

# INDUSTRIAL ENGINEERING AND MANAGEMENT SCIENCES

## NEW CENTER ENCOURAGES INTERDISCIPLINARY RESEARCH FOR OPTIMIZATION AND MACHINE LEARNING

### The Center for Optimization and Statistical Learning launched on October 1

As we become more entrenched in the Age of Big Data, the need for algorithms that can extract knowledge from unprecedented amounts of data is greater than ever.

Developing optimization formulations to design these algorithms and machine-learning techniques that can learn from and



Morton

make predictions about data is a challenge that no one field can tackle by itself.

To encourage the kind of interdisciplinary work needed to lead to new breakthroughs in this area, Northwestern Engineering established the new Center for Optimization and Statistical Learning.



“We want to bring together people from across both campuses who have different types of expertise to address larger problems” said Dave Morton, professor of industrial engineering and management sciences and director of the center.

“We hope to start conversations among members of the industrial engineering and computer science communities as well as faculty in business and medicine.”

Launched on October 1, the center explores how optimization and statistical learning can be combined to develop intelligent systems for processing images, videos, and speech; for Web search engines and recommendation systems; for allocating resources and designing markets in communication networks; for designing efficient and sustainable smart grid and renewable energy systems; for diagnosing and treating

disease; and for strengthening and securing systems of critical infrastructure.

These topics and more will be examined during a center-sponsored, interdisciplinary seminar series and annual workshop. The center has already hosted a handful of preliminary events, including a well-attended, daylong workshop in June and seminars featuring faculty research from diverse backgrounds, such as Bryan Pardo, who studies computer science and music.

Another goal for the center is to create a vibrant student community. It will fund a number of PhD fellows whose projects are in more than one area. Morton said the center also plans to develop undergraduate-level and graduate-level certificates and minors to encourage more student activity in the areas of optimization and machine learning.

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### Dear friends and colleagues,

The presence of industrial engineering and management sciences within the Northwestern landscape continues to expand. We have launched two multidisciplinary research initiatives and are in the middle of redefining the department's mission to better align it with new developments in engineering. Our undergraduate class is the largest in the department's history, requiring us to rethink our course offerings and to devise more effective ways of teaching and inspiring our students. Our faculty and students continue to garner prestigious awards. The department has had quite a busy year.

One of the most rewarding aspects in my role as department chair has been to observe how nimble and forward looking the department team is, and how all — faculty, students, staff, and alumni — work cohesively toward our common goal of keeping IEMS at the forefront of research and education.

In October, we launched the new Center for Optimization and Statistical Learning under the direction of Dave Morton (see page 1). This is a joint venture with the electrical engineering and computer

science department and builds upon our considerable expertise in optimization, statistics, simulation, and numerical software. The Center will serve as a focal point for much of IEMS's research in advanced analytics, including machine learning. It also complements our very successful Master of Science in Analytics program under the direction of Diego Klabjan. New plans to expand analytics offerings at the undergraduate level are in the planning phases and will be reported in next year's newsletter.

In October we also launched the second phase of the Center for Engineering and Health (CEH), under the continued direction of Sanjay Mehrotra. The center is a collaborative effort with the Feinberg School of Medicine and represents one of the most important areas of future development for the department: applying engineering principles to problems in the healthcare industry. The CEH has had a successful initial phase, yielding discoveries in areas as diverse as cancer treatment policies and kidney exchange programs. In its second phase, the CEH will grow both in terms of membership and in scope. Our Humanitarian Logistics initiative will now be

housed in the CEH, and there will be an increased emphasis in data driven decision-making models for medical treatment and planning.

The department is also engaged in exciting research efforts with external grantees, notably a recent project initiated with funding support from Intel®. Three of the lead investigators, Vadim Linetsky, Diego Klabjan, and Jeremy Staum, are collaborating with the electrical engineering and computer science department through the Intel® Parallel Computing Center, whose mission is to develop new financial engineering algorithms and tools that leverage high-performance computing resources. See page 9.

Our IEMS Advisory Board, under the direction of Sania Irwin, has been very active this past year. In addition to running a "Career Boot Camp" for our undergraduates every year, the board has launched a new alumni outreach program, in which undergraduate students are paired with mentors who have business or industrial experience. Rupesh Doshi and Brittany Martin-Graunke, who spearheaded this effort, enlisted 150 of our alumni to serve as mentors in this program. See more in the Assistant Chair's letter on page 6.

On September 25, the department had an all-day retreat to

plan activities for the next five years. The last retreat took place in 2009 and led to major changes in our undergraduate program, which were implemented under the able leadership of Jill Wilson. At this year's retreat, we laid out plans for changes in three undergraduate teaching areas: management sciences, senior design, and analytics. We have also devised a plan for how to integrate the Center for Optimization and Statistical Learning and the Center for Engineering and Health into the educational programs of IEMS. Much work lies ahead. We look forward to it.



**Jorge Nocedal**

*David A. and Karen Richards Sachs  
Professor and Chair*

## 2014–15 Gifts To The Department

The Department of Industrial Engineering and Management Sciences is extremely grateful for the generous donations it continues to receive from private and corporate donors. Below are donations received this year through July 31, 2015. Every dollar is used to support the academic, administrative, and research endeavors of our department. Please accept this acknowledgement with our deepest appreciation.

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# NORTHWESTERN STUDENTS HACK DATA FOR SOCIAL GOOD

## The inaugural course comprised 58 students and 33 different majors from across Northwestern's six undergraduate schools

A new undergraduate course at Northwestern Engineering is proving that analytics are not just for engineers.

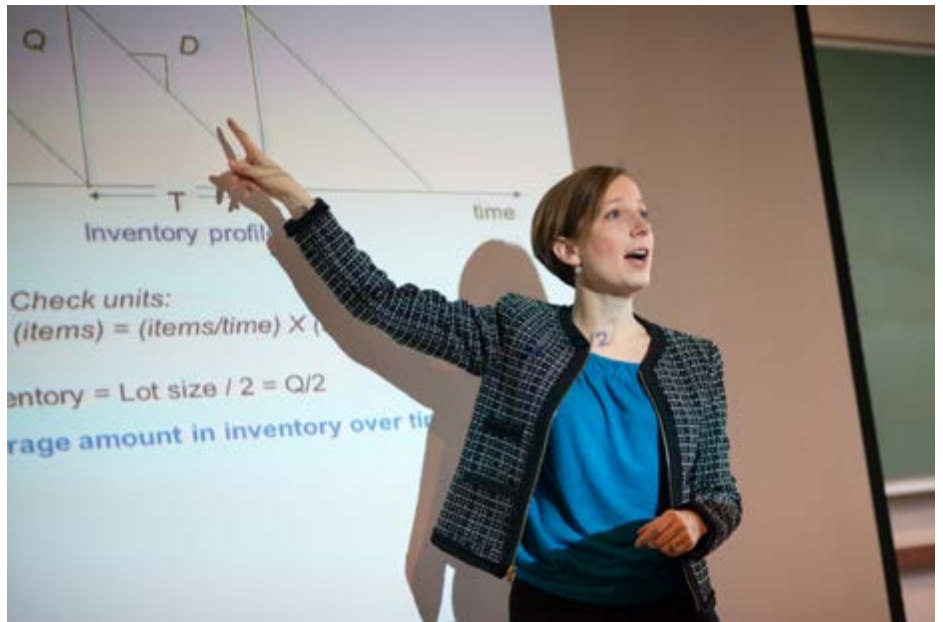
Offered by the Department of Industrial Engineering and Management Sciences for the first time last spring, the Analytics for Social Good course explored the challenges and opportunities of achieving social good in the age of big data.

In the class, students tackled topics ranging from using advanced technology for disaster response and preparedness to developing decision-making frameworks for community-based health care providers. In addition, the class hosted guest speakers from local and national organizations, who presented case studies that students worked on in interdisciplinary teams.

Taught by Karen Smilowitz, professor of industrial engineering and management sciences, the inaugural class of 58 students represented 33 different majors from all six undergraduate schools at Northwestern. Smilowitz met with engineering Dean Julio M. Ottino more than a year ago to discuss the possibility of offering an engineering course open to students from across the University. The resulting class, open to juniors and seniors, offered students a new way to look at nonprofit data problems.

In culmination of the course, students participated in the two-day IEMS 365: Analytics for Social Good Hackathon 2015, where they tackled data from the American Red Cross.

Jim McGowan, director of planning and situational awareness at the Chicago and Northern Illinois Region and North Central



Professor Karen Smilowitz taught Northwestern's inaugural IEMS 365: Analytics for Social Good course last spring. The course explored the challenges and opportunities of achieving social good in the age of big data, culminating with a two-day hackathon, during which students tackled data from the American Red Cross.

Division of the American Red Cross, told students that the hackathon is an opportunity for them to craft their own "stories" with the data. "You will see relationships develop as you begin to analyze our data sets, which will influence how you create your projects," he told the students. "Ultimately, your area of focus is up to you."

The hackathon's winning team, Sprout, developed an algorithm capable of culling the Red Cross's multiple incoming incident platforms into a single message stream so dispatch volunteers could more easily filter and respond to events.

Another team, Team Pie HFPL Mobile App, created a prototype app to benefit

the Red Cross's Home Fire Preparedness Campaign, which distributes free smoke alarms. The app not only uses data to prioritize the city zip codes that could benefit most from the program, but also digitizes the collection information, which was previously completed through paper forms.

Smilowitz said she plans to offer Analytics for Social Good again next year, and credits her inaugural class for its success.

"These students have been willing to take on this challenge. They have been excited to learn and have demonstrated the patience needed during a first-year class," she said. "It has been an amazing group of students."

"THESE STUDENTS HAVE BEEN WILLING TO TAKE ON THIS CHALLENGE. THEY HAVE BEEN EXCITED TO LEARN AND HAVE DEMONSTRATED THE PATIENCE NEEDED DURING A FIRST-YEAR CLASS."

KAREN SMILOWITZ



# IEMS 2015 GRADUATION

Hundreds of purple-robed undergraduate, master's, and PhD students graduated from the McCormick School of Engineering and Applied Science in June as part of a weekend of festivities. At Northwestern University's 157th Commencement exercises at Ryan Field, IBM president Virginia Rometty—Northwestern Engineering alumna and the first woman to head IBM—stressed the uniqueness of the time in history as big data gives rise to a new era of computing.

## PhD Graduates

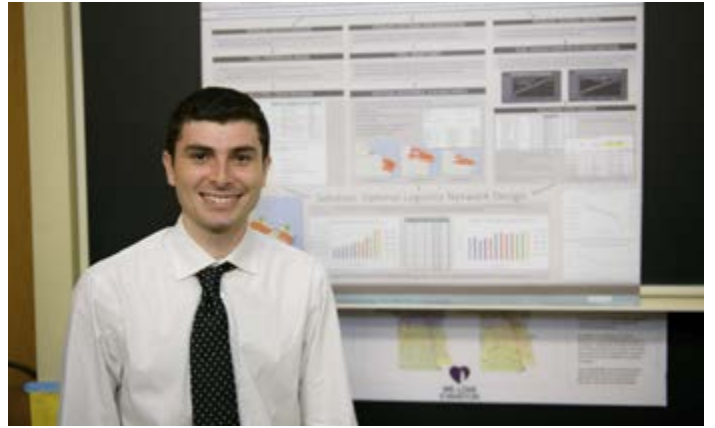
*In the 2014–15 academic year, IEMS graduated 10 PhDs: Brittany Bogle, Luis de la Torre, Tingting Jiang, Changhyeok Lee, Alvaro Maggiar, Samantha Meyer, Young Woong Park, Edwin Shi, Timothy Sweda, and Qiuping Yu. These graduates went on to academic and industry positions at places like Amazon, University of Michigan, Goldman Sachs, and Schneider National.*





## Senior Ceremony

On June 19, nearly 100 IEMS undergraduate students and their families celebrated graduation at the IEMS 2015 Senior Ceremony. The event highlighted special student awards and achievements and provided time for students, faculty, and family to connect.



## FROM THE ASSISTANT CHAIR

### Dear friends and colleagues,

I recently sponsored an INFORMS-funded workshop at Northwestern in which Professor Ken Chelst of Wayne State University introduced decision contexts to high school math teachers as a way to motivate their students to learn algebraic concepts. In my interactions with teachers, I found it intriguing that many of them had never heard the phrase “industrial engineering.” This response is consistent with what I hear from students at Northwestern and the pattern by which students become industrial engineering majors.

Our department starts the school year with fewer than 20 of the more than 400 freshmen engineering students. Three years later, we find that more than 80 of those same students are preparing to graduate with a BSIE. Many of them simply haven’t heard of our field before they arrive on campus. When they get here and learn what industrial engineering is all about, they can’t wait to get started. I find it interesting that a field as ubiquitous and valuable as industrial engineering is virtually unknown to our youth and

to many of their math teachers. We must aim to increase awareness. Strengthening our connections with local area math teachers to educate them on our favorite engineering discipline is a start.

Our student Institute of Industrial Engineers (IIE) chapter has made great strides this year in adding professional value to the industrial engineering degree and in engaging the student body. Of particular note: the chapter organized a networking event to introduce students to area employers interested in industrial engineering students. Although the academic year is packed with career-oriented events, they can be overwhelming for students, and none are specific to industrial engineering. Held in the spring, the new IIE event allowed students more time to talk one-on-one with potential employers and to think about how they might be better prepared for the coming fall recruitment season. Northwestern’s IIE plans to host a similar event again this year.

This year, the IEMS Advisory Board rolled out the new Alumni

Mentorship Program. This initiative, led by Rupesh Doshi and Brittany Martin Graunke, matches undergraduate students with participating alumni for help with anything from resume development and interview preparation to advice on career directions. The program is designed to provide meaningful connections while using alumni time as efficiently as possible. If you are interested in joining the program as an alumni mentor, contact Rupesh at [rupesh.doshi@gmail.com](mailto:rupesh.doshi@gmail.com).

In other undergraduate news, this year we prepare for the rollout of an option to complete departmental honors through the Master of Science in Analytics (MSiA) program. Two rising juniors will be chosen from a pool of applicants to take three MSiA courses to fulfill the advanced course requirement for the honors program. These students will go on to complete research projects, most likely in analytics. Applications will begin this winter, with students beginning the program in fall 2016. This initiative allows us to provide a deeper data analytics education for our strongest students while increasing our visibility in undergraduate research.

Finally, we are proud to announce that recent graduate Taylor Hanken received third prize from McCormick Advisory Board for the Mickelson Prize for Innovation and Creativity. Taylor was recognized for his work to develop a data visualization system that has been used in Forward Command at the Chicago Marathon and the Shamrock Shuffle. The Bank of America Chicago Marathon also recognized Taylor’s contribution by awarding him an honorary 2014 Chicago Marathon finisher medal.



**Jill Wilson**  
Assistant Department Chair  
for Undergraduate Studies

## FROM WELL TO WIRE

### Using life-cycle analysis to optimize shale gas production

Northwestern’s **Fengqi You** has designed computational models to analyze the “well-to-wire” life cycle of electricity generated from shale gas. His models account for a number of stages in the process, including freshwater acquisition, shale well drilling, fracking, gas production and processing, wastewater management, and electricity generation, as well as transportation and storage. By discovering optimal design and operations for the shale gas supply chain, You believes the United States will benefit both environmentally and economically.

You is an assistant professor of chemical and biological engineering with a courtesy appointment in the Department of Industrial Engineering and Management Sciences. His findings were published in the June issue of *ACS Sustainable Chemistry & Engineering*.

Through modeling, You found that environmental pollutants produced from fracking can be mitigated by restructuring the supply chain. First, You recommends using a network of pipelines to transport freshwater to drilling sites and transport shale gas to processing and power plants.

By removing trucks from the equation, the industry would save on gas and cut exhaust emissions.

Next, You suggests evenly distributing drilling activities at different well sites over the years instead of drilling all sites at once. The industry would then avoid transporting the gas to long-term storage facilities. It would also reduce the amount of water needed at one time. As a result, facilities can be designed with a more suitable capacity, reducing the capital investment and negative ecological impacts.

# DISSERTATION IMPACTS

## CHICAGO ELEMENTARY SCHOOLS

### Samantha Meyer (PhD '15) analyzed field data from nine schools

With the support of a National Science Foundation (NSF) grant, recent graduate Samantha Meyer (PhD '15) focused her dissertation on analyzing field data from nine participating Chicago Elementary Schools in the area of operations issues.

Her work specifically explored resource acquisition. Schools face limited budgets, a fact that drives schools to build resource-exchange relationships with



Meyer

external organizations in hopes of supplementing existing resources in the face of scarcity.

In particular, the nine schools in the study relied heavily on external organizations, such as non-profits, social service agencies, health centers or hospitals, and religious institutions, for critical resources such as money, materials, and services. However, the interviews and surveys made it clear that acquiring resources from these external entities was not simply a linear function of cost, but rather a function of the invested effort in

communication and relationship-building between the school and the external organization. The survey data statistically showed that the better the effort in this area, the greater quality and quantity of resources the school acquired.

With the help of Andrea Prado Tuma, a graduate student from Northwestern's School of Education and Social Policy, the team conducted more than 100 hours of interviews with school principals, staff,

broadly publish her results and track the way these schools are changing based on the data collected from her research. She hopes to continue a longitudinal study on the subject to discover how theoretical decisions play out in the real world over time.

Once Meyer's year as a research fellow concludes, she will continue her work at the University of Michigan as an assistant professor in the technology and operations

SCHOOL LEADERS ARE NOW USING INSIGHTS FROM MEYER'S DISSERTATION TO BUILD RELATIONSHIPS WITH NECESSARY PARTIES.

and parents, and collected more than 250 surveys across the nine schools. This rich data set was critical for understanding what technical problems were present and what social factors may influence solutions to those technical problems.

Meyer's dissertation not only examined the ways social relationships and resource acquisitions interact at the nine schools, but also proposed models to incorporate the strength of inter-organizational relationships into school procedures.

School leaders are now using insights from Meyer's dissertation to build relationships with necessary parties. Meyer is using her first year at the University of Michigan as a research fellow so that she can more

group at the Stephen M. Ross School of Business. Her work will focus on using field work, such as interviews and surveys, to examine operational issues in complex organizational contexts.

The NSF award that funded Meyer's dissertation work was an interdisciplinary project combining faculty across three areas: Karen Smilowitz, professor of industrial engineering; James Spillane, the Spencer T. and Ann W. Olin Professor in Learning and Organizational Change at the School of Education and Social Policy; and Paul Leonardi, the Duca Family Professor of Technology Management at the University of California at Santa Barbara.

### New Center Encourages Interdisciplinary Research For Optimization And Machine Learning

Continued from page 1 ...

"You can use optimization in surprising areas," Morton said. "Decision-making is a large part of industrial engineering. How do you use data to make informed decisions? Optimization is a part of that."

Morton's own research includes decision-making and the development of opti-

mization models to help guide the design of complex systems, such as the power grid. He joined Northwestern last year from the University of Texas at Austin, saying that he was attracted to Northwestern's interdisciplinary nature. Communication networks and optimization expert Randall Berry and machine-learning expert Doug Downey,

both professors of electrical engineering and computer science, will join Morton on the center's steering committee. The center will include a large number of IEMS faculty in the areas of optimization, statistics, and simulation and become one of the cornerstones for much of the future research in the department.



# ANALYSIS OF STATE OF THE UNION ADDRESSES WINS HACKATHON



Members of the Teradata Aster team surround Zach Anglin (middle with blue shirt) and Shawn Li (middle with grey sweater), the winners of the second annual MSiA Hackathon. IEMS professor and MSiA director Diego Klabjan (on the end in blue jacket) joins the celebration.

## The daylong competition was a collaboration between the MSiA program and Teradata Aster

Is a more positive US president also a more popular one? The student team that won Northwestern's Master of Science in Analytics (MSiA) program's Hackathon thinks so.

During its second annual Hackathon in spring 2015, MSiA graduate students Zach Anglin and Shawn Li combed through every State of the Union Address since 1790. The team used software to label the sentiment of each sentence as either positive or negative and looked at ratios between these two labels. They found that, throughout history, State of the Union addresses were typically positive. Just how positive they were did not seem to affect outside factors, such as the economy or international conflicts, but it did

affect the president's approval rating, the team found.

That insight was one of several found at the Hackathon, a collaboration between the MSiA program and leading big data analytics company Teradata. The daylong competition challenged students to apply the Teradata Aster Discovery Platform, an analytic engine designed for big data sets to solve complex problems. Students chose from eight publicly accessible data sets: NFL or MLB statistics, Amazon reviews, State of the Union addresses, airline flight data, and US consumer bank complaints. How they analyzed sets, or what insights to search them for, was up to them.

"It's beneficial for our students to receive a data set without having a clear question to solve," said Diego Klabjan, professor of industrial engineering and management sciences and director of the MSiA program. "So then they have to be creative about

finding the problem and look for a strategy to solve it."

Teradata partners with MSiA each year to expose students to analytics tools and techniques for telling stories hidden within large data sets. A day prior to the Hackathon, members of the Teradata Aster team visited Northwestern to train the MSiA students on their software. After three hours of training, students were able to fully grasp and apply the technology. During the Hackathon event, Teradata team members circulated the room to help participants successfully navigate their projects.

At the end of the day, 18 student teams presented their findings to a panel of judges and their peers. Judges evaluated students based on their abilities to think creatively about data in a limited amount of time. The first and second place teams will be sponsored by Teradata Aster to attend its Partners User Conference in Anaheim, California.

Anglin and Li impressed the judges by not just hacking the State of the Union data alone. They also compared it to approval ratings from Gallup polls taken



directly before and after the addresses. Among their findings, the team found that Republicans give even more positive addresses when the economy is poor as opposed to Democrats, who tend to be more understated during tough times. These sentiments boost Republicans' ratings and hurt Democrats' approvals.

Northwestern's MSiA program teaches students skills that drive business success in today's hyper-competitive, data-driven world. Students learn to identify patterns and trends, derive optimized recommendations evaluated through simulations, interpret and gain insight from vast quantities of structured and unstructured data, and communicate findings in practical, useful terms that help drive business management.

"Analytics is one of the hottest topics in the business world," said Oliver Ratzesberger, senior vice president of software at Teradata. "Many companies are in an analytics arms race. There is a constant battle to optimize and innovate how we deal with large sets of data."



Zach Anglin and Shawn Li present their winning findings to their peers and the hackathon judges. The team combined data from State of the Union addresses since 1790 with presidential approval ratings, finding that positive speeches lead to higher approval ratings.

## LINETSKY AT THE CUTTING EDGE OF FINANCIAL ENGINEERING

### His mathematical model has been cited by economists at central banks around the world

The past decade has seen major changes to the financial sector at both global and local scales. Although new challenges have emerged in the wake



Linetsky

of the most recent global financial crisis, new strategies have also emerged, including leveraging technology to analyze financial systems and optimize economic risk. Financial engineering — an interdisciplinary field at the intersection of financial economics, mathematical modeling, and computation — arose from the need to understand, at the most granular

level, the uncertainty present in the volatile environment of the global economy.

IEMS has the good fortune of being home to Vadim Linetsky, a global thought leader in the financial engineering field. A co-editor of the journal *Mathematical Finance* and associate editor of the finance section of *Management Science*, Linetsky is a technical adviser for international regulation in the area of aircraft financing, participating in meetings at the Organization for Economic Cooperation and Development (OECD) in Paris.

Recently, Linetsky and his colleagues Diego Klabjan and Jeremy Staum, also of IEMS, and Nikos Hardavellas of

Northwestern's Department of Electrical Engineering and Computer Science (EECS), received an award from Intel® to launch the Intel Parallel Computing Center at the McCormick School of Engineering. The collaborative effort will bring the power of Intel's new Xeon Phi coprocessor architecture to the world of finance. Linetsky and his colleagues will use this platform to push forward computational performance and accelerate discovery in a variety of financial applications, including high-frequency trading, interest-rate modeling, and Monte Carlo simulation of financial risk. The Center will support the dissertation research of several PhD students in IEMS and EECS in the area of parallel computing for financial engineering.

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## FACULTY NEWS



**Daniel Apley** was named editor-in-chief of *Technometrics*. He begins his appointment as editor-elect, handling new submissions in January 2016, and will then serve as editor-in-chief for a three-year term covering 2017 through 2019. *Technometrics* is published by the American Statistical Association and the American Society for Quality.



**Noshir Contractor** was named fellow of the International Communication Association, an academic association for scholars interested in the study, teaching, and application of all aspects of human and mediated communication.



**Karen Smilowitz** earned the Charles Deering McCormick Professor of Teaching Excellence Award for her tremendous impact on the school's curriculum. Smilowitz's courses include "Supply-Chain Modeling and Analysis," which instructs students on issues related to humanitarian and non- and for-profit logistics. She also adapted a successful graduate-level course into the undergraduate, University-wide course "Analytics for Social Good," offered for the first time in spring 2015.



**Jill Wilson** was elected vice president of education for INFORMS. This raises IEMS's visibility in the educational arena and is a clear recognition of Wilson's stature and reputation.



**Mark Werwath** was appointed assistant editor for IEEE's *Engineering Management Review*.

## SPONSORED AWARDS

**Noshir Contractor** received an NSF award for "CHS: Medium: Collaborative Research: Understanding Online Creative Collaboration over Multidimensional Networks."

**Vadim Linetsky, Diego Klabjan, Jeremy Staum, and Nikos Hardavellas** received an Intel Corporation grant for "High Performance Computing in Financial Engineering."

**Vadim Linetsky** received two NSF awards: "Market Expectations, Long Term Risk, and Stochastic Spectral Theory," and "Interest Rate Modeling at the Zero Lower Bound: Applications of Diffusions with Sticky Boundaries."

**Sanjay Mehrotra** received an NSF grant titled "Collaborative Research: Analysis and Solution Methods for Function Robust Optimization Models" as well as an award from the Office of Naval Research titled "Methods for Solving Mixed Integer and Stochastic Optimization Problems in Parallel."

**David Morton** received an Office of Naval Research award titled "Stochastic Optimization for Energy Efficient Outpost Modeling."

**Barry Nelson** received an NSF award for his project "GOAL: Computer Simulation Analytics."

## DEPARTMENT HAPPENINGS

**Jill Wilson** welcomed the birth of her son, Lincoln, in November 2014.

**Cathryn Timmers** retired after 16 years as financial assistant to the department and 26 years with Northwestern. We wish her the best years ahead!

**Victoria Richmond** joined the IEMS department staff this past summer as the financial assistant. She holds a bachelor's in art history and English from Augustana University.

The Master of Science in Analytics program welcomed two new staff members: **Megan Combs** and **Lewis Meineke**.

## Dolinskaya, Wilson Recognized for Excellence in Teaching and Advising

Two members of the Department of Industrial Engineering and Management Sciences have received the McCormick School of Engineering's annual awards for outstanding teaching and advising.

Assistant professor **Irina Dolinskaya** received the 2014 Cole-Higgins Award for



Dolinskaya

Excellence in Advising, and clinical associate professor **Jill Hardin Wilson** received special recognition for teaching and advising excellence from her students and colleagues.



Wilson

Dolinskaya, who conducts research in operations with an emphasis on large scale and computationally demanding, dynamic programming problems, was selected as an

outstanding adviser because of her availability to students and interest in their continued success.

"Professor Dolinskaya always makes herself available, whether for school advice or just to see how the students are doing," one nominator wrote. "She is very knowledgeable about recommending classes based on interests and course load. She kept me on track for graduation, tracking my classes and required paperwork."

Wilson, who is also the assistant chair of the Department of Industrial Engineering and Management Sciences, was nominated for her commitment to the success of her students and for her effort to be the "best kind of teacher students have ever had."

## STUDENT NEWS

Undergraduate **Taylor Hanken** received third place in the competition for Northwestern's Mickelson Prize for his project "Chicago Marathon Data Visualization System."

**Jack Hodapp, Bumjoon Lee, Jonathan Li, Ryan Marcus, Arturo Montalvan, Jonathan Newcomb, Meera Patel, Abinav Raja, Luis Velez Moeller, and Maurice Zeitouni** received Charles Thompson Senior Design Awards from IEMS faculty. The awards honor the best team projects during winter and spring quarters.

Undergraduate student **Haju Kim** received the Arthur P. Hurter Award for Outstanding Industrial Engineering and Management Sciences Graduating Senior at the Senior Ceremony. Runners up include **Nikhil Byanna, Derek Cox, HongJoo Lee, Jonathan Li, and Jonathan Scherzer**.

Six undergraduate students received the IEMS Academic Excellence Award in the 2015 graduating class: **Nikhil Byanna, Derek Cox, Haju Kim, HongJoo Lee, Jonathan Li, and Jonathan Scherzer**.

Two undergraduate students received the IEMS department award: **Zueber Juma** and **Taylor Hanken**. This award recognizes graduating seniors who have excelled in academics, leadership, or made other contributions to the department as nominated by the faculty.

The **IEMS INFORMS student chapter** received special recognition for outstanding participation and performance at the 2014 INFORMS Annual Meeting.

PhD students **Sina Ansari** and **Jacqueline Ng** received the Outstanding Teaching Assistant Award for 2014-15. **Francisco Jara-Moroni** received an honorable mention.

**Kibaek Kim** won the annual Nemhauser dissertation prize for best doctoral dissertation. His thesis was titled "A Two-Stage Stochastic Integer Programming Approach to Integrated Staffing and Scheduling with Application to Nurse Management."

## Linetsky At The Cutting Edge Of Financial Engineering

*Continued from page 9 ...*

Linetsky's work addresses some of the most pressing contemporary economic issues affecting the financial world today. For example, due to the national central banks' policy response in the aftermath of the financial crisis of 2008, short-term interest rates in the United States, Eurozone, and Japan have remained at or near zero. Linetsky is investigating this economic regime — what economists term the "zero lower bound" — through his NSF-funded project "Modeling interest rates at the zero lower bound: applications of diffusions with sticky boundaries."

Developed with his PhD student Yutian Nie, Linetsky's mathematical model, which addresses the liquidity trap, has been cited by economists at central banks around the world, including the Federal Reserve, European Central Bank, and Bank of Japan.

"We are developing a new generation of models that can handle the liquidity trap in realistic ways," Linetsky said.

Along with PhD student Likuan Qin, Linetsky is working on a second NSF-funded project, "Market expectations, long term risk, and stochastic spectral theory."

"These efforts focus on developing mathematical tools to recover expectations of participants in financial markets about probability distributions of future asset prices," Linetsky said, "by observing the current market prices of options on those assets."

**"WE ARE DEVELOPING A NEW GENERATION OF MODELS THAT CAN HANDLE THE LIQUIDITY TRAP IN REALISTIC WAYS."**

VADIM LINETSKY

That description illustrates the complexity of Linetsky's work — and financial engineering in general. "It can be stated more simply, though," he said. "For example, we want to know what prices of options on the stock index tell us about the future dynamics of the stock index. This question is of great interest to investment managers."

## Financial Stability Featured in Annual Wasserstrom Lecture

**P**aul Glasserman of Columbia University presented "Engineering Financial Stability" as part of IEMS's 2015 Wasserstrom Distinguished Lecture Series. Glasserman is the Jack R. Anderson Professor of Business at Columbia Business School, where he serves as research director of the Program for Financial Studies.

In an abstract for the talk, Glasserman states that, "Financial engineering has traditionally addressed problems of portfolio selection, derivatives valuation, and risk measurement. This talk will provide an overview of more recent financial engineering problems that arise in the design and monitoring of the financial system."



Paul Glasserman



BACK PAGE

# IEMS Celebrates Commencement

In June, Northwestern celebrated its 157th Commencement at Ryan Field. Nearly 100 IEMS undergraduate students and 10 PhD students participated in the day's events.

*View photos from the events on pages 4–5.*



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