Selected Mechanical Engineering Awards 2008 - 2009

Faculty

Jan Achenbach was elected "Member at Large" of the International Union of Theoretical and Applied Mechanics (only 3 from the USA)

Jian Cao was appointed to the Board of Directors of Society of Manufacturing Engineers North American Manufacturing Research Institute; chair of the ASME Manufacturing Engineering Division

Isaac M. Daniel received the Best Paper Award from the Society for Experimental Mechanics for the paper entitled "Thermomechanical Enhancement of Fiber Composites with Carbon Nanoparticles"

Horacio Espinosa was elected fellow of the Society for Experimental Mechanics

Mitra Hartmann received an NSF CAREER award

Walter Herbst received the 2008 Industrial Design Excellence Gold Medal Award

Dean Ho received the Wallace H. Coulter Foundation Early Career Award in Translational Research, the John G. Bollinger Outstanding Young Manufacturing Engineer Award of SME, the UCLA School of Engineering Distinguished Young Alumnus Award, and the NSF CAREER award

Yonggang Huang received a 2008 Guggenheim Fellowship

Sridhar Krishnaswamy was re-appointed to a second three-year term as associate editor for the Journal of Applied Mechanics

Neelesh Patankar was appointed to associate editor of ASMS Journal of Fluids Engineering

John Rudnicki received the Brown Engineering Alumni Medal in 2008 and was elected fellow of the ASME

Graduate Students

Christina Twist Barbosa won second place for her student poster at the STLE/ASME International Joint Tribology Conference in Miami, Florida in October 2008

Aaron Greco was awarded the 2009 STLE (Society of Tribologist and Lubrication Engineers) Scholarship by the Chicago section. This $4,000 scholarship is awarded to one student each year studying in the field of tribology and/or lubrication engineering, in the Chicago area

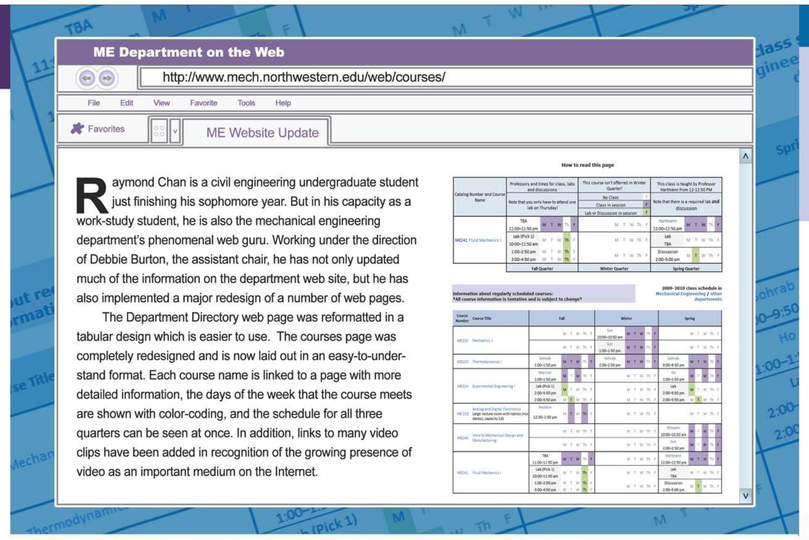
Owen Loh was awarded a 2009 Presidential Fellowship, the most prestigious fellowship awarded by Northwestern University

Binoy Shah received GE's 2008 Student Intern/Co-op Contribution Award (SICCA) for work during his summer internship as part of a team developing thin film flexible solar modules

Tom Vose won the best student paper award for "Friction-Induced Velocity Fields for Point Parts Sliding on a Rigid Oscillated Plate" at the 2008 Robotics: Science and Systems (RSS) conference in Zurich, Switzerland

In 2008, Christina Twist Barbosa won second place for her poster at the STLE/ASME International Joint Tribology Conference in Miami, Florida

In 2008, Professor John Rudnicki was awarded the grade of fellow of the ASME



ME Department on the Web

http://www.mech.northwestern.edu/web/courses/

File Edit View Favorite Tools Help

Favorites | ME Website Update

Raymond Chan is a civil engineering undergraduate student just finishing his sophomore year. But in his capacity as a work-study student, he is also the mechanical engineering department's phenomenal web guru. Working under the direction of Debbie Burton, the assistant chair, he has not only updated much of the information on the department web site, but he has also implemented a major redesign of a number of web pages.

The Department Directory web page was reformatted in a tabular design which is easier to use. The courses page was completely redesigned and is now laid out in an easy-to-understand format. Each course name is linked to a page with more detailed information, the days of the week that the course meets are shown with color-coding, and the schedule for all three quarters can be seen at once. In addition, links to many video clips have been added in recognition of the growing presence of video as an important medium on the Internet.

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SUMMER 2009

Note from the Chair

Welcome to the new, redesigned ME newsletter. Here we introduce you to our new faculty, mention a few of the faculty and student awards, highlight several outstanding activities, and present one selected research highlight. We hope you enjoy these articles about the innovation and advances in ME at NU.

If this issue stimulates you to find out even more about recent ME activities, please check out our redesigned web site which is continually being updated with the latest news and videos.

L. Cate Brinson
Chair, Department of Mechanical Engineering

Stretching Circuits

Circuits that can wrap around your arm. A camera based on the human eye. Electronic newspapers. These tantalizing technologies are not yet available to the public, but a partnership between Yonggang Huang, the Joseph Cummings Professor in civil and environmental engineering and in mechanical engineering, and John Rogers of the University of Illinois at Urbana-Champaign has brought them closer to reality.

Electronic components have historically been flat and unbendable because silicon, the principal component of all electronics, itself is inflexible: Any significant bending or compression renders an electronic device useless. Huang and Rogers have new ideas on how to overcome this hurdle. The pair has created stretchable circuits and a camera with a curved sensor array that's based on the design of the human eye, which gives a photograph a wide field of view with a greater range of focus.

To create their fully stretchable integrated circuits, the researchers began by applying a layer of polymer and then a coating of plastic to a substrate. The integrated circuit was then crafted on the surface using both conventional techniques and nanoscale printing methods. Researchers wash away the initial polymer layer, leaving

Yonggang Huang
(Photo by Andrew Campbell)

the complete circuit system with the plastic coating as a flexible substrate.

Next, this flexible, ultrathin circuit is bonded to a piece of silicone rubber that is prestretched, like a drumhead. When released, the rubber springs back to its initial shape, compressing the circuit. That compression leads to a complex pattern of buckling that allows the circuit to be folded or stretched in different directions to conform to a variety of complex shapes or to accommodate mechanical deformations during use. Huang's research group is responsible for the mechanical analysis that guides the design of these circuits.

That type of mechanical analysis also allowed Huang and Rogers to create a kind of camera based on the human eye — work featured on the cover of the journal Nature in August 2008. This application . . . *(continued on reverse)*

Stretching Circuits
(continued from front page)

uses an array of silicon detectors and electronics on a curved surface created using stretchable circuits.

First, the researchers created a hemispherical thin elastomeric membrane that can be stretched into the shape of a flat drumhead. In this form, flat electronics can be transferred onto the elastomer. In order to avoid fracture of the brittle semiconductor materials when the elastomer pops back into its hemispheric shape, the silicon components are made to be extremely small — approximately 100 micrometers square — so that they aren't affected when the elastomer changes shape. The tiny circuits on the array are connected by thin metal wires on plastic that form arc-shaped structures that Huang and Rogers call "pop-up bridges." These bridges allow for the strain associated with return of the elastomer to its curved shape.

Early images obtained using this curved array in an electronic eye–type camera produce large-scale pictures that are much clearer than those obtained with similar planar cameras when simple imaging optics are used.

Northwestern Solar Car Team Places Third In Race

The Northwestern Solar Car Team took third place in the Formula Sun Grand Prix 2009, held June 1 through 5 at the Texas Motorsports Ranch in Cresson, TX. Nine teams from across the country competed in the race, where teams attempted to drive as many laps as possible in the three-day time period.

The first two days of the race involved inspections, and the team passed them all on the first day — and ended up being the only team to complete all stations with the highest "green" ranking on the first try. For the following three days, teams raced from 9 a.m. to 6 p.m., stopping only to change tires and fix problems such as a blown out tire and faulty battery connections.

Over the three days, three drivers drove the car around 371 laps, the equivalent of 630 miles.

A majority of the Solar Car Team members are mechanical engineering undergraduate students and two of three advisors, Professors Kornel Ehmann and Walter Herbst, are mechanical engineering faculty members.

Northwestern Professor Helps Get Out The Vote

This fall before the national election, students volunteering through NU Decides, a voter outreach group, set up a booth in the lobby of the Technological Institute for registering Northwestern students "from swing states (and all states)" as their banner read. Their efforts got a boost from Michael Peshkin, professor of mechanical engineering, who created VoteBackHome.com, a web site where he compiled enrollment data showing how many students came from each swing state. The site offered a detailed kit for organizing a ground campaign to reach swing state-voters on non-swing-state campuses, like Northwestern's, which has 1,800 students from swing states.

"I've gotten a hundred e-mails reminding me to register to vote, and I'm sure the students have, too," he said. But his engineer's eye was already looking for a way to make the process more effective and efficient. "Those e-mails don't work nearly as well as talking to students face-to-face. So I created the data sets and the tools needed for students to do that."

Peshkin also helped provide the student group with

resources – like stamps and a photocopier — and printed up state-specific instructions, voter registration forms, and absentee ballot requests. "By working with the NU Decides students," he said, "I learned that efficiency is having all those forms ready so students can fill them out, make a copy of their driver's license, and then have the envelope and stamps right there ready for mailing."

More than 1,300 Northwestern students registered to vote through these efforts. The program has been picked up by over a dozen other colleges and universities from California to New York.

"I think it's a college's mission to encourage students to ask themselves, 'Am I a spectator or am I a participant?" Peshkin said. "And this helps them become participants."

Now that the election is over, Peshkin is continuing to work with a smaller group of students, including the two leaders of NU Decides. Funded by a small grant from the new Center for Civic Engagement, they are tracking down the voting records of more than 1,000 students who registered, half of whom registered to vote in person in Illinois and half of whom registered to vote absentee in their home states.

"It turned out to be a natural experiment," said Peshkin. "If we find that students voted absentee at high rates, that disproves the conventional wisdom about both absentee voting and low student turnout." Peshkin and the student group intend to document and publish their results.

New Assistant Chair Joins The Department

Debbie Burton began work in September 2008 in the new non-tenured faculty position of assistant chair. Debbie comes with industrial experience, a PhD from Northwestern, and enthusiasm to tackle issues ranging from terminal masters programs to ABET to publicity to outreach.

Debbie is responsible for a number of publicity projects. One of the first tasks she worked on was the editing of the brochures for McCormick, both the new "e-brochures" sent out by requests through the web site and also the regular printed brochures showcasing the ME department and faculty. Debbie has also been developing brochures for the different specialities within the MS program. In addition, Debbie is responsible for oversight of the department web site and helped to choose the subjects for videos made for McCormick.

Debbie works with many different groups of people. She has cheerfully substituted for undergraduate advising when faculty are unavailable and based on these experiences is planning a larger help-session for students next year. She has arranged visits and lab tours for visiting faculty from other institutions as well as prospective students and their families. She was recently involved in the organization of the annual meeting of the ME Advisory Board.

Additional duties include: organization of ABET accreditation, review of graduate admissions, publicity and candidate selection for the PIRE-ISHM undergraduate research abroad program, helping faculty with educational/outreach portions of proposals, and submission of nominations of students for fellowships.

Professor Balogun Joins The Department

When Oluwaseyi Balogun became an assistant professor of mechanical engineering and civil and environmental engineering in the fall of 2008, he was not new to Northwestern, having first come to the university as a postdoctoral fellow in 2007. Balogun earned his PhD from Boston University.

Balogun and his graduate student are working to develop advanced optical tools to assess the structural integrity of engineering structures and predict their in-service reliability and performance. He is currently developing an optical microscopy system that can be used for the noninvasive mapping of local mechanical and thermal properties in micro- and nanostructured materials used in microelectronic devices, high-temperature coating applications, sensors, and energy-storage devices. Balogun is also interested in the application of the microscopy system for the mapping of deeply buried nanoscale defects in microelectronics devices.

While the optical microscopy system Balogun is developing is tailored for the characterization of small-scale structures, he is also interested in the development of optical sensors for monitoring the structural health of large-scale civil infrastructures including bridges, dams, and levies. In the meantime, Balogun is collaborating with a faculty member at McCormick to develop optical fiber and ultrasonic sensors for monitoring the dynamic mechanical response of civil bridges. "The goal of this undertaking is to develop diagnostic and predictive tools for estimating the functional lifetime of aging civil infrastructures," he says. "This is a new and exciting area of research that directly impacts society."

Professor Gerber Joins The Department

Elizabeth Gerber joined the Department of Mechanical Engineering as an assistant professor in the fall of 2008. She is affiliated with the Segal Design Institute and her principal research interests are design and innovation work practices and service design. She also has courtesy appointments with the Kellogg School of Management and Department of Industrial Engineering and Management Sciences.

Gerber earned her MS in Product Design and PhD in Management Science & Engineering at Stanford University. She was also a post-doctoral researcher at the Hasso Plattner Institute for Design at Stanford where she helped to start up a new design school. She says that she was drawn to Northwestern because of the collaborative and entrepreneurial attitude held by the faculty and students.

Gerber has already helped two Northwestern teams to win the top two prizes in the Diabetes Mine Design Challenge. The team of two graduate students who won the $10,000 award were told about the competition by Gerber, who also informally advised them on their iPhone case and software system while one of the students was enrolled in Gerber's design course. The Most Creative award, a $5,000 prize, was won by a team of undergraduate students participating in a new program developed by Gerber called Design for America. The students designed an interactive stuffed bear with diabetes to help children understand their disease.