# ISE ANNUAL REPORT 2020

# IMPACT STARTS HERE

**ISE ranked 6th Best Undergraduate School in Industrial / Manufacturing Engineering,** ***U.S. News and World Report***


ILLINOIS
ISE | Industrial & Enterprise Systems Engineering
GRAINGER COLLEGE OF ENGINEERING


ISE

## DEBORAH THURSTON

**ISE Department Head**
**Gutsgell Professor**
**Co-Director, Technology & Management**

In my thirty-three years here at the University of Illinois, I can say this has been the most difficult, and yet the most rewarding time I've ever experienced.

COVID-19 has forced us to take unprecedented actions (in mid-semester, send everyone home and pivot to online teaching!), answer questions we've never been asked before (just exactly how can you conduct a robotics lab while keeping the students 6 feet apart?), and plan for a future whose uncertainties we've never before had to contemplate.

But working with our ISE team to protect our community's health while fulfilling our mission of delivering world-class education and research has been extremely rewarding. Students, faculty and staff have really stepped up to the plate.

We have survived, even thrived. I have never been prouder of our students, who were able to finish their already tough curriculum under difficult circumstances. Our graduating seniors gave up their last months on campus, including graduation ceremonies, in order to protect the health of others. For that, we will be eternally grateful.

This summer, our faculty participated in the Grainger College of Engineering Teaching Academy's crash courses to translate what they do so well in person to online; "flipping the classroom" for active student participation, assessing performance via homework and exams, and engaging students in laboratory courses. Academically, we were ready for the fall semester. It's a good thing, too, because our enrollment at both the undergrad and grad levels increased!

Logistically, we stepped up our game to do twice a week COVID-19 testing for every faculty, staff and student, enabling us to show our "access granted" cellphone app update to get into the building, whose hallways and classrooms have been reconfigured to achieve social distancing.

We were thrilled to learn that ISE is now ranked number 6 in undergraduate Industrial/Manufacturing Engineering programs by U.S. News and World Report. This was earned through years of hard work. We are extremely proud and at the same time humbled by this and will continue working to earn it.

I am often asked what makes Industrial and Enterprise Systems Engineering at the U of I special. Well, here it is in a nutshell: ISE faculty combine deep application domain expertise with advanced mathematical modelling skills. These two skill sets help them synergistically see problems and solution opportunities that elude others.

Our faculty have PhDs in virtually every engineering discipline; Industrial, Systems, Mechanical, Electrical, Civil, Aerospace, and Agricultural Engineering, Computer Science, Mathematics, Operations Research, Engineering and Public Policy. One even has PhD in Engineering Education!

But they have one thing in common—superb mathematical modelling formulation skills. Mathematical models are simply abstractions of reality. We create them in order to predict, control and make things better. But the devil is in the details. There is always a tradeoff between accuracy and efficiency. Large models can attempt to capture everything, but obtaining the input data and/or solution takes so long that the model is not useful. Smaller models might be set up and solved more quickly, but their solution might not be accurate. ISE's are especially good at hitting that sweet spot between accuracy and efficiency because they can simultaneously analyze both the physical system and the model itself.

Our two latest NSF CAREER winners are perfect examples. Jugal Garg's project in New Algorithmic Foundations for Fair Division through Competitive Equilibrium will help achieve a fair and efficient division of both "goods" and "bads" in settings such as managing computing resources and spectrum allocation. Rasoul Etesami's project in Duality and Stability in Complex State-Dependent Networked Dynamics will help to reduce fake news (among other things), as described in this report.

I hope that all of you have been able to stay healthy. I am so grateful for your support, and look forward to being together again in person as soon as possible.

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## FACULTY ACCOMPLISHMENTS



The Department of Industrial and Enterprise Systems Engineering (ISE) at the University of Illinois, Urbana-Champaign, *innovates* the engineering discipline with forward-thinking research and scientific discoveries; *serves* education, industry, and society; *educates* a new generation of leaders in general, systems, industrial, and financial engineering.

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*ISE Annual Report* is edited by William Gillespie. Some portrait photography by L. Brian Stauffer. Illustrations by Miriam Martincic.

Readers, alumni, students: contact us at communications@ise.illinois.edu

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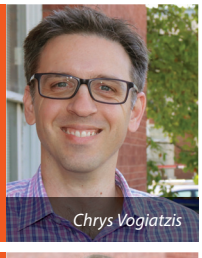
# Flipping the classroom

## ISE instructors innovate hybrid learning

WILLIAM GILLESPIE

The University of Illinois has implemented mandatory COVID-19 testing and tracking to make in-person education this fall as risk-free as possible. And many students have chosen remote learning, causing ISE teachers to create new methods of hybrid education to accommodate both in-person and distance learning in the same class. ISE professors are using this unique challenge as an opportunity to find ways to improve classroom delivery, such as "flipping the classroom," or other methods that privilege critical thinking over rote memorization, or that balance student interaction with instructor lecturing. As Chyrsafis Vogiatzis puts it, "COVID-19 came at a time when we had all these new technologies that we hadn't really incorporated into our curriculum, and, then suddenly we had to use them, so when we had the summer to plan how to use them, we could take our courses to the next level."


Chrys Vogiatzis


Molly Goldstein

Flipping a classroom isn't the same as flipping a house or a burger, nor is it a concept that was newly created in response to COVID-19. According to The Flipped Learning Network (2014), the flipped classroom is a "pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter".

In other words, lectures are recorded for students to watch asynchronously before class, while class time is reserved for exploring the concepts with teacher guidance and often small groups. Rather than use the class for content delivery, it's reserved for interaction. According to Vogiatzis, the "flip" is that homework happens during class, instruction before. "They learn during the activities. Ideally they also learn from their peers."

Molly Goldstein teaches SE101 (Engineering Graphics and Design). With a Ph.D. in Engineering Education, Goldstein has fused teaching and research, making her students' engineering laboratory her own laboratory on how to innovate and improve the educational experience. She had already been experimenting with a flipped classroom "in mini scale," using class time as lab time in ISE's Product Design Lab.

"It's great to have the resources to do this," she explains, "and a lot of my friends from grad school were blown away when I told them what kind of resources the Grainger College was giving us." Over the summer she participated, along with ISE Professor Chrys Vogiatzis, in a college-wide workshop for instructors moving classes online, in which faculty from different departments shared and peer-reviewed one another's course plans.

One of the features of her course is to show concepts across CAD and hand-drawing, as research shows drawing by hand opens unique pathways in the brain. Over the summer she executed and uploaded a collection of hand-drawing videos to flip the class such that students would get instruction before class and use class time to practice collaboratively. In this case, creating the

videos was something she had always thought would be worth doing, and she was motivated to complete them to address the problems of adapting a traditionally intimate and hands-on class to distance learning.

"Making the videos took weeks," she laughed, "but I'm happy with them."

Another lab-intensive course redesigned to accommodate distance learners is Dan Block's SE 320 (Control Systems). Students at home are paired with friends who are present in the lab, and the two will complete the lab together, allowing the student who is not present to get the same opportunities to engage with the material and access the materials" as they would in his class pre COVID-19, even though "…. their timing might be a little trickier and their bandwidth might be limited." Because students may be in different time zones, living at home with different constraints, including poor internet connectivity, he does his best to make the class asynchronous and low-bandwidth. However he does not like to teach without old-fashioned black or white board access. He finds slides alone insufficient for explaining concepts—he likes to write on the slides while he lectures. Using an iPad, he has found a way to bring the white board and dynamic hand annotations to his online lectures as he would in a classroom.

"I think the things we've learned out of necessity, going forward, also have the ability to improve teaching, not just in the same online kind of environment, but even in on-campus teaching as well. So hopefully it will give us another facet to our exiting on-campus courses."

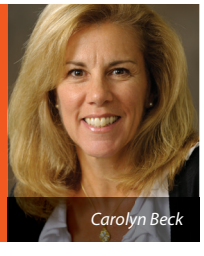
as close as possible to an in-lab experience.

Block's other lab class, SE 420 (Digital Control—lecturer, Dusan Stipanovic), has innovated further. Each student is assembling their own kit that includes all the components needed to complete the course project, an inverted pendulum. The kit is essentially a lab-in-a-box which, should there be an outbreak of COVID-19 that forces the university to close again, students can take home and still complete the project. (And indeed the University is completing the semester remotely after Thanksgiving break.) Texas Instruments donated 50 "launch pad" development boards to the cause.

Doug King is teaching IE 300 (Analysis of Data) and IE 312 (Deterministic Models in Optimization ) entirely online. His goal in teaching remotely has always been "to make sure that students still had

The tragedy of the pandemic cannot be overstated and none of those interviewed are happy for it, however they may have adapted. It is our hope for a post-pandemic world in which these semesters spent in online or hybrid teaching will lead to improvements in the way courses are taught, the way technology is used for content delivery, and, likely, renewed spirits for the prospect of classroom learning. As Doug King puts it, "I think the things we've learned out of necessity, going forward, also have the ability to improve teaching, not just in the same online kind of environment, but even in on-campus teaching as well. So hopefully it will give us another facet that we can add to our existing on-campus courses."

Doug King



Carolyn Beck

*Above: The online view of a flipped classroom. A group is discussing with the instructor one of the activities they need to solve, while sharing their solution. The instructor is annotating their solution to correct mistakes and guide the discussion. Right: The physical setup of the flipped classroom. The instructor interacts with the students using a computer and a tablet. Both images are from the Fall 2020 semester of IE 300.*

# James Allison receives funding to develop floating wind turbines

ZACK FISHMAN

The ocean waters of the United States may one day be populated by floating wind turbines that will generate renewable energy from strong winds blowing across the oceans—but they might look less like windmills and more like the oversized egg beaters.

Professor James Allison of the Department of Industrial and Enterprise Systems Engineering (ISE) at the University of Illinois Urbana-Champaign joins dozens of U.S. researchers to radically redesign floating offshore wind turbines under the new $26-million ATLANTIS program. He will collaborate with engineers at the University of Texas at Dallas and the U.S. Department of Energy's (DOE's) National Renewable Energy Laboratory (NREL) Golden, Colorado, with a focus on implementing new design approaches in the research. (The main NREL campus is in Golden, but all of Allison's collaborators at NREL are at the Flatirons campus, near Boulder.)

DOE's Advanced Research Project Agency-Energy (ARPA-E) announced the awardees of the program in September with the goal of reducing the cost of offshore wind energy by improving turbine design and control holistically .

Ocean winds along U.S. coasts are a highly promising yet mostly untapped source of energy, with the potential to provide 2,000 gigawatts of generation capacity—almost enough to power the U.S. twice over, according to the Department of Energy. Much of the wind blows above waters too deep to fix turbines to the seafloor, so floating wind turbines are necessary to capture that energy.


James Allison

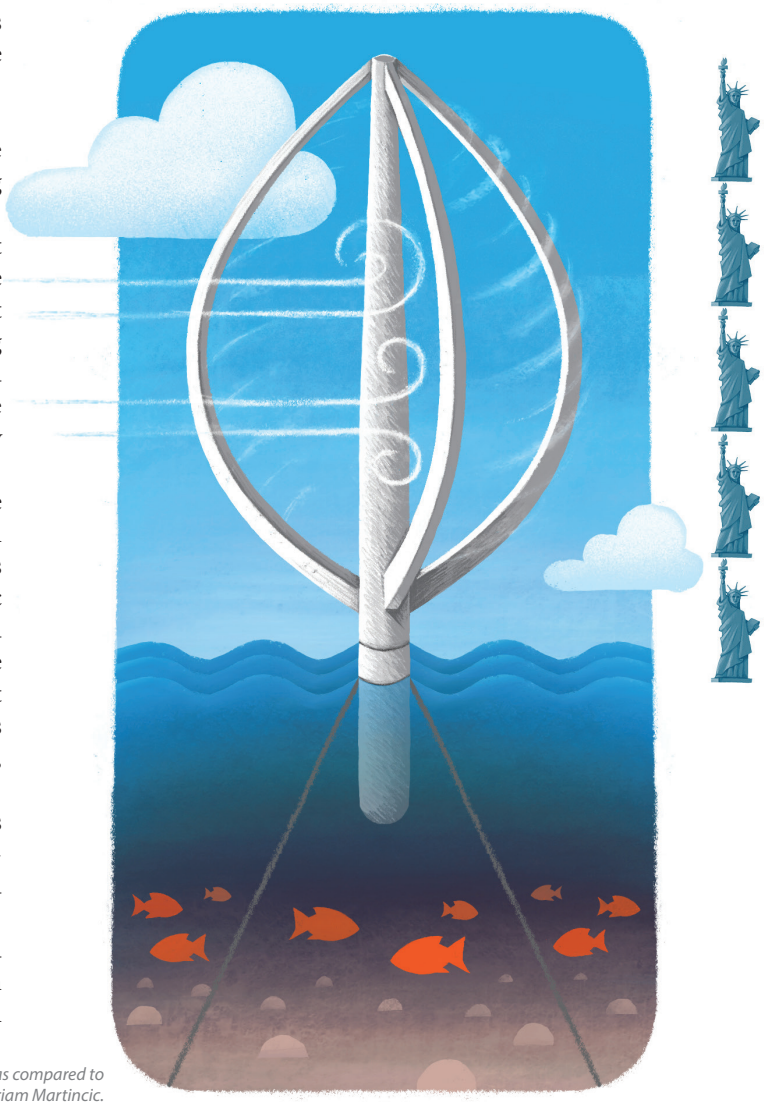
Current floating offshore turbine designs have large flotation platforms modeled on traditional offshore systems, according to an ARPA-E press release. The ATLANTIS program (short for "Aerodynamic Turbines, Lighter and Afloat, with Nautical Technologies and Integrated Servo-control") aims to design new floating offshore wind turbines and their system controls to be more stable without needing large platforms while also decreasing costs. This leads to challenging trade-offs between stability, efficiency and price, Allison says.

"It's all focused on improving the economic competitiveness of floating offshore wind turbines, but there are all sorts of different things that feed into that, like different technologies and different design methods," he says.

Allison joins the UT-Dallas team, led by researcher Todd Griffith, as a co-principal investigator to fundamentally redesign the wind turbine — by pointing it upward. Unlike traditional wind turbines, which have straight blades that rotate on a horizontal axis, The UT-Dallas researchers are developing a vertical-axis wind turbine (VAWT), which has curved blades that spin around a vertical axis of rotation. It will sit on a small flotation platform that is tethered to the seabed by cables. Allison says the geometry of the VAWT reduces the physical stress it experiences from the wind.

The UT-Dallas team's VAWT design will stand about 600-900 feet tall, but it will be stationed 20 miles from the coast and won't obstruct ocean views from the coast, Griffith says in a UT-Dallas press release.

READ THE FULL ARTICLE ONLINE:
https://ise.illinois.edu/newsroom



*This illustration shows the height of the wind turbine as compared to the Statue of Liberty. Drawing by Miriam Martincic.*

# REMADE in America

DOUG PETERSON

Products that are "Made in the USA" are increasingly being "Remade in the USA," and ISE researchers are playing a major role in this remanufacturing revolution. The REMADE Institute has awarded a $1-million grant to ISE professors Harrison Kim and Pingfeng Wang, who are leading an effort to breathe new life into used products that would otherwise be sent to the scrap heap.

With this grant, Kim and Wang will be developing new mathematical models to help industry designers determine what parts and components can be economically reused and remanufactured over multiple generations of a product. By reusing and remanufacturing parts, material usage and energy consumption can be dramatically reduced.

"We want product design to be good for the environment and good for the company's financial future as well," Kim says. "Our goal is to improve the manufacturing competitiveness of U.S. industries."

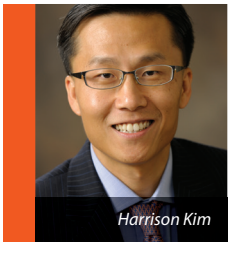
In other words, they're not just leading an effort to remake products; they're helping to remake industry.

A remanufactured product is significantly different from a reused component, Kim says. Reused parts undergo some cleaning and are almost as good as brand new. But with remanufacturing, the product is completely disassembled, and every part is inspected and then replaced, if needed. The resulting remanufactured component is considered as good as new.

John Deere, one of two industry partners working with Kim and Wang, offers remanufactured parts for farm and construction equipment through its "Reman" program. The other industry partner is the Green Electronics Council, which promotes sustainable IT products, such as phones, computers, and TV's.

According to Kim, the models they develop will work with a wide range of product families, from heavy machinery to smart phones. When you buy an iPhone, for instance, it's part of a product family that shares the same architecture but has variations, such as differences in storage space. Some phones in the product family might offer 64 gigabytes of storage space, while others have twice or four times as much space.


Pingfeng Wang


Harrison Kim

Because of the similar architecture, many parts used in a family of phones are the same. Kim and Wang's design models will determine how long the various parts can perform reliably—critical information when your goal is to reuse and remanufacture those components through multiple generations of a product.

"For example, both old- and new-generation smart phones contain a gyroscope component," Kim says. "This gyroscope enables you to flip your phone upside down or sideways, and the screen will adjust."

The gyroscope is so reliable that you can use it for two consecutive product generations without a problem, he points out. But by the third generation, it faces a risk of failing.

"Imagine having to make this kind of reliability decision for every major part and component in a product," Kim says.

The mathematical models that Kim and Wang are developing will allow designers to do just that; they will determine which components can be used for multiple generations, and which can work for only one generation of a product family.

"This is a very complex mathematical decision," he notes.

According to Wang, he and Kim make a strong team because their specialties complement each other. Wang's lab specializes in reliability and uncertainty in modeling, while Kim's lab is known internationally for working on product families and sustainability design.

Kim says their models will be able to analyze a multitude of tradeoffs during the design stage, such as material choices. In a smart phone, do you go with a metal part that is 100-percent recyclable or do you choose a composite material that may not be as recyclable but is more durable and can be used through multiple generations?

"Our models will sort through these tradeoffs," he notes.

Decisions made during the design stage also have ramifications for how easily a part can be reused or remanufactured. In a smart phone, for instance, there are several layers of materials, so where you place components can make a big difference. If you place a reusable part in the bottom layer, it will be much more difficult to get at and salvage when you disassemble the product. But if the part is placed in the top layer, you can open up the phone and remove it easily.

"You need to keep that recovery option in mind in your design process," Kim says.

The REMADE Institute, which sponsors this research, is funded by the U.S. Department of Energy and based in Rochester, New York. It was formed in 2017, with the University of Illinois as one of its founding members. Eighty percent of the $1-million funding will go to the U of I, with the other 20 percent going to the two industry partners and Iowa State University, which is providing data analytics support.

READ THE FULL ARTICLE ONLINE:
https://ise.illinois.edu/newsroom

# RESEARCH IN THE AGE OF COVID-19

Seventeen research projects are sharing nearly $800,000 in funding through the Jump ARCHES research and development program. The Jump Applied Research for Community Health through Engineering and Simulation (Jump ARCHES) program is a partnership between OSF HealthCare and The Grainger College of Engineering at the University of Illinois (U of I) at Urbana-Champaign.

These projects were submitted to an unprecedented special call for Jump ARCHES proposals to address COVID-19, pandemics, and other public health crises through smart health, data analytics, AI, and other technologies. The ARCHES program supports research involving clinicians, engineers, and social scientists from OSF HealthCare, University of Illinois, and U of I College of Medicine in Peoria (UICOMP) to develop technologies and devices that could revolutionize medical training and health care delivery.

A requirement of the grant applications was for solutions that could be deployed quickly, within four to six weeks.

"When COVID-19 was declared a pandemic, we felt that it was our responsibility to help researchers find solutions," said ISE Professor T. Kesh Kesavadas, of the Health Care Engineering Systems Center at U of I at Urbana-Champaign and Engineer-in-Chief of Jump ARCHES.

## Supply-Driven Hospital Resource Planning and Community Engagement for COVID-19 Treatment

**Lavanya Marla – Department of Industrial and Enterprise Systems Engineering; Qiong Wang – Department of Industrial and Enterprise Systems Engineering**, Grainger College of Engineering; Benjamin Davis – Carle Illinois College of Medicine, U of I at Urbana-Champaign; Dr. Kurt Bloomstead – EMS Medical Director, OSF HealthCare Heart of Mary Medical Center in Urbana

**Gaps exist in our understanding of how to simultaneously manage workforce and resource supplies in a pandemic over time. This proposal will develop algorithms for supply-side planning of both health care workforce and supplies tailored to pandemics by integrating resource inventory aspects and behavioral response to messaging. It will also generate knowledge on the right type of information dissemination to the community that models patients' response to help manage demand and not create congestion at hospitals within communities.**

## Data-driven Modeling, Analysis and Simulation of Epidemic Processes: Controlling COVID-19

**C.L. Beck – Department of Industrial and Enterprise Systems Engineering, Grainger College of Engineering, at U of I Urbana-Champaign**; M.T. Basar – Department of Electrical and Computer Engineering, Grainger College of Engineering, at U of I Urbana-Champaign; Dr. Joseph Kim – Clinical Medicine, UICOMP

**This project proposes to develop a comprehensive data-driven approach to the modeling, analysis, and control of epidemic processes over time-varying networks on multiple layers. This approach considers the impact of mitigation efforts. Ultimately, the project hopes to advance understanding of spread and control of epidemic processes over complex networks, focusing on infectious diseases, but the models can apply to the spread of computer viruses, misinformation, and adversarial processes over complex networks, such as those found in natural and engineered systems.**

## Rapid, Contactless Vital Signs Collection Using Computer Vision and Consumer Technologies

**Ramavarapu Sreenivas – Department of Industrial and Enterprise Systems Engineering, Grainger College of Engineering, U of I at Urbana-Champaign;** Roopa Foulger – Vice President of Data Analytics, Jump Trading Simulation and Education Center; Brent Cross – Simulation Engineer, Jump Trading Simulation and Education Center; Stefan Malmber and Taha Khan – Dectivio, LLC

**The goal of the proposal is to develop a computer vision algorithm for rapidly assessing an individual's key vital signs (temperature, heart rate, respiratory rate, and blood pressure) relevant to COVID-19 utilizing a consumer grade camera in the absence of contact or additional sensing elements not readily available (ambient temperature, sound). The algorithm should be appropriately containerized to integrate with on market electronic medical records and telehealth applications including Epic and Vidyo.**

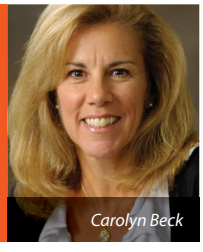
# Q&A With Carolyn Beck

Carolyn Beck has been probing how epidemic processes work, and her models can be applied to diseases of all types.

ZACK FISHMAN

Q: Can you describe what an epidemic model is, and how your new network model differs from others that are used

A: We're looking at how infectious diseases and viruses propagate in a population. For a couple hundred years, modelers have used what they call compartment models, which for the simplest model say the population is divided into two groups: They're either susceptible, meaning they're healthy and susceptible to infection, or they're infected. There are also different simulation models that describe this process and tell you what proportion of the population will be susceptible or infected over time — or if you're talking about just an individual, the probability that they'll be infected or healthy. These models assume the population mixes evenly — that is, everyone interacts with everyone else roughly to the same extent.


Carolyn Beck

But rather than assuming the population is mixing evenly, we're assuming that there's an underlying network structure that affects how these viral processes are distributed in the population. The compartment models assume everyone is interacting with everyone else equally, but the network models try to take into account the fact that we're not equally in contact with each other. In our models, we impose network structures on the population and then look at how different network structures affect how quickly people get infected and healthy, and whether they stay healthy.

I had a Ph.D. student, Philip Paré, who graduated about a year and a half ago, and this was the basis for his thesis work. He said, let's consider what happens if these networks themselves change over time. For example, during the week, we may be going to work and interacting with one group of people, but on the weekend, we may be interacting with a different group of people. So there's a time-varying nature to the network. Then he looked at what network structures will lead the population to converge to a healthy state, or alternatively converge to a state where we can't get rid of the disease.

Q: Can you give a couple examples of these networks?

A: At the finest level, you can model human contact networks; that would be on the level of every single person. That would make it pretty hard to run a lot of simulations, due to the size of the population under consideration, but you might be able to do it for, say, small towns. Another level might be aggregated populations. You can aggregate at the household level, the neighborhood level, the city level, the state level, the country level, etc. Then you can look at these different levels to get multiscale models of the interconnections between the population groups. You can also take into account where people are commuting and how they're commuting, and that can change the network dynamics as well. So we try to capture some of these varying levels in our network models to look at how diseases are propagating in a larger population.

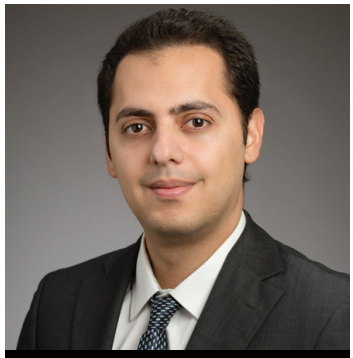
Q: Looking at your most recent research, what do you gain by creating a model that includes time-varying aspects, and what outcomes does it create?

A: It's more precise. If you take into account traffic flow, that actually has a pretty prevalent effect in our society today since we're globally connected. If you take this into account, you realize that if a sick person gets on a plane in one country and lands in another country, it creates and opportunity for a virus to become pandemic quickly.

READ THE FULL ARTICLE ONLINE:
ise.illinois.edu/newsroom

# FACULTY AWARDS & OTHER HONORS

## New NSF CAREER Awards



**Rasoul Etesami**
Duality and Stability in Complex State-Dependent Networked Dynamics

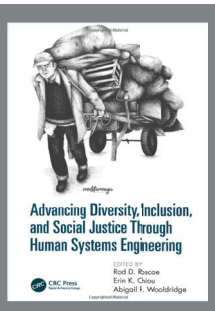
**Jugal Garg**
New Algorithmic Foundations for Fair Division through Competitive Equilibrium

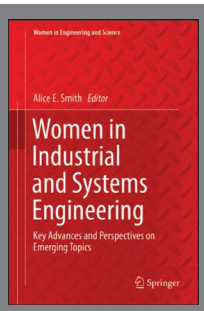
## EXCELLENCE IN TEACHING

**Sharp Teaching Award**
Chrysafis Vogiatzis

**IISE Outstanding Faculty Advisor Award (North-Central Region)**
Chrysafis Vogiatzis

**ISE Department Head's Teaching Award**
Abigail Wooldridge




We are pleased to announce a new textbook co-edited by Abigail Wooldridge: *Advancing Diversity, Inclusion, and Social Justice Through Human Systems Engineering.* Professor Wooldridge also appears with Deborah Thurston co-authoring chapters in *Women in Industrial and Systems Engineering.*

**FACULTY (AND CLASSES) RANKED AS EXCELLENT BY STUDENTS FALL 2020**

| | |
|---|---|
| **SYSTEMS ENGINEERING** | |
| * BARICH,J | SE 400 |
| * BLOCK,D | SE 420 |
| ETESAMI,R | SE 320 |
| SPENCER,G | SE 361 |
| STIPANOVIC,D | SE 420 |
| **INDUSTRIAL ENGINEERING** | |
| * CHRONOPOULOU,A | IE 400,598 |
| FENG,L | IE 522 |
| SIRIGNANO,J | IE 534 |
| SREENIVAS,R | IE 523 |
| * VOGIATZIS,C | IE 532 |

**FACULTY (AND CLASSES) RANKED AS EXCELLENT BY STUDENTS SPRING 2020**

| | |
|---|---|
| **SYSTEMS ENGINEERING** | |
| * BARICH,J | SE 400 |
| BECK,C | SE 424 |
| * BLOCK,D | SE 422,423 |
| STIPANOVIC,D | SE 525 |
| WANG,X | SE 101 |
| **INDUSTRIAL ENGINEERING** | |
| CHANDRASEKARAN,K | IE 519 |
| KIM,H | IE 431 |
| VOGIATZIS,C | IE 398 |
| WOOLDRIDGE,A | IE 340 |

* = Outstanding rankings

## Rasoul Etesami

### Professor works to reduce fake news

BY ALLIE ARP, COORDINATED SCIENCE LAB

**With the United States in the midst of another election cycle, many researchers are trying to prevent the sharing of fake or bad news. CSL Assistant Professor Rasoul Etesami is working to improve the models behind social media tracking, in order to better understand how bad news is shared.**

**"In social networks, decision-makers are humans and they decide who to interact with and how to manipulate others' opinions," said Etesami. "We want to study the stability of such networks, in terms of if an outcome can be predicted or controlled toward a certain direction."**

**Most of the current models analyzing social networks act as though a network, whether social or power, is fixed and time-invariant. In these models, there is a network (for example, Facebook), there are agents (humans), and there is interaction (sharing content), which results in an outcome. Etesami believes this doesn't accurately portray how networks operate, because agents' decisions and their interactions dynamically evolve, thereby changing the structure of the network.**

**"There isn't one well-accepted model in cognitive decision making. There are proposed models and some of them have proved successful and more descriptive compared to others," said Etesami, an industrial and enterprise systems engineering assistant professor. "Our project is to take those models and analyze them critically. If we see shortcomings in existing models, we extend them by adding extra features or constraints to capture more realistic and sophisticated scenarios."**

**As an example of this, Etesami brought up the last presidential election, the outcome of which some people believe was changed by the spread of false news over social media platforms. Whether or not it's true, Etesami says this type of information dissemination exists.**

**"You can easily manipulate people's decisions by spreading false news over a network that causes people to connect or disconnect themselves from the true source of information based on whether they like or don't like the message," he said. "If we have a better understanding of the dynamics of agents' decisions and the stability of the networks, we can control the propagation of false news. This can help us protect our social networks from adversarial attacks that can affect the whole population."**

**As part of the recently funded project "Duality and stability in complex state-dependent network dynamics," Etesami and his team are working to develop a platform that can simulate human behavior within a dynamic social network like Facebook or Twitter.**

# Brian Truesdale (BSGE 1994):
## An engineer leading in business

ZACK FISHMAN

Brian Truesdale, the president of Marmon Foodservice Technologies and an ISE alumnus, stays highly engaged with the Urbana-Champaign campus. He participates in the ISE Engineer in Residence program regularly, holds season tickets for football and has a son studying Systems Engineering and Design as he did years before. He was recently on campus to share his career experience with students as an Engineer In Residence and had a chance to share his story as an Illini and business leader.

Before he became president over a group of 5 industrial companies with revenues exceeding $300 million, Truesdale was a student in General Engineering, during which time he worked on redesigning the process of polishing pans for cookware company Revere Ware as a senior design project. Since graduation, Truesdale has largely taken on leadership roles in businesses across several industries yet attests to the usefulness of his degree, particularly because of its many specialization options.

> "I can honestly say that I wouldn't be where I am without my Illinois engineering degree."

"I developed a specialization in engineering management, which is more of a business slant to engineering—how do you optimize business processes, how do you simplify manufacturing, how do you manage product development?" Truesdale said. "The degree helped my career path going into senior leadership roles in product development and manufacturing."

He assumed such roles throughout his career in several general management positions at Illinois Tool Works, a Fortune 500 company, and as Sector President at Marmon , a Berkshire Hathaway-owned industrial conglomerate.

As a member of the ISE Alumni Board, he informs the department about the reality and demands of industry so as to better prepare students for their careers. Through his company, he has sponsored several senior design projects much like the one he worked on so many years ago, giving seniors a taste of being professional engineers.

"The senior design project program is, to me, the best I've seen in the country," he says. "It's real-world engineering work, and we end up getting a direct benefit from having invested that money into the project, so more often than not, we see 5, 10, sometimes 20 times our investment returned. It's amazing to see what a small student team can do in a matter of 3 or 4 months and have a real impact on the company."

"We love sponsoring these projects and want to continue to do it for as long as we can," he adds. Truesdale shows appreciation and admiration of the ISE program, praising its help in his own life and those of its many other graduates. "I was hired because I had an engineering degree from Illinois, and I was hired by a company that recognized the breadth of skills and problem solving that the ISE program uniquely provides."

# ISE Scholarship Recipients

## Otto Sr. and Mildred Capek Department of Industrial & Enterprise Systems Engineering Scholarship

*"With this scholarship, I am able to pursue my dream and study for a successful career."*

### Favorite Class

- SE 100 Introduction to ISE

2019 RECIPIENT

### Oscar Salazar

**Freshman**

Wheaton, Illinois (Wheaton Warrenville High School)

Even as a freshman in industrial engineering, Oscar Salazar has his thoughts set on the future. He says, "I wanted to become an engineer because I want to make the world a better place for the future. I felt that the best way to make a difference in the world is to be an engineer." Oscar was not always sure whether this dream would be achieved, but thanks to this scholarship, Oscar's dream is alive. "This scholarship is the only reason I am able to come to this school. After being accepted into The Grainger College of Engineering my only worry was money and finding a way to pay for my education."

Oscar is beginning to explore the resources that campus offers and has recently joined a social fraternity on campus, Phi Sigma Kappa, and is working to get involved in undergraduate research. He hopes to establish a positive presence on campus and work towards building a wide array of experiences. One of his career goals is to eventually be hired by Tesla after graduation. Oscar says, "My dream job is to work for Tesla and to help manufacture the best electric cars in the world so that eventually everyone will move towards driving electric cars."

Oscar is deeply honored and thankful to be a recipient of the Otto Sr. and Mildred Capek Department of Industrial & Enterprise Systems Engineering Scholarship.

# Jerry S. Dobrovolny Scholarship

*"I hope to be charitable at all points of my life. Being on the receiving end of someone's act of compassion only strengthens my desire to work hard so I can eventually do the same for others."*

## Activities and Honors

- Illinois Business Council Member
- Former Vice President of the Engineering Freshman Committee
- ActGreen

## Favorite Classes

- SE 101 Engineering Graphics and Design
- PHIL 102 Logic and Reasoning

2019 RECIPIENT

## Kyle Moukheiber

**Sophomore**

Wheaton, Illinois (Wheaton Warrenville South High School)

Kyle Moukheiber, a sophomore in Systems Engineering and Design, chose the Department of Industrial and Enterprise Systems Engineering because, "I wanted to leave campus with a vast toolkit to solve the problems I see around us. I believe that the knowledge we gain and the relationships we build in ISE will allow us to pursue our passions and be ready for any challenge that may come our way." Kyle has always been passionate about solving problems and he notes that "studying engineering gives you an incredible amount of insight into solving many different and complex problems."

Kyle is a very introspective student, one who knows himself well and uses that awareness to his advantage throughout his life and hopefully in his future workplaces. He says, "I know that my uncertainty is rooted in my desire to create impact. In a world filled with many problems and therefore many opportunities to create meaningful and positive change one thing is clear to me: I will not find myself in a job or even an industry for too long." As he's not afraid of change, Kyle has learned to embrace change for what it can mean and teach us, "I know that I learn the most and can only grow when I step out of my comfort zone. So when things get too comfortable, I'll know it's time to experience something new and try to create more impact wherever I may find myself."

Kyle is honored and thankful to be a recipient of the Jerry S. Dobrovolny Scholarship.

**ISE'S RENOWNED FACULTY make revolutionary breakthroughs to solve some of the world's biggest problems. The rich breadth of their backgrounds and research interests reflect ISE's goal to offer a comprehensive, cross-disciplinary program of teaching and research.**

# FACULTY ACCOMPLISHMENTS

## MAY 2019–MAY 2020

## Conference Papers

### JAMES ALLISON

Vedant, **J. T. Allison**. Multifunctional Structures for Attitude Control. ASME Smart Materials, Adaptive Structures and Intelligent Systems, Louisville, KY, USA, Sep 2019. DOI: 10.1115/SMASIS2019-5565

D. R. Herber, **J. T. Allison**, P. Abolmoali, R. Buettner, S. Patnaik. Architecture Generation and Performance Evaluation of Aircraft Thermal Management Systems Through Graph-based Techniques. Proc. of the 2020 AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, AIAA SciTech Forum, Jan 2020. DOI: 10.2514/6.2020-0159

Vedant, A. E. Patterson, **J. T. Allison**. Multifunctional Structures for Spacecraft Attitude Control. AAS Guidance, Navigation, and Control Conference, Breckenridge, CO, USA, Jan 2020.

A. E. Patterson, C. Chadha, I. M. Jasiuk, G. Krishnan, **J. T. Allison**. Manufacturing process-driven semi-metamaterials (MPDSMs): Design perspective and framework using scanning-type additive manufacturing processes. To appear in Solid Freeform Fabrication Symp. - An Additive Manufacturing Conf., Austin, Texas, Aug 2020.

A. E. Patterson, C. Chadha, I. M. Jasiuk, **J. T. Allison**. Fracture behavior of amorphous and semi-crystalline FDM polymer materials under plane stress and plane strain conditions: Implications for material structure design. To appear in Solid Freeform Fabrication Symp. - An Additive Manufacturing Conf., Austin, Texas, Aug 2020.

A. E. Patterson, C. Chadha, I. M Jasiuk, G. Krishnan, **J. T. Allison**. Design-for-fracture of FDM mesostructure for thermoplastic materials under manufacturability constraints. To appear in Solid Freeform Fabrication Symp. - An Additive Manufacturing Conf. Austin, Texas, Aug 2020.

C. Chadha, A. E. Patterson, I. M. Jasiuk, **J. T. Allison**. Exploring polymer healing theory to predict adhesive strength during repair of thermoplastic parts using fused deposition modeling. To appear in Solid Freeform Fabrication Symp. - An Additive Manufacturing Conf., Austin, Texas, Aug 2020.

S. R.T. Peddada, S. B. Rodriguez, K. A. James, **J. T. Allison**. Automated Layout Generation Methods for 2D Spatial Packing. To appear in Proc. of the ASME 2020 Int. Design Engineering Technical Conferences, St. Louis, MO.

S. R.T. Peddada, K. A. James, **J. T. Allison**. A Novel Two-stage Design Framework for 2D Spatial Packing of Interconnected Components. To appear in Proc. of the ASME 2020 Int. Design Engineering Technical Conferences, St. Louis, MO.

S. R. T. Peddada, A. E. Patterson, **J. T. Allison**. Manufacturing Cell Adaption to Disruptive AM Processes:Convex Optimization Approach. To appear in Proc. of the IISE Annual Conf.

and Expo, IISE - 787066, New Orleans, LA, USA, Oct 2020.

J. Jonkman, A. Wright, G. Barter, M. Hall, **J. Allison**, D. Herber. Functional Requirements for the WEIS Toolset to Enable Controls Co-Design of Floating Offshore Wind Turbines. To appear in Proc. of the ASME Int. Offshore Wind Technical Conference, Boston, MA, Oct 2020.

Vedant, **J. T. Allison**. Impact of Including Electronics Design on Design of Intelligent Structures: Applications to Multifunctional Structures For Attitude Control (MSAC). To appear in Proc. of the ASME Smart Materials, Adaptive Structures and Intelligent Systems Conference, SMASIS2020-2331, Irvine, CA, USA, Sep 2020.

## CAROLYN BECK

L. Buccafusca, J.P. Jansch-Porto, G.E. Dullerud**, C.L. Beck**. An Application of Nested Control Synthesis for Wind Farms. Proc. of the 8th IFAC Workshop on Distributed Estimation and Control in Networked Systems, 2019. Available at IFAC-PapersOnLine 52(20), 199-204.

R. Soleymanifar, A. Srivastava, **C. L. Beck**, S. Salapaka. A Clustering Approach to Edge Controller Placement in Software Defined Networks with Cost Balancing. Proc. of the 21st Int. Federation of Automatic Control (IFAC) World Congress, Berlin, July 2020.

D. Wang, J. Liu, P. E. Pare, W. Chen, L. Qiu, **C. L. Beck**, T. Basar. Controlling a Networked SIS Model via a Single Input over Undirected Graphs. Proc. of the 21st Int. Federation of Automatic Control (IFAC) World Congress, Berlin, July 2020.

X. Xie, D. Katselis, **C. L. Beck**, R Srikant. On the Consistency of Maximum Likelihood Estimators for Causal Network Identification. Accepted to the 59th IEEE Conf. on Decision and Control, South Korea, 2020.

## K. CHANDRASEKARAN

C. Carlson, **K. Chandrasekaran**, H-C. Chang, N. Kakimura, A. Kolla. Spectral Aspects of Symmetric Matrix Signings. Proc. of the 44th Int. Symp. on Mathematical Foundations of Computer Science (MFCS), 2019.

C. Beideman, **K. Chandrasekaran**, C. Xu. Multicriteria cuts and size-constrained k-cuts in hypergraphs. Int. Conf. on Randomization and Computation (RANDOM), 2020.

**K. Chandrasekaran**, E. Grigorescu, G. Istrate, S. Kulkarni, Y-S. Lin, M. Zhu. The Maximum Binary Tree Problem. European Symp. on Algorithms (ESA), 2020.

**K. Chandrasekaran**, C. Chekuri. Hypergraph k-cut for fixed k in deterministic polynomial time. To appear in IEEE Symp. on Foundations of Computer Science (FOCS), 2020.

## ALEXANDRA CHRONOPOULOU

S. Mejia, B. Ogolsky, **A. Chronopoulou**. Temporal patterns of older adult couples' spatial proximity and concordance in health and well-being. Paper to be presented at the National Council on Family Relations Conf., Fort Worth, TX, Nov 2019.

B. Ogolsky, S. T. Mejía, **A. Chronopoulou**, K. Gilleade, C. Maniotes. Physical proximity as a marker of behavioral health in older adult couples. Paper presented at the Int. Assoc. for Relationship Research Conf., Ottawa, ON, 2019.

## RASOUL ETESAMI

Y. Ruan, A. Yekkehkhany, **S.R. Etesami**. Online Learning for Job Scheduling on Heterogeneous Machines. To appear in Proc. 59rd IEEE Conf. on Decision and Control, South Korea, Dec 2020.

## JUGAL GARG

B. R. Chaudhury, **J. Garg**, K. Mehlhorn. EFX Exists for Three Agents. To Appear in Proc. of the 21st ACM Conf. on Economics and Computation (EC), 2020.

**J. Garg**, S. Taki. An Improved Approximation Algorithm for Maximin Shares. To Appear in Proc. of the 21st ACM Conf. on Economics and Computation (EC), 2020.

**J. Garg**, P. McGlaughlin. Computing Competitive Equilibria with Mixed Manna. Proc. of the 19th Int. Conf. on Autonomous Agents and Multi-Agent Systems (AAMAS), 2020.

**J. Garg**, P. Kulkarni, R. Kulkarni. Approximating Nash Social Welfare under Submodular Valuations through (Un) Matchings. To Appear in Proc. of the 31st Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2020.

## MOLLY GOLDSTEIN

**M.H. Goldstein**, Ş. Purzer, R. S. Adams. Characterizing trade-off decision abilities in middle school students. National Assoc. for Research in Science Teaching annual conference, Baltimore, MD April 2019.

R. Aleong, **M. H. Goldstein**. Balancing curriculum design trade-offs for larger learning goals: An empirical study. Clive L. Dym Mudd Design Workshop XI., Claremont, CA, June 2019.

A. Pagano, **M. H. Goldstein**, L. Liebenberg. Play-in-learning: Studying the impact of emotion and cognition in undergraduate engineering learning. Proc. of American Society for Engineering Education Annual Conf. and Exposition, Tampa, Florida, June 2019.

J. Quintana, Ş. Purzer, **M. H. Goldstein**. A discourse analysis of middle school students' explanations during a final design review. Proc. of the American Society for Engineering Education Annual Conf. and Exposition, Tampa, Florida, June 2019.

Z. Xiao, S. Zuo, J. Zhao, W. Fu, **M. H. Goldstein**, M. Philpott, J. Laystrom-Woodard, M. Pool, A. Wolters, B. Woodard. Towards understanding interrelated growth mindset and academic performance. Proc. of the American Society for Engineering Education Annual Conference and Exposition, Tampa, Florida, June 2019.

**M. H. Goldstein**, E. Sanders, G. Foreman, L. Hahn. A look at practices and effects of admission status communication. Frontiers in Education (FIE) Annual Conf., Cincinnati, OH, October 2019.

**M. H. Goldstein**, C. Schimpf, C. Understanding how high school students approach systems design. Proc. of the American Society for Engineering Education Annual Conf. and Exposition, Montreal, Canada, June 2020.

S. Gianelloni, **M. H. Goldstein**. Modelling the design systems thinking paradigm. Proc. of the American Society for Engineering Education Annual Conf. and Exposition, Montreal, Canada, June 2020.

E. Sanders, **M. H. Goldstein**, G. Foreman. Towards an understanding of the effect on summer programming on early engineering student outcomes. Proc. of the American Society for Engineering Education Annual Conf. and Exposition, Montreal, Canada, June 2020.

T. Fu, **M. H. Goldstein**, H. M. Golecki. The nuts and bolts of robotics in K-12 classrooms: A literature synthesis. Proc. of the American Society for Engineering Education Annual Conf. and Exposition, Montreal, Canada, June 2020.

C. Schimpf, **M. H. Goldstein**. Reflection in time: Using data visualization to identify student reflection modes in design. Proc. of the American Society for Engineering Education Annual Conf. and Exposition, Montreal, Canada, June 2020.

L. Bosman, E. J. McCave, **M. H. Goldstein**, K. L. Chelberg. Virtual writing group participation: Surprises and Unintended outcomes. Proc. of the American Society for Engineering Education Annual Conf. and Exposition, Montreal, Canada, June 2020.

B. E. Johnson, **M. H. Goldstein**, J. Bradley. Identifying effective student leaders to improve capstone design team assignments. Proc. of the American Society for Engineering Education Annual Conf. and Exposition, Montreal, Canada, June 2020.

## T. KESAVADAS

F. Wang, N. Toombs, **T. Kesavadas**, P. Ferreira. Mechanical Design and Modeling of a Manipulator Tool for a Compact Multiple-Tool Single Port Laparoscopic Robot Platform. Proc. of IEEE Engineering in Medicine and Biology Conf., Berlin, July 2019.

S. Pareek, H. Manjunath, E. T. Esfahani, **T. Kesavadas**. MyoTrack: Realtime Estimation of Subject Participation in Robotic Rehabilitation Using sEMG and IMU. Proc. of IEEE Robotics and Automation Conf., Paris, May 2020.

H. Sharif, S. B. Seo, **T. Kesavadas.** Hand Gesture Recognition Using Surface Electromyography. To appear in Proc. of 42nd Annual Int. Conf. of the IEEE Engineering in Medicine

and Biology Society (EMBC), Montreal, Canada, July 2020.

L. Lee, **T. Kesavadas**. Content Validation Study to Evaluate Food Safety Training in Virtual Reality. To appear in Proc. of Human Factors and Ergonomics Society (HFES) Conference, October, 2020.

N. Sankaran, **T. Kesavadas**. RNN-LSTM Based Tissue Classification in Robotic System for Breast Biopsy. To appear in Proc. of 8th IEEE RAS/EMBS Int. Conf. on Biomedical Robotics and Biomechatronics (BioRob), New York, NY, 2020.

## HARRISON KIM

M. Saidani, **H. M. Kim**, B. Yannou, Y. Leroy, F. Cluzel. Framing Product Circularity Performance for Optimized Green Profit. ASME IDETC, DETC2019-98390, 2019.

M. Saidani, **H. M. Kim**, B. Yannou, Y. Leroy, F. Cluzel. C-indicators: a web-based platform to monitor and improve the circularity potential of products. ASME IDETC, Design Tool Showcase, 2019.

M. Saidani, E. Pan, **H. M. Kim**, A. Greenlee, J. Wattonville, B. Yannou, Y. Leroy, F. Cluzel. Assessing the environmental and economic sustainability of autonomous systems: A case study in the agricultural industry. Procedia CIRP, Accepted, 2020.

A. El Ghzizal, M. Saidani, B. Yannou, Y. Leroy, **H. M. Kim**. Towards a framework to evaluate the life cycle sustainability performance of autonomous systems. eCONFERE20, 27ème colloque des Sciences de la conception et de l'innovation, 2020.

M. Saidani, B. Yannou, Y. Leroy, F. Cluzel, **H. M. Kim**. How circular economy and industrial ecology concepts are intertwined? A bibliometric and text mining analysis. INFER2020, Online Symp. on Circular Economy and Sustainability, Alexandroupolis, Greece, July 2020.

M. Saidani, B. Yannou, Y. Leroy, F. Cluzel, **H. M. Kim**. Multi-tool methodology to evaluate action levers to close-the-loop on critical materials – Application to precious metals used in catalytic converters. INFER2020, Online Symp. on Circular Economy and Sustainability, Alexandroupolis, Greece, July 2020.

M. Saidani, **H. M. Kim**, F. Cluzel, Y. Leroy, B. Yannou. Product circularity indicators: what contributions in designing for a circular economy? DESIGN, Dubrovnik, Croatia, 2020.

J. Kim, M. Saidani, **H. M. Kim**. Optimal Product Family Architecture Design and Commonality Decision for Sustainability and Intellectual Property Protection. ASME IDETC/CIE, 2020.

M. Saidani, E. Pan, **H. M. Kim**. Switching from petroleum- to bio-based plastics: visualization tools to screen sustainable material alternatives during the design process. ASME IDETC/CIE, 2020.

J. Joung, **H. M. Kim**. Importance-performance analysis of product attributes using explainable deep neural network from online reviews. ASME IDETC/CIE, 2020.

S. Park, **H. M. Kim**. Improving the Accuracy and Diversity Of Feature Extraction From Online Reviews Using Keyword Embedding and Two Clustering Methods. ASME IDETC/CIE, 2020.

M. Saidani, E. Pan, K. Ng, **H. M. Kim**. New visualization tools for designers to identify bio-based plastic substitutes considering carbon footprint and material properties. ASME IDETC/CIE, 2020.

## GIRISH KRISHNAN

N.K. Uppalapati, A. Havens, B. Walt, A. Mahdian, G. Chowdhary, **G. Krishnan**. A Berry Picking Robot with A Hybrid Soft-Rigid Arm: Design and Task Space Control. To appear in 2020 Robotic Science and Systems.

S. Satheeshbabu, N.K.Uppalapati, T. Fu, and **G. Krishnan**. Continuous Control of a Soft Continuum Arm using Deep Reinforcement Learning. To appear in Proc. of RoboSoft 2020, IEEE International Conference of Soft Robotics.

S. Satheeshbabu, **G. Krishnan.** Analysis of Soft Mechanisms Using a Homogenized Strain Induced Model. Proc. of the 2020 USCToMM Symposium on Mechanical Systems and Robotics. USCToMM MSR 2020. Mechanisms and Machine Science, vol 83. Springer, Cham (pp. 179–195).

## YUMENG LI

Z. Zheng, X. Chen, **Y. Li**. Numerical Study on the Interfacial Modification Effects Of Soy Protein on POLY(VINYLIDENE FLUORIDE), IMECE2019- 11694, Proc. of the ASME Int. Mechanical Engineering Congress and Exposition, Salt Lake City, UT, USA, Nov 2019.

H. Zhou, X. Chen, **Y. Li**. Design of Gradient Nanotwinned Metal Materials using Adaptive Gaussian Process Based Surrogate Models, DETC2019-97659, Proc. of the Int. Design Engineering Technical Conferences & Computers and Information in Engineering Conf., Anaheim, California, USA, Aug 2019.

A. Singh, X. Chen, **Y. Li**, S. Koric, E. Guleryuz. Development of Artificial Neural Network Potential for Graphene. AIAA Scitech 2020 Forum, Session: Applications of Artificial Intelligence and Machine Learning to Problems in Structures and Materials II, AIAA 2020-1861.

## LAVANYA MARLA

M. Z. Li, K. Gopalakrishnan, H. Balakrishnan, S. H. Shin, D. Jalan, A. Nandi, **L. Marla**. Dynamics of Disruption and Recovery in Air Transportation Networks. Ninth Int. Conf. on Research in Air Transportation (ICRAT), Tampa, Florida, June 2020.

A. Kolbeinsson, N. Shukla, A. Gupta, **L. Marla.** Leveraging Time Dependency in Graphs. Graph Representation Learning Workshop at NeurIPS, 2020.

## RAKESH NAGI

H. N.Z. Matin, A. Yekkekhany, **R. Nagi**. Probabilistic Analysis of UAV Routing with Dynamically Arriving Targets. 22nd Int. Conf. on Information Fusion, Ottawa, Canada, July 2019.

O. Reynen, S. Vadrevu, **R. Nagi**, K. LeGrand. Large-scale Multi-dimensional Assignment: Problem Formulations and GPU Accelerated Solutions. 22nd Int. Conf. on Information Fusion, Ottawa, Canada, July 2019.

A. Ghayoori, **R. Nagi**. Seed Investment Bounds for Viral Marketing Strategies under Generalized Diffusion. IEEE/ACM Int. Conf. on Advances in Social Networks Analysis and Mining (ASONAM 2019), Vancouver, Canada, August 2019.

S. Huang, C. Pearson, **R. Nagi**, J. Xiong, D. Chen, W-M. Hwu. Accelerating Sparse Deep Neural Networks on FPGAs. High Performance Extreme Computing Conf. (HPEC), 2018 IEEE, Waltham, MA, Sept 2019.

C. Pearson, M. Almasri, O. Anjum, Z. Qureshi, V. S. Mailthody, **R. Nagi**, J. Xiong, W-M. Hwu. Update on triangle counting on GPU. High Performance Extreme Computing Conference (HPEC), 2019 IEEE, Waltham, MA, Sept 2019.

M. Almasri, O. Anjum, C. Pearson, Z. Qureshi, V. S. Mailthody, **R. Nagi**, J. Xiong, W-H. Hwu. Update on k-truss Decomposition on GPU. High Performance Extreme Computing Conference (HPEC), 2019 IEEE, Waltham, MA, Sept 2019.

A. Yekkekhany, E. Arian, M. Hajiesmaili, **R. Nagi**. Risk-Averse Explore-then-Commit Algorithms for Finite-Time Bandits. IEEE Conf. on Decision and Control (CDC), Nice, France, Dec 2019.

D. Kim, D. Chen, **R. Nagi**. Thanos: High-Performance CPU-GPU Based Balanced Graph Partitioning Using Cross-Decomposition. 25th Asia and South Pacific Design Automation Conf. ASP DAC 2020, Beijing, China, January 2020.

S. Vadrevu, **R. Nagi**. A Dual-Ascent Algorithm for the Multi-dimensional Assignment Problem: Application to Multi-Target Tracking. 23rd Int. Conf. on Information Fusion, South Africa, July 2020.

R. Sengupta, **R. Nagi**, W. R. Norris, R. S. Sreenivas, D. Nottage, A. Soylemezoglu. A Balancing Algorithm for Robust Decentralized Parallel Machine Scheduling to Minimize Makespan. Accepted to Industrial and Systems Engineering Research Conf., New Orleans LA, Oct-Nov 2020.

J. Lewandowski, **R. Nagi**, W. R. Norris, R. S. Sreenivas, D. Nottage, A. Soylemezoglu, A. An Ontology for Semantic Classification of Construction Areas and Tasks. Accepted to Industrial and Systems Engineering Research Conference, New Orleans LA, Oct-Nov 2020.

M. Hiyadetoglu, V. S. Mailthody, C. Pearson, E. Ebrahimi, J. Xiong, **R. Nagi**, W-M. Hwu. Efficient Inference on GPUs for the Sparse Deep Neural Network Graph Challenge 2020. High Performance Extreme Comput-

ing Conference (HPEC), 2020 IEEE, Waltham, MA, Sept 2020.

## WILLIAM NORRIS

J. Xu, **W. R. Norris**. Hierarchical Mamdani-type Fuzzy Logic Control Design with Stability Criteria Accepted to CACRE 2019 and indexed by ACM.

J. Lewandowski, R. Nagi, **W. R. Norris**, R. Sreenivas, D. Nottage, A. Soylemezoglu. An Ontology for Semantic Classification of Construction Areas and Tasks. Proc. of the 2020 IISE Annual Conference.

S. Sengupta, R. Nagi, **W. R. Norris**, R. Sreenivas, D. Nottage, A. Soylemezoglu. A Balancing Algorithm for Robust Decentralized Parallel Machine Scheduling to Minimize Makespan. Proc. of the 2020 IISE Annual Conference.

H. Cui, J. Zhang, **W. R. Norris**. A Safety and Reliability Enhanced Autonomous Driving Platform using ROS2. IEEE Int. Conf. on Mechatronics and Automation, 2020.

## HENRIQUE REIS

A. Sethi, **H. Reis**. Roll threader manufacturing process control for miniature fasteners. Health Monitoring of Structural and Biological Systems XI, SPIE Smart Structures/NDE 2020, April 2020.

## RICHARD SOWERS

R. Sun, R. Kaur, L. Ziegelman, S. Yang, **R. Sowers**, M. E. Hernandez. Using Virtual Reality to Examine the Correlation between Balance Function and Anxiety in Stance. 10th Int. Workshop on Biomedical and Health Informatics/IEEE BIBM, 2019.

R. Kaur, S. Menon, X. Zhang, **R. Sowers**, M. Hernandez. Exploring Characteristic Features in Gait Patterns for Predicting Multiple Sclerosis. 41th Annual Int. Conf. of the IEEE Engineering in Medicine and Biology Society (EMBC'19), 2019.

R. Kaur, R. Sun, L. Ziegelman, **R. Sowers**, M. E. Hernandez. Using Virtual Reality to Examine the Neural and Physiological Anxiety-Related Responses to Balance-Demanding Target-Reaching Leaning Tasks. IEEE-RAS 19th Int. Conf. on Humanoid Robots, 2019.

R. Kaur, M. Korolkov, M. E. Hernandez, **R. Sowers**. Automatic Identification of Brain Independent Components in Electroencephalography Data Collected while Standing in a Virtually Immersive Environment - A Deep Learning-Based Approach. 42nd Annual Int. Conf. of the IEEE Engineering in Medicine and Biology Society (EMBC'20), Québec, Canada, 2020.

H. N. Z. Matin, **R. B. Sowers**. Nonlinear Optimal Velocity Car Following Dynamics (I): Approximation in Presence of Deterministic and Stochastic Perturbations. American Control Conference, Denver, 2020.

H. N. Z. Matin, **R. B. Sowers**. Nonlinear Optimal Velocity Car Following Dynamics (II): Rate of Convergence In the Presence of Fast Perturbation. American Control Conference, Denver, 2020.

Y. Hu, A. Bishnoi, R. Kaur, **R. Sowers**, M. E. Hernandez. Exploration of Machine Learning to Identify Community Dwelling Older Adults with Balance Dysfunction Using Short Duration Accelerometer Data. 42nd Annual Int. Conf. of the IEEE Engineering in Medicine and Biology Society (EMBC'20), Québec, Canada, 2020.

## R.S. SREENIVAS

A. Raman, R. Sowers, **R.S. Sreenivas**. An Affordable and Portable Technology for Real-Time Scheduling of Appliances in Smart Home. Proc. of the 4th North American Conf. on Industrial Engineering and Operations Management Toronto, Canada, Oct 2019.

K. Blocker, L. Koon, T. Kadylak, W. Ramadhani, R. Khaleghi, C. Kovac, **R.S. Sreenivas**, W. Rogers. Smart Home Technology for Older Adults with Mobility Disabilities: Potential and Challenges. Proc. of The Gerontological Society of America (GSA) 71st Annual Scientific Meeting, Austin, TX, Nov 2019

L. Koon, R. Khaleghi, K. Blocker, W. Rogers, **R.S. Sreenivas.** Integrating Voice-Activated Digital Assistants with Smart Home Technologies to Support People with Long-Term Mobility Disabilities: Needs-Assessment, Product-Selection and Implementation. Proc. of the 10th Int. Conf. on Industrial Engineering and Operations Management (IEOM), Dubai, UAE, March 2020.

L. Courtney, **R.S. Sreenivas**. Using Deep Convolutional LSTM Networks for Learning Spatiotemporal Features. Proc. of the 5th Asian Conference on Pattern Recognition (ACPR 2019), Auckland, New Zealand, Nov 2019.

A. Raman, **R.S. Sreenivas**. Fault-Tolerant Control of Discrete-Event Systems with Controllability Failures. Proc. of the 59th IEEE Conf. on Decision and Control (CDC), Dec 2020.

## DUSAN STIPANOVIC

M. Amrouche, T. Marinho, **D. M. Stipanović**. Vision Based Collision Avoidance for Multi-Agent Systems Using Avoidance Functions. To appear in Proc. of the European Control Conference, Saint Petersburg, Russia, May 2020.

A. Lekić-Vervoort, M. Majstorović, L. Ristić, **D. M. Stipanović**. Hysteresis Control of the Pseudo Boost PFC Converter. To appear in Proc. of 29th IEEE Int. Symp. on Industrial Electronics, Delft, The Netherlands, June 2020.

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# Grants

### JAMES ALLISON

NSF POETS (IAB Award), 2019-2020, $40,024 out of $104,925, I1.011.19 Novel Solution Methods for Optimal Spatial Packaging and Routing of Electro-Thermal Components, PI: Kai James

NSF, 2019-2020, $50,000 Workshop: Integrated Design of Active Dynamic Systems (IDADS), UIUC

ARPA-E ATLANTIS (DOE), 2020-2022, $550,450 out of $2.8 M, Wind Energy with Integrated Servo-control (WEIS): A Tool Set to Enable Controls Co- Design of Floating Offshore Wind Energy Systems, PI: Alan Wright

ARPA-E ATLANTIS (DOE), 2020-2022, $329,734 out of $3.7 M, A Low-cost Floating Offshore Vertical Axis Wind System, PI: Todd Griffith

NSF 2021, $70,000, Data-Driven Knowledge Extraction from Design Optimization Data

NSF POETS, 2020-2022, $72,708 out of $143,749, A Multidisciplinary Design Optimization Framework for Efficient Design of Multi-Domain Systems-of-Systems, PI: Kai James

NSF POETS, 2020-*2022, $169,538, Extension of POETS Packing and Routing Methods to Industry-Relevant 3D Electro-thermal Problems*

*N*NSA (DOE), 2020-2025, ~$95,000 out of $17,000,000, Center for Exascale-enabled Scramjet Design 20, PI: Jonathan Freund

### CAROLYN BECK

Jump-ARCHES, 2020, $32,000, Data-driven Modeling, Analysis and Simulation of Epidemic Processes: Controlling COVID-19

C3.ai, 6/20-6/21, $50,000 out of $300,000, Algorithms and Software Tools for Modeling, Data Assimilation and Control of COVID-19 PI: Prashant Mehta

## XIN CHEN

Kiwai, 2020-2021, $38,200, Recommendation system for Kiwai videos

## RASOUL ETESAMI

NSF-CAREER Award, 2020-2025, $500,000, Duality and Stability in Complex State-Dependent Networked Dynamics

## JUGAL GARG

NSF-CAREER, 2020-2025, $505,052, New Algorithmic Foundations for Fair Division through Competitive Equilibrium

## MOLLY GOLDSTEIN

NSF, IUSE, 2019-2023, $159,388 out of $2.2 M, Educating Generative Designers in Engineering PI: Zhenghui. Sha

## WILLIAM NORRIS

DoD Corps of Engineers, 2019-2022, $400,000 out of $1.2 M, Mission Planning and Optimization with Multiple Robotic Agents for Engineer Operations in the Deployed Environment, PI: Rakesh Nagi

DoD Corps of Engineers, 2019-2022, $1,200,000, Autonomous Steering, Speed and Implement Control Using Expert Systems and Machine Learning with Model Based Path Planning

NSF, 2020-2024, $500,000 out of $1.5 M, Modular, Interactive and Adaptive Personalized Unique Rolling Experience. In process, PI: Elizabeth Hsiao-Wecksler

Discovery Partners Institute, 2020-2021, $125,000, Developing the Center of Excellence for Autonomous Construction, Agriculture and Manufacturing at Scale (CEACAMS) Research Cluster

## NIAO HE

NSF HDR TRIPODS, 2019-2022, $1,500,000 total, HDR TRIPODS: Illinois Institute for Data Science and Dynamical Systems, Co-PIs: Maxim Raginsky, Niao He, R. Srikant, Yuguo Chen, Sanmi Kojeyo

UIUC Strategic Research Initiative, 2019-2020, $75,000 total, Towards Illinois Center For Data Science and Dynamical Systems, Co-PIs: Maxim Raginsky, Niao He, R. Srikant, Yuguo Chen, Sanmi Kojeyo

NSF AI Institute, 2020-2024, $850,000, AI Institute: Next Generation Food Systems Co-PI: Niao He

## T. KESAVADAS

Jump ARCHES, 2020-2021, $75,000, Virtual Reality to Deliver Psychotherapy to Lung Cancer Patients with Depression, PI: Rosalba Hernandez

Jump ARCHES, 2020-2021, $75,000, A-Eye: Automated Retinopathy of Prematurity Detection and Analysis, PI: Thomas Huang

Jump ARCHES, 2020-2021, $66,100, Skill Assessment in Surgery and Microsurgery, PI: Heidi Phillips

## HARRISON KIM

John Deere, 2019-2020, $96,677, Sustainable Product Design - Phase X

DOE EERE, 2021 $387,001 out of $10.9M, Development of High Energy Density Thermomagnetic Processing Technology for Intensification of Industrial Heat-treatment and Increased Material Performance, PI: Michele Manual

DoE REMADE, 2020-2022, $1,000,000, Quantification of financial and environmental benefits tradeoff in multi-generational product family development considering Re-X performances,

## GIRISH KRISHNAN

General Motors Research and Development Corportation, 2020-2021, $39,400, Feasibility assessment of lightweight structures with a pressurized reinforcing core

JUMP (ARCHES), 2020-2021, $50,000, Design and Validation of a Soft Robotic Cardiac Trans-septal Puncture Simulator

JUMP (ARCHES), 2020-2021, $20,000 out of $75,000, Autonomous Morphing Bed Mattress for ALS patients with Limited Movement Ability, PI: Elizabeth Hsiao-Wecksler

## YUMENG LI

NSF, 2020-2023, $ 59,772 out of $400,000, Bioinspired Antimicrobial Flexible Polymer Thin Films: Fabrication, Mechanism, and Integration for Multi-Functionality, PI: Dr. Qing Cao

UIUC NCSA Faculty Fellows Program, 2019, $25,000, Accelerating the Discovery of advanced nanodielectrics through AI-accelerated multiscale simulation

## LAVANYA MARLA

Jump ARCHES, 2020, $39,998, Supply-Driven Hospital Resources Planning and Community Engagement for COVID-19 Treatment

Jump ARCHES, 2020-2021, $13,652 out of $75,000, Optimizing Deployment of Community Health Workers, PI: Dr. Sarah Ramirez

## RAKESH NAGI

Discovery Partners Initiative, 2020-2021, $37,500 out of $125,000, Center for Autonomous Construction, Agriculture and Manufacturing at Scale (CEACAMS), PI Norris

Sandia National Labs, 2019-2020, $75,000, Autonomous Multi-Platform Sensor Scheduling

CERL/ERDC US Army, 2019-2022, $1,200,000, Mission Planning and Optimization with Multiple Robotic Agents for Engineer Operations in the Deployed Environment

## HENRIQUE REIS

REMADE, 2019-2021, $50,000, Strength Estimation of fatigued steel

## R.S. SREENIVAS

Office of Naval Research, 2020-2023, $224,767 out of $899,069, Explainable AI for Mission Planning and Execution with Interpretable Courses of Action, PI: H Trong

Jump ARCHES, 2020-2021, $35,000, Rapid, Contactless Vital Signs Collection Using Computer Vision and Consumer Technologies

US Army Research Laboratory, 2020-2022, $173,151 out of $865,755, Robust and Adaptive Autonomy for Multi-agent Maneuvers (RAAMM), PI: G. Chowdhary

Discovery Partners Institute, 2020-2021, $41,667 out of $125,000, The Center for Autonomous Construction, Agriculture and Manufacturing at Scale (CEACAMS), PI: W.R. Norris

## DUSAN STIPANOVIC

NSF National Robotics Initiative and USDA-NIFA, 2020-2022, $225,000 out of $749,182, Multi-Vehicle Systems for Collecting Shadow-Free Imagery in Precision Agriculture, Co-PIs: Prof. Murmann, Prof. Romlin, Dr. Poling

## CHRYSAFIS VOGIATZIS

NSF, 2019-2022, $36,981 out of $461,226, Innovations in Graduate Education: Developing a Research Engineer Identity, PI: Ram Bala

Army Research Lab, 2018-2020, $100,000, Contextualizing knowledge and perception in dynamic environments using interdependent network analysis

## PINGFENG WANG

DoE (subcontract from UTD), 2019-2022, $800,000, Multi-Timescale Nuclear-Renewable Hybrid Energy Systems Operations to Improve Electricity System Resilience, Reliability, and Economic Efficiency

iSEE Institute, 2019-2021, $30,000, Forecasting Infrastructure Impacts for Socially-aware Community Resilience with Heterogeneous Data

NSF POETS ERC, 2019-2021, $150,000 out of $500,000, C2C on Energy and the Environment: Data-driven Reliability of Carbon-based Energy Conversion, Capture and Storage Systems, PI: Debbie Senesky

NSF POETS ERC, 2020, $77,792, Reliability-Based Co-Design of a Battery Power-Thermal Coupled Management Systems

NSF POETS ERC, 2020-2021, $39,200 out of $140,000, Combined Electromigration and Mechanical Failure Risk in Interconnects: The Imminent Threat to Power Package Reliability: PI: David Huitink

Alfred P. Sloan Foundation (subcontract from Stanford), 2020-2023, $1,266,762, Data-driven Reliability of Carbon Capture and Storage (CCS) Systems via Harsh Environment Sensing

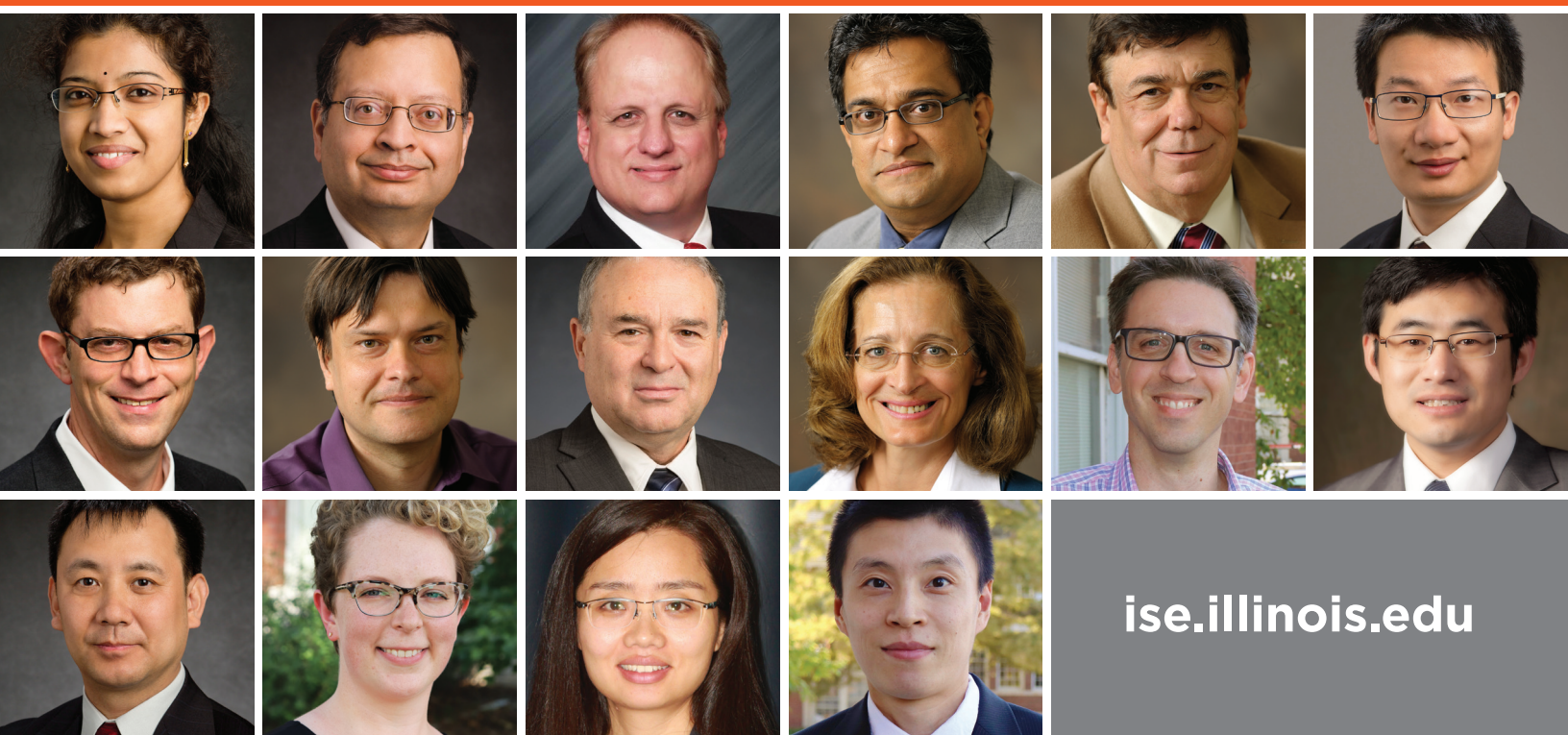
DoE (through REMADE), 2020-2022, $400,000 out of $1 M, Quantification of financial and environmental benefits tradeoff in multi-generational product family development considering Re-X performances, PI: Harrison Kim

NSF, 2021-2025, $650,000 out of $3.25 M, FMRG: Holistic Design of Low-Cost and Recyclable High Energy Density Li-ion Batteries, PI: Paul Braun

## YUAN ZHOU

JP Morgan Chase, 2020-2021, $75,000, JP Morgan Chase Faculty Award

# TEAM ISE



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