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TEXAS TECH UNIVERSITY COLLEGE OF ENGINEERING NEWSLETTER

VOLUME 01 NUMBER 01

APR 05

"Our generation of new ideas and knowledge drives the base of our state's and nation's economies."

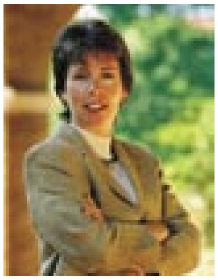
STATEMENT from the DEAN

As the Dean of the College of Engineering, I am delighted to be a part of the exciting future of the engineering disciplines at Texas Tech University. The institution was founded on the basis of the importance and contribution to the region and the state economy by the teaching and research of engineering.

Now in a global economy, our college's contributions are even more significant as we prepare a technically sophisticated workforce. Our generation of new ideas and knowledge drives the base of our state's and nation's economies.

Increasing the national visibility and external funding of our research embraces the university's goal of becoming one of the top 75 research institutions in the United States. Continually improving our college's national reputation also assures that we educate and train our future generations of engineers. As our tradition holds, our graduate and undergraduate students will be prepared to generate the innovations and knowledge that will keep our nation preeminent in this increasingly competitive global economy.

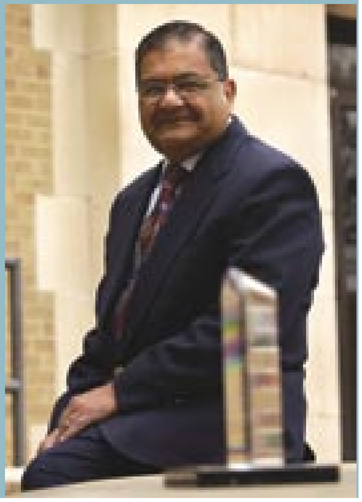
Areas in which the College of Engineering has sustained international recognition include Wind Science and Engineering and Pulsed



Power and Power Electronics. The university's first honoree of the National Academy of Engineering was elected last year when Dr. Kishor Mehta was recognized for his essential work in the mitigation of damages from wind storms. In recognizing two new Horn Professors in the College of Engineering, the Texas Tech Board of Regents honored Dr. Sunanda Mitra for her work in medical imaging and Dr. Greg McKenna for his work in polymer materials.

Other outstanding and growing research programs include: nanotechnology, materials, nanoenergetic materials, water resources and remediation, medical image processing, capabilities engineering, and high-pressure material formation. Bioengineering as a field is poised to be a significant program at Texas Tech.

Our college's new newsletter is a beginning step in communicating with our friends and alumni about the exciting legacies and progress that the Texas Tech College of Engineering faculty, students and alumni are leaving to our world. We all share in the essence of Envision.



KISHOR MEHTA, ELECTED TO THE NATIONAL ACADEMY OF ENGINEERS, HAS DIRECTED WIND SCIENCE STUDIES AT TEXAS TECH FOR 35 YEARS, ALONG WITH FOUNDERS OF THE PROGRAM , ERNST KIESLING, JIM McDONALD, SCOTT NORVILLE, RICHARD PETERSON AND JOE MINOR, WHO CREATED THE WIND ENGINEERING SCIENCE RESEARCH CENTER.

CENTER showCASE

A tornado blew into the city of Lubbock on May 11, 1970, killing 26 people and leaving a swath of destruction across half of the community. Spawned by the power of Mother Nature, researchers at Texas Tech began a long legacy of attempts to defend humanity from the wrath of such natural disasters. Thirty-five years later, the Wind Science and Engineering Research Center (WISE) involves faculty from atmospheric sciences to economics to math to engineering. Their goal is to develop a large amount of data to understand building structures, wind loads and their effects on the population. Researchers now are directing their strengths left by Horn Professor Kishor Mehta and others in building their knowledge about the other realms of wind.

Mehta's successor, Andrew Swift, is researching the use of wind as a growing source of renewable energy for electrical power generation.

The College of Engineering has put Lubbock on the map the same way the city was in the media in the aftermath of the springtime devastation. Under the longtime guidance of Mehta, researchers began embarking on storm site visits to document the effects of tornados and hurricanes on structures. Mehta's work led him to chair the wind load standards, committee of the American Society of Civil Engineers that develops national standard, and ultimately adopted by the international building code for regimens regarding the safety of buildings from strong winds.

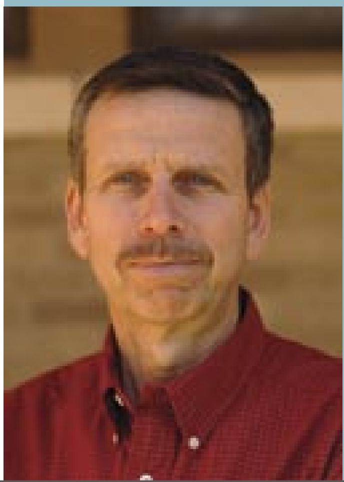
With National Science Foundation grant monies, the team created a research field laboratory to study high winds, dust and thunderstorms. They also collaborated with researchers at Colorado State University to use the institution's wind tunnel technology.

"We have built credibility, nationally and internationally. The field research site is analogous to the space station in space research. The laboratory is a major step toward developing theories of how the wind affects structures," Mehta says.

After being elected to the National Academy of Engineers, Mehta is supporting the further investigation of the work he began, while supporting the interest in wind energy that Andrew Swift is concentrating on. The natural resource of the winds is a growing alternative to traditional power sources. "Wind power is growing quickly as a major source of energy. It is the cheapest source of new electrical power generation," Swift notes.

"We see ourselves poised geographically and historically to offer expertise and new programs and to be a world-recognized center in systems of wind power systems. Wind will aid in local economic development, growth of new jobs and in the tax revenue generated by wind power plants," he says.

In a global approach to wind, Mehta has concentrated on protecting lives and structures from disaster. Now, Swift is seeking to harness the wind, finding new ways of providing energy to our dwindling supply of other natural resources.•



ANDREW SWIFT NOTES THAT THE THE RELIABILITY AND SIZE OF WIND POWER HAS INCREASED, WHILE THE COST HAS DECREASED. WIND IS A PART OF THE ALTERNATIVE ENERGY, A GROWING SECTOR IN THE POWER INDUSTRY THAT WILL AID IN ECONOMIC DEVELOPMENT, GROWTH OF JOBS AND TAX REVENUES.

STUDYING BIOLOGICAL PROCESSES THROUGH MICROSCOPY, MARK VAUGHN MEASURES NANOPARTICLES THROUGH THE REFLECTIONS OF LIGHT.

NEW faculty SYNOPSIS

Through rainbows of colors, Mark Vaughn looks into the universe of the small. Vaughn uses microscopy to measure nanoscale phenomena and determine how systems change at the molecular level when they are mechanically perturbed. With an optical microscope and optics to direct a laser beam, the microscope allows researchers to sense nanoparticles and fluorescent probes used to sense their local environment through the intensity and the color of the light. Vaughn is studying the flow-related phenomena that occur at the nanoscale. One example is to determine how the flow of blood perturbs molecular configuration of cell membranes lining the blood vessel.

"When things are affected by mechanical forces, they can be stretched or deformed. We are particularly interested in flow-related phenomena in the microcirculation, where blood vessels are about the size of strand of hair. My interest is in the surface of the cell where the cell membrane and its protein molecules interact with the flow. Cells can sense flow and change their behavior accordingly. We want to know how," Vaughn, an assistant professor, says. "With the microscope, we are developing optical techniques that depend on the diffusion or random motion of molecules." The motion of molecules can be determined through light scattering or through a technique know as FRET (fluorescence resonance energy transfer). "Every day life is seen in big things. On the nanoscale, we can't use light to sense the shape or size of the particular nanoparticle, but we can locate it, and with certain measurements like FRET, we can determine distance between particles as we excite the molecule with particular wavelengths of light."

For his work, Vaughn has received a National Science Foundation grant to study the effect of flow on the organization of fluid membranes, helping him to understand a number of biological processes. One of the practical applications is in determining mechanisms for drug delivery applications.

Circa 1650, the microscope became the earliest scientific instrument, predating the telescope. The modern instrument now used is helping engineering researchers to study the structures of living systems at the very tiniest scale, through reflections of light.•

SPOTLIGHT on STUDENTS

Where the rubber meets the road, automobile manufacturers must find alternatives to today's gas hungry vehicles, as consumers demand the same performance with cheaper, cleaner fuels. While new vehicle models are tested on the proving grounds of General Motors, Ford or Chrysler, the intriguing and intellectual designs of the vehicles of the future are being molded in Texas Tech University's Advanced Vehicle Engineering Laboratory (AVEL). Since 1989, Tim Maxwell in mechanical engineering and Micheal Parten in electrical and computer engineering have directed student teams in the quest to build the best models of the next generation of cars, trucks and SUVs.

Through sponsor-driven research, Maxwell, Parten and their engineering student teams, numbering each year of 30-50 undergraduate and 3-10 graduate students, have developed improved vehicle architectures through computer simulations and then executed their new designs in functioning vehicles. A major result of the vehicle program is to have both electrical and mechanical engineering students working together on interdisciplinary projects, prior to entering automotive work.

"Students are able to learn first-hand the complexity of an engineering system, such as that of a vehicle, and the importance of working as an interdisciplinary team to develop robust solutions. With Challenge X, our current project funded by the U.S. Department of Energy, General Motors, and other industrial partners, students explicitly will work with industry mentors as they develop their hybrid Equinox," says Maxwell, professor of mechanical engineering. "The students learn the vehicle development process that is representative of the design process for any complex system. They begin by defining the technical specifications for the vehicle and then they synthesize a vehicle architecture that will meet those specifications. Control strategies are developed and tested on subsystems. Finally a vehicle is built and tested and the results are compared to the original specifications."

TIMOTHY MAXWELL (FAR RIGHT) AND MICHAEL PARTEN (FAR LEFT), WITH STUDENTS OLUDARE SAMI AND MARIO MENDEZ, WORK IN AN INTERDISCIPLINARY ENVIRONMENT TO CREATE BETTER VEHICLES.

Challenge X will test Texas Tech's engineering students' abilities to design and develop a fuel efficient and emissions friendly vehicle powered by an electric motor, a small hydrogen fuel cell, and an engine fueled with a combination of ethanol and hydrogen. At Texas Tech's AVEL at Reese Center, students will continue to make quantum leaps into the world of future transportation. •

SUNANDA MITRA AND HER TEAMS OF STUDENTS HAVE DEVELOPED CUTTING-EDGE MEDICAL DIAGNOSTIC TOOLS.

FEATURE faculty PROFILE

The telephone rings in Sunanda Mitra's office. On the line is a doctor calling this highly trained theoretical physicist for discussing new ways to diagnose a disease. Not infrequent, doctors seek Mitra's research expertise in which she has developed methods for detecting and diagnosing diseases using image analysis, stereo imaging and three-dimensional visualization. She and her large team of students have created mathematical models to document the physiological processes in human beings, in hopes of diagnosing diseases.

Mitra, now a Horn Professor, worked as a post-doctoral fellow in plasma physics in the College of Engineering's Pulsed Power Laboratory in her early career. Prior to becoming a faculty member at Texas Tech in 1984, she developed methodologies for early detection of retinal diseases and worked at the Mount Sinai School of Medicine in New York. After joining Texas Tech, she received a National Science Foundation grant to develop a Digital Image Processing Laboratory.

The holder of the patent on high quality compression, Mitra is a pioneer in the area of medical image compression. The National Library of Medicine (NLM) and the National Cancer Institute (NCI) are using Mitra's compression technique for a pilot study to determine the level of compression that can be used for an archive of 100,000 cervix images for efficient storage and transmission to worldwide users for further research. She is developing an image-based alternative screening tool for early detection of cervical cancer in women. With early detection by a cost-effective computer-aided diagnostic tool, the more than 200,000 women who die from cervical cancer each year could be saved.

Studying glaucoma since 1980, Mitra and her students developed ways of stereoscopic image analysis for early detection of glaucoma for doctors to visualize the 3-D deformation in the optic nerve head that currently is being pursued for clinical application. "What we have developed are non-invasive and more accurate methods for disease detection. The research still needs more validation, but physicians already are greatly interested in the work and its implications for diagnostic aid," Mitra says.

Pixel by pixel, Sunanda Mitra and her team analyze images of organs in humans, helping researchers and medical practitioners to diagnose diseases in early stages to provide better health care.•

MARIO BERUVIDES FOCUSES ON PUTTING EDUCATION INTO THE LAPS OF CONSUMERS THROUGH DISTANCE EDUCATION.

GRADUATES at a GLANCE

As humans, we both fear and love our machines. "In the Information Age, individuals are seen as entities that behave in systems," says Mario Beruvides, associate professor in industrial engineering. In addressing these human systems, Beruvides is going directly to the consumers of higher education through distance education. Distance education serves the basic needs of consumers who want a product of education at their convenience.

With an eclectic group of doctoral students, Beruvides is teaching individuals how to manage technological endeavors. "If a person has no technological background, a master's of business education will not help to manage technologically focused work," he says. In his master of science in systems and engineering management courses, in addition to students from the Texas and Oklahoma regions, students come from places such as Canada, Australia, Finland, Kuwait, the United Kingdom, South America, Turkey, Mexico, West Indies, Thailand, Vietnam and Latin America, to participate in the distance education experience. "These students will become experts in quality of manufacturing, ergonomics and engineering management through an externally flexible way of learning education."

Distance education serves the basic needs of consumers who want a product of education at their convenience. With a strong emphasis on research components, Beruvides has worked with his students for 10 years in developing the current program, resulting in an education in the analysis of systems. Students study knowledge of general systems theory, chaos theory and total quality management control. "This is critical because when we mess with complex systems, there are ramifications," he notes. "Every part of the system is interrelated and interwoven."

In the meantime, Beruvides is ahead of the curve in his current and future observations regarding education presented at a distance across the globe.

Beruvides is one of the many Texas Tech University distance education professors creating a whole new university that parallels the structural buildings of a campus. •

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