DIMENSIONS

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IOWA STATE UNIVERSITY
Department of Mechanical Engineering

Message from the Chair

Dear alumni and friends,

I am proud to share the stories and achievements of our students, faculty, staff and alumni of the Department of Mechanical Engineering at Iowa State University.

This issue includes stories about:

ME researchers who are collaborating with a colleague in agricultural and biosystems engineering on a U.S. Department of Agriculture-funded project that aims to develop new data-driven irrigation systems that encourage the use of alternatives to fresh water while protecting crop health

an ME researcher who has received funding from the National Science Foundation to develop "bury-and-forget" soil sensors which can be used to improve soil and water quality

a collaboration between an ME researcher and a one from computer engineering that utilizes game theory to quantify threat levels of potential cyberattacks on the power grid

four new staff members who have joined to our team: Tessa Brow and Mindy Heggen as Academic Advisers; Kim Heller as an Administrative Specialist and Kim McFarland as the Undergraduate Program Assistant…we are also currently looking to hire new faculty members at both the tenure/tenure-track and non-tenure-track levels

an ME junior who won two national research awards while interning with the U.S. Army Research Laboratory over the summer

two ME alums who were recently named to the Board of Directors for Iowa State's Alumni Association

as the world recently celebrated the 100th anniversary of the conclusion of the Great War, we remember the role that Iowa State's Department of Mechanical Engineering played in assisting the war effort a century ago

Next year, 2019 will mark the 150th anniversary of the first class of students entering Iowa State, which included ME's first alum Edgar Stanton. To commemorate this event, we are publishing a book that will tell the story of our department's history. If you have suggestions for stories and other items we might include, please contact our communications specialist at mecommunications@iastate.edu or 515.294.5065.

Our alumni are vital to the growth and success of mechanical engineering and industry in the U.S. and abroad. We enjoy hearing about your accomplishments. Please feel free to reach out and share your story. You can contact us at mealumni@iastate.edu.

Regards,

Caroline Hayes
Department Chair
Lynn Gleason Professor of Interdisciplinary Engineering

On the cover

Logan Blom, a freshman in mechanical engineering, readies his rubber band car during the Mechanical Engineering Learning Team (MELT) fall competition which took place in the Howe Hall Atrium on Nov. 15, 2018. Photo by Nick Fetty

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Faculty and staff honors

Jonathan Claussen, Assistant Professor
Early Career Engineering Faculty Research Award

Baskar Ganapathysubramanian, Professor
Marvin A. Pomerantz Award

Chao Hu, Assistant Professor
American Society of Mechanical Engineers (ASME)Teacher Design Automation Young Investigator Award

Paola Pittoni, Lecturer
Superior Engineering Teacher Award

Jessica Van Winkle, Former Academic Adviser
Superior Engineering Adviser Award

Graduate student honors

Fall 2018 Research Excellence Awards
Jake Lindstrom
Mohammadkazem Sadoughi
Srilok Srinivasan
Cheng-Hao Wu

Fall 2018 Teaching Excellence Awards
Sayani Maity
Heather Muchowski
Ryan Ogren

Austin Downey
Patent awarded for "Apparatus, method and system for high capacity band brake type variable friction damping of movement of structures"

Undergraduate student honors

Nemeer Jaleel Padiyath, named Outstanding Senior for Fall 2018 commencement

ME 324L Undergraduate Teaching Assistant CYtation Award
Arianna Anderson
Scott Garrett
Dustin Hagemann
Preston Hoye
Jace Holton
Nathan Perk
Jacob Smidt
Dillon Waugh

Student Team Updates

Cardinal Space Mining

Cardinal Space Mining (CSM) at Iowa State University is a diverse team of students that incorporates a variety of ideas, backgrounds, and personalities. Team members range from different majors including Engineering, Liberal Arts, Agriculture, Business and Design. Each year, CSM designs and builds a specialized rover to compete in NASA's Robotic Mining Competition at the Kennedy Space Center Visitors Center. The competition consists of around 50 teams working to collect the most simulated Martian material in two 10-minute trials. Teams compete to win the Joe Kosmo Award for Excellence, which is awarded to the team showing the best all-around performance.

In September the team held their Systems Requirements Review (SRR) where they came up with requirements for what their robot must accomplish. After holding the SRR and solidifying the expectations for the year, CSM split into sub-teams who began to design the subsystems of the robot to meet the requirements. CSM then held three Preliminary Design Reviews in November to evaluate how each subsystem was meeting the expectations. These design reviews were attended by current and former CSM members as well as faculty from the College of Engineering who provided insight to each subsystem. CSM plans to wrap up their designs in January so they can begin manufacturing in February. On top of focusing on their design work, CSM members are also participating in outreach events to promote Science, Technology, Engineering, and Math (STEM) in the community. CSM will continue to seek outreach opportunities throughout 2019 as well since they are an integral part of our team.

PrISUm Solar Car

PrISUm spent the Fall Semester adapting. Following the summer competitions, many changes were discussed and made regarding the next solar car and the team. The release of a new set of competition regulations pushed us to reevaluate the core features of the Project 15. Designs were optimized even further than what had already been done, some designs went back to the drawing board, and some designs were started from scratch. However, the most important thing that happened is the start of manufacturing. Once the outer shell of the next car was finalized in September we began manufacturing the composite outer shell of the car. Key elements of that include the structural monocoque tub, the roof, and the side panels. Once those are complete in the early spring, other sub-systems such as suspension, steering, battery, interior, and more can start being installed and a car will be built.

Changes were also initiated to the workings and the culture of the team. A focus on more thorough planning of sub-projects, meeting deadlines, conducting design reviews with team members past and present, and creating a culture of accountability were some of the key goals heading into the semester. The progress along those fronts is less visible but continues to happen. PrISUm is changing the paradigm of transportation, look out for us to unveil Project 15 in the late spring to see the evolution in what is possible.

MoSAIc prepares students for careers in research, and beyond

Wubshet, fourth from the left, poses with other members of the 2015 MoSAIc REU cohort. De Penning is also pictured sixth from the left.

As a summer research program within the mechanical engineering department prepares to enter its 10th year, program alums have reflected on their experience and how it helped them get to where they are now.

The MoSAIc (Multiscale Sensing Actuation and Imaging) REU (Research Experience for Undergraduates) program was launched at Iowa State in 2010. The MoSAIc program – which is hosted by Iowa State's Department of Mechanical Engineering (ME) – serves as one site within the National Science Foundation's national REU program. MoSAIc is one of eight REU sites on campus and one of four within Iowa State's College of Engineering.

MoSAIc is a 10-week summer program that provides novel research experiences for undergraduate students in the areas of design and manufacturing of micro/nanoscale sensors, actuators, and smart materials, as well as advanced imaging and diagnostic systems. The students work alongside faculty advisers and at the end of the summer present their findings during a poster symposium which includes students from all REU programs on campus.

Each cohort consists of roughly 10 students and the program aims to prepare these students for post-undergraduate education and careers in research. Rebekah De Penning was part of the 2015 cohort and she worked alongside ME Assistant Professor Sonal Padalkar. De Penning said her experience in the MoSAIc program influenced her to pursue her Ph.D. in ME from Iowa State.

"Through the MoSAIc program, I learned research methods and writing skills. In the lab, I learned how to use the equipment, design and perform experiments and analyze data," said De Penning. "Our project was to optimize the parameters for gold nanoparticle synthesis. Gold nanoparticles are a very versatile nanomaterial, and it was my job that summer to test different ways of making them so that we could figure out which method was best."

This past summer De Penning served as the graduate mentor for the MoSAIc cohort. Her responsibilities included planning group activities, giving tours of campus and answering any questions the students had throughout the summer.

Now as a graduate student, De Penning has continued her work in the lab of Dr. Padalkar, who also serves as her adviser.

"When I was applying to grad schools, I asked her if she had room for another grad student in her lab, and she agreed to take me on. Because of the program she was already familiar with me and my work," De Penning said.

De Penning added that the skills she gained through her MoSAIc experience, continue to be applicable to the research she does today.

"I am working on different projects now, but the same research principles apply. To work in any laboratory, you need to know about safety, to patiently wait for your experiments to finish, and to be careful when setting them up. I knew some of these things from undergraduate labs, but the MoSAIc program made me really take ownership of what I was doing, so those practices really sank in," she said.

Nadab Wubshet was also part of the 2015 MoSAIc REU cohort. At the time he was a sophomore studying ME at Washington University in St. Louis. While with MoSAIc, Wubshet was advised by ME Professor Baskar Ganapathysubramanian and his summer research focused on modelling of microfluidic flow sculpting. Wubshet worked alongside then-Ph.D. student Daniel Stoecklein, who is currently a postdoc in the Di Carlo Laboratory at UCLA.

"It was very helpful for me to work under the close supervision of Dan, as he was more than willing to introduce me to the research before I became engaged fully," said Wubshet. "By the end of program, I had a strong enough understanding of the research that I co-authored an article published in the *Journal of Fluids Engineering*."

Wubshet is currently pursuing a Ph.D. in mechanical engineering from the University of Michigan where he works in Allen Liu's Laboratory of Cellular and Molecular Systems. His research focuses on building artificial cells. Similar to De Penning, Wubshet said his experience in the MoSAIc program was influential on his academic development.

"The MoSAIc experience opened multiple doors for me. First, it gave me the opportunity to have a research experience regardless of my nominal prior research experience as just a sophomore. Moreover, it was an experience that encouraged me and gave me an incentive to pursue graduate school," he said.

Both Wubshet and De Penning encourage younger students to seriously consider the MoSIAc REU program, even if those students don't know what exactly they want to do for research or what they want to do after graduation.

"Even if you're not sure you'd want to go to grad school, it doesn't hurt to try it. Think of it like an internship. You might discover that you really like grad school, and you might not. Isn't it better to figure that out during a summer internship than after you graduate?" De Penning said.

NSF grant aims to train research-based graduate students for various career paths

Brown

A National Science Foundation (NSF) grant awarded to an interdisciplinary team will combine elements of engineering with agriculture, economics and sociology to prepare research-based graduate students for an array of career paths.

Robert C. Brown, a distinguished professor of mechanical engineering and Gary and Donna Hoover Chair in Mechanical Engineering is serving as a co-Principal Investigator (co-PI) on the project, along with Sarah Ryan, Joseph Walkup Professor in industrial engineering (PI); Amy Kaleita, professor of agricultural and biosystems engineering (ABE) (co-PI); Sergio Lence, professor of economics and Marlin Cole Chair of International Agricultural Economics (co-PI); and Michelle Soupir, associate professor of ABE (co-PI).

The nearly $3 million grant was awarded by NSF's Division of Graduate Education. The project will help to prepare research-based graduate students for a variety of career paths, including research scientists, bioeconomy entrepreneurs, agribusiness leaders, policy makers, agriculture analytics specialists and professors.

"The research theme is data-driven systems modeling and decision making to more efficiently produce food, transform primary energy sources into energy carriers, and enhance water quality. The interactions among these three efforts create opportunities to improve the design and operation of all three systems together," Ryan said.

Through this project, the research team will train 48 M.S. and Ph.D. students, including 24 funded Ph.D. trainees, from ABE, agronomy, industrial engineering, mechanical engineering, and natural resource ecology and management.

"The research is inherently interdisciplinary and requires understanding of how food, energy and water systems interact. Some of the PIs and core participants bring expertise in one or more of those domains," said Ryan. "We also have team members that focus on the economic and sociological aspects of implementing solutions in the context of Midwest agriculture as well as team members with expertise in systems modeling and data analytics."

The traineeship program will cover four components. First, trainees will develop a fundamental understanding of interactions among food production, water quality and bioenergy; data acquisition, visualization, and analytics; complex systems modeling for decision support; and the economics, policy and sociology of the food, energy and water (FEW) nexus.

Second, participants will conduct interdisciplinary research on technologies and practices to increase agriculture's contributions to energy supply while reducing its negative impacts on water quality and human health, data science to increase crop productivity within the constraints of sustainable intensification, and decision sciences to manage trade-offs and promote best practices among diverse stakeholders.

Next, they will participate in a new graduate learning community consisting of a two-year series of workshops that focus in alternate years on the context of the Midwest agricultural FEW nexus and professional development, with emphasis on communication, entrepreneurship and collaboration.

Finally, they will have small-group experiences to promote collaboration and peer review. Each trainee will create and curate a portfolio that combines artifacts from coursework and research with reflections on the broader impacts of their work.

Sarkar

Soumik Sarkar, an assistant professor of mechanical engineering will also serve as a faculty mentor for students involved in the program. His research for this project focuses on data analytics and machine learning for cyber-physical systems. Faculty from aerospace engineering, agronomy, industrial and manufacturing systems engineering, natural resource ecology & management, and sociology will also serve as mentors.

Work on this project began in September and the traineeship funding continues through August 2023.

For more info, visit *www.me.iastate.edu/datafewsion/*

New faces in ME

Tessa Brow
Academic Adviser

Mindy Heggen
Academic Adviser

Kim Heller
Administrative Specialist

Kim McFarland
Undergraduate Program Assistant

Kolar goes against a West Virginia defender in Iowa State's game against the Mountaineers on Oct. 13. Photo courtesy of Iowa State University Athletics.

Three ME student-athletes receive All-Big 12 honors in football

Three mechanical engineering student-athletes have received All-Big 12 honors for football.

Charlie Kolar, a redshirt freshman tight end, and Kene Nwangwu, a redshirt sophomore running back, were both named All-Big 12 Second Team. Kolar pulled in 10 receptions for 124 yards and three touchdowns on the season. Nwangwu rushed for 143 yards on 38 carries and saw action in all 11 games this season. As a kick returner, he recorded 521 yards on 19 returns, including a long of 58 yards against Texas Tech on Oct. 27.

Mike Rose, a freshman linebacker, was named an All-Big 12 Honorable Mention. The Brecksville, Ohio native had an impressive debut season playing in all 11 games and compiling 62 total tackles (33 of which were solo) including seven tackles for loss. He also recorded 1.5 sacks and a fumble recovery for touchdown.

The Cyclones concluded the regular season with a 8-4 (6-3, Big 12) record and will play the Washington State Cougars in the Valero Alamo Bowl on Dec. 28.

Nwangwu stiff arms a Kansas defender during the Cyclones' contest against the Jayhawks on Nov. 3. Photo courtesy of Iowa State University Athletics.

Rose holds up the ball after forcing a fumble and returning it for a touchdown during the game against Kansas State on Nov. 24. Photo courtesy of Iowa State University Athletics.

Iowa State's online masters program ranks 21st

Iowa State University's online masters program in mechanical engineering is among the top 25 in the nation, according to onlinesmasters.com.

ISU's online masters of engineering (MEng) degree ranked 21st on the list of the Best Master's in Mechanical Engineering Programs for 2019.

"We are pleased to be recognized by onlinemasters.com for our online masters of engineering degree," said Pranav Shrotriya, Director of Graduate Education in mechanical engineering at Iowa State. "Students have found that our program provides them the ease of studying remotely while also getting the high-quality engineering education that Iowa State University is known for. Our program has grown since we launched it in 2009 and we anticipate that it will only continue to grow as distance learning continues to become a more viable option for students looking to expand their education and grow professionally."

Iowa State's online MEng program was launched in the fall of 2009 and as of fall 2018 has graduated 139 students.

ME's Polin Wins Best Poster at Corn Conference

Joseph Polin (center) received the first place poster award at the Corn Utilization and Technology Conference held in June 2018 in St. Louis, MO

Joseph Polin, an Iowa State University Ph.D. student in mechanical engineering working in the Bioeconomy Institute (BEI), won first place in the general session of the Student Poster Contest at the National Corn Growers Association's Corn Utilization & Technology Conference (CUTC) held in June 2018 in St. Louis, Missouri. Conference attendance by Polin and other Iowa State students was sponsored by the Iowa Corn Growers Association.

Polin's poster on "Overcoming the challenges of using corn stover as feedstock in autothermal pyrolysis" received a cash award of $500. Autothermal pyrolysis is a new technology being developed at BEI to convert biomass such as corn stover into biofuels and biochemicals.

The Gary Lamie general poster session and the mycotoxin posters sessions allow student scientists to showcase their research to a broad audience. The top three posters in both general and mycotoxin sessions received prizes.

The CUTC is a research conference that brings together leading innovators in the corn industry. This year's event focused on new uses of corn with the goal of expanding markets and ensuring demand while improving quality and efficiency. It is held annually by the National Corn Growers Association.

Polin and the other award winners are featured in an article posted on the NCGA website

Contributed by Bob Mills/Bioeconomy Institute

ME alum Joshi receives distinguished professional award

A mechanical engineering alum as been recognized by the world's largest petroleum engineering professional society.

Sadanand D. Joshi (PhDME'78) is the 2018 recipient of the Society of Petroleum Engineering's (SPE) John Franklin Carll Award for distinguished professionals. As a doctoral student at Iowa State, Joshi studied under longtime ME Professor Art Bergles. After completing his PhD in 1978, he spent nearly eight years working as a Senior Research Engineer for ConocoPhillips in Bartlesville, Oklahoma. In 1988, he founded Joshi Technologies International, Inc., an international oil and gas production and consulting company headquartered in Tulsa, Oklahoma, and currently serves as the company's president.

Joshi

Throughout his career he has written more than fifty technical papers and in 1991 published *Horizontal Well Technology*. He has also received a number of other professional accolades including being named one of the "100 Most Influential People of the Petroleum Century" by *Oil & Gas Investor Magazine* in 2000, a Distinguished Alumnus award from the Indian Institute of Technology-Bombay in 2003, the Anson Marston Medal – the highest award given by ISU's College of Engineering – in 2012 and the Improved Oil Recovery Pioneer Award by SPE in 2016.

Joshi was honored during the SPE's Annual Awards Banquet on Sept. 25, 2018 in Dallas, Texas.

ME professor contributes to polydisperse multiphase flow research at Parisian university

Alberto Passalacqua, an associate professor of mechanical engineering at Iowa State, presents a lecture about polydisperse multiphase flows at CentraleSupélec – Université Paris-Saclay in Paris, France. Photo courtesy of Cécile Oriot

A mechanical engineering professor is advancing his research by studying halfway across the globe.

Alberto Passalacqua, an associate professor of mechanical engineering with a courtesy appointment in chemical and biological engineering, is conducting research that can be used to better understand the effect that tiny particles (<10 micrometers) produced by car emissions, known as soot, can have on our lungs. Passalacqua and his team are developing mathematical formulas to study this.

Passalacqua spent his summer in the Macroscopic Molecular Energy and Combustion Laboratory (EM2C) at CentraleSupélec – Université Paris-Saclay in Paris, France, advancing this research. His travel was supported by the Jean d'Alembert fellowship program for junior researchers, which also provided funds for him to spend three months in EM2C during summer 2017. While at CentraleSupélec, Passalacqua has had the opportunity to work with Dr. Frédérique Laurent-Nègre on the modeling of polydisperse multiphase flows.

As part of his work in the lab, Passalacqua gave a lecture at CentraleSupélec entitled "How to describe polydisperse multiphase flows."

"The lecture aimed at introducing what polydisperse multiphase flows are and what are the challenges of describing them using computer simulation tools to a broad audience," said Passalacqua. "The name of these flows may seem a bit obscure, but we see them around us every day when we spray something, we produce them when we drive and pollute, they form in the clouds when volcanoes erupt, and in several industrial applications from drug production to food industry."

He said that describing the behavior of flows that contain particles, droplets or bubbles can be difficult because of the number of phenomena that can happen simultaneously. These flows also exhibit different affects when they interact with one another.

"For example, bubbles in a liquid move but break, and breaking they change velocity. Heavy particles in air tend to congregate forming regions at higher concentrations, depending on the air motion," said Passalacqua. "Being able to include all these physical phenomena in a model – think of it as a complex set of equations – is difficult, and it is only the first step. Once the equations are formulated, they need to be accurately solved, and as fast as possible to be useful for practical applications such as engineering design and environmental predictions."

Much of this research is multidisciplinary as it combines elements of mechanical engineering along with physics, mathematics and computer science to create software that can accurately recreate flows and other related phenomena.

"In my group we are contributing our developments to the community by means of our open-source framework OpenQBMM, so that others can benefit from our results," Passalacqua said.

During his lecture Passalacqua also discussed his research at EM2C which involves two aspects of quadrature-based moment methods. The first aspect concerns the accuracy of the mathematical methods used to solve models for polydisperse multiphase flows, while the second focuses on the formulation of a specific model for gas-liquid systems.

"Collaborating with the researchers at EM2C has been essential to address some of the mathematical challenges we faced when using moment methods. The mathematical background of the researchers and their long-term expertise in these methods is unique. Interacting with them and learning how they tackle problems from a different perspective was extremely beneficial," said Passalacqua. "More broadly, spending time in a different research system, which is organized, managed and funded in a quite different way than the one I am used to is very interesting and shows areas where our system may be improved."

Despite spending much of his summer in the lab, Passalacqua has been able to enjoy the sights and sounds of the City of Light.

"It is impressive to see how active, chaotic and at the same time livable Paris is. I love art, so I spend most of my spare time visiting the historical parts of the city. At every corner there is something to see, and there are a lot of little restaurants to explore," he said.

Upon returning to Ames in August, Passalacqua – who also serves as a Team Leader at Iowa State's Center for Multiphase Flow Research and Education – continued his research on a project funded by the U.S. Department of Energy's Advanced Manufacturing Office. This project aims to develop an open-source framework for the design and scale-up of autothermal biomass pyrolizers used to produce bio-oil.

Passalaqua is also collaborating with the University of Ottawa on a separate multiphase flow modeling project which aims to model electrostatics in fluidized bed reactors and this fall hosted a visiting scholar from the Ottawa institute.

"I look forward to bringing back the experience I gained during my stay in France to my group and my department," he said.

Two ME alums elected to ISU Alumni Association Board of Directors

Larry C. Pithan

Larry C. Pithan of Andalusia, Ill., a 1973 Iowa State University graduate in mechanical engineering who is the retired CEO at IMEG Corporation in Rock Island, Ill., has been elected to the Board of Directors of the Iowa State University Alumni Association. His term will expire in 2022.

Eric Wittrock

Eric Wittrock of Urbandale, Iowa, a 1992 Iowa State University graduate in mechanical engineering and current director of business development for GMT Corporation of Waverly, Iowa, has been elected to the Board of Directors of the Iowa State University Alumni Association. His term will expire in 2022.

The role of the ISU Alumni Association Board of Directors is to establish policies regarding the finances, property, management, and activities of the Association for the purpose of engaging constituents in the further advancement of Iowa State University and the Alumni Association. The ultimate objective of the board is to assist the Association staff and volunteers in carrying out the mission and strategic plan in collaboration with the strategic goals of the university and other affiliated organizations, which include learning, scholarship, and engagement.

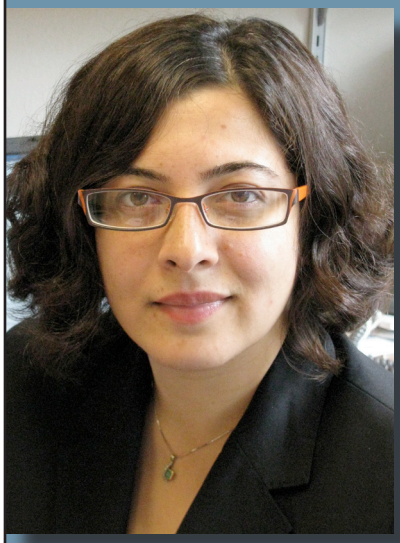
The board is composed of 20 regularly elected members and four appointed voting members. New directors are elected annually, each for a four-year term. The board meets four times yearly.

Contributed by ISU Alumni Association

Keep up with the latest ME news

www.me.iastate.edu/news/

ME professor selected to attend National Academy of Engineering symposium



Hashemi

A mechanical engineering faculty member was selected to attend a symposium for a prestigious non-governmental engineering organization.

Nicole N. Hashemi, an associate professor of mechanical engineering, was among 84 early career engineers selected to participate in the National Academy of Engineering's (NAE) 24th annual U.S. Frontiers of Engineering Symposium. The two-and-a-half day event will bring together engineers from industry, academia, and government ages 30 to 45 "who are performing exceptional engineering research and technical work in a variety of disciplines."

Hashemi's research focuses on "developing new and innovative small scale fluid systems for applications in materials processing and analysis."

"I am looking forward to learning from my peers at the symposium and exploring the impact of engineering on society," she said.

Hashemi, who joined the ME faculty at Iowa State in 2011, was also selected to attend the Kavli Frontiers of Science symposium hosted by National Academy of Sciences in 2013.

"At the 2013 Kavli Frontiers of Science symposium, I had the unique opportunity to discuss research ideas with bright scientists across a wide variety of fields. It also helped broadening my view as a researcher," she said.

Hashemi was the only researcher from Iowa State University to be invited to this year's symposium which took place Sept. 5 through 7 at MIT's Lincoln Laboratory in Lexington, Mass.

"It is critically important to bring young engineers from different technical areas together to spark innovation," said NAE President C. D. Mote, Jr. "The Frontiers of Engineering program does this by creating a space for talented engineers to learn from each other and expand their technical perspectives early in their careers. Congratulations to this year's FOE participants."

Sponsors for the 2018 U.S. Frontiers of Engineering include The Grainger Foundation, National Science Foundation, Defense Advanced Research Projects Agency, Air Force Office of Scientific Research, DoD ASDR&E Laboratories Office, Microsoft Research, and Cummins.

ME alum Mackenzie Sissel brings plenty of Iowa State engagement to role as academic adviser

Sissel

ME alum Mackenzie Sissel has returned to her alma mater as the Department of Chemical and Biological Engineering's (CBE) newest academic adviser.

"I was drawn to the instruction and student engagement side of things," she says, "so for graduate school I decided to study higher education student affairs." She earned a master's degree in that discipline from Iowa State.

While in mechanical engineering she completed a practicum with the Academic Program for Excellence (APEX) for incoming multicultural first-year students and was an instructor in Engineering 101. As a graduate student she worked as an assistant in the Women in Science and Engineering (WiSE) program and completed an advising practicum in mechanical engineering.

"I still like to practice my mechanical engineering," she laughs, "by doing lots of woodworking and home improvement construction projects." Originally from Chanhassen, Minn., Mackenzie got married in September to an Iowa State agricultural and biosystems engineering grad. She enjoys running, reading ("any kind of material, but I like to browse the teen reading section at a library to keep up with what young people are reading"), and loves coffee and tea, especially bubble tea.

ME alum named to Board of Directors for Leggett & Platt

A mechanical engineering alum has been named to the governing board for a Missouri-based manufacturing company.

Srikanth Padmanabhan (PhDME'91) has been appointed to the Board of Directors for Leggett & Platt, "a 135-year-old diversified manufacturer that designs and produces engineered products found in most homes and automobiles." The company consists of "14 business units, 22,000 employee-partners, and 120 manufacturing facilities located in 18 countries."

Padmanabhan during a visit to the Iowa State campus in fall 2016.

"Srikanth brings extensive experience in managing operations, technology and innovation across a multi-billion dollar global business," said Ted Enloe, Board Chair. "We are extremely pleased to have him join our Board."

Padmanabhan, 54, holds a B.S. in mechanical engineering from the National Institute of Technology in Tiruchirappalli, India and a Ph.D. in mechanical engineering from Iowa State. He is also a graduate of Harvard Business School's Advanced Management Program. He joined Cummins Inc. in 1991 and has served as President of Engine Business since 2016. Additionally, Padmanabhan serves as a Board Member for the Community Education Coalition as well as on the Board of Advisers for Indiana University-Purdue University Columbus. Through his work and studies, Padmanabhan has lived in India, the United States, Mexico and England.

Three ME profs supported by Exploratory Research Program

Three new early-stage, high-potential research projects from ME professors are underway with support from Iowa State College of Engineering's Exploratory Research Program. The program provides funding to faculty for novel ideas for new research efforts.

Assistant Prof. Ming-Chen Hsu's research will deal with engineered medicine, specifically, personalizing "treatment of cardiovascular diseases in patients." Hsu's team will "focus on creating multiphysics methods that enable solid and fluid simulation of patient-specific cardiac models."

Hsu

Associate Prof. Timothy A. Bigelow plans to develop a low-cost, ultrasound method to screen for ovarian cancer that could "significantly reduce the approximately 14,000 deaths each year resulting from ovarian cancer."

Bigelow

Professor Xinwei Wang will be testing the application of 2D atomic materials for "suitability for future electronic, piezoelectric and optoelectronic device applications."

Wang

Contributed by Mitchell LaFrance/Engineering College Relations

Cyclone Engineers lend expertise to data-driven irrigation research

Gomes

Soupir

Winer

Cyclone Engineers are part of a $5 million, five-year U.S. Department of Agriculture project to develop new data-driven irrigation systems that the encourage use of alternatives to fresh water while protecting crop health.

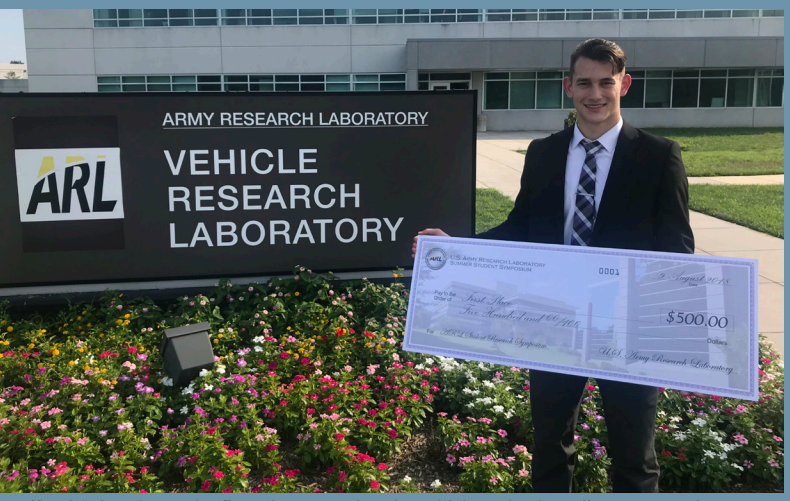
The SmartPath project, led by the University of Florida, brings together researchers from four different growing regions of the United States to answer key questions about how agricultural producers can make tailored, informed decisions about irritation water sources.

Michelle Soupir, associate professor of agricultural and biosystems engineering, Eliot Winer, professor of mechanical engineering and associate director of the Virtual Reality Applications Center, and Carmen Gomes, associate professor of mechanical engineering, will combine their expertise in pathogen monitoring, water treatment, and software development to contribute to the interdisciplinary project.

SmartPath development plans are to integrate real-time water sensors into a decision-support system, moving from studying test beds to field case studies – and eventually putting the SmartPath system into the hands of growers through integrated extension and outreach activities.

Contributed by Breehan Gerleman/Engineering College Relations

ME student wins two national awards through his summer internship



Kozak brings home the first-place award to the vehicle technology directorate as he poses in front of his summer's research laboratory.

Winning a single national research award wasn't enough for one competitive mechanical engineering student. He wanted to win more.

Nikita Kozak, a junior in mechanical engineering (ME), spent his summer as a Department of Defense High-Performance Computing (HIP) Intern at the US Army Research Laboratory (ARL) in Aberdeen, Maryland. The HIP program at ARL provides future workforce candidates with the critical skills needed to support the future warfighter's needs. Much of his research success this summer was built upon his prior experience working on finite element simulations of wind turbines in the lab of Ming-Chen Hsu, an assistant professor of ME at Iowa State.

"I used high-performance computing, super computers, to computationally investigate a novel technology of articulating the turbomachinery blades within a turboshaft engine which is the type of engine that powers today's helicopters," said Kozak, adding he was able to apply some of the same principles from his wind turbine research. "The reason I was studying this technology is because it has a direct relationship to the future vertical lift program which is a research priority for the US Army."

When he first arrived at ARL he brought along a code that was developed by Dr. Hsu's research group of the Computational Fluid-Structure Interaction Laboratory at Iowa State University which was a collaboration with ARL and others. This code modeled a single-stage gas turbine engine featuring turbomachinery blades that could be articulated. Kozak first had to implement this code on the Department of Defense's (DoD) high-performance computing systems which provided the researchers of the DoD a turbomachinery analysis tool.

Kozak said he was able to take the skills he's developed in the classroom and apply them to his summer research.

"The classroom instruction gave me a better understanding of complex framework and math behind the simulation as well as the theory behind how fluid mechanics and thermodynamics work," he said, adding that he was also able to apply several concepts from his finite element analysis class that he took last summer while at Hochschule Mannheim in Mannheim, Germany.

Kozak's ARL internship culminated with two national-level competitions at the end of the summer. For the first, Kozak competed against 34 graduate and undergraduate students from the Vehicle Technology Directorate of the ARL. After besting the field in the undergraduate category, he qualified for an additional competition in which he competed against students from all departments within the ARL. Of the roughly 230 ARL summer interns, only eight undergrad interns qualified for the final competition, and Kozak again took the top prize.

"The opportunity to research a technology that would help our future warfighters along with my competitiveness nature, motivated me to put forth all my effort in my research," Kozak said, adding that out of my own initiative he was putting in as many as 70 hours per week leading up to the competition. "When I heard I won the competitions, I was really ecstatic. Not only was it humbling and such a big honor but it was reassuring that my research efforts are helping to improve the future."

Kozak said that he wouldn't have won the competition without strong guidance and encouragement from HIP program PI's and mentors Dr. Luis Bravo, and Dr. Muthuvel Murugan, both senior research engineers from the Propulsion Division at ARL.

"They did an unbelievable job of engaging you in your work [at ARL]. They make you feel like a collaborator as opposed to just an intern," he said.

Though he spent much of the summer in the lab, he was able to travel along the east coast on the weekends, visiting museums and other historical landmarks in New York, Philadelphia and Washington D.C.

Kozak attributes his interest in engineering to his parents, both of whom are engineers.

"I've always enjoyed taking apart things," said Kozak. "Just exploring and seeing how something works and how it can be improved."

Kozak and his family left the Ukraine and moved to suburban Des Moines when he was just two years old. He graduated from Waukee High School in 2016 and he chose to come to Iowa State because of its proximity to his home as well as its reputation for engineering. Upon arriving on campus he found that ME in particular was a good fit for his career aspirations.

"The main reason I went into mechanical engineering was because I've always been interested in cars, motorcycles and basically anything with an engine," said Kozak. "Entering as a freshman, I thought studying ME would allow me to understand and work on everything I have a passion for like cars and engines."

Kozak plans to complete his bachelor of science (B.S.) in ME with a minor in mathematics in the spring of 2020. After graduation he hopes to attend a premier engineering graduate school.

Kozak said that his passion for his work is what really drives him and advises incoming and current students to find a similar sense of pride in what they do.

"My main bit of advice is to take pride in your work and take pride in your education. During my first semester, I did what I was supposed to by getting good grades but, I didn't go that extra mile," he said. "After realizing all the great opportunities Iowa state has to offer, I went that extra mile by becoming involved with research. This really opened my eyes to the limitless opportunities that we have as students. I recommend going that extra mile and when you do, you'll be shocked by things you're capable of."

ME professor emeritus publishes book on investing

After a career in the field of mechanical engineering that spanned more than half a century, a former professor has switched his focus to financial investing.

Shyam Bahadur, a university professor emeritus, recently published a book that he hopes will educate people to build wealth through investments. The 254-page book, *Guide to Investing in Stocks, Bonds, ETFs and Mutual Funds*, was published in January 2018 by LifeRich Publishing and is available through Amazon and Barnes and Noble.

Bahadur

Bahadur said that he had always been interested in investing having learned about it by reading books and literature related to finance and investing. He also gained practical experience by making real investments. To broaden his knowledge, he audited a course on investments in Iowa State's business college. He was so invested in the class that he did all the homework and even took the exams.

The motivation to write the book came from his realization that a large population of Americans do not save because they think that they need a lot of money to start saving.

"The book dispels that myth by showing that in order to build wealth one needs to start investing with whatever one has on a regular basis and as early as possible so as to derive the maximum benefit from compounding," said Bahadur. "Many people do not invest because they find investing difficult to comprehend. There are some books which mislead people into believing that their misguided approaches will lead to success in the stock market. With these factors in mind, the book has been written requiring no prior knowledge on the part of the reader."

The book begins with the basics of stock market investing and covers topics such as stock valuation, analysis of stocks with practical data and examples, selection of stocks, sectors and industries for investment, asset allocation, diversification and portfolio rebalancing. It also provides insight on mutual funds, exchange traded funds and bonds.

Bahadur grew up in a modest family in India with little direction and support from his family during an era when the level of education in India was not high. The motivating factor for him was knowing that a college degree would help him to achieve success in life. After completing his bachelor's degree in ME from the Indian Institute of Technology-Roorkee in 1957, Bahadur pursued his master's degree, also from Roorkee, while also serving as a faculty member in mechanical engineering. He served in teaching positions for ten years prior to coming to the United States. During that period, he published a book and established a new mechanical engineering degree program at Gorakhpur in Uttar Pradesh, India.

In 1967, Bahadur left India to pursue a Ph.D. in mechanical engineering at the University of Michigan in Ann Arbor which he completed in just two-and-a-half years. His research focused on the tribology of polymers and composites. He said the reason he worked in tribology was because it was a brand new discipline and very little work was being done at that time particularly on the tribology of polymers and composites.

After completing his doctorate in 1970, Bahadur was hired by Iowa State as an assistant professor of ME. Two years after coming to Ames, Bahadur received tenure and promotion to associate professor and then three years later he was promoted to full professor. He said that his many years of past teaching experience, a successful graduate research program at Iowa State and a few grants from the National Science Foundation (NSF) helped to fast-track this process for him.

At Iowa State, Bahadur published about 100 papers and also helped to organize a number of international conferences. He held the title of Fellow for both the American Society of Mechanical Engineers (ASME) and the American Society of Testing and Materials (ASTM). He also developed two graduate-level courses: one on polymers and composites and another on tribology. He even served as a visiting professor at the University of Cambridge in England for six months while on faculty improvement leave.

Having taught in various countries, Bahadur said the difference in the teaching cultures was one of the first things he noticed when he moved to the United States in the late 1960s.

"In India the teacher would tell the students what they were expected to know as per the syllabus and not what would necessarily be covered in the class. This is important in the context of the system in India because the final exam papers were set by external examiners and the teachers had no knowledge of the questions in the paper," said Bahadur. "Thus the students tried to study even the extra topics in case they were not discussed in the class. The students in the United States want everything covered in the class. As for the problems in the exam, if they are not direct then the students complain."

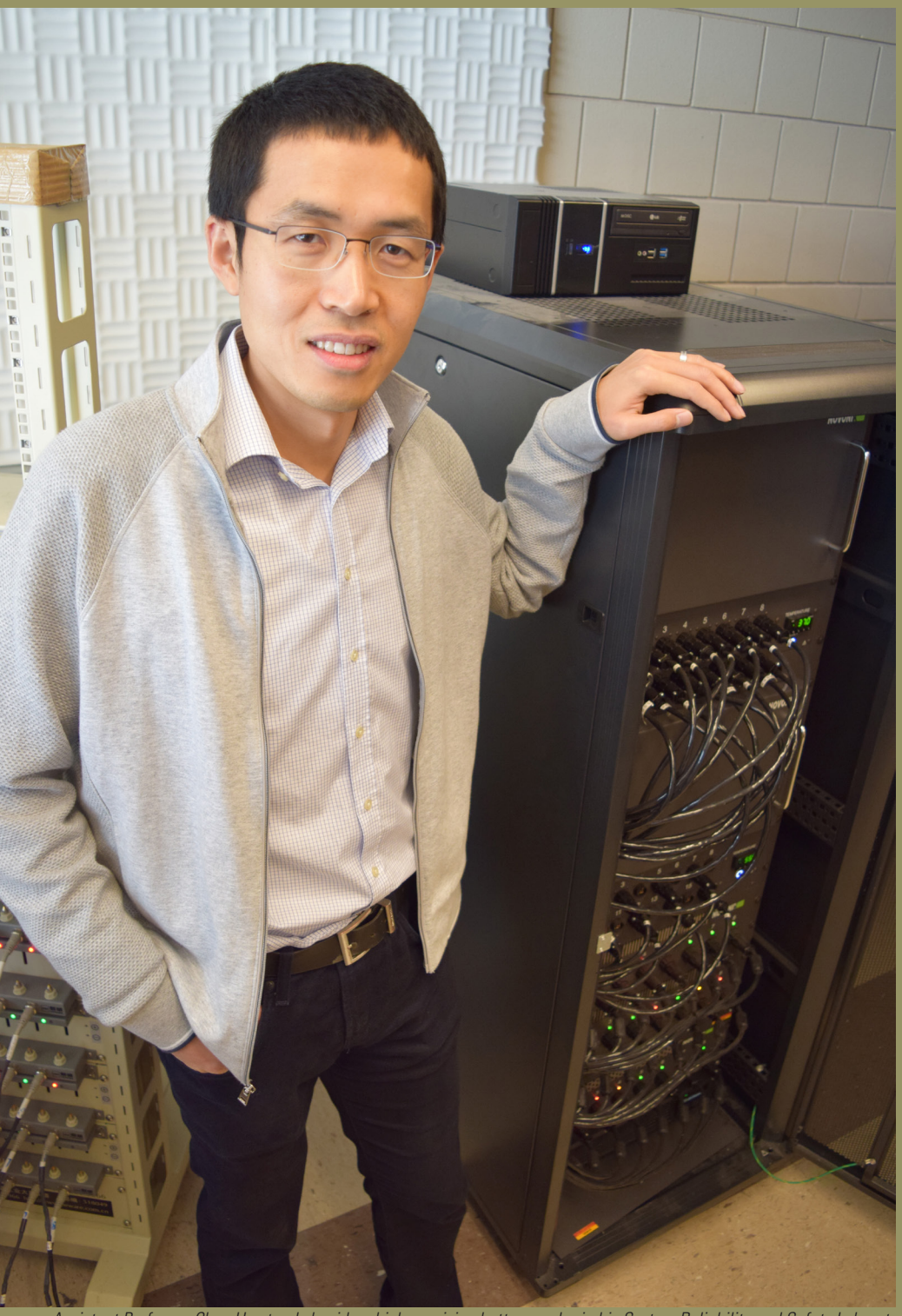
Bahadur said that he used to tell the students, "If you can't be creative, what type of engineer will you be?" He cited this as the reason he had a reputation as a tough professor in the classroom.

During his career, Bahadur also served as the acting chair of the ME department. In the year 2000, he was bestowed with the title of University Professor, which is given to those faculty members whose work extends beyond the excellence in teaching and research and who are recognized to have made "significant contributions that have improved the university." He retired in 2006 with the rank of University Professor Emeritus.

"Even though I'm retired, I still follow the routine of an active worker. I come to my office on-campus every day except the weekends and I'm usually in my office until about 6 or 6:30 each evening. This is what keeps me in good spirits and I feel as young as ever," he said, adding that he enjoys reading and keeping up with the developments in his field and other matters of interest. He has traveled extensively, having visited many countries and every major national park in the U.S. He said that he feels he has had a fulfilling life, enjoyed it thoroughly and has no complaints.

For young students today he has the following advice: "Think what you want to do in your life. Pick a major based on that. Work for your goal and be willing to do whatever it takes," he said. "I'm a believer that you can do anything you really put your heart into but you have to work for it and it takes a lot of hard work."

Hu receives ASME Design Automation Young Investigator Award



Assistant Professor Chao Hu stands beside a high-precision battery cycler in his System Reliability and Safety Laboratory inside Black Engineering Building on October 30, 2018.

A mechanical engineering faculty member has received a young investigator award for his contributions in design automation from his field's largest professional society.

Chao Hu, an assistant professor of mechanical engineering (ME) with a courtesy appointment in electrical and computer engineering, is a 2018 recipient of the Design Automation Young Investigator Award from the American Society of Mechanical Engineers (ASME). The award recognizes "an outstanding young investigator who is making noteworthy contributions in the area of design automation, including research in design representation, design optimization, design evaluation, and/or design integration." Recipients must have obtained their last degree within the past seven years and be less than 40 years of age, be a member of ASME, and be in good standing with ASME.

Hu's research is focused on developing new methods for simulation-based design and sensor-based prognostics that can be used to design engineered systems for failure resilience. As such, his research expertise is in the areas of engineering design under uncertainty and post-design failure prognostics and has applications within wind turbines (energy generation), lithium-ion batteries (energy storage), and large-scale structural systems. The ultimate goal is to enable these engineered systems to achieve and sustain near-zero breakdown performance.

"It was a great honor to receive the Young Investigator Award. It shows that designing failure resilience in engineered systems is recognized of increasing importance in the engineering design society," said Hu. "I want to express my special thanks to Dr. Judy Vance, who nominated me for this award, and my research group, the System Reliability and Safety Laboratory, or SRSL, who have all put tremendous efforts over the past three years to advance this line of research."

Hu added that it is important to bring solutions for post-design failure prediction/prevention into early-stage system design.

"This represents a promising way to meet the need of safety-critical systems, such as airplanes and bridges, for design methods that can ensure near-zero breakdown performance," he said.

This marks the fourth ASME award for Hu, who holds a BE in Engineering Physics from Tsinghua University and a Ph.D. in Mechanical Engineering from University of Maryland-College Park. He received Top 10 Best Paper Awards at the ASME Design Automation Conference in 2011 and 2012 as well as the Ford Motor Company – Best Paper Award during the 2013 ASME Design Automation Conference.

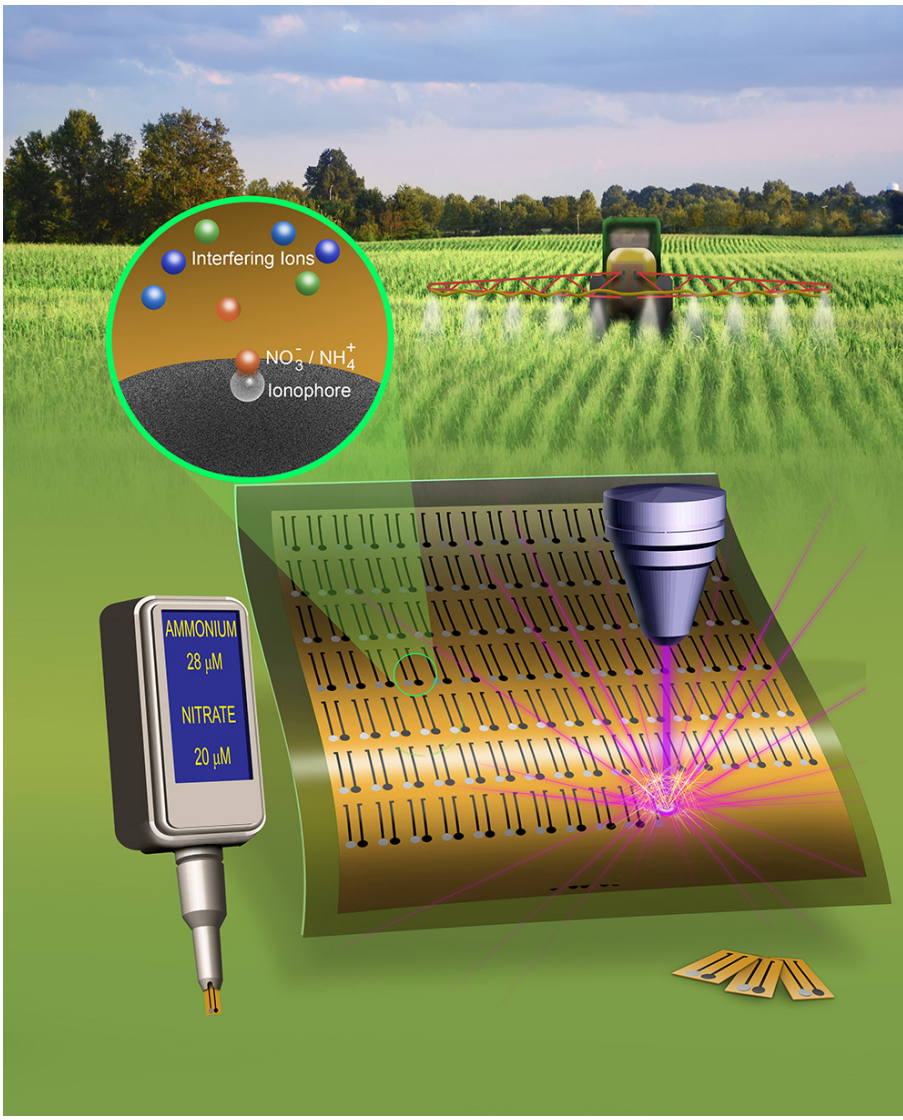
The award was presented during ASME's 2018 International Design Engineering Technical Conference (IDETC), which was held on August 26–29, 2018, in Quebec City, Canada. Hu is the eighth recipient of the award.

Engineers develop 'bury-and-forget' sensors, data networks for better soil, water quality

Claussen

The satellite images are full of red warnings: Miles and miles of bright red along the Louisiana coast; boiling reds covering most of Florida's Lake Okeechobee.

The images show harmful algae blooms that the U.S. Environmental Protection Agency says can create toxins, endanger human health, kill fish and wildlife, rob water of oxygen and otherwise create environmental trouble.



Engineers at Iowa State University and the University of Florida are working on a new system of "bury-and-forget" soil sensors and remote, wireless, data-collection networks that could help reduce the fertilizer that leaves farm fields and feeds the harmful algae blooms both states are working to control. Iowa's efforts are, in part, aimed at reducing fertilizer drainage and runoff that flows down the Mississippi River and contributes to the "dead zone" of oxygen-depleted water in the Gulf of Mexico along the Louisiana coast.

The healthy-soil system envisioned by the engineers could help reduce the amount of nitrogen fertilizer that leaves farm fields by using data from the sensors to build better models of the interactions of fertilizer, soil and crops. Those models could help farmers reduce the fertilizer they use.

Currently, farmers test for soil nutrients by taking soil samples and sending them off for laboratory analysis. That can be a slow, expensive and imprecise process.

"If we had a better predictive model, we could have better remedies for farmers," said Jonathan Claussen, an Iowa State assistant professor of mechanical engineering and leader of the project. "A better model could tell them they can use less fertilizer."

The project is supported by a two-year, $300,000, "Signals in the Soil" grant from the National Science Foundation. The engineers hope to collect enough data and demonstrate enough potential to successfully compete for more funding and additional research.

In addition to Claussen, the research team includes three engineers from the University of Florida in Gainesville: William Eisenstadt, a professor of electrical and computer engineering; Melanie Correll, an associate professor of agricultural and biological engineering; and Eric McLamore, an associate professor of agricultural and biological engineering.

Claussen has expertise in developing low-cost, flexible sensors based on inkjet-printed and laser-treated graphene circuits. The sensors in this project will detect ammonium and nitrate ions in soil. Claussen hopes they'll work for an entire growing season.

Eisenstadt has expertise in electronics and wireless sensor systems. Correll has expertise in crop modeling, including soil biochemistry. And McLamore has expertise in environmental-agricultural chemistry as well as biosensors.

The engineers will build the sensors, connect them to a wireless network, test how deep the sensors can be buried while maintaining network connections, build a testbed facility using tomato plants as a model crop and collect high-resolution nitrogen data from the soil while monitoring plant growth.

"Such sensor networks and resultant models," the researchers wrote in a summary of their project, "are expected to lead to precision agriculture where fertilizers are spread onto specific locations of the field in a metered fashion and only when needed."

And that could help lead to satellite images of algae concentration showing greens and blues instead of red warnings.

Contributed by Mike Krapfl/ISU News Service

ME student designs award-winning solar-powered backpack

Courtney Beringer poses with her solar backpack.

A dying cell phone or laptop battery can be a source of anxiety for an already busy college student, but a project by a mechanical engineering senior aims to alleviate that.

Courtney Beringer, a senior in ME with a minor in energy systems, has spent the past three years working with Eulanda Sanders, Donna R. Danielson Professor in Textiles and Clothing and Chair of the Department of Apparel, Events, and Hospitality Management (AESHM), developing and prototyping a solar panel-equipped backpack.

The idea for the backpack came about because of Beringer's participation in the first-year mentor program offered by Iowa State's Honors Program. Sanders was interested in overseeing an interdisciplinary project that would bring engineering students together to design a wearable product incorporating solar panels. Beringer jumped at the opportunity since it allowed her to combine her two passions: engineering and environmental sustainability. She started on the project in January of 2016 and worked with Sam Vande Loo, a fellow undergraduate in ME.

"I conducted a focus group interview to collect qualitative data and then made an online survey that received over 700 usable responses with qualitative and quantitative data," said Beringer. "From this data, we decided to design a solar powered book bag that uses solar energy to create electrical energy that can charge various devices."

She then conducted industry-approved tests on the textile materials to determine what was best for a book bag with electrical integration including color fastness, abrasion and water resistance. By incorporating design and drafting skills she learned in the ME curriculum, she was able to determine the correct electrical components and proper solar panel size. She also incorporated design features suggested by her survey respondents such as laptop and water bottle pockets, a removable panel, battery storage and the ability to charge a laptop. Much of the research took place in the textile experiment labs and product development facilities inside LeBaron Hall. Beringer also collaborated with Ames-based PowerFilm Solar on this project.

"Like assembling any part in engineering, method of assembly is extremely important in creating a shelf ready product. With the help of graduate students, I learned to sew and completed two prototypes and a final product," Beringer said, adding that she was grateful for the help from now-AESHM Ph.D. graduate Chanmi Hwang and current AESHM doctoral student Bingyue Wei.

After developing a near-final prototype she submitted an abstract and a 30-page paper about her project to the International Textile and Apparel Association Best Student Paper competition in April. She was notified the following month that her project that received first place.

"I was so surprised and thankful. This research has taken a lot of time and effort and it was wonderful to hear that scholars appreciated the work," she said, adding that she completed the final product in October of 2018 then had the opportunity to present her research at the International Textile and Apparel Association (ITAA) Annual Conference in Cleveland, Ohio earlier this month.

Beringer grew up in Dubuque, Iowa and excelled in math and science classes. She developed an interest in the environment through her involvement in the Sierra Club as well as her middle school's composting program.

"As I went through school with these two interests, I started to learn how I could combine my passion for the environment and my skills in math and science through engineering," she said.

Attending Iowa State was an easy choice for her, given the university's strong reputation for engineering coupled with all of the opportunities that a large academic institution offers.

"I knew I wanted to go to a large school to broaden my perspectives and have opportunities to interact with people outside of my major and identities," she said. "I chose mechanical engineering because I wanted to tailor my education around energy harvesting and power generation."

Beringer has presented at the National Conference on Undergraduate Research in Oklahoma, Research at the Capitol in Des Moines, and the Iowa State Conference on Undergraduate Research in Ames. Additionally she has worked in the Experimental Multiphase Flow Lab, overseen by Ted Heindel, Bergles Professor of Thermal Science and a professor of mechanical engineering.

"In Dr. Heindel's lab I help run X-ray experiments and do much of the designing and construction for the experiments. I often use Boyd Lab to fabricate parts as well as the water jet in Sukup Hall," said Beringer. "I also complete research by writing programs, analyzing data from X-ray experiments, and presenting my findings."

Beringer plans to complete her degree in May 2019 and after graduation will work in Des Moines, designing and consulting green energy systems for new buildings. After that she plans to attend graduate school where she will pursue a doctorate in the renewable energy field.

Research project aims to improve manufacturing processes using acoustic fields

A project by a mechanical engineering researcher could improve manufacturing processes for agriculture equipment companies in Iowa and beyond.

Jaime J. Juárez, an assistant professor of mechanical engineering (ME), and his research team have been studying ways that composites can be modified to create a stronger, more durable end product. Their research was the cover article in the December edition of the journal *Chemical Engineering Science*. Juárez explained that typically particles and polymers are blended together, similar to how ingredients are mixed in a kitchen blender.

Jaime J. Juárez (left), an assistant professor of mechanical engineering, poses with Soheila Shabaniverki, a Ph.D. student in ME.

"The final product is homogeneous, or uniform, throughout," said Juárez. "The inclusion of small particles in a polymer composite act like miniature anchors that keep the polymer from coming apart when you pull on it."

A recent simulation study of particle-polymer composites found that by packing the particles together to form a structure within the polymer, it increased the strength of the composite by a factor of 100 beyond what the blended particle-polymer composite is capable of. In this study, Juárez and his team used an acoustic field to pack the particles together, forming a structured particle-polymer composite.

"As a plate vibrates it also generates small sound waves, any particles on top of the plate will move around due to the pressure caused by the sound waves. The particles will eventually settle in areas were the sound wave generation is minimal, thereby forming into patterns that change with frequency," Juárez said.

Work on this research began in the summer of 2017, as a project within ME's Multiscale Sensing Actuation and Imaging (MoSAIc) Research Experience for Undergraduates (REU) site, a program supported by the National Science Foundation. Juárez served as a faculty mentor for Sarah Thorud, an undergraduate physics student at Bethel University, who was studying how small particles assemble under the influence of a vibrating plate. Soheila Shabaniverki, a Ph.D. student in ME at Iowa State, also advised Thorud and was part of the research team for this project.

"Soheila's research in polymers was largely responsible for serving as a foundation for this research," said Juárez. "After I saw Sarah's results, I suggested that Soheila add some of the polymer she was working with to the system to create the composite and we saw results within two weeks."

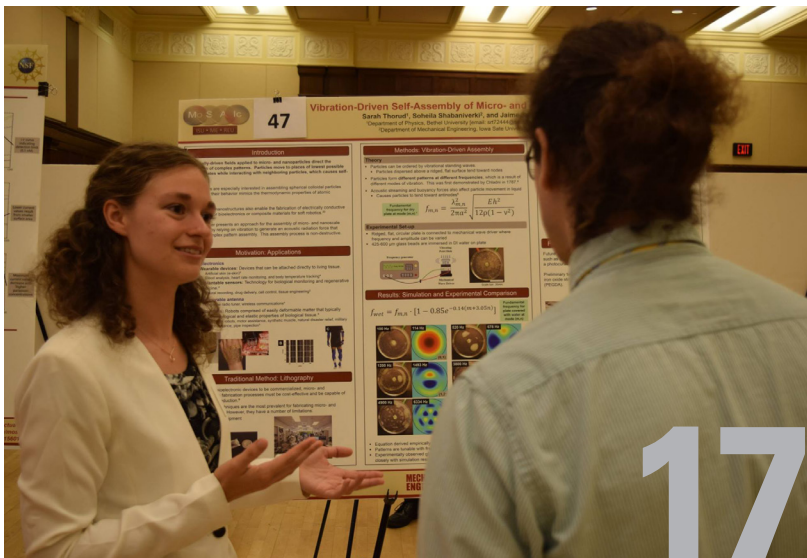
This research can be applied to the field of additive manufacturing, which according to the 2018 Wohlers Report, exceeded $7.3 billion in revenue and continues to grow. Juárez said that one of the major challenges in the additive manufacturing industry is discovering ways to deposit different types of materials simultaneously. His research examines ways that acoustics can be used to form different types of materials in a single process by changing the applied frequency.

He added that this research can have an impact on the manufacturing industry in Iowa, specifically with companies like Pella-based Vermeer as well as 3M, which has a plant here in Ames.

"Stronger polymer-particle composites can be used in a variety of manufacturing processes that directly impact Iowa. Companies like Vermeer and 3M use polymers to create components for products like agricultural equipment or aftermarket automotive supplies. Processes like the one described above can be used to make some of these products stronger or more resilient to wear and tear," he said.

The next step for Juárez and his team is to use their additive manufacturing platform to create a functional material that can be used as an active component for a mechanical actuator or robot. They are also looking at ways to miniaturize the process so that it can be mounted on a 3D printer.

Sarah Thorud, left, presents her research during the 2017 Summer Undergraduate Research Symposium at the Memorial Union on August 3, 2017.



$6 million gift from Boeing to support Iowa State University's Student Innovation Center and undergraduate researchers

The Boeing Company made a $6 million commitment to Iowa State University that will enhance the educational experience for all students at Iowa State, inspire innovation on the university's campus, and support engineering students interested in research.

A significant portion of Boeing's gift will support construction of the Student Innovation Center, the approximately 140,000-square-foot, state-of-the-art building that will serve as the hub on campus for hands-on projects where students can collaborate across a wide range of disciplines.

With construction funded through the Iowa legislature and private support, the Student Innovation Center (pictured above) will be a flagship facility elevating Iowa State's commitment to interdisciplinary, experiential learning and enriching the learning experience for thousands of students across the university. The anticipated completion date of the facility is January 2020.

Students from all of Iowa State's undergraduate colleges will use the Student Innovation Center, which will provide space for individual and group activities and capstone projects, and for classes and student clubs involved in hands-on learning. The space will offer resources for planning, designing and making, including labs and workshops featuring state-of-the-art tools and technology.

"Boeing is committed to inspiring the next generation of innovators and equipping them with the skills they need to excel in the modern workforce," said Dennis Muilenburg, Boeing chairman, president and chief executive officer. "The Student Innovation Center at Iowa State University will help encourage innovation on campus and in graduates' future careers, positioning them for success in STEM-related fields."

In addition, part of Boeing's commitment will provide financial support for engineering students seeking to broaden and enhance their educational experience by participating in undergraduate research.

"The foresight Boeing has shown through its long-standing support of hands-on collaborative learning environments across campus and educational opportunities beyond the classroom is a testament to its innovative focus as a company and its commitment to ensuring engineering students are well-prepared for early success in their careers," said Sarah A. Rajala, James L. and Katherine S. Melsa Dean of Engineering at Iowa State University.

In the Iowa State University College of Engineering, undergraduate students in all eight academic departments are actively engaged in meaningful research experiences. Many departments have year-end events where students highlight their work, and students are invited to participate in Iowa State's Symposium on Undergraduate Research and Creative Expression, a day-long symposium during which undergraduates from all academic disciplines share their research.

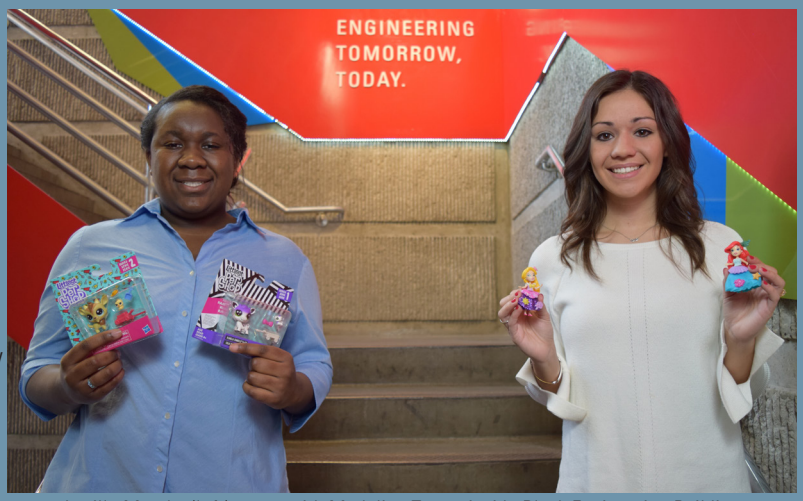
Boeing's engagement at Iowa State brings together philanthropic investment with consistent support of the educational experience. Company representatives are involved in student organizations and competitions, classroom visits and student recruitment. Through their service on advisory councils at Iowa State, industry experts from Boeing are helping to enrich curricula, enhance governance and increase awareness of issues related to diversity and women. Boeing supports several Iowa State programs that immerse students in activities that test their skills and build their knowledge within their major.

Contributed by ISU Foundation

ME students preparing to become tomorrow's toymakers

With the holidays right around the corner, a pair of mechanical engineering students hope that they can one day spread the holiday cheer through their passion to design children's toys.

Madeline Turner, a senior in ME, and Lucille Murphy, a sophomore, are at different stages in their academic careers but the duo share the goal of wanting to apply their ME skills to the toy industry. For both of them, their passion for toys can be traced back to their childhoods.



Lucille Murphy (left) poses with Madeline Turner inside Black Engineering Building. The two mechanical engineering students have a passion for toy design.

"When I was a kid, I loved playing with Polly Pocket and Littlest Pet Shop toys, and thought that the coolest job in the world would be setting up the little playsets and toys for the pictures that they take for commercials and packaging," said Turner, who grew up in Cedar Rapids.

Turner was encouraged to pursue a career in toy design because of the groundwork laid by Debbie Sterling, an entrepreneur and a mechanical engineering graduate from Stanford University. Sterling founded GoldieBlox which aims to empower young girls by integrating STEM with storytelling and promoting creativity.

"Hearing about Debbie Sterling reminded me of my childhood dream job, and made me realize that a career in the toy industry is possible. It also showed me that being an engineer can be very fun. Realizing that my interests in math and science could be combined with creativity made the decision to study mechanical engineering very easy," said Turner, adding that her father Chris Turner was a 1983 graduate of ME at Iowa State and also influenced her.

Murphy, who grew up just down the road from Turner in Iowa City, said that her creative imagination as a child led her to pursue a degree in ME with the hope of one day working in the toy industry.

"I always was creating worlds with my Littlest Pet Shop toys. Even though I had a lot of items I bought for them, I never had exactly what I wanted to make my own stories so I started to paint and redesign my toys and make houses and objects out of cardboard, paper, tape, and anything else I could get my hands on," Murphy said.

They each chose to attend Iowa State because of its strong reputation for engineering. Turner said that Iowa State's ME curriculum has done a nice job of providing her with a framework of skills and knowledge that helped her to get a co-op with the toymaker Hasbro in the spring of 2017.

"Manufacturing classes taught me about injection molding, which is how many of the toys are made. Materials classes taught be about the different types of plastics, and the properties associated with them. But aside from these technical skills, the ME curriculum taught me how to solve a problem, which I feel is very valuable in any workplace," she said.

During her six-month co-op at the Hasbro office in Burbank, California, she had the opportunity to work on toys in the Disney princesses line as well as characters from the Disney film *Frozen*. She said the experience taught her a lot about the toy development process from designing to engineering to marketing to packaging and distribution. During her co-op she assisted the engineers with cost analysis, production schedule monitoring and function reviews.

"It is a very creative, innovative, and fast passed industry to work in," said Turner. "It's also very rewarding to see a toy go from a sketch on paper, to a product on the shelf. I was amazed at how much work goes into each product to ensure customers are getting the best value possible."

As just a sophomore, Murphy has yet to complete an internship or co-op but she's gaining experience through her own entrepreneurial efforts. She is in the process of launching her own toy company, Blue Diamond Toyhouse, which she plans to manage alongside her responsibilities as a student. Similar to Turner, Murphy said Polly Pocket and Littlest Pet Shop were her favorite toys growing up but she also drew inspiration from Disney movies.

"My favorite Disney character was of course Tiana," said Murphy, referring to the main character from the 2009 Disney film *The Princess and the Frog*. "She was the first black woman entrepreneur that I had ever seen and even today she is one of my biggest role models."

For aspiring toymakers, both Murphy and Turner said that imagination is key to achieving this dream.

"I am passionate about this because using imagination and creating new items from your mind is what allows us as humans to not only grow but have a future. We need to be innovative and by making toys that encourage imagination and innovation I am helping others invent the future," Murphy said.

Turner echoed this sentiment.

"I think that play is so important for kids' development and imagination. I think about all of the time I spent playing as a kid, and the imaginary worlds I created, and have such fondness for those memories," she said. "With a career in the toy industry, I feel that I get to be a part of creating this same experience for a new generation."

Turner graduated in fall 2018 and in January will begin work as an Associate Project Engineer for Hasbro in Burbank. Murphy plans to graduate in either 2021 or 2022 and hopes to also work for Hasbro after graduation, or perhaps even peruse her own entrepreneurial endeavors. Both women hope that they might one day be able to serve as role models for young girls who have a similar dream of becoming toy designers.

"Being a girl in engineering, I see a great need for more girls to become engineers. I feel that many girls view engineering how I used to, or are not exposed to it at all, but making it a part of play is a fun, creative way to fix this problem," Turner said.

Remembering the ME dept's role during WWI

November 11, 2018 marked the 100th anniversary of the signing of the Armistice which ended World War I. In commemoration of this historic event, we remember the role that Iowa State's mechanical engineering department played during the Great War and also recognize those servicemen who gave the ultimate sacrifice.

In April 1918, a training program for military auto mechanics, blacksmiths, and machinists was launched as 500 soldiers arrived on Iowa State's campus. Though completely separate from the college's academic program, the training was led by ME Professor Warren Meeker. During World War I, the work of every department was reorganized to render maximum service to the nation. Courses not directly connected with the war effort were dropped. To further assist with the war effort courses were added in radio communications, signal corps practice, telegraph and buzzer signaling, military reconnaissance, gas engines, machine shop, and more. Professor Meeker taught an eight-week course that provided enlisted men with "extensive training" in machine shop, auto mechanics, and repair processes.

An army training course taught by Professor Meeker in 1918.
Photo courtesy of Iowa State University Library Special Collections and University Archives

Following the conclusion of the war, immense growth took place on the Iowa State campus as returning servicemen enrolled in classes. ME enrollment in particular hit 430 in 1919, which was more than double the enrollment of the previous year.

MEs who gave the ultimate sacrifice during WWI

Pvt. Harold Allen – Harold Allen came to Iowa State as part of the Mechanical Training Detachment, Company A. The Sutherland, Iowa-native died of influenza at Iowa State College in 1918.

LDS Charles Bilderback – (Landsman) Charles Bilderback served as a mechanic's mate in naval aviation at the Great Lakes Naval Training Station in Illinois. The Adel, Iowa-native died of pneumonia following the influenza outbreak in 1918

Pvt. Laurence Caspor – Laurence Caspor was part of the Mechanical Training Detachment, Company A. The Hinton, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Everett Clark – Everett Clark was part of the Mechanical Training Detachment, Company B. The Cedar Falls, Iowa-native died of influenza in 1918.

Pvt. Eugene Colburn – Eugene Colburn was part of the Mechanical Training Detachment, Company B. The West Union, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Anton Dahl – Anton Dahl was part of the Mechanical Training Detachment, Company B. The Cherokee, Iowa-native died of influenza at Iowa State College in 1918.

2nd Lt. O. Dean Davidson – O. Dean Davidson earned a B.S. in Mechanical Engineering and Agricultural Engineering in 1915. The Omaha, Nebraska-native died in an airplane accident at Richmond, Texas in 1919.

2nd Lt. Matthew Eckerman – Matthew Eckerman would have graduated in 1918 with a degree in mechanical engineering but instead enlisted in Officer Training School at Fort Snelling, Minnesota in May 1917. The Des Moines-native was killed in 1918 while doing scouting work in Alsace, France, possibly by friendly fire.

Pvt. Thomas Ellis – Thomas Ellis was part of the Mechanical Training Detachment, Company A. The Spencer, Iowa-native died of influenza in 1918.

Maj. Matthew King – Matthew King graduated with a B.M.E. in 1906. The Indianapolis-native was a major in aviation and died in Fort Sheridan, Illinois in 1919.

Pvt. Ralph Kirk – Ralph Kirk graduated with a B.S. in mechanical engineering in 1916. The Dunlap, Iowa-native died of pulmonary tuberculosis in 1919 while serving with the army of occupation in Coblenz, Germany.

Pvt. Henry Larson – Henry Larson was part of the Mechanical Training Detachment at Iowa State. The Story City, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Wendal Macy – Wendal Macy was part of Mechanical Training Detachment Company B. The Searboro, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. William Martin – William Martin was part of the Class of 1920 and studied mechanical engineering at Iowa State. The Odebolt, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Everett Marvin – Evertt Martin was part of Mechanical Training Detachment Company B. The Waterloo-native died of influenza at Iowa State College in 1918.

Pvt. Ehrhardt Michaelsen – Ehrhardt Michaelsen was part of the Mechanical Training Detachment. The Arion, Iowa-native died of influenza at Iowa State College in 1918.

ME serviceman honored during Gold Star Hall ceremony

In 1914, Iowa State University student Floyd Wambeam penned an editorial in the student newspaper calling for a student union building on campus.

Fourteen years later as construction of the Memorial Union was completed, Wambeam's was one of 117 names of Iowa Staters killed in World War I engraved on the limestone walls of Gold Star Hall.

As we mark the 100th anniversary of the end of World War I this year, the 2018 Gold Star Hall ceremony will include the story of how the Memorial Union came to be following the deaths of more than 100 Iowa State students and alumni in WWI.

Lt. j.g. Suesens

Iowa State's annual Gold Star Hall ceremony honors Iowa Staters who lost their lives in war. Former students' names are engraved on the Gold Star Hall walls if they attended Iowa State full-time for one or more semesters and died while in military service in a war zone. As names become known, they are added to the wall and the service members are honored in the university's Veterans Day observance.

This year's Gold Star Hall ceremony took place on Nov. 12 in the Memorial Union Great Hall. Three servicemen who gave the ultimate sacrifice were recognized:

- **William Howard Butler**, Indianola, studied agricultural engineering at Iowa State in the 1940s. He enlisted in the U.S. Army Air Force three months after the attack on Pearl Harbor, in 1942. He was killed when his plane crashed shortly after takeoff in China in July 1945.

- **Robert Vance Rannells**, Dunlap, enrolled at Iowa State in 1936, studying agronomy. A month before receiving his degree, he enlisted in the U.S. Air Force Reserve. He died in April 1945 when his B-29 bomber went down in the Pacific Ocean near Japan.

- **Richard Wayne Suesens**, Burlington, came to Iowa State in 1937 to study mechanical engineering. He enlisted in the U.S. Navy Reserve in 1938. He was announced missing in action during the Battle of Midway in June 1942, and a year later was declared killed in action

While their names are already engraved on the wall, these men have not yet been honored in a Gold Star Hall ceremony.

Today, Gold Star Hall includes the names of the nearly 600 Iowa Staters who have died in war: in World War I, World War II, Korea, Vietnam, Somalia and in the Global War on Terrorism.

Contributed by ISU News Service

MEs who gave the ultimate sacrifice during WWI

Cpl. William Moore – William Moore studied mechanical engineering at Iowa State. The Des Moines-native died of pneumonia (possibly flu-related) at Camp Meade in Maryland in 1918.

Pvt. Philip Mueller – Philip Mueller came to Iowa State as part of the third Mechanical Training Detachment, Company B. The Hudson, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Cale Neal – Cale Neal came to Iowa State as part of the Mechanical Training Detachment, Company A. The Portland, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Clarence Nelson – Clarence Nelson came to Iowa State as part of the Mechanical Training Detachment, Company B. The Jewell, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Carl Polson – Carl Polson came to Iowa State as part of the Mechanical Training Detachment, Company A. The Indianola, Iowa-native died of influenza at Iowa State in 1918.

Pvt. James Powers – James Powers came to Iowa State as part of the Mechanical Training Detachment, Company B. The Duncomb, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. William Reints – William Reints came to Iowa State as part of the mechanical training corps. The Stanton township, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Peter Sand – Peter Sand came to Iowa State as part of the Mechanical Training Detachment, Company B. The Dubuque, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Lester Schoech – Lester Schoech came to Iowa State as part of the Mechanical Training Detachment, Company B. The Ottumwa, Iowa-native died of influenza at Iowa State College in 1918.

1st Lt. Charles Schumacher – Charles Schumacher received a B.S. in mechanical engineering from Iowa State in 1912. He worked as a civilian engineer at the air field at Fort Sill, Oklahoma and enlisted as a private there in October, 1917. He died at the aviation repair depot in Montgomery, Alabama in 1919.

Pvt. Lowell Sheldon – Lowell Sheldon was part of the Mechanical Training Detachment, Company A at Iowa State. The Eldora, Iowa-native died of influenza at Iowa State College in 1918.

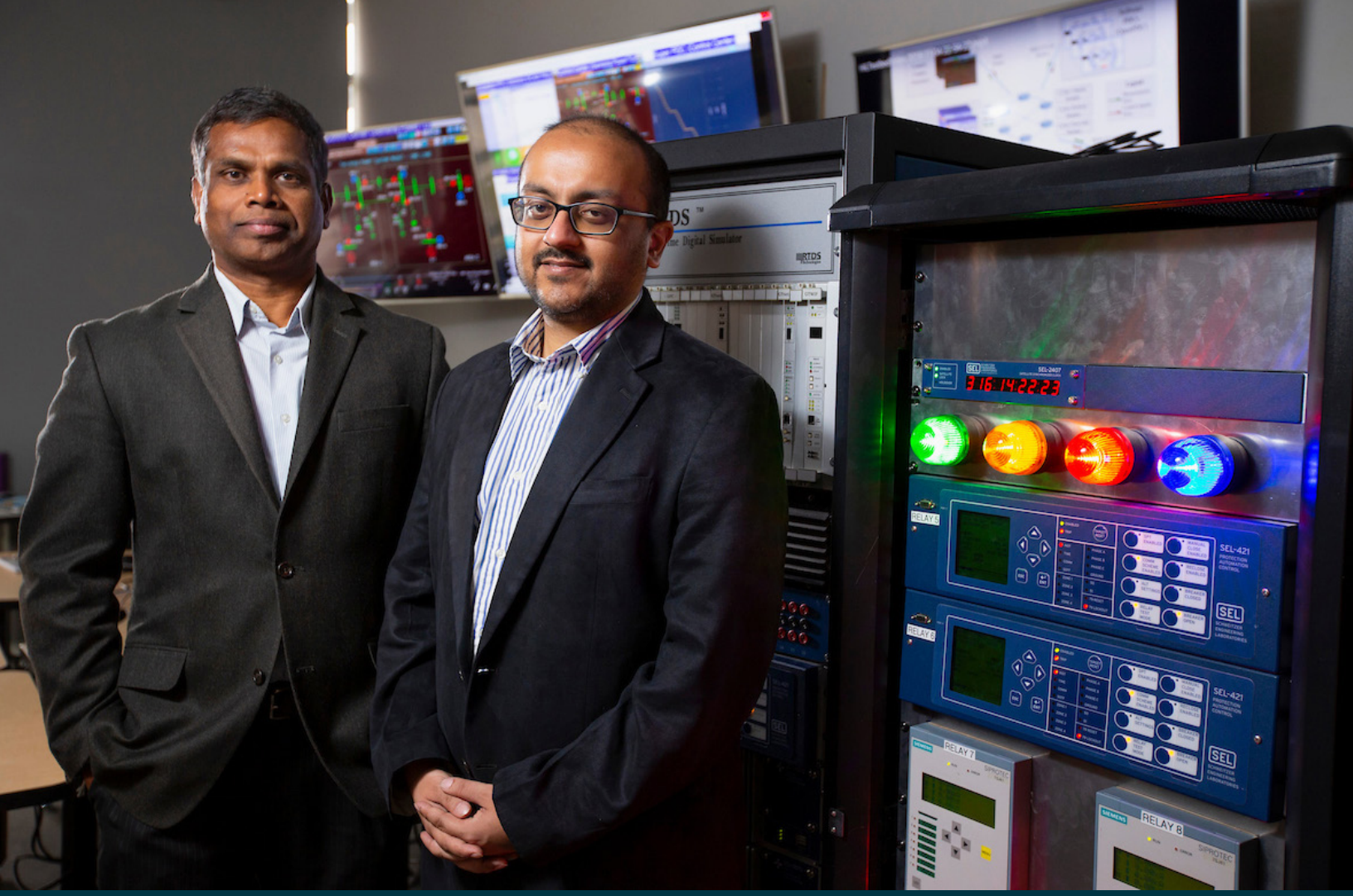
Pvt. Tracy Sparks – Tracy Sparks was part of the Mechanical Training Detachment, Company B at Iowa State. The Kellogg, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Ralph Warrington – Ralph Warrington was part of the Mechanical Training Detachment, Company B at Iowa State. He died of influenza at Iowa State College in 1918.

Pvt. Frank Waugh – Frank Waugh was part of the Mechanical Training Detachment at Iowa State. He died of influenza at Iowa State College in 1918.

Pvt. John Wilmes – John Wilmes was part of the Mechanical Training Detachment, Company A at Iowa State. The LaMotte, Iowa-native died of influenza at Iowa State College in 1918.

Pvt. Pearl Yates – Pearl Yates was part of the Mechanical Training Detachment at Iowa State. The Albia, Iowa-native died of influenza at Iowa State College in 1918.



Iowa State engineers, left to right, Manimaran Govindarasu and Sourabh Bhattacharya are developing tools to protect the power grid from cyberattacks. Larger photo. Photo by Christopher Gannon.

ME's Bhattacharya use game theory to quantify threats of cyberattacks on power grid

Threat levels for cyberattacks on the power grid are usually labeled high, medium or low. Well, that's not good enough for a team of Iowa State University engineers.

That's too qualitative and too subjective, according to a new College of Engineering research project, which involves ME assistant professor Sourabh Bhattacharya.

And, as he and his research collaborators wrote in a summary of a project to develop a better way to assess the threats of cyberattacks on the power grid, current assessments are "grossly inadequate" to account for dynamic and uncertain adversaries and the complexity of the computer controls and networks that support the grid.

Could engineers incorporate scientific methods? Computer algorithms? And given that there are attackers and defenders – just like in a soccer match – could game theory be applied to help with risk assessment, attack-defense modeling and "what-if" contingency analysis that could help mitigate any attacks?

A three-year, $777,271 grant from the National Science Foundation is supporting research and development of the idea. Manimaran Govindarasu, Ross Martin Mehl and Marylyne Munas Mehl Computer Engineering Professor, is leading the project with the collaboration of Sourabh Bhattacharya, an Iowa State assistant professor of mechanical engineering. Iowa State doctoral students Srayashi Konar (ECpE), Hamid Emadi (ME) and Burhan Hyder (ECpE) are contributing to the project.

"We want to prove this concept is doable," Govindarasu said. "And we want to develop a software tool industry can use – one that provides a systematic way of security planning and investment."

The key will be developing models that analyze and predict threats, vulnerabilities and consequences, Govindarasu said. Of those, threat modeling is the least understood. He thinks game theory could change that.

Bhattacharya has expertise in game theory and is using it for other projects related to drones and multi-robot systems.

"That's a powerful tool to develop strategies to protect the system. Given a fixed budget for security, it can show whether your need better locks in the 'windows' or the 'doors.'"

~Sourabh Bhattacharya

Bhattacharya says game theory is all about quantifying how people or teams try to maximize their outcomes – whether that's scoring soccer goals or defending the power grid from cyberattacks.

"We can use game theory tools to figure out what we can expect from such interactions," he said.

The primary tools are mathematical models that measure "optimality," or "what's the best I can do?" in any given scenario, Bhattacharya said.

In the case of the power grid, operators want to keep their computers and controls safe behind firewalls with strong authentication and access-control mechanisms. Attackers want to evade those protections and bring down the grid.

"They fight against each other," he said.

That fight can be modeled to show how and where the grid is vulnerable to cyberattacks, Bhattacharya said.

"That's a powerful tool to develop strategies to protect the system," he said. "Given a fixed budget for security, it can show whether your need better locks in the 'windows' or the 'doors.'"

Developing a useful tool for industry is an important part of the project. Govindarasu has long worked with industry on cybersecurity, including deployment of technologies and sharing lessons and training on the "PowerCyber" grid testbed developed at Iowa State. Iowa State's Electric Power Research Center will also be involved in demonstrating and sharing the tools.

The study's tools could also be adapted to other cyber-physical infrastructure such as oil, natural gas and transportation systems.

"We need to work hard to make something happen," Govindarasu said. "We need to figure out how we can take this into the field because cybersecurity is a real problem."

Contributed by Mike Krapfl/ ISU News Service

In Memoriam

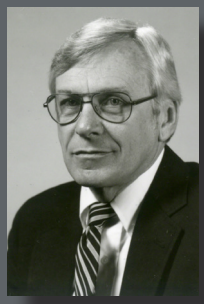
Alfred "Al" Joensen

Associate Professor Emeritus Al Joensen passed away May 10th, 2018 at the age of 87

Al Joensen, a previous associate professor in the Department of Mechanical Engineering, passed away May 10, 2018 at Mary Greeley Medical Center in Ames. Alfred William Joensen was born in New York City on July 24, 1930. He grew up in the Bronx and graduated from Stuyvesant High School in 1948. He then attended the City College of New York from 1948 to 1950, during which time he played varsity football and lacrosse. In 1951, he joined the Air Force and flew in missions all over the world. Following his active duty, he continued to serve in the Air Force Reserve for 28 years and retired with the rank of Lieutenant Colonel. After an honorable discharge from his Air Force active duty, he enrolled at Iowa State and graduated with his bachelor's degree in mechanical engineering in 1957. After graduation he was hired by the department as instructor while simultaneously taking graduate courses. He married Marilyn Simington in 1959 and together they went on to raise four sons and a daughter. He completed his master's degree in ME in 1965. During his career, Al's research and teaching focused on power plant design, thermodynamics, and alternative fuels. He was also involved with the refuse-to-energy research project between the ME department and the Ames Resource Recovery Plant in the 1970s. Outside of work, Al served on the Ames Utility Board and was also a supporter of Ames High and Iowa State athletics, often working as a timer at ISU track meets. He also served as a simulated patient for the University of Iowa College of Medicine. He was active with his church, serving as an usher and minister for St. Thomas Aquinas Parish (1959-1976) and as an usher, minister to the sick and homebound, and a member of the Facilities Committee for St. Cecilia Parish (1976-2018). Al is survived by his wife, five children, and seven grandchildren.

George Junkhan

Professor Emeritus George Junkhan passed away August 6, 2018 at the age of 89



George Junkhan, a previous professor in the Department of Mechanical Engineering, passed away on August 6, 2018 at Mary Greeley Medical Center in Ames. George H. Junkhan was born January 30, 1929 in Peoria, Illinois. He served in the Air Force from 1950 to 1953 and enrolled at Iowa State after his service. He earned his B.S. (1955) and M.S. (1959) in mechanical engineering and joined the ME faculty as an assistant professor after graduation. While serving on the faculty he simultaneously pursued a Ph.D. in theoretical and applied mechanics and mechanical engineering, completing it in 1964. During his career his research focused on heat transfer and fluid mechanics on which he authored or co-authored dozens of articles. He served stints as a visiting professor at various institutions including Prairie View A&M, a historically black college in Texas, as well as at the von Karman Institute for Fluid Dynamics in Brussels, Belgium. He also did consultation work for Deere and Co., Caterpillar Tractor Co., Bock Corporation, and Check-all Valve Corp. George received the ME department's Professor of the Year award in 1980 and in 1987 received the ISU Alumni Association Award for distinguished service. He retired with the rank of Professor Emeritus in 1994. George is survived in death by his wife, two

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