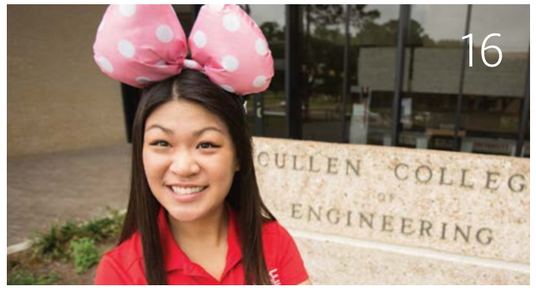
IE Optimum

Cullen College of Engineering
Industrial Engineering Magazine | Fall 2017

EYES IN THE SKY:

ENGINEERING THE FUTURE OF DRONES

CONTENTS



IE Optimum

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UNIVERSITY of HOUSTON
CULLEN COLLEGE of ENGINEERING

INDUSTRIAL ENGINEERING BY THE NUMBERS

CORE RESEARCH AREAS

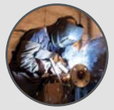

Healthcare and Medical Decision Making

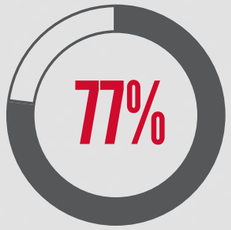

Homeland Security, Port Security


Energy


Reliability and Maintenance


Logistics and Transportation, Supply Chain


Manufacturing



OF IE STUDENTS GRADUATE WITHIN 6 YEARS

$88,530

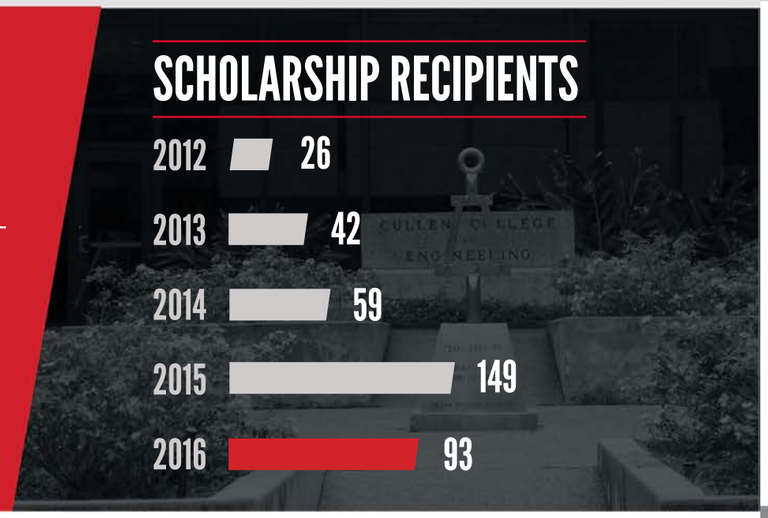
NATIONAL AVERAGE ANNUAL SALARY WITH B.S. IN INDUSTRIAL ENGINEERING

$111,800

AVERAGE ANNUAL SALARY WITH B.S. IN INDUSTRIAL ENGINEERING IN HOUSTON, TEXAS.

SOURCE: U.S. BUREAU OF LABOR STATISTICS NATIONAL OCCUPATIONAL EMPLOYMENT AND WAGE ESTIMATES, MAY 2016

SCHOLARSHIP RECIPIENTS

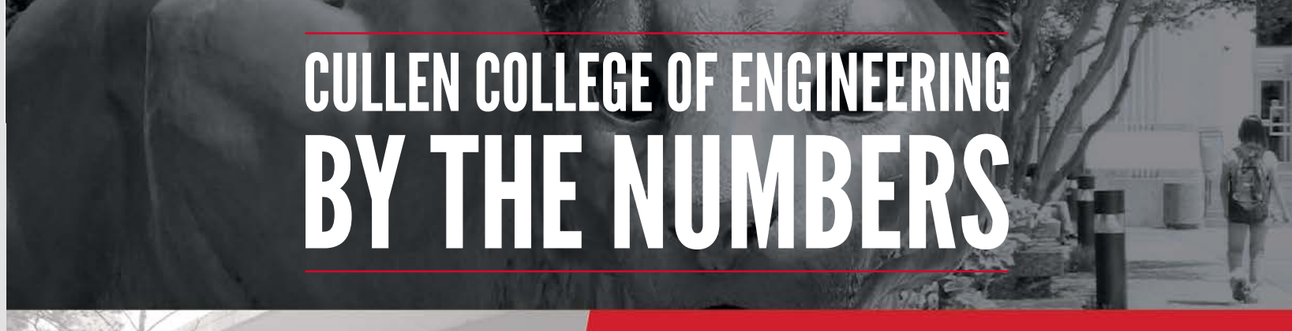


113%

INCREASE IN STUDENT ENROLLMENT SINCE 2012

IE FALL 2017 STUDENT ENROLLMENT

DEGREE	B.S.	M.S.	PH.D.	TOTAL
ENROLLMENT	133	152	21	306
DEGREES AWARDED (2017)	27	109	2	138



CULLEN COLLEGE OF ENGINEERING BY THE NUMBERS

#73

BEST ENGINEERING PROGRAM IN THE NATION

(Source: *U.S. News & World Report*)

3,721 UNDERGRADUATE STUDENTS

1,266 GRADUATE STUDENTS

138 TOTAL FACULTY

13 NATIONAL ACADEMY OF ENGINEERING FACULTY MEMBERS

DEGREES AWARDED IN 2017:

601 B.S.

405 M.S.

72 Ph.D.

1300 AVERAGE SAT SCORE OF ENTERING FRESHMAN

TOP-RANKING GRADUATE PROGRAMS IN:

#56 AEROSPACE

#59 ENVIRONMENTAL

#73 BIOMEDICAL

#50 INDUSTRIAL

#38 CHEMICAL

#71 MATERIALS

#60 CIVIL

#69 MECHANICAL

#65 ELECTRICAL

#12 PETROLEUM

$26M ANNUAL RESEARCH EXPENDITURES

25% ENGINEERS IN THE HOUSTON METRO AREA EARN HIGHER ANNUAL SALARIES THAN THE NATIONAL AVERAGE

(SOURCE: U.S. BUREAU OF LABOR STATISTICS, MAY 2016)

$104,640

AVERAGE SALARY FOR ENGINEERS IN HOUSTON, TX

(SOURCE: U.S. BUREAU OF LABOR STATISTICS, MAY 2016)

87,500

JOBS IN ENGINEERING AND ARCHITECTURE IN THE HOUSTON METRO AREA IN 2016

(SOURCE: U.S. BUREAU OF LABOR STATISTICS, MAY 2016)

FACES OF IE:

Q&A WITH

ASSISTANT PROFESSOR TAEWOO LEE

By Laurie **Fickman**

Taewoo Lee joined the UH Cullen College as an assistant professor in industrial engineering (IE) in January of 2017, fresh off a stint as a research fellow at Rice University, where he worked on medical decisionmaking in organ transplantation. Read on to find out why Lee loves his profession, UH and the city of Houston.

Q: What do you find special about industrial engineering?

A: To me what makes IE really special is its creative, interdisciplinary and problem-solving nature – we identify problems from systems, find the best tools to solve them and help make better decisions.

Q: When and how did you decide to pursue industrial engineering as your career?

A: Within the broad field of IE, my expertise is in operations research (OR). In fact, it was not OR that I wanted to pursue at first; it was industrial design and ergonomics. I had great interest in designing chairs and tables. I was good at math and science, so I felt I had to do something that uses both.

Then in my junior year, I attended a seminar where Drs. Robert Bixby and David Simchi-Levi gave talks about how applicable optimization is to a wide range of real-world problems, from kidney exchange to space logistics.

In the same year, I took a course on the topic of optimization and became immediately fascinated by the idea of mathematically modeling a complex decisionmaking process and "designing" decisions. The field of OR seemed just limitless – and I still think it is. This is when I decided that I should study OR and that was a great decision I made.

Q: Why did you decide to become a faculty member at the UH Cullen College of Engineering?

A: While at Rice, I had the opportunity to give a seminar talk in the IE department at UH. I had great fun with the faculty members and Ph.D. students in the department and was very impressed by their active collaboration with local hospitals as well as other industries and this strongly drew me to UH. To me, joining UH means the opportunity to pursue exciting research problems in healthcare.

Q: Much of your research focuses on improving treatments for cancer. Can you describe your research in more detail?

A: I am very much interested in automating and personalizing the decisionmaking process in cancer therapy treatment planning. Most cancer treatment planning systems already involve optimization to address various decision problems – for example, how much radiation dose should be delivered to which part of the patient's body. However, little is known about designing such optimization models in the first place, which leads to a time-consuming trial-and-error planning process and hinders the potential for automation.

For example, some questions that arise from this challenge include, "What are the most important clinical criteria for this particular patient?" and "How important is it for this patient to spare the spinal cord relative to the heart?"

Answers to these types of questions are hard to quantify, yet play a critical role in treatment efficiency as well as quality. My research aims to address these questions by learning from accumulated knowledge through historical treatments and automatically determining the optimal treatment settings for each individual patient. Specifically, I use inverse optimization statistical machine learning.

Q: What are your research goals at the University of Houston?

A: I am currently working with several members of the Texas Medical Center on the topic of cancer therapy treatment planning and organ transplantation. I'm looking forward to expanding the network of collaboration.

I am very much interested in working with researchers in public health to build a collaborative research platform to solve healthcare policy problems using optimization. For example, determining personalized dietary guidelines and developing effective Medicare and Medicaid reimbursement systems.

My research goal is to provide novel and effective decision-support tools that improve current healthcare systems by combining mathematical optimization and data analytic skills with the knowledge in medical practice; that is, tools that learn from the medical knowledge, model the medical intuition and prescribe better decisions for clinicians and practitioners. I believe the University of Houston, sitting at the heart of healthcare research in the country, offers the perfect opportunity to achieve this goal.

Q: What advice do you give to your industrial engineering students about their future careers in IE?

A: IE is at the core of many important problems in the modern world, ranging from personal daily decisionmaking to societal policymaking. While it revolves around a mathematical core, your role is to learn the tools and translate the mathematics into everyday life. Naturally, it needs your creativity and problem-solving skills.

I tell students to have a broader view of their study and look closely at problems they come across in daily life. IE will give you tools that are incredibly expandable – you can find it pretty much everywhere: You can be an R&D analyst who constructs rosters and game tactics for the Astros, a data analyst who generates a product assortment for Amazon, a physicist who designs a cancer treatment plan, a developer who creates diet recommendations and so much more.

Q: What do you love about Houston?

A: Houston offers a great quality of life and boundless potential for research in healthcare. It's also a good city to start a family. Sometimes I miss the snow, but these things that Houston offers make me easily get over that. ■

NEW OFFERINGS

UNIVERSITY OF HOUSTON LAUNCHES INDUSTRY-RELEVANT ONLINE ENGINEERING PROGRAMS

The UH Cullen College has launched flexible, online master's programs in civil, mechanical, subsea and industrial power systems engineering, tailored for working professionals. "It is critical that the Houston region and the U.S. has the engineering talent required to address the grand challenges in energy, infrastructure and the environment facing our society," said Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the UH Cullen College of Engineering.

LEARN MORE AT
onlinelearning.egr.uh.edu

UH ENGINEERING OFFERS DATA ANALYTICS CERTIFICATE FOR ENERGY INDUSTRY

A new graduate certificate offered by the University of Houston Cullen College of Engineering focuses on helping oil and gas producers more efficiently use and maintain equipment by making better use of the terabytes of data streaming from monitoring sensors built into equipment. The certificate, titled Data Analytics for Condition and Performance Monitoring of Engineered Systems, launched in fall 2017.

READ THE FULL STORY AT
www.egr.uh.edu/news/201701/uh-engineeringoffer-data-analytics-certificate-energy-industry

UNIVERSITY OF HOUSTON OFFERS ENERGY-FOCUSED COURSES IN KATY

The UH Cullen College of Engineering is expanding its roster of innovative and industry-relevant course offerings in the Katy area. In the fall of 2016 UH began offering graduate-level engineering courses at the Houston Community College Katy Campus in petroleum, subsea, electrical and environmental engineering.

LEARN MORE AT
www.egr.uh.edu/engineering-katy

WORD ON THE STREET

UH AMONG TOP U.S. UNIVERSITIES FOR RETURN ON INVESTMENT AND UPWARD MOBILITY

Stellar academics, strong career prospects for graduates and affordability are among the reasons the University of Houston has been featured in the *Princeton Review*'s 2017 edition of "Colleges That Pay You Back: The 200 Schools That Give You the Best Bang for Your Tuition Buck." In addition, a recent study by the Equality of Opportunity Project shows UH is among the best universities in the U.S. at turning low-income students into top earners.

READ THE FULL STORY AT
www.egr.uh.edu/news/201702/uh-among-top-us-universities-returninvestment-and-upward-mobility

UH RATED AMONG BEST COLLEGES FOR UNDERGRADUATE EDUCATION BY PRINCETON REVIEW

Princeton Review ranks UH among the nation's best institutions for undergraduate education in the 2017 edition of its flagship college guide, "The Best 381 Colleges," based, in part, on surveys from students. "Outstanding academics are the chief reason we chose UH for this book, and we strongly recommend it to applicants," said Robert Franek, *Princeton Review*'s editor-in-chief and author of "The Best 381 Colleges."

READ THE FULL STORY AT
www.egr.uh.edu/news/201609/uh-rated-among-bestcolleges-undergraduate-education-princeton-review

FORBES.COM LAUDS UNIVERSITY OF HOUSTON AS LEADER IN ENERGY RESEARCH AND EDUCATION

Forbes.com calls UH an epicenter of energy education and research, saying it is "increasingly a rival to places like MIT in advancing not just cleaner, safer and more efficient ways of extracting oil and gas from the earth, but also cleaner energy and zero-carbon energy."

READ THE FULL STORY AT
www.egr.uh.edu/news/201611/forbescom-laudsuniversity-houston-leader-engineering-research-andeducation

UH RANKS AMONG BEST UNIVERSITIES IN THE WORLD FOR ENGINEERING AND TECHNOLOGY BY CEOWORLD MAGAZINE

The University of Houston is one of the best universities in the world from which to earn an engineering degree, according to 2017 rankings released by *CEOWorld Magazine*. The UH Cullen College of Engineering was ranked No. 73 in the list of top destinations to receive an engineering or technology degree. *CEOWorld Magazine* ranked institutions based on academic reputation, admission requirements, job placement rate, recruiter feedback, specialization, global reputation and influence.

READ THE FULL STORY AT
www.egr.uh.edu/news/201702/uh-ranks-among-best-universities-engineering-and-technology-ceoworld-magazine

CULLEN COLLEGE TEAM KNOWS HOW TO

RESTORE POWER QUICKLY

...AND WIN AWARDS

By Laurie **Fickman**

Whether you've suffered through a major Houston hurricane, flood event or momentary glitch in the power grid, no doubt you understand the severity of a power blackout. And lest you think Houston has cornered the market on such catastrophes, think back to 2003 when the biggest blackout in U.S. history left 50 million people in darkness in the northeast corner of America stretching into Canada.

In the case of these disasters, the first question **Saeedeh Abbasi** thinks about is: "What do we have to do to restore the power quickly?"

Luckily for us, Abbasi has answers. She is a doctoral candidate studying under Professor **Gino Lim**, chair of the Cullen College's department of industrial engineering and Hari and Anjali Agrawal Faculty Fellow. The pair, along with **Masoud Barati**, an instructional assistant professor of electrical and computer engineering, published the answers in a paper "A multi-objective MPEC model for disaster management of power system restoration," given the Best Paper Award in the Energy Systems Division by the Institute of Industrial and Systems Engineers (IISE) during its annual conference in May 2017.

POWERING BACK UP

"We want to restore the power grid as soon as possible, so time is the most important factor in our study," said Abbasi. "We also want to reduce the number of people impacted by a power failure."

As an optimization expert, Abbasi breaks the population into segments, isolating those with the most critical needs like hospitals and data centers, giving them top priority in the restoration plan. Once she segments the power network into smaller sections, or micro grids, Abbasi proposes to restore power of the islanded (or independently operable) sections at the same time. This way there is less load on the lines and the power is restored quickly.

It appears to be a low key approach, even with the necessary mathematical algorithms – called mathematical program with equilibrium constraints (the MPEC from the paper title) – to determine assignment of demands to emergency power generators, known as black start generation units. Still, turning on one segment at a time seems such a simple solution.

◂ **FROM LEFT:** GINO LIM, SAEEDEH ABBASI AND MASOUD BARATI ARE WORKING HARD TO KEEP THE LIGHTS ON

> "IF YOU ASK ANYONE ABOUT THE GREATEST IDEAS, THEY ARE ALWAYS THE VERY EASIEST AND SIMPLEST."
>
> – GINO LIM

"If you ask anyone about the greatest ideas, they are always the very easiest and simplest," said Lim.

BREAKTHROUGHS

Currently in the power industry, during a failure, the black start generation units are used to restore power. These generators don't depend on the failed electric grid to operate, but their capacity for generation is limited. Using the sectional approach, Abbasi has found a solution for their limited effectiveness.

Her solution minimizes the lost load and restoration time as well as power generation cost.

Another important innovation in the paper, said Barati, is the application of distributed energy resources in the restoration process of the power grid.

"Take, for example, the power grid on the UH campus," said Barati. "It can be categorized as a low voltage system. The black start generation units within these systems can help the bigger power systems for the restoration process, showing the capability of the micro-generation units and micro grid in restoration of the bulk power system."

In the end, the researchers see a better future for power restoration through the work.

"We are trying to maximize the resiliency of the restored power grid," said Barati. With the system for restoration institutionalized, precious time can be saved in restoring power after a failure occurs.

"Resiliency is all about evolution," said Lim. "Once you go through a process you understand the weaknesses and challenges and the process can be adapted so if the same thing happens again you will have much less damage and, in this case, quicker restoration of power."

If anything can benefit from evolution it would be the American power grid, built in 1882 and launched by Thomas Edison at the Pearl Street Station in Manhattan. While it has expanded beyond anyone's conception at that time, it has had few adaptations since.

"It's a very vulnerable asset," said Abbasi. ■

THE REALITY OF PROJECT-BASED LEARNING

By Audrey **Grayson**

AMANDA HERRERA BEAMS OVER A JOB WELL DONE

Industrial engineering professor Randal Sitton begins his "Engineering Systems Design" class with the same introduction each year: "This is the hardest class you're ever going to take."

It's no small claim. Most of the undergraduate students in Sitton's class are seniors, some mere months away from graduation. All have made it through the rigorous coursework, labs and exams leading up to this class. If you can call it a class.

"In the senior design course, the project is the class," Sitton says.

At the UH Cullen College of Engineering, all undergraduates take a senior design course, also called a capstone design course, in their final year of school, applying all of the engineering knowledge and skills they've learned so far to solve a real-world problem.

In architecture a capstone is affixed to the top of an edifice, representing a crowning achievement. Like its namesake, Sitton's class represents the final academic triumph for these students.

"The senior design course is a bridge between academia and the real world," Sitton explains.

DOWN TO BUSINESS

During the first week of class, Sitton randomly creates student teams and presents each group with their real-world challenge. "All of the projects are sponsored by companies who come to us with a specific problem they're facing in the industry and ask if we can find a solution to it," says Sitton.

Last spring leading pipe manufacturer Tenaris sponsored a student team to increase safety while reducing the time it takes to conduct collapse testing at TenarisBayCity in Bay City, Texas. Trafficware, a company specializing in the manufacture and design of traffic management hardware and software, sponsored a project to increase efficiency and improve storage space by redesigning the company's stockroom.

Once the projects are assigned, Sitton steps back from his traditional role as a professor. There is no weekly lecture or chalkboard problem-solving. Instead, students file weekly status reports with Sitton, whose role is more project facilitator than teacher.

There is no hand-holding, no long-winded discussions about what to do next, how to do it or who to ask for help along the way. In Sitton's words, there's only one thing for the students to do next: "They have to get creative."

"There's no silver bullet in the real world. Sometimes there are clear answers, and sometimes there's not. Sometimes not even the problem itself is clear or well-defined," Sitton adds.

NO HYPOTHETICALS

For industrial engineering student **Amanda Herrera**, the most difficult course she ever took at the Cullen College of Engineering was also the most rewarding.

"Dr. Sitton was right. This was by far the hardest class I took as an undergrad," Herrera said.

Herrera was assigned to a team with fellow industrial engineering undergrads **Brandon Kwan**, **Cindy Sanchez** and **Craigan Wild**. The group was asked to scrutinize a rather large and ill-defined optimization problem: MD Anderson Cancer Center's operating room (OR) turnover time – the time between one patient leaving the OR and the next patient entering the OR – is approximately 56 minutes.

Their task was to reduce the OR turnover time to the national average of 30 minutes.

In addition to solving a complex real-world problem in one academic semester, there were also the challenges of juggling schedules, delegating workloads, communicating effectively and managing emotions among a team of very different personalities.

"The project-based learning course taught me so much more than a traditional class. We were given a really tough real-world problem – not a hypothetical problem – that a company was facing and needed to fix," Herrera said. "We had to learn by doing and we had to come together as a team to get it done."

FIRST THINGS FIRST

Before they could work on tackling the problem, the UH team had to start with the basics. Sitton requires each group to complete a project overview statement outlining their problem, objectives, goals, obstacles and success criteria. The project sponsors approve each team's statement before the real work begins.

Herrera's team worked with MD Anderson project facilitators and senior healthcare systems engineers Dalia Farhat and Ashley Robinson, who acted as liaisons between the UH engineering students and MD Anderson's operations executives.

"Everyone we worked with at MD Anderson treated us like legitimate contractors rather than a student team, and at first that really intimidated us," Herrera said.

Visits to MD Anderson and meetings with project facilitators were scheduled between classes, tests, study groups, part-time jobs, families and social lives. The student team met each Tuesday and Thursday to discuss project deliverables and milestones, reporting their progress to Farhat and Robinson by email weekly.

"They had a thorough project plan and timeline, which they delivered to us without us asking them for it. They gave regular progress reports and sent their questions for each meeting ahead of time so that we had time to prepare. I was beyond impressed," Farhat said.

The students' efficiency, organization and hard work paid off by the end of the course – to the tune of $3.5 million.

SOLVING A MULTI-MILLION DOLLAR PROBLEM

Operating rooms are one of the most expensive components of hospital operations. Increasing efficiency and productivity in the cleanup and setup that takes place between each surgery can mean incredible cost savings. But the solution is multi-faceted and complex, involving human factors, room layouts, scheduling, staffing, hospital culture and equipment organization.

> "WE HAD TO LEARN BY DOING AND WE HAD TO COME TOGETHER AS A TEAM TO GET IT DONE."
>
> – Amanda Herrera

"So many factors have to be taken into consideration to solve this problem," Herrera said. "MD Anderson knew there was a problem, but they didn't know where it was coming from. We had to look at their whole system to get the answers."

The team started by interviewing the entire OR staff, including doctors, nurses, anesthesiologists, maintenance and cleaning personnel, to understand their roles. Then the UH students verified the anecdotal information with video footage of the OR operations, taking notes on the processes, shift changes, staffing levels and seemingly minute details that can impact OR turnover time.

"We began to notice all of the little problems that created the big problem," Herrera said.

By standardizing cleanup and setup processes, instituting new safety and time-saving procedures, reorganizing equipment, and changing staffing levels and schedules, the student team successfully reduced the turnover time to 30 minutes and identified more than $3.5 million in potential cost-savings in the process.

"The [UH Engineering] team completed the project in two and a half months. That's a lot of work," Farhat said.

TRY BEFORE YOU BUY

Each senior design class culminates with the student teams presenting their solutions to the companies or individuals who sponsored their project. Herrera and her teammates presented their findings to an audience of more than 25 senior engineers at MD Anderson.

"They came up with extremely valuable solutions and the engineering team was very impressed with their presentation," Farhat said.

The UH team's recommendations are being reviewed and may be implemented at MD Anderson as early as this fall, Farhat said.

"There's a 'try before you buy' aspect to the course," Sitton says. "The students get a glimpse into what it's really like to work in a certain industry, and companies get a chance to test out potential employees."

As a result, senior design courses can lead to job and internship offers for many UH Engineering students.

That may very well be the case for Herrera, who envisions a future for herself in the healthcare field.

"I dreamed of working in healthcare before this project, and now I can't imagine working anywhere else," she said. "Working at MD Anderson would be a dream come true."

EYES IN THE SKY:

ENGINEERING THE FUTURE OF DRONES

By Laurie **Fickman**

SEON JIN KIM (LEFT) FLIES WHILE GINO LIM DIRECTS

In **Gino Lim**'s estimation, drones will soon take over the sky, delivering medical kits and medicines to rural patients, relaying sensitive military information to troops and, yes, one day picking him up at his Pearland home and delivering him to his office at UH. In fact, the future as he sees it is something he could drone on about for hours.

"We're just at the infant stage with drones right now," said Professor Lim, chair of the Cullen College's department of industrial engineering and Hari and Anjali Agrawal Faculty Fellow. "Imagine 15 years ago where iPhones were and now everyone uses them. I'll tell you right now, drones will be like that in no more than 15 years from today."

He touched on the relevance of drones in medicine with his Ph.D. student **Seon Jin Kim** in their article called "Drone-aided healthcare services for patients with chronic diseases in rural areas."

HOUSTON WORK WILL IMPACT SOUTH KOREAN MILITARY

Kim's official title is Major Kim, engineer in the South Korean army. He's on a four-year leave of absence to work under Lim's tutelage.

"Here at UH, Dr. Lim is my commander," laughs Kim, and then quickly corrects himself: "No, he's my general!" Kim expects to take the lessons learned with Lim back to South Korea for practical use in the military. They've published another paper called "Drone relay stations for supporting wireless communication in military operations."

Lim initiated the concept of applying drones to real-world problems.

"We provided a template for drone routes to help healthcare services, especially targeting chronic patients in rural areas," said Kim. Their template includes the locations and number of healthcare centers in specific areas and determines the optimal number of drones needed in each center.

Because chronic patients need recurring treatment and rural patients live far from treatment centers, they propose that drones will close the healthcare disparity among those groups.

Lim says that older patients who live far from doctors or hospitals can actually put more lives at risk.

"They need medical attention and if they are forced to drive, they and others could be in jeopardy," said Lim. "When drones can deliver the necessary medicine or testing kits and be sent back, unnecessary traffic will be reduced."

MEDICAL DELIVERY

MILITARY INFORMATION

TRANSPORTATION

> "I KNOW THAT DRONES HAVE A GREAT FUTURE, THERE'S NO DOUBT ABOUT IT."
>
> – GINO LIM

If it sounds like a brave new world, that's because it is. And Lim is helping usher it in, setting up the mathematical models to better utilize drones for everything we do.

IT'S THE FUTURE

Lim's drone work spans the highly imaginative to the minutely specific. "The mathematical models we are setting up will allow us to better utilize the drones and map drone routes across all applications. In Houston, for example, we could utilize drones to find out where flooding is happening in real time or where power needs to be restored," he said.

Lim says in military operations drones are better communication systems than satellites. "Satellites are wonderful things, but there are delays," said Lim. "With drones, you get real time information because they are so close to the ground and you control them 100 percent." Lim posits that drones, because they fly so low, can see real enemies or equipment on the ground and communicate those finds in real time, like a live television signal. Ultimately, Lim says, if the drone gets shot down, it's just the cost of doing military business. And that cost is greatly reduced.

"Imagine satellites and their cost – millions of dollars," said Lim. "A drone might be $500."

SCIENCE ASCENDING

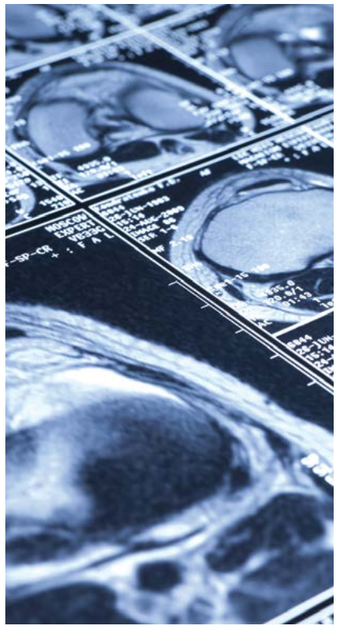
In Dubai they're testing drones you can ride on. Lim would love to take that ride, if even as a carpool to work. But mainly he wants to continue on the frontier of drone advancement.

"I know that drones are our future, there's no doubt about it," he repeats emphatically. "I want to stay in the mainstream in improving the efficiency of drones, including extending battery life and improving their reliability." Lim begins just about every other sentence with the word "imagine."

"Imagine 15 years from now..."

"Imagine driverless cars as a concept years ago..."

Lim's vivid imagination combined with engineering prowess will create the kind of drone efficiencies that will aviate and soar for decades to come. ■



CULLEN COLLEGE'S CHAIR OF INDUSTRIAL ENGINEERING IS

QUITE A FELLOW

By Laurie **Fickman**

If you've ever evacuated your home in the Houston area because of a threatening flood or hurricane, you've felt the impact of **Gino Lim's** work. If you or someone you know has ever been treated with radiation for cancer therapy, you've also felt the impact of Gino Lim's work. Among many career highlights, Professor Lim, chair of the Cullen College department of industrial engineering and Hari and Anjali Agrawal Faculty Fellow, has developed efficient evacuation routes with Harris County and Houston Transtar and developed mathematical algorithms used to determine how much radiation will heal rather than hurt you.

That's just how the world-renowned industrial engineer rolls, improving different areas of life with his skill at engineering industrial solutions.

In an office full of awards, Lim says he is thrilled to receive his latest, the distinction of becoming a Fellow of the Institute of Industrial & Systems Engineers (IISE), an honor that usually goes to older engineers capping a lifetime of achievement.

"I'm pretty young to be awarded and it's nice to hear that people appreciate what I've done," said Lim. "Plus this is not something I initiated. People from outside, not even from UH, initiated this on my behalf."

At most, 20 engineers become IISE Fellows annually. This year Lim is among only a dozen. The stringent criteria takes full account of a candidate's success in management, technical innovation, practice innovation and leadership in promoting industrial engineering.

EXCEEDING QUALIFICATIONS, AND THEN SOME

By every measure, Lim exceeded the qualifications.

In the area of management, Lim has increased enrollment in industrial engineering (IE) with unprecedented results. During his tenure at the Cullen College as chair since 2011, the IE department has experienced a 300 percent increase in master's students, a 31 percent increase in bachelor's students and a 66 percent increase in doctoral students graduated per faculty each year. He, himself, has graduated 16 Ph.D. candidates in the last 13 years – well above the average number among his academic peers. He has also taken management and leadership roles on the Industrial and Systems Engineering Research Council, serving as program chair for several annual conferences including IISE's Industrial and Systems Engineering Research Conference (ISERC) and INFORMS, the world's largest professional association dedicated to best practices and advances in operations research, management science and analytics.

Considered a leading researcher in proton-based radiation treatment planning in the IE community worldwide, Lim has excelled in the field of technical innovation such as his pioneering work on Gamma Knife radiotherapy optimization for brain cancer patients. For developing the mathematical algorithm determining the optimal amount of radiation needed at cancer sites, he won the 2002 Pierskalla Best Paper Award from INFORMS.

Lim's work in developing innovative practice methods for scheduling nurses in operating suites was tested and adopted at MD Anderson Cancer Center and published in *IIE Transactions on Healthcare Systems Engineering*.

A HAPPY ACCIDENT

Lim's accomplishments seem unbelievable, especially because he said he got into industrial engineering "by accident." Actually, it was less accident and more a good career counselor in Korea.

"Initially I was looking at chemical engineering, but I was also interested in management and using people skills," said Lim. "The career counselor said to consider industrial engineering if I wanted to work with people, and I did. Working with people makes me happy."

It obviously delights others, too. His peers' recommendations from across the United States surely weighed heavily on IISE's decision to name him a Fellow. ■

IE DEPARTMENT WELCOMES NEW FACULTY MEMBER

YING LIN

By Laurie **Fickman**

Ying Lin joins the Cullen College industrial engineering faculty in the fall of 2017 as an assistant professor.

Lin tackles data analytics to facilitate effective use of information technology and quality improvement in complex systems. To accomplish this Lin uses statistical modeling, optimization, data mining and operations research.

The applications for Lin's work extend from complex system modeling, monitoring and management to disease diagnostics and prognostics.

Lin earned her Ph.D. in industrial and systems engineering from the University of Washington in August, 2017. Her thesis was titled "Large-scale personalized health surveillance by collaborative modeling and selective sensing." ■

INDUSTRIAL ENGINEERING STUDENT'S

Disney Dreams Come True

AT DISNEYLAND INTERNSHIP

By Audrey **Grayson**

> All our dreams can come true if we have the courage to pursue them.
>
> *Walt Disney*

When industrial engineering undergrad **Britney Shum** was a child, nothing cheered her up quite like Pluto, the impossibly affable and loyal canine companion to Disney's Mickey Mouse.

The same holds true today. After a particularly stressful day at her internship last fall, Shum liked to walk the 500-or-so-feet from her office to the bustling heart of Mickey's Toontown, where her favorite childhood cartoon character stood in the flesh, happy as ever to put a smile on her face.

In the summer of 2016 Shum interned with The Walt Disney Company in Anaheim, California, where she worked with the Industrial Engineering Department's Project Development Team inside of the Disneyland theme park, just steps away from the magical world she was helping bring to life.

And there, in the land of Pluto and Mickey, Shum says she not only found her passion for industrial engineering, but also the career of her dreams.

> The flower that blooms in adversity is the most rare and beautiful of all.
>
> *– The Emperor, "Mulan"*

For Shum, the Disney dream was a long time coming.

Growing up, Shum always dreamed of going to Disney World. When she graduated from the University of Texas at Austin with a bachelor's degree in business in 2011, Shum's parents surprised her and her then-18-year-old brother with a trip to Disney World in Orlando, Florida.

"It was the best time of my entire life," Shum said. "So many adults are running around as if they're children. Disney has such a positive impact on so many people, no matter how old or young they are."

From that moment on, Shum said her mind was made up: "I knew this was my dream. I wanted to work for Disney."

At that time, Shum had never heard of industrial engineering. She was also unsatisfied with the current direction of her career.

Then, while surfing the internet, she did something so many of us do multiple times a day – she accidentally clicked a link on a website she didn't mean to click on. It was an innocuous mistake that would change her life forever.

Shum had stumbled upon the website of the industrial engineering department at UH by accident, but once she arrived there, she never really left. She applied to the undergraduate program and enrolled at UH in 2015.

When she arrived at UH, Shum says her dreams for the future began to multiply.

> "Even miracles take a little time."
>
> – Fairy Godmother, "Cinderella"

Prior to her internship with Disney, Shum had already gained professional experience in both energy and healthcare through prestigious internships with Cameron and MD Anderson. Despite her wide range of technical experience, Shum said nothing prepared her for her internship at Disney quite like the industrial engineering courses at UH.

"Industrial engineering at Disney is very specific to Disney. The projects I worked on were very unconventional, so nothing I could have learned through textbooks could have prepared me," Shum said. "I was prepared for the position because the industrial engineering department taught me analytical thinking skills."

While at Disney, Shum would often recall something that Gino Lim, chairman of the industrial engineering department, said in his linear optimization course: "It's one thing to know the right answer, but it's another thing to know what it means."

"Dr. Lim taught us that you have to understand the technical side and translate that to non-engineers, and that takes a lot of creativity," Shum explained.

At a place like Disney, where, according to their website, "Imagineers bring art and science together to turn fantasy into reality and dreams into magic," creativity is a commodity in high demand.

For instance, Shum recalls working with a senior industrial engineer on a project involving "Cars Land," a land inside of the theme park which, as the name implies, is devoted entirely to the Disney-Pixar movie franchise "Cars."

There was only one problem: Shum had never seen any of the "Cars" movies. Despite all of the industrial engineering experience she brought to the table, Shum had a full plate of homework to get through if she wanted to succeed at her new internship: Watch "Cars" and "Cars 2" as closely and as soon as possible.

Beyond just enjoying the movies – which she did, thoroughly – Shum said the experience made her an all-around better engineer. "No detail is overlooked with Disney. You have to understand the Disney storylines to be able to understand the characters we're bringing to life," Shum said.

These are the invaluable engineering lessons that Shum says she's brought back to Houston with her: No detail is too small to overlook and always, always engineer with the end-user in mind.

The experience connected-the-dots for Shum, bringing new focus and clarity to her career. "I saw this is where my passion is," she said.

> "In every job that must be done there is an element of fun."
>
> – Mary Poppins, "Mary Poppins"

Back at UH to tackle the final year of her bachelor's degree, Shum says she has a new appreciation for the industrial engineering field and her future in it.

"At its core, industrial engineering is about connecting the technical side of things with the people side of things," Shum said. "You have to present information to someone who doesn't care about your spreadsheet or your graph, so you have to tell them a story in a creative way that they would care about."

Shum said she felt compelled to share her newly found passion for her field with other students. A member of the UH chapter of the Institute of Industrial and Systems Engineers (IISE), Shum launched a mentorship program within the organization to help new industrial engineering students choose classes, find study groups and get advice on professors and activities.

"I'm so excited about what I'm doing now, but it scares me that I sort of stumbled on it by accident," Shum said. "I wanted to find a way to inform other students about what the industrial engineering field can offer much earlier than I found out about it."

> "Venture outside your comfort zone. The rewards are worth it."
>
> – Rapunzel, "Tangled"

After deciding on a career change and arriving at the UH industrial engineering department, things didn't get easier for Shum right away.

"Your first year as an engineering student is tough. Finding a mentor who's farther along in the program and can give you advice is crucial," she said.

Shum and other chapter officers paired seven first-year students with upperclassmen mentors through the IISE mentorship program, now in its second year. They also launched a welcome orientation for all first-year industrial engineering students.

"We're a small department, so I really wanted to leverage that smallness to be more like a family – to know everyone else's name and help each other out," Shum said. It's just the type of dream for the future that you'd expect from a Disney enthusiast.

In a fantasy future, Shum says she'd be working full-time as an industrial engineer with Disney. It's extremely competitive – there are usually only a few openings for hundreds of well-qualified candidates – but she's not willing to give up on the Disney dream quite yet.

Shum just wrapped up another summer internship with Disney, this time at the Disney World theme park in Orlando, Florida. It seems in Shum's case, Cinderella's advice was right: "If you keep on believing, the dream that you wish will come true." ■

THINKING LIKE EXECUTIVES,

INDUSTRIAL ENGINEERING STUDENTS BRING HOME PRIZE

By Laurie **Fickman**

A team of four Cullen College master's candidates in industrial engineering is quick to tell you that industrial engineers make the best CEOs.

"Sundar Pichai," throws out **Dhinesh Thiru Narayanan Muralitharan**, who also is a teaching assistant in the C.T. Bauer College of Business. No less than the CEO of Google is Muralitharan's pick when talking about industrial engineers and their business prowess.

"Of course the CEO of Microsoft is an engineer, too," adds **Dinesh Babu Sivasamy**, citing Satya Nadella as his illustrious example.

"Oh, and they're both from India, too!" said Muralitharan, as the group laughs in agreement that as Indian Americans they are in good company.

Muralitharan, Sivasamy along with **Srivignesh Somasundaram** and **Anand Krishnamoorthy** have reason to be counted among their prosperous peers. Collectively called "Team Bottomliners," they brought home first place in the annual Institute for Supply Management's Houston Case Competition.

A CASE FOR CHANGE

In the competition, the group was presented with an actual business case that had really taken place in a company's history. In this case, Scotts Miracle-Gro was under pressure due to high plant and labor costs at their plant in Temecula, California.

Faced with the choice of outsourcing, the team went to work like a well-oiled C-suite of executives, identifying cost drivers, calculating variable costs, performing statistical analyses and analyzing risks. In the end, they proposed staying put to benefit the long-term prospects of the company, though a move would have saved $7 million in the short term. As the team concluded, "Supply chain is all about value creation and not just cost cutting."

"We acted as the owners of the company, not as consultants, and that helped us a lot," said Somasundaram, who served as team lead. He said the judges indicated that kind of thinking propelled them to first place among 12 Texas teams.

BUILDING THE TEAM

Before ending up in the same class and heading to the competition, the four members of Team Bottomliners were all neighbors in Houston's Linkwood area, but they didn't know each other well. Since they formed the team, they all became best friends.

"Oh, we probably spend too much time together now," laughed Sivasamy.

Krishnamoorthy admits his presentation skills were a little rusty when he joined the team. "I last participated in a competition in second grade," he said. "So I was a little nervous, but it was a very good experience and we even beat a team where someone had 20 years of experience."

He says winning gave him a direction for his future. "Since winning the competition I have confidence I can go in this path of supply chain management," he said. ■

By Audrey **Grayson**

It was 1995 and **Eric Ayanegui** (BSIE '95) was an industrial engineering undergraduate student at the University of Houston Cullen College of Engineering. He found himself in unfamiliar surroundings – at the Cintas Facility and Uniform Services plant a few miles from UH – nervously presenting findings from his class project on improving quality control in their garment inspection department.

The presentation went well, you could say: Ayanegui was offered an internship at Cintas that day.

Now, 22 years later, he walks by the conference room inside Cintas and remembers standing at the head of a long conference table, delivering the first presentation of his professional career to the group of Cintas managers.

"This conference room has a lot of significance to me," said Ayanegui, director of quality and engineering at Cintas Corporation. "This is where it all started."

And where it has continued ever since. Through the opportunity afforded him as a Cullen College student, he was allowed into a growing company he is still working for today.

COMBINING ENGINEERING WITH INDUSTRY AND EDUCATION

"I'm an extrovert – a very people-oriented guy," Ayanegui said. Originally inspired to follow in his father's footsteps by becoming a chemical engineer, a pamphlet on industrial engineering changed the course of his career forever.

"The pamphlet explained what industrial engineering is, how the field focuses on people and processes. It listed the courses for the curriculum – human factors, facilities planning, analysis of industrial activities. It was a mix of engineering and business, which really attracted me," he said.

Ayanegui excelled in his engineering coursework, devoting himself to the field while working full-time to pay his way through school. "I only went to one UH football game," he said. "I had rent and tuition to pay. But that hard work brought a sense of maturity."

Project-based learning is the rule at the UH Cullen College of Engineering. In many undergraduate courses, students are assigned projects – often sponsored by industry – to find solutions to critical engineering challenges faced in the field.

While pursuing his bachelor's degree, Ayanegui worked on projects proposed by NASA, a local machine shop and an oil company before tackling the quality control project at Cintas that landed him an internship with the company.

Working as an industrial engineering scholar at Cintas in his final year of college, Ayanegui took on projects streamlining and improving processes in the Houston plant.

"As I was learning at UH, I was literally applying it at Cintas," Ayanegui said.

In addition to the technical work he was doing at Cintas, Ayanegui said his supervisors provided him with opportunities for management training and leadership experience.

"I learned about motivation, leadership, different engagement phases employees go through as they learn and how to get different personality types to be top performers. We are a very people intensive industry, so they teach you that very early on," he said.

The experience ignited Ayanegui's passion for his field. "My internship completely rounded me out and solidified the fact that industrial engineering was the degree for me."

Ayanegui's focus and drive at Cintas caught the eyes of his supervisors, as did his ability to speak fluent Spanish. Cintas operates plants in North America, Canada, Mexico, Honduras and China, and Ayanegui's way with people and lack of language barriers helped him quickly move up the company ranks.

CINTAS AND YOU

You might not know it yet, but Cintas is a company that likely touches many aspects of your workday.

The uniform you put on for work, the entrance mat you wipe your feet on in front of the office, the fire extinguisher you walk past in the hallway, the hand soap and paper towel dispenser you use in the public restroom – Cintas designs and distributes all of these products and much more, providing specialized services to businesses.

The company is one of the largest in the industry, employing more than 35,000 people to service more than 900,000 business customers. Cintas has grown tremendously in recent years, most recently acquiring its third largest competitor, G&K Services, last March. Known for their commitment to impeccable customer

THE BIGGEST PIECE OF ADVICE I GIVE TO ENGINEERS EARLY IN THEIR CAREERS IS TO CHOOSE A COMPANY WITH A CORPORATE CULTURE THAT FITS YOUR PERSONALITY AND YOUR VALUES.

– ERIC AYANEGUI

service and employee relations, Cintas has been named among the "Most Admired Companies" for eight consecutive years by *Fortune Magazine*.

At the center of Cintas' success is its position that people always come first. "At Cintas, if you don't have the people behind you the process isn't going to work the way you want. The results won't be there," Ayanegui said.

And in that place where people and processes meet, Ayanegui thrives, employing his industrial engineering skills to increase the safety, quality, reliability and efficiency of the company's processes while maximizing employees' trust, happiness and room for personal and professional growth.

COUGAR CLIMBING THE CORPORATION

After his internship, Ayanegui was hired on full time as a production supervisor, overseeing plant processes and rolling out new ones to increase efficiency. From there he moved to the Cintas headquarters in Cincinnati to assist in the construction of new plants. Another promotion took Ayanegui to the manufacturing division, where he implemented process improvements at garment manufacturing plants in South America, Central America and Mexico before moving to California to manage plants in San Diego and Los Angeles.

"Around every corner when they'd change my assignment I had some sort of basic understanding of that topic from my coursework at UH, so my learning curve was shorter," Ayanegui said.

In the early 2000s, Cintas began an effort to improve safety processes across the company's global plants and offices. Ayanegui's industrial engineering skills were once again put to the test when he accepted the position of regional health, safety and environmental coordinator in 2004 – a job that would bring him back to the Cintas offices in Houston where he gave his first professional presentation as a University of Houston undergraduate student.

ENGINEERING SAFETY, RELIABILITY AND DIVERSITY

Employing a combination of the technical engineering skills he gained in college and the leadership skills he learned during his time with Cintas, Ayanegui analyzed several processes to improve safety across all of its plants. Once new processes were developed, Ayanegui and the Cintas safety team were responsible for training employees and managers on the new safety measures being rolled out.

"I had to influence leaders to buy into new ideas. I was applying the leadership skills I learned over the years to people who didn't directly report to me. I had to influence their decisionmaking process and earn their trust and buy-in," Ayanegui said.

Since 2007, Cintas' total recordable injury rate fell more than 67 percent, with 36 Cintas locations achieving the Voluntary Protection Program Star Certification, the highest safety designation by the Occupational Safety and Health Administration.

For the last 10 years Ayanegui has served as director of operations engineering, providing technical direction for plants across North America and China. He currently oversees the professional development of engineers and develops and coordinates implementation of reliability programs to reduce equipment downtime and maximize throughput across Cintas' plants.

To ensure the proper implementation of safety measures, Ayanegui provides hands-on training to Cintas' over 500 plant technicians. As you can imagine, he's learned a lot about leadership and management in his current role.

"One of the things that works well with me is I never see myself as your boss. I see myself as your most effective assistant," he said. "I'm the person that will work really hard to make sure you have all the tools you need to be successful."

Ayanegui is now applying the skills and lessons he's learned as a member of the company's executive diversity committee, which is charged with ensuring its workforce, suppliers and customers are inclusive and ethnically diverse.

"Cintas has a very deliberate and active diversity initiative. I'm extremely proud to be involved in employee resource groups devoted to improving diversity at all levels," he said.

THE SCIENCE OF RELATIONSHIP BUILDING

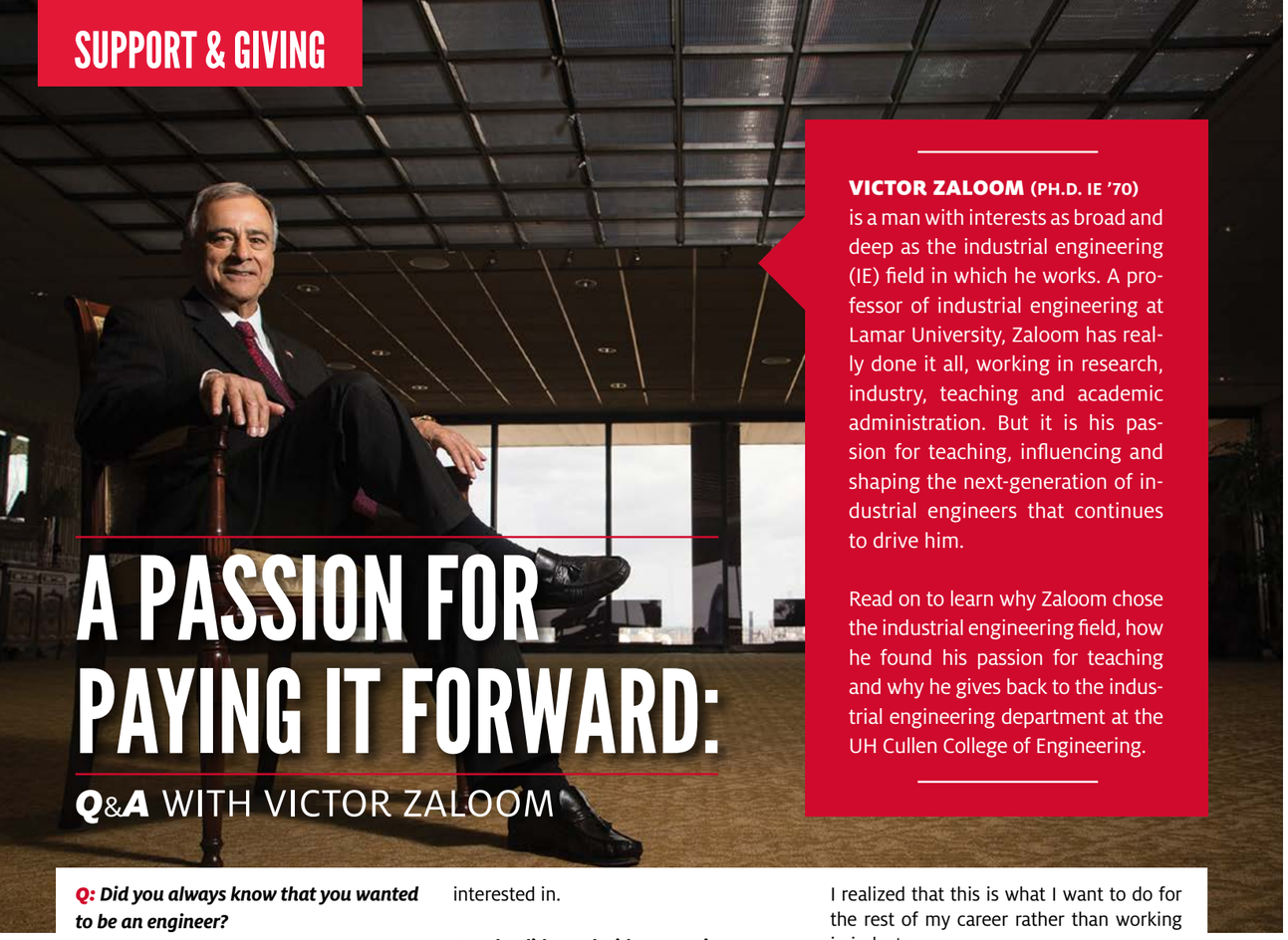
It seems that one of Ayanegui's natural strengths is bridge-building. At Cintas, Ayanegui connects-the-dots between high-level engineering principles and the people and processes they impact the most. He connects managers to the workers on the floor of the plants; he effectively communicates technical information to non-engineers, bridging the gap between the technical side and the people side of business operations.

So it only makes sense that Ayanegui would also build bridges between Cintas and the UH Cullen College of Engineering, where he actively recruits students and alumni for internships and full-time positions.

That's not the only reason Ayanegui says he keeps coming back to his alma mater. "Being around industrial engineering students at UH energizes me. It reminds me why I chose this field and fell in love with this work." He serves as a member of the Industry Advisory Board for the Cullen College's industrial engineering department and has served as the industry advisor for the regional student conference of the Institute for Industrial and Systems Engineers.

In a recent workshop for students in the Program for Mastery of Engineering Studies (PROMES), Ayanegui offered career advice: "The biggest piece of advice I give to engineers early in their careers is to choose a company with a corporate culture that fits your personality and your values. It's very important to find out what a company's values are and how they align with yours."

In the case of Cintas, a company that prominently displays its corporate values, policies and goals on its website, Ayanegui couldn't have found a better fit. ■



A PASSION FOR PAYING IT FORWARD:

Q&A WITH VICTOR ZALOOM

VICTOR ZALOOM (PH.D. IE '70) is a man with interests as broad and deep as the industrial engineering (IE) field in which he works. A professor of industrial engineering at Lamar University, Zaloom has really done it all, working in research, industry, teaching and academic administration. But it is his passion for teaching, influencing and shaping the next-generation of industrial engineers that continues to drive him.

Read on to learn why Zaloom chose the industrial engineering field, how he found his passion for teaching and why he gives back to the industrial engineering department at the UH Cullen College of Engineering.

Q: Did you always know that you wanted to be an engineer?

A: I never had a plan to be an engineer early on. When I was a junior in high school I think I was only interested in playing baseball and other sports.

Q: Why did you pursue industrial engineering in college?

A: I grew up inside of my parents' grocery store in Miami, so I was always interested in business. Engineering, science and math came pretty naturally to me, and I enjoyed those subjects in school, so that led me to pursue an engineering degree at the University of Florida.

One of my "intro to engineering" courses went over all of the different engineering disciplines and careers. That's the first time I was introduced to industrial engineering – they sold it as a broad field, a combination of science and business. It was a perfect blend of the two things I was most interested in.

Q: Why did you decide to continue on to graduate school after earning your bachelor's in IE?

A: When I became a senior at the University of Florida I interviewed for several jobs and got job offers but none of them seemed interesting to me, so I decided rather than take a job I wasn't passionate about I'd stay on in school. After I finished my master's degree I got fewer job offers, but they were more interesting. I chose to take a position at Lockheed Martin in the Dallas area.

Q: What prompted you to make the transition from private industry to academia?

A: While working at Lockheed I was asked to teach a night course at Texas Christian University (TCU) in Fort Worth pretty much out of the blue. I had never taught anything before in my life, but I decided just to do it. In the early part of teaching that course I realized that this is what I want to do for the rest of my career rather than working in industry.

Q: How did you end up at the University of Houston to pursue your doctoral degree in IE?

A: Once I found my passion for teaching I knew I needed to get my doctoral degree to compete for professor positions. Then I seriously started looking at Ph.D. programs. I was drawn to the city of Houston and the industrial engineering department at UH, but I had a family and needed financial support to get my Ph.D. The UH Cullen College offered me a fellowship right away and I made the decision to leave my job at Lockheed to pursue my degree at UH.

Q: Did you find that doors opened for you after earning your doctoral degree in industrial engineering from UH?

A: Without it I couldn't have had the career that I've had. I owe UH a lot for believing in me from the start. They looked at my background – I had good degrees, I was mature and had experience working in industry – and they offered me financial support to pursue my degree and didn't ask me to prove myself first. That meant a lot to me. UH was a very welcoming place for me.

Q: Where did your career take you from there?

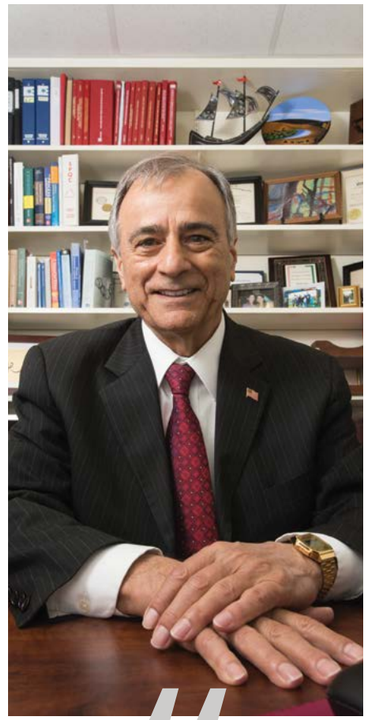
A: After earning my Ph.D. in 1970 I joined the IE faculty at Auburn University and taught there until '78. That really got me a great start in my academic career.

I had decided early on in my career that I'd like to be a department chair. The role combines teaching as well as administration and management, which really appeals to me. I had an opportunity to do that at North Carolina A&T State University in Greensboro, North Carolina, a historically black school that had just started an industrial engineering department at the time. I was the department chair there from '78 to '81, and during that time I got the department accredited by the Accreditation Board for Engineering and Technology (ABET).

Then I was offered a bit of a promotion at Lamar University – a department chair position as well as heading up their graduate program in engineering. I jumped at the opportunity and I've been at Lamar University since then. I have also served as the chairman of the industrial engineering department, associate dean of engineering, interim dean of the college of engineering, dean of the graduate school and, of course, professor of industrial engineering.

Q: You are a long-time supporter of UH Engineering and have established the Dr. Victor A. Zaloom Scholarship Endowment for industrial engineering students. Why do you feel it is important to give back to your alma mater?

A: My career is totally dependent on the University of Houston believing in me and helping me with financial support and with office space while I earned my doctoral degree. The faculty at the Cullen College were very friendly and treated me as an adult – not just as a student, but as a fellow scholar. That shaped me a great deal and helped solidify my goal of becoming a faculty member myself. It's so important to me to help ensure future IE students have the same opportunities that I did.



> I THINK IE IS GOING TO BE AN IMPORTANT MAJOR FOR THE INFORMATION ECONOMY. INDUSTRIAL ENGINEERS ARE VERY FLEXIBLE AND I THINK THAT'S A VERY IMPORTANT QUALITY TO HAVE TODAY.

Q: Where do you see the IE field going in the future?

A: I think IE is going to be an important major for the information economy. Industrial engineers are very flexible and I think that's a very important quality to have today. Fifty years ago you could have one career your whole life, but nowadays you need to change career paths maybe several times to be successful. With industrial engineering, the flexibility and broadness of the degree is very amenable to that. I think the kinds of people who are attracted to IE are the kind of people that our country needs to lead us into the future.

Q: Do you have any career advice for current IE students?

A: Find your passion, no matter what it is. You need to find out what type of work you want to do. Whether it's teaching and research, administration, working as an IE in a company or working for yourself as a consultant – find your passion and pursue it.

I often repeat Confucius' words to my students: "Choose a job you love and you'll never have to work a day in your life." It's so important to find your passion. I found mine very inadvertently. I was working for a company and got a call one day and was asked to teach a course. I had no idea if I wanted to be a teacher but I was open-minded and willing to make sacrifices, and that allowed me to find my passion. I would wish anybody to do that. As a professor I try to encourage and help my students to do the same.

Socrates said, "The unexamined life is not worth living." In that case, look at where you are and if you're not doing something you want to do, then look at your options and pursue them. ■

NEWS BYTES 2017

UH CHAPTER OF INSTITUTE OF INDUSTRIAL AND SYSTEMS ENGINEERS HOLDS ANNUAL BANQUET

The UH chapter of the Institute of Industrial and Systems Engineers (IISE) hosted its annual IISE Banquet last May at the University of Houston student center. Industrial engineering students and faculty in attendance enjoyed dinner, guest speakers, awards and prizes at the annual event, sponsored by the UH industrial engineering department.

HTTPS://WWW.FACEBOOK.COM/GROUPS/IISEUH/

UH INDUSTRIAL ENGINEERING STUDENTS CONNECT WITH STUDENTS AT ELKINS HIGH SCHOOL CAREER FAIR

Industrial engineering (IE) undergrads Britney Shum, Brandon Kwan, Hussam Alsinan and Christopher Avalos recently attended a high school career fair outreach event at Elkins High School in Missouri City. The UH IE students gave a presentation on the industrial engineering field, providing specific examples of projects that industrial engineers work on and the various types of career paths they can embark on. The UH industrial engineers also spoke about how their education at UH shaped their academic and professional development as well as their experiences with internships, student groups and various other aspects of college life at UH.

DEPARTMENT OF INDUSTRIAL ENGINEERING

Selected IE Faculty Publications

FENG, QIANMEI
PUBLICATIONS: 2016 - 2017

Xiang, Y. Coit, D.W., Feng, Q., Zhu, Z., Condition-based Maintenance under Performance-based Contracting. Submitted to Computers & Industrial Engineering. (Accepted, July 25, 2017)

M. Zhou, L. Kong, L. Xie, T. Fu, G. Jiang, Q. Feng, Design and Optimization of Non-circular Mortar Nozzles Using Finite Volume Method and Taguchi Method. International Journal of Advanced Manufacturing Technology, 90(9), 3543-3553, May 2017.

Rafiee, K., Feng, Q., Coit, D.W., Reliability Assessment of Dependent Competing Risks with Generalized Mixed Shock Model. Reliability Engineering & System Safety, 159:1-11, March 2017.

Rafiee, K., Feng, Q., Coit, D.W., Reliability Analysis and Condition-based Maintenance for Failure Processes under Degradation-Dependent Hard Failure Threshold. Quality and Reliability Engineering International. (Online 11/22/2016)

Shu, Y., Feng, Q., Kao, E., Liu, H., Levy Driven Non-Gaussian Ornstein-Uhlenbeck Processes for Degradation-Based Reliability Analysis. IIE Transactions, 48(11), 993-1003, November 2016.

Feng, Q., Jiang, L., Coit, D.W., Reliability Analysis and Condition-based Maintenance of Systems with Dependent Degrading Components based on Thermodynamic Physics-of-Failure. International Journal of Advanced Manufacturing Technology, 86(1), 913-923, September 2016.

Song, S., Coit, D.W., Feng, Q., Reliability Analysis of Multiple-Component Series Systems Subject to Hard and Soft Failures with Dependent Shock Effects. IIE Transactions, 48(8), 720-735, August 2016.

Kheirkhah, P., Feng, Q., Travis, L.M., et. al, Prevalence, Predictors and Economic Consequences of No-shows, BMC Health Services Research, 16(13): 1-6, January 2016.

Hu, L., Zhou, M., Xiang, F., Feng, Q., Modeling and Recognition of Steel-Plate Surface Defects Based on a New Backward Boosting Algorithm, Submitted to The International Journal of Advanced Manufacturing Technology.

Li, S. Feng, Q., Physics-of-Failure based Statistical Models for Lithium-ion Battery Lifetime Estimation. Submitted to Reliability Engineering & System Safety.

Song, S., Coit, D.W., Feng, Q., System Reliability with Clusters of Dependent Degrading Components. Submitted to IEEE Transactions on Reliability.

Shu, Y., Feng, Q., Kao, E. Coit, D.W., Liu, H., Markov Additive Processes for Degradation with Jumps under Dynamic Environments. Submitted to IIE Transactions.

Feng, Q., Jiang, L., Su, Q., Condition-based Maintenance of Multi-State Power Transformers with Multiple Failure Modes using Markov Decision Processes. Submitted to International Journal of Reliability, Quality and Safety Engineering (IJRQSE).

KHATOR, SURESH
PUBLICATIONS 2016 – 2017

Arab, A., Tekin, E., Khodaei, A, Khator, S.K., Han, Z. "Systems Hardening and Condition-Based Maintenance for Electric Power Infrastructure Under Hurricane Effects". IEEE Transactions on Reliability, 65 (3) 1457 – 1470, September 2016

Arab, A., Tekin, E., Khodaei, A, Khator, S.K., Han, Z. "Electric Power Grid Restoration Considering Disaster Economics". IEEE Access, Vol. 4, 639 – 649, 2016.

LEE, TAEWOO
PUBLICATIONS: 2016 - 2017

T. C. Y. Chan, T. Lee, D. Terekhov, "Inverse Optimization: Closed-form Solutions, Geometry and Goodness of fit," arXiv:1511.04650

T. C. Y. Chan, T. Lee, "Trade-off preservation in inverse multi-objective convex optimization," arXiv:1706.06926

LIM, GINO
PUBLICATIONS: 2016 - 2017

S. Kim, G. J. Lim, J. Cho, and M. Cote, "Drone-aided Healthcare Services for Patients with Chronic Diseases in Rural Areas," accepted for publication, Journal of Intelligent & Robotic Systems, March 2017

M. Zaghian, W. Cao, W. Liu, L. Kardar, K. S. Randeniya, R. Mohan, G. Lim, "Comparison of linear and nonlinear programming approaches for "worst case dose" and "minmax" robust optimization of intensity-modulated proton therapy dose distributions," Journal of Applied Clinical Medical Physics, vol. 18, no. 2, pp. 15-25, March 2017

G.J. Lim, S. Kim, J. Cho, Y. Gong, and A. Khodaei, "Multi-UAV Pre-positioning and Routing for Power Network Damage Assessment," in press, IEEE Transactions on Smart Grid, December, 2016.

L. Liao, G. J. Lim, Y. Li, J. Yu, N. Sahoo, H. Li, M. Gillin, X. Zhu, A. Mahajan, S. J. Frank, D.R. Grosshans, Q. Nguyen, D. Gomez, and X. Zhang, "Robust optimization for intensity modulated proton therapy treatment plans with multi-isocenter large fields," International Journal of Particle Therapy, vol 3, no. 2, pp305-311, December, 2016.

G.J. Lim, A. Mobasher, J.F. Bard, A. Najjarbashi, "Nurse Scheduling with Lunch Break Assignments in Operating Suites," Operations Research for Health Care, 10, pp. 35-48, September 2016.

G.J. Lim, S. Zangeneh, and S. Kim, "A clustering approach for defining hurricane evacuation zones," Journal of Urban Planning and Development, vol. 142, no. 4, 04016008-1, December, 2016

T. Biobaku, G. Lim, S. Bora, J. Cho, and H. R. Parsaei, "An optimal sonar placement approach for detecting underwater threats under budget limitations," Journal of Transportation Security, 7(1), pp17-34, June 2016

S. Lin, G. Lim, and J. Bard, "Benders Decomposition and an IP-based Heuristic for Selecting IMRT Treatment Beam Angles," European Journal of Operational Research, 251(3), pp715-726, June 2016

G.J. Lim and M.R. Baharnemati, and S. Kim, "An Optimization Approach for Real Time Evacuation Reroute Planning," Annals of Operations Research, 238(1), pp375-388, March 2016

M. Akladios, G. Lim, and H.R. Parsaei, "How Does Effectiveness of Student Learning Differ: a Comparison between Online vs. Face-to-Face formats," International Journal of Business, Humanities and Technology, 5(6). pp18-21, December, 2015

Xiang W, Yin J, Lim G, "An ant colony optimization approach for solving an operating room surgery scheduling problem," Computers and Industrial Engineering, 85, pp. 335-345, July 2015

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," Special issue "Proton Therapy for Cancer", Cancers, 7(2), pp574-584, June 2015.

T. Biobaku, G. Lim, S. Bora, J. Cho, H. Parsaei, "Literature survey on underwater threat detection," Transactions on Maritime Science, 4(1), pp 14-22, April 2015.

Xiang W, Yin J, Lim G, "A short-term operating room surgery scheduling problem integrating multiple nurses roster constraints," Artificial Intelligence in Medicine, 63(2), pp. 91-106, February 2015

G.J. Lim, M. Rungta, and M.R. Baharnemati, "Reliability Analysis of Evacuation Routes under Capacity Uncertainty of Road Links," IIE Transactions, vol. 47, pp 50-63, January 2015. (FLIM,

LIN, YING
PUBLICATIONS: 2016 - 2017

Lin, Y., Huang, S., Simon, G.E., and Liu, S., "Analysis of Depression Trajectory Patterns using Collaborative Learning", Mathematical Biosciences, 282: 191-203, 2016.

Li, M., Lin, Y., Huang, S., and Crossland, C., "The Use of Sparse Inverse Covariance Estimation for Relationship Detection and Hypothesis Generation in Strategic Management", Strategic Management Journal, 37: 86-97, 2016.

Lin, Y., Liu, K., Byon, E., Liu, S., and Huang, S., "A Collaborative Learning Framework for Estimating Many Individualized Regression Models in A Heterogeneous Population", IEEE Transactions on Reliability, under third round review.

Lin, Y., Liu, S., and Huang, S., "Selective Sensing of A Heterogeneous Population of Units with Dynamic Health Conditions", IIE Transactions, under second round review.

Duan, C., Lin, Y., Won, D., Huang, S., You, J., and Chaovalitwongse, W.A., "A Cost-sensitive Rule-based Classification Framework for Medical Diagnosis and Decision Making", Annals of Operations Research, under review.

PENG, JIMING
PUBLICATIONS: 2016 - 2017

R. Batta and J. Peng (Eds). Leading Developments from Informs Communities. Forthcoming, Informs Tutorials in Operations Research, October, 2017.

J.Q. Hale, E.L. Zhou and J. Peng. A Lagrangian Search Method for the KMedian Problem. J. Global Optimization, 2016. DOI 10.1007/s10898-016-0481-x

L. Mujkerjee, J. Peng, T. Sigmund and V. Singh. Network flow formulations for Learning Binary Hashing. Lecture Notes in Computer Science (LNCS), Volume 9909. European Conference on Computer Vision (ECCV), October, 2016. pp 366--381.

J. Peng and X. Chen. A new analysis on sparse solutions to random standard quadratic programming problems and extensions. Mathematics of Operations Research, 40(3):725-738, 2015.

J. Peng and T. Zhu. A nonlinear semidefinite optimization approach to worstcase linear optimization under uncertainties. Mathematical Programming, 152(1), 593-614, 2015.

J. Chen, L.M. Feng and J. Peng. Optimal deleveraging with nonlinear temporary price impact. E. J. Operations Research, 244(1), 240247, 2015.

J. Peng, T. Zhu, H. Luo and K. Toh. SDP relaxations for quadratic assignment problems based on non-redundant matrix splitting. J. Comp. Optimi. Applications, 60(1), 171-198, 2015.

Selected IE Faculty Grants

FENG, QIANMEI

Principal Investigator of "Exploring Heterogeneous Complex Systems in Dynamic Environments: Stochastic Degradation-based Reliability and Unified Maintenance Decision-making," with Lamar University (Dr. Yisha Xiang), CMMI-1728321, National Science Foundation, 09/01/2017-08/31/2021, $348,077 (100%).

Co-Principal Investigator of "Texas Mill Test Information for Load Ratings," with Drs. Mina Dawood (PI) and Abdeldjelil Belarbi, Texas Department of Transportation, 09/01/2016-8/31/2018, $260,476.38 (10%).

Co-Principal Investigator of "Smart Channel Initiative: Interdisciplinary Approach to Sustainability and Resilience," with Drs. Bruce Race, Gino Lim et al., Hobby Center for Public Policy, UH, 02/01/2016-12/31/2016. $25,000 (8%).

LIM, GINO

"Understanding Biological and Physical Factors Affecting Response to Proton Therapy to Improve its Clinical Effectiveness," CPRIT, $879,362, 3/1/2016-2/28/2019, Role: Co-PI. Lead: UT-MD Anderson Cancer Center collaborating with UH and Rice University.

"Robust models and computational algorithms for a fully automated intensity modulated proton therapy treatment planning system," Global Oncology One, Inc., Houston, TX, $25,648, 10/1/2015-9/30/2016, PI: Lim (100%).

"Mathematical models and computational algorithms considering Relative Biological Effects for IMPT Treatment Planning," U of Texas MD Anderson Cancer Center, $29,136, 1/16/2016-1/15/2017, PI: Lim (100%).

"Smart Channel Initiative: Interdisciplinary Approach to Sustainability and Resilience," Hobby Center for Public Policy and the Division of Research, A seed grant, $25,000, 1/15/2016-12/31/2016, Team Leader.

"Optimization of intensity-modulated proton therapy incorporating physical and biological characteristics of protons," U of Texas MD Anderson Cancer Center, $90,000, 11/16/2015-11/15/2016, PI: Lim (100%).

"Risk Analysis and Efficient Logistics for Maritime Ports and Waterways" Qatar National Research Funds (NPRP 4-1249-2-492), $898,697 ($251,494 UH: PI: Lim (100%)), 3/15/2012 – 1/15/2016. Collaboration with Rutgers Univ. and Texas A&M - Qatar.

"Robust Optimization considering Relative Biological Effects for Intensity-Modulated Proton Therapy Treatment Planning," U of Texas MD Anderson Cancer Center, $10,160, 9/1/2015-1/15/2016, PI: Lim (100%).

PENG, JIMING

"Increasing Healthcare Access for At-Risk-Populations: Research-based Policies for Mobile Health Clinics". TMC Health Policy Institute, $150000. Role: Co-PI.

"Alternate Direction Method: A New Recipe for Non-convex Quadratic Programming with Applications". NSF, $220000. Role: PI.

"Increasing Healthcare Access for At-Risk-Populations in Smart Communities: Research-based Policies for Mobile Health Clinics". NSF, $250000. Role: Co-PI.

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