



University of Idaho  
College of Engineering

# MECHANICAL ENGINEERING NEWS

## UPDATES FROM OUR STUDENT ORGANIZATIONS

### ASME INDUSTRY TOURS AND REVAMPED CLUB LOUNGE MAKE FOR A BUSY YEAR

This academic year has been very productive for our American Society of Mechanical Engineers student section. The club facilitated a broad spectrum of industry tours and has completely revamped the ASME lounge. The room now includes a new refrigerator, rearranged furniture for more effective study groups, and storage lockers for rent. The club is also in the early stages of implementing an ASME store, which offers Arduino kits and Vandal gear. As part of the 2019 Engineering Design EXPO, ASME will be hosting an egg launch competition for prospective as well as current students to heighten awareness and respect for the discipline.



ASME officers Mike Odell, Chris Douglas and Nick Brubaker (left to right).



Vandal Engineers assemble in front of a picture of a Kodiak airplane produced by Quest Aircraft.

This past fall, we had the opportunity to go on two different industry tours hosted by alumni on the Mechanical Engineering Advisory Board. In September, students were guided on a journey through Quest Aircraft's primary production facility by University of Idaho alumni and Principal Engineer Jamie Slippy. Students experienced the entire assembly process of the Kodiak 100 from part fabrication through the final stages of quality inspection.

In October, a smaller group of students visited Little Falls dam, which is about an hour outside of Spokane on the Spokane River, and owned/operated by the Avista Corporation. The company was in the final stages of their updating their turbines. Our tour was hosted by University of Idaho alumni and Avista Chief Dam Safety Engineer PJ Henscheid, and project mechanical engineer Nick Agostinelli. We got a rundown of how the dam works, as well as a close-up look at the turbine blade and housing. Agostinelli spoke to us about what goes into a project like this; from pre-staging, specifying different parts, lead times from overseas shipping, to the final assembly.

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# UPDATES FROM OUR STUDENT ORGANIZATIONS

## Annual Industry Tours in Seattle

At the beginning of the spring semester, the U of I ASME Club visited Seattle for several industry tours as well as a mixer with alumni in the area.

Vandal students visited Electroimpact and learned about their innovative and successful approach to making special purpose manufacturing robots. Guided by Chief of Staff Ben Hempstead, students saw an array of unique world-class products designed, marketed, sold, manufactured, assembled, and tested by the engineers themselves. Electroimpact's Mukilteo, WA campus featured numerous buildings containing products ranging from airplane parts to towering mobile robots fitted with secondary feedback controls that improve end-effector accuracy to levels comparable to the hands of a skilled watchmaker.



ASME Members at Electroimpact.



ASME Members at Kenworth's truck assembly plant in Renton.

Students also toured the Kenworth Truck assembly line, a branch of PACCAR, Inc. PACCAR was originally started in 1905 to engineer and produce logging equipment in Western Seattle. Kenworth was initiated in 1923 and engineered an assembly line to produce custom trucks for a wide variety of customers. On the manufacturing floor students saw a moving assembly line that supported mixed-mode fabrication of different sized, different colored, different featured semi-trucks. Many lean manufacturing principles were illustrated in the feeder line layout, the standardized work procedures, and the real-time metrics displayed on production screens.

The third stop on the trip was Boeing in Renton, Washington where we met with U of I alumni, Paul Huber, 737 Interiors, Product Excellence Group Manager. While there, we toured the facility that produces the brand new 737 Max and saw final assembly operations from the deck overlooking one of three lines that together produce more than 50 aircraft each month. We also viewed the wing production area which used several of the custom riveting machines produced by Electroimpact. Our Boeing hosts were gracious, articulate, and entertaining. They made our relatively small group feel very welcome.

At the Flying Heritage & Combat Armor museum in Everett, we were shown three hangers focusing on aircraft used in different international conflicts over the last century. Numerous aircraft on display



ASME members alongside Boeing's 737 final assembly line in Renton.



# UPDATES FROM OUR STUDENT ORGANIZATIONS

are kept in flight-ready condition so that they could be shown off in summer airshows beginning on the adjacent runway. The docents had first-hand experience in the factories where some of these planes were made, various roles in flying them over enemy airspace, and special responsibilities in supporting them on the ground between missions. There were also interactive display panels that featured several documentaries on different war periods as well as exercises to think about diplomacy and the causes of various world wars. Near the end of the tour a large group formed around a WWII veteran who was stationed in one of the hangers as he related his life story, answering many questions about his proud and inspiring career.

Over 20 Mechanical Engineering alumni joined 40 attendees on the spring ASME Industry Tours at the Brave Horse Tavern in downtown Seattle. The purpose of the evening was networking and sharing information about career paths in regional industry. As the evening rolled along, it was evident mechanical engineering alumni enjoyed reconnecting with their peers and former classmates just as much as they enjoyed chatting with current students. Great connections were made and renewed, tasty brews were sipped, a variety of hearty appetizers were sampled. In short, it was a memorable evening of Vandals engineering fellowship between current students and participating alumni.



Dr. Sean Quallen, Archana Dahal, Nikki Imanaka, Jazmyn Ray, Emily Chambers, Megan Ellis, Sara Murphy, Jadzia Graves, Bethany Kersten, Hailey Johnson (left to right).

## SOCIETY OF WOMEN ENGINEERS ATTEND ANNUAL CONFERENCE

*Sean Quallen*

This past October I had the honor of attending the Society of Women Engineers' (SWE) annual conference, WE18. This was the first major SWE event I have attended as the faculty advisor for the University of Idaho's SWE section. I attended with 9 SWE student members.

The conference was an eye-opener for me—men comprised about 1% of the attendees. This was a complete reversal of the social environment I see in my engineering courses, in which women are only about 15% of enrollees. I truly appreciated the opportunity to experience this highly interactive conference. My presence as a male faculty advisor was welcomed, even encouraged, by the other advisors in attendance which were exclusively women. I was able to establish lines of communication with many of them, recognizing them as future allies as I work to promote our local SWE section.

The students attending with me were also very active and engaged in the conference activities. Several of them were offered interviews and internships/jobs at the WE18 Career Fair. It was encouraging to see so many universities and private companies send representatives to the

conference to get to know emerging women leaders in engineering. Our entire student section volunteered during the "Invent It. Build It" event which brought in several hundred 6th-8th grade girls for engineering demonstrations and challenges.

Four members of our SWE section also competed in the PepsiCo/SWE Student Engineering Challenge, a nationwide undergraduate competition. Our team placed in the top 3 teams overall and were awarded with a fully funded trip to WE18 where they presented their final product design to PepsiCo representatives. I'm proud of their performance and tenacity in meeting this challenge.

We were able to offer this great opportunity to U of I SWE members via funding and donations from the Idaho Space Grant Consortium, Micron, the university's Engineering Student Advisory Council, the Mechanical Engineering Department, and the Chemical Engineering Department. Thank you for your commitment to our local SWE section and its professional development activities.

# TEACHING INNOVATIONS

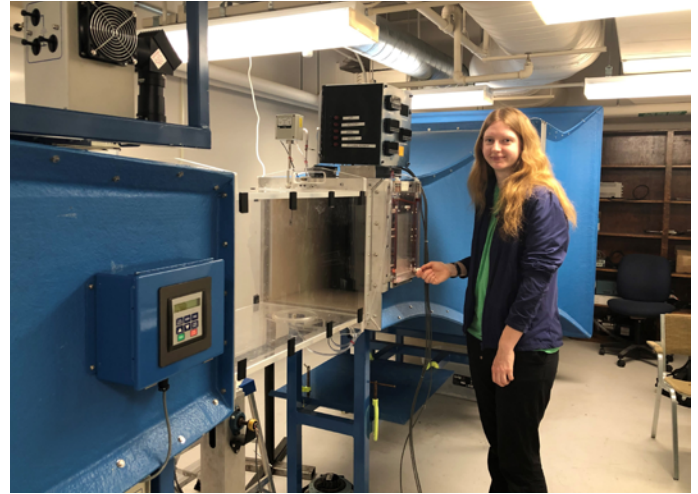
## EMBEDDED HONORS SECTION IN ENGINEERING FLUID MECHANICS COURSE

*Dr. Tao Xing*

The University of Idaho Honors Program (UHP) is an academic program that offers admitted students a vibrant, intellectual and social community. It emphasizes small honors class size and opportunities for undergraduate research and experiential learning, which enable students to work with selected professors one-on-one. In general, honors students take one honors course each semester in order to complete the program. Many of these courses also satisfy general education requirements. For many years, the College of Engineering has assisted Honors Program students by providing a special honors sections of statics and dynamics. Recently, the Mechanical Engineering department has helped honors students expand their engineering science options by creating embedded honors sections within additional engineering science courses. This past fall, Dr. Tao Xing, Associate Professor of Mechanical Engineering, taught ENGR 335 Engineering Fluid Mechanics with an embedded UHP section. Students who signed up for this section were required to complete additional homework problems and six hands-on experimental projects using everyday items.

The projects were:

- 1 SURFACE TENSION:** Design a simple experiment that demonstrates effect of temperature on surface tension.
- 2 HYDROSTATICS** Through experimentation and analysis determine if it is possible to fill in the bottle with just the right amount of water to make it sit in the water in an upright position.
- 3 TRANSIENT FLUID FLOW:** Compare analytical and experimental times for water at atmospheric pressure to empty a cylinder-shaped container through a hole of uniform diameter at the bottom of the tank.
- 4 BERNOULLI EQUATION:** Use knowledge learned in class to create a demonstration of this principle and explain the results.
- 5 MOMENTUM PRINCIPLE:** Design an experiment that demonstrates and explains the importance of this principle.
- 6 WIND TUNNEL TESTING:** Conduct velocity measurements using Pitot-static Tube and Inclined Manometer.



*ENGR 335 Honors student, Nicole Lorvick, learning to operate the subsonic wind tunnel.*

Honors program students used the data from their own measurements to validate their theoretical predictions, in addition to using knowledge learned in class to explain (both qualitatively and quantitatively) what they observed in the experiments. The interaction between these two approaches helped students identify the important flow physics happening in their everyday lives.

### WATCH VIDEO

Check out videos of each of these projects online at

[uidaho.edu/me-newsletter](http://uidaho.edu/me-newsletter).

# TEACHING INNOVATIONS

## WHAT'S NEW IN CAPSTONE DESIGN?

Dr. Matthew Swenson

The interdisciplinary capstone design program continues to evolve, with several new initiatives providing students with a real-world design experience. One new feature is a requirement for students to conduct a formal Engineering Release Review with their client, instructors, and fellow students during the second semester. This event signifies the timing for official engineering “release” of the student designs for a final prototype build. The new rubric includes the following deliverables: a) clear value proposition, b) understood product requirements, c) proof of concept, d) final design with models, drawings, and BOM, e) manufacturing and validation plans, f) overall project plan, and g) strategies for risk management. Instead of a traditional 1-5 scoring scale, the rubric uses a Red/Yellow/Green system for each deliverable, ensuring the students strive for readiness (“Green”) to proceed with building their design and enabling review participants to provide tangible go/no-go feedback to the students.



Seniors Caleb Smith (left to right) and Preston Stephens present the progression of their advanced multi-rotor drone during the final Snapshot before EXPO 2019.

| COMPETENCY   | NOT READY  | ALMOST   | READY TO GO   |
|--|--|--|---|
| <b>Value Proposition</b>   | <i>Missing</i> – No attempt to describe why the project is important; not relatable for the audience.  | <i>Technical Only</i> – Partial articulation of project impact; not relatable for non-technical audience.  | <i>Engaging</i> - Clear articulation of larger project impact; relatable to a non-technical audience.   |
| <b>Product Requirements</b>                                      | <i>Superficial Formulation</i> - Some relevant factors identified, few measurable.   | <i>Adequate Formulation</i> – Most relevant factors considered, some measurable.   | <i>Insightful Formulation</i> – All relevant factors considered, many measurable  |
| <b>Preliminary Proof of Concept</b>                              | <i>Missing</i> – No mention of modeling, testing, or prototyping at any scale.   | <i>Satisfactory</i> – High- level data without specified purpose or application.   | <i>Complete</i> – Focused data with relevant interpretations and conclusions.   |
| <b>System Design</b><br>(including any Models, Drawings and BOM) | <i>Missing</i> – No overall system architecture or knowledge of how subsystems relate to one another; no models or drawings available.                                 | <i>Basic</i> – Broad concept of a design with a basic idea of how it satisfies client needs; models, drawings, BOM partially complete.             | <i>Thorough</i> - Proposed solution(s) directly addresses client needs and specifications; models, drawings, and BOM available.   |
| <b>Manufacturing and Validation Plan</b>                         | <i>Disorganized</i> – Vague idea of components to be purchased and how parts fit together; largely unaware how to fabricate needed parts; unclear path for validation. | <i>Developed</i> - Selection of purchased components in progress; materials identified but may not be optimal; validation plan partially complete. | <i>Well Planned</i> - Specific vendors and model numbers ready for order; tooling and fixture needs understood; drawings reviewed by shop manager; clear validation plan. |
| <b>Project Management</b>  | <i>Wistful</i> – Path to completion unclear; budget uncertain.   | <i>Appropriate</i> - Credible timeline and budget given.   | <i>Insightful</i> - Contingencies considered in managing time and budget.   |
| <b>Risk Management</b>   | <i>Unaware</i> - No acknowledgment of project risks; relies only on a “home-run” solution.   | <i>Considerate</i> – Acknowledges risks and incorporates potential plans for worst-case scenario.  | <i>Mitigated</i> – Identifies logical risks and clear paths and fallback plans to address each.   |



# INFRASTRUCTURE IMPROVEMENTS

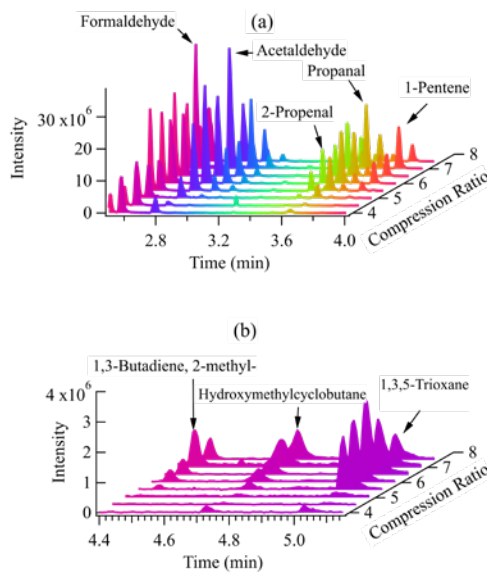
## COMBUSTION DIAGNOSTICS

Dr. Kamal Kumar

The Energy Systems Laboratory saw significant equipment upgrades over summer 2018. Researchers in the laboratory work on fundamental and applied combustion. A Finnigan TRACE mass spectrometer underwent repairs and was used after nearly a decade of dormancy. A new Fourier Transform Infrared Spectrometer was also acquired. Funds from the Office of Research and Economic Development matching grant and Idaho Space Grant Consortium project enabled these upgrades. Both devices are now being used to study the oxidation kinetics of conventional and alternative fuels in internal combustion engines, as well as in solid fuel combustion research.



Finnigan TRACE mass spectrometer

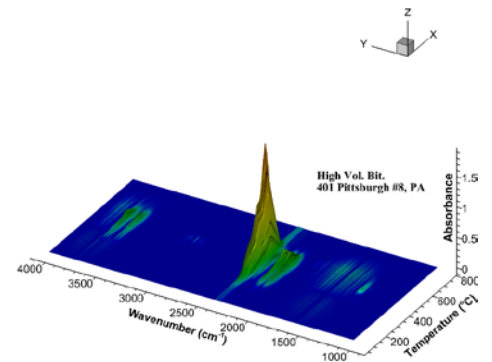


Total Ion Chromatogram (a) retention times 2.5–4.0 min and (b) 4.4–5.15 min

Ph.D. student, Elyasa Al-Gharibeh, investigated oxidation of premixed n-heptane during the early stages of ignition in a single cylinder Cooperative Fuel Research (CFR) engine located in the Small Engine Research Facility. The progress of reactions was followed based on the exhaust speciation analysis using a Gas Chromatograph coupled to the Mass Spectrometer. A clear picture of the evolution of reactant intermediates was obtained for various compression ratios as shown in the figures below.

These motored engine studies using the Mass Spectrometer are expected to provide valuable information for the validation of combustion models for conventional and alternative fuels. The validated models can then be used to design cleaner and more efficient engines.

The newly acquired Fourier Transform Infrared Spectrometer (FTIR) has been extensively used by master's degree student, Samuel Stuhlman, to understand the oxidation kinetics of American Coals. His work is relevant to processes that use coal to produce value-added chemicals or in combustion for power production. A qualitative comparison of the species evolution trend over the entire temperature range from his study are shown in the figures.



Qualitative species evolution trends for high, medium, low volatile and subbituminous coals.

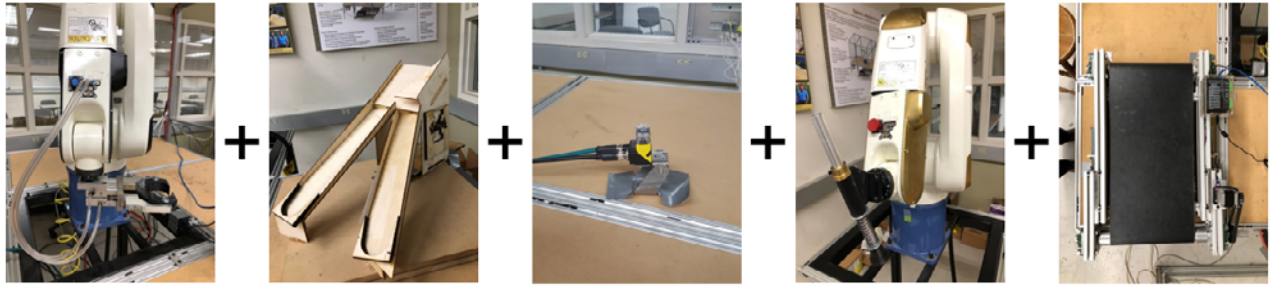
## DUAL ROBOT OPERATIONS IN U OF I MANUFACTURING CELL

Mark Leitner

During the 2018 summer-fall capstone cycle, four seniors (Mark Leitner, Faihan Aldouseri, Abdulmuhsen Alhajeri, and Iulian David) collaborated in creating a simulated manufacturing process that involved two robotic arms working in consort, part feeding, bar code scanning, assembling fixtures, and conveyor transporting finished goods. All members of the team took the inaugural technical elective offering on Industrial Automation that coincided with the first half of the project. This course was featured in the fall 2018 issue of the ME newsletter.

In the capstone project that concluded in December, the team leveraged knowledge about WINCAPS III Software, Arduino Ethernet, two Denso controllers, solid modeling skills, and machining know-how acquired in the lean manufacturing class. Ultimately, six different part configurations could be assembled in the cell based on bar code information stored on each part. The scanner allowed the robots to work together in sorting the parts and using a special end-effort to assemble the parts, ultimately resulting on a different delivery point for each part

# INFRASTRUCTURE IMPROVEMENTS



Pic 1: Robot 1 in rest position. Pic 2: Material handling ramp. Pic 3: Cognex scanner. Pic 4: Robot 2 with push finger end effector. Pic 5: Product delivery conveyor.

at the end of the conveyor. Based on the robot cell capabilities demonstrated in this project, more complicated end-effectors and material handling systems can be tackled in future projects.

The department is indebted to the Boeing Company for supplying the two Denso robots and controllers that represent the core infrastructure for our robotic manufacturing cell.

Among team members, the project experience spawned interest in future manufacturing roles involving automation. Learning outcomes included methods for design validation, strategies for synchronizing robot movement, debugging WINCAPS code, communicating with vendors, and defining specific locations within the workspace.

# UNDERGRADUATE STUDENTS

## KENDALL GRAY RECEIVES ALUMNI AWARD FOR EXCELLENCE

Kendall Gray is a 5th year senior in the Mechanical Engineering department who excels in her studies, her sport (golf), and various club/volunteer activities. She has spent the last four years as a member of the Women's Golf team and is currently working as the Women's Golf Assistant Coach.

Kendall is active on and off campus, volunteering at Walk to School Day, Vandal Trick-or-Treat at the Dome, Idaho track and field meets, Humane Society Food Drive and the Palouse Cares Food Drive, and teaching junior golf at Sahalee Country Club in Sammamish, WA. She is a founding member of the U of I Women in Science Society and serves as the Scheduling Coordinator for the Society.

Lisa Johnson, Head Golf Coach, says this about Kendall, *"Kendall's many awards and honors are a testament to her skill at successfully balancing the rigorous demands of academia and athletics. As last year's team captain and now assistant coach, Kendall leads by example. She played a crucial role in the successes of our team including Big Sky Conference team titles in 2016 and 2018, and NCAA Regional appearances the same years. She is a Pacific Northwest Golf Association Tournament Champion and was named All-Big Sky Third Team as well as an honorable mention award."*

Kendall had the opportunity to name an inspirational mentor, who also received an award. Kendall named Dr. John Crepeau because *"throughout my entire college career, he has always encouraged me to*



*Dr. John Crepeau, Inspirational Mentor (center left) and Kendall Gray (center right) strive for greatness and be the best engineer I can be. Whenever I would miss class to travel to golf tournaments, he took the time to sit down with me and make sure I understood all the material that I missed. Dr. Crepeau has inspired me to work hard every day to be a great engineer. I am honored to be able to have had him as a professor and mentor throughout college."*

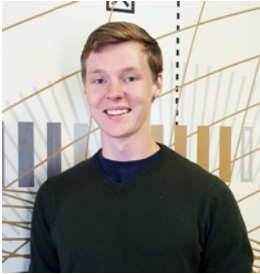
Kendall completed a summer internship at Boeing and has accepted a position to work at the company after graduation.

# UNDERGRADUATE STUDENTS

## 2018 ME GRAND CHALLENGES SCHOLAR PROJECTS

Three ME students involved in the Grand Challenge Scholars Program participated in the pitch competition last fall. All three were pursuing projects related to the area of sustainability. Each of these students is identified below along with a personal statement about their project pitch.

You can read more about the research, interdisciplinary, entrepreneurship, global dimension, and service learning components of these Grand Challenge Scholar projects at [uidaho.edu/grandchallenges](http://uidaho.edu/grandchallenges).



### **Ryan Burr** Pitch Topic: *Stalk Lodging*

*"While conducting research on the strength of corn stalks, getting a good cross-sectional image has been a challenge. I am looking for a specific type of saw to get a better image of the cross-section. I will also be traveling to a plant conference to deliver research findings to plant chemists and biologists. This research is important to me, because without the sustainability of plants, the world as we know it will not be here in the future. The mass amounts of food loss we have now will devastate the world population if it continues to grow."*



### **Jadzia Graves** Pitch Topic: *Characterization of High Entropy Alloys*

*"I am working with a high entropy alloy, an advanced material with unique properties. Known for high strength and ductility, this alloy can deform up to 50 percent before breaking, lending it to damage-tolerant structures like car frames. My research will allow me to gain an understanding of microstructure and mechanical properties and how they relate. This understanding is crucial to materials science as a whole."*



### **Steven Haener** Pitch Topic: *Energy Infrastructure in Germany*

*"The U.S.'s current energy infrastructure is not viable due to the growing consequences of climate change. We need to look toward global leaders in renewable energies if we are to progress toward a more sustainable future. Germany is transitioning toward sustainable energy and is a global leader in the field of engineering. As part of my project, I intend to spend eight months studying and researching there to learn about their infrastructure and engineering and expand my understanding of global issues and how other countries work to combat climate change."*



## SCHELLENGER SCHOLARSHIP IN ENGINEERING RECIPIENT TITUS HANSON

Titus was the first recipient of the \$10,000 per year Schellenger Scholarship in Engineering, established by Rick and Linda Schellenger for students who, due to financial need, might not be able to finish a bachelor's degree without assistance.

During the 2018 fall semester, Titus completed the senior design sequence, enrolled in a robotics class, and joined a team of students developing technology to assist stroke victims. The team traveled to Italy to present their findings during an assistive technology conference in Italy. Without the Schellenger Scholarship, Titus would not have been able to afford the extra class or the trip.

Titus completed his B.S. in Mechanical Engineering and graduated in December 2018.

**Read More About Titus at**  
[uidaho.edu/titus-hansen](http://uidaho.edu/titus-hansen)



# GRADUATE STUDENTS

## SARAH WILLIS RECEIVES ALUMNI AWARD FOR EXCELLENCE

Sarah Willis is a Master of Science student with a 4.0 GPA who is planning to graduate during the spring 2019 semester. Sarah was instrumental and is a coauthor for an article submitted to the American Journal of Orthodontics and Dentofacial Orthopedics entitled "Orthodontia: A Mechanical Engineering Perspective." For this article Sarah performed numerous finite element analyses to benchmark a locally developed closed form numerically solved mechanics model. She is currently involved with two other articles. Her groundbreaking inter-disciplinary work promises to define a new frontier for research and development between dental science and engineering mechanics. Sarah's expertise in solid modeling led to her appointment as a co-instructor in two of the most popular technical electives that deploy solid modeling to advance design thinking (ME 421 and ME 490). In addition to strong facilitation skills, she has made significant refinements to the public-facing websites that support these courses.

She is leader on the graduate student team that collaborates with professional staff to provide stewardship of computer-aided design and manufacturing resources within our department. She mentors six senior design teams, participating in design reviews and guiding students in the machine shop during the fabrication of projects

Sarah has volunteered her time as tour guide for prospective students and their families, presented at Envision Idaho as well as Invent Idaho events, assisted with Uldaho Bound days, and exhibited at Tech Day in



Dr. Edwin Odom, Inspirational Mentor (center left) and Sarah Willis (center right)

Spokane. Her passion for engineering, as well as her highly developed skill in connecting with diverse audiences, has shined through all of these venues.

Sarah had the opportunity to name an inspiration mentor, who also received an award. Sarah named Dr. Edwin Odom because *"It is evident to me that he has been a very successful engineer and professor, and has taught me the most about what I need to know before I enter the engineering workforce."*

Sarah has accepted an offer to work for Janicki Industries after graduation.

## GRADUATE STUDENTS PROFILE: JOSE RAMIREZ RUIZ



I am originally from Oaxaca, a southern state on the Pacific coast of Mexico. As a child, I was very curious and would always welcome new challenges. I applied and was accepted to the National Autonomous University of Mexico (UNAM) in Mexico City where I studied metallurgical engineering. During my last year as an undergraduate student, I became very interested in modeling plastic deformations

in metals and alloys. Solid mechanics and materials modeling was not a strong research field at UNAM, so I did modeling of a vanadium redox battery.

Upon graduation, I pursued my interest in advanced microstructural characterizations and was accepted into the materials institute at UNAM. I completed my master's degree in advanced characterizations of Al-Li alloys. This led to an opportunity to study and work in France as a research engineer where I worked in the CEMEF Center at École des Mines de Paris, one of the most prestigious engineering universities in France. I performed numerical simulations of closed die forging operations and studied post fracture analysis. During this time, I became passionate about modeling discontinuities and cracks for structural components.

As a graduate student in the Mechanical Engineering Department at the University

of Idaho, I have been researching fracture mechanics and computational simulations using the finite element method, in addition to teaching undergraduate and graduate courses. I collaborated on a research project that had three main axes: 1) creep-fatigue testing, 2) creep microstructural characterization and 3) numerical simulations. As a research group, we collaborated to characterize high temperature fracture behavior of Alloy 709, an austenitic chromium-nickel steel to be employed in the next generation of nuclear reactor components. My dissertation work, stemming from this project, focuses on models that can predict plasticity-induced crack closure and creep-fatigue crack growth rates in Alloy 709. This work is highly relevant because it provides critical information for the design and safety of core components in power plants. Research is challenging but I love challenges, and I have grown so much throughout my journey as a graduate student.

# FACULTY AND STAFF

## DR. MICHAEL ANDERSON RETIRES AFTER 30 YEARS IN ME AT U OF I

We asked Dr. Anderson to reflect on his time at U of I and to tell us a little about his plans during retirement.



**How did you find yourself coming to the University of Idaho?**

*I am a Pacific Northwest person, and wanted to stay in the NW. Also, U of I gives the opportunity for a “big-city” job while living in a rural environment.*

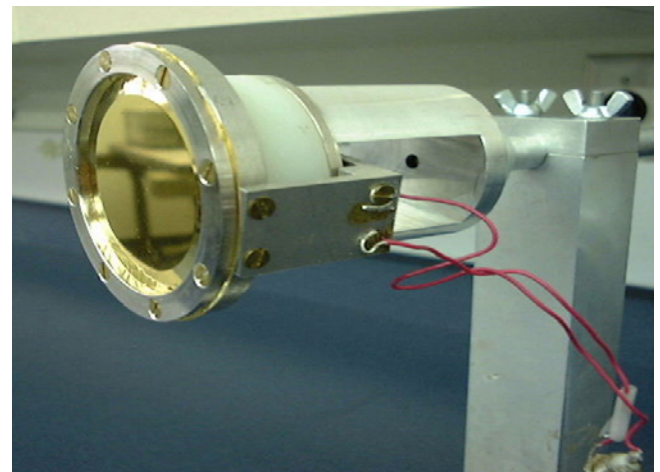
**What do you consider your most significant teaching successes? Why?**

*Contributing to the development of talent in young adults. It gives me great pleasure to visit with alumni, and to see their success and positive contribution to society. Recently, given that technology has become ridiculously inexpensive, it was possible for me to integrate a microcontroller project into ME313. Each student completes the project with apparatus given to them in class.*

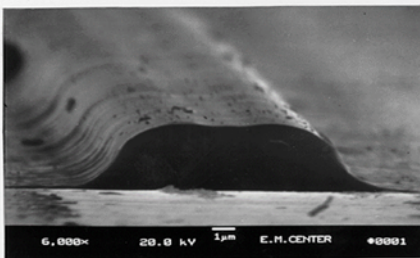
**What do you consider your most significant research successes? Why?**

*Development and fabrication of electrostatic ultrasonic transducers. Micromachined ultrasonic transducers were developed in 1995. A paper describing these transducers, entitled “Broadband Electrostatic Transducers: Modeling and Experiments”, appeared in the Journal of the Acoustical Society of America in 1995. According to the Google Scholar, as of March 2019, other researchers have cited this article 258 times. A photograph of an assembled transducer, and an electron microscope picture of tiny ridge-features contained in the internal structure of the transducer are shown at the right. To my knowledge, this was the first published work in the area of MEMS at the University of Idaho. I would like the U of I administration to take concrete steps to encourage work in this area.*

*Otherwise, in performing research work, it is very satisfying to see the change in a student that happens in a short two-year period.*



Assembled Transducer



5 $\mu$ m tall by 10 $\mu$ m wide ridges micromachined in transducer

**In retrospect, what do you consider the most significant attributes of our program? The university?**

*The most significant attribute of the U of I ME program is the design sequence. Hopefully, the ME department will acquire the resources to emphasize other aspects of ME at a similar level. Regarding the University, I believe there is a serious interest in student success. I also like the residential nature of campus, and the fact that campus is not near a large urban area. U of I is like a retreat center, focused around higher-education. How fun!*

**In your opinion, what the most significant ways engineering education has changed over the time that you have been here?**

*The adoption of the computer as a tool. I see a lot of headroom in this area, as software lags hardware capability by a large margin.*

**What is your advice to current and future students so that they get the most out of their education at the University of Idaho?**

*Attend class regularly and interact with faculty. Take time to visit faculty during their office hours. This is a good opportunity for students to get help on their homework, to interpret grading feedback from the instructor, and to get career advice. After all, we faculty are very expensive, and you have already paid for the office-hours!*

**What words of wisdom do you have for current and future faculty? For staff? For administrators?**

*I would encourage faculty to present research results at technical conferences, so that papers become influential. It is crucial for administration to support this type of travel. Otherwise, a tree falling in the woods won't make a sound.*

*In my personal experience, staff have always been helpful, and willing to grow in their positions. However, I worry about wages for staff.*


# FACULTY AND STAFF

*I believe administrators are in a tough spot. The Idaho legislature and State Board of Education apply high pressure to increase enrollments. I don't think that this is always a positive. For example, if a student is unsuccessful, he/she is still responsible for paying back student loans without the advantage of a higher education. It could also be the case that the focus on enrollments may not provide the level of support for successful students to reach their potential.*

**What activities/relationships/experiences are you most looking forward to in retirement?**

*One goal that I have is to drive on every dirt road in Idaho. I think it will take about 5 years. I would also like to learn more about programming and software, so that I can assemble gadgets around the house and outdoors. I look forward to visiting with my grandchildren, family and friends. Finally, my lazy carcass needs to spend a significant amount of time laying on the beach!*

**We asked current and former students to say a little about Dr. Anderson. Unfortunately, space prohibits publication of all the thoughtful testimonials we received, however all comments will be shared with Mike in a memory book.**



Mike Anderson was my lead professor as I pursued my master's degree at U of I. I was fortunate to have been chosen for a competitive research position studying acoustics and vibration. The unique experiences he provided were a benefit in more ways than I can mention; they shaped who I am today. I appreciate his confidence when choosing me for the position, as well as the enthusiasm, patience, encouragement, and education he provided me so many years ago. I share the memories I have of Mike often, and I'm thankful for the many achievements I have because of him. Mike, Congratulations on your retirement! Enjoy it!

— JONATHAN RICHARDS, MS 2007  
Currently with Schweitzer Engineering Laboratories

Dr. Anderson was a big part of my experience in engineering school at the U of I--one of the most rewarding and enriching periods in my life. Combined with his commanding grasp of applied math and science, Dr. Anderson's passion and enthusiasm for teaching left me with my own love of engineering that continues to pay dividends even now twenty years later. A couple memorable quotes from Dr. Anderson that have stuck with me:

"In the future you won't have to memorize anything other than a bunch of passwords."

"Engineers are nerds and geeks that tend to let the financial guys make all the money. You are creating the value they are selling--so stand up for yourself and claim your share of the pie!" (Paraphrased from memory.)

— JOE FRANKEL, BS 2001  
Currently with FormFactor Inc.

Dr. Anderson was a not only a great professor, but also a fabulous mentor. I took multiple classes from Dr. Anderson, including ME313 and ME413, where my interest in engineering exploded into a passion for wanting to understand what made complex systems tick. Although, the classroom is not where I truly got to know Dr. Anderson. This occurred my senior year, when my senior design group reached out to Dr. Anderson for his technical knowledge with acoustics. He decided to not only give us a few tips but work alongside us through the whole project as a peer. Dr. Anderson was one of the best professors at U of I because of his care for student success and always having the time for anyone that came to his door. Dr. Anderson you will be missed, and I hope you enjoy your well-deserved retirement.

— MARK WOODLAND, BS 2017  
Currently completing a MS degree at Michigan Technological University

Dr. Anderson's relaxed style was empowering and made engaging with him and the lesson easy. His clean and clear way of presenting the material made the content feel intuitive. It was always a pleasure to take one of his classes. I'm grateful to have had him as a professor.

— JOHN FEUSI, BS 2013  
Currently with Jabil



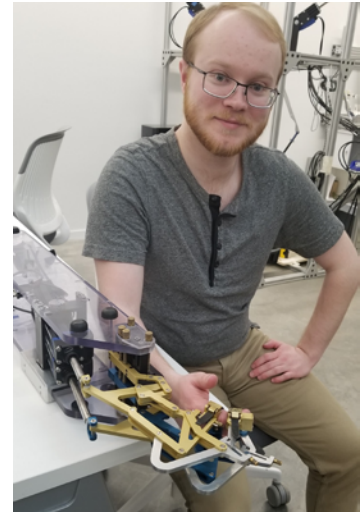


# FACULTY AND STAFF

## REHABILITATION ROBOTIC EXOSKELETON UPGRADE

Dr. Eric Wolbrecht

Finger INdividuating Grasp Exercise Robot, or FINGER, is a novel robotic finger training device that assists participants in moving their index and middle fingers through naturalistic curling motions, typically while playing a musical computer game similar to Guitar Hero. The original FINGER was designed and built at U of I as part of a 5-year NIH funded collaboration with researchers at UC Irvine. This research used FINGER to test the hypothesis that proprioceptive integrity is a gateway for robotic assistance because it allows such assistance to stimulate a Hebbian-like learning mechanism. The project enjoyed significant success, and multiple version of the FINGER robot are still be used for rehabilitation research at UC Irvine and The Wadsworth Center in New York. Last fall, NIH approved a 5-year renewal of the grant (2R01HD062744-06) to continue the research with the additional hypotheses: improving proprioceptive capacity with targeted training will enhance the effectiveness of subsequent robotic finger training, and proprioceptive integrity modulates spontaneous self-training outside of formal training. As part of this continuing collaboration with researchers at UC Irvine, Dr. Wolbrecht and Dr. Perry will lead the design and development of FINGER 2.0, which will add a thumb module to the original FINGER device allowing for thumb and finger therapy and assessment.



Graduate Student, Marshall Townsend, demonstrates the FINGER robot.

Watch a Video of the FINGER in Action at [bit.ly/FINGER-robot](https://bit.ly/FINGER-robot)

## DR. BEHNAZ REZAIIE APPOINTED TO EDITORIAL BOARD OF ENERGY EQUIPMENT AND SYSTEMS JOURNAL

Assistant Professor of Mechanical Engineering Dr. Behnaz Rezaie has been appointed to the editorial board of Energy Equipment and Systems (energyequipsys) which is an internationally recognized multi-disciplinary scientific and engineering journal with a focus on the broad field of power generation systems. Energyequipsys is published quarterly in March, June, September, and December of each year. The University of Tehran owns energyequipsys and covers publication expenses. The journal is aimed to provide a dependable peer review platform for publishing original research articles, review papers and communications which are compiled to advance the current state of the knowledge about different aspects of the energy-related systems based on the fossil fuel, biofuel, and renewable energy sources. Energyequipsys highlights major theoretical achievements, numerical/computational simulations and the experimental investigations of the energy production, conversion and storage equipment, and systems.



## FACULTY PROFILE: DR. MICHAEL MCKELLAR (IDAHO FALLS)



Michael McKellar joined the faculty of the University of Idaho in August of 2017. From 1991 to 2017, Dr. McKellar worked at Idaho National Laboratory as a research engineer where he performed research in the areas of hybrid refrigeration systems, nuclear integrated hybrid energy systems, integration of process heat applications to nuclear reactors, high temperature steam and carbon dioxide electrolysis, power conversion systems for small modular and micro nuclear reactors, radioactive waste treatment, and small-scale natural gas liquefaction. He had the honor of participating on a team that received the R&D 100 Award in 2006 for the small-scale liquefaction system.

For nearly two decades, Dr. McKellar has been an expert with process modeling, which expertise, he brings to the University of Idaho. His research continues in the areas of hybrid nuclear systems, power conversion development, and improving food processing. His favorite part of the University of Idaho is the students. He loves teaching! His

current courses include a graduate class on thermodynamics and a course on modeling of thermal and chemical processes. He received a BSME at Brigham Young University (1984) and a MSME (1987) and Ph.D. (1992) at Purdue University.

Dr. McKellar is also a professional magician and performs magic throughout southeast Idaho and northern Utah. He and his wife Ellen have been married for 35 years and have 4 children and 7 grandchildren.

# FACULTY AND STAFF

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## BEST WISHES, MOLLY!

Molly Steiner has accepted a new position with the U of I WWAMI Education Program.



## CONGRATULATIONS MR. & MRS. COLPAERT!

Becky Schoenberg, ME Department Administrative Assistant, and Shawn Colpaert were married February 2, 2019.

# ADVISORY BOARD

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## ADVISORY BOARD PROFILES



### *Amanda Battles*

Amanda is a Facilities Preservation Engineer/Mechanical Engineer, P.E. with Clearwater Paper Corporation in Lewiston, Idaho. She earned both B.S. and M.S. Degrees in Mechanical Engineering from the University of Idaho in 2011 and 2013, respectively. During her undergraduate education, Amanda completed a research internship with U of I (Boise campus), two BP internships (Cherry Point Refinery, Blaine WA and Pipeline and Logistics, Naperville IL), and another internship in the maintenance department at Clearwater Paper, Lewiston ID. While completing her M.S. Degree, she received a fellowship with NYATT to work on emissions of vehicles and traffic research.

Hired after graduation with Clearwater Paper, Amanda started out as a Capital Project Engineer. In 2018, she moved to the maintenance department working as the Facilities Preservation Engineer. She also manages the engineering internship program at Clearwater Paper for the Lewiston facility.

Outside of work, Amanda keeps busy with two children (ages 10 months and 3 years) plus her golden retriever fur-kid. She enjoys running, hunting, camping, fishing, shooting, and boating.



### *Victoria (Tory) Kampf*

Tory is a Shift Refueling Engineer at Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF) in Bremerton, Washington for four years. She earned her B.S. and M.S. in Degrees in Mechanical Engineering from the University of Idaho. Outside of work, Tory STEM mentor for the Bremerton school district and PSNS & IMF. She enjoys traveling, hiking, golfing, reading, and chilling with her dog, Timber.



### *Luke Nelson*

Luke is a Manufacturing Engineer at Nelson Irrigation Corporation in Walla Walla, Washington. Nelson Irrigation makes state of the art products for agricultural irrigation. He works to design equipment for automated high-speed assembly. Prior to working for Nelson Irrigation, Luke was employed at Janicki Industries in Sedro-Woolley, Washington where he worked as a Design Engineer for aerospace tooling and large-scale composite manufacturing.

Luke received a BS in Mechanical Engineering from the University of Idaho in 2014. He was a member of ASME, the Micro-Baja Team, as well as being a teaching assistant for 3D CAD courses. Luke was invited to join the Mechanical Engineering Advisory Board in the fall of 2018 and is looking forward to working to provide students with the best resources and experiences to help them start their careers.

Outside of work, Luke and his wife Nadine enjoy spending time outdoors, hiking, backpacking, hunting, fishing and skiing, along with woodworking and spending time with family and friends.

# ADVISORY BOARD

## FALL 2018 ME ADVISORY BOARD MEETING HIGHLIGHTS

Fourteen advisory board members, eleven faculty/staff, and more than twenty current students joined in the October 1st evening meeting that occurred ahead of the Fall Career Fair. The meeting was organized by our new advisory board chair, Caitlin Owsley (Janicki Industries) in collaboration with Steve Beyerlein (ME chair) and Chloe Rambo (ME liaison in the college development office).

### GOALS FOR THE MEETING

- Meet and greet with students/faculty/staff in the senior design suite
- Tour of IRIC, thinkTANK, and Student Center
- Development report and discussion
- Overview of COE Recruiting and Retention
- Department update

### TOUR OF ROBOTICS LAB AND IRIC BUILDING

- Presentation from Joel Perry and Eric Wolbrecht
- Projects: Blue Sabino and Finger 2.0 (robotically assisted rehabilitation for stroke victims)

### TOUR OF THINKTANK AND NEW MICRON STUDENT CENTER

- Resources and common space for younger students
- Freshman advisors
- Engineering Club storage areas

### DEVELOPMENT REPORT

#### *Vandal Giving Day resulted \$63k from 167 gifts in 2018*

- Raised most money of any college
- Highest % of staff and faculty participation across the University
- Matching funds from Micron Foundation and Dean of Engineering doubled impact

#### *What our donors make possible for the College of Engineering*

- Scholarships, (like the ME Advisory Board Scholarship), ~\$423,000 for FY18
- Engineering Ambassadors, ~\$15,000 this year
- Competition Projects, \$10,000 – 12,000 for FY18
- EXPO Sponsorships, ~\$100,000 for 2018
- Facilities Upgrades, \$600,000+
- Discretionary Funds for ME Department, ~\$19k for FY18, 143 gifts from 68 donors

### ME Fundraising Priorities

- ME Advisory Board Scholarship
  - ME is the only advisory board to fund a scholarship for students
  - Funds and resources will be evaluated March 2019, and students will be selected for scholarship following
  - Total amount awarded ranges from \$1250-2000 (depends on donations received)
- Upgrades to Equipment in Machine Shop & Labs (Replacement of 60-year-old manual lathes is a top priority.)
- ME Development Fund
  - ME Student Clubs: ASME, Clean Snowmobile Competition Team, SME, SWE, NSBE
  - Student Travel: conferences, workshops, industry tours
  - Matching funds for infrastructure improvements: equipment, facilities
  - Special events: transportation for seminar speakers, faculty/student meals with visitors
  - Alumni Relations: ME newsletter, alumni social gatherings, AB meetings, mailings

### COLLEGE OF ENGINEERING RECRUITING AND DIVERSITY INITIATIVES

- Paulette House and Patrick Determan gave a college level view of recruiting/retention/diversity and shared online resources.

ME Newsletter [uidaho.edu/engr/departments/me/news/newsletters](http://uidaho.edu/engr/departments/me/news/newsletters)

ME Department [uidaho.edu/engr/departments/me](http://uidaho.edu/engr/departments/me)

Grand Challenge Scholars Program [uidaho.edu/grandchallenges](http://uidaho.edu/grandchallenges)

COE Student Services [uidaho.edu/engr/our-people/student-services](http://uidaho.edu/engr/our-people/student-services)

U of I Engineering Design Expo [uidaho.edu/EXPO](http://uidaho.edu/EXPO)

Honors Program [uidaho.edu/academic-affairs/university-honors-program](http://uidaho.edu/academic-affairs/university-honors-program)

### DEPARTMENT UPDATE

- ME Department was recognized as having one of the top three annual assessment reports across campus in a recent mid-cycle institutional accreditation review by Northwest Consortium of Colleges and Universities
- New ABET Student Learning Outcomes (1-7) replace the older (a-k)
- Next ABET visit will be in fall 2019. We will be drafting our Self Study this spring and asking for feedback.





*Dr. Steve Beyerlein, Professor and Chair, Mechanical Engineering Department (left) and Dr. Barry Willis, Professor and Associate Dean for Outreach, College of Engineering (right)*

## Expanded EO Mission

Since its start in the early 1970s, Engineering Outreach (EO) has focused on delivering graduate/professional education to students at a distance in the US and internationally. Continuing this tradition, EO is now partnering with Mechanical Engineering and other academic departments in our college to focus on Generation Z (GenZ) students, ages 17-22. Currently, these learners incorporate online digital media (e.g., YouTube, Khan Academy) throughout their academic careers. Related pedagogical studies indicate that GenZ learners find short and focused content presentations, followed by interaction and assessment, to be more effective than traditional 50-minute lectures.

## Next Generation Curriculum

The challenge for technical content specialists is to create and maintain learning engagement throughout the teaching-learning process. This requires pedagogical approaches rising above the 'noise' of simply wading through monotonous lectures or looking up answers online without the backdrop of social learning processes that lead to content mastery. Research shows that short, topic focused presentations, followed by interactive discussion/problem solving, mentoring, and assessment, are a more effective way for individuals to learn. In this 'blended' approach, one-way (teacher-to-learner) lectures are replaced by an integrated approach combining professionally produced learning modules (between five to ten minutes in length), in-class hands-on learning activities, student-student interaction, problem sets that emphasize transferring knowledge/skills to new situations, assessment, and remediation strategies (including re-viewing the learning modules).

## FE Review Case Study

This instructional model was adopted for the newly reconfigured Fundamentals of Engineering Review Course during the 2018-19 academic year. Nearly 200 video shorts have been created for more than a dozen topic areas featured on the Mechanical Engineering FE Exam. These videos include overviews of different chapters in the FE reference manual (the only online resource available during the exam) as well as step by step solution of simulated exam problems. An online quiz bank consisting of 20-40 representative problems for each topic area (totaling more than 500 FE style problems) has been created to support an online assessment system. As part of the review course, students try out quizzes on each topic before class, watch videos about items connected to concepts/problems which they were most uncertain, come to the weekly review class for large group discussion/problem solving, and then take another online quiz to demonstrate competency on each topic.

## Next Steps

FE materials will next be used as pre-assessment and post-assessment tools in our engineering science courses. Lessons learned in video creation and in-class facilitation will be applied to improve access to just-in-time learning modules on specific sub-topics, strengthen problem solving skills, and collect classwide performance data for selected topic areas.

Steve Beyerlein  
Chair, Department of Mechanical Engineering

# ME LOBBY GETS VANDAL REDESIGN

Molly Steiner recently oversaw aesthetic and functional upgrades to the ME lobby using seed monies from ME alumni working for Schweitzer Engineering. Vandal colors, varied height seating, and electrical outlets have made the space more inviting for students and faculty to work together. Becky and Debbie enjoy the upgraded view from the ME Office!



After



Before



After

# KEEP IN TOUCH!

*We want to hear from you!*

## CONTACT US AT:

Phone: (208) 885-6579

Web: [www.uidaho.edu/engr/me](http://www.uidaho.edu/engr/me)

Mail: University of Idaho  
 Mechanical Engineering Department  
 875 Perimeter Dr. MS 0902  
 Moscow, ID 83844-0902

## GIVE TO THE DEPARTMENT

Donate to the ME Department to the address listed, or at [www.uidaho.edu/engr/give](http://www.uidaho.edu/engr/give). Click "Give Now" and "Select a Fund Priority," type "mechanical" to search funds.

- ✓ Mechanical Engineering Scholarships
- ✓ Endowed Chair for Mechanical Engineering
- ✓ Mechanical Engineering Senior Design Projects
- ✓ Collegiate Competition Teams
- ✓ Shop/Lab Infrastructure

Name

E-mail

Phone

Address

City  State  Zip

U of I degree & year

Employer

Position

Comments