

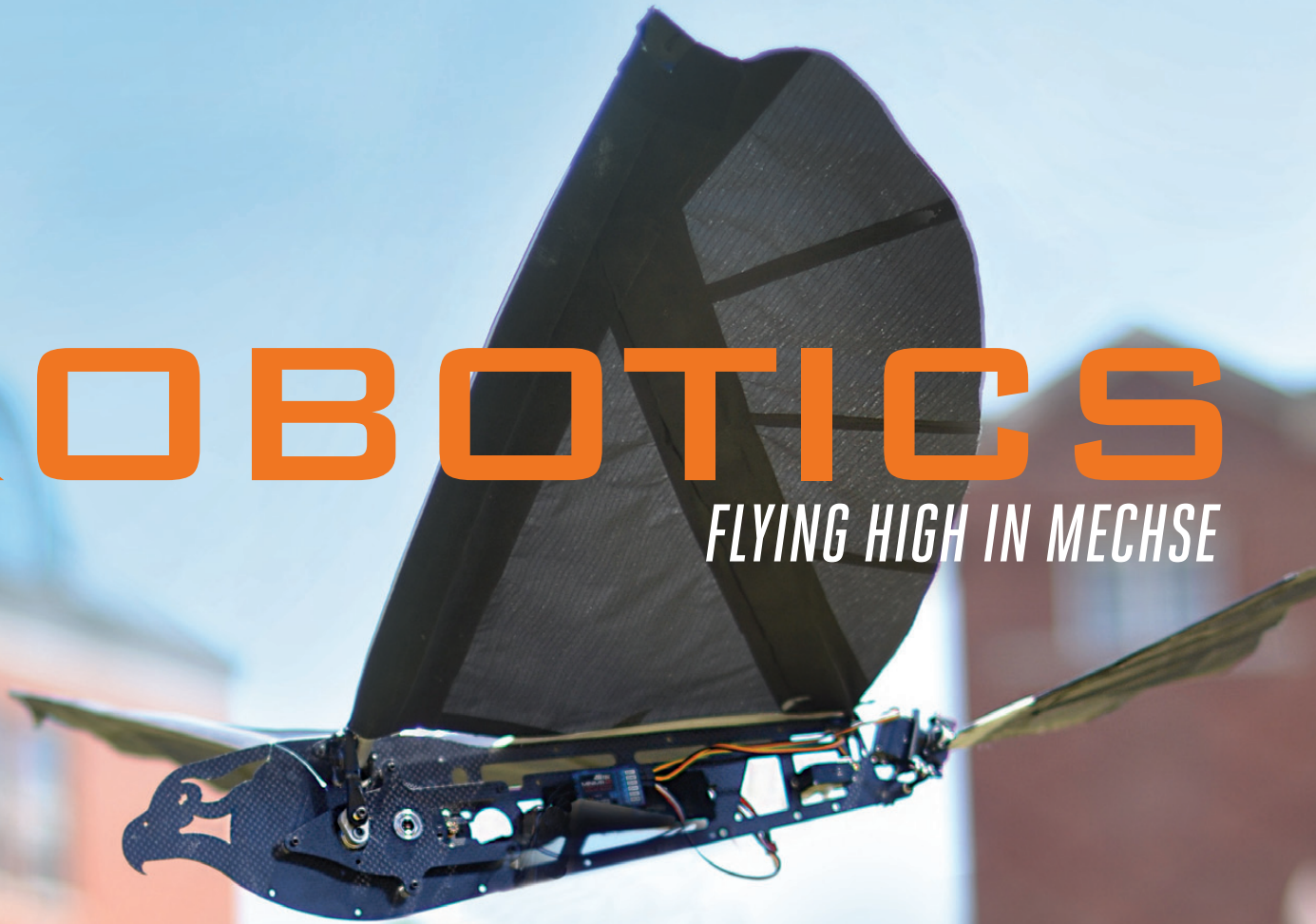
MECHANICAL SCIENCE AND ENGINEERING / SUMMER 2017

MechSE



ROBOTICS

FLYING HIGH IN MECHSE



ALUMNUS
HELPS END
108-YEAR
DROUGHT

 ILLINOIS

"MECHSE WEST" OPENS NEAR CAMPUSTOWN

Transform MEB project moves forward as MechSE West opens in Campustown



In January 2017, a newly renovated facility at 607 East Healey Street opened its undergraduate instructional labs for the spring semester, and “MechSE West” was born.

Known for years as the Optical Physics Engineering Laboratory (OPEL), the white block building sits on the same city block as Green Street staples Panera Bread, Panda Express, and Murphy’s Pub.

An integral part of the “Transform MEB” project, many of the instructional labs from Mechanical Engineering Laboratory were moved to MechSE West. This will enable the move of several faculty labs from MEB to the newly vacant space in MEL. The final step in the shuffle will be bringing the MechSE West labs to their permanent home in MEB after the renovation is completed. MechSE will likely relinquish the MechSE West space at that point.

MechSE facilities and operations director **Damon McFall** (BSME ’05) had to do his best HGTV-like renovation, flipping the new MechSE West facility into labs and graduate student offices. OPEL had at one time been

“I’m happy as an alumnus of this department to be able to give back to help us move forward.”

used for groundbreaking research, including plasma technology for TVs, but in the past few years it had become a repository for old electronics, furniture, tools, pieces, and parts.

“On first look, no one would have wanted to move into that building,” McFall said. “However, this was the space the College had available.”

To flip this underutilized structure into productive workspace, McFall strove to make it a haven for undergraduates and graduate students alike.

The first floor, home to the labs where undergraduates work, features walls that are covered in quotes of wisdom shared from successful alumni.

The graduate student work areas are on the second floor and look down onto the work stations below. McFall wanted this upper area to have a “think tank” feel. There

is a Google-inspired color scheme with bold primary colors. The walls are covered in more quotes meant to inspire.

McFall, Professor **Elizabeth Hsiao-Wecksler**, Director of Undergraduate Programs **Emad Jassim**, Lecturer **Blake Johnson**, and Director of Technical Services **Ralf Moller** held meetings to design the space and used a design-build approach because of the condensed schedule.

McFall said this was just the first big step in making some major changes to transform the department.

“I’m happy as an alumnus of this department to be able to give back to help us move forward.”

Please contact us to find out more about the Transform MEB project and how you can get involved:



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From the Department Head



It is summer! The summer break provides an ideal opportunity to reflect on the past year and make plans for the future. MechSE just completed an incredible academic year, and we are heading into another that promises to be just as exciting. In this magazine we give you a look at some of the current activities and recent events lifting us to new heights.

Along those lines, MechSE students continue to energize us with their talents and dedication.

On pages 16 and 17, you will find details on some of the great design work our undergraduate students are doing both inside and outside of their classes. On pages 18 and 19, you can read about a few of our top graduate students and receive updates on our newest degree program, the Master of Engineering in Mechanical Engineering.

In January 2017, we opened a new facility, which we affectionately call MechSE West. Many of our undergraduate teaching labs have been moved there, as have many of our graduate student workstations. This new facility is a temporary yet vital space for us, as we reconfigure our labs for the Transform MEB project. I want to thank MechSE’s **Damon McFall** for his tireless work and impressive planning in making this project a reality. On the facing page, you can read more about the challenges he faced.

Our MechSE professors continue to lead and inspire, in Urbana and around the world. You can read about some of their work in this magazine. In particular, we chose this issue to highlight some of our faculty projects in robotics, an exciting, vital, and dynamic part of the mechanical engineering landscape. While an exhaustive look at our robotics work is beyond the scope of one magazine section, I hope you’ll enjoy this quick glimpse.

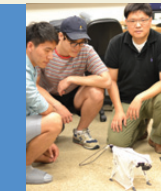
We are equally proud of our alumni and the ways in which they are changing the world through leadership in academia, in countless industries, and in public service. We have included a fun look at one alumnus, **Andrew McIntyre**, who has taken an unconventional route in his career, ending up an integral part of a professional sports championship that garnered quite a few headlines recently.

I hope you enjoy this magazine and that it might contribute a little to your summer reflections. As always, we thank you for your continued support of MechSE.

Best regards,

Anthony Jacobi
Department Head
Richard W. Kritzer Distinguished Professor

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ON THE COVER

Inspired by the agility, adaptability, and efficiency of birds’ wings, Assistant Professor Aimy Wissa has designed and built an ornithopter. Her research aims to revolutionize unmanned aerial vehicle designs. Read more about the robotics work of Wissa and other MechSE professors, starting on page 6.



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Addy among College of Engineering 2017 Distinguished Alumni



A.L. (Tad) Addy (PhD ME '63) was one of a select group to receive the College of Engineering Distinguished Alumni Award this year. A professor emeritus and former department head

of MechSE, Addy was recognized for his distinguished research in fluid dynamics and outstanding leadership of the department, as well as his advocacy for quality and innovation in education. A pioneer of fluid mechanics, he attributes his experiences at Illinois as what motivated him to conduct research on ejectors and separated flows. In addition to his groundbreaking research, Addy had a profound impact on the department's quality of education, research, and public service.

Ewoldt wins presidential honor

In January, Assistant Professor **Randy Ewoldt** was among the 102 scientists and researchers named by President Obama as recipients of the Presidential Early Career Awards for Scientists and Engineers (PECASE), the highest honor bestowed by the U.S. government on science and engineering professionals in the early stages of their independent research careers. "These innovators are working to help keep the United States on the cutting edge, showing that federal investments in science lead to advancements that expand our knowledge of the world around us and contribute to our economy," President Obama said.



Deputy Secretary of Defense visits Hovakimyan's robotics lab

In May, the University of Illinois welcomed a noteworthy alumnus—U.S. Deputy Secretary of Defense **Bob Work**—back to campus for a tour of several state-of-the-art research facilities. Visiting as an official representative of the Department of Defense (DoD), Work observed robotics research in progress at the Intelligent Robotics Lab in the Coordinated Science Lab, and visited the Beckman Institute to learn about research advances in materials. MechSE professor **Naira Hovakimyan** and her group demonstrated miniature UAV flight inside the lab's indoor VICON environment. Hovakimyan also discussed her L1 adaptive control system, which has been tested on a Learjet and an F16 at Edwards Air Force Base over the last two years.

Startup raises \$800K for game-changing cast



The year 2017 started off well for one MechSE alumnus, **Jason Troutner** (BSME '16), and his business partners. Cast21, the startup company that's creating a waterproof, breathable cast to heal broken bones

without the discomfort of a traditional cast, raised \$800K in funding to continue the research and development of its product, a potential game-changer that would allow the wearer of the cast to be as mobile and comfortable as possible.



Adrian receives University of Illinois honorary degree

Professor Emeritus **Ron Adrian** was the 2017 Honorary Degree recipient for the University. One of the world's authorities on fluid mechanics, he joined the Department of Theoretical and Applied Mechanics (TAM) at Illinois in 1972. He said he was struck by the quality of the Illinois students, who he described as "excellent and serious," as well as by the "mix of applications and foundations at Illinois." After retiring from Illinois in 2002, Adrian became the Regents' Professor and Ira A. Fulton Professor of Mechanical and Aerospace Engineering at Arizona State University, where his career continues to this day.

Pantano hopes to improve parachutes for Mars missions



Associate Professor **Carlos Pantano** garnered some media attention for his work to develop simulations of improved parachutes for rovers moving through Mars' atmosphere. Parachutes are one way for capsules holding rovers to decelerate before making landfall, but due to the capsules' increased size and the large forces around them, these parachutes tend to break upon deployment. Pantano was awarded one of 13 Early Stage Innovation grants from NASA, and he aims to create better

parachutes through computer simulations prior to NASA's subsequent expensive experiments. "If you have the technology to land safely you would like to send the biggest capsule," Pantano said. "It's a small increase in cost but it's a large improvement in the science."



Khan opens manufacturing plant in Detroit

U.S. auto parts maker Flex-N-Gate, based in Urbana and owned by 1999 MechSE Distinguished Alumnus **Shahid Khan** (BSIE '71), broke ground

in April on a new manufacturing facility in the I-94 Industrial Park in Detroit, Michigan. Local officials described it as the largest investment by an automotive supplier in decades. Khan said business owners in the automotive industry "have to have a social conscience. You can do that and still make investments like this."

ROBOTICS

IN MECHSE

"What will emerge is personalized robotics, just like the personal computers we have today. You plug in a new app or device, some information downloads, and your robot has new capabilities."

—Naira Hovakimyan

One of the world's fastest-growing fields, robotics is a highly interdisciplinary branch of engineering and science that includes electrical engineering, computer science, and of course mechanical engineering, among many other concentrations. Advances in robotic technologies are hurtling forward as rapidly as their fields of implementation are expanding. And many of the challenges in robotics lie not only in making breakthrough developments, but in finding ways to make them affordable for widespread use throughout society.

Robotics is a growing field within the MechSE Department as well. New professors who predominantly study robotics have been hired in recent years. Many tenured faculty also have steered their research toward robotic technologies or have discovered uses for robotics in their existing work. This section provides a look at some of the robotics research and applications currently undertaken in MechSE.

Hovakimyan utilizing machine learning in agriculture analytics

Professor **Naira Hovakimyan's** aerial imagery analytics company, IntelinAir, received a 2016 AgFunder Innovation Award and was recognized as one of five agriculture technology companies for the "Most Innovative U.S. Pre-Series A Startups." The company's researchers used drones to develop ground-breaking algorithms and novel solutions to major farming challenges, such as weather, insect, or nutrient damages that could have negative effects on a farm's enterprises. One of their breakthrough innovations is AG-MRI, a field health monitoring system that allows farmers to proactively oversee the health and growth of their crops. Hovakimyan said IntelinAir will work to further advance their ability to identify the causes of crop damage, including plant diseases and nitrogen deficiency sources and combine data further with soil analysis. She added that she believes digital agriculture is the next industry to have a major revolution, and will be extremely valuable for society. "With that, we are paving the path," Hovakimyan said. "We are building the industry, and we are one of the leaders. I want our goal as a Midwestern agriculture company to be of benefit to the state and its economy."

Naira Hovakimyan and one of her drones.

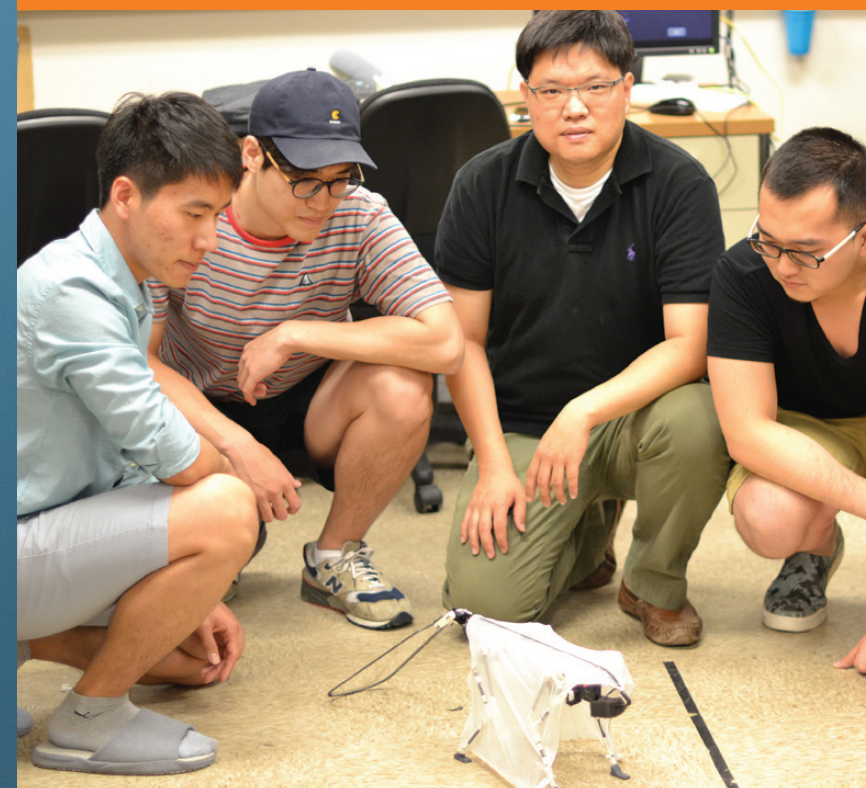


"We are building the industry, and we are one of the leaders. I want our goal as a Midwestern agriculture company to be of benefit to the state and its economy."

—Naira Hovakimyan

Park to introduce robotic flying squirrels

MechSE assistant professor **Hae-Won Park** has been awarded funding from the Defense Advanced Research Projects Agency (DARPA) to design a hybrid robot that can glide, land, and walk. His groundbreaking design is inspired by the flying squirrel. Park's robot would be dropped from an aerial vehicle, glide like a flying squirrel, then land and continue walking on a variety of terrains, with proposed applications in reconnaissance missions, military scouting, and disaster response efforts, particularly in difficult-to-access or hazardous environments. Park's flying squirrel will address the flaws of past attempts at this type of robot. The combined mobility of walking and flying will give the bots the large range of existing flying robots as well as the long-lasting operational hours of a ground vehicle. It will also boast the ability to gather information about environmental conditions, crucial to the robot's missions; they can work independently or in swarms to share environmental awareness via a mobile sensor network. His design includes development of soft silicone wing structures that attach to the robot's limbs and allow it to glide. The body frame is 3D-printed with lightweight materials—allowing for fast prototyping—like carbon fiber composite material, engineered plastics, and compliant resins.



Hae-Won Park and students show the robotic flying squirrel prototype in his lab.



Harry Dankowicz with robotic arm test bed.

Dankowicz aims for timely impact on field-crop agriculture

Efficient planting is crucial to large-scale farming operations. Funded by the U.S. Department of Agriculture, MechSE professor **Harry Dankowicz** is working to develop an autonomous robotic vehicle that limits planting interruptions by streamlining the refilling of seed tanks. Typically, farmers need to stop planting and meet up with another truck to manually refill tanks. The proposed seed-refilling vehicle autonomously knows when a seed tank is running low, finds it in the field, and fills the tank while the planter is still moving. Dankowicz is focusing on the dynamics of the robotic arm and design of the seed-transfer mechanism that docks with the tank while both the planter and robotic vehicle are in motion. “Compared to rovers used for planetary exploration,” Dankowicz said, “our robotic design must be able to control the manipulator dynamics during travel, as the rover moves across a large agricultural field at a fast clip.” With appropriate scheduling, a single refilling vehicle could be used to service several parallel planting operations. Dankowicz added that similar robotic service vehicles could be used to further automate farmers’ existing practices while giving them precise information about the status of their crops, fields, and farm equipment.

"The ability to produce a functional and geometrically complex 3D mechanical system from a flat sheet introduces exciting opportunities in the field of robotics."

—Sameh Tawfick and Aimy Wissa

Tawfick, Wissa team with students to develop origami-inspired robot

New research from a team of MechSE professors and students, soon to be published as an invited paper in *Smart Materials and Structures*, details how origami structures and bio-inspired design can be used to create a crawling robot. Assistant professors **Aimy Wissa** and **Sameh Tawfick**, along with graduate student **Alexander Pagano** and undergraduates **Tongxi Yan** and **Brian Chien**, used origami paper-folding principles to construct and actuate mechanisms and machines for possible integration with small, scalable, and cheap robots as well as deployable adaptive structures. “The robot uses origami building blocks to mimic the gait and metamer properties of earthworms and directional material design to mimic the function of the setae on earthworms that prevents backward slipping,” Wissa said. Their design utilizes the origami tower as a simple mechanism to transform motor rotation to linear motion, enabling a crawling gait. It can go forward and turn left and right using repeated expansion and contraction. “The ability to produce a functional and geometrically complex 3D mechanical system from a flat sheet introduces exciting opportunities in the field of robotics for remote, autonomously deployable systems or low-cost integrated locomotion,” they wrote. Moving forward, this design can also be used in manipulations, booms, and active structures.

Sameh Tawfick and Aimy Wissa discuss their crawling robot prototype with students.



LaViers studying expressive robotic motions

MechSE assistant professor **Amy LaViers** believes a key prerequisite for robots becoming a larger part of everyday life is people becoming more comfortable around them. In one of the major projects in her Robotics, Animation, and Dance (RAD) Lab, she and her team work to develop robotic movement that is more relatable to humans. With a background in dance performance and the physical precision it demands, LaViers is uniquely qualified to examine these fine aspects of human movements. “I think of dancers as the philosophers of movement,” she said. “They are thinking very deeply about all the different types of movement profiles that we might see or might want to generate.” One method her team is working on is the development of a bipedal walking platform and corresponding controller that has an actuation strategy similar to how humans actually walk. Many robots walk with distally located actuation points in the ankle, hip, and knee to generate their gait. The LaViers group is working to develop points of actuation in the core near the center of mass, one step closer to human-like motion.

Amy LaViers shows students movement development in robots.

"I think of dancers as the philosophers of movement." —Amy LaViers

Powered orthotics utilizing small, soft robotics

Professor **Elizabeth Hsiao-Wecksler**’s Human Dynamics and Controls Laboratory (HDCL) designs powered orthotics that provide delicate force to make a weakened limb functional, typically for people disabled by neuromuscular disease or injury. For example, the HDCL uses Fiber Reinforced Elastomeric Enclosures (FREE) actuators—consisting of an elastic inner tube that can be inflated and a mesh layer, which constricts—to create a forearm support for people who need crutches to get around in everyday life. This “pneumatic ergonomic” crutch uses the FREE actuator to generate temporary constriction force around the forearm, ensuring a portion of the body weight of the person using the crutch will go into the forearm and the crutch rather than the hand and wrist. Another recent product developed in the lab is SMALL exos, or Soft, Modular Architecture, Lightweight, and Low-profile exoskeletons. This project aims to create wearable robotics technology that is unobtrusive, allowing for a very lightweight, low-profile exoskeleton that can be worn under clothes or even could work as actuated clothing or undergarments. The SMALL exo-technology has the potential to help with knee, joint, and/or lumbar support on people who perform heavy lifting in their jobs. ISE assistant professor **Girish Krishnan** is Hsiao-Wecksler’s collaborator on these projects.

Elizabeth Hsiao-Wecksler tests the orthotic with students from her research group.





"We can attach lateral muscles to the body and then activate them so they contract and release, resulting in a complex gait."

—Mattia Gazzola

Mattia Gazzola and his student demonstrate the bending and stretching modes that occur when a cylindrical filament is twisted.

Gazzola and Saif making bio breakthroughs with micro-bots

For the last several years, Professor **Taher Saif** has collaborated with bioengineers at Illinois to develop a class of tiny bio-bots that swim in fluids. Modeled after single-celled creatures with flagella, the body of the bio-bot is 3D-printed from a flexible polymer, with cultured heart cells near the junction of the head and tail. The cells self-align and synchronize to beat together, sending a wave down the tail to propel it forward. Now, taking that work even further, Assistant Professor **Mattia Gazzola** is optimizing the configuration of these micro-bots to produce the most efficient movements through fluid. Using the design geometry and data from Saif's bio-bots, Gazzola has modeled and simulated them virtually with computational tools. From there, he and his team have identified the optimal characteristics that could enable them to swim 200 to 300 percent faster. "What we do is use our simulations to understand the fluid mechanics—how the fluid interacts with the oscillation of the body—and how we can use that knowledge for rational design purposes. You can think of a little snake or swimmer as just a flexible body with muscles. We can attach lateral muscles to the body and then activate them so they contract and release, resulting in a complex gait. But we can do much more than this—we could create sheets of tissue or muscle, and change the skeleton by adding multiple flagella, for instance," he said. This kind of forward engineering is paving the way for promising applications in the biomedical arena, in which, for example, micro-bots could deliver a drug directly by swimming through blood vessels.

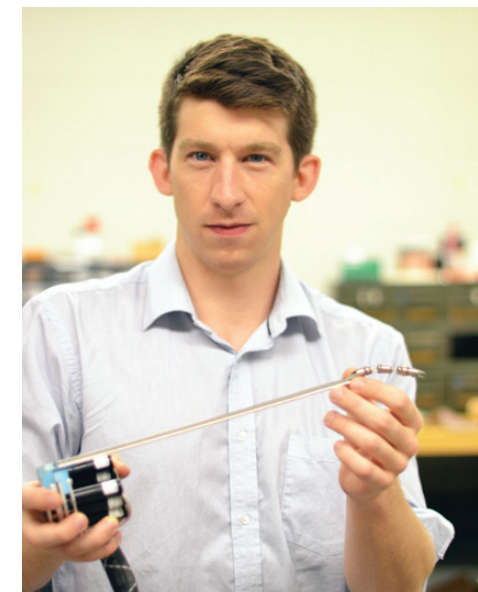
iRobotics now 500 members strong

There is not a lot of empty space at general meetings for iRobotics, the largest engineering RSO on campus. There are more than 500 members, including many from MechSE. The RSO's projects are spread out over different teams within the organization. There are battlebots, the Midwestern Robotic Design Competition (MDRC), Vex, and project teams, all of which give members the chance to challenge themselves in the robotics field. In all, they build between 10 and 20 robots per year. Much of their work comes to fruition during Engineering Open House weekend, when both MDRC and battlebots compete against other area teams and put on demonstrations for enthusiastic onlookers. MechSE senior **Ian Weivoda** spent all four years as a part of the MDRC team for iRobotics, including the 2016-17 year as captain. "I already had a big interest in going into robotics career wise before iRobotics, and iRobotics has kept me on that path," Weivoda said. "I'm going to work for John Deere to design and build giant tractors, which fortunately I found out are basically just giant robots."

Ferreira and Toombs advancing robotic surgical systems

Professor **Placid Ferreira** and PhD candidate **Nicholas Toombs** are developing a compact robotic device that could set a new benchmark for minimal invasiveness in abdominal surgeries such as gall bladder removal. With a working name of MIRA (minimally invasive robotic apparatus), it consists of a system of long, miniature robotic manipulators at the end of a single tube, which allows entry into the human body through a single incision. In the current landscape of robotic instruments, only one robotic surgical system—the da Vinci system—has been approved by the FDA to be used on humans. While groundbreaking and widely used, the da Vinci system is large and somewhat limited in contortion, needing to enter the body through multiple ports—one for each robotic arm in use. Conversely, each of MIRA's four arms will be contained within a single insertion tube, so it needs only one port of access. Each of the MIRA system's four robotic arms would feature a front-end tool (performing tasks inside the body) connected to tendons that run through a long, thin rod to pulleys at the back end, where the surgeon remotely controls the entire system. The project is being funded by Jump Trading in collaboration with the Peoria Children's Hospital.

Nicholas Toombs shows one arm of the MIRA prototype.



Joseph Bentsman, Leonardo Chamorro, and Martin Ostoj-Starzewski.

Faculty team bringing the robotics to robotic surgery

In collaboration with professors at the University of Illinois at Chicago and the new Carle Illinois College of Medicine, MechSE professors **Joseph Bentsman**, **Leonardo Chamorro**, and **Martin Ostoj-Starzewski** are breaking ground on innovative technology that combines robotics and electrosurgery. "Monopolar electrosurgery now is the absolute leading tool in surgery," Bentsman said. "But its application in the closed space through tubular guide is at present unsafe. Our project is to do whatever is necessary to enable reliable and safe use of monopolar electrosurgical tools in internal surgery situations." Bentsman looks at actuating, sensing, and then controlling the system. Chamorro leads an effort in generating and measuring thermal response of biological tissue samples, using his extensive experimental fluid mechanics background. Ostoj-Starzewski, who specializes in theoretical and applied mechanics, is working on creating a mathematical model of what is going on inside the body when a surgeon applies monopolar electrosurgery. "We're trying to bring it, through modeling and capturing the phenomenology of the process, to the state where it indeed will start acquiring robotic elements in terms of closed loop, autonomy, and communication to the surgeon at the high level so that the surgeon can delegate decisions to the low level that will then be executed autonomously," Bentsman said. "That really would be a true interaction between engineering and medicine."



Alumni spotlight: Melonee Wise

Alumna **Melonee Wise** (BSME '04, MSME '06) is the CEO of Fetch Robotics, which optimizes warehouse operations through two core robot offerings. Both products are autonomous mobile robots that operate safely in commercial and industrial environments shared by people. With a 12,000-square-foot facility in San Jose, 40 robots, and about 35 employees, Fetch Robotics is a fast-growing startup looking to soon grow its staff to about 60. Wise described the atmosphere at the company as one that's inspiring and unique. "When you walk into Fetch, you see a lot of robots," she said. "At any one time in any one area, we probably have 10-15 robots just strolling around. We also have a secondary site where we do testing, so we have a fake warehouse." In 2014, Wise was named to "The 15 Most Important People Working in Robotics" list by *Business Insider*. She was also one of three MechSE alumni to receive the Distinguished Alumni Award for 2016. After earning her degrees, Wise worked as manager of robot development at the widely revered startup Willow Garage. She then went on to be CEO and co-founder of Unbounded Robotics, where she and her team were the inaugural winners of the RoboBusiness Pitchfire Competition.



McIntyre and his mother on "ring day."

MechSE alumnus Andrew McIntyre is Heading the tech behind the champs

When the ball nestled into first baseman Anthony Rizzo's glove in early November 2016, the Chicago Cubs became World Series champions for the first time since 1908. It had taken a true team effort to climb back from a three-games-to-one deficit in the series and catapult Cubs nation into jubilation. A 108-year championship drought had ended.

On a larger scale, the entire Cubs organization has made a more impressive comeback, not only assembling championship-caliber talent on the field, but reconstructing historic Wrigley Field, revitalizing building after building throughout Wrigleyville, building a top minor league system, and creating a strong

organizational structure to support it all.

Technical systems—from user operations to facility infrastructure to custom software development—form a large part of this structure, and that is where MechSE alumnus **Andrew McIntyre** (BSME '96) enters the picture. As the Cubs' Vice President of Technology, he has ventured off the path taken by most mechanical engineering majors.

"Even going into Illinois, I didn't know if mechanical was the right fit for me," McIntyre said. "But the engineering skills, the trouble shooting, the problem solving—the path it put me on was spot on."

Those core skills helped McIntyre earn an MBA from Illinois and undertake seven years of consulting work before pivoting into technology positions at CNO Financial Group and Bankers Life and Casualty.

And then emerged a once-in-a-lifetime opportunity—at least for sports enthusiasts in Chicagoland: a highly sought-after position on the business side of the Cubs.

"I was a candidate from outside the industry and had a completely different background, but that's what the Cubs were looking for," McIntyre said. "One of the philosophies here is to compile people from outside

the industry together because they're going to bring unique and different viewpoints."

This belief system comes from the current ownership, which took over the Cubs in October 2009.

"When the Ricketts family purchased the Cubs, that was the beginning of a big change in the direction for the organization," McIntyre said. "They established three main goals. The first was to win the World Series, the second was to restore Wrigley Field, and the third was to be a good neighbor."

"All of our efforts have been rolling back to those three goals."

In his work, McIntyre has three main responsibilities as well.

The first is managing a somewhat traditional IT team, which handles technical operations—including all phones, computers, and tech support—for both the business side and the baseball side of the organization.

His second group is the infrastructure team, which spans all networking and audio/video technology that enables broadcasting from both Wrigley Field and Sloan Park, the Cubs' spring training facility in Mesa, Arizona.

His third team handles software development for all areas of business operations, including sales, marketing, human relations, and accounting. One major area of focus

is in customer-relationships management—the technology that leads to making Cubs fans happy.

"We have our hands dabbling in all of the fun areas of technology," McIntyre said.

But their work is not limited to Chicago and Mesa, as the Cubs opened a training academy in the Dominican Republic in 2013.

"I spent a lot of time down there when we were developing it," McIntyre said. "It's really a full development academy because the Ricketts family feels very strongly about helping these individuals prepare for life even if they don't make it in baseball."

The Ricketts' plans have been coming to fruition in Chicago as well, and not just because of

the World Series victory. From concerts in Wrigley, to a hotel nearing completion on Clark Street, to the purchase and revitalization of surrounding buildings, the neighborhood is transforming quickly. In April 2017, McIntyre and his team moved into a freshly erected office building adjacent to Wrigley.

"From my window, I can see where the double-wide trailer sat that was my first office here," he said. "We had four double-wides in all. Then we moved to a building across the street, and then this year this facility was launched."

The view from his window shows so much—Wrigley

"I was a candidate from outside the industry and had a completely different background, but that's what the Cubs were looking for."



Three views of McIntyre's championship ring

Field and a view through to the pitcher's mound directly to his left, the nearly completed Hotel Zachary to his right. In the center lies a new park designed for multiple uses: people gather and socialize there on game days, kids can play there every day, and organized events from movies to concerts to farmers' markets are scheduled as well.

"The idea is that it becomes more of a 365-day area, more than just for Cubs games," he said.

Behind these myriad efforts the organization has undertaken, McIntyre and team have been there "doing the plumbing." Rarely does McIntyre's work cross over into anything described as mechanical engineering, but he credits his undergraduate education for helping him in everything he does.

"The biggest thing I took away from school was the thoughtful and process-based ways to solve problems," he said. "And that problem solving I've used my entire career: what are we trying to define, what are the requirements, and how do we work our way through them. Just that process ability."

"Because in every class I took, whether it was heat transfer or thermodynamics or any others, it was always a process of the steps you need to take to get to the solution."

Beecher joins FloridaMakes board



Bayne Beecher (BSME '98), a glass operations leader, has been appointed to the FloridaMakes board of directors. "Mr. Beecher brings with him a wealth of manufacturing experience in the automotive and building products industries," said Kevin Carr, CEO, FloridaMakes. Beecher joined PGT Custom Windows + Doors in 2008 and has held various leadership positions across the company, including quality systems management, operations management, production planning and control, and program management.

Butler named president of Embry-Riddle



Barry Butler (PhDME '84) has been named the new president of Embry-Riddle Aeronautical University. His most recent position was executive vice president and provost at the University of Iowa. Butler has been active on the MechSE Alumni Board in recent years, including serving a term as president. "I'm thrilled to be named Embry-Riddle's next president and look forward to building upon the outstanding global reputation of the university," Butler said.

Casselle launches STEM-based after-school studios



Omowale Casselle (BSME '02) has co-founded a Chicagoland company called Digital Adventures, which runs summer camps and after-school programs based on engineering and computer science. The company has studios in Chicago's Lincoln Park neighborhood and north-shore suburb Wilmette, and may open a third location in western suburb Hinsdale. Casselle and his company were featured in the *Chicago Tribune* in February.

Chen elected to NAE



Xiangli Chen (MSME '88, PhDME '94) has been elected to the National Academy of Engineering (NAE), one of the highest professional distinctions accorded to an engineer. Chen, formerly a vice president of General Electric and president of GE China Technology Center, was elected for pioneering work in optical sensing and precision laser processing, and for leadership in globalizing industrial research and development. Chen received MechSE's Distinguished Alumni honor in 2016.



Khan "google doodled"

The late Dr. **Fazlur R. Khan** (MSTAM '55) has received one of today's most visible honors. On April 3, which would have been his 88th birthday, he was the "google doodle" for the day on google.com, the world's most-visited website. Known as the "father of tubular designs," Khan designed Chicago's Willis Tower and John Hancock Center, among many other buildings. Khan received MS and PhD degrees in civil engineering at Illinois, in addition to his TAM degree.

Gold named Honeywell VP



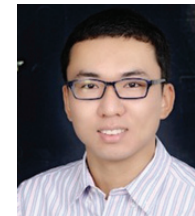
Stephen Gold (BSME '82) has been named Vice President and General Manager, Connected Enterprises at Honeywell. Previously, Gold had served as principal architect and Chief Marketing Officer of IBM's Watson Group as well as Vice President, Business Development, commercializing solutions based on Watson's transformative technology in industries such as healthcare, finance, education, retail, marketing, supply chain management, and in the Internet of Things.

Grandone to head product development at Theranos



Cass Grandone (BSME '83) has taken on the role of Senior Vice President of Product Development at Theranos. Grandone's career has included leading the delivery of Abbott's multi-billion dollar ARCHITECT and Accelerator diagnostic platforms. "Cass brings a passion for healthcare along with considerable experience in launching global diagnostic platforms that save and improve lives," said Theranos CEO Elizabeth Holmes. "His leadership will be critical to helping Theranos realize its longstanding mission to make lab testing more accessible."

Han wins Chinese government award



Kewen Han (PhDME '17) has received a Chinese government award for outstanding self-financed students studying abroad. "Kewen spearheaded my lab's research effort on opto-mechano-fluidic resonators for acoustic biodetection over the past five years," said MechSE assistant professor **Gaurav Bahl**. "His best work on the world's first label-free optomechanical cytometer was published in *Optica* and his device was featured as the journal cover in June 2016."

Hites accepts CIO post at SMU



Michael H. Hites (MSME '92) was named Chief Information Officer at Southern Methodist University. Hites had served as senior associate vice president for administrative IT services and CIO with the University of Illinois System. He will lead SMU's Office of Information Technology, including the Academic Technology, Infrastructure, Applications Support, Project Management, Customer Service, and Information Security teams, as well as overseeing the university's high-performance computing initiatives.

Jerrell to head Allison's worldwide facilities



Denise Jerrell (BSME '94) has been appointed executive director of worldwide facilities for Allison Transmission. She most recently held positions as both global maintenance and engineering manager for Eli Lilly and Co. and prior to that held multiple positions within the Ford Motor/Visteon Corp. In her new role, Jerrell will assume management oversight of all corporate worldwide facilities activities, including facilities operation, engineering, and maintenance.

Lawley named department head at Texas A&M



Mark Lawley (PhDME '95) has been appointed head of the Department of Industrial and Systems Engineering at Texas A&M University. Lawley joined the department in 2014 after serving for 17 years on the faculty at Purdue University and two years as a faculty member at the University of Alabama. He has also held engineering positions with Emerson Electric Company and Westinghouse Corporation, and has done extensive consulting.

Perez-Blanco wraps up 27 years at Penn State



Horacio Perez-Blanco (MSME '76, PhDME '79) has retired after serving as a mechanical engineering professor for 27 years at Penn State University. Perez-Blanco keeps fond memories of his advisers at the University of Illinois, including professors S. L. Soo and B. T. Chao. "They were not only great researchers and professors, but insightful, experienced, and kind."

Qiao receives Jones Fellowship at Virginia Tech



Rui Qiao (PhDME '04) has been awarded the John R. Jones III Faculty Fellowship in Mechanical Engineering by the Virginia Tech Board of Visitors. He is an associate professor of mechanical engineering and director of the Laboratory of Transport Phenomena for Advanced Technologies in the College of Engineering at Virginia Tech.

Wilson to lead design at SmithGroupJJR



Larry Wilson (BSME '82) has been hired at the Chicago office of SmithGroupJJR, one of the nation's largest architecture, engineering, and planning firms. As a senior mechanical engineer, Wilson will provide design leadership for both the Chicago office and the firm's national healthcare practice. He previously served as a director at PositivEnergy Practice, Chicago, a high-performance consulting engineering firm.

Three alumni to lead Notre Dame department

There may be some Fighting Illini orange spotted soon in the Department of Aerospace and Mechanical Engineering at the University of Notre Dame. **Kenneth Christensen** (PhDTAM '01) has been named the department's new Chair, joining fellow MechSE Illinois alumni **Joseph Powers** (BSME '83, MSME '85, PhDME '88), Associate Chair and Director of Undergraduate Studies, and **Timothy Ovaert** (BSME '81), Director of Graduate Studies.



Christensen



Powers



Ovaert

MechSE students win Shell's Hack-a-Truck competition



Alessia Serafino, Jason Pard Liew, Jigar Patel, and Michael Shea

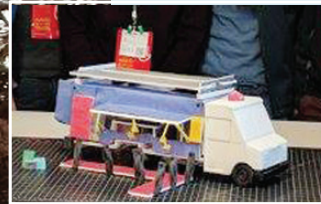
After competing in Shell's first Hack-a-Truck competition at the Google Garage in Mountain View, California, four members of the Illini EcoConcept team returned as first-place winners for their food truck design.

MechSE seniors **Jason Pard Liew**, **Jigar Patel**, and **Alessia Serafino**, and sophomore **Michael Shea** successfully developed an eco-friendly food truck.

"One of the goals with this hack-a-thon was to find a new and exciting way to enjoy a phenomenon that everyone would like, in a more energy-efficient way, while also looking into renewable energy sources," Liew said. "So they thought the best way to celebrate this was with food and the food truck trend."

The Hack-a-Truck competition involved eight universities from around the country, each one paired with another to create a team. The University of Illinois was paired with Louisiana Tech University, and the two teams worked together to design the truck, which took first place for best design and as the overall winner.

Serafino said the team aimed to keep human interaction in mind when designing their truck, considering aspects like where customers would order, whether they would sit around the



"The main things Shell wanted to get across were that we were using all the types of renewable technology that they had to offer and try to create this eclectic and unique experience through these combinations of technology, our ideas, and our design."

vehicle and eat, and the idea of providing entertainment.

Another major part of the design focused on the food. Serafino said it was necessary for them to know their menu so they could design around space requirements for food prep and appliances. For this food truck, the team chose gyros as the primary food offering. With a superhero theme, they named their company SuperGyros.

To make the truck eco-friendly, they incorporated the concept of capture mobility, which captures and uses the energy generated from moving people and vehicles. One technology they used was a tile that generates electricity when touched and walked upon. As the chefs and employees walk around, they generate the electricity required to keep the truck running. The team also added gravity light, which uses a pulley system to generate electricity. Additionally, the truck's design included solar panels and a sliding rooftop.

"The main things Shell wanted to get across were that we were using all the types of renewable technology that they had to offer and try to create this eclectic and unique experience through these combinations of technology, our ideas, and our designs," Shea said.

Three MechSE undergrads named Knights of St. Patrick

In Spring 2017, **Oluwami Dosunmu-Ogunbi** (BSME '17), **Liz Livingston** (BSEM '17), and **Karla Rivero Valles** were honored as Knights of St. Patrick, one of the College of Engineering's highest honors.

While at Illinois, Dosunmu-Ogunbi visited seven countries, completed a co-op with Toyota, and worked in two research labs. She was also heavily involved in several organizations on campus including Pi Tau Sigma, the National Society of Black Engineers, and Engineering at Illinois First Year Experience. Her plans include pursuing a PhD in hopes of one day becoming a professor.

Livingston's EM degree included a secondary field in biomechatronics, and she earned a minor in computational science



Liz Livingston, Oluwami Dosunmu-Ogunbi, and Karla Rivero Valles

and engineering. She was also a member of the Illinois Track and Field team as a pole vaulter. She will remain in MechSE, pursuing a graduate degree in TAM, and aims to find a career in prosthetic and assistive devices.

Rivero Valles is entering her final undergraduate year, pursuing a mechanical engineering degree with a minor in the Hoeft Technology and Management Program. In addition to her

studies, she is president of the Society of Hispanic Professional Engineers (SHPE), serves as an Engineering Learning Assistant, and is a research assistant in MechSE assistant professor **Shelby Hutchens'** research group.

ME 370 robots traverse Boneyard Creek



MechSE is happy to report that no robots plummeted to their demise.

This semester's ME 370 (Mechanical Design I) final competition consisted of 40 student-designed robots climbing ropes strung across Boneyard Creek on the Bardeen Quad. During the event, the student teams' robot designs were judged based on speed, mechanics of the design, and creativity. Professors **Darrell Socie**, **Sam Tawfick**, and **Arend van der Zande** led the teams. Following in the custom of previous robot races, MechSE students demonstrated their impressive creativity and hard work.

"The ME 370 robot race is now a favorite MechSE tradition!" said Tawfick. "Students hear about it and have watched it since their freshman year. By the time they take the class, they work so hard to win. Also, the skills of MechSE students are progressively increasing every semester. So, as instructors, we have to raise the challenge to keep up with our own students. This semester, the professors also built a robot to compete, but the fastest robot was one of the student teams! This was a happy moment for us."



Distinguished Graduate Students recognized for publications

This spring, Department Head **Tony Jacobi** announced the newest group of Distinguished Graduate Students. They represent the department's top three percent in the number of peer-reviewed journal and conference papers published in 2016. Each of them published an impressive five or more papers last year: **Ronald Choe, Venanzio Cichella, Shenghan Jin, Huize Li, Ahmad Raeisi Najafi, Kewang Nan, Karthik Nithyanandan, Avinash Ojha, Rajivasanth Rajasegar, and Krishnan Swaminathan-Gopalan**. The students and their advisors were honored at a luncheon in March.

"MechSE changes the world, and a big part of how we do it is through our research activities. The ten students we recognized have achieved something truly exceptional. I feel honored to be a part of MechSE, where I can work for students who have this level of impact," said Jacobi.

MechSE's graduate program climbs to No. 4

Graduate research and education in MechSE has always attracted the best and brightest scholars from around the world, ensuring our reputation as one of the best programs in the nation. Now, that world-class reputation has been further strengthened with the latest *U.S. News and World Report* rankings. Jumping two spots since last year, the University of Illinois has risen to No. 4 in mechanical engineering, tied with Caltech. The University of California, Berkeley was the only public institution ranked higher.

"We are very proud of our graduate programs, and our excellence is demonstrated every day through the incredible research and teaching of our grad students. They consistently receive prestigious fellowships and awards, and they play a key role in elevating our faculty research programs. Our students and peers know that our graduate experience is unparalleled," said Professor **Taher Saif**, Associate Head for Graduate Programs.

Tobin makes breakthrough in windfarm efficiency

Theoretical and Applied Mechanics PhD candidate **Nick Tobin** has discovered that the use of windbreaks help increase the amount of power harvested by wind farms.

Working with his advisor, Assistant Professor **Leonardo Chamorro**, in the Renewable Energy and Turbulent Environment Lab, Tobin said his research arose from work he had done with Chamorro when they were both at the University of Minnesota (Tobin as an undergraduate and Chamorro as a post-doc). At the time, they were analyzing how the surface of the ground between wind turbines impacts the amount of power generated by those turbines. What Tobin found was that rougher patches of ground could help wind speeds to recover more quickly between turbines, since more turbulence is created to spread the turbines' wakes.

"If you have a large array of wind turbines, and if you have one in front of the other, it's going to slow down the wind for the second one, causing it to produce less power," Tobin said.

This research formed the basis of Tobin's proposal for his National Science Foundation (NSF) fellowship. He proposed planting rows of trees as roughness elements, which are commonly used on farms to prevent soil erosion as well as to reduce the impact of wind on buildings.

Tobin used computational simulations to study the effect of windbreaks immediately downwind of turbines. He found, however, that the negative impact of the windbreaks slowing the wind was greater than the effect of the enhanced wake spreading. But by moving the trees to the upwind side of the turbine, the results changed. As the wind flow approached the turbines and had to go over the trees, it accelerated above the trees.

Tobin is in contact with a local wind farm near Bloomington, Illinois, to simulate this mechanism to conduct a design study in the real world. He wants this technology to expand to places in the United States that may not have been economical enough in the past to have a wind farm.

"I hope this will lead to more wind energy production," Tobin said. "I care about carbon emissions and I want to help move forward the transition to renewable energy."

His research was recently published in the journal *Boundary-Layer Meteorology*.

Be part of the fast-growing M.Eng.ME program!



The Master of Engineering in Mechanical Engineering degree track allows you to spend as little as one year to earn a non-thesis professional master's degree in mechanical engineering from the University of Illinois—on campus or online, and full-time or part-time.

Demand for the program is growing quickly—with a projected Fall 2017 enrollment of nearly 10x the number of students enrolled since our launch just two years ago!

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- Nanomechanics and nanomanufacturing
- Solids and materials
- Mechanics and computation
- Energy systems
- and many others

... plus an anticipated certificate in Additive Manufacturing, a swiftly growing focus of the engineering industry.

A Master of Engineering degree from Illinois will prove invaluable after graduation, from starting salary to future promotion potential and career trajectory. Our graduates have gone on to positions at world-renowned companies such as Tesla, Deloitte, and Navistar.

MechSE alumni are encouraged to apply. Successful candidates typically have an undergraduate GPA of 3.25 or higher. The application process is simple and does not require the GRE.

Now accepting applications for Spring and Fall 2018 entry. Contact us today to learn more!

To find out more about this opportunity to join our program, please contact:

Katrina Hagler
Associate Director of Student Recruitment and Admissions
Department of Mechanical Science and Engineering
Call 217-244-3416 or email mechse-grad@illinois.edu

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Andrew Alleyne gave the keynote remarks at the university's doctoral hooding ceremony in December. He also presented one of two plenary talks at IEEE's 55th Conference on Decision and Control.



Gaurav Bahl was awarded a 2017 Director of Research Early Career grant from the Office of Naval Research, a competitive award of \$1M over five years. He will pursue research on non-reciprocal systems for sound and microwaves. He was also one of nine from MechSE to receive an Engineering Council Award for Excellence in Advising.



Leonardo Chamorro developed a versatile experimental approach for simultaneous 3D measurements of flows and flexible structures at high temporal resolution in Eulerian and Lagrangian frames of reference. His group has uncovered, for the first time, the structure of the spectral energy cascade of body rotations and oscillations under the effect of turbulence. These new developments were published in the American Physical Society's *Physical Review*.



Harry Dankowicz received the Archie Higdon Educator Award from the American Society for Engineering Education for his outstanding contributions to engineering mechanics education.



Alison Dunn was one of nine from MechSE to receive an Engineering Council Award for Excellence in Advising. As a part of the newly-formed China-America Joint R&D Center, a relationship between the College of Engineering at Illinois and the China Railway Rolling Stock Company (CRRC), she was awarded support for a 1-year project to build a laboratory-scale wear tester for rail steels, and to study the transitions that steel surfaces undergo as they plastically deform and begin to wear.



Elif Ertekin was one of nine from MechSE to receive an Engineering Council Award for Excellence in Advising.



Randy Ewoldt was one of only 102 researchers to receive the Presidential Early Career Award for Scientists and Engineers (PECASE) from President Obama—the highest honor bestowed by the U.S. government on science and engineering professionals. This spring, he also received state-of-the-art instrumentation from Anton Paar to support his rheology research. Additionally, one of Ewoldt's rheology papers was among those most cited in the *Journal of Rheology*.



Placid Ferreira received the NAMRI/SME Outstanding Paper Award at the 2016 North American Manufacturing Research Conference. He also presented the keynote lecture at the 2016 Multi-Materials Micro-Manufacturing/International Workshop on Micro-Factories 4M/IWMF in Copenhagen, Denmark.



Paul Fischer won an R&D 100 Award for his simulation software, NekCEM/Nek5000. Known as the “Oscars of Invention,” the awards are organized by *R&D Magazine* and recognize the top technologies of the year.



Jonathan Freund won the 2017 Campus Excellence in Faculty Mentoring Award.



Gavin Horn received the Chancellor's Academic Professional Excellence Award from the university.



Naira Hovakimyan was named a Fellow of the American Institute of Aeronautics and Astronautics (AIAA). She recently co-authored a new book on the latest UAV research, *Time-Critical Cooperative Control of Autonomous Vehicles*.



Elizabeth Hsiao-Wecksler was named one of the inaugural faculty in the new Carle Illinois College of Medicine. She and her student research team were awarded two U.S. patents: one for a portable active pneumatically powered ankle-foot orthosis, and one for a forearm and wrist support for crutch users.



Shelby Hutchens won a highly competitive NSF Faculty Career Development (CAREER) Award for her proposal, “Measurement and analysis of osmosis-mediated, closed-cell poroelastic dynamics.”



Iwona Jasiuk was named a 2017-18 Associate in the university's Center for Advanced Study (CAS). Only a handful of faculty from across campus are selected each year. She received the American Advanced Materials Award from the International Association of Advanced Materials. She was also named one of the inaugural faculty in the new Carle Illinois College of Medicine.



Emad Jassim won a 2017 Award for Excellence in Undergraduate Teaching from the Office of the Provost, indicating his stature as one of the top instructional staff on campus. He also won the award at the college level—as the only recipient of the College of Engineering Teaching Excellence Award.



Harley Johnson was named PI of a College of Engineering Strategic Research Initiatives award, titled “Building the Next UIUC Center for Computational Materials.” He is also a co-investigator of a newly awarded NCSA Faculty Fellows project on data science in computational design of semiconductor nanocrystals, along with Andre Schleife and Cecilia Leal from Materials Science and Engineering and Andrew Smith from Bioengineering.



Mariana Kersh received the Alice L. Jee award from the Orthopaedic Research Society to present work at the Musculoskeletal Biology Workshop at Sun Valley.



Seid Koric was named Technical Assistant Director at the National Center for Supercomputing Applications.



Amy LaViers won the Defense Advanced Research Project Agency's YFA Director's Award for her project “Choreography of Embodied, Platform-Invariant Motion Primitives.”



Moshe Matalon received the Fluid Dynamics Award from the American Institute of Aeronautics and Astronautics and delivered a plenary lecture at the AIAA AVIATION 2016 Forum and Exposition. He also delivered a series of lectures on flame instabilities at the Nordic Institute of Theoretical Physics in Stockholm, and received distinguished paper honors at the Combustion Institute's 36th International Symposium on Combustion in Seoul, Korea.



Nenad Miljkovic and his research group developed a single-camera technique capable of providing 3D information through use of focal plane manipulation. His findings were published in *ACS Nano*. Miljkovic also won a Young Investigator Award from the Office of Naval Research.



SungWoo Nam's findings that nano-level lubricant tuning improves material for electronic devices and surfaces was recently published in *Nano Letters*. He was the recipient of a Young Investigator Award from the Office of Naval Research. He also won the Hanwha Advanced Materials Non-Tenure Faculty Award to further develop his research on mechanical deformation of atomically-thin materials. Finally, he won two competitive College of Engineering awards: the Dean's Award for Excellence in Research and an Engineering Council Award for Excellence in Advising.



Martin Ostoja-Starzewski presented talks this spring on continuum mechanics at the University of Seville. In January, he gave the Director's Seminar at the Beckman Institute at the University of Illinois.



Carlos Pantano earned widespread press for an Early Stage Innovation grant he received from NASA to improve parachutes for Mars missions.



Arne Pearlstein was one of nine from MechSE to receive an Engineering Council Award for Excellence in Advising.



Jim Phillips was one of nine from MechSE to receive an Engineering Council Award for Excellence in Advising.



Huseyin Schitoglu received a Best Paper Award from the *Shape Memory and Superelasticity* journal.



Chenhui Shao earned the distinction of a Scholar-in-Residence at NCSA while he works on his project, “Big Data Enabled Multi-Level Decision Making for Smart Manufacturing.” He received the Best Paper Award at the 2017 ASME International Manufacturing Science and Engineering Conference. He also earned the Best Application Paper Award from the Institute of Industrial and Systems Engineers journal *Transactions on Quality and Reliability Engineering*.



Mariana Silva was one of nine from MechSE to receive an Engineering Council Award for Excellence in Advising.



Sam Tawfick and his research group developed a “wonder material”—synthesized thin carbon nanotubes (CNTs) that are 50 times stronger than the copper films currently used in flexible electronics. He was one of nine from MechSE to receive a 2017 Engineering Council Award for Excellence in Advising. He also won ASME's competitive Chao and Trigger Young Manufacturing Engineer Award for 2017.



Brian Thomas was recognized as a Distinguished Member and Fellow of the Association for Iron and Steel Technology. The association recognized him as “one of the world's leading experts in the field of validated computational models” and said, “he has distinguished himself as a prolific author, researcher academic, and innovator.”



Daniel Tortorelli retired in October as the George B. Grim Professor of Mechanical Science and Engineering. He will return to the MechSE department as the George B. Grim Professor Emeritus. He is also the Director of the new Center for Design and Optimization at the Lawrence Livermore National Laboratory. At the recent 12th World Congress of Structural and Multidisciplinary Optimisation in Braunschweig, Germany he delivered one talk, was the co-author on four additional talks, served as the chair for two sessions and presented the lecture “Topology Optimization: Achievements and New Frontiers.” He also has two entries on the *Computer Methods in Applied Mechanics* list of most downloaded articles.



Kimani Toussaint joined the editorial board of Nature's *Scientific Report*. He won the College of Engineering Everitt Award for Teaching Excellence, an award selected by the student-led Engineering Council. In April, he presented a webinar for the online magazine Photonics.com on his group's work with plasmonic nanoantennas.



Charles Tucker retired in June as the university's Vice Provost for Undergraduate Education and Innovation. He will return to the MechSE Department as an emeritus faculty member.



Amy Wagoner Johnson was named a 2017-18 Associate in the university's Center for Advanced Study (CAS). Only a handful of faculty from across campus are selected each year. She is a Visiting Professor at the Grenoble Institute of Technology in Grenoble, France for 2016-17. She has also been named one of the inaugural faculty in the new Carle Illinois College of Medicine.

"I was a musician and I was also really interested in math, science, and engineering, so acoustics was the perfect collaboration of those interests."



Matlack uses acoustics to design better materials

New MechSE assistant professor **Kathryn Matlack** is expanding her fascination with acoustics and sound waves to further research and understand how waves propagate through various materials.

Matlack arrived at Illinois in January 2017 after completing a postdoc at ETH in Zurich, Switzerland. She earned all of her degrees in mechanical engineering—MS and PhD degrees from Georgia Tech, and a bachelor's degree at MIT.

She pursued acoustics during her undergraduate career, minoring in music. She grew up singing and playing the piano and the violin, so acoustics and sound were always a large part of her life.

"Back in high school I was a musician and I was also really interested in math, science, and engineering, so acoustics was the perfect collaboration of those interests," Matlack said.

Although she did not end up pursuing music in graduate school, Matlack said acoustics has always fascinated her. This intrigue led her to study wave propagation. Her research explores how waves propagate, or spread, through materials. A better understanding of this can allow researchers to more easily use wave propagation data to image defects in materials, and to design materials that will be able to control propagation. For example, she explained that by designing the structure of a

material to be periodic, certain frequencies cannot travel through the material, making it immune to vibrations.

Matlack's research shares many ideas from the civil engineering field; her interests also apply in areas of turbines and aircrafts, as well as in seismic wave propagation.

"One project we are working on is with seismic metamaterials that could potentially be buried in the ground to mitigate seismic wave propagation from fracking-induced seismic waves," she said.

Currently, engineers identify materials for the design of structures, but there is not much flexibility to simultaneously designate tailored requirements for these materials, such as

stiffness, strength, vibration absorption, and damage-tolerance properties. Matlack said her research, combined with 3D printing prototypes, can yield more flexibility for designing a range of multifunctional materials.

Additionally, she has been working on the idea of designing new materials that can change properties according to their environments. For example, there could be a spacecraft covered with material that could change its characteristics—such as structural properties and vibrational response—to adjust to the various layers of atmosphere it passes through.

Investing in the next generation



Launched with the help of a \$30 million endowment from the Grainger Engineering Breakthroughs Initiative to the College of Engineering, the **Engineering Visionary Scholarship** (EVS) Initiative boosts our ability to bring the best engineers to Illinois by making college more affordable for students and their families. Our long-term vision is to provide our students with large, renewable scholarships that transform their undergraduate experience, and help them choose Illinois.

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"This is an amazing opportunity, and it's a great time for our alumni and friends to step up. Our supporters have always been tremendously generous. Now we can double the impact of that generosity."

Andreas Cangellaris
Dean, Engineering at Illinois

To find out more about this inspiring opportunity, please contact:



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Somewhere under the rainbow...

...was Mechanical Engineering Laboratory on the evening of April 3, 2017.
Thanks to MechSE's Kelly Stephani for capturing it!

