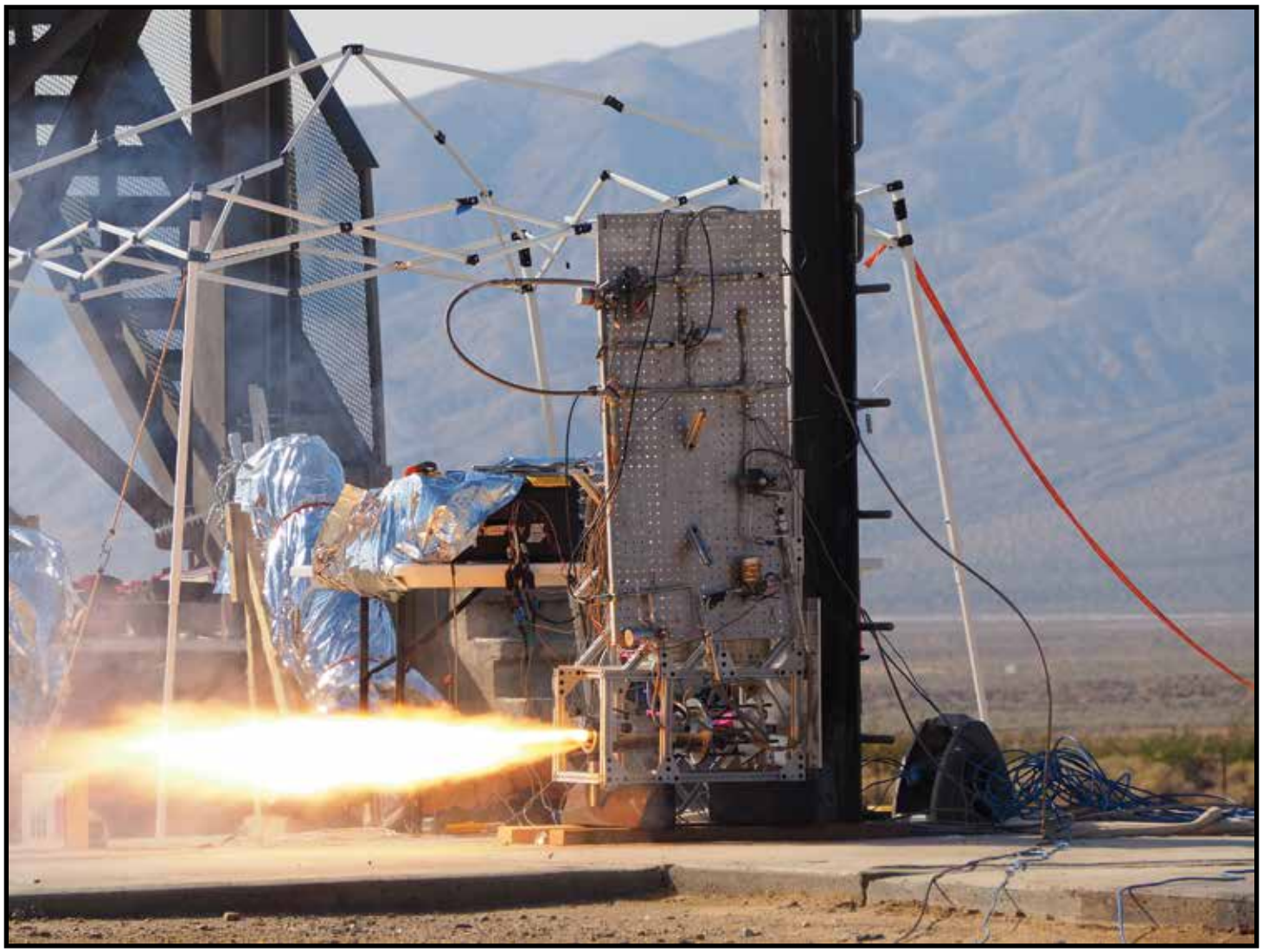
Mechanical & Aerospace
Engineering Department
2016-17



UCLA ENGINEERING
Henry Samueli School of
Engineering and Applied Science

Birthplace of the Internet

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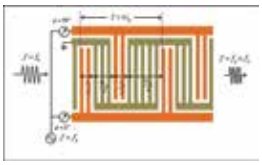


UCLA MAE ANNUAL REPORT 2016-17

Cover image: UCLA MAE undergraduates conduct their first successful hot-fire test of a student-designed and -built bipropellant liquid rocket engine in the Mojave desert during the summer of 2017. The student-led UCLA Rocket Project will be competing in a new launch competition in 2018 that focuses on liquid rockets.

Thanks to all who contributed to this report. Designed and edited by Alex Duffy.

Chair's Message

2016-17: An Academic Year of Challenges and Achievements

Welcome to UCLA's Department of Mechanical and Aerospace Engineering at the Henry Samueli School of Engineering and Applied Science.

The College of Engineering was opened in 1945 with an initial cohort of 379 students. In 1969 the College became the School of Engineering and Applied Science to better address the upward shift in education level of engineers and the crucial role of the engineer in society. The School was organized into seven departments, one of which has become today's Department of Mechanical and Aerospace Engineering. The common thread woven throughout the history of MAE at UCLA is excellence in education and research.

Our faculty expanded during 2016-17. Dr. Timothy Fisher joined, adding his expertise in nanoscale heat transfer research, and Dr. Lihua Jin's research complemented our department's wide reach into the field of stretchable electronics, advanced materials, and soft robotics.

Our department is emphasizing six areas of research focus. These areas represent the future of MAE research and its applications.

- **Advanced Materials**: We develop lighter, stronger, better materials for traditional machines such as cars and airplanes, and newer machines such as industrial robots. Flexibility and softness complement durability and heat/cold resistance.

- **Air & Space**: We are educating the next generation of rocket scientists in the discipline and wonder of space exploration with research focusing on chemical propulsion for rockets and electric propulsion for moving satellites once in space.

- **Energy**: We develop solutions and build machines that harvest solar, wind, steam, and fusion energy, contributing to the development of a sustainable energy portfolio for the nation.

- **Manufacturing**: Precision and efficiency in manufacturing are necessary for today's high performance machines used for medical and industrial purposes. From the small to the large, from the micro to the macro, we approach manufacturing as a smart discipline.

Christopher Lynch

- **Mechanical Engineering in Medicine**: Mechanical engineering used to address biological systems has led to breakthroughs in collaborative robotic surgery, advanced stents and advanced ultrasound.

- **Robotics & Cyber-Physical Systems**: MAE is one of the prime spots on the West Coast for robotics research. At UCLA we develop robot hands that grip and give haptic feedback, robots that walk on two legs, and surgical robotics.

Undergraduate engineering societies sponsored by AIAA, ASME, SAE, and others, give our undergraduate students the opportunity to work on hands-on engineering projects from designing and building a formula one race car to a liquid fueled rocket that will reach 300,000 ft.

Many students working in industry after earning their BS degrees are able to earn their MS degrees through our #1 ranked MS Online Program, where they can earn their MS in Mechanical Engineering, Aerospace Engineering, or Manufacturing and Design.

The research activities of our faculty and students are broad, and the size of our growing program provides challenges and opportunities for our students in areas beyond the core mechanical engineering program. Multi-disciplinary opportunities abound. The research experience of our faculty is reflected in the classroom experience, enabling our ME students and graduates to go out and address the world's many challenges.

— Christopher S. Lynch

Timothy Fisher

Timothy S. Fisher

Timothy S. Fisher (PhD 1998, Cornell) was born in Aurora, IL USA. He joined UCLA's Department of Mechanical & Aerospace Engineering in 2017 after spending 15 years at Purdue's School of Mechanical Engineering, and several years previously at Vanderbilt University. He is the founding Director of the Center for Integrated Thermal Management of Aerospace Vehicles, supported by the US Air Force Research Laboratory and leading industrial members: Boeing, Honeywell, Lockheed Martin, Northrop Grumman, and Rolls-Royce. He is an Adjunct Professor in the International Centre for Materials Science at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) and co-directs the Joint Centre on Nanomaterials for Clean Energy and Environmental Sensors. From 2009 to 2012, Prof. Fisher served as a Research Scientist at the Air Force Research Laboratory's newly formed Thermal Sciences and Materials Branch of the Materials and Manufacturing Directorate. In 2013 he became the James G. Dwyer Professor in Mechanical Engineering at Purdue, and in the same year he founded a start-up company to commercial inventions from his laboratory. Prior to his graduate studies, he was employed from 1991 to 1993 as a design engineer in Motorola's Automotive and Industrial Electronics Group. His research has included studies of nanoscale heat transfer, carbon nanomaterial synthesis, coupled electro-thermal effects in semiconductor and electron emission devices, energy conversion and storage materials and devices, microfluidic devices, biosensing, and related computational methods ranging from atomistic to continuum scales.

Lihua Jin

Lihua Jin

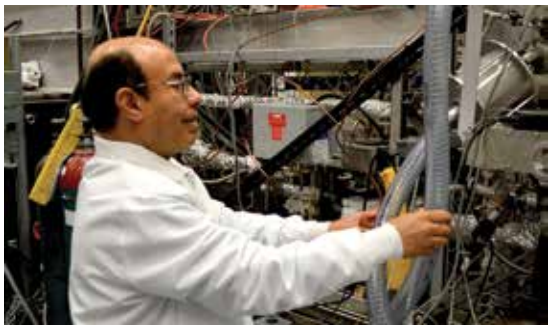
Lihua Jin has joined UCLA's Mechanical and Aerospace Engineering Department as an assistant professor. Prof. Jin's research interests include mechanics of soft materials; constitutive behavior of stimuli-responsive materials; design and fabrication of soft robotics; nanomechanics and multiscale modeling. Prof. Jin was most recently a post-doctoral scholar at Stanford University, where she worked on mechanics of stretchable electronics. She received her Ph.D. in engineering sciences from Harvard University in 2014.

Mohamed Abdou: Receives Fusion Power Associates Distinguished Career Award

Mohamed Abdou

Distinguished Professor Mohamed Abdou, Director of UCLA's Fusion Technology and Research Center, received the 2016 Fusion Power Associates Distinguished Career Award, the most prestigious award in the nuclear fusion field. The award has been given annually since 1987 to individuals "who have made distinguished, life-long, career contributions to fusion development." The award citation to Prof. Abdou reads "In selecting you, the Board recognizes the leadership and scientific contributions you have provided over many decades on the important issues associated with nuclear technologies for future fusion power plants. The Board especially notes the breadth of your many scientific contributions in such areas as neutronics, tritium behavior, and fusion fuel cycles and the leadership you have provided to the world effort on the design of tritium breeding blankets and to numerous fusion power plant studies."

The award was presented to Prof. Abdou in a ceremony on December 13, 2016 in Washington, D.C. which was attended by international fusion leaders, representatives of the US Department of Energy and the Office of Science, and selected members of Congress.



Eric Chiou: Elected Fellow of RSC, AIMBE; two prestigious journals highlight research

Pei-Yu Chiou

Professor Eric Chiou was elected a Fellow of the Royal Society of Chemistry in the United Kingdom.

To be eligible for fellow status, members of the Royal Society of Chemistry must have a minimum of five years of professional experience and made an outstanding contribution to the advancement of chemical sciences. Achieving fellow status denotes a high level of accomplishment as a professional in the field.

Chiou was also elected to the College of Fellows at the American Institute for Medical and Biological Engineering (AIMBE). The AIMBE College of Fellows represents the most accomplished and distinguished medical and biological engineers responsible for innovation and discovery. Chiou was inducted at AIMBE's 2017 Annual Event, March 19-20, 2017, in Washington, DC.

The prestigious journal Proceedings of the National Academy of Sciences (PNAS) published a two-page story about UCLA's development history of the photothermal nanoblade technology in the past 10 years, and Prof. Chiou's involvement. The article is "Inner Workings: Light-controlled cellular surgery," from PNAS vol. 113 (35).

An article from Chiou's UCLA Optofluidics Systems Laboratory, "Microfluidics: Tunnel Dielectrophoresis for Tunable, Single-Stream Cell Focusing in Physiological Buffers in High-Speed Microfluidic Flows," was published in SMALL vol. 12 (32), and chosen as the inside front cover of the journal.

Rajit Gadh: Recognized expert in current energy research trends

Professor Rajit Gadh, Director of the Smart Grid Energy Research Center (SMERC), was visited by the U.S. Secretary of Energy, and was widely quoted about current energy research trends.

In late 2016, Gadh took U.S. Secretary of Energy Ernest Moniz on a tour of the Smart Grid Living Lab in Parking Structure 9 with its solar panels, EV chargers and fast chargers that are integrated into the grid. Then they visited the Smart Grid Energy Research Center in Engineering IV, where Moniz watched research and technology demonstrations involving battery energy storage, demand response and microgrids.

Additionally, Gadh was sought out and quoted by the following news content providers during 2016-17:

"Santa Monica Teams Up with UCLA to Install Experimental EV Fast Charger" (Santa Monica Patch).

"DWP still investigating cause of transformer explosion that left 140,000 Valley customers without power" (LA Times).

"Californians take a shine to solar power" (UK Daily Mail).

"Tesla Is Betting On Scarcity, Not Luxury" (Fast Co. Design).

"Smart grids could be the route to a truly renewable energy system" (New Economy).

Professor Rajit Gadh, Director of the Smart Grid Energy Research Center, points out solar panels to U.S. Secretary of Energy Ernest Moniz on a tour of the Smart Grid Living Lab on the top level of Parking Structure 9.

Chih-Ming Ho: Named AAAS fellow; continues Phenotypic Personalized Medicine research

Distinguished Research Professor Chih-Ming Ho was elected a fellow of the American Association for the Advancement of Science (AAAS). Ho was recognized for "pioneering contributions in phenotypic personalized medicine, microfluidics, bio-molecular sensing and control of turbulent flows."

Though retired, Prof. Ho continues research on phenotypic personalized medicine. The technology has the ability to accurately identify a person's optimal drug and dose combinations throughout an entire course of treatment. In addition, the technology platform does not require any complex and expensive analysis of a patient's genetic information or the biological basis of the disease, greatly accelerating the ability to optimize and personalize care. This technology may go a long way toward overcoming the challenges of treatment for acute lymphoblastic leukemia, among the most common types of cancer in children. It also gives a new approach toward tuberculosis therapy, a potential drug regimen that could cut the treatment time by up to 75 percent, while simultaneously reducing the risk that patients could develop drug-resistant TB.

Ho gave the Air Products Distinguished Lecture at Penn State College of Engineering on January 30, 2017 on "Redefining the Drug Discovery Pathway – From Drug Candidate Search to Phenotypic Personalized Medicine." Ho also delivered a lecture on "Complexity and Simplicity" in the "Hefei Forum of Great Minds" at USTC.

Chih-Ming Ho

Dennis Hong: New robots LARA and Ballu; wins URAI Best Paper Award

Dennis Hong

LARA

Professor Dennis Hong, Director of UCLA's Robotics & Mechanisms Lab (RoMeLa), and MAE students built a new robot concierge for the UCLA Meyer and Renee Luskin Conference Center. Visitors can interact with Los Angeles' first-ever robot concierge, called LARA, which will be a permanent fixture at the conference center. LARA — "Luskin Automated Robotic Assistant" — was custom built by Hong's students, one of whom also provided the voice for the two-foot-tall humanoid robot.

Hong also built BALLU, the world's first robot that always stays upright.

From Popular Science 11/17/16:

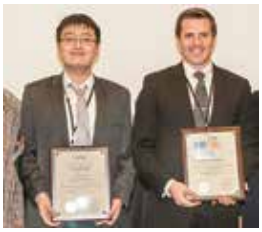
> Enter BALLU, the "Buoyancy Assisted Lightweight Legged Unit." It's a balloon with legs. That balloon is filled with helium, so it's not defying gravity, exactly, but it is using the buoyancy of the body to keep missteps from turning into embarrassing falls.

RoMeLa won the Best Paper Award for "Investigation of a Non-Anthropomorphic Bipedal Robot With Stability, Agility, and Simplicity" at the 13th International Conference on Ubiquitous Robots and Ambient Intelligence, August 19-22, 2016, in Xian, China.

BALLU

Jonathan Hopkins: Wins ASME IDETC Awards for Young Investigator, Contributions

Jonathan Hopkins



Jonathan Hopkins and Frederick Sun receive the 2016 Young Investigator Award.

Assistant Professor Jonathan Hopkins, and ME Ph.D. candidate Frederick Sun, received the 2016 Freudenstein/General Motors Young Investigator Award at the American Society of Mechanical Engineers (ASME) International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC/CIE) for their paper "Mobility Analysis of Interconnected Hybrid Flexure Systems Using Screw Algebra and Graph Theory." They also received a Best Paper Honorable Mention Award for the same paper. The conference was held in Charlotte, North Carolina, and they received the awards on August 16, 2016.

Hopkins, and UCLA Flexible Research Group Ph.D. candidates Ali Hatamizadeh and Yuanping (Adam) Song were awarded the Theoretical Contributions in Compliant Mechanisms Award, received at the ASME Mechanisms and Robotics Conference in the IDETC/CIE Conference for a paper titled, "Geometry Optimization of Flexure System Topologies Using the Boundary Learning Optimization Tool," in Cleveland, Ohio, August 17, 2017.

Ali Hatamizadeh, Yuanping (Adam) Song (not in picture), and Jonathan Hopkins receive Theoretical Contributions in Compliant Mechanisms Award at ASME's IDETC Conference.

Yongjie Hu: Receives two Young Investigator Awards; UCLA award with Adrienne Lavine

Assistant Professor Yongjie Hu received the Doctoral New Investigator Award from the American Chemical Society (ACS). Hu was chosen to receive the award for his proposed research focused on improving interfacial heat transfer for thermal management.

Hu also received the 2017 Air Force Office of Scientific Research Young Investigator Research Program (AFOSR YIP) Award. His project on investigating nano-architectures and ultrafast spectroscopy for energy transport was selected from a nationwide competition for a 3-year grant support.

Additionally, Hu and Professor Adrienne Lavine are part of a research team awarded a competitive research grant as part of UCLA's Sustainable LA Grand Challenge.

"We are grateful to the Sustainable LA Grand Challenge and the Anthony and Jeanne Pritzker Family Foundation, who allow us to bring together the team of experts from different backgrounds. This is a good opportunity to push for real interdisciplinary innovation by integrating energy conversion and storage systems. It's a very exciting starting point and we are aiming for big things," said Hu, the Principal Investigator (PI). The team is developing a novel and high-efficiency integrated solar and thermal energy system to increase energy generation and availability into the L.A. electricity market.

"Yongjie had the idea to integrate three different innovations in order to create a solar energy system that will be more efficient than ever before and will incorporate storage to make baseload solar energy a reality," said Professor Adrienne Lavine, Co-PI of the team.

Yongjie Hu

Adrienne Lavine

Lihua Jin receives the 2016 Haythornthwaite Young Investigator Award

Assistant Professor Lihua Jin received the 2016 Haythornthwaite Young Investigator Award. With funding from the Robert M. and Mary Haythornthwaite Foundation, the Executive Committee of the Applied Mechanics Division of ASME established the Haythornthwaite Research Initiation Grant Program, targeting university faculty engaged in research in theoretical and applied mechanics that are at the beginning of their academic careers. In 2016, Jin's proposal on mechanics of photo-responsive hydrogels was selected as one of the top four proposals for the Haythornthwaite Research Initiation Grants, and is awarded at the amount of $20,000. Robert Haythornthwaite was the founder and first President of the American Academy of Mechanics.

Jin's research focuses on mechanics of soft materials, stimuli-responsive materials, soft robotics, and stretchable electronics. Jin joined UCLA in 2016. She was most recently a post-doctoral scholar at Stanford University, and she received her Ph.D. from Harvard University.

Lihua Jin

Ann Karagozian: LA Times quote "New generation of giant rockets to blast off"

Ann Karagozian

Distinguished Professor Ann Karagozian was quoted in the July 14, 2017 Los Angeles Times article "A new generation of giant rockets is about to blast off":

> The first-stage booster of ULA's proposed Vulcan rocket, for example, could be powered by BE-4 engines under development by Blue Origin that run on oxygen-rich staged combustion of liquefied natural gas and liquid oxygen. Those engines will also be used in Blue Origin's own New Glenn heavy-lift rocket.
>
> Liquefied natural gas, or methane, is cleaner than kerosene, a more conventional rocket fuel. That means it's less likely to clog up fuel lines in the engine and makes it easier to purge and use again, said Ann Karagozian, a UCLA professor of mechanical and aerospace engineering.
>
> Methane also self-pressurizes, which could eliminate the need for a separate tank pressurization system.
>
> "It would be quite new and novel and different to use methane," Karagozian said. "But ... it hasn't been used to any significant degree in this country at all," so there's no infrastructure in place at launch facilities.

Pirouz Kavehpour: Featured in AIP Inside Science documentary on fluid dynamics in nature

Pirouz Kavehpour

Professor Pirouz Kavehpour was featured in a segment of an Inside Science documentary, the American Institute of Physics' news service . The documentary titled "Fish, Feathers, Fluid, Phlegm and Freaks," is about fluid dynamics research based on simple forms found in nature. Kavehpour's segment is "Preening Penguins Inspire Ice Resistance," which discusses his research into elimating ice build-up on planes by studying the cold-weather adaptations of penguins. His segment is between 4:30-6:44, a little over two minutes.

INSIDE SCIENCE Reliable news for an expanding universe

From the transcript:

"In general I'm an observer of nature; and when I was watching a documentary on PBS, there were a lot of penguins jumping in and out of water and splashing, there were a lot of droplets around. I was very curious that none of these droplets stick to their feathers, and it's minus 40 degrees C outside but you don't see any ice form on their feathers," Kavehpour said.

"We are hoping to take this, to further study this, look at the different species as well as try to have a bio-mimicked, bio-inspired surfaces. Ice formation changes the profile of a surface. So for example, on airplane that can affect the drag and lift and actually may cause a lot of accident, a lot of money spent at the airports in winter time trying to de-ice the airplane, cause a lot of delays."

CJ Kim: Named to Volgenau Chair; Physics World superhydrophobic surfaces article

Professor Chang-Jin "CJ" Kim was named the inaugural holder of the Volgenau Chair in Engineering.

The chair was established in 2014 by a $2 million endowment gift from UCLA Engineering alumnus Ernst Volgenau, chairman of the information technology firm SRA International, and his wife Sara. The chair honors a professor who is an accomplished researcher, teacher and mentor to future engineering leaders.

Kim, who joined the UCLA Henry Samueli School of Engineering and Applied Science in 1993, is best known for pioneering work in microfluidic MEMS, specifically with the electrowetting on dielectrics or EWOD – that is, manipulating and moving micro-scale size droplets of fluids on surface using only electric voltages.

Superhydrophobic surfaces with the right microscopic structures could be the key to reducing friction on marine vessels explained Kim in a May 18, 2017 article in Physics World.

Kim summarized nearly 20 years of superhydrophoic surface research and outlined two key areas should these surfaces be effective on reducing drag on ocean-going vessels – drag reduction large enough to be practical and the maintenance of an air layer between the vessel and the water.

He noted that the knowledge confirmed for laminar flows has been instrumental to explore the superhydrophobic effect in turbulent flows.

CJ Kim

Xiaochun Li: Nanoparticles improve melting; leads smart manufacturing $140M US hub

Professor Xiaochun Li is leading a team in an advance that could lead to improved manufacturing. Adding nanoparticles to metals during the melting process allows for better control during melting.

The melting and solidification of metals are important processes in manufacturing, used in welding and also 3-D printing. For example, laser welding has been used to build cars and ships for decades. However, the researchers suggest that improvements in melting/solidification processes could have financial benefits resulting from increased efficiency and reliability.

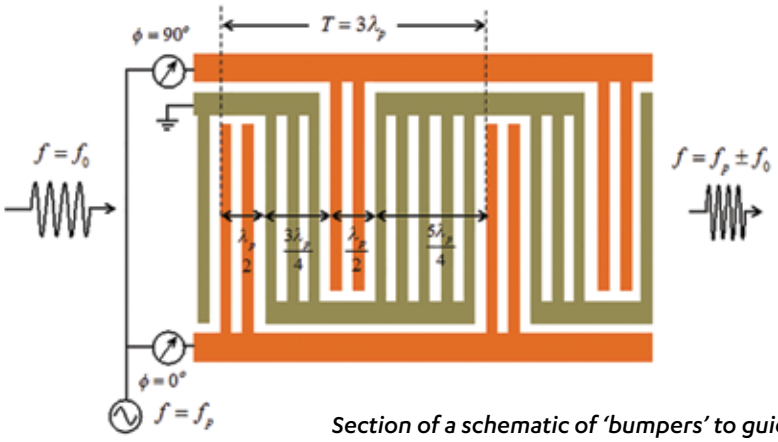
There are two important "zones" in a metal during melting. The first is the "melting zone," where the metal turns into a liquid, which allows it to be spread and shaped as desired. The second is the "heat-affected zone." In this adjacent zone, the metal is not molten, but its microstructure could deteriorate from the heat.

Li is also the technical director for the Smart Manufacturing Innovation Institute, with the goal of improving the efficiency of advanced manufacturing.

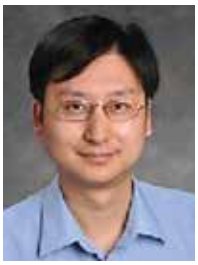
The institute will be headquartered in downtown Los Angeles in partnership with the city, led by the Smart Manufacturing Leadership Coalition and supported by UCLA's leadership. It will include a national network of five regional manufacturing centers funded by $70 million from the U.S. Department of Energy and more than $70 million in matching funds from many of the institute partners.

Xioachun Li

Engineering researchers receive $2 million NSF grant to 'bend rules of classical physics'



Section of a schematic of 'bumpers' to guide acoustic waves in a semiconductor chip.



Ethan Wang

Greg Carman

Christopher Lynch

An interdisciplinary team of researchers from the UCLA Henry Samueli School of Engineering and Applied Science have been awarded a four-year, $2 million grant by the National Science Foundation to "bend the rules of classical physics" in developing a new class of wireless communication and sensor technologies that could be significantly smaller and more efficient than current state-of-the-art technologies.

The research is being led by Yuanxun "Ethan" Wang, associate professor of electrical engineering, with co-principal investigators Greg Carman and Christopher Lynch, both professors of mechanical and aerospace engineering.

The researchers seek to exploit "time reversal symmetry breaking," a phenomenon in classical physics in which an electromagnetic wave, or acoustic wave, must travel the same way in one direction as it does in the opposite direction. Acoustic waves carry information. Acoustic radio frequency devices, which are standard in all of today's cell phones, work by converting electromagnetic waves into acoustic waves, then processing them and converting them back into electromagnetic waves. This mechanism is what sends data into and out of the phone. The researchers seek to "bend the rules" of time reversal symmetry by guiding acoustic waves along specific paths — without creating additional noise. By way of illustration, the researchers offer this scenario: Imagine shouting to a work colleague across a sizable office filled with cubicles walls. You need to shout loud enough for the sound wave to have enough strength to reach your colleague beyond the walls and other objects that dampen the sound. Now imagine everyone loudly shouting to each other, which uses a lot of energy and creates a lot of noise that interferes with effective communication. But what if everyone could simply speak in a normal voice and the walls, made of a specialized material, would relay your message directly to your colleague? You'd use less energy and enjoy a much quieter office.

The UCLA Engineering researchers are pursuing a similar concept at the tiny scale of semiconductor chips and the acoustic waves that propagate along the chip's surface. Their efforts could lead to dramatic improvements in efficiency and decreases in size for wireless technologies and sensor components such as electronic circuits, mixers and amplifiers. To accomplish their goal, the researchers must guide and amplify the acoustic waves, guiding them along specific paths without creating additional "noise" — something no currently available device can do.

The researchers' approach is to create periodic acoustic "bumpers" along the semiconductor chip pathway. The bumpers vibrate under the force of an external oscillating electric field. The way these bumpers are laid out and the electric field controls will override the time-reversal symmetry, effectively amplifying the acoustic waves traveling in one direction and converting them to a higher frequency. Meanwhile, the acoustic waves moving along the chip in the opposite direction will propagate as if they do not see the bumpers at all.

Laurent Pilon: Leads new UCLA sustainability program; team receives $1.5M Carbon XPRIZE for CO2NCRETE

Professor Laurent Pilon is leading a new UCLA initiative that trains graduate students to become leaders in sustainability, and gives them the opportunity to conduct research that will help the Los Angeles region become more sustainable. This is thanks to a five-year, $3 million grant from the National Science Foundation's NSF Research Traineeship program.

"This program will bring together a diverse and interdisciplinary team of UCLA faculty to train graduate students on the relationship between food, energy and water in urban settings," Pilon said. "UCLA is a world-class research institution in the second-largest city in the U.S. We are well-positioned to apprehend the challenges and develop innovative solutions toward a sustainable city that can serve as a template to others."

Pilon is also a member of UCLA's Carbon Upcycling team, which received a $1.5 million donation in the Carbon XPRIZE competition. The funds will support the team's efforts to develop a process for capturing carbon dioxide and converting it into a material that can be used in building and construction. UCLA's Carbon Upcycling team is one of 25 that has advanced to the semifinals by demonstrating a process for capturing carbon dioxide emissions from power plant smokestacks, the largest single source of greenhouse gas emissions. The trapped emissions will be used to create a carbon dioxide–neutral building material called CO2NCRETE, which can replace traditional concrete. The binding component of traditional concrete is responsible for nearly 9 percent of global carbon dioxide emissions.

Laurent Pilon

C02NCRETE

Jacob Rosen: Wins 2017 SoCal Robotics Symposium Best Poster Award; interviewed by Industrial Robot

Professor Jacob Rosen's graduate students Sahba Pedram and Peter Ferguson along with post-doc Ji Ma won the best poster award at the 2017 SoCal Robotics Symposium, which was attended by students and faculty members from USC, UCLA, UCSB, UCSD, CalTech, and JPL. This work is a result of ongoing research efforts with Dr. Erik Dutson at the UCLA Center for Advanced Surgical and Interventional Technology (CASIT) and the Department of Surgery in the general field of automation in surgical robotics.

In 2016, Rosen was interviewed by Joanne Pransky from Industrial Robot: An International Journal. One of many interesting quotes follows:

Pransky: Let's assume that your life is only 50 per cent complete. What groundbreaking challenges do you think you'll be working on 25 and 50 years from now?

Rosen: Communicating directly with our brains is likely to be a long-term major challenge for humankind. The brain's anatomy, unlike any other organ in our body, does not in most cases teach us about its function. Although we understand how a single neuron works to some extent, we are far from understanding the function of the brain's network as a whole and in particular the effects of brain damage.

From the human machine interface perspective, it is critical to create a reliable neural interface somewhere along the neural system that the body will not reject over time and yet will also allow access of both downstream and upstream flows of information.

Jacob Rosen

Veronica Santos: $719K grant from DOD ONR + DSSG Class of 2018-19; Science News cover + VOA video

Veronica Santos

Associate Professor Veronica Santos received a $719,000 grant from the Department of Defense's Office of Naval Research to develop a robot that would be capable of handling and disposing of ordnance.

The grant will be used to purchase a major piece of equipment in support of research that Santos is leading to advance robotics capabilities for explosive ordnance disposal. Last year, she received a five-year, $1.6 million research grant, also from the Office of Naval Research, for "haptic search and retrieval of objects buried within granular media."

Santos was one of 16 individuals selected for the Defense Science Study Group (DSSG) Class of 2018-2019. Selection for the DSSG presents a two year opportunity, beginning in 2018, for emerging leaders in the fields of science and technology to learn about and participate in dialogues related to US security challenges.

Santos was interviewed in the recent Science News article "For robots, artificial intelligence gets physical," and her robot testbed from the UCLA Biomechatronics Lab was featured on the cover.

Voice of America's Spanish language site, Voz de América, recently featured Santos and her Biomechatronics Laboratory, where she described the work of her research group working on developing tactile sensors and new capabilities for robots that rely on the sense of touch. Graduate students Kenneth Gutierrez and Cheng-Ju Wu were also featured in the two-minute segment.

Mitchell Spearrin: Completes new 157A aerospace capstone class design-build-launch curriculum

Mitchell Spearrin

Assistant Professor Mitchell Spearrin and his students recently completed a new design-build-launch curriculum for the 157A aerospace capstone class. The team-based course involved the development of student-built rockets and culminated in a launch competition in the Mojave desert. A series of structured labs, each focused around one component of a rocket, were conducted in parallel to the team design project, and covered a range of analytical tools, aerospace materials, manufacturing techniques, and testing methods. The class was taken by approximately 45 AE majors in their senior spring quarter.

Spearrin designed the course to help students prepare for the aerospace industry, which is the desired destination for most AE students. He stated that "in almost all of our classes students solve problems with clean analytical solutions, but real engineering problems are messy. It's important that engineers understand where simple analysis fails and succeeds. Real problems typically require the application of numerical models that provide approximate solutions and testing of prototypes or system components that involve some trial and error. Both of these approaches—modeling and testing—are part of the general process to design and build products in industry, and I tried to incorporate that into the class."

Spearrin hopes to continue the design-build-launch curriculum for years ahead. "We can change the mission objectives and competition criteria to make it a unique experience while using the same approach. This is the way most companies go about developing new products. The process is about the same, while the final products differ."

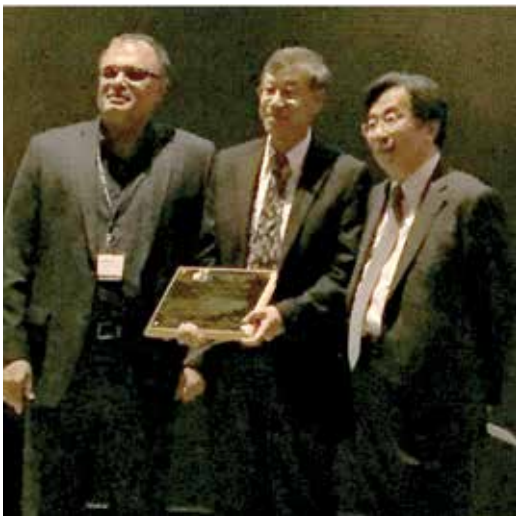
Tsu-Chin Tsao: Receives the 2016 IFAC Mechatronics Systems Award

UCLA MAE Professor Tsu-Chin Tsao received the 2016 International Federation of Automatic Control (IFAC) Mechatronics Systems Award. The award was from the IFAC Technical Committee on Mechatronic Systems, and was presented at the 2016 IFAC Symposium on Mechatronic Systems in Loughborough, UK, on September 7, 2016.

The citation was as follows:

For outstanding contributions in the design, modelling, control, and realization of mechatronic systems, and for investigation and engineering of precision motion and vibration control to achieve high performance in engineering systems.

Please visit http://www.maclab.seas.ucla.edu/ for more information on Prof. Tsao's research.



Tsu-Chin Tsao

Richard Wirz: Expertise sought by news agencies on rocket research and renewable energy

Associate Professor Richard Wirz, Director of UCLA's Plasma & Space Propulsion Lab, was quoted in the Los Angeles Times article "Elon Musk's Mars plan involves giant reusable rockets, spaceships flying 100 people." "None of the things [Musk's] mentioning are technological impossibilities," [Wirz] said. "It's whether or not we can get the money to do it, and if we're willing to accept the risk."

SpaceX [Musk's company] recently reused and recovered its Falcon 9 booster on March 31, 2017. Wirz was interviewed before and after the launch by the LA Times, LinkedIn, and Al Jazeera. During the interviews, Wirz expressed that successful relaunch is important to the overall space community and the potential to bring launch costs down for future missions. In the LA Times and LinkedIn interviews, Wirz explained that both NASA and SpaceX had a big role in where we are today with launch technology. For example, decades ago, NASA paved the way for this accomplishment by successfully reusing the Space Shuttle Main Engines (SSMEs) many times in what was considered an "absolute engineering marvel" at the time.

Wirz was also interviewed by "Fox 11 News In Depth" in June 2017 about the N. Korea ICBM capabilities and the U.S. interceptor capabilities.

Wirz who is Director of UCLA's Energy Innovation Lab, was on NPR 89.3 KPCC's show "Take Two" on how California's sustainable future begins with renewable energy, including the need to build new off-shore wind-farms, and for more solar and wind energy storage facilities.

Richard Wirz

Los Angeles Times

ALJAZEERA

FOX 11 NEWS IN DEPTH

LinkedIn

npr 89.3 KPCC

MAE-spinoff cleantech startup, Element 16, wins $1.5M grant for new heat energy storage approach

Parker Wells

Hamarz Aryafar

Richard Wirz

MAE-affiliated heat energy storage startup Element 16 Technologies won a $1.5M grant from the California Energy Commission to build and install a pilot plant, which will provide electricity, heating, and cooling on demand to a commercial facility in Los Angeles, with an energy storage capacity of 540 kWh (~10 Tesla Model 3's but at a fraction of the cost).

Element 16 (e16tech.com), founded by Parker Wells (MAE M.S. 2017) and MAE Associate Professor Richard Wirz in April 2016, uses technology based on a breakthrough in heat energy storage, which uses low-cost molten sulfur to replace molten salts and thermal oils. After winning the Transformational Idea Award at the Caltech FLOW competition, Element 16 attracted the attention of Dr. Hamarz Aryafar (UCLA MAE Ph.D. 2008) who came on board as CTO in late 2016.

Space Queen wins the MAE 157A design-build-launch rocket competition in the Mojave desert

MAE157A students traveled to the Mojave desert to launch custom rockets as part of the course's design-build-launch competition. Congratulations to Elisabeth Yu, Carter Pedersen, Parmida Mozafari, Rocio Sotelo, and Rudy Crespo on their winning rocket, Space Queen, in the MAE 157A design-build-launch competition. The Space Queen ascended to 1996 ft and safely landed an egg with no damage.

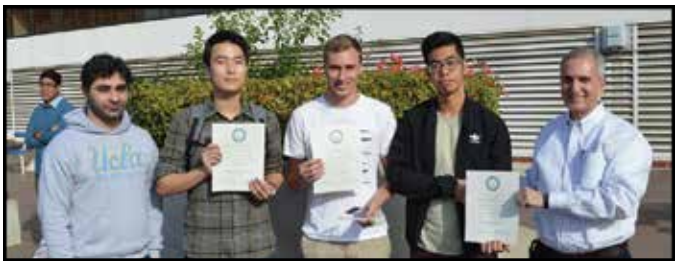
Samira Chizari receives 2017 NSF Fellowship

Samira Chizari

Second-year UCLA mechanical engineering graduate student Samira Chizari has received a National Science Foundation Graduate Research Fellowship. The competitive fellowship recognizes "outstanding graduate students in NSF-supported science, technology, engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees at accredited United States institutions." It provides three years of financial support, including an annual stipend of $34,000, along with a $12,000 cost-of-education allowance for tuition and fees.

Chizari is a member of Professor Jonathan B. Hopkins' Flexible Research Group. Her research focuses on developing an advanced optical microfabrication technique that can enable additive manufacturing of mechanical metamaterials. This method combines holographic optical tweezers and direct laser writing via two-photon polymerization to achieve its goal.

MAE mini solar cars race to the finish!



The Mechanical Engineering Computer-Aided Design course at UCLA, is a hands-on CAD and product design and realization course. This year there were 17 teams and the project was to develop a solar panel powered model car, weighing no more than 150 g with maximum dimensions of 10 cm x 10 cm x 20 cm. Teams were supplied with a 3V solar panel (2"x2"), a small motor, and two metal axles (2 mm x 70 mm). All other necessary parts of the car had to be 3D printed using ABS plastic. All 17 teams successfully demonstrated their devices Monday, Nov 28th 2016 and they competed for the fastest run time. The top three winners were awarded with extra credit towards their final grade. Team-8, Luke Allee, Hanwul Lee, and Hung Wengson was this year's winner with the fastest car. They were clocked at 2.46 mph.

MAE Ph.D. student John Domann accepts Virginia Tech BEAM Department assistant professor position

John Domann

John Domann accepted an Assistant Professor position in the Biomedical Engineering and Mechanics (BEAM) Department at Virginia Tech. He finished his PhD working in the Active Materials Laboratory of Professor Greg Carman at UCLA. Prior to UCLA he earned his BS and MS degrees from the University of Kansas. At KU, he was a Fellow with the Institute for Advancing Medical Innovation and co-invented a piezoelectric spinal fusion implant that recently finished a successful animal trial and has been licensed by a startup company.

At UCLA, John's work has broadly focused on the dynamics of magnetoelastic materials across numerous size and time scales. He has worked with AFRL researchers from Eglin Air Force Base to conducted experimental studies on the impact and shock response of the magnetoelastic material Galfenol. This work included analysis of Galfenol's use in pulsed power generation devices, as well as the first analytic model of a strain powered antenna.

MAE alumnus Sameer Behere wins 2016 AEE Energy Innovator of the Year Award

Sameer Behere

MAE alumnus Sameer Behere (MS ME '09) won the 2016 Association of Energy Engineers (AEE) Energy Innovator of the Year Award. The award was given "for outstanding accomplishments in applying innovative practices, principles and procedures of energy engineering." The award was presented on Sept 20, 2016 at the World Energy Engineering Congress in Washington DC. Behere was the winner for Region V (AK, AZ, CA, HA, ID, NV, OR, UT, WA). In order to be eligible for the award, one has to be nominated by industry peers and mentors. The committee then selects one individual for the award from hundreds of nominations.

ME student Aaron Feigelman External VP for UCLA Solar Decathlon

Second-year mechanical engineering student Aaron Feigelman is the External Vice President for the UCLA Solar Decathlon, which is working to build a 975-square-foot home that will supply its own food, water and energy.

The UCLA Solar Decathlon team is building the home for the 2019 Solar Decathlon competition, which is hosted every two years by the U.S. Department of Energy. This is UCLA's first time competing among 19 other college teams to design and build a solar-powered house with a focus on sustainability.

So far this year, the team has recruited about 40 new members and secured a 1500-square-foot lab space in the engineering building.

ME students Abolfazl Sadeghpour and Zezhi Zeng win first place at IMECE Conference NSF poster competition

Abolfazl Sadeghpour and Zezhi Zeng

Abolfazl Sadeghpour and Zezhi Zeng won first place in the NSF poster competition at the IMECE Conference, for the poster titled "Effect of Nozzle Geometry on Instability of Wetted Wire Columns." The competition was held November 15, 2016, in Phoenix, Arizona. Sadeghpour and Zeng are Mechanical Engineering graduate students working in Prof. Sungtaek Ju's Lab. Their research focuses on an innovative design for improving the efficiency of Heat/Mass exchangers. Large-scale evaporative cooling is one of the leading sources of fresh water consumption. Dry cooling based on existing heat exchangers, however, has found limited usage due to the high cost and large foot prints/weights. Thus, development of alternative low-cost lightweight heat exchangers for dry cooling is urgently needed and has the potential to make a difference. One promising design for such alternative heat exchangers is what we call DIrect-contact Liquid-on-String Heat Exchangers (DILSHE). Fluid Dynamics and Heat Transfer are critical aspects of this design.

Bruin Space relaunches as undergrad resource center, runs four UCLA aerospace projects

Bruin Space originally launched in 2013. In fall 2016, students rebranded the club as a resource center for undergraduates who want to explore spacecraft engineering. Members are currently working in teams to prepare for several competitions this year, including one hosted by NASA in Texas.

Bruin Space is currently running four independent UCLA aerospace projects:

- The Sandbox Initiative–a platform for students to assemble teams and take part in fast-paced open-competition opportunities.
- Project Overseer–a high altitude balloon platform for research and technical demonstrations.
- Project Reach–a small rocket payload designed for Rocket Project at UCLA's Intercollegiate Rocket Engineering Competition rocket.
- Project Rapid–an initiative to secure and execute future CubeSat programs at UCLA following the completion of the ELFIN CubeSat.

Mahmoud Lotfy and Marco Riva win Best Paper Awards at the TOFE Conference

Mahmoud Lotfy

Mahmoud Lotfy and Marco Riva, both MAE Ph.D. students in Professor Mohamed Abdou's Fusion Science and Technology (FST) Center, were awarded Outstanding Student Paper and Honorable Mention Student Paper, respectively, at the prestigious international TOFE conference in Philadelphia, PA. The conference was the 22nd American Nuclear Society Topical Meeting on the Technology of Fusion Energy – TOFE 2016, With the theme of "Advancing the Globalization of Fusion Energy Technology," the conference was attended by scientists and engineers from countries around the world. The conference papers covered broad range of cutting-edge fusion nuclear technology.

Marco Riva

Lotfy is a third-year Ph.D. student whose research involves modelling and experiments including first-of-a-kind experiments. Riva is a first-year Ph.D. student working on advanced 3-D modelling of neutron and gamma-ray transport in tritium breeding blankets for fusion power reactors.

UCLA Engineering names Audrey Pool O'Neal to lead Women in Engineering Program

Audrey Pool O'Neal

Audrey Pool O'Neal, a lecturer in Mechanical and Aerospace Engineering and former senior manager with General Motors, has been named director of the Women in Engineering program at the UCLA Henry Samueli School of Engineering and Applied Science (WE@UCLA). Through academic reinforcement, mentorship, team-building, research experiences, industry internships, and personal and professional development activities, WE@UCLA will provide a unique environment for female students to thrive in engineering and computer science.

"At the undergraduate level, women who attend UCLA Engineering will be part of an active learning community, with the sole focus of ensuring their academic and professional success," said Jayathi Murthy, Dean of UCLA Engineering. "Upon graduation, these women will join a network of more experienced female engineers who can continue to foster a supportive and collaborative environment for new engineers and computer scientists."

UCLA Formula SAE Team featured in LA Times article about aerospace recruitment

UCLA's Formula SAE Team was featured in the LA Times article "Where do SpaceX and other aerospace companies find engineers? On the race track."

Owen Hemminger works on UCLA Formula SAE team's car

From the article:

> Each Saturday for the last few months, about 30 members of the UCLA Formula SAE team pumped up the music in their ground-floor shop on campus and worked almost all day on their car. That's in addition to the hours they spend there in between classes.
>
> Students on the team get greater hands-on engineering experience than they might in academic classes, said Owen Hemminger, 20, a mechanical engineering student and financial director of UCLA's team.
>
> Everyone learns how to use engineering software and do machining in school, "but not to the depth we use it," he said.

COMMENCEMENT AWARD WINNERS

2017 ENGINEERING ACHIEVEMENT AWARDS FOR STUDENT WELFARE

Rodolfo Isaac Barranco, B.S., ME, Sp17
Roselin Campos, B.S., AE, Sp17
Stephanie Celeste Cantu, B.S., ME, W17
Scott Langley Gee, B.S., AE, Sp17
Khurram Syed Hashimi, B.S., ME, Sp17
Mohammed Husain, B.S., AE, Sp17
Christopher Maxwell, B.S., ME, Sp17
Salvador Perez, B.S., ME, Sp17

MECHANICAL & AEROSPACE DEPARTMENTAL AWARDS

Phillip Chiu, Ph.D., AE, Sp17
Amine Mohamed Elhafsi, B.S., AE, F16
Danny Fong, Ph.D., ME, W17
Ruben Thomas Ghijsen, M.S., AE, Sp17
Christopher Perez, B.S., ME, W17
Takeshi Shoji, Ph.D., AE, Sp17
Parker Wells, M.S., ME, Sp17

William S. Klug Memorial Scholarship Fund

William "Bill' Klug (June 19, 1976 – June 1, 2016) was a beloved friend and colleague, an inspiring mentor and, above all, a cherished husband and devoted father.

In the words of those who knew him best, he was an unwaveringly kind and gentle man. His wellspring of patience and generosity knew no bounds, and we will continue to remember the warmth and camaraderie that made Bill such a remarkable individual.

A proud Bruin, Bill earned his master's degree in civil engineering from UCLA and returned soon after to become a well-respected professor in mechanical and aerospace engineering. As professor, Bill received a number of prestigious awards, including a National Science Foundation Career Award and his department's Samueli Teaching Award. Bill served as a trusted guide to students who continue to carry his work forward through their own academic success.

Bill's research pursuits also made an indelible impact on the lives of many. Through his work in computational biomechanics, he dedicated himself to research focused on understanding how the mechanics of biological systems affect their function, and most recently was researching the electro-mechanics of the heart.

To honor Bill and his many contributions, the UCLA Henry Samueli School of Engineering and Applied Science has created the Bill Klug Memorial Scholarship Fund. The fund will be used to support promising UCLA undergraduate students in mechanical and aerospace engineering who positively contribute to the campus community.

The endowed scholarship was established with a generous initial gift from Arconic and the UCLA Chancellor's Centennial Scholars Match program. Contributions to this fund will increase the level of support provided to students.

Thank you for your continued commitment to outstanding members of the UCLA family.

National Academy of Engineering Members

Albert Carnesale

Election Year: 2011.

Election Citation:

"For bringing engineering excellence and objectivity to international security and arms control, and for leadership in higher education."

Vijay Dhir

Election Year: 2006.

Election Citation:

"For work on boiling heat transfer and nuclear reactor thermal-hydraulics and safety."

Dan Goebel

Election Year: 2015.

Election Citation:

"For contributions to low-temperature plasma sources for thin-film manufacturing, plasma materials interactions, and electric propulsion."

Chih-Ming Ho

Election Year: 1997.

Election Citation:

"For contributions to the understanding and control of turbulent flows."

John Kim

Election Year: 2009.

Election Citation:

"For development of direct numerical simulation and seminal contributions to the understanding of the physics and control of turbulent flows."

Kuo-Nan Liou

Election Year: 1999.

Election Citation:

"For contributions in the theories of radiation transfer and light scattering, with applications to remote sensing technology and climate modeling."

Ali Mosleh

Election Year: 2010.

Election Citation:

"For contributions to the development of Bayesian methods and computational tools in probabilistic risk assessment and reliability engineering."

Lucien A. Schmit, Jr.

Election Year: 1985.

Election Citation:

"For pioneering work in structural synthesis, combining finite element analysis and nonlinear programming algorithms to create a powerful class of modern structural design methods."

Jason L. Speyer

Election Year: 2005.

Election Citation:

"For the development and application of advanced techniques for optimal navigation and control of a wide range of aerospace vehicles."

Design, Robotics, and Manufacturing


Rajit Gadh


Dennis Hong


Jonathan Hopkins


Xiaochun Li


Jacob Rosen


Veronica Santos

ALSO: Abdou, Carman, Ghoniem, Tsao

Fluid Mechanics


Jeff Eldredge


Ann Karagozian


Pirouz Kavehpour


John Kim


Mitchell Spearrin


Richard Wirz


Xiaolin Zhong

Heat and Mass Transfer


Mohamed Abdou


Vijay Dhir


Yongjie Hu


Adrienne Lavine


Jayathi Murthy


Laurent Pilon

ALSO: Ju, Kavehpour, Spearrin

MEMS and Nanotechnology

Yong Chen

Pei-Yu Chiou

Vijay Gupta

Chih-Ming Ho

Sungtaek Ju

Chang-Jin Kim

ALSO: Carman, Hu, Jin, Kavehpour, Li, Pilon

Structural and Solid Mechanics

Oddvar Bendiksen

Greg Carman

Nasr Ghoniem

Lihua Jin

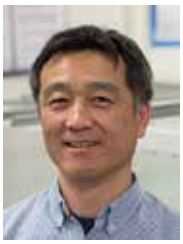
Christopher Lynch

Ajit Mal

ALSO: Gupta, Hopkins, Li

Systems and Control

Steven Gibson



Tetsuya Iwasaki

Robert M'Closkey

Jason Speyer

Tsu-Chin Tsao

ALSO: Hopkins, Santos

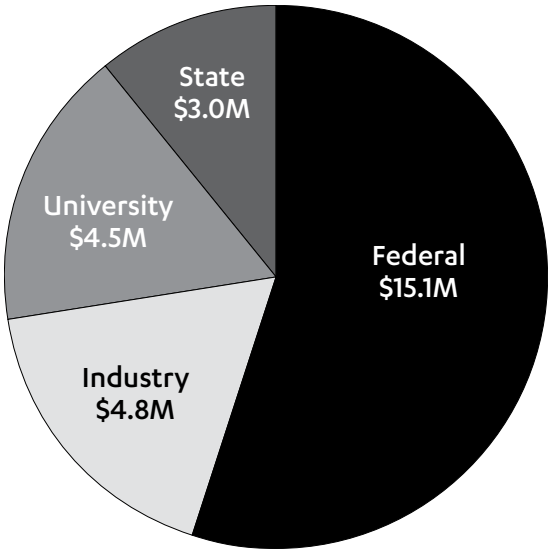
Faculty and Staff

Ladder Faculty	36
Joint Appointments	5
Emeriti Faculty	12
Staff	24

Recognitions

NAE Members	9
Society Fellows	63
CAREER Awards	10
Young Investigators	8

Research Budget (in millions)



Total $27.4M

Research Centers

The Mechanical and Aerospace Engineering Department contributes to the following Research Centers:

CCAS - UCLA-AFRL Collaborative Center for Aerospace Sciences (Karagozian)

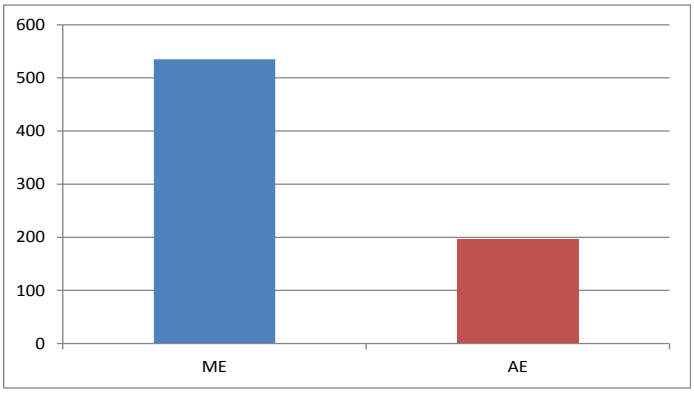
FSTC - Fusion Science and Technology Center (Abdou)

SMERC - Smart Grid Energy Research Center (Gadh)

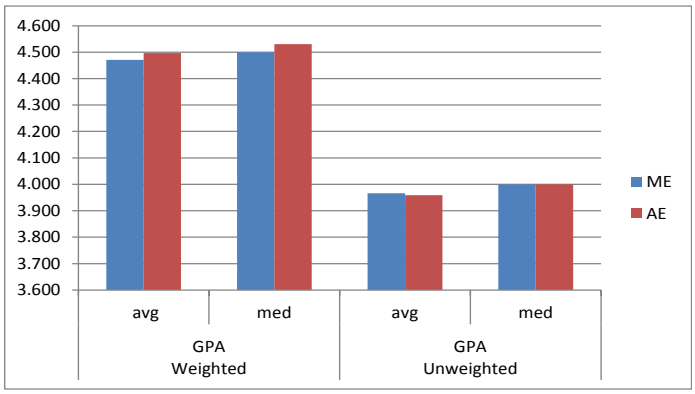
TANMS (NSF-NERC) - Center for Translational Applications of Nanoscale Multiferroic Systems (Carman)

UCLA MAE Department Overview

2016 Fall Quarter Undergraduate Enrollment

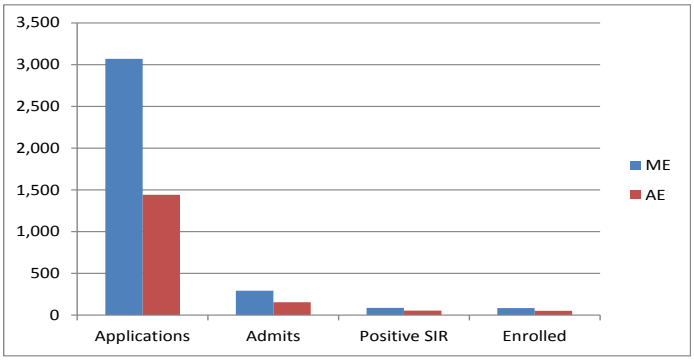


2016 Fall Quarter Enrolled Freshman GPA

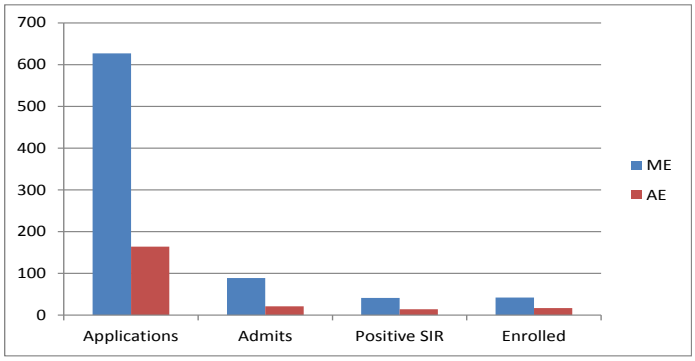


2016-17 Undergraduate Admission Statistics

Freshman



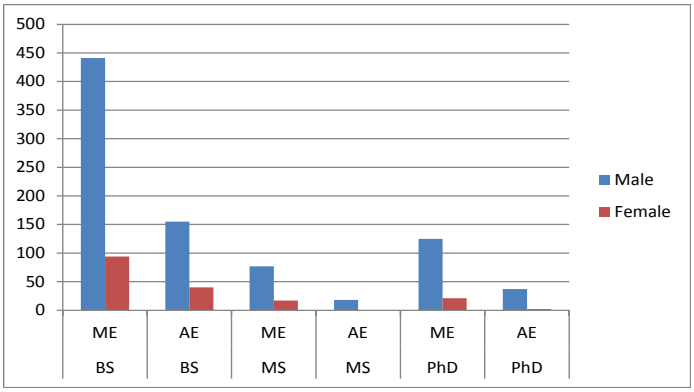
Transfer



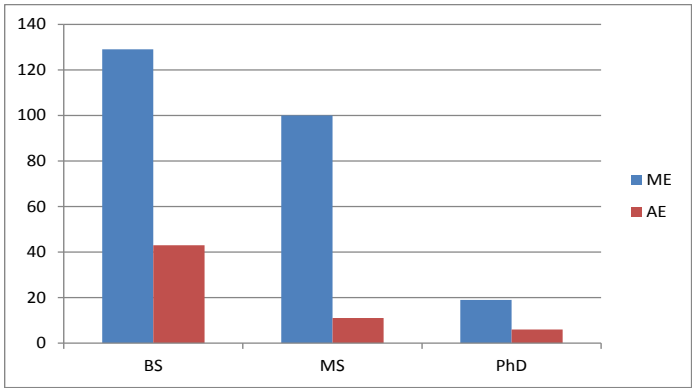
2016-17 Graduate Admissions Statistics

	Applicants			Admits			Enrolled		
	Domestic	Foreign	Total	Domestic	Foreign	Total	Domestic	Foreign	Total
ME	229	561	790	150	158	308	52	43	95
AE	94	86	180	55	14	69	20	2	22
Total	323	647	970	205	172	377	72	45	117
% Foreign		66.70%			45.62%			38.46%	

2016 Fall Quarter Gender Breakdown by Major



2016-17 Degrees Granted



Industrial Advisory Board

MAE Industrial Advisory Board Meeting February 16, 2017. Left to right: William Goodin, MAE AAB Chair; Mitchell Spearrin, MAE Assistant Professor; Rajit Gadh, MAE Professor; David McBride, NASA Armstrong Flight Research Center; Luke Haylock (IAB Chair), Arconic; Marianne So, Honeywell; Ingo Foldvari, National Instruments; Karen Tokashiki, Northrop Grumman; Christopher Lynch, MAE Chair and Professor; Eric Hall, Aerospace Corporation; Steven J. Yahata, Boeing Company; Geoffrey McKnight, HRL Laboratories; Lihua Jin, MAE Assistant Professor; Eugene Lavretsky, Boeing Company.

Aerospace Corporation
Dr. Eric Hall
General Manager, Vehicle Systems Division

Air Force Research Laboratory
Michael T. Huggins
Chief/Site Director, Rocket Propulsion Division

Arconic
Luke Haylock (IAB Chair)
Director of New Product Development

Boeing Company
Eugene Lavretsky
Senior Technical Fellow

Boeing Company
Steven J. Yahata
Director, Structures Technology,
Boeing Research & Technology

Honeywell Aerospace
Matt Schacht
Director of Engineering, Environmental Control Systems

HRL Laboratories, LLC
Geoffrey McKnight
Scientist, Sensors and Materials Laboratory

Intel Assembly Technology Development
Gaurang Choksi
Manager, Core Competency Development

JPL NASA
Tom Cwik
Manager of the NASA Space Technology Program
JPL Astronomy, Physics, and Space Technology Directorate

Lockheed-Martin Aeronautics Company
Philip A. Conners
Engineering Director – Palmdale Site

NASA Armstrong Flight Research Center
David McBride
Center Director

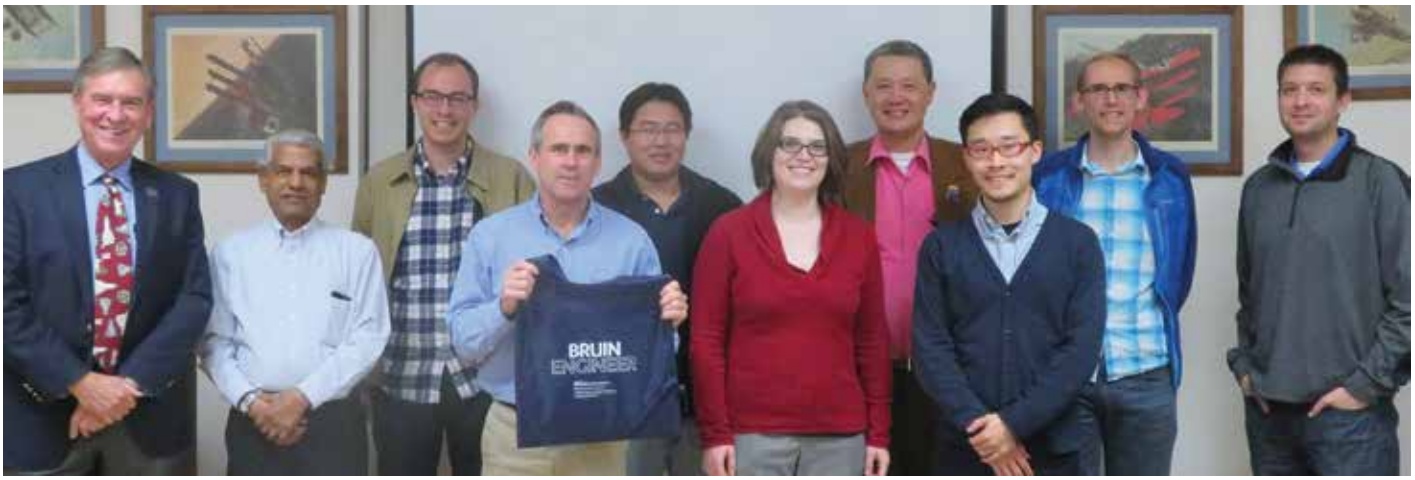
National Instruments
Ingo Foldvari
University Program Manager, US West

Northrop-Grumman Aerospace Systems
Timothy J. Frei
Vice President, System Enhancements and Product Applications

RAND Corporation
Natalie W. Crawford
Senior Fellow and former Director, Project AIR FORCE

Raytheon Space and Airborne Systems
Patrick J. Fitzgerald
Department Manager, Thermal & Structural Design Dept.
Mechanical & Optical Engineering Center

Alumni Advisory Board



MAE Alumni Advisory Board. Left to right: William Goodin, MS '71, PhD '75 ME (Chair), Prof Ajit Mal, Chris Underhill '13 ME, Mark Ford '82, MS '88 AE, Edward Lin '13 AE, MS '14 ME, Eliza Sheppard MS '05 ME, MBA '10, David E Lee '85 Math, MS '90 ME, PhD '98 ME, Kai Matsuka '16 AE, Merrick Campbell '16 ME, James Sharp '03, MS '06 ME.

Sharat Batra, '05, ME, LA DWP

Eddie Chau, '89, ME, CCI Valve

Mark Ford, '82, MS '88, AE, Northrop Grumman

Anthony Gambardella, '12, MS '13, ME, SpaceX

Greg Glenn, '03, MS '06, ME, Freedom innovations

Aditi Gobburu, '07, MS '08, ME, Northrop Grumman

William Goodin, 'MS '71, PhD '75, ME, UCLA

Bill Holbrow, '90, ME, Blakely Sokoloff LLP

Sean Hutchinson, '12, AE, Zodiac

Hannah Jorgensen, '10, AE, Northrop Grumman

David E. Lee, 'MS '90, PhD '98, ME, Northrop Grumman

Sasha Lukyanets, '07, MS '09, AE, The Aerospace Corporation

Mark Malicdem, '05, AE, B/E Aerospace

Eugene Nemirovsky, '05, ME, Scaled Composites

Avi Okon, '02, MS '05, ME, JPL

Yesha Shah, '14, AE, Orbital ATK

James Sharp, '03, MS '06, ME, Northrop Grumman

Brian Shedd, 'MS '05, PhD '08, ME, UCLA

Eliza Sheppard, 'MS '05, MBA '10, ME, Northrop Grumman

Marianne So, '07, ME, Honeywell

Norris Tie, '14, AE, Northrop Grumman

Gerard Toribio, '08, AE, Northrop Grumman

Anthony Tyson, '12, ME, Aerojet Rocketdyne

Sarah Vasquez, '08, ME, Chevron

Melody Vo, '11, ME, Kia Motors America

Marisa H. Wells, '04, ME, Northrop Grumman

UCLA ENGINEERING
Henry Samueli School of
Engineering and Applied Science

Birthplace of the Internet

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Los Angeles, CA 90095-1597

www.mae.ucla.edu