



IN THIS ISSUE

- Edgar Williams Stanton page 3
- 'Donkey factor' among important lessons learned page 4
- March establishes endowed faculty position page 8

Message from the Chair



In a special issue last spring ranking graduate schools, *U.S. News and World Report* featured an article titled "Mechanical Engineering Is on the Rise: The classic discipline is cutting-edge again." At Iowa State, we certainly see a strong and growing interest among students and employers, and we further recognize our responsibility to play a leading role in mechanical engineering education. As has been the case for the past three years, mechanical engineering is the most popular major on campus, and our impact continues to grow, particularly with increasing enrollments of out-of-state and international students. Our undergraduate enrollment stands at 1,020 students, and graduate enrollment in mechanical engineering is up 20 percent compared to last year.

We welcomed four new faculty members to the mechanical engineering department this fall: Professors **Timothy Bigelow**, **Baskar Ganapathysubramanian**, **Valery Levitas**, and **Song Zhang**. You can read more about their teaching and research interests on page 11 in this issue of *Dimensions*.

Beginning last summer and continuing through the upcoming spring semester, we are renovating the second floor of the Black Engineering Building. Our undergraduate students will be better served by an expanded and modernized advising center, and to support our expanding master's and doctoral programs we are creating a new graduate programs office suite. The renovations will be accompanied by improved technology use—electronic displays in the hallways will announce seminars, student group meetings, employer visits to campus, and other functions in the life of our department.

I am pleased to announce that the new minor degree in nuclear engineering, spearheaded by **Greg Maxwell**, has received official approval from the university. It will be offered in collaboration with other Big 12 universities. This exciting program will have its center of gravity in the mechanical engineering department but will be available to any student in the college. We are already seeing significant interest from students and the nuclear power industry. In a similar vein, we are developing

a new one-year, coursework-only master's degree that will be accessible to either on-campus or off-campus students through distance education.

This semester, our senior design class is working with seven companies and nonprofit institutions. "Coaches" at those organizations develop real-world projects that serve as the theme for the design work, mentor our students through design reviews and plant visits, and provide sample hardware. This program, led by **Jim Heise**, is becoming an excellent means for our students to develop their design skills in the context of practical industrial and social problems.

The department has also completed its strategic planning initiative to define our "Vision 2025." Our faculty, staff, students, alumni, and industrial advisory council worked together to develop a shared vision, which you can read at www.me.iastate.edu/strategicplan.html. You may also be interested in the department's strategic performance indicators, including enrollment, degrees awarded, extramural research support, research publications, student credit hours taught, student scholarships, number of faculty, and so forth. Our annual report is intended to capture that data concisely and disseminate it to the department's community and is available online at www.me.iastate.edu/annualreport.html.

We are always interested to hear what is new with you to include in an upcoming newsletter. Feel free to share your career developments and interesting accomplishments by sending a note to mealumni@iastate.edu.

Jonathan Wickert

On the Cover

Engineering students in Mali, Africa, learn about local cooking practices to design appropriate and sustainable solutions for residents as part of the course ME 389x.

Fall 2008 | Issue No. 17

Published twice a year by the Department of Mechanical Engineering, College of Engineering, 2025 Black Engineering, Iowa State University, Ames, IA 50011-2161; www.me.iastate.edu; jlstrawn@iastate.edu

Prepared by Engineering Communications and Marketing, College of Engineering ECM 09097

Iowa State University does not discriminate on the basis of race, color, age, religion, national origin, sexual orientation, gender identity, sex, marital status, disability, or status as a U.S. veteran. Inquiries can be directed to the Director of Equal Opportunity and Diversity, 3680 Beardshear Hall, 515 294-7612.

Edgar Williams Stanton (1850–1920)

Character, scholarship, and service were among the many notable traits of **Edgar Williams Stanton**. The first individual awarded a diploma from the Iowa State College of Agriculture and Mechanic Arts, Stanton graduated in mechanic arts, a course of study that included mechanical engineering. While receiving the first diploma was an admirable achievement, it was Stanton's continued devotion to the college that earned him the well-deserved respect of members of the college and community. To celebrate and preserve his story, the college published *Edgar Williams Stanton*, a biographical book that traces his history and ties to Iowa State College. Using information from this book, this article shares some highlights of his story—a story that represents a lasting connection to the university's heritage for the Department of Mechanical Engineering and provides an example of the leadership and responsibility it takes to grow and advance an academic institution.

Stanton was born on October 3, 1850, in Waymart, Pennsylvania. He spent his childhood helping his father, who was a farmer, lumberman, and owner and operator of a water-powered sawmill. He attended the Waymart Normal Institute, and then at age 16 or 17 he went to the Delaware Literary Institute in Franklin, New York. From there, he went to Poughkeepsie, New York, to study telegraphy. During his education, he made connections with several individuals, including **George W. Jones**, who would be the driving force behind Stanton coming to Iowa.

Jones joined Iowa State College as a professor in mathematics when it opened on October 21, 1868, and acted as the president of the college while president-elect **Adonijah S. Welch** finished his term as a United States senator. Jones sent several letters to Stanton, noting the opportunity that the college offered. Stanton eventually decided to make the journey to Iowa, arriving at Iowa State College on March 5, 1870.

Among the first out-of-state enrollments, Stanton entered the engineering program and stayed with Jones and his family. He was allowed to join the upper class because of his former education experience and Jones' endorsement of his abilities as a student. Despite not being an original member of the class of '72, Stanton embraced the traditions that had formed and began forging friendships that would last a lifetime.

On November 12, 1872, Stanton graduated with the first class of Iowa State College. "On graduation day, Dr. Welch intended to present to each student individually his diploma, from memory calling him by name. As he looked at the twenty-six before him and the names slipped, his eyes rested for a moment upon Mr. Stanton and he called his name first." Not only did Stanton receive the first diploma awarded from the college that day, he also began his career as a teacher. He was elected an instructor of mathematics and English composition. From there, he was promoted to several positions, including assistant professor of mathematics, professor of mathematics—a position he would hold for the rest of his life—and professor of economy until 1906. He also served as the secretary for the board of trustees in 1874, secretary of the college in 1909, dean of the junior college beginning in 1903, vice president in 1913, and president from 1890 to 1891, 1902 to 1903, 1910 to 1912, and 1917 to 1918.

Being an educator was one of his greatest passions in life, and he felt that "the knowledge which mathematics conveys is to



Edgar Stanton was awarded the first degree from Iowa State University in "mechanic arts including mechanical engineering."

find concrete expression in engineering structures, in dynamos and motors, systems of water supply, electric railways and vast systems of transportation, while in other lines of applied science mathematics is the indispensable instrument of advanced study and research." His goals in education centered on "the making of men and women of such intellectual fiber and more worth as shall to prepare them in training and purpose to perform aright all the duties that go with citizenship in a free industrial republic."

Stanton had close ties to alumni and even started the campaign to build the original Alumni Building. He was actively involved in the community outside of the college. Among many organizations, he was a member of the Sons of the American Revolution, the American Association for the Advancement of Science, and the honorary fraternities Phi Kappa Phi and Tau Beta Pi.

On February 22, 1877, Stanton married **Margaret Price MacDonald**, and the couple had four children together. Margaret passed away on July 25, 1895, and in the following November, the new women's building was named Margaret Hall in her honor. Stanton, who was so appreciative of the gesture, decided he would donate a chime of bells to the college. The college furnished the tower and clock, and so the campanile was created, with Stanton's vision to "have our college chimes such that they will turn the thought of student and teacher for the moment from daily cares to holier thinking and become and remain a continuously ennobling influence in college life."

Stanton remarried in 1899 to Julia Ann, who returned to the college to teach in mathematics. The couple remained committed to the institution of higher education. In Stanton's will, he "included the college as of equal importance with members of his family." He passed away on September 12, 1920, and was laid to rest in the college cemetery, "where his many friends returning may bow their heads for a moment in remembrance of the man whose gentle wisdom, keen insight, and deep, broad, tender sympathies so influenced their lives. And as they bow, the college chime, his chimes shall break the stillness."

'Donkey factor' among important lessons learned during Applied Methods in Sustainable Engineering and International Development

As ME undergraduate students designed projects for a rural African village, they took into consideration many external factors. What they did not anticipate was that a donkey would cause them to rethink one of their design plans altogether.

Mechanical engineering's appropriate technology course series, taught by Associate Professor **Mark Bryden**, includes three courses wherein students learn about engineering for developing countries. ME 388X, Sustainable Engineering and International Development, provides students with an overall sense of systems and sustainability; ME 486X, Design for Appropriate Technologies, allows students to design solutions for real problems; and ME 389X, Applied Methods in Sustainable Engineering and International Development, places students in the field, allowing them to implement the designs developed in ME 486 on location.

"The courses provide students with a culturally different engineering experience," Bryden says. "They introduce students to sustainability and appropriate technologies and allow students to make a difference in the lives of rural Malians."

This summer, students traveled to Mali, Africa, to implement designs for water system valves, household cook stoves, and village lighting.

As they worked on designs in Iowa, they considered things such as being cost effective, using materials that are readily available to the village, and ensuring the design could operate without running electricity.

When they got to Mali, it was clear some things just needed to be experienced to truly understand the external factors that impact design. To develop an effective cook stove, students worked with Malians to understand the cooking process. Buying equipment in the village was nearly impossible and proved to be quite expensive, requiring students to reconsider some design decisions. And then, there was that donkey.

"We installed a water valve with a long handle," says **Wes Meier**, a 2008 ME graduate who completed all three appropriate



Wes Meier, a 2008 ME graduate, works with rural Malians to install a water valve.

technology courses. Anticipating that the longer handle would make the valve easier to use, the students never imagined that a donkey would run into the valve and break it, rendering the design unusable. "There are just so many things you cannot anticipate until you have your project in place and you observe how it works within the actual environment," Meier says.

The group of students made a significant impact in the village, even receiving a chicken as a sign of gratitude for their work. The offering left a lasting impression with Meier. "We were truly honored," he says. "To see how much our work affected Malians was amazing."

Among all the lessons learned during the experience, Meier took the need to apply engineering solutions to address global issues to heart. Now on assignment with the Peace Corps, Meier plans to continue using his education and experience to promote and help design appropriate technologies in developing countries.

ME student focuses on sustainability in Uganda

As part of the Iowa State chapter of Engineers for a Sustainable World (ESW), **Greg Swiss**, a senior in mechanical engineering, spent the past two summers building and improving biogas digesters and rainwater harvesters in Uganda.

"The projects have been an engineering learning experience," he says, "but more importantly, I have seen firsthand how our profession can help others."

In biogas digesters, bacteria break down organic material, such as manure, creating a gas that the digesters capture. Individuals can use this gas for cooking or lighting. In 2006, an ESW team built a biogas digester for a rural farming family in Uganda to replace indoor wood fires.

"During my trip in 2007, we were able to build a second biogas digester," Swiss says. "The fires currently used in homes are a leading cause of blindness and respiratory problems in Uganda." In the summer of 2008, students worked on implementing the next phase of the biogas digester project.

The rainwater harvesting projects also were designed for rural farming families. The first water project collected surface water runoff for irrigation of crops during the dry season to ensure the crops could be harvested to feed a family. The second water project involved collecting rainwater from a roof in a 1,500-liter brick tank.

"Before the collector was installed, the family of eight had to walk two kilometers to get what we would consider filthy water from the Nile River," Swiss says. The students have continued to research methods to improve the rooftop collector design.



Greg Swiss, an ME senior, helps residents in Uganda through Iowa State's chapter of Engineers for a Sustainable World.

"Rural families need a smaller water harvesting system that can meet a majority of their water needs," he said. "Our hope is that our projects helped solve this problem."

Before returning home, the students taught local builders how to plaster the tanks to be watertight. "By sharing our knowledge with the people of Uganda, we increased the likelihood that our projects would be implemented at more farms across the country."

Check it Out!

The next time you're online, be sure to check out the latest news and videos on the College of Engineering homepage.

Even if you're on your way to your favorite departmental page, take a minute or two to watch an interview with an astronaut or see the latest ways that Iowa State engineers are changing the world.

And if you like what you see, tell your friends in Facebook, or MySpace, or LinkedIn, and let the world know by linking your favorite stories to Digg, del-icio.us, or another news aggregator. Show your pride in engineering at Iowa State and let everyone know about it!

Try it: visit www.engineering.iastate.edu.

Outreach to graduate students is collaborative effort

Amy Carver, program assistant for graduate education, has been on the road this semester making connections with academic institutions and prospective graduate students. Working closely with **Nancy Knight**, director of graduate enrollment management for the College of Engineering, Carver has been directing her visits to institutions that have strong undergraduate students whose education would naturally prepare them for graduate education in mechanical engineering.

Carver visited the University of Wisconsin-Platteville with **Ted Heindel**, associate chair for academic affairs and mechanical engineering professor; Luther College with **Kathryn Andre**, graduate assistant working with Knight; Wartburg College with Knight; and Dordt College with Knight and **Sriram Sundararajan**, associate chair for graduate studies and research and mechanical engineering associate professor. "I have enjoyed meeting with prospective students and extending the outreach of our department," Carver says. "The payoff from these personal visits will be significant."



Summer fellowship demonstrates life of a researcher to ME undergrad

From Memorial Day to just before fall classes began, **Bethany Juhnke** was a “SURFer” with researchers at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland. Juhnke, a junior in mechanical engineering, was awarded a Summer Undergraduate Research Fellowship (SURF) with NIST, spending nearly three months learning what it is like to be a researcher.

A significant experience for Juhnke, the fellowship helped her solidify future plans. Entertaining the idea of pursuing a master’s degree when the summer began, Juhnke is now certain it is what she wants to do. “Ultimately, I want to be a biomedical engineer,” she says. “I decided to pursue mechanical engineering as an undergraduate at Iowa State because it offers a wide range of opportunities and will provide me with a strong foundation for my future career.”

Working for the Biomaterials Group in the Materials Science and Engineering Laboratory, Juhnke characterized biodegradable polymers using a new automated imaging process. “The goal of the research was to decrease the length of time it took to characterize the polymers, allowing researchers to receive FDA approval for the polymers sooner,” she says. Juhnke was able to characterize six polymers in the time she was there, an impressive rate of production considering it typically takes three months to complete one polymer.

Aligning with Juhnke’s future goals, the polymers she characterized have potential to improve and advance biomedical procedures. They can be used to create biodegradable material for surgeries, including a mesh used to repair hernias, a stent for heart procedures, and bone scaffolds to help heal breaks. “The polymers biodegrade, allowing the body to heal itself and preventing the need for future surgeries to remove the material,” Juhnke says. “During my fellowship, I also looked at how cells reacted to different polymer compositions and characterized them, finding the polymer that will be most effective for particular applications.”

Juhnke entered the fellowship a little unsure of what the experience would be like. “I was working on projects that I knew very little about in the beginning,” she says. “But, we each had advisers to help us along the way.”

By the end of the fellowship, Juhnke was able to present a talk to experts in the field. “My presentation was titled ‘Assessing cell morphology and adhesion on a small library of tyrosine-derived polycarbonates,’” she says. After she gave her talk, Juhnke had to take questions from the audience, which consisted of researchers who spend their entire day working on similar projects.

“The experience was intense, but I definitely want to go back again next year,” Juhnke says.

Graduate student honors and awards

Stephen Gent

Teaching Excellence Award

Doug McCorkle

Research Excellence Award

Wen Wang

Brian Gleeson (MSE)

Dan Sordelet (Ames Lab)

U.S. patent for High-Temperature Coatings with PT Metal Modified γ -NI+y'-NI3AL Alloy Compositions

Zhonghua Xu

Waters 2050 Challenge Graduate Fellowship

Mechanical engineering department appoints five new graduate fellows

Daniela Faas, Victor Orlando

Roa-Baerga, Tristan White,

Melissa Wickham, and Yan

Yan—all graduate students in

mechanical engineering—were recently appointed Seward, Ratcliffe, and Galloway Foundation Mechanical Engineering Fellows for fall 2008. This named assistantship is awarded to selected on-campus graduate students who are enrolled full time in the Department of Mechanical Engineering and is made possible through the Roderick Seward, Flossie Ratcliffe, and Helen M. Galloway Foundation, Inc.

“Recognizing students as they work toward their graduate degree is a wonderful opportunity,” says

Jonathan Wickert, department

chair and Larry and Pam Pithan

Professor of Mechanical

Engineering. “The continued

commitment of organizations

like the Roderick Seward, Flossie

Ratcliffe, and Helen M. Galloway

Foundation enables the department

to enhance our students’

educational experiences and

acknowledge their efforts.”

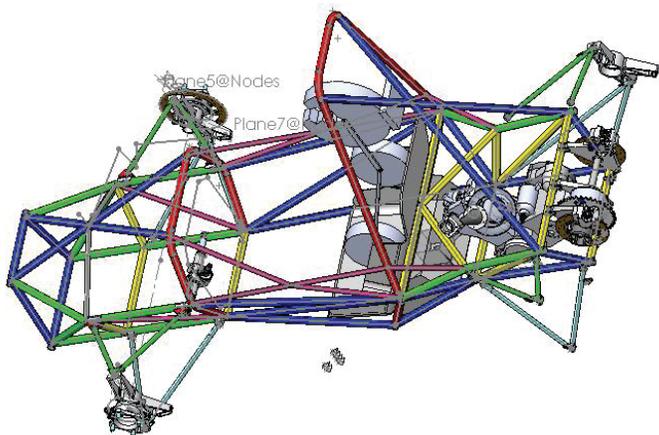


Iowa State student engineers race mini Baja car to top-20 finish

Iowa State University's student-designed, student-built, and student-raced mini Baja car made 34 laps in four hours of muddy off-road competition. Even with a joint failure in the steering mechanism and a couple of flat tires, the team earned a 10th-place finish in the endurance event at this spring's competition for mini Baja racers sponsored by the Society of Automotive Engineers. The competition was held from May 28 to 31, 2008, and 94 university teams made the trip to Caterpillar's Edwards Demonstration Facility near Peoria, Illinois. The endurance race was worth 40 percent of the team's score. The team's solid finish pushed Iowa State up to 16th overall in the annual competition—way up from last year's 87th-place finish. And it had been at least twelve years since the team posted a top-20 finish.

Iowa State Formula SAE team looks for speed in re-engineered race car

This year was a rebuilding year for the Formula SAE car. With many senior members leaving and new, younger members taking their place, the team completely redesigned the car they planned to compete with in the Formula SAE competition in Michigan held from May 14 to 18, 2008. While the team ended the competition in 93rd place, they scored high in the cost section, meaning they were efficient with their expenditures, and they were among sixteen teams whose car used E-85 fuel. Viewing the competition as a learning experience, the team has made an effort to manufacture parts and systems for the car that are simple rather than intricate, creating a car that handles better and is easier to maintain. With a year of competition under their belt, the team is ready to begin planning for the next year's competition.



Iowa State's better human powered vehicle wins engineering competition

Members of Iowa State University's Human Powered Vehicle Team had a successful year during the Human Powered Vehicle Challenge East held at the University of Wisconsin–Madison from April 25 to 27, 2008. The vehicle they designed and built won nine awards during the competition sponsored by the American Society of Mechanical Engineers. This year's vehicle was 25 percent lighter than last year's model, allowing the vehicle's riders to sit inside a frame of steel tubing, that used thinner, lighter steel than last year's model. Their vehicle, nicknamed "Le Tigre," was a three-wheel design with its two riders sitting back to back—a design the team has used before, but now it featured a 27-speed drive train that allowed the two riders to pedal independently. The vehicle's front-end featured a steering mechanism that allowed the two front wheels to have slightly different turning angles, helping with speed. The team's awards included first overall in the multi-rider category, first in design for multi-rider vehicles, second in the utility contest, second in the multi-rider sprint, and second in utility design.



Iowa State solar car finishes 2,400-mile race in eighth place

From July 13 to 22, 2008, Sol Invictus, Iowa State University's solar race car, was on a mission to complete the 2,400-mile North American Solar Challenge. Team PrISUm started the race in Plano, Texas, in 13th place and managed to make their move throughout the week of racing, despite a small fender bender at the beginning and cloud cover toward the end. Twenty-five teams attended the race qualifications, with 13 meeting all the tests and inspections to race and two teams racing noncompetitively. Team PrISUm and Sol Invictus finished in eighth place overall with a time of 91 hours and 12 minutes.

March establishes endowed faculty position in mechanical engineering

William March, BSME'45, continually looks for ways to give back to the university that gave him so much. March has created two scholarships to help students pursue an engineering degree and honor two very important people in his life. Most recently, he established a new endowed faculty position.

The Howard H. Lyon Engineering Scholarship, which is awarded to a student from Iowa pursuing a degree in mechanical engineering, honors his college roommate who made a significant impact in his life, even standing up with March at his wedding as his best man. The Lewis Paul Drew Engineering Scholarship is awarded to a civil engineering student from Iowa. This scholarship honors his uncle, **Lewis Paul Drew**, a 1912 civil engineering graduate from Iowa State. March stayed with his uncle during high school and was always guided by his insight.

The William March Scholar in Mechanical Engineering, which was awarded for the first time this year, recognizes March's appreciation for the education he received at Iowa State. "I wanted to find a way to help the department continue its tradition of providing excellent education," March says.

March's career has afforded him many life experiences for which he is grateful. From serving as a naval officer in the Pacific Ocean to selling diesel generating units in Iowa and Nebraska to working in the municipal bond field in Nebraska, March has just about done it all. He has even used his retirement years to enter into independent ventures, including investing in the banking industry.

Among his many accomplishments, March reflected fondly upon his experience at Iowa State. "I first came to Iowa State as a sophomore in the Navy V12 college training program in 1943," March says. "I worked hard, attending class for three semesters a year, and finished in two years."

After graduating, March spent a year aboard a naval ship in the Pacific. "When I came home from the war, I returned to campus to take some additional courses," March says. "That was when I became acquainted with **Henry Black**, who was head of the ME department, and we became great friends."

March's contributions will help the department to continue building upon its excellent faculty. Assistant Professor **Baskar Ganapathysubramanian**, who is the inaugural William March Scholar in Mechanical Engineering, says the award played a significant role in his decision to come to Iowa State. "This honor has helped me launch my career," Ganapathysubramanian says. Recently graduating from Cornell, he is looking forward to working with the department's faculty and other colleagues across the engineering college.

"William's generosity is remarkable," says **Jonathan Wickert**, ME department chair and Larry and Pam Pithan Professor of Mechanical Engineering. "The William March Scholar in Mechanical Engineering reflects his desire to help others, and it has had an immediate and positive impact on our department. A named faculty position such as this enables us to compete nationally in recruiting and retaining top scholars in mechanical engineering to Iowa State."

Bernard named interim dean of Iowa State University College of Engineering



On September 2, 2008, **James Bernard**, Anson Marston Distinguished Professor of Engineering and a 25-year member of the Iowa State University mechanical engineering faculty, stepped in as interim dean of the College of Engineering.

Bernard succeeds **Mark J. Kushner**, who joined the University of Michigan faculty, and he will lead Iowa State's College of Engineering until a permanent dean is named.

"I have enjoyed the opportunity to serve Iowa State as a teacher, researcher, and administrator in the College of Engineering, and I look forward to helping the college continue to progress as the search for our new dean is under way," Bernard says.

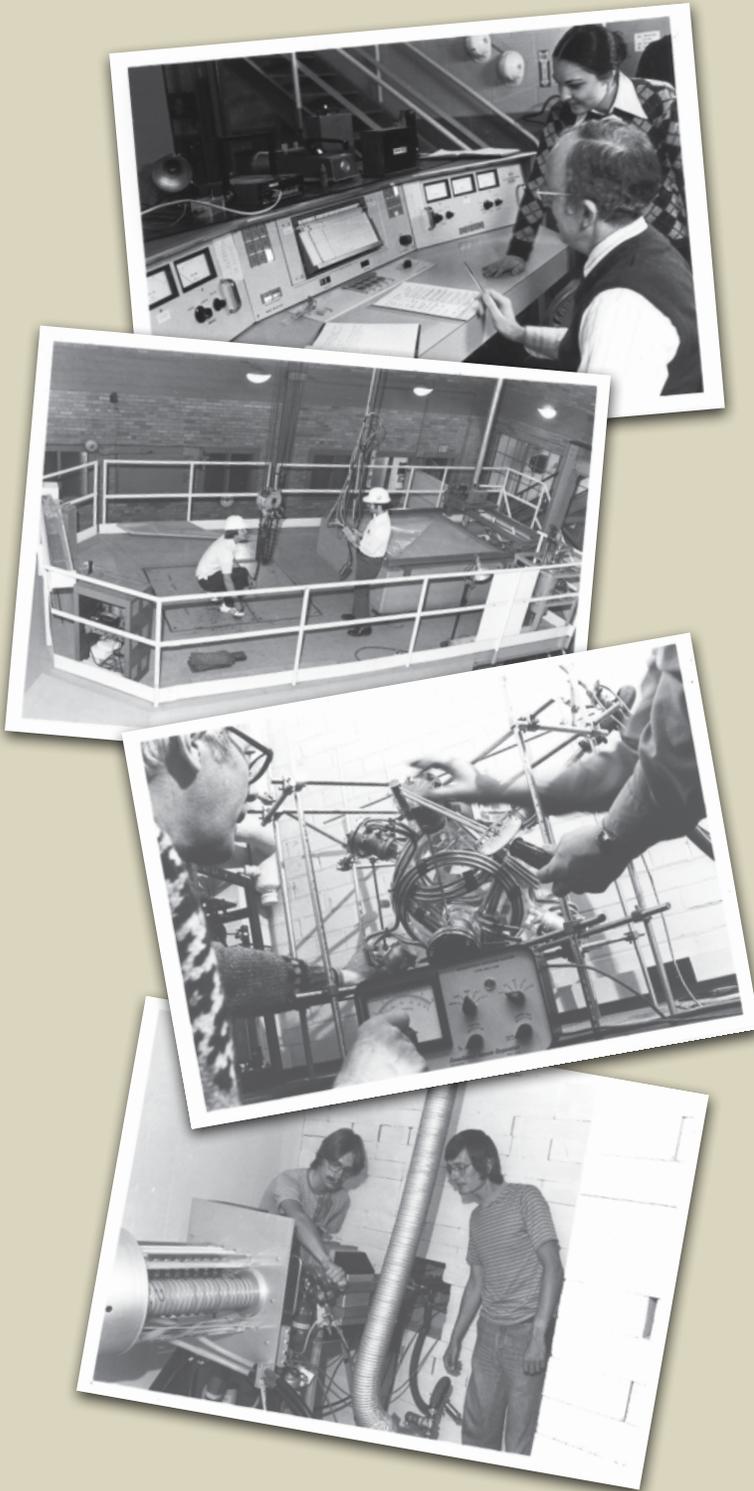
A leading authority in vehicle dynamics, vehicle simulation, and virtual reality applications, Bernard became the founding director of the Virtual Reality Applications Center (then known as the Iowa Center for Emerging Manufacturing Technology) in 1990. He also co-founded Engineering Animation Inc., now part of Siemens PLM Software, a global provider of product life-cycle management software.

Bernard earned bachelor's (1965), master's (1967), and doctoral (1971) degrees in engineering mechanics from the University of Michigan, Ann Arbor. He developed vehicle simulations at the University of Michigan's Highway Safety Research Institute from 1971 to 1976, when he joined the mechanical engineering faculty at Michigan State University, East Lansing. At MSU, he was the founding director of the Engineering College's Case Center for Computer-Aided Design.

At Iowa State, Bernard chaired the mechanical engineering department from 1983 to 1990, was interim director of the computing center from 1995 to 1997, and was director of VRAC from 1990 to 2003. He led the group of faculty who laid the groundwork for Iowa State's human-computer interaction graduate program. Bernard is a fellow of the American Society of Mechanical Engineers.

Do you remember?

We have been digging through our archives and came across these photos. Do you know what is going on in the photos? Are you among the people shown or do you know who they are? Send your memories about these photos or your experiences in Iowa State's mechanical engineering department to mealumni@iastate.edu. Be sure to include what you are up to now, your degree earned, and your year of graduation.



Levitas publishes in *Physical Review Letters*



Recent research on nucleation theory conducted by **Valery Levitas**, Schafer 2050 Challenge Professor at Iowa State University, could soon draw worldwide attention. This welcome recognition comes from a paper he recently had published in *Physical Review Letters* (PRL), the world's foremost physics journal, providing rapid publication of short reports of significant fundamental research.

Levitas and Nataliya Altukhova, graduate research assistant at Texas Tech University, had a paper published in PRL in September 2008 (see the article in PRL, 2008, 101, 745703). This paper is the fifth accepted into the journal for Levitas since 2004, when he started to apply his continuum mechanics approach to physical problems. Levitas was invited to submit a newspaper-type summary that will be considered for *Physics Today*, *Physical Review Focus*, and other American Physical Society and American Institute of Physics publications. Additionally, this work could receive recognition in worldwide newspapers and magazines.

Entitled "Sublimation inside an elastoplastic material," the paper discusses several conceptual problems in classical nucleation theory that Levitas and Altukhova discovered. The researchers addressed these problems using examples of sublimation, or the transition from the solid to gas phase with no intermediate liquid stage, inside solids under applied tensile pressure.

In traditional theory, researchers study the appearance of a critical nucleus during any phase transformation. Nuclei of a smaller size, or subcritical nuclei, most often disappear during these transformations. Because a system's behavior is reversible, researchers have never observed changes in materials after the subcritical nuclei disappear. When gas appears inside a solid, however, it creates high pressure that expands a hole in the solid significantly and plastically (that is, irreversibly).

The emergence of irreversibility creates numerous conceptual problems unknown in classical nucleation theory. Specifically, Levitas and Altukhova found that some subcritical nuclei do not disappear; rather, they remain as stable nanovoids. While subcritical nuclei cannot grow through solid-gas transformation, some expand mechanically like a balloon, transforming into supercritical nuclei that can grow. The irreversibility Levitas and Altukhova discovered also identifies oversights in classical definitions of the thermodynamic driving force and activation energy. These new theories are important for understanding the processes that occur while shock loading and laser treating materials.

Research briefs

Wang starts up company that extends his research to industry

In April 2008, **Xinwei Wang**, ME professor, officially started LeapTek, a company that measures thermophysical properties of materials of all shapes and sizes. If an organization or industry wants to know the properties of materials such as a ceramic coating, film, paint, or wire, they can submit a sample of the material to LeapTek. Using nondestructive technologies, LeapTek makes measurements with no contact, thereby leaving the sample undamaged. "The unique thing about LeapTek is our ability to measure small, thin materials," Wang says. "Measurements of nanoscale materials are important for ensuring the properties of a material are appropriate given its environment." The technologies of LeapTek can measure the thermophysical properties of films, coatings, and wires millimeters down to 100 nanometers thick. For more information about LeapTek, visit www.leaptekin.com/home.

Kong explores ammonia as a source of renewable energy

Looking for an energy source that does not produce carbon dioxide is the primary goal of alternative energy researchers. While many researchers focus on biomass, wind, solar, and water sources for energy, **Song-Chang Kong**, assistant professor, is looking at ammonia. Because of the hydrogen it carries, ammonia is a viable option for alternative energy; however, if the concentration of ammonia in exhaust is too high, it can be poisonous. "Interest around ammonia as an energy source is just starting to stir," Kong says. "We have a lot of research to do to remove the risks of using ammonia, but there is potential in using it in the future." During the 5th Annual Ammonia Fuel Conference held in September, Kong presented his research on the topic in a session entitled "Combustion Efficiency and Exhaust Emissions of Ammonia Combustion in Diesel Engines."

Engineering professors are finalists in Pappajohn competition

Atul Kelkar, a professor in the Department of Mechanical Engineering, and **Jerald Vogel**, an emeritus professor in the Department of Aerospace Engineering, were among the finalists for a \$25,000 prize in the John Pappajohn Iowa Business Plan Competition. Three Iowa technology companies share this distinction.

Kelkar and Vogel co-founded Innovative Vibration Solutions, a subsidiary of an Ames business Kelkar created in 2004 to produce commercial uses for research he conducts in noise and vibration control. The first product of the subsidiary is a device used to reduce the vibrations experienced by over-the-road truckers. The finalists made presentations during the October 15 Iowa Venture Capital and Entrepreneurship Conference in Des Moines. Innovative Vibration Solutions was awarded \$10,000 for third place.

Mechanical engineering professor's technology used in music video

When **Song Zhang**, assistant professor in mechanical engineering, developed a high-resolution, real-time 3-D shape measurement system, he knew it would have many scientific research and industrial applications. The entertainment industry, however, has been among the first professions to benefit from his work.

In the music video "House of Cards," Radiohead, an alternative rock band from England, scanned the lead singer's face to create a 3-D image of him singing. The system creates these 3-D images by projecting computer-generated fringe patterns on an object while a high-speed camera acquires the images from the projector. Using three consecutive images, the system reconstructs each frame of the shape to create a 3-D model. The video, available on YouTube, demonstrates the realistic images the system creates.

"The technology has potential to be used in manufacturing, medical science, computer science, biometrics, and entertainment," Zhang says. "We still need to overcome challenges, such as reducing the size of the data the system generates, before we will see a wide-scale use of the technology."

Faculty/staff honors and awards

Doug Beck (Academic adviser, advising center coordinator, and member of the College of Engineering Learning Community Task Team)

Learning Community Scholarship Award

2008–09 College of Engineering Adviser of the Year

Robert Brown (Anson Marston Distinguished Professor of Engineering) and former ME graduate students

Corey Wistrom and **Jerod Smeenk**
U.S. patent for Method and Apparatus for Filtering Gas with a Moving Granular Filter Bed

Song-Chang Kong, Society of Automotive Engineers

Ralph R. Teeter Educational Award

Pranav Shrotriya (Virginia and William Binger Assistant Professor in Mechanical Engineering)

2008 Young Engineering Faculty Research Award

Promotions and appointments

Song-Chang Kong reappointed as assistant professor

Jim Heise appointed design projects coordinator

Michael Olsen appointed associate chair for undergraduate studies

Gloria Starns promoted to senior lecturer and selected as teaching schedule coordinator

Shankar Subramanian promoted to associate professor with tenure

Sriram Sundararajan promoted to associate professor with tenure

Business office adds new staff



Janet Huggard, *department secretary*

As the department secretary, Janet Huggard's responsibilities range from coordinating the department's telecommunication needs to organizing the logistics of departmental seminars to assisting with key and supply orders. Working for Iowa State since 1981, Huggard previously worked in the admissions office and was the sociology graduate secretary for 21 years.



Carol Knutson, *account clerk*

Carol Knutson maintains the department's accounting, budget, payroll, and other financial statement records. She began her career at Iowa State in the agronomy department in 1999 and transferred to the apparel, education, and hospitality management department in 2002. This December, Knutson will earn her associate of science through DMACC, after which she will start working toward her bachelor's degree at Iowa State.



Cindy Manning, *education programs secretary*

Joining the department in a newly created position, Cindy Manning provides assistance to the department's undergraduate and graduate programs. Among her many responsibilities, she helps coordinate the application process for graduate students and manage course evaluations for the undergraduate program. Manning's career at Iowa State began in 2005 with human resource services.



LyondellBasell supports ME undergraduate program

David O'Brien and representatives of LyondellBasell presented the department with a gift of \$15,000 for the Black-Hilstrom Excellence Fund on September 23, 2008.

ME welcomes four new faculty members



Timothy Bigelow

Assistant Professor

Timothy Bigelow joined the mechanical engineering and electrical and computer engineering departments as a College of Engineering cluster hire in biosciences and engineering. Before coming to Iowa State, Bigelow was an assistant professor in electrical engineering for the University of North Dakota. His research interests focus on improving the diagnostic and therapeutic effectiveness of medical ultrasound. In January 2007, he received a prestigious National Science Foundation CAREER Award to develop a system to use ultrasound to treat cancer.



Baskar Ganapathysubramanian

Assistant Professor

William March Scholar in Mechanical Engineering

Baskar Ganapathysubramanian came to Iowa State after completing his graduate education at Cornell University in mechanical engineering with minors in materials science and physics. As a member of the mechanical engineering department, he works in the broad area of computational mechanics and his primary area of research is applied mathematics fused with parallel and high-performance computing concepts. These concepts are coupled with realistic physical modeling toward the analysis, control, and design of complex systems.



Valery I. Levitas

Schafer 2050 Challenge Professor

Valery Levitas is a College of Engineering cluster hire in energy science and technology, and he is part of the mechanical engineering and aerospace engineering departments. He also holds a courtesy appointment with materials science and engineering. Before joining Iowa State, Levitas was a mechanical engineering professor at Texas Tech University. His research primarily focuses on advancing the fundamental understanding of material behavior, including energetic and nanoenergetic, superhard, and smart materials.



Song Zhang

Assistant Professor

Song Zhang joined the department after completing postdoctorate research at Harvard. He received his PhD in mechanical engineering from Stony Brook University. Zhang's research is in real-time three-dimensional optical metrology, machine and computer vision, virtual reality, human-computer interaction, nondestructive evaluation, and biometrics. His goal as a faculty member is to facilitate students as they learn how to perform independent research in research labs or institutions, start their own business related to three-dimensional products, or become outstanding engineers in industry.

Department of Mechanical Engineering

2025 Black Engineering
Iowa State University
Ames, IA 50011-2161

Your support makes a difference

Generous gifts from our alumni, corporate sponsors, and other partners enable the mechanical engineering department to continue its tradition of academic excellence. Your contributions to the Black-Hilstrom Excellence Fund make a lasting impact on our program and the success of our students through initiatives that include

- Providing scholarships and fellowships for recruiting and retaining students
- Supporting student leadership groups
- Awarding seed money for new projects
- Funding access to state-of-the-art technology through new equipment purchases and laboratory renovations
- Attracting top-caliber faculty to Iowa State

Please use this form to contribute or contact our development officer, Hyemi Sevening, at 515 294-6055 or sevening@iastate.edu to learn about other ways you can support the mechanical engineering department.

Black-Hilstrom Excellence Fund

- I would like to contribute to the department in the amount of
 - \$50 \$100 \$250
 - \$500 \$1,000 Other \$ _____
- I am interested in information on establishing a scholarship, naming a laboratory, or creating a named faculty position.
- I would like information on planned giving.
- I have included the Department of Mechanical Engineering in my estate plan.

Name _____ Date _____

Degree(s) _____ Year(s) granted _____

Address _____

City _____ State _____ Zip _____

E-mail _____ Phone _____

My gift does does not qualify for a company matching gift.

Payment Type

- Check enclosed (payable to the ISU Foundation)
- Credit card Select type: Visa MasterCard Discover

Credit card number _____ Expiration date _____

Name as shown on credit card _____

Cardholder signature _____

Please return form and payment to: **The ISU Foundation**
2505 University Boulevard
Ames, Iowa 50010-7164

We appreciate your support!