ME Connections

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

Fall 2018

FROM THE CHAIR

With this communication, the Department of Mechanical Engineering (ME) at The University of New Mexico is reaching out to you. The newsletter showcases some of our recent accomplishments and provides a sampling of our educational initiatives, cutting-edge research, student activities, and community engagement.

ME is a student-centered, discovery-driven, and globally-engaged academic department. The positive momentum the department has gained will become evident as you look through the pages. We strive to create innovations in teaching, foster technological advancement, and push forward the boundaries of knowledge.

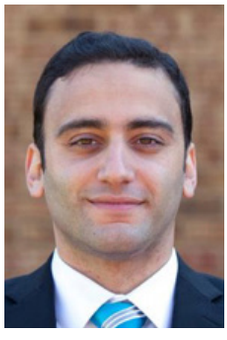
Special thanks go to Christos Christodoulou, dean of the School of Engineering, for his strong support of the ME department, and to Kim Delker, School of Engineering marketing manager, for her invaluable help in preparing this publication.

Yu-Lin Shen
on behalf of the entire ME family

Tehrani receives ONR Young Investigator Award

Mehran Tehrani, assistant professor of mechanical engineering, has been awarded the 2018 Office of Naval Research Young Investigator Award.

Tehrani was one of 31 selected out of 340 applicants to receive this award. Each award is $510,000 over a three-year period. The Young Investigator Program awards are given to scientists whose research holds strong promise across a wide range of naval-relevant science and technology areas.



Tehrani's project is "Next Generation Electrical Wires for Navy Applications." This project will seek to fundamentally understand the effects of combining nanocarbons with metals toward the development of nanocarbon-based cables that significantly reduce weight and increase performance efficiencies for various applications.

"This understanding will allow for faster development and manufacturing of such cables toward the fundamental goal of replacing existing copper-based cables with ones that are based on carbon nanotubes (CNT's) or other related nanostructures," he said. "The current lack of such fundamental understanding of the metal-nanocarbon interactions has led to a steep learning curve for cable development and this project will address such shortcomings and ultimately increase the speed for CNT-based cable development."

Tehrani said this prestigious award will give his research a boost. "I am very excited about this opportunity for my group to contribute to a very important scientific problem that also has extremely significant economic and societal impacts."

Truman receives 2019 AIAA Sustained Service Award

Randy Truman, a professor in the Department of Mechanical Engineering, is one of four recipients of the 2019 AIAA (American Institute of Aeronautics and Astronautics) Sustained Service Award.

The Sustained Service Award recognizes sustained, significant service and contributions to AIAA by members of the Institute. Truman was named an AIAA Associate Fellow in 1993, and received the National Faculty Award in 2000.

Truman has been active in AIAA since joining as a student member in 1972. Upon joining the Department of Mechanical Engineering. Truman recruited student members to charter a student branch in 1982. He served as faculty advisor until July 2018, taking numerous students to the Region IV Student Conference. Truman has also been active in the AIAA Albuquerque Section. As membership chair, he established the Corporate Liaison Committee with representatives from as many as 20 local companies. Since 1990, Randy has remained an active member of the Albuquerque Section Officers' Board in an ex-officio role as UNM faculty advisor.

Truman was appointed to the AIAA Student Activities Committee in 1990, and served until January 2018. From 2002-2011, he chaired its Scholarships & Awards Subcommittee that made annual selections of 30 undergraduate scholarships, a dozen graduate fellowships, and the National Faculty Advisor Award. Truman recruited more than 50 judges to ensure that each application was reviewed by multiple judges. He closely advised AIAA Staff in developing the online system now used for judging.

Poroseva receives UNM Women in STEM Award

Svetlana Poroseva, associate professor in the Department of Mechanical Engineering, is one of the recipients of UNM 2018 Women in STEM Awards.

The Women in STEM awards are in their third year and are presented by Advance at UNM, a five-year National Science Foundation grant to recruit, retain and promote women and minority STEM faculty.

The awards are supported by an anonymous gift made to UNM to support research by, and professorships for, women faculty in science, technology, engineering, and mathematics. Income from investment of this gift will be used to help UNM women tenure-track and tenured assistant and associate STEM professors to establish new lines of research and to develop research collaborations.

Poroseva's research project in conjunction with this award is titled "Developing "Smart Grass" for Harvesting Wind Energy in Urban Areas." She will be developing a new device for harvesting wind energy in urban areas. "Strong winds in cities are not strong enough for traditional technologies. Combining new technology (smart materials) with an idea borrowed from Mother Nature may give us a solution for a new "natural" way of safely harvesting wind energy in houses and outside," Poroseva said.

"Students love projects where nature and technology work together and so do I. This is a new research area for me and this award will help me to advance in this area and to establish new collaborations with my colleagues including a new assistant professor in our department, Dr. Nathan Jackson," she said.

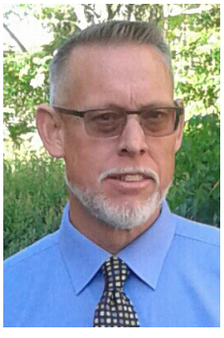
CONGRATULATIONS TO THE SCHOOL OF ENGINEERING 2018 ANNUAL AWARD WINNERS!

Senior Faculty Research Excellence Award — Peter Vorobieff

Peter Vorobieff has been with the Mechanical Engineering department since 1999. His technical expertise lies in the areas of fluid mechanics, hydrodynamics instabilities, shock-accelerated flows, advanced flow measurement, and renewable energy. He led UNM research teams responsible for at least two major discoveries – formation of a braiding pattern in rivulets, and a new class of shock-driven instabilities. In the latter case of Professor Vorobieff's research breakthroughs, his team discovered a new hydrodynamic instability mechanism which manifests in gas or plasma containing non-uniformly distributed non-gaseous inclusions (particles or droplets) after the passage of a shock wave. It has serious implications in many areas of science, from astrophysics, where shocks propagate through dusty plasma, to aerospace science, where the new instability may affect mixing of drops of fluid with supersonic gas in a supersonic combustion ramjet engine. The work would not have been possible without years of preceding effort that led to the construction of the unique shock tube research facility in our department. This facility sets the standard for the state of the art in experimental studies of compressible multiphase flow.

Vorobieff's research excellence is recognized by the national and international community of scientists. He is associate editor of *ASME Journal of Fluids Engineering* and a member of the international scientific advisory board and editorial board at the Wessex Institute. He has organized several international conferences on multiphase flow. He is not only a brilliant experimental scientist but also an excellent teacher, and an effective, dependable, and entertaining colleague in the Department of Mechanical Engineering.

Outstanding Staff Award — Ronald McKinstry



Ron has been with the Mechanical Engineering department since 2015. He has a very wide range of duties spanning facilities/technical support, inventories, safety protocols, IT support, building and lab access etc. He carries out his duties efficiently and, most importantly, with a very positive attitude, always taking things upon himself. Whenever Ron senses something that may cause concerns, he is prompt to investigate and seek solutions. He takes safety and occupational health very seriously. Normally a technician would react to things when they happen, but Ron is proactive in identifying problems and looking for areas to make improvement.

Ron has always shown professionalism, respect and a great attitude toward whomever he is helping and whatever job is requested. His attention to detail and quality of work alone sets him apart from others by taking the extra time to ensure the job is done correctly and efficiently. Students, staff and faculty in the department are all very impressed with Ron's ability to multitask and not only complete the job but to ensure that the person requesting help is satisfied with the results.

Naseri receives Outstanding Lecturer of the Year award

Asal Naseri, Senior Lecturer II in the Department of Mechanical Engineering, is one of the recipients of UNM 2017-2018 Outstanding Lecturer of the Year awards.

The award recognizes her contributions to the university's teaching mission. Naseri's primary areas of expertise are in dynamics, control, automation, and space systems. Since joining the department in 2014 she has been well known for her student-centered active learning approach. She is also known as a pioneering online instructor. In addition to teaching, Naseri also conducts research in space systems and spaceflight. She and her graduate students have been developing the guidance, navigation, and control algorithms that are needed for the autonomous astrometric alignment of CubeSats.

STUDENT AWARDS

Several mechanical engineering students received awards so far in 2018:

Jaylene Reyanne Martinez was selected to receive the prestigious National Science Foundation Graduate Research Fellowships for 2018. Fellows receive a three-year annual stipend, including a cost-of-education allowance, which gives them the chance to conduct their own research at any accredited U.S. institution. The program also provides an opportunity for international research, as well as professional development.

Mark Blair received the George E. Breece Award. The award was established in 1921 to honor the UNM School of Engineering senior with the highest grade-point average from each graduating class.

Rachel Starkweather received the Mechanical Engineering Outstanding Sophomore Award.

Josh Ludwigsen received the Mechanical Engineering Outstanding Junior Award.

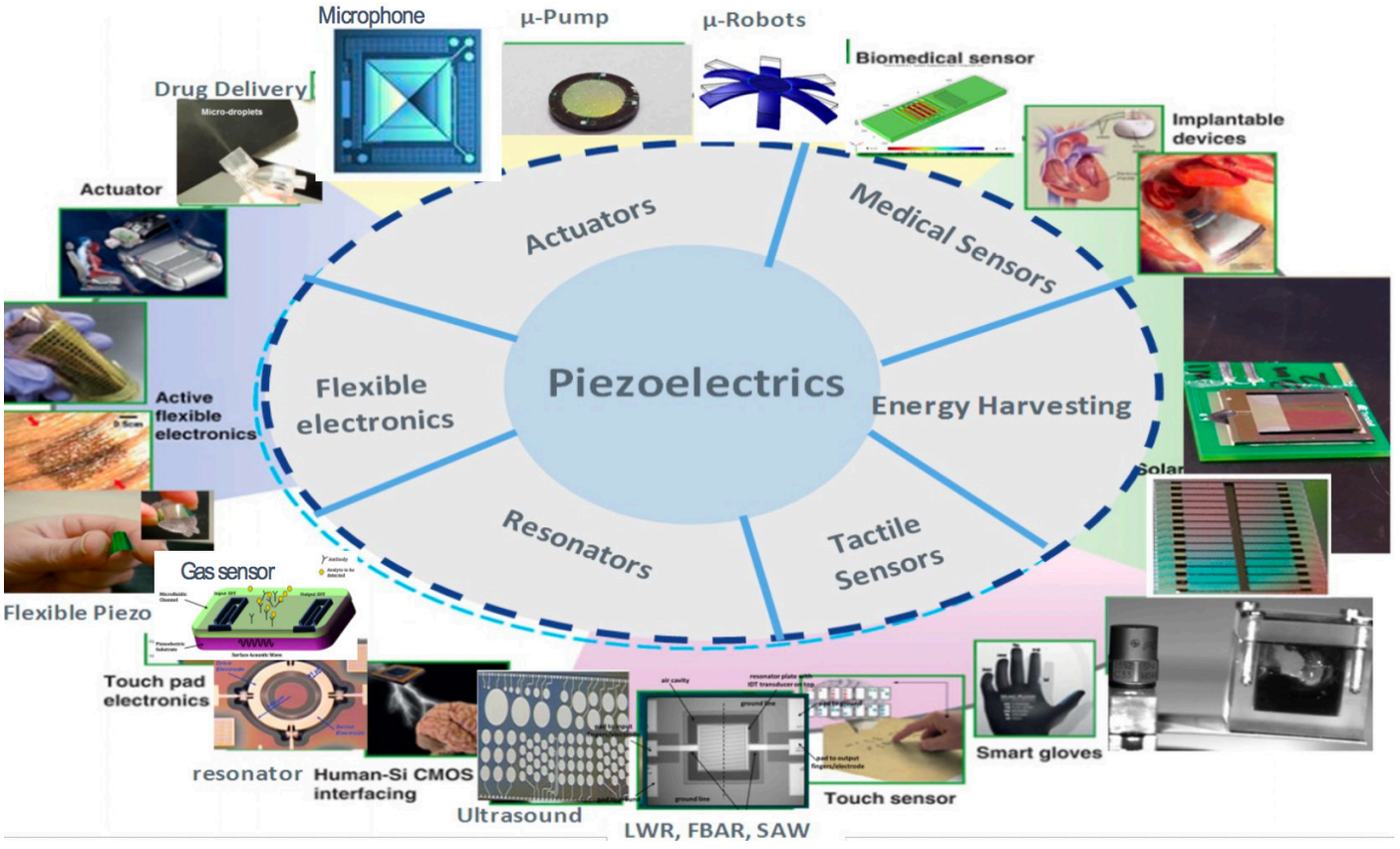
Melanie Schneider received the Mechanical Engineering Outstanding Senior Award.

Patrick Wayne received the Mechanical Engineering Outstanding Graduate Student Award.

STAFF NEWS

In the Department of Mechanical Engineering, staff members play a key role in supporting the teaching, research and service missions. Here are some of the recent happenings to our staff:

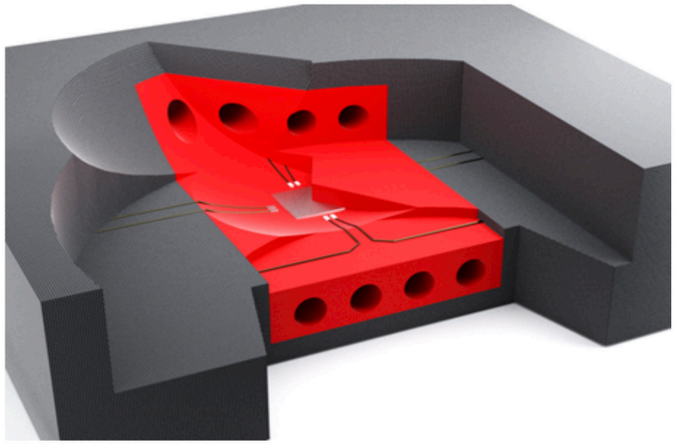
- Two staff members recently received promotions: **Cindi Sanchez** has been promoted to Administrative Assistant III, and **Ron McKinstry** has been promoted to Supervisor, Engineering Lab. Congratulations!
- **Denisha Garcia** joined the ME department in May 2018 as a lead accounting staff. Welcome!
- **Anna Mae Apodaca** and **J.J. Conn**, our two advisement staff, both traveled to Phoenix to attend the NACADA (National Academic Advising Association) 2018 Annual Conference. NACADA promotes and supports quality academic advising in institutions of higher education to enhance the educational development of students.
- **Mike Arnold**, a veteran of the Indy Car circuit, joined the department as the Formula SAE lab manager. He has since been working with the program to provide expertise on organization of the shop and the building and fabrication of the racecars.
- Senior Machinist **Jason Church** has an active role in not just managing the ME Machine Shop but instructing the laboratory sections of our Design courses. He has helped devise many new teaching modules and contribute to a wide variety of student design projects and research activities.
- Department Administrator **Shannon Siderius** recently completed her Executive MBA degree from UNM Anderson School of Management. Congratulations!



RESEARCH ROUNDUP

Assistant Professor **Nathan Jackson** is developing next-generation microsystem devices by integrating them with functional materials such as thin-film piezoelectrics (above). His focus is on developing MEMS (micro-electro-mechanical sysems) devices for Internet-of-Things applications as well as BioMEMS, including: energy harvesters, acoustic resonators, sensors, ultrasound, and flexible/stretchable electronics. His investigation on functional materials involves enhancing properties as well as methods of manufacturing the materials to be compatible with standard MEMS processing. The work will aid in the development of future MEMS devices and knowledge transfer to industry.

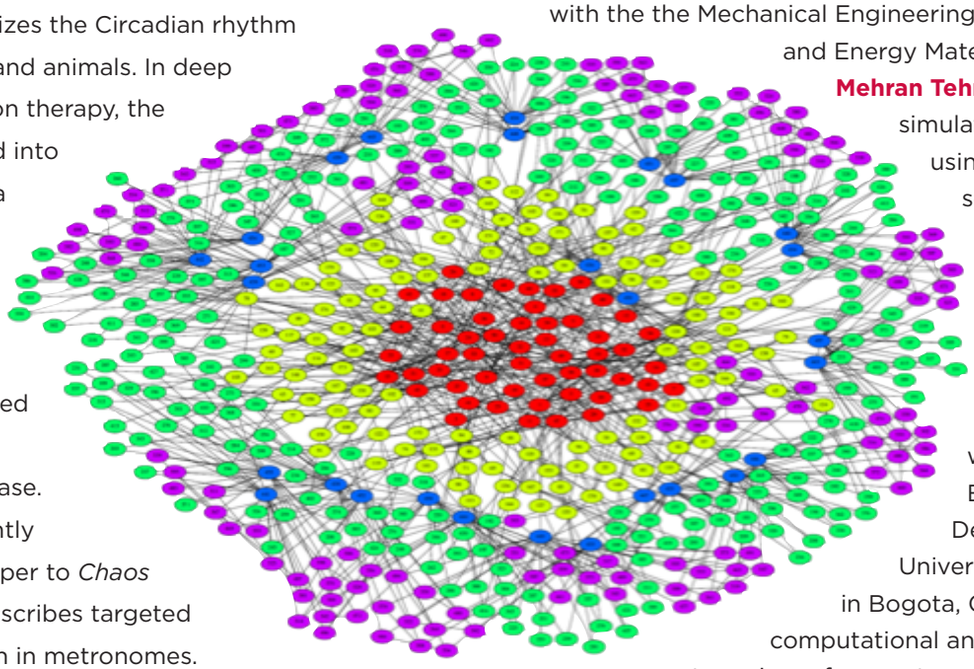
Professor **Mehran Tehrani**'s team is working with Air Force Research Laboratory (AFRL) to develop a multi-material additive manufacturing (AM) approach using space compatible materials and engineered interfaces to produce spacecraft components and systems that offer improvements in cost, mass, fabrication time, and



performance. This work is a part of the AFRL-UNM Agile Manufacturing for High-Value, Low-Volume Production, for which Tehrani is leading the multi-material additive manufacturing thrust. This project involves understanding the materials and mechanics issues related to AM space materials. Tehrani's team will research state-of-the-art composite and conductor materials under space radiation and thermal environments.

RESEARCH ROUNDUP

Associate Professor **Francesco Sorrentino,** postdoctoral researchers **Karen Blaha** and **Fabio Della Rossa**, and recent electrical engineering master's degree recipient **Sumit Chhabria** are studying the synchronization of metronomes driven by an external servo motor. The team recently documented for the first time the phenomenon of targeted synchronization; this occurs when the appropriate choice of driving causes some parts of a population to synchronize while not synchronizing other parts of the population that receive the same driving. Oscillator populations driven by external signals arise in numerous biological systems and medical therapies. Pacemaker cells regulate synchrony in the beating of the heart, as do artificial pacemakers. The day-night light cycle synchronizes the Circadian rhythm in both plants and animals. In deep brain stimulation therapy, the signal delivered into the brain with a surgically-implanted electrode is thought to disrupt undesired synchrony caused by disease. The team recently submitted a paper to *Chaos Journal* that describes targeted synchronization in metronomes. Also, Sorrentino and his Ph.D. student **Isaac Klickstein** are currently working on methods to generate large networks with many symmetries. Many networks seen in the applied sciences, from neuronal interactions in our brain to the power grid and the internet have an abundance of complex and non-obvious symmetry patterns (figure above). While the behavior of networks with symmetry is well understood using tools such as the Master Stability Function, how symmetries arise in networks has not yet been explored. Sorrentino and Klickstein have recently submitted a paper to IEEE Transactions on Network Science and Engineering [https://arxiv.org/abs/1808.05166] that offers the first glimpse into how symmetries may arise in networks along with a practical algorithm to generate networks with any desired symmetry pattern. The figure shows one large network produced by the algorithm, with the nodes colored the same being related by a symmetry operation.



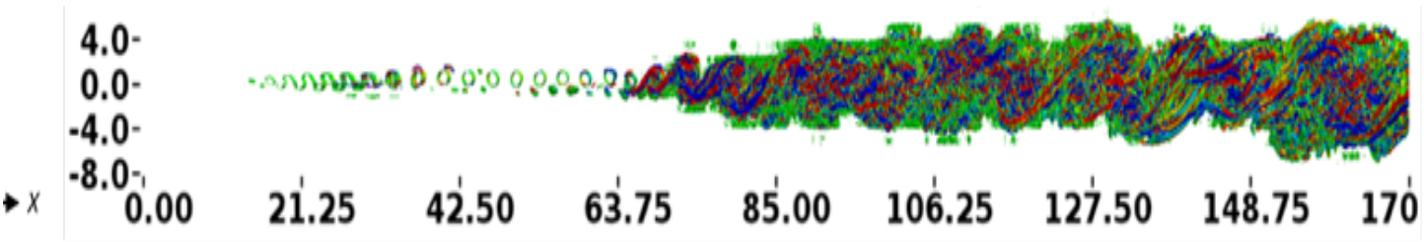
The Rotorcraft Aerodynamics group (advisor: **Svetlana Poroseva**) conducts experimental and numerical analysis of the aerodynamic performance and energy consumption of bio-inspired small rotor blade designs in collaboration with the the Mechanical Engineering Advanced Structural and Energy Materials Lab led by **Mehran Tehrani**. Numerical simulations are conducted using commercial software Star-CCM+. Recently, the group experimentally analyzed the effects of 3D printing on the rotor performance and collaborated with the Mechanical Engineering Department at the Universidad de los Andes in Bogota, Colombia, on the computational analysis of a quadcopter rotor using a free-vortex wake methodology.

This year, collaboration with the Idaho National Lab (INL) has started on the probabilistic analysis of the electric grid resilience. The project objectives are to evaluate the grid resilience due to its topology, to develop strategies for its enhancement by modifying the topology, and to determine optimal scenarios for the grid dynamic adaptation. The project is supported by the National University Consortium established by INL.

RESEARCH ROUNDUP

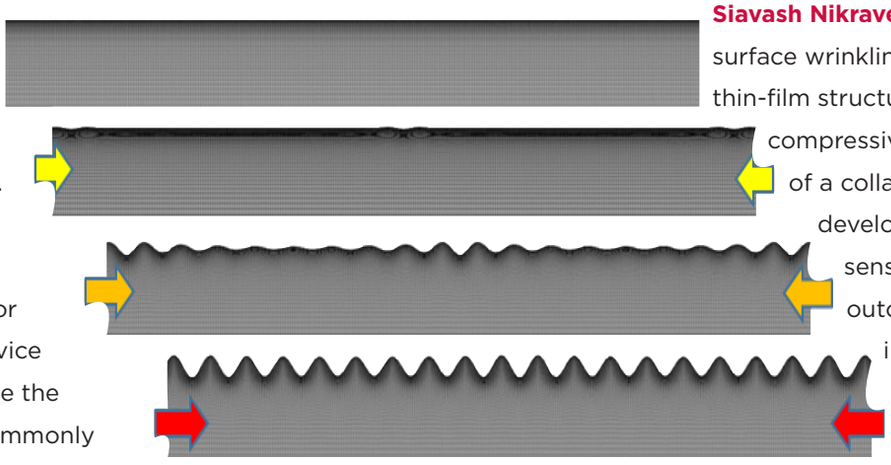
Professor **Tariq Khraishi** has received two recent contracts from Sandia National Laboratories to conduct research in fatigue testing of a magnetic material, Hiperco, and to conduct simulations of crystal plasticity using the 3D Dislocation Dynamics method. In conjunction with the first project, he has been leading the efforts in equipment update for the departmental materials testing laboratories, resulting in state-of-the-art fatigue testing capabilities. Professor Khraishi also managed two large awards from National Science Foundation through 2018, for providing mentorship, internship, scholarship, and conference trip opportunities for School of Engineering students. These NSF projects have garnered praise and attention due to their highly successful outcomes.

Mechanical engineering department alumnus **Scott Lovald**, who was advised by Tariq Khraishi, has published a recent book titled *Orthopaedic Biomaterials in Research and Practice* with two other co-authors Kevin Ong and Jonathan Black.



Understanding spatial development of a turbulent mixing layer is essential for various engineering applications. Ph.D. candidate **Juan Diego Colmenares F.** (advisor **Svetlana Poroseva**) uses the advanced spectral-element code developed (figure above) at the Argonne National Laboratory to conduct direct numerical simulation of such a flow. This work is in collaboration with colleagues from NASA Ames and Arizona State University.

Yu-Lin Shen and his graduate students have been working on numerical predictions of deformation instabilities in materials containing surface features. This broad effort includes the analysis of shear band formation in multilayer composite coatings under indentation loading, and the surface wrinkle formation in thin films constrained by a compliant polymer substrate. Instabilities typically lead to premature failure or degradation of device performance. While the phenomenon is commonly observed, its modeling has never been straightforward. A robust computational approach is needed for the purpose of design and performance analysis.



The figure at left shows the work by doctoral student **Siavash Nikravesh** on the evolution of surface wrinkling in an optoelectronic thin-film structure, triggered by compressive loading. It is a part of a collaborative research for developing self-powered strain sensing composites. The outcome can also lead to improvement in structural reliability of flexible electronic devices.

FSAE team walks away with more than a trophy from competition

For most spectators, everything about racing seems big — large and powerful motors, oversized tires, loud sounds, fast speeds.

But as The University of New Mexico's Formula Society of Automotive Engineers team has recently learned, racing actually relies upon the tiny details — fractions of an inch in a miscalculation or a split second in speed can mean huge impacts on results. The team emerged from their annual international competition June 20-23 in Lincoln, Neb., with both some good results and some lessons for the future.

Overall, the team finished 28 out of 80. They also tied for eighth place in design and finished seventh place in skid pad. The team has made major improvements in the reliability of their engine in recent years, said John Russell, professor of mechanical engineering and director of the program. But a structural failure in the endurance event cost them a potential 350 points out of 1,000.

Russell said that many highly-ranked engineering programs, such as University of Illinois at Urbana-Champaign, Iowa State, University of California at Los Angeles and many others didn't place as highly as UNM. Also, judges at Lincoln praised the design of UNM's car, saying it had the potential to be a top-finisher.

In the end, the students walked away with valuable lessons. For team leader and FSAE veteran Jonathon Abeyta, the Lincoln competition was another real-life reminder of the importance of checking and double-checking details and design.

Marissa Martinez, who will be on the 2019 chassis team and working on the electric car, said her first time at Lincoln was a powerful experience that underscored the importance of discipline and precision in engineering.

"I immediately learned that time management is crucial to succeeding at competition. We had an hourly breakdown of where we needed to be, which enabled us to adequately compete in every event," she said.

The goals for the 2019 team are to complete the car by early March so the team will have more testing and driving time, as well as to continue to work to lower the weight of the car.

Changes for the program include building a second car for competition. Twenty of the 100 cars in competition were electric this year. UNM's team has just begun work on an electric car, but they hope within a couple of years, the car will be ready to compete. Russell said donors have expressed serious interest in funding the program, and Jane Lehr, professor of electrical engineering, has signed on to direct students in the building of the car.

Alumnus' gift to benefit FSAE

School of Engineering has received $3 million from the estate of an alumnus, which will benefit students and faculty in the departments of Civil Engineering and Mechanical Engineering by creating laboratory and learning spaces unlike any other in the country.

The gift from the estate of Dana C. Wood is the largest cash gift in the School of Engineering's history.

"We are extremely grateful for the generosity of the Wood family for these gifts," said Christos Christodoulou, Jim and Ellen King Dean of Engineering and Computing. "These gifts will benefit the School and students in several important ways and will go a long way toward enhancing our reputation among peers and prospective students."
The largest part of the gift, $1.5 million, will go toward a 7,000-square-foot space on the ground floor of the Farris Engineering Center that will be dedicated to the UNM Formula Society of Automotive Engineers (FSAE) program.

This program is housed in the Department of Mechanical Engineering but also partners with other departments, such as the Department of Electrical and Computer Engineering. The gift for the Formula SAE program will enable the program to gain more space for designing and building the racecar that annually competes in an international contest. Currently, the space for the car is located in the basement of the Mechanical Engineering Building. For many years, the program has outgrown the space and is in need of more space and new equipment, said John Russell, professor of mechanical engineering and director of the Formula SAE LOBOmotorsports program.

Wood, a native of Gallup, New Mexico, received a bachelor's degree in 1977 and a master's degree in 1990, both in civil engineering from UNM. He died after a long battle with cancer in 2013.

Wood's first job out of college was for Bohannan Huston, Inc. His lifelong passion for computers was put to good use when Bohannan Huston started a spinoff company called Diginetics that developed one of the first CAD programs for civil engineering. He helped write the software that was sold to other engineering firms in the United States and eventually rose to lead Diginetics. Later, Wood developed a software called PowerMerge, which would sync a user's files on different computers before the Internet and "cloud" were pervasive. He and his associates also launched Leadertech, a company that had offices in Albuquerque and Los Angeles.

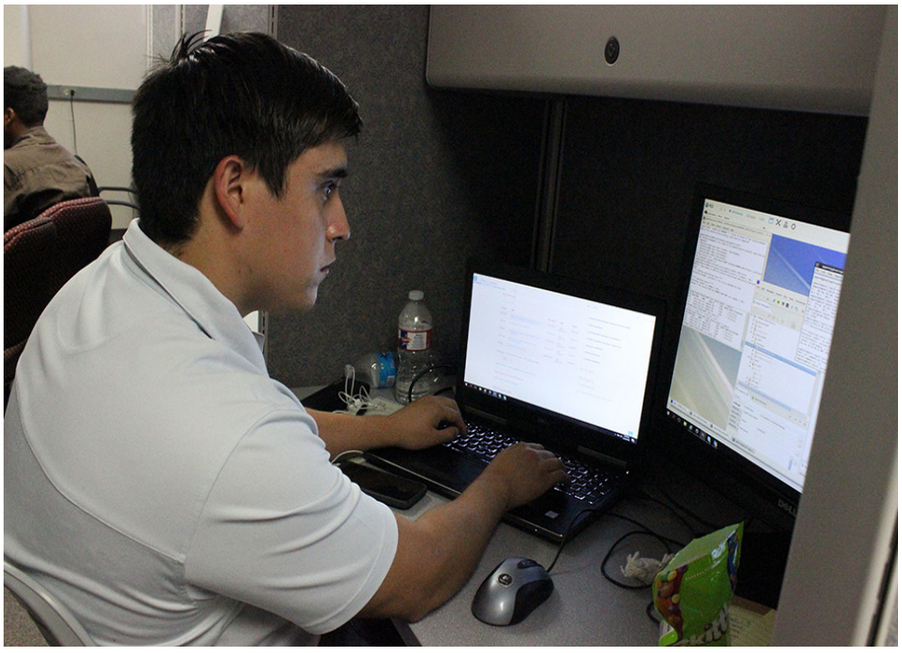
Previously, the Wood family donated $150,000 for an endowed scholarship for School of Engineering students and $750,000 to The University of New Mexico Comprehensive Cancer Center, where Dana received treatment.

FSAE thrives on your support!

The FSAE program relies heavily upon donations.
To donate to the traditional Formula SAE program, go to **https://www.unmfund.org/fund/formula-sae-team/**

To donate to the FSAE electric car (right) go to **https://www.unmfund.org/fund/fsae-electric-car/**

Mechanical Engineering partners with Sandia for NOMAD summer program



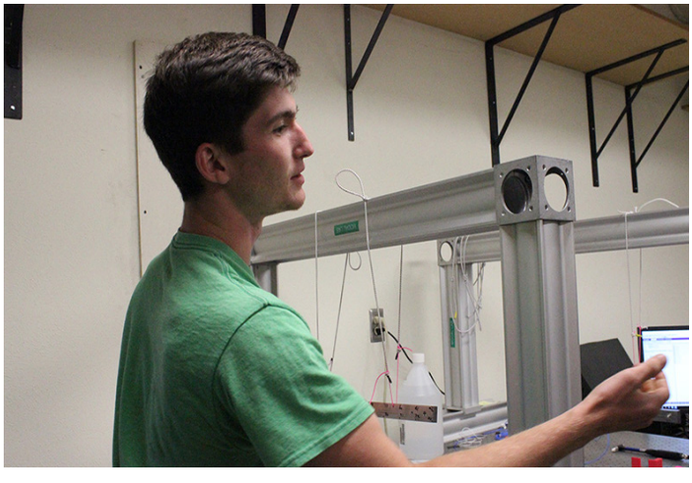
The Department of Mechanical Engineering was a partner and host for the 2018 Sandia National Laboratories' Nonlinear Mechanics and Dynamics (NOMAD) Summer Research Institute. The summer program, which brings together graduate students and researchers from around the world, including from Sandia and UNM, was held June 18-Aug. 2, 2018, at UNM Mechanical Engineering Building. The program seeks to tackle research challenges in the field of nonlinear mechanics and dynamics. Dr. Tariq Khraishi, Professor of Mechanical Engineering, was the UNM lead in this summer program.

The goal of this year's institute was to improve the way experiments and modeling are done in the engineering sciences. Often, they are performed in isolation from each other, so NOMAD seeks to explore ways in which the processes can be better integrated, improving the outcomes of each, said Robert Kuether, an engineer at Sandia National Laboratories who organizes this year's institute.

Seventeen mostly graduate-level students from around the world worked on one of the six technical projects. Each project was organized by mentors from various government, academic, or industrial institutions. About 20 mentors were advising the teams over the summer.

This year's NOMAD project list included:

- Constructing Optimal Surrogate Models for Bolted Fasteners in Multiaxial Loading
- Influences of Modal Coupling on Experimentally Extracted Nonlinear Modal Models
- A Priori Methods to Assess the Strength of Nonlinearities for Design Applications
- Fatigue Properties of Additively Manufactured Hiperco
- Material Failure Model and Properties for Puncture Simulations
- Predictive Structural Dynamics Modeling of Bolted Interfaces.



Solar Splash team takes home multiple awards at international competition

The University of New Mexico's Solar Splash team won 10 awards during the Solar Splash competition June 5-9 in Springfield, Ohio.. The UNM team won fourth place overall, and for the second year in a row took home the Outstanding Solar System Design Award.

The team also won:

- The Most Improved Team Award
- Outstanding Electrical System Design Award
- First place Outstanding Workmanship Award
- Second place in solar slalom
- Second place in technical report
- Third place in the 300-meter sprint
- Third place in visual display

This is the third year that UNM has participated in the contest. Last year, the team placed seventh overall, and in 2016, the team placed fourth overall. The team is made up of students from the departments of Mechanical Engineering as well as Electrical and Computer Engineering. The mechanical engineering team lead, Daniel Taylor, is a master's student in the department and the instructor of the Solar Splash mechanical engineering class. Taylor was also a team lead last year and provided much-needed continuity and first-hand competition knowledge to the team. Faculty advisors to the team were Peter Vorobieff, professor of mechanical engineering, and Jane Lehr, professor of electrical and computer engineering.

For the second year in a row, the boat used photovoltaic cells purchased at a substantial discount from SolAero Technologies of Albuquerque. This year's boat also uses the previous Gheenoe hull, but the drivetrain was completely overhauled. The team opted for a dual-motor setup that has three times the power of last year's. Some new features were also added on the boat, including an automatic solar tracker, a telemetry system, a cooling system, and an automatic pilot "cruise control," all of which are designed to work together to automatically monitor battery performance, efficiency, temperature, and power and deliver a more consistent power supply for the boat in the various competitions. The telemetry system wirelessly linked to a computer on shore to deliver real-time data.

ME Design 1 offered for high school students

Here is a great opportunity for high school juniors and seniors interested in pursuing an education in mechanical engineering to start early with the dual-credit/concurrent enrollment course: ME160L.

Learn how to take an engineering design concept in your imagination and produce an engineering technical drawing. You will learn how to sketch by hand and utilizing state of the art design software, SolidWorks culminating in a team project design, documentation, and final presentation. The spring semester offering is held after school at no cost to high school students.

Check out the dual-credit program at http://advisement.unm.edu/dual-credit/

Students attend AIAA regional conference at UNM

The American Institute of Aeronautics and Astronautics (AIAA) 2018 Region IV Student Conference took place on UNM campus on April 13-14. Students and faculty representing institutions from New Mexico; Texas; Oklahoma; and Chihuahua, Mexico, participated in the event.

The conference started by an inspiring presentation by Heather A. Taylor about her documentary *Breaking Through the Clouds – The First Women's National Air Derby*. The speaker elaborated on how women overcame difficulties to passionately fly above all expectations. It was followed by presentations of student papers covering various fascinating topics, as well as the Young Professionals Panel.

The conference proceeded on the second day with a tour of Air Force Research Laboratory organized by Nicholas Morley. Here, students had the opportunity to learn about the various research being conducted at the facilities.

The event was organized by the AIAA UNM student chapter.

New online master's degree offered in space systems engineering

The Department of Mechanical Engineering is pleased to offer a new online master's program in space systems engineering beginning in fall 2018.

This program, initiated by Professor Chris Hall, is one of the first master's-level space systems engineering programs in the country. All courses for the space systems engineering managed online program are offered in an 8-week format. The degree will provide students with a unique skillset, giving our graduates a jump start in their careers. All courses in the program are offered in a convenient, accelerated format, which is designed for both graduate students joining the program directly from a bachelor's program, or for busy working professionals looking to take their career to the next level.

CAREER POSSIBILITIES

This degree program was crafted with careers in mind. It was developed with input from the Air Force Research Laboratory Space Vehicles Directorate, located in Albuquerque, which ensures that graduates of the program will have the kinds of skills that space systems industry employers are looking for, including orbital mechanics, space situational awareness, spacecraft design, satellite communications, and much more.

Possible employers of our graduates include the U.S. Department of Defense, NASA, and private-sector space systems companies. Students will be prepared for space systems program career paths such as mission planning, project management, and spacecraft integration activities.

For program details, visit http://mespaceonline.unm.edu

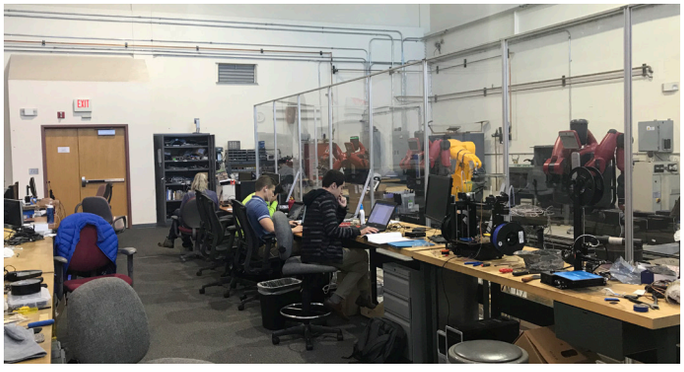
$6.7 million agreement to focus on manufacturing techniques of future

The University of New Mexico and the Air Force Research Laboratory (AFRL) are partnering on a major new project that focuses on agile manufacturing for cost-effective and efficient production of small spacecraft and integrated directed-energy systems.

The $6.7 million cooperative agreement is aligned along four research areas: multi-material additive manufacturing; machine learning and transfer learning; machine vision and scene decomposition; and advanced manufacturing concepts.

"This agreement will enable the School of Engineering to not only conduct research in advanced 3D printing but also become a national leader in agile manufacturing, which will attract more manufacturing companies to the state," said Christos Christodoulou, Jim and Ellen King Dean of Engineering and Computing.

The project will create a strategic relationship between UNM and AFRL New Mexico's directed energy and space vehicles directorates in the areas of small satellite technologies and directed-energy systems with a focus on advanced manufacturing concepts.



"Our team of AFRL researchers and UNM faculty has the complementary expertise needed to develop novel analytical and computational tools to make agile manufacturing a reality," said Rafael Fierro, UNM principal investigator of the project and a professor of electrical and computer engineering. "This cooperative agreement will have a profound effect on training the new generations of New Mexico scientists and engineers. The research results, the software tools, and the robotic testbeds will be integrated with graduate and undergraduate curricula at UNM."

Several Mechanical Engineering faculty members are on this multidisciplinary research team, including John Wood, Mehran Tehrani, Ron Lumia, and Asal Naseri.

UNM a part of Structural Reliability Partnership

The Structural Reliability Partnership (SRP) is a consortium of industry, academia, and government labs to coordinate research, share best practices, and leverage intellectual and capital resources towards the advancement of capabilities and techniques for assessing the reliability of engineered structures. The partnership is intended to serve as an umbrella organization coordinating efforts to address additional areas that affect reliability, such as long-term creep, hydrogen-embrittlement effects, stress corrosion cracking, fatigue and other factors.

The partnership will demonstrate quantifiable and deployable improvements in structural reliability assessment.

At the initiative of Department of Mechanical Engineering, UNM has now become a contributing member of SRP. The departmental expertise in mechanical behavior of materials, additive manufacturing, and modeling and simulations aligns well with the core mission of the consortium. Researchers involved in this undertaking include Mehran Tehrani, Yu-Lin Shen, Tariq Khraishi, Deborah Sulsky, Nima Fathi, among others.

ME Connections

NEW FACULTY

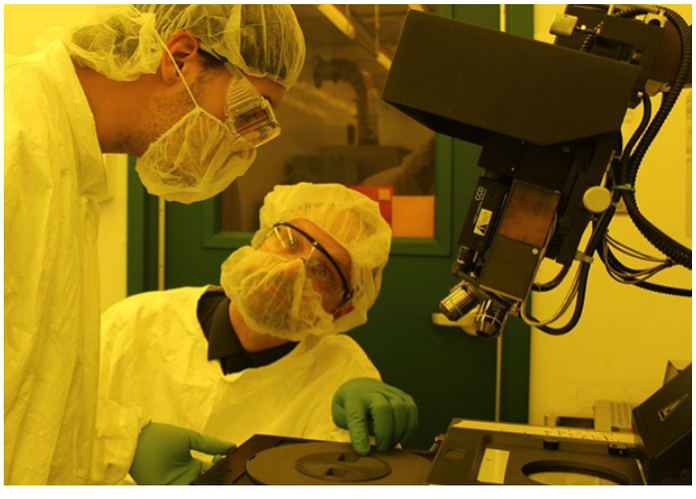
Sakineh Chabi joined the Department of Mechanical Engineering as an assistant professor in August 2018. She received her Ph.D. in materials engineering from University of Exeter in 2015. During her Ph.D. studies, she made a variety of graphene related 2D and 3D materials and graphene composites. Prior to joining UNM, she worked as postdoctoral researcher at Temple University, Mechanical Engineering (2017-2018) and Florida Institute of Technology, Chemistry Department (2015-2017). Her research areas include: graphene technology, multifunctional materials, mechanics of materials, polymers, and energy storage and conversion devices. Chabi's research has been published in high-impact journals including *Energy & Environmental Science*, *Advanced Materials*, *ACS Nano*, and many others.

Matthias Pleil recently accepted the permanent position of Lecturer III in Mechanical Engineering. He is the principal investigator for two National Science Foundation-funded centers: the Southwest Center for Microsystems Education (2004-2018) and the Support Center for Microsystems Education (2017-2021). He has held a UNM research professor appointment since 2008. In addition to his teaching and research duties, Pleil supports students and local micro tech companies in his role as UNM's MTTC clean room manager and associate director of manufacturing engineering program. He has been a faculty member at Central New Mexico Community College in both the Schools of Applied Technologies and Math, Science and Engineering. With 12 years of engineering experience in semiconductor manufacturing engineering at both Texas Instruments and Philips Semiconductors, he infuses valuable industry lessons learned into his mechanical engineering design and fabrication courses.

Pleil received his Ph.D. in physics in 1993 from Texas Tech University, where he completed original research on time-resolved fluorescence spectroscopy. He designed, constructed, characterized, and calibrated a time-correlated, single-photon counting detection system to measure weak fluorescence emission of microscopic sized samples in both the wavelength and picosecond time domains. Pleil enjoys engaging undergraduate students with hands-on project and team-based learning opportunities.

Course focuses on MEMS, small devices

Nathan Jackson and Matthias Pleil have teamed up to bring interested mechanical engineering students a set of hands-on opportunities within three engineering courses. Students are first introduced to the fabrication methods of making small devices in the Design II course, ME260L whereby they learn cleanroom protocol, safety and basic processing. In their senior year, students may select to explore further with two courses on MEMS and NEMS (nano) fabrication, characterization and theory. These courses educate the students on theory as well as give them hands on training on manufacturing sensors and actuators.



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Mechanical Engineering launching a 3-year fund drive

The department is launching a three-year drive to raise $300,000 in donations to create a new permanent endowment in perpetuity for mechanical engineering students.

As you may be aware, the tuition and fees on students have been going up in the last few years. To help reduce the burden on current and future students, we are asking your help in creating this endowment. Any alumni capable of helping with this drive to donate only $300 each will have their name on a new banner to be placed in the ME building atrium (this is the minimum amount needed to get a banner made and installed). If we work collectively as a team (something the ME department teaches as part of its curriculum), we can reach this fundraising goal by doing our small part. If you, as a supporter/alumni would like to donate more than $300, you are welcome to do so. It only takes about 300 donors at $1,000 each to reach this goal.

HOW TO GIVE

To donate, go to https://www.unmfund.org/fund/mepsf/
or send a check made out to
"ME Permanent Scholarship Fund" to
The University of New Mexico School of Engineering,
MSC01 1140
Attn: Courtney Holmes
Albuquerque, NM 87131

Scholarships provide another way to support students

If you would like to establish a scholarship endowment under your or a loved one's name, you may donate a minimum of $25,000 to the UNM Foundation. Contact Leslie Currie, senior director of development, at leslie.currie@unmfund.org. The scholarship can target the student population of interest to the donors(s).