Meetings and more

MechSE’s new Grad Lounge opened in late September on the lower level of the Mechanical Engineering Building. The lounge serves as a place for graduate students to meet, relax, and study. It features a kitchenette, comfortable furniture, and an adjoining conference room equipped with a projector and screen. Here, members of GraMS (Graduate MechSE Students) mingle in the lounge before a night out in Campustown.
MechSE students have a message for our alumni and donors…

A s we head into the Spring 2014 semester in the Department of Mechanical Science and Engineering, our students, faculty, and alumni continue to make us proud with their incredible achievements. We are pleased to share many of these with you in the pages of this magazine.

For the 2013-14 academic year, our incoming freshmen had a mean composite ACT score of 32.2, the highest in recent history. And when the undecided engineering students have committed to their majors, this year’s class may end up being our largest ever as well.

Our new graduate students are equally impressive. With the 2013-14 incoming class the largest on record, we have surpassed the 400-student mark for total grad students, up more than 30 from a year ago. These new students also have the highest GPA and test scores of any class for which we have data.

In August 2013, we welcomed three extremely accomplished new faculty members to the department: Leonardo Chamorro, Tonghun Lee, and Sameh Tawfick. Beyond impressive research credentials, their dedication to education ensures our students will benefit greatly from their instruction and guidance.

From the Air Conditioning and Refrigeration Center, which celebrated its 75th anniversary in 2013, to the International Institute for Carbon-Neutral Energy Research, MechSE faculty members are leaving a large and very integrated footprint in the energy field. And a new Department of Energy Center will soon be underway at Illinois, with several MechSE faculty members helping to lead its efforts. The pages that follow highlight the involvement of our faculty, students, and alumni in this crucial industry.

The entrepreneurial spirit has also been a consistent theme among our alumni, and we have provided listings of some of their great companies. In particular I think you will enjoy the story of Microlution, a company turned to the very same name, even though we were unaware of its historical significance. I think you will enjoy reading the sidebar on this page, which describes the development of the composite material used in their solar panel products.

On the topic of start-ups, we recently unearthed some fascinating information about the beginnings of our department. In fact, we discovered that 143 years ago, the name of our department was Mechanical Science and Engineering. After many decades and several name changes, we have returned to the very same name, even though we were unaware of its historical significance. I think you will enjoy reading the sidebar on this page, which excerpt word-for-word information published about the department from the 1870-71 academic year.


Third Year, Second Term: Practical Mechanics continued.

Second Year, First Term: Descriptive Geometry.


Third Year, First Term: Cinematics or Comparison of Motion. Principles of Mechanism.


First Year, First Term: Drawing.


Fourth Year, Second Term: Prime Movers. Drawings (Complete Drawings of Machinery).

Fourth Year, Third Term: Mill Work and Machinery. Drawing (Designing of Machinery, Drawings, and Estimates).

From the Department Head

Mechanical Science and Engineering: 143 years ago

The following is excerpted from the Mechanical Science and Engineering section of the University’s Board of Trustees 1853-71 Annual Report.

The studies of this Department are intended to qualify young men for the designing, constructions or superintendence of all kinds of machinery. It will embrace a thorough course of instruction in the principles of mechanical philosophy, of mechanical devices and the parts of machines, of pattern making, finishing and mechanical proportion, and of mechanical designing and drawing. A very important element of mechanical training, too often overlooked, is that of shop practice. Many of the schools of mechanical engineering have met with but partial success from the neglect of this important element of instruction. Here practical instruction goes hand-in-hand with the study of theory, not for the purpose of teaching mere mechanic art, which can be learned in any of the thousand shops of the country; but to give a practical character and value to the instruction and to teach more effectually the work of the mechanical engineer.

Mechanical Science and Engineering Curriculum from 1870-71

First Year, First Term: Drawing.

First Year, Second Term: Descriptive Geometry.

Second Year, First Term: Designing and Drawing.


Second Year, Third Term: Practical Mechanics continued.

Third Year, First Term: Cinematics or Comparison of Motion. Principles of Mechanism.


Fourth Year, Second Term: Prime Movers. Drawings (Complete Drawings of Machinery).

Fourth Year, Third Term: Mill Work and Machinery. Drawing (Designing of Machinery, Drawings, and Estimates).
whether we put it to use in our cars, in our houses, or in our places of business, having energy is paramount to our society. As fossil fuels become more expensive, and further evidence of their negative effect on the environment appears, the importance of energy efficiency has increased dramatically. Capturing energy from the world around us has always been an engineering pursuit, and today it is no different; faculty members throughout the MechSE department are putting their diverse skills to use developing new ideas in energy research.

By having carried out this analysis, we usually identify the roadblocks in the research that need to be addressed for a specific pathway in order to make it more efficient, perhaps by adapting the point that it can be applied to hydrogen, Pomerol has identified a strategic research cluster on energy analysis in order to identify the roadblocks to achieving a carbon-neutral energy society, which exist due to the constraints of both primary energy availability and resources, by measuring CO2 emissions, efficiency, and cost. Once the roadblocks have been identified, the primary goal of this research group is to establish a roadmap toward a sustainable and low-carbon society over mid- and long-term scenarios by continuously assessing the relevance of the Institute's research activities. This roadmap, which helps Pomerol achieve its vision, is made up of technologically feasible pathways to a carbon-neutral society, which are identified through quantitative analysis. Within this roadmap, there may be multiple pathways that will each require various research and development (R&D) strategies. Further, each of these R&D strategies may involve different technologies to be developed. However, Pomerol will focus on the central issues of important technology targets.

“By having carried out this analysis, we usually identify the roadblocks in the research that need to be addressed for a specific pathway in order to make it more efficient, perhaps by adapting the point that it can be applied to hydrogen, I2CNER’s Hydrogen Compatibility research team aims to improve the structure and properties of existing materials or come up with new material microstructures to find those that are resistant enough to store or transport hydrogen long-term. We try to develop tough materials, as tough as we can make them, better than the materials we have today,” Sofronis said. “We start by focusing on materials that we know. We have first understood the existing materials such as austenitic and ferritic steels, and we find out which ones are the best candidates that can operate safely and reliably. And then we try to understand how and why the best candidates are degraded by hydrogen. Once we understand that, we try to modify these materials. At a later stage, since we will know how these materials respond and how they are degraded by hydrogen, we can come up with new alloys.”

Pomerol is now in its third year of operation and is progressing rapidly toward becoming what Sofronis calls a “world class institute.” Recently, Pomerol established a thematic research cluster on energy analysis in order to identify the roadblocks to achieving a carbon-neutral energy society, which exist due to the constraints of both primary energy availability and resources, by measuring CO2 emissions, efficiency, and cost. Once the roadblocks have been identified, the primary goal of this research group is to establish a roadmap toward a sustainable and low-carbon society over mid- and long-term scenarios by continuously assessing the relevance of the Institute’s research activities. This roadmap, which helps Pomerol achieve its vision, is made up of technologically feasible pathways to a carbon-neutral society, which are identified through quantitative analysis. Within this roadmap, there may be multiple pathways that will each require various research and development (R&D) strategies. Further, each of these R&D strategies may involve different technologies to be developed. However, Pomerol will focus on the central issues of important technology targets.

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**MechSE faculty play major role in new DoE center**

The U of I will receive $15 million to fund a new center that will leverage extreme-scale computing to predict how plasmas could be used to control combustion. The research may pave the way for cleaner-burning combustors and more reliable and higher performance jet engines.

Professor Jonathan Freund of MechSE is co-leading the center with Computer Science professor William Gropp, the principal investigator on the cooperative agreement and director of Illinois’ Parallel Computing Institute, which administers the new center. Freund will orchestrate the predictive physics modeling and simulations, including the supporting experiments.

“Plasmas offer a little-explored means of tuning combustion to meet engineering objectives of performance or efficiency,” Freund said. “Harnessing the power forthcoming computer architectures, as is planned within this center, will enable truly predictive simulations that can advance this technology.”

Other MechSE faculty—Harley Johnson, Carlos Pantano-Rubino, and Nick Glumac—are also heavily involved in the center. Named the Center for Exascale Simulation of Plasma-Coupled Combustion, it will be funded for five years by the Office of Advanced Simulation and Computing of the National Nuclear Security Administration (NNSA), part of the U.S. Department of Energy. The center, one of three Multidisciplinary Simulation Centers funded through NNSA’s Predictive Science Academic Alliance Program II, comprises of researchers from Illinois and the Ohio State University.

“This would be a whole new mode of managing combustion,” Gropp said. “We aim to make breakthroughs in this emerging field at the basic science level that ultimately lead to a greener world.”

In a normal combustion event, many steps occur between the spark and the firing of an engine. Control of the intermediary steps is not possible with current technology. However, plasma—a gas that is transformed into a new state of matter when its atoms are ionized—has properties that enable intervention at intermediary steps. Plasmas could also help stabilize flames for hypersonic, high-speed jet engines, in which air passes through so fast that the flame can be extinguished.

But understanding just how to manage plasma is a difficult problem, requiring three-dimensional, fluid computer simulations that can cover many space and time scales. To make reliable predictions, researchers need scalable computational resources to model and analyze the physics components, which range from flow turbulence to electro-dynamics.

“You have to be able to understand what’s happening at the atomic scale all the way up to the bulk flow in the plasma, which you can measure with a ruler,” said Gropp, the Siebel Chair in Computer Science at Illinois. “We can’t do this on one big computer, so we have to create new techniques that will help us stitch everything together.”

The efforts will include the development of new technologies for heterogeneous petascale and exascale systems. Computer scientists and engineers will create better tools for managing efficient data structures, mitigate the irregularities that come with both extreme-scale computing and the fluid nature of the chemical processes, develop novel computational and programming tools for mapping hardware architectures, and design simulation models specifically for turbulence, combustion, plasma dynamics and the electro-chemical properties of surfaces.

Established by Congress in 2000, NNSA is a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear science. NNSA maintains and enhances the safety, security, reliability and performance of the U.S. nuclear weapons stockpile without nuclear testing; works to reduce global danger from weapons of mass destruction; provides the U.S. Navy with safe and effective nuclear propulsion; and responds to nuclear and radiological emergencies in the U.S. and abroad.

**Alumni in Energy: Steve Vavrik**

Steve Vavrik (BSME ’90, MSME ’91) is the executive vice president of business development at Apex Wind Energy. In this role, he directs efforts in power marketing, origination, and acquisitions for Apex’s wind and solar projects. Previously he has worked in management positions at CleanPath Ventures LLC, a solar project investment firm, SunPower Corporation, a solar panel manufacturer, First Wind (formerly UPC Wind Management), a wind energy company, and energy companies PPM Energy and Dynegy. “While all projects are challenging, renewable energy projects help create a positive legacy for future generations,” Vavrik said.

The first photovoltaic cell, more commonly known as a “solar cell,” was engineered in 1883. Despite being 150 years old, solar cell technology is still in a very young stage of its development, far behind most other forms of energy production. “Solar cells have existed in some form or other for more than a hundred years now,” MechSE assistant professor Elf Erikstein said. “But they still haven’t been optimized; their performance is still not as good as it could be. So we’re trying to determine what we have to do at the materials level to manufacture devices that are better at converting sunlight to electricity.”

Erikstein’s research is in computational modeling and materials design, with interests that include thermoelectrics and photocatalysts as well as photovoltaics. Although her work is entirely computational, she works closely with the experimentalist who synthesizes the materials and measure their properties.

“It’s a pretty exciting time for computational work,” Erikstein said. “Systems that our group can model on a computer can now be grown almost exactly—down to the atomic scale—in a laboratory.”

With the average efficiency of a conventional solar cell, it takes one to two years to generate the same amount of energy needed to make the silicon the cell is made of. In order to compete with other forms of energy production, the efficiency needs to be increased significantly. One potential way to do this is “hyperdoping” the silicon with impurities. Hyperdoping is giving the silicon impurities at concentrations several orders of magnitude higher than the said solubility limit. This process creates what is called “black silicon,” a material Erikstein and her group are studying that would be capable of absorbing sunlight in the low-energy portion of the solar spectrum, and is a good model system to explore how to make silicon a better absorber of sunlight.

There are also other factors to consider, such as manufacturing costs. In order to augment the efficiency and decrease the costs, Erikstein and her group are looking at alternatives to the bulk silicon that most modern solar cells use as the active layer.

“We want a low-cost material that is still good at converting sunlight to electricity even when it’s been manufactured at low-temperature
In 2013, the Air Conditioning and Refrigeration Center (ACRC) marked the 25th year it has called the MechSE department home. The ACRC, a cooperative research center founded by the NSF, promotes collaboration between industry and university research in advanced air conditioning and refrigeration systems. It seeks to develop more energy-efficient equipment and to provide a forum for industry to share pre-competitive research and results. The center is co-directed by MechSE professors Predrag Hrnjak and Anthony Jacobi, who both research heat transfer and energy systems. They have been involved with the center for more than 20 years and have served as directors 15 years.

“In the United States, this is the only NSF-funded center in this area,” Jacobi said. “There are a handful of related efforts at other universities, but they are much smaller. ACRC dominates the area in the U.S.”

The center began in 1988, co-founded by Clark Ballard and Roy Crawford, who were professor and assistant professor, respectively, in the ME department (predecessors to MechSE) at the time. “The need for such a center arose after international agreements began limiting certain refrigerants that had been proven to damage the ozone layer. Research was desperately needed to find alternative technologies for the refrigeration industry, and the ACRC was the answer,” bringing university researchers and refrigeration/air conditioning companies together to make progress in the field. By the mid-1990s the ACRC had grown to involve 30 member companies, which each contributed to a pooled research fund. The companies would then vote on research projects the faculty proposed, and the projects selected for funding were supported by this pool of common resources. “The center has operated as a virtual lab, and although the companies are not in the lab, they can access it,” Hrnjak explained.

“ACRC is making powerful strides in research for the refrigeration industry, the center has seen great success since its founding. Countless papers have been published through its research, and the students that participate in it fare well after graduation. “We’ve seen our students graduate and go to academic positions and become our competitors, which is good,” Jacobi said. “We’ve seen our students go to our sponsoring companies and become our bosses, which is good. We’ve seen our students graduate and then become the leaders of big government activities, where they go in and make big changes and suddenly rise to the top. To me, it is probably as rewarding as the research itself to watch our young people go out there and hit a home run.”

The center has also become more focused on energy efficiency. As efficiency standards for refrigeration and air conditioning systems rise, the industry has a vested interest in keeping ahead of those standards. “The industry is pushing very hard in increasing energy efficiency,” said Hrnjak. “How is the industry going in that direction? By improving the components, improving the systems, and improving buildings. We hope that we are contributing to that effort.”

The ACRC is making powerful strides in research for the refrigeration and air conditioning industry, bringing industry leaders together to make meaningful change. Hrnjak and Jacobi speak with pride of the difference the center has made in the field throughout its years. “I think a lot of the time, the results of the center just quietly show up in the marketplace,” Jacobi said. “Then we see it and say, ‘Oh, we know where that came from!’ I think that’s good. That’s the way we want to be involved.”

Most importantly, efficiencies with CTS are already up to about 12%. The best semiconductor solar cells are about 27-29% efficient out of a laboratory, and 21-23% efficient off of a manufacturing line or industrial process. Thin film modules can range from 10% to a little under 20%. Compared to these efficiencies, 12% for a CTS cell doesn’t seem entirely impressive—but considering the age of the technology relative to that of other solar cell materials, it’s actually quite surprising. “It’s a very early-stage material,” Ertékin said. “The research community has only been working on CTS for a handful of years. The fact that it’s as high as 12% so early in the game makes you think there’s still a lot of room for improvement in this particular material. “And I think that as photovoltaic technology continues to improve, as it gets more convenient and more reliable, we’ll see more and more adoption here in the country. It’s an exciting time for the field right now.”

Jacobi said. “That is one of the beauties of the ACRC,” Hrnjak said. “Students and faculty can interact with companies if it is in the interest of their research and teaching.”

The ACRC celebrates 25 years at Illinois

MechSE professors Predrag Hrnjak manages more than 25 graduate students and many labs in Mechanical Engineering Laboratory as part of his work for the Air Conditioning and Refrigeration Center (ACRC). It’s own in this industry, it has developed a culture of exploration and trust, allowing faculty to go down a lot of unexplored paths. The center has been very well integrated into the department. Faculty members can interact with companies if it is in the interest of their research to do so, or they can pull away for a time to do their own research and development. Thus the ACRC is able to pursue projects of interest to the sponsoring companies, but these projects must involve intellectual property. This gives the center the flexibility to pursue projects that have high potential for commercialization. The ACRC is making powerful strides in research for the refrigeration industry, the center has seen great success since its founding. Countless papers have been published through its research, and the students that participate in it fare well after graduation. “We’ve seen our students graduate and go to academic positions and become our competitors, which is good,” Jacobi said. “We’ve seen our students go to our sponsoring companies and become our bosses, which is good. We’ve seen our students graduate and then become the leaders of big government activities, where they go in and make big changes and suddenly rise to the top. To me, it is probably as rewarding as the research itself to watch our young people go out there and hit a home run.”

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Isotopes are a common sampling technique used to study the properties of materials. Using isotopic analysis, researchers can determine the origin and behavior of various materials, including silicon wafers. This technique is particularly useful in understanding the behavior of materials under different conditions, such as high temperature or pressure. By studying the isotopic composition of a material, researchers can gain insights into its structure and composition, which can help optimize its performance in various applications.

In addition to isotopic analysis, other techniques such as optical microscopy, X-ray diffraction, and electron microscopy are commonly used to study the properties of silicon wafers. These techniques provide detailed information about the microstructure of the material, including the size, shape, and distribution of defects and impurities. This information is crucial for optimizing the properties of silicon wafers for use in various applications, such as solar cells or electronic devices.

Overall, the study of silicon wafers is an active area of research, and new techniques and methods are continually being developed to improve our understanding of these materials. By combining traditional techniques with emerging methods, researchers can gain a more complete picture of the properties of silicon wafers and optimize their use in various applications.
The Element House was transported on three tracks from Chicago to Urbana in August 2013. Built in 2007 to compete in the U.S. Department of Energy’s Solar Decathlon, the totally solar-powered house has been on display at the Chicago Center for Green Technology for the past five years where several thousand visitors toured the house when it was featured during Biosciences Institute (EBI) Research Farm just south of the U of I campus.

“This new facility is an ideal location to accommodate the Element House,” explained Robert Coverdill, MechSE’s director of advancement and outreach. “The intention of the Solar Decathlon team was always to return the Element House to a suitable location on campus where the building could be used for ongoing education and research in renewable (clean) energy, and where it could be viewed by visitors, especially local K-12 school groups.”

The Element House was designed and built by a collaborative team of architecture, engineering, and industrial design students to compete in the competition, held in Washington D.C. on the National Mall. After two years in planning and development, the University’s first Solar Decathlon entry finished 9th overall in 2007.

The University of Illinois is the only school to be invited to each of the past three Solar Decathlon international events hosted in the United States, earning 2nd place honors in 2009, and 7th place overall in 2011.

“Because the 2013 Solar Decathlon team is participating in China, there have been fewer local project opportunities to engage the very large Solar Decathlon USD (registered student organization),” Coverdill noted. “We see this house as providing just such an opportunity.”

It will likely take two semesters to fully refurbish and update the house, with a “grand reopening” possible at the end of the spring 2014 semester. Since opening in 2007 the EBI Research Farm has welcomed more than 2,000 visitors ranging from top executives from BP and Under Secretaries of Agriculture and Energy, federal program managers, and EPA staff, to various environmentalists and land-owners from across the U.S. and around the globe.

“This is the largest experimental farm in the U.S., dealing with second generation sustainable bioenergy crops, and supports a wide range of rural bioenergy projects and assessments of environmental services,” said EBI Farm Manager Tim Mies. “Combining the Element House with the Energy Farm will increase the visibility of both. While the houses may provide accommodation for short-term research visitors, this location will also provide a one-stop site to a collection of diverse interdisciplinary research activities addressing the challenges of climate change.”

After six years “on tour,” the University of Illinois’ Element House returned home in August 2013. Built in 2007 to compete in the U.S. Department of Energy’s Solar Decathlon competition, the totally solar-powered house has been on display at the Chicago Center for Green Technology for the past five years where several thousand visitors toured the house when it was featured during a Green Tech conference in 2007. Its new home will be located at the Energy Biosciences Institute (EBI) Research Farm just south of the UI campus.

One major problem with keeping a flame stable is how to deal with “turbulence” from the motion of moving parts or moving air. Almost all practical applications of combustion operate under turbulent conditions of some kind. Matalon and his group have researched how quickly a turbulent flame propagates—a property crucial to determine the mean fuel consumption rate of a combustion system. This information could be incredibly helpful for optimizing internal combustion engines and improving current models of similar systems.

“Jigar Shah specializes in the study of electrochemical transport of electrical current and heat are carried through a material. These characteristics are very important in a thermoelectric material, especially when the goal is to make the electric conductivity high and the thermal conductivity low, but there are no cheap and abundant materials with these characteristics. They decided to find a material that they could change the characteristics of in order for it to meet the necessary standards.
“Just before our work began,” Sinha said, “a discovery was made that if silicon was structured as a nanowire, the thermoelectric energy conversion efficiency gets a significant boost. So our project here involved using silicon nanowires in a scalable fashion, trying to engineer it to be able to boost energy conversion efficiency, and to understand the physics of transport inside this structure.”

This effort took interdisciplinary cooperation between faculty members and departmental affiliates from three College of Engineering departments: Professors John Rogers and David Cahill from Materials and Engineering; Associate Professor Xueling Li from Electrical Engineering; and Sinha and Department Head Placid Ferreira from MechE.

Nicholas Fang, formerly an assistant professor in MechE, and now an associate professor at Massachusetts Institute of Technology, also collaborated on the project, in addition to approximately 20 students across the three departments.

Waste heat doesn’t just come from polluting sources of energy—thermoelectric energy conversion can be used with all types of energy production, including alternative sources such as solar power and biofuels.

“It’s going to be there for the vast majority of energy solutions that are being talked about,” Sinha said. “It’s nature’s garage. No matter what energy portfolio you create, there will be a significant advantage to be able to get waste heat and convert it at low cost.”

More robust controls can limit wasted energy in power plants

The U.S. electrical power grid is one of the largest machines in the world. It is made up of 5,200 utilities, whose companies sell $600 billion worth of electricity a year. Efficiency in the power plants that generate this electricity is very important to reduce waste and keep prices from rising.

Professor Benjamin H. Cho, whose research interests lie in the control of nonlinear and distributed parameter systems as well as network control, has been working with the Electric Power Research Institute to improve the performance robustness of its power plant control systems. A system with poor performance robustness is very sensitive to changes in the plant’s core parameters, which can lead to excessive waste and pollutants.

“The control system performs less well if the parameters change, and this deficiency can only be marginally affected through tuning,” Bement said. “This is a pervasive plant operation maintenance problem. If something changes, someone has to show up and tune the system. Something changes again, someone has to come in and tune. Tuning is a very difficult thing, and this creates a maintenance nightmare.”

Bement found two solutions to this problem: introducing iterative, self-tuning control, where the control clusters of the power plant would tune themselves in response to changes in core parameters; and “rebootification” of the clusters, correcting the structural deficiencies of the existing clusters by inserting additional control elements. Tests on a simple model showed the “rebootification” method can improve the performance by up to three times. Replacing the existing clusters with an iterative, self-tuning control could improve it by up to 30 times. However, the “rebootification” method is much more preferable to the power plants, because self-tuning control clusters would require replacing the existing ones with a system that operators may not be able to understand.

“In many manufacturing industries, the operator wants to be the ultimate control authority on the process if something goes wrong,” Bement said. “In order to do that, the operator has to have a grasp of what the controller does. An operator would have no insight into what’s going on with an advanced feedback control design. And as a result, industry has not been accepting it very well.”

So to make something that will still improve the robustness and efficiency of existing clusters, without blinding the operators to the processes going on inside, Bement took control cluster elements from a full-order advanced control design and placed them on top of the clusters. The system has performed well on simple models. The next step is to test it on a high-fidelity simulator of a power plant’s control system, before it is actually implemented in a power plant. Once it is, Bement said, it should improve the efficiency of the plant and reduce waste.

Alumni in Energy: Greg Haas

Greg Haas (BSME ’97, MSME ’89) is the manager of research, integrated oil, and gas at Hart Energy, a leading provider of news, data, and analysis for the global energy industry. In 2012, Haas was the lead author on a report titled “Refining,” which analyzed and projected crude demand, oil and gas consumption, and refinery margins for the next five years. He has worked with Exxon, the Electric Power Research Institute, and with pipeline and power consulting firms.

Alumni in Energy: Donald Langley

Donald C. Langley (BSME ’78) is the Senior Vice President and Chief Technology Officer of The Babcock & Wilcox Company (B&W), where he oversees research and development projects such as those related to clean coal technology development. B&W provides services such as engineering, manufacturing, and facilities management to energy companies all over the world, including clear and renewable energy producers. Langley has been with B&W since 1973.
In September 2013, the sixth annual Cusp Conference—a gathering of designers, artists, professors, and other innovators who share unique, potentially world-changing design ideas—was held in the main auditorium at Chicago’s Museum of Contemporary Art. Among these highly accomplished professionals was MecSHE graduate student Sanat Bhole (BSME ’13), who presented to the audience his experiences working on electric vehicle technologies and the importance of student-led design.

Cusp organizers say it is “a conference about the design of everything.” The 2013 presenters ranged from the designer of NASA’s Johnson Space Center and the inventor of an electric cargo scooter, to the creator of the University of Illinois’ new model of MBA projects, which seeks to create a series of technologies that weren’t currently being considered at the University or among the other design teams, they came across several major speed bumps. With limited resources, their approach to design a simple but functional chassis resulted in the extensive use of aluminum honeycomb, which was easy to fabricate but proved to be too heavy and lacking in structural rigidity and reliability.

“If you go to our shop at the University, you can still see black and white pieces (of the aluminum) that fell off after we came back from the competition,” Bhole said.

For the 2013-14 car, the Illini EcoConcept team decided early on that they were interested in excelling in the requirements of the competition, to push themselves even further into innovative territory. They wanted their vehicle to travel at least 30 miles per hour, have a fuel efficiency of 100 miles per gallon, and offer a comfortable ride for the driver and passenger. Of course, with great expectations come great challenges. As the team strove to incorporate novel technologies that weren’t currently being considered at the University or among the other design teams, they came across several major speed bumps. With limited resources, their approach to design a simple but functional chassis resulted in the extensive use of aluminum honeycomb, which was easy to fabricate but proved to be too heavy and lacking in structural rigidity and reliability.

“Students come to class and see that modern dance isn’t just what Azeredo refers to as a ‘project’ or a ‘carrier’; it’s fun, it’s creative, and it has important implications for my future teaching goals.”

For the 2013 competition, Bhole said the car’s major advancements will be the use of a new, lighter, and more efficient fuel cell and a focus on improving the efficiency rather than the practicality of the vehicle.

Bhole concluded his presentation to the Cusp Conference audience by reiterating that student-led design is vital because it “engages students, stimulates innovation, and develops outstanding students into outstanding professionals.” He furthered his work as a researcher for the Army Corps of Engineers and as a graduate research assistant for Professor John Rogers, while working toward his M.S. in mechanical engineering.

MecSHE graduate student Sanat Bhole presents at the Cusp Conference in September 2013.

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American Society of Mechanical Engineers (ASME)

To help attract freshmen, ASME hosted a Freshman Conference geared toward helping new students understand the MechE flow chart and learn more about future classes. The conference closed with a design competition in which students were challenged to build a mechanism to launch a marshmallow as far as possible. For the 2013 homecoming parade, the ASME Special Projects Committee built a "300" movie-themed float to help reduce rolling resistance and drag. The vehicle's engine has also been updated. The new model features a spoked sprocket and a wheel that is 40 percent larger while increasing drag forces only by about 15 percent. Work on the vehicle's engine has also begun. Eco-Illini's goal with the new engine is to reduce fuel consumption by adding variable ignition timing and fuel injection while also increasing the compression ratio and reducing displacement. The society continues to dyno-test and EFI tune the engine.

Eco-Illini

In Fall 2013, the Eco-Illini car was no longer suffering from drivetrain and electrical reliability issues that cropped up in Spring 2013. Eco-Illini's new car accommodates a larger-diameter wheel to help reduce rolling resistance and drag. Designed to be lighter than in the past, the new model features a spoked sprocket and a wheel that is 40 percent larger while increasing drag forces only by about 15 percent. Work on the vehicle's engine has also begun. Eco-Illini's goal with the new engine is to reduce fuel consumption by adding variable ignition timing and fuel injection while also increasing the compression ratio and reducing displacement. The society continues to dyno-test and EFI tune the engine.

Illini EcoConcept

As the society continues to participate in student-led design, the team decided to build a more compact, one-person vehicle this year to cut material usage and costs as well as drop overall weight from the car. This year's vehicle will also include a new fuel cell with a more efficient direct-drive power train package, which will limit mechanical losses found in more traditional drive systems that use chains, sprockets, and differentials. In September 2013, former President of Eco-Urban Concept Santan Thibodeau gave a lecture in Chicago (see page 16). "I feel that student-led design certainly is beneficial for students," Thibodeau said. "If industry doesn't support these types of endeavors, who knows how many innovators and inventions we might miss out on in the future?"

Formula SAE

In May 2013, the Formula SAE team finished third and was the top U.S. team at the Formula North competition in Barrie, Ontario, Canada. At the Missouri State and Technology Autocross in September 2013, Formula SAE's car had the fastest time and took first place in the competition. The team returned home with a set of Hoosier tires as its prize. In May 2014, the society plans to attend the Formula SAE Michigan competition. FSAE also hopes to compete at Formula Student Germany in Hockenheim during Summer 2014. The contest requires teams to build a single-seat formula racecar to compete against teams from across the globe. The team with the best overall construction, performance, and financial and sales planning takes first place. Experts from auto, motorsport, and supplied industries will judge the teams' cars and plans.

iRobotics

In Fall 2013, the i-Robotics team displayed its entry from a Jerry Sanders Design Competition. This robot won the consolation prize. In terms of outreach, IFE will attend Mahomet, Illinois, and talk about the science behind electric race cars. The society also hopes to work with the Aerospace Engineering Department to attend Space Day.

Pi Tau Sigma (PTS)

In Fall 2013, PTS members helped to host Engineer- ing Family Night. About 50 families attended the event and partook in any of seven activities set up in different rooms, including mining for chocolate and balancing dominos. The society continues its outreach visits to Booker T. Washington School, a local middle school, to lead an after-school club featuring hands-on projects focused on math, science, and engineering principles. With these opportunities, the society hopes to introduce students to STEM fields at an early age. In Spring 2014, Texas A&M will host the PTS National Convention. Illinois’s chapter will send at least five members to attend and connect with other chapters. As PTS nears its 100-year anniversary, the society begins to make plans for a celebration in Spring 2015. The Illinois chapter will send invitations to more than 150 chapters across the nation to attend an annual awards ceremony, panel for company representatives, social events for networking, and more.

Society for Experimental Mechanics (SEM)

SEM kicked off 2013-14 with three times as many members as in previous years and numerous projects to begin designing. In November 2013, the society participated in the Punkin Chunkin competition, which challenges competitors to engineer a device that will launch or “chuck” a pumpkin as far as possible. The society has two teams working on their own t-shirt cannon for a university-wide competition, tentatively scheduled for Homecoming 2014.
Scholarships

Scholarships are an important way of making it possible for undergraduate students from Illinois and around the world to attend the University. Listed below are MechSE’s scholarship recipients 2013-14. We congratulate these students and would like to express our thanks to the alumni and friends who made these honors possible.

MechSE Endowed Scholarships

James W. Ashbrook
Alumni Foundation of Illinois
Scott Zacek
Cassidy Warning
Justin Hunter
Scholarship
Vincent Hughes
Patrick B. and Janet Jerome Orzech Scholarship
Donald E. Carlson Scholarship
recipients 2013-14. We congratulate these students and would like to express our thanks to the alumni and friends who made these honors possible.

Athrey Nadhan
Athrey Nadhan Scholarship
Nicha Viraporn
Thomas J. Breen and Paul A. and Edna M. Michael Martin
Scholarship
Angela P. Davis
A. Richard Ayers Scholarships
James W. Ashbrook
Karl W. Kolb and Emily Weerakkody
Erle E. Johnson Corporation
Brett Glasner
Zachary Renwick
Miles and Louise Scholarships
Sonja Brankovic
Ray L. and Edna P. Sewigert Memorial Fund
Kylie Johnson
Charles K. Taylor Scholarship
Anheuser-Busch Foundation
Monica Ngo
Caterpillar Scholarships
Alejandro Schloeffl
Robert D. and Dianna thawp Family Foundation Scholarship
Robert Bosch Tool Corporation
Michael Lynch

We’d like to hear from you! If you have news you’d like to share with us and your fellow alumni, please contact Betty Brown at epowers2@illinois.edu. Thanks!

Grant

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If you have news you’d like to share with us and your fellow alumni, please contact Betty Brown at epowers2@illinois.edu. Thanks!
Launched in MechSE, Microlution now rewarding alums’ efforts in Chicago

“IT all started at Illinois in grad school,” said Andrew Honegger (BSME ’03, MSME ’05). “More specifically, it started in the research group of Professor Shiv Kapoor and the late Professor Richard DeVor. The “IT” is Microlution, which is now a 24-employee company that designs and manufactures specialty machines that create tiny, high-precision parts on machines among other emerging technologies at the International Manufacturing Technology Show (IMTS) at McCormick Place in Chicago. We had people come by from places that were cool-sounding to us, like the jet propulsion laboratory, places that were cool-sounding to us, and that were levels when Illinois was when the company’s roots were planted and the founders showed the dedication and perseverance it takes to keep their dream afloat.

“They are a lot of horror stories that we have about starting the company, and there were a number of times when Andy and myself had a U-Haul truck with the entire contents of our dorm room in it. We spent hours moving out and then packing it up. The sooner you find that out and try to figure out a way to fill in those gaps. The sooner you find that out and try to address it, the better.”

Kathryn Svoboda became the 99th MechSE alumna at Microlution in 2011.
Alumni in Memoriam

1949
Almon Joseph Frost, 12/29/2012
Chester Max Peterson, 10/09/2012
Royce E. Beckett, 07/10/2012

1956
Arthur G. Kozacka, 06/01/2013
Bernard Fred Kalvagiou, 08/29/2012
Elmer Narcisi, 05/15/2013
Forest Eugene Block, 02/07/2013
Fred Abdul, 10/10/2012
Gene E. Hayward, 09/17/2012
John D. Dwyer, 06/26/2012
Robert H. Mitchell, 09/09/2012
Robert J. Lankin, 06/13/2013
William Edward Dearlove, 09/19/2012
William Francis Barbour, 10/31/2012

1961
Roger T. Henry, 12/08/2012
Wallace J. Beck, 01/14/2013

1963
Frederick G. Bauling, 09/09/2012
John F. Loos, 01/10/2013
Loren Noia Montgomery, 08/15/2012
Wayne R. Nixon, 06/05/2013

1964
William E. Dobus, 06/22/2013

1965
Harvey B. Kapriel, 09/01/2012
Richard J. Teutsch, 06/01/2013
Donald Wayne Hageman, 01/18/2013

1967
Gilbert L. Burns, 11/27/2012

1970
Malvin B. Partridge, 08/27/2012

1973
National Board for the year 2014

1977
Robert H. Mitchell, 09/09/2012
William Edward Dearlove, 09/19/2012
William Francis Barbour, 10/31/2012

1982
Jeffrey Allen Moorehouse, 05/12/2013

1984
Jimmie Glen Hangartner, 09/28/2012
Robert Earl Woods, 07/20/2012

1984
Chester J. Carlson, 09/12/2012
Gerald A. Moyer, 07/05/2012

1986
John Victor Larson, 01/24/2013

1987
Bruce H. Mauritzon, 10/31/2012
Robert G. Baillie, 08/18/2012

1988
Charles A. Rose, 09/12/2012
Ronald J. Placke, 12/21/2012

1989
George Earl Stiler, 11/04/2012

1990
Ninidra Kruke Cooksey, 12/07/2012

1992
Gregory T. Ball, 01/29/2013

2004
Christopher L. Sanger, 02/25/2013

2004
Melvin B. Partridge, 08/27/2012

2007
Michael Healy Pleck, 06/15/2013

2011
Mark C. Peterson, 02/15/2013
Michael A. Swinn, 02/10/2013

2013
Dennis A. Schwertman, 09/09/2012
Don Letffoy Thompson, 08/10/2013

2013
Victor Michael Parker, 06/03/2013

2013
Ronald L. Barsema, 10/09/2012

2013
George Earl Sliter, 11/06/2012

2013
Charles A. Bouc, 09/12/2012

2013
Gerald J. Moyar, 07/05/2013

2013
David Scott Troeger, 08/06/2013

2013
Jimmie Glen Hangartner, 09/28/2012
Robert Earl Woods, 07/20/2012

The MechSE Alumni Board held its Fall 2013 meeting at the Illini Center in downtown Chicago.

From the MechSE Alumni Board

We are restarting the Alumni Board meetings, held in the spring and fall, from the single meeting we have been holding the last several years. This will greatly help us to support additional initiatives, which we will be sharing soon. At our Fall 2013 meeting, Thomas Donovan (BME ’82) of Barnes & Thornburg LLP was named the new vice president of the board. He brings tremendous energy and ideas. Having settled in Chicago he also has a local Illinois presence. I wish to thank and acknowledge Professor Joseph Powers (BME ’85, MSME ’85, PhDME ’86) of the University of Notre Dame for his outstanding service as the outgoing president of the board.

We also receive tremendous support from MechSE’s director of advancement and outreach, Robert Coverdill (BME ’83, MSME ’85), and its coordinator of student and alumni relations, Betsy Powers (BACOM ’86). If you are looking to connect with the department or the board, I urge you to reach out to them. As we work to give back in support of the department, its students, and alumni, we are always open to your ideas and help. Let us know your thoughts.

Being an alumnus of both Mechanical Engineering and Theoretical & Applied Mechanics at the University of Illinois means a lot to me—it has contributed to everything I have done personally and professionally. To me, serving on the Alumni Board is just one small way I can give back to the department and university! Join me in sharing your own alumni story and in giving back to the department and university!

Sincerely,
Eric N. Brown
President, MechSE Alumni Board of Directors
MechSE graduates head out into the world prepared to succeed, and many of them do so through entrepreneurship. We are proud to feature several of these business pioneers here, helping to build the incredible contacts available to our graduates through the MechSE alumni network.

We want to continue building this network of MechSE start-ups, so if you have started your own business, we want to hear from you. Please contact us at MechSE.Advancement@illinois.edu and tell us about your company.

Allomet Corporation
Richard Toth (BSME ’83, MBA ’97) www.allomnet.com
World-renowned manufacturer of fuel cells for portable energy production

Bump
Adam Boehler (BSME ’11) www.madebybump.com “OpenSocked” prosthetic-arm tethers, and counterbalances Newell Instruments NEW
Ben Newell (BSME ’12, MBA ’16) www.newellinstruments.com Green energy systems and solutions. Originally revolving around customized electronic concentration sensors, Newell Instruments’ expertise now spans energy conversion, air conditioning, refrigeration, heat transfer, fluid mechanics, controls and instrumentation, solar energy, and building technology.

Inventables
Zachary M. Kaplan (BSME ’11) www.inventables.com “The designer’s hardware store / online sales

JCC Energy-Solutions, LLC
Jack C. Ciesa (BSME ’71) www.jccenergy.com Energy efficiency for industrial manufacturers

J.L. Meece Engineering, Inc.
Jerry L. Meece (BSME ’97) www.jlmece-eng.com Engineering consulting in manufacturing

Microtollation
Andrew Honeyger (BSME ’05, MSME ’08), Andy Phillips (BSME ’09, OMK Bhatacharya) (BSME ’08, MSME ’14) www.microtollation-inc.com Machines for manufacturing small parts (see page 22)

Servabo
Timothy Dorney (BSME ’06, MSME ’09, PhDME ’11), Nishant Ismail (MSME ’11) www.servabo.com “AIcAlert” personal protection device, designed to connect to and utilize smart phone-to-machines to make distress calls.

Three Sigma Manufacturing, Inc.
Ken Frankel (BSME ’77) www.3sigmaeq.com Three Sigma’s 18,000-square-foot facility in Kent, Washington, houses a variety of machinery including CNC mills, CNC lathes, CNC grinder, wire EDM, grinders, and inertia welding. Its high-end CAD/CAM capability (Pro/Engineer) allows its technicians to efficiently model and generate CNC cutter paths.

Vulcan Spring & Manufacturing Company
Alexander Rankin V (BSME ’57) www.vulcanspring.com A leading spring manufacturing providing flat steel springs, retrackable display security tethers, retail cable tethers, and cable cinch lanyards.

Biovic Science
Gary Holmes (BSME ’66, MSME ’72) www.z-bioscience.com Founded by Holmes, a MechSE distinguished alumnus (1990), Biovic Science is a biotechnology company based on the application of microorganisms as a mechanism to eliminate pathogenic bacteria without creating antibiotic and antibiotic resistant “superbugs.” The range of applications for this technology spans across human, agricultural, commercial, and industrial markets.

Leonardo P. Chamorro
Assistant Professor Leonardo P. Chamorro joined MechSE in August 2013. For the fall 2013 semester, Chamorro taught the Theoretical and Applied Mechanics course TAM 538: Turbulence. He also advised a group of students in the senior design class ME 470 who built a hydrokinetic device, and the independent study class ME397, which focuses on mathematical analysis of vortices-induced vibration in complex systems.

Chamorro received his B.S. in civil engineering from the University of Chile, and his M.S. and Ph.D. from the University of Minnesota, where he then worked as a research associate in the St. Anthony Falls Laboratory. There he helped found the lab’s renewable energy program.

Chamorro’s research specializes in fluid dynamics, particularly turbulence and boundary layer flow phenomena. Please see page 5 of this magazine, in the energy research section, for more details on Chamorro’s research.

One of the most exciting business programs on campus is the Bud Select twin turbine boat that was powered by two 2,800 horse-power (tying J10’s gas turbines) and rode smoothly over 200 miles per hour. The company has supplied precision machined components to the marine industry since 1989.

Innoventor
Kent Schien (BSME ’83) www.innoventor.net Entrepreneurial design-build engineering firm

Newell Instruments NEW
Ben Newell (BSME ’12, MBA ’16) www.newellinstruments.com Green energy systems and solutions. Originally revolving around customized electronic concentration sensors, Newell Instruments’ expertise now spans energy conversion, air conditioning, refrigeration, heat transfer, fluid mechanics, controls and instrumentation, solar energy, and building technology.

Oso Technologies
Michael Clemenson (MSME ’12), Eduardo Torredch (BSME ’11) www.myosolink.com Smart technology producer for gardening, taking the watering of plants to a new level of ease and accuracy.

PrairieFyke Consulting, Inc.
New Drow Crownell (BSME ’08, MSME ’10), Michael Lopes (BSME ’91) www.plfci.com Prairiefyke Consulting is an engineering consulting company that analyzes system sensitivities and simulates manufacturing of products to make the design insensitive to variation. It incorporates variations from sources including manufacturing, the environment, time, and the user, quantitatively predicting quality, performance, and fit-to-validate products before production.

Sameh Tawfick
Assistant Professor Sameh Tawfick brings to MechSE his research program in scalable nanomanufacturing, a field that bridges the gap between manufacturing research and nanomaterial science.

“There’s been a myriad of recent discoveries of new types of nanomaterials and individual nanomaterials with outstanding electrical and mechanical properties,” Tawfick said. “As mechanical engineers working on these, we want to bring them into the environment here. This means that of Associate Professor Tonghue Lee. Lee was previously an associate profes-

Serapho
Timothy Dorney (BSME ’06, MSME ’09, PhDME ’11), Nishant Ismail (MSME ’11) www.servabo.com “AIcAlert” personal protection device, designed to connect to and utilize smart phone-to-machines to make distress calls.

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New companies are now to this magazine, not necessarily to the marketplace

Tawfick received his bachelor’s and master’s degrees in mechanical engineering from Cairo University in Egypt. Between receiving those degrees, he carried out a postdoctoral associate at the Massachusetts Institute of Technology (MIT). For his Ph.D. research, Tawfick developed a process to manufacture multifunctional carbon nanotube surfaces and fibers using capillary forces. Capillary forces act on the surfaces of liquids and are what enable certain insects to walk on the surfaces of ponds and lakes.

“These forces are not as weak as we tend to think; and they can perform manufacturing work,” Tawfick said. “At the nanoscale they have two advantages: their magnitude can deform solids, and their direction can be locally self-controlled. This means that those liquid molecules can be programmed to do a specific mechanical job at very small scales. By simply submerging a large surface having millions of sparse nanotubes in a liquid, and drying it under controlled conditions, capillary forces can organize the nanotubes into more robustly integrated assemblies with enhanced bulk properties.”

Tawfick is also part of the MechSE teams implementing a new competition in ME371, known among the students as “the dart project,” where students design and build a mechanism to throw darts at a dart board. In parallel, he is developing a new 400-level nanomanufacturing class, which he intends to offer next year. The class will cover the fundamental principles and challenges of scalable nanotechnologies, including self-assembly, electro-hydraulic jetting, nano-molding and imprinting.

“learn by making,” he says, “so I am planning for this class to have hands-on activities.”

Part of what drew Tawfick to Illinois, he says, was available resources for micro- and nanoresearch, and above all the pioneering faculty in these fields. “I think the labs at Illinois are unmatched.” Tawfick said. “Their organizational structure also makes them accessible, especially to young faculty. Collaborations on research and education are integrated into the environment here.

“This is not just a philosophy here,” Tawfick said. “And my family and I feel that we are truly welcomed.”

Lee received his bachelor’s degree in mechanical engineering in 2000 from Yonsei University in Seoul, South Korea. He then moved to the United States, where he completed his master’s degree (2002) and Ph.D. (2006) in mechanical engineering at Stanford University. He says he had two main reasons for coming to Illinois:

“...and a lot of people in my field that I can interact with. Those are the main reasons I came to Illinois.” Please see page 11 of this magazine, in the energy research section, for more details on Lee’s research.

Tonghun Lee
Another new face in the MechSE department is that of Associate Professor Tonghun Lee. Lee was previously an associate profes-

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Timothy Dorney (BSME ’06, MSME ’09, PhDME ’11), Nishant Ismail (MSME ’11) www.ser Luna Technologies
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New Drow Crownell (BSME ’08, MSME ’10), Michael Lopes (BSME ’91) www.plfci.com Prairiefyke Consulting is an engineering consulting company that analyzes system sensitivities and simulates manufacturing of products to make the design insensitive to variation. It incorporates variations from sources including manufacturing, the environment, time, and the user, quantitatively predicting quality, performance, and fit-to-validate products before production.

Sameh Tawfick
Assistant Professor Sameh Tawfick brings to MechSE his research program in scalable nanomanufacturing, a field that bridges the gap between manufacturing research and nanomaterial science.

“...and a lot of people in my field that I can interact with. Those are the main reasons I came to Illinois.” Please see page 11 of this magazine, in the energy research section, for more details on Lee’s research.

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Faculty News

Narayana Aluru is the director of the new Computational Science and Engineer -
ing program at Illinois, through which undergraduate students within the College of Engineering and other selected departments can earn a Certificate in Computational Science and Engineering as part of their regular coursework.

Kenneth Christensen has been named a Fel -
low of the American Physical Society. This honor is bestowed to no more than one half of one per -
cent of the society’s membership.

Harry Dankowicz co-authored the book Recipes for Continuation, which was published in May 2013 and is meant to be used in tandem with the Computational Continuation Code (COCO) program. He teamed up on both the book and program with Dr. Frank Schilcher from the Technical University of Denmark.

Randy Ewoldt received National Science Foundation funding for “HAGGIE: Hagfish Defense Gel and the Rhology Zoo,” which will establish his Rhology Zoo project. The Zoo will be a venue for part of a six-week summer program to help incoming students transition to college, including a large number of students from underrepresented groups. Ewoldt also received ASME’s Pi Tau Sigma Gold Medal for outstanding achievement within 10 years after graduation.

Jonathan Freund is co-leading the new Center for Exascale Simulation of Plasma-Coupled Combustion, funded by the National Nuclear Security Administration, which is part of the Department of Energy (see page 6).

John Georgiadis was interviewed by National Geographic, which published the interview in September 2013. The topic was the functionality of gas masks, which emerged as an area of national interest in the wake of alleged chemical weapons attacks in Syria.

Nick Glumac will be conducting research for the new Center for Exascale Simulation of Plasma-Coupled Combustion, funded by the National Nuclear Security Administration, which is part of the Department of Energy (see page 6).

SungWoo Nam was awarded a research grant from the U.S. Air Force (AFOSR/AODA). This grant supports research at the con -
vergence of nano, bio, and information technology (NBIT). A total of eight projects were funded to advance the NBIT research related to the U.S. Air Force, all at top U.S. uni -
versities. Among these, Nam was the only junior faculty member se -
lected for this funding.

Martin Ostijo -

ra -

kar -

Kowarski received funding for his personal Fractal -

Patterns in Frac -

ture and Damage Phenomena from the NCSA/JACAT Fellows program, along with MechSE Adjunct Asis -
tant Professor Seid Koric. He was appointed Associate in the Center for Advanced Study for 2013-14. Ostijo-Starzewski also was inter -
viewed and published in Interna -
tional Innovation. The interview was titled “Interpreting Patterns in Materials” and his article was titled “The Inner Workings of Fractal Materials.”

Carlos Pantano -

Rubino will be con -
ducting research for the new Center for Exascale Simulation of Plasma-Coupled Combustion, funded by the National Nuclear Security Administration, which is part of the Department of Energy (see page 6).

William P. King pub -
lished a paper on py -
roelectric electron emission that became the No. 1 download on Applied Physics Letters for a period of several months in 2013. Other contributors to the paper were Patrick C. Fletcher, formerly of King’s research group, as well as Vengadesh Kumara R. Mangalam and Lane W. Martin from Materials Science and Engineering. King also received ASME’s Pi Tau Sigma Gustav L. Larson Memorial Award for outstanding achievement 10 to 20 years after graduation.

In Memoriam

Elna Luks, faculty emeritus, died September 20, 2013. He was 91. A professor at Illinois from 1955 to 1988, Luks was also an alumnus of the department, having received his MSEE degree in 1950 and Ph.D. degree in 1953. The late Dr. Helmut Kortz was Luks’s faculty advisor. Despite economic and political un -
certainty, Kortz courageously left China to pursue education in the United States, inspir -
ing and enabling relatives to follow his path. In his 50-year academic career at the Univer -
sity of Illinois and Florida Atlantic University, he developed novel analytical and numerical methods to address complex fluid and gas dynamics problems, delivered practical and valuable solutions to the aerospace industry (including the U.S. Space Shuttle program), and passed along lessons learned to inter -
estigated colleagues and students of all ages.

Frederick A. Leckie, MechSE professor emeritus and former department head of Theoretical and Applied Mechanics, died June 14, 2013 in New York. He was 84. A member of the TAM Department from 1978 to 1988, Leckie served as department head for four years beginning in 1984. During his first six years at Illinois, he held a joint professor position split between TAM and Mechanical Engineering. In February 1988, he left Illinois to become head of the mechanical engi -
nering department at the University of California at Santa Barbara. Leckie was born in Dundee, Scotland, and obtained his bachelor’s degree from St. Andrews. In 1954, he came to the United States and received an M.S. in Civil Engineering in 1955 and a Ph.D. in Engineering Mechanics in 1957, both from Stanford University. While serving as a lec -
turer at Cambridge for nearly 10 years, Leckie col -
laborated on a textbook, Matrix Methods in Elasto -
mechanics (McGraw-Hill, 1963). During the 1944-45 academic year, he was a visiting associate professor at Brown University. In 1968, he authored a book on Engineering Plasticity which was published by Cam -
bridge Press. He was also in 1948 that Leckie left Cambridge to become professor of engineering at Leicester University, where he stayed for ten years before coming to Illinois.

Myunghoon Seong, post-doctoral scholar in MechSE, passed away on July 30, 2013. Born in 1977 and raised in Seoul, South Korea, he received a B.S. degree with honors in Mechanical and Aerospace Engineering from Seoul National Uni -
versity (SNU) in 1999, and an M.S. degree in Me -

chanical Engineering from Stanford University in 2001. Seong served as a naval officer at the Repub -
lic of Korea Naval Academy from 2002 to 2005. He returned to the United States and earned his Ph.D. degree in Mechanical Engineering from the University of California at Los Angeles in 2009 for his research on thin film valves based on micro-electromechanical systems (MEMS). He joined MechSE in 2009 and worked with multiple faculty members in the department. Seong notably con -
tributed to the development of silicon-based ther -
molectric heat engines for waste heat recovery. An expert in semiconductor micro-fabrication, he performed key measurements on the thermoelec -
tric properties of silicon nanostructures. Seong is survived by his wife, Eun, and four children, as well as his parents and siblings.

Spring 2014
G-BAM Camp proves girls make awesome mechanical engineers

A ccording to MechSE associate professor Matthew West, “I’ve talked to some of our undergraduates, and you hear them say, ‘Engineering’s not like what I really thought it was. I somehow wound up here, and actually it’s really cool now that I’m here.’ I always think, ‘Oh, if only we could have told them beforehand that it’s going to be this fun.'”

During the first-ever G-BAM (Girls Building Awesome Machines) G.A.M.E.S. camp held in July 2013, West got his wish. He and Assistant Professor Elif Ertekin, who together co-directed the camp, and numerous other excited MechSE, graduate students, and undergrads got to show 16 high school girls how much creativity there is—and how much fun can be had—in mechanical engineering. Since the overall theme of the camp was energy, the main overarching project for the camp was designing and building wind turbines, which culminated in an end-of-the-week competition to see whose wind turbine produced the most power. The girls worked on the projects every day over the course of the week.

The goal of G-BAM planners was to equip the girls to address difficult problems and figure out how to solve them by offering a balance between guided options, while leaving some room for design creativity and flexibility. After learning how to use CAD to design their wind turbines, the girls then participated in a variety of activities introducing them to manufacturing technologies using machinery available in Mechanical Engineering Laboratory. For example, they experimented with rapid prototyping, 3D printing, sand casting (which involves casting liquid aluminum in sand molds), injection molding, thermal imaging, and other techniques, and then needed to choose one of these technologies to manufacture their turbine blades.

“Part of the whole design aspect was to expose them to manufacturing technologies, and then give them the freedom to decide what they want to make their blades out of,” West said.

The campers also made nano-particles, experienced the clean room, and learned about advanced microscopy using the Scanning Electron Microscope. During a field trip to John Deere, Caterpillar, and JUMP at the Research Park, they experienced many of the tasks engineers undertake in industry. While at Caterpillar, the campers participated in a hands-on project designing a fan for use in a cooling assembly for large equipment. Fans were tested based on air flow produced and stability, while remaining below a temperature threshold.

Another energy-related project campers tackled was to design and assemble solar thermal ovens. The project required the girls to play with design aspects to, for example, figure out what kind of reflector shape and area is optimal for focusing the energy of the sun to a point. The goal? To boil water.

“So we were hoping for a sunny day,” Ertekin said, prompted by the previous day’s heavy storm. According to West, these solar ovens are the type of devices used for cooking in third-world countries to reduce pollution from wood fires.

Both Ertekin and West agreed that, in addition to exposing the campers to fun engineering projects, there were several messages that the girls had to take away.

First: this isn’t your father’s (or your mother’s) mechanical engineering anymore.

“The traditional picture of a mechanical engineer from 30 years ago is very different from today’s mechanical engineers and what we do,” Ertekin said. “So we’re trying to expose everybody to some of these non-traditional things they may not have thought of as being a part of a mechanical engineering career.”

Their second message was that if the girls want to choose a career where they do really matter and can truly help society, they should consider mechanical engineering.

West explained to them that mechanical engineering is about much more than just cars and engines.

“If you want to save the world,” he said, “mechanical engineers, surprisingly enough, have something to contribute to improving people’s lives.”

Keeping this in mind, the camp included what West called a “health impact strand.”

For example, the girls participated in a prosthetics laboratory designed by graduate student Laurie Rustom. This project was spun out of a brainstorm at the Research Park, a non-profit involved in the design of prosthetics for deployment in developing countries. Designed to be manufactured locally in developing countries, the prosthetics are robust and use readily available materials. In addition to the lab on campus, the girls visited hump to see the operation for themselves.

West and Ertekin agreed that while it is great to be politically active and to care about things, in order to have an impact, someone has to design and then actually build something.

“There’s a huge, huge role for mechanical engineers to really drive a lot of these,” Ertekin said. “We, not just we as academics, but we as a society, historically haven’t done a good job of explaining to the public in general what it is that engineers do. It’s at the end of the day, instilling a value in society for engineering, for research, for the societal benefits of these things. It’s it’s up to us, and we need to do a better job of it.”

Overall, the biggest message G-BAM planners hoped to get across was this: engineering is a great career for women. Ertekin and West admit that, for the 16 girls who attended, at least, they hoped to change the mindset that engineers should be men.

“One of these ideas is kind of subconsciously instilled in people’s minds,” Ertekin said. “And I think early, continual, persistent exposure is the key to eliminating that.”

To help combat this flawed perception, the G-BAM camp exposed the girls to a really good group of role models. It involved a huge group of female graduate students, undergraduates, and faculty.

“Not only do the camp participants get to see female role models featured through this activity,” Ertekin said, “but our female undergraduate and graduate students get to see how they can play a role in outreach and in inspiring young students as well.”
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