MEUS

Mechanical Engineering Undergraduate Symposium

April 13, 2017

COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING
UNIVERSITY OF MICHIGAN

Rubik's Cube Unveiling

Welcome
Noel Perkins
Mechanical Engineering

Comments
David Munson
Former Dean of the
College of Engineering

Aaron Ridley
Faculty Advisor,
CoE Honors Program

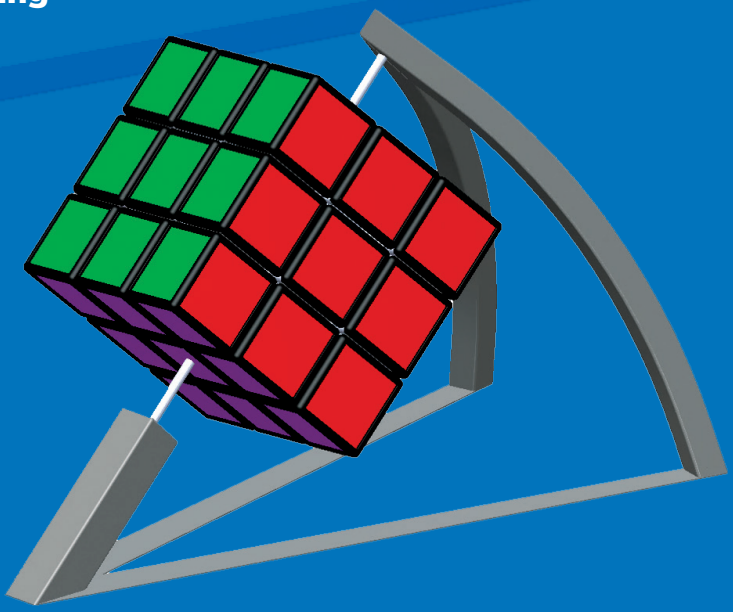
Presentation of Student Awards
Kon-Well Wang
Chair, Mechanical Engineering

Student Comments and Unveiling

Time
11:30 am to noon

Location
2nd Floor of the GG Brown New Addition

Student Team
Kelsey Anne Hockstad
Martin Turner Harris
Daniel James Hiemstra
Samuelina Mae Wright
Ryan Douglas Kuhn
Jason Samuel Hoving
Douglas Riley Nordman



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Welcome

On behalf of the Mechanical Engineering Department at the University of Michigan, we would like to welcome you to the Winter 2017 Mechanical Engineering Undergraduate Symposium (MEUS).

MEUS provides a venue for our exceptional undergraduate students to showcase their projects from RISE (Research, Innovation, Service and Entrepreneurship) as well as their Design and Manufacturing X50 Courses.

In RISE, our undergraduate students leverage our state-of-the-art facilities working side-by-side with internationally-renowned faculty to tackle cutting edge projects that impact our society. Projects range from transportation systems to mechanical system design, robotic systems, biological and fluidic systems, manufacturing processes and systems, and mechanical art!

Running concurrent to the MEUS poster and presentations sessions is Design Expo. Have an exciting day cheering for the ME 250 teams in their project competition, view the ME 350 four-bar linkage that automatically positions a cup to catch falling balls, and engage with our seniors as they display their ME 450 capstone design projects.

Top off the evening with our MEUS reception and poster session, celebrating a successful semester for our Mechanical Engineering Community.

The goal of MEUS is to provide an intimate forum for a vibrant exchange of ideas and results within our University of Michigan Mechanical Engineering Community. We are thrilled with the exceptional response. Our sincere appreciation goes to all the students and their RISE/X50 mentors for choosing to share their very best work at MEUS. The planning of MEUS has been a significant team effort of faculty, staff and students. Our thanks go to them for assembling such an outstanding event.

We look forward to seeing you at MEUS! May the students' work inspire you!

Kon-Well Wang, PhD
Tim Manganello/BorgWarner Department Chair and
Stephen P. Timoshenko Collegiate Professor of Mechanical Engineering

MEUS Planning Committee

MEUS Technical Planning Committee

Diann Brei	MEUS Co-Chair/Poster Judge/ Session Chair
Chinedum Okwudire	MEUS Co-Chair/Session Chair
David Dowling	Session Chair
Kenn Oldham	Session Chair
Jwo Pan	Poster Judge
Claus Borgnakke	Session Chair
Alan Wineman	Session Chair
Mike Umbriac	ME 250 Course Coordinator/ME 350 Course Coordinator
Amy Hortop	ME 450 Course Coordinator

Graduate Student Judges

Angela Wu
Rohith Mittapally
T.J. Flynn
Mayur Birla
Jintao Chen
Kai Chen
Mehdi Sadeghpour
Ahmet Mazacioglu
Deema Totah
Ali Attari
Keval Ramani
Shreyas Kousik
Deokkyun Yoon
Jintao Chen
Siddesh Shinde
Saeed Kazemiabnavi
Brian Worthmann
Ashwin Kannan Iyengar
Chris Pannier
Yang Liu
Mohsen Taheri Andani
Emma Treadway
Narayanan Kidambi
Sajedeh Nasr Esfahani
Hang Yang
Nicholas Wurtz

MEUS/RISE Organizers

Kristel Briney
Rachel Casanova
Grey Cichy
Michele Goci
Michael Hopko
Tim Moore
Katie Morningstar
Audrey Oosterwal
Lisa Rogers
Julie Tashjian
Angela Wegrecki
Ken Wilson

RISE: Research, Innovation, Service, and Entrepreneurship

Through the RISE program, mechanical engineering undergraduate students leverage our state-of-the-art facilities working alongside internationally-renowned faculty to tackle cutting edge projects that impact our society. The Mechanical Engineering Undergraduate Symposium (MEUS) is the accumulation of the students' work.

During the day, seniors in ME 490 will present their RISE projects in 20 minute presentations. Everyone is welcome to attend these sessions and ask probing questions!

Sophomores and juniors conclude their projects with a poster session during the evening reception, where students will be available to discuss their projects in detail. The posters will also be on display during the day, if you are unable to attend the reception.

The public is invited to peruse the posters, attend presentations, and interact with the students throughout the day.

Schedule at a Glance

April 13, 2017

Session 1
Thermal and Fluidic Systems
Room: 2636 GGB
9:20 am–10:20 am

Session 2
Smart Materials Devices and Structures
Room: 2540 GGB
9:40 am–10:20 am

Session 3
Acoustics
Room: 2636 GGB
12:00 pm–12:40 pm

Session 4
Actuators and Sensors
Room: 2540 GGB
12:00 pm–12:40 pm

Session 5
Sensing and Controls
Room: 2540 GGB
1:20 pm–2:00 pm

Session 6
Device Design and Testing
Room: 2540 GGB
2:40 pm–4:00 pm

Session 7
Fluids and Gases
Room: 2636 GGB
2:40 pm–3:40 pm

Session 8
Poster Session
BorgWarner Galleria
4:30 pm–5:30 pm

ME Reception &
BorgWarner Galleria
4:30 pm–5:30 pm
Reception open to ME students participating in Design Expo or MEUS.

Session 1

Thermal and Fluidic Systems

Session Chair: Chinedum Okwudire
2636 GGB

9:20 am **CFD Modeling of Electrohydrodynamic Jet Printing**

Student: Maxwell Wu
Instructor: Kira Barton

9:40 am **Ignition Experiments on Cetane Reference Fuels**

Student: Archit Gupta
Instructor: Andre Boehman

10:00 am **Analysis of Spray Geometry**

Student: Evan Harris
Instructor: Andre Boehman

10:20 am **Microfluidics/Nanoelectronics-Integrated Biosensors with Mechanical Flexibility**

Student: Jung Hyuk Kim
Instructor: Xiaogan Liang

Session 2

Smart Materials Devices and Structures

Session Chair: Kenn Oldham
2540 GGB

9:40 am **3D-Printed Self-Locking Origami Metamaterials with Piecewise Stiffness**

Student: Shihcheng Chu
Instructor: Kon-Well Wang

10:00 am **Piezoelectric Polymer REM Sleep Sensor**

Student: Andrew Holmes
Instructor: Kenn Oldham

10:20 am **Variably Ventilated Veneers**

Student: Brian Kalinowski
Instructors: Diann Brei, Jonathan Luntz

Session 3

Acoustics

Session Chair: David Dowling
2636 GGB

12:00 pm **Detection of Transients in Noise**

Student: David Lectka
Instructor: David Dowling

12:20 pm **Measurement of the Theorized Frequency-Difference Autoproduct Field**

Student: Jessica Lipa
Instructor: David Dowling

12:40 pm **Relationship Between Tail-Pipe Bevel Angle and Reflection Coefficient at Low Acoustic Frequencies**

Student: Stefano DeBellis
Instructor: David Dowling

Session

4

Actuators and Sensors

Session Chair: Kenn Oldham
2540 GGB

12:00 pm **Investigation into the Energetic Effects of Various Spinal Morphologies in Quadrupedal Robots**

Student: William Yang
Instructor: C. David Remy

12:20 pm **Knitting Active Materials**

Student: Sumayya Atmeh
Instructors: Diann Brei, Jonathan Luntz

12:40 pm **Cardiovascular Sensing-Finger Phantom Construction**

Student: George Tsirukis
Instructor: Kenn Oldham

Session 5

Sensing and Controls

Session Chair: Claus Borgnakke
2540 GGB

1:20 pm **Software-Defined Control of Smart Manufacturing Systems**

Student: Vincent Salpietro
Instructor: Dawn Tilbury

1:40 pm **Biometric Sensor Integration into Automotive Systems**

Student: Syed Mahdi
Instructors: Diann Brei, Jonathan Luntz

2:00 pm **Development and Validation of a Toolkit for Time Series Data Feature Selection**

Student: Anne Gu
Instructor: Kira Barton

Session 6

Device Design and Testing

Session Chair: Diann Brei
2540 GGB

2:40 pm **Stress/Strain Testing on Patient Ovarian Cancer Cells**

Student: John Bohenick
Instructor: Krishna Garikipati

3:00 pm **Design, Modeling, and Experimental Evaluation of Non-Invasive Methods for Bio-Logging Sensors**

Student: Riley Doherty
Instructor: Kira Barton

3:20 pm **Veinless Vents**

Student: Mary McMeekin
Instructors: Diann Brei, Jonathan Luntz

3:40 pm **Inflatable Attachments**

Student: Jesse Velleu
Instructors: Diann Brei, Jonathan Luntz

4:00 pm **Software-Defined Control of Smart Manufacturing Systems**

Student: Michael Murray
Instructor: Kira Barton

Session

7

Fluids and Gases

Session Chair: Alan Wineman
2636 GGB

2:40 pm **Development of an Aerosol Deposition System for Battery Prototyping**

Student: Kenny Van
Instructor: Jeff Sakamoto

3:00 pm **The Effects of Diffusion of Non-Condensable Gases on Cavitation in Soft Tissue**

Student: Daniel Knister
Instructor: Eric Johnsen

3:20 pm **Ultraviolet Cleaning of Diesel Fuel**

Student: Benjamin Golder
Instructor: Andre Boehman

3:40 pm **Edge Detection Method to Support Differential Approach to CBR**

Student: Xi Chen
Instructor: Bill Schultz

Session 8

Poster Session
BorgWarner Galleria
4:30 pm–5:30 pm

Bulk Modulus of Compressibility of Different Fuels
Student: Jiawei Song
Instructor: Andre Boehman

Thin-film Piezoelectric Microactuators for Into-Tissue Imaging by Endoscopic Microscopy
Student: Issac Loo
Instructor: Kenn Oldham

Design of a Reconfigurable 3D Printer
Student: Justin Joseph
Instructor: Chinedum Okwudire

Redesign of Experimental Set-up for Dual Beam Laser Welding
Student: Quinton Ho
Instructor: Elijah Kannatey-Asibu Jr.

Modeling Bi-Directional Trust in Semi-Autonomy for Improved System Performance
Student: Beth Beindit
Instructor: Dawn Tilbury

Non-Linear Control System for Lightweight and Portable Transportation Device
Student: Benjamin Eu
Instructor: Ram Vasudevan

ME Reception

BorgWarner Galleria
4:30 pm–5:30 pm

ME is pleased to conclude the day's activities with a reception to celebrate a successful semester for the ME Community and to announce the ME Undergraduate Symposium Best Poster and Best Session Award winners.


MEUS
Mechanical Engineering Undergraduate Symposium
December 8, 2016
9:00 AM – 4:30 PM
Visit MEUS.engin.umich.edu for presentation schedule and locations.
ME Reception
4:30 PM – 5:30 PM
BorgWarner Galleria
College of Engineering
Mechanical Engineering
University of Michigan

RISE Awards

We are pleased to hold three competitions for the Mechanical Engineering Undergraduate Symposium: Best Poster, Best Session, and Best Paper.

Best Poster Award

All RISE ME 290 and ME 390 students will automatically be entered to compete for the Best Poster Award. The best poster will be judged by faculty and graduate students based upon quality of the project work, the poster, and the presentation of the work.

Winners of the award will be honored at the reception with a certificate and monetary award.

Best Session Award

All RISE ME 490 students that present at MEUS will be automatically entered to compete for the Best Session Award. Judges will attend the presentations and will select the best of each session based upon the quality of the presentation and the project work.

Winners of each award will be honored with a certificate.

Best Paper Award

The top RISE award is the Best Paper Award. The judges will review the final papers from the winners of the Best Session Award to select the best overall project based upon the quality of the project work and the presentation in both oral and written forms.

The winner of the Best Paper Award will be honored with a certificate and monetary award.

Collaborating Programs and Student Organizations

We are very grateful for the assistance of our collaborating programs and student organizations in promoting RISE and helping to plan and execute MEUS.

ASME (American Society of Mechanical Engineers)

ASME is an organization devoted to the enrichment of the UM Mechanical Engineering experience. Through seminars with professors, corporate information sessions, and visits to companies, ASME allows students to see the applications of classroom learning in the real world. Additionally, ASME works to create a community within the Mechanical Engineering Department by helping with events such as the ME Pancake Breakfast, Halloween Bash, and the ME T-shirt Contest. ASME provides an opportunity for students to meet and network through various social events, intramural sports, and community service. To learn more about our chapter, visit our website at www.umich.edu/~asme/.

PTS (Pi Tau Sigma)

Pi Tau Sigma is the international mechanical engineering honor society. Juniors and seniors are invited to join based on their academic achievements, and are initiated after showing desired involvement with the society, department, and college. You can see PTS members around campus grilling brats in the warm weather, tutoring in the FLC, hosting corporate info sessions, volunteering at department events such as the Halloween Bash and Pancake Breakfast, and on the ice for IM broomball. To learn more about our chapter, visit our website at www.umich.edu/~ptsme/.

MEGC (ME Graduate Council)

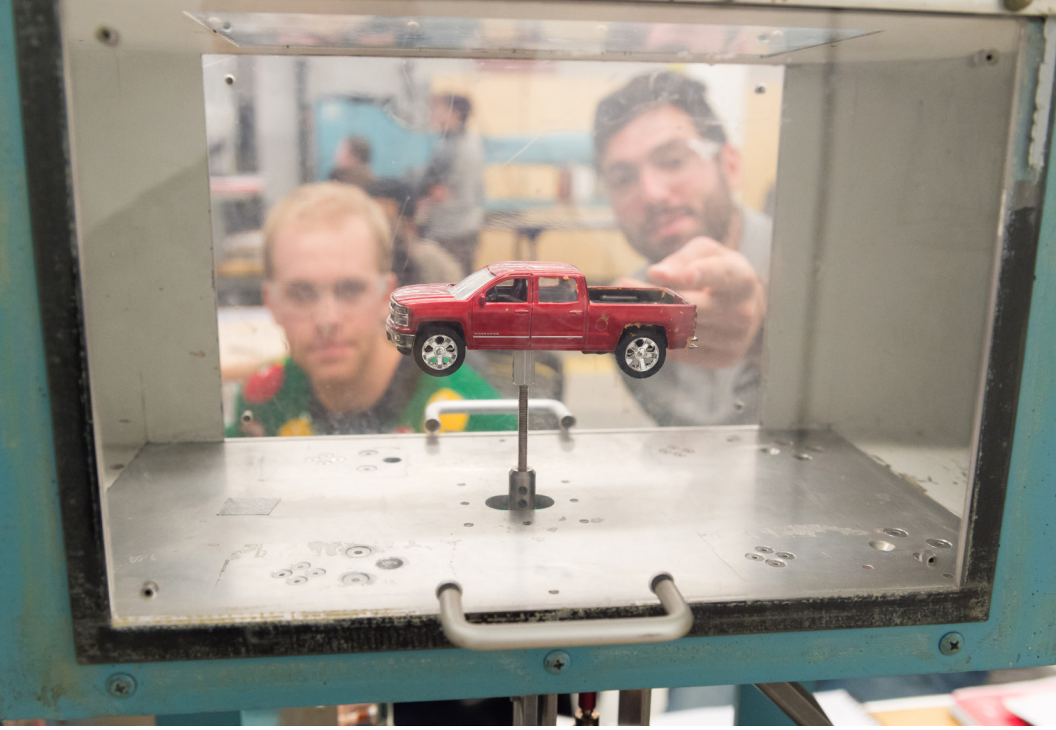
MEGC serves as a liaison to voice the opinions, problems and issues of the graduate students in the Department of Mechanical Engineering. The council engages in organizing student-led research seminars, technical workshops, professional development events, outreach, mentorship, and social activities. Additionally, MEGC aids the department in activities such as recruiting weekends, new student orientation, etc. Visit our website at me.engin.umich.edu/Gradcncl/index.html.

College of Engineering Honors Program

The College of Engineering Honors Program provides a unique opportunity for highly-motivated students to reach their full potential, both inside and outside of the classroom. Specialized academic requirements create an enriched learning environment that caters to the various disciplines of the College of Engineering. Honors students work closely with faculty and student mentors, facilitating strong intellectual bonds and personal growth, culminating in the creation of an Honors Capstone project. Students from Engineering Honors will be presenting their Honors Capstone project at the MEUS in April 2017. Visit our website at honors.engin.umich.edu/.

Multidisciplinary Design Program (MDP)

The College of Engineering MDP offers students a wide variety of long-term, team-based experiential learning opportunities. We partner with research faculty and industry leaders to bridge the gap between the classroom and professional experience. Additionally, MDP pilots new models for experiential learning and conducts educational methods research to improve the quality of the experiential learning opportunities we offer. Students participate in MDP by joining a Faculty Research or externally-sponsored project, earning academic credit through a student competition team, or attending a technical workshop. The program is focused on engineering projects but is open to students from over eleven different schools and colleges across campus. To learn more about our program and academic minor, visit our website at mdp.engin.umich.edu.



ME X50 Projects

The Michigan Engineering Design Expo is held concurrently with the Mechanical Engineering Undergraduate Symposium (MEUS).

The Design Expo showcases the achievements of our students in engineering design and prototyping, and demonstrates applications of their studies that solve real-world problems.

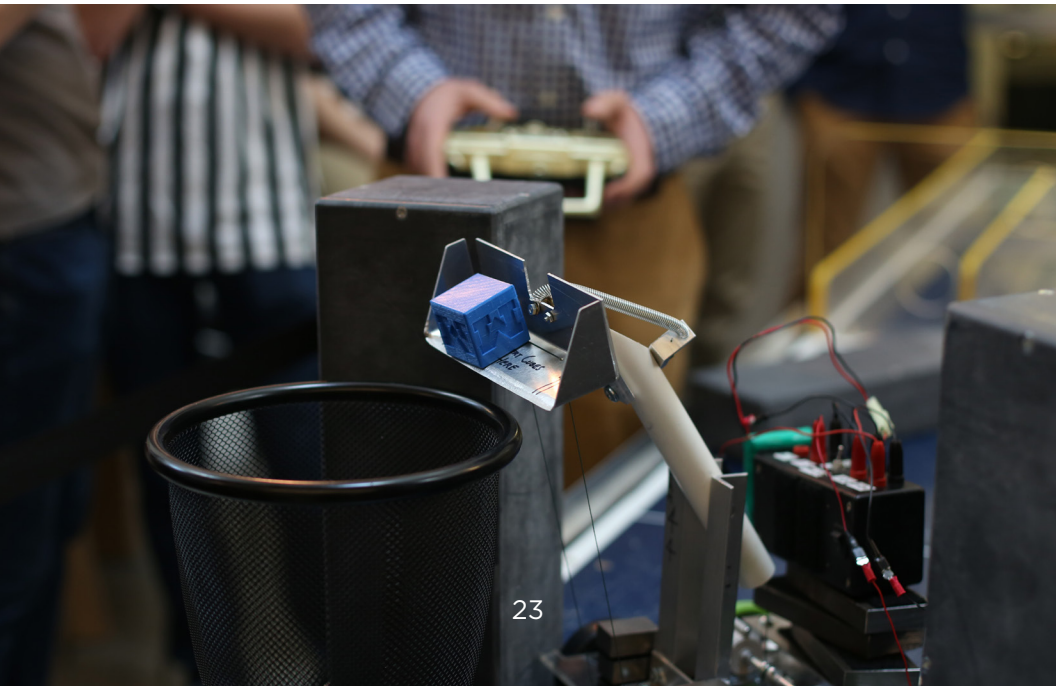
Students in mechanical engineering design and manufacturing courses (ME 250, 350, 450, and 455), will present their projects for the Design Expo during the ME Undergraduate Symposium.

ME 250

Design and Manufacturing I
BorgWarner Galleria
1:00 pm–3:00 pm

In ME 250, the students learn engineering drawing; CAD and solid modeling; use of mechanical elements such as bearings, gears, and springs; engineering analysis; and manufacturing processes. They get hands-on experience using machine tools such as a milling machine, lathe, laser cutter, and water jet cutting machine, as well as a 3D printer.

In the course project, the students put their knowledge to use. They work in teams of four to design and build a remote-controlled machine that must compete to move objects in an arena. The students learn to choose a strategy, generate concepts for the design, perform analysis on their concept, and then design the individual components. They are given a kit of materials which they can use to manufacture the components using the student machine shop. They test and validate their designs before the competition, which is held during the MEUS.

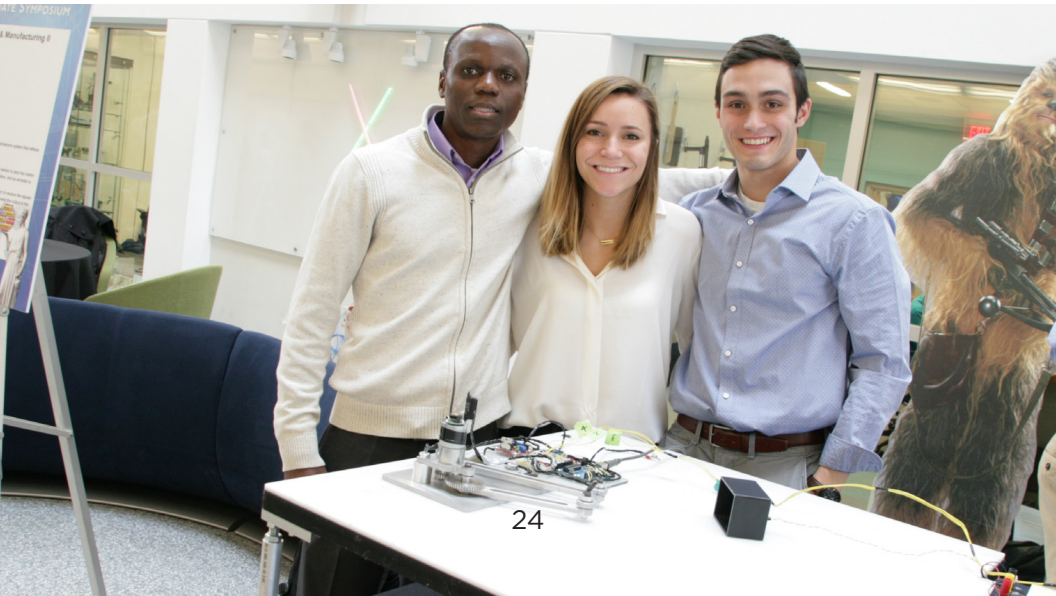


ME 350

Design and Manufacturing II
BorgWarner Galleria
1:00 pm–3:00 pm

In ME 350, the emphasis is on the model-based design of mechanical and mechatronic systems. The students learn the design of mechanisms, the design of mechanical elements for strength, and mechatronics. Mechatronics is the synergistic integration of mechanics, electronics, control theory, and computer science within product design and manufacturing, in order to improve and/or optimize its functionality.

In the course project, students work in teams of four to design, build, and test a four-bar linkage to automatically position a cup to catch falling balls. The students use a motor and transmission to move the linkage, limit switches to calibrate the linkage position, and an encoder to keep track of the position. The students learn to program an Arduino microcontroller board (running a PID controller) to receive the signals from the sensors and make decisions based on these signals, and send the output to the motor driver to position the cup to catch the balls. The Arduino also reads a color sensor to decide where to put each ball after it is caught.

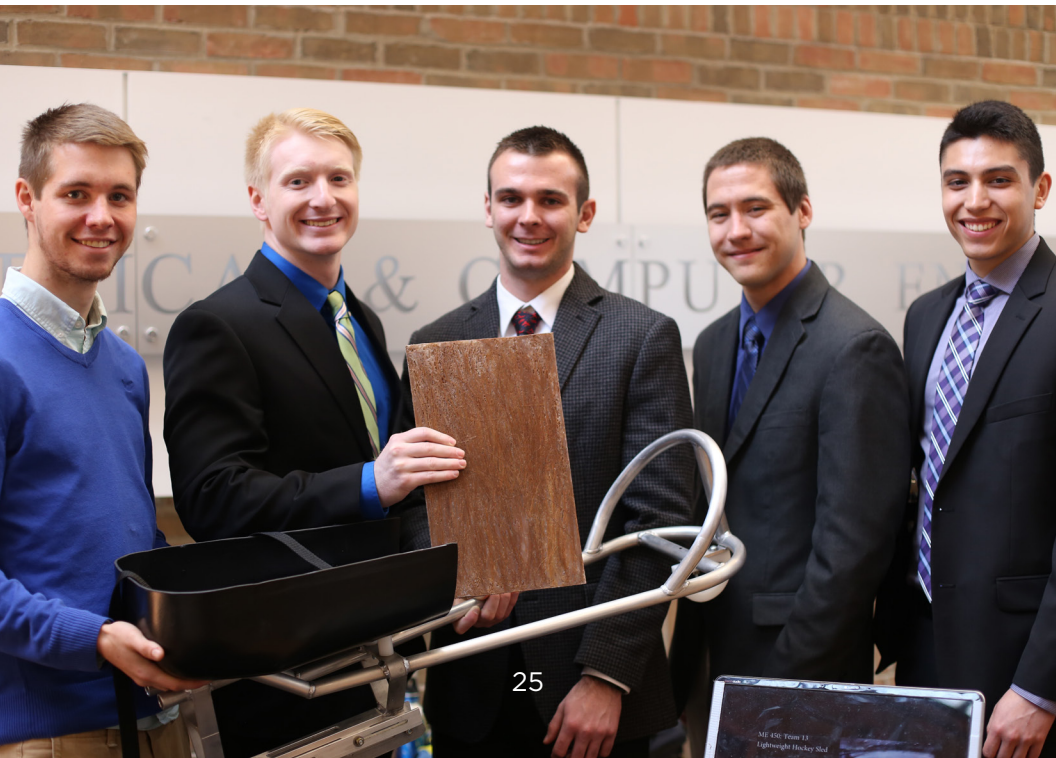


ME 450

Design and Manufacturing III
Mechatronics Lab/Blue Lounge/
EECS Building
12:00 pm–4:00 pm

ME 450 is the capstone in our unique design and manufacturing sequence. Students are taught to approach open-ended design challenges through processes, to manage and work in collaborative teams, and to synthesize and apply diverse engineering knowledge to the design and manufacturing of real mechanical systems. Teams of 3–5 students work together on a semester-long design problem, typically from industry, or faculty research, and present a working prototype at Design Expo. Students are exposed to the design process from eliciting user needs and generating concepts through to prototype validation.

ME 450 projects can be viewed in the Duderstadt Building Atrium and EECS Building as part of the Design Expo from 12:00 pm–4:00 pm.



ME Project Sponsors

The Mechanical Engineering Department would like to thank our 2016–2017 ME 450/ENG 490 project sponsors and mentors!

Jolly Pumpkin/Doors & Drawers
Dr. Neil Alexander
Prof. Shorya Awtar
Prof. Mihaela Banu
Mr. Brad Bowden
Prof. Nikos Chronis
Prof. Roy Clarke
Ms. Eden Ericson
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Prof. Brent Gillespie
Mr. Garrick Hu
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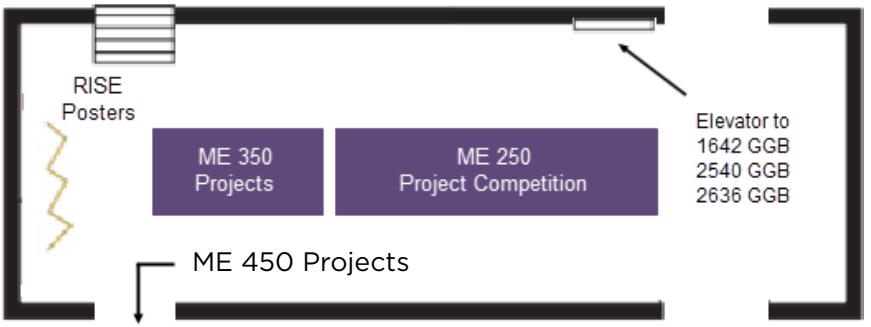
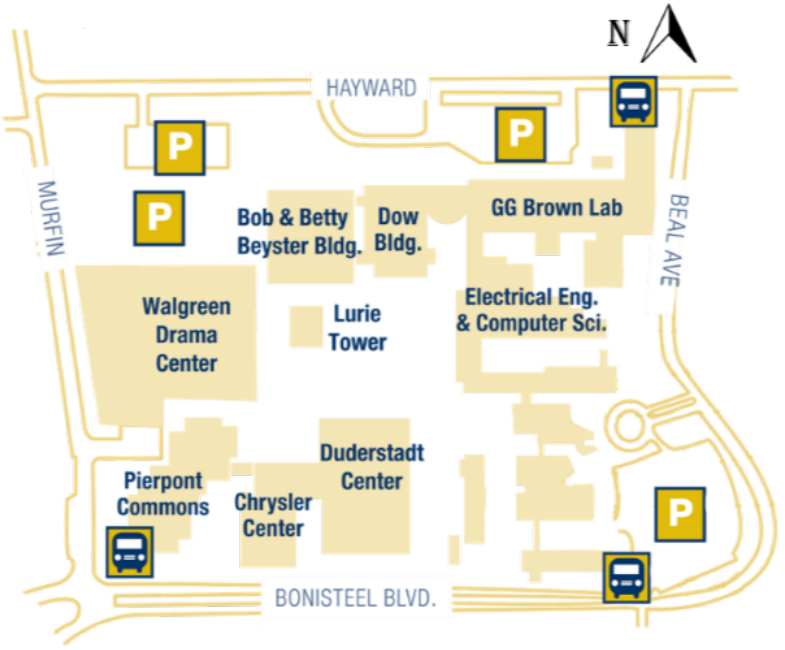
Maps

BorgWarner Galleria

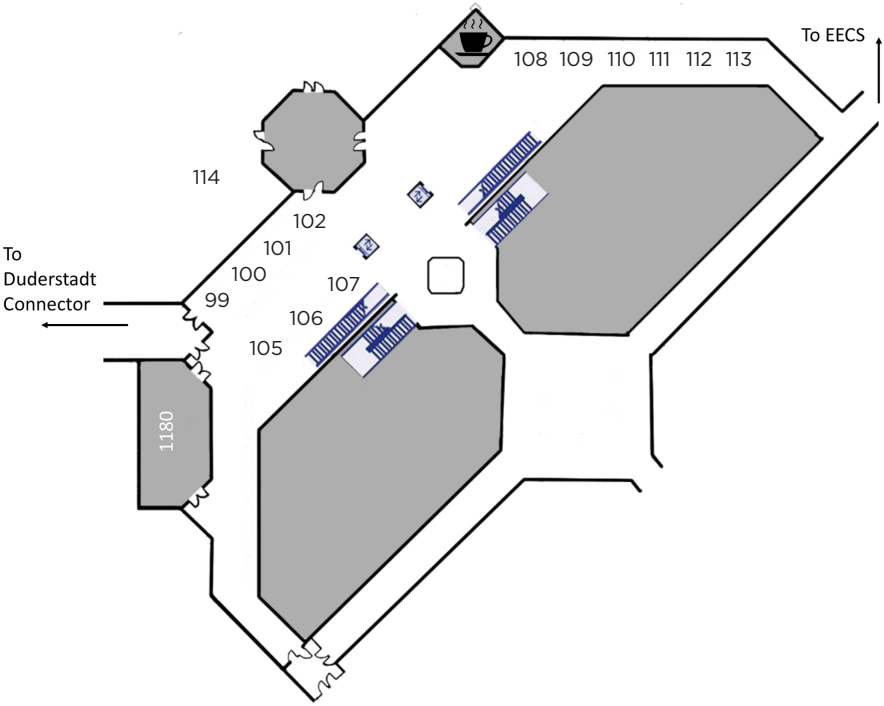


U-M North Campus



Maps

Duderstadt Building
ME 450/ENG 490 Projects

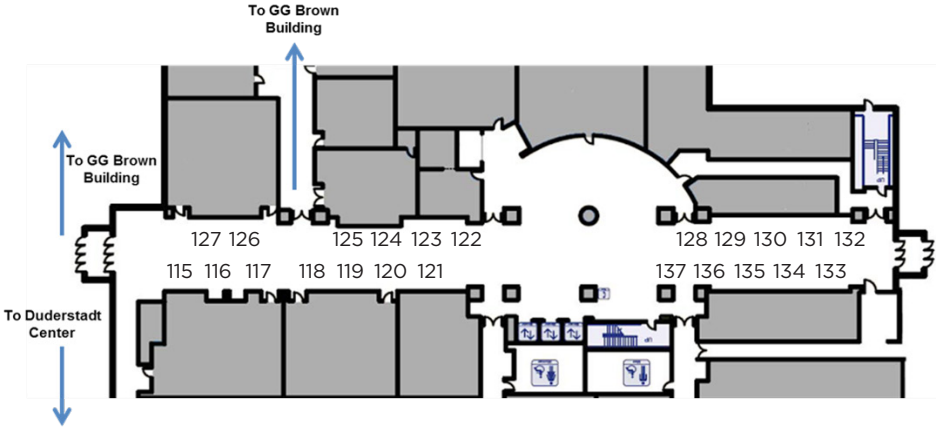


EXPO #	Project Name
99	Surgical Sponge Counter
100	DualSense—Pressure Monitoring Bed
101	Autonomous GoKart—Electrical
102	Autonomous GoKart—Mechanical
IP RM	Eye Disease Simulator
IP RM	Beer Barrel Charring
105	Artificial Iris Prosthesis
106	ADI Castings for Cost and Weight Reduction

EXPO #	Project Name
107	Robotic Blacksmithing
108	Electronic Heat Sink
109	Astronaut Urine Repurposing Apparatus
110	MiTEE Tether and PicoSat Slow-Deployment System
111	Hardware Store Part Matcher
112	MiTEE Tether and PicoSat Fast-Deployment System
113	One-Way Lacrimal Bypass Tube
114	Lacrosse Ball Feeding Device (Ball Collection, Storage, and Systems Integration)

Maps

EECS Building
ME 450 Projects



EXPO #	Project Name
115	Flex-N-Gate Air Dam
116	Automotive OEM—Tailgate Redesign
117	VA Ann Arbor Healthcare System Mobility Assist
118	Augment an Autonomous Baja Ground Vehicle Platform
119	Lightweighting of Sledge Hockey Sled
120	Electric Motorcycle Student Project Team
121	REFRESCH Incubator for Compromised Newborns for Use in Off-Grid Maternity Clinics
122	Pelico Design: A Positioning Sensor for a Curb Climber Attachment on Lightweight Wheelchairs
123	An Assistive Device for Fall Prevention
124	Wheelchair Solution
125	REFRESCH Fruit Dryer
126	Design and Evaluation of fMRI Compatible Sensory Stimulation Device

EXPO #	Project Name
127	Device to Study Non-Invasive Method for Assessing Long-Term Changes in Mechanical Tissue Properties of Skin
128	Composite Material Using Bamboo Fibers
129	Composite Suspension Links
130	Jetstyx
131	Mracing Test Bench
132	Mechatronic Actuation of a Printer Head for a Nanoscale Additive Manufacturing System
133	KID Watchful but Safe Eyes on Baby: A Safe Monitor
134	Remote Controlled Automated Vehicles
135	Packsize Corrugate Laser Cutting and Creasing
136	EPA Carbon Capture Canister
137	Nanosystems Inc. Foam Manufacturing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