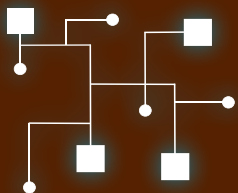


INDUSTRIAL AND SYSTEMS ENGINEERING

FALL NEWSLETTER 2022

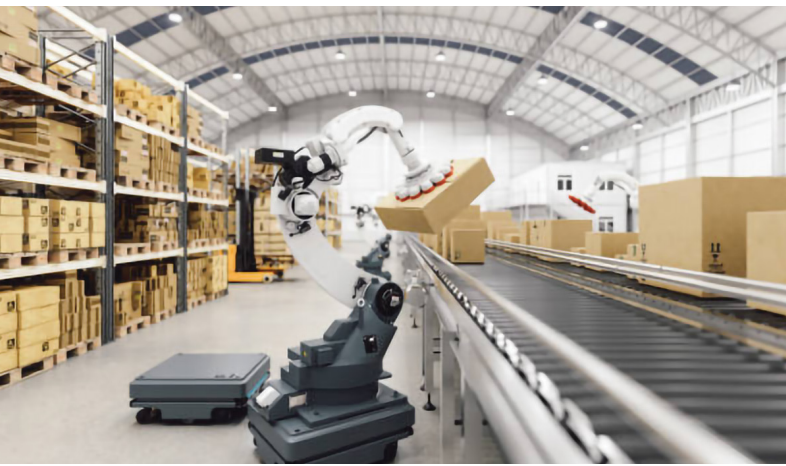


ICCOPT 2022 Gathered 600 Participants From 30 Countries on Lehigh Campus



LEHIGH
UNIVERSITY

P.C. Rossin College
of Engineering and
Applied Science



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NEWSLETTER FALL 2022**

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Dear Lehigh ISE Community,

The Department has had excellent moments of internal and external recognition during spring and summer of 2022.

ISE Professor **Xiu Yang** was awarded an NSF CAREER award, one of the most prestigious and instrumental research awards a junior faculty can receive in the US. He got it the first time he applied, which is really outstanding. Congratulations Xiu!

ISE Professor **Lawrence V. Snyder** was awarded the Lehigh's Wagner endowed chair. Only a small percentage of full professors in the US hold endowed chairs. There was an internal competition among different Rossin departments to refill this endowed chair, despite the fact that it was given to Lehigh to support manufacturing systems engineering. The process was challenging but we were able to put forward an outstandingly strong application for Larry, who deserved the Wagner chair more than anybody else. This was a story with a happy ending!

The list goes on.

Professor **Karmel S. Shehadeh** has been having two years of spectacular academic and research activity since joining Lehigh. The Rossin Newsletter Resolve featured Karmel in a 2022 number that we are proud to reproduce here for you in our own ISE Newsletter. Karmel has been obtaining awards as a reviewer of the year in different reputed journals, and has very recently been selected as a finalist for various INFORMS awards (to be reported later). We are very proud of Karmel's trajectory towards world leadership.

In July 2022 we held **ICCOPT 2022**, the seventh international Conference on Continuous Optimization of the Mathematical Optimization Society. ICCOPT 2022 was a huge success and brought enormous visibility and prestige to our Department. The event was one of the largest, if not the largest academic event ever held on Lehigh's campus, welcoming approximately 600 participants from around 30 countries. This colossal enterprise required a tremendous effort

from the main organizers, ISE Professors **Daniel P. Robinson** and **Frank E. Curtis**, and from our staff members **Sheila Dorney** and **Mark Motsko**. Our gratitude is extended to all members of the local Organizing Committee. Also, many, many thanks to I-DISC business manager **Sarah Wing**, to the ISE postdoc **Tommaso Giovannelli**, and to all other staff members and volunteers.

The Quantum Computing Optimization Lab (QCOL) is now one of the flagship research groups of our ISE Department. **We have summarized for you in this NL number some of the achievements of QCOL since its formation two years ago**, and you will be hopefully convinced that we are leading in the strategic, cutting-edge field of quantum computing. Cudos to ISE Professors **Tamás Terlaky**, **Luis F. Zuluaga**, and **Xiu Yang**.

Moreover, we have developed in 2022 our **Diversity, Equity, and Inclusion Plan**, which is now online on our webpage (**About** dropdown menu). Speaking about diversity, one article in this number of our Newsletter will depict photos of our activity of **celebrating world cultures** in the ISE Office around the dates of their main holidays.

You will read about these and many other wonderful things this fantastic department has been doing despite the challenge of current times and the competitive resources. As it was also broadcast among the Lehigh ISE community, we have won the two \$1,000 Dean awards, the one for the Rossin department with the most dollars raised and the one with the most donors, during 2022 **Lehigh's Giving Day** (April 27). We were able to raise more than \$15K in a day. We are extremely grateful to all of you for having helped us engineer this successful event, from the smallest generous gifts to the great open-handed contributions.

Again, thank you all for your continued support and commitment to Lehigh ISE. We hope that on the next Giving Day we will be able to raise even much more than we did in 2022, but you don't need to wait until then. You can go to our webpage click on **Contact** and then select **Support Lehigh ISE** from the dropdown menu.



LUIS NUNES VICENTE
ISE Department Chair

ISE FACULTY & STAFF

news

XIU YANG

Lehigh ISE Assistant Professor Xiu Yang won an NSF CAREER Award

The Lehigh ISE Department is extremely pleased to announce that Professor **Xiu Yang** was awarded an NSF CAREER Award. The project title is **Uncertainty Quantification for Quantum Computing Algorithms**. The total award amounts to \$400,000 and spans five years (from September 2022 to August 2027).

The NSF CAREER is one of the most prestigious awards a junior faculty member can receive. It will support Prof. Yang serve as an academic role model in research and education, contributing to advancing the mission of Lehigh's ISE Department and College of Engineering. In the words of Xiu: "I am thrilled that NSF has selected my project, which will provide steady support for the next five years of my research and student-mentoring plans."

Xiu Yang obtained his PhD in Applied Mathematics from Brown University in 2014. Before coming to Lehigh, he spent five years at Pacific Northwest National Laboratory (PNNL), first as a postdoctoral researcher (2014-2016) and then as a research staff member (2016-2019). He received an Outstanding Performance Award from PNNL for two consecutive years (2015 and 2016).

His research has been centered around modern scientific computing including uncertainty quantification, multi-scale modeling, physics-informed machine learning, and data-driven scientific discovery. Xiu has been applying his methods on various research areas such as fluid dynamics, hydrology, biochemistry, soft material, climate modeling, energy storage, and power grid systems. Currently, he is focusing on quantum computing algorithms for scientific computing. "This award will allow us to develop new uncertainty quantification methods for quantum computing and build the foundation of a "quantum numerical analysis" framework from a probabilistic perspective." says Xiu Yang.



LAWRENCE V. SNYDER

Lehigh ISE Professor Larry Snyder appointed to the Harvey E. Wagner Endowed Chair

The Lehigh ISE Department is delighted to announce that ISE Professor **Lawrence V. Snyder** was appointed to the **Harvey E. Wagner Endowed Chair in Manufacturing Systems Engineering**, effective July 1, 2022.

Larry Snyder is an established leader in the field of operations research and systems engineering, with a vast and highly cited publication record. He received his PhD from Northwestern University in 2003 with a dissertation on robustness and reliability of supply chains. Since that time, he has greatly expanded his research portfolio to include work on logistics, transportation theory, facility location, inventory models, energy systems, decision-making under uncertainty, and machine and reinforcement learning. He has a strong record of interdisciplinary research excellence, spanning his entire career over 19 years at Lehigh, where he has also been a stellar educator, highly appreciated by his students. He currently serves as the Director of Lehigh's Institute for Data, Intelligent Systems, and Computation (I-DISC).

Wagner's endowment was made in 1987 to award a Lehigh industrial / manufacturing systems engineering professor. According to former Lehigh Provost David A. Sanchez, the chair was made possible through a \$1.25 million gift from Harvey E. Wagner, Lehigh Class of 1957, and a \$250,000 grant from IBM Corporation. Previous holders of the Wagner endowed chair were Professor Roger N. Nagel (1987-2003) and Professor Katya Scheinberg (2014-2019). Harvey had an accomplished life as an entrepreneur. He founded Teknekron Corporation in Berkeley, California, which developed emerging computing technologies. Lehigh is highly grateful for his contribution for hiring and retaining some of our most talented faculty.

There is an important interconnection between manufacturing systems engineering and Larry's main research topic, supply chain theory and modeling. In fact, supply chains play an increasingly important role in manufacturing systems, because modern manufacturing processes are tuned carefully to the flows of raw materials and parts coming into the complex multi-layered manufacturing system and the flows of finished products coming out of the system. Supply chain management provides tools to evaluate, forecast, manage, and optimize these flows. The rise of "just-in-time" or "lean" manufacturing in the 1980s and 1990s eschewed inventory and other redundancies. More recently, many companies are returning to a "just-in-case" approach, which uses inventory to buffer against uncertainty, in response to the enormous uncertainties faced by today's supply chains. Both approaches rely heavily on mathematical models for supply chains, including network design, inventory optimization, transportation modeling, and forecasting. The modern version of "just-in-case" focuses especially on supply uncertainty, a major topic of Larry's research for the past 20 years.

The Lehigh ISE Department now has three endowed chair professors, Lawrence V. Snyder (Harvey E. Wagner '59), Tamás Terlaky (George N. and Soteria Kledaras '87), and Luis Nunes Vicente (Timothy J. Wilmott '80). Sam Banks '63 has recently endowed another faculty chair at our Department.

ISE FACULTY & STAFF

news

***Karmel S. Shehadeh:
Better models for better health care***

KARMEL S. SHEHADEH

We are excited to share with you that Lehigh ISE Assistant Professor **Karmel S. Shehadeh** was featured in a recent article in the RCEAS Resolve Magazine. The article highlights Karmel's research areas in optimization under uncertainty, mixed-integer programming, scheduling theory, and algorithm development and how it is being applied in healthcare operations and analytics. We are extremely pleased to see Karmel's academic and research endeavors being recognized by our College of Engineering.

Professor Shehadeh joined the Lehigh ISE Department as Assistant Professor in August 2020. She earned a Ph.D. in Industrial and Operations Engineering (IOE) from the University of Michigan and was awarded a Presidential and Dean Postdoctoral Fellowship at the Heinz College of Information Systems and Public Policy at Carnegie Mellon University. Professor Shehadeh was elected as a Director of Operations Research Division of the Institute of Industrial and Systems Engineers for 2021-2023. Her work as peer reviewer has been recognized by the prestigious journals INFORMS Journal on Computing (IJOC Meritorious Reviewers 2021) and Transportation Science (2022 Meritorious Service Award).

Please enjoy the full Resolve Magazine article (Page 24, Volume 1, 2022) reprinted below.

"I am in love with mixed integer programming," says **Karmel Shehadeh**. "There's nothing in this world that's certain, so I really enjoy it when I solve problems that involve random factors."

Shehadeh is an assistant professor of **industrial and systems engineering (ISE)** who joined the Lehigh faculty in August 2020. Her research areas include optimization under uncertainty, as well as mixed-integer programming, scheduling theory, and algorithm development. And the primary application of her work is in health care operations and analytics.

"Health care systems are one of the most complex systems to manage," she says. "They're expensive to operate, and there are so many sources of uncertainty like surgery duration, patient arrival, and tight capacity. And we have seen how the health care system pretty much broke down during the pandemic. So the complexity of the system, the unlimited number of research problems, and the impact you can have by solving these problems is what I think attracted me to health care."

Specifically, she and her team are working on the application of data-driven operations research and optimization methods to address problems around patient and operating room scheduling, ICU capacity planning, hospital readmission, and recently, facility location. By applying her scheduling models for example, she says, hospitals could best determine how many patients a provider sees in a shift, and in what order. And that order is important.

“If it’s done arbitrarily,” she says, “you might allocate 30 minutes for a complex patient who actually needs 40 minutes. The model then could tell you, okay, this type of patient needs 20 minutes, this type needs 30, this type needs an hour. So ideally, if these models are implemented, they can make the system run smarter so that everyone benefits. The provider has enough time with each patient, so there will be better outcomes for the patient and more satisfaction for the provider.”

Shehadeh recently published a book chapter with ISE professor Larry Snyder focused on integrating equity into health care facility location algorithms. They looked at how equity is being modeled and recommended ways to make the models more “inequity averse” to prevent unequal solutions. Which would again, she says, benefit everyone.

“Better models could help the government determine where to locate federally funded facilities,” she says. “They could help private investors who are concerned about equity. For example, if a company wanted to have a mobile outpatient clinic, they could use this inequity averse model to route and schedule the clinics to serve patients in previously underserved areas.”

And, she says, better models could ensure that all patients, regardless of age, gender, location, or socioeconomic factors, have the same access to care.

“There’s a recent report we included in the chapter that showed that in 2020, 20 percent of the population lived far away from COVID-19 testing clinics, while a huge percentage of the population lived within three miles or less. Distance to a facility is just one factor when it comes to equity, but it’s a huge factor.”

As an extension of her equity work, Shehadeh recently supervised a group of women engineering undergraduates as part of the Lehigh Outreach ISE program. One of the program’s initiatives is to expose undergraduates to research. Shehadeh’s student group was tasked with measuring access to hospitals in Pennsylvania. Using ArcGIS mapping software, the students located all hospitals in the state and measured the distance to them from each population center.

“That helped us learn how many people had access within 10 minutes, within 20 minutes, within 60 minutes,” says Shehadeh. “So that’s step one. The hope is to expand this approach to the entire U.S., and to include a range of health care facilities, including outpatient clinics, blood banks, and trauma centers. These amazing students got the data, cleaned it, added it to the geographical system, created these maps, and ended up with a report that hopefully will be turned into a paper that we can make publicly available to colleagues in the field.”

Shehadeh is also part of a working group led by **Fathima Wakeel**, an associate professor in Lehigh’s **College of Health**, that created a survey to study the various physical and mental health impacts of COVID-19.

“I joined this group a couple of months before I even came to Lehigh, and I’ve really enjoyed learning from everyone. I love solving problems in health care, so it’s been a natural fit for me.”

Another thing she loves is working with—and learning from—her students. “I’m a new faculty member, but so far I have two PhD students at Lehigh, and I’m co-advising two other PhD students at other universities. It’s been great watching them grow and improve as researchers,” she says. “I always say that working with them is the best part of my job.”

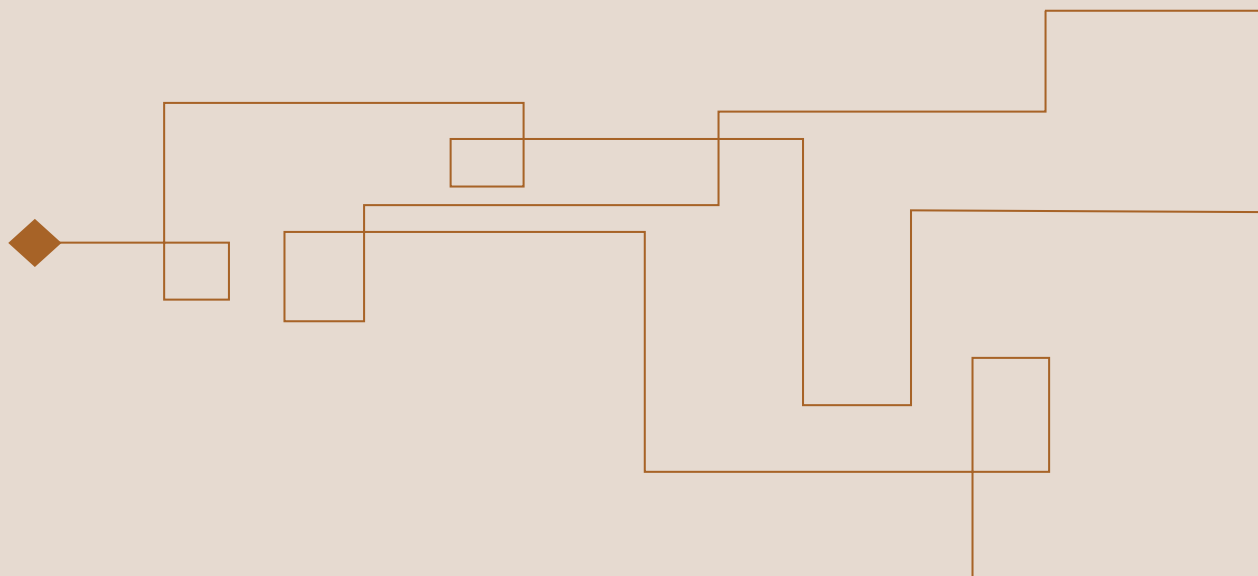
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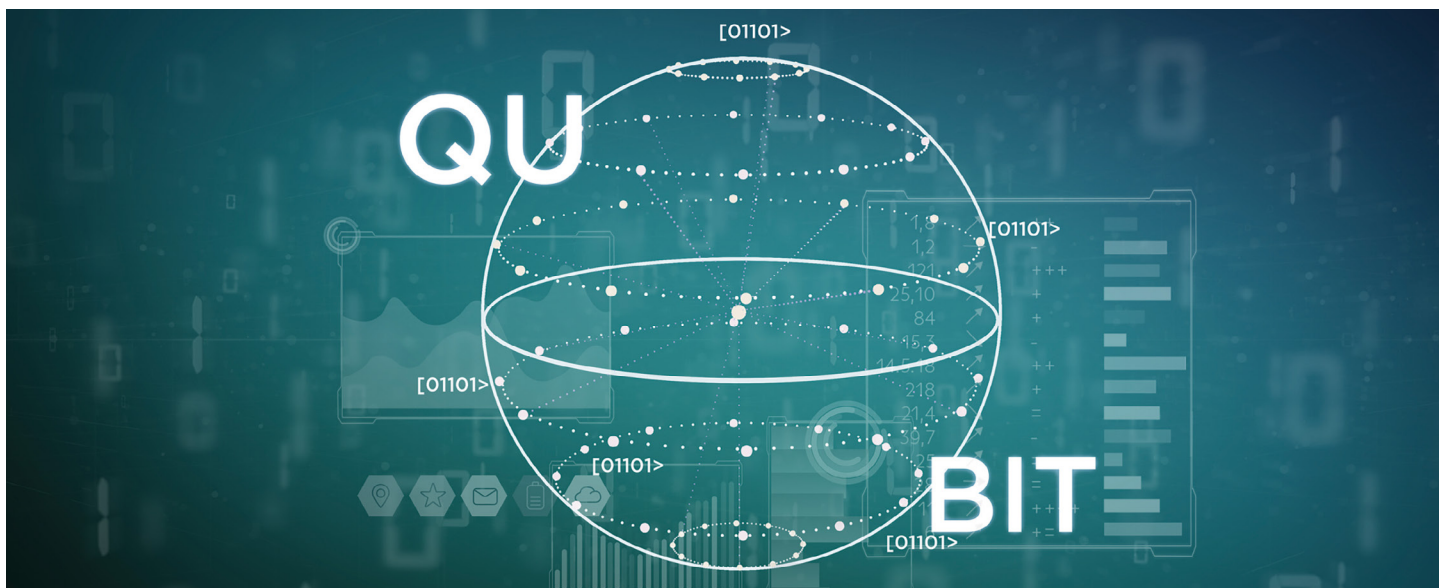
news



JOYCE LAI GABAY

Originally from Hong Kong, Joyce Lai Gabay joined the ISE Department as the Graduate and Department Coordinator in April 2022. She is a marketing specialist with a Master's degree in professional communications and diverse working experience in advertising, public relations and market research. As an environmentalist and writer, she self-published an e-book, hosted a website and wrote a blog on climate change. She was awarded an Honorable Mention Certificate from the L. Ron Hubbard's Writers of the Future Contest, and had volunteered at the Climate Cost Project as their Communications Consultant and at Crisis Text Line as a Volunteer Crisis Counselor.





Lehigh ISE Quantum Computing Optimization Lab is at the forefront of the Quantum Revolution

Lehigh's **Quantum Computing Optimization Lab (QCOL)** was launched by ISE faculty to develop State-of-the-art optimization algorithms for quantum computers with the major goal of outperforming classic computing performance. The lab was formed in 2019 with major support from a **\$2.2M DARPA grant** and Lehigh's Department of Industrial and Systems Engineering, and it has recently joined the **IBM Quantum Hub** at NC State University. QCOL is led by Lehigh ISE professors Tamás Terlaky, Luis F. Zuluaga, and Xiu Yang and computer science professor Arielle Carr.

Quantum computing is a revolutionary new computing paradigm, where instead of traditional binary bits (electrical or optical pulses that translate to zeros and ones), the “qubits” (electrons or photons) used by quantum computers can exist in multiple states at one time, leading to superior computational performance. QCOL members' expertise in conic linear optimization (Terlaky), polynomial and combinatorial optimization (Zuluaga), and uncertainty quantification (Xiu) has been leading to novel QC methodologies for the solution of complex optimization problems. NSF has recognized this effort by granting Prof. Xiu a NSF CAREER grant to develop uncertainty quantification for QC algorithms.

As an interdisciplinary lab, QCOL is already playing a major role at Lehigh's College of Engineering and Institute for Data and Intelligent Systems. QCOL has been featured in a recent article of Lehigh's RCEAS Resolve Magazine. More prominently, American Physical Society TV has also produced an **episode** about QCOL.

Please enjoy the full Resolve Magazine article (Pages 10-11, Volume 2) reprinted below.

To the casual observer, a quantum computer—with its tiered, “upside-down wedding cake” design, strands of precisely strung wires, and shiny, metallic finish—could be mistaken for a funky chandelier or a work of modern art.

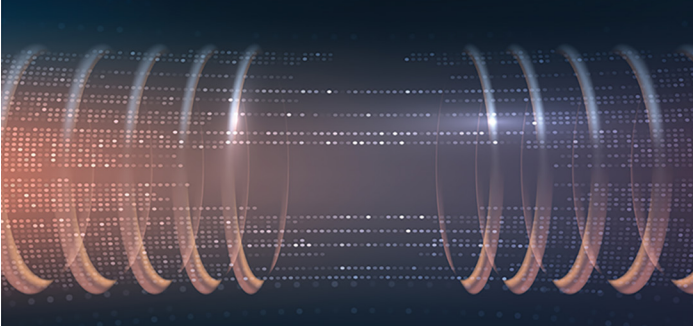
Yet, despite the machine's futuristic look, the computing technology, as it exists today, is somewhat clunky.

“Quantum computers are in their early stage of development,” says **Tamás Terlaky**, George N. and Soteria Kledaras '87 Endowed Chair Professor in the Department of Industrial and Systems Engineering (ISE). “They have limited capacity. They are not reliable. They are ‘noisy,’ meaning error-prone. You could relate them to the early vacuum-tube, first-generation computers that existed before the silicon transistor was discovered.”

It's the benefit of hindsight, having witnessed the wide-ranging impact of the “silicon revolution” and the invention and growth of the internet, that has Terlaky and fellow members of Lehigh's Quantum Computing and Optimization Lab (QCOL) excited to play a leading role in what they see as the dawn of a new technological age.

QCOL was formed in 2019 with major support from the Defense Advanced Research Projects Agency (DARPA) and Lehigh's ISE department. The group is led by Terlaky and includes ISE faculty members **Luis F. Zuluaga** and **Xiu Yang** (a 2022 recipient of the NSF CAREER award), computer science and engineering assistant professor Arielle Carr, graduate students, and outside collaborators from industry, national labs, and academia.

The interdisciplinary lab, a research group within Lehigh's Institute for Data and Intelligent Systems (I-DISC), is working



on optimization algorithms in quantum computing (QC) that could hold the key to “solving problems in economics, transportation and supply chains, telecommunications, and other areas that are unsolvable today,” says Terlaky.

“Quantum computing is a revolutionary new computing paradigm,” he says. “We cannot fully assess its long-term potential and impact.”

Seizing a subatomic edge

“Quantum computing uses subatomic particles to represent and operate abstract mathematical concepts; like using nature to compute for us,” says ISE doctoral student **Muging Zheng**. “It inspires people to use an entirely new perspective to describe things that they have been working on for years, and eventually make improvements in both the classical and quantum world.”

In very basic terms, QC harnesses the unusual properties of subatomic particles to gain a computational edge. Where traditional computers process binary bits (electrical or optical pulses that translate to zeros and ones), the “qubits” (electrons or photons) used by quantum computers can exist in multiple states at one time (a property called superposition), which has the potential to exponentially increase the systems’ number-crunching power.

One of QCOL’s main goals is to evidence that quantum computers can outperform classical computers in solving sophisticated optimization problems—that is, to show that there is quantum supremacy, says Zuluaga.

As an example, Zuluaga points to the quadratic assignment problem, which aims to allocate a set of facilities to a set of locations, while minimizing costs associated with distance, commodity flow, and other factors. “This type of problem, which cannot be solved with current classical computing resources, arises, for instance, when designing the placement of interconnected electronic components onto a printed circuit board or on a microchip.”

The field has already produced major theoretical advances in the solution of unstructured search problems, such as the factorization of large numbers (the backbone behind cryptography and security keys technology), says Terlaky, but that’s only scratching the surface of its potential to supercharge optimization.

Starting at square one

The ability to solve such complex optimization problems could drive progress, not just in the next generation of electronics but

also in drug development, data encryption, and a myriad of other areas of profound social impact.

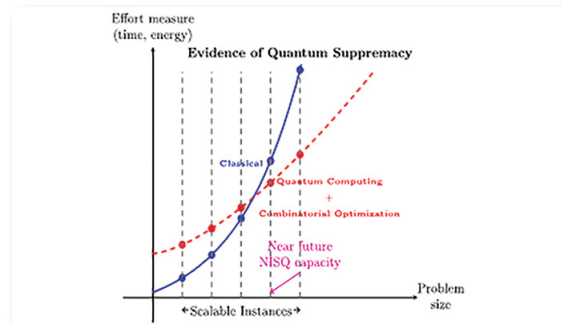
That potential is a big draw for graduate students, who, Terlaky says, are among the very few pioneering researchers coming from ISE, operations research, and algorithmics areas to explore the emerging power of quantum computing in solving difficult optimization problems.

“Young researchers are curious and open-minded,” he says. “To work on something that is completely new, a lot of time and effort must be invested. At the same time, they realize that being among the first in the world to work in this area will bring strategic advantages for their careers.”

PhD student **Brandon R. Augustino** agrees: “It’s not very often that one is able to get in on the ground floor of such an exciting and likely impactful line of research, so I jumped at the opportunity.”

Joining the quantum community

To strengthen its footing in the field, Lehigh recently became a member of the **IBM Quantum Hub** at NC State University. The partnership primarily gives Lehigh researchers access to cutting-edge quantum computing systems for testing algorithms, conducting experiments, and engaging in industrial collaborations.



Lehigh is also among the founding academic members of the **Quantum Economic Development Consortium**, a federal initiative to stimulate economic developments that are made possible by the emergence of quantum computing. QED-C also includes established companies and startups, as well as other research and academic institutions.

“We participate in workforce development activities, discussing educational programs and learning about industry case studies,” Terlaky says. “The QED-C membership showcases Lehigh as a major player in the rapidly developing area of quantum computing, and at the same time, it provides QCOL access to invaluable information about hardware and software developments, industry pilot projects, and potential internship opportunities for our students.”

And while the number of QC-related jobs is growing exponentially, he adds, the supply of highly skilled quantum optimization researchers remains limited.

“By graduation, our students will be uniquely positioned to choose an excellent job in the area of their choice.”

Lehigh ISE celebrates diversity by sharing cultural traditions

The ISE Department is a community of people from diverse cultures and traditions. In Fall 2021, we started a program of celebrating holidays from around the globe. Our goal was to provide a sense of home for many of those who come to the ISE Office by decorating it with elements of different cultures around the day of their main holidays.

During 2022/2023, we celebrated Diwali, Hanukkah, Christmas, Chinese New Year, Nowruz (Persian New Year), and Ramadan

Eid. We aim at being inclusive and celebrating more holidays if more students, staff, and faculty reach out to us.

We are grateful to the ISE PhD and master's students who volunteered their time to help us decorate the ISE Office.

Please enjoy our holiday displays for Diwali, Hanukkah, Christmas, Chinese New Year, Nowruz (Persian New Year), and Ramadan Eid.



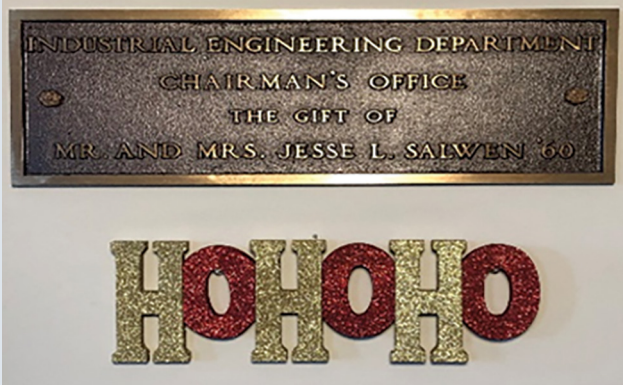
**Diwali, Indian Festival of Lights,
November 4, 2021**



**Hanukkah, Hebrew Festival of Lights,
November 28 – December 6, 2021**



ISE PROGRAMS



Christmas, December 25, 2021



Chinese New Year, February 1, 2022



Norwiz, Persian New Year, March 20, 2022



Ramadan Eid, Feast of Breaking the Fast, May 1-2, 2022



ICCOPT 2022 gathered 600 participants from 30 countries on Lehigh campus

Lehigh University proudly hosted the 7th “International Conference on Continuous Optimization” (**ICCOPT 2022**) of the Mathematical Optimization Society from July 23 through July 28, 2022. The conference was co-chaired by Lehigh ISE faculty members Daniel P. Robinson and Frank E. Curtis and, amongst various other sponsors, it received generous financial and administrative support from Lehigh ISE. This summer, the traditional yearly Lehigh ISE “Modeling and Optimization: Theory and Applications” (MOPTA) conference coincided with ICCOPT 2022.

ICCOPT 2022 welcomed approximately 600 participants from around 30 countries. For many, it was the first large completely in-person conference that they attended since the start of the world-wide COVID-19 pandemic. The conference consisted of a summer school for graduate students, plenary and semi-plenary talks from leaders in the field, almost 200 parallel sessions, a Best Paper session and prize, a Best Poster session and prize, and the 14th AIMMS-MOPTA Optimization Modeling Competition. In addition to the fantastic scientific contributions to the conference, participants had the opportunity to explore Bethlehem’s rich history and contemporary culture, as well as Lehigh University’s picturesque campus.

The event was one of the largest, if not the largest academic event ever held on Lehigh’s campus. Lehigh ISE is proud to have hosted such a visible and highly successful event that undoubtedly left participants with lasting memories and a wonderful impression of all that Lehigh has to offer.

SPENCER C. SCHANTZ

lecture series



MICHAEL PINEDO

Michael Pinedo gave a Spencer C. Schantz Distinguished Lecture in May 2022

The Lehigh ISE Department welcomed Professor **Michael Pinedo**, Julius Schlesinger Professor of Operations Management Technology, Operations, and Statistics (TOPS) Department Stern School of Business, New York University as the Spencer C. Schantz Distinguished Speaker on Wednesday, May 4, 2022, to give a **Spencer C. Schantz Distinguished Lecture (Technical Talk)**. Professor Pinedo's talk was titled **Scheduling Applications in Industry - Steelmaking and Microelectronics**, and was held on May 4, 2022 from 4:30 p.m. to 5:30 p.m. in Mohler Laboratory room 453, 200 West Packer Avenue, Bethlehem, PA. A luncheon was served at Lehigh's University Center in the Asa Packer Dining Room from 12:00 p.m. to 14:00 p.m. for faculty and students. To learn more about Professor Pinedo and his talk, please read his abstract and bio below.

Abstract: Efficient scheduling of industrial systems typically have a major impact on their productivity levels. In this presentation we focus on some scheduling applications in two different industries, both being of importance, namely steelmaking and microelectronics.

In steel production the steelmaking-continuous casting (SCC) process is typically a bottleneck. Its scheduling has become more challenging over the years. We first describe the modeling of the essential features of an SCC process, such as unrelated parallel machine environments, stage skipping, and maximum waiting time limits in between successive stages. The objective is the minimization of the total weighted waiting time, total earliness, and total tardiness. The problem can be formulated as a mixed integer program and we present an iterated greedy matheuristic that solves its subproblems to find a near-optimal solution. Through numerical experiments, we show the effectiveness of such an algorithm.

The microelectronics industry is conceptually very different from the steel making industry. The manufacturing processes in a wafer fab can be modeled as flow shops with re-entry, which are special cases of job shops with recirculation. The

re-entries of the orders make the associated scheduling problems conceptually very difficult. We discuss the properties of the optimal schedules for various different objective functions.

We conclude this presentation with some other scheduling applications in industry that deserve research attention.

Bio: Michael Pinedo is the Julius Schlesinger Professor of Operations Management at New York University's Stern School of Business. He received an Ir. degree in Mechanical Engineering from Delft University of Technology (in the Netherlands) in 1973 and a Ph.D. in Operations Research from the University of California at Berkeley in 1978. He has taught at Columbia University from 1982 till 1997 and at New York University since 1997. His research focuses on the modeling of service systems, and in the development of planning and scheduling systems, as well as systems for measuring operational risk. Over the last decade his research has focused on operational risk in financial services. He is co-editor of *Creating Value in Financial Services: Strategies, Operations, and Technologies* (Kluwer), and co-editor of *Global Asset Management: Strategies, Risks, Processes, and Technologies* (Palgrave/McMillan). He has co-authored the book *Operations in Financial Services - Processes, Technologies, and Risks* (NOW Publishers) together with Yuqian Xu. Professor Pinedo has been actively involved in industrial system development. He supervised the development of systems at Goldman Sachs, Siemens, and at Merck. Professor Pinedo is Editor of the *Journal of Scheduling* (Springer), Associate Editor of the *Journal of Operational Risk*, Department Editor of *Production and Operations Management* and Associate Editor of *Annals of Operations Research*.

Spencer C. Schantz Distinguished Lecture Series: This lecture series is endowed in the name of the late Spencer C. Schantz, who graduated from Lehigh in 1955 with a B.S. in Industrial Engineering. Following progressive responsibilities with several electrical manufacturing companies, in 1969 he founded U.S. Controls Corporation and became its first CEO and President. **The Spencer C. Schantz Distinguished Lecture Series** was established by his wife Jerelyn as a valuable educational experience for faculty, students, and friends of Lehigh's Industrial and Systems Engineering department.



STEPHEN J. WRIGHT

Stephen J. Wright gave a Spencer C. Schantz Distinguished Lecture in July 2022

The Lehigh ISE Department was pleased to welcome Professor **Stephen J. Wright**, the George B. Dantzig, the Sheldon Lubar, and the Amar and Balinder Sohi Professor of Computer Sciences at the University of Wisconsin-Madison, to Lehigh University to give the **Spencer C. Schantz Distinguished Lecture (Technical Talk)**. Professor Wright's talk was titled **Primal-Dual Optimization Methods for Robust Machine Learning and Generalized Linear Programming** and was held on July 28, 2022, in Perella Auditorium at the Rauch Business Center from 5:00 p.m. to 6:00 p.m. To learn more about Professor Wright and his talk, please read his abstract and bio below.

Abstract: We consider a convex-concave primal-dual optimization framework in which the coupling between primal and dual variables is bilinear. This framework admits linearly constrained optimization together with a variety of interesting problems in machine learning, including (linear) empirical risk minimization with various regularization terms. It also includes a formulation that we term “generalized linear programming” (GLP) in which regularization terms and constraints are added to the traditional linear programming formulation, provided they admit efficient prox operations. Problems from differentially robust optimization (DRO), using either f -divergence metrics or Wasserstein metrics, can be formulated as GLPs.

We describe algorithms for our framework that take prox-gradient steps alternately in the primal and dual variables, but incorporate such additional features as coordinate descent, variance reduction, dual averaging, importance sampling, and iterate averaging. Our methods can also exploit sparsity in the matrix that couples primal and dual variables. Our methods match or improve on the best-known worst-case complexity bounds in various settings. Computational experiments indicate that our methods also have good practical performance.

The talk represents joint work with Ahmet Alacaoglu, Jelena Diakonikolas, Chaobing Song, Eric Lin, and Volkan Cevher.

Bio: Stephen J. Wright holds the George B. Dantzig Professorship, the Sheldon Lubar Chair, and the Amar and Balinder Sohi Professorship of Computer Sciences at the University of Wisconsin-Madison. His research is in computational optimization and its applications to data science and many other areas of science and engineering. Prior to joining UW-Madison in 2001, Wright held positions at North Carolina State University (1986-1990) and Argonne National Laboratory (1990-2001). He has served as Chair of the Mathematical Optimization Society (2007-2010) and as a Trustee of SIAM for the maximum three terms (2005-2014). He is a Fellow of SIAM. In 2014, he won the W.R.G. Baker Award from IEEE for best paper in an IEEE archival publication during 2009-2011. He was awarded the Khachiyan Prize by the INFORMS Optimization Society in 2020 for lifetime achievements in optimization and received the NeurIPS Test of Time Award in 2020 for a paper presented at that conference in 2011. Prof. Wright is the author / coauthor of widely used text and reference books in optimization including “Primal Dual Interior-Point Methods” and “Numerical Optimization” and, most recently, “Optimization for Data Analysis.” He has published widely on optimization theory, algorithms, software, and applications. Prof. Wright served from 2014-2019 as Editor-in-Chief of the SIAM Journal on Optimization and previously served as Editor-in-Chief of Mathematical Programming Series B. He has also served as Associate Editor of Mathematical Programming Series A, SIAM Review, SIAM Journal on Scientific Computing, and several other journals and book series.

Spencer C. Schantz Distinguished Lecture Series: This lecture series is endowed in the name of the late Spencer C. Schantz, who graduated from Lehigh in 1955 with a B.S. in Industrial Engineering. Following progressive responsibilities with several electrical manufacturing companies, in 1969 he founded U.S. Controls Corporation and became its first CEO and President. **The Spencer C. Schantz Distinguished Lecture Series** was established by his wife Jerelyn as a valuable educational experience for faculty, students, and friends of Lehigh's Industrial and Systems Engineering department.

**TAIS O'DWYER**

Lehigh ISE announced Tais O'Dwyer '00 as recipient of the 2022 Distinguished Alumni Award for Excellence in Industry

Lehigh ISE was pleased to announce **Tais O'Dwyer**, Head of Financial Services Business Strategy at Microsoft, as the recipient of the 2022 **ISE Distinguished Alumni Award**. This annual award acknowledges the importance of our fabulous alumni community, and its many contributions to our educational mission and industry engagement over the years. Tais has had an impressive career in management consulting, financial services, and technology, in various leadership positions at Morgan Stanley, Bank of America, CIT Group, and Google.



MARK MOTSKO

Lehigh ISE IT Client Support Specialist Mark Motsko won the 2022 Rossin Citizenship Staff Award

Lehigh ISE IT client support specialist **Mark Motsko** was the recipient of the 2022 P.C. Rossin College of Engineering and Applied Science **Citizenship Staff Award**. This award recognizes an exceptional Rossin college staff member who goes above and beyond the call of duty in their daily work and activities, serving as an example of dedication, support, and excellence in upholding the college's mission and supporting its various initiatives. This is ISE's second Rossin staff award in three years.



TAMÁS TERLAKY

Lehigh ISE Professor Tamás Terlaky won the 2022 Rossin Outstanding Doctoral Student Advising Award

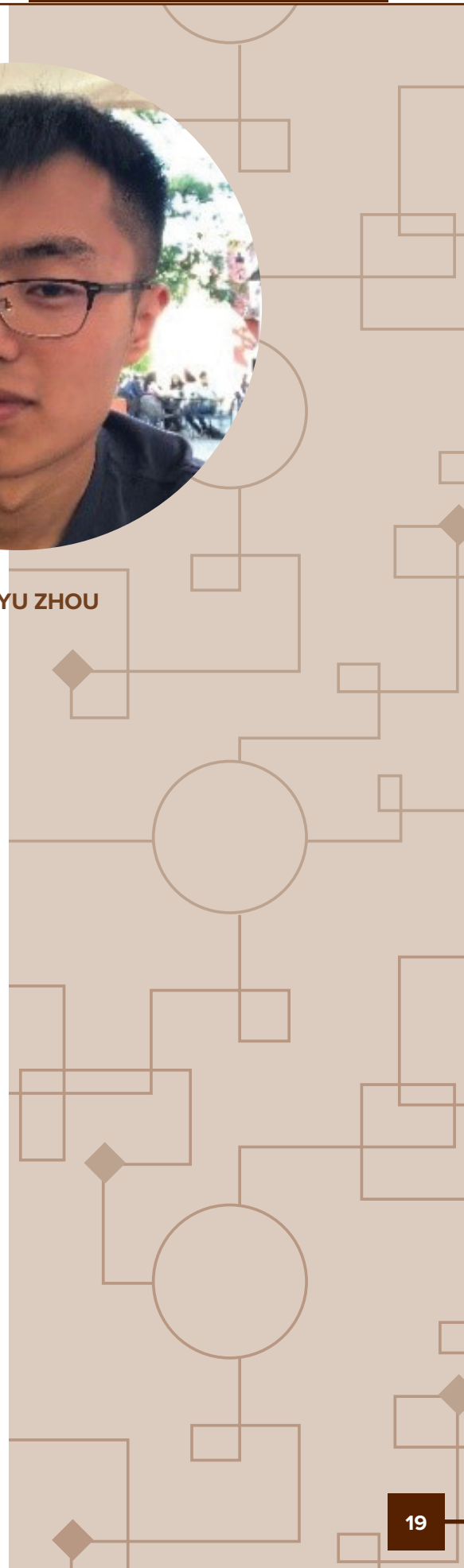
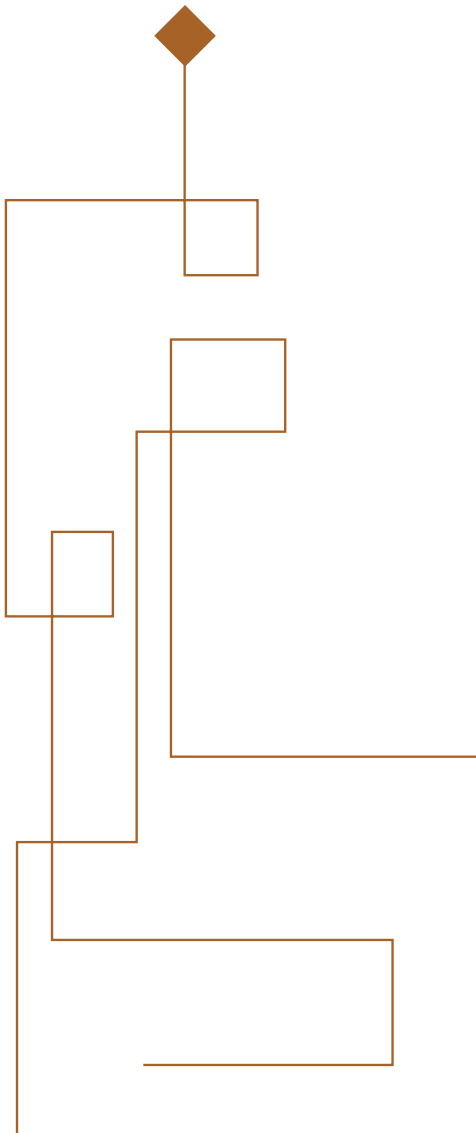
Lehigh ISE George N. and Soteria Kledaras '87 Endowed Chair Professor Tamás Terlaky was the recipient of the 2022 P.C. Rossin College of Engineering and Applied Science Outstanding Doctoral Student Advising Award. This award recognizes a Rossin college faculty member who has a strong commitment to the doctoral education and provides excellent support and mentorship to doctoral students they work with. This is our fifth Rossin faculty award in four years.

Lehigh ISE PhD Student won the 2022 Rossin Stout Dissertation

Lehigh ISE Ph.D. student **Baoyu Zhou** has won the 2022 P.C. Rossin College of Engineering and Applied Science **Elizabeth V. Stout Dissertation Award**. The title of Baoyu's thesis was "Methods for Large Scale Nonlinear Optimization and Equality Constrained Stochastic Optimization", developed under the supervision of Professor **Frank E. Curtis**. This is ISE's second Stout award in four years.



BAOYU ZHOU



2022

Lawrence E. White Fellowship



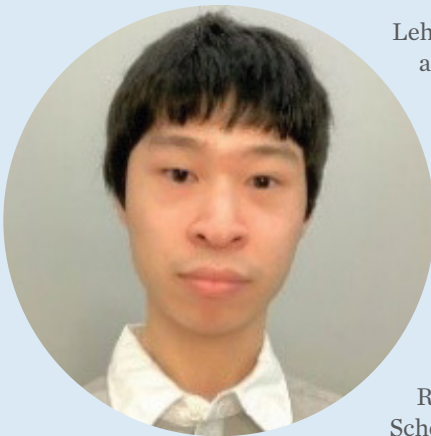
Lehigh's ISE was proud to announce **Matthew Harrison** as the recipient of the 2022 Lawrence E. White Fellowship for Master's in Management Science and Engineering. This fellowship is made available through the generosity Lehigh and department alumnus Lawrence E. White ('64, '65, '69) for a full tuition towards

30 credits of master's degree study. Matthew Harrison graduated

from Lehigh University with a Bachelor of Science in Chemical Engineering in 2015. After graduation, he went to work in the beverage distribution and software industries in sales and logistics. The Selection Committee was formed by Professors Robert E. Storer, Tamás Terlaky, and Luis Nunes Vicente (chair).

2022

Van Hoesen Family Best Publication Award



Lehigh's ISE was pleased to announce **Man Yiu (Tim) Tsang** as the recipient of the sixth annual **Van Hoesen Family Best Publication Award**. Tim received a plaque and a \$1,000 monetary prize for his paper "Stochastic Optimization Models for a Home Service Routing and Appointment Scheduling Problem with Random Travel and Service Times", co-authored with his adviser

Professor **Karmel S. Shehadeh**. This award inspires students to publish influential research, software tools, and applications, and was made available through a generous gift from Everett Van Hoesen '55. The Selection Committee was formed by Professors Akwum Onwunta, Frank E. Curtis (chair), and Daniel P. Robinson.

ISE ALUMNI, FACULTY AND STUDENT AWARDS OF THE YEAR 2022

- Industrial and Systems Engineering Distinguished Alumni Award: **Tais O'Dwyer**
- Industrial and Systems Engineering Sophomore of the Year: **Brooke Canon**
- Integrated Business and Engineering Sophomore of the Year: **Owen Brown**
- Industrial and Systems Engineering Junior of the Year: **Josie Charles and Morgan Heller**
- Integrated Business and Engineering Junior of the Year: **Tobey Bill and Matthew Calvin**
- Industrial and Systems Engineering Senior of the Year: **Sophie Champ**
- Integrated Business and Engineering Senior of the Year: **Joseph Min**
- Industrial and Systems Engineering Master's Student of the Year: **Jorgo Damtew Tesfa**
- Management Science and Engineering Master's Student of the Year: **Jorge Hernandez**
- Health Systems Engineering Master's Student of the Year: **Swati Lakshmi Palghat**
- Financial Engineering Master's Student of the Year: **Jack Dean**
- ISE Ph.D. Student of the Year: **Mohammadhossein Mohammadisiahroudi**
- Undergraduate Faculty Member of the Year: Professor **Gregory Tonkay**
- Master's Faculty Member of the Year: Professor **Ana I. Alexandrescu**
- Ph.D. Faculty Member of the Year: Professor **Frank E. Curtis**

student news



MINHAN LI
Congratulations to **Minhan Li** for successfully defending his PhD Thesis, Topics on Data Science and Optimization on December 2, 2021. Minhan's advisor was Professor Frank E. Curtis. Minhan is employed at Facebook/ Meta as a Machine Learning Engineer.



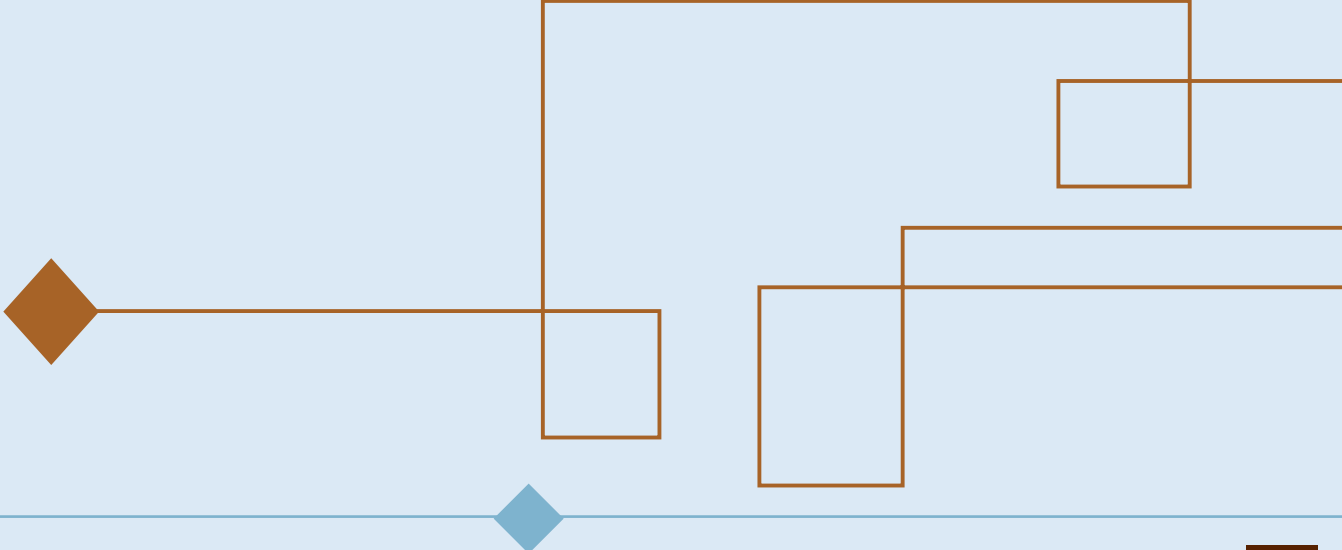
ZHENG SHI
Congratulation to **Zheng Shi** who successfully defended his thesis: Advanced Algorithms and Applications in Machine Learning on April 26, 2022. Zheng's advisor was Professor Martin Takac. During his doctoral study, Zheng worked at IBM as a technical lead in data science, and since 2020, Zheng has been a data science team lead at IBM.



SUYUN LIU
Congratulations to **Suyun Liu**, who successfully defended her thesis: Stochastic Multi-Objective Optimization and Its Application to Fairness in ML, on April 19, 2022. Suyun's advisor was Professor Luis Nunes Vicente. Suyun joined Amazon as an Applied Scientist in July 2022.



BAOYU ZHOU
Congratulations to **Baoyu Zhou** who successfully defended his thesis: Methods for Large Scale Nonlinear Optimization and Equality Constrained Stochastic Optimization, on April 19, 2022. Baoyu's advisor was Professor Frank E. Curtis. Baoyu is employed by the University Of Chicago Booth School Of Business as a Principal Researcher.



DEGREES AWARDED

SPRING 2022

Ph.D. INDUSTRIAL AND SYSTEMS ENGINEERING

- Suyun Liu
- Zheng Shii
- Baoyu Zhou

M.ENG. HEALTHCARE SYSTEMS ENGINEERING

- Anna Katz
- Edward Leggett
- Jennifer Nowak
- Swati Laskshmi Palghat
- Jeffrey Wiswell

M.ENG. INDUSTRIAL AND SYSTEMS ENGINEERING

- Jorgo Damtew Tesfa
- Jing Wang
- Yakun Wang

M.ENG. MANAGEMENT SCIENCE AND ENGINEERING

- Daniel Cunningham
- Yikun Li
- Giavanna Tabbachino

B.S. INTEGRATED BUSINESS AND ENGINEERING HONORS PROGRAM (ISE MAJOR)

- Gabrielle Effendi
- Mary Grabowski
- Ryan Heaton
- Austen Johnson
- Maxwell Kemper
- Amanda Morrison
- Sheina Patel
- Jonathan Schiltz

B.S. INDUSTRIAL AND SYSTEMS ENGINEERING

- Nathaniel Alter
- Justin Cajamarca
- Sophie Champ
- John Fris
- Aiden Gales
- Samuel Geroux
- Emma Grothaus
- Elizabeth Haines
- Jacob Kassis
- Alexandra Largey
- Alexander Lidonnici
- Aidan Liston
- Sage Lucas
- Amanda Morrison
- Samantha Nason
- Zachary Olson
- Ryan Palmer
- Valentine Perevalov
- Pritam Reddy
- Jonathon Schiltz
- Kate Silverman
- Logan Stormont
- Owen Thomas
- Sarah Vaknin
- James Wood

B.S. INTEGRATED BUSINESS AND ENGINEERING HONORS PROGRAM (FINANCIAL ENGINEERING MAJOR)

- Nicholas Evangeline
- Michael Jeney
- Connor Sept
- Sean Stix

DEGREES AWARDED

SUMMER 2022

M.ENG. HEALTHCARE SYSTEMS ENGINEERING

- Abigail Mitchell

B.S. INDUSTRIAL AND SYSTEMS ENGINEERING

- Ryan Morgan

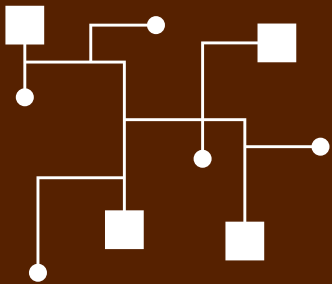
ISE ALUMNI NEWS

ISE alumnus Irwin Young passed away on January 20, 2022, at the age of 94.

Irwin was DuArt Film Laboratories Chairman and premier supporter of New York filmmakers, responsible for much of the history of independent film making. He received prestigious industry awards and in 2000 he won an Oscar for technological contributions to the motion picture industry.

Irwin was a 1950 graduate of Lehigh, with a B.S. in Industrial Engineering. In 2011 he was awarded the Lehigh ISE Distinguished Alumni Award and returned to Lehigh's campus to deliver a Spencer C. Schantz Distinguished Lecture and share highlights of his 60-year filmmaking career success.

Lehigh's ISE is grateful for his contributions to the motion picture industry.



LEHIGH
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