UNIVERSITY of HOUSTON | DEPARTMENT of INDUSTRIAL ENGINEERING

IE Optimum

Cullen College of Engineering
Industrial Engineering Magazine | Fall 2015

HELPING HOUSTON'S FIREFIGHTERS STAY SAFE

IBM EXECUTIVE JOINS INDUSTRIAL ADVISORY BOARD

OUT OF THE LINE OF FIRE

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IE Optimum

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UNIVERSITY of HOUSTON
CULLEN COLLEGE of ENGINEERING

Industrial Engineering at the Cullen College:

BY THE NUMBERS

CORE RESEARCH AREAS:

- Healthcare and Medical Decision Making
- Homeland Security, Port Security
- Energy
- Reliability and Maintenance
- Logistics and Transportation, Supply Chain
- Manufacturing

$62,184

= AVERAGE STARTING SALARY WITH B.S. IN INDUSTRIAL ENGINEERING
(Source: National Association of Colleges and Employers 2015 Salary Survey)

78%

OF ALL IE STUDENTS GRADUATE WITHIN 6 YEARS

188%

INCREASE IN STUDENT ENROLLMENT SINCE 2011

SCHOLARSHIP RECIPIENTS

2012	2013	2014	2015
26	42	59	149

IE STUDENT ENROLLMENT FAST FACTS

DEGREE	ENROLLMENT	DEGREES AWARDED (2014)
B.S.	120	34
M.S.	182	20
Ph.D.	24	5
Total	326	59

University of Houston Cullen College of Engineering:

BY THE NUMBERS

TOP 100
ENGINEERING SCHOOLS IN THE U.S. (RATED #76 BY U.S. NEWS & WORLD REPORT)

28
ENGINEERING STUDENT ORGANIZATIONS

22:1
STUDENT TO FACULTY RATIO ACROSS UH

$25.8M
IN RESEARCH EXPENDITURES

80%
OF UH ENGINEERING STUDENTS ARE EMPLOYED IN TEXAS WITHIN 1 YEAR OF EARNING B.S. DEGREE

11 NAE
(NATIONAL ACADEMY OF ENGINEERING) FACULTY MEMBERS

$113,277
AVERAGE SALARY WITH B.S. IN INDUSTRIAL ENGINEERING IN HOUSTON
(FLC DATA CENTER WAGES FOR 2014-2015)

18,045+
TOTAL ALUMNI OF THE CULLEN COLLEGE OF ENGINEERING

POINTS OF PRIDE

We've got everything you'd expect from a top engineering college – outstanding faculty, cutting-edge research and state-of-the-art facilities.
But just how good are we?

- ☑ UH engineering students ranked 15th in the U.S. for salary earning potential (Source: PayScale.com)
- ☑ Named one of Princeton Review's "Best Value Colleges" and "Nation's Best Colleges" (2013, 2014)
- ☑ Listed as one of the world's top universities for grads who go on to become CEOs (Source: The Times Higher Education of London)
- ☑ Ranked #4 in the nation for "Top Colleges Where Students Get the Best Bang for Their Buck" (Source: PolicyMic, 2013)
- ☑ Ranked among the top 75 in the nation and #1 in Houston for engineering research and development expenditures (Source: National Science Foundation, 2011)

BOOM IN MIE/MSIE APPLICATIONS

This year brought a boom in applications to the industrial engineering (IE) graduate programs, with a total of 478 applications received by the department. Gino Lim, Hari and Anjali Agrawal Faculty Fellow and industrial engineering department chair, said that more students applied for the industrial engineering graduate programs than any other graduate programs in the UH Cullen College of Engineering. "It's a very exciting time to be an industrial engineer, and the career opportunities in this field continue to grow exponentially each year," Lim said. "It's no wonder that there is a corresponding increase in the number of applications for our highly-ranked IE graduate programs."

IE LUNCHEON

Current and past students from the Cullen College's industrial engineering department came together last April at the annual Industrial Engineering Alumni Luncheon. Luncheon guests enjoyed a full buffet, door prizes and lots of laughter and catching up.

Alumni of the industrial engineering department at UH can be found in leadership positions throughout the Houston region. Many of the department's alumni return to the Cullen College to meet with current students and offer them professional advice to help guide them through the engineering careers that lie ahead of them.

View photos from this and other recent events at www.egr.uh.edu/news/photo-gallery.

CAREER FAIR FORT BEND

Several UH industrial engineering (IE) students representing the student chapter of the Institute of Industrial Engineers (IIE) participated in an Engineering Career Fair for current and upcoming high school students in the Fort Bend Independent School District. Over 50 students from the Elkins High School Engineering Academy and Dulles High School Math and Science Academy participated in the event on April 13th at Elkins High School. The goal of the event was to give the students a better understanding of the different engineering disciplines.

The participating students included Veronica By, John Crawford, Rosendo Cardoso, Saeid Heidari and Anita Vaezian. Members of the IE Industry Advisory Board, including Victoria Jordan, director of quality measurement and engineering at MD Anderson Cancer Center, and Wayne Mausbach, managing partner at Intuitvum, also attended the event to provide insight to students about the industrial engineering profession.

FACES OF IE:
NANCY CURRIE

Nancy Currie (Ph.D. IE '97)
Principal Engineer, NASA Engineering and Safety Center

by Natalie Thayer

As a veteran astronaut, retired U.S. Army colonel, master army aviator and NASA engineer, Nancy Currie has a wealth of experience to share. Currie received her doctoral degree from the Cullen College's industrial engineering department in 1997 and now serves as a principal engineer at the NASA Engineering and Safety Center.

Known for her unwavering commitment to the safety of others and her significant contributions to spaceflight, she recently presented the keynote speech at the 2015 Institute of Industrial Engineers (IIE) Annual Conference and Expo in Nashville, TN.

Read our Q&A with Nancy to learn more about her IIE keynote presentation, experience as a woman in the fields of aviation and aerospace and ideas for the future of the Cullen College's industrial engineering department.

Q&A

Q: What inspired your interest in aviation and spaceflight?

A: My father served as a bombardier on B-29s during World War II. He instilled patriotism, admiration for military service and a love for aviation in me as a child. I credit my parents and teachers with never explaining to a little girl born in 1958 that a career as a military pilot was not an option.

During my high school and undergraduate education, acceptance of women in the field of aviation became more widespread. The first women were trained as aviators in the U.S. military and the first female astronauts were selected. By the time I graduated from college, all the doors for women in aviation and aerospace were wide open. All I had to do was to walk through them.

Q: How did you decide to study industrial engineering?

A: In 1981, I was commissioned as a second lieutenant in the U.S. Army and attended flight training at Fort Rucker, Alabama. Flying was just as exciting, rewarding and challenging as I had imagined. Very quickly, though, I also learned of the risk involved in my profession. After witnessing a devastating systems malfunction accident that claimed the lives of several peers, I decided to attend graduate school to study engineering.

While pursuing my master's degree, I specialized in human factors engineering, which is the discipline of applying what's known about human capabilities and limitations to the design of products, processes, systems and work environments. I then went on to earn my doctoral degree in industrial engineering from the UH Cullen College of Engineering.

Q: Safety is a major area of focus in your work. How did this inform your keynote presentation at this year's IIE Annual Conference?

A: The importance of industrial and systems engineering in an organization that engages in high-risk operations, such as NASA, can't be overstated. I believe it is important to keep in mind what we have learned through experience about the importance of safety in systems engineering.

At the IIE conference, I discussed the importance of rigorous systems engineering and integration function in the design and operation of complex systems. Weaknesses in systems engineering and integration, including systems safety engineering, were cited in past human spaceflight accidents, such as the Space Shuttle Challenger accident in 1986 and the loss of the Space Shuttle Columbia in 2003.

I also discussed the role of the NASA Engineering Safety Center (NESC). The NESC was founded in response to the Columbia accident and established around three basic tenets: strong in-line checks and balances of critical systems design and analysis, healthy tension between the engineering organization and program/project management, and value-added independent assessments.

Q: What is the most exciting current development at NASA?

A: One of the most exciting developments is additive manufacturing. We recently deployed a 3-D printer to the International Space Station (ISS) and successfully demonstrated its capabilities by printing out a test plastic ratchet wrench. The wrench was designed by engineers on the ground and then the file was uplinked and printed out onboard the ISS by the astronauts. The entire end-to-end process, including the design, safety review and printing of the object, was only a week long.

So, at NASA we are really excited about the potential to use additive manufacturing during space missions and the ISS is an excellent test bed for this technology because tools can be developed in a short period of time, printed out on orbit and then returned to the ground for analysis.

Q: What advice can you share with current engineering students?

A: Your achievements can be as great as your dreams. Don't ever let anyone look you in the eye and say you cannot accomplish something. If you have the skills and the desire to succeed, you can achieve anything. There are no barriers in today's society.

Q: What do you see for the future of the Cullen College's industrial engineering department?

A: Because I am passionate about mentoring students and educating the nation's next generation of engineers and space explorers, I want to share NASA's goal of high innovation with students and inspire them to join the world of human space flight. Traveling to Mars will require out-of-the-box thinking and game-changing technology and I believe that the students in the UH industrial engineering program are just the right people to make those visions a reality. The UH Industrial Engineering Department provides students the training they'll need to make meaningful contributions as humankind continues to reach further toward the stars.

UH EXPANDS IN SUGAR LAND AND KATY, PLANS FOR BIG PARTNERSHIPS

State leaders have paved the way for a $54 million new construction at UH Sugar Land (UHSL), a campus of the University of Houston, and an entirely new campus in Katy worth $46.8 million. UHSL received the allocations in HB100, which the governor signed last June.

The 150,000-sq.-ft. Sugar Land facility, planned to be completed in 2019, will primarily house programs offered by the UH College of Technology. A portion of the college will relocate to Sugar Land, and additional programs in business, education and health-related fields are also expected in the next two to five years.

The addition of a fourth building to the 250-acre campus allows for expanded programs that complement the workforce needs of the area, which is home to a number of technology and engineering companies, such as Fluor, Schlumberger and Texas Instruments. Greater Fort Bend Economic Development Council CEO Jeff Wiley says the county is one of the largest in the state, boasts one of the most highly educated populations and consistently ranks nationally in the Top 10 for population employment growth rate.

"If UH is going to continue to meet the higher education needs of the Houston area, we need to be building where people live," said Provost Paula Myrick Short, UH senior vice president for academic affairs. "There is tremendous growth in Fort Bend County. We are grateful for the incredible support of the legislature, which will help further develop this campus and expand higher education opportunities in the region."

The new UH campus in Katy – one of the fastest growing areas in the Houston region – will offer degrees most relevant to current industry demands, including engineering, business and nursing.

Read more about this story in the Daily Cougar: http://thedailycougar.com/2015/08/19/uh-expansion-in-sugar-land-katy-plans-for-big-partnerships.

BRANCHING OUT:
NEW BUILDINGS, NEW CAMPUSES

The UH Cullen College of Engineering will double its student enrollment by 2025 while continuing to raise admission standards and graduation rates. To accommodate the growth of its faculty and student body, the Cullen College will add new, state-of-the-art classroom and research spaces and extend its reach to UH branch campuses, satellite campuses and other locations across the Greater Houston area.

NEW BUILDINGS

The 120,000 square foot Multidisciplinary Research and Engineering Building (MREB), a $51 million engineering research facility, will allow students to conduct industry-relevant research inside one of the most cutting-edge laboratories in the city of Houston

PARTNERING WITH INDUSTRY

UH Engineering will partner with industries throughout Houston to create mutually beneficial educational facilities located within local corporations and businesses

ONLINE COURSE OFFERINGS

UH Engineering will expand its online course offerings and introduce new, industry-relevant certificate programs

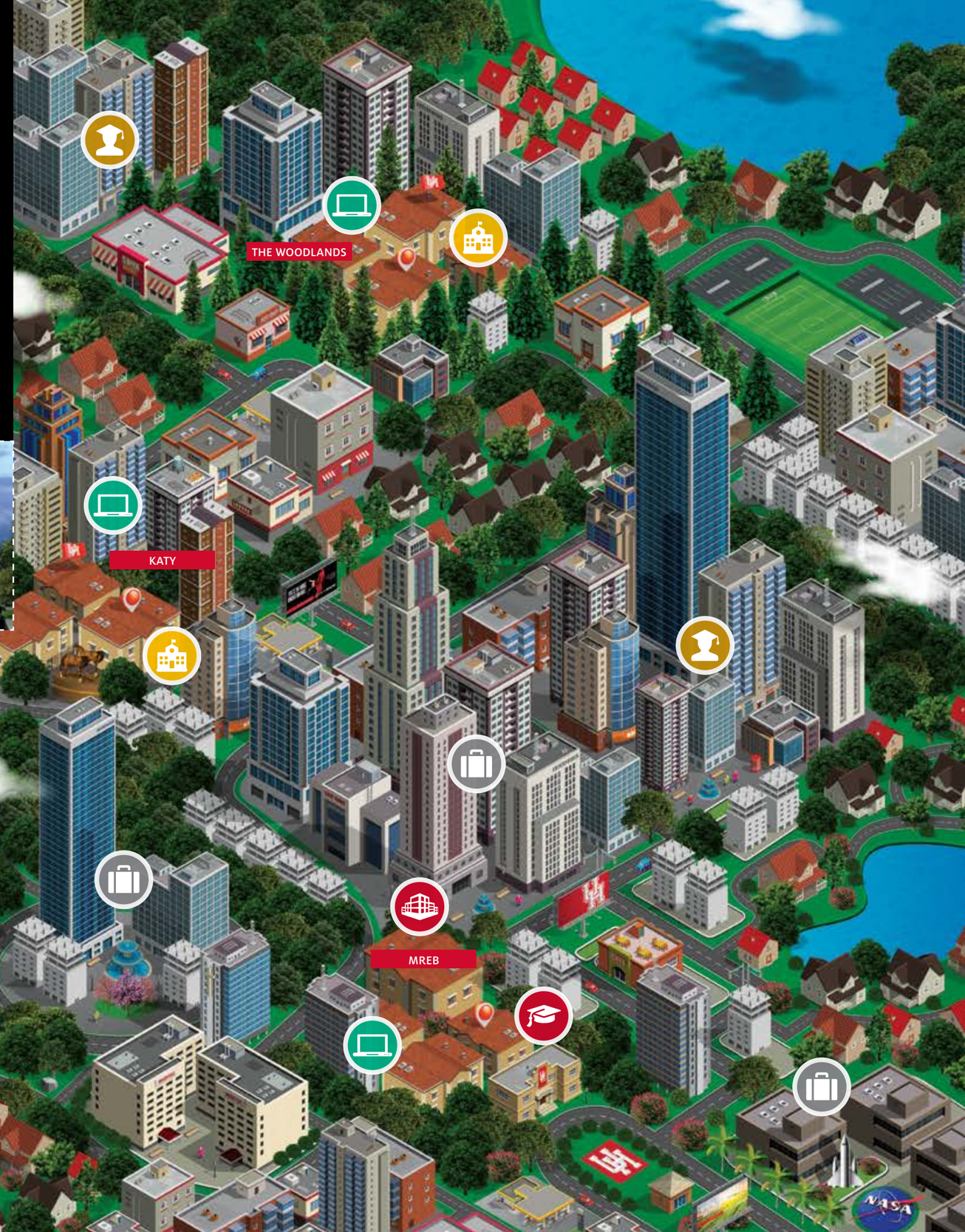
GRADUATION RATES

By 2025, 2,000 world-class engineers will graduate from UH each year

- 80% of all Cullen College graduates are employed in the state of Texas within one year of graduation

DIVERSIFYING STEM

600 female engineers, 700 Hispanic engineers and 300 African American engineers will graduate from UH and enter Houston's STEM workforce in 2025



OUT OF THE LINE OF FIRE

by Audrey Grayson

It was only four years ago that real-time flood mapping systems created by UH industrial engineering chairman **Gino Lim** made waves throughout the Houston region by helping emergency first responders to better navigate treacherous flooded roadways. Lim's flood maps, which were developed with a grant from the city of Houston, have meant the difference between life and death for many of Houston's first responders.

Now, Lim and his famous computer-based, real-time maps are making a splash in Houston once again. This time, however, Lim isn't just helping drivers to stay safe in flash floods – he's also helping Houston's firefighters stay out of the line of fire.

Lim's latest maps are devoted to tracking wind directions and speeds in real time. Fernando Herrera, Deputy Chief of the Houston Fire Department, said that this information is critical when attempting to safely extinguish a fire.

"Knowing wind speed and direction assists incident commanders when developing strategies and tactics, including whether or not emergency responders will operate inside or outside of a burning structure," Herrera said.

Wind speeds greater than just 10 miles per hour can have a profound effect on how quickly a fire spreads and in what direction, Herrera added.

"One can only imagine how drastic interior conditions can change if a window, door, or roof should suddenly fail, allowing high winds to rush inside and fan the flames," he said.

Access to real-time wind speed and direction is also critical for emergency personnel responding to incidents involving hazardous materials. Wind information not only helps responders approach from a safe direction, but it also plays a role in determining whether Houstonians should evacuate or hunker down in a safe shelter.

Herrera operates out of Houston Fire Station 37 on Stella Link Road, where computer monitors throughout the station display Lim's wind maps of the Houston area. The maps look nearly identical to a Google map, except for nine large, colored arrows dotting the map.

"With these maps, all we need to do is give them a glance and we instantly know the wind speed and direction, which helps keep us safe. I am so happy that UH stepped up to the plate to help us," Herrera said.

The arrows point in the direction that winds are blowing in that location, and wind speed is displayed inside the base of the pointer. The color of the arrows also provide an at-a-glance view of several locations across the city – red arrows indicate winds of 15 miles per hour and above, yellow arrows indicate wind speeds of 10 to 14 miles per hour, and speeds below that are displayed with green arrows.

Lim and his team collect data from sensors placed all over the Houston region by the Harris County Flood Control District, the Texas Department of Transportation and the U.S. Geological Survey. Many of these sensors are piezoelectric, which means they experience an electrical charge from the force of the wind blowing against them, and this data is transmitted to a central monitoring database.

Lim writes and deploys algorithms to turn this data into simple graphical displays on a map – in this case, colored arrows.

"Now our department uses this map at our Office of Emergency Communications (OEC). Our OEC personnel have the map on their individual consoles or utilize large image projection, so if a commander or someone in the field requests wind direction and speed for a fire or hazardous materials incident, OEC can provide that information in a matter of seconds," Herrera said.

The fact that this information is now available in seconds, rather than minutes, is part of what is so new and valuable about Lim's wind maps, Herrera said.

"There are some services out there to get wind information, but they don't display it in an intuitive graphic display. In some cases you have to look up a particular part of town and read through all of the numbers, which is slow and cumbersome," he said.

Although Lim's wind maps have had a profound impact in protecting the lives of Houston's firefighters, Herrera and Lim both agree that funding to increase the number of sensors throughout the region is the next big step for this project.

There are approximately 350 sensors across the Houston region – some as far north as Conroe and Willis – but only about 18 of these sensors have the capability of sending information on wind speeds and directions to a central computing station.

"We absolutely need more reporting stations," said Lim. "There are voids and pockets in the wind map that currently have no information. We need to get those pockets filled."

Herrera and Lim are both actively seeking additional funding to place more sensors throughout the Houston area. Once more reporting stations are added, Herrera said the Houston Fire Department will have improved data for predicting weather fronts that can drastically impact a fire or hazardous materials incident.

Lim is being assisted by graduate students and researchers from UH's Systems Optimization and Computing Laboratory (SOCL) in the industrial engineering department, and the Southwest Public Safety Technology Center (STWC).

Lim founded SOCL, where researchers explore mathematical programming techniques to solve various optimization problems. SWTC is led by Steven Pei, a professor of electrical and computer engineering at UH. SWTC is a grant-supported project dedicated to research and education in the area of public safety technology and homeland security.

> "[THESE MAPS] HELP KEEP US SAFE. I AM SO HAPPY THAT UH STEPPED UP TO THE PLATE TO HELP US."

EMPOWERING OPTIMIZATION:

Professor Develops Innovative Approaches to Tackle Challenging Optimization Problems

In general terms, optimization problems consist of identifying the best possible input to get the best possible outcome while taking into account certain constraints over the input parameters. For many real-world optimization problems – such as estimating the catastrophic impact of the failure of a single financial institution to the entire U.S. financial system, as evidenced during the 2007-2008 financial crisis – optimization models and techniques have proven to be powerful tools for identifying optimal strategies to address these fluid and complex issues.

With a grant from the National Science Foundation (NSF), associate professor **Jiming Peng** will develop a new approach to address these classes of hard optimization problems that arise from disciplines such as financial engineering and communications. The award totals $220,000 over a period of three years.

As an active scholar in optimization modeling, theory and algorithm design, Peng has been conducting research on the frontiers of optimization for a decade. In recent years, his research has been supported by the NSF and the Air Force Office of Scientific Research (AFOSR).

With funding from a previous NSF award in 2011, Peng's research group introduced a new optimization model to capture problem semantics from numerous disciplines, such as data mining and communications. His team developed novel optimization methodologies for the new model, which takes into account that sparse solutions are often the most optimal solutions for many real-world applications.

Peng's team also developed a new theoretical framework to interpret sparse solutions in quadratic optimization. His results have built a bridge between the optimality conditions in optimization and some probability events. This framework also addresses long-standing issues regarding sparse solutions in quadratic optimization problems, which arise when several variables with multiple linear constraints are at play.

The new NSF grant will support research on the design of novel approaches for the class of non-convex quadratic optimization problems. Although quadratic optimization problems (QPs) have attracted many experts to conduct research in the field, the current scientific literature does not offer an optimal computational solution for what Peng calls "the class of the hardest optimization problems."

To address the challenge in the study of non-convex QPs, Peng's team proposed to develop an integrated approach based on several optimization techniques, such as linear approximation, convex relaxation and line search.

"Except for the common names, the new optimization techniques we proposed are very different from the existing ones in the optimization literature," Peng said.

For example, Peng's group proposed splitting the non-convex objective function as the difference of two convex functions. The team then lifted the split problem into a higher dimensional space where the optimal Lagrangian multipliers can be identified analytically with respect to the concave quadratic term in the split objective function.

"How to choose suitable Lagrangian multipliers to speed up the solving process has been an active research subject in the optimization community for years. It is a surprise that we can effectively select the Lagrangian multipliers that are theoretically optimal," Peng said.

Peng's team also introduced a novel line search technique to cut-off large regions described by the input parameters without missing any potentially optimal solutions.

"To characterize the behavior of the new algorithm, some new optimization concepts were introduced and these new concepts transformed our understanding in non-convex optimization and linked various simple effective optimization techniques together," Peng said.

Thanks to the support from the NSF, Peng and his team have made incredible progress in defining new methods for solving some subclasses of non-convex QPs, but he added that the research still has a long way to go. However, Peng said he hopes to drastically expand the scope of applications for his novel approach to optimization problems.

"In the coming years, we plan to extend our approach to generic QPs with mixed integer constraints or polynomial optimization. We also plan to apply the new approach to estimate the systemic risk in the financial market and energy system," he said.

JUMPS IN DEGRADATION OR OPTION PRICE?

Faculty Op-Ed By: Qianmei (May) Feng, Graduate Program Director, Brij and Sunita Agrawal Faculty Fellow and Associate Professor of Industrial Engineering

Unavoidable degradation is one of the major failure mechanisms of many systems due to internal properties (mechanical, thermal, electrical, or chemical) and external influences (temperature, humidity, or vibration). Such degradation in critical engineering systems (for example, wind turbines, power/smart grids, and mechanical devices) takes the form of corrosion, erosion, fatigue crack, deterioration or wear that may lead to the loss of structural integrity and catastrophic failure. Therefore, developing stochastic degradation models based on appropriate stochastic processes becomes imperative in the reliability and statistics research communities.

With the support of a National Science Foundation (NSF) grant, my doctoral student Yin Shu and I will develop a new research framework to integrally handle the complexity in degradation processes – including the intrinsic/extrinsic stochastic properties and complex jump mechanisms – based on general stochastic processes including Le´vy processes, non-Gaussian OU processes, and Markov additive processes.

We will also develop a new systematic procedure for reliability analysis that provides powerful and explicit results for reliability function and lifetime characteristics. We introduce Le´vy processes, a versatile stochastic process, from the recent application in financial economics (e.g., option pricing, insurance risk) to degradation based reliability analysis.

The research findings have attracted wide attention in the reliability research community after the publication of two papers and the presentations at two national conferences. One of the papers, "Markov Additive Processes for Degradation with Jumps under Dynamic Environments" has been selected as one of the three papers for the QSR (Quality Statistics and Reliability) refereed track best paper competition being held for the first time at the INFORMS Annual meeting in Philadelphia 2015.

PROFESSOR SPEARHEADS UH COMMUNITY EFFORT TO HELP AFGHAN CHILDREN

by Natalie Thayer

Thanks to industrial engineering associate professor **Lawrence Schulze** and the generosity of the UH community, more than 20 boxes full of school supplies and children's clothing items were hand-delivered to schools and orphanages in Afghanistan.

Schulze, who is currently deployed in Afghanistan as a Lieutenant in the U.S. Navy, contacted the UH Cullen College of Engineering last spring to ask if UH students, faculty and staff members could contribute to a "truly international community effort" called the Centipede Movement. Established by Bela Gran Jensen, the Centipede Movement enlists armies around the world to help deliver school supplies and clothing to children in need throughout the world.

The Cullen College sent an email out to the UH community asking for donated materials, such as spiral notebooks, pens, pencils, t-shirts, flip flops and other children's clothing items. The response from faculty, staff and students across the University was overwhelming; within two weeks, the college had surpassed its goal of collecting 20 boxes of donations.

Schulze partnered with U.S. Army Major Steven Beard and Captain Josef Danhel from the Czech Republic to distribute the donations to schools and orphanages throughout Afghanistan. The U.S. Army's Special Forces donated hundreds of pink and khaki-colored backpacks, which soldiers helped to pack with supplies and give out to the school children.

Schulze's group also created three boxes of art supplies and two boxes of teacher supplies for classroom use. One of the art supply boxes was delivered to an orphanage along with the clothing donations. The backpacks, boxes and clothes were distributed with the assistance of the Task Force Solid of the U.S. Army's 101st Airborne Division, the Czech Republic Army and the Afghan National Army.

MEET INDUSTRIAL ENGINEERING STUDENT ROSIE ORTIZ!

by Natalie Thayer

During her time at the UH Cullen College of Engineering, Rosie has taken advantage of just about every opportunity that has come her way – from student groups and professional societies to research programs and internships. Rosie is a teaching assistant for the PROMES Program (Program for Mastery in Engineering Studies) and a mentorship coordinator for the PROMES Action Committee, a member of the Society of Hispanic Professional Engineers (SHPE), a historian for the Institute of Electrical and Electronics Engineers (IEEE) and a webmaster for the Subsea Engineering Society. She also participated in the Summer Undergraduate Research Fellowship (SURF) program, conducting real-world research inside of industrial engineering professor Ali Kamrani's laboratory.

Read our Q&A with Rosie on the following page to learn more about her Cullen College experience and her advice for other IE students!

Q&A

Q: What was your path to study engineering at the University of Houston?

A: I am a Hispanic only child and the first one in my family to attend college. In the spring of 2012, I graduated from both Houston Community College with an Associate's Degree with highest honors and from East Early College High School as salutatorian. Early College High Schools allow students to take dual-credit classes and graduate with 50+ credit hours of college-level courses. Therefore, when I got accepted to the University of Houston, I had completed my core classes and began to take engineering courses toward my second semester in college.

Q: The transition from high school to college can sometimes be a challenge. How did you handle the transition and what is your advice for other students looking to ease into college life?

A: The transition from high school to college had a great impact on me since I had no one in my family to ask questions regarding the campus life. To make the transition easier for me, I decided to actively involve myself in various organizations in the engineering department and network with other students who had the same career goals as I did.

Q: How did you decide to pursue industrial engineering?

A: I have always been a people person, and I've always liked talking to people. I used to work in a flea market, and I really enjoyed the customer service aspect of it – meeting people's needs, making people happy. So, I always knew I had to do something with my career that centered around people, but I've always also wanted to pursue math and science, to be in a STEM field. One day I saw a pamphlet for industrial engineering at UH and it seemed like it was a degree made just for me. It's the perfect combination of using STEM to meet the needs of people.

In fall 2014, I was accepted into the accelerated B.S./M.S. program, which allows students to finish their graduate degree immediately upon completion of the IE B.S. degree.

Q: Tell us more about your SURF experience. What kind of research were you involved in?

A: The SURF Program allows students to participate in a focused, full-time, 10-week research experience under the guidance of a UH faculty member. I conducted research with professor Ali Kamrani and Ted Lin, a Ph.D. candidate in the materials engineering program. We worked together to study phase diagrams, primarily focusing on the Tungsten-carbide phase-diagram, which is often used for tooling in the oil and gas industries. It was an amazing experience, and it gave me a background knowledge that complemented what I was learning in my classes.

As part of my research, I had to present my findings at the annual UH Undergraduate Research Day (URG), where more than 150 students from all over the University of Houston campus present their research to other UH students and faculty. Students participating in URG compete to win best presentation and best poster. I was awarded 2nd place for audience's favorite poster.

Q: What has been one of the highlights of your experience as a Cullen College student?

A: In February 2014, I was nominated by professor Gino Lim to be recognized as the outstanding IE junior student and was chosen based on academics, leadership and involvement in the Cullen College of Engineering. All top students from each engineering department were recognized at the EAA Engineers Week 2014 Reception and Program. I was awarded the Industrial Engineering Excellence Award and a $500 check, which were presented by Cameron.

Q: What was your summer internship experience like?

A: Last summer I interned with the global oil and gas company I have always wanted to work with: Cameron. I was an operations intern in the Global Rotational Development Program in the Surface Systems Division. As an intern, I was given various tasks and projects that allowed me to apply skills and methods I learned in college to real world projects. From working with a team of professional engineers, to getting my hands dirty on the shop floor, to creating a safety video for visitors, I learned something new every day and had an unforgettable learning experience.

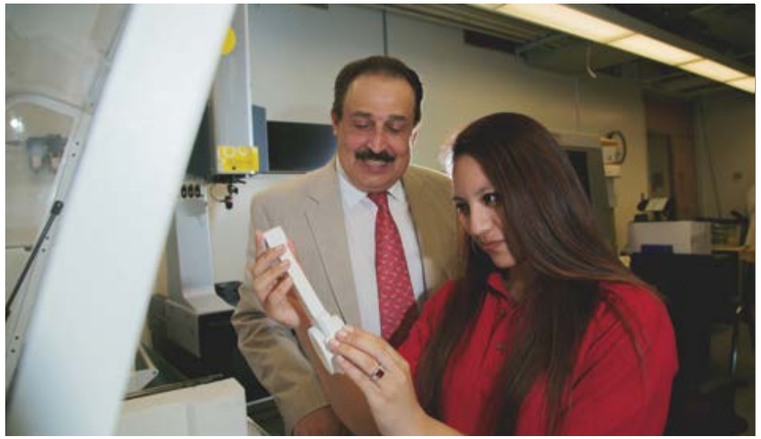
With one more year of school left, my goal is to graduate from UH with my bachelor's in industrial engineering and work full-time at Cameron.

Q: Do you have any words of wisdom you would like to share with other UH Engineering students?

A: With hard work, dedication and teamwork, I have accomplished so much at the University of Houston and am grateful for all of the opportunities that have been presented to me. By taking small steps at a time, we are able to do big things in life and meet personal goals. There are sometimes obstacles in the way, but with the help of professors, friends and family, we can overcome them. And, sooner than later, we will be walking across the stage with our degree in hand.

Watch our video interview with Rosie at the 2014 Undergraduate Research Day at https://youtu.be/F5xR-XEpcGo

> "BY TAKING SMALL STEPS AT A TIME, WE ARE ABLE TO DO BIG THINGS IN LIFE AND MEET PERSONAL GOALS."



IE PROFESSIONAL STUDENT GROUP HOSTS RESEARCH CONFERENCE

by Audrey Grayson

The UH chapter of the Institute for Operations Research and the Management Sciences (INFORMS) hosted the flagship event, "UH Industrial Engineering Research Conference and Expo," last fall. Industrial engineering students presented research papers, Capstone Design Projects and research and project posters to IE professors and professionals.

INFORMS is the largest society in the world for professionals in the field of operations research, management science and analytics. INFORMS serves the scientific and professional needs of analytics professionals and operations researchers including educators, scientists, students, managers, analysts and consultants.

Established in the fall 2004, the INFORMS-UH student chapter seeks to foster interest in operations research and management sciences among students from diverse disciplines, including engineering, business, science and mathematics. The mission of the group is to provide a channel between academia and industries in the greater Houston area.

In addition to the IE Research and Conference Expo, which the group hopes to hold every year, INFORMS-UH holds weekly seminars, discussion groups and various social events to bring together students and professionals in the field.

IBM FELLOW AND IE ALUMNUS GIVES TALK ON BIG DATA ANALYTICS

by Elena Watts

Watson, a computer program named for IBM's founder, defeated the two best human players on "Jeopardy!" one of the most challenging game shows of all time, in 2011, marking a significant milestone in the advancement of big data analytics.

Since then, big data has spread into many academic disciplines and industry practices. Earlier this year, three alumni of the University of Houston's Bauer College of Business MBA program won awards for papers on big data in analytics. Facebook began analyzing social media activity to target consumers with advertising, and grocery stores started examining individual purchasing patterns to determine product placement.

"It's good that we have access to lots of information, but it's too much," said Haluk Ogmen, professor of electrical and computer engineering and director of the Center for Neuro-engineering and Cognitive Science at the UH Cullen College of Engineering. "The idea is to use big data analytics to extract the useful information."

Shivakumar "Shiv" Vaithyanathan, chief scientist for big data analytics at IBM Research, talked about ways to make that happen during a presentation on the UH campus last October.

Vaithyanathan, an industrial engineering alumnus of the UH Cullen College of Engineering, also manages the Machine Learning Systems Group at IBM Research. His work is at the intersection of natural language processing, machine learning and databases. He was named an IBM Fellow in 2014.

Only 257 employees have earned IBM's highest honor since Thomas J. Watson Jr. founded the IBM Fellows program in 1962. The company employed more than 400,000 people worldwide in 2013, according to the IBM website. The Fellows have generated 7,700 patents collectively, and five Fellows have won Nobel Prizes.

In his talk, Vaithyanathan introduced several applications of big data analytics technology for tasks ranging from investment and equity research to social media lead generation.

He also described major analytic phases at the core of the applications. The phases include text analytics, semi-structured data processing – including joins, group-by and aggregation operations – and statistical and predictive modeling.

"At IBM, we are building tools and technologies to support each of these analytic phases," Vaithyanathan said. "In particular, we are building declarative languages for these phases."

Vaithyanathan also spoke about SystemML, which expresses ML algorithms in a higher-level language and compiles and executes them in a MapReduce environment. He ended the talk with a discussion of speeds, feeds and comparisons.

Before Vaithyanathan joined IBM, he was a founding member of the Altavista Group at Digital. He has co-authored more than 40 papers for major conferences and was a keynote speaker at the 2011 German Database and the 2011 ACM SIGIR Industrial Track Conferences. He was also associate editor for the *Journal of Statistical Analysis and Data Mining* from its inception until 2012.

"Big data analytics is a very contemporary area that is of interest to many people," said Gino Lim, professor and chair of the department of industrial engineering at the UH Cullen College of Engineering. "It's in every discipline because you have so much data with the Internet, so now the limitation is how fast you can process such a large amount of data to extract useful information."

ALUMNUS SUPPORTS COLLEGE WITH $4.5M CHARITABLE GIFT ANNUITY

by Audrey Grayson

Over the course of his career as an engineer, **Larry Snider** (BSIE '55) lived and worked all around the world. Larry and his wife, Gerri, have called many places "home," from California and Iran, to Ohio and Pakistan. Yet no matter where his career took him, Larry said there was one place he always returned to: the University of Houston.

"My education at the University of Houston Cullen College of Engineering has helped me and my family in so many ways," Larry said. "That's why we feel it is so important to give back to the University that has given us so much."

Larry and Gerri decided to support the UH Cullen College of Engineering with a testamentary charitable gift annuity in the amount of $4.5 million. The gift is unique in that it allows the Sniders to provide an annual income to both of their adult daughters throughout their lifetimes.

"This plan for supporting the University is really a win-win," Larry said.

A charitable gift annuity is a contract between a donor and UH wherein the donor agrees to make a gift to the University while also agreeing to pay a designated beneficiary a fixed amount each year for the rest of their life.

"You can give money to the University and at the same time use that money to fund a charitable gift annuity, which pays an income to your children all of their lifetimes," he said. "Your children get a current income every year during their lives, and when they pass, the residuum of the annuity goes to the UH Cullen College of Engineering."

The Sniders have specified how the residuum will be used once it is transferred to the Cullen College. The first funding priority is for an endowed department chair. The remainder of the funds will go towards funding professorships and full-time scholarships.

The Sniders said they felt it was particularly important to share the news about their gift to the Cullen College in order to raise awareness among alumni who may not have known such a gift agreement was a possibility.

"If God has blessed you with financial success as he has done us, we would like to invite you to consider investigating whether establishing a charitable gift annuity is a good fit for your portfolio, as the Cullen College would really benefit from having many more alumni establish these win-win gift agreements," Larry said.

In addition to their most recent gift, the Sniders have supported the University of Houston and its Cullen College of Engineering by funding scholarships.

The R. Larry and Gerri R. Snider Native American Scholarship, established by the Sniders in 2003, offers $10,000 per year to any engineering student entering their sophomore year or above who is a citizen of a federally recognized tribe. Larry is a citizen of the Cherokee Nation, and gives preference to Cherokee student applicants.

In 2009, the Sniders also established two other scholarships at the Cullen College. Named after their daughters, the Melody Kathryn and Becky Snider Women in Industrial Engineering scholarships are available to female engineering students.

"We've always felt that education is so important, and it has helped us in so many ways," Gerri said. "We hope that this gift will help a bunch of people." The Sniders said they feel very passionate about supporting hard working students who have to put themselves through college, as they can personally relate to such a struggle. Larry worked 40 hours per week while attending the Cullen College full-time. Gerri also worked full-time and managed their household.

After five years at the Cullen College, Larry earned his bachelor's degree in process engineering, a combination of industrial and chemical engineering. From there, Larry's engineering career took him around the world, moving his family a total of 35 times. He has worked for Sheffield Steel Corp., Kaiser Steel, Booz Allen Hamilton, Peat Marwick & Mitchell, Sterling Electronics, RAPOCA Energy, Korn Ferry International, and Coopers and Lybrand. Upon his retirement in 1995, Larry established RLS Professional Services LLC.

Larry received the UH Engineering Alumni Association's Distinguished Engineering Alumni Award in 1991 and the Lifetime Achievement Award in 2013. He and Gerri are also members of Cullen College Bridge Builder Society.

MEET BEN AMABA:

IBM Executive, IE Guru and the Newest Member of the IE Industry Advisory Board

by Natalie Thayer

Ben Amaba isn't from the city of Houston, and he isn't an alumnus of the University of Houston. But as an industrial engineering guru, Amaba said he now finds himself inextricably tied to both Houston and its University.

"There is so much opportunity in Houston for industrial engineers, and the University of Houston is a big part of that," Amaba said. "That's why I'm here, and that's why I'm such a big supporter of the University of Houston and its industrial engineering programs."

Amaba is the newest member of the UH Cullen College of Engineering's Industry Advisory Board for the Industrial Engineering Department. As a worldwide executive for IBM, Amaba spends his days eating, sleeping and breathing industrial engineering processes for optimizing the performance of systems and integrating humans, machines, materials and information.

Tech, Amaba said, is the next great frontier for industrial engineers to tap into, and Houston is the best city in the world to do it in.

Q&A

Q: What are industrial engineers responsible for at IBM and how do they contribute to the company?

A: Industrial engineers contribute to the company in a myriad of ways because they can apply their skillsets across the company. The five major cross-disciplinary areas that industrial engineers work in at IBM are systems analysis and design, facilities, logistics, quality, and human factors and ergonomics.

Q: You gave the Cullen College's Industrial Engineering Department the gift of a scholarship for students pursuing a Professional Engineering (P.E.) license. What motivated you to provide this scholarship?

A: I think it's very important for engineers to aspire toward that level of professionalism because, as an engineer, you're responsible for public health, safety, security and environmental protection. I gave the scholarship to increase awareness of the Professional Engineering license amongst students and to remove the economic constraints of pursuing it. I believe it's very important for established industry professionals to mentor young engineers and help them get to the professional level.

Q: What career advice can you share with industrial engineering students and recent graduates?

A: First of all, target and brand yourself as a professional by pursuing a P.E. license. Secondly, collaborate in public and private partnerships, like industry consortiums, to figure out where you want to go and where the industry is going. And, thirdly, find mentors that you can turn to for advice on your career path. Much like a corporation benefits from a board of directors, you can benefit from the feedback of trusted advisors.

Q: What do you see as the future of industrial engineering?

A: Since industrial engineers are not constrained by industry, geography or domain, the possibilities are almost endless. Because industrial engineers can apply their skillsets to so many avenues – from a hospital, to a theme park like Disney, to a software factory – I don't think you can put borders on the discipline right now. I think the future is wide open.

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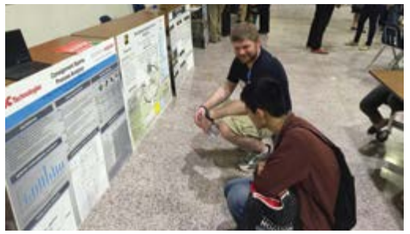

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CULLEN COLLEGE of ENGINEERING
Department of Industrial Engineering

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Research Interests: Applied optimization, large-scale computational optimization, robust optimization, operations research applications in health systems, and resilient network design.

Selected Publications:

G.J. Lim, S. Zangeneh, and S. Kim, "A clustering approach for defining hurricane evacuation zones," accepted for publication with a minor revision, Journal of Urban Planning and Development, September 2015.

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Research Interests: Large-scale optimization, integer and linear programing, and optimization under uncertainty.

Selected Publications:

W. Cao, G. Lim, Y. Li, X. Zhu, and X. Zhang, "Improved beam angle arrangement in intensity modulated proton therapy treatment planning for localized prostate cancer", Cancers, 7(2), 574-584, 2015.

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Research Interests: Applied probability and statistics, quality and reliability engineering, and economic optimization in manufacturing.

Selected Publications:

Shu, Y., Feng, Q., Coit, D.W., Life Distribution Analysis Based on Lévy Subordinators for Degradation with Random Jumps. Naval Research Logistics. (Published online)

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Selected Publications:

J. Chen, L.M. Feng and J. Peng. Optimal deleveraging with nonlinear temporary price impact. E. J. Operations Research, 244(1), 240–247, 2015.

J. Peng, T. Zhu, H. Luo and K. Toh. Semidefinite programming relaxatios of quadratic assignment problems based on nonredundant matrix splitting. J. Comp. Optimi. Applications, 60(1), 171-198, 2015.

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Selected Publications:

A. Katariya, S. Cetinkaya and E. Tekin, "On the comparison of risk-neutral and risk-averse newsvendor problems", Journal of the Operational Research Society, 65(7), 1090-1107, 2014.

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