

MECHANICAL & INDUSTRIAL ENGINEERING
DEPARTMENT NEWSLETTER

JULY 2017

MIE

 THE UNIVERSITY OF IOWA

College of Engineering

Growing with Excellence



2016-2017 WAS ANOTHER PRODUCTIVE YEAR for our faculty and students. We are all very excited about the progress our department continues to make.

Our faculty's research has been and will be recognized at the college, university, and national levels. Professor Tom Schnell won the College of Engineering Faculty Excellence Award for Research and Professor KK Choi received the University of Iowa (UI) Startup of the Year Award. Professor Christoph Beckermann will be presented with the Heat Transfer Memorial Award during the 2017 ASME Mechanical Engineering Congress and Exposition in November. Several faculty have new appointments on professional society committees and as journal editors and editorial board members. Associate Professor Sugiyama was granted tenure and Lecturer Justin Garvin was promoted to Associate Professor of Instruction. In his first semester at the UI, Assistant Professor Casey Harwood was already awarded a federal grant. Over one year, our faculty has received a total of 39 new grants, totaling a budget of 5.8 million dollars.

Our curriculum continues to grow and improve, even creating connections outside the UI community. Under the supervision of Lecturer Matias Perret, the Virtual International Project Team (VIPT) senior design program, has completed its first year with a new partnership with the Hong Kong University of Science and Technology that has been a great success. Assistant Professors Xuan Song and Zhen Kan have developed and offered new courses in mechatronics, control and robotics. As for community service, Song and Kan assisted local blind high school students with designing and building a robotic system for the First Robotics Competition. In addition, we established a new collaboration with Iowa Quality Center, enabling

our students to attend a Six Sigma training workshop and obtain Yellow Belt certificates. Among the 66 College of Engineering faculty recognized by the 2017 graduating class for making a positive difference in their lives, 20 are our faculty members.

Our students continue to excel themselves. Avik Samanta and Silvia Volpi won the Graduate Best Poster Award, and Nathaniel Weger won the Undergraduate Best Poster Award at the College of Engineering Research Open House. Undergrad, Abbey Hunt received the Spring 2017 Virgil M. Hancher Scholarship. Our student organizations also continue to grow and bring our students together in creative collaboration as well.

One of the most rewarding aspects of my job is keeping up with not only the research the university continuously supports, but also hearing about the amazing careers our alumni go on to pursue. I feel tremendous pride when, for example, I read that one of our graduates now works for NASA. Our alumni, faculty, and most importantly, students, are what makes this department continue to move forward in new and exciting directions.

Ching-Long Lin

Ching-Long Lin,
Edward M. Mielnik and Samuel R. Harding Professor



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Advisory board tour of the new CoE annex

CONTRIBUTORS:

UI College of Engineering, Maria Chusin, Nicholas Gaul, Anastasia Hertz, Emma Menich, David Herwaldt, and Tara Hoadley

Professor's Company Awarded University Startup of the Year



Professor Tom (MACH) Schnell preparing to fly an Aero Vodochody L-29 Delfin aircraft for a flight test

Tom Schnell Receives College Faculty Excellence Award for Research

INDUSTRIAL ENGINEERING PROFESSOR TOM SCHNELL, a test pilot with over 5,700 flight hours, has established a renowned Operator Performance Laboratory (OPL), which allows studies of human factors and information management in aviation in a real world setting. The assets in the OPL are unique and include five instrumented manned aircraft (two fighter jet trainers, one turbine helicopter, and two piston aircraft) and four instrumented unmanned aircraft testbeds which enable present and future research in unmanned aircraft systems. These aircrafts are equipped with the most state-of-the-art systems, such as sensors and helmet mounted displays that support the OPL research mission.

Schnell's lab has used the test aircraft to generate many datasets that are unique in the research community and that are being used world wide. These datasets include system performance assessments in GPS challenged (denied) areas, systems and avionics components testing for 4th and 5th generation fighter aircraft such as the F/A-18 and the F-35, sensor penetration data in degraded visual environments such as dust and snow, military and commercial pilot performance during recovery from unusual attitudes, prevention of controlled flight into terrain (CFIT), and landmark datasets for netcentric flight training systems referred to as Live Virtual Constructive (LVC) where real

aircraft seamlessly interact with flight simulators and artificially controlled entities. His research has also helped to save lives of pilots and passengers by helping to prevent CFIT.

Schnell's lab has also developed a Synthetic Vision System (SVS) aircraft cockpit instrument suite which has been commercialized under the Dynon SkyView brand and is now flying in thousands of aircraft cockpits. Furthermore, the Cognitive Assessment Tool Set (CATS) model, developed by OPL, measures the mental workload of a person in real-time. CATS has been used in numerous simulator and flight test projects and it enables adaptive training systems capabilities which modulate training difficulty to match the trainee skill levels. The Target Visibility Prediction (TarVIP) model, also developed at the OPL, can be used to quantify how far traffic signs and pavement markings are visible at night under automobile and fixed roadway lighting conditions. TarVIP and its analyses have been used by the US Federal Highway Administration (FHWA) in the establishment of roadway marking and signing minimum requirements.

Congratulations to Professor Tom Schnell for your achievements!



RAMDO Solutions has developed an advanced software system to enhance the reliability of commercial and military ground and air vehicles as well as many manufactured products that are design focused. RAMDO gives industries the ability to obtain an optimum design prior to prototype development, reducing product development costs. RAMDO can be used in conjunction with other computer-aided engineering applications to find the optimal design. Very recently RAMDO was awarded additional US Army SBIR Sequential Phase II for \$1 million for June 2017-May 2019.

ROY J. CARVER PROFESSOR IN MECHANICAL ENGINEERING Kyung K. Choi's company, RAMDO Solutions, LLC, was selected to receive The University of Iowa Startup of the Year Award for 2017. RAMDO, which stands for Reliability Analysis and Multidisciplinary Design Optimization, provides its clients with the ability to obtain an optimum design before prototypes are even created. Ultimately, RAMDO Solutions helps companies save money by increasing product reliability. Instead of spending time and money on modifying designs after they have failed in the field, RAMDO Solutions designs a better product from the start.

The recipients of The University of Iowa Startup of the Year Award exhibit passion, devotion, and innovation in planning and deploying their startup and by proving positive impact by job creation and revenue gain, among other things. Professor Choi was formally recognized for his achievements at an awards ceremony in late April.

The COO and co-founder of the company, Nicholas Gaul, was once Choi's graduate student. Nicholas Gaul earned both his undergraduate and graduate degrees from the UI. He explains that he was able to maintain and form stronger connections with his professors by remaining at the UI for his graduate study. When asked what he enjoys most about RAMDO Solutions, he responded that he loves how the company is always changing. With new developments in software, the addition of new clients with complicated projects, and ongoing research, Gaul must be extremely adaptable. He feels that his experiences within the UI College of Engineering helped him learn to do so.

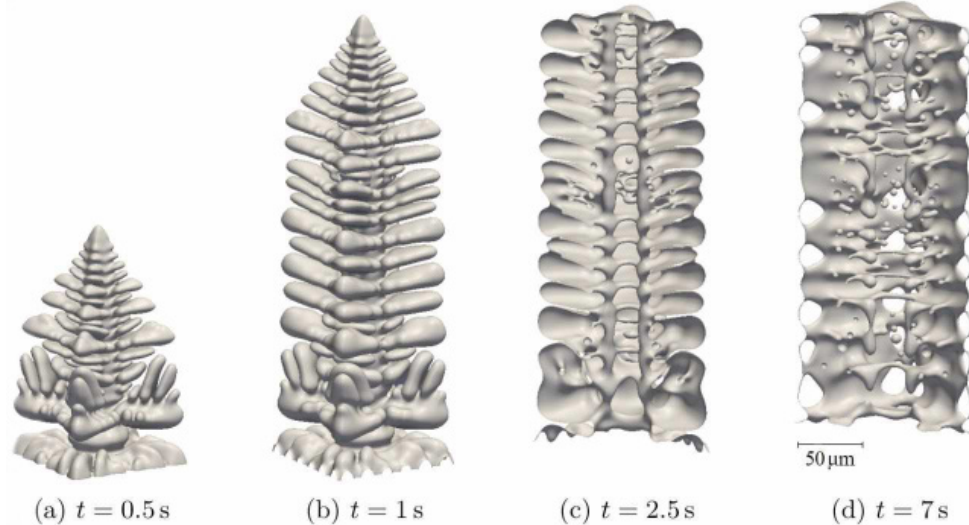
Read more at: <https://uiventures.uiowa.edu/our-ventures/ramdo-solutions>



Beckermann Wins 2017 ASME Heat Transfer Memorial Award



Results from Professor Beckermann's 3D phase-field solidification model showing the evolution of a columnar dendrite.



CHRISTOPH BECKERMANN, University of Iowa Foundation Distinguished Professor of Mechanical and Industrial Engineering and director of the UI Solidification Laboratory, has been selected to receive the 2017 Heat Transfer Memorial Award in the science category from ASME (American Society of Mechanical Engineers).

ASME is recognizing Beckermann "for pioneering theoretical and experimental research on heat and mass transfer in materials processing with applications in solidification and casting of metals; for mathematical models that are now standard textbook material and in casting simulation software used worldwide; and for research on dendritic growth and the phase-field method that has led to significant advances in the understanding of solidification microstructure formation." Professor Beckermann will be presented with the award in November at the ASME Mechanical Engineering Congress and Exposition.

Professor Beckermann has also been selected to receive the 2017 Outstanding Mechanical Engineer Award from his alma mater, Purdue University. The award is given to alumni who demonstrate exemplary accomplishments and leadership in industry or academia.



Danny Grimes, a blind student from Iowa City, gets help building a bumper for his team's robot from Prof. Song

The Darkside Designers

Prof. Xuan Song and Zhen Kan help a visually impaired high school robotics team create, code, and compete in a robotics competition

THIS MARCH, UI PROFESSORS Xuan Song and Zhen Kan teamed up with a group of high school students from the Iowa Educational Services for the Blind and Visually Impaired (IESBVI) to compete in a robotics competition in Cedar Falls, IA. The robotics team calls themselves The Dark Side, and it was their first year entering the contest.

Professors and graduate students from the university collaborated with the students to design mechanical parts, wire circuit boards, and program the robots to perform tasks. During the competition, the students used their robots to prepare a model spaceship for launch, using computer coding software to remotely control them. To complete their project, students used computer programs such as one that reads computer code aloud as the student types to help.

"I realize the importance of doing and showing in the classroom," says Professor Song. "If students don't have the opportunity to actually build a robot, for example, they may never believe they can do this. After they complete the project, they have more confidence in themselves and their skills."

Read more at: <https://now.uiowa.edu/2017/02/ui-team-helps-blind-high-schoolers-build-robot-competition>

Teaching and Dedication to Student Success Awardees

THE UNIVERSITY OF IOWA College of Engineering has awarded Professors Priya Pennathur and Kamran Samani with the Excellence in Teaching & Dedication to Student Success award for Fall 2016, and Professors Ruben Beltran del Rio and Justin Garvin for Spring 2017. This award is given every semester to a faculty member in each program during fall and spring commencements who demonstrates exemplary teaching efforts. Each graduating class nominated these talented professors.



Dr. Priyadarshini Pennathur
Assistant Professor
Industrial Engineering



Dr. Kamran Samani
Lecturer
Mechanical Engineering



Dr. Ruben Beltran del Rio
Lecturer
Industrial Engineering



Dr. Justin Garvin
Associate Professor of Instruction
Mechanical Engineering

Casey Harwood

Assistant Professor, Mechanical Engineering



DR. CASEY HARWOOD JOINED the University of Iowa as an Assistant Professor in Mechanical Engineering and an Assistant Research Engineer with IIHR – Hydrosience and Engineering. He received his M.S.E. and Ph.D in Naval Architecture and Marine Engineering from the University of Michigan and his B.S., also in Naval Architecture and Marine Engineering, from the Webb Institute in New York. His doctoral research sought to address fundamental questions regarding the complex fluid-structure interactions of flexible marine lifting surfaces in ventilated and cavitating flows through towing tank experiments and experiments in a large free-surface cavitation tunnel in Italy.

Dr. Harwood's background and expertise in experimental hydrodynamics led him to join the MIE department and IIHR, where he will use the towing tank and wave basin to perform experimental hydrodynamics research. As a researcher at the UI,

Dr. Harwood plans to investigate complex fluid-structure interactions and hydroelasticity, instrumentation design, reduced-order and physics-based modeling, and resistance and maneuvering of marine vessels. Through research in IIHR facilities, and collaboration with researchers at UI as well as other institutions in the USA and abroad, Dr. Harwood aims to improve the efficiency, reliability, and safety of advanced marine vessels and systems operating in challenging environments.

Students and student organizations interested in naval architecture and experimental fluid dynamics are encouraged to contact Dr. Harwood for research and advising opportunities.

Read more about Dr. Harwood's education, research, and involvement with our IIHR program, click here:

<https://www.engineering.uiowa.edu/faculty-staff/casey-harwood>



As both an undergrad and graduate student, Matias Perret studied at the University of Iowa. Now, he's a Mechanical Engineering Lecturer at UI! Dr. Perret races ahead down the very same hill the original engineering building, now the Seamans Center, was built over one hundred years ago. Our faculty consistently excel both within and outside of academia!

International Connections

Through VIPT, UI students collaborate on projects with engineering students from France and China

THE VIRTUAL INTERNATIONAL PROJECT TEAM (VIPT) is a year-long project option within the capstone design program which focuses on the collaboration of engineering students across the globe. For the 2016-2017 academic year, UI MIE partnered with two international universities, Aix-Marseille University in Marseille, France, and the Hong Kong University of Science and Technology in Hong Kong. Nineteen UI students participated, all were mechanical engineering students with the exception of three industrial engineering students.

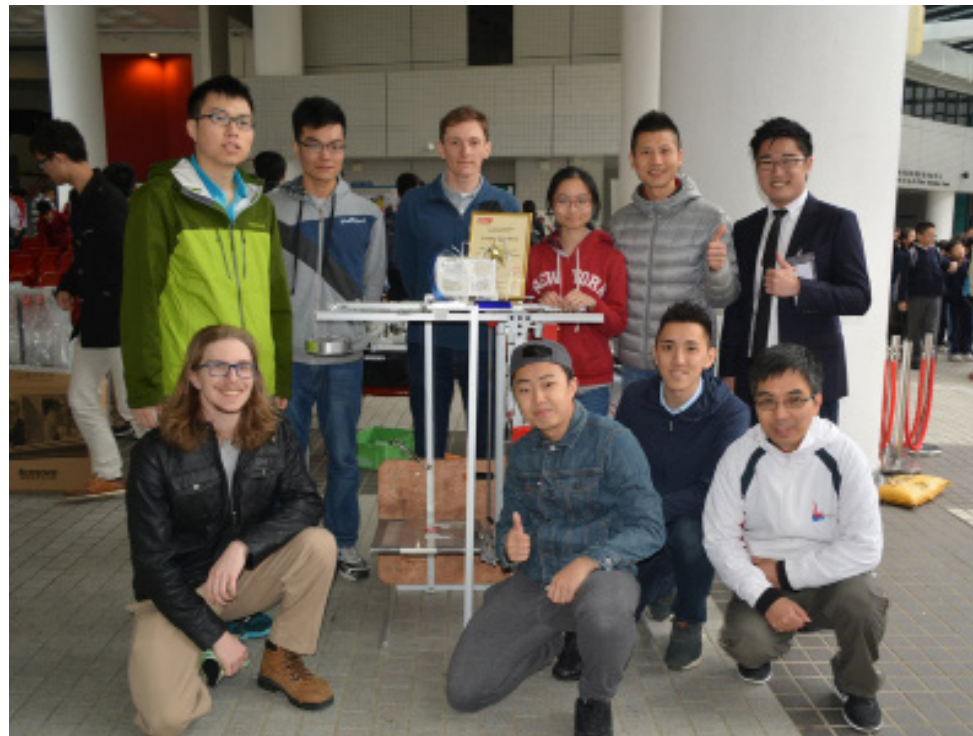
There were two separate projects that students engaged in. The VIPT students were tasked with designing the heating, ventilating and air conditioning (HVAC) system for the new University of Iowa Museum of Art which will replace the building that was flooded in 2008. The team worked for the UI Facilities Management organization which is responsible for completing the new building. Students from each university contributed

different elements of the proposed HVAC design. Through this part of the design program, UI engineers had the opportunity to visit their French teammates in Marseille this January.

In addition, students from UI and Hong Kong also participated in The Greater China Design Competition (GCDC), held in Hong Kong last March. GCDC is a two-day event that aims at providing a platform for engineering students to demonstrate their knowledge, while strengthening their presentation skills by designing an innovative prototype focusing on topics which range from environmental to social issues depending on the year.

Students from both institutions were collectively required to design and build an effective system for mining industry handling. The new designed robot prototype had to utilize the nature of gravitational potential energy stored in two liters of water to lift the simulated ore (grains of rice) as much as possible out of the simulated mine and deposit the stored rice to the container. The new designed system was required to demonstrate a number of improved characteristics in terms of its effectiveness, sturdiness and maneuverability. The goal was to develop and nurture skills in problem-solving, communication, interpersonal interaction, and project and time management throughout the entire project.

While coordination of the design activities for all of the different aspects of the VIPT program was well managed via video chats and e-mail, the students' visits to Marseille and Hong Kong not only allowed the two groups to collaborate face-to-face but also provided enriching cultural experiences as well. As much of the large scale collaboration our students will do in the future is likely to involve people with a variety of educational and cultural backgrounds, students ultimately gained a diverse wealth of knowledge by participating in these projects.



New Course Offerings

Spring 2017



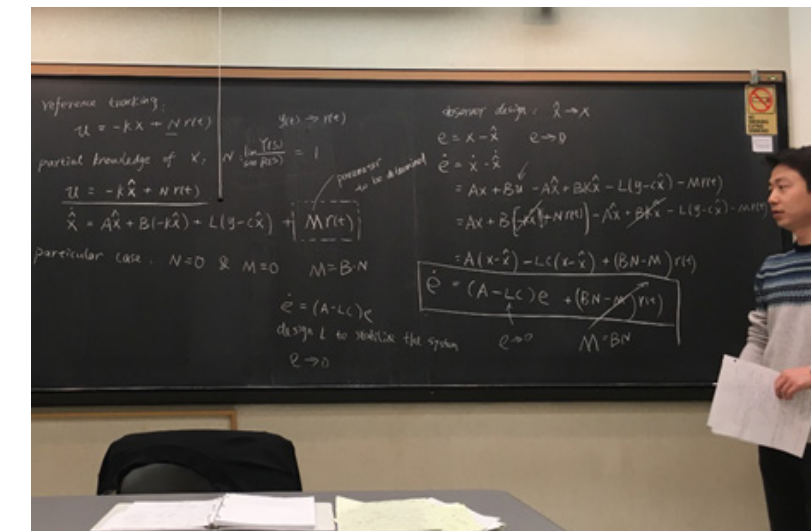
MECHATRONICS ENGINEERING FOR SMART DEVICE DESIGN
PROF. XUAN SONG
IE/ME: 4650

THIS COURSE INTRODUCES senior undergraduates as well as graduate students to basic mechatronics system components. Students also learn design principles related to meeting functionality requirements of products, processes, and systems. The course centers around several lab-oriented assignments and team-based projects that ultimately result in students designing and implementing their own complete mechatronic system that incorporates mechanical, electrical, and software components. The course is intended for students who are interested in pursuing a career in the area of product development and engineering, robotics, design and manufacturing, and technology management and innovation.



DESIGN OF EXPERIMENTS FOR QUALITY IMPROVEMENT
PROF. RUBEN BELTRAN DEL RIO
IE: 4620

THIS COURSE WAS DESIGNED to be a continuation of Quality Control (IE: 3600) for those students who wish to further develop the skills necessary to efficiently and effectively design and analyze experiments for process improvement. This class provides that great opportunity. Course activities include planning and design of experiments and statistical analysis of the results, with a particular emphasis on quality improvement and manufacturing processes characterization. Students will be able to develop successful experiments that can lead to reduced defective parts, increased process capability, and improved product quality.



CONTROL OF MECHANICAL ENGINEERING SYSTEMS
PROF. ZHEN KAN
ME: 5114

THE COURSE OBJECTIVE is for undergraduate students to acquire skills to model simple engineering systems, apply time and frequency domain analysis techniques, and design control systems to achieve specific dynamic characteristics. Students will gain knowledge related to how signals are used for feedback that gives insight into the ability to design and conduct experiments, as well as analyze and interpret data. The class will put control theory into a practical foundation with regard to impacts on global, economic, environmental, and societal contexts. Modern engineering tools such as mathematical computer simulation package (e.g. MATLAB) will be used to help prepare the student for professional careers.

LEAN Principles & Six Sigma Certification

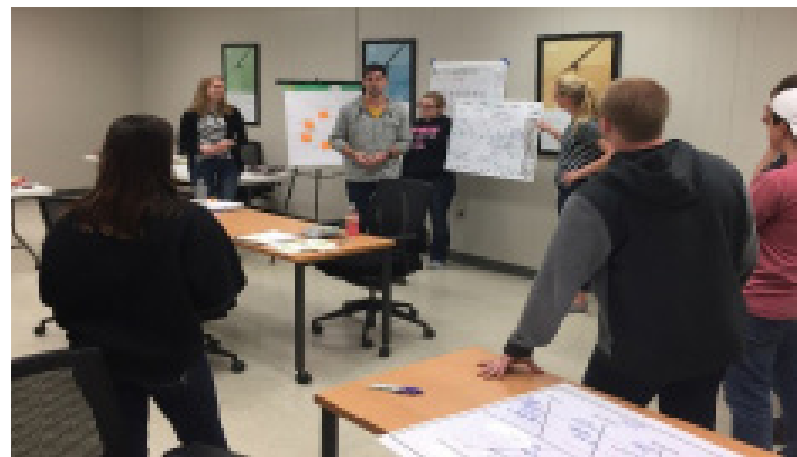
IE students learn about quality control through certification programs offered this Spring

THIS SPRING, JUNIOR AND SENIOR

Industrial Engineering students had the opportunity to participate in two different workshops, a Lean Principles training workshop and/or a Six Sigma workshop. Each workshop provided hands-on experience for applying quality control management principles to industry issues in the real world.

The Lean Principles workshop stems from collaboration between the Professional Chapter of the Quad Cities IISE (Institute of Industrial and Systems Engineers), the HNI Corporation, and the UI student chapter of IISE. This is the second year in which HNI offered the training workshop to our students. Seventeen IE students and one ECE student participated in the all-day workshop, which included a plant tour of the Allsteel Facility, followed by a Box Company hands-on exercise. Students also had the opportunity to network with HNI engineers at the end of the workshop.

The Six Sigma workshop provided a "Yellow Belt" certification opportunity managed by the IQC (Iowa Quality Center). This one-day workshop was facilitated by Clipper Windpower and sponsored by the MIE department. It was taught by experienced and certified IQC instructors, who lead highly engaging learning activities based on 'trail-mix' simulations designed by IQC. Fourteen IE students attended, many of them were enrolled in Introduction to Six Sigma course (IE:4900) within the MIE department. This workshop was used as an extension of the academic course to take the theories discussed in the classroom and apply them to real world industry issues and conditions.



Industrial Engineering Lecturer Ruben Beltran del Rio instructs students during the certification program. Dr. Beltran del Rio has a black belt six sigma certification himself.

Society of Women Engineers

Annual High School Conference

EVERY YEAR, THE UNIVERSITY OF IOWA Society of Women Engineers (SWE) hosts a high school conference meant to give high school junior and senior level girls the chance to come learn about what a career in engineering entails. This year, the UI Mechanical and Industrial Engineering Department provided financial support to the program which was instrumental. The support from MIE and others allowed conference organizers to purchase supplies for the activities, t-shirts for the participants, and food for the event.

Planning for the conference began in August. Co-chairs Tess Davis and Anastasia Hertz (both biomedical engineering undergraduates) collaborated with the East Central Iowa professional SWE chapter to put the event on in April. Thirty young women, many of whom have already been accepted into The University of Iowa's College of Engineering attended the conference this year. In fact, many of the current SWE members attended this conference when they were in high school as well, including conference co-chair Anastasia Hertz. She explains the event's importance to her as "a wonderful way to get a head start in learning what engineering is and that there are some pretty awesome women engineers at The University of Iowa."



Prof. Matias Perret demonstrating the use of equipment in the Design for Manufacturing lab

The conference included activities such as binary coding bracelets, discipline presentations presented by current UI engineers, a professional engineering panel consisting of women engineers, dinner with faculty members, lab tours, and more.

Hertz concludes her thoughts on this year's conference by saying "we are very thankful to have the support from the Mechanical and Industrial Engineering department to host the High School Conference whose main goal is to spread information about women in engineering careers." Ultimately, the SWE high school conference provides a welcoming and valuable community setting for high school girls to learn more about engineering through hands on experiences.



Institute of Industrial and Systems Engineers

North Central Regional Conference



UI attendees enjoying themselves at conference

THE NORTH-CENTRAL INSTITUTE of Industrial and Systems Engineers (IISE) Regional Conference is an annual three-day event that brings together a couple hundred students. The conference provides students with the opportunity to socialize and exchange ideas through workshops, plant tours, social events, and competitions. This year, 26 UI students attended the conference.

UI industrial engineering student, Emma Menich explains, "It is a wonderful experience to have as a student preparing to enter the real world. It allows us to gain a lot of knowledge and experience in our field of study and have a lot of fun while doing it! It gives us an opportunity to network and bond with other students in our organization and we are very excited to go every year!"

The MIE department is excited that, in 2018 the UI chapter will be hosting the IISE conference in Iowa City. For more information on conference sponsorship opportunities, please contact uiowaiise@gmail.com.



Outstanding MIE Students



Associate Dean Milan Sonka presenting Silvia Volpi with her award

EVERY YEAR, THE COLLEGE OF ENGINEERING hosts a Research Open House in April. This provides graduate and undergraduate students alike with the opportunity to present posters on their own research to faculty members and company representatives. At the College of Engineering Open House, grad and undergrad students alike presented posters on research topics they studied. Congratulations to our two ME graduate students who won the best poster display award: Avik Samanta with his poster entitled "Simulations of Microstructure Evolution During Friction Stir Blind Riveting Using a Cellular Automation Method" and Silvia Volpi and her poster entitled "Towards the High-Fidelity Multidisciplinary Design Optimization of a 3D Composite Material Hydrofoil."



Avik Samanta



Congratulations also to Spring 2017 graduate, Abbey Hunt, who won the Virgil M. Hancher scholarship in recognition of her academic excellence, leadership, and social responsibility.

Congratulations also go to ME undergraduate student Nathaniel Weger for winning the undergraduate best poster display as well as 2nd place in the popular choice award with his poster "Gasification and Combustion of Miscanthus."

Read more here: <https://www.engineering.uiowa.edu/research/research-open-house>



Nate Weger posing by his winning poster

Design For Manufacturing Photos

Students pose with their winning designs with their team members



Making Old Spaces New

LAST SUMMER, THE MIE DEPARTMENT RENOVATED the 1307 space in the Seamans Center for a new use. Previously, the space served as the departmental teaching assistant (TA) office, which TAs and students alike would utilize for office hours to provide and receive assistance outside of class time. With a poorly designed layout separating the space into two rooms, each further compartmentalized by outdated cubicles, and lit with old florescent bulbs, the space was in need of updating. It was decided to remodel the space and repurpose it as the MIE Design Lab.

Utilized by the senior capstone design students, the MIE Design Lab has completed its first academic year (2016-2017) of use. The renovations drastically changed the space and breathed new life and possibility into it. Having gotten rid of the cubicles, the room now provides four group workstations to facilitate design collaboration, a small conference area for telecommuting with sponsors, and a final small group study area for discussions. The new layout is much more open and inviting. Students can even rearrange the new furniture to fit their needs. This, coupled with several writing surfaces available for brainstorming, encourages students to collaborate and discuss their design projects.

This summer, focus has moved to G130, which served as the TA space for the 2016-2017 academic year, as it was displaced due to the repurposing of 1307. Again, renovations will focus on creating an open floor plan that will allow itself to be changed as needed. The main use of the space will be to provide TA office space, however it may also be a multi-purpose room used to host small group gatherings such as seminar speaker receptions in the future. Features include two open spaces for small group work, large monitors for small group instruction or to display course and departmental announcements, and six stations for TAs to schedule office hours for one-on-one assistance. We hope that this will be a welcomed update for both our teaching assistants and the students.

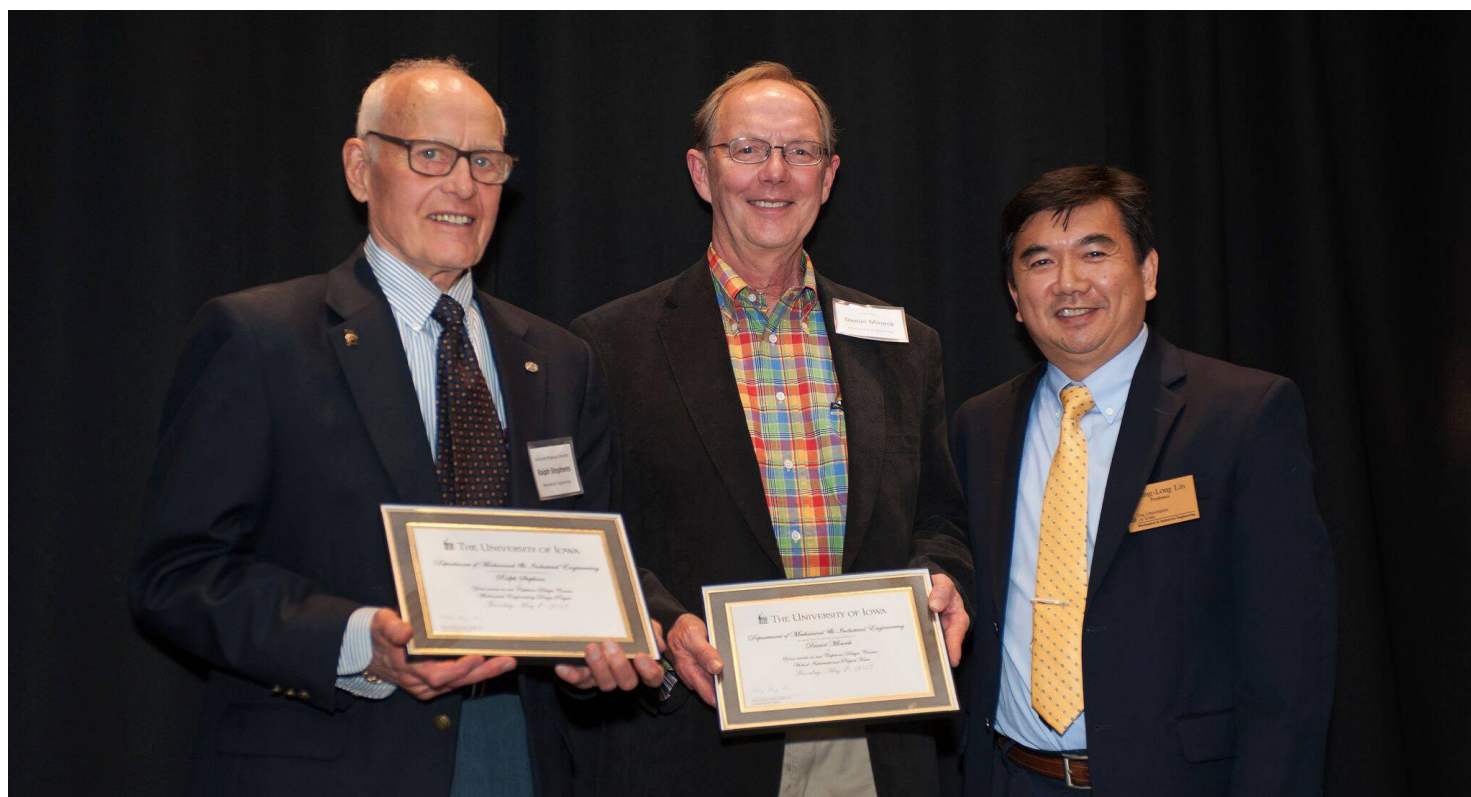
Looking to the future, next summer (2018) we plan to focus our renovation efforts on the ALCOA room (2128 SC). This conference room is frequently utilized by faculty, staff, and department visitors for meetings, interviews, and teleconferencing needs.



Feedback from our students has been extremely positive!



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DEO Ching-Long Lin presents emeritus faculty, Professor Ralph Stephens and Adjunct Lecturer Dan Mineck with certificates of appreciation for their involvement with MEDP and VIPT sections of the capstone design program.