The Florida Engineer

FALL 2005

In this issue:

A Spotlight on Chemical Engineering

Plus

2004-05 Annual Report

UNIVERSITY OF FLORIDA

Chemical Engineering Statistics

29% of ChE students are admitted into the UF Honors Program

The ChE student body is diverse: 13% Hispanic, 6% African American, 30% women

The average ChE student SAT score is 1310

ChE has 26 National Merit Scholars enrolled

ChE undergraduate programs are ranked 13th among public institutions and 21st of all institutions by the 2005 US News & World Report

ChE ranked 8th in number of BS degrees granted in 2002-03 and 6th in number of PhDs granted the same year, nationwide

Cover photo: Chemical Engineering chair Jennifer Curtis works with Michael Leclair and Dr. Caner Yurteri to measure droplet diameter and velocity using Laser Doppler Anemometry.

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Dean & Publisher
Pramod Khargonekar

Publications Adviser
Cammy Abernathy

Managing Editor
Ron Franklin

Content Editor & Principal Writer
Martha Dobson

Copy Editor
Christine Hale

Contributing Writers
Cristián Cárdenas-Lailhacar
Christine Hale
Aaron Hoover
Danny Rigby
Reshelle Smith

Photographers
David Blankenship
Ron Franklin
Dan Dobson

Designer
Christina Loosli

Printing
Boyd Brothers, Inc.

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The Florida Engineer
PO Box 116550
University of Florida
Gainesville, FL 32611

P: 352.392.0984
E-mail: rfran@eng.ufl.edu
Web site: www.eng.ufl.edu

Dean's Letter

As I write this letter, Federal Reserve Bank Chairman Alan Greenspan is delivering his assessment of the US economy at his annual Jackson Hole, Wyo., conference.

Greenspan said, "… In recent years, the US economy has prospered notably from the increase in productivity growth that began in the mid-1990s and the enhanced competition engendered by globalization. Innovation, spurred by competition, has nurtured the continual scrapping of old technologies to make way for the new. This difficulty is most evident in the increased fear of job-skill obsolescence that has induced significant numbers of our population to resist the competitive pressures inherent in globalization from workers in the major newly emerging market economies. It is important that these understandable fears be addressed through education and training …."

Engineering research and education is intertwined with the dynamic interplay between globalization, international competition, rising living standards, and the long term sustainability of worldwide industrialization. There is little doubt that our faculty and students – past, present, and future – will play an important role in shaping this evolving world. Indeed, engineering innovations in information, communication, manufacturing, and design technologies are at the root of this latest phase of globalization.

Several recent books have brought into focus the issue of globalization and its impact on the US science, technology, and economy. For example, Tom Friedman's *The World is Flat: A Brief History of the 21st Century* has made globalization a household word. Of course, globalization is nothing new. International trade has been going on for thousands of years. And leadership in knowledge, science, technology, economy, and social progress has changed among nations every few centuries.

Innovation and its commercialization will be the key to success and prosperity in this emerging world. It thus becomes important to understand the fundamental sources of innovation. History suggests that innovations come from several factors. Research, fundamental and applied, creates the knowledge which becomes the basis for innovation. At the same time, there must be a deep understanding of business and societal needs. An environment where conventional wisdom is routinely challenged allows for innovative ideas to take root and flourish. Infrastructure such as availability of capital, experienced management, educated workers, and facilities can transform innovations into major businesses. This is the ecosystem that nourishes an innovation driven, high productivity economy, and prosperous society.

It is abundantly clear that the US is the world leader in fostering innovations and their commercialization. However, unless we continue to focus on the essential elements that have been responsible for our success, our international competitors may well steal the lead. Research universities and engineering colleges can help the US maintain this lead through the fundamental and applied research done by our faculty and students. We provide our students opportunities to become exposed to entrepreneurship through courses, competitions, projects, and experiential learning.

But there are some dark clouds on the horizon. Significant levels of high level engineering design and manufacturing continue to move overseas. This outflow is driven by disparity in wages between US engineers and their counterparts abroad. While it has existed for decades, the increasing competency of foreign engineers makes the transfer of sophisticated work overseas even more compelling. If design and manufacturing activity in the US falls below a certain critical level, it can seriously damage the ecosystem of innovation. In some industries, this has already happened. For example, in consumer electronics, the bulk of innovations have come from Asia and Europe in the last two decades. (Apple's iPod is a nice counterexample in this regard.)

In the College of Engineering at the University of Florida, we are educating our students to become leaders in this emerging world. They are getting a rigorous preparation for lifelong productivity in rapidly changing circumstances. At the same time, our faculty and students are working together to discover nature's secrets and invent creative solutions to societal problems. There are significant opportunities for cross disciplinary collaborations, deep interactions with industry, and exposure to entrepreneurship. We hope and expect that our graduates will contribute significantly to important innovations that are surely just around the corner.

In this issue of the *Florida Engineer*, you will get a glimpse of the exciting research, education, and outreach activities of our highly talented faculty, students, and staff. It is an amazingly dynamic enterprise. We look forward to your continued support of the college of engineering in the years to come.

Pramod P. Khargonekar
Dean

Jennifer Curtis wants everyone to know

Chemical Engineering Has Elements of Greatness

The Chemical Engineering (ChE) department has been doing outstanding research for years, but up to now only a few of ChE's many successes have been communicated to the outside world. It is high time for everyone to hear about just how good the department is, says Jennifer Curtis, who joined ChE as chair in early 2005.

"We have not done enough to promote what we are doing," Curtis says. For example, not many people know that two promising ChE assistant professors, Jason Butler and Jason Weaver, received prestigious National Science Foundation CAREER awards in 2004.

"ChE also has 26 National Merit Scholars enrolled in its undergraduate program. And we are 6th among ChE departments nationally in producing PhD students. We need to talk about these things," Curtis says. (See the inside front cover for more ChE marks of distinction.)

Heightened visibility is key to the plans Curtis has for the department.

"Visibility, particularly among our chemical engineering peers, is important because that is how our *US News & World Report* engineering departmental rankings are determined. When *US News* does the poll for chemical engineering graduate program rankings, they don't ask industry or alumni for their opinions. The only people polled are chemical engineering department heads.

"Our ranking is very important because a lot of faculty and PhD graduate student candidates look at it and take it seriously," Curtis says.

A related concern is maintaining a strong connection with ChE alumni.

"Alumni are very important," Curtis says. "Last April [2005] we had our first alumni open house. We will hold these twice a year. We also had a reunion this summer of the classes that graduated around 1980. I'm also committed to putting out our departmental newsletter and other alumni communications regularly so we can reach as many alumni as possible."

Curtis realized that communication with industry needs to be better, too, when she found out that Dow Chemical had been considering removing ChE from their recruitment list.

"Fortunately, that decision is being revisited," Curtis says, but she knows that it's up to ChE to keep industry well informed about department activities. "It will help us recruit graduate students and present our case for corporate donations," she says.

Getting the word out about the department has already paid off in ChE being able to hire four new faculty, including two who are working in bioengineering. "I'm very pleased. Getting top notch people is very important. But, having new faculty raises a fourth issue," Curtis says.

Chemical Engineering needs more space. ChE has been allocated some space in the Nuclear Sciences Building, but even before that was done, some department faculty were obliged to move their research to labs outside the ChE building.

Anuj Chauhan has
A Clear Path to Better Vision

Special contact lenses that contain drugs for treating glaucoma will be safer and more effective than the eye drops that now deliver the same drugs, says Anuj Chauhan, the UF chemical engineering assistant professor who invented the medicated lenses.

The glaucoma drugs are contained inside nanoparticles that are embedded in the lens material. When the lenses are placed in the eye, the drugs travel from the particles through the eye cornea to treat the disease directly. The eye receives 50 to 60 percent of the drug in the lens, which is far better than the 1 to 5 percent of the drug that reaches the eye when drops are used.

The need for a better treatment option is acute. Glaucoma causes fluid pressure to build up in the eye, which damages the optic nerve. Worldwide, more than 66 million people have impaired vision caused by glaucoma; nearly 7 million are blind. In the US, more than 2 million people have glaucoma, with more blacks and Hispanics affected than whites. With so many patients suffering the disease, interest in the contact lenses has been intense.

"Our most exciting research right now is on timolol, which is a very important glaucoma drug," says Chauhan. "The way we put the drug inside the lens has never been done anywhere else in the world. First we put the drug inside particles which are a few nanometers in size. Then we incorporate the nanoparticles in the contact lens material itself. Imagine wearing a contact lens, and inside the lens these tiny particles are everywhere. The particles are so tiny, you really can't see them."

The particles slowly release the drug into the contact lens and then into the eyes for long periods of time. Current studies indicate that the lens can release particles for as long as a month.

The efficiency of using contact lenses for treatment will be welcome to everyone who is familiar with how messy eye drops can be. Usually the patient puts too much of the solution in the eye. About 15 to 20 percent of the drug just rolls out of the eye as a result. Most of the remaining drug in the eye mixes with normal tears and flows away into a duct that connects the eye to the nose. The drug ends up in the nose and from there enters the bloodstream where it travels to other organs of the body.

"So, 90 to 95 percent of the drug doesn't go to the eyes. It goes to other organs through the blood," Chauhan says. "Eye drops contain about 50 times the amount of the drug that you need because you lose so much."

"We are trying to reduce the loss of drugs to other organs," Chauhan says, "so that instead of 1 to 5 percent of the drug, with the lenses maybe 50 to 60 percent goes to the eye. Our mathematical models tell us that it should be about 50 percent."

Drugs that do reach the body's organs can cause side effects. Some drugs which treat glaucoma can have a negative effect if they reach the heart.

Another drug that the lenses could deliver more safely is Restasis, which the FDA recently approved for treating dry eyes. Restasis is a form of cyclosporin, an immunosuppressant. The drug is useful because it reduces the inflammation associated with dry eyes, but if it goes to other organs, there could be side effects.

An additional benefit of this drug delivery approach would be better compliance with the treatment regimen by the patient. If a treatment calls for eye drops three times a day, a patient might not always do this. With a contact lens, all the patient has to do is put it on and leave it there for the prescribed time.

So far, the team has worked exclusively with traditional HEMA-based soft contact lenses. (HEMA stands for

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"We are working on getting a new wing on our existing building," Curtis says. "We need labs, of course. We also want a state-of-the-art classroom with a staging room where we can prepare experiments for hands-on demonstration during lectures. The classroom will need computer capabilities so we can do interactive teaching."

Curtis believes the ChE faculty have unique resources available that help make the ChE research programs successful, including connections with the Biomedical Engineering and Materials Science & Engineering departments, the Particle Engineering Research Center, and the UF College of Medicine.

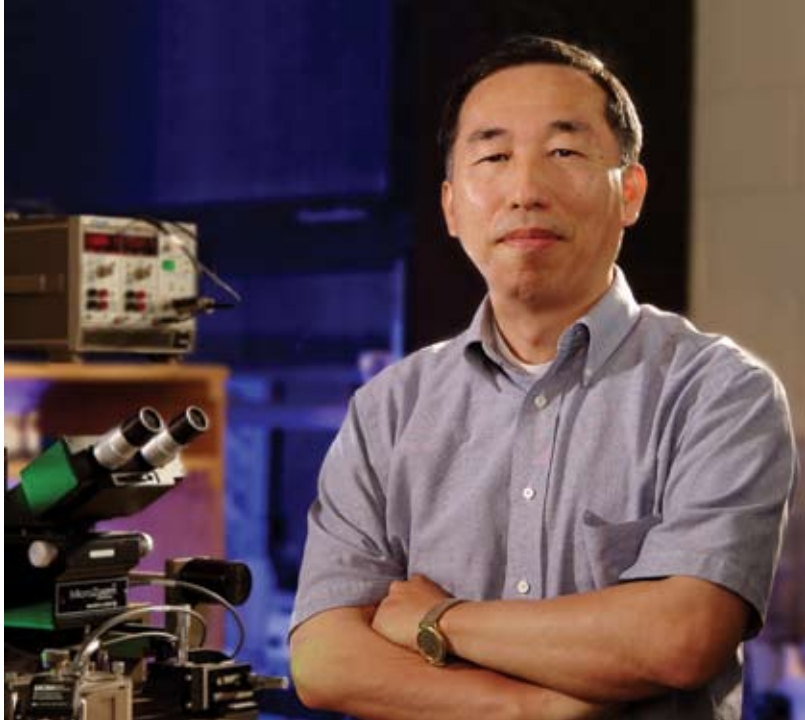
"Now," she says, "let's get the word out."

Martha Dobson

www.che.ufl.edu

Learn more about Chemical Engineering in this issue of The Florida Engineer. We are featuring the programs of senior faculty Anuj Chauhan, Mark Orazem, and Fan Ren; the innovative new research of CAREER award winners Jason Butler and Jason Weaver; and we meet the four new ChE faculty who joined the department this fall. A special story celebrates the career of Dinesh Shah, who retired in 2005.

Mighty Mite Electronics Are the Next Big Thing



Professor Fan Ren works on tiny devices that are changing the world of electronics. A chemical engineer, Ren uses a semiconductor material, a gallium and nitrogen compound called gallium nitride (GaN), and applies it to semiconductors fabricated on the nanoscale. These semiconductors have extraordinary capabilities that are revolutionizing electronics by their use in transistors, switches, and sensors.

In 1998, Ren joined UF and teamed up with Professors Steve Pearton and Cammy Abernathy in the Materials Science & Engineering department to work on wide energy bandgap semiconductor materials and devices. "Wide energy bandgap" means that the energy between the valence band and the conduction band in a GaN semiconductor is 3.3 electron volts (eV); in a conventional silicon device, it is 1.12eV. The technical definition of an electron volt is the energy transferred in moving a charge equal to the charge on an electron, through a potential difference of 1 volt.

Thermal energy will generate carriers in the semiconductors. The lower the energy bandgap of the semiconductor, the more carriers will be created at elevated temperatures. Since the energy bandgap of silicon (Si) is 1.12 eV, ambient temperature has a significant effect on the performance of Si chips. That is why computers have fans to cool down the silicon chips inside. If the chips aren't cooled, then the thermal energy generated within the semiconductor can cause the device to fail.

The wider the energy bandgap, the higher the temperatures the semiconductor can handle. Because the energy bandgap for gallium nitride is 3.3 electron volts, Ren explains, a device made of GaN can sustain a temperature up to 700 degrees C and still operate normally.

"There is no cooling needed for this kind of material," Ren says. "Even when our test station became red hot, the device still worked." Because of their thermal resistance, GaN semiconductors can be used as sensors in high temperature engine environments such as automobiles, aircraft, and even spacecraft.

Gallium nitride is not only resistant to high temperatures, it is one of the most chemically stable materials known. Aqua regia, a combination of hydrochloric and nitric acid that can etch even gold, cannot attack GaN. The only known chemical that can etch GaN is molten sodium hydroxide, or lye, at 400 degrees C, making GaN devices useful in hot, harsh chemical environments.

"The other beauty of these materials is that we can do energy bandgap engineering," Ren says. "We can add aluminum (Al) or indium (In) to make aluminum gallium nitride (AlGaN) or indium gallium nitride (InGaN). The atoms of aluminum are smaller than those of gallium, so the bandgap goes even higher; InGaN goes the other way. These compounds are already used in optical devices. By adjusting the energy bandgap, different color LEDs and lasers can be fabricated. These LEDs and lasers can be used for high density information storage in CDs, in full color displays and medical technology.

The scientists found something else interesting: If a very thin layer of AlGaN is placed on a layer of GaN, each layer just a few tenths of a micrometer thick, the difference in the crystal lattice structure of

the layers generates a high carrier concentration. There are no impurities needed to generate carriers, such as when phosphorus is intentionally introduced in Si to make n-type Si. This leads to a simpler process for realizing high-power, high-temperature transistors.

Electric companies are also interested in making power switches out of this material. The companies now use mechanical switches with poles. When the poles make contact, the power supply oscillates. To avoid constant trip-outs on the power line during switching, the operating voltage has to be raised, with a consequent waste of 5 to 10 percent of the power. Switches made of the new material will eliminate this problem. Ren and his research colleagues Pearton and Abernathy developed and demonstrated an AlGaN Schottky diode with a diameter thin as a human hair, yet able to hold 10,000 volts. The work was carried out five years ago under DARPA and EPRI contracts led by Pearton, and still holds the record for the highest breakdown voltage for this kind of device.

"With a switch made of our material, the delay during the switch is just a microsecond," says Ren. "It is almost instantaneous and is expected to be a part of advanced power flow control circuits that will be needed to avoid voltage fluctuations that can trip-out computers and other sensitive electronics."

Another use for the layered material is making sensors that can measure within seconds the presence of chemicals like atmospheric pollutants down to five parts-per-million. The team has also made a sensor to test for proteins and antibiotics, and one to measure pH.

Ren's team is moving into creating GaN nanorods, which he says has been made possible thanks to the new nanofabrication facility in the physics building at UF. With these new developments, the work is of increasing interest to both industry and the military. The research being done by Ren and his colleagues is supported by several government agencies, including NASA, the Office of Naval Research, the National Science Foundation, and the Air Force, and new grants will enable them to continue on for years to come.

Martha Dobson

Anuj Chauhan has A Clear Path to Better Vision

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hydroxyethyl methacrylate, a polymer.) Chauhan wants to expand the research to include newer types of soft contact lenses that are based on silicone hydrogels.

"The HEMA lenses typically are not worn overnight," Chauhan says. "Silicon lenses can be worn 24/7. A patient could put a silicon lens on, wear it nonstop for 15 days, and then throw it away."

Chauhan points out that work needs to be done to find the best lens for delivering different kinds of drugs.

"The oxygen permeability of silicon lenses is much higher than the HEMA-based lenses," Chauhan says. "On other issues, the mechanical properties of HEMA are slightly superior."

There are differences in how much drug can be put in each type of lens, and differences in which kind of drug can be put in each lens. Silicon material is much more hydrophobic and HEMA is comparatively hydrophilic, so the type of nanoparticle that can be put in each is different.

"It is important that we develop both, because certain drugs may work better with either HEMA or silicon. We hope that these lenses will also be able to treat infections and allergies. And perhaps some diseases of the back of the eye, like macular degeneration," Chauhan says.

Right now it is almost impossible to deliver drugs to the retina in the back of the eye. Drugs can't be delivered to the retina through blood because of the blood-brain barrier that protects the brain and the eyes from toxins carried by blood.

"We are hopeful for contact lenses, because we can keep them in the eye for a long time and some of the drug might get to the retina. That is like a holy grail," Chauhan says. "If you can get drugs to the retina, then there are just so many drugs you could use. That is the final goal."

The National Science Foundation provides funds for the project, which has been underway for less than four years. Chauhan is pleased by the rapid development of the lenses, and while he doesn't know when the lenses will be on the market, he believes it can happen much faster than he predicted at the beginning of the project.

"We are working with one of the biggest contact lens companies in the world on this project, and all of us are very excited about this," he says. "Three years ago, I said it might take a decade. Now I think it might take about four or five years, or maybe even less."

Martha Dobson

Dinesh Shah has spent his life

Working for the Greater Cause with Gusto

Professor Dinesh O. Shah retired from the Chemical Engineering and Anesthesiology departments in the summer of 2005 after 35 years of dedicated service to his students, the University of Florida, and the Gainesville community at large.

To say that Shah is dedicated is the simple truth. A native of India, Shah lives by the philosophy of Mahatma Gandhi, to work selflessly for the benefit of the larger community.

"In that philosophical tradition, you devote yourself to the greater cause to help people around you," explains Pramod Khargonekar, dean of the UF College of Engineering. "Dr. Shah thinks of his work as how he can make people around him happier. He has been driven by that, and I think his legacy is going to be multifold, in research, academic leadership, mentoring, and in community service."

Shah believes that his life has also been shaped by his eternal optimism and dogged perseverance. "Having come up the very hard way from high school, to college, and to the US, I always had the optimism that there had to be a way, that I could find a solution to a problem," he says.

Shah needed to be inventive to help his widowed mother support her family and pay his own way through school. He stepped out of traditional caste boundaries to do manual work while in high school.

Although well qualified for the University of Bombay, he soon ran out of money to finance his studies. He took a chance and approached the family of a well-known attorney who had been prominent in India's independence movement. The attorney's daughter-in-law hired Shah as a tutor for her servant's children and paid him by providing his tuition throughout his undergraduate studies.

Although Shah's heart was in the arts (he is a published poet and a heartfelt poem about his students and his guiding philosophy as a teacher is on the inside back cover), he studied science, and in 1960 he applied to Columbia University for graduate study in biophysics. He worked with Professor J.H. Schulman, a pioneer in surface and colloid science, which would be Shah's focus throughout his career.

At Columbia, Shah found that he had a gift for teaching. "I was deeply influenced by Jack Schulman. He was such an inspiring teacher that I really felt I would like to be a professor," he says.

Shah's focus on biophysics was a little ahead of its time. He found that there were very few jobs available after he received his PhD in 1965. However, he had done half his PhD studies in chemical engineering, so he looked for opportunities in that area. After working for a while at the NASA Ames Research Center doing research on chemical evolution and the origin of life, he applied to the UF Chemical Engineering department.

Chemical Engineering was doing cooperative research with the Anesthesiology department in the UF College of Medicine in 1970, so the decision was made to hire Shah on a joint appointment to work in both areas. "My students always say that my common phrase is 'go with gusto'. So I joined UF as an assistant professor with enthusiasm, and in five years they gave me a full professorship," he says.

Shah quickly built his academic reputation for innovative research. Shah believes he has made significant contributions in four areas. The first was an ocular lubricant for dry eyes, marketed as NeoTears, which he developed between 1970 and 1975. Second, he designed and implemented a multidisciplinary program in enhanced oil recovery that was the first academic program of this type in the country. Shah edited two books on enhanced oil recovery that are still used in the petroleum industry.

The third area Shah points to is his work in nanoemulsions and nanodroplets. He built up a core of basic knowledge on oil-water emulsions that is used for applications from flavors and fragrances to drug delivery, petroleum production, and lubrication. The last area of significant work Shah cites is the application of his work in nanodroplets to the detoxification of drug victims. "If someone is unconscious with a drug overdose you can inject this nanodroplet emulsion into the blood," he explains. "Then it extracts all the drug molecules into those tiny, tiny droplets."

Shah's research has not ended with his retirement. He has a new invention that he believes will help a lot of people: a magic

chemical, as he calls it, which will help washing machines spin out more water from laundered clothes.

"That means laundry can be dried in one-third less time and use one-third less energy doing it, "he says. "When you extrapolate that saving to every household, it is equivalent to a $900 million energy cost saving each year in the US alone."

Shah's research brought a lot of visibility to the university and to the department, and led to Shah becoming, as Dean Khargonekar describes him, one of the most well-recognized faculty members in all of engineering at the University of Florida, both nationally and internationally.

The dean considers Shah's work as Chemical Engineering department chair from 1987 to 1991 to be equally important. "He brought the department vision, stature, and brought all the stakeholders together to build an outstanding advisory board. He connected very, very well with the alumni, a great ambassador for the department, college, and the university. I think he was really instrumental in moving the department forward," the dean says.

But there is another aspect of his career that is just as important to Shah: mentoring students with the kind of care and concern that directly reflects his life philosophy.

"In India, we have a traditional saying that the whole world is one family. I took that literally in my interaction with students in teaching and research, even in helping in their personal lives," Shah says. "It is important for a professor to see that students go out into the world as well-rounded persons, not just good in science. You fail as a teacher if you do not inspire them to become considerate, thoughtful, sensitive human beings." Over his 35 years, he has always responded to crises in the lives of colleagues, students, or staff like a family member.

"My students are making a wonderful contribution to humanity. And these students will train more students and influence a lot more people than I can as an individual."

Dean Khargonekar believes that Shah set an example for faculty mentors that will be a lasting legacy within the college. "It is hard to think of anyone who has done this better than he has."

One of Shah's proudest accomplishments for students was the construction of the India Cultural and Education Center in Gainesville. Shah saw there was a need for a social center for Indian students after three Indian students at UF committed suicide within a two-month period in 1990. Shah and his wife, Suvarna, mobilized the community and raised nearly one million dollars to build the center.

"Without his vision and drive and dedicated effort in the face of very, very tough odds, that facility wouldn't exist as we know it," says Dean Khargonekar. And it was Shah's work to create the center that was the deciding factor in his selection for the Florida Blue Key Distinguished Faculty Award in 1992 and to be the grand marshal of the 1992 homecoming parade.

That event brought the moment that put his whole life into focus, Shah says.

"There I was sitting in that first car, me and my wife, and waving at the spectators. You feel a little awkward for the first two blocks. But the little kids on the sidewalk are very friendly, and you feel like waving at them and you get into the swing of it.

"But when I came close to where my mother, who was 84 years old, was sitting in her wheelchair and waving at me, this was the most poetic, traumatic, moving experience anyone can have. Here was my mother, who became a widow at age 40, raised the kids, and sold all her jewelry to support the education of the kids. She came all the way here, and she was about to see her son recognized as a distinguished faculty member at the university. It was priceless," Shah says. "My joy and her joy, it was boundless. I felt that all the struggle of the previous years was worth it."

The India cultural center opened in 1998. Not long after, Suvarna Shah was diagnosed with cancer and died in 2000. Shah credits her hard work and support for his academic success. He looked upon her loss in terms of his life philosophy, as a challenge to serve as a positive example to others on how to stand tall after a tragedy. So he carried on his research and teaching, and expanded his interests in the arts. Shah organized the annual Poetry Festival of India, which is held in Florida every winter. He also set up a Foundation for Music and Poetry in India to promote young artists. He established the Suvarna Shah scholarship fund and is now working to establish an endowed professorship in surface science in the Chemical Engineering department (see story p. 17).

"My mother used to say that when you enjoy mango, remember that the mango tree was planted by someone else. Now in your lifetime, make sure you plant some mango trees, not for you but for others to enjoy the fruits. My gift of this endowed professorship is my small effort to make sure that there will always be a scholar on this campus to provide leadership in teaching, research, and service at the national and international level in the area of surface science, because surface science is key to solving many of our problems in engineering and biomedical systems," Shah says.

Shah knows his accomplishments will be his legacy, but he hopes that his life story will carry a universal message.

"People once asked Mahatma Gandhi what was the message he would like to give his people. He said, my life is my message. For me, I have lived my life in such a way that if people follow the same compass that I used to guide me, it would be a better world.

"I do feel that everyone should look at a human being as a human being. All of these barriers that we see, race, religion, caste, creed – all of those things are created by men. In my eyes, all students, wherever they are from, are all my students. I don't differentiate in how I speak with them. They are all my children," Shah says.

"I would like my legacy to be a new way of thinking where we just try to see each other as human beings belonging to one large global family."

Martha Dobson

2004 NSF CAREER Winners

Jason Weaver: Oxidation Catalysis

Assistant professor Jason Weaver has been studying surface reactions since he arrived at UF in 1999.

Weaver focuses on the study of heterogeneous catalysis at a molecular level, specifically looking at oxidation catalysis. Many industrial processes utilize oxidation catalysts to convert hydrocarbons into more valuable chemicals. Even your car uses this process to help in pollution control. Through his research, Weaver attempts to better understand these everyday reactions.

"To do that, we have to investigate reactions in a very well-controlled environment, an ultra-high vacuum (UHV), and we work with well-defined systems, a solid surface that has well defined geometrical structure, for example a single crystal," Weaver said. "Then we'll introduce specific types of gases and study the interactions at the solid surface. Another advantage to working in UHV is that we can use sensitive spectroscopic tools to examine changes in surface properties, such as the chemical states and composition. In addition, we can study the surface reaction kinetics in detail."

In real-world applications, the chemistry occurs at atmospheric pressure and uses materials much more complex than a single crystal.

To bridge the gap between the ideal model and real-world catalysts, Weaver uses metal nanoclusters deposited on thin film oxides to serve as model catalysts. While these clusters are not as complex as the materials employed as industrial catalysts, they replicate more of the material complexities than does a single crystal, and these complexities may be controlled to a large extent.

Using these nanoparticles, he aims to study the intermediate states or phases, each with possible distinct chemical properties, that are found between dilute chemisorbed oxygen and a bulk oxide.

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Jason Butler: Complex Fluid Motion

Assistant Professor Jason Butler, studies complex fluids. Butler's interest in physical chemistry drew him to complex fluids and how particles move at a molecular level.

His award-winning work began when he looked at the sedimentation process of large rods suspended in fluids. After writing codes that accounted for the hydrodynamics of such systems, he decided that he needed to study the same type of system at a molecular level, where things can change drastically.

Molecular models have to account for Brownian motion of particles and for surface interactions not present with large particles. Making his research more difficult is the fact that a lot of study has been done in systems where the particles are spheres, but not much has been done on suspensions with rods. Spheres are easier to study because of their uniform shape. Rod-shaped particles have different physics than spheres. Butler had to develop different equations and different models to explain their motion.

One aspect that posed a problem to many scientists was the rotational diffusivity, or change in orientation, of rods suspended in fluid. In the past, scientists could not agree on the relationship between rotational diffusivity and concentration. It was understood that more rods added to the same fluid amount decreased diffusivity; the question was to what degree.

Butler's research settled the long-standing argument. He found that everyone involved was actually right, they had just studied the problem starting at different points and using different models.

"For this particular project, I've had a lot of fun telling people about the result because it is so surprising, and it is something that interests a great amount of people in my general community and others as well," he said.

The work, however, is not done for Butler. There is another aspect of motion he would like to account for in his models – hydrodynamic interactions. How does a rod moving in fluid affect the other rods, even if they do not touch? Adding this aspect will help further characterize the systems which, until now, have not been well understood.

The goal of all his research is to give scientists a deeper understanding of the materials they work with. Using rheology, scientists can get a set of numbers to describe a material,

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Mark Orazem: Helping to Close the Gaps in Azerbaijan

The newly constructed Central Azeri platform in the Caspian Sea will produce approximately 450,000 barrels of oil per day. The pillars to the left will support a platform for gas and water re-injection. Photograph courtesy of BP Azerbaijan.

The University of Florida has established a presence in Azerbaijan, thanks to Chemical Engineering professor Mark Orazem.

"It is a fascinating country," says Orazem, who went there to teach outreach courses to local engineers for the past two years. It also has the potential to become a very wealthy nation and a valuable western ally.

Azerbaijan, a former Soviet Socialist Republic just south of the Caucasus Mountains, sits atop rich deposits of oil and natural gas. Western oil companies are working with the people of Azerbaijan (the Azeris) to develop their resources.

One consortium led by British Petroleum (BP) is developing an oil field under the Caspian Sea that is estimated to have seven billion barrels of recoverable oil. The consortium has built the BTC pipeline, which goes from Baku, the capital of Azerbaijan, through Georgia into Turkey and has the promise of delivering one million barrels of high quality crude a day. Several other consortia are developing undersea reserves as well.

Azerbaijan and the BTC pipeline

In addition, Azerbaijan has as much natural gas as Saudi Arabia, so much that it comes up naturally through the ground and burns spontaneously, but has never been used as a resource. A pipeline to deliver the natural gas to market is being planned.

The economy of Azerbaijan, a Muslim nation with a pro-western government, desperately needs the income from its oil reserves, Orazem says. He cites the example that an Azeri college professor makes the equivalent of $50 a month, but a new Lada, a Russian-made automobile available there, costs $5-6,000.

Azeri engineers are eager to work in the new oil industry, but their training at the local technical schools has left serious gaps in their education. The problem is that after the USSR dissolved, the local soviet-style education system, including the institute that trained oil engineers, deteriorated. The oil companies are working with several universities in the west and in Turkey to provide additional training for the Azeri engineers so they can become certified professional engineers according to British standards.

The Ateshgyakh Fire-Worshippers' Temple is located 15 km from Baku. The temple, built in the 18th century and reconstructed in 1975, was devoted to the religion of Zoroastrianism, in which fire plays a central role. Flaming torches of gas, escaping from under the ground in many places on the Apsheron Peninsula, were believed to have divine power. Note: the extraction of oil from this region has altered the subterranean pressures to the extent that the gas no longer escapes from the ground in this temple. The flames of natural gas seen in the picture emanate from pipes.

Orazem became involved at the request of an old friend, BP engineer Kevin Kennelley, who is managing BP's project in Azerbaijan. As a result, Orazem has been traveling to Baku for the past two years to teach fundamental courses to the Azeri engineers.

"I didn't even know where Baku or Azerbaijan was until I looked on the map," Orazem says. "I went out there in July 2003 and taught a two-week short course on transport phenomena."

Noting the difference between American and Azari students, he says, "I have been teaching for many years, and students often tell me that they just want to know where to find the equations in the book." Orazem teaches them the science behind the equations anyway. The Azari engineers haven't been so lucky.

"The Azari engineers who had been trained under the Soviet system knew where the equations were, but they didn't understand where they came from. So they were making big mistakes. BP asked me to come and teach them the theory," Orazem says.

Orazem began teaching two-week short courses on transport phenomena, fluid mechanics, heat transfer, and mass transfer. "The Azeri students are eager to learn and talented," Orazem says. "I have enjoyed working with them. BP is definitely getting a group of good workers and they are putting a lot of effort into training them."

Part of that effort now includes on-campus degree studies at UF for selected students. "We realized the two-week courses weren't going to do the job, so we thought that it might be possible for some of their best engineers to come and take classes at UF," Orazem says.

Four Azeri engineers have come to study at UF. Two have taken one year of undergraduate classes in chemical engineering and are now working toward master's degrees. Two more students began the undergraduate training in May 2005.

Orazem is also working with the UF EDGE distance learning program to develop a general engineering Master of Science program appropriate for Azeri engineers. Orazem notes that many international companies like BP are creating local energy/manufacturing companies in developing countries. To do this properly requires well-educated and well-trained engineers. This is a rapidly expanding market and one where UF could establish a competitive edge.

The UF EDGE program and the college as a whole may receive a further spin-off benefit from the BP connection. A general Master of Science program for engineers similar to that developed for Azerbaizan would be of value to the engineering community here in the US. Such a degree program could be set up for each engineering discipline with appropriate technical courses as well as project management courses.

The Chemical Engineering department, too, is seeing positive benefits from Orazem's connection to BP. Kevin Kennelley has agreed to be on the department's advisory board and BP is donating significant financial resources to upgrade the department's undergraduate unit operations lab.

The future of the BP/UF/Azerbaijan cooperation looks hopeful. "Azerbaijan is pro-American. People there are very friendly, and they appreciate what we are trying to do for them," Orazem says.

Martha Dobson

SEEKING FOOTHOLD IN FAST-GROWING CHINA, UF OPENS BEIJING OFFICE

The University of Florida is joining other American schools that, like corporations and professionals, are putting down roots in rapidly growing China.

The UF Center for International Studies in Beijing opened in June, joining a growing number of US universities establishing offices or otherwise ramping up activities in China, home to the world's second-largest and fastest-growing economy.

UF and institutions such as the University of Michigan and the University of Maryland have long had agreements or collaborated with Chinese universities on, for example, international study programs in Chinese or English. UF's new China-based office seeks to expand these kinds of collaborations into a palette of distance-learning classes and other offerings. The goal: to both entice top Chinese students to pursue UF degrees and help a growing number of American students seeking careers in China get a foothold in the country.

"After 9/11, the number of international students applying to UF and other universities basically dropped 30 percent, so we have a need to increase our efforts to recruit international students," said Sherman Bai, an associate professor in the Industrial & Systems Engineering department and the center's director. "And because of developments in China, our students are becoming more and more interested in business and careers there, and demand is increasing for Chinese language and cultural classes and opportunities to visit China."

Peggy Blumenthal, vice president for educational services at the New York City-based Institute of International Education, said Chinese students no longer view the United States as the must-have option for graduate studies. Also, she said, more and more American students are opting to study in China – in fact, according to Chinese government figures, some 3,730 American students journeyed there to study in 2003, she said.

"China is becoming one of the leading host countries as well as a leading sending country, and that's quite new," she said.

Not only that, with increasing funding from the Chinese government, Chinese university graduate research programs are rapidly improving their quality and capabilities, she said. The result of all these trends is that US universities increasingly see opening China-based offices or enhancing China activities as key to their future success.

"I think the growth of graduate programs in China is opening opportunities for collaborative research," she said. "And I think there's a wide range of ways where, if you have a presence on the ground, you can explore a lot of opportunities for academic linkages, beyond just receiving students."

Bai turned to UF's Office for Distance Learning and International Center for help with funding. The office of Distance, Continuing and Executive Education provided $129,000 and UF's International Center contributed $30,000 to launch the project. With UF support, Bai rented office space in the China Agricultural University's international conference center in Beijing. The conference center is located in the city's Haidian district, an area known as the university zone because 10 Chinese universities are based there.

The center has several specific functions, but its overall goal is to boost UF programs and interests through its official presence, Bai said. "With a permanent center, we can constantly build relationships with the Chinese government and Chinese corporations," he said. "It's a much more integrated and networked effort."

That's important in part because UF students are already pursuing careers in China, he said. This summer, for example, a handful of students participating in a UF architecture summer program received job offers from Chinese firms seeking talent in the design of skyscrapers, he said. "Three or four students are starting to learn Chinese immediately and expect to go back to China and get jobs after they graduate," he said.

To meet this new demand, the center will seek to support current international study programs and create new ones focusing on Chinese language and culture, Bai said. The center also expects to serve growing Chinese student interest in earning credits and degrees from US universities through distance-learning programs. UF colleges and schools that have expressed an interest in offering distance-learning classes in China include engineering, medicine, pharmacy, and building construction, Bai said. One day soon, it may be possible to earn a UF degree without leaving China, he added.

Bai said many challenges lie ahead for the center, not the least of which is coordinating with the Chinese government.

"If you offer anything in China, you need to get government approval to do so," he said. "Another challenge is networking. You need to build up a network, and that takes time. And setting up programs takes time, too."

Aaron Hoover

bai@ise.ufl.edui

The team at the entrance of SOQUIMICH (SQM) Coya Sur Solar Evaporation Plant in the Atacama desert. Left to right: Ina Agaj, Andrew Mosseley, Stephen Marsh, Brian Po-Feng, John Lehman, Carlos Romero, Tabitha Robinson, Dr. Cristián Cárdenas, Michael Johann, Carolina Padilla, Yeh Kuang-Hao, David Kelly, and Juan Espinoza.

First International Engineering Course in Energy Management

In summer 2005, for the second year in a row, UF's Industrial and Systems Engineering (ISE) department offered International Industrial Energy Consulting – CHILE, a three-credit course open to all College of Engineering graduate and undergraduate students. The course, EIN 4905 – ESI 6912, was created and taught by Cristián Cárdenas-Lailhacar, an ISE faculty member and technical manager of the UF Industrial Assessment Center.

The course begins on campus by analyzing the economics and energy situation of the Latin American and Caribbean region, with a special focus on Chile as the fourth NAFTA country. Then the class travels to Santiago, Chile, to perform an energy audit on a local industrial manufacturing facility, and write a report on their findings for the client. The course is sponsored in part by the UF International Center, the College of Engineering Office of Development and Alumni Affairs and Office of Academic Programs, and the ISE department through Professor and Chair Donald Hearn. This year, the class formed a team of seven undergraduates and five master's degree students.

After a day of acclimatization in Santiago, the team performed a five-day visit to two chemical plants of the Sociedad Quimica y Minera de Chile SOQUIMICH: the "Maria Elena" and the "Coya Sur." The plants manufacture saltpeter (potassium nitrate – a fertilizer). To reach the plants, the team flew for 2.5 hours from Santiago to the northern city of Calama. The plants are located in the most arid area of the Atacama, the world's most arid desert.

The students, directed by Cárdenas-Lailhacar, separated into two groups. They thoroughly inspected the plants' processes, and exchanged and discussed energy usage and technical issues with the plants' engineers and CEOs. At the end of the visit, the team made a PowerPoint presentation to top management showing 35 potential energy and waste savings for the plants, and offering productivity enhancement recommendations. The team estimated that the waste savings and increase in productivity would come to about $7.5 million dollars. This fall, the team is working on the technical report.

In addition to all the work, the team was exposed to the Northern Chilean desert culture. They visited the little town of San Pedro de Atacama, which has a great museum of mummies (mostly with earlier dates than those in Egypt); the local site known as the Valley of the Moon; volcanoes; and the old, once-lost fortress/city of Pucará de Quitor, which was conquered by the Incas.

After returning to Santiago, the team visited but did not audit three additional facilities: Viña Concha y Toro and Viña Ventisquero, two of Chile's largest and most prestigious vineyards, and Ladrillos Princesa, a clay brick manufacturing facility. Finally, the team exchanged ideas with graduate students and faculty at the Pontificia Universidad Catolica (PUC) de Chile College of Engineering, an ABET certified college of engineering and one of the most prestigious universities in Chile and Latin America.

The team had free time in Santiago, a city of seven million that is vastly different from northern Chile, to learn some history and stories about the city, and visit museums, old churches, and other sites. The team also went to the beach and tried typical Chilean seafood, and enjoyed the snow in a ski resort in the Andes.

A mummy, about 11,000 years old, of a young adult of the San Pedro culture from the Atacama desert in northern Chile. These habitants of the desert, the Atacameños, believed in the life after death. They buried their loved ones dressed and with food for their trip to the afterlife. They worshiped nature, were peaceful, and were the most developed pre-Columbian culture in Chile.

They also discovered some country food when they visited Pomaire, a typical Chilean small town making pottery and arts and crafts. The trip closed with a celebration dinner at a Polynesian restaurant.

The 2005 team included the following students:

Undergraduates
Tabitha Robinson (ISE)
Michael Johann (ISE)
Andrew Mosseley (ISE)
Juan Espinoza (MAE)
Ina Agaj (ChE)
Stephen Marsh (ChE)
David Kelley (ChE)

Graduates (all ISE master's degree students)
Carolina Padilla
Yeh Kuang-Hao
John Lehman
Brian Po-Feng
Carlos Romero

The course will be offered again during the Summer C – 2006 term.

Cristián Cárdenas-Lailhacar
cardenas@ise.ufl.edu

Jason Weaver: Oxidation Catalysis **from page 10**

"At high pressure you can have different types of oxygen on the surface of a noble metal," Weaver said. "If we want to learn about the basic chemical properties of these oxygen phases, we must be able to prepare such phases in the well-controlled high vacuum environment, where we can characterize their properties in detail, and that's what we've succeeded in doing. It's a powerful approach."

A novel aspect of his research is the use of a beam of oxygen atoms rather than O_2 molecules to oxidize noble metal surfaces in UHV. At high pressure, O_2 molecules can generate high concentrations of atomic oxygen on noble metal surfaces, but under vacuum conditions it is only possible to adsorb small concentrations using O_2. Using a beam of oxygen atoms has allowed Weaver to adsorb significantly higher concentrations of oxygen on noble metal surfaces than can be obtained using O_2 in the high vacuum environment.

"We are ultimately trying to learn about the types of molecular processes that govern catalytic behavior under realistic conditions," he said. "I think that the ability to prepare these high-concentration oxygen phases, and looking at more realistic materials, these nanoparticles, is a step in that direction."

Recently, he has been using a scanning tunneling microscope to image reactions as they occur. "What we're starting to do is to study surface chemical reactions in real time and real space," he said. "So you can actually see changes in atomic-level structure as the reactions occur.

Ultimately, we want to be able to describe catalytic reactions under realistic conditions at a molecular level, incorporating what we learn about atomic level processes," he said. "Will we ever be able to do that? Probably not in my lifetime, but hopefully we can gain some insights to help it along."

Reshelle Smith

Jason Butler: Complex Fluid Motion **from page 10**

but they don't know how to manipulate materials to get the numbers they want. Butler hopes to change that. "What our work will offer people is a way to characterize their materials more than anything else."

Being able to characterize fluids is essential in the understanding of the motion of everything from Kevlar to viruses to carbon nanotubes. "We're trying to give scientists a better idea of when they go and do an experiment to characterize their material, what it is they are actually looking at," Butler said.

The CAREER award was just an added bonus for Butler. "I was very pleased to get it. I was walking around with a smile on my face for about a month," he said.

Reshelle Smith

Manuel Bermudez(R) discusses research and international cooperation with Prof. Alfonso Perez Gama, prominent Colombian artificial intelligence researcher and past president of IEEE Colombia, following a conference presentation on latest trends in artificial intelligence.

UF, Latin American Universities Establish Distance Learning Courses in Computer Graphics

The University of Florida has renewed a cooperative agreement with the Universidad Militar Nueva Granada (UMNG) in Bogotá, Colombia, to establish distance learning courses in computer graphics. The agreement was negotiated by Manuel Bermúdez, associate professor and Latin American Outreach Coordinator for UF's Computer & Information Sciences & Engineering department. Bermúdez is the lead contact between the two universities.

The courses will focus on the latest techniques and methods in computer graphics and on incorporating them into UMNG's existing multimedia engineering program. The program, like UF's Digital Arts and Sciences program, synthesizes computer science, art, three-dimensional design, and engineering.

The cooperative agreement will be renewed in late 2005 and will last five years.

Bermúdez has fostered similar collaborations with other Latin American universities. He established a formal academic cooperation agreement between UF and the Universidad de los Andes in Mérida, Venezuela, in 2003, and provided guidance regarding the school's master's degree program in systems engineering. He continues to work with the Venezuelan university to encourage its graduates to pursue further studies in the US.

Bermúdez has also established an academic cooperation agreement with the Universidad Latina in San José, Costa Rica, which will host the 2007 Centro Latinoamericano de Educación en Informática (CLEI) conference. Bermúdez will be the program committee chairman for the CLEI conference, the oldest and most prestigious computer science conference in Latin America.

Bermúdez traveled to Latin America on sabbatical as a Fulbright Scholar in 2003-04, during which time he nurtured ties between UF and his host institution in Mérida, as well as universities in Bogotá and San José. His Fulbright appointment was extended from ten to fifteen months, with full support from the Council on International Exchange of Scholars, in 2004. He also taught several undergraduate and graduate courses at the Universidad de los Andes during that time. His worked was highlighted in the Fulbright Quarterly Newsletter Fall 2004: http://exchanges.state.gov/education/fulbright/newsletter/oct04/reports4.htm

Danny Rigby

Faculty FOOTNOTES

Agricultural & Biological Engineering

Wendy Graham, professor and chair, has been elected to the board of trustees of the American Society of Agricultural and Biological Engineers (ASABE), formerly known as the American Society of Agricultural Engineers.

James W. Jones, distinguished professor and ASABE Fellow, has received the Kashida International Award from the ASABE.

Fedro S. Zazueta, professor, has been named a Fellow of the ASABE.

Michael Dukes, assistant professor, was named the ASABE Florida Section Young Researcher for 2005.

Chemical Engineering

Mark Orazem, professor, was elected vice president of the International Society of Electrochemistry for 2006 – 2008.

Civil & Coastal Engineering

Robert Thieke, assistant professor, is one of two University of Florida faculty members selected for the 2004-2005 university-wide Teacher of the Year Award.

Computer & Information Science & Engineering

Benjamin Lok, assistant professor, was named the 2005 Association for Computing Machinery (ACM) Teacher of the Year.

Electrical & Computer Engineering

Jian Li, professor, was named as a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and of the Institute of Electrical Engineers.

José Principe, distinguished professor, has received the 2005 IEEE Engineering in Medicine and Biology Society's Career Service Award

Fred Taylor, professor, has been named a Fellow of the IEEE.

Professor Dinesh Shah Offers Gift for Endowed Professorship

Professor Dinesh Shah has offered the University of Florida a challenge gift of $200,000 to establish an endowed professorship, a Chair in Surface Science in the Chemical Engineering department. Shah, who retired in 2005, is the director of the Center for Surface Science and Engineering in the College of Engineering.

Shah is encouraging matching corporate and alumni donations of $400,000 to help fund the chair. The State of Florida can then offer an additional $400,000 in matching funds, for a total of one million dollars to support the chair.

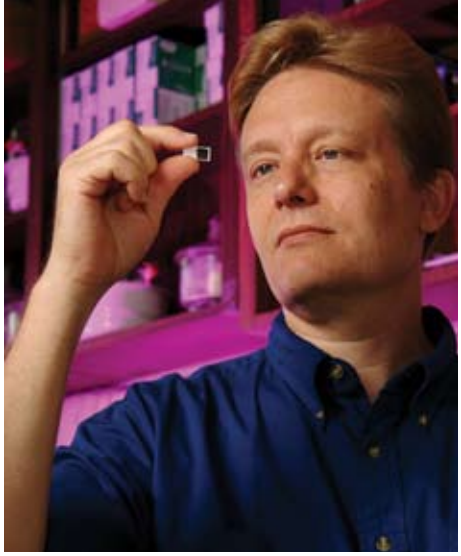
Shah's donation caps a distinguished 35-year academic and humanitarian career. Shah came to UF in 1970. He served as chairman of Chemical Engineering from 1987 to 1991 and was appointed the first Charles A. Stokes Professor of Chemical Engineering in 1996. He organized the International Symposium on Surfactants in Solutions in 1990, a meeting that brings scientists from around the world to UF every five years.

Shah has received many honors and awards. Among them, he was UF's Teacher/Scholar of the Year for 1984-85 and he received the Florida Scientist of the Year Award in 1988. He was named the Florida Blue Key Distinguished Faculty Member in 1992, and served as the Grand Marshal of the homecoming parade that year. In 1993, he received the Pride of India Award from India's Ambassador to the United Nations, and the Florida Academy of Science named him the Distinguished Florida Scientist of the Year.

Shah hopes the creation of the endowed professorship will further establish UF as a world-class teaching and research facility in surface science, and, as he says, "will allow me to leave my invisible fingerprints on the university that I love so dearly."

Donations may be directed through the College of Engineering development office.

Anthony J.C. Ladd



Eric Wachsman

Reynaldo Roque

Three Engineering Faculty Named UF Research Foundation Professors for 2005

Three College of Engineering professors were named by the University of Florida Research Foundation as UFRF Professors for 2005-2008:

- **Anthony J.C. Ladd**, Chemical Engineering
- **Reynaldo Roque**, Civil & Coastal Engineering
- **Eric Wachsman**, Materials Science & Engineering

UFRF Professors must have a distinguished current record of research and a strong research agenda that is likely to lead to continuing distinction. Publications in scholarly journals, external funding, honors and awards, development of intellectual property and other measures appropriate to their field of expertise are considered when selecting the UFRF Professors.

The three-year award carries with it a $5,000 annual salary supplement and a $3,000 grant. The professorships are funded from the university's share of royalty and licensing income on UF-generated products.

The UF Research Foundation provides a mechanism by which research can be conducted flexibly and efficiently and by which intellectual property can be transferred from the laboratory to the marketplace. Funds generated by licensing such discoveries are used to enhance research at the university.

Information provided by Joseph Kays

Vice President Phillips Honored by ASME

Win Phillips, UF vice president for research and former College of Engineering dean, has received the Ralph Coats Roe Medal from the American Society of Mechanical Engineers (ASME).

The citation noted that Phillips received the honor for "extraordinary achievements as an engineering educator, and for leadership in several professional societies to promote public understanding and appreciation of engineers."

A Fellow of ASME, Phillips served on the Board of Governors in 1994-98 and as president in 1998-99. He is a trustee of the ASME Foundation and serves on many ASME committees and councils.

Phillips was president of the Accreditation Board of Engineering and Technology (ABET) in 1995-96 and the American Society for Engineering Education (ASEE) in 1996-97. He is a Fellow of ABET and ASEE, the American Association for the Advancement of Science, the American Astronautical Society, the American Institute for Aeronautics and Astronautics, the American Institute for Medical and Biological Engineering, the New York Academy of Sciences, and the Royal Society for Arts (England), and is a member of several professional and scientific societies.

Assistant professor Oana Cazacu (r) teaches at REEF

Graduate Engineering Research Center Now Called REEF

The College of Engineering's Graduate Engineering Research Center (GERC) has a new name: The University of Florida Emerald Coast Research and Engineering Education Facility (REEF). The name change, announced formally at a ceremony August 11, reflects a new strategic direction for the center and identifies its location in the Florida Panhandle, often referred to as the Emerald Coast.

REEF is located adjacent to Eglin Air Force Base near Fort Walton Beach, Fla. The REEF has a close working relationship with Eglin and related industrial and commercial aerospace partners in the area. John (Row) Rogacki, formerly of NASA and the Air Force Research Lab, and a UF Mechanical & Aerospace Engineering faculty member, is the REEF's director.

Research at the REEF includes laboratory studies of short duration events, such as the impact of projectiles and shock waves, using diagnostic tools such as lasers and high-speed imaging cameras. The REEF recently received nearly $2 million in grants from the Air force Office of Scientific Research for projects in vision-based control, rapid prototyping, aerodynamic characterization, and hardware-in-the-loop simulation.

The REEF is affiliated with the UF EDGE program, which offers graduate studies to students who cannot come to campus. Currently, the REEF has about 100 graduate students enrolled in master's, PhD, and certificate programs with a focus on:

- Agile autonomous flight
- Micro-air vehicles
- Computational mechanics
- Probabilistic optimization
- Microwave photonics
- Systems engineering
- Application of electromagnetic fields

www.gerc.eng.ufl.edu

Chemical Engineering New Faculty 2005

Aravind Asthagiri
Assistant Professor
PhD Carnegie Mellon University, 2003

Aravind Asthagiri's research involves the simulation of novel materials from an atomistic level. He uses a multi-scale modeling approach to link atomic-level information to observable macroscopic properties. The accurate simulation of material properties is critical for insight on the underlying phenomena and design of novel materials.

Yiider Tseng
Associate Professor
PhD Johns Hopkins University, 1999

Yiider Tseng exploits biophysical methods for novel aspects of biomechanical signaling. Tseng introduced multiple-particle tracking microrheology, and extended the method to living cell mechanics as intracellular microrheology (ICM), which can directly measure the viscoelasticity of living cells in real time. Tseng is active in the development and characterization of molecular biomechanics.

Sergey Vasenkov
Assistant Professor
PhD Institute of Chemical Kinetics and Combustion (Novosibirsk), 1994

Sergey Vasenkov studies transport phenomena in nanostructured materials on all relevant length scales. New microscopic techniques allow direct studies of the relation between structure and transport in molecular diffusion in nano- and microscale materials. His recent work has been on locating ways to use pulsed field gradient (PFG) NMR, interference microscopy, and IR microscopy to study molecular transport in nanoporous solids such as zeolites.

Kirk J. Ziegler
Assistant Professor
PhD University of Texas - Austin, 1996

Kirk Ziegler has worked on processes to cut micron long nanotubes into segments below 100 nm and sort them by length. His interests include physical chemistry and applications of complex fluids, colloids, and interfaces for the synthesis of nanomaterials for use in microelectronics, manufacturing, healthcare, biotechnology, energy, and materials science.

Robotics Labs Join Forces

They have similar missions but different backgrounds. They've worked together in the past, but were never this close. Now in the same building, they hope to create a more complete, better funded robotics program at UF.

After years of being housed separately in the Mechanical and Aerospace building and in Benton Hall, the Center for Intelligent Machines and Robots (CIMAR) and the Machine Intelligence Lab (MIL) are now just a few steps from each other.

"This is something we started talking about three or four years ago. When it became possible again and Carl Crane, the director of CIMAR, still wanted it, it was a no-brainer," said Eric Schwartz, associate director of MIL. "We definitely said it would be a great thing."

MIL is a part of the Electrical & Computer Engineering department, while CIMAR is part of the Mechanical & Aerospace Engineering department. That difference has kept them apart, but it is now what they hope will enable them to build better machines.

"I think the main reason we wanted to do it was because they have certain expertise that really we don't," said Crane, referring to MIL. "It's not just duplicate, where they do the same things we do, but they've got different strengths."

The move will give experts more time to work on what they know best, Schwartz said. Doctorate students in electrical engineering shouldn't have to spend their time doing mechanical design when a master's student in mechanical engineering could easily do it faster. Similarly, mechanical engineering doctorate students shouldn't be doing what a master's student in electrical engineering could do.

It will also allow students in electrical engineering to freely mingle with those in mechanical engineering, Crane said.

"If one of their students needs help from us, it's a snap, and vice versa," Schwartz said.

Before the move, there were a few students who would cross over from other departments to work in MIL or CIMAR, but the move makes it even easier for students who wish to explore all the aspects of the world of robotics.

The result, Schwartz said, will hopefully be better robots, with better mechanical designs and better electronics.

"We can put it all together," Schwartz said. "What's necessary to build a robot, a real robot, a good robot, a robust robot, is theory and practice of electrical, mechanical, and computer engineering, and that's what we bring together that was never together in one place on this campus before."

They hope to combine their knowledge not just in the actual building of robots, but also in getting the funding for those robots.

"The biggest reason to come here is to help both of our funding," Schwartz said.

According to Schwartz, both labs will have input into most, if not all, grant proposals, research proposals, and papers. He said he believes that this will bring in more funding for both labs.

"I don't see any downside," Crane said. "There's no way that the labs are going to come together and things be worse than they were, so I think there's only a good side to it."

The move was just the first step. Long-term goals of the labs include a degree in robotics and a robotics institute, something few universities in the world have, Schwartz said.

"I feel that the move is going to give us a chance to be more than we or CIMAR could have ever been before, to be a robotic institute at least in ideas," he said.

Reshelle Smith

http://cimar.mae.ufl.edu/

http://www.mil.ufl.edu

GATOR Engineering®

Robot Submarine SubjuGator Hints at the Future

On the heels of the rescue of a Russian mini-submarine by a remotely operated sub, UF engineering students are leading their compatriots in the design of the next generation of robotic underwater vehicles.

SubjuGator, built by eight students in the Machine Intelligence Laboratory, placed first in a national competition of 21 student-built robotic submarines in August. The sub points the way toward a future of smart, compact robotic submarines that could repair underwater pipelines, guard ports, and conduct military offensive operations underwater.

"The military wants to have a significant percentage of its battle infrastructure done without humans in 10 years - by 2015, 30 percent of all US military vehicles should be capable of autonomous navigation," said Eric Schwartz, the Electrical & Computer Engineering faculty adviser for the SubjuGator project. "These robotic subs could serve as spy-bots or plant explosives. You don't always want to use humans because we value human lives and fighting is risky."

On Aug. 7, 2005, the remote-controlled British "Scorpio" underwater vehicle disentangled a Russian mini-submarine that had been trapped for days beneath the Bering Sea, saving the seven-member crew. The rescue highlighted the capacity of remotely operated subs to lend assistance in situations that are either too dangerous or too deep for human divers - in this case, cutting the mini-sub free of fishing nets and other debris that had trapped it more than 600 feet below the surface.

The next step is to make submarines autonomous, or able to navigate and complete tasks without human assistance. UF teams have worked on that thorny challenge since at least 1998, when they entered the first Autonomous Underwater Vehicle Competition. Although the UF team placed among the top three in four previous competitions, the Aug. 3-7 competition at the Space and Naval Warfare Systems Center near San Diego was its first victory. The competition is sponsored by the Association for Unmanned Vehicle Systems International and the Office of Naval Research.

Three teams achieved one of the competition's main objectives: Finding an underwater pinger, or sound-generating device, in a murky pond, and then rising to the surface directly above the pinger. UF took first place because SubjuGator at 30 pounds was at least 40 pounds lighter than the other finalists.

"We forced ourselves into a small design by buying a small shell," said team leader Jim Greco, who earned his BS degree in 2005 and began his doctoral program this fall, both in electrical and computer engineering.

"All of our electronics had to fit within the shell. At UF, to save money, we make a lot of our electronics, whereas other teams might buy it off the shelf."

Besides the electronics, the SubjuGator has five thrusters that give the computer complete three-dimensional control, said team member Jose Carlo Francis. It is powered by lithium polymer batteries that allow it to operate for 90 minutes. The design is completely new.

Greco said building the sub was a good introduction to collaboration and other skills of professional engineering. "Our classes are great, but it's mostly just theory," he said. "There aren't a whole lot of practical applications, and this allows you to get a leg up."

He added that one problem with today's remotely operated submarines is that they require a cable or other communications link to the operator at the surface. "If you're going down into the Marianna Trench, the deepest spot on Earth, you can't exactly drop a cable in there," he said.

Robotic subs remove this impediment, but as Grego noted, "They have their own problems to work around." One major challenge: programming the subs to "see" and react to objects or changes in the terrain, a difficult task for land-based robots made even harder underwater by limited visibility and difficulty of controlling the vessel.

Aaron Hoover

www.mil.ufl.edu/

Student Competition Roundup

Micro Air Vehicle Team Wins Again in International Contest

The UF Micro Air Vehicle (MAV) team won the 9th International MAV Competition on May 21, 2005, in Seoul, Korea. The team finished first in the overall competition for the seventh consecutive year.

The teams compete in four categories: surveillance, endurance, ornithopter, and design report. In the surveillance mission, the smallest possible MAVs must navigate to a target located 600 meters from the launch site and obtain a clear image of the target. UF holds the record by completing the mission with a 5.25 inch aircraft.

In the endurance mission, the objective is to fly the smallest aircraft as long as possible. UF won with a 4.5 inch aircraft that flew for 14:54 minutes.

UF Wins Tandem Bicycle Competition Again

UF mechanical engineering students took first place in the tandem division of the 2005 ASME Human Powered Vehicle Challenge. This is the third year that UF has won the tandem division in the competition sponsored by the American Society of Mechanical Engineers. The contest was hosted this year April 22 - 24 at the University of Alabama in Tuscaloosa.

UF Aces ASCE Steel Bridge and Concrete Canoe Regional Contest; Team Is Second in Nationals

Students in the American Society of Civil Engineers (ASCE), under the guidance of faculty adviser Thomas Sputo, brought home regional and national honors again for the University of Florida, and one team reclaimed a title it previously held for eight consecutive years.

The ASCE Concrete Canoe, Steel Bridge, Tech Paper, Visual Display and Concrete Horseshoe teams placed first over 20 universities in the Southeast Region competition. The Steel Bridge team reclaimed first place after losing the title in 2004, the first time in eight years the team did not place first in the regional competition.

The Steel Bridge team went on to place second overall at the ASCE national competition held May 27-28, 2005, at the University of Central Florida.

Formula SAE

The UF Society of Automotive Engineers (SAE) competed in the 2005 SAE Formula Competition May 18-22, 2005, at the Pontiac Silverdome in Pontiac, Mich. The team of Mechanical & Aerospace Engineering students finished 53rd overall out of 140 schools, and had their bright spots in individual events. The team placed 14th in the skidpad event, 11th in the autocross and scored more points in both the cost event and the sales presentation than the prior year.

www.eng.ufl.edu/elinks/news/student/index.php

Graduate School Prospects Get a Warm College Welcome

The College of Engineering is aggressively working to increase graduate student enrollment. Part of the program is inviting potential students to spend a weekend visiting the college and the campus during spring term.

The weekends are directed at the best qualified of the students who have applied to enter the college's graduate programs, and the effort has been successful. Attendance at the annual affair has risen from 126 students in spring 2003 to 174 in 2004 and 193 in 2005, and the subsequent enrollment numbers of new students in the fall reflect this increase.

"We show them the advantage of coming to Florida, and they come," says Tim Anderson, the college's associate dean for research and graduate programs.

Courting the best graduate students is necessary because the number of qualified prospects is not large. The problem is faced by colleges nationwide. The number of bachelor's degrees in engineering granted each year fluctuates somewhat over time, but has remained fairly constant. It isn't growing enough to meet the demand for graduate students.

"Couple that with a good job market – pretty much everyone is getting offers now – and the supply of students is squeezed," Anderson says. "What we really need to do is increase our pool of applicants. Bucking national trends, we have been able to do that fairly well on the domestic side," Anderson says, referring to students who are American citizens. In 2003, the college had 345 new American graduate students; in 2005, there are 461.

But recruiting international students has become much more difficult since the 9/11 attack on the World Trade Center. The perception by international students is that it is harder to get visas to study in the US now than it was before 9/11.

"Actually, about the same number of students have visa problems as before 9/11," Anderson says. "The process simply takes longer than it used to."

The impact on international admissions has been serious. In 2002, the last year not impacted by the attack, the college had 4500 international applications. In 2005, there were 2400. Other factors that have affected international student applications are improved graduate school offerings abroad and stronger economies in Asia and India, which supply most of UF's engineering graduate students, that are creating more jobs and keeping graduates at home.

One pool of applicants has dramatically increased: Master's degree students who are not supported with financial aid. So in a trial program, the college is offering an achievement award for students who do not have other support. The award is a partial waiver of their tuition.

"Our initial enrollment figures this fall suggest the program was very successful," Anderson says.

Martha Dobson

www.eng.ufl.edu/students/admissions/graduate/index.php

A CISE Summer Workshop Shows

Computers Are a Girl Thing, Too

If you can catch them early, they may be hooked for life.

That's the idea behind the Women's Summer Workshop presented by UF's Computer & Information Science & Engineering (CISE) department. Now in its second year, the workshop is a four-day program that introduces high school girls to the world of computer science and technology. It's an area where women have been in the minority since the late 1980s .

"Currently, the field has only about 16 to 18 percent women," said workshop director Rory De Simone, a CISE faculty member.

"It appears that high school women are reluctant to go into computer science engineering because they think that it is difficult and that it consists primarily of programming," she said. "Although the work is difficult, women have historically risen to the challenge. However, over the past 20 years, more women have entered the softer sciences such as biology and more societal engineering areas such as environmental or industrial engineering. An excellent example is that medical school enrollments are now 51 percent women. These fields require the same high levels of math and science skills, so there is no question that women can do the work."

It is also a misconception that computer engineers only do code, De Simone said. The intention of the workshop is to show girls the many diverse opportunities available to CISE graduates. "We hope the girls will develop an understanding of the importance of technology to our future as we encourage these talented young women to be among the technical innovators of their generation. The computer industry needs and is asking for women. They need their ideas, influence, creativity, and perspective."

Camp attendee Vicky Smith, a sophomore a St. Petersburg High School, said she now realizes that more women need to go into computer engineering.

"I think a lot of women don't go into it because girls just think men are more into computers and all that stuff, but I think women need to go into it to help bring in the creative side," she said. "After all, anyone can do well in math classes, not just boys."

The problem, De Simone believes, is a misconception that girls are not as good as boys at math and science. On July 18-21, 40 girls from different Gainesville area high schools and of different ethnicities came together to help dispel that idea. Most had no experience in computer programming or computer science, but on the first day they were able to build and program Lego robots.

"I was amazed at how quickly they grasped things," De Simone said.

The girls who attended helped make the program what it was, De Simone said. "They were bright, curious, dynamic, and polite," she said. "They continually asked excellent questions and were interested in all they learned."

Vicky agreed, adding that being one of the only girls from out of town made no difference in her experience. "All of the girls were kind and intelligent," she said.

In addition to building the Lego robots, the girls talked with women in the computer science/engineering industry and UF researchers, explored the world of virtual reality, toured UF's Smart House, and visited DisneyQuest for a customized behind-the-scenes tour.

On day one, IBM executive Julie Schunemen spoke about her experience as a woman in engineering and Denise Atteberry explained the various degrees offered by CISE. The girls also built their robots and programmed them for a variety of functions.

The girls loved the robots. "I wanted to take my robot home," Vicky said.

On the second day the girls learned the basics of the object-oriented programming language Alice and the graphic program Maya. They saw demonstrations of DIANA, a virtual patient used to train medical students, and the NAV, a digital program that illustrated a realistic virtual tour of UF's campus, both developed by CISE researchers.

On day three, the girls met a panel of women from industry and academia. They also toured the Smart House designed by UF researchers to provide automated assistance to elderly residents.

On the fourth day, the girls traveled to Orlando for a behind-the-scenes tour of DisneyQuest. They met technicians who work on Disney's computer systems and learned about the computer processes that keep Disney World running. The girls also observed that few women were working as engineers or technicians at Disney, which brought home the point that computer science needs women. In the afternoon, they explored DisneyQuest on their own.

Vicky said the field trips to DisneyQuest and the Smart House were her favorite parts of the workshop. "We got to see computer engineering in action and how it can be used in the real world," she said.

The workshop was an unqualified success, De Simone said. "It exceeded my expectation. I was very pleased."

Almost every girl indicated she would like to return next year.

"I would love to come back," Vicky said. "It was a lot of fun, and I learned a lot. At the beginning I didn't think I would be interested in computers at all, but by the end of the camp I realized that I should at least take a few classes because so many fields use computer engineering, and it's actually very interesting."

The increased interest means the workshop will need to expand. De Simone hopes to eventually have 100 girls attend and to have two sections, one for the girls who have attended before and one for new girls. It's a major expansion for the workshop which had only 12 girls in 2004.

"This year's workshop was the blockbuster, next summer will be the sequel," De Simone said.

The workshop was funded through grants and support from Lockheed Martin and Progress Energy. Departing gifts were donated by Microsoft and IBM.

Teaching assistants Christian Roberson, Alexandra Martinez, James Nichols, and Kevin Lawler, and academic advisor Amy Landendorf were all instrumental to the workshop's success.

Thanks also go to Mike Scott of Disney Quest; Cammy Abernathy, associate dean for academic affairs; Jonathan Earle, associate dean for student affairs; Sartaj Sahni, CISE chairman; and CISE faculty Sumi Helal, Jorg Peters, and Ben Lok.

Reshelle Smith

www.cise.ufl.edu/~rjd/workshop.html

Development Report
2004-2005

Dear Alumni and Friends,

It is a special pleasure to thank you for your continued support during the 2004-2005 fiscal year. The Florida Fund and your annual contributions to the College of Engineering allow Dean Khargonekar and the department chairs to provide extraordinary opportunities for our faculty and students. Your gifts provide direct support for:

- laboratory and classroom exercises
- equipment and materials not available through state-appropriated funds
- topical seminars and prominent guest lecturers
- travel to attend competitions for our many student organizations, and
- academic and research opportunities for students, faculty, and staff.

Your annual gifts provide the margin above basic state funding that enables the College of Engineering to excel over its peers and reach toward its goal of being a top-20 ranked engineering program.

The college is deeply appreciative of our Gator Engineering family for your interest and investment in the ideas, beliefs, and people who form this outstanding institution. The college is committed to continue its strides toward excellence in order to enhance the quality and reputation of the programs that you have come to respect at the University of Florida.

The development team is available to assist you with any questions about gifts to the College of Engineering to aid its quest to develop new processes, materials, and knowledge.

On behalf of the college, departments, faculty, and students, we thank you sincerely for your gifts.

With appreciation,

Edward M. Kominowski
Director of Development
E-mail: ekominowski@eng.ufl.edu

C. Ellis Pope
Director of Development
E-mail: epope@eng.ufl.edu

Engineering Development Office
College of Engineering
University of Florida
P O Box 116575
Gainesville, FL 32611-6575

P: 352.392.6795
F: 352.846.0138

New Senior Development Officer Named

Dean Pramod Khargonekar has announced the appointment of Ann McElwain as senior director of development for the College of Engineering. McElwain joined the College of Engineering in early October.

McElwain is a 1990 UF alumna in Economics. She also has an MBA from Nova Southeastern University in Ft. Lauderdale. She has held fund raising positions in Broward County since 1997, first at Nova Southeastern and at Jack & Jill's Children's Center, where, in 2003, she was promoted to managing director. She was named Outstanding Fundraising Executive, Broward County, in 2004 by the Association of Fundraising Professionals.

To the Gator Engineering Family:

GATOR Engineering

It is my sincere pleasure to announce the creation of a donor recognition wall. I believe that as a college we must always show our appreciation of the generous support you and your families have given to the educational and research mission of Gator Engineering.

The drawing above shows the donor recognition space. It is important that all who enter the College of Engineering will realize how many strong supporters the college has had during its many years.

The new space will be completed this fall. I sincerely hope that you will have an opportunity to visit so that we may express in this small way our gratitude for your past and continued investment in our tremendous faculty, students, and staff.

The donor wall will provide space that we may honor both past and future donors who have accepted the goal of providing Gator Engineering with the private support that gives the college its margin for excellence.

We look forward to your visit and welcome the opportunity to thank you in this significant manner.

Sincerely,
Pramod P. Kharagonekar
Dean, College of Engineering

UF Engineering Alumnus Named Head of Sandia Labs

Thomas O. Hunter became president of the Sandia Corporation and director of Sandia National Laboratories on April 29, 2005. Hunter most recently had served as Sandia's senior vice president for defense programs, with oversight of the US nuclear weapons programs.

Hunter joined Sandia in 1967 after he received his bachelor's degree in mechanical engineering from the University of Florida in 1966. While working at Sandia, he earned his PhD in nuclear engineering from the University of Wisconsin. Hunter has been recognized as a distinguished alumnus by both UF and the University of Wisconsin, and he serves on the Dean's Advisory Board for the UF College of Engineering.

Sandia's laboratories in Albuquerque, New Mexico and Livermore, California are funded primarily by the US Department of Energy, with additional funding by the Department of Homeland Security and Department of Defense. Sandia's mission is to develop technologies for national security, which includes maintaining the nation's nuclear stockpile. The laboratories are managed by the Lockheed Martin Corporation.

Information Courtesy of Sandia Laboratories

College of Engineering Spring Commencement Honors

Nils J. Diaz

Hyung-Khu Lim

Robert Cohn

Gator Engineers Named UF Distinguished Alumni at Spring Commencement

The University of Florida has recognized Nils J. Diaz and Hyung-Khu Lim for their accomplishments by naming them UF Distinguished Alumni at the May 2005 commencement ceremony.

Diaz is the chairman of the US Nuclear Regulatory Commission (NRC) and a professor emeritus in the Nuclear & Radiological Engineering department. Lim is the president of Corporate Technology Operations for Samsung Electronics.

Diaz, a native of Cuba, received his MS and PhD degrees in nuclear engineering from UF. He joined the UF faculty, teaching nuclear engineering sciences and serving as director of the Innovative Nuclear Space Power Institute, a national consortium of industries, universities, and national laboratories. In 1996, Diaz was named to the Nuclear Regulatory Commission. In 2003, President George W. Bush selected Diaz to be the NRC chairman. As chairman, Diaz is responsible for NRC's administrative functions. He also has authority for all NRC emergency functions involving an NRC licensee.

Lim received his PhD in electrical engineering from UF. He then returned to Samsung, where he had been employed as a staff engineer, to work on memory semiconductor products. He spearheaded the development of EEPROM, Flash Memory, and SRAM and DRAM products. While Lim was managing executive director and executive vice president of Samsung's memory division, the company became the leading manufacturer of DRAM chips, the major memory components of PCs and laptop computers.

Venture Capitalist Robert Cohn Addressed Spring Commencement

UF alumnus Robert Cohn, an independent investor and advisor to growing companies, spoke to graduating engineers at the spring commencement ceremony. He received a BS in mathematics and computer science from UF and an MBA from Stanford University.

Cohn became a venture capitalist during his 2002-04 partnership in Sequoia Capital, a high-tech venture capital firm in Silicon Valley. In 1982, Cohn founded Octel Communications Corporation, a manufacturer of voice mail equipment. He was chairman and CEO of Octel until the company was purchased by Lucent Technologies, Inc. in 1997. He then served as an executive vice president of Lucent and retired in 1999.

More information about Diaz, Lim, and Cohn can be found at the following Web site:

www.eng.ufl.edu/newsroom/spotlights

write
send

pubsmail@eng.ufl.edu

Editor, The Florida Engineer
University of Florida
PO Box 116550
Gainesville FL 32611-6550

www.eng.ufl.edu/home/pubs

Alumni Updates

Bill Bierbower, patent US 6,865,999 for the Monster Wakeboard Tower.

1959

Henry Katz, BS AeroE, retired after 31 years with the National Security Agency. He now is a full-time lecturer with the University of Maryland Baltimore County (UMBC) Computer Science department. As of this year, he has finished 14 years of teaching part-time at UMBC and eight years of full-time teaching. Katz reports that UMBC has many students with very high SAT scores and a chess team that won the national collegiate title in April 2005. "Also, we are undefeated in football, as we do not have a football team."

1963

Thomas C. Breske, BS ChE, has retired from DuPont after more than 35 years with the company. He is now a consultant in industrial water treatment, including design, operation, and troubleshooting. He resides in Perryville, Md.

1978

Ronald E. Jarnagin, BS ME, MS ME 80, is now vice president of the American Society of Heating, Refrigerating and Air-Conditioning Engineers. He has also received ASHRAE's Distinguished Service Award. He is a staff scientist and program manager at Battelle's Pacific Northwest National Laboratory, Richland, Wash.

Harold Dubon

Marc O'Connor

1987

Bill Bierbower, BS ME, has received patent US 6,865,999 for the Monster Wakeboard Tower. His company, Monster Tower, was two years old on April 16, 2005, and has quickly become the most popular aftermarket wakeboard tower with distribution in more than thirty countries.

1990

Harold Dubon, who pursued distance learning graduate studies during the 1990s through the program now known as UF EDGE, is the Jacksonville office manager of the Florida-wide engineering firm Nordarse & Associates. Dubon holds bachelor's degrees in civil engineering and architectural engineering from the University of Miami. Dubon, a Professional Engineer, formerly worked with the Florida Department of Transportation.

Megan O'Connor

Marc O'Connor, BS ISE, has been named president of Maxon Holdings. Maxon is a Green Energy Development Company in Atlanta, Ga., and is developing the south's largest district energy network in association with the Atlantic Station development in downtown Atlanta. He lives with his wife Barbara O'Connor (UF 91 Finance) and their young daughter, Megan, in Atlanta, Ga.

2004

Bibo Zhang, MS CE, is a structural engineer in the bridge department of HNTB Corporation, Lake Mary office. She will do analysis and design for several Florida bridge projects.

Friends We Will Miss

1936 Drayton D. Bernhard, BS ME, of Lake City, Fla., died April 24, 1995.
Ray Tylander, BS IE, of Jupiter, Fla., died May 9, 2005.

1938 Clark B. Smith, BS CHE, died March 17, 2001.

1939 John M. Tubbs, BS IE, of Dutton, Va., died January 16, 2005.

1940 Robert G. Crosby, Jr., BS EE, Georgetown, Tex., died June 4, 2005.
Robert R. Godman, BS ME, of Cape Coral, Fla., died March 13, 2005.

1941 Charles Castellano, BS ME, of Minneapolis, Minn., died April 4, 2004.

1943 Daniel M. McCarthy, BS CHE, of Clewiston, Fla., died February 25, 2005.
William H. Mahoney, BS CE, of Jacksonville, Fla., died March 22, 2005.

1944 S.N. Finney, Jr., BS CHE, of Tallahassee, Fla., died July 25, 1996.

1948 Wayne D. Barton, BS EE, of Sacramento, Cal., died February 5, 2005.
Richard H. McCart, BS CE, of Mount Dora, Fla., died March 14, 2005.
Sydney E. Smith, BS EE, of North Fort Myers, Fla., died October 24, 2004.

1949 Alexander L. McLeod, Jr., BS IE, of Roanoke, Va., died May 11, 2005.
Richard C. Mills, BS CE, of Pompano Beach, Fla., died May 3, 2005.

1950 Bernard A. Parkin, Jr., BS CHE, of Pomona Park, Fla., died January 15, 2003.
James Yontz, Sr., BS EE, of Rockledge, Fla., died January 23, 2004.

1951 Robert R. Jones, BS ME, of Whittier, Cal., died April 4, 2005.
Hurdis E. Wise, BS ME, of Benton, Ark., died March 7, 2005.

1952 Milton J. Wood, BS CE, of Ponte Vedra Beach, Fla., died October 23, 2004.

1954 Thomas E. Martin, BS ME, of Cary, N. Car., died February 24, 2005.

1957 Sherod E. Dewell, BS IE, of Tampa, Fla., died March 23, 2005.
Victor L. Fabry, BS CHE, of Bellaire, Ohio, died May 12, 2003.

1958 Donald E. Houston, BS EE, of Gainesville, Ga., died May 22, 2003.

1960 Raymond N. Summy, Jr., BS ME, of Rockledge, Fla., died April 11, 1999.

1961 Reuben A. Keppel, MS CHE, of Gainesville, Fla., died July 14, 2004.

1964 Karol G. Brechka, BS EE, of Bacliff, Tex., died September 18, 1988.
Peter P. Pierce III, BS ME, of Tokyo, Japan, died April 8, 2001.

1966 Thomas R. Shaw, BS ME, of Dearborn, Mich., died February 23, 2005.

1969 Joseph J. Vick, ME ISE, of Gulf Breeze, Fla., died March 23, 2005.

1970 Harold C. Baker, ME, of Rockville, Md., died May 5, 1990.

1971 Charles D. Burnside, MS ISE, of Placentia, Cal., died September 17, 2004.

1972 Marvin E. Oakes, Jr., BS EE, of Lehigh Acres, Fla., died June 10, 2005.

1977 Douglas E. Meilahn, BS CE, of Boynton Beach, Fla., died May 14, 2005.
Richard E. Oakley III, BS CE, ME CE 78, of Houston, Tex., died September 21, 2004.

1979 Patrick J. Cahill, MS ME, of Hollywood, Fla., died April 5, 2005.

1981 Chin-Ching Chang, ME EE, of Saratoga, Cal., died May 15, 1995.

1982 Wendy K. Cavallaro, BS ISE, of Ponte Vedra, Fla., died August 11, 2001.

1984 Patrick J. Cleary, BS CE, ME CE 86, of Ames, Iowa, died November 10, 2004.

1985 Mario J. Bassignani, BS ME, of Colorado Springs, Col., died February 6, 2001.

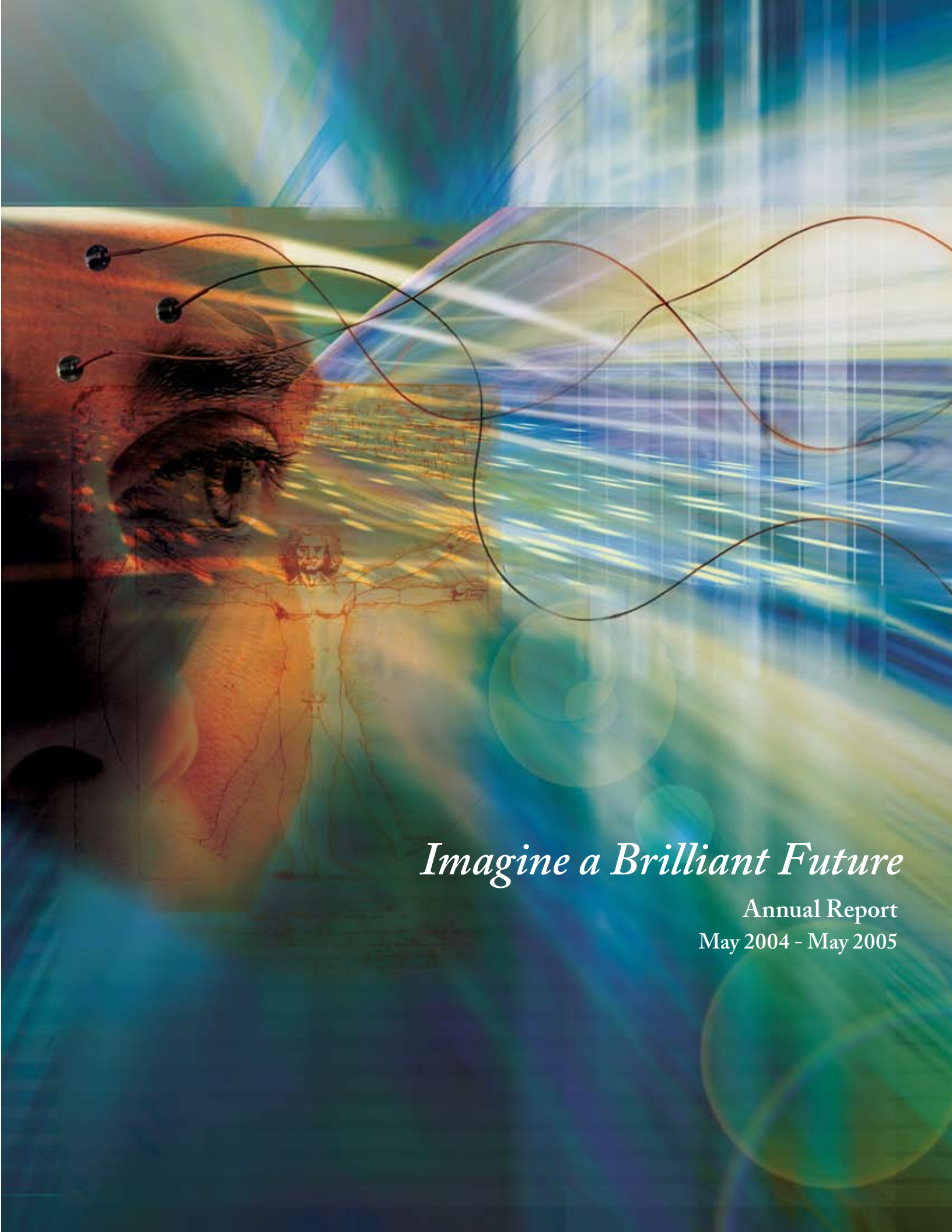
1987 Malcolm H. Curry, MS ISE, of Hamilton, Bermuda, died May 23, 2005.

1999 Christopher M. Plummer, BS CEN, died May 5, 2005.

2000 Misty R. Carroll, BS CEN, BS EE, of Raleigh, N. Car., died May 21, 2005.

2001 Julia M. Tyson, BS CE, of Bradenton, Fla., died March 13, 2005.

Information is provided by the University of Florida Foundation., Inc. Academic major or hometown data may not be available.



Imagine a Brilliant Future

Annual Report

May 2004 - May 2005

Better than Ever

US News & World Report Rankings August 2005

Undergraduate Programs

18th (public)
31st (all institutions)

Undergraduate departments ranked in the top 25 by specialties

Aerospace	14th (public)	19th (all)
Agricultural	10th (public)	11th (all)
Chemical	14th (public)	21st (all)
Civil	10th (public)	17th (all)
Environmental	7th (public)	14th (all)
Industrial	12th (public)	16th (all)
Materials	6th (public)	10th (all)
Mechanical	14th (public)	23rd (all)
Nuclear	9th (public)	10th (all)

Harris Corporation Gift to UF Engineering Tops $1 Million

In a major show of support for the College of Engineering, the Harris Corporation, an international communications equipment company headquartered in Melbourne, Fla., has pledged $1,025,000 that will be used to endow multiple professorships in UF's engineering program.

Howard Lance, chairman, president, and chief executive officer of Harris, made the presentation to UF President Bernie Machen and Dean Pramod Khargonekar at a news conference in UF's New Engineering Building on July 22, 2005. Machen announced that the gift will be matched with $250,000 from a special fund set up through his Faculty Challenge initiative.

"We are very excited about the direction Dean Khargonekar is taking the UF engineering program," said Lance. "UF has created a challenging and innovative engineering curriculum, and the quality of graduating students is superb. The energy at UF clearly matches the momentum at Harris, and we hope this gift provides the college with some of the resources to take their programs up another level."

UF is also eligible to receive $768,750 in matching funds from the State of Florida Major Gifts Trust Fund as a result of the gift, bringing the potential cumulative value of the gift to more than $2 million.

UF has been the number one university recruiting source for Harris for the past five years. Harris currently employs 460 UF graduates and recently recruited an additional 22 from the spring graduating class.

"The Harris Corp. has certainly demonstrated that they are tuned in to our initiative to build on our world-class faculty," said Machen. "The partnership represented by UF's relationship with Harris is exactly the type of public-private partnership that makes public research universities successful."

UF's Faculty Challenge initiative was launched by Machen in August 2004, with a goal of raising $150 million to give faculty the tools they need to enhance classroom instruction and conduct world-class research. The Faculty Challenge is part of a plan to make UF one of the nation's premier research universities.

In recognition of the gift, UF will name the rotunda, entry hallways, and the teaching auditorium in the New Engineering Building the Harris Corporation Rotunda and the Harris Corporation Auditorium

"Harris is one of the major economic engines in the state and we're very pleased to be part of their team," said Khargonekar. "Our collaboration on research projects, and in being a source of talented graduates, is the essence of a healthy and mutually beneficial relationship."

Christopher Brazda
UF Foundation

A Note from Dean Khargonekar

Our students, faculty, and staff effected remarkable achievements during the last academic year. Their tremendous hard work coupled with their enormous talents led to improved college rankings, increased graduation rates, more research publications in top-level journals, many patent applications on novel and useful technologies, and significant impact on industry and society.

We are attracting extremely talented students. The average SAT score for the incoming freshman class in fall 2004 was 1310, an all-time record. By this metric, our student community is among the best in the nation's public universities and rivals some of the most competitive private universities. The quality of our graduate students continues to improve as well. In 2004-05, we graduated 974 students with BS, 528 with MS, and 145 with PhD degrees. We note with much pride that the number of doctoral degree recipients set an all-time record. It is a result of our systematic investment in improving the quality and size of the doctoral program. It is also an excellent indicator of the depth and breadth of the research programs pursued by our faculty. Demand for our graduates, always very strong, has increased as the national economy has improved, with our students getting multiple job offers at nationally competitive salaries.

We created a major new distance learning initiative, UF EDGE, the University of Florida Electronic Delivery of Graduate Engineering. UF EDGE currently focuses on eight specially targeted, complete master of science degrees from six departments, with plans to offer degrees from all of our departments. These programs are identical to our on-campus residential programs in quality, rigor, and requirements. We hope that these programs will serve working professionals interested in increasing the depth of their technical knowledge while continuing to work and live at home with their families. We strongly believe that there is a large and growing latent need for distance education for working engineers. Initial response from potential students for the UF EDGE program is very encouraging. We are cautiously optimistic that it will be a very successful program and have a long-term positive impact on the state, the nation, and the world.

The college's research enterprise remains strong, vibrant, and robust. Our faculty members are successful in competing for grants and contracts from federal, state, industry, and non-profit sources. New research grants and contracts from external sponsors increased modestly from $58M to $63M. To assist our faculty in pursuing novel research directions, we continue to invest in state-of-the-art equipment and laboratory infrastructure. The creative work of our faculty and students is being published in top-tier academic journals. In recognition of their contributions, our faculty continue to be named as fellows of their professional societies and win major awards from professional societies.

Our faculty are active in interdisciplinary collaborations that are looking for solutions to many pressing societal problems. They collaborate within and across the college's departments as well as with colleagues throughout UF in Liberal Arts and Sciences, Medicine, Agriculture and Life Sciences, Fine Arts, Business, and other colleges. Numerous examples of such interdisciplinary research and education are in this annual report.

Finally, we are pleased that the overall reputation and quality of the College of Engineering continues to grow. One measure of this is our successful recruitment of excellent new faculty members. Another measure is the increasing quality of academic records documented in the dossiers of junior faculty members when they apply for promotion and tenure. Our young faculty continue to raise the standard for successful promotion and tenure for their successors.

We note with satisfaction that our graduate programs are now ranked 25th overall and 15th among public universities by *US News & World Report*. This is the highest ranking we have achieved since the magazine started to rank engineering graduate programs. It is most gratifying to note that we have moved up to 25th and 15th from 35th overall and 20th among public universities in 2001. Our undergraduate programs were ranked 31st overall and 18th among public universities, a remarkable improvement from last year's rankings of 39th overall and 23rd among public universities. All things considered, we believe we have made significant progress and we remain firmly on course to continue to make important strides in education, research, and public service and outreach.

As Dean of the College of Engineering, I take great pride in our students, faculty, and staff, and I hope you will enjoy reading about their work in this report. Our graduates have the technical knowledge, highly developed curiosity, excellent work ethic, and strong civic sense to solve the complex problems facing mankind. We are also creating the fundamental and applied knowledge that will help our society prosper and our people lead much improved lives. I close this letter with a quotation from the famous futurist Alvin Toffler that seems to capture the mood and the challenge at this particular time in our history.

"All education springs from some image of the future. If the image of the future held by a society is grossly inaccurate, its education system will betray its youth."

Engineering Scholars

Two engineering assistant professors received highly competitive National Science Foundation (NSF) CAREER awards in 2005. CAREER awards support the early career-development activities of teacher-scholars who are most likely to be academic leaders in the 21st century.

Alin Dobra

Juan C. Nino

Materials Science & Engineering

Juan C. Nino
Assistant Professor
Fundamental Structure-Dielectric Property Relationships of Pyrochlore Ceramics

Dielectric ceramics are used in virtually every electronic application for passive components such as capacitors, filters and resonators. This project focuses on developing new and improved dielectric materials that will make possible the reduced size and increased functionality that are expected of the next generation of handheld electronics and wireless communications devices. In particular, this research investigates pyrochlore ceramics. Pyrochlores are oxide compounds of great interest because their crystalline structure accepts a broad range of atomic substitutions, therefore allowing for the tailoring of the physical properties towards a diverse set of applications.

At a local and national level, the educational component of the project focuses on increasing Hispanic participation in the science and engineering of ceramic materials. It also provides exposure to ceramics research for middle and high school teachers and students, as well as undergraduate engineering students. This is achieved as part of Nino's participation in ongoing UF programs such as the Junior Science, Engineering and Humanities Symposium (JSEHS) and the K-12 program Materials Science and Engineering for Teachers (MSE TEACH), and the National Science Foundations' Research Experience for Undergraduates (NSF REU).

Internationally, a series of short workshops on electronic ceramics will be organized at targeted universities in South America to foster Pan-American collaboration in the field and identify potential candidates for student/researcher exchange programs.

jnino@mse.ufl.edu

Computer & Information Science & Engineering

Alin Dobra
Assistant Professor
New Technologies for Approximate Query Processing

Due to the growing discrepancy between the volume of information that must be processed for applications in science, engineering, and national defense, and the computational resources or communication capabilities available there is a growing need for tools that provide good quality approximate results but require significantly smaller resources.

The goal of this project is to develop approximate query processing algorithms that allow the efficient processing of large volumes of data under two different assumptions: Data cannot be stored and has to be processed as it is produced, and data is stored or produced in multiple locations and has to be processed without moving it to a central location. Both computational models are required for realistic applications – a typical example is the processing of sensor data produced by large sensor networks. Some of the challenges in this project are to find a unifying theoretical framework that allows the developing of methods that work under both assumptions and to use the developed theory to design efficient algorithms.

adobra@cise.ufl.edu

Mechanical & Aerospace Engineering Department Chair Named

S. (Bala) Balachandar, professor of Mechanical and Industrial Engineering at the University of Illinois, Urbana-Champaign, is the new chair of the University of Florida Mechanical & Aerospace Engineering (MAE) department. He will also hold the William F. Powers Professorship in Mechanical & Aerospace Engineering. He will join the department in January 2006.

Balachandar also served as the associate head of the Theoretical and Applied Mechanics department at the University of Illinois, Urbana-Champaign. He is a key member of the multi-million dollar Department of Energy-funded Center for Simulation of Advanced Rockets (CSAR), where he is the co-leader of the fluids group and a member of its core science steering committee.

Balachandar received his undergraduate degree in mechanical engineering from the Indian Institute of Technology, Madras, in 1983. He received master's degrees in engineering and in applied mathematics and, in 1988, his PhD in engineering, all from Brown University.

Balachandar first served as a postdoctoral research assistant at the Center for Fluid Mechanics, Turbulence and Computations, then worked with the NASA Langley Research Center.

He joined the University of Illinois in 1990 as an assistant professor, was named a full professor in August 2001, and later became associate head of the department. He was a visiting professor at the Jawaharlal Nehru Center for Advanced Research, Bangalore, India, and the University of Melbourne, Australia, in 2000-2001.

Balachandar won the Francoise Frankiel Award from the American Physical Society for the best paper in physics of fluids. He won the Arnold O. Beckman Award and was named the University Scholar at the University of Illinois. He received the Alexander von Humboldt Fellowship in 1991, but he was unable to hold the fellowship due to visa difficulties.

Balachandar is the author or co-author of many papers in refereed journals, conferences, and book chapters. He is an associate editor of the American Society of Mechanical Engineers (ASME) *Journal of Fluids Engineering* and a member of the editorial board of the *International Journal of Multiphase Flow*.

Balachandar replaces Gene Hemp, a UF vice provost and professor emeritus of Mechanical & Aerospace Engineering, who has served as interim chair since January 2005. Previously, MAE was led by Wei Shyy, who is now chair of the University of Michigan Aerospace Engineering department.

Engineered Materials and Intelligent Infrastructure

Recent Research at Civil & Coastal Engineering

UF Develops Ductile Concrete

Conventional concrete suffers from a number of inherent deficiencies. The primary drawbacks relate to its lack of ductility and its susceptibility to long-term durability issues. Other shortcomings include low tensile strength, poor impact resistance, and a tendency to undergo significant shrinkage during curing. To overcome some of these deficiencies, Associate Professor Bjorn Birgisson, Civil & Coastal Engineering (CCE), and Professor Charles Beatty, Materials Science & Engineering (MSE), have developed a new process to make ductile concrete that shrinks less than regular concrete.

The process used by the researchers is based on the nanomodification of the structure of Portland cement paste. The basic building block of hydrated cement paste, or concrete, is calcium-silicate-hydrate, and is the spongy-looking material in the background in Figure 1a. Calcium-silicate-hydrate takes the form of very small crystals that are packed closely together to form a very dense structure. The larger, layered plate-like crystals in Figure 1a are calcium hydroxide. These crystal platelets are considered the weak link in concrete because they do not pack well and tend to exhibit weakness between layers due to poor bonding. The presence of calcium hydroxide platelets is responsible for concrete being permeable, brittle, and weak in tension.

The researchers modified the basic structure of the cement paste at the nano-level by introducing a combination of chemically-treated clay and a reactive polymer. The result is a completely modified cement paste matrix shown in Figure 1b. All of the calcium hydroxide is used up in the chemical process, resulting in a much more homogeneous structure. The resulting hydrated cement paste and concrete are now ductile, due to the elimination of the calcium hydroxide and the introduction of the polymer. In addition, the new system does not shrink significantly upon curing when compared to unmodified concrete. Given that shrinkage is responsible for most cracks in concrete, the elimination of shrinkage promises much longer lasting, more durable concrete.

Figure 2 shows a comparison plot of the stress-strain response between unmodified cement paste and cement paste modified with the new process. The modified cement illustrates a gradual failure after reaching the peak of the stress-strain diagram. The unmodified cement paste shows a sudden failure once the peak of its stress-strain curve is reached.

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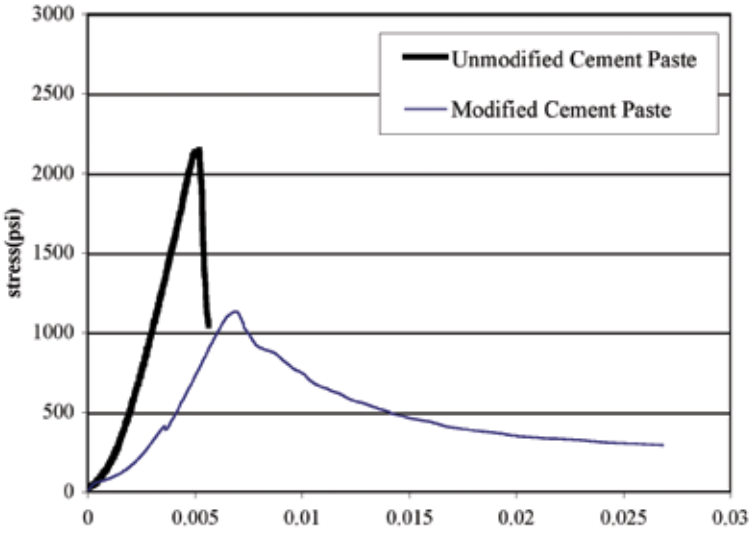


Figure 2

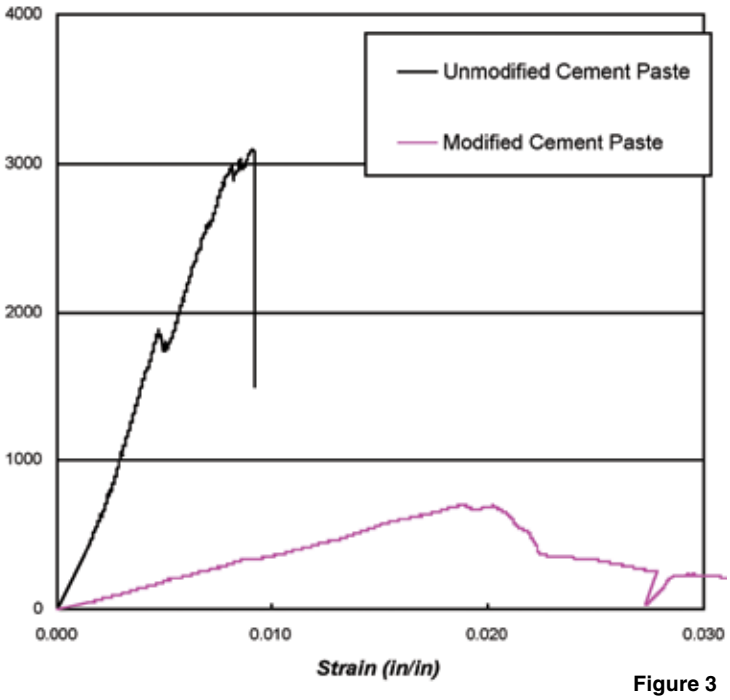
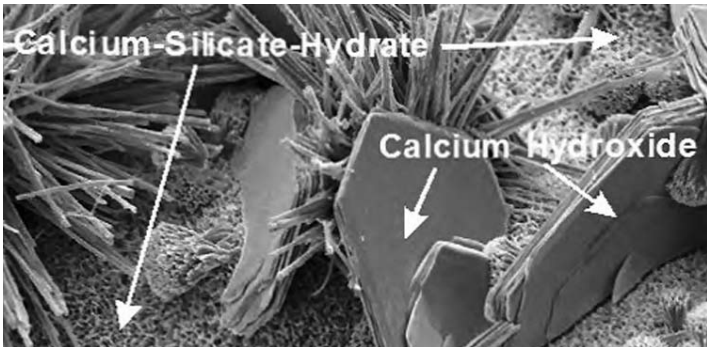


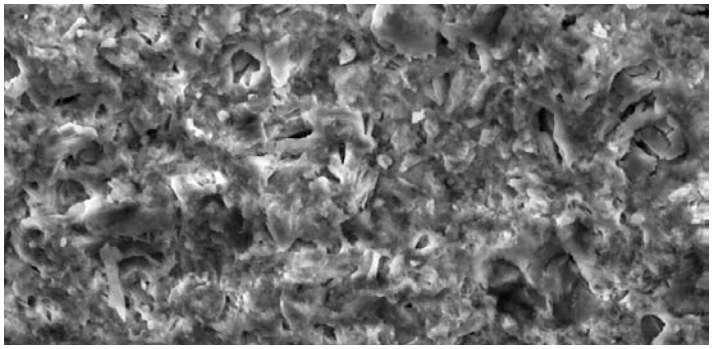
Figure 3

1a) Unmodified 1b) Modified. Scanning electron micrographs of typical unmodified and modified hydrated cement paste (This picture was obtained with the new environmental scanning electron microscope in Civil & Coastal Engineering)

1a



1b



The Portland cement referred to in Figure 2 is termed Type 1 cement, which is coarsely ground. The use of the more finely ground type 2 Portland cement results in an even more pronounced ductile behavior, as shown in Figure 3. The researchers are now studying the modification process in more detail with the aim of optimizing the stress-strain response of concrete for various different structural applications. The goal is to engineer concrete for a variety of combinations of strength and ductility that can be defined by the observed differences between the two curves shown in Figure 3. Based on the work to date on nanomodification of concrete and cementitious materials, Birgisson and CCE Professor Reynaldo Roque, along with collaborators in Materials Science & Engineering, will host an international NSF-sponsored workshop in 2006 on the Nanomodification of Cementitious Materials.

Recent Wireless Sensor Research

Wireless instrumentation and radios are now being cast within infrastructure elements during fabrication. These include systems that monitor stresses and deformations that occur from the construction period and after (health monitoring) as well as possible extreme events (earthquake, vessel collision, or terrorist activity).

CCE Professor Michael C. McVay and his colleagues have developed a wireless system to monitor construction pile driving. Figure 4 shows the basic concept behind McVay's system, which has been patented by UF. The system uses Bluetooth® radio and micro-electro-mechanical systems technology. The measured signals are transmitted to a laptop via a wireless radio transmitter. Antennae are mounted to the outside of construction members for radio transmission, and the system is powered by rechargeable batteries or solar power. The system allows the energy occurring during pile driving to be monitored in real time. This new technology is low cost and versatile, and promises to replace existing wired technology. The research has already led to a new start-up company in Florida that has licensed this technology and is actively developing it for the large geotechnical market in Florida and nationwide.

Another recent invention by CCE Associate Professor David Bloomquist and McVay is a wireless highway beacon capable of warning motorists about adverse travel conditions, including smoke, fog, and rain. The beacons can be placed in a row alongside the road. When one beacon senses adverse travel conditions, it starts blinking. The beacon uses Bluetooth® radio to notify the next beacon in line of the adverse conditions, and it starts blinking as well. Eventually, the signal travels to all of the beacons in sequence so that they can blink and warn motorists of impending adverse conditions ahead.

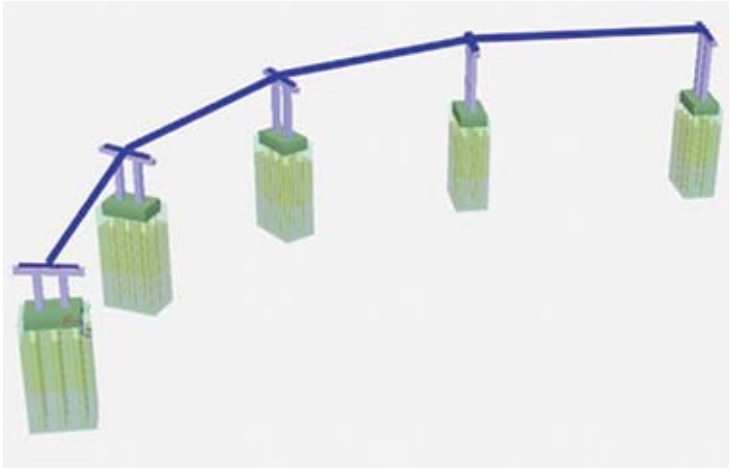


Figure 4

Figure 5

This invention, patented by UF, has led to a new start-up company located in Gainesville, Fla. The focus of the start-up is to extend the beacon communication technology to Ultra Wide Band Radio (UWB), thus allowing detection of vehicles and automated traffic control on roadways. The new technology has very high data transfer rates in excess of 500 megabites per second, thus also allowing for infrastructure monitoring and communication with motorists.

The design, construction, and maintenance of the infrastructure data is beginning to be shared. Significant savings in labor and time occur in a seamless exchange of information. Format for the data exchange is eXtended Markup Language (XML). McVay, Marc Hoit, a CCE professor and UF's interim associate provost for information technology, and their co-partners (the Federal Highway Administration, state departments of transportation, the Association of Geotechnical and Geoenvironmental Specialists, The Construction Industry Research and Information Association, and Consortium of Organizations for Strong-Motion Observation Systems) are developing international XML schemas for transportation data, which are Geography Markup Language compliant. The goal is the development of intelligent systems for quality analysis and control during the construction and life of infrastructure, such as the health monitoring of bridges and roads (see Figure 5).

One issue with wireless sensors is providing enough power for the sensors to operate. The wireless highway beacons currently use solar power, but in collaboration with Assistant Professor David Arnold and his colleagues in UF's Electrical & Computer Engineering department, other battery-free power systems are being investigated.

The Alliance for Engineered Materials and Intelligent Infrastructure

In 2003, the American Society of Civil Engineers (ASCE) estimated it would cost $1.3 trillion dollars to upgrade our national infrastructure to acceptable levels. The Association of State and Highway Transportation Officials (AASHTO) estimates that yearly capital outlays by federal and state governments would have to increase by 42 percent to maintain the current infrastructure. The federal transportation bill for 2006 authorized only $56.8 billion per year for the nation's highway and transit systems.

It seems clear that there are not enough funds available to keep up with needed infrastructure upgrades. In order to meet current and future demands on our infrastructure, UF is proposing a large, new research center initiative entitled the Alliance for Engineered Materials and Intelligent Infrastructure (AEMII) to develop the advanced technologies needed to upgrade our infrastructure within existing budget constraints. This new initiative is being headed up by Birgisson, McVay, and Bloomquist and their colleagues in Civil & Coastal Engineering. This new multi-disciplinary initiative includes researchers from various UF College of Engineering departments, as well as faculty from the UF Economics department. The focus of AEMII will be to develop and integrate new high performance engineered materials and intelligent wireless sensor technologies into our infrastructure.

Contact

David Arnold
darnold@ufl.edu

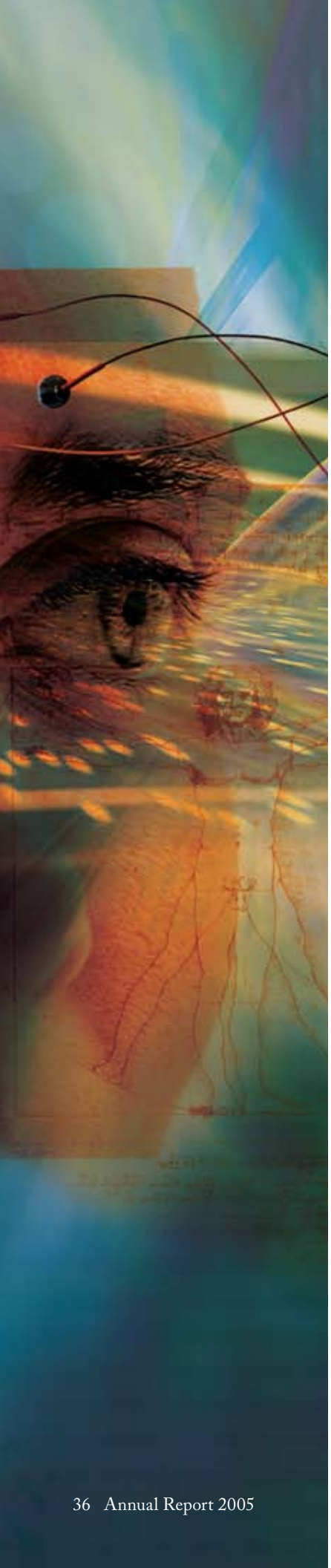
Charles Beatty
cbeat@mse.ufl.edu

Bjorn Birgisson
bbirg@ce.ufl.edu

David Bloomquist
dave@ce.ufl.edu

Marc Hoit
mhoit@ufl.edu

Michael McVay
mcm@ce.ufl.edu



UF Computer Engineering Connects Worlds Within and Without

Computer engineering research at the University of Florida is developing interconnected systems that are global beyond the ordinary definition of the term. The initial connection is across campus, with research done by teams drawn from the departments of Computer & Information Science & Engineering (CISE) and Electrical & Computer Engineering (ECE). Ultimately, the connections reach from the far side of the world to the depths of the mind.

Some of the most exciting work is in:

- **High performance computing**
- **Networking**
- **Grid computing**
- **Intelligent systems and image/signal processing**

A few of these projects are outlined here.

High Performance Computing – The International Research Connection

Computers become more powerful every year, with desktop units now more powerful than supercomputers of the 1980s. However, many applications need resources hundreds to thousands time greater than a desktop provides. For example, Wal-Mart routinely collects terabytes of information that is mined to analyze customer behavior and manage the supply chain to meet customer needs. NASA's Earth-observing system and climate models produce hundreds of terabytes of data for weather prediction.

The UF High Performance Computing team is developing a campus-wide, grid-based infrastructure that will provide teraflops of computing power. Grid computing provides resource sharing among wide-spread individuals and organizations, and creates a virtual computer for solving massive problems too large for a single computer. UF's major computational labs will be connected with a ten gigabit-per-second network to provide highly effective resource sharing.

Applications in a large-scale network need to be broken into smaller portions and assigned to different processors. Synchronizing the smaller sections generates a large amount of intercommunication. The latency and bandwidth of the connections affect how many processors can be effectively used. The main UF HPC facility will use a state-of-the-art Infiniband interconnect donated by Cisco to connect two hundred nodes, resulting in more than two teraflops of computing power.

An important aspect of HPC systems is the amount of electrical power required to operate them. These systems can use hundreds of kilowatts of power. New multi-core processors developed by Intel and AMD have more than one CPU. Having more CPUs on a chip can reduce the power consumption while effectively providing the same computational power. The distributed HPC facility is using these processors for minimizing energy consumption.

The HPC campus grid will have a high-performance computer backbone known as CASTOR, which stands for Communication And Storage. Sanjay Ranka (CISE) is the principal investigator (PI). Co-PIs are Peter Sheng (Civil & Coastal Engineering), Alan George (ECE), and Paul Avery and Samuel Trickey from Physics. The NSF has provided $600,000 in funds.

CASTOR will provide a 10 gigabit-per-second network with 100 terabytes of data storage. It will link research groups across campus. Further, high bandwidth networks will make full-motion videoconferencing, real-time international cable TV, and full-motion video-on-demand practical and inexpensive. CASTOR will also connect to Florida Lambda Rail (FLR), a consortium of 10 Florida universities that is is part of the National Lambda Rail, a national high-speed information infrastructure for research universities and technology companies.

UF has received NSF Information Technology Research grants to develop infrastructure, software, and applications for the HPC infrastructure, as well as $2.5 million for its role in the Data Intensive Science University Network, a multi-university computer grid for advanced research in high energy physics and cyber-infrastructure.

Networking – Connecting the Here and Now with Everywhere

For several years, UF researchers have been developing mechanisms to create secure, stable cross-platform wireless networks for advanced applications, particularly in the area of multi-national defense operations.

Randy Chow, Michael Fang, and Richard Newman are researching multipath routing and forward error correction schemes that enhance data delivery reliability and security by dispersing information through several systems. The research also has applications in wireless sensor networks and multimedia data streaming, which are being studied by Fang and Jonathan Liu, respectively.

Fang and Oliver Wu developed a light-weight key-exchange protocol for mobile networks and an anonymous medium access control protocol for group communication. Chow and Newman have developed a hierarchical key-assignment scheme for policy-based security, and are working on a solution to information leakage in the multi-network environment.

Data delivery through these networks in real time requires auto-configurations and reconfigurations. One problem is that of sending urgent real-time video to a central location. Fang and Wu's team have investigated energy-efficient monitoring so that energy can be directed either to video monitoring or to compressing and transmitting the video data, according to need. To optimize multi-path routing for congestion-free data delivery, Fang and Shigang Chen developed a novel flow control strategy.

Wireless multimedia services must deliver data ranging from high-bandwidth video to low-bandwidth voice signals, with variable quality of service. In separate studies, Jonathan Liu developed technology to provide quality of service to real-time video monitoring and Jenshan Lin created a remote heartbeat sensing system. They are integrating their technologies for multimedia sensor data detection and delivery. Fang, Wu, and Janise McNair are investigating quality of service optimization in layered multipath routing and handoff. Fang, John Shea, and Tan Wong have developed a framework which allows multiple nodes to transmit and receive information packets collaboratively.

Networks ultimately are intended to facilitate information transmission for collaborative decision-making. For end users of wireless networks, the UF Digital Worlds Institute has developed collaborative systems in its REVE (Research, Education, and Visualization Environment) laboratory, led by James Oliverio. The REVE has successfully demonstrated cross-platform, cross-cultural, and cross-continental immersive digital media events. Also, Richard Newman has developed a distributed conferencing system that supports generic conference functions, including group decision making through secure weighted voting schemes.

A special class of peer-to-peer (P2P) networks offer decentralized content-based searches for information. Chow and Chen are working P2P techniques to reduce storage and time requirements for search operations and allow the networks to evolve with dynamic situations. They are also investigating load sharing and methods of preventing denial-of-service attacks.

Grid Computing – Connecting the Parts to Make a Stronger Whole

The Advanced Computing and Information Systems (ACIS) Laboratory at UF has become a leader of research on grid-computing, transnational digital government, and nanocomputing. Although grid systems potentially offer large, diverse capabilities, their design offers significant security, management, and configuration problems.

ACIS has pioneered an approach that enables the safe deployment of grids for scientific, government, enterprise, and other business applications. The key is software that makes each physical resource appear as multiple distinct entities called

José Fortes

"virtual resources." ACIS has also developed virtualization software for networks, applications, and data. Additional software developed by ACIS is then used to aggregate all virtual resources into virtual grids on which customer services are deployed. The research was funded by the NSF, the Army Research Office, the Southwest Universities Research Association, with equipment grants and donations from IBM, Cyberguard and VMWare. ACIS software has been packaged as In-VIGO, or In-Virtual Information Grid Organizations. In-VIGO users include the Network for Computational Nanoelectronics, the Southeastern University Research Association Coastal Ocean Observing Program, and the UF High Performance Computing Initiative.

An important application of distributed information processing is transnational digital government, collaborations by national governments that rely on authorized information sharing to meet common goals. Innovative information technology is needed to eliminate barriers created by different languages, policies, infrastructures, and cultures. ACIS leads an NSF-funded, multi-university effort to create a transnational information system that enables countries to query member databases and receive timely information related to border control. The project is in a test in two countries of services for automatic translation developed at Carnegie Mellon University, conversational interfaces developed at the University of Colorado, and distributed queries and event notification software developed at UF.

In contrast, nanocomputers will have sizes comparable to the thickness of a human hair. They will be built out of transistors and memory cells that use only a few electrons, making them susceptible to surrounding electromagnetic noise and manufacturing imperfections. ACIS is investigating fault-tolerant models and techniques to minimize the impact of device faults on nanosystems. The research includes the design and evaluation of reconfigurable memories that isolate and replace faulty cells, masking logic that hides errors caused by faults, bio-inspired intelligent sensors that try to mimic fault-tolerance in brains, and codes that recover from errors in quantum computers. Funding is from the NSF, NASA, and the Semiconductor Research Corporation.

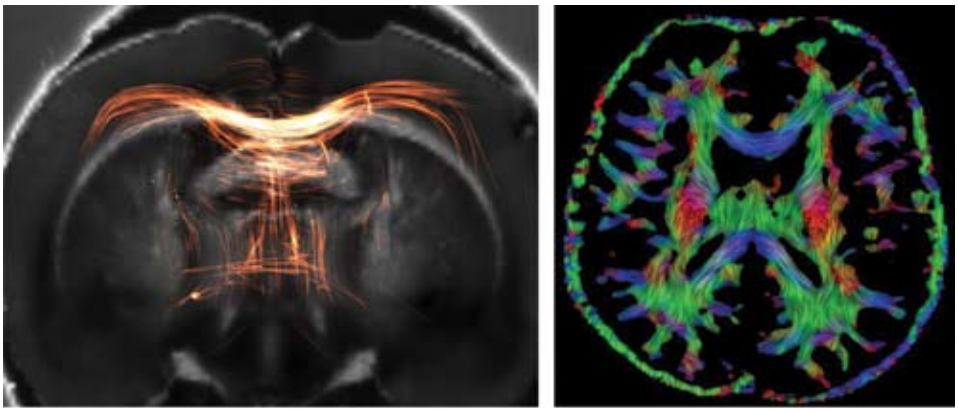
ACIS faculty are José Fortes, Renato Figueiredo, Oscar Boykin, Herman Lam, and Tao Li. UF collaborators include José Principe, John Harris, Stanley Su, Peter Sheng, and Jianbo Gao.

Brain/Machine Interface Project – The Meta-Personal Connection

José Principe and John Harris lead the Computational NeuroEngineering Laboratory (CNEL) research team working on brain/machine interfaces (BMIs). CNEL has a long-term, DARPA-funded collaboration with Duke, SUNY, and MIT to develop an integrated sensor and actuator system that responds to brain activity alone. The research offers the possibility that in the future quadriplegics will be able to remotely control external devices such as robotic arms using the intent of limb movement.

CNEL's role has been to model neural signals and create ultra-low-power and miniaturized advanced instrumentation to relay those signals. In testing with chimpanzees at Duke and rats at UF, the team determined that the real-time algorithms successfully predicted the animals' hand motions.

Another advance has been the development of a wireless, portable low-power digital signal processing (DSP) board that receives data directly from signal amplifiers implanted in the test animals' brains. The board computes in real time a prediction



Nerve fiber tracking

of the animal's hand position and then transmits wireless commands expressing that motion to a robot arm. The third generation of these DSP boards has been designed with Karl Gugel's help.

The team has a new understanding of how the brain's motor cortex coordinates motion commands, which means they must redefine the paradigm to train the BMI to effectively utilize the time-varying, spatial-temporal patterns of motor cortex activity. Two CNEL PhD students are looking at alternate, nontraditional ways to train the dynamical models in real time.

In another part of the project, Principe and Harris are developing ultra low power subdermal amplifiers and transmitters to transfer the data to external DSP boards. They have proposed a new method to transfer the data from the amplifier to the computer and applied for a patent on it.

The new methods and VLSI circuits to encode sensory signals as pulse trains which Harris and his graduate students developed were inspired by how neurons in the brain represent information. The integrate-and-fire coding technique transforms a continuous-time analog signal into a series of asynchronous digital pulses whose timing information completely encodes the signal. The key advantage is that the front-end circuits are simple, small, noise robust, and extremely low-power.

PhD candidate Dazhi Wei used this technique to create a 10-bit CMOS analog-to-digital converter chip that uses less power than commercial alternatives. The chip is attractive for power-constrained applications such as remote sensing and hearing aids. PhD candidate Du Chen used a similar method to design an integrated neuro-amplifier with pulse-based output for amplifying, coding, and transmitting extracellular microelectrode recordings. Chen's circuit will be used in the BMI project as part of a low-power wireless implant. The recorded signals will be further processed to control a robotic arm and other computer-based devices.

Other professors working in the BMI project include Toshi Nishida, on new electrodes; Rizwan Bashirullah, on ultra-low power transmitters for the wireless transmission of data; and biomedical engineer Justin Sanchez, on the experimental animal paradigm.

The work has been aided by an enhanced animal testing lab CNEL helped create in Paul Carney's lab at UF's Brain Institute. Principe has applied for a NSF grant to create a formal center for research and teaching in brain/machine interfaces at UF. Another proposal submitted to the NSF with José Fortes would support a grid computing, virtual reality environment to test algorithmic models on quadriplegics.

Intelligent Systems and Image/Signal Processing – The Practical Connection

Computational neuroscience research blends logically with intelligent systems. Intelligent systems try to emulate human learning and perception behavior. Applications are very broad, from neural networks to data warehousing and datamining and to image and signal processing.

Gerhard Ritter and Arunava Banerjee are modeling neural networks, emulating neural connections in the brain to develop computer models for intelligent systems. Instead of the knowledge being explicitly written down as statements, it is coded

numerically within the artificial set of neurons. A neural network can be shown many variables of a single item. It studies them mathematically and classifies the data.

Banerjee is looking directly modeling actual neurons. Ritter is applying lattice algebra to single neuron computation, research in artificial neural networks that is inspired by research in the biophysics of biological cortical neurons.

Intelligent systems are used to query and find relationships within aggregates of electronic data. The aggregates, or databases, collected by institutions are immense. Much of the data is unstructured, like genetic and other biological data. Chris Jermaine is working to advance the ability to use data repositories by developing query technologies that give users quick, approximate answers to questions. The initial results give a high-quality estimate of the ultimate answer, allowing the user to kill or modify the query and try again.

Douglas Dankel has developed an interactive query system that evaluates and recommends therapies for stroke patients. The system asks a series of questions concerning the current status of the patient's ability to move and speak and about behavior patterns, then recommends a therapy.

Intelligent systems are also well attuned to linguistic analysis. Dankel began a linguistics project while on Fulbright at the University of Akureyri, Iceland, to aid the teaching of Icelandic. He has a Web site, www.icehead.net, which illustrates the pronunciation of the various phonemes of Icelandic.

Several faculty are working in aspects of signal and image analysis, with medical and defense applications the focus of many projects. Paul Gader and Joseph Wilson are applying intelligent systems methods to the problems of landmine detection. They are developing new concepts for airborne, hand-held, and vehicle-mounted mine detection that have resulted in dramatic improvements in performance.

Finding mines from the air can be particularly difficult. Signals that show round spots may indicate where people have dug holes to bury mines. But round spots are everywhere, including trees. It's just a variation in the color of the trees that makes a spot that looks round. So the detector has to be instructed how to do scene analysis, providing it with a description of the object sought and the correct context where it should be found. The detector also has to be taught how to differentiate between soil types, ground water, vegetation, and buried objects that are not mines.

It is a difficult problem for intelligent systems, but Wilson and Gader and colleagues from Duke University and the University of Missouri have solved the algorithmic aspects well enough to provide algorithms for a hand-held detector and two robot detectors that are being built by private companies. The detector is in use by the military and the robots are under development.

Baba Vemuri and Anand Rangarajan at the Center for Vision, Graphics and Medical Imaging are developing algorithms for such applications as 2D/3D image and motion segmentation, image indexing for content-based retrieval, visualization and nerve fiber tracking, and automatic shape-based classification of epileptic foci classes based on MRI scans of the hippocampus area of the brain.

The UF College of Medicine is interested in nerve-fiber tracking as it reveals areas of the brain that have been traumatized, information useful in diagnosis and treatment planning. Similarly, clinicians can diagnose epilepsy and identify its locus in the brain to 96 to 97 percent accuracy based on the shape of the hippocampus as revealed by MRI scans.

Jian Li developed and patented an enhanced microwave imaging system for breast cancer detection. The system can identify the different water content in normal breast tissue (high-fat, low-water, low-salt) versus malignant tumors (low-fat, high-water, high-salt). Microwave technologies can exploit this difference for early detection, when tumors are as small as 2 mm, as treatment to kill breast cancer cells before surgery, and to reduce unnecessary breast biopsies.

Bringing it home literally and metaphorically, Sumi Helal has combined networking and signal processing in a "smart house" for the elderly. The house has sensors everywhere – floor, bed, appliances, door, windows, lights – that locate the occupants and transmit information about their activities to caregivers not on the scene. The system is interactive, so it can tell the residents to take their medicine or how long to leave something in the microwave, and can watch out for fire or strangers at the door.

Computer engineering connects us all. UF computer engineers are vital to those links.

Computer Engineering Faculty at the University of Florida

Faculty may be contacted at their home departments:

Computer & Information Science & Engineering (CISE)
www.cise.ufl.edu

Electrical & Computer Engineering (ECE)
www.ece.ufl.edu

Computer Networking & Security

CISE

Shigang Chen, *Assistant Professor*
Randy Y.C. Chow, *Professor*
Abdelsalam Helal, *Professor*
Jonathan C.L. Liu, *Associate Professor*
Richard Newman, *Assistant Professor*
Sartaj Sahni, *Distinguished Professor and CISE Chair*
Ye Xia, *Assistant Professor*

ECE

P. Oscar Boykin, *Assistant Professor*
Yuguang (Michael) Fang, *Associate Professor*
Alan George, *Professor*
Haniph Latchman, *Professor*
Janice McNair, *Assistant Professor*
Dapeng Oliver *Wu, Assistant Professor*
John Shea, *Assistant Professor*
Tan Wong, *Associate Professor*
Liuqing Yang, *Assistant Professor*

Computer Vision & Intelligent Systems

CISE

Arunava Banerjee, *Assistant Professor*
Douglas Dankel, *Assistant Professor*
Paul Gader, *Professor*
Jeffrey Ho, *Assistant Professor*
Richard Newman, *Assistant Professor*
Anand Rangarajan, *Associate Professor*
Gerhard Ritter, *Professor*
Baba Vemuri, *Professor*
Joseph Wilson, *Assistant Professor*

ECE

A. Antonio Arroyo, *Associate Professor*
Jian Li, *Professor*
José Principe, *Distinguished Professor*
Clint Slatton, *Assistant Professor*
Dapeng Oliver Wu, *Assistant Professor*

Computer Graphics & Modeling

CISE

Paul Fishwick, *Professor*
Benjamin Lok, *Assistant Professor*
Jorg Peters, *Professor*

Computer Systems

CISE

Manuel Bermudez, *Associate Professor*
Randy Y.C. Chow, *Professor*
Abdelsalam Helal, *Professor*
Prabhat Mishra, *Assistant Professor*
Richard Newman, *Assistant Professor*
Jih-Kwon Peir, *Associate Professor*
Beverly Sanders, *Associate Professor*
Stephen Thebaut, *Assistant Professor*

Databases and Information Systems

CISE

Su-Shing Chen, *Professor*
Alin Dobra, *Assistant Professor*
Joachim Hammer, *Associate Professor*
Chris Jermaine, *Assistant Professor*
Tamer Kahveci, *Assistant Professor*
Markus Schneider, *Assistant Professor*
Stanley Su, *Distinguished Professor Emeritus*

High Performance Computing

CISE

Timothy Davis, *Associate Professor*
Li Min Fu, *Professor*
Prabhat Mishra, *Assistant Professor*
Sanjay Ranka, *Professor*
Sartaj Sahni, *Distinguished Professor and CISE Chair*
Meera Sitharam, *Associate Professor*
Alper Ungor, *Assistant Professor*

ECE

José Fortes, Professor, *Bell South Scholar*
Renato Figueiredo, *Assistant Professor*
Alan George, *Professor*
Herman Lam, *Associate Professor*
Tao Li, *Assistant Professor*

Image/Signal Processing

ECE

John Harris, *Associate Professor*
Jian Li, *Professor*
José Principe, *Distinguished Professor*
K. Clint Slatton, *Assistant Professor*
Fred Taylor, *Professor*
Dapeng Oliver Wu, *Assistant Professor*

CISE

Image/signal processing faculty are part of the intelligent systems group.

Administration

Pramod P. Khargonekar
Dean
Associate Vice President, Engineering & Industrial Experiment Station
Eckis Professor of Electrical & Computer Engineering
300 Weil Hall
352.392.6000
ppk@ufl.edu

Cammy R. Abernathy
Associate Dean for Academic Affairs
Professor of Materials Science & Engineering
310 Weil Hall
352.392.0943
caber@mse.ufl.edu

Timothy J. Anderson
Associate Dean for Research and Graduate Programs
Professor of Chemical Engineering
300 Weil Hall
352.392.0946
tim@ufl.edu

Jonathan F. K. Earle
Associate Dean for Student Affairs
Associate Professor of Agricultural & Biological Engineering
312 Weil Hall
352.392.2177
jearl@eng.ufl.edu

Agricultural & Biological Engineering

Wendy D. Graham
Professor and Chair
www.agen.ufl.edu

The retail food industry in the US generates more than $500 billion in sales each year and employs about 3.5 million people. More than 50 percent of annual sales are generated by perishables such as produce, meat, fish, and baked goods. Retail stores rely on volume sales to maintain adequate revenue as the average profit is only about 1 percent. One key factor for the industry is to limit losses and continually innovate in order to keep or gain market share.

With support from major retail chains, food manufacturers and suppliers, equipment and packaging manufacturers, and the USDA, faculty members Jean-Pierre Emond and Bruce Welt have established a number of research projects to address the challenges of this industry.

Projects are under way to study how changes in supply chain and distribution techniques impact overall efficiency, security, and final product quality. Techniques include smart packaging technologies such as digital time-temperature integration (TTI). Foods and medicines are sensitive to thermal exposure. Product shelf-lives tend to be longer at lower temperatures and very short at abusively high temperatures. Traditional TTI's use specially formulated chemical reactions or physical transitions to mimic rates of change observed in product quality or safety. Work is under way to build a prototype digital TTI device that greatly extends flexibility and performance of such devices. Adoption of such technologies should improve performance of supply chains as well as value of final goods.

Other projects include improved tracking technologies such as machine vision, barcoding, and radio frequency identification (RFID), which will track products from the field to the shelf; operations modeling; and application prototyping. This work will lead to supply chain operations that are more secure and efficient while providing higher quality goods to retail consumers.

New Faculty

Reza Ehsani
Assistant Professor
PhD University of California, Davis, 2000

Gregory A. Kiker
Assistant Professor
PhD Cornell University, 1998

Pratap C. Pullammanappallil
Assistant Professor
PhD University of Florida, 1993

Kati L. White
Assistant Professor
PhD University of Arkansas, 2005

2004-05 Degrees Granted

BS	MS	PhD	Eng
24	7	1	1

2004-05 Fall Enrollment

BS	MS	PhD
157	12	33

Biomedical Engineering

William Ditto
Professor and Chair
www.bme.ufl.edu

Professor Huabei Jiang is developing new techniques for breast cancer imaging. The technology is promising because the process is painless for the patient and the data is always comparable and often better than that of a traditional mammogram. Supported by a five-year, $1.4 million grant from the National Institutes of Health, Jiang's method uses an array of fiber optics to image the tissue and gather functional information. He tracks where light is absorbed and scattered, then analyzes the data. Researchers extract information regarding cell densities and structures, hemoglobin, water content, and lipid concentration, which allows them to establish a diagnosis. Tumors have a different structure than regular breast tissue, and the light draws out the dissimilarities. Currently, doctors must use biopsies to investigate odd masses discovered in mammograms, but Jiang's innovations may eliminate the need for such invasive and painful procedures.

BME research has led to several innovative technologies, and BME faculty and student researchers have worked with the UF Office of Technology Licensing to pursue patents and collaborate with industry. Professor William L. Ditto created Chaologix as a spin-off company to explore the field of chaotic computing and Professor J. Chris Sackellares licensed neonatal epilepsy monitoring technology to Seattle-based NeuroBionics.

New Faculty

Benjamin G. Keselowsky
Assistant Professor
PhD Georgia Institute of Technology, 2004

William Ogle
Assistant Professor
PhD University of Chicago, 1998

Brian Sorg
Assistant Professor
PhD University of Texas at Austin, 2001

2004-05 Research Awards
$1,724,368

2004-05 Degrees Granted

BS	MS	PhD
0	19	2

2004 Fall Enrollment

BS	MS	PhD
0	18	35

Chemical Engineering

Jennifer Curtis
Professor and Chair
www.che.ufl.edu

The erosion of fractured mineral formations by the flow of a weakly acidic fluid, such as dissolved CO_2, is a critical component of theoretical models for geological systems. Understanding the interplay of fluid flow, reactant transport, and chemical kinetics can lead to a fundamental understanding of such geological mysteries as the formation of limestone caverns, and can contribute to new technologies such as CO_2 pt sequestration. The US Department of Energy has invested in a major research program to investigate the feasibility of storing large quantities of CO_2 in underground formations, thereby reducing the atmospheric excess. At present, models of fracture dissolution are largely phenomenological, relying on average flows and effective mass transfer coefficients. However, such approaches are unreliable due to the strongly non-linear feedback between transport and kinetics. The work of Professor Tony Ladd and his research group is aimed at developing a microscopic and fundamental description of the erosion process, which can then serve as a test bed for statistical theories that are necessary to connect laboratory and geological scales.

Professor Ladd and his group have developed numerical simulations of fracture dissolution at the laboratory scale, comparing erosion morphologies with experimental results for a specific initial topography. The simulations include fluid flow in the specific fracture geometry, transport of reactants and products, and chemical kinetics at the eroding surfaces. New algorithms have enabled them to simulate systems of comparable scales to those studied in the laboratory, but with more detailed information about the fluid flow and chemical transport.

New Faculty

Helena Hagelin-Weaver
Research Assistant Professor
PhD Royal Institute of Technology, Stockholm, 2004

2004-05 Research Awards
$5,434,257

2004-05 Degrees Granted

BS	MS	PhD
76	8	18

2004 Fall Enrollment

BS	MS	PhD
354	24	70

Civil & Coastal Engineering

Joseph W. Tedesco
Professor and Chair
www.ce.ufl.edu

A multi-university consortium research team led by Professor Kurt Gurley has developed portable weather stations to capture the true behavior of ground level winds as hurricanes impact populated areas. The teams deploy the instrumentation in the path of landfalling storms to collect wind velocity data, as well as dynamic uplift pressure on the roofs of residential structures. The wind data is transmitted in real-time during the storm to a public access Web site (www.ce.ufl.edu/~fcmp). Atmospheric scientists at NOAA's Hurricane Research Division and the National Hurricane Center use the data to test their remote sensing capabilities, and interact with the team to optimize deployment locations.

The consortium (UF, FIU, Clemson, FIT) captures this data to provide a direct measured link between the turbulent ground level wind behavior, structural loading, observed damage, and cost effective mitigation solutions. In 2004 the group's efforts resulted in the only known source of directly measured full-scale loading of an occupied structure during sustained hurricane force winds. The data captured from the roofs of the instrumented homes will be compared with wind tunnel studies of those houses and ultimately with American Society of Civil Engineers wind load provisions. During spring 2005 the team also conducted a quantitative study of the performance of the Florida Building Code (FBC) for the Florida Building Commission. More than 200 randomly selected homes were inspected in the highest wind zones of hurricanes Charley, Frances, Jeanne, and Ivan. The Florida Building Commission is currently considering a range of code improvements based in part on the study findings.

2004-05 Research Awards
$11,467,410

2004-05 Degrees Granted

BS	MS	PhD
110	64	16

2004 Fall Enrollment

BS	MS	PhD
600	93	92

Computer & Information Science & Engineering

Sartaj Sahni
Distinguished Professor and Chair
www.cise.ufl.edu

CISE researchers Paul Gader, Joseph Wilson, Gerhard Ritter, and Mark Schmalz are providing international leadership to help solve the landmine problem. Landmines pose a serious threat to civilians as well as military personnel throughout the world because they remain active long after conflicts are over. Estimates of the numbers of buried landmines vary considerably, ranging from 45 to 110 million. In 1998 it was estimated that someone was injured or killed by a landmine every 20 minutes; by 2001 this figure was reduced to every 50 minutes.

CISE researchers, sponsored by the US Army Humanitarian Demining and Countermine divisions, are at the forefront of efforts to develop software algorithms for automated analysis of sensor data for landmine detection. Traditionally, human operators with metal detectors searched for landmines. However, most modern landmines are encased in plastic and very difficult to locate with metal detectors. Therefore, sensors that can "look" underground, such as ground-penetrating radars, acoustic devices, and hyper-spectral imaging spectrometers, are under investigation at laboratories around the country. The CISE researchers are developing methods to automatically analyze the complex signals produced by these sensors to discern the presence of landmines. The goal is a robotic system that can detect and clear landmines automatically, thereby reducing the threat to human life.

The research team uses many tools including signal and image processing, statistical pattern recognition and machine learning, artificial neural networks, and intelligent systems for decision-making. They also apply knowledge of the physics of sensing processes (e.g. electro-magnetics, acoustics, imaging spectroscopy, etc.).

The research is both theoretical and applied. Methods based on state-of-the-art theoretical techniques are implemented on real systems and field tested. In the past four years, at least seven blind field tests have proven the algorithms perform very well, sometimes reducing false alarm rates by orders of magnitude.

2004-05 Research Awards
$4,286,410

2004-05 Degrees Granted

BS	MS	PhD
218[1]	87[2]	8

[1]Includes 37 BA (CIS), 55 LS (CSC)
[2]Includes 25 LS (CSC)

2004 Fall Enrollment*

BS	MS	PhD
897	142	154

*Includes computer science students from the Liberal Arts & Sciences and Business colleges.

Electrical & Computer Engineering

Mark E. Law
Professor and Chair
www.ece.ufl.edu

Professors Mike Fang and Oliver Wu are working on a new National Science Foundation-sponsored project with colleagues at the University of Missouri-Columbia. They are developing tools to track wildlife populations with a wireless sensor network called DeerNet. The relationships between wildlife and humans have never been tighter. Infectious disease outbreaks among wildlife can spread to domesticated animals or humans and threaten our health and economy. Tracking wildlife populations is a vital component of understanding wildlife interactions with the environment.

The research will focus on providing video data from sensors in real-time over unreliable networks. It will also focus on developing techniques for integrating data from animal mounted video sensors which are obviously mobile. There will need to be a focus on energy scalable video encoding, resource control and allocation, and routing for moving and unreliable network nodes. Work funded in this project will extend our knowledge of wireless mobile sensor networks, energy-aware video processing, and wildlife behavior.

New Faculty

David Arnold
Assistant Professor
PhD Georgia Tech, 2004

2004-05 Research Awards
$7,716,399

2003-04 Degrees Granted

BS	MS	PhD
249	150	24

2004 Fall Enrollment

BS	MS	PhD
740	194	229

Environmental Engineering Sciences

James P. Heaney
Professor and Chair
www.ees.ufl.edu

The safe collection, disposal, and recycling of solid wastes is a vital need everywhere but especially in Florida where solid wastes are put in sanitary landfills that are located just above the ground water that provides 90 percent of our water supply. Professor Tim Townsend, working with the College of Engineering's Florida Center for Solid and Hazardous Waste Management, has developed a unique research and education program dealing with solid waste management. During the past five years, his research has focused on bioreactor landfills, construction and demolition debris, special waste management, and leach testing of wastes. His research team works very closely with state and federal regulators and the waste management industry.

Townsend is the lead investigator on the Florida Bioreactor Demonstration Project, a $6 million research effort at an operating landfill about 35 miles north of the UF campus. The demonstration site is the most heavily instrumented and monitored site of its kind in the US and probably the world. His research group is also involved in bioreactor research at several other landfills in the state and is the most active research group on this topic in the country.

Townsend has graduated numerous undergraduate, master's, and PhD students who are now leaders in solid waste field in Florida and throughout the world. In recognition of his accomplishments, he was named the inaugural recipient of the Jones, Edmunds and Associates Professorship in Environmental Engineering Sciences in November 2004.

New Faculty

John J. Sansalone
Associate Professor
PhD University of Cincinnati, 1983

2004-05 Research Awards
$2,604,122

2004-05 Degrees Granted

BS	MS	PhD
16	23	7

2004 Fall Enrollment

BS	MS	PhD
83	34	61

Industrial & Systems Engineering

Donald W. Hearn
Professor and Chair
www.ise.ufl.edu

Optimization modeling and computation is a common theme for much of the current research in ISE. In 1992 the Center for Applied Optimization was founded in collaboration with the Mathematics department, and faculty from various engineering departments became affiliates. Now the ISE faculty have broadened the scope of applications to many areas. The National Science Foundation-sponsored SCALE Center fosters research in supply chain analysis and design and in methods for scheduling of complex airline and rail systems. The Risk Management and Financial Engineering lab focuses on decision making in uncertain environments such as financial markets, military tactical planning, and cooperative guidance and control of aircraft and munitions. ISE faculty also work with health systems and other medical researchers on models to improve all aspects of health care delivery including design of radiation oncology treatment processes, design and data analysis in epileptic seizure prediction, and capacity expansion of health systems that balance cost effectiveness with improved quality of treatment. ISE research has also focused on decision modeling of Florida's future water supplies, congestion tolling of urban traffic networks, new methods for lean manufacturing, and the design of remanufacturing systems for major auto manufacturers.

New Faculty

Cole Smith
Associate Professor
PhD Virginia Tech, 2000

Amar Sapra
Assistant Professor
PhD Cornell University, 2004

2004-05 Research Awards
$1,021,945

2004-05 Degrees Granted

BS	MS	PhD
76	60	9

2004 Fall Enrollment

BS	MS	PhD
356	125	54

Materials Science & Engineering

Kevin S. Jones
Professor and Chair
www.mse.ufl.edu

We are pleased to congratulate Professor Reza Abbaschian on becoming Dean of Engineering at the University of California, Riverside. His work in leading MSE to become a top 10 program cannot be overstated.

Three outstanding faculty will join MSE in fall 2005. Henry Hess brings a novel approach to biomaterials by developing bioactive transport systems which offer the possibility of a truly unique method of assembling complex molecular structures. Recognizing the rapid growth in organic electronics, MSE also welcomes Franky So and Jiangeng Xue. So has spent the past 13 years as a leader in the organic light emitting display industry. Xue's expertise is in organic photovoltaic devices. These outstanding scientists will strengthen MSE's research activities in organic electronics, an area offering many exciting research opportunities to aid in the development of cheap, flexible displays, circuits, and solar cells.

Our academic programs continue to excel. The graduate program is now 8th overall in the *U.S. News and World Report* rankings. The department is very proud of the outstanding quality of the record 70-plus graduate students enrolling this fall. This follows the graduation of a record 43 PhD students this past year. Our undergraduate population continues to grow with the addition of a new biomaterials specialty, undergrad lab, and the new Research Experience in Materials (REM) program aimed at providing lab experience to freshmen and sophomores interested in materials science. Finally, MSE is proud to announce that ASM International is helping sponsor MSE TEACH, a summer program that invites high school and middle school science teachers for a week of hands on training in MSE. The purpose is to provide those teachers with exciting examples to bring back to the classroom to share with students.

New Faculty

Henry Hess
Assistant Professor
PhD Free University Berlin, 1999

Franky So
Associate Professor
PhD University of Southern California, 1991

Jiangeng Xue
Assistant Professor
Princeton University, 2005

2004-05 Research Awards
$11,059,053

2004-05 Degrees Granted

BS	MS	PhD
29	47	43

2004–05 Fall Enrollment

BS	MS	PhD
124	56	157

Mechanical and Aerospace Engineering

Gene Hemp
Professor and Interim Chair
www.mae.ufl.edu

Professor Nagaraj Arakere, PhD candidate Erik Knudsen, and NASA Marshall Space Flight Center researchers are investigating crack propagation in the foam that insulates the Space Shuttle's external tank. In February 2003, the catastrophic failure of Space Shuttle Columbia was caused by a piece of foam striking the wing during liftoff. The Space Shuttle Discovery on its takeoff in August 2005 was also struck by foam, leading NASA to postpone further flights until 2006.

Small voids are created during the deposition of foam insulation on the tank exterior. These voids become pressurized due to cryogenic temperatures at the surface exposed to the tank and aerodynamic heating on the surface exposed to air as the shuttle is accelerating to low-earth orbit. With enough pressure, the cracks can propagate toward the surface of the foam and large pieces can fall off the tank surface. The investigation focuses on the propensity of the foam to fracture off the tank surface by a combination of experimental testing of fracture specimens and finite element modeling. Additionally, the foam is not an isotropic material. Calculations for the stresses, displacement fields, as well as the stress intensity factors must include the effects of anisotropy.

2004-05 Research Awards
$8,713,658

2004-05 Degrees Granted

BS	MS	PhD
163	57	12

2004 Fall Enrollment

BS	MS	PhD
1115	116	159

Nuclear & Radiological Engineering

Alireza Haghighat
Professor and Chair
www.nre.ufl.edu

The Nuclear & Radiological Engineering (NRE) department offers a unique curriculum in nuclear science and its applications in engineering and medicine. Fields include power generation, space nuclear power and propulsion, nuclear detection, nondestructive testing, medical diagnosis and therapy, and dosimetry. NRE has MS and PhD programs in nuclear engineering, as well as in medical physics and health physics with support from the Radiology and Radiation Oncology departments at UF-Shands Healthcare.

The quality of NRE's faculty has earned the department high rankings in such national reviews and magazines as *US News & World Report*. NRE graduates have built significant reputations in high positions in government and industry.

NRE has several laboratories and facilities:

- The Florida Institute of Nuclear Detection and Security (FINDS). FINDS designs and tests innovative interrogation, detection, and assessment devices to monitor nuclear materials in ports, on aircraft, in buildings, etc., using interrogation systems using radiation transport methods and codes created by the UF Transport Theory Group; room temperature detectors; patented x-ray lateral migration radiography methodologies; and neutron-based active interrogation techniques and devices.
- The Advanced Nuclear Fuels Laboratory (Prof. James Tulenko)
- The University of Florida Training Reactor - UFTR (Dr. William Vernetson)
- The Particle Transport and Distributed Computing (PTDC) Laboratory (Prof. Alireza Haghighat)
- The Microimaging for Skeleton Dosimetry Laboratory (Prof. Wesley Bolch)
- The Innovative Nuclear Space Power and Propulsion Institute - INSPI (Prof. Samim Anghaie)
- The Lateral Migration Radiography Laboratory (Prof. Edward Dugan)

NRE's medical physics program is CAMPEP accredited and has a close teaching and research collaboration with UF's College of Medicine. The nuclear engineering curriculum is ABET accredited.

New Faculty

Sanjiv Samant
Associate Professor
PhD University of Western Ontario, 1988

2004-05 Research Awards
$2,126,485

2004-2005 Degrees Granted

BS	MS	PhD
11	6	5

2004 Fall Enrollment

BS	MS	PhD
73	33	40

New UF Provost Joins Biomedical Engineering Faculty

Janie M. Fouke, who took up duties as University of Florida provost on August 15, 2005, has also been named a member of the Biomedical Engineering department faculty.

Fouke, who was dean of Michigan State University's College of Engineering prior to joining UF, has had a distinguished career in biomedical engineering. She received her master's in biomedical mathematics and engineering from the University of North Carolina at Chapel Hill in 1980. During that time, she was a research assistant in the division of pulmonary diseases. She earned her doctorate in the same field from UNC in 1982.

From 1981 to 1999, Fouke rose through the faculty ranks in the Biomedical Engineering department at Case Western Reserve University in Cleveland with teaching and research interests in medical instrument design and development.

She was the inaugural director of the newly created division of bioengineering and environmental systems with the National Science Foundation in Washington, D.C., from 1995 to 1999.

She serves on advisory boards for several universities and federal agencies and is a Fellow in several professional societies, including the American Association for the Advancement of Science, the American Institute for Medical and Biological Engineering, the Institute for Electrical and Electronics Engineers, and the Biomedical Engineering Society.

A Teacher's Tribute to Students

By Dinesh O. Shah

I searched many lands and skies
And I crossed many stormy oceans
I traveled through scorching deserts
But finally I found some jewels in the sand!

These jewels are colorful as the rainbow in the sky
They sparkle like rubies and diamonds
They are precious although they are not set in gold!

Nationality, race, or religion,
Nothing separates these jewels
No hardship can break them
As they are strong as diamonds!

When everyone saw a candle burning
They saw a flickering flame!
But I saw millions of lamps hiding in that flame
And that has been the secret of my life!

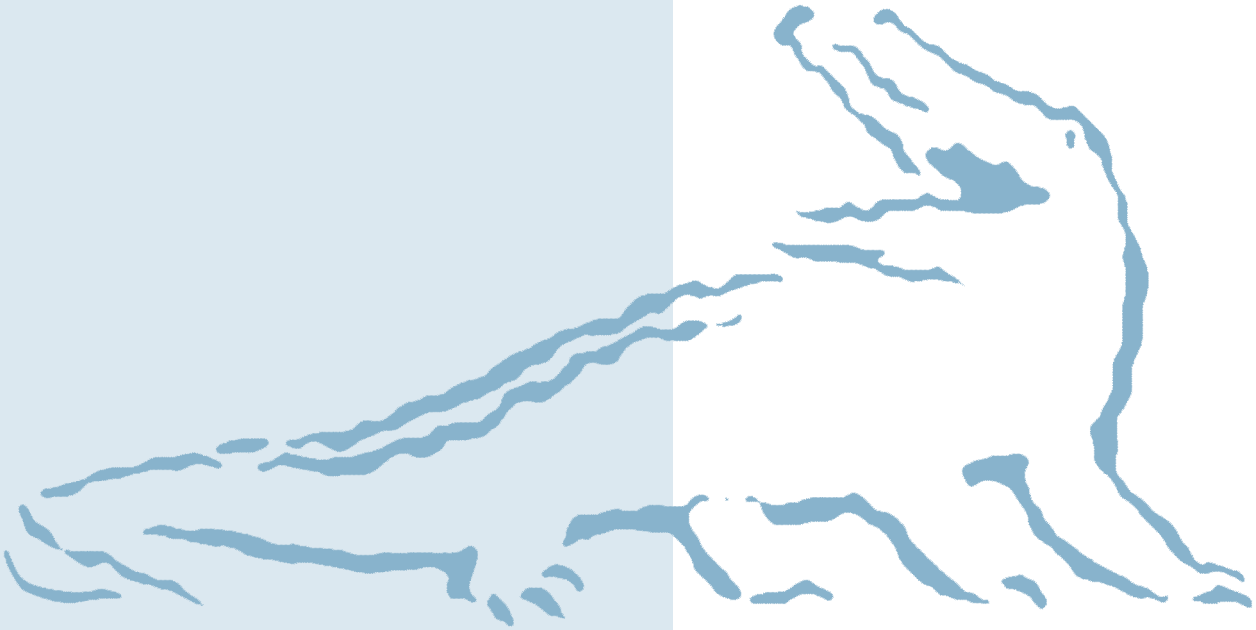
Translation from Parab Tara Pani
Published Bombay, India, August 1986

Mark Your Calendar for Upcoming Events

November 3-5, 2005

Grand Guard Reunion

The Grand Guard Reunion, honoring the Class of 1955 and all prior years, will be held November 3-5, 2005, by the University of Florida Alumni Association. For additional information on this festive weekend of events, please visit their Web site at www.ufalumni.ufl.edu or call 352.846.3580.



UNIVERSITY OF
FLORIDA

College of Engineering
PO Box 116550
Gainesvile, FL 32611-6550

www.eng.ufl.edu

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