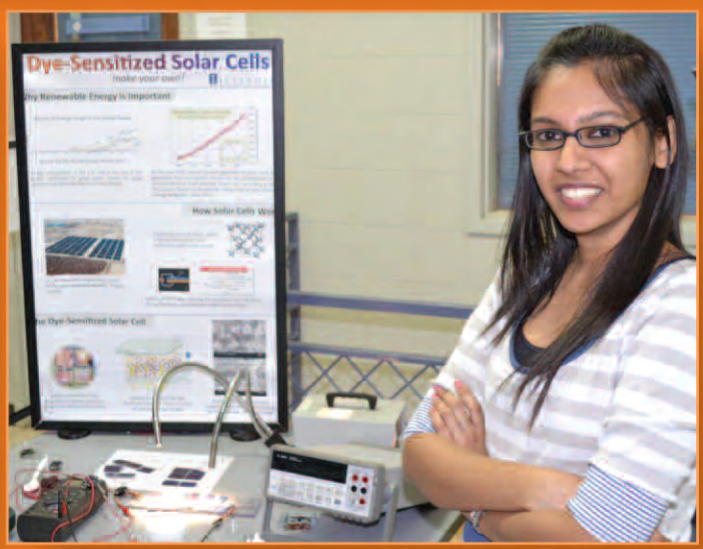
ENGINEERING AT ILLINOIS

Fall 2012

Mechanical

SCIENCE AND ENGINEERING



Moving the World Forward

Contents

Mechanical Science and Engineering

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Thank you, alumni and sponsors!

MechSE alumni and sponsors provide so much for the department and the students, including many of the honors that were given at the awards banquet on April 13. See page 9 for a full list of student honors.

From the Department Head

We have recently concluded the 2011-12 academic year, one of the greatest we have had in the Department of Mechanical Science and Engineering. This was primarily due to our incredibly talented students. From our stellar class of freshmen to our high-achieving seniors who contributed right up until graduation day and our ever-impressive graduate students, we are extremely proud of the talented young people who make up our undergraduate and graduate student bodies.

As you will read in the following pages, MechSE students achieved great things this year. With Luke Zaczek winning the College of Engineering's highest student honor, Niket Patel winning an ASME oral competition, and our Eco-Illini team bringing home another first-place finish from the Shell Eco-Marathon in Houston, we have had much to celebrate.

MechSE was named the top department in all of the College of Engineering for our 2012 Engineering Open House exhibits, thanks to our students' impressive dedication. Our Pi Tau Sigma students volunteered their time each week at a local elementary school, perhaps inspiring the minds of tomorrow's great engineering students.

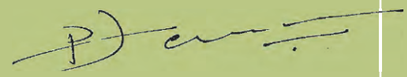
And student-run start-up companies EscaWheel, HigherMed, and Oso Simple Technologies won prizes for entrepreneurship and may soon put extremely innovative products on the market, making the world a better place.

As we look toward the future, we need to ensure our students remain at the forefront of not only mechanical engineering and engineering mechanics, but of the advances being made in technology, communications, and global interaction.

Young alumni Jigar Shah and Neel Kashkari came back to the department to be honored this year. They serve as first-hand proof that the world is changing and it does not take decades to reach a high level of success. These are world-famous men in their thirties, and we hope to have many more students follow their path to making a positive impact on the world. But to prepare our students to meet the new challenges, industries, and technologies springing up around us, we will need to advance our facilities and the breadth of education we provide.

On the next page, you will read more about some of our thoughts on this matter. And then you will continue reading about the incredible students, alumni, and faculty that make up the MechSE family. I am proud to be a part of this special group and hope you are as well.

With best regards,



Placid Ferreira
Department Head
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Giving a gift to MechSE online is simple and secure. Just go to **mechse.illinois.edu/giving**. If you have a smart phone, you can access this page by scanning the accompanying QR code.

QR code reader app must be used to scan this code.

Keep in touch

Keep up to date with the MechSE Department! Just go to **mechse.illinois.edu/contact** to sign up with your current contact information or email Betsy Powers at epowers2@illinois.edu. If you have a smart phone, you can access this page by scanning the accompanying QR code.

QR code reader app must be used to scan this code.

Attention, entrepreneurs!

MechSE wants to hear from all of our alumni who have started their own businesses. Please contact Betsy Powers at epowers2@illinois.edu, and provide a short description of your company. We will be assembling this information for future publication.

Join our social networks—just go to mechse.illinois.edu!

Envisioning a Mechanical Engineering Building **for the new millennium**

Left: MEB in 1949; Top: MEB in 2012.

Our today

The MechSE Department is one of the best, most innovative, and most ambitious engineering programs in the world. Our graduate and undergraduate student bodies are stocked with incredibly bright young minds, year after year. Our faculty can claim a record of achievement and ability that stacks up against that of any department at any university. And we rank at or near the top of every list of mechanical engineering and engineering mechanics departments.

Indeed, our program shines brightly and prominently today. We attract the top students and faculty, and we provide the best education available. But to ensure a future as bright as our present, much more needs to be done. And to our good fortune, an opportunity has emerged to build that future today.

Our yesterday

MechSE's Mechanical Engineering Laboratory (MEL) began its life originally named the Mechanical Engineering Building. It was built in 1905 for a cost of $25,000. Through its 40-year tenure as MEB, the building was the home of many important innovations, including the groundwork for the Holland Tunnel ventilation system and the "Smokeless Furnace." In the late 1940s, it took its new name of Mechanical Engineering Laboratory. When MEL's recent renovation was completed in 2002, it featured modern laboratories and meeting spaces. It has been an incredible advancement for the department, but even this beautiful new space is not on a large enough scale to impact all of MechSE's 1,000+ students.

The current MEB, located at 1206 West Green Street in Urbana, opened its doors on May 12, 1950 and featured 113 rooms for department use, including 16 laboratories and 32 classrooms, which were designed to be everything a mechanical engineering student could want in the 1950s. MEB continues to serve as a useful space today, but understandably it has become outdated technologically over the years. It, too, needs a major renovation—and perhaps even more.

Our tomorrow

Thanks to funding from the university, MEB's main section, which faces Green Street, is scheduled to receive a full renovation. Instructional facilities will be brought up to date with proper space allotments and designs to provide the best possible learning environment for the students now and in the future. The energy footprint will be significantly improved by focusing on MEB's building envelope, bringing the heating and cooling systems up to modern efficiency standards, and creating a greener, more sustainable facility.

MEB in 2015, with a new east wing? It's a possibility.

This renovation will boost the 60-year-old MEB several steps closer to the top tier of facilities utilized by other engineering departments, both at Illinois and at other universities. And while it will be a welcomed and vast improvement over the building's current state, there is more we need to do to create a world-class engineering education so that our students will impact the world for generations to come.

Our opportunity

In conjunction with this multi-million dollar renovation project, our administrative staff, our faculty, and even our classes will be temporarily moved out of MEB. Each floor of the building's south wing will be taken apart before being put back together in an optimal design for learning and for the functionality of the department. On one hand, this mass upheaval will be an extreme logistical challenge for all involved. But on the other hand, it represents an incredible opportunity to take on an additional, even more ambitious project: the construction of a brand new east wing to MEB, designed specifically for student innovations.

A Student Innovation Center

The department head from 1984 to 1998, Professor A.L. (Tad) Addy led the modernization effort for MEL, and he also had a vision for building an MEB east wing that is still extremely relevant today. With the upcoming major construction now scheduled for MEB, this is the ideal time to bring Professor Addy's plans to fruition, while incorporating new needs and technologies that have emerged over the past 20 years. The result will be a student innovation center: a combination of state-of-the-art classrooms, development labs, computer and technology stations, meeting areas, and educational displays—all geared toward educating students and attracting top talent to mechanical science and engineering at Illinois.

A vision of a modern MEB

MEB's potential future includes students exploring product development and global engineering, access to state-of-the-art product realization tools, and collaborative spaces. Information technologies and global communications are transforming the way students interact and learn. Besides classroom lectures, today's students participate broadly in team-based exercises and activities. They collaborate with colleagues at Illinois and at other campuses on projects and competitions. The learning experience has become a complex web of instruction, hands-on activities, collaborative learning, and high-tech communication systems. Our facilities need to reflect and enhance this experience, preparing our students for an increasingly global career in engineering.

A location of prominence and prestige

Space on the Illinois campus is an incredibly valuable commodity. The university, particularly the engineering campus between Green Street and University Avenue, and between Wright Street and Goodwin Avenue, has exploded with growth and now represents one of the most impressive cores of engineering and technology anywhere in the world. Undoubtedly, the most prominent remaining buildable space on the Illinois engineering campus is at the major intersection of Green and Goodwin, where MechSE's new Student Innovation Center—the MEB east wing—will be built. It will serve as a cornerstone of this incredible sector, which will see many of society's major technological advances throughout the 21st century and beyond.

Continuing our leadership

Energy, nanotechnology, bioengineering, and other areas are emerging as exciting new fields of study and research in the MechSE Department. We continue to hire new faculty with these advances in mind, and many of the most gifted students are gravitating toward these cutting-edge areas. The new Student Innovation Center will allow us to embrace these technologies and continue our leadership role for education in mechanical engineering and engineering mechanics for the foreseeable future. There has never been a more exciting time to be involved with MechSE.

MechSE student wins Oral Presentation competition

In late March, **Niket Patel** traveled to the University of Missouri to compete in the Old Guard Oral Presentation competition, a highlight of the American Society of Mechanical Engineers' (ASME) Student Professional Development Conference. He walked away with not only first place overall in the Old Guard competition but also an extra prize for best technical presentation. The content of his presentation came from his work with MechSE assistant professor **Amy Wagoner Johnson**, researching synthetic bone substitute materials and systems.

"The research is motivated by bone loss in people due to injuries and accidents," Patel said. "If you get a minor fracture, you can cast it up and the bone will regenerate, but if you have significant loss, the bone cells can't regenerate."

He will have the opportunity to compete again in the final Old Guard competition November 9-15 at ASME's 2012 International Mechanical Engineering Congress & Exposition in Houston.

Three MechSE students named to Senior 100

MechSE seniors **Bryce Austell**, **Stan Chang**, and **Eric Gobst** were named to the university's "Senior 100" for 2012.

"We are proud to have three of our MechSE students recognized for this prestigious Senior 100 Award, for their leadership and many campus contributions," said Associate Professor **Michael Philpott**, MechSE's associate head for undergraduate programs. "Stan, Eric, and Bryce have been in the forefront of our MechSE student activities, and their contributions to our department have been outstanding."

Back-to-back: another first-place finish for Eco team

The Eco-Illini Team and the Illini EcoConcept Team competed in the Shell Eco-Marathon in Houston, Texas on March 29, and brought back another first-place trophy.

After grabbing first place in 2011 in the alternative energy category, this year it was the Illini EcoConcept Team that won, in just the first year MechSE fielded a team in the urban concept competition. The team designed a hydrogen car, which uses a gas bottle of hydrogen as the fuel source. This hydrogen is converted to electricity in the fuel cell. Their car, named The Chief, was awarded first place and a $2,000 prize in the Fuel Cell category, reaching 17.6 miles per kilowatt-hour (approximately equivalent to 66 miles per gallon).

"This was an amazing achievement for this team's first entry into this event," said Associate Professor **Michael Philpott**, the faculty advisor to both teams. "I was particularly impressed with how they overcame some very tough technical issues with the fuel cell, including switching it out overnight during competition when it went into a fatal overload condition and systematically reducing vehicle weight to meet the weight limit requirements; and then going on to win!"

Senior wins highest COE award

Mechanical Engineering student **Luke Zaczek** was the 2012 recipient of the Harvey H. Jordan Award, the highest academic award in the College of Engineering, which is given to only one engineering student per graduating class.

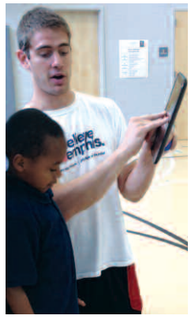
Zaczek was not sure about majoring in mechanical engineering, coming into the university as a freshman in 2008.

"I knew I wanted to go into something where I could build things," Zaczek said. "I ended up really liking it."

For his acceptance speech, he decided to define what he thought engineering really meant.

"It's not about equations or building things," Zaczek said. "It's just the desire to help people and make the world a better place."

Pi Tau Sigma works with elementary school tech club



PTS member Caleb Gray shows a BTW student how to use an iPad as a remote control.

Pi Tau Sigma (PTS) members spent time every Monday afternoon in Spring 2012 at Champaign's Booker T. Washington STEM Academy, educating kindergarteners through fifth graders in the school's tech club. PTS members engaged the kids in hands-on projects, teaching them about buoyancy, aerodynamics, robots and controls, structures, and more.

"The experience has been a positive and rewarding one for not only the students at Booker T. Washington, but for the members at Pi Tau Sigma as well," PTS president **Chris Delaney** said. "Our members have gotten as much out of it if not more than the elementary schoolers."

The magnet school's technology club was started this year. Nearly 80 students participate in the club each week.

Left to right: Niket Patel, Eric Gobst, Stan Chang, Bryce Austell, Luke Zaczek

Cozad, Innoventor competitions reward MechSE students' entrepreneurship

Three teams of mechanical engineering and engineering mechanics students won prizes for entrepreneurship this spring.

A contest for startup companies and business plans, the Cozad New Venture Competition is run by the Technology Entrepreneur Center and the Academy for Entrepreneurial Leadership at Illinois. The competition is designed to encourage students to create new sustainable businesses in the Champaign-Urbana area. Teams create business plans around topics of their choice and are provided mentors and workshops to help them stabilize their business plans.

The Innoventor Trophy entails a phased competition designed to let students pursue an original idea that has significant mechanical engineering content, addresses a societal need, and has potential for commercialization. Selected projects satisfy the ME 470 Senior Design requirement and are supplemented with a project budget. The winning team receives an additional cash award with the ultimate goal being to form a startup company or commercialize the idea in some other manner, such as licensing or selling it to another company.

Innoventor trophy sponsor Kent Schien (BSME '81) with EscaWheel's Chris Delaney, Eric Gobst, Jake How, and Anando Naqui.

Anando Naqui provides an EscaWheel demonstration.

EscaWheel

Chris Delaney, **Eric Gobst**, **Jake How**, and **Anando Naqui** (all BSME '12) formed EscaWheel as a project intended to provide wheelchair users with a more affordable and reliable way to go up and down stairs. It was one of three winners of the EnterpriseWorks incubator prize at the Cozad competition. EscaWheel was also awarded space in EnterpriseWorks, a business incubator for early-stage tech firms in the Research Park at the university.

In addition, EscaWheel was named the winner of the first Innoventor Trophy.

"It was inspiring to see a group of students accomplish the objectives and goals of the Innoventor Trophy Competition with enthusiasm, great initiative, intelligence, and determination," said **Kent Schien** (BSME '81), whose company, Innoventor, sponsors this award. "The EscaWheel product is an example of an original idea that fills a specific niche in the marketplace."

HigherMed

HigherMed, a startup company founded by MechSE junior **Daniel Borup** and his business partner, **Evan File,** won the Adobe Technology Innovation Prize as well as second place overall at the Cozad competition. The company's goal is to design and market a pill-dispensing prescription bottle cap, aimed at consumers with poor dexterity. As the company was in the business planning stage at around the time the contest was announced, the Cozad competition presented itself as a very timely opportunity.

"One of the best parts of Cozad was that every step in the process–the elevator pitch, business plan, and presentation—forced us to think very critically about our business," Borup said. "It's easy for us to be excited about our own idea, but convincing others forced us to gain a much more detailed understanding of everything that will factor into our potential success."

The Cozad competition has also provided HigherMed with the opportunity to work with the College of Law's Patent Clinic. The team hopes to have its first sales by the end of 2012.

Oso Simple Technologies

Oso Simple Technologies, comprised of **Eduardo Torrealba** (Mechanical Engineering), **Michael Clemenson** (Mechanical Engineering), **Brad Sanders** (Electrical and Computer Engineering), and **Trevor Hutchins** (Mechanical Engineering/Aerospace Engineering), provides a service that analyzes the amount of water used on lawns and gardens through wireless moisture monitors, and notifies gardeners in real-time about the water needs of their plants. This is intended to prevent overwatering and reduce wasted water. Oso Simple Technologies was one of two teams that received the Cozad prize for Best Mobile Application, sponsored by the National Center for Supercomputing Applications (NCSA).

"Our team gained some valuable insights from the judges at every step in the process," Torrealba said. "Even though we had presented to some investors before the competition started, we were still able to refine our company strategy and improve the way that we told the judges about our business and the goals that we have for it. It will be exciting to see where Oso Simple Technologies goes next."

Fall 2011 Senior Design

Fiber-optic cable team wins first-place prize in ME 470

Anthony Grazian, Andrew Banko, and Jonathan Youngren.

MechSE seniors **Andrew Banko**, **Anthony Grazian**, and **Jonathan Youngren** were awarded first place out of 24 teams in the Fall 2011 session of ME 470, the department's senior design class.

Their project was sponsored by ISS, Inc., a Champaign company that manufactures biomedical instrumentation and research fluorescence instrumentation for major universities, corporations, hospitals, and research institutions.

"This was an exciting group to work with," said **Dennis Hueber**, Director of Engineering at ISS. "The students grasped the concepts we were trying to implement for our device and put them into a design solution conducive to a suitable and working prototype."

The goal of the project was to design a new coupler for a fiber-optic cable needed for one of the company's products, which needed a fiber-optic cable with a core much smaller than the original.

The product, a non-invasive tissue oximeter called the OxyplexTS, uses Near Infrared (NIR) light to measure the amount of oxygenated and de-oxygenated hemoglobin concentrations in tissue. This measurement has applications in anesthesiology, neonatal studies, and research into diseases such as obstructive sleep apnea syndrome or attention-deficit hyperactivity disorder.

The main objective of the project was to take 50% of the light emitted by a laser diode inside the machine, and focus it into a fiber optic cable. The ME 470 team exceeded this objective, ending with a product that focused approximately 55% of the light.

"If you put in the effort, it's very rewarding," Grazian said. "You can come out with a project that you're very happy with and that the company is very happy with."

Project improves energy efficiency of Beckman Institute

Seniors **Josh Remaley**, **Matthew Morris**, **Amy Foltz**, and **Rebecca Greetis** spent three months devising a plan to improve the energy efficiency of the Beckman Institute for Advanced Science and Technology.

"Beckman was built over 20 years ago, and the standards and energy requirements were a little bit different than they are now," said **Emad Jassim**, Director of Undergraduate Programs at MechSE. "So they had the opportunity to actually speak with the engineers that designed Beckman, and they came up with methods to save energy in that building and to make it more sustainable."

The student team worked with the university's retrocommissioning office, a group of engineers and technicians who maintain and update HVAC systems and maintenance programs throughout campus in order to keep buildings in line with current energy standards and maximize energy conservation and sustainability. The project demanded in-depth investigation and allowed the students to look at real HVAC systems in incredible detail.

"The experience was really beneficial, being in another system, seeing another building and how it works, getting that hands-on," Remaley said. "We got to go to the buildings and look at the systems, the floor plans, blueprints, drawings, everything, just getting more experience."

In the end, the team proposed solutions based on extensive and detailed analysis of the building's energy output, which the retrocommissioning team will use in their work on the building. Remaley, still working for retrocommissioning, will get to see the project through to its implementation.

Beckman Institute.

Steve Braun, Jaesik Yu, and Lee Ann Monaghan.

Students build chainless bicycle for class, competition

Another Fall 2011 ME 470 team built a hydraulic-powered bicycle, which would ultimately be entered along with a Spring 2012 model in the 2012 Chainless Challenge, sponsored by Parker Hannifin, a manufacturer of motion control products.

The Chainless Challenge is a competition between 11 universities (including four Big Ten schools) to build the most efficient bicycle without the use of chains. Each bicycle is then judged according to its performance in a 100-yard sprint race, its design ingenuity and novelty, its reliability and safety, its manufacturability and workmanship, a design report, and ultimately its performance in a 12-mile endurance race. Awards are given to the winning team in each category, as well as for the overall competition.

The Fall 2011 Chainless Challenge team consisted of seniors **Lee Ann Monaghan**, **Jaesik Yu**, and **Steve Braun**, who completed the initial design and construction during the fall semester, while they were taking the class. Like many Senior Design teams, the Fall 2011 Chainless Challenge team experienced an unexpected sense of dedication to their project.

"The real thing that was beneficial about this project was that it had the same problem-solving mindset as a lot of our engineering work, but it had much more tangible results than anything else I've ever done," Braun said. "It was extremely satisfying."

The team ended up performing well at the challenge, bringing home second place for both workmanship and cost analysis, third place for ingenuity and innovation, and fourth place for best paper and presentation. The team was guided by their faculty advisor, Associate Professor **Liz Hsiao-Wecksler**, who also attended the challenge with the team.

Student Honors

The following students were recognized for their outstanding achievements during the 2011-12 academic year. They received their awards at the Department of Mechanical Science and Engineering Annual Awards Banquet held at the end of the spring semester.

MechSE Graduate Awards

Hassan Aref Memorial Award for Theoretical and Applied Mechanics
Reetesh Ranjan

James O. Smith Memorial Award
Joel David Krehbiel

Stanley I. Weiss Outstanding Thesis Award
Amir H. G. Isfahani

MechSE Departmental Awards

Bei Tse & May Chao Award
Timothy Ewan

Innoventor Trophy Competition Award
Chris Delaney
Eric Gobst
Jake How
Anando Naqui

Clarence L. & Harriette Johnson Award
Kathryn Neville

O. A. Leutwiler Award
Daniel Borup
Madison Whitt

Fred B. Seely Award
Mustafa Mohamad

Marvin C. Stippes Award
Ryan Mott
Kendall Rak

MechSE Interest Area Awards

Caterpillar Award
Jack Sormaz

John C. & Elizabeth J. Chato Award in Bioengineering
Lee Ann Monaghan
Conrad Smith

A. G. Friederich Memorial Award
Zachary Weiner

George W. Harper Award
Sanat Bhole
Andrew Lee
Matthew Sells
Tejas Shah

Helmut H. Korst Award
Anthony Fiorino
Jake How
Lee Ann Monaghan

Materials Processing Award
Zachary Renwick

T. A. Peebles Award
Eric Gobst

T & AM Merit Award
Ian Berg

Kenneth J. Trigger Award
Andrew Banko
Chris Delaney
Thomas Satrom

MechSE Student Society Awards

Konzo/ASHRAE Engineers Award
Joseph Latimer
Greg Williams

ASME Junior Leadership Award
Ann Zuzuly

ASME Old Guard Oral Competition Award
Niket Patel

Patrick B. & Janet A. Flanagan ASME Senior Leadership Award
Christine Littrell

Pi Tau Sigma Sophomore Award
Joshua Kim

James W. Bayne Award for Outstanding Senior in Pi Tau Sigma
Chad Becker
Chris Delaney

GM/Philip W. Leistra Jr. Society of Automotive Engineers Award
Greg Catrambone

Undergraduate Research Awards

Leonard Fieman Student Research Award
Chih-Chung (Stan) Chang
Niket Patel

College of Engineering Awards

Harvey H. Jordan Award
Luke Zaczek

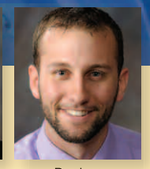
Knights of St. Patrick
Chih-Chung (Stan) Chang

Stanley H. Pierce Award
Chih-Chung (Stan) Chang

University Honors

Bronze Tablet
Andrew Banko
Chris Delaney
Kent Yee Lui
Adam Russell
Nicholas Steach
Amanda Stowers
Marco Venturato
Luke Zaczek


Banko

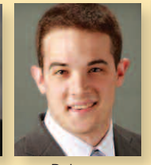

Becker


Berg


Bhole


Catrambone


Chang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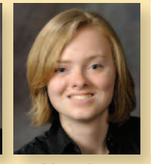
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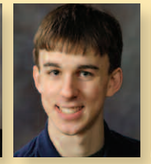
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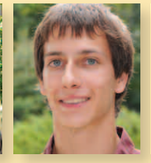

Venturato


Weiner


Whitt


Williams


Zaczek

Zuzuly

MechSE grad students **launch GraMS group**

GraMS social events in Spring 2012 included a barbecue held in the MEB courtyard and happy hours at Murphy's Pub on Green Street.

Lance Hibbeler has been a graduate student in MechSE for almost six years. For much of that time, he felt the opportunities to connect with fellow graduate students were limited to the lab or classroom. Last semester, Hibbeler and several other MechSE students decided to do something about that.

"I've always wanted more of a social aspect of my time here at Illinois, so I stepped up and spearheaded our efforts," Hibbeler said.

Hibbeler is the president of the newly formed Graduate MechSE Students (GraMS) organization, which hosted its first general meeting in January. The group seeks to provide opportunities for graduate students to connect through social and service opportunities, but Hibbeler admits that research is a favorite conversation topic.

"When you get two grad students together in a room, they're just going to talk about research, that's what's going to happen," Hibbeler said. "Even if they're not in your exact field, you can bounce questions off other people, you can have meaningful conversations about work in a lower-stress environment."

Tim Deppen, vice-president of GraMS, said he and other students had been looking for a way to connect graduate students in MechSE for a while. He said the foundation for GraMS began to take shape through Professor **Harley Johnson**, MechSE's associate head for graduate programs. Johnson encouraged the students to find a way to better integrate and communicate.

Deppen said he thought department-sponsored events in the past, including monthly graduate student mixers, were not strongly attended because students either went with people they already knew or chose not to attend at all because they were unsure whether anyone they knew was going.

"I think having GraMS be a student-led initiative means that there are people that other graduate students can identify as, 'Oh, I know this student and he's going to be there and he's involved,' so that maybe makes them more inclined to go," Deppen said.

GraMS meets every other Friday, usually in John Deere Pavilion, followed by a happy hour at Murphy's on Green Street.

Hibbeler and Deppen said they have tried to bring more to the group than just social events, such as getting graduate students involved in the faculty recruiting process or having faculty give presentations about their hobbies or interests at the general meetings. Hibbeler said the most popular presentation so far was a talk Professor Emeritus **Jon Dantzig** gave about applying engineering principles to racecar driving.

Deppen said the group is planning a service project at the sustainable student farm in the near future. It also co-sponsored the MechSE Volleyball Tournament with Pi Tau Sigma in April.

Hibbeler said that the group has helped him and other active members become better acquainted with their MechSE peers.

"I recognize people in the hall, just walking around...I know a lot more students," Hibbeler said. "It's made the department a lot more social in that regard."

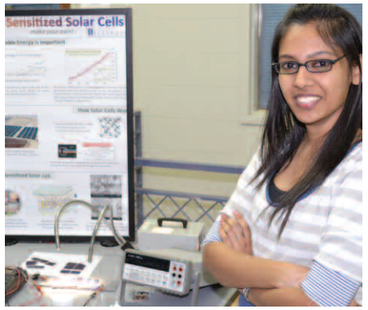
MechSE named top department at EOH 2012

MechSE students shined in March at Engineering Open House 2012, winning the Spirit of Illini Engineering award for the department. MechSE students and faculty gathered the following week in the John Deere Pavilion at the Mechanical Engineering Laboratory to celebrate this and other awards with dinner and a ceremony.

"I'm completely confident that this award is well deserved," MechSE's department head, Professor **Placid Ferreira**, said. "There was lots of spirit out there."

While the department as a whole took the college's top honor, individual exhibits earned awards as well. The mechanical engineering honor society Pi Tau Sigma's (PTS) sand-casting exhibit earned first place honors in the "Encore Non-Technical" category. Sand casting is an industrial process used to make large metallic parts, usually with a lot of internal features. PTS held a sand-casting lab, where visitors got to pack sand molds by hand, watch the metal be poured, and take their hardened metallic creations home. The kid-friendly designs included a car, a star, and a dinosaur. They cast aluminum, which melts at a lower temperature and hardens faster, using scraps from various department labs.

The honor society also earned a third place prize in "Encore Technical" for its PTS Grillz exhibit, which featured a gas grill that had been redesigned and improved to fix a structural failure. PTS sold food cooked on the grill and donated the proceeds, more than $700, to Relay for Life.



Top: Jack Miller and Joel Campbell put Formula SAE's 2011-12 car in display position outside of Mechanical Engineering Laboratory.
Lower left: Claire Slupski poses in front of a thermal image of her own face.
Lower right: Grad student Chandini Jain explained dye-sensitized solar cells to EOH visitors.

The Illini EcoConcept Team placed third for their exhibit on fuel cell technology in the category "Dream. Design. Discover."—this year's EOH theme. To show visitors how fuel cells work, the team used hydrogen fuel cells to generate electricity that powered small vehicles. The team went on to win the urban concept competition at the Shell Eco-Marathon later in March.

MechSE's interim associate head for undergraduate programs, Associate Professor **Michael Philpott**, and director of undergraduate programs, **Dr. Emad Jassim**, also recognized MechSE student societies with department awards for their displays. The award for Best MechSE EOH display went to the American Society of Mechanical Engineers (ASME) for multiple displays. The Society of Women Engineers (SWE) won second place and the Society for Experimental Mechanics (SEM) tied with PTS for third place. PTS also won a prize for best documentation of MechSE EOH for a video that PTS historian **Nick Froggat** and president **Chris Delaney** produced.

"The MechSE department is very proud of our students' efforts and ingenuity put forth in this year's EOH," Jassim said. "We are also grateful to the MechSE staff and faculty who helped provide support for the student projects."

Jigar Shah receives his Distinguished Alumni award from Professor Emeritus Ty Newell.

Renewable energy leader receives Distinguished Alumni Award

Jigar Shah (BSME '96) evidently likes taking on challenges—and succeeding. While at Illinois, he directed Engineering Open House as just a sophomore, among many other accomplishments. As an entrepreneur, he founded what would become the nation's largest solar services provider.

He returned to campus in April to receive the Distinguished Alumni Award from MechSE. While here, he reflected on his time in school and his accrual of real-world achievements in the short time since he graduated.

"I got a tremendous amount of responsibility at a very young age," Shah said of his experiences as a mechanical engineering student, particularly his EOH management.

For EOH, an event that draws 20,000 visitors to campus each year, Shah led a large group of students from throughout the College of Engineering and pioneered such innovations as a food tent and T-shirt sales. He said learning how to overcome logistical and political obstacles in the process was an important part of his education that came from such extracurricular responsibilities.

Shah also said his experience as an undergraduate in mechanical engineering has helped prepare him for his biggest undertakings later in life.

"The thing about mechanical engineering is that it's one of the most flexible curriculums in the engineering college," Shah said. "And that really allowed me to take a variety of courses, so I was able to develop a pretty well-rounded education."

In 2003, Shah founded SunEdison, a solar electricity company that changed the way customers purchase solar energy and became the largest producer of solar services in the United States by 2009.

"I'm probably more business-minded than engineering-minded," he said. "But having that engineering core is just so critical in working in the renewable energy industry because technology really plays a big role."

In building a solar services provider that Shah said was "trying to replicate the experience" that consumers had with the existing utility structure, he and his partners wanted consumers to be able to purchase electricity from solar plants with "no money down." Standing in their way was a complex patchwork of codes and regulations, as well as the need to get the solar plants physically connected to the existing power grid.

"If you don't question people's motives but instead question their conclusions and try to figure out how we actually go through the facts together to get there, you really can make a big difference," he said. "And I have to say that a lot of that I learned at Illinois. I think a part of my success has come from really knowing what I could change and what I couldn't change and learning to know the difference."

By changing the way commercial electricity consumers purchased solar energy, Shah and his colleagues at SunEdison were able to actually improve the experience. He said they not only matched the utility pricing at the time, but their contracts offered pricing below what the conventional electric utility was charging. This saved customers money right away, but SunEdison was also able to lock in the electricity rates for the next 20 years, providing a hedge against future rate increases.

"Electricity prices went up an average of 4.5 percent a year since 2000," he said. "So, because our prices were only going up by, let's say, one percent a year, it really ended up being a lot of money savings for the customer."

In 2009, Shah sold SunEdison for $200 million. Shortly thereafter, he became the first CEO of the Carbon War Room, a global organization founded by Richard Branson that "harnesses the power of entrepreneurs to unlock gigaton-scale, market-driven solutions to climate change," according to the organization's website.

"This was a really amazing opportunity for me because it allowed me to take the systems thinking that I developed at SunEdison and apply it to 17 different sectors, from cement to agriculture, livestock, shipping, aviation, and renewable fuels," Shah said.

Today, Shah continues to serve on the board of the Carbon War Room, but is now CEO of his own firm, Jigar Shah Consulting. He said he sees clean energy as a huge growth area and thinks that MechSE produces graduates who are well-equipped for relevant work in that area. But, he said he would like to see the campus become greener, and he encouraged students to take a more active role in working to make changes within the university.

"The thing about mechanical engineering is that it's one of the most flexible curriculums in the engineering college. And that really allowed me to take a variety of courses, so I was able to develop a pretty well-rounded education." - Jigar Shah

Distinguished Alumnus Kashkari offers students career advice

"When I went to Washington, I drew on my engineering skills even more than I did on my finance skills. Policy making is about problem-solving. This really stemmed back from my engineering training, and so these were very useful skills that I built at Illinois."
– Neel Kashkari

To say **Neel Kashkari** (BSME '95, MSME '98) has ascended rapidly in his career would be a severe understatement. He became the leader of the U.S. Government's Office of Financial Stability —and was referred to in the media as "the $700 Billion Man"—less than ten years after leaving MechSE.

Now the head of global equities for PIMCO, Kashkari was back on campus in April to receive the Distinguished Alumni Award from the department. And when asked to share his thoughts on careers with current engineering students, he proved willing and generous as he described his three keys to success.

"One is hunger—real drive. Number two is skill," he said. "And number three is luck. In our society, in my view we underappreciate the importance of luck. Luck matters a lot. And I've been very lucky."

Illustrating his point on drive, he mapped out the path he has taken since his time at Illinois: west to Los Angeles for an engineering job; east to Philadelphia for business school; west to San Francisco for his first finance job; east to Washington, D.C. to work in government; and now back west to southern California for his PIMCO work.

"That's an illustration of what I'm willing to do in pursuit of opportunity," he said. "And so I think hunger and drive is a huge determinant of long-term results."

Kashkari's drive was evident when he left a promising career in engineering to earn his MBA and start a new career in finance at Goldman Sachs, and again when he left his lucrative position at Goldman Sachs to take a lower-level position in government. But this move to government, which many people might consider too risky, put him in position to ultimately head up the huge bailout effort. He claims that luck was a factor for him being in a position to assume this high-level post, but he obviously would have never been given this enormous, nationally prominent position without skills—many of which he attributes to his training in MechSE.

"The problem-solving skills that we learn as engineers are applicable in many different fields," Kashkari said. "Especially when I went to Washington, I drew on my engineering skills even more than I did on my finance skills. Policy making is about problem-solving. This really stemmed back from my engineering training, and so these were very useful skills that I built at Illinois."

Much of Kashkari's time at Illinois was spent leading the solar car project, which he said took up many 60-hour weeks during his senior year and two years in grad school. It entailed complicated work in fundraising, budgeting, and managing 80 to 100 other students, in addition to the work of designing and building the car and traveling to competitions.

"For me, the solar car was literally a transformative experience," he said. "When I walked out of here, I walked away with tremendous confidence that I could accomplish things. I feel very fortunate to have had that experience."

In his current position with PIMCO, the world's leading investment firm in bonds, Kashkari directs the company's effort to build an array of stock funds for their clients' portfolios. And even now, his engineering education continues to pay dividends.

"It's coming up with a plan, figuring out what the right plan is, what we can actually implement, getting the right people on board to develop it, and then actually executing the plan," he said. "So I think what I'm seeing the students here do is going to be applicable wherever they want to take their careers and is great to see."

Kashkari noted that his schedule has allowed him very few trips back to Urbana-Champaign, but that he was pleased to see the department is doing so well today. And being on campus brought back fond memories as well.

"One thing that I'll always remember is that after long days in the auto lab, we would often go to Murphy's for burgers, so that was a favorite for everybody," he said. "That's probably the place that I remember the most, going from the auto lab to Murphy's—and back to the auto lab."

University of Iowa makes MechSE alum its **executive vice president and provost**

Barry Butler (PhDME '84) has been named executive vice president and provost at the University of Iowa.

"I can't think of anyone better suited to this position or more committed to the University of Iowa than Barry Butler," University of Iowa President **Sally Mason** said. "As dean of the College of Engineering, interim provost, and as a world-class engineer and educator, Barry has my every confidence that he will be an excellent leader of our institution's faculty and academic programs."

Prior to his appointment as provost, Butler was dean of the College of Engineering, where he holds the rank of full professor in the Department of Mechanical and Industrial Engineering. He earned his bachelor's and master's degrees from Aeronautical Engineering at Illinois in 1979 and 1981, before receiving his PhD in mechanical engineering in 1984.


Barry Butler

"I have spent my entire academic career at the University of Iowa and have developed a deep understanding of and great respect for the institution," Butler said. "Under the leadership of President Mason, the University of Iowa has an opportunity to build on existing strengths and to develop strategic areas that have the potential to further distinguish us on a national and international level. I am honored to be a part of her leadership team."

As provost, Butler is responsible for more than 100 academic programs in the university's 11 colleges, oversees the Division of Continuing Education, the UI Library and Museum of Art, and is responsible for a general education fund budget in excess of $440 million. He will be instrumental in advancing the university's strategic plan, is responsible for coordinating the academic components of the arts campus rebuilding effort, and provides leadership in the university's recent cluster hiring initiatives in water sustainability, aging mind and brain, and digital public humanities.

As a student at the University of Illinois, he volunteered as a youth basketball coach, and at the Rehabilitation-Education Center as a reader/recorder of technical books and legal briefs for visually impaired students.

In 2012, Butler was honored at the University of Illinois with the College of Engineering Alumni Award for Distinguished Service.

Butler served as MechSE's alumni board president from 2009 to 2011.

University memories, department aspirations key **to alum's gift decision**

Eugene Neigoff (BSME '65) recalls the great snow storm of 1963 like it was yesterday. Of course, it is probably difficult to forget snow drifting 10 feet or more up the side of a dormitory.

"We were jumping out the windows on trays and skiing down it—you remember those times," he said. "You remember the things you did that were both adventurous and foolish!"

Fond memories of his time at Illinois represent one of the reasons Mr. Neigoff and his wife, **Judith**, recently decided to give a major gift to the MechSE Department. Their generous bequest will support endowed faculty positions, promote academic excellence, and increase educational opportunities for students, especially those with financial need.

"I carried a pretty good load here and I was very happy with the quality of what I got," he said. "The quality of the training put me in good stead."

Mr. Neigoff believes hands-on experience during an engineer's college career is vital to ultimate success after graduation. This design training was prevalent during his time at Illinois, and during a recent visit back to campus, he was pleased to see the design stem within the current undergraduate curriculum.

"They've got to be ready to produce from Day 1 that they get out of school," Mr. Neigoff said. "In talking with (MechSE Department Head) **Placid (Ferreira)**, he has the same belief as I do. We've got to work on developing the skill set brought to industry, because we don't have the time to retrain an engineer in the real world."

After leaving Illinois with his degree, Mr. Neigoff spent more than four years in the military, serving in the Vietnam War.

Once his tour was over, the Chicago native returned home to begin a long engineering career at several different Chicagoland companies, including Motorola and Atlas Electrical Devices. He also served as the vice president for General Manufacturing Corp. and chief operating officer for Hommer Tool & Manufacturing. He earned an MBA degree at Loyola University in Chicago along the way. After retiring at 55, he continued doing consulting work. He and Judith now live in Surprise, Arizona.

When the Neigoffs began to discuss where their estate would go, Mr. Neigoff's idea was to leave it to the school that had given him such a good foundation for his career.

"I am happy to see what is going on now, especially after talking with Placid," Mr. Neigoff said. "It was interesting to see that we are in so much agreement as to where the engineering program has to go to keep the school's reputation for quality engineers that are coming out of school, and I would certainly challenge any of my peers to consider supporting the university with an appropriate bequest to ensure these high-quality programs continue in the MechSE Department."


Eugene and Judith Neigoff

Ehsan Noursalehi, Adam Booher, and Jonathan Naber of Illini Prosthetic Technologies.

Alumni non-profit takes prosthetics to the third world

Illini Prosthetic Technologies (IPT), a nonprofit organization founded by engineering students at Illinois, was recently featured on the Big Ten Network on its "Impact the World" series.

"It was really kind of a neat chance to reach out to a larger audience," said the president of IPT, **Adam Booher** (BSEM '11). "And maybe reach people who hadn't heard about what we were doing before."

IPT began as an idea in the summer of 2008, when **Jonathan Naber** (BSMatSE '11) decided he wanted to use his technical skills to make a difference in the world. He had worked with people with disabilities before, so he decided to combine those two passions.

After doing preliminary research, he was inspired by the Jaipur Foot, a prosthetic foot and leg that was being manufactured and sold for very low costs in India. While prosthetic feet and legs normally cost thousands in American dollars, the Jaipur Foot could be manufactured for less than $50, and was often provided to patients below the poverty line for no charge by the Jaipur Foot Team.

Naber realized that there was nothing similar for upper-extremity prosthetics. In fact, there appeared to be a technology gap between lower- and upper-extremity prosthetics worldwide. One of his first action steps was approaching MechSE associate professor **Michael Philpott** with his idea, asking for advice on how to begin and how one would manufacture an affordable, yet durable, prosthetic.

"They were playing with things like soda cans and coke bottles and two-liter bottles for what you put over the stump of your arm, as opposed to buying something ready-made," Philpott said. "So their first prototypes were all coupled together out of everyday products. It was very creative."

Naber recruited several of his peers to help him in his endeavor, and IPT has now expanded to a team of both student and alumni engineers from multiple departments, working on their first viable, marketable product. They have enlisted the help of faculty, such as Philpott and MechSE associate professor **Liz Hsiao-Wecksler**. They have also met with members of the original inspiration of the project, the Jaipur Foot Team, to start forming a partnership.

"They had the business savvy and marketing knowledge that poised IPT to be an innovative commercial enterprise," Hsiao-Wecksler said. "Admirably, though, they decided to become an innovative non-profit organization to better serve the population. Their premise is to do something amazing that will change the world."

Among the grants the IPT team has received is a public engagement grant through the MechSE Department to run field and validation tests in Guatemala for 18 months. Their current advanced prototype has been tested and verified, both in the lab and in Guatemala, and they have used feedback from those tests to make changes and improvements on the original design. The grant allows them to return to Guatemala, where they will try to integrate IPT into the international developing community there, as well as set up the long-term validation testing of the latest prototype, which they hope is ready to take to market.

"What this grant is going to help us to do is to go from what we're calling an advanced prototype to what will really be the first product that we can put in the field," Booher said. "Our goal, down the road, is to be able to have this technology and then distribute it to aid organizations all over the world. The big thing right now is that with current prosthetic arms, you have to custom-fabricate them, you have to use special tools, you have to use special processes. It takes time, it takes training, and it takes special equipment. And with our device, you can do the same type of fitting without a lot of that special equipment. We can use a pair of pliers, a pair of wire cutters, just some simple tools, and we want to make it so that you can walk into someone's home with one of our products in your backpack and actually fit it to them right then and there."

IPT has also sponsored a project group in ME 470, the department's senior design class. The group is currently designing a system that can test the arm for fatigue, so that data can be gathered both from field tests and environmental tests in the lab.

"It's going to be really valuable information for us," Booher said. "We've always had really strong support from this department, and we really want to continue to work with this group because it's a great university department to be partnered with."

Their work has been highly praised and supported by the scientific community. In 2010, Naber was the winner of the fourth annual Lemelson-MIT Illinois Student Prize for his innovation and leadership in IPT. In August 2011, IPT was named "Autodesk Inventor of the Month" by Autodesk, Inc. in their Manufacturing Community online publication. Their product design was a finalist for the James Dyson Award in 2011, the only finalist from the United States. Naber was also awarded the William E. Simon Fellowship for Noble Purpose upon his graduation in 2011.

The team encourages anyone interested in its project to visit its website, www.supportipt.org, to keep updated on its progress.

Familiar faces join alumni board

Two long-time members of the MechSE family joined the department's alumni board in 2012.

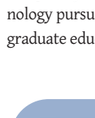
Professor Emeritus **Robert Miller** (BSAEE '54, MSTAM '55, PhDTAM '59) began his career in academia as a graduate teaching assistant in the former Department of Theoretical and Applied Mechanics in 1954. He became an assistant professor in 1959 and was promoted two years later to associate professor with tenure. He became full professor in 1968 and retired as a professor emeritus in 1994. During his career, he positively influenced hundreds of students, receiving top evaluations from them each semester, and maintained an active research program. He received the College of Engineering Alumni Award for Distinguished Service in 2010.

Former MechSE staffer extraordinaire **Bob Coverdill** (BSME '83, MSME '85), who left in 2011 to become the associate director of the I-STEM Educational Initiative, has stayed involved in the department since his departure and took on an official role when named to the alumni board. He managed countless projects and took on a vast range of responsibilities while working in MechSE, including the massive renovation and expansion of Mechanical Engineering Laboratory. The board will benefit greatly from his thorough knowledge of the department's research, facilities, faculty, and students.

Benjamin P. Barnes (BS/MSME '09) was recognized as the 2011 Charles C. Stewart International Young Humanitarian Award Winner at UIUC's International Achievement Awards Banquet in April 2012. Ben was selected because of his extraordinary commitment to Engineers Without Borders (EWB). In 2005, he co-founded the EWB's Adu Achi Water Project in Nigeria. Ben lived in Adu Achi for over 16 months to help facilitate meetings in which community members designed the system's management structure and to provide input on technical design. He currently works for the Construction Engineering Research Lab (CERL) of the U.S. Army Corps of Engineers, where he is developing community scale energy optimization and planning methods for large institutions.

David J. Hoelzle (MSME '07, PhDME '11) wrote the article *Design and Manufacture of Combinatorial Calcium Phosphate Bone Scaffolds,* which served as the cover story in the October 2011 edition of the Journal of Biomechanical Engineering. This article was coauthored by **Shelby R. Svientek** from UIUC's Department of Bioengineering and Hoelzle's PhD advisors from MechSE, Professor **Andrew Alleyne** and Assistant Professor **Amy Wagoner Johnson**. Hoelzle is serving as a post-doc at UCLA in the Department of Integrative Biology and Physiology until December 2012, and he will then start his academic career as an assistant professor in the Department of Aerospace and Mechanical Engineering at the University of Notre Dame.

Zachary M. Kaplan (BSME '01) is the founder and CEO of Inventables, an online hardware store for DIY manufacturing that sells all kinds of materials in small quantities for purchase with a credit card. The software and hardware tools for design and engineering continue to become less expensive. Kaplan's online store sells new tabletop machines and the supplies they use to make it possible to create and validate ideas very quickly.



R. Craig McClung (MSTAM '84, PhDME '88) received the Award of Merit from ASTM International Committee E08 on Fatigue and Fracture. The Award of Merit is ASTM's highest organizational recognition for individual contributions to standards activities. McClung has served as a member of ASTM International since 1990 and has chaired several workshops. After earning his PhD at Illinois, he began his career at Southwest Research Institute in San Antonio, Texas. McClung has displayed incredible commitment to this institute and currently serves as its program director.

Henry J. Petroski (MSTAM '64, PhDTAM '68) published his 17th book,

To Forgive Design: Understanding Failure, which hit shelves in March 2012 and surveys some of the most well-known engineering failures of our time, such as the sinking of the Titanic and BP's Deepwater Horizon Oil Spill. In this book, he argues that design failure alone is not to blame for these and other tragedies. Petroski suggests that cultural and socioeconomic factors contribute to the complexity of engineering and technology pursuits. His memories of his graduate education in TAM and photos of well-known MechSE places and people, such as the Talbot Lab and the late Professor Don Carlson, are also highlighted. Petroski currently serves as the Alexander S. Vesic Professor of Civil Engineering and a professor of history at Duke University.

Nicole E. (Lammers) Reifman (BSME '03 and JD '06) is a partner with McDonnell, Boehnen, Hulbert, & Berghoff (MBHB), LLP in Chicago and specializes in intellectual property law. She is a member of the Chicago Bar Association, the International Trademark Association, and the American Intellectual Property Association. Reifman is actively involved with The Junior League of Chicago and was awarded the Shining Star award for excellent service from this organization. She was made income partner at MBHB in 2011. In 2009, she married fellow MechSE alum **Robert Reifman** (BSME '03), and in the fall of 2012, the couple welcomed their first child.

Bradley J. Tran (BSME '11) took a month off after graduation to travel around Brazil and Ushuaia, Argentina—the southernmost city in the world. Upon returning to the United States, Tran moved from campus to Chicago to begin his career with Accenture, a major consulting firm. He currently works as an analyst within Accenture's Technology Consulting practice, and he has been assigned to his first client and project since the middle of August 2011. In January, Tran took some time off to visit Hawaii with a friend from school, and he spent most of June traveling in Europe.

We'd like to hear from you!

If you have news you'd like to share with us and your fellow alums, please contact Betsy Powers at epowers2@illinois.edu. Thanks!

I²CNER symposium

brings international energy leaders to Illinois

As concern over future energy supply and climate change mounts, global cooperation becomes increasingly important to overcome the challenges of developing renewable energy resources and curbing carbon dioxide emissions. Bringing together some of the leading energy researchers from around the globe, the International Institute for Carbon Neutral Energy Research (I²CNER) satellite institution at UIUC hosted a kick-off symposium in March 2012 to foster collaboration across national boundaries.

The institute, which is the sixth and newest member of the World Premier International (WPI) Research Center Initiative launched in 2007 by Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT), is a partnership between Kyushu University in Japan and the University of Illinois.

I²CNER Director **Petros Sofronis**, who is also a MechSE professor and the department's associate head for mechanics programs, said the symposium showed that I²CNER is a concerted institutionalized effort that is moving forward.

"Never before have we had such a list of energy experts at this campus," Sofronis said. "If you were faculty in attendance, you got great ideas about serious outstanding problems that are related to the realization of what we call a renewable energy portfolio tied with sustainability."

Speakers from the partner institutions as well as representatives from the U.S. Department of Energy, National Science Foundation, National Laboratories, and the Fuel Cell System Engineering Division of Toyota Motor Corporation, discussed energy challenges and some of the required technology breakthroughs for meeting these challenges.

"I²CNER aims to pursue green innovation and reduced CO_2 emissions, as well as to advance fundamental science and develop science-based technological solutions for the reorganization of sustainable and environmentally friendly society," said **Setsuo Arikawa**, president of Kyushu University.

Arikawa's remarks also touched on scientific issues relevant to ongoing discussion and debate in Japan as to what the energy mix should be in that country. He said that I²CNER could address the energy issues raised by those discussions.

"In such a situation, our research is expected to help our people as well as our society," he said. "I hope that more collaborative research between Japan and the United States will be initiated by this symposium."

Ilesanmi Adesida, Dean of Engineering at the University of Illinois, stressed that the University of Illinois is a global research university, noting that many international students are enrolled at the university and that a high percentage of undergraduate and graduate students study abroad.

"International collaboration for us is in the DNA for our college and for the university as a whole, so that's something that we are very proud of," Adesida said.

In addressing the technical, political, and economic challenges to sustainable energy's success, **George Crabtree** of Argonne National Laboratory told the symposium that "energy is making an historic transition from fossil to alternative."

"The bottleneck is basic science understanding for materials and chemistry," Crabtree said. "There's a wonderful opportunity there (for both Japan and the United States with the development of I²CNER)."

Sofronis said the distinguished speakers all shared with him their positive impressions of the symposium and many expressed their willingness to help I²CNER in achieving its goals.

"The symposium was an overwhelming success," Sofronis said. "We covered almost everything there is about energy—from all aspects, various angles—so that's what makes this symposium something I'm so pleased about."

The executive meeting between administrators of the University of Illinois and Kyushu University was one of many break-out meetings at the symposium.

MechSE group leading worldwide steel research

Steel is one of the most utilized materials in the world. About 1.3 billion tons are produced every year—and 500 million tons of that steel is recycled, equivalent to 180 Eiffel Towers every day. That's more than recycled paper, aluminum, plastic, and glass combined!

C.J. Gauthier Professor **Brian Thomas** is particularly interested in this essential material. His Continuous Casting Consortium (CCC), a cooperative research effort that involves some of the biggest names in the steel industry, is continually working to understand and improve the steel-making process. Members of the CCC come to MechSE from all over the globe, including the U.S., Sweden, China, Japan, the Netherlands, and Korea.

"What most people don't realize," said **Seid Koric**, Thomas' colleague and an adjunct assistant professor in MechSE, "is that Brian Thomas is the go-to guru for the steel industry. Everybody in the world comes to CCC and the University of Illinois to solve their problems, not just the producers in the United States."

Continuous casting produces over 96% of the steel in the U.S. The process begins with molten steel being poured into an open-ended, bottomless, water-cooled mold. As it flows downward through the mold, a thin shell of steel solidifies and cools along the inside of the mold, and thickens as the molten steel moves farther and farther down. The shell is pulled from the bottom of the mold, where it acts as a container for the steel that is still liquid inside. Like a water balloon, the soft, weak shell must be supported below the mold to prevent it from bulging out of control. The shell is continuously pulled through the supporting and straightening rollers and eventually the steel cools all the way to the center. It is then cut to a predetermined length and sent for rolling and further processing into different shapes according to the needs of the client manufacturer.

"If you can get the whole process to run a steady state, that's how you make your highest-quality steel," Thomas said. "You don't want things to deviate."

Thomas and his group are looked to as experts in this crucial process, and they continually work to make it more efficient and to minimize weaknesses and defects in the product. Their main tools are comprehensive mathematical models of the continuous casting process for casting steel slabs, developed to improve understanding and optimization of the process.

Some of the problems the group has solved have been specific practical problems for the steel industry, through the involvement of the steel corporations in his CCC. The member companies of the CCC invest funding and interest into Thomas' work, as his achievements can directly improve their processes.

"The CCC members are interested in an improved understanding of the process and things that they can do to make the process better," he said. "My main task is to really understand where the defects are coming from, and by getting all the details nailed down, we can find out the most optimal way of fixing the problem."

The CCC holds an annual meeting for the member companies, in which Thomas's students show presentations on what they have been researching, and hold several workshops. At these workshops, the member companies give their own presentations on a certain predetermined topic, such as longitudinal cracks, and compare data and methods of fixing the problem.

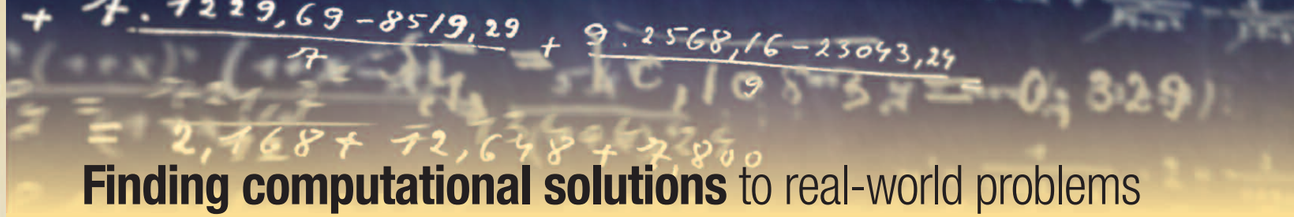
"People don't like to talk about defects in public," Thomas said. "But by getting people to agree that everybody attending has to give a presentation, that's how you get into the workshop. It's been really successful because they have really opened up and have talked about all kinds of stuff. These are 'competitors,' but they all have the same problems."

In this way, the CCC encourages not only positive collaboration between the research group and industry, but also between the companies themselves. The projects of the CCC vary and cover multiple aspects of the process, resulting in Thomas collaborating with researchers from many different fields within the University of Illinois and from around the world.

His research group includes undergraduates, graduate students, PhD students, and visitors from other universities and steel companies. The students come from a number of engineering fields, such as materials, electrical, or nuclear, but most come from MechSE.

"I like the mechanical science and engineering base because the students have a good mathematical rigor," Thomas said. "They know their mechanics better, and therefore they can be better at doing the computational modeling. What I try to get them to do is to apply the computational modeling to a real-world process, and make a difference to that process to solve that problem. They usually graduate and get good jobs in industry applying that modeling methodology to very different problems."

Above: Professor Brian Thomas (center) with his grad students Kai Jin, Rui Liu, ASM Jonayat, and Seong-Mook Cho.



Finding computational solutions to real-world problems

Everyone has had the experience of participating in a conversation in a crowded room. But very few people have ever thought about the remarkable ability of humans to infer useful information, even as the speech is corrupted, distorted, or muffled by ambient noise—music playing in the background, the sound of traffic wafting in through the window, or the sound of other conversations in the room.

The problem of inference—how to extract information from noisy and incomplete time-series data—pervades many aspects of engineering, biology, economics, and atmospheric sciences. A textbook example is that of radar, which uses radio waves to infer the location, bearing, and speed of a moving target, like aircraft or a weather cell. The radar measurements are affected by random thermal radiation in the atmosphere as well as "clutter" in the environment. In practice, it is important to filter, or de-noise, the radar time-series data to infer a moving target location.

MechSE associate professor **Prashant Mehta** and his research group work in the theory and practice of nonlinear filtering and estimation, and have recently created a novel class of algorithms for real-time inference. The foundation of these algorithms is the celebrated Bayes' theorem, which is used to update the probability estimate for a hypothesis as additional evidence is gathered.

"The challenge is in implementing Bayes' theorem when the information carrying signal is nonlinear and the probabilities are non-Gaussian," said **Tao Yang**, a third-year graduate student in Mehta's research group.

The solution that Mehta and his research group have been working on combines ideas from statistical mechanics and control theory. Their novel algorithm, called the feedback particle filter, is implemented on a computer and comprised of a population of "particles," each of which represents a competing hypothesis. The winning hypothesis is the one that is supported by the most particles and represents the result of the inference.

As new evidence becomes available, like the measurement from the latest radar sweep, every particle in the population compares the newly arrived evidence against its own prediction of the same. A particle's prediction is based in part on its own hypothesis and in part on the average prediction of the entire population. The average may be viewed as a measure of the collective wisdom of the population and serves as a hedge against the possibility of the particle's hypothesis being erroneous. This comparison—between the newly arrived evidence and the particle's prediction—is used by the particle to update (auto-correct) its own hypothesis. Over a period of time, the algorithm leads to a solution of the inference problem.

Mehta's work is being applied in many areas, including detection, estimation, and tracking of multiple targets using radar and other types of sensors, and in autonomous navigation of vehicles in unknown environments.

Their newest project is in the field of neuroscience. Inference is believed to be a fundamentally important computational function for biological sensory systems. The Bayesian model of sensory (e.g., auditory) signal processing suggests that the cortical networks in the brain encode a probabilistic "belief" about reality. The belief state is updated based on comparison between the novel stimuli (from senses) and the internal prediction.

"A natural question to ask," said **Adam Tilton**, a second-year graduate student in Mehta's research group, "is whether there is a rigorous methodology to implement complex forms of inference via Bayes' theorem at the level of neurons—the computing elements of the brain."

Tilton and Mehta provide a positive answer to this question based on the feedback particle filter methodology.

In a recent work carried out in collaboration with MechSE associate professor **Liz Hsiao-Wecksler**, they describe the methodology with the aid of a model problem involving inference of a "walking gait cycle" using noisy measurements. The gait cycle refers to the cyclical motion of the legs while walking, beginning with the contact of the heel to the ground, and ending with the subsequent contact of the same foot.

By using the feedback particle filter methodology, Tilton and Mehta designed a circuit comprised of a network of model neurons. Using data from experiments carried out in Hsiao-Wecksler's lab, they showed that the circuit correctly inferred the walking gait based only on noisy time-series measurements from pressure sensors.

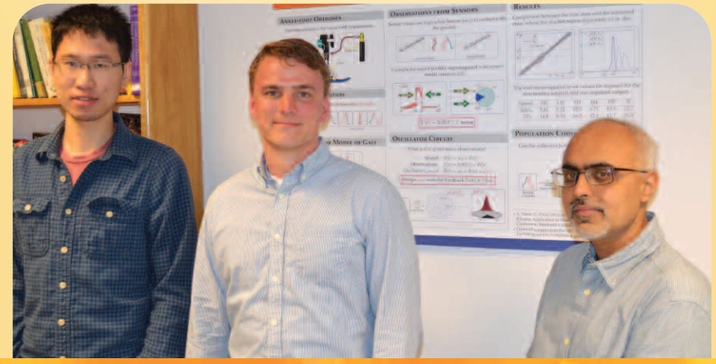
The project has implications for the field of neuroscience and our understanding of how the mind works, a field also called the "science of the mind." Mehta's research could provide significant new insights to the field.

"The significance of our research to neuroscience is multi-fold," Mehta said. "Our research shows that neural rhythms—the collective dynamics of neuronal networks—are potentially relevant to the signal processing functions in the brain. Our work also provides a new algorithmic framework for synthesis of signal-processing circuits with neuron-like oscillator elements."

Going forward, Tilton aims to relate their research more closely to neuroscience.

"For an animal to move in an uncertain environment, it must process (noisy) sensory input from the environment," Tilton said. "Our work suggests a signal processing solution based on neurobiologically plausible neuronal models. The next step is to experimentally validate the proposed methodology by using, for example, neural activity recordings of central pattern generator."

Professor Prashant Mehta (right) with his grad students Tao Yang and Adam Tilton.



Undergrad design stem **emphasizes creative thinking**

MechSE equips students well to analyze physical structures and develop solutions to society's pressing problems. But engineering requires more than state-of-the-art analysis and simulation techniques—it demands creativity in applying the fundamental principles of math and science.

"We have to have these outlets for students' creativity," said Professor **Placid Ferreira**, MechSE's department head. "That is what allows them to do things that they are passionate about while applying what they are learning in terms of scientific methods."

Underclassmen now have increased opportunities to express their creativity, both inside the classroom and out, while gaining hands-on design experience. In Fall 2011, a revised computer-aided design course and the addition of a Lego Robotics competition to freshman engineering orientation ENG 100 were the first in a series of improvements to the MechSE undergraduate program's design stem. The changes are aimed at allowing students to get more involved in engineering design from the beginning of their freshman year.

The overhaul of the design stem will ultimately affect a handful of courses, among them ENG 100 (Engineering Orientation), ME 170 (Computer-Aided Design), and ME 199 (Undergraduate Open Seminar), the first courses to be updated. Later, changes will take effect in ME 350 (Design for Manufacturability), ME 370 (Mechanical Design I), and ME 371 (Mechanical Design II), which will feed into ME 470 (Senior Design Project). Director of Undergraduate Programs **Emad Jassim** and his colleagues in the Design Stem Subcommittee hope that the changes help students get a better grasp on design by having the hands-on design experience throughout the curriculum.

"We wanted students to really see what the applications are that they could potentially solve towards the end," Jassim said. "And so we wanted to have them get to see what mechanical engineering is—not in their junior year, but earlier on."

The revised ME 170 course now includes selected topics on manufacturing processes that had previously been part of ME 350. This shift allows for room in ME 350 to introduce more instruction related to machine components.

MechSE freshmen like Madeline Acri now make their own remote-controlled LEGO-bot creations in Engineering 100.

Additionally, the kinematic component of the Pro/ENGINEERING (ProE) computer-aided design software known as Mechanism Design is introduced as part of ME 170. Students learn to use the component at an introductory level, conducting 3D motion analysis, running the mechanism through its motion cycle, and creating trace curves, motion envelopes, and 3D animations. Later courses, ME 370 and 371, build on this introduction.

Another element of the design stem improvements involves the elective ME 199. Students will have the opportunity to participate in design projects while taking this one-hour course for three consecutive semesters, beginning no later than the first semester of the sophomore year.

"It could be any number of different competitions," Jassim said. "Or, if the students had an entrepreneurial idea to pursue, they could start doing so in ME 199."

He said projects could include design competitions such as the Society of Automotive Engineers' (SAE) miniature Baja, Formula-1, or Formula Hybrid competitions, Shell's Eco-marathon competition, Parker Hannifin's hydraulic bicycle competition, and others.

"It's really great in terms of being very hands-on—you take everything you learn in class and apply it directly to a project," said **Greg Catrambone**, SAE president and Formula SAE chassis team leader. "I can't think of many things where you get much more real engineering experience than the SAE program, because not many people can come out of college and say, 'Well, I've already designed and built this subsystem for a race car.'"

As the department phases in the improvements, changes in advanced courses such as ME 350, ME 370, and ME 371 will build upon lessons learned in lower-level courses.

Students in the revised ME 350, for example, will actually design and build a component. This activity will allow them to apply lessons from introductory Theoretical and Applied Mechanics (TAM) courses in practical laboratory experiences.

One lab proposed by the subcommittee would have students use ProE to design a carrier for a set of planetary gears, fabricate the carrier using rapid prototyping, and then assemble the gear set and carrier to examine its operation.

The ME 370 and ME 371 sequence is being revised so that students gain more experience with the use of computer codes in engineering design and analysis. The kinematics component that was added to ME 170 will provide a base for later work in ME 370 that will expand on the Mechanism Design module of ProE in a four-week lab. The new course content will also build upon MATH 415 (Linear Algebra) by dealing with closed linkages in a 3D, rather than a 2D, approach.

"ME 370 is mainly focused on dynamic modeling and students being intelligent users of different applications that are out there, and learning some of the basics of machine design," Jassim said. "ME 371 is largely the implementation of those tools with a hands-on design component."

Jassim also said the department will allocate space for students in ME 371 to design their machinery. At the end of the design stem, students in ME 470 will be equipped with the skills and knowledge of a real-world design problem from industry or a design competition.

Disquisitiones Mechanicae brings leading mechanicians to Illinois campus

Disquisitiones Mechanicae 2011-12 featured lectures on fluid mechanics in complex environments by four renowned international experts, who each spent two days at the University of Illinois for lectures, meetings, and shared learning between November 2011 and March 2012.

The invited guests gave presentations in their areas of specialty designed to enrich the mechanics community at Illinois. Their visits resulted in vigorous discussion and debate on issues of interest to the mechanics community and exposed students to topics that are at the forefront of current research in this field.

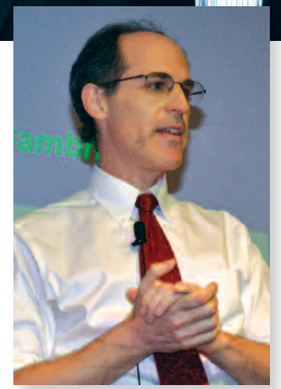
"The Disquisitiones Mechanicae lecture series was by all measures a tremendous success," said Professor **Moshe Matalon**, who along with Associate Professor **Kenneth Christensen** were the primary organizers. "The four distinguished scientists we brought to campus talked about cutting edge research in the broad area of fluid mechanics in complex environments and attracted extremely large and diverse audiences for both their perspective seminars and fluid mechanics seminars."

The event was inspired by Disquisitiones Mechanicae 1996, organized by the Department of Theoretical and Applied Mechanics (TAM), which differed in format but was also designed to engage the mechanics community at Illinois, both faculty and students, in discussing issues at the forefront of mechanics research.

"There are still many stubborn problems in mechanics that, if solved, would have an enormous impact on a range of societal and technological challenges," said Professor **Petros Sofronis**, the associate head for mechanics programs in the MechSE Department. "One way to deal with these problems is to convene those who are experts and recognized authorities in these specific areas and have an open discussion with them."

Matalon and Christensen brought in top lecturers from around the world: Professor

Top: MechSE professors Moshe Matalon (left) and Kenneth Christensen (right) welcomed four world-renowned guest lecturers to campus, including Professor Ivan Marusic (center), for Disquisitiones Mechanicae 2011-12.



Right: Professor Raymond Goldstein presented "Evolution of Biological Complexity" to a standing-room-only crowd in November 2011.

Raymond Goldstein from the University of Cambridge in November 2011; Professor **George (Bud) Homsy** from the University of British Columbia in December 2011; Professor **Howard Stone** from Princeton University in February 2012; and Professor **Ivan Marusic** from the University of Melbourne in March 2012. Each lecturer attended meetings with faculty and graduate students and gave two lectures: a perspective lecture designed for a broader audience and a focused lecture during the regular departmental fluid mechanics seminar.

"All of the speakers sit at the forefront of mechanics research in their respective areas of expertise, oftentimes bridging a broad cross-section of fields in science and engineering," Christensen said. "Illinois faculty and students were not only able to learn more about each speaker's research activities but were also given the unique opportunity to showcase their own research activities and interests to these prominent researchers."

The interdisciplinary nature of their research attracted venue-filling crowds of faculty and students to their seminars, not only from MechSE but also from many other engineering disciplines, biology, chemistry, and geology.

"All four speakers were very complimentary about the talent and energy of our faculty, and with the diversity of the mechanics work being carried out at Illinois," Matalon said.

Faculty News

Narayana Aluru received the College of Engineering's Excellence in Teaching Award in 2012 and was named a 2012 Engineering Council Outstanding Advisor.

Quinn Brewster was reappointed as Hermia G. Soo Professor in 2010.

Kenneth Christensen received the College of Engineering Dean's Award for Excellence in Research in 2012. He was named a Kritzer Faculty Scholar in 2011.

Harry Dankowicz received the College of Engineering Collins Award for Innovative Teaching in 2012. He was named a Cannon Faculty Scholar in 2010.

Debasish Dutta was named an AAAS Fellow in 2011.

Jonathan Freund was named an AIAA Associate Fellow and an APS Fellow, both in 2011.

Pedrag Hrnjak received the IOR Institute of Refrigeration J&E Hall Gold Medal in 2012.

Jimmy Hsia was named an AAAS Fellow in 2011.

Iwona Jasiuk was named an SES Fellow in 2012.

Shiv Kapoor received the Campus Award for Excellence in Grad Student Mentoring in 2011.

William King was named an ASME Fellow in 2011.

Dimitrios Kyritsis received the MechSE Alumni 2-Year Effective Teaching Award in 2012 and the Alpha Omega Epsilon Engineering Council Award for Outstanding Advising in 2011. He was also named a 2012 Engineering Council Outstanding Advisor.

Chia-Fon Lee received the Alpha Omega Epsilon Engineering Council Award for Outstanding Advising in 2011.

Moshe Matalon was named an AIAA Fellow and was reappointed as College of Engineering Caterpillar Professor, both in 2012.

Carlos Pantano-Rubino was named an AIAA Associate Fellow in 2011.

Jim Phillips received the MechSE Alumni 5-Year Effective Teaching Award in 2012.

Michael Philpott was named MechSE's Acting Associate Head for Undergraduate Programs for Spring 2012 through Fall 2012.

Christophe Pierre received a Doctorate Honoris Causa from the National Technical University's Kharkov Polytechnic Institute in Ukraine in 2011.

Andreas Polycarpou was named the Founding Chair at the Department of Mechanical Engineering at Khalifa University of Science, Technology and Research (KUSTAR) in the United Arab Emirates in 2011, and took his position there in January 2012. He will return to MechSE in January 2013.

David Saintillan received the National Science Foundation CAREER Award in 2012.

Huseyin Sehitoglu received the Campus Award for Excellence in Graduate Student Mentoring in 2012.

Mark Shannon was reappointed as J.W. Bayne Professor in 2010.

Sanjiv Sinha received the Alpha Omega Epsilon Engineering Council Award for Outstanding Advising in 2011.

Brian Thomas received the HPC Innovation Excellence Award from the International Data Corporation in 2011, for the Continuous Casting Consortium he directs in MechSE.

Pratap Vanka received the ASME Freeman Scholar Award in 2011.

Amy Wagoner Johnson was named a 2012 Engineering Council Outstanding Advisor.

Message from the Advancement and Communications Office

Dear MechSE Alumni & Friends,

I hope you have enjoyed reading the amazing stories throughout this magazine. From designing assistive products for wheelchair users and creating prosthetic extremities for the third world, to founding the nation's largest solar services company and running a $700 billion bank bailout, our MechSE students, faculty, and alumni are indeed moving the world forward.

As we look to the future, we are excited to see what the next decade holds for us. The renovation of our main Mechanical Engineering Building, coupled with the possibility of adding a 25,000-square-foot Student Innovation Center, will ultimately provide MechSE with the state-of-the-art space required to continue our forward momentum. As we envision this future, we will need your help. We are currently in the initial stages of exploring the feasibility of a capital campaign to provide the necessary philanthropic support to make this dream a reality. This will require the support of our alumni worldwide, and if you would like to be a part of the initial planning process, please contact me at 217-244-4341 or via email at crohlfs@illinois.edu.

This fall we plan to offer some new alumni events, including a tailgate party for the November 17 football game versus Purdue. We are also planning a series of alumni activities in San Francisco, Boston, Houston, and Chicago, so please look for more information in the future. If you would be interested in hosting an alumni gathering in your community, I'd welcome the opportunity to work with you.

We largely communicate these alumni events via email, so please take a moment to provide us with your current email address by visiting the alumni and friends page at www.mechse.illinois.edu.

Thank you so much for your support of MechSE. We hope you will visit us on campus soon!

Best regards,

Chad Rohlfs

Chad Rohlfs
Director of Advancement

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Keep in touch

Keep up to date with the MechSE Department! Just go to **mechse.illinois.edu/contact** to sign up with your current contact information or email Betsy Powers at epowers2@illinois.edu. If you have a smart phone, you can access this page by scanning the accompanying QR code.

Attention, entrepreneurs!

MechSE wants to hear from all of our alumni who have started their own businesses. Please contact Betsy Powers at epowers2@illinois.edu, and provide a short description of your company. We will be assembling this information for future publication.

Join our social networks—just go to mechse.illinois.edu!

Around Campus

Ilesanmi "Ade" Adesida, who has been the dean of the College of Engineering at Illinois since 2006, has been named Vice Chancellor for Academic Affairs and Provost of the Urbana campus. He assumes this new role on August 16, 2012.

He will be filling the post held by Richard Wheeler on an interim basis since January 2010.

"Dean Adesida's global experience, expertise in innovation, and leadership in public and private partnerships has given him a solid foundation on which to build as he helps guide our campus forward," said **Phyllis Wise**, the chancellor of the Urbana campus and a university vice president. "He has an outstanding record of scholarship, a proven commitment to excellence, and an ability to successfully collaborate with colleagues at Illinois."

Adesida will play a critical role in developing and executing the next steps in the Visioning Future Excellence initiative, which has challenged staff and faculty members to submit new ideas that will be used to plot the Urbana campus's course far into the future, Wise said.

"Dean Adesida will be a critical asset for our campus as we seek to more aggressively advance our mission," Wise said.

Adesida has served in various roles since joining the Illinois faculty in 1987. Named the dean of COE in 2006, he also has been a director of the Center for Nanoscale Science and Technology since 2001. A Donald Biggar Willet Professor of Engineering, Adesida earned his undergraduate and doctoral degrees at the University of California, Berkeley.

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