TEXAS Mechanical Engineer 2022

NEW CENTER FOR ADDITIVE MANUFACTURING AND DESIGN INNOVATION

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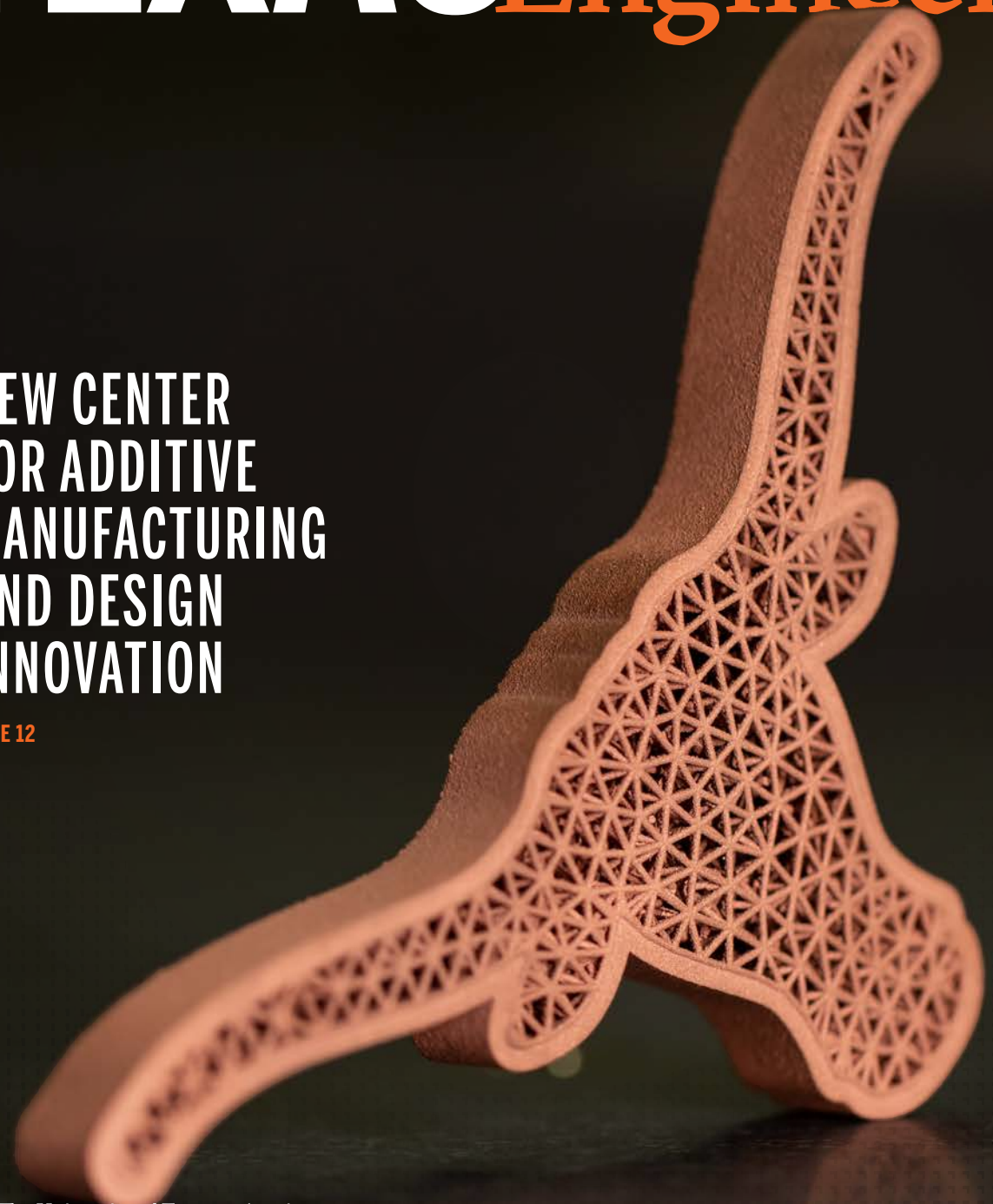

The University of Texas at Austin
Walker Department of Mechanical Engineering
Cockrell School of Engineering

TEXAS MECHANICAL ENGINEER

Texas Mechanical Engineer is published annually for alumni and friends of the J. Mike Walker Department of Mechanical Engineering in the Cockrell School of Engineering at The University of Texas at Austin.

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FROM THE CHAIR

Dear Friends,

It's an honor to serve as the next Chair of the Walker Department of Mechanical Engineering. My term began on September 1, 2021, and follows a dozen years on the faculty at the University of Michigan and earlier positions in industry (Ford Motor Company) and at national laboratories (Sandia National Labs and the Naval Research Lab). My role at UT has benefitted from five preceding years of departmental leadership by Rick Neptune. I would like to thank Rick for his service to the department, especially for his efforts to navigate the uncharted waters of the coronavirus pandemic. As you will see in this latest issue of Texas Mechanical Engineer, the Walker Department continues to thrive, and this is in large part due to Rick's leadership. Thank you, Rick!

While the pandemic continues to impact our operations, these impacts have diminished significantly as of mid-February 2022. Virus transmission in our classrooms and laboratories remains low. Essentially all our courses have returned to in-person instruction. Many faculty have gone the extra mile by implementing a hybrid teaching mode that allows students to either attend class in person or watch a livestreamed and recorded version of their classes. I'm grateful for the time that our faculty have devoted to making their lectures accessible to all and for maintaining the high quality of instruction for which UT is known. Our research program has returned to pre-pandemic levels of activity – our laboratories are fully open for business. Over the next few months I hope to continue the process of reconnecting and re-establishing our sense of community. We restarted the ME Tailgate in November 2021 and are planning for as many in-person events as possible in 2022.

In the pages that follow you will hear from some of our newest faculty members, get an in-depth look at our new Center for Additive Manufacturing and Design Innovation, meet some inspiring students, and learn about some of the cutting-edge research being done by our faculty. Thank you again to all of our students, faculty, staff, and alumni for your continued support.

Hook 'em!

DON SIEGEL
CHAIR, WALKER DEPARTMENT OF MECHANICAL ENGINEERING

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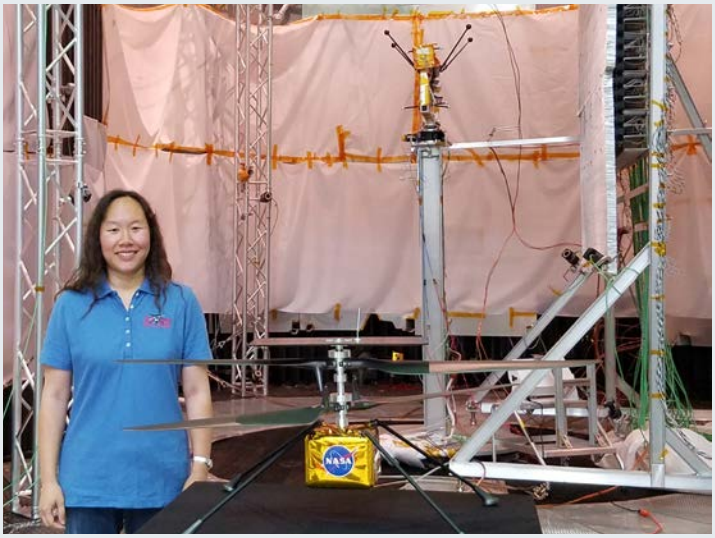

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GETTING OFF THE GROUND

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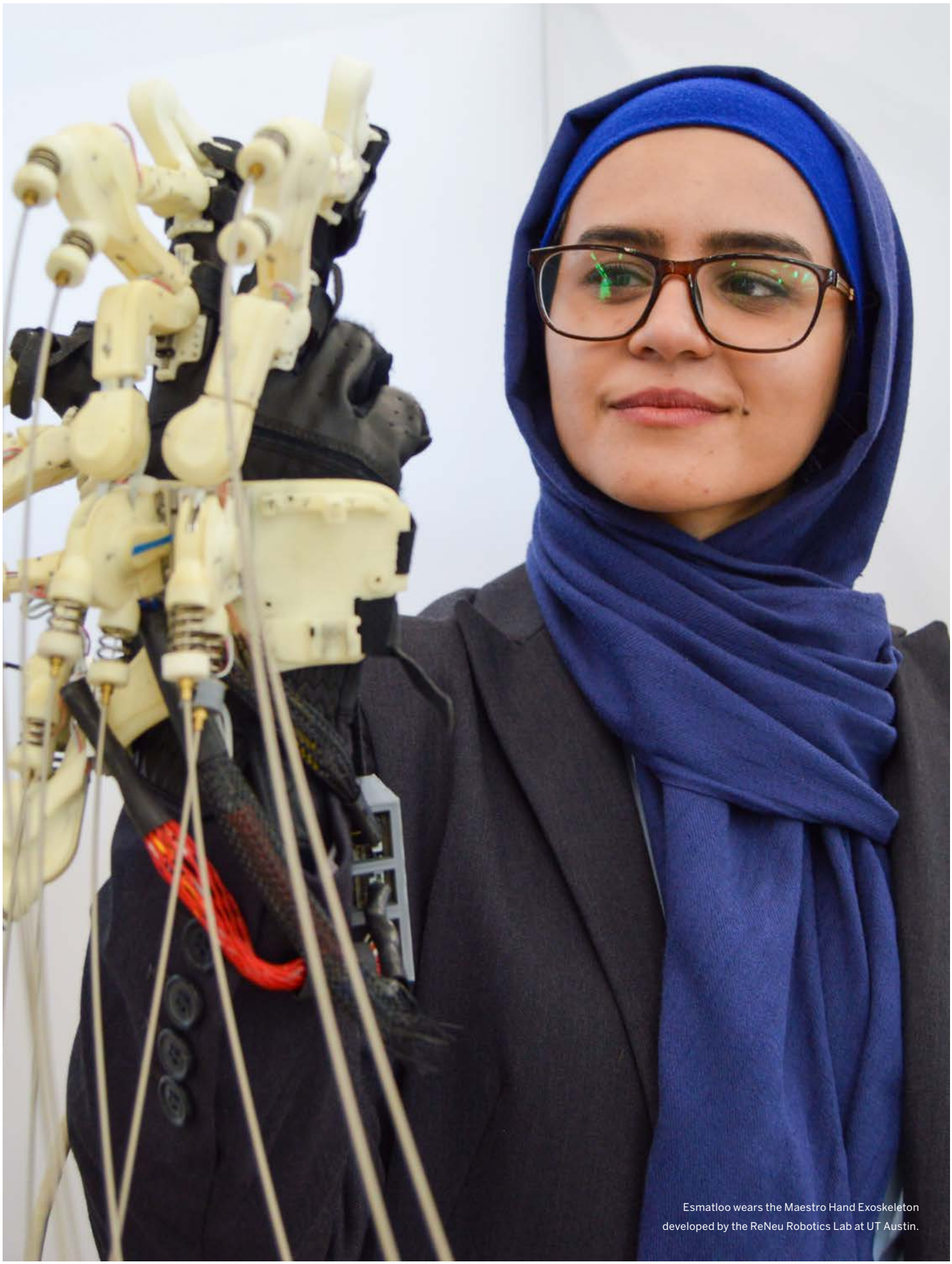


Esmatloo wears the Maestro Hand Exoskeleton developed by the ReNeu Robotics Lab at UT Austin.

PARIA ESMATLOO

Growing up in Iran, Paria Esmatloo wanted a way to combine her love of physics and movement with robotics and working with others. She was interested in machines that used the principles of mechanics, not just computer programs, **that could also actually help people**.

She quickly discovered the field of rehab robotics and The Rehabilitation and Neuromuscular (ReNeu) Robotics Lab, led by associate professor Ashish Deshpande at UT Austin. It checked all her boxes.

Currently a Ph.D. student in mechanical engineering, Esmatloo earned her bachelor's degree in her home country of Iran before moving to Austin for graduate school in 2015. She earned her master's in mechanical engineering in 2019 from UT Austin.

The ReNeu Robotics Lab builds devices to either help people regain function after injuries or to understand how people perform movements. This helps to better understand how people control their limbs. They mainly work with people who have suffered spinal cord injuries or strokes, and the devices help to determine how to provide them with the best functionality.

Esmatloo specifically works with the Maestro Hand Exoskeleton, a robotics glove that can be worn on the hand and can move the different digits of your fingers. It has eight degrees of freedom that can control not only the position but also the forces that are applied to your fingers. This allows you to perform different kinds of grasps as well as manipulate a variety of delicate or heavy objects with multiple fingers.

Working with people with disabilities and hearing their feedback on the devices has been a highlight of Esmatloo's Ph.D. work. Rehab robotics has allowed her to have a direct impact on people's lives.

> "I HAD SOMEONE WITH A SPINAL CORD INJURY FROM OVER 10 YEARS AGO AND IT WAS THE FIRST TIME HE WAS ABLE TO OPEN AND CLOSE HIS OWN FINGERS," ESMATLOO REMEMBERS. "THE LOOK ON HIS FACE WAS AMAZING."

Working in the ReNeu Robotics Lab over the past six years has also provided Esmatloo with a sense of community and family.

"I have never seen another lab with such a positive and supportive atmosphere between colleagues. It makes room for people to collaborate, talk openly about concerns, and for colleagues to share their similar experiences," said Esmatloo.

Outside of the lab Esmatloo's biggest passion is photography. Although the COVID-19 pandemic has made it a bit more difficult to pursue that passion.

"Usually when I get the chance to take photos is when we're travelling," said Esmatloo. "It's the magic of taking something and being able to look at it a thousand different ways and then making something beautiful out of it."

She is also what many would describe as an adrenaline-junkie, enjoying high-energy activities such as skiing or going to amusement parks. Her most recent adventure was a trip to Hawaii where she learned to swim and then scuba dive all in one day.

Both Esmatloo and her husband, also a Ph.D. student in mechanical engineering, hope to defend their theses by the end of this year. After that, the pair are not sure where they're going next. Working in an industry setting and getting to test out research ideas and do human trials is very appealing to Esmatloo. Whatever she does, you can be sure that it will focus on the human element of engineering, and making people's lives better. ■

FACULTY AWARDS

S.V. Sreenivasan
- Elected to National Academy of Engineering

Arumugam Manthiram
- Electrochemical Society's Battery Division Technology Award

Guihua Yu
- 2021 Class of Blavatnik National Awards Honorees for Young Scientists
- Brimacombe Medalist, *The Mineral, Metals and Materials Society*
- Edith and Peter O'Donnell Award in Engineering, *The Academy of Medicine, Engineering and Science of Texas*
- 2022 Norman Hackerman Award in Chemical Research, *Welch Foundation*

Joseph Beaman
- General Pierre Nicolau Award, *International Academy of Production Engineering*

Donglei "Emma" Fan
- Elected as Fellow to the Royal Society of Chemistry

John Goodenough
- Washington Award, *Western Society of Engineers*

WELCOME NEW FACULTY

NARAYANA ALURU
Professor

RESEARCH AREA: MULTISCALE NANOTECHNOLOGY

Narayana Aluru joined the department in August 2021 as a professor. He is also a core faculty member in the Oden Institute for Computational Engineering and Sciences and a professor in the Texas Materials Institute at UT Austin. Aluru comes to UT from the University of Illinois at Urbana-Champaign where he has been on the faculty since 1998. He holds a M.S. degree from Rensselaer Polytechnic Institute and a Ph.D. degree from Stanford University. In addition, Aluru was a Postdoctoral Associate at the Massachusetts Institute of Technology. He currently leads the Multiscale Nanotechnology Group which is working on projects that use nanomaterials to solve problems like DNA sequencing and protein recognition and creating clean energy alternatives.

HOW WOULD YOU DESCRIBE YOUR RESEARCH?

We develop multiscale methods linking quantum to continuum scales and use multiscale computational approaches to understand the physics of nanosystems. We then translate these fundamental understandings into applications in water, energy, and health.

WHAT HAVE YOU ENJOYED MOST ABOUT JOINING UT?

Many things like in-person teaching and interacting with undergraduate students, getting to know new people, and walking around the UT campus. The hot weather reminds me of the weather back home in India! ■

ZHENGHUI SHA
Assistant Professor

RESEARCH AREA: ADVANCED MANUFACTURING AND DESIGN

Zhenghui Sha joined the department in August 2021 as an assistant professor. Sha comes to UT from the University of Arkansas where he was an assistant professor. He was also a Postdoctoral Fellow in the McCormick School of Engineering at Northwestern University. He holds a M.S. degree from Xi'an Jiaotong University and a Ph.D. degree from Purdue University, both in Mechanical Engineering. Sha currently leads the System Integration and Design Informatics Lab in the department.

HOW WOULD YOU DESCRIBE YOUR RESEARCH?

Research on complex systems engineering and design is inherently challenging because of the large number of components, multiple stakeholders, uncertainties, human factors, social impact, and institutional policies. Knowledge and theories from different disciplines must be synthesized and translated to innovate new research approaches and tools to address these challenges. Towards this pursuit, my research goal is to establish a decision-centric science foundation for complex systems engineering and design. Such a foundation is expected to support deep integration across disciplines and amplify the power of data in design research and systems science.

WHAT HAVE YOU ENJOYED MOST ABOUT JOINING UT?

What I have enjoyed most so far is the people. The diversity at UT is amazing. Whether faculty or students, they have shown a great variety in terms of research interests, teaching experiences, backgrounds, views, etc. Particularly during the pandemic, while I was relocating from another state and transitioning into a new environment, the challenge to my entire family was unprecedented, but people here are so friendly and supportive. Without the people at UT, particularly the people in the ME department, I could not have settled down so quickly. Also, people's passion for their work is very impressive. Faculty, staff, and students all have left a deep impression on me about UT's people. I'm thrilled to join UT and be a part of the Longhorn family! ■

CREDIT: Rahim Fortune for Bloomberg Businessweek

BATTERIES IN THE NEWS

Our faculty are on the cutting edge of battery breakthroughs. Learn more about their research and where it's been featured in 2021:

Bloomberg Businessweek
The Energy Future Needs Cleaner Batteries
Professor Arumugam Manthiram
https://bloom.bg/3ATfxc5

PV Magazine
Sodium Battery Research Tackles Formation of Dendrites
Professor David Mitlin
https://bit.ly/3on5rv5

CNBC
How Removing Cobalt From Batteries Can Make EV's Cheaper
Professor Arumugam Manthiram
https://youtu.be/DFL8iQ3p3cI

YouTube

AN EMPOWERED

JOURNEY

Growing up picking cotton on his family's ranch in Austin, Texas, Milton Lee thought his future had already been written. That was, until a STEM teacher at his segregated school showed him the possibility of another path.

In 1971, Lee became the third ever Black mechanical engineering graduate in the Cockrell School of Engineering (formerly the College of Engineering) at The University of Texas. After a career that has spanned decades and numerous C-suite positions, he currently serves on multiple boards and councils and founded his own consulting firm, Lee Energy Partners, LLC. He was a speaker at the Cockrell School's 2010 commencement, is an active member of the Cockrell School's Engineering Advisory Board, and has been inducted into the Mechanical Engineering Academy of Distinguished Alumni.

"My experiences as a student at UT taught me many lessons about perseverance despite difficulty – lessons I then honed throughout my career. It wasn't easy. I eventually just had to get used to the discrimination, even though it was hard to accept it. But, I'm proud of everything I have accomplished, the people I've met along the way who have encouraged me throughout my journey and the leader I've become because of these challenges."

At the time Lee was a student at UT, emphasis was strongly placed on teaching engineering students the technical skills they needed to succeed in industry with little attention to the leadership skills necessary to succeed in those positions. Faculty/student mentoring was not widely prevalent, and therefore students lacked strong mentors to guide them through their collegiate journey. Lee credits much of his own leadership development to his time spent at General Electric in San Francisco and Schenectady, New York, where he served as an engineer in Nuclear Steam Supply Systems and Nuclear Fuels for six years. It was there that Lee learned the importance of mentorship and cultivating relationships.

"It's always one of my biggest pieces of advice for students: develop relationships at a young age that you can carry for a lifetime," Lee said. "Those relationships that I created way back at UT, and it wasn't that many but there were a few, and I still have some of those to this day."

In addition to advocacy of student mentorship and leadership opportunities, Lee is a strong voice for diversity and inclusion. Most recently, he was a panelist for the Cockrell School's Black alumni panel event, "Celebrating Cockrell's Black Excellence," hosted virtually in 2021. During the event, he stressed the importance of continuing to have crucial conversations around race and gender equality, noting how those conversations should, ideally, be initiated at the leadership level.

"Leaders need to become good listeners. Being able to ask the right open-ended questions and carry on a dialogue without 'yes' or 'no' answers is key. When leadership takes diversity efforts seriously, everyone else will follow. When you have opportunities as a person of influence, you need to take advantage of them."

Lee believes that once you find personal or professional success it is up to you to use that opportunity to make a difference in people's lives. Especially when it comes to diversity and inclusion issues, you need to leave an organization better than when you found it.

"You need to become the CCO – the Chief Courage Officer – to make those tough decisions when needed and make sure you take full advantage of these opportunities." ■

"You need to become the CCO – the Chief Courage Officer – to make those tough decisions when needed and make sure you take full advantage of these opportunities."

SKETCH OUT A WIN

61 UNIVERSITIES | **9** COUNTRIES

THE UT AUSTIN TEAM WAS THE ONLY U.S. TEAM TO PLACE IN THE TOP **5**

A GROUP OF MECHANICAL ENGINEERING STUDENTS EXCEL WITH THEIR SKETCHBOOK-THEMED AMUSEMENT PARK DESIGN

A team of Texas Engineering undergraduate students, working together virtually, took a colorful approach to the 2021 Cornell Theme Park Design Competition and won two out of five competition categories, placing second overall.

Kendall Duggar, Katie Kahoutek, Olivia Pierce and Scia Verma, all mechanical engineering students and members of the Texas Theme Park Engineering Group, developed everything from the park's technologies to its master plan and layout.

Their proposed amusement park concept, Illustratia, transports park-goers into the pages of a sketchbook. Guests are immediately immersed in a storyline as they engage with the park's interactive elements and are encouraged to "join the battle between the Greyscale Group and the Color Crew," a yearslong feud between embracing a monochromatic world or making Illustratia the most colorful town in the sketchbook.

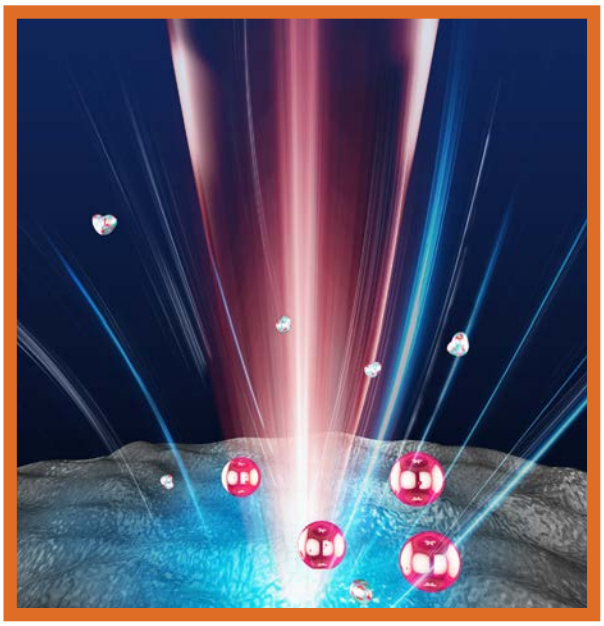
"Our team started with the idea of a land based on color," Duggar said. "From there we wanted to create a dueling sides story, similar to Galaxy's Edge in the Disney theme parks, so we combined the two ideas to form Illustratia."

The team's detailed storyline, technology integration, and attention to ADA guidelines, set them apart from competitors, leading them to take the top spot in the Innovation and Master Planning categories.

"While several groups succeeded in meeting the innovation goal, it was thrilling to see such deep understanding of these advanced technologies with the [UT Austin team]," said one of the competition's judges and an industry expert from CAVU Designwerks. "Their incorporation of radio frequency identification bands to assist operators with guest flow while simultaneously pushing guests deeper into the story through personalized interactivity is what set them apart." ■

TURNING UP THE HEAT

Optical Tweezer Technology Tweaked to Overcome the Dangers of Heat



Three years ago, Arthur Ashkin won the Nobel Prize for inventing optical tweezers, which use light in the form of a high-powered laser beam to capture and manipulate particles. Despite being created decades ago, optical tweezers still lead to major breakthroughs and are widely used today to study biological systems.

However, optical tweezers do have flaws. The prolonged interaction with the laser beam can alter molecules and particles or damage them with excessive heat.

Researchers in the Walker Department of Mechanical Engineering have created a new version of optical tweezer technology that fixes this problem, a development that could open the already highly regarded tools to new types of research and simplify processes for using them today.

The breakthrough that avoids the problem of overheating comes out of a combination of two concepts: the use of a substrate composed of materials that are cooled when a light is shined on them (in this case, a laser); and a concept called thermophoresis, a phenomenon in which mobile particles tend to gravitate toward a cooler environment.

The cooler materials attract particles, making them easier to isolate, while also protecting them from overheating. By solving the heat problem, optical tweezers could become more widely used to study biomolecules, DNA, diseases and more.

"Optical tweezers have many advantages, but they are limited because whenever the light captures objects, they heat up," said Yuebing Zheng, the corresponding author of a new paper published in Science Advances and an associate professor in the Walker Department of Mechanical Engineering. "Our tool addresses this critical challenge; instead of heating the trapped objects, we have them controlled at a lower temperature."

Optical tweezers do the same thing as regular tweezers — pick up small objects and manipulate them. However, optical tweezers work at a much smaller scale and use light to capture and move objects.

Analyzing DNA is a common use of optical tweezers. But doing so requires attaching nano-sized glass beads to the particles. Then to move the particles, the laser is shined on the beads, not the particles themselves, because the DNA would be damaged by the heating effect of the light.

"When you are forced to add more steps to the process, you increase uncertainty because now you have introduced something else into the biological system that may impact it," Zheng said.

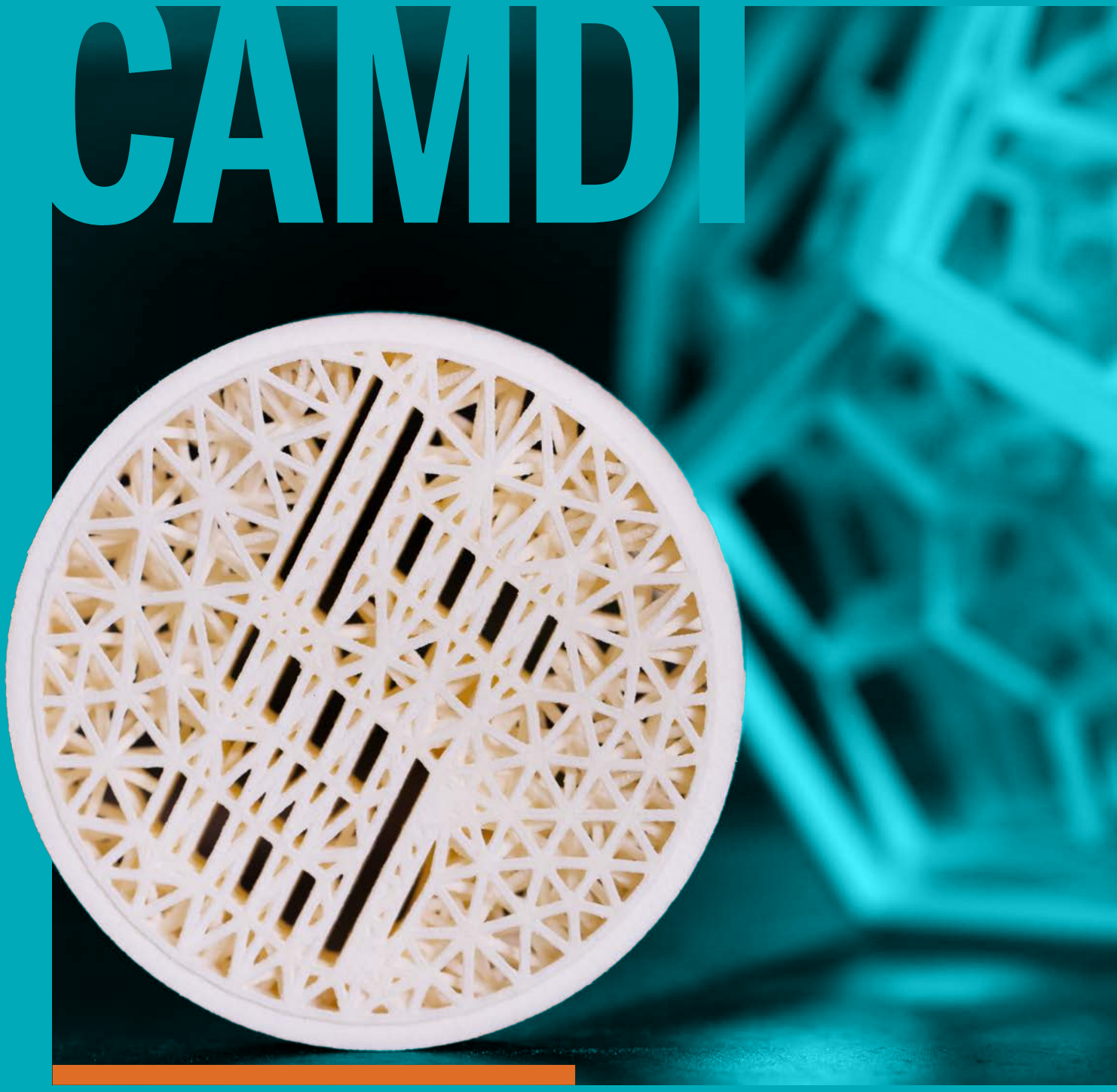
This new and improved version of optical tweezers eliminates these extra steps.

The team's next steps include developing autonomous control systems, making them easier for people without specialized training to use, and extending the tweezers' capabilities to handle biological fluids such as blood and urine. And they are working to commercialize the discovery.

Zheng and his team have a variety of aspects to their research, but it all centers on light and how it interacts with materials. Because of this focus on light, he has closely followed, and used, optical tweezers in his research. The researchers were familiar with thermophoresis and hoped they could trigger it with cooler materials, which would actually draw particles to the laser to simplify analysis.

This research was supported by grants from the National Institutes of Health's National Institute of General Medical Sciences and the National Science Foundation. ■

EXPLORING CAMDI



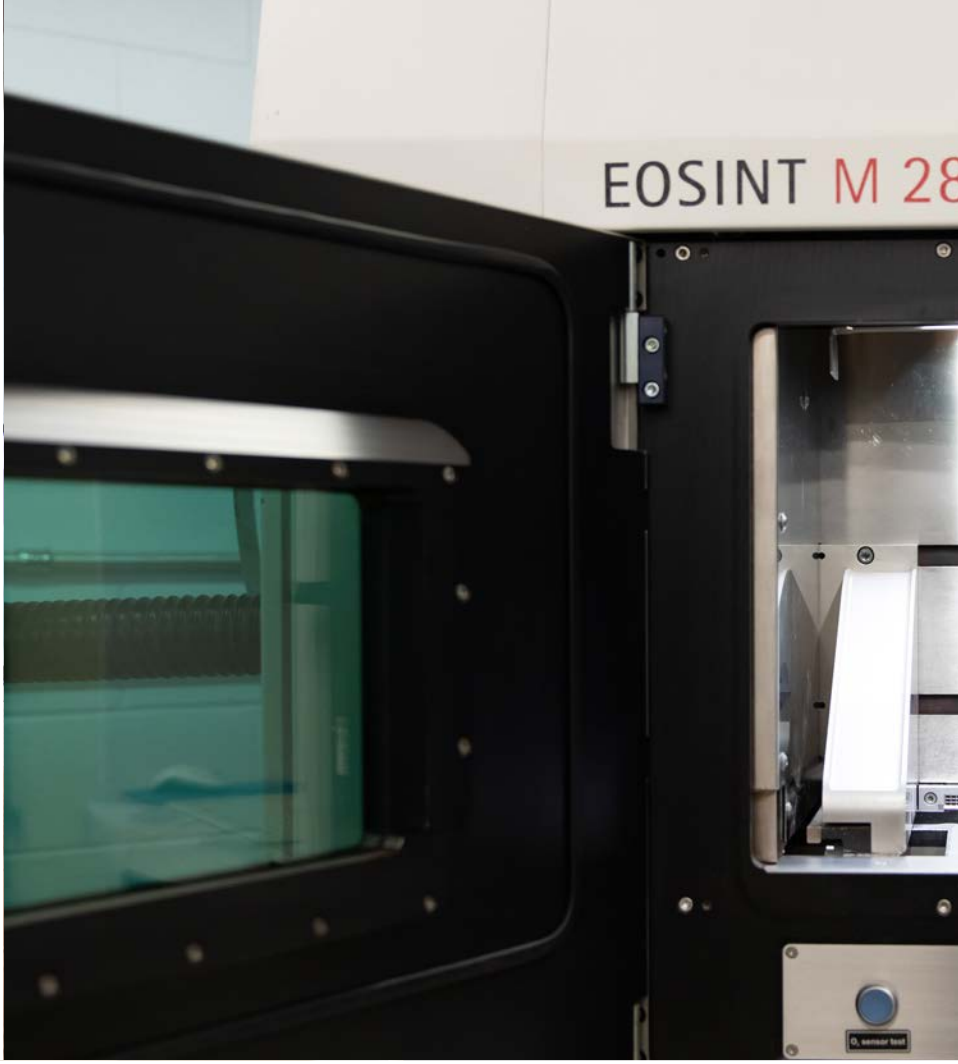
For decades, Texas Engineers have been on the forefront of what the public knows as 3D printing. In March 2021 we took the next step with the opening of the Center for Additive Manufacturing and Design Innovation (CAMDI) in the Walker Department of Mechanical Engineering.

Carolyn Seepersad, Professor of Mechnical Engineering and Director for CAMDI

The 3,000-square-foot facility features more than $1.5 million worth of commercial-grade machines that can print complex parts used in a variety of fields, including medical research, aerospace, energy, robotics and more.

3,000
SQUARE FEET

$1.5M
COMMERCIAL-GRADE MACHINES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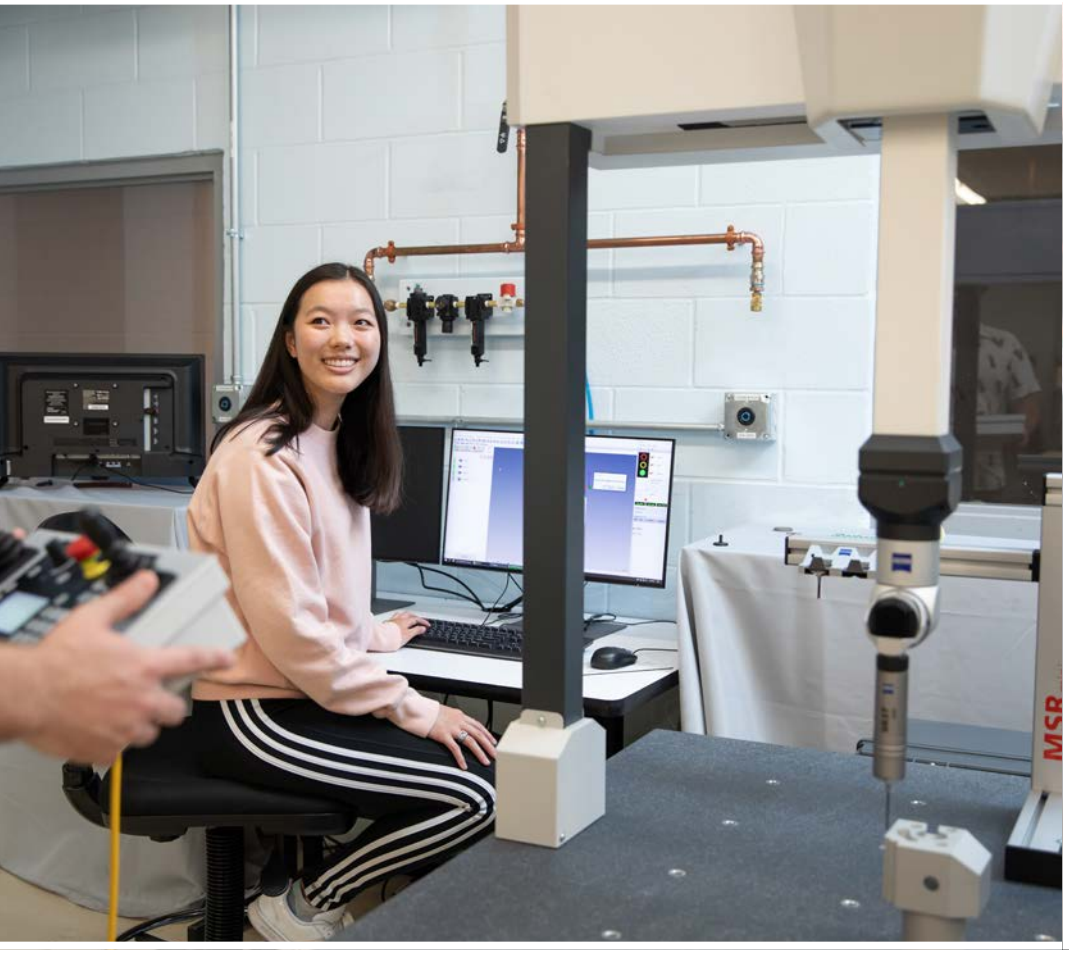

The facility has boosted research capabilities in additive manufacturing, the technical term for 3D printing preferred by those in the field. The center has also launched an industry affiliates membership program where researchers can team up with companies with an eye toward advancing what can be done in additive manufacturing.

"We are interested in working with partners who want to push the envelope of what we can print — creating new materials, designing new processes and R&D applications that move the technology forward," said center director and professor Carolyn Seepersad.

Austin has become an additive manufacturing hub, due to the presence of leading companies and the prominent role The University of Texas at Austin has played in the industry dating back to its early days. Over the years, the big picture goal of additive manufacturing production has shifted from an emphasis on making small machines that anyone could use to focus more on large machines used by companies and other creators. That has also shifted how researchers think about the technology.

INSIDE THE CENTER, THERE ARE SEVERAL LABS AND STATE-OF-THE-ART EQUIPMENT THAT RESEARCHERS AND INDUSTRY AFFILIATES CAN UTILIZE:

The Polymer Bed Fusion Lab is the home of Selective Laser Sintering, the process of fusing layers of polymer powders together using a laser, that was created at UT by professor Joseph Beaman in the 1980s.

The Metal Powder Bed Fusion Lab houses machines that can create durable metal parts with complicated shapes and structures. These parts can be used in airplanes, drilling equipment, or for medical solutions.

The Liquid Polymer Lab includes machines capable of printing a variety of flexible materials with a range of potential uses. Some can create materials that mimic the mechanical function of organs and tissue, while others can build highly accurate large polymer parts that can be used in building robots.

The Metrology Lab, which is still awaiting additional machines, will allow researchers to test the accuracy of print jobs. Heat maps show where the printing process was most accurate on a specific part and where there were departures from the initial design.

Center operations manager Jared Allison has been impressed with the center's reception in its first year.

"We have attracted groups from all over the university that are interested in using our resources. We have fabricated parts for researchers and senior design teams, and our business is growing. People at the university recognize the limitations of desktop 3D printers, particularly in research applications, and come to the center for higher quality parts," said Allison.

The goal is to make UT Austin the premiere additive manufacturing research hub in central Texas. This can be accomplished by working with a number of different startups as well as established companies in the area to bring more equipment and more research to the center.

Longer-term goals see the center also moving into training and education. Plans include developing an additive manufacturing curriculum that would count as a graduate certificate in addition to training courses geared towards industry professionals. ■

5 QUESTIONS ? 5 QUESTIONS ? 5 QUESTIONS ? 5 QUESTIONS ?

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5 Questions with

DON SIEGEL

In September 2021 we welcomed Don Siegel as the new chair of the Walker Department of Mechanical Engineering. Siegel joins UT after serving on the faculty at the University of Michigan since 2009, where he held multiple appointments. Learn more about what brought him to Austin and his plans for the future of mechanical engineering.

1 WHAT MOST ATTRACTED YOU ABOUT UT AUSTIN?

There were several factors that played a role – the strength of the department, the support and engagement of alumni, and the high importance placed on energy R&D and computational sciences (my research areas) within the Cockrell School and across the university. As someone who worked in industry, and who values industrial collaborations, I'm also excited by the opportunity to harness Austin's thriving energy, technology, and manufacturing sectors for the betterment of the department. Finally, I love tacos and barbeque!

2 WHAT ARE YOUR TOP PRIORITIES FOR THE DEPARTMENT IN YOUR FIRST YEAR?

My first priority is to listen and to learn. As part of that process, I've assembled a Planning Committee to help me to understand the department's policies and to generate ideas for improvements, when appropriate. The committee meets bi-weekly and is working through a list of topics that cover all aspects of what we do.

Mentoring is one example of a priority that's high-up on the list. I'd like to grow the undergraduate mentoring program that's been initiated by our ME Academy of Distinguished Alumni, create Launch Committees for our junior faculty, initiate a mentoring class for our incoming graduate students, and increase career-development opportunities for our staff. I'm currently on the lookout for ideas about how to extend these opportunities to mid-career faculty.

3 HOW HAS THE TRANSITION BEEN WITH MOVING AND STARTING A NEW JOB DURING A PANDEMIC?

Starting the new position was a smooth transition; the staff and faculty have been very welcoming and patient as I come up to speed. One aspect that's been slower than I expected was getting to know the names of over 100 faculty and staff without the benefit of regular in-person meetings.

On the other hand, the moving process itself was challenging. Although my family found a great house in a beautiful neighborhood, there is no doubting that Austin real estate has become expensive!

4 HOW HAVE YOUR RESEARCH AND LEADERSHIP ROLES AT THE UNIVERSITY OF MICHIGAN PREPARED YOU FOR THIS NEW POSITION?

UT is very similar to the University of Michigan, so I had a hunch that many of the things I've learned in administration at UM would translate to UT. At Michigan I spent three years as Associate Chair for Graduate Education, where I was responsible for graduate recruiting and for the graduate program overall. I also have experience chairing faculty hiring committees and with mentoring junior faculty.

On the research side, my group focuses on materials for energy storage applications. Mechanical engineering at UT is clearly a leader in this space, especially in experimental studies involving batteries. My focus on computation strongly complements this effort; I see many opportunities to collaborate with the department's existing faculty, which will be mutually beneficial and maximize impact.

5 WHAT PIECE OF ADVICE WOULD YOU GIVE TO A STUDENT LOOKING TO PURSE MECHANICAL ENGINEERING?

Do it! I would impress upon them the impact that mechanical engineers have on our society and the multiple doors that open with an ME degree. (ME is the father of many disciplines: bio-engineering, aerospace, robotics…) Moreover, ME is a diverse discipline with many opportunities to chart one's own path. I'm also excited about new directions the department is considering related to the integration of data science into our curriculum. In short, it's hard to go wrong with a degree in mechanical engineering. ■

FERTILIZING
THE FUTURE

Researchers discover a sustainable process to producing a key fertilizer element

Urea is a critical element found in everything from fertilizers to skin care products. Large-scale production of urea, which is naturally a product of human urine, is a massive undertaking, making up about 2% of global energy use and emissions today.

For decades, scientists and engineers have sought to make this process more energy efficient as demand for fertilizer grows with increased population. An international research team that includes scientists and engineers from The University of Texas at Austin has devised a new method for making urea that is more environmentally friendly than today's process and produces enough to be competitive with energy-intensive industrial methods.

Making urea today involves a two-step thermal process that requires high levels of heat and pressure under controlled harsh environments. But this new process requires just one step and relies on a concept called electrocatalysis that uses electricity — and potentially sunlight — to trigger chemical reactions in a solution at room temperature in ambient conditions.

"Around the world we need to lower emissions. That's why we want to develop these more sustainable pathways to produce urea using electrocatalysis instead of this energy-intensive two-step process," said associate professor Guihua Yu, who co-lead the team that published a new milestone paper about the process in Nature Sustainability.

Today, synthetic urea is produced primarily via the Haber-Bosch method — which is known as one of the greatest inventions of the 20th century because it enabled mass production of fertilizer and helped increase global food supply. It combines nitrogen and hydrogen to make ammonia, which then bonds with carbon dioxide to make urea. This two-step process requires heating to 400 or 500 degrees Fahrenheit to perform the reaction, using huge amounts of energy and producing significant emissions along the way. Producing urea through electrocatalysis is an alternative process that is more sustainable and energy efficient. However, this method historically has not produced enough to make it viable. It created too many byproducts and required much energy to break the bonds of the molecular building blocks to trigger the reaction.

Finding the right elements or catalysts to create an efficient chemical reaction was the primary challenge. The UT team used nitrate, instead of the typical nitrogen, to bond with carbon dioxide. And the catalyst solution is composed of indium hydroxide nanomaterials.

This highly efficient nanomaterial electrocatalyst has "high selectivity," Yu said, meaning it produces only what the researchers want it to produce, not a bunch of byproducts. And it creates a higher yield of urea than previous attempts using electrocatalysis.

"It takes much less energy to break the bonds of nitrate, compared to nitrogen, and that helps produce a lot higher yield of urea," Yu said.

Yu sees this formula as applicable to large- and small-scale uses. Electrocatalytic devices could be operated by individuals and sold to individual farms so they could generate their own urea for soil. And the hope is to provide alternative solutions to large-scale industrial processes to reduce energy use, which can play a role in a more sustainable future as the population and demand for urea will surely grow.

Next steps in this process involve improving further the yield and selectivity, as well as a prototype device that can scale up production. And the research team is trying to find a way to power the process using solar energy rather than direct electricity. ■

> Around the world we need to lower emissions. That's why we want to develop these more sustainable pathways to produce urea using electrocatalysis instead of this energy-intensive two-step process.

GUIHUA YU

GETTING OFF THE GROUND

WITH ALUMNA AMIEE QUON

In July 1997 Amiee Quon saw NASA's Sojourner Mars Rover on the cover of *Time Magazine* and had a passing thought: **Wouldn't it be cool to work on that?**

Fast forward to April 2021, and the Mars Helicopter Ingenuity made its first successful flight on Mars...with Amiee Quon serving as the mission's chamber test engineer.

Growing up in Houston near the Johnson Space Center, Quon (M.S. ME 2007) always had an interest in space, but wasn't sure exactly how she wanted to be involved. While earning her master's at UT Austin, she fortuitously met with an on-campus recruiter from NASA's Jet Propulsion Laboratory (JPL). Upon her graduation, she began her work at JPL on the Mars Curiosity Rover.

In 2014, the engineers at JPL were purposed with a simple question: Can you achieve enough lift to fly on Mars? With the atmosphere on Mars being so thin compared to Earth's atmosphere, it becomes very difficult to achieve liftoff. To prove that it was possible, the Mars Helicopter, named Ingenuity, was born and Quon was asked to join the project.

On April 11, 2021, after years of calculating and testing and a successful voyage to Mars, Ingenuity, weighing in at just four pounds, was ready to make its first flight with the whole world watching. Unfortunately, a software quirk delayed the flight by over a week.

"We've done all this testing but you never know, you test as well as you can, but there are some things that you just can't simulate," explained Quon. "You actually have to be there where the rubber meets the road and see how it goes. And so, this turned out to be one of those outside issues that we hadn't seen before in our testing."

With a software patch in place, Ingenuity was able to take flight on April 19, 2021 and has now completed dozens of successful flights of varying complexity. As a technology demonstration, the helicopter has achieved what it originally set out to do. Although ultimately this may not be the end Ingenuity's journey, Quon will now be focusing on other projects.

Quon also hopes that the public nature of her work will inspire other young people, especially girls, to become involved in STEM. She explains, "I'm glad that I can show people that there are women who do this kind of work. I think it helps to be able to see people, to be able to picture yourself in that position. And if this is something that you're interested in, being a female is not something that should hold you back. There's no reason that you can't do anything that anybody else can do."

Getting others involved in engineering is a passion for Quon. She is heavily involved in the NASA Community College Aerospace Scholars program, a program that allows students to work and interact with NASA engineers while encouraging them to finish their degrees and pursue a NASA-related career.

At the end of the day, Quon hopes that seeing the helicopter will encourage people to go into engineering, even if they don't get involved in space. "Like the Sojourner made me say, 'Oh wow, I want to work on that,' maybe some kids now will go on to work on the next air vehicle on another planet, or they will discover an entirely new field of engineering that interests them. There are lots of ways that engineering helps this world." ■

Left: Amiee Quon working with students as part of the NASA Community College Aerospace Scholars program

ACADEMY *of* DISTINGUISHED ALUMNI

CLASS OF
2020

Established in 2004, the Academy of Distinguished Alumni represents the highest honor that the Walker Department of Mechanical Engineering bestows on its alumni. Including this year's honorees, 164 alumni have been selected for this award, recognizing them as highly respected professionals, dedicated engineers, and supporters of higher education.

The Academy honors alumni in four different categories: Outstanding Young Mechanical Engineer, Distinguished Mechanical Engineer, Mechanical Engineering Hall of Fame and Honorary Mechanical Engineer.

DUE TO COVID-19 RESTRICTIONS, THE CLASS OF 2020 WAS UNABLE TO HOLD ITS ANNUAL IN-PERSON CEREMONY. WE HONOR THEM HERE.

Outstanding Young Mechanical Engineer

Albert W. Swanter
B.S. ME 2007, M.S. ME 2009
CTO and Co-Founder
Mobile Tech RX

Distinguished Mechanical Engineer

Scott D. Arnold
B.S. ME 1982, M.S. ME 1984
Vice President of Integrated Air and Missile Defense
Lockheed Martin

Matthew D. Chasen
B.S. ME 1998, MBA 2004
Founder and CEO
LIFT Aircraft

Amanda Dodd
B.S. ME 2001, M.S. ME 2003, PhD. 2009
Senior Manager, Computational Science and Analysis
Sandia National Laboratories

Jill Engel-Cox
B.S. ME & BA Plan II 1989, M.S. ME/Env. E 1993, PhD. 2004
Director
Joint Institute for Strategic Energy Analysis

W. Matt Ralls
B.S. ME 1971, MBA 1973
Executive Chairman (Retired)
Rowan Companies

Gregory N. Smith
B.S. ME 1985, M.S. IE 1999, Texas Executive Education Program 2010
Flight Operations Integration Lead, Human Lander System
NASA Johnson Space Center

Steven Nichols
B.S. ME 1972, M.S. ME 1973, PhD. 1975, JD 1983
Professor of Mechanical Engineering (Retired)
Director, MSE in Engineering Management

William A. Zalter
B.S. ME 1987, MBA 1989
Founder, Chairman, and CEO Solaris Oilfield Infrastructure, Inc.
Founder and CEO Solaris Midstream Holdings

Mechanical Engineering Hall of Fame

Robert L. Bass
B.S. ME 1964, M.S. ME 1966, PhD. 1968
Vice President (Retired) Mechanical and Materials Engineering Division
Southwest Research Institute

Jack Howe
B.S. ME 1967, M.S. ME 1968
Corporate Senior Vice President (Retired)
Chevron Phillips Chemical

H. Lee Norris
B.S. ME 1970, M.S. ME 1971, PhD. 1975
Co-Founder
LWI International

Honorary Mechanical Engineer

Richard R. Neptune
B.S. ME 1991, M.S. ME 1993, PhD. 1996
Professor and Former Chair
Walker Department of Mechanical Engineering, UT Austin

View the virtual ceremony

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