2021 DEPARTMENT STATS AT A GLANCE

FACULTY AND RESEARCH

- 17 full professors
- 10 associate professors
- 4 assistant professors
- 105 journal publications
- 24 conference papers

STUDENTS AND GRADUATES

- 53 Capstone projects
- $1,058,000 in Capstone grants
- 206 undergraduate students mentored in paid research positions
- 599 students in the freshman seminar
- 1,397 undergraduate students enrolled
- 121 graduate students enrolled
- 177 bachelor's degrees awarded
- 15 master's degrees awarded
- 3 doctoral degrees awarded

FROM THE CHAIR

Dear Alumni and Friends,

Students are the primary focus of mechanical engineering at BYU. While we are proud of the world-class research and teaching skills of our faculty and the dedication and talents of our staff, students are our most valued scholarly products. We believe that it is through them that we can best influence the world.

We are excited by growth. In the 2020–21 academic year, our freshman Introduction to Mechanical Engineering class had a record 599 students. The university has added faculty, staff, and budget resources to accommodate these students. We are expanding experiential learning within and outside of the required curriculum. Our department has combined with electrical and computer engineering to form a Capstone program that now includes more than 360 students and over $1 million in funding for 53 projects. The department and college support 10 competition teams. A record 206 of our undergraduate students were involved in paid undergraduate research projects, with 53 of these students authoring or coauthoring a conference or journal paper. As has been the case for several years, our undergraduates rank third in the nation in the number who go on to receive a PhD.

I hope you enjoy reading about a few of our undergraduate engineering projects and learning more about our students and faculty.

Dale R. Tree

Dale R. Tree, **PROFESSOR AND CHAIR OF MECHANICAL ENGINEERING**

BEST PAPER AWARD

A groundbreaking paper examining and bringing attention to the topic of social impact by Gabrielle Johnson and Marin Fisher, two undergraduate mechanical engineering students, received the best paper award in the ASME design for life manufacturing category at the 2021 Design for Manufacturing and the Life Cycle Conference in August.

The paper, "Product Development Using Perceived Correlations Between the United Nations Sustainable Development Goals and Social Impact Categories," analyzed the link between 11 social impact categories and the 17 UN Sustainable Development Goals.

"I feel like when people think of engineering papers, they think of just long equations," Fisher said. "This one was more about how what you're doing as an engineer affects the whole world."

The two seniors work as researchers in the Design Exploration Research Group and are mentored by professors John Salmon and Chris Mattson.

LAPAROVISION: A STUDENT-CREATED MEDICAL DEVICE

Mechanical engineering students Jacob Sheffield and Amanda Lytle Bartschi created an origami-inspired windshield wiper for laparoscopic cameras. Together they won the 2021 BYU Student Innovator of the Year competition for their innovation, called LaparoVision. The student-run medical device startup Bloom Surgical is now taking the product to market.

The objective of Sheffield and Bartschi's work was to engineer a functional and manufacturable wiper mechanism to remove blood, tissue, and other debris obscuring the vision of surgeons during laparoscopic surgeries. A key characteristic of LaparoVision is that the wiper mechanism can be manufactured as just one part. As a compliant mechanism, it gains its motion and restorative force through the flexing of the mechanism and the stored strain energy. Both Sheffield and Bartschi are researchers in the Compliant Mechanism Research Group, led by professors Larry Howell and Spencer Magleby.

There are more than 13 million laparoscopic surgeries performed per year, globally. Generally, laparoscopes are removed from patients every 12 minutes to clean the lens. Not only is there a significant financial benefit to cleaning without removing the laparoscope (average operating room costs are $65 a minute), but the need to clean often occurs at critical moments in the surgery, such as when making an internal incision.

When asked about the engineering, Sheffield said, "The innovation is not the idea of coming up with a windshield wiper. . . . The innovation is how the mechanical engineering checks out to be both technically feasible and economical to produce. These are two aspects that make this commercially viable . . . and are key to the success of this project."

FACULTY AWARDS

The following faculty were recognized in 2021 for their contributions to BYU and the engineering profession.

Doug Cook: NSF CAREER Award, "CAREER: Combining Engineering, Biomechanics, and Genetic Analysis to Enable the Design of Structurally Superior Grain Crops"

Andrew Ning: AIAA Associate Fellow and Early Career Scholarship Award (University Award)

David Fullwood: Outstanding Scholar (College Award)

Dan Maynes: Doug Chabries Professorship (College Award)

Scott Thomson: Faculty Development (College Award)

Brent Webb: Most Influential Faculty Member (College Award)

Marc Killpack: Excellence in Research (Department Award)

Steven Charles: Excellence in Teaching (Department Award)

Mark Colton: Advancement in Rank to Professor

Oliver Johnson: Continuing Faculty Status and Advancement in Rank to Associate Professor

Brad Adams: Continuing Faculty Status

INFLUENTIAL ALUMNI

Kimberly Treanor (BS '95) earned an MS from Georgia Tech and spent her early career as a plant engineer at DuPont before shifting into operations management and leadership, obtaining an MBA in international business from Saint Louis University and working as sourcing director at Solae and vice president of sourcing at Foster Farms. She currently works at Corning Inc., where she leads their sourcing and supply group within emerging innovations. Treanor is grateful for her BYU Capstone experience, which helped better prepare her for industry.

Sterling Anderson (BS '07) is the cofounder and chief product officer of Aurora Innovation. Prior to forming Aurora, he led the design, development, and launch of the Tesla Model X and, subsequently, the team that delivered the first and second generations of Tesla Autopilot. Anderson's work in vehicular autonomy began at MIT, where he developed MIT's intelligent copilot, a shared autonomy framework that paved the way for broad advances in cooperative control of human-machine systems. Anderson holds a BS from BYU and an MS and a PhD from MIT.

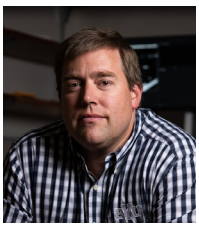
Jenny Pate (BS '11) has worked in the energy industry since graduating from BYU. She is currently a project manager at ExxonMobil, where she has held a variety of technical and commercial roles. Pate has focused on improving career trajectories for women engineers by lobbying for increased support policies and programs for parents. She credits the undergraduate opportunities she had at BYU for helping shape her career, and she has remained engaged with the department by serving on the Mechanical Engineering Advancement Council.

PLEASE JOIN US

DURING HOMECOMING WEEK IN 2022

FOR OUR NEXT ALUMNI DINNER.

NEW FACULTY



Dr. Jeff Hill received his BS and MS degrees from BYU and his PhD from Penn State. He has been working at Sandia National Laboratories for the past 10 years, designing and testing various electromechanical systems. Prior to that he was a visiting research investigator at the University of Michigan. His area of research is in impact and shock testing, with a focus on protecting electronics in harsh environments.

Dr. Christopher Dillon received his BS degree from BYU and his PhD in bioengineering from the University of Utah. Previously, he was a senior computer scientist at Sandia National Laboratories, where he developed computational models of assembled systems in fire environments. His research areas include characterization of human tissue properties and bioheat transfer modeling for magnetic resonance–guided focused ultrasound therapies.

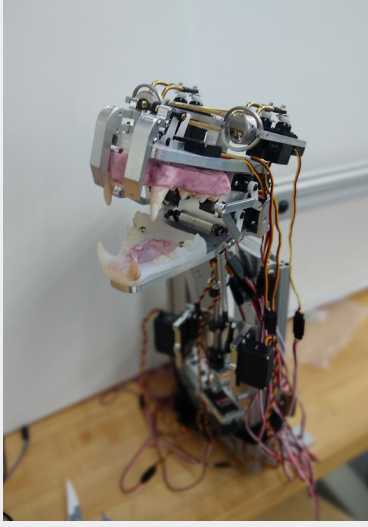
CAPSTONE PROJECTS HIGHLIGHT: COSMOTRON CAPSTONE COLLABORATION

Cosmo the Cougar has been the mascot and a staple of BYU since 1953. However, fans will have a new, entirely animatronic Cosmo thanks to the combined efforts of two BYU engineering Capstone teams, a group of theatre and media arts (TMA) students, and funding from Ira Fulton.

Cosmotron, the name given to the animatronic cougar, was designed for the theatre department to introduce plays and similar events. Although engineering Capstone projects typically develop products for clients outside the university, this experience provided a unique learning and collaboration opportunity for the three teams of students from both ends of campus during the 2020–21 academic year.

The software, mechanical, and TMA student teams spent hours studying an actual cougar and building on the work of others to make both the outside and inside of Cosmotron as realistic as possible. Operated by two PlayStation 4 controllers, the cougar can express personality by tilting and turning its head, opening its jaw at different speeds for speech, smiling and frowning, opening and closing its eyes, raising its eyebrows, and flapping its ears.

As Cosmotron came together, the students were excited to see their teamwork and their knowledge from their coursework applied to something both useful and impactful. Claire Lore, a member of the mechanical engineering team, said, "I have spent the last five years learning equations, but applying them like this is really amazing because you can really understand how all those puzzle pieces fit together."



ELECTROSPINNING COVID MASKS

A BYU engineering mask team of undergraduate researchers—Austin Kerr, Ethan Fullwood, and Katie Varela—won first place in the 2020 International Mechanical Engineering Congress and Exposition (IMECE) student poster competition for their work on "Accessible Design of Electrospinning Device for N95 Compliant Filter Media." The IMECE is ASME's largest R&D conference, with roughly 2,400 papers, presentations, and posters given annually.

The poster highlighted the students' work in developing an electrospinning process for creating N95-compliant filter media that could be easily replicated in any community around the world using readily available materials. Electrospinning creates nanofiber membranes that can be added to existing personal protective equipment (i.e., masks) to dramatically improve health outcomes for those affected by air pollution. The membranes can also help to fulfill the urgent need for improved masks to combat the COVID-19 pandemic. The membrane is estimated to block 90 to 99 percent of particles, increasing filtration effectiveness while preserving breathability.

The research was a collaborative effort with the Nanos Foundation and was supervised by BYU professors Anton Bowden and David Fullwood. You can see a video describing this process in more detail at youtube.com/watch?v=llqx8FfnCXs.

STAY CONNECTED

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