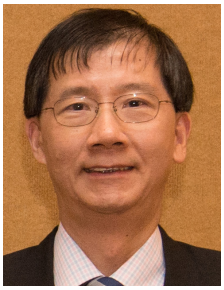
ME Connections

A publication of The University of New Mexico's
Department of Mechanical Engineering

Fall 2020

FROM THE CHAIR

Despite the ongoing COVID-related challenges, the Department of Mechanical Engineering at The University of New Mexico enters the 2020-2021 academic year with a cheerful outlook. Student success has always been at the forefront of our mission. The department is shaping a culture of continuous improvement, self-reflection, equity, and inclusion as we move forward.



Our faculty and student researchers continue to push forward the frontiers of research, to help address societal challenges in sustainability, security, and human wellbeing.

In this issue of *ME Connections*, we highlight some of our recent accomplishments and present a sampling of our educational initiatives, cutting-edge research, and community engagement. Special thanks go to Christos Christodoulou, dean of the School of Engineering, for his strong support of the ME department, and to Kim Delker, School of Engineering marketing manager, for her invaluable help in preparing this publication.

Yu-Lin Shen
on behalf of the entire ME family

Khraishi elected to leadership position in ASEE

Tariq Khraishi, a professor of mechanical engineering, was elected as chair-elect of Zone III of the American Society of Engineering Education (ASEE). His appointment as chair will begin in June 2021.

As chair of Zone III, he will be serving on the national ASEE Board of Directors and will attend annual meetings of three different ASEE sections under Zone III: the Midwest Section, which represents Arkansas, Kansas, Missouri, Nebraska, Oklahoma; the North Midwest Section, which represents Iowa, the Michigan upper peninsula, Minnesota, North Dakota, parts of South Dakota, Wisconsin and parts of Canada; and the Gulf Southwest Section, which represents Louisiana, New Mexico and Texas. In addition, he will attend the national ASEE Conference and Expo.

ASEE, headquartered in Washington, D.C., was founded in 1893 and is a nonprofit organization of individuals and institutions committed to furthering education in engineering and engineering technology. ASEE develops policies and programs that enhance professional opportunities for engineering faculty members and promotes activities that support increased student enrollments in engineering and engineering technology colleges and universities.

Sorrentino honored with NIH Trailblazer Award for drug-delivery project

Francesco Sorrentino, associate professor of mechanical engineering, has been awarded the National Institutes of Health Trailblazer Award from the National Institute of Biomedical Imaging and Bioengineering (NIBIB) for a project that could improve the way drugs for diseases are timed and delivered to patients.

The title of the project is "A Closed Loop Control System with Live Cells in the Loop." Andrew Shreve, Regents' Professor in the Department of Chemical and Biological Engineering, and Todd Thompson, associate professor in the Department of Pharmaceutical Sciences at the UNM Health Sciences Center, will serve as co-principal investigators with Sorrentino on the project.

For the project, Sorrentino and his team will apply mathematical modeling and optimal control methods to develop innovative approaches to multiple drug therapies in which the sequence and timing of their administration is optimized. Designing new delivery schedules has significant benefits, including minimizing the overall dose of each drug, which can reduce overall toxicity.

While the range of applications for this research is vast, the focus of Sorrentino's research for this project is on optimization of drug schedules to regulate autophagy, a key physiological process known to be involved in cellular aging, neurodegeneration and immune defense. The enhancement of autophagy during cellular stress, as when patients are undergoing cancer treatment, can lead to therapeutic resistance, making it an effective model for the design of optimal strategies.

Key aspects of this research will be conducted in the UNM Autophagy Inflammation and Metabolism Center, the only autophagy-focused NIH Centers of Biomedical Research Excellence (COBRE) center in the country, of which Sorrentino is an associate member.

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TRAILBLAZER AWARD

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Although much has been achieved in tailoring cancer therapies based on molecular events that drive cancer development and progression, there is significant potential for control theory-based treatments to enhance the well-being of cancer patients through careful tuning of dosage delivery of multiple pharmacological reagents.

In the overall context of control implementation in translational settings, the most successful example to date is the design of insulin-delivery functions in patients with diabetes. Progress in that area offers strong motivation for development of control strategies for drug delivery in treatment of other diseases, in particular, cancer.

"The long-term impact of this work is significant, as it will advance scientific knowledge leading to the development of optimized therapies for other diseases," Sorrentino said. "These therapies have the potential to impact millions of people around the world."

New pathway

This area of research marks a new pathway in Sorrentino's career. He has conducted extensive research in the area of control theory and synchronization, with complex mathematical equations filling the board in his office and prominently displayed in a lot of his academic publications. Creating mathematical models — a theory-based practice — has been the focus of his work.

His work looking at how various systems are linked and how each action affects another action has explored such areas as how to reduce energy consumption when trying to control a large distributed system, such as the power grid, the food web or the Internet.

Last year, Sorrentino became involved in a project that crossed over into the healthcare realm, publishing an article in the journal *PLOS One* called "Optimal regulation of blood glucose level in Type 1 diabetes using insulin and glucagon." Co-authors were Afroza Shirin, Fabio Della Rossa, Isaac Klickstein, and John Russell, all from UNM's Department of Mechanical Engineering. In that work, the team looked at how timing affects insulin dosage around meals. Although there are various ways in which diabetes can be managed, including automated pumps that provide the patient insulin based on estimations, or manual dosage administration, managing the condition is still a challenge for many. The team found that timing of dosages of insulin and glucagon matters, and they proposed a timing recommendation that — at least in theory — is an improvement.

Another paper authored by Shirin, Klickstein, Yen Ting Lin, Song Feng, Bill Hlavacek (the last three at Los Alamos National Laboratory), and Sorrentino, recently published in *Scientific Reports*, focuses instead on control of autophagy.

However, as Sorrentino mentioned, since a lot of the work was theoretical, testing in the real world on actual patients would be needed. That's why he is eager and optimistic about the multidisciplinary team assembled for the Trailblazer project. Sorrentino said the ability to take his theoretical work and collaborate with those in the medical field to develop new ways of treating challenging diseases like diabetes is one of the best things about working in academia.

"You work for a long time in one area of focus, so it's invigorating to be able to find new applications for your work and collaborate with researchers in other areas whom you might not ordinarily collaborate with," he said. "My hope is that this Trailblazer Award will bring visibility to the work being done in this area and one day lead to improve treatment and cures for patients."

Jackson in Innovate New Mexico Technology Showcase

Nathan Jackson, assistant professor in mechanical engineering, was one of several local inventors who took part in the Innovate New Mexico Technology Showcase on March 3, hosted by STC.UNM (now called UNM Rainforest Innovations).

The event had more than 150 attendees, which included local and national companies, investors, entrepreneurs, and local business and community leaders. Twelve researchers and inventors from UNM, the Air Force Research Laboratory, Los Alamos National Laboratory, Sandia National Laboratories, NASA-White Sands Test Facility and Johnson Space Center, and New Mexico State University pitched their technologies to industry representatives and investors.

Jackson pitched his Microsystem-Based Aerosol Generator, which addresses some of the downsides of electronic cigarettes and medicinal inhaled drug delivery systems. Jackson's technology seeks to improve upon current technologies regarding vaporization methods, which can have potential health complications. His aerosol generator would provide an alternative method of manufacturing a monolithic microfabricated vibrating mesh atomizer, which could control droplet size and eliminate ultrafine particle formation.

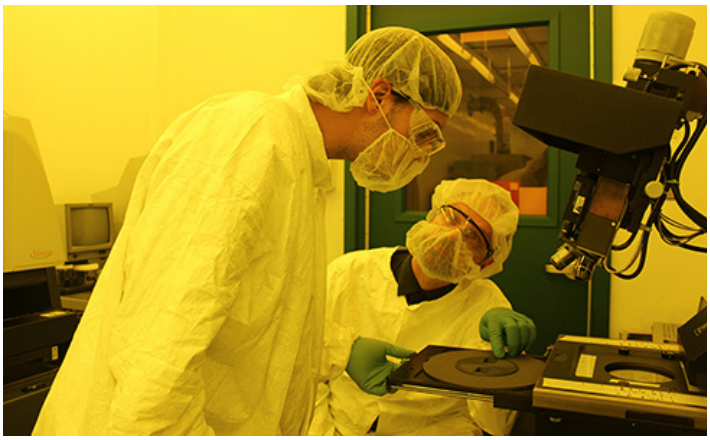
Microsystems education efforts receive recognition

The University of New Mexico's efforts with microsystems education were mentioned recently in an article published in *Pasadena Now.*

Pasadena City College in California is leading a National Science Foundation-backed $7 million effort to expand nanotechnology education. The grant will create the Micro Nano Technology Education Center, a consortium bringing together community college and baccalaureate-granting educational institutions, research laboratories, and private corporations working in micro- and nanotechnology fields.

In the article, The University of New Mexico Support Center for Microsystems Education was referenced as a model program. UNM is also a sub-awardee on the grant, with more than $500,000 of the $7 million coming to UNM.

Matthias Pleil, a research professor and lecturer in the Department of Mechanical Engineering at UNM, has been leading UNM's efforts since 2004. The article lauded Pleil's efforts in bringing faculty and students together for cleanroom-based workshops.



In 2017, UNM received a $1.6 million award from the National Science Foundation to continue their microsystems education efforts. The center recently received a supplemental $300,000 for an undergraduate research experience focused on technician students over the next two years.

The initiative was initially called the Southwest Center for Microsystems Education, but changed its name to the Support Center for Microsystems Education.

STUDENT AWARDS

RAJU GHIMIRE, a doctoral student in the Nanoscience and Microsystems Engineering Program at UNM, was selected as one of 16 to receive the 5 Sigma Physicist Award, given by the American Physical Society (APS). The 5 Sigma Physicist Award is awarded to APS members for "outstanding advocacy that is crucial to maintaining the strength of the scientific enterprise," according to their website. Ghimire said his advocacy work would not have been possible without the support of his advisors **MEHRAN TEHRANI**, formerly of the Department of Mechanical Engineering at UNM and now at UT Austin, and **YU-LIN SHEN**, professor and chair of the Department of Mechanical Engineering at UNM.

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Graduate student **IRMA ROCIO VAZQUEZ** was named the Charles Griffith Graduate Fellow in Science and Technology. Reserved exclusively for UNM doctoral students in STEM programs, the Griffith Fellowship is extended to a highly-qualified graduate student who is nominated by a department and subsequently selected by a subcommittee of UNM's Faculty Senate. Vazquez's record of academic achievement pushed her to the top of a competitive applicant pool for this prestigious fellowship.

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Graduate students **JAMES YOUCHISON** and **LAITH ALQAWASMI** won the Graduate Research Fellowship ($10,000 for the 2020-21 year) from the New Mexico Space Grant Consortium.

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The following students won the 2020 School of Engineering Annual Awards:

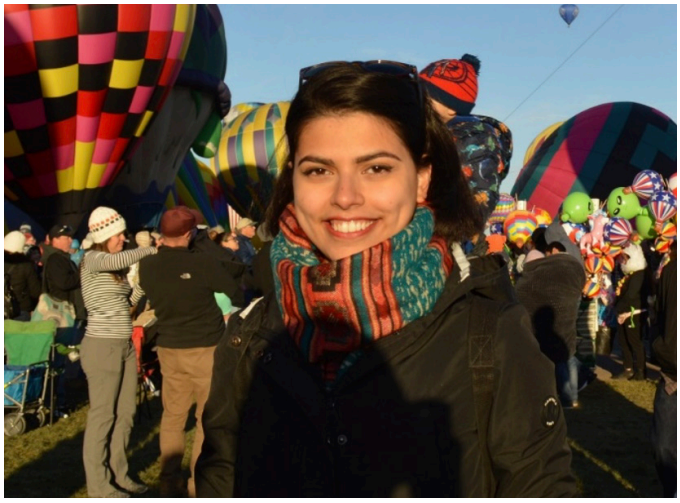
- **MARY ARNHART** received the Mechanical Engineering Outstanding Sophomore Award.
- **DONATO PIROSCAFO** received the Mechanical Engineering Outstanding Junior Award.
- **RACHEL STARKWEATHER** received the Mechanical Engineering Outstanding Senior Award.
- **BRIAN ROMERO** received the Mechanical Engineering Outstanding Graduate Student Award.

Student spotlight: **Maimuna Hossain**

Maimuna Hossain is a Ph.D. student in mechanical engineering, pursuing research in structural dynamics and vibrations. She received her bachelor's degree in mechanical engineering from Columbia University, and prior to graduate school, worked as a mechanical engineer in the Satellite Communications Branch at the Tobyhanna Army Depot.

Hossain currently works on a Sandia National Laboratoties project focused on finding the dynamic properties of a structure under vibration. She has been making steady progress, including publishing papers. This project will become her dissertation work.

"Working with Sandia has expanded my understanding of structural dynamics for aerospace applications," Hossain said. "It exposed me to

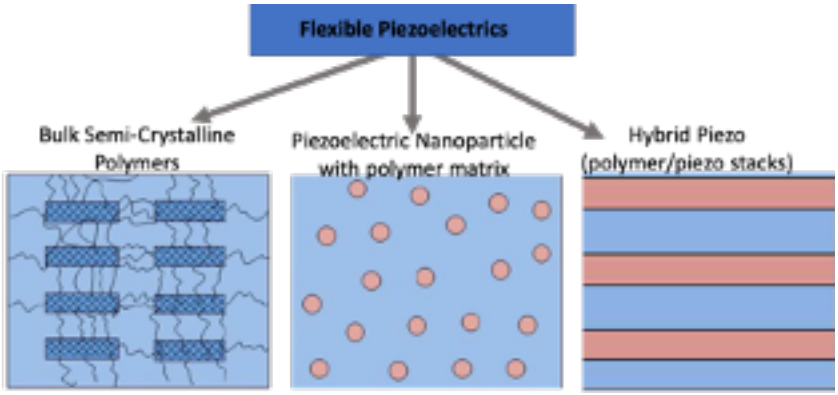


what it is like to work for the Labs and allowed me to meaningfully combine skills in linear algebra, advanced computation techniques as well as mechanical and structural engineering in order to solve technical problems."

Department of Defense project to develop advanced materials for military, civilian use

Smart contact lenses with virtual and augmented-reality capabilities, wearable electronics with sensors, and flexible robotic sensors are just some of the futuristic-sounding devices that could soon be a reality, thanks to a new project led by a ME faculty member.

Nathan Jackson, an assistant professor of mechanical engineering at UNM, is the sole principal investigator for a project called "Development of Multifunctional Flexible Piezoelectric Materials for MEMS." The three-year project began July 31. The project is funded by the Army Research Office, an element of the U.S. Army Combat Capabilities Development Command's Army Research Laboratory. The award amount is $658,334.



For the project, Jackson will focus on piezoelectric materials, which convert mechanical energy into electric energy (or vice versa), to develop a new class of multifunctional smart polymer materials that are compatible with standard microfabrication manufacturing methods.

There are currently a lot of microscale devices that utilize piezoelectric materials in both military and commercial applications, such as ultrasound transducers; sensors for gas, humidity, acceleration and medical; RF filters; and microphones. But these devices have limitations due to the stiffness of conventional thin-film piezoelectric materials, Jackson said.

"Current piezoelectric devices are made from stiff, inorganic materials, which do not meet the mechanical demands for wearable or implantable technology that infantry members need in the field, and they cannot be used by autonomous vehicles or drones as lightweight transducers," he said. "They also are not ideal for underwater sonar or portable bio/chemical sensors."

He said current polymer piezoelectric materials also are a disadvantage for usage in micro-devices because of their low thermal, piezoelectric and acoustic velocity properties.

"Low thermal properties prevent the materials from being manufactured into microscale devices which require elevated temperature processing steps," he said.

"Each piezoelectric material has advantages and disadvantages that make them uniquely ideal for specific applications. For Department of Defense-related applications, there is a need to develop a new class of piezoelectric polymers that can both withstand the elevated temperatures required for microscale manufacturing and be enhanced with multifunctional properties tailored for specific applications."

Jackson, along with a team of undergraduate and graduate students, will utilize UNM's Center for High Technology Materials to conduct the tasks for the project. "The creation of a new class of polymer piezoelectrics will give design engineers the ability to create technology that is currently not feasible," he said.

UNM-Los Alamos to offer bachelor's program in mechanical engineering

The University of New Mexico-Los Alamos (UNM-LA) and the UNM School of Engineering are collaborating to expand an existing two-year pre-engineering program to a bachelor of science in mechanical engineering program on the UNM-LA campus. The program was developed to meet identified workforce needs at the Los Alamos National Laboratory (LANL) but will also provide local students the same opportunity.

This fall, four engineering courses will be offered in Los Alamos. Two courses are offered at the 100-200 level as part of the pre-engineering degree curriculum, and two courses are 300-level courses taught by the UNM Department of Mechanical Engineering. Because of COVID-19 precautions, two of the classes are scheduled to be completely online, while the others are scheduled as hybrid classes. Additionally, several related mathematics and science courses are scheduled for the fall 2020 semester at UNM-LA.

"I thank UNM-Los Alamos for pioneering a program that serves both existing Laboratory employees seeking to upgrade their skills and new students seeking quality education close to home," said Thom Mason, director of Los Alamos National Laboratory. "The Laboratory expects to hire about 1,000 employees per year in all fields over the next five years. I encourage tomorrow's engineers to use this program to begin their careers with us."

This pilot program, which was enabled by funding from the New Mexico Consortium, will allow students to complete their BSME without traveling to UNM's Albuquerque campus or to another four-year institution. Students can pursue their pre-engineering associate degree from UNM-LA, and as they complete the prerequisites, can enroll in the upper-division engineering courses that will be offered on the Los Alamos campus.

"This new collaborative program with the UNM School of Engineering will increase the number of mechanical engineering graduates, meeting an identified workforce need with LANL and providing area residents with increased access to education and career opportunities," said Cynthia Rooney, chancellor of UNM Los Alamos. "This program serves as a model for innovation and cooperation, where UNM-LA, a branch campus-community college, works with the School of Engineering on the UNM Albuquerque campus, to serve as partners to provide the academic preparation needed in the local workforce."

In recent years, the role of mechanical engineers in research and development and other areas at LANL has expanded. This new collaboration is expected to increase the supply of mechanical engineers within the existing LANL workforce. Over 100 current LANL employees attended information sessions related to this proposed program. In addition to providing an educational opportunity for existing employees, this partnership will help build a sustainable pipeline (from community college through graduate school) of skilled graduates to address these local demands, while also providing students with well-paid, rewarding jobs.

To learn more about the bachelor's program in mechanical engineering, contact Irina Alvestad, UNM-LA associate dean of instruction, and mathematics and engineering division chair, at irina@unm.edu

State of shock: 200-year-old law about gas mixtures called into question

According to a study led by a team from the Department of Mechanical Engineering, centuries-old laws about the behavior of gas mixtures do not apply in the presence of shock waves.

This finding could have potential impact for everything that involves mixtures of gases exposed to a shock wave, for example, during combustion in an engine. This is also relevant for conventional and nuclear explosions, supersonic jets, gas-cooled nuclear reactor plants, and inertially-confined fusion.


Wayne

The results were published in the paper "Dalton's and Amagat's Laws Fail in Gas Mixtures with Shock Propagation" in *Science Advances*. UNM authors on the paper were Patrick Wayne, Daniel Freelong, Gregory Vigil, Timothy Clark, Peter Vorobieff and C. Randall Truman from the Department of Mechanical Engineering. Other co-authors were from Texas A&M University; Air Force Institute of Technology; The Ohio State University; and the Joint Institute for High Temperatures, Russian Academy of Science.

The study, conducted at UNM, involved pre-mixing two gases with dramatically different properties: light helium and heavy and viscous sulfur hexafluoride. The team characterized the properties of the resulting mixture, which agreed well with classical theory, then a shock wave was introduced, and the temperature and pressure of the shock-accelerated medium were measured over several milliseconds – a short time to think of in normal terms, but a long interval compared with the time scales associated with the shock wave passage.

The researchers found that the temperature and pressure after the shock compression did not line up with what would have been expected from the predictions of either of the two classical theoretical laws – Dalton's or Amagat's.

French physicist Emile Hilaire Amagat's law of partial volumes from 1880 states that the total volume of a gas mixture is equal to the sum of the partial volumes each gas would occupy if it existed alone at the temperature and pressure of the mixture. And in 1802, scientist John Dalton stated that the total pressure in a non-reactive gas mixture – at constant temperature and volume – is equal to the sum of the partial pressures of the component gases.

"Our study found that classical laws used to predict gas mixture properties fail to work in a fairly common and practically important situation," Vorobieff said.

The reason for disagreements is that neither classical law can accurately describe what happens on the molecular level, he said. Simple considerations of time scales from kinetic molecular theory, and how they are affected by shock acceleration, appear to provide at least a qualitative explanation of the experimental observations.

Vorobieff said that although this is a solid first step, the ultimate implications have not yet been determined, and much further study is required. Possible impacts could mean a design change in mechanisms like engines that take into account how shock waves affect the gas mixture properties.

Funding for this project was provided by the National Nuclear Security Administration.

Cool idea: UNM-led NASA project seeks to develop heat-transfer solution for space

A mechanical engineering faculty member is leading a NASA project that will develop a more efficient method of cooling that relies on electromagnetic fields instead of moving parts and is believed to be well-suited for a zero-gravity environment, such as space.

The proposal, titled "Efficient Microgravity Heat and Mass Transfer with No Moving Parts," is funded by the NASA EPSCoR (Established Program to Stimulate Competitive Research) Program Office. The principal investigator is Peter Vorobieff, professor of mechanical engineering at UNM. He is working with Paulo Oemig of the New Mexico Space Grant Consortium based at New Mexico State University, who is the designated NASA ESPCoR director on the project.

Vorobieff

The new device will allow for a more efficient way of transporting heat in microgravity, Vorobieff said. Unlike a traditional pump used to transport liquid for cooling and heat transfer, this new method does not employ any moving parts — which can wear out and need maintenance — and requires only a modest power supply, so it is potentially superior to current heat-transfer methods in extreme environments like space. This design will instead use a magnetic field to move liquid around.

"This method has been tested extensively on Earth, and there is strong evidence that it should work even better in microgravity environments," Vorobieff said. In Earth's gravity field, heat and mass transfer in liquids occurs via a process called natural convection, provided a thermal gradient exists, such as the clash of hot and cool air. On Earth, hotter and less dense material rises, and cooler and denser material sinks due to the Earth's gravitational pull. But in the microgravity environments of space, forced convection is needed to move hotter material away. Without some kind of a device to stir the fluid, heat transfer in microgravity will be much less efficient.

The project is part of the NASA EPSCoR International Space Station Flight Opportunity. The projects that have been selected for funding will be tested on the International Space Station (ISS) on a future mission.

In the experiment in space, the team will test to see if fluid heat transfer can be enhanced in a microgravity environment. In the studies, an enclosed cell will be filled with water and infused with a small amount of magnetic platelets. One part of the cell will be heated, and without any artificial movement of heat, the temperature will rise quickly near the heat source. Then using the new design, the water will be electromagnetically drawn through the cell, keeping the temperature from rising as quickly.

Results of microgravity and ground tests will then be compared. The goal is to determine the most effective magnetic fields to apply to optimize the heat transfer.

"The ISS is the perfect platform to test this new approach in microgravity because we will have the ability to control heat and mass transfer with no moving parts and very low power requirements," Vorobieff said.

Vorobieff said the project will provide an important first step in implementing this technology in future space systems.

Professor makes history by converting in-person conference to online format

Planning had been taking place for months, but like so many other events this past spring, it was on the brink of cancellation due to the COVID-19 pandemic.

Tariq Khraishi, a professor of mechanical engineering at The University of New Mexico, was tasked with chairing a large regional conference to be held in Albuquerque at the end of March, and everything was set to go. The 2020 American Society for Engineering Education (ASEE) Gulf-Southwest (GSW) section conference was to be held at the Albuquerque Marriott in Uptown.

But instead of attracting faculty members, administrators, staff, professionals and students from around the country to the Duke City, the worsening coronavirus pandemic forced Khraishi to cancel the in-person conference, which was a highly disappointing outcome for something he had planned so hard to organize (along with faculty members from UNM, New Mexico Tech and New Mexico State University).

However, he didn't give up. Instead, he came up with an entirely new mode of delivery: moving everything online.

Khraishi, who is chair-elect of Zone III of ASEE (with his appointment as chair beginning June 2021), was confident that instead of scrapping the conference that was ready to launch, he could transfer it online and still have a meaningful experience for attendees.

So, within about a month, that is exactly what happened. Khraishi was able convert the conference to a series of online presentations and messages on April 23-24 and April 29.

"It was the first ASEE section conference to be done fully online and therefore had the attention of the ASEE national organization, which was very interested in seeing how it went, its successes and its challenges."

— Tariq Khraishi

Khraishi said the Gulf Southwest section was the first ASEE section conference in the country to be conducted fully online, which intrigued ASEE headquarters, which holds many in-person conferences that will likely need to be converted to online in the coming months.

"It was the first ASEE section conference to be done fully online and therefore had the attention of the ASEE national organization, which was very interested in seeing how it went, its successes and its challenges," he said. "They want to use the lessons learned as they move themselves into digital conferencing for the main summer conference and others."

Not only was the conference successfully transferred to a virtual arena, but nearly all of the attendees kept their registration or participation, he said. There were 87 total presentations, 32 of those by students, and 76 papers submitted.

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Award winners from ASEE Conference

The following students and faculty from Department of Mechanical Engineering received awards at the 2020 ASEE Gulf-Southwest Annual Conference:

Student paper awards

First Place

JESUS ORTEGA, "Thermal Energy Storage: Gaps and Bridges for Concentrating Solar Power Technologies"

Fourth Place

IRMA ROCIO VAZQUEZ (Co-author: **SAKINEH CHABI**, assistant professor of mechanical engineering), "Solar Fuels: Importance of Material Compatibility in Their Production"

Faculty paper awards

Second Place

KRISTINE DENMAN, Joel Robinson (NM Institute for Social Research) and Tariq Khraishi, "A Study of the Impact of an NSF Internship and Conference Participation Program on Student Success"

ASEE CONFERENCE

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Since the conference was originally scheduled to be spread over one-and-a-half days of presentation sessions, it was spread over three days in the virtual version, since there couldn't be any concurrent sessions as in an in-person conference.

Also, since Khraishi was the moderator of all the sessions, he wanted to make sure there were enough people who tuned in for each session.

"This totally-online experience was new to us and thus had an element of unknown. We didn't know what to expect," he said.

The theme of the conference was "Engineering Engineering Education (E3): Innovations in the Classroom and Beyond." The online conference featured a welcome video message from Christos Christodoulou, Jim and Ellen King Dean of Engineering and Computing.

The topics covered in the sessions were wide-ranging, including technology in the classroom, diversity, student engagement, integrating design thinking into engineering courses, ethics education, professional skills, augmented reality, mentorship, and even differential calculus and geometry.

Presenters were from universities and organizations, including ASEE, Texas A&M, University of Texas-Dallas, Rice University, Texas Tech, as well as UNM, New Mexico State and New Mexico Tech.

In addition to the professional sessions, there was also a full slate of student technical presentations on a wide variety of engineering topics.

The ASEE GSW section is one of the most active ASEE sections in the country, Khraishi said, representing ASEE members in New Mexico, Texas, and Louisiana. Through the Gulf-Southwest section, members participate in professional activities at the local level and form regional networks of educators with common interests and goals. Section activities include an annual section conference; conducting workshops and professional development activities for faculty members and administrators; sponsoring awards for professional excellence; and issuing newsletters.

Lessons still learned despite cancellation of three student design competitions

Every June, Formula SAE, Solar Splash and Lobo Launch each culminate in international competitions, in which large student teams participate. But not this year, thanks to COVID-19.

Instead, all of these competitions were canceled, and social distancing protocol required that students stay out of the labs and rely on online learning to finish the semester, which put hands-on projects like these in peril. However, even though the projects were not completed and the competitions did not happen in 2020, there was still much that was gained.

Race car: LOBOmotorsports (Formula SAE)

The Formula SAE team, under the direction of Professor John Russell, was ready to drive the car for a test run March 15, which would have been the earliest date ever. "This was a tremendous setback as this was one best-prepared teams we have had considering both the car design and drivers," Russell said.

Sam Casaus, project manager for the 2020 team, said the cancellation was disappointing on a lot of fronts. "We are absolutely heartbroken."

The plan is for the 2020 internal combustion car to compete in the 2021 contest. Russell said priorities for the coming year will be to finish the 2020 internal combustion (IC) car, complete the electric vehicle (EV) prototype, design and build as much of a competition 2021 EV car as possible, and start a 2021-22 IC car.

Eric Benfield, the leader of the 2021 team, said that even though the pandemic has significantly changed the team's plans, thanks to a good foundation laid by the 2020 team, they are coming out of this with a renewed enthusiasm for June 2021, as well as lessons that will last far beyond that. "We are still in the early stages of designing the 2021 car, so I am sure there will be many more lessons to be learned as we continue."

Solar boat: Solar splash

The Solar Splash solar-powered boat team has competed successfully the last few years in the international competition in Ohio. This year, the team had high hopes to place even higher.

Trey Alexanderson was a solar array subteam member on this year's team said the team had made a variety of improvements to the boat for 2020, including building a new wooden hull that was designed, built and about to be tested by the team. "We were hopeful that this new boat hull was going to be lighter and was going to reduce drag compared to the last hull that we used," he said.

Despite the unexpected outcome, he said he still is walking away wiser. "I gained more knowledge in the design and use of different electrical motors and solar cells, as well as the many steps it takes to successfully design a boat."

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LESSONS

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Rocket: Lobo Launch

The Lobo Launch rocket had great success in 2019, competing for the first time in the Spaceport America Cup, placing No. 5 overall and No. 3 in its height class. Fernando "Doc" Aguilar, the director of the Lobo Launch program, said he hopes that the students can test launch the rocket they were working on sometime yet this year.

Deanna Jaramillo, who was in charge of public relations and mentoring for this year's Lobo Launch, said because the labs closed, the team couldn't test any of the components, pre-assemble the rocket, or test the diagnostics. The semester was finished up with lectures via Zoom. She said that while it was extremely disappointing to the team to have the competition canceled, all was not lost. "The main thing that the entire class needs to remember was that the competition was an extra bonus to the class," she said. "We decided at the beginning of the fall semester last year that we wanted to go to competition but that wasn't our first priority. Our first priority was to design, build, and test a rocket. We used the competition rules and requirements as a guide for the rocket design."

Construction begins on new facility for FSAE

Construction began in July 2020 on the new lab space for the UNM Formula Society of Automotive Engineers (FSAE) program. The 7,000-square-foot space on the ground floor of the Farris Engineering Center will be dedicated to the FSAE program to replace the aging and cramped space in the basement of the Mechanical Engineering Building. Bradbury Stamm Construction was selected for the project. The construction is slated to be complete in October 2020, and the program will likely move in over the winter break, with faculty and students being able to use the new space in spring 2021. The new lab will be named the Dana C. Wood FSAE Racing Lab.

FSAE car on display at Wheels Museum

The 2017 FSAE car is on display at the Wheels Museum in Albuquerque, nestled among vintage trains, bicycles and automobiles at the museum, which is located next to the Albuquerque Railyards at 1100 Second St. SW.

Leba Freed, president of the Wheels Museum Inc., said she had seen the FSAE car at various events over the years and thought it would be a strong attraction to have at the museum, so she connected with the dean of engineering to make it happen. "It's such a great program and wonderful tool for education and recruitment," she said. "We thought it would be a natural fit to have in our museum."

Department welcomes 3 new faculty

CLAUS DANIELSON joined the Department of Mechanical Engineering as an assistant professor in August 2020. He received his Ph.D. in 2014 from the Model Predictive Control Laboratory at the University of California, Berkeley. He received his master's and bachelor of science in mechanical engineering from Rensselaer Polytechnic Institute and the University of Washington, respectively. For the past six years, he has been a principal research scientist at Mitsubishi Electric Research Laboratories in Cambridge, Mass. His research interests are in motion planning and constrained control. His specialty is developing methods for exploiting structure in large-scale or complex planning, control, and optimization problems. He has applied his research to a variety of fields, including autonomous vehicles, robotics, spacecraft guidance and control, heating ventilation and air conditioning, energy storage networks, adaptive optics, atomic force microscopy, and cancer treatment.

ALI HEYDARI joined the Department of Mechanical Engineering as an assistant professor in August 2020. He received his B.S. and M.S. degrees in aerospace engineering from Sharif University of Technology, Iran, and his Ph.D. from the Missouri University of Science and Technology (Missouri S&T). He has previously held tenure-track appointments at Southern Methodist University (SMU) and South Dakota School of Mines and Technology (SDSMT). His research is focused on mathematical analysis of machine learning and on its robotic applications. He serves on the editorial board of *IEEE Transactions on Neural Networks and Learning Systems*.

PANKAJ KUMAR joined the Department of Mechanical Engineering as an assistant professor in August 2020. He received his Ph.D. in Materials Science and Engineering from the University of Utah in Salt Lake City. Following postdoctoral work there, he joined the chemical and materials engineering department at the University of Nevada, Reno, as a research assistant professor. His research focus is on additive manufacturing techniques; developing advanced manufacturing strategies for metal and alloys; designing microstructure and alloys for extreme environments; and improving the physical understanding of deformation micro-mechanisms in metallic materials.

Sorrentino receives Dean's Excellence Lectureship Award

Francesco Sorrentino, associate professor in Mechanical Engineering, is among the three recipients of the inaugural School of Engineering Dean's Excellence Lectureship Award. He will hold the title through the 2021-22 academic year.

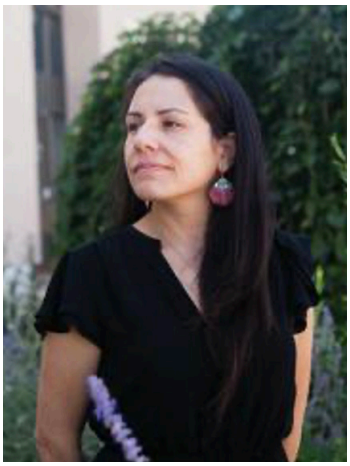
The Dean's Excellence Lectureship Award was established as a way to reward outstanding faculty who have been nominated for the UNM Regents' Lecturer or Professor titles. Winners receive $2,000 per year for three academic years.

ME Alum Spotlight: Erica Velarde, BSME 2007

From the Santa Fe New Mexican, 2019

When she was 26, Erica Velarde remembers looking at her 1- and 4-year-old daughters — overwhelmed by doubt, but still hopeful.

Already the first woman in her family to earn a degree, the single mother had gone back to school for a bachelor of science in mechanical engineering at The University of New Mexico. She was determined to survive with the aid of welfare and food stamps en route to carving out a better life for her family.



In her job, Velarde has launched the State Building Green Energy Project, a $31.7 million initiative to upgrade 32 buildings in Santa Fe using energy-efficient resources, with the end goal to convert all 750 government buildings in the state to energy-efficiency resources — ideally within the next eight years. She said upgrading the buildings in Santa Fe will save 52 percent of the facilities' kilowatt usage per hour and save the state 5,363 metric tons of carbon dioxide per year. The project also will save money: Trane U.S. Inc., the project's contractor, has guaranteed savings of at least $1.1 million a year. Velarde said after the project's first 12 years — following the initial two-year construction — savings could surpass $1.4 million annually.

Of the 32 buildings committed to energy upgrades, such as sustainable lighting and HVAC systems, 19 are dedicated to renewable solar energy. They include the Toney Anaya Building, which houses the New Mexico Regulation and Licensing Department, and Wendell Chino Building, home to the General Services Department.

Her journey into engineering began when she was enrolled at Northern New Mexico College in pursuit of an associate of arts degree in business administration and she took an astronomy class for fun and earned a 110 percent grade with the addition of extra credit. One day, her professor, Ajit Hira, pulled the then-pregnant Velarde aside and asked a question that ultimately changed her life: "Have you ever thought about engineering?" Velarde recalled. "I didn't know what engineering was." But after some research, her interest was piqued.

The next chapter, she said, was among her life's hardest. She commuted from Santa Fe to Albuquerque up to seven days a week for class and group projects. Her daughters often tagged along, playing with Barbies and drawing in coloring books while she worked. "I cried at 3 a.m. a lot," Velarde said. "... I thought I couldn't do it." But her daughters inspired her to persevere. She is now the mother of three: Arianna Gonzales, 19; Devina Gonzales, 16; and son Lucas Carrillo, 8.

Velarde worked for the Department of Transportation and Energy Conservation and Management Division before accepting her job with Facilities Management. Since Velarde's arrival, she's pushed New Mexico to join the Better Buildings Challenge, a nationwide initiative led by the U.S. Department of Energy to prioritize energy efficient buildings. She's also served in leadership positions with the Energy Services Coalition since 2015. Now, Velarde is an energy engineer with the Facilities Management Division of the state General Services Department, responsible for implementing renewable energy and energy-efficient projects in government building across New Mexico.

In 2019, for all her efforts, she received the Energy Manager of the Year Award at the annual New Mexico Association of Energy Engineers and the New Mexico Energy Services Coalition conference.

Though humbled by the honor, Velarde said it's the work that matters most. "We don't have much time. [Climate change] isn't a joke."

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Online M.S. program in space systems engineering earns top rankings

The University of New Mexico's online master of science in mechanical engineering program with the Space Systems Engineering concentration is ranked No. 1 nationwide in a list of the 2020 Most Affordable Online Master's Programs in Mechanical Engineering by OnlineU. The same program is also ranked No. 1 for the 2020 Most Affordable Online Master's in Aerospace Engineering Programs, and No. 6 for the 2020 Best Online Master's in Mechanical Engineering Degrees. Those rankings are based on degree-level and program-specific tuition rates and PayScale salary data. The master's in space systems engineering at UNM is an all-online degree program that was one of the first master's-level space systems engineering programs in the country. The program was developed with careers in mind, with input from the Air Force Research Laboratory Space Vehicles Directorate, based in Albuquerque, to provide graduates with the advanced skills to further their career in the aerospace industry. All courses for the program are offered in an 8-week format.

Learn more at online.unm.edu