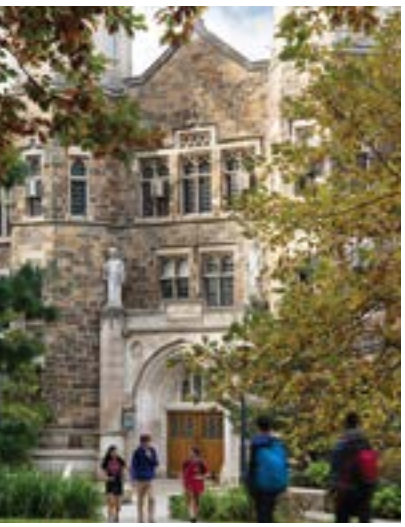
INDUSTRIAL AND SYSTEMS ENGINEERING

NEWSLETTER 2021

ISE in the forefront through expansion in Outreach and Alumni

LEHIGH UNIVERSITY | P.C. Rossin College of Engineering and Applied Science



INSIDE THIS ISSUE

ISE DEPARTMENT NEWSLETTER FALL 2021

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READER FEEDBACK:

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Dear Lehigh ISE Community,

I hope that summer 2021 allowed you some time for leisure and getting together with family and friends that we missed for so long.

The ISE faculty and staff are delighted to be back on Lehigh's beautiful campus at Mohler Lab engaging with our students and preparing them for a successful and meaningful academic year.

The ISE Department is thriving and we have exciting news in personnel and accomplishments.

Professor and Director of Graduate Studies, **Frank E. Curtis** won the prestigious 2021 Lagrange Prize in Continuous Optimization jointly given by the Mathematical Optimization Society (MOS) and the Society for Industrial and Applied Mathematics (SIAM). This prize is awarded for outstanding works in the area of continuous optimization and represents extraordinary achievement.

Professor **Tamás Terlaky, George N.** and **Soteria Kledaras '87** Endowed Chair Professor, was inducted a fellow of the International Federation of Operational Research Societies (IFORS). The IFORS Fellow Program is very selective, and Tamás was among the only six 2021 inductees, the only one from the Americas. This fellow distinction is certainly a major accolade.

Professor **Karmel S. Shehadeh** was elected as a Director of Operations Research Division of the Institute of Industrial and Systems Engineers (IISE) for 2021-23. IISE is one of the main institutes or societies of our field, and Karmel will assist with a number of relevant IISE activities and projects, strengthening IISE and bringing additional visibility and reputation to our Department.

We are happy to announce that we have a new Department and Graduate Coordinator, **Lori D'Nicuola**, who started working for us early July 2021. We thank Jennifer Vargas for her dedication to the ISE Department.

Lori was previously an executive assistant at the Stevens Institute of Technology, and her talent and professional engagement are already making an impact!

Last but not the least, I would like to draw your attention to two new programs that have just been launched, and that will be transformative to our Department and Community in so many regards. You will find articles about them in this number of our Newsletter, but let me just briefly describe them to you in my own humble words.

Lehigh ISE Outreach Program (OutreachISE for short). The most recent world events have shown that communicating science is nowadays as important as doing it. As academicians or researchers, we have a societal obligation to expose our findings and knowledge to the public. OutreachISE is an innovative program that will promote the general awareness of our beautiful field and engage undergraduate students in exciting research. OutreachISE will change the language used to address the various communities of prospective students.

Lehigh ISE Alumni Academy (ISE Academy for short). We have a tremendous resource in our Department, our Alumni, and we ought to make better use of it. The ISE Academy will comprehensively engage our former students in our programs of study, our student mentoring activity, and our industrial cooperation, bringing their innovative vision to our classes.

As one of my predecessors said once, your support, suggestions, and observations are critical for making informed decisions about our Department. You all own a little bit of it and it is your sense of ownership that will drive your contribution.

I wish you a continuation of a pleasant and vibrant Fall. Stay healthy, Luis!

LUIS NUNES VICENTE
ISE Department Chair

ISE FACULTY & STAFF *news*

Lehigh ISE Professor Frank E . Curtis wins a major award of two prestigious societies

FRANK E. CURTIS

Industrial and Systems Engineering Professor **Frank E. Curti**s was awarded the 2021 Lagrange Prize in Continuous Optimization, jointly given by the Mathematical Optimization Society (MOS) and the Society for Industrial and Applied Mathematics (SIAM). The Lagrange Prize in Continuous Optimization is awarded every three years for an outstanding contribution in the area of continuous optimization published in the six calendar years prior to the award year.

The ISE Department congratulates Frank for this formidable achievement. **The Lagrange Prize in Continuous Optimization** is a major award MOS and SIAM, which are irrefutably two of the most prestigious societies of optimization and applied mathematics. It has been awarded since 2009, and among past awardees there are famous mathematicians and optimizers such as Emmanuel J. Candès, Roger Fletcher, Jean-Bernard Lasserre, and Francis Bach.

The selection committee awarded Frank E. Curtis and his co-authors Léon Bottou and Jorge Nocedal for the paper L. Bottou, F. E. Curtis, and J. Nocedal, Optimization methods for large-scale machine learning, SIAM Review, 60 (2018) 223–311. Their work provides a foundational and insightful review of optimization methods for large-scale machine learning, including a new perspective for the simultaneous consideration of noise reduction and ill-conditioning and the foundations and analysis of second-order stochastic optimization methods for machine-learning.

The selection committee for the 2021 award consisted of Sven Leyffer (Chair), Argonne National Laboratory; Xiaojun Chen, The Hong Kong Polytechnic University; Etienne de Klerk, Tilburg University; and Philip Gill, University of California, San Diego. The prize was awarded at the 2021 SIAM Annual Meeting held in a virtual format on July 19-23, 2021.

Frank E. Curtis is an Associate Professor and Director of Graduate Studies in the ISE Department. His research spans theory, algorithm design, and numerical computation in the field of continuous mathematical optimization. Frank is also a recipient of the ICS Prize awarded by the INFORMS Computing Society. His research has been supported by the U.S. Department of Energy (including an Early Career award), National Science Foundation, and Office of Naval Research.

Lehigh ISE Professor Tamás Terlaky inducted fellow of the International Federation of Operational Research Societies (IFORS)

TAMÁS TERLAKY

Tamás Terlaky, George N. and Soteria Kledaras '87 Endowed Chair Professor, Department of Industrial and Systems Engineering of Lehigh University, has been inducted a fellow of **IFORS**, the International Federation of Operational Research Societies. Founded in 1955, IFORS has a long history and is the only global organization in the Operations Research field.

The **IFORS Fellows Award** serves to recognize a distinguished individual's contribution to international operations research and its communities. The program is very selective, and Professor Tamás Terlaky was among the only six 2021 inductees, the only one from the Americas.

Professor Terlaky is a leading optimization expert with four authored books and over 180 scientific papers. He is Founding Editor-in-Chief of the journal Optimization and Engineering, and founder of EUROPT. Currently, **Tamás** is a faculty member of Lehigh's ISE Department that he chaired during 2008-2017. He previously served as Canada Research Chair in Optimization at McMaster University, Founding Director of Canada's first School of Computational Engineering and Science. He received the MITACS Mentorship Award, the Award of Merit of CORS, the Egerváry Award of HORS, the Wagner Prize of INFORMS, and the Outstanding Innovation in Service Science Engineering Award of IISE. He is a Fellow of The Fields Institute, INFORMS, SIAM, and the Canadian Academy of Engineering, and currently serves as Vice President of INFORMS and as Editor in Chief of the Journal of Optimization Theory and Applications.

Terlaky says: *"I am humbled and incredibly honored to be inducted in this distinguished group of IFORS Fellows. Serving our Operations Research communities around the World is a lifetime experience, and I sincerely appreciate the many opportunities the IFORS community provided to me"*

KARMEL S. SHEHADEH

Lehigh ISE Professor Karmel S. Shehadeh elected as a Director of the IISE Operations Research Division

ISE Assistant Professor, **Karmel S. Shehadeh** has been elected as a Director of **Operations Research Division** of the **Institute of Industrial and Systems Engineers** (IISE) for 2021-2023.

IISE is a global organization recognized for advancing, promoting, and uniting the profession of industrial and systems engineers through cutting-edge education, training, research, and development of industrial and systems engineering.

The Operations Research Division applies mathematics and computer programs to solve complex engineering problems. OR members work in a variety of areas such as forecasting, statistical analysis, and simulation.

As a Director of the IISE Operations Research Division, Karmel will assist with the OR division initiatives, support the IISE president and its board members, help to foster diverse and equitable networks that are all inclusive, and work to strengthen the value and impact of ISE professional.

The ISE Department congratulates Karmel on her appointment as a Director of the IISE Operations Research Division.

LUIS NUNES VICENTE

Luis Nunes Vicente was co-recipient of the 2019 Computational Optimization and Applications Best Paper Award

A paper co-authored by **Luis Nunes Vicente**, Timothy J. Wilmott Endowed Chair Professor and Chair of the Department of Industrial and Systems Engineering of Lehigh University, was granted the 2019 **Computational Optimization and Applications** (COAP) Best Paper Award. Each year, the editorial board of COAP selects a paper from the preceding year's publications for the Best Paper Award. Two of the 92 papers published by the journal in 2019 tied for the award. His paper is titled S. Gratton, C. W. Royer, L. N. Vicente, and Z. Zhang, Direct search based on probabilistic feasible descent for bound and linearly constrained problems, Computational Optimization and Applications, 72 (2019) 525-559.

The awarded paper describes a direct-search scheme for solving linearly constrained optimization problems in which the derivatives of the objective are not available for algorithmic use. This derivative-free algorithm relies on randomly generated directions and is analyzed from a probabilistic viewpoint, leading to complexity guarantees for both deterministic and probabilistic versions of the method. These bounds suggest that strategies which incorporate randomness may prove more efficient, which is confirmed by the practical experiments.

The COAP Best Paper Award exists since 2003, and the list of awardees include famous optimizers such as Roger Fletcher and Olvi Mangasarian. The ISE faculty congratulate Professor Nunes Vicente for his excellent contribution to the literature.

Launching the new Lehigh ISE Outreach Program

Lehigh's Industrial and Systems Engineering (ISE) department has launched the **Lehigh ISE Outreach Program** (OutreachISE for short), which aims to improve general awareness of ISE and promote ISE research. We want to expose students and the general public to systems engineering concepts and methodologies and help them develop effective tools for decision making in a variety of industry and society settings. Led by ISE Professor of Practice Ana Alexandrescu, OutreachISE consists of two initiatives: raising awareness about the field and providing opportunities for undergraduate students to do research in ISE.

Throughout the **OutreachISE Awareness Initiative**, we are engaging our students and faculty to create memorable experiences and share academic and professional opportunities in industrial and systems engineering with groups of high-school and college students, as well as to other young professionals looking to enter graduate education. This fall, we are kickstarting a number of initiatives to increase awareness of opportunities in ISE, from webinars about programs of study, to a podcast featuring ISE students, researchers and industry professionals, to experiential learning opportunities in collaboration with local high-schools. We are also planning to expand our collaboration with our university's programs and initiatives that promote diversity and inclusion in our student body, such as CHOICES, which gives middle-school girls an opportunity to learn about engineering. Finally, we have also started a number of experiential learning opportunities for our undergraduate students to practice operations management and develop awareness of professional opportunities in ISE.

The second part of our exciting new program revolves around the **OutreachISE Research Initiative**, which aims to engage undergraduate students in research with ISE faculty and learn about the research process and opportunities in our field. This initiative is ground-breaking in that it involves students across a variety of disciplines working in research teams in different areas. Six different academic disciplines are represented among the 14 students that started this semester, and their projects, led by six different ISE Faculty Leads, span three tracks: Applied ISE, Mathematics & Statistics in ISE, and Software & Computing in ISE. In parallel with their projects and getting hands-on experience with ISE research, we are holding a series of seminars that are engaging the students in learning about and considering an academic and/or research path in our field, and we are tackling topics from the very practical (how do you find and read ISE papers?) to the more abstract (how do you decide if you want to pursue grad school / research in ISE-related areas?).

The faculty and student response to both OutreachISE initiatives has been very enthusiastic and we are off to a very good start! Over the next three years, we expect both initiatives to grow and align themselves with goals and funding priorities set by the National Science Foundation (NSF) through the two flagship programs, Research Experience for Undergraduates (REU) and Broadening Participation in Computing (BPC), respectively. On the research front, we aim to open up these projects to undergraduate students outside Lehigh, while in the awareness area our goal is to continue to grow our visibility and connect with more students and young professionals, empowering them to make better decisions using the power of ISE tools. "This is a great time to be in Lehigh's ISE department, both as a student and as a faculty. There are so many exciting interdisciplinary learning and research opportunities," says Professor Ana Alexandrescu, who leads the OutreachISE Program. "The energy is fantastic!" Ana adds.

For more information and to express interest in what we are doing in terms of outreach, please contact our OutreachISE Coordinator, Lori D'Nicuola, or send us an email at **outreachISE@lehigh.edu**.

Launching the new Lehigh ISE Alumni Academy

Lehigh Industrial and Systems Engineering (ISE) has a fantastic network of alumni. Our alumni are generous, willing to give back, extremely well trained, and highly qualified. Many have become true leaders and mentors in their industry sectors and ISE is most fortunate to have their support!

Lehigh ISE is pleased to announce the launch of the **Lehigh ISE Alumni Academy**. Professors **Derya Pamuku** and **Emory W. Zimmers** are co-directing this dynamic new program, which aims at drawing on the vast experience and knowledge of our talented ISE alumni to increase the engagement between ISE alumni and undergraduate and graduate student education.

We are excited to share the following opportunities for ISE alumni to participate and help future ISE graduates become successful students and future leaders:

1) **Alumni Lectures:** ISE alumni can participate in currently offered courses through giving a lecture and sharing with students and faculty their practical experiences. These lectures are the genesis for further engagement and collaboration.

2) **UG Mentors:** ISE alumni meet with students on a regular basis to advise them about internship opportunities, industry challenges, and the societal and ethical implications of their profession. Alumni may become industry mentors and provide shadow opportunities. All sophomore, junior, and senior students are thus given the opportunity to have an industry advisor.

A significant number of our alumni are highly knowledgeable in their fields and many have been engaging in professional training for decades. Many of our alumni are willing to engage in a college teaching opportunity either on campus or on online. Online teaching provides an opportunity for alumni to participate, regardless of their geographic location. Alumni who are interested in lecturing content that is not currently being offered as a course may have a chance to promote a new course in emerging topics.

For more information or to express interest in contributing or joining the ISE Academy, please contact our ISE Academy Coordinator: Sheila Dorney (**skd220@lehigh.edu**).

research grants


ROBERT H. STORER


LAWRENCE V. SNYDER

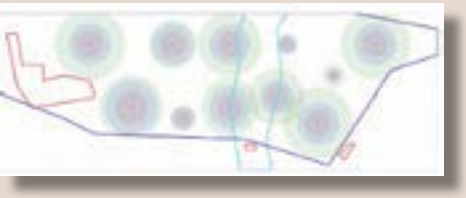

LUIS F. ZULUAGA


BOB SPEAR


YIHE ZHUO

Optimization Algorithms for Layout of Ammunition Support Activities

A Lehigh team is working on a 3-year grant from the US Army to build optimization algorithms for automating the design of layouts for ammunition support activities. The research team consists of Professors **Bob Storer**, **Larry Snyder**, and **Luis Zuluaga** from ISE, **Mike Spear** from CSE, and PhD student Ruby Zhuo.



The main focus of the research is the design of field-based ammunition supply points (ASPs) and ammunition transfer points (ATPs). There is an obvious need for expediency in the design and construction of these facilities in field operations. The current process of laying out theater field storage facilities is a manual, time consuming, and labor-intensive process that relies extensively on the experience of ammunition Chief Warrant (CW) Officers. Aided by mapping and graphical software, the designer can plan the ASP design by locating the various facilities on a map, observing the flaws in the design, and then reconfiguring the design in a "manual" trial and error procedure. This process is time consuming, and offers little guarantee of the ultimate quality and effectiveness of the design. In short, it presents an ideal opportunity for automated optimization algorithms.

The main issue in designing ASPs is the need to separate, at a safe distance, multiple explosive storage units from each other and from roads, buildings and other vulnerable sites. Quantity Distance (QD) rules, established by the Department of Defense, are a set of guidelines that determine the required distance between an explosives storage facility and another exposed facility. These distances are dependent on the hazard class division (HCD) and the quantity of net explosive weight (NEW) being stored at a storage unit. Different distance requirements exist depending on the nature of the sites. For example, there are different requirements for distances from public roads, inhabited building, and other explosive storage sites.

In the approach taken by the team, one assumes that each of the individual facilities/elements of the ASP that need to be located (both storage units and other exposed sites) are known, including the contents of each storage unit. Given this information, the minimum distance requirements can be calculated, and each facility will be located so as not to violate minimum distance requirements and optimize the area used or an appropriate measure of risk.

TED RALPHS

Partnership with University of Pittsburgh yields grant from the Office of Naval Research

ISE faculty member **Ted Ralphs**, in partnership with Oleg Prokopyev at University of Pittsburgh, has won a three-year, half million dollar grant from the Office of Naval Research to study how to more realistically model and solve certain game-theoretic optimization problems. The idea behind the project is to relax the stringent assumptions underlying classical models of human behavior in game theory, which consider all players to be completely rational. Although "rationality" sounds like a reasonable assumption, the technical meaning of "rationality" goes beyond the conversational interpretation, e.g., "rational thinking," which is usually taken informally to mean thinking that is clear-headed and logical. In the technical interpretation, rationality requires that all decision-makers are equipped to determine a precise optimum to any optimization problem they face. In the real world, however, the sheer complexity of the problems faced by a decision-maker may make it impossible to behave rationally, in this technical sense.

This may not seem crucial, but when this important assumption does not hold, sophisticated algorithms for analyzing classical game-theoretic models may no longer produce good results. Even in the case of a simple leader-follower game in which the leader makes an initial decision and the follower reacts, the leader's optimal strategy under the assumption that the follower is acting rationally can be very different from the optimal strategy if the follower is instead using a sub-optimal heuristic. The result is that even if the leader is using technically superior algorithmic technology, the false assumption of rationality may lead to the generation of strategies by the leader that are far from optimal.

In this project, Ralphs and his co-PI at University of Pittsburgh are studying how to incorporate various notions of "bounded rationality" that are more appropriate for modeling real-world behavior into efficient algorithms. So-called "interdiction problems," naturally arising in defense applications, provide a classic example of a leader-follower game in which the leader attempts to disrupt the activities of the follower. In this case, the follower, is, e.g., a smuggler and the leader is a law enforcement agency that must choose which potential smuggling routes to surveil in order to minimize the activity of the smugglers. Counterintuitively, relaxing the standard assumption of rationality may actually make the leader's problem harder, in a sense, since the behavior of an irrational follower may be more difficult to predict. Thus, one avenue of investigation is how to produce solutions that are more robust against unpredictable behavior by the follower.

Lehigh ISE hosted MOPTA 2021 in new IPVS Format

ISE hosted its' annual **Modeling and Optimization: Theory and Applications (MOPTA)** conference on August 2 -4, 2021 at Lehigh University's Mohler Laboratory, Department of Industrial and Systems Engineering. The MOPTA conference brings together a distinctive group of people from operations research, working on both theoretical and applied aspects, and provides a forum for researchers to interact in the framework of a medium-scale event. This year's Chair of the Organizing Committee was University of Michigan Professor and former ISE Postdoctoral Research Fellow, **Albert S. Berahas**. Lehigh University Endowed Professor **Tamás Terlaky** was co-chair.

This year we were excited to announce an innovative hybrid format that accommodated the wishes of participants and speakers who wanted to attend remotely, while still offering the in-person experience for those who preferred to participate in-person.

Participants were able to select between two attendance modes: Virtual (VIRT) and In-Person Virtual Sharing (IPVS). IPVS participants were able to attend talks together in rooms equipped with large screens and room sound systems. Questions were asked via personal laptops and/or cell phones in the Zoom chat.

IPVS allowed all speakers to present remotely. In-person speakers were assigned a room to deliver their talk remotely using their laptops, and then had the opportunity to interact with in-person participants after their virtual talk.

The success of the three-day conference was accredited to the robust lineup of invited talks from distinguished speakers and selected contributed talks. The ISE Department was honored to have 8 plenary speakers (Hamsa Balakrishnan, Amy Cohn, Simge Küçükyavuz, Jeffrey T. Linderoth, Michael Mahoney, Catherine McGeoch, Anna Nagurney, and Distinguished Spencer C. Schantz speaker Yurii Nesterov), 29 contributed sessions, and 87 talks.

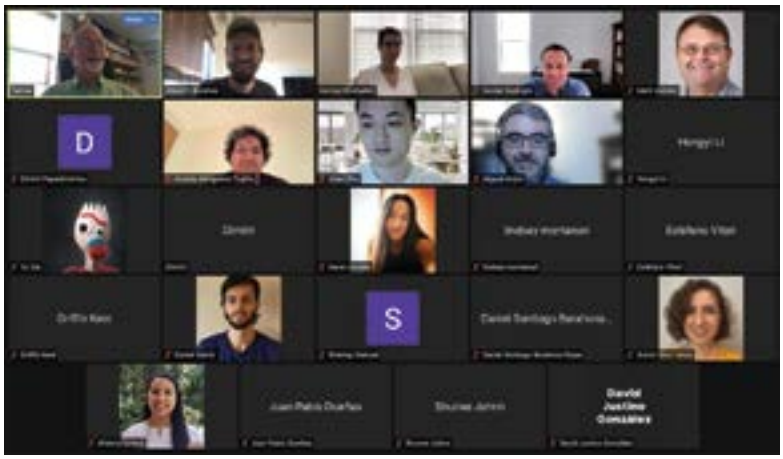
The 13th AIMMS MOPTA Optimization Modeling Competition was a result of cooperation between AIMMS and the organizers of the MOPTA Conference. 14 teams from around the world registered for the competition. The three finalist teams participated and solved a challenging home service assignment routing, and appointment scheduling (H-SARA) problem under uncertainty. The teams had to form a mathematical model of the problem, implement it in AIMMS, solve it, create a graphical user interface and write a 15-page report on the project. ISE Professor, Karmel S. Shehadeh, was MOPTA Competition Chair.

The AIMMS MOPTA competition panel of judges included Mohan Chiriki (AIMMS), Professor **Albert S. Berahas** (University of Michigan) and Lehigh Professors **Ana I. Alexandrescu**, **Karmel S. Shehadeh** and **Luis F. Zuluaga**. The judges were most excited to announce first prize was awarded to **Team SolvED** from the University of Edinburgh. (Shunee Johnn, Andrès Miniguano-Trujillo, Yiran Zhu, and advisor Ashkay Gupte). First place winners received a monetary prize of $1,200, a team trophy and certificates.

Second place was awarded to **The Optimistics** from Universidad de los Andes, Columbia. (Daniel Yamin, Daniel Barahoma, and advisor Alfaima Solano). Second place winners received a monetary prize of $600, a team trophy and certificates.

Third place was awarded to Flamerunners from Brown University, (Enrique Areyan Viqueira, Shamay Samuel and advisor Serdar Kadioglu). Third place winners received a monetary prize of $300, a team trophy and certificates.

A student social for in-person PhD students and Postdocs was held the first evening of the conference. Informs Vice-President Ramin Fakhimi hosted the event at Packer House.



SPENCER C. SCHANTS
lecture series

Yuri Nesterov gave a Spencer C. Schantz Technical Talk at MOPTA 2021

YURI NESTEROV

The ISE Department was honored to have Professor **Yurii Nesterov**, University of Louvain give a Spencer C. Schantz Technical Talk via Zoom during the MOPTA 2021 Conference on Monday, August 2, 2021.

The title of Professor Nesterov's talk was Inexact High-Order Proximal Point *Methods with Auxiliary Search Procedure.*

In this paper, we present the further development of Bi-Level Unconstrained Minimization by a new pth-order proximal-point method with the convergence rate O(1=k(1+3p)=2), where k is the iteration counter. In this method, we replace the auxiliary line-search procedure by a segment search. This allows bounding its complexity by a logarithm of the desired accuracy. Each step in this search needs an approximate computation of a high-order proximal-point operator. Under assumption on the boundedness of the (p+1)th derivative of the objective function, this can be done by one step of the pth order augmented tensor method. In this way, for p = 2, we get a new second-order method with the rate of convergence O(1=k7=2) and logarithmic complexity of the auxiliary search at each iteration. Another possibility is to compute the proximal-point operator by a lower-order minimization method. As an example, for p = 3, we consider the upper-level process convergent as O(1=k5). Assuming boundedness of the fourth derivative, an appropriate approximation of the proximal-point operator can be computed by a second-order method in a logarithmic number of iterations. This combination gives a second-order scheme with much better complexity than the existing theoretical limits.

Bio: Born: 1956, Moscow. Master degree 1977, Moscow State University. Doctor degree 1984. Professor at Center for Operations Research and Econometrics, UC Louvain, Belgium. Author of 5 monographs and more than 120 refereed papers in the leading optimization journals. International recognition: Dantzig Prize 2000, John von Neumann Theory Prize 2009, Charles Broyden prize 2010, Francqui Chair (Liege University 2011-2012), SIAM Outstanding paper award (2014), EURO Gold Medal 2016. Main research direction is the development of efficient numerical methods for convex and nonconvex optimization problems supported by the global complexity analysis: general interior-point methods (theory of self-concordant functions), fast gradient methods (smoothing technique), global complexity analysis of second-order and tensor schemes (cubic regularization of the Newton's method), accelerated proximal-point methods.

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.

Lehigh ISE welcomed Jorge Nocedal to give the first in-person Spencer C. Schantz Technical Talk of 2021

JORGE NOCEDAL

On Tuesday, September 14, 2021 ISE was honored to have Professor **Jorge Nocedal**, Walter P. Murphy Professor of Industrial Engineering and Management Sciences, Northwestern University give the Spencer C. Schantz Technical Talk. A cocktail reception and dinner was held in honor of Professor Nocedal's visit for students and faculty at the University Center Asa Packer Dining Room.

The title of Professor Nocedal's talk was *Constrained Optimization in the Presence of Noise*.

Modern nonlinear optimization methods have seen great success in a wide range of application areas. However, little is known about their behavior when function and constraint evaluations contain errors (or noise). This talk outlines a research agenda to redesign classical methods (and their software implementation) so that they are efficient and accurate in the presence of errors. The guiding principle is provided by some fundamental theoretical results that are presented for a classical method based on sequential quadratic programming. One of the main applications of this work lies in the area of derivative-free optimization.

Bio: Jorge Nocedal was born in Mexico City where he obtained a B.S. degree in physics from the Universidad Nacional Autónoma de Mexico (UNAM). Currently, he is the Walter P. Murphy Professor in the Department of Industrial Engineering and Management Sciences at Northwestern University. His research is in optimization, both deterministic and stochastic, and with emphasis on very large-scale problems. Over the years, he has developed open source and commercial optimization software that is widely used in industry. He is a SIAM Fellow, was awarded the 2012 George B. Dantzig Prize, and the 2017 Von Neumann Theory Prize for contributions to theory and algorithms of nonlinear optimization. He is keenly interested in undergraduate education, and was one of the creators of the Engineering First curriculum at Northwestern. His book, Numerical Optimization, co-authored with Stephen Wright, has become a standard reference in the field.

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2020–2021 ISE Seminar Series

The ISE Department hosted an impressive lineup of seminars and enjoyed hearing from some of the world's top research experts

FAll 2020

DECEMBER 1, 2020
Ilya Safro, University of Delaware
"Multiscale Methods in action: From Machine Learning and Graphs to Realistic Future for Quantum Computing"

NOVEMBER 17, 2020
Raghu Bollapragada, University of Austin (UT)
"Adaptive Sampling Methods for Derivative-Free Stochastic Optimization"

OCTOBER 27, 2020
Kim-Chuan Toh, National University of Singapore (NUS)
"Exploiting Second Order Sparsity in Big Data Optimization"

OCTOBER 13, 2020
Coralia Cartis, Oxford University
"Dimensionality Reduction Techniques for Large-Scale Optimization Problems"

OCTOBER 6, 2020
Miles Lubin, Google NYC
"Placement, Provisioning, Packaging"

SEPTEMBER 29, 2020
Juan C. Vera, Tilburg University
"The Simplex Way to Obtain Non-Negative Certificates Over Compact Semialgebraic Sets"

SEPTEMBER 8, 2020
Jeff Zhang, Carnegie Mellon University
"On Local Minima in Polynomial Optimization"

Spring 2021

APRIL 27, 2021
Dr. Swati Gupta, Stewart School of Industrial & Systems Engineering, Georgia Tech
"Bridging Classical and Quantum Computing with Warm-starts and Coupling Graphs"

APRIL 20, 2021
Andrés Medaglia, Department of Industrial Engineering, Universidad de los Andes, Columbia
"Exact Bidirectional (pulse) Algorithm for Constrained Shortest Path Extensions"

APRIL 19, 2021
Akwum Onwunta, Center for Mathematics and Artificial Intelligence, George Mason University
"Optimization Under Uncertainty: Current Approaches and Beyond"

APRIL 12, 2021
Wesley Marrero Colón, Harvard Medical School
"Flexible Treatment Plans and Genetic Testing Strategies for the Management of Cardiovascular Diseases"

APRIL 8, 2021
Anirudh Subramanyam, Argonne National Laboratory
"Mitigating Extreme Failures in Complex Infrastructure Systems"

APRIL 6, 2021
John F. Raffensperger, RAND Corp., Santa Monica, CA USA
"A price on warming with a supply chain directed market"

MARCH 30, 2021
Siqian Shen, Department of Industrial and Operations Engineering, University of Michigan
"Facilty Location Involving Competition or Decision-dependent Uncertainty: New Models, Solution Approaches and Insights"

MARCH 23, 2021
Meisam Razaviyayn, University of Southern California
"Non-convex min-max optimization: challenges and recent advancements"

MARCH 9, 2021
Guanghui (George) Lan, Georgia Institute of Technology
"Advancing Stochastic Optimization for Reinforcement Learning"

FEBRUARY 23, 2021
Andrea Qualizza, Amazon
"Transportation and Fulfillment Optimization at Amazon"

FEBRUARY 9, 2021
Samantha Keppler, University of Michigan Stephen M. Ross School of Business
"On the Use of Operations Management in Public Education Systems"

ISE ALUMNI AWARDS

Lehigh ISE announces Philip Sheibly ‘81 as recipient of the 2021 Distinguished Alumni Award for Excellence in Industry

The Industrial and Systems Engineering Department keeps a strong connection with their alumni and they have been contributing tremendously to our success, in the most various ways, through their own accomplishments and contacts, through their knowledge of the industry needs and trends, and also through their unconditional advice and generous support. One of the means we have to recognize the importance of our alumni community is by presenting the ISE Distinguished Alumni Award of the Year.

The ISE Department is delighted to announce **Philip Sheibley** ‘81 as the recipient of the 2021 ISE Distinguished Alumni Award.

Phil currently serves as chairman of the board for Fiberight, a clean energy company converting MSW to biofuels and other outputs. Phil spent 30 years as a management consultant with Accenture, where he focused on the Life Sciences area, holding a variety of leadership positions including North American Industry Director for Life Sciences and Global Lead for Management Consulting. He also served as a member of the Products Operating Group Executive Committee.

Phil’s consulting work focused on defining and executing strategies to create leading-edge business capabilities, working with U.S. and internationally headquartered pharmaceutical companies, biotech, and medical product producers, as well as contract research organizations. Phil also played a leadership role in a number of joint-venture and new venture start-up engagements where company operating model and capability strategies needed to be defined for successful launch.

Since leaving Accenture in 2010, Phil has focused on venture capital investment and consulting, helping to negotiate and structure financing transactions for early-stage and scale-up stage companies, assisting with scale-up strategy/execution, and participating as a board chair/member and management advisor for several of the companies.

Phil holds a B.S. in Industrial Engineering from Lehigh University, and is currently Vice Chair of the Lehigh board of trustees. He lives in New Canaan, CT, where he also volunteers with EMS and serves as deputy director for the town’s office of emergency management. Phil and his wife Kajsa have two grown daughters.

The ISE Department is grateful to our alumni for their support of Lehigh’s mission and their valuable contributions to society. We are extremely proud to present Phil with this great honor of our alumni association.

TAMÁS TERLAKY

Lehigh ISE Professor Tamás Terlaky won the 2021 RCEAS Excellence in Research Scholarship Award

ISE is proud to announce that **Tamás Terlaky**, Kledaras Endowed Chair Professor of Industrial and Systems Engineering, was the recipient of the **2021 Lehigh University Rossin College Excellence in Research Scholarship and Leadership Award.**

The 2021 Lehigh University Rossin College Awards were announced Thursday, April 22, 2021. This annual event honors the achievements and commitments of Rossin College's faculty and staff. You can read more about Tamàs and the other awardees **here**.

The Industrial and Systems Engineering (ISE) Department nominated Professor Terlaky on account of his impressive record of research scholarship and leadership in ISE during his 12 years at Lehigh.

Tamás Terlaky chaired the ISE Department from 2009 to 2017, building a world-class faculty profile in Optimization at Lehigh, and accomplishing a number of other achievements, such as the now well-established Master's Program in Healthcare Systems Engineering and the international conference series MOPTA, held every summer at Lehigh.

After his tenure as department chair, Tamás collected an impressive number of awards and recognitions:

- He was a recipient of the Wagner Prize for Excellence in Operations Research of the Institute for Operations Research and the Management Sciences (INFORMS).
- He was elected Fellow of the Society for Industrial and Applied Mathematics (SIAM) and elected Vice-President of INFORMS.
- He received the Outstanding Innovation in Service Systems Engineering Award from the Institute of Industrial and Systems Engineers.
- He was elected chair of the Optimization Activity Group of SIAM and elected to the Canadian Academy of Engineering.

These awards and positions brought immense visibility and increased reputation to our college and university.

Tamás has recently built a Quantum Computing Optimization Lab, and such an effort was awarded by DARPA with a two million research grant. Due to his vision and research leadership, Lehigh is becoming part of the quantum computing revolution.

His scholarly visibility and recognition have been at a peak with more than 15 plenary lectures and colloquia given since his chair service. He is truly an ambassador for Lehigh throughout the world.

Lehigh ISE Professor Lawrence V. Snyder won the 2021 Rossin College Interdisciplinary Research Excellence Award

LAWRENCE V. SNYDER

ISE is proud to announce **Lawrence V. Snyder**, Professor of Industrial and Systems Engineering, was the recipient of the **2021 Rossin College Interdisciplinary Research Excellence Award**.

The 2021 Lehigh University Rossin College Awards were announced Thursday, April 22, 2021. This annual event honors the achievements and commitments of Rossin College's faculty and staff. You can read more about Larry and the other awardees **here**.

The ISE Department nominated Professor Snyder due to his strong and long-standing record of interdisciplinary research excellence, spanning his entire career over more than 15 years at Lehigh.

Since his PhD work on robustness and reliability of supply chains, Larry has vastly expanded his research portfolio to include work on operations research topics, such as logistics, transportation theory, facility location, and inventory models, as well as on various interdisciplinary topics related to energy applications, decision-making under uncertainty, and machine and reinforcement learning.

His record of collaboration with faculty members and students throughout Lehigh is extensive and includes his leadership roles in the Integrated Networks for Electricity (INE) Research Cluster, the Center for Supply Chain Research, and the Power from Oceans, Rivers, and Tides (PORT) Lab.

Beyond Lehigh, Larry is a Senior Research Associate with Opex Analytics, a company that aims to solve "complex business problems with human and artificial intelligence". An elegant example of his scholarship that crosses boundaries is the publication of a two-volume book on a masterful collection of puzzles using math, operations research, and computer science.

- Through these collaborative efforts, Larry has been successful in obtaining research funding, as well as in publishing impactful articles. His funded research grants have been joint efforts between him and faculty members from the departments of Civil, Electrical, and Mechanical Engineering and the College of Business.
- Last but not the least, Larry has been co-directing the Institute for Data, Intelligent Systems, and Computation (I-DISC) at Lehigh since Summer 2019.

The ISE Department congratulates Larry on this prestigious award!

TED RALPHS

Lehigh ISE Professor Ted Ralphs is recipient of the 2021 Rossin College Outstanding Doctoral Student Advising Award

The ISE Department is proud to announce **Theodore Ralphs**, Professor of Industrial and Systems Engineering, as the recipient of the **2021 Lehigh University Rossin College Outstanding Doctoral Student Advising Award**.

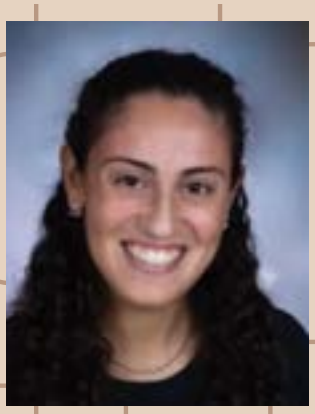
The Outstanding Doctoral Student Advising Award recognizes a Rossin College faculty member who has a strong commitment to the doctoral education and provides excellent support and mentorship to doctoral students they work with.

During his career at Lehigh, Ted Ralphs has supervised 10 PhD students and has served on 18 PhD committees. He is currently the advisor to four students. He has always been a key contributor to the ISE PhD program, serving in the selection and curricula committees multiple times in the last 20 years. He played a critical role establishing a strong program curriculum and he was the first to lecture many of our current courses. He was founding adviser of our doctoral INFORMS Student Chapter. His efforts were recognized by Lehigh's 2007 Hillman Award for Excellence in Graduate Advising.

Moreover, Prof. Ralphs has contributed to the development of the ISE PhD Program in other impactful ways. He co-founded the COR@L Laboratory which hosts the computer cluster intensively used by our PhD students to run their numerical experiments. Our current PhD Student Seminar has grown out of his pioneer efforts in the INFORMS Student Chapter and COR@L research events. ISE faculty and students post their research papers in the ISE Technical Report repository, to which Ted Ralphs has also made substantial contributions.

In the words of one of his current doctoral students, Suresh Bolusani: *"I nominated him for multiple reasons. Research-wise, he has a great step-by-step approach to introducing new research topics to Ph.D. students. He gave me multiple options to explore in my first year. By the end of the year, I had enough knowledge about different topics to make an informed decision and arrive at a mutually agreeable research topic for my dissertation. Further, his research approach itself fascinates me even today. He has a great ability and inclination to find connections between perceivably unrelated research areas, which is possible only upon having a deeper understanding of the subject. It is one of the reasons why I love to work with him and develop unifying theoretical concepts and algorithms. On a personal level, he provided me an environment that made me feel at ease and interact freely. Overall, he was highly supportive of me both professionally and personally throughout my stay, especially since the beginning of the pandemic last year. All these experiences made me understand advising better, and I aspire to become a great advisor like him."*

The ISE Department congratulates Professor Ralphs for winning this outstanding award!.



GIAVANNA TABBACHINO

Lawrence E. White Fellowship 2021

The Industrial and Systems Engineering Department is pleased to announce **Giavanna Tabbachino** as the recipient of the 2021 Lawrence E. White Fellowship for Master's in Management Science and Engineering offered by the ISE Department. This fellowship is made available through the generosity of Lehigh and department alumnus Lawrence E. White ('64, '65, '69) for a full tuition towards 30 credits of master's degree study.

Giavanna Tabbachino is currently an undergraduate senior at Lehigh University, majoring in Industrial and Systems Engineering and minoring in Women, Gender, and Sexuality Studies. Throughout her time at Lehigh, Giavanna has challenged herself academically and athletically as a member of Lehigh's Division I Cross Country and Track and Field teams. She looks forward to continuing her education with intentions of pursuing a career in logistics and supply chain management.

Lawrence E. White earned a bachelor's degree in Electrical Engineering from Lehigh in 1964, followed by a master's degree in Management Science in 1965 and a Ph.D. in Industrial Engineering in 1969. While a student, White was a member of the wrestling team and Theta Delta Chi. He has made his career in real estate, and is currently a consultant with Red Jacket Development. White has long supported initiatives at Lehigh, and is a member of the Asa Packer Society and Tower Society. His generosity has supported the renovation of Grace Hall, Athletics Partnership, and the wrestling program. In 1999, White endowed the Lawrence E. White '64 Head Wrestling Coach position.

White and his wife Ann have seven children between them, and live in Orlando, FL. Larry was honored with the ISE Distinguished Alumni Award in 2018.

The Selection Committee was formed by Professors Luis Nunes Vicente (chair), Robert H. Storer, and Tamás Terlaky.

The ISE Department is grateful to the White Family for their generosity and investment in Lehigh's mission to produce leaders who will serve and inspire others.

Van Hoesen Family Best Publication Award 2021

Through a generous gift from the Van Hoesen family, the Industrial and Systems Engineering Department is pleased to announce **Baoyu Zhou** as the recipient of the seventh annual Van Hoesen Family Best Publication Award. Baoyu will receive a $1,000 monetary prize for his paper:

A. Berahas, F.E. Curtis, and B. Zhou, *Limited-Memory BFGS with Displacement Aggregation*. ISE Technical Report, 19T-001 Lehigh University, to appear in Mathematical Programming.

The Van Hoesen Family Best Publication competition was established in the ISE Department in 2015. This award inspires students to publish influential research, software tools, and applications.

Everett Van Hoesen graduated from Lehigh University in 1955. He was a Distinguished Military Graduate, attained membership in the engineering honor society Tau Beta Pi, and was honored with the ISE Distinguished Alumni Award in 2014.

The Selection Committee was formed by Professors Ted Ralphs (chair), Daniel P. Robinson, and Luis F. Zuluaga.

The ISE Department is grateful to the Van Hoesen family for their continued support of ISE and inspiring excellence in research.

BAOYU ZHOU

ALLY MACHLIS

CAMERON MENNA

MIT Supply Chain Excellence Award 2021

Each year MIT presents its Supply Chain Excellence Award to outstanding graduating seniors from Lehigh. The ISE Department is pleased to announce that **Suyeon Hong** received an Honorable Mention for the 2021 MIT Supply Chain Excellence Award. **Cameron Menna** was named as a Qualified Nominee of the 2021 MIT Supply Chain Excellence Award.

Suyeon is currently enrolled in Lehigh's Industrial and Systems Engineering Program. Cameron is currently enrolled in Lehigh's Integrated Business and Engineering Honors Program.

Suyeon is a senior graduating in May with a Bachelor of Science in Industrial and Systems Engineering and a minor in Supply Chain Management.

As the recipient of an Honorable Mention Award, Suyeon will receive a fellowship toward MIT SCM Master's Program, or an MIT International SCALE master's program at centers in China, Luxembourg, Malaysia, or Spain.

Cameron is a dual degree senior graduating in May with a Bachelor of Science in Integrated Business and Engineering, majoring in Finance and also a Bachelor of Science in Industrial and Systems Engineering.

As a qualified nominee, Cameron will receive a fellowship to an MIT International SCALE master's program centers in China, Luxembourg, Malaysia, or Spain.

The Lehigh liaisons for the MIT Supply Chain Excellence Award are Professor Lawrence V. Snyder, Department of Industrial and Systems Engineering (Rossin College of Engineering and Applied Science) and Professor Zach G. Zacharia, Department of Decision and Technology Analytics (College of Business).

The ISE Department is extremely proud of these remarkable students and wishes them continued success in their future endeavors.

ISE Alumni, Faculty and Student Awards of the Year 2021

- Industrial and Systems Engineering Distinguished Alumni Award: **Philip Sheibley '81**
- Lawrence E White Fellowship: **Giavanna Tabbachino**
- Van Hoesen Family Best Publication Award: **Baoyu Zhou**
- Industrial and Systems Engineering Sophomore of the Year: **Morgan Heller**
- Integrated Business and Engineering Sophomore of the Year: **Tobey Bill**
- Industrial and Systems Engineering Junior of the Year: **Valentine Perevalov**
- Integrated Business and Engineering Junior of the Year: **Annalise Davis**
- Industrial and Systems Engineering Senior of the Year: **Sophie Smith**
- Integrated Business and Engineering Senior of the Year: **Abbey Goldenberg**
- Industrial and Systems Engineering Master's Student of the Year: **Sean Conway**
- Management Science and Engineering Master's Student of the Year: **Sofia Ramirez**
- Financial Engineering Master's Student of the Year: **Randall Parker**
- Health Systems Engineering Master's Student of the Year: **Joseph Golob**
- Industrial and Systems Engineering Ph.D. Student of the Year: **Baoyu Zhou**
- Undergraduate Faculty Member of the Year: Professor **Robert H. Storer**
- Master's Faculty Member of the Year: Professor **Anna I. Alexandrescu**
- Ph.D. Faculty Member of the Year: Professor **Ted Ralphs**

MAHID JAHANI

Majid Jahani receives a 2021 IISE Doctoral Student Colloquium Best Presentation award

The ISE Department is pleased to announce that ISE PhD graduate **Majid Jahani** was awarded **Best Presentation** award of one of the three tracks of the **2021 IISE Doctoral Student Colloquium** for his work titled Quasi-Newton Methods for Deep Learning. The IISE Doctoral Colloquium is a segment of the **IISE Annual Conference and Expo 2021**, sponsored by the Council of Industrial Engineering Academic Department Heads (**CIEADH**).

The IISE Annual Conference and Expo is the largest event that brings together field experts, gifted scholars and students to learn about the latest advances in the industry, and it is an excellent forum for collaboration and growth of professional networks.

Majid was nominated for the IISE Doctoral Colloquium by the ISE Department. Acceptance into the IISE Colloquium required a presentation of a virtual poster on May 23. The poster content included a summary of the problem, a unique research contribution, key findings, future work, and answering questions about the work.

The ISE Department is extremely proud of Majid and congratulates him on this great achievement!

PhD Defense Dissertations

LIYUAN (LEON) CAO

MAJID JAHANI

YIHE ZHUO

Congratulations to **Liyuan (Leon) Cao** who successfully defended his PhD thesis *Model-Based Derivative Free Optimization Methods and Analysis of Stochastic Nonlinear Optimization* on April 29, 2021. Liyuan's advisor was Professor Katya Scheinberg. Liyuan is now a postdoctoral researcher at the Beijing International Center for Mathematical Research.

Congratulations to **Majid Jahani** who successfully defended his PhD thesis *Efficient and Scalable Optimization Methods for Training Large-scale Machine Learning Models* on April 28, 2021. Majid's advisor was Professor Martin Takac. Majid has joined Target as a Senior AI Scientist.

Congratulations to **Yihe Zhuo** who successfully defended her PhD thesis *Modeling and Algorithms: Applications in Power Systems and Facility Layouts* on June 14, 2021. Yihe's advisor was Professor Larry V. Snyder. Yihe has joined Amobee as an Operations Research Scientist.

DEGREES AWARDED SPRING 2021

Ph.D. INDUSTRIAL AND SYSTEMS ENGINEERING

- Majid Jahani

M.ENG. HEALTHCARE SYSTEMS ENGINEERING

- Varun Joseph Andrews
- Teresa Carotenuto
- Jeffrey Dicker
- Joseph Golob
- Elizabeth Kim
- Nico Lastaukas
- Jake Levine
- Neha Vijay Mandhyani
- Ryan Seth
- Namya Elsa Thupili
- Elizabeth Turi
- Veliz Croldy
- Christina Vkingstad

M.S. INDUSTRIAL AND SYSTEMS ENGINEERING

- Sean Conway
- Wei Ke
- Sudeep Methai
- Ved Pate
- Huicong Qian
- Yujie Zhang
- Jingchao Zhu

M. ENG. INDUSTRIAL AND SYSTEMS ENGINEERING

- Joel Benko
- Hannah Chalk
- Neeraj Sandesh Deodikar
- Elizabeth Duong
- Ashutosh Vilas Inamdar
- Quifan Ji
- Saketh Lingam
- Anuraag Yatin Mehta
- Jake Mella
- Unnam Nikhil
- Huicong Qian
- Chintah Shah
- Kush Pravinkumar Trivedi

M.S. MANAGEMENT SCIENCE AND ENGINEERING

- Shutian Li

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

- Anna Francisco
- Abbey Goldenberg
- Eliza Howard
- Yanzhe Ma
- Jack Sullivan

B.S. INDUSTRIAL AND SYSTEMS ENGINEERING

- Robert Allen
- Thomas Alvarado
- Samantha Baker
- Molly Benning
- Nathan Blair
- Olivia Braunstein
- Reilly Burns-Cohen
- Lyle Chamberlain
- Katherine Eyring
- Andrew Fedun
- Abbey Goldenberg
- Paula Gonzalez
- Colin Hanlon
- Jack Heller
- Suyeon Hong
- Arzoo Karki
- Pierre Klur
- Conor Leahy
- Yanzhe Ma
- Arnella Margolin
- Gustav Masch Jiminez
- Cameron Menna
- Odilon Bertrand Niyomugabo
- Samantha Sagi
- Sophie Smith
- Kyle Sparks
- Gaivanna Tabbachino
- Fangyi Teng
- Jorgo Damtew Tesfa
- Paula Torrebiarte Neuweiler
- Delton Tschida
- Wade Warner
- Zhiyuan Wei
- Michael Weimann
- ZongLe Zhao

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

- Elizabeth Drobiz
- Abbhinav Sekar

DEGREES AWARDED SUMMER 2021

PH.D. INDUSTRIAL SYSTEMS AND ENGINEERING

- Liyuan Cao
- Yihe Zhuo

M. ENG. INDUSTRIAL AND SYSTEMS ENGINEERING

- Wei Wei

DEGREES AWARDED SUMMER 2021 (cont.)

M.ENG. MANAGEMENT SCIENCE AND ENGINEERING

- Kabita Karki
- Sofia Ramirez

M.ENG HEALTHCARE SYSTEMS ENGINEERING

- Leigh Friedman
- Joshua Spair

ALUMNI NEWS

ISE Advisory Council Welcomed three new members in the Spring of 2021:

Chuck Coxhead '88 BSIE, Director of Sales & Marketing, Procensis

Chuck is a manufacturing executive with 30 years of experience in Engineering, Operations, Sales, Marketing, and General Management. He is well versed in the challenges facing small businesses, especially manufacturers working in commercial and Department of Defense markets.

Over the course of his career, Chuck's career has focused on process and organizational improvement and growth from the manufacturing operation, to ERP and automation implementation, inventory planning, project management, and supply chain improvements. With Lucent Technologies, he played an instrumental role in commercializing world changing optoelectronics technology powering fiber-optic backbones for worldwide data and voice communications. During his time with Koaxis, Chuck led the creation of a business turn-around with a paradigm-shifting delivery model using eCommerce and "Ready 48" (2 day) lead-time for custom RF-Microwave products.

Rob Weisstuch '85 BSIE, Nonprofit Industry Consultant

Upon graduating from Lehigh Rob joined the consulting firm that would later be known as Accenture and was admitted to the partnership as a member of the Media and Entertainment practice. After leaving Accenture Rob served in several leadership roles for companies including Unisys, HIT Entertainment, and HarperCollins Publishers. Rob pivoted to a career focused on working with nonprofits and became COO of 100Kin10, a national nonprofit focused on improving STEM education in the United States. He currently continues consulting work for nonprofits, serves as a member of the board of New York City-based Education Through Music, and was elected to the Mamaroneck district's school board in 2020.

Kathleen Zanowic '85 BSIE, Vice President – Senior Privacy Officer, Verizon

As Vice President-Senior Privacy Officer at Verizon, Kathy Zanowic is responsible for developing and implementing privacy programs and policies enterprise-wide. She ensures that privacy issues are identified and resolved in the design and development of consumer-focused products and services and advises product and technical teams on privacy controls and permissions for data collection and use practices across networks, technologies and devices. She also responds to laws, regulations, government inquiries, legislation, new industry practices and consumer trends affecting Verizon, its employees and its customers in areas including privacy, big data, machine learning, and artificial intelligence.

Prior to her current position, Ms. Zanowic was Vice President-Federal Government Relations at Verizon and had responsibility for maintaining legislative relationships in the U.S. Congress. Here, she specialized in policy areas including telecom and cable competition, antitrust, intellectual property, and privacy.

Ms. Zanowic holds a BS in Industrial Engineering from Lehigh University and an MBA from George Washington University. She is certified by the International Association of Privacy Professionals as an Information Privacy Professional and Information Privacy Technologist.

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