Welcome

On behalf of the Mechanical Engineering Department at the University of Michigan, we would like to welcome you to the inaugural 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-art facilities working side-by-side with internationally-renowned faculty to tackle cutting edge projects that impact our society. Projects range from health, energy, robotics & mechatronic systems, nano-materials and amazing enablers and Rubik’s Cube!

Running concurrent to the MEUS poster and presentation sessions is Design Expo. Have an exciting day cheering for the ME 250 teams in their ping-pong ball squash competition, view the ME 350 four-bar linkage that automatically positions a mirror to reflect several laser beams onto a target, and engage with our seniors as they display their ME 450 capstone design projects.

The goal of the MEUS is to provide an intimate forum for a vibrant exchange of ideas and results within our UM ME 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.

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

ME Reception and Poster Session
BorgWarner Galleria
4:00 PM - 6:00 PM

Mechanical Engineering (ME) is pleased to conclude the day’s activities with a reception to celebrate a successful semester for the ME Community and announce the RISE and X50 Award winners.

ME Community members are invited to join us in the BorgWarner Galleria from 4:00 PM – 6:00 PM.
ME 450 Sponsors (continued)

MEUS Planning Committee

MEUS Technical Planning Committee

Diann Brei MEUS Chair
Claus Borgnakke Session Chair
Amy Hortop ME 450 Course Coordinator
Chinedum Okwudire Session Chair
Kenn Oldham Session Chair
Gabor Orosz Session Chair
Jwo Pan Session Chair
Alan Wineman Session Chair
Mike Umbriac ME 250 Course Coordinator / ME 350 Course Coordinator

MEUS / RISE Organizers

CJ Anslow Paige Jackson
Ken Arbogast-Wilson Michele Mahler
Marc Brigolin Katie Morningstar
Melissa Cooper Sarah Sobek
Angela Fichera Nikki Taylor-Vargo
Jacob Hayward Michele Wong
Linh Huynh

Human Powered Submarine Team
Schedule at a Glance

**Poster Judging**
BorgWarner Galleria
10:45 AM - 12:30 PM

**2a. Health & Energy**
Session Chair: Gabor Orosz
Room: 2636 GGBA
12:10 PM - 1:10 PM

**3a. Efficient Use of Energy Sources**
Session Chair: Jwo Pan
Room: 1642 GGBA
1:30 PM - 2:30 PM

**4a. Amazing Enablers**
Session Chair: Kenn Oldham
Room: 2215 GGB
2:20 PM - 4:00 PM

**4:00-6:00 pm Reception**
BorgWarner
(Open to ME students participating in)

ME 450 Sponsors
The Mechanical Engineering Department would like to thank our Winter 2015 ME 450 project sponsors:

Professor Brian Gilchrist
Professor Brent Gillespie
Grocoff Family
Professor Elijah Kannatey-Asibu
Professor Art Kuo
Dr. Greg Less
Professor Wei Lu
Professor Moses Musaazi
Professor Chinedum Okwudire
Professor David Remy
Professor Kathleen Sienko
Professor Steven J. Skerlos
Dr. Luis Savastano, MD
Prof. Huei Peng
Dr. James Sayer
Mr. Mike Umbriac
Dr. Ronald Chervin
Dr. Jeffrey Stanley
Dr. Erin McKeen
Dr. Aaron Faber
Dr. Paul Cederna
Dr. William Meurer
Mr. Matthew Weber
Dr. John Arnedt
Dr. Christine Nelson
Dr. Gary Fisher
U-M Laboratory for Innovation in Global Health Technology
U-M Institute for Humanitarian Technology
ME 450 Design and Manufacturing III
Duderstadt / Pierpont Commons
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 4-5 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 and Pierpont Commons as part of Design Expo from 12-4pm and an encore of the posters can be viewed in the Lee Iacocca Room (1504 GGB) from 4:45 PM -6:00 PM.
RISE: Research, Innovation, Service, Entrepreneurship Projects

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.

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 mirror to reflect several laser beams onto a target. The students use a motor and transmission to move the linkage, an infrared sensor to stop the motion if an object is in the way, 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 mirror for each firing of the lasers.
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 gather ping-pong balls and squash balls 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 at the Design Expo.
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, and 450), will present their projects for the Design Expo during the ME Undergraduate Symposium.
RISE Awards

We are pleased to hold two competition for this year’s Mechanical Engineering Undergraduate Symposium: Best Poster and Best Presentation.

Best Poster Award

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

Best Presentation Award

All RISE ME 490 students will be automatically entered to compete for the Best Presentation Award. Faculty judges will attend the presentations and will judge each presentation on quality of project work and presentation.

Winners of each award will be honored with a certificate and $500 award.

Session 1a. Robotic & Mechatronic Systems
Session Chair: Kenn Oldham
Room: 1642 GGBA

10:40 AM  Design and Characterization of a Piano Key Measurement Motor
STUDENT: Robert Self
INSTRUCTOR: Brent Gillespie

11:00 AM  Dynamic Study and Analysis of Active Headrest Systems
STUDENT: Robert Shone
INSTRUCTOR: Volker Sick

11:20 AM  Development of 2nd Generation Foambot
STUDENT: Joseph Jang
INSTRUCTOR: C. David Remy
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Presenter(s)</th>
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<tbody>
<tr>
<td>12:10 PM</td>
<td>Sustainable Electricity Generation in Isolated Brazil</td>
<td>Simon Trask</td>
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<td>STUDENT: Simon Trask</td>
<td>INSTRUCTOR: Margaret Wooldridge</td>
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<td>12:30 PM</td>
<td>Bottom-Up Synthetic Biology for Building Artificial Platelets</td>
<td>Christopher Coyne</td>
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<td>STUDENT: Christopher Coyne</td>
<td>INSTRUCTOR: Allen Liu</td>
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<td>12:50 PM</td>
<td>Treating Primary Postpartum Hemorrhage in Low Resource Settings</td>
<td>Bianca Pillarella</td>
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<tr>
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<td>STUDENT: Bianca Pillarella</td>
<td>INSTRUCTOR: Kathleen Sienko</td>
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<tr>
<td>2:45 PM</td>
<td>Rubik Overview</td>
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<td>2:50 PM</td>
<td>Mechanical Art: Giant Rubik's Cube</td>
<td>Samuelina Wright</td>
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<td>STUDENT: Samuelina Wright</td>
<td>INSTRUCTOR: Noel Perkins</td>
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<td>3:00 PM</td>
<td>Mechanical Art: Giant Rubik's Cube</td>
<td>Daniel Hiemstra</td>
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<td>STUDENT: Daniel Hiemstra</td>
<td>INSTRUCTOR: Noel Perkins</td>
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<td>3:10 PM</td>
<td>Mechanical Art: Giant Rubik's Cube</td>
<td>Martin Harris</td>
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<td>STUDENT: Martin Harris</td>
<td>INSTRUCTOR: Noel Perkins</td>
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<td>3:20 PM</td>
<td>Mechanical Art: Giant Rubik's Cube</td>
<td>Kelsey Hockstad</td>
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<td>STUDENT: Kelsey Hockstad</td>
<td>INSTRUCTOR: Noel Perkins</td>
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Session 4a. Amazing Enablers
Session Chair: Kenn Oldham
Room: 2215 GGB

2:20 PM  Verification of Mode Coupling Effects on the Ultra-Precision Manufacturing Machine Using ADAMs
STUDENT: Wei Hon Yap
INSTRUCTOR: Chinedum Okwudire

2:40 PM  SMA Pawl and Ratchet Mechanism Design
STUDENT: Mary Molepske
INSTRUCTOR: Diann Brei

3:00 PM  Study of Silicon Nanowires Synthesis through VLS Process
STUDENT: Hyunwoo Park
INSTRUCTOR: Neil Dasgupta

3:20 PM  11L Volvo MD11 Engine Configuration
STUDENT: Lucas Marshall
INSTRUCTOR: Andre Boehman

3:40 PM  Installation and Testing of Turbo-generator on DD13 Engine
STUDENT: Harvey Nelson
INSTRUCTOR: Anna Stefanopoulou

Session 2b. Nano-material Investigations
Session Chair: Alan Wineman
Room: 1642 GGBA

12:10 PM  Induce Nanostructures with External Fields
STUDENT: David Pei
INSTRUCTOR: Wei Lu

12:30 PM  Bio-Templated Hierarchical Nanomaterials with Atomic-Scale Interfacial Control
STUDENT: Rachel Goubert
INSTRUCTOR: Neil Dasgupta

12:50 PM  Assessment of Electrical Output of Predetermined Material for Use in a Triboelectric Nanogenerator
STUDENT: Qingtian Yin
INSTRUCTOR: Katsuo Kurabayashi
### Session 3a. Efficient Use of Energy Sources
Session Chair: Jwo Pan  
Room: 1642 GGBA

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<th>Time</th>
<th>Title</th>
<th>Speaker</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>1:30 PM</td>
<td>Efficiency of an Organic Rankine Cycle</td>
<td>Yihao Zhang</td>
<td>Claus Borgnakke</td>
</tr>
<tr>
<td>1:50 PM</td>
<td>Substitution of Natural Gas for Electrical Industrial Drying Overview</td>
<td>Aditya Chintalapati</td>
<td>Claus Borgnakke</td>
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<tr>
<td>1:55 PM</td>
<td>Substitution of Natural Gas for Electric Industrial Drying</td>
<td>Nicholas Myers</td>
<td>Claus Borgnakke</td>
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### Session 3b. Actuation and Control of Legged Systems
Session Chair: Chinedum Okwudire  
Room: 2636 GGBA

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<tr>
<td>1:30 PM</td>
<td>Understanding and Testing Self-Sensing McKibben Artificial Muscles</td>
<td>Khai Yi Chin</td>
<td>C. David Remy</td>
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<tr>
<td>1:50 PM</td>
<td>Pneumatically Powered Lower Limb Exoskeletons</td>
<td>Reilley Jones</td>
<td>C. David Remy</td>
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<tr>
<td>2:10 PM</td>
<td>Passive Dynamic Walking Robot Improvement</td>
<td>Brian McCann</td>
<td>C. David Remy</td>
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