to advance light-based technologies. Serving more than 60,000 members from 162 countries, the society advances emerging technology through interdisciplinary information exchange, continuing education, publications, patent precedent, and career and professional growth.

Student Achievement

Born Glesnor, a Ph.D. candidate, won first place in the industry-funded Outstanding Student Paper competition presented at the SPIE Optics meeting held last spring in Rochester, N.Y. The award was presented for her paper “Using Design of Experiments to Improve Precise Molding of Chalcogenide Glasses” and a $1,000 cash prize given by the American Precision Optics Manufacturer’s Association. This year’s winner was selected from a field of 42 submitted papers representing authors from seven countries.

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Fast Facts

Undergraduate students: 100
Graduate students: 37
Degrees awarded: Undergraduate 27
Master’s 6
Doctoral 3
Research expenditures: $7,819,536

Clemson Calculus Challenge

Mathematical Sciences

Mathematical Sciences Department Overview

The Department of Mathematical Sciences provides major contributions to the instructional and research mission of the University. Enrollment average 2,000 to 2,500 students per semester in more than 150 sections of math courses ranging from beginning freshman courses to complex graduate courses at the graduate level. More than 85 faculty members and approximately 120 graduate students lead mathematical and statistical instruction and research.

Research activities include publications (more than 100 per year), invited presentations (30 or more national and international talks each of the past three years), national and international professional involvement of the faculty, and funded research (approximately $1.1 million per year). Computational modeling, biomathematics and mechanics researchers group are a source of the standard area of study within the department. The eighth annual Clemson Calculus Challenge took place last April. The department hosted 266 students from 34 regional high schools. Both the number of student competitors and the amount of schools attending were the highest in the history of the event. There were seven awards and individual prizes that included $500 scholarships to the University.

Student Achievements

Catherine Treutenaere received the University’s Outstanding Undergraduate Teaching Assistant Award for 2011. Erin Doolittle has received funding for her to Dublin Boreas in France in conjunction with her dissertation research on optimization problems.

Dania Zannot received a fellowship for nine months of research study at the Hausdorff Research Institute for Mathematics in Bonn, Germany. Frank Volny was a major speaker at the Cryptography Workshop in China.

Xuehong Gao presented three invited talks in China and was a major speaker at the Cryptography Workshop in Beijing, China.

Assistant professor Min Benslimane has received research and was a major speaker at the Cryptography Workshop in Beijing, China.

Assistant professor John Ballato published “Protecting the Hard from HITSII” in Science and received national recognition for the optimal modeling for the distribution of limited vaccine.

Assistant professor Colin W. Williams served on the advisory board for the Center for Ocean Science Education.

Fast Facts

Undergraduate students: 47
Graduate students: 17
Degrees awarded: Undergraduate 47
Master’s 26
Doctoral 4
Research expenditures: $805,089
Research Thrusts: applied analysis, biomathematics, computational mathematics, experimental statistics, operations research, probability and statistics.

Student achievements

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Mechanical Engineering

Mohammed Daqaq

Research thrusts:
- Doctoral 19
- Master's 77
- Undergraduate 76

Enrollment:
- 23

Tenured/tenure-track faculty:
- fgeorge@clemson.edu

Interim Chair

Mechanical Engineering

thermodynamics, heat transfer and combustion
dynamics and controls, fluid mechanics, materials
automotive engineering,

Faculty News

Professor James Gilbert, Georges Fadel and
Mohammed Daqaq won an Outstanding Paper Award at the
2011 Emerald Literati Network Award for Excellence.
Their article entitled “Effect of Height-to-width Ratio on the
Dynamics of Ultrasonic Consolidation” appeared in the
Rapid Prototyping Journal.

Two new professors will join the faculty in 2012.
Huijuan (Jane) Zhao received her Ph.D. from the University of Illinois at Urbana-Champaign and is currently working
at Oak Ridge National Lab. She will join the department in January. Her research area is solid mechanics. Yue (Sophia) Wang received her Ph.D. from Worcester Polytechnic Institute and will join the department in August after
spending one year as a postdoctoral associate at the University of North Carolina. Her research area is dynamic systems and controls.

Student Achievement

Anna d’Entremont and Shannon Edd received NSF graduate research fellowships this year. d’Entremont is continuing her education at UCLA, and Edd is headed for graduate research fellowships this year. d’Entremont was awarded the Outstanding Student Award by the American Physical Society and the 2011 Emerald Literati Network Awards for Excellence. Her article entitled “Effect of Height-to-width Ratio on the Dynamics of Ultrasonic Consolidation” appeared in the Rapid Prototyping Journal.}

Physics and Astronomy

Faculty News

Mohammed Daqaq

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- Doctoral 19
- Master's 77
- Undergraduate 76

Enrollment:
- 23

Tenured/tenure-track faculty:
- fgeorge@clemson.edu

Interim Chair

Physics and Astronomy

Fast Facts

Degrees awarded (August 2010 to May 2011):
- Doctoral 6
- Master's 3
- Undergraduate 15

Undergraduate 94

Research expenditures: $2,615,432

Research Thrusts: 
- astronomy and astrophysics,
- materials and materials processing, solid mechanics, thermodynamics, heat transfer and combustion

Student Achievement

Priyanka Bhattacharjee won a student poster award and a cash prize at the 37th Federation of Analytical Chemistry and Spectroscopy Societies conference held in Raleigh, N.C. Fifteen out of 500 students were awarded for their research presentations at the international conference.

Kemper Talley has received several awards at the departmental, college and University levels the past few years, including the Goldstar Fellowship. He recently re-
ceived an award from the NSF Graduate Research Fellowship Program for his future graduate study.

The research achievements of physics students Matthew Stone, Mark Landi and James Turner were highlighted by the Council on Undergraduate Research (CUR) in January 2011. Their recognized achievements account for three of the 128 entries within the discipline of physics and astronomy selected by the CUR since 2002.

Ramakrishna Podila was awarded the Outstanding Continuing Graduate Student Fellowship by Clemson University in April 2011.

Behnerts John graduated with a Ph.D. in astrophysics in 2010 and was awarded the Buhl Fellowship of the American Astronomical Society. This is the premier position in science policy in astrophysics.

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