TRANSPORTATION

ENGINEERING AT ILLINOIS

Rakesh Nagi

Department of Industrial and Enterprise Systems
Engineering Head & Donald Biggar Willett Professor
Fellow, Institute of Industrial Engineers

An expert in location theoretic approaches to facilities design, production systems engineering, information-based manufacturing, and military application of operations research, Rakesh Nagi works at the interfaces between supply chains, logistics, scheduling, distributions systems, facilities design, location, and economic modeling. An early leader in agile manufacturing research, he is widely recognized as one of the top contributors to the field.

A long-time faculty member at the University at Buffalo (SUNY), Nagi served as the chair of their Department of Industrial and Systems Engineering from 2006 to 2012.

" Rakesh Nagi is an exceptional researcher, educator, and respected administrator. His work on the fusion of sensor-based data and human information sources augments our rapidly growing Big Data efforts as part of the $100 million Grainger Engineering Breakthroughs Initiative. "

— Andreas Cangellaris,
dean of the College of Engineering

Message from Rakesh

It is a tremendous honor to undertake the stewardship of the Department of Industrial and Enterprise Systems Engineering. With the support and involvement of our student, faculty, and alumni family, and the collaboration of our peer institutions, I intend to protect the proud traditions of our acclaimed General Engineering and Industrial Engineering programs as we continue to adapt them to the rapid changes in engineering. Our newer tracks in Financial Engineering (page 6), and Systems and Entrepreneurial Engineering, our joint MBA/MS degree, our plans to launch a Masters of Engineering in Advanced Analytics, our relationship with the new Health Care Engineering Systems Center (21), all build upon the 60-plus-year history of the Industrial Engineering degree and General Engineering department as well as the leading-edge research advanced by our excellent faculty.

We are a great school with a great legacy. The University is one of the 37 land grant institutions created by the Morrill Act, fulfilling a democratic promise to provide higher education to the public. The College of Engineering at Illinois is currently regarded as the fifth best engineering school in the nation. Within the college, our department offers a unique opportunity for students in its amalgamation of engineering, communication, and business, expressed through our coursework (courses such as Engineering Law), the flexibility offered students by Secondary Field and Track Options, the vibrant and historic Senior Engineering Project (12), and our myriad ties with industry.

This Annual Report summarizes our year in retrospect, as well as the history of the department, whose roots go as deep as the University itself (2). Our faculty and students have accomplished much in the way of honors, awards, and placement after graduation. 40% of our faculty are now NSF CAREER Award winners, a percentage we believe is unusually high (22). Many scholarships and fellowships are the direct result of support from our alumni. We look forward to subsequent years of even better accomplishments, and improved engagement with all our constituencies. For alumni, our Alumni Board, our Engineer in Residence Program, and the Senior Engineering Project offer avenues to reconnect with the department and help advance our mission (40).

During my first year as department head, I have been gifted to befriend many alumni who still consider our department their home. Going forward, my door remains open to all members of the ISE family. To those who graduated with degrees in General or Industrial Engineering before the merger that created ISE: please know that your fond memories are in good hands. The degree program you remember is as strong as ever and remains open to you, and your participation in setting the direction of the department is welcome. Our team—faculty, staff, administration, and the college itself—continues to grow in size and strength. We invite you to be a part of it.

Contents

Innovate. Serve. Educate. ISE.

ENGINEERING AT ILLINOIS

From the Managing Editor's Desk

Here starts the next chapter in the story of ISE.

Our history is like a state-of-the-art steam locomotive entering a tunnel a century ago and emerging as a computerized bullet train. Okay, I'm up against a deadline, and it's hard to find a metaphor to sum up everything that ISE, its history, and its future represent. But as you'll learn in this issue, our Transportation Building was originally dedicated to teaching railroad engineers, thus the name.

A Google image search on "engineering" still turns up dated images of cogs, slide rules, and pocket protectors, but ISE hosts a diverse faculty implementing radical improvements in big data, optimization, biology, analytics, health care, control systems, decision making, sustainability, design, and environmentalism. After a year working with these minds, I now see the engineering in everything from the thermos I'm drinking my coffee from to the software I'm typing with. Our ISE bullet train continues to rocket into the future of science, discovery, technology, and improvements that make the world better, safer.

And we're very fortunate that (pun intended) the engineer of this train is now our tireless friend Rakesh Nagi.

In this first issue of our annual report and newsletter, you can trace the history of our department, whose roots go back to the very beginning of the University of Illinois, and whose blossoms are entering a phase of fresh growth. You'll also read about numerous accomplishments of faculty, students, and alumni from this past year.

I still have a lot to learn about the department. Luckily, it's small enough that I'm able to meet students, faculty, and alumni one-on-one. Please email me to let me know what you're up to or if you have a story for me. All news is good news. Next year, we hope to add a section for alumni news. I can hardly wait for next issue!

— William Gillespie, Communications and Marketing Coordinator, gillespi@illinois.edu

Photography by L. Brian Stauffer

HISTORY OF ISE

Engineers drawing, ca. 1900

Transportation Building without north wing, ca. 1912

This timeline is a work in progress. Much assistance was provided by College of Engineering archival specialist Bethany Anderson, and Jerry Dobrovolny's *A History of the Department of General Engineering.* We have found no similar document for Industrial Engineering. Please email corrections and additions to William Gillespie at gillespi@illinois.edu, so that we may continue to assemble a more complete history of ISE.

1862
Abraham Lincoln signs Morrill Act establishing 37 public land-grant institutions

1867
Illinois Industrial University, as it was first called, opens

Engineering curriculum founded

1868
James Newton Matthews becomes the University's first student

1870
Instructional program in engineering created with four departments: Mechanical Science and Art, Civil Engineering, Mining Engineering and Metallurgy, and Architecture and Fine Arts. Stillman Williams Robinson, Illinois' first professor and later dean of Engineering, designs an innovative engineering curriculum that includes both science-based lectures and experimental laboratory practice.

Trustees allow women to attend

1885
Illinois Industrial University renamed University of Illinois

1887
Illinois admits first African-American student

General engineering drawing curriculum founded—the roots of ISE

1893
Graduate school and extension program established

James David Phillips first professor tasked to coordinate general engineering drawing curriculum
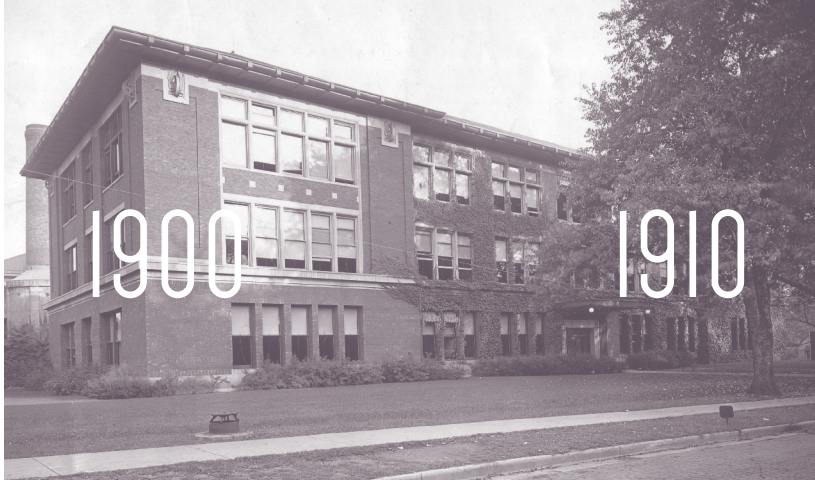
1894
Engineering Hall completed
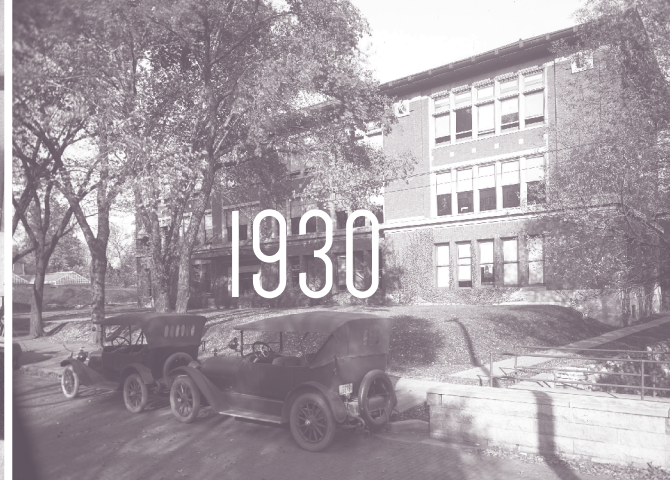
Transportation Building after 1921 with north wing

Transportation Building (view of interior hallway)

Transportation Building, ca. 1918

1900

Illinois graduates its first African-American student

1903

First Engineering Experiment Station in America established at Illinois, it's first experiments are an investigation of reinforced concrete

1904

General Engineering Drawing Department requested

1908

Assistant Dean Fred Duane Crawshaw in charge of general engineering drawing curriculum, vesting responsibility for this program in the Office of the Associate Dean

1910

Harry W. Miller placed in charge of general engineering drawing curriculum; in 1912 he publishes two textbooks: *Mechanical Drafting* and *Descriptive Geometry*

1912

First half of Transportation Building completed in 4 months for $86,000; third floor dedicated to General Engineering Drawing; building houses Department of Railway Engineering—railway motifes can still be found in exterior and banister designs, notably winged locomotive wheels on upper exterior corners

1917

Harvey H. Jordan becomes head of general engineering drawing curriculum

1920

First Engineering Open House

1921

Transportation Building finished, the total cost was $168,000

General Engineering Drawing becomes a department

1924

First College of Engineering Parade

1940 — 1950 — 1960 — 1970 — 1980

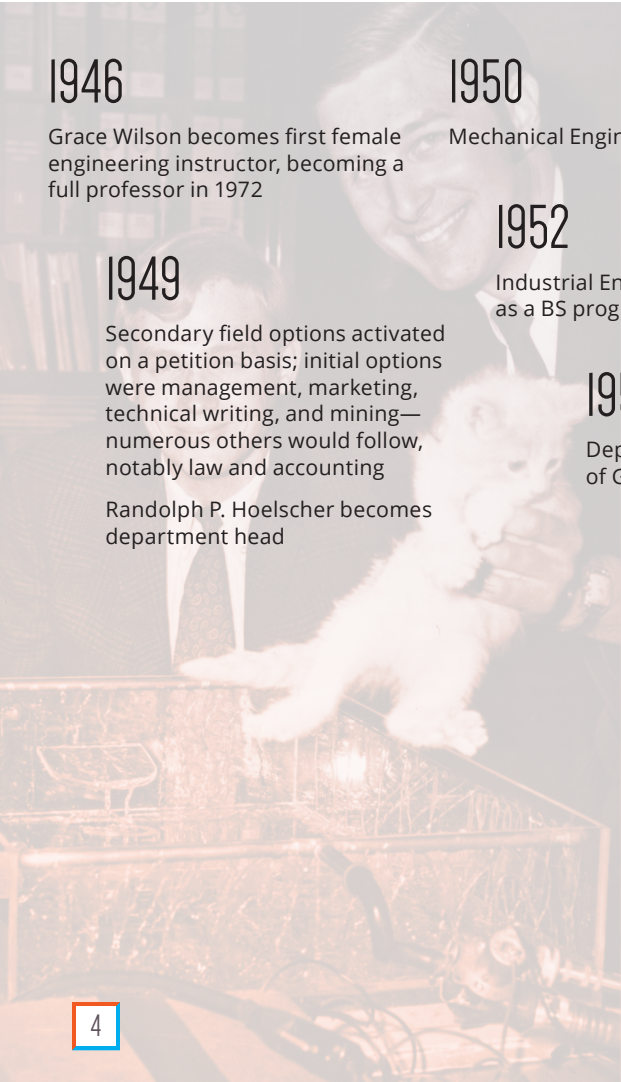Department Head Jerry S. Dobrovolny

J.E. Pearson and photomultiplier, ca. 1963

Professor M.H. Pleck and graduate strudent D.D. Burn test new printer, 1974

1946

Grace Wilson becomes first female engineering instructor, becoming a full professor in 1972

1949

Secondary field options activated on a petition basis; initial options were management, marketing, technical writing, and mining—numerous others would follow, notably law and accounting

Randolph P. Hoelscher becomes department head

1950

Mechanical Engineering building opens

1952

Industrial Engineering is established as a BS program

1953

Department renamed Department of General Engineering

1959

Randolph P. Hoelscher retires; university decides to continue Department of General Engineering after publishing a study entitled the *Luke Report*

Jerry S. Dobrovolny becomes department head

1960

Industrial Engineering merges with Mechanical Science and Engineering to become MechSE/IE

1961

Design sequence introduced into GE curriculum

1966

Ford Foundation grant creates industry collaborations that would become the Senior Engineering Project, then GE 242.

1968

Michael Pleck introduces CAD in GE 103

1969

Inspired by a visit to San Antonio, Dobvrovolny inspires a student-led project to beautify the polluted Boneyard Creek, which the City of Champaign had planned to pave over. The fruits of this 100-year project can be enjoyed today.

1971

Ford Foundation grant runs out; Senior Engineering Project continues as a corporate-sponsored endeavor. ABET will eventually recommend that all engineering curricula adopt such a capstone secior design project, and institutions nation-wide emulate it.

1977

Illinois Board of Higher Education approves Master of Science Degree in General Engineering (MSGE)

1981

First MSGE students graduate.

Fourth floor of Transportation Building converted to computer labs

1982

University considers terminating IE for budgetary reasons and is flooded by letters of protest from many esteemed sources, including Republic Steel, Anheuser-Busch, Eastman Kodak, General Dynamics, Illinois Power, United Airlines, International Business Machines, Ford Motor Company, United States Steel, along with other University of Illinois departments, including Accountancy and Civil Engineering

Thomas Conry, GE Department Head, 1987

Professor Deborah Thurston's research group, 1990

Professor R.S. Sreenivas, 1993

1985
First supercomputer installed at Illinois

1986
Mark Spong introduces a course on robotics

1987
Thomas F. Conry becomes department head

Henrique Reis buids Nondestructive Testing and Evaluation Research Laboratory

1993
Department of Aeronautical and Astronautical Engineering moves out, leaving General Engineering the only tenant of Transportation Building

1994
Grainger Library, the largest engineering library in the United States, opens

1998
Mechatronics Lab established by Professors Tsao and Spong with grant from John Deere

2001
Research Park opens

2006
Industrial Engineering and General Engineering merge to become IESE, later renamed ISE

First two Systems and Entrepreneurial Engineering Ph.D.s granted

2007
Jong-Shi Pang becomes department head

Operations Research Lab opens

2008
Senior Engineering Project Lab undergoes $1.1 million renovation

2009
Master of Science in Financial Engineering approved

2013
Rakesh Nagi becomes head of ISE

2014
$250,000 of changes to Transportation Building approved...and many other exciting changes detailed in this issue!

MASTERS OF SCIENCE IN FINANCIAL ENGINEERING

The *Financial Engineer* re-affirmed the ranking of the University of Illinois' MSFE Program as the 9TH BEST PROGRAM in the United States, a position we gained in the 2014 rankings.

MSFE ILLINOIS
MASTER OF SCIENCE IN FINANCIAL ENGINEERING

the **synergy** of business and engineering

Financial Engineering is a multi-disciplinary field that pertains to the application of engineering approaches and methods to the analysis and management of financial problems, particularly where risk is a concern.

The field has emerged as the result of the ever-growing complexity required in describing and solving these business problems whose resolution requires fundamental economic principles and finance theory coupled with state-of-the-art mathematical methods, computational tools, and computer programming expertise.

Risk is everywhere and the financial industry deals with it. Natural disasters happen. Prices collapse. Customers default. Complex financial institutions and markets are designed to handle those risks. But people need to know how to make those institutions and markets work. Regulators need to understand how to guide them successfully. Businesses have to be able to use them to solve their own risk management tasks. All of this takes sophisticated mathematical and computational techniques, combining expertise in finance, economics, and engineering.

We teach the skills needed for quantitative analysis of financial instruments and markets. Our graduates are able to take these tools to corporations, financial institutions, and regulatory bodies to use these markets to manage risk effectively today—and to develop the techniques and institutions to manage the new risk challenges of tomorrow.

The Illinois MSFE degree is both technical and pragmatic. Students receive training in the most advanced techniques, providing them with the grounding and tools to advance quickly in the field. The curriculum is drawn from topics in stochastic modeling optimization, computing and computational methods, and finance, and is taught by internationally recognized engineering and finance faculty.

Further, the featured Practicum in the third semester of the program serves as a bridge with industry focusing on real world financial modeling problems. The Market Information Lab, sponsored in part by the Chicago Mercantile Exchange, provides students with state-of-the-art analytic tools and software products, enhancing their educational experience.

Making a Splash

Chelsey Coombs

Mary Beth Howard is a senior in General Engineering with a minor in business. She has also competed with the University of Illinois Varsity Swim Team for the last three years, recently participating in a record-breaking relay at the Big 10 Championship. But this summer, she traveled to Central America to make a different kind of splash. At Ministries of Divine Mercy, a K-12 school in Tegucigalpa, Honduras, she implemented a clean water system she designed under the supervision of Associate Professor Harrison Kim.

Howard's parents, working with a group of Christian missionaries, make twice-yearly visits to developing countries to help improve residents' living conditions. In May 2013, during a trip with them to the school in Honduras, Howard saw an opportunity to combine her compassion and engineering skills to solve a problem. She improved the school's computer lab, installing operating systems and repairing computers, and initiated a project to install an internet satellite dish. As the school community previously had no internet connection and no libraries, her general engineering skills allowed her to create a vital educational resource for the teachers and students.

But her multidisciplinary abilities as a general engineering student are not limited to computer networks—she can also build water networks.

During the trip, she observed that the school water system produced impure drinking water. The old system siphoned rainwater through PVC piping from a 10,000-gallon storage tank seven miles up in the mountains to a 400-gallon tank on the school roof. From this tank, the water went to an above-ground cement storage tank. This water was used for all purposes, including drinking, but its contamination issues made it hazardous for human consumption.

The people of the town tried to remedy the situation with a well, but legal issues with the well's location prevented them from beginning the clean water project.

Through this, Howard saw another opportunity to enact real change for the people of Tegucigalpa.

In the fall, back at the Department of Industrial and Enterprise Systems Engineering, Howard took her concerns to Professor Kim. In the fall semester, she took Kim's engineering design course (GE 310). That spring, she did an Independent Study (GE 397) with Kim to design a clean water system. Her new system taps into the 400-gallon tank, runs the water through a carbon-block sediment filter, and exposes it to UV lighting to keep pathogens like bacteria and viruses from reproducing, thus making it safe for humans to drink. This pure, filtered drinking water is then kept in a sterile storage tank.

Mary Beth and her team begin bringing the system indoors by drilling a hole through the school's wall.

Two of the children at the school found a stray puppy on the site while the team worked on the project.

> "...you're going to run into engineering problems throughout life. That's just when you go to Plan B, or in our case, Plan C.

A team member opens the valve to get the first cup of clean water from the system.

Mary Beth's parents photographed the still-operational clean water system during a return trip in November.

Over the summer, she flew back to Tegucigalpa to implement the system, parts in tow. At first, the system was going to be completely outdoors; however, a local said the children who live on the school's property were a bit mischievous and might be prone to tampering with it. So it was on to Plan B.

"I came in thinking this was going to be it, we are just going to do it, get it done, it'll be simple. But then we had to figure out a way to tap into the existing system we had designed and branch it off to go inside the school," Howard said.

Howard and her team bought a drill to get the PVC pipes through the school's wall and set up the system inside. They set to work to install the entire system and were ready to test it out. But when they plugged in the UV lamp, it started smoking—they had accidently run 120V through the 12V lamp.

"After the lamp broke, I was so heartbroken," Howard said. "But the best part was the support everyone gave us. They were like, 'No, it's okay, this stuff happens in the real world. You're going to run into engineering problems throughout life, that's just when you go to Plan B, or in our case, Plan C.'"

And that's what Howard and her team did; another mission trip group arrived in Honduras a few weeks later with a new UV lamp, and when they plugged it in, the water was crystal clear, just as they had planned. She accomplished her goal to bring clean drinking water to the school and the surrounding community.

Although Howard won't graduate until May 2015, she already has big plans. She hopes to get a job in technical consulting where she can combine her love of talking to people with business and engineering.

Now that's how a dedicated athlete, engineer, and humanitarian spends her summer vacation.

Des Peres Hospital in St. Louis contributed funds for the effort.

Kirkwood Scholarship Makes Huge Impact

Mike Koon

It goes without saying that getting a scholarship can be a difference maker, but for Connie Kim, it was an affirmation in a tough time for her and her family.

In March of 2010, the spring of her senior year of high school, Kim's mother was diagnosed with stage III lung cancer, with a life expectancy of around 15 months. After surgery to remove one-third of her lung and three months of chemotherapy, her mother was making progress toward recovery — until doctors discovered she also had a brain tumor, which required more surgery and several more rounds of radiation.

That kind of experience would be challenging for any daughter, but Kim, from suburban St. Louis, was also attending college some 200 miles away at the University of Illinois in the highly respected general engineering program.

Kim chose a general engineering major both to follow in the footsteps of her parents, who are both engineers, and because of its strong ties to business and the fact the she had strong people skills. However, the stress of excelling at school while her mind was with her mother at home made her contemplate delaying completion of her degree. "It's been tough on me to be away from home and focus on school," Kim said. "My parents had financial burdens, and I didn't know if I could finish my degree because I would prefer to be home with my parents."

It took the initiative and personal interest of a staff member to help ease part of the burden. Lynnell Lacy, Assistant Director of Alumni and Student Relations for Industrial and Enterprise Systems Engineering, has helped Kim deal with the tough situation and supported her for nomination for one of our Kirkwood Scholarships, a $15,000 award given to female students with strong dedication and service to the College of Engineering.

Despite her personal hardships, Kim's achievements have gone beyond academics. She has been heavily involved in the ISE department, co-founding and serving as president of Diversity in ISE, an organization that strives to celebrate all aspects of academic and professional diversity.

"Having a diversity group within the College is important because we have such a large international population here with such wide backgrounds and experiences," Kim said. "I'm proud that I got to bring something like that forward."

Kim is also vice president of the Illinois Society of General Engineers (ISGE) and treasurer of the Theta Tau professional engineering fraternity. Mindful of her mother's battle with lung cancer, she helped Theta Tau raise $2000 for Relay for Life, which supports cancer research. Her summer internships have included two summers at Courion Doors, a St. Louis-based freight elevator company, and one summer at Yaskawa America, a manufacturer specializing in AC drives and motion control systems with a base in suburban Chicago.

Photography by L. Brian Stauffer

"Connie Kim is an exceptional young general engineering student who has faced some extraordinary challenges during her time on campus," Lacy says. "In spite of overwhelming worry, Connie dutifully attended classes and tended to her academic responsibilities. She also continued to perform the numerous leadership roles in the organizations for which she has served at ISE, the College of Engineering, and surrounding communities. In all situations, Connie is a polished, professional young woman, and a most deserving recipient of the Women in Engineering Kirkwood Scholarship."

"I don't know how to express how grateful I am towards the scholarship and the Koe Family," Kim says. "They are not just people who give money. Their goal is to help and inspire students. Getting to know them on a personal level has inspired me to give back."

The scholarship has given Kim the motivation to press on toward her degree.

"Sometimes during my freshman and sophomore years, it was rough on me to be motivated in school when I was dealing with things back at home," Kim said. "There have been certain points where in my head, I thought I should take a semester off and focus on being at home.

"The scholarship definitely will take a financial load off of my family, which takes a burden off of me. More importantly, however, it was the affirmation to my contributions to the College of Engineering and the confidence I needed to stick it out."

Kim has gone on to earn a coveted spot as a Knight of St. Patrick. She has also been a recipient of the Bechtel Women in General Engineering Scholarship (2013–14), the ISE Department Service Award, the University of Illinois Engineering Council Committed Student Service Award, and the H.L. Wakeland Undergraduate Leadership Award.

In the process of completing her degree in general engineering, she has left a legacy of service that will benefit the college long after she leaves.

Mike Hirschi inducts Connie Kim as a Knight of St. Patrick, an annual award given by the College of Engineering to approximately 10-15 students who represent leadership, excellence in character, and exceptional contribution to the College of Engineering and its students. The award is one of the highest honors received by a student from the College Of Engineering.

Photography by Memory Lane Photography

H.L. Wakeland Undergraduate Leadership Award

During his 24 years as an associate dean in the College of Engineering, H. L. "Howie" Wakeland fostered many student organizations and activities and actively promoted student leadership opportunities. This award recognizes a junior or senior who has demonstrated outstanding leadership and who has maintained a minimum 3.00 grade point average. Leadership activities can include university, campus, college, departmental, local, and community involvement.

SENIOR ENGINEERING PROJECT
SUCCESS WITH SPARTAN TOOL
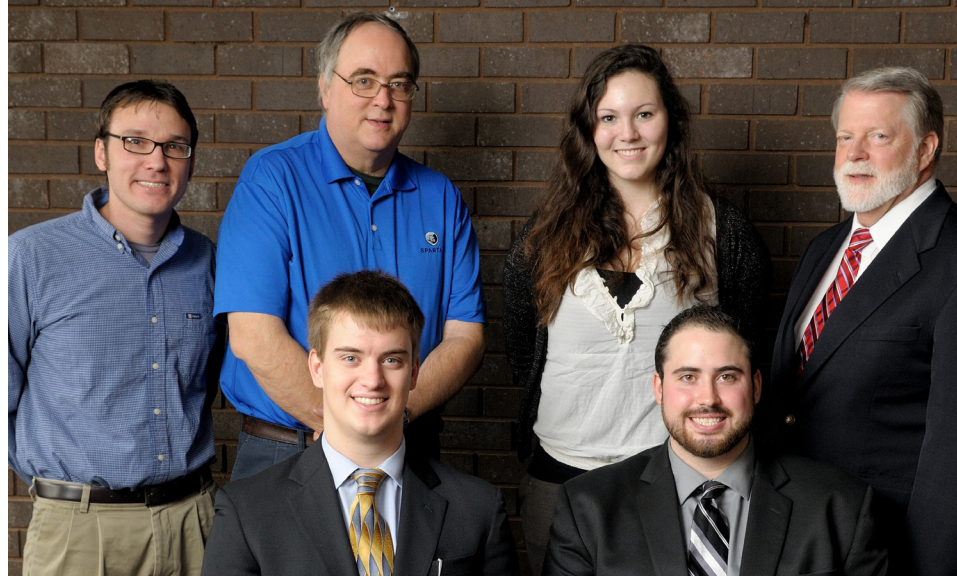
Spartan Tool Team.
Back row (left to right): Spartan Tool representatives John Spelich (GE grad) and Ross Wilson, team member Hannah Thomas, and Harry Wildblood. Front row (left to right) team members Kevin Dineen and Matthew Anderson.

Photography by Thompson-McClelland

Chelsey Coombs

Senior Design is the capstone course of the ISE undergraduate majors, the culmination of four years of coursework. The course allows student groups to work on real engineering problems with real companies.

One group, students Matthew Anderson, Kevin T. Dineen, and Hannah Thomas, teamed up with Spartan Tool to create an item that has gone from senior project to saleable product.

Spartan Tool charged the group with creating a tool called a jetter hose footage counter. Jetter hoses are used to excavate blockages in sewer pipes, but there is no way to know where and how much of a hose is in a sewage pipe at a time. The Spartan Team's project was to remedy this situation by creating a device that calculates this distance, and displays it to the jetter hose's operator.

The counter had to be waterproof, resettable, able to display both feet and meters, and retrofittable to all types of jetter hose reels—all within a budget of $500.

As with any engineering project, there were some setbacks, including a long battle with parsing out the algorithm to display the amount of hose paid out at any given time and getting those measurements displayed on the screen itself. With long nights in the lab, the team ultimately succeeded in creating a working jetter hose counter.

"Many times throughout the semester I honestly thought I wouldn't make it through, but... if I just kept working and remained focused, everything worked out," Hannah Thomas said.

"[The counter] uses retrofitted functions based on the rotations of the reel the hose is kept on based on the jetter pump model, hose size, and hose length to calculate length," says Thomas.

Spartan Tool is currently selling the team's product on their website, and the group is waiting to hear about the status of some patents they filed.

"Knowing there was nothing out there regarding this type of product, starting from scratch, working all the kinks out, seeing something we design being

marketed all within half a year, it's an amazing feeling like no other; that's why I became an engineer," Anderson said.

The Spartan Team's tenure at the University of Illinois may be over, but its members are off to do some great things. Thomas is currently working as an operations engineer for Medline Industries with plans for a master's degree, and Andersen is working as a mechanical design engineer for Ingersoll Machine Tools. Kevin Dineen was recruited as a Project Engineer at Spartan Tool, LLC.

From the Spartan Tool website:
http://www.spartantool.com/jetter-hose-footage-counter-soldier-products-4196.php

2014 ENGINEERING OPEN HOUSE AT ISE

Clockwise, from lower left: Yining Wang, Xin Niu, and Mike Salihoglu at DISE; David Wiggs at Supply Chain Tetris; egg dropping; unidentified Frisbee-firing robot attacks children on Bardeen Quad; a home-made bridge. *Photography by Heidi Craddock.*

Spring brings warm weather, flowers, young love, and Engineering Open House, in which students college-wide showcase interactive projects for an audience of all ages that comes from all over. Here is a sampling of this year's contributions from ISE.

Egg Drop
Illinois Society of General Engineers (ISGE)
Back by popular demand, Gamma Epsilon and Alpha Pi Mu presented the 2014 egg drop. Using limited materials, participants engaged their inner engineers to construct a design built well enough to protect an egg from breaking in a two-story plunge.

The Power of Diversity
DISE
What do a lemon, potato, and a tomato all have in common? They're delicious and nutritious, but they can also conduct electricity! Diversity in ISE invited participants to pick favorite fruits and veggies and convert them from scrumptious, nutritious snacks into fun, functional batteries! Is it possible to power a light bulb with just a bunch of fruit and some wire? DISE enlightened all attendees.

Spaghetti Tower Consulting Competition
Engineering Initiatives
Participants tested creativity and problem-solving skills by constructing a tower from spaghetti noodles using only pasta, masking tape, and string. Towers were judged by height and strength, and had to support a minimum weight of a single marshmallow. Like an engineering consultant, participants decided what kind of tower to build and how to go about building it. Then they presented their tower and briefly described their design process. Towers were measured and tested using books to determine how much weight they could support.

Engineering Buffet
Engineering Freshman Committee
Engineering buffet offered a tasty sampling of smaller, interactive projects from a variety of engineering disciplines. Most of the projects were affordable, useful, and could be easily replicated and improved upon at home.

Supply Chain Tetris
Institute of Industrial Engineers
Think playing Tetris on your computer is fun? At IIE's exhibit, vistors played a real-life version of this classic game! Various "work stations" simulated the operations of a distribution center. At each station, participants tried to fit a given set of objects (the "order") into the smallest box possible as fast as possible. But with care!—the order was immediately "shipped" to the customer. Saving space and time drastically reduced the company's supply chain costs, but errors led to unhappy customers!

Bridge on a Budget
Illinois Society of General Engineers (ISGE)
Participants were given a budget, a list of supplies, and the task of building the best bridge as efficiently as possible. Total score took bridge strength and efficiency into account.

Photography by Chelsey Coombs

Multidisciplinary Optimization

Chelsey Coombs

Google's recent announcement of its driverless car prototype has made waves in the field of system design. As self-driving vehicles with numerous control and autonomy systems become more common, their engineering will need to be streamlined.

Professor of Industrial and Enterprise Systems Engineering James Allison and graduate student Daniel Herber are using a process called multidisciplinary optimization to recalibrate the way engineers create dynamic systems.

Multidisciplinary analysis, which allows engineers to solve problems using a variety of disciplines, was first used by aerospace engineers to optimize the design of aircraft wings by combining structural analysis predicting stresses and deflections with a study of the pressures applied to the wing.

"An airplane wing is a very intuitive example you can use to see the tradeoff between these two disciplines you have modeling," Herber said. "Sometimes different engineering groups are modeling these different disciplines. The traditional paradigm that companies use when designing these systems is to break it up into different disciplines and they want a formal way to account for the coupling between them."

However, many engineering fields are still using single-discipline analysis, which Herber says "overlooks the coupling in the system" and often leads to poor or even infeasible designs. By contrast, multidisciplinary design optimization helps engineers improve the performance of a dynamic system's performance and achieve an optimal design with capabilities beyond designs resulting from single-discipline analysis.

"We really want to take a systems-oriented approach in which we think about what is best for the overall functionality of the system, as opposed to thinking of the system in really siloed terms: what's best for the mechanical system and what's best for the control system," Allison said.

Allison and Herber have been working to implement their multidisciplinary analysis process in new fields. For the past year, Herber has worked with engineers at John Deere to design a better hybrid powertrain for their vehicles. Their team is trying to take a specification of the architecture of the tractor and use multidisciplinary optimization to size the physical components of the tractor and gain optimum control of those components.

But that's not the only dynamic system the team is thinking about: they're looking further into the future toward the best way to design products like autonomous farm equipment.

"Having a human operator is a big resource constraint. If we lifted that constraint and instead had one human supervisor supervising operation of six or a dozen different pieces of equipment, what would the optimal fleet be? How should we design each element of that fleet to have complementary functionality? Multidisciplinary design optimization is the right framework for solving these kinds of problems," Allison said.

JAMES ALLISON

General Engineering

Chelsey Coombs

The flood of new technologies over the last few decades has changed more than what incoming students are learning: it's also changed the way these students learn best. These dramatic changes are reflected in ISE's undergraduate program in changes spearheaded by Assistant Professor James Allison.

When Allison came to Illinois, he saw that first-semester undergraduates had the mathematics and physics knowledge necessary to begin their college engineering studies but hadn't received much hands-on engineering experience during high school.

"When I went through high school, it was normal to take metal shop and wood shop and auto shop and get hands-on experience and learn how to make things and fix things," he says. "There are students I've met coming through the program who don't know what a bearing is or what it's for, or what a gear is, and these are things that I, just coming in, assumed students would know."

So during his first semester of teaching, Allison conducted hands-on in-class demonstrations, completely dismantling an automatic transmission to show students how the mechanical components came together to work as a complete system.

"Engineering is a creative activity focused, at least as I see it, on design," Allison said. "If engineers want to design or create something, they need to understand the media that they are creating with, just like an artist needs to understand how to work with clay or another type of media."

In the fall of 2012, Allison redesigned GE 100 as a class that lets students engage firsthand with the engineering process. In the new GE 100, freshman GE majors bring the 12th century to the 21st by designing their own trebuchets (catapults).

The trebuchets are made from prefabricated kits, and the students have four design decisions to make to optimize the trebuchet's launch distance.

"They test out these different design ideas based on their intuition. For the most part, they are trying to maximize the projectile distance, and for the most part, at the beginning, they don't do so well," Allison says with a laugh.

Students begin by adjusting and testing the trebuchets using only their intuition and trial and error. Then, Allison introduces the concept of multibody dynamics to enable them to grasp the behavior mechanics of interconnected bodies. With this knowledge, they use computer modeling to adjust their designs and simulate their performance. At the end of the semester, they take to the Engineering Quad to field test the newly designed trebuchets—whose performance, in most cases, has improved dramatically.

Each summer, Allison and a group of graduate and undergraduate students make further improvements to the course, supported by a grant from the College of Engineering's Academy of Excellence in Engineering Education (AE3). The project's second phase was funded in May 2014. Graduate student Daniel Herber, who himself took GE100 before the new class was implemented, has taken an active role in its development.

"This summer, we're trying just to refine the trebuchet with small design improvements so it's easier for the students to do things, some things like it's easier to take the wheels on and off," Herber says. "We're also trying to make the project more open-source so other universities or departments with similar curriculums or interests can develop a project similar to ours."

The summer research team is also incorporating the industrial engineering side of the department into their efforts, trying to make the launches more efficient by modeling the best group ordering for launch day, as well as adding a computer vision system that will be able to resolve projectile trajectories in three dimensions and more quickly calculate the projectile launch distances.

"This new curriculum brings in more elements that help strengthen what I refer to as engineering judgment, the integration of both a practical understanding of engineering and intuition in engineering systems with the fundamental math and science and engineering analysis behind it," Allison said. "We're trying to graduate engineers, not physicists. They need to understand how the physics and math applies to making engineering decisions in real life."

Crowdsourcing work improves efficiency of new market

Katie Carr, CSL

One might think that it would take a NASA expert to classify and identify hundreds of thousands of galaxies and, in the process, help scientists understand how these galaxies evolve. But now, with the help of crowdsourcing—where large numbers of people are asked to contribute their skills or ideas to a project—people across the globe can be involved in work like this that is outside their normal realm. Crowdsourcing companies such as Galaxy Zoo, Foldit, and Amazon Mechanical Turk break large-scale problems down into small tasks that can be electronically distributed to on-demand human contributors, such as image labeling, character recognition, translation, transcription, and other tasks computers don't perform well.

Assistant Professor of Industrial and Enterprise Systems Engineering Sewoong Oh is working in this area to design reliable and cost-efficient crowdsourcing systems using tools from applied probability, graph theory and related mathematical tools.

Oh graduated from Stanford University with a Ph.D. in Electrical Engineering in 2011 and worked as a postdoctoral researcher at MIT before becoming an assistant professor of industrial and enterprise systems engineering in 2012. He joined the Coordinated Science Laboratory in August 2013 and is continuing his work on crowdsourcing, as well as ranking and recommendation systems.

While crowdsourcing is often an efficient way to solve large-scale problems, there are difficulties that come along with trusting large amounts of people. "People are noisy because they are humans," Oh said. "They might try to scam you or are just lazy. We need algorithms to detect who is lazy or spamming to be able to use crowdsourcing more efficiently. People are also participating in this because it's fun or to be part of something bigger and to help people. We're also trying to figure out what motivates people, whether it's monetary or being part of a grand challenge."

According to Oh, crowdsourcing in the real world is a fast-growing industry, with a lot of room for improving how information is aggregated, jobs are allocated, and incentives are determined.

"There are many aspects to crowdsourcing, such as designing better incentives or better algorithms, that leave a lot of room to improve how it's done in practice," Oh said. "The application area is in its infancy and new problems are emerging with new intellectual challenges for researchers."

In addition to his crowdsourcing work, Oh's research at CSL also relates to ranking and recommendation systems. He's most concerned with extracting meaningful information from the data generated by people's everyday activities to improve their lives, such as how search engines rank search results based on what they believe they know about a certain person.

"If you Google something, they will provide you with a list and try to rank it in a way that's sorted best to suit your goal," Oh said.

By using simple comparison questions between pairs of items, Oh is attempting to make this ranking system more accurate to reflect global preferences. He is working to incorporate that into recommendation systems that will ask users not to rate results but to rank them.

Based on this idea, he's looking into creating new recommendation systems for companies such as Netflix. When Netflix recommends movies or shows to their users, they have users give star ratings to shows they've already seen. Oh is looking for more efficient and accurate ways to recommend products and services to users.

Star ratings can be highly subjective. "When using people's input in this way, you want to ask people the simplest questions possible," Oh said. "What people typically do is rate [films] using stars, but that's not really consistent and the scale varies. My three stars mean something different from your three stars."

Using pair-wise comparisons, such as asking multiple questions that compare two items, the results are much more reliable and less likely to change over time. Oh proposes to combine the knowledge he obtains from ranking and choice

models, which he believes will lead to more efficient and reliable recommendations.

"When we interact, we think we can ask people complex questions and expect them to be very rational and very smart in giving you complex answers and then learn a lot from those answers," Oh said. "But in truth, people are not good at assessing or judging themselves and other things. We believe we can learn more about people reliably by actually having them do simple things and asking them simple questions, but asking them many questions."

Beyond rating retail shopping experiences and movie reviews, Oh believes this research can be applied to many areas, such as finding out where people are willing to get off a train to help a city determine where they should build new train stations, adjust their traffic systems, or solicit opinions on new policies.

"If you just ask people those questions, you don't get the information quickly," Oh said. "People don't always know why they like or dislike things. They may know if they like it or not, but not why or how much. I'm working on solving those problems."
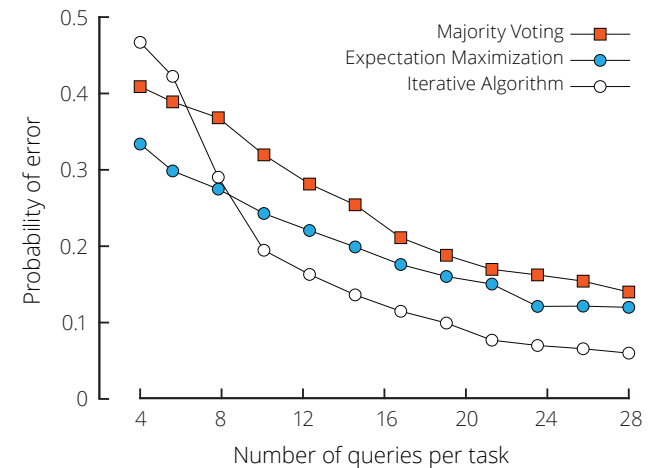
The proposed approach improves over existing techniques for a wide range of parameters on real experiments on the Mechanical Turk.

NEGAR KIYAVASH

Researchers make improvements on 45-year-old coding theory problem

Katie Carr, CSL

In today's fast moving, tech savvy world, new advances in research and technology are common. However, it's not every day that someone makes advances on a problem that's been around for over 45 years.

Recently, Assistant Professor of Industrial and Enterprise Systems Engineering Negar Kiyavash and Electrical and Computer Engineering graduate student Daniel Cullina have done just that by advancing coding theory established by Russian scientist Vladimir Levenshtein in the 1960s.

"A lot of the classic problems in coding theory are comparably old and are now extremely well understood. People know exactly what to do in practice," Cullina said. "However, progress on this problem has been relatively slow since Levenshtein's time."

In the early 1960s, Levenshtein found an optimal code for correcting a single deletion, as well as upper and lower bounds on the size of the best codes capable of correcting multiple deletions. His work still guides modern thinking about errors in communication channels, many of which distort the data messages transmitted by devices—such as computers and wireless phones—by erasing, substituting, inserting, or deleting message symbols.

Insertions and deletions pose a significantly bigger challenge than substitutions and erasures, according to Cullina. Consider a message of ABCDE. When a symbol is erased, the recipient of a message sees the empty space instead of the original symbol (ABC_E), but the deletion of a symbol leaves no trace (ABCE).

Another source of difficulty is that insertions and deletions change the alignment of symbols throughout the entire message. ABCDE can be transformed into DABCE with one deletion and one insertion, but those two strings of symbols differ in four out of five positions. Therefore, even a small number of insertions and deletions can create a large number of substitution errors, making it hard to apply substitution error correcting techniques.

The Illinois researchers have been working on the design of deletion correcting codes and discovered that they were able to tighten Levenshtein's upper bound on code size. Their research has focused on how correctly and efficiently a person can decode a message with insertions and deletions and how many errors is too many before it's impossible to decode a message.

An error correcting code is a set of messages that can always be distinguished from each other after undergoing some number of errors. A fundamental problem in coding theory is finding the relationship between code size and error correcting capability.

"There's always some tradeoff between communication rate and error probability," Kiyavash said.

"People want a reliable communication system, but they also want to send lots of information."

Any code that can correct a particular number of deletions can also correct that many insertions or a mixture of that many total insertions and deletions. Levenshein's upper bound on code size comes from an adversarial set of deletion error patterns. Even though the ability to correct insertions is equivalent to the ability to correct deletions, the corresponding bound using insertion errors is much weaker. Kiyavash and Cullina were able to show that the best version of the bound uses a mixture of mostly deletions and a few insertions.

The key component of their proof is a partial solution to a combinatorial problem: on average, how many different output messages can a deletion-insertion channel produce?

"There are a lot more open questions than resolved ones in this area," Cullina said. "We only closed a fraction of the gap between the upper and lower bounds on code size, and only for channels that make relatively few errors."

The problem of deletion correction is connected to diverse real world problems, including DNA sequencing and network forensics.

ECE graduate student Daniel Cullina

Kiyavash and Cullina's work was presented at the 2013 IEEE International Symposium on Information Theory and a journal article has been submitted to the IEEE Transactions on Information Theory.

"Any breakthrough in terms of fundamental limits is just beautiful because it satisfies our mathematical curiosity," Kiyavash said.

Negar Kiyavash has been promoted to Associate Professor with Indefinite Tenure effective August 16, 2014.

Kiyavash was awarded the Dean's Award for Excellence in Research, College of Engineering, 2014. Five awards are given to assistant professors who have been judged by their colleagues to have conducted the best research during the last academic year.

Kiyavash continues to receive funding awarded through the Air Force's Young Investigator Research Program (YIP).

ISE AFFILIATE FACULTY
SHELDON H. JACOBSON

Seatbelt laws encourage obese drivers to buckle up

Liz Ahlberg,
University of Illinois News Bureau

Obesity is associated with many health risks, but ISE researchers have found a possible way to mitigate one often-overlooked risk: not buckling up in the car.

A new study led by Professor Sheldon H. Jacobson found that increasing obesity rates are associated with a decrease in seatbelt usage. However, these effects can be mitigated when seatbelt laws are in effect.

"Primary seatbelt laws lead to increased use of seatbelts," Jacobson said. "On the other hand, as obesity levels increase, seatbelt use drops, in both primary- and secondary-law states. The key observation we made is that primary seatbelt laws attenuate this drop as obesity rates increase."

Studies have shown that obese drivers are much less likely to use seatbelts, possibly due to discomfort.

"Given that many automobiles have grown smaller, and people have grown larger, larger people may find it physically uncomfortable to put on and wear a seatbelt," Jacobson said. "There also may be the false perception that a larger person who fits snugly into a car may not need a seatbelt."

Jacobson, along with ISE Lecturer Douglas M. King, and former ISE graduate student Banafsheh Behzad (see page 28), analyzed government data regarding seatbelt use and obesity rates spanning the years 2006 to 2011.

The researchers wanted to know the degree to which seatbelt use decreased as obesity rates rose within a state. They created a mathematical model to study the association. Working in the Simulation and Optimization Laboratory at the U. of I., they first recognized the impact of primary seatbelt laws, under which officers can issue tickets for not wearing seatbelts without any other traffic offenses occurring. Thirty-three states have such laws in place for drivers and front-seat passengers as of 2013.

The team analyzed data from states with primary seatbelt laws and states without such laws. They found that states without primary seatbelt laws experienced a much sharper decrease in seatbelt use as obesity rose—in fact, more than nine times greater compared to states with primary laws. The researchers published their work in the journal *Public Health*.

"Seatbelts can reduce the risk of injury or death in car accidents, so it is critical that we understand the factors that influence seatbelt use," King said. "While it is not surprising that primary seatbelt laws can increase seatbelt use, quantifying their interaction with obesity rates provides new insights that policymakers can consider."

ISE Lecturer Doug King

WELCOMING NEW FACULTY TO ISE

Dr. Alexandra Chronopoulou is a new assistant professor in the Department of ISE. Chronopoulou received her Diploma in Applied Mathematics from the National Technical University of Athens, as well as a Ph.D. in Statistics from Purdue University. She most recently served as an assistant professor at the City University of New York. She has worked as a post-doctoral researcher in INRIA, France, and as a visiting assistant professor at the University of California, Santa Barbara. Her expertise includes financial engineering and stochastic modeling and simulation.

Radha Nandkumar is joining the ISE faculty to serve as the interim director for the proposed master's degree in Decision Analytics. Nandkumar received an Executive M.B.A. and a Ph.D. in Physics from Illinois and has been working in leadership and program management for more than 25 years at the National Center for Supercomputing Applications in High Performance Computing. Dr. Nandkumar has more than a dozen publications in peer-reviewed journals related to her research work and over 250 technical presentations related to NCSA's HPC infrastructure, applications research, and information technologies.

Dr. Thenkurussi (Kesh) Kesavadas has accepted the position as the first director of the new Health Care Engineering Systems Center at Illinois and professor in the Department of Industrial and Enterprise Systems Engineering. Through the center, the College of Engineering has partnered with the Jump Simulation and Education Center (Jump) of the OSF Saint Francis Medical Center in Peoria to develop new technologies and cyber-physical systems, advance medical simulation and training, and drive a transformation in the practice and quality of health care. Professor Kesavadas earned his PhD in industrial engineering from Pennsylvania State University, and is co-founder of Simulated Surgical Systems LLC. Since 1996, he has been a faculty member at the University at Buffalo where he founded the UB Virtual Reality Laboratory.

Dr. Karthekeyan (Karthik) Chandrasekaran is joining ISE as an assistant professor. Chandrasekaran received his B. Tech. in Computer Science and Engineering from the Indian Institute of Technology, Madras, and Ph.D. in Algorithms, Combinatorics and Optimization (ACO) from the Georgia Institute of Technology. More recently, he was a Simons postdoctoral fellow in the School of Engineering and Applied Sciences at Harvard University. His expertise includes integer programming, combinatorial optimization, probabalistic methods and samples, and randomized algorithms.

Photography by L. Brian Stauffer and William Gillespie

CELBRATING ISE'S NSF CAREER AWARD WINNERS

NEWEST WINNER: Alex Olshevsky

Ph.D., MIT (2010) + SIAM Paper Prize (2011) + INFORMS ICS Prize (2012)

ALGORITHMS AND FUNDAMENTAL LIMITATIONS FOR SPARSE CONTROL

The purpose of Professor Olshevsky's research is to develop strategies to control and estimate large-scale systems by affecting or measuring them in only a few places. A motivating application is the control of chemical reaction networks within the human body. Another motivation comes from the problem of estimation in electric power grids. The project will develop efficient algorithms for identification of a small number of "sites" that will allow large systems to be efficiently observed and controlled from few inputs or few measurements.

Olshevsky explains: "While the initial focus of the project is primarily theoretical, the methods developed here could have widespread applications throughout control theory.... This project will develop algorithms which can reconstruct system states from a small number of possibly corrupted measurements..."

Eight National Science Foundation Faculty Early Career Development (CAREER) Award winners:

(left to right)

Angelia Nedić (2008)

Negar Kiyavash (2011)

Alex Olshevsky (2014)

Carolyn Beck (1998)

Harrison Kim (2010)

Deborah Thurston (1989*)

Rakesh Nagi (1996)

Ali Abbas (2009) not shown

*NSF Presidential Young Investigator
  Award—predecessor to CAREER Award

Photography by L. Brian Stauffer

ISE UNDERGRADUATES NEWS

Parkland College for Kids Program

ISE undergraduate and graduate students swung into the Parkland College for Kids Program in July to bring a some fun physics to elementary and middle schoolers.

The Engineering System Design Lab, headed by Professor James Allison, has previously assisted in GE 100, the introductory general engineering course all freshman in the program take, with the creation of a trebuchet design project. Through the course of the semester, the students are taught engineering principles and are charged with designing a trebuchet that will fling a ball at a maximal distance.

Students Daniel Herber, Anand Deshmukh, Kevin Lohan, Michael Sim, Jennifer Woo, In Suh, and Sarah Ng adapted that curriculum for the students in College for Kids' Camp KaBoom. The ISE students explained the physics behind trebuchets and the design variables the kids could choose to alter. Then, armed with new technical knowledge, the elementary and middle school participants went out to have fun hurling projectiles with their catapults.—CC

Hoeft Technology & Management Program selects four ISE students

Four ISE students were selected as members of Class XX of the Hoeft Technology & Management Program. In the words of John Quarton, T&M Director, "these talented and diverse students will join an amazing network of leaders and team members who are shaping the future of the innovation economy."

Congratulations to Nicholas Binkus, General Engineering, Rebecca Freeman, General Engineering, Joel Sarmiento, General Engineering, and Christine Currie, Industrial Engineering.

The Technology & Management Program at the University of Illinois bridges the gap between traditional engineering and business education by offering a unique curriculum to a select group of highly qualified undergraduates drawn from the Colleges of Engineering and Business.—WG

GE Undergrad Lauren Terzinski awarded Gilman Scholarship to study abroad

ISE student Lauren Terzinski received a Gilman Scholarship to study abroad this last summer in Pisa, Italy.

Terzinski is currently in her junior year of General Engineering, with a concentration in Business Administration. In Italy, she took part in a nuclear engineering energy systems class, as well as a class on Italian language and culture.

She says the tourist side of her "wanted to go to Italy because of the rich history surrounding the area… But the engineer side of me wanted to expand my learning into the nuclear engineering sector, because I previously had no knowledge of the subject, and I wanted to get the widest depth as a general engineer."

To other students considering international study, she says, "don't let the fear of going out on your own keep you from experiencing memories you'll never forget."

Fifteen University of Illinois students received Gilman scholarships to study abroad this summer and fall semester, placing the University of Illinois atop the Big Ten and in the top twenty in the country for Gilman Scholarship recipients during these terms.—CC

Vaibhav Maheshwari awarded Howard N. Bernstein Industrial Distribution Scholarship.

Vaibhav Maheshwari, a junior in ISE majoring in Industrial Engineering with a minor in Business, has been awarded the Howard N. Bernstein Industrial Distribution Scholarship.

Vaibhav will be completing two track options in the IE curriculum: Supply Chain, Manufacturing, and Logistics; and Economics and Finance. Upon graduation, he hopes to work full-time in the supply chain/manufacturing industry for a couple of years before pursuing an MBA.

The Bernstein scholarship promotes the study of material handling. The goal of the scholarship program is to encourage careers in industry and teaching and research that will prepare the next generation of industry leaders.—CC

Star ISE Student Takes Extra Initiative

Terrance Phillips is a senior in Industrial Engineering and president of the University of Illinois at Urbana-Champaign branch of the National Society of Black Engineers.

A Chicago native, Phillips began his post-secondary education at Harold Washington College. Terrance is the oldest of three children and is paying for college on his own.

"I was interested in ISE because the program was marketed as being very interdisciplinary. They seemed focused on helping young professionals become the best they could be."

Terrance receives the MAP and PELL grants to assist with school costs and plans to graduate in December 2015.

Phillips has requested financial assistance from the department to attend the 29th Black Engineer of The Year Awards (BEYA) STEM conference, hosted by Lockheed Martin. The conference will be held in February 5-7 2015 in Washington, DC. Companies in attendance at BEYA include Accenture and Caterpillar.

"There is a unique set of challenges for young black engineers. You have to work harder to defy stereotypes, especially in classes where you might be the only black student present," Phillips says.—WP

IE Students win Tractor-Building Competition

Last March, four representatives from The Institute of Industrial Engineers (IIE) at ISE attended the IIE North Central Regional Conference, hosted at the South Dakota School of Mines and Technology in Rapid City, SD. Pratham Gandhi, Andrew Kerr, Mike Vahldick, and Jeremy Ward spent three days collaborating and networking with IIE students and professionals from across the region. Events included technical paper presentations, plant tours, corporate information sessions, social events, and a tractor-building competition.
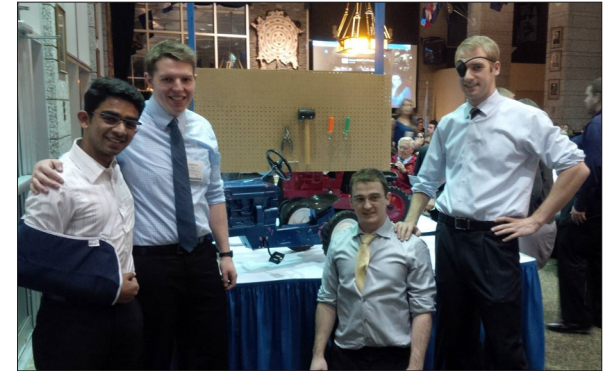
The tractor competition provided a fun activity to promote teamwork through industrial engineering concepts. Each attending university created a team of four tractor builders. Each team had to assemble a children's pedal tractor as fast as possible with the least amount of errors. However, there was a catch: before construction, each team member was randomly assigned a disability. Ranging from blindness (using an eye patch) to limited mobility (competing from one's knees), each team member had to overcome their disability to get the job done quickly and effectively. After placing second in the round-robin tournament, the Illinois team of four won the championship round against the University of Wisconsin, Madison to claim first place and take home the trophy.—AK

This is our first issue, and we recognize that this is not a complete listing of our students' collective accomplishments. Please feel free to keep in touch by emailing William Gillespie at gillespi@illinois.edu, or drop by 107 TB to say hi and sare your good news.

ISE Systems and Entrepreneurial Engineering Ph.D. student Megan McGovern selected as Mavis Future Faculty Fellow

Megan McGovern, an ISE Ph.D. student in Systems and Entrepreneurial Engineering, has been selected as a Mavis Future Faculty Fellow (MF3).

This program in the College of Engineering facilitates the training of the next generation of great engineering professors, emphasizing research, teaching and mentoring.

McGovern works in the Non-Destructive Testing and Evaluation Laboratory, focused on assessing structural materials via non-destructive techniques. Currently, her research is centered on using a nonlinear ultrasonic approach to assess the damage in asphalt concrete caused by oxidative aging.

She says, "It is my hope that this award will prepare me to become a successful and highly productive faculty member in a research university."

Grad student Nicholas Farace wins fellowship from Nondestructive Testing and Evaluation Research Laboratory

SE graduate student Nicholas Anthony Farace has won an ASNT Graduate Student Fellowship from the American Society for Nondestructive Testing for "Quantitative Evaluation of Rejuvenators Using Acoustic Emission towards Effective Pavement Maintenance/Preservation." The award will provide $20,000 to support the project for one year.

Farace describes the project as follows. "Rejuvenators have the potential to restore asphalt concrete pavement surfaces to their original condition in the same manner as various creams restore youth to human skin. However, a simple evaluation tool to assess the effectiveness of rejuvenators does not yet exist. Currently, the evaluation of rejuvenators is qualitative, cumbersome, and unreliable, which makes their effectiveness to be viewed with a great degree of skepticism. The main goal of this project is to develop a method for quantitative evaluation of rejuvenators."

Marzieh Abolhelm presents at the 12th conference of Probabilistic Safety Assessment and Management

Marzieh Abolhelm, PhD Student in IE, presented a paper at the 12th Probabilistic Safety Assessment and Management Conference. The paper was titled "Toward Demonstrating the Monetary Value of Probabilistic Risk Assessment for Nuclear Power Plants."

Her research, introduced for the first time by this paper, is summarized as follows:

"Can Probabilistic Risk Assessment (PRA) help Nuclear Power Plants (NPPs) become more profitable and, at the same time, meet safety requirements? If PRA applications help avoid costly plant outages (which run nearly two million U.S. dollars per day), should PRA still be considered as an "expensive" tool? Should industry and regulatory agencies continue to implement, regulate, and enforce the use of PRA?

This is first-of-its-kind research aimed at uncovering the financial advantage of conducting PRA-based applications in high-risk, socio-technical systems such as NPPs. By discovering the causal relationships between system safety and financial performance, this research will (1) model and quantify the costs and benefits associated with PRA programs, (2) provide critical insights for the industry and regulatory agencies on the enhancement of risk-informed applications and the enforcement of risk-informed regulations, (3) advance methodologies to quantify a socio-technical risk framework, where organizational and environmental factors dynamically interact and shape financial outcome and system safety risk, and (4) help identify and mitigate the underlying organizational root causes of accidents (e.g., managerial decision-making)."

Rebecca Reck awarded honorable mention for 2014 NSF Graduate Research Fellowship Program

ISE graduate student Rebecca Reck has been awarded honorable mention for the 2014 National Science Foundation (NSF) Graduate Research Fellowship Program, based on her research's intellectual merit and potential to have broader impacts.

Reck says, "My research will develop an affordable laboratory kit for multi-disciplinary controls education at the undergraduate and graduate levels. It will greatly enhance the accessibility of the laboratory experience for students in budget-strapped campus laboratories and those participating in distance education or massive open online courses."

This is our first issue, and we recognize that this is not a complete listing of our students' collective accomplishments. Please feel free to keep in touch by emailing William Gillespie at gillespi@illinois.edu, or drop by 107 TB to say hi and sare your good news.
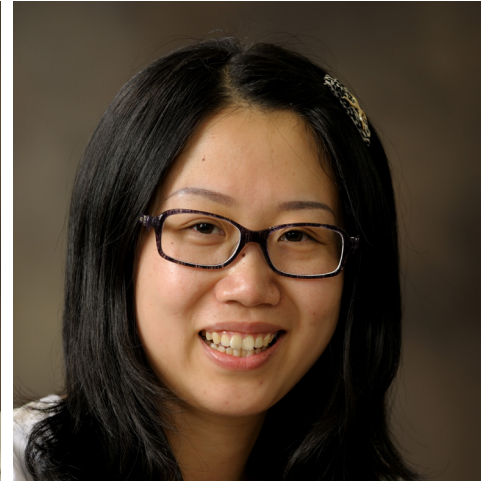
Golshid Baharian-Khoshkhou received her Ph.D. in Industrial Engineering with professor Sheldon Jacobson. She studied OR stochastic systems. Her dissertation is titled "Stochastic Sequential Assignment Problem."

Golshid Baharian is accepting a post-doctoral position at the University of Montreal.

Banafsheh Behzad received her Ph.D. in Industrial Engineering under Sheldon Jacobson. Her dissertation is titled "Analysis of the United States Pediatric Immunization Market: A Game Theoretic Approach," and focuses on the pricing of pediatric vaccines, research helpful to the Centers for Disease Control and Prevention (CDC). She hopes to continue her public health-related research using game theory to better understand obesity.

Behzad will be joining California State University, Long Beach, as an assistant professor.

Jingnan Chen received her Ph.D. in Industrial Engineering with professor Liming Feng. She studied OR optimization and her dissertation is titled "Optimal Deleveraging and Liquidation of Financial Portfolios with Market Impact."

Chen will be joining Singapore University of Technology and Design as an assistant professor in Engineering Systems and Design, helping to develop its economics and finance track.

Estelle Kone received her Ph.D. in Industrial Engineering in May 2014 with professor Richard Sowers. She studied OR stochastic systems, and her dissertation is titled "Monitoring Unknown Source IP Addresses and Packet Sizes to Detect DDOS attacks."

Kone currently works at Goldman Sachs in New York City as a controllers modeling associate.

2014 Ph.D.s not pictured:

Yerkin Abdilin's dissertation "Multiattribute Utility Functions for the Deep Bore-hole Filter Restoration Problem" was completed with advisor Ali Abbas.

Limeng Pan's dissertation "Dynamic Decision-Making under Uncertainties: Algorithms Based on Linear Decision Rules and Applications in Operating Models" was completed with Xin Chen.

Fuyuan Wang completed her dissertation "Forward and Inverse American Option Priving Via Complementarity Approach" under Jong-Shi Pang and Liming Feng. **Wang currently works at Goldman Sachs**.


Chris Quinn received his Ph.D. in Electrical and Computer Engineering under professor Negar Kiyavash. He worked on developing a method to better understand the network topology, or structure, of causally interacting processes. He used simulations, identified the functional connectivity in neuroscience data as well as inferred influences in the Twitter social media network to prove his method's effectiveness.

Quinn is joining Purdue University's School of Industrial Engineering as an assistant professor.
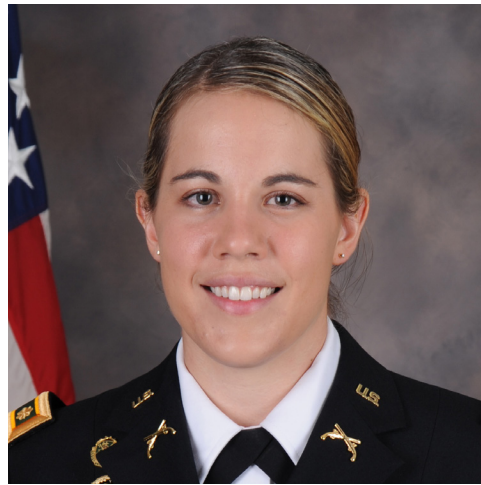
Heather Ritchey's M.S. thesis "Military Budget Decisions: Inferring Trade-Offs Using Decision Analysis" was written under professor Ali Abbas. She writes, "My graduate experience at UIUC exposed me to the wide range of subjects within the field of Industrial Engineering. An international faculty and student population added to the richness of the experience and provided additional insights beyond the pages of our text books."

She will be teaching at the United States Military Academy, Department of Systems Engineering, at West Point, NY.
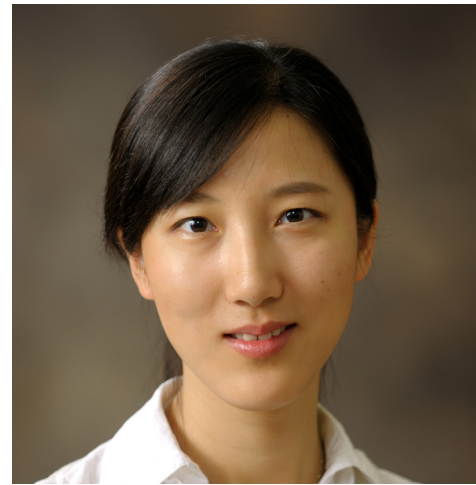
Yunwen Xu wrote her dissertation "Clustering and Aggregation Methods for Large Networked Systems" under professor Carolyn Beck. An expert in Control and Optimization, Xu will be working for GE Global Research Center in Niskayuna, NY as a Research Scientist. Xu says, "After graduating from the University of Illinois, I plan to join an industrial research lab, spend several years working with practical problems, and really understand how theory works."

She is working at GE Global Research Center, Niskayuna, NY.

Vijayalakshmi Deverakonda wrote her thesis "Disjunctive Normal Formula Based Supervisory Control Policy for General Petri Nets" with Professor R.S. Sreenivas. About her experience earning her MSIE, she says she enjoyed the people and atmosphere of ISE and "working and studying with world-class professors and students."

**She is working at Amazon.com in Seattle, WA.**

ISE FACULTY
NEWS, AWARDS, AND HONORS

CAROLYN BECK

Associate Professor of Industrial and Enterprise Systems Engineering Carolyn Beck was invited to give a semi-plenary lecture at the 21st International Symposium on the Mathematical Theory of Networks and Systems (MTNS 2014) at the University of Gronigen in the Netherlands. Beck's lecture is titled "Aggregation for control, and control in aggregation."

LIMING FENG
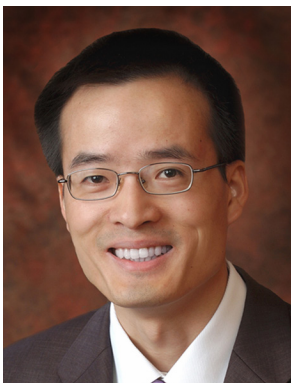
Associate Professor Liming Feng accepted an invitation to be an Associate Editor for *Mathematical Finance*, a top journal in its field.

Jingnan Chen, Feng's student, won first place in the 2013 INFORMS Financial Services Section Best Student Research

Paper Award for "Optimal Portfolio Liquidation with a Markov Chain Approximation Approach" jointly written with Feng and Professor Jiming Peng at the University of Houston. Jingnan joined the Singapore University of Technology and Design as an Assistant Professor in Fall 2014.

HARRISON KIM

Associate Professor Harrison Kim has been awarded with research funding from Deere and Co. for a new fiscal year ($150k) for a research project titled Sustainable Product Design. The project has been providing foundations for Deere to lead the initiative in environmentally sustainable product design and development. The team has been developing a new life cycle assessment (LCA) framework for a family of complex products in collaboration with Deere and Co. The award total is $558,435 for four years (2010-2014).

Kim was elected as a member of the executive committee of the Design Automation Committee (DAC) in the American Society of Mechanical Engineers (ASME) with a five-year commitment. He is slated to chair an upcoming design automation conference.

Kim won the Reviewers' Choice Award, International Conference on Engineering Design (ICED 2013). His paper was ranked in the top 10% among 345 papers accepted.

As faculty advisor, Kim took third Place in a poster competition for American Center for Life Cycle Assessment (ACLCA).

Kim was awarded Dean's Award for Excellence in Research 2014 (formerly Xerox Award). Four awards are given to associate professors who have been judged by their colleagues to have conducted the best research during the past five academic years.

GIRISH KRISHNAN

Assistant Professor Girish Krishnan organized the Student Mechanism and Robot Design Competition at the American Society of Mechanical Engineers (ASME) International Design Engineering Technical Conference in Buffalo, New York. Both undergraduate and graduate students submitted projects judged at the conference on their "creativity, practicality, integrity of analysis and design methodology, and quality of a

fabricated prototype and a final report."

Krishnan's graduate research on elastic design, which was inspired by animals like worms and octopuses that can move easily without a skeletal structure, was mentioned in a May 2014 article in Scientific American entitled "Shape-Shifting Things to Come."

FOR FURTHER READING

http://www.scientificamerican.com/article/flexible-bio-inspired-machines-are-the-future-of-engineering/
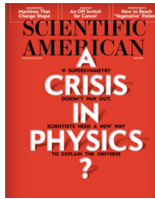
RICH SOWERS

ISE Professor Richard Sowers and a team of researchers recently received a $3,500 award to create an app that will use big data to give consumers more knowledge about the produce they buy. The app, called Food Origins, will help users trace where and when their food was harvested, its genetic strain, and its recall status.

FOR FURTHER READING

http://engineering.illinois.edu/news/article/8519

DUŠAN M. STIPANOVIĆ

Associate Professor Dušan M. Stipanović was awarded the Sharp Outstanding Teaching Award in Industrial Engineering. The Sharp Outstanding Teaching Award in Industrial Engineering was endowed by a philanthropic gift from Dr. James Franklin Sharp of New York, New York (originally from Chester, Illinois)

DEBORAH THURSTON

Professor Deborah Thurston was awarded ASME's Kos Ishii Toshiba Award for sustained and meritorious contributions to design for manufacturing and life cycle.

For Thurston, the Kos Ishii award goes beyond mere professional recognition. Ishii was her long-time friend and colleague. "We came up together. We were both in the same area, research-wise. We both started out in artificial intelligence and design, and then

we both moved into lifecycle and environmentally conscious design."

She says that, despite the competition in the field and the difficulty in finding venues for research in the early days of environmentally conscious design, Ishii "was a good friend who would freely share useful information." When asked for particular memories of Ishii, she remembers him as being always cutting-edge. "In the days when most of us still brought transparencies to give talks at conferences, Kos was the first person I ever saw using a laptop to put finishing touches on his powerpoint presentation just minutes before he had to speak," she laughs.

QIONG WANG
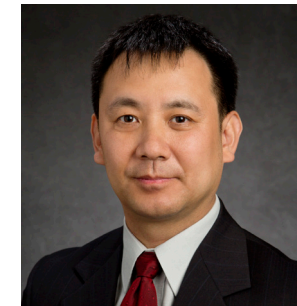
Associate Professor Qiong Wang received an award from NSF's Science of Science Program on a project of modeling and optimizing operations in industrial laboratories, in collaboration with Columbia University.

This project, entitled "Collaborative Research: Models and Analyses of Industrial Laboratories: Returns, Risks, and Structural Efficiency, with Implications for Sustainability and Science Policy," is under the direction of Wang.

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6. **Abbas, A. E.**, Bakir, N., Klutke, G., and Sun, Z., 2014, "The Effects of Risk Aversion on the Value of Information in Two-Action Decision Problems," *Decision Analysis,* 10(3), pp. 257–275.

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8. Karandikar, J., **Abbas, A.,** and Schmitz, T., 2014, "Tool Life Prediction Using Bayesian Updating, Part 2: Turning Tool Life using a Markov Chain Monte Carlo Approach," *Precision Engineering,* 38(1), pp. 18-27.

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28. Kwak, M., and **Kim, H. M.,** 2013, "Design for Lifecycle Profit With a Simultaneous Consideration of Initial Manufacturing and End-of-Life Remanufacturing," *Engineering Optimization Journal*.

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88. Behdad, S., Berg, L., **Thurston, D.** and Vance, J., 2014, "Leveraging Virtual Reality Experiences with Mixed-Integer Nonlinear Programming Visualization of Disassembly Sequence Planning under Uncertainty," *Transactions of ASME: Journal of Mechanical Design,* 136(4).

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92. Plambeck, E. L., and **Wang, Q.,** 2013, "Implications of Hyperbolic Discounting for Optimal Pricing and Information Management in Service Systems," *Management Science,* 59(8), pp. 1927-1946.

ISE FACULTY GRANTS

1. **Abbas, Ali** (PI), Collaborative Research, National Science Foundation, "Organizational and Uncertainty Impacts of Couplings in a System Design Framework," $240,000, 8/1/13-07/31/16.

2. **Abbas, Ali** (PI), Early Concept Grants for Exploratory Research (EAGER), National Science Foundation, "A Decision Analytic Framework for Large-Scale Design and Manufacturing," $298,924, 9/15/12-8/31/15.

3. **Allison, James T.** (PI), American Society of Mechanical Engineers (ASME), "Network Analysis of ASME Design Automation Literature," $16,000, 1/2014-9/2014.

4. **Allison, James T.** (Co-PI), Defense Advanced Research Projects Agency (DARPA), "Illinois Biological Foundry for Advanced Biomanufacturing (iBioFAB)—TA1," $264,612, 3/2014-8/2014. (PI: Huimin Zhao, UIUC.)

5. **Allison, James T.** (PI), Jet Propulsion Laboratory (JPL), "Strain Actuation & Sensing of SC Structures for Payload Jitter Suppression and Momentum Dumping," $30,000, 3/2014-6/2014.

6. **Allison, James T.** (Co-PI), Center for Compact and Efficient Fluid Power, NSF, "Rheological Design for Efficient Fluid Power," $208,250, 5/2014-4/2016. (PI: Randy Ewoldt, UIUC).

7. **Allison, James T.** (PI), Deere & Company, "Development of Generative Algorithm-Based Strategies for System Architecture Design Optimization with Large-Scale Capabilities," $100,000, 11/2013-10/2014. (Successfully renewed for Year 2.)

8. **Chen, Xin** (PI), CMMI, NSF, "Pricing Analytics: Modeling, Theory and Algorithms," $300,000, 5/15/14-4/30/17.

9. **Chen, Xin** (PI), NSF, "Tractable Approximation of Dynamic Decision Making Models Under Uncertainty," $150,000, 7/2010-6/2014. (Continuing)

10. **Chen, Xin** (PI), National Science Foundation of China, "Inventory and Pricing Strategies for Perishable Products in the New Era," ¥200,000, 1/2013-12/2014. (Continuing)

11. **Feng, Liming** (Co-PI), Civil, Mechanical, and Manufacturing Innovation (CMMI), NSF, "Market-Based Calibration of Pricing Models For Financial and Energy Option Contracts, $340,000, 9/1/10-8/31/14. (PI: Jong-Shi Pang, University of Southern California. Continuing)

12. **Kim, Harrison** (PI), Deere and Company, "Sustainable Product Design (Phase IV)," $150,000, FY2014.

13. Kiyavash, Negar (PI), Faculty Early Career Development (CAREER), NSF, "A Timing Approach to Network Forensics," $450,000, 2011-2015. (Continuing)

14. **Kiyavash, Negar** (Co-PI), Multidisciplinary Research Program of the University Research Initiative (MURI), Air Force Office of Scientific Research (AFOSR), "Multi-Layer and Multi-Resolution Networks of Interacting Agents in Adversarial Environments," 2010-2015, $407,208. (PI: Tamer Başar, UIUC. Continuing)

15. **Kiyavash, Negar** (PI), Division of Computer and Communication Foundations (CCF), NSF, "Toward a General Theory of Information Transfer via Timing, $314,965, 2011-2015**.** (Continuing)

16. **Krishnan, Girish** (Co-PI), Center of Compact and Efficient Fluid Power, NSF, "Soft Pneumatic Actuators for Arm Orthosis," $212,666 (requested; amount received TBD), 6/1/14—5/31/16. (PI: Elizabeth Hsiao-Wecksler, UIUC.)

17. **Nagi, Rakesh** (PI), Army Research Labs (via CUBRC, Inc.), "Hard-Soft Data Fusion MURI - Technology Transition," $95,000. 8/2014—12/2014.

18. **Nagi, Rakesh** (PI), Office of Naval Research (ONR) 11-001 (via CUBRC), "Control of Anarchical and Ordered Systems (CAOS): Mathematical Programming Approaches for Measuring Decentralized and Centralized Network Operations," $977,418 (UI subcontract $142,251), 7/2012-6/2015. (With co-PIs Mark Karwan, R. Batta, and M. Sudit (CUBRC PI), all of University of Buffalo).

19. **Nagi, Rakesh** (PI, 1/2011-), Multidisciplinary University Research Initiative (MURI), Army Research Office (ARO), "Unified Research on Network-based Hard/Soft Information Fusion," *US Army Research Office*, $6,250,000 (University of Illinois subcontract $291,807), 6/2009-2/2015. (With James Llinas (PI, 6/2009 to 12/2010) and co-PIs Ann Bisantz and Moises Sudit, all of University of Buffalo; additional sub-contractors Penn State, Tennessee State, and Iona College).

20. **Nedich, Angelia** (PI), Division of Mathematical Sciences, NSF, "Optimization With Uncertainties Over Time: Theory and Algorithms," $183,768, 2013-2016.

21. **Nedich, Angelia** (Co-PI), CCF, NSF, "Controlled Sensing, and Distributed Signal Processing and Decision Making in Networked Systems," $1,069,290, 2011-2016. (PI: Venugopal Veeravalli, UIUC. Continuing)

22. **Nedich, Angelia** (PI), Office of Naval Research, "Information Structures, Signaling, and Competitively Optimal Policies in Decentralized Online Optimization," $249,000, 2012-2017. (Jointly with PIs Maxim Raginsky and Cedric Langbort, UIUC. Continuing)

23. **Nedich, Angelia** (PI), Office of Naval Research, "Optimization Algorithms for Resource Management: Decentralization, Near-Optimality and the Price of Anarchy," $374,500, 2012-2015. (Jointly with PI Rayadurgam Srikant, UIUC. Continuing)

24. **Oh, Sewoong** (Co-PI), Strategic Instructional Initiatives Program, College of Engineering, "Adaptive Learning via Big Data," 2013-2015. (With Co-PIs Matt West, Geir Dullerud, and Craig Zilles, UIUC. Continuing)

25. **Olshevsky, Alex** (PI), CAREER, "Algorithms and Fundamental Limitations for Sparse Control," $400,000, 3/1/14-3/1/19.

26. **Price, Raymond** (iFoundry Co-Director), Severns Family Foundation, The Illinois Foundry for Innovation in Engineering Education (iFoundry), 9/2013-9/2014, $50,000.

27. **Price, Raymond** (iFoundry Co-Director), VentureWell (formerly the National Collegiate Inventors and Innovators Alliance (NCIIA)), funding for iFoundry Innovation Certificates, $41,000, 7/2012-1/2016. (Continuing)

28. **Price, Raymond** (iFoundry Co-Director), Proctor and Gamble Fund, funding for Innovation Certificates, $9,500, 12/2011-12/2014. (Continuing)

29. **Sowers, Richard** (PI), DMS, NSF, "Systemic Risk and Topology," $134,990, 10/1/13-9/30/15. (Jointly with PI Henry Schenck, UIUC.)

30. **Srinivas, R. S.**, Grants for Advancement of Teaching Engineering (GATE), "Introduction of Portable Laboratory Kits into the General Engineering Introduction to Control Systems Course," $25,600, 5/2014-5/2015.

31. **Stipanović, D. M.** (PI), Qatar National Research Fund, "Smart Systems for Field Monitoring and Surveillance, $150,000 (total: $300,000), 2011-2014. (Jointly with PI Petros G. Voulgaris, UIUC. Continuing)

32. **Stipanović, D. M.** (Senior Personnel), Small Business Technology Transfer (STTR), Department of Defense/U. S. Air Force, "Game-Theoretic Space Situational Analysis Toolbox (Phase 1)," $50,000 (total: $150,000), PY2013. (PI: Aleksandar Zatezalo, Scientific Systems Company, Inc., Woburn, MA. Continuing)

33. **Thurston, Deborah** (Co-PI), CMMI, NSF, Enhanced Immersive Technology to Improve Collaborative Decision Making, 2011-2014, $589,192 (PI: Judy Vance, Iowa State University. Continuing)

34. **Wang, Qiong** (PI), CMMI, NSF, "Inventory Management in Assemble-To-Order Systems: Analysis, Policies, and Asymptotic Optimality," $349,999, 4/1/14-3/31/17.

35. **Wang, Qiong** (PI), Science of Science Policy (SciSIP), NSF, "Models and Analyses of Industrial Laboratories: Returns, Risks, and Structural Efficiency, with Implications for Sustainability and Science Policy," $261,968, 5/1/14-4/30/17.

36. **Wang, Qiong** (PI), CMMI, NSF, "Strategic Planning of Internet Services in the Presence of User-Initiated Innovations: Implications for Network Neutrality," in collaboration with Columbia University, $102,724, 9/1/14-8/31/17.

ISE FACULTY CONFERENCE PUBLICATIONS

1. **Abbas, A. E.,** 2013, "Normative Perspectives on Engineering Systems Design," IEEE Systems Conference, SYSCON, Orlando, FL.

2. Sun, Z., and **Abbas, A. E.,** 2013, "Bayesian Updating on Price Elasticity of Uncertain Demand," IEEE Systems Conference, SYSCON, Orlando, FL.

3. Valicka, C, **Stipanovic, D.,** and **Abbas, A. E.,** 2013, "Multiattribute Utility Copulas for Multiobjective Control," Proc. American Control Conference, Washington, DC.

4. Abdildin, Y.G. and **Abbas, A.E.,** 2013, "Canonical Multiattribute Utility Functions: Enumeration, Verification, and Application," Proc. International Conference on Computational Science, Procedia, Barcelona, Spain.

5. **Allison, J. T.,** 2013, "Design Principles for Autonomous Engineering Systems," poster presented at AHEAD Autonomy Research Showcase, Dayton, OH.

6. **Allison, J. T.,** 2014, "Rethinking MDO for Dynamic Engineering System Design," SIAM Conference on Optimization, San Diego, CA.

7. Guo, T., and **Allison, J. T.,** 2013, "On the Use of MPCCs in Combined Topological and Parametric Design of Genetic Regulatory Circuits," Proc. 10th World Congress on Structural and Multidisciplinary Optimization.

8. **Allison, J. T.,** Khetan, A., and Lohan, D, 2013, "Managing Variable-Dimension Structural Optimization Problems using Generative Algorithms." Proc. 10th World Congress on Structural and Multidisciplinary Optimization.

9. Bharadwaj, N. A., **Allison, J. T.,** and Ewoldt, R. H., 2013, "Early-Stage Design of Rheologically Complex Materials via Material Function Design Targets," Proc. 2013 ASME International Design Engineering Technical Conference (IDETC), Portland, OR.

10. Herber, D. R., and **Allison, J. T.,** 2013, "Wave Energy Extraction Maximization in Irregular Ocean Waves using Pseudospectral Methods," Proc. 2013 ASME IDETC, Portland, OR, DETC2013-12600. Finalist for DAC Best Paper Award.

11. Deshmukh, A., and **Allison, J. T.,** 2013, "Design of Nonlinear Dynamic Systems using Surrogate Models of Derivative Functions," Proc. 2013 ASME IDETC, Portland, OR, DETC2013-12262.

12. Ma, J. and **Kim, H. M.,** 2013, "Continuous Preference Trend Mining for Optimal Product Design With Multiple Profit Cycles," Proc. ASME IDETC.

13. Kwak, M. and **Kim, H. M.,** 2013, "Green Profit Maximization Through Joint Pricing and Production Planning of New and Remanufactured Products," Proc. ASME IDETC, Portland, OR, DETC2013-12162.

14. Kwak, M. and **Kim, H. M.,** 2013, "Design for Lifecycle Profit With a Simultaneous Consideration of Initial Manufacturing and End-of-Life Remanufacturing," ICED13, Seoul, Korea.

15. Quinn, C., Etesami, J., **Kiyavash, N.,** and Coleman, T., 2013, "Robust Directed Tree Approximations for Networks of Stochastic Processes," IEEE International Symposium on Information Theory (ISIT), Istanbul, Turkey.

16. Quinn, C., Pinar, A., and **Kiyavash, N.,** 2013, "Optimal Bounded-Degree Approximations of Joint Distributions of Networks of Stochastic Processes," IEEE ISIT, Istanbul, Turkey.

17. Cullina, D., and **Kiyavash, N.,** 2013, "An Improvement to Levenshtein's Upper Bound on the Cardinality of Deletion Correcting Codes," IEEE ISIT, Istanbul, Turkey.

18. **Krishnan, G.,** Rank, R., Rokosz, J., Carvey, P., and Kota, S., 2013, "A Strength-Based Approach for the Synthesis of a Compliant Nonlinear Spring for an Orthotic Knee Brace," Proc. of the 2013 ASME IDETC, Portland, OR.

19. Bishop-Moser, J., **Krishnan, G.,** and Kota, S., 2013, "Force and Hydraulic Displacement Amplification of Fiber Reinforced Soft Actuators," Proc. of the 2013 ASME IDETC-CIE, Portland, OR.

20. Bishop-Moser, J., **Krishnan, G.,** and Kota, S., 2013, "Force and Moment Generation of Fiber-Reinforced Pneumatic Soft Actuators," IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Tokyo, Japan, pp. 4460-4465.

21. Herber, R. D., McDonald, J. W., Alvarez-Salazar, O. S., **Krishnan, G.,** and **Allison, J. T.,** 2014, "Reducing Spacecraft Jitter During Satellite Reorientation Maneuvers Via Solar Array Dynamics," AIAA Aviation 2014.

22. Arena, J., **Allison, J. T.,** and **Krishnan, G.,** 2014, "Co-design of a Compliant Pick and Place Robot," AIAA Aviation 2014, Atlanta, GA.

23. **Allison, J. T., Krishnan, G., Thurston, D.,** 2014. "Design of Engineering Systems in Industrial and Enterprise Systems Engineering Department at the University of Illinois," Fourth International Engineering Systems Symposium, Hoboken, NJ.

24. **Nedic, A.,** and **Olshevsky, A.,** 2013, "Distributed Optimization Over Time-Varying Directed Graphs," Proc. of the 52nd IEEE Conference on Decision and Control, Florence, Italy.

25. Lee, S., and **Nedic, A.,** "Gossip-based Random Projection Algorithm for Distributed Optimization: Error Bounds," Proc. of the 52nd IEEE Conference on Decision and Control, Florence, Italy.

26. **Nedic, A.,** and **Olshevsky, A.,** 2013, "Distributed Optimization of Strongly Convex Functions on Directed Time-Varying Graphs," Proc. Inaugural IEEE Global Conference on Signal and Information Processing (GlobalSIP) Conference, Austin, TX.

27. Lee, S., and **Nedic, A.,** "Distributed Mini-batch Random Projection Algorithms for Reduced Communication Overhead," Proc. Inaugural IEEE GlobalSIP Conference, Austin, TX.

28. Chang, T-H., **Nedic, A.,** and Scaglione, A., 2013, "Distributed Sparse Regression by Consensus-Based Primal-Dual Perturbation Optimization," Proc. Inaugural IEEE GlobalSIP Conference, Austin, TX.

29. Kerker, D., Jenkins, M.P, Gross, G.A., Bisantz, A. and **Nagi, R.,** 2014, "Visual Estimation of Human Attributes: An Empirical Study of Context-Dependent Human Observation Capabilities," IEEE International Multi-Disciplinary Conference on Cognitive Methods in Situation Awareness and Decision Support (CogSIMA), San Antonio, TX.

30. Ortiz-Pena, H., Hirsch, M., Karwan, M., **Nagi, R.** and Sudit, M., 2013, "A Multi-Perspective Optimization Approach to UAV Resource Management for Littoral Surveillance," 16th International Conference on Information Fusion, Istanbul, Turkey.

31. Date, K., Gross, G.A., Khopkar, S., **Nagi, R.** and Sambhoos, K., 2013, "Data Association and Graph Analytical Processing of Hard and Soft Intelligence Data," 16th International Conference on Information Fusion, Istanbul, Turkey.

32. Ogaard, K., Roy, H., Kase, S., **Nagi, R.**, Sambhoos, K. and Sudit, M., 2013, "Searching Social Networks for Subgraph Pattern Occurrences," 2013 SPIE Defense, Security, and Sensing (SPIE, DSS 2013), Baltimore, MD.

33. Ortiz-Pena, H., Hirsch, M., Karwan, M., **Nagi, R.** and Sudit, M., 2013, "Representation of Potential Information Gain to Measure the Price of Anarchy on ISR Activities," Proc. SPIE 8758, *Next-Generation Analyst*, 87580M.

34. Date, K. and **Nagi, R.,** 2013, "Optimal Placement of a Finite-size Facility: A Computational Study of Sequential and Parallel Implementations," MIM 2013 IFAC Conference on Manufacturing, Modelling, Management, and Control, St. Petersburg, FL.

35. Yousefian, F., **Nedic, A.,** and Shanbhag, U. V., "A Regularized Smoothing Stochastic Approximation (RSSA) Algorithm for Stochastic Variational Inequality Problems," Proc. 2013 Winter Simulation Conference, R. Pasupathy, S.-H. Kim, A. Tolk, R. Hill, and M. E. Kuhl, eds., Washington, DC.

36. Touri, B., Farnoud, F., **Nedic, A.,** and Milenkovic, O., 2013, "A General Framework for Distributed Vote Aggregation," IEEE American Control Conference (ACC), Washington, DC.

37. Etesami, S. R., Basar, T., **Nedic, A.,** and Touri, B., 2013, "Termination Time of Multidimensional Hegselmann-Krause Opinion Dynamics," IEEE ACC, Washington, DC.

38. Yousefian, F., **Nedic, A.,** and Shanbhag, U. V., 2013, "A Distributed Adaptive Steplength Stochastic Approximation Method for Monotone Stochastic Nash Games," IEEE ACC, Washington, DC.

39. Lee, S., and **Nedic, A.,** "Epoch Gradient Descent for Smoothed Hinge-loss Linear SVMs," IEEE ACC. Washington, DC.

40. Jain, P., **Oh, S.,** 2014, "Learning Mixtures of Discrete Product Distributions using Spectral Decompositions," 27th Annual Conference on Learning Theory, Barcelona, Spain.

41. Karger, D., **Oh, S.,** and Shah, D., 2013, "Efficient Crowdsourcing for Multi-class Labeling," Proc. of ACM SIGMETRICS, Pittsburgh, PA.

42. Marcus, A., Karger, D., Madden, S., Miller, R., **Oh, S.,** 2013, "Counting With the Crowd," Proc. 39th International Conference on Very Large Databases, Riva Del Garda, Trento, Italy.

43. Blondel, V., Jungers, R., **Olshevsky, A.,** 2013, "On Primitivity of Sets of Matrices," Proceedings of the IEEE Conference on Decision and Control, Florence, Italy.

44. Leonard, N., **Olshevsky, A.,** 2013, "Cooperative Learning in Multi-Agent Systems from Intermittent Measurements," Proceedings of the IEEE Conference on Decision and Control, Florence, Italy.

45. Hendrickx, J. M., **Olshevsky, A.,** 2013, "Symmetric Continuum Opinion Dynamics: Convergence, but Sometimes Only in Distribution," Proceedings of the IEEE Conference on Decision and Control, Florence, Italy.

46. **Olshevsky, A.,** 2013, "Consensus with Ternary Messages," Proceedings of the IEEE Conference on Decision and Control, Florence, Italy.

47. Jadbabaie, A., **Olshevsky, A.,** 2013, "Combinatorial Bounds and Scaling Laws for Noise Amplification in Networks," Proceedings of the European Control Conference, Zurich, Switzerland.

48. Behnia, B., Dave, E.V., Buttlar, W.G., and **Reis,**

H., 2013, "Acoustic Emissions (AE) Technique for Evaluation of Embrittlement Temperature of Asphalt Binders: Development and Field Calibration," 2013 ASCE T&DI Airfield & Highway Conference, Los Angeles, CA.

49. Behnia, B., Dave, E.V., Buttlar, W.G., and **Reis, H.,** 2013, "Acoustic Emissions Technique for Evaluation of Embrittlement Temperature of Asphalt Binders: Development and Field Calibration," 5th European Asphalt Technology Association (EATA) Conference, Braunschweig, Germany.

50. Beall, F.C., **Reis, H.,** Senalik, A., and McGovern, M., 2013, "Ultrasonic Nondestructive Evaluation of Wood and Wood Products—Past, Present, and Future," 9th International Conference on Wood Science and Engineering (ISWSE), Brasov, Romania.

51. Behnia, B., Dave, E., Buttlar, W.G., and **Reis, H.,** 2013, "Acoustic Emissions (AE) Technique for Evaluation of Embrittlement Temperature of Asphalt Binders," 5th European Asphalt Technology Association Conference, Braunschweig, Germany.

52. Beall, F.C., **Reis, H.,** Senalik, A., and McGovern, M., 2013, "Ultrasonic Nondestructive Evaluation of Wood and Wood Products—Past, Present, and Future," 9th International Conference on Wood Science and Engineering (ISWSE), Brasov, Romania.

53. McGovern, M.E, and **Reis, H.,** 2014, "Linear and Nonlinear Characterization of Limestone Rock Using Non-Collinear Ultrasonic Wave Mixing," SPIE Smart Structures/NDE / Health Monitoring of Structural and Biological Systems Conference, San Diego, CA. *Health Monitoring of Structural and Biological Systems 2014*, Tribikram Kundu, ed., Proc. of SPIE, 9064, 906404-1/ 906404-15.

54. McGovern, M., Behnia, B., Hill, B., Buttlar, W.G., and **Reis, H.,** 2014, "Characterization of Oxidative Aging in Asphalt Concrete Pavements Using Its Complex Moduli," SPIE Smart Structures/NDE / Health Monitoring of Structural and Biological Systems Conference, San Diego, CA. *Health Monitoring of Structural and Biological Systems 2014*, Tribikram Kundu, ed., Proc. of SPIE, Vol. 9064, 906404-1/ 906404-15.

55. Block, D., Gatzke, N., and **Sreenivas, R. S.,** 2013, "On Controlling the Segboy using a Gameboy Advance," International Conference on Robotics, Biomimetics, Intelligent Computational Systems (ROBIONETICS 2013), Yogjakarta, Indonesia.

56. Block, D., Gatzke, N., and **Sreenivas, R. S.,** 2013, "On Using the Gameboy Advance as a Controller for Inverted Pendulums," ROBIONETICS 2013, Yogjakarta, Indonesia.

57. Singh, N., and **Sreenivas, R. S.,** 2013, "Wireless Networks: An Instance of Tandem Discrete-Time Queues," Fifth International Conference on Networks & Communications (NetCom 2013), Chennai, India.

58. Zatezalo, A., **Stipanović, D. M.,** Mehra, R. K., and Pham, K., 2014, "Constrained Orbital Intercept-Evasion," Proc. SPIE, Baltimore, MD.

59. Zatezalo, A., **Stipanović, D. M.,** Mehra, R. K., and Pham, K., 2014, "Space Collision Threat Mitigation," Proc. SPIE, Baltimore, MD.

60. Zatezalo, A., **Stipanović, D. M.,** Yu, S., and McLaughlin, P., 2014, "Game-Theoretic Approach to Peer-to-Peer Confrontations," Proc. AUVSI's Unmanned Systems, Orlando, FL.

61. Valicka, C., **Stipanović, D. M.,** and Abbas, A. E., 2013, "Multiattribute Copulas for Multiobjective Control," Proc. ACC, Washington, DC.

62. Atinc, G. M., **Stipanović, D. M.,** Voulgaris, P. G., and Karkoub, M., 2013, "Collision-Free Trajectory Tracking while Preserving Connectivity in Unicycle Multi-Agent Systems," Proc. 2013 ACC, Washington, DC.

63. Atinc, G. M., **Stipanović, D. M.,** Voulgaris, P. G., and Karkoub, M., 2013, "Supervised Coverage Control with Guaranteed Collision Avoidance and Proximity Maintenance," Proc. IEEE Control and Decision Conference, Florence, Italy.

64. Panagou, D., **Stipanović, D. M.,** and Voulgaris, P. G., 2013, "Multi-Objective Control for Multi-Agent Systems using Lyapunov-like Barrier Functions," Proc. IEEE Control and Decision Conference, Florence, Italy.

65. Behdad, S., Berg, L., **Thurston, D.,** and Vance, J., 2013, "Between Normative and Descriptive Design Theory and Methodology," Proc. ASME 2013 IDETC-CIE, Portland, OR.

66. Behdad, S., Joseph, L., and **Thurston, D.,** 2013, "Systems Simulation of Design for End-of-Life Recovery under Uncertainty," Proc. ASME 2013 IDETC-CIE, Portland, OR.

67. Fu, K., Reid, T. N., Terpenny, J. P., **Thurston, D.,** Vance, J., Finger, S., Wiens, G., Kazerounian, K., Allen, J., and Jacobson, K., 2013, "Broadening Participation: A Report on a Series of Workshops Aimed at Building Community and Increasing the Number of Women and Minorities in Engineering Design," Proc. ASEE Conference on Engineering Education, Atlanta, GA.

68. Mitra, D., and **Wang, Q.,** 2014, "The Stability of Best Effort and Managed Services in the Internet, and the role of Application Creation," Proc. IEEE INFOCOM2014, Third Workshop on Smart Data Pricing, Toronto, Canada.

WELCOMING ISE CLASS OF 2019!

ISE ALUMNI BOARD

The ISE Alumni Advisory Board is a group of ISE alums who want to stay connected to the Department and help make it even stronger. The 20-member Board meets twice a year on campus to learn about Department status, programs and plans, and to provide feedback and support. Appointed members are asked to serve for a four-year term and are encouraged to participate in one of the three standing committees. Past activities include mixers, networking events, resume and interview skills coaching for students, and lectures to scheduled ISE classes in targeted areas of practice.

COMMITTEES

- **Student Enrichment**—plans activities that enrich the ISE student experience
- **Alumni Relations**—organizes outreach activities to help ISE alums stay in touch
- **Business Perspectives**—serves as a resource for the Department to hear from ISE alums and leverage their experience

If you're interested in being nominated for membership, please contact Rick Blackwell at rblackwell@punshui.com

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Engineer in Residence Program

Our students value and are inspired by interaction with our alumni.

An Engineer in Residence will:
- Spend approximately 7-8 hours on campus
- Speak to our GE 390 class
- Stay "in residence" for an afternoon and/or morning for individual appointments with students

If you are interested in being an Engineer in Residence, please contact Shawna Graddy at sgraddy@illinois.edu.

Senior Engineering Project (SEE PAGE 14)

We invite your company to participate as an Industry Partner in the Senior Engineering Project. Within this unique class, we routinely accomplish the goals of educating our students with real world problems, solving special problems of our partnering companies and organizations, and introducing your company to potential recruits (see page 12).

If you have engineering projects that you think may be suitable for this program, please contact Harry Wildblood at wildblod@illinois.edu.

Endowment needs in ISE

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Fund a Fellowship | $300,000
The recruitment of top graduate students allows for a robust top-tier research program. Fellowships help to provide a pipeline of academic excellence for the next generation of faculty members and practitioners. While ISE at Illinois has rich research offerings to entice students, we must also compete against the financial incentives offered by other institutions.

Fund a Faculty Scholar | $250,000
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Fund a Scholarship | $250,000
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Allow faculty and students to interact with distinguished leaders who are influencing disciplines, society, the nation, or the world. Income from the fund is used to provide the resources to cover the expenses of bringing such speakers to campus.

Annual needs in ISE

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