The Fulton Undergraduate Research Initiative (FURI) enhances and enriches a student’s engineering and technical education by providing hands-on lab experience, independent and thesis-based research and travel to national conferences.

At this semiannual symposium, students present their research and share their findings with peers, the Fulton Schools, the ASU community and the community at large.

The Fulton Undergraduate Research Initiative (FURI) enhances and enriches a student’s engineering and technical education by providing hands-on lab experience, independent and thesis-based research and travel to national conferences.

At this semiannual symposium, students present their research and share their findings with peers, the Fulton Schools, the ASU community and the community at large.

Thank you for joining us at the Fall 2017 Fulton Undergraduate Research Initiative (FURI) Symposium. As you will see today, our undergraduate students have applied their knowledge to address real-world challenges in health, energy, education security and sustainability over the past semester.

FURI, one of the Fulton Schools’ signature events, enhances students’ engineering and technology education through hands-on research in the labs of our renowned faculty.

FURI provides exposure of our students to the research enterprise — from conceptualization of an idea, to a plan, to investigation, to presentation of the outcomes of their investigations. This provides invaluable opportunities to develop and hone skills that will serve our students well in their future pursuits and careers — to think independently, problem solve on the fly and defend their findings.

Along with research, FURI provides undergraduate students with other opportunities often only available to graduate students, such as the opportunity to travel to academic conferences to present their work. The access to research at a level typical of graduate students can open up additional doors to scholarships, internships and further research at graduate school.

As you browse the poster session, be sure to talk with our students about their research. We are excited to share their work and we are very proud of what they’ve accomplished.

Sincerely,

Kyle D. Squires, Ph.D.
Dean, Ira A. Fulton Schools of Engineering
Professor, Mechanical and Aerospace Engineering

Kae Sawyer
Associate Director
Student Engagement
Students in the Fulton Schools’ FURI research program develop a proposal under the mentorship of a faculty member, then apply for funding. Once accepted, they perform research, attend workshops, and prepare research summaries. Participants receive stipends and research supply budgets. The travel grant program helps students present their research at national conferences by providing financial assistance with travel expenses.

Grand Challenge Scholars Program students conduct research in a grand challenge theme and are invited to present their research at the FURI Symposium.

ASU KERN Project grant recipients and KEEN supported FURI students receive funding to support research, projects or travel that exemplifies an entrepreneurial-minded approach. These students are invited to share their work at the FURI Symposium.

YiZhuang Garrard
Daniel Gentry
Kiana Ghazouli ●
William Gibbs
Anikki Giessler ●
Tiffany Gong
Smita Gopalakrishnan
Preston Goulet
Anna Grabek
Sahil Gupta
Sue Han
Hunter Haynie
Taylor Hearn ●
Joseph-Herrera-Theut
Daniel Hill
Lucien Hollins
Anna Hu
Zachary Humphreys
Timothy Huynh
Cody Iwertz
Ishitha Jagadish
Everett Johnson
Ladan Kamali Sarvestani
Yunyi Kang ●
Mark Kapron
Andrew Barnes
Jayanth Karthikeyan
Aditya Khuller ●
Ben Killpack ●
Galen Kingsley
Michael Kintschner
Jacob Knaup
Eunsol Ko
William Kostecki
Itai Goeta Kreisler
Sidharth Kulkarni
Irfan Kula ●
Jonathan LaBarge
Kaylie Lam
Lee Lambert
Stephen Lane
Cecilia La Place ●
James Larson
Alessandro Maria Lapina
Andrew Leaton
Sara Lee
Zhiquian Li
Jennapher Lingo VanGilder ●
Noah Livingston
Brianna Lopez
Kevin Lough
Trevor Lucero
Roquesan Luckett
Christopher Lue Sang
Kishen Mahadevan ●
Luke Mains
Sonia Malek
Alex Maltagliati ●
Amber Mani
Danielle Mara
Logan Mathesen ●
Cameron McAllister
Ethan McDermott
Alexander McGregor
Devin McManimon McNally
Alisha Menon
Ivan Milosalvjevic
Zachary Monroe
Rex Moore
Tray Moraca
Evan Morton ●
Adriana Moya
Philip Mulford
Akshay Nalla
Connor Nelson
Michael Nguyen
Aaron Nichols
Koen Nijssen
Calvin Norman
Kyrsten Novak ●
Tyrine Jamella Pangan ●
Min Su Park
Bryan Parrish
Supavpa Paruthy
Dhruv Patel
Jacob Peplinski
Diego Perozo
Tu-Uyen Phan
Rachel Ponstein
Eric Probst
Alexis Rainery
Sierra Ramirez
Neil Rastogi
Mykol Reklatis
Hansol Rheem ●
Levi Riley
Jorge Roldan
Trevor Rosenkilde
Christopher Saar ●
Michael Sanchez
Ashley Satkowski
Suzanne Schadel
Stephen Seidel
Aashiq Shaikh
Nandini Sharma
Aditya Shekhawat
Thembielihle Shongwe
Andrew Shurman
Run Si
Kevin Sidbon
Richard Simpson
Komaldeep Singh
Alarmel Sira
Travis Skinner
Christina Smith
Aldo Soberon
Amber Sogge
Shubham Sonawani ●
Curtis Sparks
Mark Sprows
Gavin Steeber
Andrew Sweeney
Cesar Tamayo Claro
Amar Thaker ●
Nicholas Theut
Philip Thomas ●
Robert Tichy
Zachary Ticktin
Jordan Todd
Zachary Tronstad ●
Ariana Tse
Michael Tucker
Paulo Vasconcelos
Derek Vihlauer ●
Claudio Vignola
Jonacarl Vilchez
Yugansh Virmani
Joseph Vlastos
Julie Vuong
Feiyan Wang ●
Peiyuan Wang ●
Samuel Welker
Justin Whetten
Christopher Wiedeman
Ben Wik ●
Geoffrey Wong
John Woodward ●
Nan Xu
Yifei Xu ●
Tae Hun Yun

| Undergraduate Research Travel Grant Program | Graduate Research Travel Grant | ASU KERN Project grant recipients and KEEN supported FURI students |
---|---|---|
<p>| ● | ● | ● |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>David Allee</td>
<td>professor</td>
</tr>
<tr>
<td>Jean Andino</td>
<td>associate professor</td>
</tr>
<tr>
<td>Panagiotis Artemiadis</td>
<td>associate professor</td>
</tr>
<tr>
<td>Robert Atkinson</td>
<td>associate professor</td>
</tr>
<tr>
<td>Daniel Aukes</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Ajay Bansal</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Srivida Bansal</td>
<td>associate professor</td>
</tr>
<tr>
<td>Chitta Baral</td>
<td>professor</td>
</tr>
<tr>
<td>Hugh Barnaby</td>
<td>professor</td>
</tr>
<tr>
<td>David Becker</td>
<td>associate professor</td>
</tr>
<tr>
<td>Heni Ben Amor</td>
<td>professor</td>
</tr>
<tr>
<td>Visar Berisha</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Spring Berman</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Mariana Bertoni</td>
<td>associate professor</td>
</tr>
<tr>
<td>Jennifer Blain Christen</td>
<td>associate professor</td>
</tr>
<tr>
<td>Stuart Bowden</td>
<td>associate professor</td>
</tr>
<tr>
<td>Treavor Boyer</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Russell Branaghan</td>
<td>associate professor</td>
</tr>
<tr>
<td>Junseok Chae</td>
<td>professor</td>
</tr>
<tr>
<td>Chaitali Chakraborti</td>
<td>professor</td>
</tr>
<tr>
<td>Candace Chan</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Linda Chattin</td>
<td>principal lecturer</td>
</tr>
<tr>
<td>Aditi Chattopadhyay</td>
<td>Regents’ Professor</td>
</tr>
<tr>
<td>Erin Chiou</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Phil Christensen</td>
<td>Regents’ Professor</td>
</tr>
<tr>
<td>Charles Colbourn</td>
<td>professor</td>
</tr>
<tr>
<td>Scotty Craig</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Peter Crozier</td>
<td>professor</td>
</tr>
<tr>
<td>Lenore Dai</td>
<td>school director and professor</td>
</tr>
<tr>
<td>Shuguang Deng</td>
<td>professor</td>
</tr>
<tr>
<td>Sandwip Dey</td>
<td>professor</td>
</tr>
<tr>
<td>Adam Doupe</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Heather Emady</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Adolfo Escobedo</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Erica Forzani</td>
<td>professor</td>
</tr>
<tr>
<td>John Fowler</td>
<td>professor</td>
</tr>
<tr>
<td>Tirupalavanam Ganesh</td>
<td>associate dean and associate research professor</td>
</tr>
<tr>
<td>Matthew Green</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Anoop Grewal</td>
<td>lecturer</td>
</tr>
<tr>
<td>Susan Hallbeck</td>
<td>assistant professor, Mayo Clinic</td>
</tr>
<tr>
<td>Karmella Haynes</td>
<td>associate professor</td>
</tr>
<tr>
<td>Stephen Helms Tillery</td>
<td>associate professor</td>
</tr>
<tr>
<td>Julianne Holloway</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Claire Honeycutt</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Laura Hosman</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Huei-Ping Huang</td>
<td>associate professor</td>
</tr>
<tr>
<td>Rafiquil Islam</td>
<td>faculty associate</td>
</tr>
<tr>
<td>Hanqing Jiang</td>
<td>professor</td>
</tr>
<tr>
<td>Nathan Johnson</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Shawn Jordan</td>
<td>associate professor</td>
</tr>
<tr>
<td>Feng Ju</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Subbarao Kambhampati</td>
<td>professor</td>
</tr>
<tr>
<td>Jennifer Kitchen</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Jeffrey Kleim</td>
<td>associate professor</td>
</tr>
<tr>
<td>Vikram Kodibagkar</td>
<td>associate professor</td>
</tr>
<tr>
<td>Jeffrey La Belle</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Micah Lande</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Hyungiae Lee</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Robert LiKamWa</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Yongming Liu</td>
<td>professor</td>
</tr>
<tr>
<td>Thurmon Lockhart</td>
<td>professor</td>
</tr>
<tr>
<td>Joshua Loughman</td>
<td>lecturer and assistant director of EPICS</td>
</tr>
<tr>
<td>Lydia Manikonda</td>
<td>graduate research associate</td>
</tr>
<tr>
<td>Hamid Marvi</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Giuseppe Mascaro</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Abdel Mayyas</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Troy McDaniell</td>
<td>research assistant professor</td>
</tr>
<tr>
<td>Bin Mu</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Brent Nannenga</td>
<td>assistant professor</td>
</tr>
<tr>
<td>David Nielsen</td>
<td>associate professor</td>
</tr>
<tr>
<td>Mehdi Nikkhah</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Paolo Papotti</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Giulia Pedrielli</td>
<td>associate professor</td>
</tr>
<tr>
<td>Matthew Peet</td>
<td>associate professor</td>
</tr>
<tr>
<td>Francois Perreault</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Patrick Phelan</td>
<td>professor</td>
</tr>
<tr>
<td>Panagiotis Polygerinos</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Kaushal Rege</td>
<td>professor</td>
</tr>
<tr>
<td>Fengbo Ren</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Yi Ren</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Andrea Richa</td>
<td>professor</td>
</tr>
<tr>
<td>Bruce Rittmann</td>
<td>Regents’ Professor</td>
</tr>
<tr>
<td>Tom Roberts</td>
<td>former ASU professor of practice</td>
</tr>
<tr>
<td>John Robertson</td>
<td>professor</td>
</tr>
<tr>
<td>Armando Rodriguez</td>
<td>professor</td>
</tr>
<tr>
<td>Alexandra Ros</td>
<td>associate professor</td>
</tr>
<tr>
<td>Rod Roscoe</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Rosalind Sadleir</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Sydney Schaefer</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Thomas Seager</td>
<td>associate professor</td>
</tr>
<tr>
<td>Jorge Sefair</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Paulo Shakarian</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Karl Sieradzki</td>
<td>professor</td>
</tr>
<tr>
<td>Angela Sodemann</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Sarah Stabenfeld</td>
<td>associate professor</td>
</tr>
<tr>
<td>Violet Syrotiuk</td>
<td>associate professor</td>
</tr>
<tr>
<td>Timothy Takahashi</td>
<td>professor of practice</td>
</tr>
<tr>
<td>Meng Tao</td>
<td>professor</td>
</tr>
<tr>
<td>Trevor Thornton</td>
<td>professor</td>
</tr>
<tr>
<td>Sefaattin Tongay</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Amy Trowbridge</td>
<td>senior lecturer and director of GCSP</td>
</tr>
<tr>
<td>Brent Vernon</td>
<td>associate professor</td>
</tr>
<tr>
<td>Erin Walker</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Liping Wang</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Qing Hua Wang</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Kristen Ward</td>
<td>lecturer</td>
</tr>
<tr>
<td>Daniel White</td>
<td>lecturer</td>
</tr>
<tr>
<td>Yezhou Yang</td>
<td>assistant professor</td>
</tr>
<tr>
<td>Masoud Yekani Fard</td>
<td>assistant research professor</td>
</tr>
<tr>
<td>Hongyu Yu</td>
<td>associate professor</td>
</tr>
<tr>
<td>Wenlong Zhang</td>
<td>associate professor</td>
</tr>
<tr>
<td>Yu Zhang</td>
<td>assistant professor</td>
</tr>
</tbody>
</table>
Katherine Adams, Industrial Engineering  
Graduation: May 2018  
Hometown: Arujá, Brazil

**An Integrated Optimization-Based Tool to Assist Conservation Planning Decisions**

Mentor: Jorge Sefair, assistant professor  
Research Theme: Sustainability

Conservation planning decisions are essential to preserve biodiversity. However, these decisions are complex due to their multiple ecological, financial and geographical aspects. The aim of this project is to create an integrated decision planning tool that leverages existing landscape attributes to support systematic conservation planning. This tool features a mathematical programming model that recommends which patches to protect in a candidate region, based on patch attributes such as cost, size, species representation, species survival probability, resource availability, current conservation status and migration paths. Future improvements include enforcing connectivity on the selected patches and testing on a real landscape.

Wade Adams, Engineering (Robotics)  
Graduation: May 2018  
Hometown: Sedona, Arizona

**Soft-Robotic Water Pipe Inspector**

Mentor: Panagiotis Polygerinos, assistant professor  
Research Theme: Sustainability

The objective of this project is to create a soft robotic device that will perform routine maintenance inspections of city water main pipes. This device will eliminate the need of using highly invasive methods of inspection, both rigid robotic and human. The goal is to reduce the amount of infrastructure downtime and cost of performing these inspections. In the future, devices such as these could be used in many other in-pipe environment situations from other infrastructure challenges as far as space travel.

Byron Alarcon-Benedetto, Biomedical Engineering  
Graduation: May 2019  
Hometown: Gilbert, Arizona

**QK Peptide in Hydrogel**

Mentor: Mehdi Nikkhah, assistant professor  
Research Theme: Health

The project explores methods by which human umbilical vein endothelial cell growth can be enhanced using QK, a vascular endothelial growth factor mimicking peptide in hydrogel. Microfluidic devices are used to model a 3D environment. The devices are cast using PDMS (silicone), bound to glass slides, sterilized in an autoclave and then surface treated. There are tremendous efforts to develop injectable biomaterial for regeneration of blood vessels, but existing scaffolding lack vasculogenic properties, which are essential to the regeneration and integration of the matrix with the host milieu. Future work will include imaging and quantification of samples in device.

Omar Alavi, Aerospace Engineering  
Graduation: May 2020  
Hometown: Glendale, Arizona

**Pulsed Plasma Thruster Electrode Geometry Study**

Mentor: Daniel White, lecturer  
Research Theme: Energy

A pulsed plasma thruster (PPT) is a type of compact thruster design for small satellites ideal for precise attitude changes in a vacuum. Data from more than 40 electrode configurations included in this study will lead to a more efficient and precise design for an 8-thruster multi-axis 0.5-1U (10 cm by 10 cm by 5-10 cm) application. Such a thruster applied on a CubeSat would potentially enable more accurate, longer and affordable data collection beyond Earth’s magnetosphere.
Alissa Albrecht, Civil Engineering

Graduation: May 2018
Hometown: Sebastian, Florida

Controlling Nanochannel Dimensions in Graphene Oxide for the Fabrication of Graphene-Based Desalination Membranes

Mentor: Francois Perreault, assistant professor
Research Theme: Sustainability

The purpose of this research was to produce reduced graphene oxides for the fabrication of desalination membranes. Graphene oxide membranes have the potential to perform above the permeability-selectivity tradeoff by reduction through heat or Vitamin C, making desalination more energy efficient. Both reduced and unreduced graphene oxide membranes were created and evaluated by their ability to filter dye and salt in a pressurized membrane cell. The permeability and rejection of the graphene membrane is found to be dependent on the oxidation level of the graphene material. Future research should focus on creating larger-scale graphene membranes for use in industrial processes.

Mayar Allam, Biomedical Engineering

Graduation: May 2019
Hometown: Cairo, Egypt

Effect of Cancer Associated Fibroblasts (CAFs) on Breast Cancer Cells Proliferation Rate Using 3D Micro-engineered in Vitro Model

Mentor: Mehdi Nikkhah, assistant professor
Research Theme: Health

The primary goal of this study is to understand the effect of cancer associated fibroblasts (CAFs) on proliferation rate of different tumorigenic breast tumor cells (MDA-MB-231, MCF-7) within the native microenvironment. To achieve this, a 3D in vitro high-density tumor microarray model was used by micromolding collagen I. The tumor cells were seeded within microwells while CAFs were embedded within collagen surrounding the tumor region. Results demonstrate that while CAFs enhanced the growth of less invasive MCF-7, the proliferation rate of highly metastatic MDA-MB-231 cells was diminished. Future research can be conducted toward understanding the influence of CAFs on tumor cell invasiveness.

Anas Arafat, Industrial Engineering

Graduation: May 2018
Hometown: Kamaran, Yemen

Student Retention

Mentor: Linda Chattin, principal lecturer
Research Theme: Education

The objective of this research is to improve the freshman retention of the Ira A. Fulton Schools of Engineering. The researchers will identify characteristics of students who leave Arizona State University after their first year and examine significant factors by building statistical models to predict the causes of student attrition. The intent of these models are to guide advisors and faculty members to recognize at-risk students who have a higher probability of leaving ASU, or switching to non-engineering majors, so they can intervene to help to retain those students.

Polette Avila, Biomedical Engineering

Graduation: May 2019
Hometown: Phoenix, Arizona

3D Electroactive Poly-Amidoamine Polymer

Mentor: Jeffrey La Belle, assistant professor, Rafiqul Islam, faculty associate
Research Theme: Health

The objective of the research is to be able to work with EPOP (Electroactive Poly-Amidoamine Polymer), learn as much as possible and then mimic an EPOP filament. Important advances that have been discovered about EPOP are learning how electrons are transferred and how configuration impacts the product. Current research progress is creating the batch of EPOP and learning fundamentally how EPOP works and reacts. Afterward, the researcher will 3D print the filament and print EPOP electrodes within circuits.
Zachary Ayers, Computer Science
Graduation: May 2019
Hometown: Tempe, Arizona
A Case Study of Natural Language Processing for Human-Robot Interaction
Mentor: Yu Zhang, assistant professor
Research Theme: Education, Health
This project focuses on linking language processing with machine learning to create a robotic assistant that can decipher a range of commands. It builds off of previously developed code, focusing on getting them to work together as a voice controlled robot. The process involves building a world with a Kinect camera, extrapolating commands with learning code for the robot based on vocal commands given to Amazon's Alexa, and having the robot execute those commands. This robot could be an assistant to anyone from a person with a disability to a mechanic. Future research directions include adding mobility and object recognition.

Juan Bahena, Mechanical Engineering
Graduation: December 2017
Hometown: Phoenix, Arizona
Design and Programming of an LED Ring for Visual Feedback on a Swarm Robotic Platform
Mentor: Spring Berman, assistant professor
Research Theme: Security
Swarms of autonomous robots can potentially perform tasks, such as surveillance, chemical detection and search-and-rescue missions. The purpose of this research is to implement LED rings on small mobile robots to display colors that correspond to their behavioral states, such as “idle” and “searching.” Image processing algorithms are programmed on each robot’s computer to interpret neighboring robots’ LED colors from images acquired by the robot’s onboard camera. Future research can focus on detecting robot states from aerial vehicles, such as quadcopters, and developing better visual feedback with faster microprocessors and improved image detection algorithms.

Matthew Bajamundi, Aerospace Engineering
Graduation: May 2019
Hometown: Tempe, Arizona
The Effects of Propeller Configurations on Aerodynamic Surfaces
Mentor: Timothy Takahashi, professor of practice
Research Theme: Education
The effects of blockage behind a propeller will be tested through various static and dynamic tests in a wind tunnel. Such a blockage behind the airfoil may affect the overall performance of an aircraft. To address such a problem, different airfoil shapes will be tested with a set motor and propeller configuration. Using a force sensor, the amount of thrust produced by the propeller will be measured and tabulated to determine the advantages and disadvantages of certain airfoils. This data can help students and the general aerospace community in the building and design of aircraft structures.

Samantha Baker, Informatics
Graduation: May 2018
Hometown: Danville, California
Robot Interaction: Investigating the Influence of Gestures on Robot’s Social Presence
Mentor: Erin Walker, assistant professor
Research Theme: Education
The objective of this project is to determine whether the realism of a humanoid robot’s gestures has an impact on people's perceptions of its friendliness and humanlike qualities. Researchers implemented 20 gestures on the NAO humanoid robot to compare participants’ perceptions of a learning companion robot that performed no gestures, realistic gestures, and exaggerated or cartoonish gestures. Knowing whether social engagement can be increased by tailoring the type of gestures the robot uses could be a valuable tool for future robotic learning companions.
Quantifying the Corrosion Characteristic of Alkali-Activated Concretes Using Electrochemical Impedance Spectroscopy

Mentor: Narayanan Neithalath, professor
Research Theme: Sustainability

Alkali-activated (A-A) concretes can reduce or eliminate the need for carbon dioxide intensive ordinary Portland cement (OPC) as a binder. To investigate the effect of A-A systems’ higher alkalinity on the chloride-induced corrosion of steel reinforcement, electrochemical impedance spectroscopy was performed on carbon steels inside of simulated pore solutions (SPS) as well as A-A SPS at varying chloride ion concentrations. Concrete systems which facilitate the passivation of reinforcement steel, and therefore halting corrosion, are suitable for constructing durable and sustainable structures in chloride-intensive environments, such as saltwater jetties or bridge decks subjected to de-icing salts. This research integrates an entrepreneurial mindset by applying curiosity and connections to create extraordinary value for stakeholders.

Nanoparticle Delivery through a Resection-Disrupted Blood Brain Barrier for the Treatment of Glioblastoma

Mentor: Sarah Stabenfeldt, associate professor
Research Theme: Health

The standard of care for Glioblastoma (GBM) is surgical resection; however, tumors recur within a few centimeters from the resection cavity behind an intact blood-brain-barrier (BBB). This project looked at the spatiotemporal disruption of the BBB by surgical resection to deliver nanoparticles (NPs) to the peri-resection tissue (PRT). When NPs were administered immediately after surgery, they reached PRT. When administered two hours after surgery, they reached distant tissue. This work provides insight into treating GBM’s invasive tumor cells. Future studies will use immunohistochemistry to investigate the infiltration of inflammatory cells to identify possible mechanisms for NP accumulation.

Evaluating the Effect of Visual Stimuli on the Intelligibility of Dysarthric Speech

Mentor: Troy McDaniel, research assistant professor
Research Theme: Health

The main goal of this project is to see if the dysarthric speech can be more easily understood if a visual modality is introduced. Dysarthria is a speech disorder which makes individuals difficult to understand due to impaired movement of the muscles used for speech. Showing that the pairing of visual and audio will increase intelligibility will open doors for technical advancements in speech recognition. The next step is to take the data set from this project and show where and how improvements can be made in state-of-the-art technologies.

Study of Liquid Phase Exfoliation for Obtaining Desired TMC Nanomaterial Dimensions

Mentor: Sefaattin Tongay, assistant professor
Research Theme: Sustainability

Transition metal chalcogenides (TMCs) is a class of layered materials. As it is exfoliated toward a monolayer, properties may shift in technologically advantageous ways. Liquid phase exfoliation (LPE) was studied to understand how LPE parameters affect distribution of TMC nanomaterial dimensions and nanomaterial properties to increase the efficiency of obtaining needed nanomaterials for study. Two important issues were resolved by using a vacuum filtration system, which are of the following: suspending nanomaterial in dried solvent and obtaining a limited quantity. Now that a workable amount of nanomaterial is obtainable, further research will delve into the aforementioned topics and devices to bypass silicon-based device restrictions.
Brittany Blevins, Mechanical Engineering Systems
Graduation: December 2018
Hometown: Mesa, Arizona

SolarSPELL
Mentor: Laura Hosman, assistant professor
Research Theme: Education Health

SolarSPELL is a Solar Powered Educational Learning Library, which is a digital library over an off-line Wi-Fi hotspot, and it’s designed to simulate an online experience. Making use of open-source educational resources and ever-smaller and more efficient technology, SPELL provides an all-in-one, self-powered plug-and-play kit, ready to be deployed with absolute minimal training or maintenance required for start-up and continued operation. This project's goal is to support education in all subject areas and enable the development of Internet-relevant skills by providing access to books, videos, and other valuable educational content through an offline digital library, including content specifically curated for the Pacific Islands.

ASU KERN Project KEEN supported FURI student

Andrew Boateng, Engineering (Robotics)
Graduation: May 2018
Hometown: Kumasi, Ghana

How Does a Robot’s Expression of Certainty Affect Human Trust in a Robot?
Mentor: Angela Sodemann, assistant professor
Research Theme: Education, Health, Security

As robotics technology advances, robots are being created for use in situations where they collaborate with humans on complex tasks. For this to be safe and successful, it’s important to understand what causes humans to trust robots more or less during a collaborative task. This research project aims to investigate human-robot trust through a collaborative game of logic that can be played between a human and a robot. The robot's expressions of certainty will be varied, and the human's likelihood of accepting the robot's information will be measured.

Julia Boese, Chemical Engineering
Graduation: May 2018
Hometown: Gilbert, Arizona

Modulating the Heat Shock Response in E. coli to Regulate Membrane Protein Expression
Mentor: Brent Nannenga, assistant professor
Research Theme: Health

Membrane proteins (MP) show potential as pharmacological targets, yet research lags due to expression-related cell toxicity. It was hypothesized that modifying the heat shock response of Escherichia coli (E. coli), by inserting antisense DNA to vital MP binding-site sequences, could regulate and optimize MP expression. Two antisense sequences were each cloned into an E. coli vector where the cell growth could then be tested. A 40 percent growth difference favored the non-MP-expressing controls over the expressing cells, with no significant difference seen between the expressing and test cells. Further work includes determining experimental design flaws and their effect on the data.

Alireza Boloori, Industrial Engineering
Graduation: December 2018
Hometown: Tempe, Arizona

Data-Driven Management of Post-Transplant Medications: An APOMDP Approach
Mentor: John Fowler, Motorola Professor of International Business, W. P. Carey School of Business
Research Theme: Health

Patients after organ transplantations receive high amounts of immunosuppressive drugs (e.g., tacrolimus) to reduce the risk of organ rejection. However, this practice has been shown to increase the risk of new-onset diabetes after transplantation (NODAT). The researchers propose an ambiguous partially observable Markov decision processes (APOMDP) framework to generate effective medication management strategies for tacrolimus and insulin. This approach increases the patient's quality of life while reducing the effect of transition probability estimation errors. The researchers also provide several managerial and medical implications for policy makers and physicians.

Graduate Research Travel Grant
Of all the joints on the body, the ankle is the most susceptible to abuse, which greatly impairs mobility. The development of a system of wireless sensors can aid in the treatment of these ankle injuries by allowing rehabilitation therapists to provide more detailed care to their patients. Through designing many different sensor configurations and comparing them with current methods of measuring the desired information it has been found that the best way to collect the data is using low-profile “button” type sensors. Future designs will lead to smaller and more accurate sensors.
<table>
<thead>
<tr>
<th>Name</th>
<th>Field</th>
<th>Graduation</th>
<th>Hometown</th>
<th>Project Title</th>
<th>Mentor</th>
<th>Research Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The effects of ultrasound on the regeneration process of silica gel are investigated with the assistance of IR imaging. The purpose is obtain a better understanding on how ultrasound affects heat and mass transfer in silica gel and like-adsorbents so that the performance of adsorption cooling systems may advance. It has been found that ultrasound does improve heat transfer, as well as increase desorption rate. The first experiment has revealed design flaws that dampen the ultrasonic effect. Recommended work for the future would be to design the experiment to be a closed system with an air flow with controlled humidity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Prosthetic hands can be costly and complicated. This project investigates implementing underactuation and laminate fabrication techniques to simplify the problem at low cost. The deflection of flexible laminate links can be used to sense the location, magnitude and number of contact forces by matching link curvature existing beam models. This concept is embodied in a prototype hand with embedded, modified flex sensors that measure link curvature. This allows for detection and avoidance of high-force contact situations. Collected data can be used to graphically plot the curvature of the hand's deformation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>This project seeks to adapt previously developed laser-activated sutures for use in intestinal surgeries. Previous work in this area developed laser activated sutures that improve wound healing by providing an immediate seal upon activation through laser irradiation. This project will help address the issue of common, life-threatening complications in intestinal surgeries due to the absence of such a seal. The current aim of this research is to do this by improving the mechanical strength of previously developed laser-activated sutures under wet conditions through chemical cross-linking. Future work will include in vivo testing of these sutures in rat models.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The goal was to investigate the impact of the National Academy of Engineering’s Grand Challenge Scholars Program on student development as Grand Challenge Scholar-Engineers. Qualitative coding methods were used to analyze student portfolios and interview data. Preliminary relationships between navigation, identity formation and disciplinary knowledge on student growth were identified. Future work includes collecting and analyzing additional portfolio, interview and survey data to provide stronger evidence for or changes to the preliminary conclusions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Quantifying Fatigue in EMG Signals

Mentor: Panagiotis Artemiadis, associate professor
Research Theme: Health

The purpose behind this research is to study and quantify how electromyographic (EMG) signals are affected when muscles start to become fatigued. To achieve this goal, the EMG signals are processed in order to identify key features in the time and frequency that are representative of muscle fatigue. This research leads to the control of robotic devices that may be used to assist human limbs in an attempt to help them become mobile.

Krysta Clark, Chemical Engineering
Graduation: May 2018
Hometown: Phoenix, Arizona

Nanostructured Faujasite Zeolites for Carbon Dioxide Adsorption
Mentor: Shuguang Deng, professor
Research Theme: Sustainability

The objective of this research is to determine how the adsorption breakthrough properties of a nanostructured Faujasite zeolite vary with gas composition, pressure, and flow rate in a gas chromatographer apparatus. The adsorption and pressure data of N2, CH4, and CO2 were analyzed to determine if they fit the linear, Langmuir, and/or Freundlich isotherms. The proposed improvements to the current zeolite based post-combustion capture system will be scalable to industry, providing an economical way to reduce carbon dioxide emissions. Future research will be conducted in alumina tubes of varying sizes.

Sydney Connor, Biomedical Engineering
Graduation: May 2019
Hometown: Lake Stevens, Washington

Age-Related Declines in Generalization of Motor Skill Learning: Implications for Task-Specific Training in Older Patients
Mentor: Sydney Schaefer, assistant professor
Research Theme: Health

Task-specific training promotes relearning of a motor skill through repetitive practice, but can other tasks also improve? Since many patients undergoing neurorehabilitation are over the age of 65, the purpose of this study was to test whether the aging brain can generalize learned information between two motor skills. The researchers hypothesized that in adults 65 and older, repetitive practice of one skill would improve performance of a different motor skill that was not practiced. Regression analysis revealed that the older the participants the less they generalized. Results suggest that task-specific training may not be beneficial for older patients in neurorehabilitation.

Zackary Crosley, Computer Science
Graduation: December 2017
Hometown: Brentwood, California

Toward Inductive Reverse Engineering of Web Applications
Mentor: Adam Doupé, assistant professor
Research Theme: Security

This research employs reverse engineering techniques to identifying the logic behind existing software without direct access to its source code. By comparing automatically generated input to output, the research application can develop equivalent software instructions through inductive programming techniques augmented for web applications without a database (state) or loops. The researcher will produce an application tool REClone that incorporates this functionality and provide evaluation methods, which indicate successful replication of various tests. Future extensions of the REClone tool may apply the program clone for identifying security risks and add support for databases and loops.
Eric Dan, Chemical Engineering
Graduation: May 2019
Hometown: Gilbert, Arizona
Enhancing Inorganic Carbon Uptake in Synechocytis
Mentor: Brent Nannenga, assistant professor
Research Theme: Energy, Sustainability

Knowledge of hydrophobic membrane proteins has been rare due to the difficulty of capturing the structure of the protein without any contaminants or dissociation of the protein. Although it requires a substantial amount of work and resources in determining the protein structures of insoluble membrane proteins, the product is quite rewarding. Referencing the research conducted in Nannenga’s lab, one of the goals is to increase the efficiency uptake of bicarbonate of proteins, such as BicA and SbTa protein through repetitive processes to isolate the membrane protein to contribute to biofuel and biochemical production.

Himanshu Dave, Aerospace Engineering
Graduation: May 2019
Hometown: Ahmedabad, India
Decentralized Autonomous UAV Systems
Mentor: Panagiotis Artemiadis, associate professor
Research Theme: Energy, Health

This research investigates communication between multiple aerial robots through a decentralized system. This provides solutions to many problems in the real world, specifically in disaster-management and security sectors. Drones can be controlled autonomously using optical flow, cameras and client-server systems. A key area to develop in the future is to remove the drones from an inbuilt environment and take them to the real world where there are no ideal environments, and the drones can still recognize objects and surroundings.

Ryan Davis, Aerospace Engineering
Graduation: May 2018
Hometown: Plano, Texas
FA-18 Hornet Nonlinear Dynamic Controller
Mentor: Matthew Peet, associate professor
Research Theme: Security

High-performance aircraft today are inherently unstable, and thus can fall into unstable flight modes. The pilot can often control the aircraft to regain stable flight, but in extreme cases a controller may be required to avoid a crash. The first objective of this project sought to develop a linearized model of the FA-18’s nonlinear dynamic system. After a linearization is created, MATLAB is used to develop an MPC (model-predictive controller) to initialize the system in falling-leaf mode and drive the aircraft to stable flight conditions as quickly and efficiently as possible.

Brandon Dawson, Aerospace Engineering
Graduation: May 2019
Hometown: Phoenix, Arizona
Propeller Dynamics of Quadcopters
Mentor: Wenlong Zhang, assistant professor
Research Theme: Security

The objective of this research project is to create a more accurate quadcopter model that can be used to better test the stability of the quadcopter without risking hardware damage caused by experimental testing. This will be done by implementing a dynamic propeller model into a simulation space, Air Sim, in order to better represent the propeller effects on the motion of a quadcopter. The successful completion of this project will eventually allow for the further development of stable autonomous tandem flight between multiple quadcopters.
Arlin Dean, Industrial Engineering
Graduation: December 2018
Hometown: Lake Havasu City, Arizona
Guiding Power Grid Investments for Mitigating the Effects of Extreme Weather Events
Mentor: Adolfo Escobedo, assistant professor
Research Theme: Sustainability

Extreme weather events can cause damage to current power systems infrastructure resulting in power outages that range in severity from hours to days. This project seeks to utilize a recovery decision model to minimize power lost from load shedding due to blackouts. A comparative analysis is conducted between optimized transmission line switching and the adoption of high temperature low sag lines using simulated outage conditions. Current analysis demonstrates positive results in conjoined utilization of both technologies. In the future, economic constraints will be added to the model to better reflect real-world investment decisions.

Aditya Deotale, Computer Science
Graduation: May 2018
Hometown: Chandrapur, India
Security vs. Usability: Impact of Artificial Intelligence on the Society Using Social Media Data
Mentor: Subbarao Kambhampati, professor, Lydia Manikonda, graduate research associate
Research Theme: Security

The recent breakthroughs in Artificial Intelligence (AI) have allowed individuals to rely on automated systems and are helping humans be productive and efficient in their everyday tasks at home or workplace. Some of these systems include devices like Amazon Echo and Google Home, which are also called Intelligent Personal Assistants (IPAs). The researchers aim to investigate how and why users are balancing the usability vs. privacy while utilizing IPAs and specifically the privacy effects on individuals using machine learning techniques.

Ermias Dheressa, Chemical Engineering
Graduation: May 2018
Hometown: Ethiopia
Degradation Kinetics of PLGA Fiber Mat as a Function of its Diameter and its Drug Releasing Dynamics
Mentor: Matthew Green, assistant professor
Research Theme: Health

Chronic wounds affect more than 6.5 million people in United States. Despite $25 billion in annual expenditures for treatment, a significant number of cases have a poor prognosis of which a majority lead to amputation. The objective of this research is to fabricate poly(lactic-co-glycolic acid) (PLGA) electrospun fibrous mats, study the degradation kinetics in phosphate buffer saline, and investigate drug release dynamics. The fibrous mat will be used as a wound dressing, which gives excellent mechanical.

Scott Fitsimones, Computer Science
Graduation: May 2019
Hometown: Phoenix, Arizona
Computer Vision for Environment Mapping
Mentor: Troy McDaniel, research assistant professor
Research Theme: Health

This project investigates how computer vision and haptic feedback can assist individuals who are blind with gaining familiarity with new environments. The first phase involved the development of a model to detect objects using OpenCV, in an effort to help users detect and avoid obstacles. While results were promising, the approach lacked generalization and required training on every object. The next phase will involve the sensing and display of a depth map of the environment, using the Orbbec Astra 3D camera and a vibrotactile display, respectively, to help individuals who are blind navigate crowds, rooms and obstacles via sensory substitution.
Diane Flores, Engineering (Robotics)
Graduation: December 2017
Hometown: Gilbert, Arizona

Haptic Vision Substitution
Mentor: Angela Sodemann, assistant professor
Research Theme: Health

The goal of the Haptic Vision Substitution Project is to create a device that will assist the blind in “feeling” their surroundings. The device under research and development is a 64x64 vibrating pin array that will emulate visual feedback from the user. This technology heavily relies on the user’s ability to associate vibrating frequencies with what is interpreted as a specific light intensity. By utilizing SolidWorks and Wire EDMs, researchers under this project are creating prototypes of the pin arrays responding to various sound frequencies. Future goals include converting the visual feedback into frequencies that will vibrate corresponding pins.

Collin Foster, Mechanical Engineering
Graduation: May 2018
Hometown: Tucson, Arizona

Damage Tolerant Design Guidelines for Seamless Carbon Fiber Composite Structures for Pressurized Cylinders
Mentor: Masoud Yekani Fard, assistant research professor, Aditi Chattopadhayay, Regents’ Professor
Research Theme: Security, Sustainability

The main objective of the research is to develop design guidelines for damage tolerant structures for circular hollow sections of seamless carbon fiber reinforced polymer (CFRP) matrix composites. The results of the investigation will result in design guidelines for different fracture modes. The shape factor for inner and outer cracks in circular hollow sections will also be investigated. The testing of these pressurized pipes has many applications, such as rehabilitating mechanical systems in power plants. Improved understanding of seamless CFRP composites will improve the safety and service life of many integral structures throughout the nation.

Linda Fou, Mechanical Engineering
Graduation: May 2018
Hometown: Gilbert, Arizona

The Variable Impedance Treadmill (VIT) for Robot-Assisted Rehabilitation
Mentor: Panagiots Artemiadis, associate professor
Research Theme: Health

For individuals with impaired gait, recovering walking ability is a priority and a challenge. This research focuses on the development and characterization of the Variable Impedance Treadmill (VIT), a novel device that can alter the surface compliance felt by users, and, for the first time, enables all forms of impedance in a surface to be controlled. This work has potential applications in walking surface simulation, gait investigation and robot-assisted rehabilitation technology.

Andrew Garman, Interdisciplinary Studies (Applied Analytics and Business)
Graduation: December 2017
Hometown: Scottsdale, Arizona

AZLoop, Arizona’s SpaceX Hyperloop Competition
Mentor: John Robertson, professor
Research Theme: Energy

The AZLoop Hyperloop team sees an opportunity to bridge the gap between sustainable and affordable transportation by developing a high-speed ground transportation system contained in a near-vacuum tube environment. The Hyperloop system will reach speeds of 760 mph and sustainably operate emissions-free with Lithium-ion batteries and compressed air, connecting our world faster and more sustainably than any existing form of transportation. AZLoop is a team of high caliber graduate and undergraduate students from Arizona’s universities. Collectively, the team aims to bring the Hyperloop to Arizona and the world at large.
Developing a Waypoint Navigation System for Unmanned Aerial Vehicles

YiZhuang Garrard, Engineering (Robotics)
Graduation: May 2019
Hometown: Tokyo, Japan

There is no tablet-based ground control system (GCS) that controls multiple UAVs simultaneously. The development of such a GCS permits certain business and humanitarian activities to be automated, such as land surveying and finding people in disaster areas. This project combines elements from open-source desktop and mobile GCSs to create a final product, which can control multiple UAVs concurrently from a single mobile interface. Future work includes integrating automated land surveying capabilities and human detection using machine vision.

Yield Release of Local Anesthetics Via Novel Polymer Hydrogel

Daniel Gentry, Biomedical Engineering
Graduation: May 2017
Hometown: Gilbert, Arizona

Post operational surgical pain is experienced in 30 percent of patients, and while being uncomfortable, it can also hinder recovery if improperly managed. Typical narcotic non-steroidal anti-inflammatory drugs treatments can have severe side effects or facilitate addiction while local anesthetics are limited by effective time interval and difficult dosing. The goal of this research is to develop a polymer hydrogel that provides sustained delivery of local anesthetics to the surgical site; therefore, making local anesthetics a viable pain management methods and eliminating the risk of severe side effects or drug dependency.

Canaries in Native Android Libraries

William Gibbs, Computer Science
Graduation: December 2018
Hometown: Phoenix, Arizona

The purpose of this project is to determine how prevalent the canary security feature is in android applications. Applications that do not contain canaries are potentially easier to exploit. A large sampling of android applications will be taken and analyzed to determine if they have canaries and if they have a predisposition for containing canaries based on date or development platform. Results indicate that approximately 3 percent of all Android applications do not contain canaries. Future research goals include creating a framework for determining the exploitability of these applications.

Dielectrophoretic Response of Condensed DNA Clusters in AC Fields

Anikki Giessler, Chemical Engineering
Graduation: May 2018
Hometown: Tempe, Arizona

Insulator-based dielectrophoresis (DEP) has been applied in analytical research as a method to separate DNA in lab-on-a-chip devices. The development of similar continuous-flow, size-based separation techniques for DNA next-generation sequencing (NGS) could advance the speed and efficiency of in situ analysis of genomic/biological data. The researchers believe applied low-frequency potentials generates clustering behavior, which influences the dielectrophoretic response of DNA. DNA clustering was largely observed with frequencies ranging from 10-100 Hz and electric field strengths above 800 V/cm. Future work aims to enhance techniques capable of automatically tracking DNA clusters throughout high-frame rate imaging to further understand clustering and transport mechanisms.
Testing for Molecular Recognition Elements on Screen Printed Graphite Electrodes

Mentor: Jeffrey La Belle, assistant professor

Research Theme: Health

The research goal is to create a point-of-care sensor capable of measuring glucose and insulin levels simultaneously. Point-of-care glucose sensors have been prepared and tested. This same sensor preparation technique will be used to create a point-of-care insulin sensor. Once this step has been accomplished, the protocols will be combined such that the sensor can detect both insulin and glucose. This research will improve the management of diabetes and provide a better overall picture of patient health. Future research could investigate the differences in detecting long-acting versus short-acting insulin.

Assessing the Ability of Startle to Predict Learning Retention

Mentor: Claire Honeycutt, assistant professor

Research Theme: Health

The ability to learn and retain new motor tasks is essential to everyday life; however, the neural mechanisms governing this process are poorly understood to date. Recent evidence demonstrates that a shift from cortical to subcortical structures occurs during procedural task learning, detected by startle-evoked movement (SEM). The objective of this study is to determine if SEM presence can predict learning retention. Subjects are trained a novel finger movement and analyzed after one month to examine retention. This research has future implications for enhancing motor performance of older adults and patient populations who struggle with learning or retaining learning.

IMODS

Mentor: Srividya Bansal, associate professor

Research Theme: Education

The purpose of the Instructional Module Development (IMOD) software system is to guide instructors, step-by-step, through an outcome-based education process through which they will define learning objectives, select the content that is to be covered and define the learning environment and context for their course(s). IMODs is designed to assist new teachers instructing in science, technology, engineering and math (STEM) degree programs to create better course curriculum that will improve the educational experience for students. The objective of this FURI project is to assess the effectiveness, efficiency and usability of the IMOD system in creating outcome-based course design.

A Computational Model for Evaluating Cross-Linguistic Differences in Patients with Parkinson’s Disease

Mentor: Visar Berisha, assistant professor

Research Theme: Health

Sufferers of the motor speech disorder dysarthria see a marked decline in their intelligibility, and by extension, quality of life. Until recently, it was thought that dysarthria affected a bilingual person’s ability to speak both of their languages equally, but recent research has shown that dysarthria may instead have language-specific effects. The research in this project delved more deeply into this area, using state-of-the-art signal-processing techniques to analyze acoustic variables from recordings of bilingual dysarthria patients. Through this quantification of the differential effects of dysarthria, it is hoped better treatments may be made available to bilingual sufferers of the disease.
The research goal is to see if the dysarthric speech can be more easily understood if a visual modality is introduced. Dysarthria is a speech disorder which makes individuals difficult to understand due to impaired movement of the muscles used for speech. Showing that the pairing of visual and audio will increase intelligibility will open doors for technical advancements in speech recognition. The next step is to take the data set from this project and show where and how improvements can be made in state-of-the-art technologies.

Sue Han, Chemical Engineering

Graduation: May 2017
Hometown: Phoenix, Arizona

Optimizing Cell Growth and Protein Expression in Escherichia coli

Mentor: Brent Nannenga, assistant professor
Research Theme: Health

The research studied the effects of heat shock promoters and antisense mRNA inserts in plasmid on E. coli growth and membrane protein transcription rates. Through cell transformation and optical density studies, it has been found that the protein expression within cell increases as cell growth rate decreases. Increase in protein expression will aid in further study of membrane proteins, which are used as markers for targeted medicine and detection of diseases. Further studies with different membrane proteins will show if the findings are universal or not.

Hunter Haynie, Chemical Engineering

Graduation: May 2019
Hometown: Gilbert, Arizona

Effect of Defects on UIO-66 and How it Affects Ferrocene Uptake

Mentor: Bin Mu, assistant professor
Research Theme: Sustainability

Metal-organic frameworks (MOFs) are porous materials with large surface areas that are made up of inorganic metals and organic ligands. They are currently being studied vigorously for gas separations. The impact of increasing defects, or missing ligands, on UIO-66 was studied to see if this would increase the incorporation of ferrocene into its framework. Ferrocene is a redox-active organometallic molecule that increases O₂ adsorption once it is a component of the molecule. If it is found that there is a relationship between defects and ferrocene incorporation, further studies will be conducted to test their O₂ adsorption.
Joseph Herrera-Theut, Civil Engineering
Graduation: May 2019
Hometown: Scottsdale, Arizona
How Technology Influences Engineering Education
Mentor: Kristen Ward, lecturer
Research Theme: Education

The research study is being conducted to develop new technological methods with which incoming students can learn MATLAB skills. In all fields of engineering, computer programming skills are crucial to computing complex systems. An initial student survey was conducted to understand the varying skill levels and technological backgrounds. The survey showed that many students are more comfortable using a smartphone rather than a computer. A MATLAB code is being created that students will run from the MATLAB app, which will help teach the basics of the program.

Daniel Hill, Computer Science
Graduation: May 2019
Hometown: Chandler, Arizona
Using Dynamic Localization with Holograms to Improve Human Robot Interaction
Mentor: Yu Zhang, assistant professor
Research Theme: Education, Security

How can holographic technology make human-robot interactions more intuitive? The goal of this research project is to connect the Microsoft Hololens spatial mapping to the simultaneous localization and mapping (SLAM) of the Velodyne laser sensor. This would allow dynamic localization communication between the Hololens and any robot using the laser sensor. Thus far, the spatial mapping of the Hololens and Velodyne sensor are set up and the code is underway to communicate between the two. Once this channel of communication is set up, then practical applications can be developed to enhance human-robot interaction.

Lucien Hollins, Aerospace Engineering
Graduation: May 2019
Hometown: Richmond, Virginia
Assessing the Utility of Additive Manufacturing CubeSat Structures with Alternative Materials
Mentor: Daniel White, lecturer
Research Theme: Education, Security

Use of additive manufacturing and modern materials can potentially reduce cost and assembly time of CubeSat structures and has the potential to improve material properties versus the standard aluminum. A material and satellite structure design have been selected based upon structural integrity, cost, and the ability to manufacture. The research has evolved from attempting to prove the concept of additive manufacturing of CubeSats to challenging the current standard. The standard specifies the use of aluminum, a material with high embodied energy and subsequently is less sustainable. Future research would further pursue new materials or configurations.

Anna Hu, Mechanical Engineering
Graduation: May 2019
Hometown: Manhattan, New York
Effect of Temperature on Microfibrillar Adhesives
Mentor: Hamid Marvi, assistant professor
Research Theme: Energy, Sustainability

Modern adhesives have a few major flaws: failing under extreme temperatures and an inability to detach. A switchable gecko inspired microfibrillar adhesive eliminates one of these issues by detaching through the buckling of fibers. The goal is to create an adhesive based on this microfibrillar structure that can withstand space conditions. The adhesive force of these adhesives, fabricated from PDMS and Polyurethane (PU), is tested over temperatures from -150 to 150 degrees Celsius to determine an optimal material and shore for space applications. This knowledge would further the ability for robots to participate in space exploration and maintenance.
Zachary Humphreys, Biomedical Engineering
Graduation: May 2019
Hometown: Corvallis, Oregon

Clinical Imaging of White Matter to Improve Epilepsy Surgery Planning
Mentor: Vikram Kodibagkar, associate professor
Research Theme: Health

In epilepsy, malformations that cause seizures are identified with neuroimaging to help diagnosis and plan surgery. Advanced imaging methods have the potential for improving the clinical approach to epilepsy. Diffusion tensor imaging (DTI) uses MRI to measure white matter of the brain and is a promising, advanced imaging method that has not been well explored clinically, despite its heavy presence in research. This project develops a DTI post-processing pipeline for detecting white matter malformations and guiding surgical resections for improving surgical outcomes for patients who suffer from epilepsy.

Timothy Huynh, Computer Systems Engineering
Graduation: May 2019
Hometown: Milwaukee, Wisconsin

Developing Autonomous Control for a Motorized Phenotyping Cart for Improved Imaging Quality and Reduced Labor
Mentor: Wenlong Zhang, assistant professor
Research Theme: Health, Sustainability

Autonomous control is a method of integrating sensors and programming to be able to operate mechanisms without the full need of user input. Phenotyping is the evaluation of physical characteristics of genes, in the case of this project is evaluating plant traits. This project is in cooperation with the USDA’s (United States Department of Agriculture) branch in Maricopa, Arizona. This project of autonomous control and phenotyping can reduce the labor needed to operate machines during the dangerously high temperatures that Arizona is known for. Future work will include developing the autonomous cart with higher end sensors to improve phenotyping.

Ishitha Jagadish, Biomedical Engineering
Graduation: May 2019
Hometown: Gilbert, Arizona

The Feasibility of Iron Oxide Nanoparticles in Monitoring Traumatic Brain Injury
Mentor: Sarah Stabenfeldt, associate professor
Research Theme: Health

Traumatic brain injury (TBI) is a leading cause of death and disability with limited options in diagnostics and therapy. This project aims to elucidate the feasibility of iron oxide (IO) nanoparticles (NPs) for TBI diagnostics via the dual functionality of the NPs (magnetic resonance and near-infrared imaging). NP characterization included size, zeta potential, morphology and relaxivity measurements. The NPs were injected into a mice TBI model followed by post-mortem histological staining for IO (Prussian blue staining) and fluorescence microscopy to assess NP localization in vivo. Future research includes incorporating novel materials within NPs to achieve therapeutic outcomes for TBI cases.

Cody Iwertz, Computer Systems Engineering
Graduation: December 2019
Hometown: Las Vegas, Nevada

Predicting Cyber Attacks Using a Data Driven Approach
Mentor: Paulo Shakarian, assistant professor
Research Theme: Security

This research aims to relate events of software vulnerability mentions found in darkweb/deepweb (D2web) sites with data about events of real-world cyber-attacks obtained from external sources. Using a data driven approach, vulnerability mentions on D2web sites preceding real-world attack events are analyzed to learn causal rules. These rules will subsequently be useful to predicting future real-world cyber-attacks, which helps in setting up proper countermeasures to prevent possible damage (e.g., data breach or web services interruption). Future work includes further classifying the different types of D2web events to reason about causality relationships with external sourced data and learn further rules.

Ishitha Jagadish, Biomedical Engineering
Graduation: May 2019
Hometown: Gilbert, Arizona

The Feasibility of Iron Oxide Nanoparticles in Monitoring Traumatic Brain Injury
Mentor: Sarah Stabenfeldt, associate professor
Research Theme: Health

Traumatic brain injury (TBI) is a leading cause of death and disability with limited options in diagnostics and therapy. This project aims to elucidate the feasibility of iron oxide (IO) nanoparticles (NPs) for TBI diagnostics via the dual functionality of the NPs (magnetic resonance and near-infrared imaging). NP characterization included size, zeta potential, morphology and relaxivity measurements. The NPs were injected into a mice TBI model followed by post-mortem histological staining for IO (Prussian blue staining) and fluorescence microscopy to assess NP localization in vivo. Future research includes incorporating novel materials within NPs to achieve therapeutic outcomes for TBI cases.
Everett Johnson, Electrical Engineering  
Graduation: May 2018  
Hometown: Tempe, Arizona  
**Novel Solar Array Interface Electronics for Maximum PV Power Extraction**  
Mentor: Jennifer Kitchen, assistant professor  
Research Theme: Energy  

Current technology in solar arrays does not allow for the full amount of power produced to be utilized. The purpose of this project is to analyze the performance of current solar arrays and develop an electronic interface with better performance by optimizing the individual power converter circuits used in the arrays. The configuration is followed by determining the best type of switch to use in the solar arrays. Future work will include creating a prototype to test the configurations designed.

Ladan Kamali Sarvestani, Biomedical Engineering  
Graduation: May 2018  
Hometown: Tempe, Arizona  
**Quantifying Post-Surgical Brain Shift to Improve Multi-Modal Imaging Applications in Surgical Treatment of Epilepsy**  
Mentor: Vikram Kodibagkar, associate professor  
Research Theme: Health  

Clinicians use images and electrical recordings of the brain to identify brain tissue that can be removed to treat epilepsy. However, co-localizing the electrodes on pre-operative images can be challenging because the brain shifts during surgery. Though this brain shift is not a clinical issue, accounting for the shift is critical for state-of-the-art epilepsy diagnosis methods that combine imaging and electrophysiology. This study characterized the post-operative brain shift by quantifying the distance between the implanted electrodes (from post-operative CT images) and the pre-operative brain surface (from MRI). Knowing the expected shift will help clinicians interpret post-surgical data.

Yunyi Kang, Industrial Engineering  
Graduation: May 2020  
Hometown: Harbin, China  
**Flexible Maintenance Schedules for Multistage Degradation Systems**  
Mentor: Feng Ju, assistant professor  
Research Theme: Energy, Sustainability  

This project develops preventative maintenance strategies for manufacturing system with machines suffering multi-stage degradation. With the help of Markov decision model and analytical approaches, systematic maintenance schedules are generated considering both machine states and buffer levels. Moreover, this project achieves high flexibility than previous research work so that a machine can be recovered to any better operating state through partial maintenance. Computation experiments show that system performance is better than other existing methods. Furthermore, the work can be extended to incorporate into smarting manufacturing systems and achieve multiple goals, such as energy saving and waste reduction.

Mark Kapron, Electrical Engineering  
Graduation: May 2019  
Hometown: Chandler, Arizona  
**Using TI SensorTags to Enhance Athlete Performance through Wireless Motion Analysis**  
Mentor: Trevor Thornton, professor  
Research Theme: Health  

It has been observed that there is a greater frequency of injury to the ankle of gymnasts while in competition compared to practice. To better understand the forces applied to the ankle upon impact with the ground, this research will use accelerometer data collected through a wireless sensor to measure forces in three axes. Using resources from Texas Instruments, the researcher designed code to remotely communicate at a sub-1 GHz frequency. This tool will positively impact the health of student gymnastic athletes by building a quantitative model of their sport.
Andrew Karnes, Software Engineering
Graduation: May 2018
Hometown: Mesa, Arizona

Bipedal Stabilization Control through Use of an Onboard Neural Network: A Small-Scale Test
Mentor: Wenlong Zhang, assistant professor
Research Theme: Education

This research focuses on determining the effects of neural networks on bipedal stabilization. By using various advances in computing, the Raspberry Pi and different methods of stabilization optimization, zero moment point and biomimicry, the research is being conducted to determine if the neural network implementation positively affects the balance of a biped robot. This information can then be used in conjunction with other external stabilization methods such as Control Moment Gyrosopes.

Jayanth Karthikeyan, Aerospace Engineering
Graduation: December 2018
Hometown: Chennai, India

Orbital Debris Remediation
Mentor: Daniel White, lecturer
Research Theme: Security, Sustainability

The aim of this research is to explore and develop a new method to “deorbit the space/orbital debris with minimal extension to Kessler syndrome.” Current methods come with a heavy launch and operational cost, hence, there is a need to develop a fully re-usable CubeSat which can accomplish the mission using ion thrusters and electromagnetic/laser beam to break down the debris, which will burn upon atmospheric reentry. Advances in this research are important for future human space explorations and building sky labs like International Space Station where zero gravity scientific research takes place.

Aditya Khuller, Aerospace Engineering
Graduation: May 2019
Hometown: Delhi, India

Mapping Variability in the Medusae Fossae Formation: Yardang Morphologies, Fluvial Reworking and Crater Depth to Diameter Ratios
Mentor: Sandwip Dey, professor
Research Theme: Energy, Sustainability

The Medusae Fossae Formation is a voluminous, fine-grained deposit on Mars, thought to be of pyroclastic origin. While it contains widespread, well-preserved inverted fluvial features, its pervasive cover of dust means that little is known about its composition, and indirect means must be used to characterize its material properties. This project correlates fluvial features in the Western MFF with other indicators of material strength: yardang morphology and crater depth-to-diameter ratios. The preservation of fluvial activity indicates that some of the most well-preserved stratigraphy could perhaps be accessed by future Martian surface exploration.

Ben Killpack, Manufacturing Engineering
Graduation: May 2018
Hometown: Mesa, Arizona

Smolder: Precision Screen Printer for Conductive Circuits
Mentor: Micah Lande, assistant professor
Research Theme: Energy, Health, Sustainability

Screen-printing, traditionally used in graphic arts, is often viewed as much of art as it is a science. Many variables contribute to the overall quality of screen printed circuits. Factors such as squeegee speed, the distance of screen to the printing surface, the force of the squeegee on the screen and many other variables lead to the print’s overall quality. By automating the screen printing process, Smolder aims to better understand and control the variables associated with printing circuits.

Undergraduate Research Travel Grant Program

ASU KERN Project KEEN supported FURI student
This research project investigated the design and implementation of a motor-controlled pitot probe for measuring dynamic pressure in a wind tunnel. A basic computer coding architecture has been designed to coordinate motor movement to place the probe into position and record the pressure data to a text file. A map of the dynamic pressure for the entire cross-sectional area of the wind tunnel is useful for aerodynamicists to examine the velocity behind an object in the wind tunnel; this probe could be used to examine the wake profile behind a wing to observe lift and drag effects.

**Realtime Remote Control Application for Micro-Robots**

Mentor: Hamid Marvi, assistant professor
Research Theme: Health

With micro-robots becoming popular for medical applications, effective remote-control systems are needed to operate a micro-robot in a human body while neither tethering it to an outside device nor giving it space-consuming fully onboard systems. This research uses C++ to develop a real-time application that gives a user with a game controller predictable, measurable control over a magnetized robot via an electromagnetic field. Control is driven by the user, with assistance from sensors to correct errors and increase precision in a closed, feedback loop. Such control is necessary for operating in inaccessible, confined spaces such as the human body.

Laminate devices have the potential to lower the cost and complexity of robots. Taking advantage of laminate materials' flexibility, a high-performance jumping platform is developed. The platform is designed by simulating variable leg dimensions, first with a simplified single-mass variable-force model, and then through a full dynamic computer simulation incorporating variable lengths, densities and flexibilities. The leg design parameters are chosen to optimize jump height. The platform's jumping ability is then tested and analyzed in comparison with the simulation results. An embedded force sensor is used in conjunction with laminate materials' inherent flexibility to enable force-feedback control of the platform.

Continuously variable transmissions (CVTs) are well known for their great fuel economy, smooth stepless gear shifting and, hence, superior drivability. However, in practice, they are still not completely optimized. The CVT gear strategies can be further optimized if the driver commands can be estimated for a finite time in the future, either by using learning techniques or extra sensors. The researchers will add predicted driver commands profile to a vehicular Simulink model and observe the performance, and then compare the results with experiments. Thus the CVTs can increase the performance (fuel economy, drivability) of cars even further.
William Kostecki, Computer Systems Engineering
Graduation: December 2018
Hometown: Mesa, Arizona

Area Mapping and Localization of Drones Using Exclusively Onboard Sensors
Mentor: Panagiotis Artemiadis, associate professor
Research Theme: Security

This project seeks to create quadcopters that can use optical flow sensors for closed loop navigation of indoor and outdoor environment, while simultaneously mapping their local environment. Optical flow sensors use relative motion between two images taken by the quadcopter’s camera to determine the velocity of the quadcopter. The first objective of this project was to ensure that the optical flow sensor would be a viable (accurate) alternative for GPS tracking. Currently, the sensor is being implemented into several drones where only onboard sensors in a closed system will be used to guide their flight patterns.

Itai Goeta Kreisler, Biomedical Engineering
Graduation: May 2018
Hometown: Tucson, Arizona

Using Non-Linear Dynamics and Chaos Theory to Determine Dynamic Stability and Fall Risk
Mentor: Thurmon Lockhart, professor
Research Theme: Health

This project seeks to investigate the effectiveness of methods of measurement to determine dynamic stability for fall risk assessment. Much research has been conducted analyzing static stability, taken when standing still and for individual steps, but little research has been done on stability during dynamic movement. Since most falls occur during dynamic movement, it is important to understand dynamic stability. By understanding fall risk in patients like the elderly and those with spinal injuries causing lower extremity difficulties, it will be easier to identify rehabilitation or treatment pathways. Future work could include testing in different environments and with other perturbations.

Sidharth Kulkarni, Computer Science
Graduation: May 2020
Hometown: Chandler, Arizona

Robot Learning through Demonstration and Two-Way Interaction
Mentor: Chitta Baral, professor
Research Theme: Education, Energy, Health, Security

Robotics has two major challenges. First, the difficulty of teaching robots, and second, the inability to generalize these teachings. The goal of this research is to develop a framework for teaching tasks to robots that addresses both challenges. The primary focus is teaching through demonstration over description and natural language over computer programming. This is a step forward into the future of robotics, as it opens the door to a new world of possibilities by making robotics more accessible.

Irfan Kula, Human Systems Engineering
Graduation: May 2018
Hometown: Mugla, Turkey

IEEE International Conference on Advanced and Trusted Computing (ATC) 2017
Mentor: Rod Roscoe, assistant professor
Research Theme: Education, Sustainability

Traditional user experience assessments rely on self-report (e.g., questionnaires and interviews), performance and observational data may only partially capture users’ actual cognitive demands, processing or affect. In this paper, the researchers consider how innovative sensor-based affect detection technologies (e.g., eye-tracking, electroencephalography, galvanic skin response and facial expression analysis) may be combined to complement traditional methods. By directly measuring biometric indicators of cognitive and affective states, the researchers can gain potentially richer and more accurate insights into the user experience.

ASU KERN Project KEEN supported FURI student
System Expansion Design for a Load-Managing PV System

Mentor: Meng Tao, professor
Research Theme: Energy, Sustainability

The purpose of this project is to design a 5 kW to 10 kW load managed photovoltaic system for the use of electric vehicle charging. Batteries will be implemented into the design to simulate the charging and discharging effects of electric vehicle batteries. A suggestion for solar panel type will be made and this suggestion will help aide in the system expansion goal. Results of this expanded system will ideally approach 100 percent efficiency. Future work will include building the proposed expanded system design.

Removal of Metal Ions from Water Using Molybdenum Disulfide-Polyurethane

Mentor: Qing Hua Wang, assistant professor
Research Theme: Sustainability

Heavy metals such as lead (Pb) in water can be very harmful to human health and can originate from corroded lead pipes or fixtures. Due to their atomically thin structure, mechanical strength and large surface area, the use of two-dimensional (2D) materials are being evaluated by researchers as alternatives to the current methods of water purification. Here, the researchers will observe how much lead nitrate (Pb(NO₃)₂) can be adsorbed by a composite foam made of MoS₂ embedded in polyurethane foam. This strategy is a promising route to a cheaper, more efficient way of water filtration.

Measurements of Near-Field Radiative Heat Transfer with Polystyrene Nanoparticles as Nanometric Spacers

Mentor: Liping Wang, assistant professor
Research Theme: Energy, Sustainability

The objective of this experiment is to test radiative properties of different materials at nanometric distance separation. Polystyrene particles are spread over a material surface and used as spacers creating a nanometric separation between the two material surfaces. When heat radiation is measured across this nanometric separation, very large, previously unutilized energy amounts can be harvested. This experiment attempts to verify/validate prior research in the amount of energy that can be utilized through photovoltaics and to then further said research through the implementation of different substrate materials.

There are over 10 million people worldwide living with the debilitating effects of Parkinson’s disease (PD). Vagus nerve stimulation (VNS) is a method of stimulating the vagus nerve and is FDA approved to treat epilepsy and depression and may be a viable treatment for PD. This study focuses on the effects of VNS on both motor function and gastrointestinal impairments in a rat model of Parkinson’s disease.

A reaching task and fecal water content are used to evaluate motor and gastrointestinal effects of control, PD, and PD+VNS groups.
Cecilia La Place, Software Engineering
Graduation: May 2018
Hometown: Pembroke Pines, Florida

Engineering Students Rapidly Learning at Hackathons
Mentor: Shawn Jordan, associate professor
Research Theme: Education

Current education teaches generalized methodologies of learning, and leaves some students struggling to learn new concepts. Students should not keep falling behind because they do not know how to learn. This study sought to observe the ways self-regulated learning (SRL) presents itself in hackathon participants and getting their introspective view on how they feel they learned during the hackathon. After qualitative analysis, it was found that students having motivation in their projects were determined to learn what they needed to complete it. Further research would involve more data collection to get a broader understanding of different approaches to SRL.

Undergraduate Research Travel Grant Program

James Larson, Engineering (Electrical Systems)
Graduation: May 2018
Hometown: Incline Village, Nevada

Adaptive Expertise in Embedded Systems Design
Mentor: Shawn Jordan, associate professor, Micah Lande, assistant professor
Research Theme: Education

The mindset of an adaptive expert will serve any engineer in designing successful engineering solutions. In the embedded systems design course taught by Shawn Jordan, associate professor, students design and fabricate their own printed circuit boards (PCBs). By fabricating prototypes, students learn strategies for troubleshooting and technical design, and iterations of the part demand reflection on previous design thinking. Showing how this design curriculum fosters adaptive expertise will add to existing literature, providing a framework for stimulating adaptive design thinking in classrooms. Disseminating these findings to curriculum designers will encourage more engaging, effective classes.

Alessandro Maria Laspina, Aerospace Engineering
Graduation: May 2018
Hometown: Rome, Italy

Design and Construction of an Inverted Pendulum Thrust Stand for Low Thrust Thrusters
Mentor: Daniel White, lecturer
Research Theme: Energy

The objective is to design and manufacture an inverted pendulum thrust stand for the measurement of electric propulsion thrusters. Such devices output low thrusts for use in attitude control of satellites. An accurate enough voltage reading can be acquired by using an LVDT sensor with a system of equations describing the movement of the pendulum. The main design has been constructed via Solidworks, and is ready to be manufactured out of a lightweight and cheap aluminum alloy.

Andrew Leaton, Mechanical Engineering
Graduation: May 2018
Hometown: Vienna, Virginia

Optimal Co-Design of Structure Topology and Sensor Deployment for Balanced System Performance and Observability
Mentor: Yi Ren, assistant professor
Research Theme: Security, Sustainability

The goal of the project is to find a balance between the observability and the structural stiffness of a material topology. Such a balance is critical in the design of soft capacitive tactile sensors where the two desired properties have a fundamental trade-off. Ren’s current research found that by optimizing the topology, while fixing sensor locations, a structure optimized for observability can achieve correct force estimation within half of the response time. The researchers hypothesize that besides the topology, observability is also sensitive to sensor locations. The ongoing research will quantitatively characterize how sensor deployment affects the observability.
Sara Lee, Chemical Engineering
Graduation: May 2019
Hometown: Gilbert, Arizona
Enhancing Inorganic Carbon Absorption and Fixation by Cyanobacteria Using Amine Absorbents
Mentor: David Nielsen, associate professor
Research Theme: Sustainability

Development of sustainable efforts to capture carbon dioxide emissions are important to mitigate the effects of climate change. Bioprocesses from cyanobacteria are a promising technology to fix CO2 into biofuels. Several issues limit the viability of this use, one of which is the low solubility of CO2 in water limiting the rate of initial CO2 capture. This project considers using different amine compounds, such as putrescine and cadaverine, as absorbents to test greater growth rates and the limits of CO2 production in cyanobacteria. Future work will include testing other biocompatible absorbents and their effect in culture growth and CO2 fixation.

Zhiqian Li, Computer Systems Engineering
Graduation: December 2017
Hometown: Hangzhou, China
IoT Solution for Smart Pet Feeder
Mentor: Fengbo Ren, assistant professor
Research Theme: Health

This project’s objective is to build a smart pet feeder solution with internet of things technology. By connecting the feeder with smartphone APP through a server, the pet owner will be able to keep track of their pets' health status and make timely adjustments in the following feeding. The feeder has a built-in camera that will record the eating activities of pets, which will enhance interactions between pets and owners. Future work will focus on creating a wearable collar device for pets to collect more activities of pets.

Jennapher Lingo VanGilder, Biomedical Engineering
Graduation: May 2020
Hometown: Gilbert, Arizona
Using Clinical Neuropsychological Assessments to Predict Motor Learning in Non-Demented Older Adults
Mentor: Sydney Schaefer, assistant professor
Research Theme: Health

The purpose of this study was to test whether visuospatial testing predicted motor skill learning in nonclinical older adults. Twenty-four participants (age >65) completed an age-adjusted neuropsychological exam that assessed five different cognitive domains. Visuospatial scores predicted motor skill retention over one week, where higher scores indicated better motor skill retention. These quick tests may provide valuable insight about a patient's response to motor rehabilitation. Future directions will explore the underlying neural mechanism of why visuospatial tests appear to uniquely capture the aging brain’s motor learning capacity.

Noah Livingston, Industrial Engineering
Graduation: December 2017
Hometown: Lake Oswego, Oregon
An Optimization Model for Emergency Crew Location within a Theme Park
Mentor: Jorge Sefair, assistant professor
Research Theme: Health, Security

Every year, millions of guests visit theme parks internationally. Within that massive population, accidents and emergencies are bound to occur. Choosing the correct location for emergency responders inside the park could mean the difference between life and death. A theme park is different from a regular residential or commercial area; the crowds and shows block certain routes, and they change throughout the day. This model aims to find the optimal placement of responders at different times of the day, and maximize the number of effective responses.

Graduate Research Travel Grant
Quorum sensing systems contain a sender cell that produces chemical signals which are sent to receiver cells that initiates production of a protein, such as green fluorescent protein. In this project, the relationship between the concentration of synthetic AHLs and GFP induction by the receiver recognizing the AHLs was investigated. Using an AHL concentration range of 10E-4 M to 10E-14 M, data was acquired using a variety of synthetic AHLs and engineered receivers. The results showed a correlation between a lower AHL concentration and a lower GFP expression. These findings are useful in future research of synthetic genetic circuits.
Christopher Lue Sang, Electrical Engineering  
Graduation: December 2018  
Hometown: Mesa, Arizona  
Wearable Respiratory Sensor for the Detection of Obstructed Airways  
Mentor: Junseok Chae, professor  
Research Theme: Health  
Asthma is estimated to cost the U.S. $56 billion each year. Part of that cost comes from traditional pulmonary function tests (PFTs). Current PFTs require bulky and costly equipment, as well as trained clinicians to administer the test. This research aims to provide an alternative method for assessing lung function by constructing a wearable device capable of monitoring the wearer’s ribcage. Current findings suggest the device is capable of tracking key traits of normal or abnormal lung function. Ongoing research seeks to increase the device’s precision, improve its wearability and expand its robustness.

Kishen Mahadevan, Electrical Engineering  
Graduation: May 2018  
Hometown: Bangalore, Karnataka, India  
Centralized Control of Swarm Robots using Active Perception  
Mentor: Yezhou Yang, assistant professor  
Research Theme: Health, Sustainability  
Technological revolution in the sector of field painting has remained stagnant and has not experienced any changes from the past 10 years. The existing technology lacks accuracy and requires a lot of efforts and involves health hazards to the painters. Using swarm robotic technology with a centralized control to paint these sports fields can reduce effort of manual labor and increase efficiency and accuracy of the entire process. This is a highly economic solution to the existing technology and thereby can sow the seed for a sporting revolution. This kind of technology can not only be used to revolutionize the way field painting is carried out but also can be applied to various applications in local parks and recreational facilities.

Luke Mains, Computer Systems Engineering  
Graduation: May 2019  
Hometown: Phoenix, Arizona  
Randomized Algorithmic Construction of Scattering Hash Families  
Mentor: Charles Colbourn, professor  
Research Theme: Education, Security  
This research project is concerned with creating a randomized algorithm for constructing a scattering hash family (ScHF). ScHFs are a form of perfect hash families with less restrictive conditions, which can be computationally checked by an efficient algorithm. They are represented as an integer matrix for this project and the algorithm will be created with the C++ programming language. This research will attempt to broaden the knowledge of current construction methods and create useful hash families for broadcast encryption schemes and other variants of encryption.

Sonia Malek, Chemical Engineering  
Graduation: May 2019  
Hometown: Tempe, Arizona  
Mapping Waste Streams for the Phoenix Metropolitan Area  
Mentor: Joshua Loughman, lecturer and assistant director of EPICS  
Research Theme: Sustainability  
This research aims to alter the linear trajectory of the traditional economic cycle of extraction, production and disposal by creating a map of solid waste streams of the Phoenix metropolitan area. This map would be used to expose engineering gaps in the linear model and to propose sustainable solutions to those gaps. A draft of the map indicates that diversion rates of solid waste from industries can be improved with a sustainable engineering design, educating the general public and changing Arizona policy. Future improvement includes using Vensim as a modeling tool to program the flow of solid waste.
Alex Maltagliati, Chemical Engineering
Graduation: May 2019
Hometown: Avondale, Arizona
Investigating the Properties of Breast Cancer Dormancy via 3D Spheroids and Assessing Potential Therapy Treatments
Mentor: Kaushal Rege, professor
Research Theme: Health

In breast cancer patients, there is a high tendency for relapse to occur — the cancer reemerges after several years of dormancy. Little is understood about the nature of cancer cells during the dormancy phase and dormant cells are highly resistant to conventional treatments. In Rege’s laboratory, 3D spheroids have been made with various cancer cell lines on amikagel platforms to analyze properties that are difficult to study in the traditional 2D model. The aim of this research project is to investigate 3D spheroids on the amikagel platform and assess potential gene and drug therapies.

ASU KERN Project KEEN supported FURI student

Amber Mani, Biomedical Engineering
Graduation: May 2020
Hometown: Chandler, Arizona
Bioengineering Health Systems With Bacterial Communication Senders
Mentor: Karmella Haynes, assistant professor
Research Theme: Health

Quorum sensing is a type of bacterial communication and it can be used for different applications, including early detection of disease. Unfortunately, synthetic systems often suffer cross communication from unrelated systems, known as crosstalk. This experiment was designed to uncover orthogonal QS pathways with potential for future applications. In this experiment, E. coli was used, which produces acyl-homoserine lactones, which communicates and coordinates gene expression. This project tested AHL sender cells with AHL receiver cells that produced fluorescent protein when activated by AHLs. For example, the system using the “Las” receiver with HSLs from “Bra” sender produced no signal.

ASU KERN Project KEEN supported FURI student

Danielle Mara, Electrical Engineering
Graduation: May 2020
Hometown: Scottsdale, Arizona
Concussion Diagnostics Using Postural Stability and Mobile Phone Applications
Mentor: Thurmon Lockhart, professor
Research Theme: Health

The research objective is to discover an effective and easy method to diagnose concussions in a field/dynamic environment. Concussed athletes stand for 30 seconds while the Lockhart Monitor™ measures standing balance and calculates sway velocity and area. Postural stability is proven to be affected when concussed. It is expected that after seven days, a player’s balance deficits cease and their postural stability returns to normal. This test will be used to immediately diagnose if athletes can return to play after a hard head impact. In the future, more concussed athletes will be analyzed to increase population size and study reliability.

ASU KERN Project KEEN supported FURI student

Logan Mathesen, Industrial Engineering
Graduation: May 2020
Hometown: Tucson, Arizona
Trust Region Based Stochastic Optimization with Adaptive Restart: A Family of Global Optimization Algorithms
Mentor: Giulia Pedrielli, assistant professor
Research Theme: Sustainability

The field of simulation optimization has seen algorithms proposed for local optimization, drawing upon different locally convergent search methods. Similarly, there are numerous global optimization algorithms with differing strategies to achieve convergence. The researchers investigate meta-model based algorithms that stochastically drive global search through an optimal sampling criteria evaluated over a constructed meta-model of the predicted response. They propose Trust Region Based Optimization with Adaptive Restart (TBOAR), a family of algorithms that dynamically restarts a trust region based search method via an optimal sampling criteria derived upon a meta-model based global search approach.

Graduate Research Travel Grant
<table>
<thead>
<tr>
<th>Cameron McAllister, Chemical Engineering</th>
<th>Ethan McDermott, Computer Science</th>
<th>Alexander McGregor, Mechanical Engineering</th>
<th>Devin McManimon McNally, Aerospace Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving D-glucaric Acid Yield through Ion Exchange and Downstream Processing</td>
<td>Threat Intelligence Analysis</td>
<td>Mechanics of Origami-Inspired Foam Structures</td>
<td>Remote Sensing with Fixed Wing UAVs</td>
</tr>
<tr>
<td>Mentor: David Nielsen, associate professor</td>
<td>Mentor: Adam Doupé, assistant professor</td>
<td>Mentor: Hanqing Jiang, professor</td>
<td>Mentor: David Allee, professor</td>
</tr>
<tr>
<td>Research Theme: Sustainability</td>
<td>Research Theme: Security</td>
<td>Research Theme: Security</td>
<td>Research Theme: Energy</td>
</tr>
</tbody>
</table>

**D-glucaric Acid** is a high-value chemical present in many consumer products. Optimization of the purification of the product stream is needed to scale-up new E. coli pathways. Ion exchange is a proven method for removal of soluble compounds from liquids, investigated here for its application to glucaric acid uptake. Progress this semester has focused on procurement of appropriate ion exchange resins and testing of various acids for optimal ion-exchange column desorption. Proof-of-concept experiments to validate the potential of hydrochloric acid to desorb glucaric acid from XAD-4 resin are underway, and testing of the process in a column assembly is soon anticipated.

**Threat Intelligence Analysis**

Mentor: Adam Doupé, assistant professor  
Research Theme: Security

As the number of ransomware attacks rises in 2017, the need for automated malware analysis systems is greater than ever. The Threat Intelligence Analysis project aims to autonomously scrape the underground communities for malware, automatically dissect them and correlate the information gathered with online communities to better aid researchers in tracking groups and malware campaigns.

**Mechanics of Origami-Inspired Foam Structures**

Mentor: Hanqing Jiang, professor  
Research Theme: Security

This research project will test the structural properties of a 3D printed origami inspired structure and compare them with a standard honeycomb structure. The models will have equal face areas, model heights, and overall volume but wall thicknesses will be different. Stress-deformation curves have been produced from preliminary testing. Preliminary testing showed weak areas in the origami structure that have been addressed in a second iteration design. Going forward, a new design will be printed in new ductile material and tested until failure.

**Remote Sensing with Fixed Wing UAVs**

Mentor: David Allee, professor  
Research Theme: Energy

The focus of this research is to develop a medium-sized unmanned aerial vehicle (UAV) capable of carrying electronic testing equipment, such as very low frequency (VLF) and electro-optical sensors, over an extended flight period without motor power. Past designs do not feature cavities large enough to hold the hardware. In order to determine optimal airframe shape, simulations were run on the average glide times of multiple consumer gliders. By implementing proven past concepts and new design solutions, the sensing teams will be able to take more precise measurements.
The human brain’s computational capabilities are far beyond that of traditional Von Neumann architectures, thus neuromorphic computing systems built with hardware designed to function like biological neurons is becoming increasingly recognized as one of the next great potential leaps in computing. Brain-inspired systems offer the combined advantages of increased speed, while also significantly decreasing the need for large amounts of power and memory. This project aims to contribute to this field and its applications by designing, improving and fabricating CMOS Leaky Integrate-and-Fire integrated circuits to mimic spiking neurons and in doing so, laying the foundation for neuro-inspired computing systems.

Ivan Milosalvjevic, Aerospace Engineering
Graduation: December 2017
Hometown: Phoenix, Arizona
Piloting Education in Order to Improve Commercial Aviation Safety
Mentor: Timothy Takahashi, professor of practice
Research Theme: Education

The current standards for piloting procedures during takeoff and landing of commercial aircraft operating under 14 CFR (Code of Federal Regulations) part 121 are lacking in precise methods due to vague regulations. The evidence found during this research shows a clear lack of compliance in the existing regulations as well. The research shows that this is not necessarily due to poor piloting ability, but rather due to vague procedures in the published aircraft flight manuals. This project aims to improve the safety standards in commercial aviation by adding these much needed procedures to the existing flight manuals.

Zachary Monroe, Software Engineering
Graduation: May 2019
Hometown: Chandler, Arizona
Using Machine Learning to Investigate Password Security
Mentor: Ajay Bansal, assistant professor
Research Theme: Security

Determining the strength of a password is a difficult endeavor. Many websites employ simple rules like mandating symbols, but while this sometimes increases password complexities, it also reduces the possibilities “hackers” must try, called the keyspace (ignore passwords without symbols). This research aims to develop a reliable, adaptable model to quickly determine a password’s value using machine learning. This model will be able to evolve through use of a new password set and different tests to fit current attack methods, and should not decrease the keyspace associated with passwords that pass it.

Rex Moore, Biomedical Engineering
Graduation: May 2019
Hometown: Phoenix, Arizona
Nephrotoxicity Investigations of a Medicated Hydrogel Polymer
Mentor: Brent Vernon, associate professor
Research Theme: Health

The objective of the research is to determine the toxicity of a medicated hydrogel polymer that is used for the treatment of prosthetic joint infections (P JIs). The hydrogel contains the antimicrobials tobramycin and vancomycin, which have been shown in previous studies to successfully eradicate common infections present in P JIs, but are known to cause dose-related nephrotoxicity. Potential toxicity of the hydrogel will be determined through the analysis of blood collected for both serum chemistry and pharmacokinetic analysis of systemic antimicrobial concentrations. Future projects would involve other species of animals to define interspecies differences in susceptibility to toxicity of the hydrogel.
Tray Moraca, Materials Science and Engineering
Graduation: May 2020
Hometown: Cave Creek, Arizona

Study of the Formation of Voids in Passivated emitter Rear Contact Solar Cell in the Local Back Surface Field

Mentor: Stuart Bowden, associate research professor
Research Theme: Energy

A Passivated emitter rear contact (PERC) solar cell is an advanced diffused junction solar cell that uses back surface passivation to maintain positive photovoltaic properties and to reflect unabsorbed light back into the photovoltaic material. This simple addition to standard solar cells has allowed increases in solar cell efficiencies to the 25 percent range. Due to PERC’s local back metal contacts, it creates a greater likelihood of void formation in the metal while firing. By studying the presence of voids in PERC cells at different firing parameters, the ability to create a more consistently efficient PERC cell is achievable.

Evvan Morton, Civil Engineering
Graduation: December 2019
Hometown: Cincinnati, Ohio

Sustainable Waste Management Strategies for Sittee River, Belize

Mentor: Tom Roberts, former ASU professor of practice
Research Theme: Energy, Sustainability

Current waste management methods in Sittee River (SR), Belize, include burning, burying or disposing of waste in nearby open bodies of water. This research works toward improving the sustainability of SR’s waste management system using anaerobic digestion (AD). The waste audit reports that the amount of food waste produced in the village is enough to displace dependency on butane. Preliminary risk analysis and interviews further show the feasibility of implementing AD. This research could lead to job creation and potential business ventures in the village such as biogas and lunch sales. Future work includes AD construction and training community members.

Adriana Moya, Chemical Engineering
Graduation: May 2019
Hometown: Houston, Texas

In Vitro Osteogenic Study of hMSCs Under Diabetic Conditions

Mentor: Julianne Holloway, assistant professor of practice
Research Theme: Health

This project aims to determine the effects of type 2 diabetes mellitus (T2DM) on the proliferation and differentiation of human mesenchymal stem cells (hMSCs). hMSCs are cultured in growth or osteogenic media under three different glucose concentrations that mimic healthy, pre-diabetic and diabetic conditions. Four different stains will be used to determine cell morphology, differentiation, and mineralization after 28 days in culture. Future studies will evaluate how saturated fatty acids and advanced protein glycosylation lead to diabetic complications and affect osteogenesis.

Philip Mulford, Aerospace Engineering
Graduation: May 2019
Hometown: Warrenton, Virginia

Viability Study for the Utility of a 2-Degree-of-Freedom Canfield Joint for Spacecraft Attitude Control Applications

Mentor: Daniel White, lecturer
Research Theme: Education

This project focuses on the development of a Canfield Joint for improved spacecraft attitude control. Current methods rely on a gimbaled approach, where multiple different rocket motors fire from the edges of the spacecraft to attain a desired attitude vector. This approach requires significantly more fuel than necessary, and neglects the potential for inertial control. The Canfield Joint should allow for more direct vectoring, and the motion of the arm should allow for inertial control. The current scope of the project deals with the mechanical design of the joint, as well as the system to control it.
Carbon fiber reinforced polymer (CFRP) composites are becoming increasingly popular materials for designing aerospace structures due to their superior strength to weight ratio. Recent studies have shown that integrating buckypaper, a membrane of flattened carbon nanotubes exhibiting self-sensing properties, in CFRP composites can further increase their effectiveness, leading to materials with the capability of real time damage assessment and excellent mechanical properties. Such materials exhibit tremendous potential for use in structural applications that are highly sensitive to damage. The objective of this project is to test the mechanical properties and real time damage sensing of CFRP plates with buckypaper membranes.
Koen Nijssen, Civil Engineering
Graduation: May 2018
Hometown: Vught, the Netherlands
Controlled Release of Nutrients on Plants through Encapsulated Nano-Fertilizer
Mentor: Francois Perreault, assistant professor
Research Theme: Sustainability

The experiment was performed to increase the capacity of nano-fertilizer for controlled delivery to plant roots. Nano-carriers were modified with a bio-molecule to increase affinity to the roots. Suspensions of pristine and functionalized fluorescent particles were flown through a soil column and roots and the amount of particles leaving the column was measured at wavelengths 480/510 nm. These values were then compared to the zero-experiment of soil without roots. This research showed that changing the surface chemistry influences affinity of nano-carriers to a soil/root system. Further research should focus on the actual yield of plants using this controlled delivery system.

Calvin Norman, Computer Science
Graduation: May 2019
Hometown: Phoenix, Arizona
Integration of Sensors on Autonomous Vehicles for Agricultural Use
Mentor: Wenlong Zhang, assistant professor
Research Theme: Sustainability

In this project, an autonomous navigation system was developed for integration on an agricultural vehicle. The information for the autonomous navigation comes from GPS modules, using positional data for navigation. This was a joint project with the USDA, with the goal of improving the high throughput phenotyping method of farming, which uses large amounts of data for analysis. By automating the data collection, human error is reduced and more data can be collected. The goal moving forward is to integrate Real time kinematic GPS into the navigation system.

Kyrsten Novak, Human Systems Engineering
Graduation: May 2017
Hometown: Bethlehem, Pennsylvania
Human Factors and Ergonomics Society International Conference
Mentor: Russell Branaghan, associate professor
Research Theme: Education

Human Factors and Ergonomics Society’s (HFES) International Annual Meeting seeks to gather field professionals and academic researchers to create a collaborative environment to discuss the latest research discoveries, field needs and scientific developments. The HFES advocates for the use of knowledge and research in combination with human centered design and societal needs. The conference encapsulates the engineering skills set and entrepreneurial mindset by creating an environment that focuses on the user and industry needs.

ASU KERN Project KEEN supported FURI student

Tyrine Jamella Pangan, Software Engineering
Graduation: May 2018
Hometown: Mesa, Arizona
Developing Engineering Talent Among Navajo Youth with Chain-Reaction Machines
Mentor: Shawn Jordan, associate professor
Research Theme: Education

This research aims to develop culturally contextualized engineering design curricula for Navajo middle school students to illuminate pathways toward STEM careers based on how Navajo students and professionals experience, understand and apply engineering design in the context of culture, community and society. This study uses a phenomenographic approach in the first phase to explore how Navajo students and professionals experience engineering design in the context of their culture, using a design-based research approach in the second phase to apply the results from the phenomenography to the iterative development of culturally contextualized engineering curricula and theory.

Undergraduate Research Travel Grant Program
Improving Biochemical Production in Escherichia coli by Nutrient Limitation

Min Su Park, Chemical Engineering
Graduation: May 2018
Hometown: Gilbert, Arizona

The goal of the project is to test different mechanisms of controlling microbial uptake of nutrients, specifically phosphate and to dynamically limit cell growth to improve chemical production in E. coli, in this case, for the production of L-phenylalanine. Preliminary results show that deleting three of the four phosphate importers improves production up to 30 percent. Three methods (CRISPRi, CRISPR and a tunable toggle switch) to dynamically “knock down” phosphate importers will be further tested in order to limit cell growth. Once the most effective method is determined, it can be applied to other pathways, such as strains producing biofuels.

Auto-Redaction of Sensitive Information for Law Briefs

Bryan Parrish, Software Engineering
Graduation: May 2018
Hometown: Moore, Oklahoma

The project objective is to create software to reduce the time needed for the librarians at the ASU Law Library to redact information from law briefs as prescribed by the Arizona Revised Statutes (ARS) to allow law students access to a searchable database for their studies. There are more than 50,000 briefs and can take several man-hours to properly redact. The current aim is to create software using knowledge representation and Natural Language Processing (NLP) techniques to determine if an item needs to be redacted to reduce man-hours needed by at least 75 percent.

Effects of Manufacturing Methods on Piezoresistive Properties in Advanced Carbon Nanotube-Based Sensors

Suparva Paruthy, Mechanical Engineering
Graduation: May 2018
Hometown: New Delhi, India

The main objective of this research is to characterize the two fabrication techniques for manufacturing carbon nanotube based sensors and optimize them for piezo-resistive response. The traditional method of fabrication, vacuum filtration (VF) is investigated along with a novel method called surfactant-free (SF). Samples from both methods are prepared by modulating pre-fabrication conditions and their homogeneity is tested using Raman spectroscopy. Their piezo-resistive response will be tested under tensile and tensile cyclic loading, and their change in resistance will be recorded using a digital multi-meter.

Effects of Imposing Negative Damping on the Human Ankle

Dhruv Patel, Computer Science
Graduation: May 2020
Hometown: Gilbert, Arizona

This study explores the effects of constant negative damping on lower-limb motor control. The trends in kinematic and EMG responses for negative damping trials were compared and analyzed with zero damping and positive damping trials. It was concluded that the artificial negative damping provided by the anklebot robot provides assistance to the human ankle, therefore, reducing the time it takes for the subject to reach the target. In the future, a variable negative damping could be implemented to see if it is more effective compared to constant negative damping.
The objectives of this investigation are to evaluate coded excitation for 3D ultrasound imaging, and devise methods to compensate for nonlinearities caused by the ultrasonic transducer. Binary codes have mathematical properties that can be exploited when paired with a matched filter to increase signal-to-noise ratio. However, the limited bandwidth of the transducer can inhibit the benefits of coded excitation. An optimization engine was created to minimize the contributions of the transducer. Optimized filters are also designed for both Barker and linear chirp signals. Results show a reduction in side lobes that render both excitation types acceptable for 3D ultrasound imaging.

Society will always need engineers, hence ASU has an interest in retaining as many students as possible. This research project attempts to use statistical models to find factors that contribute to student retention and develop a retention plan. The current status of the project is the definition of factors. Using linear regression for mechanical engineers, factors such as scholarship status, cumulative GPA and the number of credits in the spring semester have been found to be significant. Future work includes the consideration of other majors and the integration of proportion hypothesis testing to better study these factors.

The goal of the project is to study mixed metal oxide interfaces between CeO₂-TiO₂ and CeO₂-TaO₅ for visible-light driven water splitting, a method of storing solar energy in the form of chemical energy. X-ray diffraction and electron microscopy are used to assess the particle size and nanostructures present, respectively. Modified synthesis of TiO₂ yielded desired crystallite sizes of less than 20 nm. However, upon CeO₂ loading, coarsening occurs and doubles the support particle size. Future work includes minimizing the heat treatments during CeO₂ loading to prevent coarsening of the TiO₂ and applying similar methods to synthesize CeO₂-TaO₅.

Concept mapping is a reflective technique that shifts the classroom from a traditional lecture format to a more active learning environment. Studies show that students benefit from the visualization of connections and cross-links between concepts. This work improves the understanding of junior-level biomaterials concepts by measuring Hake gain over three quizzes separated by different learning activities: studying, individual mapping and collaborative mapping. This work determines the effectiveness of concept mapping as an active learning practice in an engineering classroom in terms of student achievement. Assuming a significant relationship is found, this study should be repeated with a larger population.
Eric Probst, Mechanical Engineering
Graduation: May 2018
Hometown: Littleton, Colorado
Fabrication of Buckepaper via Additive Manufacturing
Mentor: Masoud Yekani Fard, assistant research professor
Research Theme: Energy, Security

The scope of this FURI research project is to address the time intensive problem of fabricating Buckepaper by using fused deposition modeling (FDM). Buckepaper has already shown proven benefits to society due to its unique properties that allow real time strain sensing. Findings have shown that 3D printer thermoplastic filament can be dosed with a large amount of CNT (carbon nanotubes) to improve and alter the properties, which will be needed to produce buckepaper. The advances in printer filament is pushing the FDM industry beyond the purposes of pure prototyping and gaining more functional properties.

Alexis Rainery, Chemical Engineering
Graduation: May 2019
Hometown: Phoenix, Arizona
Cleaning Recycled Si from Crystalline-Si Solar Cells
Mentor: Meng Tao, professor
Research Theme: Energy, Sustainability

As the solar industry continues to grow, so does the burden of the waste it produces. The Terawatt Photovoltaic Lab has recently developed a solar panel recycling process that recovers more than 90 percent of the silicon as well as other materials. Conveniently, some of the chemicals used in the recycling process are similar to those used generally used in standard cleaning processes for silicon. Early results have been promising so that a new comprehensive process from end-of-life solar panel to industry-ready silicon is possible. Now, the goal is to continue fine tuning the process as well as confirm previous results.

Sierra Ramirez, Mechanical Engineering
Graduation: May 2018
Hometown: Phoenix, Arizona
Asteroid Mobility Using Screw-Powered Vehicles
Mentor: Hamid Marvi, assistant professor
Research Theme: Education, Sustainability

The objective of this research is to conduct and gather experimental results concerning screw-powered vehicles (SPVs) under granular media. The experimental setup contains a designed Archimedes screw submerged in a bed of glass bead material and tested under varying RPM speeds. Those experimental results are then compared with simulated results from EDEM, a modeling software for granular environments, in hopes of validating the experimental methodology. Future research will include performing this same experimental procedure in a functioning air fluidized bed to test provide insight on SPVs under microgravity.

Neil Rastogi, Chemical Engineering
Graduation: May 2019
Hometown: Chandler, Arizona
Selective Electro-Fermentation of Scenedesmus Algae
Mentor: Bruce Rittmann, Regents’ Professor
Research Theme: Energy, Sustainability

The goal of this research project is to develop a microbial electrolysis cell (MEC) to maximize carbohydrate and protein degradation and lipid conservation in an electro-fermentation process of scenedesmus acutus. The quantification of H₂ production rates will provide adequate data to support biohydrogenation via H₂ in the anode. The flux of H₂ across the membrane is also measured to detect the rate of H₂ diffusion that may impact lipid biohydrogenation. Results of this research may lead to a viable method for producing biofuels to replace non-regenerative fossil fuels.
Mykol Reklaitis, Engineering (Electrical Systems)
Graduation: May 2020
Hometown: Phoenix, Arizona

Team Cognition in an Immersive Simulator
Mentor: Scotty Craig, assistant professor
Research Theme: Education

The current study, Team Cognition in an Interactive Simulator, investigates the impact of participants’ perceived stress level on team behavior within an immersive simulator. Participants will be presented with an immersive, team-based, simulator using a pre-existing game called Artemis. This study investigates how teamwork within a collaborative simulation environment impacts stress on group dynamics.

Hansol Rheem, Human Systems Engineering
Graduation: May 2019
Hometown: Seoul, South Korea

Give and Take in a Mousetracking Choice Paradigm
Mentor: David Becker, associate professor
Research Theme: Education

Moving a mouse cursor to a stimulus can reveal online choice-dynamics that are richer than simple RTs, reflecting implicit associations, like female-good/male-bad. The current study investigated whether such gender-valence biases interact with approach-avoidance movements. On every trial, the shape of the mouse cursor appeared as either a flower or a spider; then both a male and female face appeared on the screen, and the participant had to move this cue to one of the genders and then withdraw it. The results suggest that implicit associations interact with behavior, rather than exerting a one-sided effect on the behavior.

Levi Riley, Biomedical Engineering
Graduation: May 2019
Hometown: Yuma, Arizona

Norepinephrine and Adenosine Infused Microparticles for Brown Adipose Tissue Stimulation
Mentor: Brent Vernon, associate professor
Research Theme: Health

The objective of the research for this semester is to develop a protocol which consistently yields biodegradable microparticles of the correct dimensions and surface morphology. Thus far, two protocols which consistently yield two different size particles have been developed. Further modifications are required in order to optimize the encapsulation efficiency, particle distribution, and particle yield. The particles have the potential to incorporate a wide range of drugs for sustained subcutaneous release. These particles are recommended for use in incorporating norepinephrine and adenosine to be injected into brown adipose tissue for metabolic stimulation; however, other drugs could be used.

Jorge Roldan, Computer Science
Graduation: May 2018
Hometown: Los Angeles, California

Understanding Becoming a Grand Challenge-Scholar Engineer
Mentor: Tirupalavanam Ganesh, assistant dean and associate research professor, Amy Trowbridge, senior lecturer and GCSP director
Research Theme: Education

The aim was to use qualitative data analysis to understand the impact of the Grand Challenge Scholars Program (GCSP) on engineering student development. Open and axial coding methods were applied to student portfolios and interview data. Initial analysis showed how research, entrepreneurship, interdisciplinary, global, and service learning components of the program are connected and how those relationships affect the student. Anticipated results include identification of the skills or mindset that distinguish the traditional engineer from the Grand Challenge Scholar-Engineer. These findings will impact universities with GCSP and also improve general engineering education.

Graduate Research Travel Grant

Graduate Research Travel Grant

Graduate Research Travel Grant
A Benchmark for Automated Fact Checking

Mentor: Paolo Papotti, assistant professor
Research Theme: Education, Security

The overall goal of this project is to create a benchmark with a large variety of annotated datasets and metrics to evaluate automatic fact checking tools on a level playing field in addition to experimental results from the comparison between at least two systems on the same dataset. Given the novelty of the field and the complexity of the problem, there is still no established benchmark for automatic fact checking systems; therefore, it is a challenge to compare any two fact checking systems. Future work includes testing more systems on more challenging datasets.

Magnetic Flux Density Comparisons Between MREIT and FE Models

Mentor: Rosalind Sadleir, assistant professor
Research Theme: Health

MREIT can be used to recover in-vivo current density images from measured Bz data. Sensitivity studies based on these images can be used to validate computational model results. The preliminary results suggest that electrodes a quarter of the size suggested by electrode surface area, in combination with high skin conductivity values, produced the best match in Bz profile lines between MREIT results and IACS simulations.

Virtual Reality Phantom Limb Pain Treatment

Mentor: Panagiotis Artemiadis, associate professor
Research Theme: Health

The objective of this project is to exploit a virtual reality treatment that reduces the recovery time of phantom limb pain. Current treatments include virtual reality because it is more interactive, which are key points for tricking the brain into thinking it still has the missing limb. For example, one method is a stimulating stump that sends tiny electrical impulses, which can recreate the sensation for the limb. When using EEG signals, there is no biofeedback. Nonetheless, having more knowledge on how this phenomenon works can have an impact on rehabilitation therapy for many other neurological disorders.

Spatiotemporal Framework for Dynamic Merged Reality Content Creation

Mentor: Robert LiKamWa, assistant professor
Research Theme: Education

Merged reality produces an immersive user experiences by combining the real world with the virtual world to create new environments and visualizations. The objective of this research focused on building a spatiotemporal framework that assists in dynamic merged reality content creation. The tool will allow users to take computer-generated holographic data and map it to physical objects so that they are able to interact in real-time. By working with the AMUSEUM, educational holographic data will be mapped to exhibits using the HoloLens in which visitors can then see with their mobile device.
**Suzanne Schadel, Civil Engineering**

Graduation: December 2019  
Hometown: Portland, Oregon

**Simulating Interdependent Infrastructure Vulnerability to Extreme Events in Hawaii**

Mentor: Nathan Johnson, assistant professor  
Research Theme: Energy, Sustainability

The objective is to simulate interdependencies between water-power systems in an urban environment. These simulations run over a long temporal span to simulate increasing anthropogenic and flooding impact due to urbanization and climate change, respectively. Afterward, critical nodes and tipping points for cascading failures will be determined. Background research is currently being conducted of RISE (resilient infrastructure simulation environment) functionality and critical infrastructure operation in anticipation of confirmation of receiving data that may be used to integrate into RISE. Recommended future work involves incorporating more complexities into the simulations, such as the Urban Heat Island effect and more infrastructure systems.

---

**Stephen Seidel, Computer Systems Engineering**

Graduation: December 2017  
Hometown: Florence, Arizona

**Using Locating Arrays for Screening in a Wireless Network Testbed**

Mentor: Violet Syrotiuk, associate professor  
Research Theme: Sustainability

There are many factors, and even more interactions between these factors, that affect the performance of computer networks. The objective of this research is to find the factors and interactions that most significantly affect network performance. A unique piece of software, under development since the summer of 2017, attempts to find these most significant factors by creating a model for the network performance. Once a model is created, the researchers can begin to explore network performance improvements. Future research involves more testing using this software and extended analysis to validate the factors and/or interactions it identifies.

---

**Aashiq Shaikh, Computer Science**

Graduation: December 2019  
Hometown: Cupertino, California

**Dynamic Prefetching**

Mentor: Robert LiKamWa, assistant professor  
Research Theme: Education, Energy

The objective is to create a data distribution system that uses location data from the user’s mobile device to anticipate what information their device will need in the immediate future. The local app will then download the information so that the user can enjoy a seamless entertainment experience. In the golden age of user experience, consumers need an algorithm that can anticipate what media they may want to experience in the future so that they can enjoy it without a long loading time. Currently, this research is being used to further an augmented reality museum curation project.

---

**Nandini Sharma, Biomedical Engineering**

Graduation: May 2020  
Hometown: Scottsdale, Arizona

**Managing Respiratory Disease with Wearable Devices**

Mentor: Jennifer Blain Christen, associate professor  
Research Theme: Health

Dust particles and ozone worsen symptoms in patients with respiratory disease. Currently only a single value is available for each pollutant representing the entire greater Phoenix area. The goal of this project is to develop wearable devices from small, inexpensive microprocessors and sensors that will measure pollutants, including particulates and ozone. A custom device with integrated dust, ozone and temperature sensors has been created with a gyroscope to account for how movement affects the values gathered. Additional sensors: galvanic skin response, pulse oxygen and forced expiratory volume will be integrated and the data will be correlated to local pollution levels.
Aditya Shekhawat, Electrical Engineering
Graduation: December 2018
Hometown: Jhunjhunu, India
Design and Optimization of Antenna Using Origami
Mentor: Hongyu Yu, associate professor
Research Theme: Education, Security
Origami is traditionally the art of paper folding. The integration of origami, art and technology offers unique opportunities to create products important to society. Creating a simpler, more compact antenna would allow for a greater access to communications in all situations. First a computer simulated design will be produced and simulation will be run by changing the geometry of the antenna. Depending on the simulation results, important decisions about the antenna design will be made. A problem could arise while designing the antenna on HFSS, because making the 3D models by changing the geometry of antenna can be difficult.

Thembelihle Shongwe, Chemical Engineering
Graduation: May 2018
Hometown: Manzini, Swaziland
Impact of Impurities on a Solar Assisted Fischer-Tropsch Synthesis to Produce Large Hydrocarbons
Mentor: Jean Andino, associate professor
Research Theme: Energy, Sustainability
In pursuit of sustainable sources of energy that do less harm to the environment, numerous technologies have been developed to reduce carbon emissions in the atmosphere. The implementation of the carbon capture and storage system (CCS) has played a crucial role in the pursuit, but the risks of leakages have become a major push for utilizing carbon dioxide as soon as it is produced. This project aims to contribute to carbon capture and utilization systems by exploring the possibility of simultaneously converting a mixture of CO2 and NOx to large hydrocarbons for transportation fuels, and environmentally friendly nitrogen-containing compounds.

Andrew Shurman, Computer Science
Graduation: December 2018
Hometown: Gilbert, Arizona
Constructing Practical Low-Density Parity-Check Codes
Mentor: Charles Colbourn, professor
Research Theme: Security
Low-density parity-check (LDPC) codes are a form of high performance error-correcting codes with a substantial amount of theory developed for their uses in classical and quantum systems. However, practical applications have been limited by the difficulty of finding good LDPC codes for specific parameters. The objective of this research is to devise efficient algorithmic methods for the construction of LDPC codes for practical parameters. The construction of a library of these codes using efficient algorithms would be a substantial benefit to the field of information security and society at large.

Run Si, Mechanical Engineering
Graduation: May 2018
Hometown: Zhengzhou, China
Tomographic Damage Imaging with Inverse Imaging Method Using Piezo Sensor Network
Mentor: Yongming Liu, professor
Research Theme: Sustainability
The research's purpose is using a piezo sensor network to generate data and inverse imaging to assess the tomographic damage image of carbon fiber materials. This Lamb wave-based damage detection method will help simplify the testing process and reduce the cost of internal damage detection without causing further damage on the testing sample. The result of this research can be used to obtain the internal damage of carbon fiber material due to manufacturing limitations and fatigue and it is important for health monitoring and sustainability. For example, it can be used to monitor the health condition of an aircraft.
Kevin Sidbon, Software Engineering
Graduation: May 2019
Hometown: Tempe, Arizona

Autonomous Search in GPS-enabled and GPS-denied Environments
Mentor: Spring Berman, assistant professor
Research Theme: Security

This project seeks to provide mobile robots with several autonomous navigation systems depending on the environment and the availability of a GPS-like localization system. It addresses the problem of using robots instead of humans to access potentially dangerous environments under conditions where signals between the robots and a command center are interrupted or absent. The goal is to program the robots with path-finding algorithms and enable them to situate themselves in space while using heuristics to find and potentially acquire a target object.

Richard Simpson, Engineering (Robotics)
Graduation: May 2019
Hometown: Bountiful, Utah

MicroMilling Testbed Interface
Mentor: Angela Sodemann, assistant professor
Research Theme: Education, Health

Current MicroMilling research is limited by the interface that is used in industry. While this is beneficial for those who are directly going into this industry, this causes some issues for students who are interested in completing research topics at an early stage of their academic career like FURI. Due to this, the project is tasked with creating an interface system that will allow people to quickly and easily understand how to control the machine and give them an opportunity to explore testing different ideas to improve processes in the MicroMilling industry.

Kamaldeep Singh, Electrical Engineering
Graduation: December 2017
Hometown: Bhopal, India

Viability Validation of Miniaturized Hydrogel Passive Check-Valve for Hydrocephalus Treatment
Mentor: Junseok Chae, professor
Research Theme: Health

This research is validating a miniaturized hydrogel passive check-valve’s viability to ensure a successful alternative treatment approach for hydrocephalus. Validation requirements are determined by achieving cracking pressure values in cerebral ventricles leading to the proper drainage of cerebrospinal fluid with negligible reverse flow leakage via a superior sagittal sinus from physiological activities. The researcher is studying fluidic flow visualization and functionality of hydrogel values under implantable conditions by replicating biological dimensions and hydrodynamic measurements of a targeted region of the brain. Following this success is the introduction of technology to in-vivo testing animal models, consolidating an alternative Hydrocephalus treatment approach.

Alarmel Sira, Biomedical Engineering
Graduation: May 2019
Hometown: Gilbert, Arizona

Observing the Induction of Vagal Nerve Stimulation-Induced Plasticity in a Rat Model of Parkinson’s Disease
Mentor: Jeffrey Kleim, associate professor
Research Theme: Health

Parkinson’s disease (PD) is a neurodegenerative disorder that often causes tremors, imbalance and digestive issues that is characterized by a loss of neurons within the substantia nigra. Studies have shown that neural plasticity, the ability of the brain to “reorganize” itself, improves motor function in patients with PD and may prevent cell loss. Vagal nerve stimulation (VNS) is one method by which plasticity can be induced. This project seeks to determine whether VNS effectively alters cell loss in a rat model of PD. Histology will consist of a tyrosine-hydroxylase stain to identify dopaminergic neurons in the substantia nigra.
**Travis Skinner, Mechanical Engineering**

Graduation: December 2017  
Hometown: Thatcher, Arizona  

**Micromechanisms Governing Fatigue Response of Nickel Superalloys**  
Mentor: Aditi Chattopadhyay, Regents’ Professor  
Research Theme: Energy, Sustainability  

The high fatigue and creep resistance of nickel superalloys is due in large part to their microstructures, and makes them uniquely suited for extreme applications. The aim of this research is to directly quantify and correlate the effects of superalloy microstructure on fatigue crack initiation and propagation behavior, with particular attention devoted to the effect of slip plane orientation on persistent slip band and fatigue crack formation. The results of this research will enable a more thorough understanding of the dependence of fatigue performance of nickel superalloys on microstructural parameters such as grain size, precipitate size and precipitate volume fraction.

---

**Christina Smith, Biomedical Engineering**

Graduation: May 2019  
Hometown: Scottsdale, Arizona  

**New Receivers with Hybrid Promoters for Quorum Sensing Systems**  
Mentor: Karmella Haynes, assistant professor  
Research Theme: Health  

Quorum sensing (QS) is an important tool for bioengineering and synthetic biology. Understanding and modeling these systems will allow scientists to use these systems in a variety of fields, such as drug delivery systems and tissue engineering. Inducible promoters regulate gene expression that will facilitate scientists to confirm these quorums sensing circuits. For this reason, properly fabricating these inducible promoters is essential for the field of bioengineering. This research explores hybrid promoter design for inducible promoters in order to find orthogonal QS systems. In addition, it explores whether or not these inducible promoters provide better expression for the system.

---

**Aldo Soberon, Aerospace Engineering**

Graduation: May 2019  
Hometown: Chandler, Arizona  

**High-Velocity Impact Assessment and Mechanical Characterization of Carbon Nanotube Embedded Composite**  
Mentor: Aditi Chattopadhyay, Regents’ Professor  
Research Theme: Security  

The aim of this project is to determine how single-wall carbon nanotube (SWCNT) can affect impact and tensile performance of carbon fiber reinforced polymers (CFRP). So far, testing shows CNT content in CFRPs seems to improve impact characteristics in CFRPs, as well as improving tensile properties, such as Modulus of Elasticity (Young’s Modulus). Future work entails conducting further rigorous impact damage assessment to better determine ballistic limits and other damage and failure phenomena.

---

**Amber Sogge, Modulus of Elasticity**

Graduation: May 2019  
Hometown: Montrose, Colorado  

**Building an Adaptable 3D Bioprinter**  
Mentor: Julianne Holloway, assistant professor  
Research Theme: Health  

The objective of this project is to convert a 3D filament extrusion printer into a bioprinter to produce a hydrogel matrix with replicable quality. It has been determined that this task can be accomplished using open source designs, which have results that are consistent and replicable. The bioprinter must have an adaptable design to print a variety of hydrogel solutions and structures. Future work should include testing a variety of solution types and printed structures for human mesenchymal stem cell viability and differentiation.
Shubham Sonawani, Electrical Engineering
Graduation: May 2018
Hometown: Nashik, India
Control, Localization, and Path Planning for an Intelligent Autonomous Robotic Vehicle
Mentor: Armando Rodriguez, professor
Research Theme: Education, Security, Sustainability

The main goal of this research has been to systematically and rapidly generate an accurate 2D map of an uncertain environment (satisfying a priori assumptions) with an a priori specified accuracy (and time constraint) using low-cost LiDAR (light detection and ranging), stereo, and an RGBD (depth-sensor) camera with filtering methods, such as the extended Kalman filter (EKF) and particle filter (PF) to facilitate simultaneous localization and mapping (SLAM). Here, localization addresses “where am I?” while mapping addresses generating a map of the environment. Future work will examine the design of a highly robust fleet of cooperating autonomous robots.

Curtis Sparks, Engineering (Robotics)
Graduation: May 2019
Hometown: Libertyville, Illinois
Designing Soft Robotic Actuators for Assisting Impaired Users
Mentor: Panagiotis Polygerinos, assistant professor
Research Theme: Health

The soft material properties, which give soft robotics its name, make soft actuators an ideal choice for interfacing with people. This project focuses on designing and evaluating novel soft robotic actuators in order to develop a soft robotic arm for assisting activities of daily living of impaired users. So far, the research work has resulted in the successful design and evaluation of a fully functioning soft robotic arm. Future work will focus on improving the dynamic stability of the device and creating a functional control system.

Mark Sprows, Chemical Engineering
Graduation: May 2018
Hometown: Tempe, Arizona
Development of a Wearable Sensor for Metabolic Tracking Based on Acetone Vapor Present in Skin Headspace
Mentor: Erica Forzani, associate professor
Research Theme: Health

This study strives to develop a sensor capable of measuring the acetone vapor expiration rates from skin using the color change of a sensitive chemical indicator. The development of such a sensor offers a way to passively determine a person’s rate of fat metabolism and alert diabetics of the onset of diabetic ketoacidosis. Durability experiments have been performed on a hydroxylamine based chemical sensor that shows promising stability in a high temperature environment. The next phase of the study will serve to calibrate the colorimetric response of the sensor to acetone vapor, as well as to expired skin gas.

Gavin Steeber, Chemical Engineering
Graduation: May 2019
Hometown: Tucson, Arizona
Enhancing Inorganic Carbon Uptake in Synechococcus sp. PCC 7002
Mentor: David Nielsen, associate professor
Research Theme: Energy, Sustainability

The utilization of CO2 and light have emerged as promising platforms for conversion to biomass and other useful products. There is an obvious need for renewable resources, noting that non-renewable fossil fuels constitute more than 80 percent of the U.S. total energy consumption. The objective of this project is to enhance the inorganic carbon uptake, which would make production more feasible, in an organism capable of producing valuable chemicals that are currently produced geochemically. The benefits of using this autotrophic system is the few growth conditions necessary to produce valuable products, only needing recycled water, light and a carbon source.
Shape Memory Polymers Fabricated with Recycled Thermoplastics by 3D Printing

Mentor: Masoud Yekani Fard, assistant research professor, Aditi Chattopadhyay, Regents' Professor
Research Theme: Energy, Health, Sustainability

The goal of this research is to characterize the material properties of shape memory polymers (SMPs) as they are repeatedly broken down and recycled. SMPs have medical and military applications, and can be rapidly prototyped using 3D printing, which results in relatively large quantities of thermoplastic waste. If this research can prove that recycled SMPs sufficiently retain their critical properties, it will increase recycling in the growing field of 3D printing, reducing carbon footprint and energy usage. It is recommended that future research characterize additional material types in order to further expand the use of recycled thermoplastics for 3D-printed SMPs.

High energy ionizing radiation is commonly used for the ablation of malignant tumors. During this process, surrounding healthy tissues are also exposed and damaged. To avoid this it is necessary to measure and record the exact dose of radiation absorbed by the sample, which is currently difficult to do. We have developed a maltose binding protein (MBP)-nanoparticle based radiation sensor which changes its color upon exposure to ionizing radiation, due to the formation of gold nanoparticles. The color change can be used to predict the radiation dose delivered, and can be seen for doses as low as 3 grays.

Graduate Research Travel Grant
### Philip Thomas, Aerospace Engineering

**Graduation:** December 2018  
**Hometown:** Poway, California  

**Air Devils Drone Investigation Workshop, AIAA Project Proposal Workshop**  
Mentor: Timothy Takahashi, professor of practice  
Research Theme: Education  

In cooperation with the KEEN foundation, the Air Devils’ drone investigation workshop was designed to teach students the entrepreneurial mindset through rapid prototyping and design. Student teams were challenged to develop a launched glider that carried a randomized payload for as far a distance as possible. Through this challenge, students developed their curiosity in the design of a functioning aircraft. Teams developed connections through real-world testing, and developed value through a holistic experience of aircraft design. By combining the entrepreneurial mindset with product development, students are granted a greater opportunity to develop themselves as engineers and broaden their skillsets.

### Robert Tichy, Mechanical Engineering

**Graduation:** May 2019  
**Hometown:** Chicago, Illinois  

**Soft Robotic Ankle Therapy Device**  
Mentor: Panagiotis Polygerinos, assistant professor  
Research Theme: Health  

The purpose of this research is to develop a soft robotic medical device used in aquatic therapy for individuals suffering from decreased proprioception, strength deficits and spasticity. The research was conducted by studying the biomechanics of the ankle and the gait cycle, and developing a novel soft robotic sock, which can be worn during aquatic therapy sessions. By using inflatable artificial actuators, the device provides support to the wearer’s ankle, corrects stance and also improves the quality of physical therapy.

### Zachary Ticktin, Biomedical Engineering

**Graduation:** May 2018  
**Hometown:** San Francisco, California  

**The Application of Startle Evoked Movements with Facial Muscles Used for Speech**  
Mentor: Claire Honeycutt, assistant professor  
Research Theme: Health  

Startle evoked movement (SEM), the involuntary activation of a planned movement using a stimulus, has been evaluated in upper extremity control and enhanced movement following stroke. The goal of this research is to evaluate if speech is susceptible to SEM, and gain a better understanding of the limitations of the startle reflex. The long term goal is to use startle evoked movement alongside traditional therapy to enhance speech in stroke or initiation-specific disorders.

### Jordan Todd, Biomedical Engineering

**Graduation:** May 2019  
**Hometown:** Glendale, Arizona  

**The Effect of Platelet-Like-Particles on Traumatic Brain Injury**  
Mentor: Sarah Stabenfeldt, associate professor  
Research Theme: Health  

Traumatic brain injury (TBI) is one of the leading causes of injury-related deaths and may lead to hyperperfusion. Reduction of hyperperfusion may be achieved by using platelet-like-particles (PLPs). PLPs are composed of microgels that aid in clotting. The objective is to investigate the effect of PLPs (unconjugated and conjugated with anti-fibrin antibody) on the healing process of TBI when compared to untreated groups. Each of the groups will be observed at 24 hours and 7 days. Analysis of neural pathology between each of the groups at 24 hours and 7 days will be performed to assess the outcome.
Formation Mechanisms of Nanoporous Morphology in the Dealloying of Crystallographically Different Parent Phase Cu3Au Alloys

Mentor: Sefaattin Tongay, assistant professor, Karl Sieradzki, professor
Research Theme: Energy

Nanoporous gold (NPG) has found revolutionary applications in energy and biomedicine-related fields. Despite this, there is little understanding on the ordering mechanisms that occur during the dealloying process while developing the bicontinuous solid-void morphology. By understanding that NPG adopts the same structure and orientation as its parent phase material (PPM), comparing the NPG structures created from compositionally identical, yet crystallographically different PPM, will shed some light on the mechanisms that take place in forming the structure. In this research, ordered and disordered Cu3Au alloys were dealloyed and analyzed for morphological differences that could unravel these mechanisms at hand.

Developing Fatigueless 3-phase Nanocomposite Sensors

Mentor: Masoud Yekani Fard, assistant research professor
Research Theme: Security, Sustainability

This research focuses on enhancing the fatigue response of strain sensors to be embedded in composite laminae. These sensors will have a carbon nanotube (CNT) membrane (buckypaper) fitted inside a glass fiber-reinforced polymer (GFRP) substrate. If made fatigueless, these non-intrusive strain sensors can be integrated into composite structures made for various real-world applications. So far, there has been an extensive literature search on the fabrication process of CNT-based composite sensors. Physical properties for CNT membranes, epoxy-resin, and GFRP substrates were found and tabulated. Additionally, a method on how to make buckypaper more flexible while retaining high resistivity was explored.

Using CFD Tools to Determine the Lift and Drag of Floating Objects in Engineering Applications

Mentor: Huei-Ping Huang, associate professor
Research Theme: Energy

Many engineering applications involve the interaction between fluid flow and a moving body, such as an airplane or a Frisbee. Numerical simulations using computational fluid dynamics (CFD) solvers can assist the analysis of such interactions and quantify lift and drag. This project, in its first phase, uses Ansys-Fluent to simulate a 2D flow passing a Frisbee-like object. It assessed the impact of mesh resolution and choices of numerical schemes on the results, and also post-processing tools. This sets the stage for the next phase of fully 3D simulations and analysis of lift, drag and stability.

Comparison of Compression-Based Mechanical Properties between Low-Cost Foam Materials and Skin for Tourniquet Application Training

Mentor: Susan Hallbeck, professor, Mayo Clinic
Research Theme: Health

Medical Simulation with low-fidelity trainers has been identified as an effective, low-cost medical education practice. Medical colleagues have noted that even most high-fidelity trainers do not simulate skin compression properties adequately for tourniquet application. The objective of this project is to compare the compression-based mechanical properties of varying low-cost, commercially available foam materials to human skin for future application as a simulated skin during tourniquet application training.
Claudio Vignola, Engineering (Robotics)
Graduation: December 2018
Hometown: Milan, Italy

Investigation on Haptic Wearable Input Devices
Mentor: Angela Sodemann, assistant professor
Research Theme: Education

This project seeks to expand access to technology for people with disabilities, particularly due to technology progressing and becoming essential to daily life. One way to address this issue is to expand additional sensory feedback beyond the visual and audio. Thus, the focus of the research will be on the design, prototype and testing a low-cost 3D haptic user interface device that can make technology accessible without undue stresses to differently abled.

Jonacarl Vilchez, Computer Science
Graduation: May 2020
Hometown: Los Angeles, California

The Use of Augmented Reality (AR) and Physical Activity (PA) to Help Students with ADHD Learn
Mentor: Troy McDaniel, research assistant professor
Research Theme: Education

The goal of this project is to create a beneficial learning experience for students with attention deficit hyperactivity disorder (ADHD). This will be done by building an educational game that combines physical activity (PA) and augmented reality (AR). Studies have provided evidence that PA and AR help students with ADHD concentrate and engage. School subjects will be taught, through the game, using AR. The lessons begin until the user walks a certain distance, which is how PA is motivated. The purpose is to determine whether the game is more motivating than traditional classroom activities.

Yugansh Virmani, Mechanical Engineering
Graduation: December 2018
Hometown: Faridabad, India

In-Situ ABI Testing of Pipeline Materials
Mentor: Yongming Liu, professor
Research Theme: Security, Sustainability

About 45 percent of crude oil pipelines in the U.S. are over a half-century old, and these pipelines deteriorate gradually. Their integrity is important to avoid leakage, leading to safety and environmental hazards. Therefore, it is of great importance to develop non-destructive, or minimally destructive mechanical test methods, which can be performed in-situ. The objective of this research is to predict the mechanical properties of a material using Automated Ball Indentation testing. The ABI test is based on multiple indentations on the same location of a polished surface. This will enable researchers to carry out life assessment of the pipelines non-destructively.

Joseph Vlastos, Aerospace Engineering
Graduation: May 2019
Hometown: Millstadt, Illinois

Low-Cost Fabrication and Optical Characterization of Nanoparticle Based Selective Meta-Surface Absorbers for Solar Thermal Energy Harvesting
Mentor: Liping Wang, assistant professor
Research Theme: Energy, Sustainability

The primary objective is increasing solar thermal efficiency by improving solar absorbance. Solar absorbency is the amount of light energy that is converted to heat energy, which can be readily converted to electricity. Gold nanoparticles will adhere to aluminum-plated silicone. This has been hypothesized to increase absorbance. Research and preparations have been conducted in anticipation for the first test. Previous results indicate that consistency is still needed and machinery is being ordered to remove human error. Future work may include expanding the techniques used, as well as exploring biomedical applications.
Julie Vuong, Mechanical Engineering
Graduation: May 2018
Hometown: Phoenix, Arizona

Improving Step Length Estimation for Gait Analysis Through Kinematic Models and Sensor Fusion
Mentor: Wenlong Zhang, assistant professor
Research Theme: Health

There is a need to make gait monitoring/analysis, currently restricted to on-site locations, more convenient and accurate by bringing it outside of a controlled environment. The purpose of this research is to improve step length estimation for gait analysis using captured data of lower limb kinematics from the pairing of smart shoes and inertial measurement units (IMUs). The data collection is analyzed using human modeling to estimate step length. Future work includes improving the design of smart shoes and IMUs as a unit, developing a user interface and creating an improved gait model for analysis.

Feifan Wang, Industrial Engineering
Graduation: May 2021
Hometown: Anji, China

Real-Time Control of Geometric Serial Lines with Residence Time Constraints
Mentor: Feng Ju, assistant professor
Research Theme: Sustainability

Scrap due to residence time constraints are commonly seen in manufacturing systems. In such systems, minimum and maximum waiting times for each part are enforced in the buffer. To optimize the trade-off between production rate and scrap rate, an on-off control policy for a two-machine geometric production system is derived using Markov decision processes with state approximation. An iteration method is further provided to improve the control policy.

Graduate Research Travel Grant

Peiyan Wang, Biomedical Engineering
Graduation: May 2020
Hometown: Baotou, China

Predicting Motor Skill Retention in Older Adults with the Visuospatial/Executive Subtest of the Montreal Cognitive Assessment
Mentor: Sydney Schaefer, assistant professor
Research Theme: Health

Cognitive screening may improve clinicians’ ability to predict patients’ responsiveness to motor rehabilitation. Previous research demonstrated in adults over 65 that lower scores on standardized visuospatial tests are associated with less retention of a motor skill. The purpose of this study was to determine whether a briefer cognitive screening tool could predict motor skill retention as well. Cognitive status was tested with the Montreal Cognitive Assessment (MoCA), which is very brief (<5 mins). Participants were trained for a functional novel upper extremity motor task that simulated feeding. Stepwise regression revealed that higher Visuospatial/Executive score is predictive of better skill retention.

Graduate Research Travel Grant

Samuel Welker, Electrical Engineering
Graduation: December 2018
Hometown: Tempe, Arizona

Asthma Sensor
Mentor: Junseok Chae, professor
Research Theme: Health

The purpose of this project is to design and build a wearable sensor that monitors breathing patterns with the intent of aiding doctors in diagnosing early symptom of asthma. The sensor measures real-time data taken from the subject’s chest circumference and logs it into an on-board SD (secure digital) card. The device utilizes a non-ionizing non-invasive technique to capture breathing data. More work on optimization of the sensors size and battery life needs to be completed to create a more robust and publicly acceptable design.
Synthesis and Application of Next-Generation Nano-ceramic Electrolyte

Mentor: Candace Chan, assistant professor
Research Theme: Energy, Sustainability

Solid lithium lanthanum zirconate (LLZO) shows to be a promising candidate to replace dangerous liquid electrolytes and increase the overall battery properties to meet our increasing need for energy storage. This research focuses on synthesizing LLZO with Nano-synthesis techniques to stabilize its most promising structure. It was found that through a highly basic molten salt medium LLZO could be synthesized at significantly lower temperatures. The research then extended to implementing the nanoceramic into a polymer composite matrix to synergistically increase Lithium ion transport in battery device fabrication while lowering the amount of reactive, expensive and toxic ingredients.

Predictive Relationship Between EEG and EMG Signals

Mentor: Panagiotis Artemiadis, associate professor
Research Theme: Health

The purpose of this research is to isolate and measure brain activity associated with movement before movement occurs. Active motor control in human beings produces at least two different electric signals: a neural signal in involved muscles, which can be measured using EMG, and a neural signal from the brain’s intent of action, which can be measured through EEG. This experiment simultaneously captured EMG and EEG signals from a subject and analyzed the correlations between the two signals. Future work should involve implementing the predictive EMG and EEG relationships into human-machine interfaces.

Employing the Entrepreneurial Mindset at WEFTEC in Chicago

Mentor: Treavor Boyer, associate professor
Research Theme: Education, Health, Sustainability

In the past three months, the team have led the chartering of SWEL, a new ASU student organization that has seen great initial success. SWEL's parent organization on the national level, the Water Environment Federation, held their annual conference (WEFTEC) in Chicago, Illinois. By attending WEFTEC while employing the three C's of the entrepreneurial mindset, the SWEL leaders have identified their professional goals. They inspired curiosity through a service event at a local elementary school, made connections via copious networking, and created value by sharing their lessons with the rest of the student organization.

Characterizing the Energy Efficiency of Fiducial Tracking on Mobile Devices

Mentor: Robert LiKamWa, assistant professor
Research Theme: Education, Energy

In order to provide richer augmented reality experiences, the system must improve the energy efficiency of tracking fiducials, visual anchors upon which synthetic images are displayed. To achieve this goal, finding a balance between sufficient performance and low energy usage is essential. To better understand the effect various influences have on performance and efficiency, data of several augmented reality applications have been collected. Some metrics taken into account throughout data collection include image size, camera configurations, and frame rate. Future work involves creating an OpenCV augmented reality application in order to fully customize and test the desired parameters.
Carbon nanotube (CNT) membranes have been shown to exhibit a sensitive and stable piezoresistive response. This investigation aims to develop a commercially viable glass fiber packaged carbon nanotube membrane based strain sensor from a proof-of-concept. Performance enhancements will be achieved through inducing a residual compressive pre-stress state on CNT membranes, and integrating multiple self-sensing layers for added redundancy. In this study, the effects of real environmental conditions on sensor gauge factor are explored under static and fatigue conditions.

The objective of this research is to examine the fatigue strength due to various microstructural features and crystal plasticity theories, and to implement a multiaxial fatigue failure prediction model. The material microstructure was generated by using a Voronoi diagram in commercial finite element software ABAQUS, then uniaxial tension and shear simulation will be performed through the user defined element of crystal plasticity. The next step, the macro level fatigue-life curves, will be obtained and to investigate the microstructure texture effect on the material fatigue-life curves by parametric studies. This prediction model can help predict possible failures of aircraft components.

We will present an environmentally responsive hydrogel that exhibits the following features: enhanced mechanical property, upper critical solution temperature (UCST) swelling and responsiveness to visible-light. By forming a double network between polyacrylamide and poly(acrylic acid), the hydrogel toughness was significantly improved compared to the single network. The hydrogen bonding dissociates and re-forms within the double network as temperature changes facilitating a UCST swelling behavior. By incorporating a chromophore, the hydrogel demonstrated a positive swelling upon the irradiation of visible-light. This double network system shows a potential route in developing “smart” hydrogels using visible-light as a simple and inexpensive stimulus.

The internet of things (IoT) for Pet Care will allow pet owners to check their pet's health status through the smartphone app. The pet feeder and mobile app are both connected in Artik cloud to communicate to each other. Pet feeder tracks the weight of the pet and food intake on a daily basis. It also allows the owner to watch a video of their pet eating, as well as Facetime with the pet. This will conveniently allow pet owners to check their pet's health status. The next step will be analyzing collected data to represent the pet's health status.
The Fulton Schools Grand Challenge Scholars Program (GCSP) combines innovative curriculum and cutting-edge research experiences into an intellectual fusion that spans academic disciplines and includes entrepreneurial, global and service learning opportunities. The program’s goal is to prepare tomorrow’s engineering leaders to solve the grand challenges facing society during the next century. Through completion of the five components of the program, students will have the opportunity to engage in research relating to their selected grand challenge, explore interdisciplinary coursework, gain an international perspective, engage in entrepreneurship and give back to the community through service learning. Fulton Schools students who complete the program will achieve the distinction of Grand Challenge Scholar, endorsed by ASU and the National Academy of Engineering (NAE), and will be uniquely prepared to collaborate and succeed in a transdisciplinary and global environment.

Grand Challenge Scholars Program students who receive the GCSP Research Stipend are invited to share their research with the community by participating in the FURI Symposium.

Omar Arafa, Chemical Engineering
Graduation: May 2018
Hometown: Chandler, Arizona
Ethanol Production with Hollow fiber Membranes in Microbial biofilm Reactors
Mentor: Bruce Rittmann, Regents’ Professor
Research Theme: Sustainability

Hollow fiber membranes are used as a means of delivering gas to a microbial biofilm reactor (MBfR). These reactors use bioconversion processes to produce ethanol from this inlet gas. The transfer properties of a composite and Matrimid® membrane in a gas-liquid interface were studied. An MBfR running on hydrogen gas was operated continuously using a bicarbonate feed. The mass flow rate of the outlet ethanol was monitored over the duration of two months. Future work will optimize the MBfR yield by studying various operating conditions.

Ryan Fagan, Aerospace Engineering
Graduation: May 2019
Hometown: Peoria, Arizona
Handheld IR Interferometer
Mentor: Phil Christensen, Regents’ Professor
Research Theme: Education

The research goal is to determine if a multimillion dollar Infrared spectrometer can be produced for less than $10,000 without sacrificing performance and maintain a small footprint. Preliminary designs and comparative performance calculations have been used to determine that it is possible to achieve similar performance around the price point of $10,000 per instrument by utilizing spare components, off-the-shelf hardware and utilizing the technological improvements gained from previous instruments. The next step in the process is to verify that the key components in determining the performance of the system by purchasing and experimentally verifying them.
Zachary Tronstad, Chemical Engineering
Graduation: May 2019
Hometown: Tucson, Arizona

Tuning the Hydrophilicity of Electrospun Membranes for Water Filtration
Mentor: Matthew Green, assistant professor
Research Theme: Sustainability

Reverse osmosis (RO) is an extraordinary method of desalinating water, but it is very susceptible to fouling and thus needs pretreatment membranes to filter the saline water. Most membranes are unable to find a suitable compromise between filtration performance and flow rate. Through electrospinning, the hydrophobic polymer poly(vinyl chloride) (PVC) and hydrophilic polymer poly(vinyl alcohol) (PVA) can be combined to form a non-woven, micron-sized membrane. Using water contact angle and turbidity measurements to determine the hydrophilicity and filtration performance (respectively), this project aims to model how differing weight ratios of PVC:PVA affect these membrane characteristics.

Kiana Ghazouli, Computer Science
Graduation: May 2018
Hometown: Redwood City, California

The Impact of Time Constraints on HackerRank Assessments
Mentor: Robert Atkinson, associate professor
Research Theme: Education

The purpose of this study is to determine whether time constraints impact individual performance on HackerRank coding assessments. One condition of subjects will be given a standard 30 minutes to complete the assessment, while the other will be given an additional 15 minutes to revise. Subjects wear two physiological sensors, a shimmer and Advanced Brain Monitoring headset that measure cognitive workload, engagement and distraction. External eye trackers and facial recognition webcams will measure visual attention, engagement, drowsiness and emotional arousal. Using these metrics and a personality survey, the study will examine the difference in subjects’ performances based on time constraints.

BECOME A GRAND CHALLENGE SCHOLAR

- Make solar energy economical
- Engineer better medicines
- Provide energy from fusion
- Reverse-engineer the brain
- Develop carbon sequestration methods
- Prevent nuclear terror
- Manage the nitrogen cycle
- Enhance virtual reality
- Provide access to clean water
- Advance personalized learning
- Manage the nitrogen cycle
- Engineer the tools of scientific discovery
- Secure cyberspace
- Advance health informatics

Learn more at gcsp.engineering.asu.edu
Where are they now?

Jeremy Adams (Chemical Engineering Spring ’17, FURI Spring ‘16–Fall ‘17) is pursuing a doctorate in chemical and biomolecular engineering at the University of California, Berkeley.

Rick Ahlf (Aerospace Engineering Spring ’17, FURI Spring ’14) is working as an aerodynamics engineer in the low-speed aerodynamics product development group at Boeing in Mukilteo, Washington, and serving as the CTO of 643 Charts, LLC.

Andre Apostol (Mechanical Engineering Spring ’17, FURI Spring ’17) is pursuing his doctorate in mechanical engineering at Clemson University with a focus on control systems for autonomous vehicle applications.

Regina Arreola (Chemical Engineering Spring ’11, FURI Fall ‘09–Spring ‘10) is helping grow user base and adoption for Workplace by Facebook as a strategic partner manager.

FURI helped me multitask and prioritize my activities during crucial undergrad years.

— Regina Arreola

Payal Bhavsar (Biomedical Engineering ‘08, FURI ’07) is an integrated circuit design engineer at Medtronic’s Tempe Campus.

Daniel Bishop (Bioengineering Spring ’09, FURI ’05–’09) is running Qualaris, a health IT startup, with his ASU alumni co-founders.

Hone your skills during your undergrad years and find great mentors and great friends. All three will stick with you and serve you well in life.

— Daniel Bishop

Lyle Bliss (Chemical Engineering Spring ’17, FURI Fall ’15–Spring ’17) is pursuing his doctorate in chemical engineering at the University of Colorado, Boulder.

Lexie Brunelle (Biomedical Engineering Spring ’16, FURI Spring ’15–Fall ’15) is a research associate at Abcam.

FURI opened so many doors and allowed me to network with peers as well as faculty members that I may not have otherwise met.

— Lexie Brunelle

Kecin Bunish (Materials Science and Engineering ’15, FURI Fall ’13) is a senior design engineer at Honeywell Aerospace.

Dillon Card (Mechanical Engineering Spring ’14, FURI Fall ’12–Spring ’14) is a build reliability engineer specializing in metallic primary structure, avionics and propulsion at SpaceX in Hawthorne, California.

Emma Card (Chemical Engineering Spring ’17, FURI Spring ’16) is a process development engineer in Ingevity’s performance materials division.

Megan Card (Mincieli) (Mechanical Engineering Spring ’14, FURI Fall ’12–Spring ’14) is a composites build reliability engineer II at SpaceX in Hawthorne, California.

FURI gave me the opportunity to get involved early in my degree and gain experience that was the focus for my first interview.

— Megan Card (Mincieli)

Joe Carpenter (Chemical Engineering Spring ’14, FURI Summer ’12–Spring ’14) is pursuing his doctorate in materials, focused on electron microscopy at ASU.

Matt Carroll (Mechanical Engineering Spring ’13, FURI Spring ’11–Fall ’12) is a licensed professional engineer working as a design engineer for Southland Industries.

Kregg Castillo (Electrical Engineering Spring ’17, FURI Spring ’16, Spring ’17) is currently working toward a master’s degree at the University of Illinois Urbana-Champaign and serves as a teaching assistant.

David Cayil (Mechanical Engineering Spring ’17, FURI Fall ’15–Spring ’16) is a graduate student at the University of Texas at Austin.

Priya Challa (Aerospace Engineering, Earth and Space Exploration – Astrophysics Spring ‘14, FURI Spring ’13–Spring ’14) is a propulsion development engineer at Blue Origin.

Chris Chandler (Computer Science ’06, FURI ’08) recently started a video game studio.

Michael Christy (Engineering Spring ’16, FURI Fall ’15–Spring ’16) is a manufacturing applications engineer at Tata Consultancy Services.

Zhanelle Coleman (Engineering Robotics) Spring ’17, FURI Spring ’17) is pursuing Lean, Six Sigma, and Project Management Professional certifications, and interning at Just Huynh.

FURI taught me to take greater initiative, and to expect more of myself with each learning experience.

— Zhanelle Coleman

Jerry Crum (Chemical Engineering Spring ’17, FURI Spring ’16) is pursuing a doctorate at the University of Notre Dame in chemical engineering.

Joshua Daymude (Computer Science and Mathematics, Summer ’16, FURI Spring ’15) is pursuing his doctorate in computer science at Arizona State University.

Angelo Deliuomo (Electrical Engineering Fall ’16, FURI Fall ’15) is an applications engineer at Analog Devices.

Abhishek Dharan (Electrical Engineering Spring ’14, FURI Fall ’13–Spring ’14) is a medical student at the Paul L. Foster School of Medicine at Texas Tech University Health Sciences Center in El Paso.

Andrew Dopilka (Chemical Engineering Spring ’17, FURI Fall ’15–Spring ’16) is pursuing a doctorate in materials science and engineering at Arizona State University and is working as a research assistant.

Meera Doshi (Biomedical Engineering Spring ’17, FURI Fall ’14–Spring ’15) is a Fulbright Scholar in Malaysia and will be a business analyst at McKinsey & Co. in Fall 2018. Doshi currently works as a customer business analyst at Intel.
FURI helped me learn how to think critically, collect and analyze data to come to meaningful conclusions, and work in a team. These skills have all been invaluable in my development as a person and as a professional.

— Meera Doshi

Bryan Duarte (Software Engineering Spring ’16, FURI Fall ’14–Spring ’15) is pursuing his doctorate in computer science at Arizona State University under the IGERT Fellowship.

FURI allowed me to spend time researching complex problems I was unable to do in standard courses. Through FURI I found an area which still needed attention. As a result I began pursuing a PhD in the area of Person-Centered Accessible Technology.

— Bryan Duarte

Nathan Dunkin (Civil and Environmental Engineering Spring ’11, FURI Spring ’09–Spring ’11) is a consultant at a Boston Consulting Group after recently completing his doctorate from the Johns Hopkins Bloomberg School of Public Health.

Laila El-Ashmawy (Civil and Environmental Engineering Spring ’11, FURI Fall ’10–Spring ’11) works on energy statistics at the International Energy Agency as an energy data manager with a focus on Middle East and African countries.

Darcy Frear (Biomedical Engineering Spring ’13, FURI Fall ’11–Spring ’13) is pursuing her doctorate in hearing engineering at Harvard University.

Gordon Freirich (Mechanical Engineering Spring ’12, FURI Fall ’09–Spring ’10) is a product development engineer for Hunter Douglas.

Alison Gibson (Aerospace Engineering Spring ’15, FURI Fall ’12–Fall ’14) is a space operations engineer at SpaceX.

Taylor Graber (Biomedical Engineering Spring ’13, FURI Fall ’12–Spring ’13) graduated with a medical doctor degree from the University for Arizona's College of Medicine - Phoenix, and is now doing residency in anesthesiology at University of California, San Diego.

Omar Habib (Electrical Engineering Spring ’10, FURI Spring ’10) is a senior design engineer at Apple Inc. and pursuing a doctorate in electrical engineering at Arizona State University.

Mackenzie Hagan (Civil (Environmental) Engineering Spring ’15, FURI Spring ’12–Spring ’13) is a civil designer (EIT) for the Water/Wastewater Treatment and Consulting Group at GHD Inc.

If you’re passionate about your field, don’t stop when FURI does. FURI is an amazing way open the door, but do your best to keep it open.

— Mackenzie Hagan

Emily Herring (Biomedical Engineering Spring ’16, FURI Spring ’12–Fall ’13) is pursuing her doctorate in biomedical sciences with a focus on computational biology and bioinformatics at the University of Notre Dame and working as a research assistant.

Trent Hoffman (Aerospace Engineering Spring ’14, FURI Fall ’12–Fall ’13) is working as patent agent at Snell & Wilmer.

Katherine Huffer (Ruh) (Biomedical Engineering Spring ’12, FURI Spring ’11–Spring ’12) is a research and design engineer at Bard Peripheral Vascular.

You never know where your research will take you — you could get your work published in a journal, you could create something worth putting a patent on or you could present your research to many industries leaders.

— Katherine Huffer (Ruh)

Philbert Huskun (Bioengineering Spring ’08, FURI Fall ’06–Spring ’08) is a biomedical equipment specialist at Whiteriver Indian Hospital.

James Hutchins (Computer Science Spring ’17, FURI Fall ’16) is a computer science master’s student at Arizona State University.

Lordan Lordanov (Chemical Engineering Spring ’17, FURI Spring ’14–Spring ’15) is a research and development engineer at Quantum Clean.

Katherine Irimata (Ca) (Chemical Engineering and Statistics, Spring ’13, FURI Spring ’10–Fall ’12) is a doctoral candidate in statistics at Arizona State University.

Ben Jimenez (Aerospace Engineering Fall ’10, FURI Spring ’07–Fall ’09) is a refrigeration heat transfer and fluids engineer at the Whirlpool Corporation.

Galen Johnson-Bates (Chemical Engineering Fall ’11, FURI Fall ’08–Fall ’10) is building killer apps for the industrial internet as an APM product owner for General Electric.

Paul Juneau (Biomedical Engineering Spring ’14, FURI Spring ’13–Summer ’13) is a software engineer specializing in writing software for Business Process Management and Customer Relationship Management at G/O Digital Marketing.

Amy Kaczmarowski (Aerospace Engineering Spring ’12, Fall ’11–Spring ’12) is a materials science engineer at Sandia National Laboratories.

Nick Kemme (Mechanical Engineering Spring ’16, FURI Fall ’15–Spring ’16) is working on lasers at General Atomics as an opto-mechanical engineer.

Haroon Khan (Computer Engineering Spring ’13, FURI Fall ’10–Spring ’11) is pursuing his master’s in business administration at University of Virginia.

Alexander Kim (Mechanical Engineering Fall ’16, FURI Fall ’16) is a clinical research technician at the University of Arizona.

FURI gave me tangible proof that I was making a meaningful contribution to society. It taught me real-world skills that I’m still using at my job today.

— Alexander Kim

Julia King (Chemical Engineering Spring ’16, FURI Fall ’14–Spring ’15) is pursuing her doctorate in chemical engineering at the University of Washington.

Nathan Kirkpatrick (Biomedical Engineering Spring ’16, FURI Fall ’15–Spring ’16) is chasing that doctoral dragon at Georgia Institute of Technology and Emory University in biomedical engineering.

Kody Klimes (Mechanical Engineering Spring ’15, FURI Summer ’13, Summer ’14) founded and is running a SBIR funded Company, and on track to obtain a doctorate in materials engineering in Spring ’18.

Katelyn Kline (Mechanical Engineering Spring ’17, FURI Spring ’15–Fall ’15) is pursuing a graduate degree at ASU.

John Kondziolka (Civil and Environmental Engineering Spring ’12, FURI Fall ’10–Spring ’12) is an environmental engineer at Gradient in Cambridge, Massachusetts.
Andrea Ladner (Keck) (Mechanical Engineering Spring '07, FURI Fall '06–Spring '07) is a process engineer at Intel.

Arad Lajevardi-Khosh (Electrical Engineering Spring '09, FURI Fall '11–Spring '11) is a biomedical engineering doctoral candidate at the University of Utah.

Kevin LaRosa (Electrical Engineering Spring '12, FURI Spring '10–Spring '12) is an electrical engineer at Texas Instruments.

Andrew Larson (Chemical Engineering Spring '11, FURI Fall '10–Spring '11) is an advanced process control engineer at CITGO Petroleum Corp.

David Latshaw II (Chemical Engineering Spring '09, FURI Fall '08–Spring '09) is a senior scientist at Johnson & Johnson specializing in process science and analytics for pharmaceutical manufacturing.

Alec Laws (Mechanical Engineering Spring '16, FURI Spring '16) is working on an advanced materials master's degree at Universität Ulm, Germany.

Mikaela Links (Stadie) (Chemical Engineering Spring '15, FURI Fall '12–Spring '15) is a quality engineer at W. L. Gore & Associates.

FURI helped develop my passion for hands-on research and development, ultimately leading me to the incredible, innovative company I am fortunate enough to work at today.

— Mikaela Links (Stadie)

Isaías Martínez (Aerospace Engineering Spring '14, FURI Spring '13) is a mechanical engineer at Raytheon Company.

Chelsey McAlpin (Materials Science and Engineering Spring '15, FURI Spring '12) is a process engineer for IM Flash technologies.

Soroush Mirtalaei (Bioengineering Fall '06, FURI '06) is an associate manager supporting global manufacturing of medical devices at Baxter International Inc.

Ngoní Mugwisi (Electrical Engineering Spring '17, FURI Summer '14–Spring '15) is pursuing his doctorate in electrical engineering (with a focus on power electronics for microgrid systems) as a Rhodes Scholar at University of Oxford.

Seek to connect with other student researchers and learn from students in other labs.

— Ngoní Mugwisi

Kazuko Niimi (Chemical Engineering Summer '17, FURI Spring '17) is a manufacturing technician at Intel Corporation in Chandler, Arizona.

Elizabeth Nofen (Walker) (Chemical Engineering Spring '12, FURI Summer '10–Spring '11) graduated from ASU in 2016 with her doctorate in chemical engineering and now works in Materials Technology Development at Intel Corporation in Chandler, Arizona.

Brian Perea (Chemical Engineering Spring '12, FURI Spring '09–Spring '11) is a data scientist transforming mobile app testing at HeadSpin, Inc.

Alexandra Porter (Computer Science, Mathematics Spring '17, FURI Spring '14–Fall '14) is a graduate student in the computer science doctoral program at Stanford University.

Emily Preston (Sutton) (Materials Science and Engineering Spring '13, FURI Summer '11–Spring '12) is a new product integration engineer at FormFactor in Oregon.

Spencer Prost (Computer Science Spring '13, FURI Fall '11–Spring '13) is a software engineer at Pacific Northwest National Laboratory, a DOE Office of Science National Laboratory.

Ellen Qin (Chemical Engineering Spring '14, FURI Summer '11–Spring '12, Fall '13–Spring '14) is pursuing her doctorate in materials science and engineering at the University of Illinois, Urbana-Champaign.

Maria Jose Quezada (Biomedical Engineering Spring '17, FURI Fall '16–Fall '17) is pursuing a dual doctorate program in physical therapy and biomedical engineering at Northwestern University.

During your research there will be a lot of failures and challenges, but there will also be ‘aha’ moments — cherish them because those are the ones that will keep you motivated.

— Maria Jose Quezada

Elizabeth Quigley (Materials Science and Engineering Spring '16, FURI Spring '15–Spring '16) is pursuing a doctorate in materials science and engineering at Georgia Institute of Technology and is a National Science Foundation Fellow.

Liliana Rincon Gonzalez (Biomedical Engineering Summer '07, FURI '06 and '07) is an assistant research professor at Florida International University.

Mariela Robledo (Chemical Engineering Fall '13, FURI Summer '11–Spring '13) is a manufacturing team leader for the snacks department at General Mills in Albuquerque, New Mexico.

FURI gave me confidence in my academic abilities, the opportunity to build a strong bond with my mentor, and the support to be involved in meaningful work.

— Mariela Robledo

Julie Rorrer (Chemical Engineering Spring '14, FURI Spring '12–Spring '14) is a doctoral candidate in chemical engineering at the University of California, Berkeley.

Susan Sajadi (Biomedical Engineering Spring '16, FURI Fall '15–Spring '16) is an engineer at W. L. Gore & Associates.

Matthew Sawtelle (Chemical Engineering Fall '12, FURI Spring '10–Fall '12) is an analytical scientist at Genus Lifesciences, Inc.

Matthew Schneider (Aerospace Engineering Spring '17, FURI Fall '16–Spring '17) is a systems engineer at Honeywell Aerospace.

Jared Schoepf (Chemical Engineering Spring '13, FURI Spring '12–Spring '13) received his doctorate in chemical engineering from ASU and is now the director of operations for EPICS at ASU and a lecturer for Ira A. Fulton Schools of Engineering.

Christopher Schott (Mechanical Engineering Spring '15, FURI Fall '14) is an engineer at Ford Motor Company.

Christy Sennavongsa (Chemical Engineering Spring '17, FURI Spring '15) is a dry etch process engineer for Micron.

FURI helped me learn to think about problems from different angles to get a complete picture. There’s more than one way to do something and solve a problem.

— Christy Sennavongsa

Steven Shark (Aerospace Engineering Spring '09, FURI Spring '09) is a propulsion development engineer at Blue Origin.

Bryan Smith (Chemical Engineering Spring '16, FURI Fall '15–Spring '16) is a field applications engineer at Tokyo Electron America.
FURI taught me valuable lessons in managing a schedule to stay on track and how to collect, analyze, and present data in a clear manner.
— Bryan Smith

Bethany Smith (Materials Science and Engineering Spring ‘15, FURI Summer ‘12–Fall ‘12) is pursuing her doctorate at the University of California, Berkeley and is a graduate student researcher.

Amanda Snodgrass (Chemical Engineering Spring ‘15, FURI Spring ‘13–Spring ‘14) is an engineer at the University of Dayton Research Institute and is pursuing a master’s degree in materials engineering at UD.

Abbey Soulek (Biomedical Engineering Spring ‘14, FURI Fall ‘11–Spring ‘12) is a new product development engineer at Powerex, Inc.

Robert Srinivasiah (Computer Science Summer ’07, FURI Fall ’04–Fall ’07) is a VR/AR graphics engineer at Unity Technologies.

Cassandra Steeno (Electrical Engineering Fall ‘16, FURI Spring ‘15–Fall ‘15) is pursuing a master’s in electrical engineering at ASU and is a graduate student and software intern at Intel.

Stephanie Thacker (Naufel) (Biomedical Engineering Spring ‘10, FURI Spring ‘09–Spring ‘10) is a technical and scientific consultant for DARPA.

FURI supported my immersion into neural engineering, which launched my career.
— Stephanie Thacker (Naufel)

Logan Van Engelhoven (Mechanical Engineering Fall ‘12, FURI Fall ‘11–Fall ‘12) is in grad school at the University of California, Berkeley, one semester away from a doctorate.

Anthony Volpe (Electrical Engineering Fall ‘08, FURI Spring ‘07–Fall ‘07) is pursuing a Juris Doctor of Law at Pepperdine University, Malibu California.

Nicholas Wagner (Materials Science and Engineering Spring ‘14, FURI Spring ‘12, Fall ‘12) is pursuing a doctorate in materials at Northwestern University and is looking forward to becoming a data scientist upon graduation.

Shawn White (Mechanical Engineering Spring ‘17, FURI Fall ‘15–Spring ‘16) is pursuing a master’s degree in mechanical engineering at ASU and interning at MD Helicopters in Mesa, Arizona.

Take advantage of all the opportunities that ASU provides to build you experience prior to graduation.
— Shawn White

Andrew Williams (Mechanical Engineering Spring ’08, FURI Fall ’06–Spring ’08) completed medical school at the University of Arizona College of Medicine - Phoenix, completed residency in Combined Internal Medicine and Pediatrics at Banner University Medical Center - Phoenix, and is now an Adult Cardiology Fellow at the University of Oklahoma.

Eric Yee (Industrial Engineering and Computer Science Spring ’11, FURI Summer ‘17, Fall ‘10–Spring ‘11) is a computer security analyst at McAfee, Inc.

Brian Zucker (Materials Science and Engineering Spring ’17, FURI Spring ’17) is working as an Additive Manufacturing Engineer at Titan Industries.

Not sure how to create a research question?
Conduct a literature review?
Make undergraduate research a reality for you?

In collaboration with the ASU Library, the Fulton Undergraduate Research Initiative has designed a free, user-friendly research ASU Libraries Orientation for FURI course on Blackboard.

By taking this course, you will learn how to create a research question, conduct a literature review, maximize library resources and more.

Find out how to join at furi.engineering.asu.edu

Students taking the course will get a #FURlous T-shirt after completing at least a couple modules.
What does it mean to bring an entrepreneurially minded approach to research?

In a dynamic and interconnected world, it is critical for the Fulton Schools to teach a technical skillset along with an entrepreneurial mindset that fosters curiosity, connections and the creation of value (3Cs). ASU has long been a leader in entrepreneurially minded learning, with a range of programs, resources and classes to empower students. Programs such as FURI teach students how to apply entrepreneurial thinking to a given career or field, leading to innovative solutions that create extraordinary value.

When research is approached with an entrepreneurial mindset, students use their curiosity as the impetus for determining their area of investigation. They synthesize information from multiple sources as well as the discoveries made in their work to develop a deep understanding of all stakeholders involved. Researchers anticipate societal and economic trends to provide valuable solutions for new or improved business opportunities.

KEEN proudly supports the Fulton Undergraduate Research Initiative and the program’s efforts to instill curiosity, connections and the creation of value into research projects.

Learn more about KEEN and the 3Cs at engineeringunleashed.com
Financial support for the FURI program is made possible by Ira A. Fulton.

Special thanks to all of the mentors, family and friends for supporting our students through this program.

We appreciate the efforts of all who helped make this program a success, especially:

Jean Andino
Susan Baldi
Sabrina Beck
Kevin Buck
Tamera Cameron
Bridgett Cantu
Scotty Craig
Arnaud Ehgner
Jhanaye Glynn
Michael Goryll
Debra Gower
Usha Jagannathan
Cheryl Jennings
Jessica Jensen
Peggy Kilgore
Cortney Loui
JoAnne McDermand
Kelley McManus
Barbara Minich
Cynthia Moayedpardazi
Bin Mu
Beverly Naig

Jay Oswald
Yulia Peet
Shannon Pete
Deb Prewitt
Shaunna Price
Yueming Qiu
Cheryl Roberts
Arthur Sainz
Wesley Scruggs
Shevonda Shields
Barbara Smith
Jenna Snowberger
Angela Sodemann
Sohum Sohoni
Tomi St John
Alicia Stiers
Sefaattin Tongay
César Torres
Shane Underwood
Brent Vernon
Gary Waissi
Qing Hua Wang
Fueling Innovation
Building Engineers

At Arizona State University, we've been educating engineers for Arizona and the world for nearly 60 years. With more than 20,000 students, we are building the engineers of the future and pursuing the discoveries and solutions to challenges facing society.

In 2003, Ira A. Fulton, founder and CEO of Arizona-based Fulton Homes, established an endowment of $50 million in support of ASU’s College of Engineering and Applied Sciences.

His investment served as a catalyst, enabling the development of a dynamic portfolio of strategic initiatives that benefit our students and faculty and the communities where they live and work.

Throughout the years, Ira A. Fulton has remained an active supporter of the school that bears his name. He is a familiar face to students and a regular presence at events such as this semiannual FURI Symposium.

“I strongly believe you cannot have a great city without a great school of engineering.”
Ira A. Fulton