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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 Fall 2015 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 dynamics and controls to gas and engines, advanced manufacturing, and medical devices!

Running concurrent to the MEUS poster and presentation 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 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 MEUS is to provide an intimate forum for a vibrant exchange of ideas and results within our University of Michigan 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
MEUS Planning Committee

MEUS Technical Planning Committee

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

MEUS / RISE Organizers

Ken Arbogast-Wilson
Rachel Casanova
Jacob Hayward
Linh Huynh
Katie Morningstar
Sarah Sobek
Nikki Taylor-Vargo
Michele Wong
Schedule at a Glance

1. Dynamics and Control
   Session Chair: David Dowling
   Room: 2636 GGBA
   10:40 AM - 12:20 PM

3. Advance Manufacturing
   Session Chair: Chinedum Okwudire
   Room: 2636 GGBA
   1:30 PM - 2:30 PM

5. Advance Manufacturing II
   Session Chair: Gabor Orosz
   Room: 3690 GGB
   3:00 PM - 4:00 PM
December 10, 2015

2. Gas and Engines
Session Chair: Claus Borgnakke
Room: 3350 GGB
12:00 PM - 1:00 PM

4. Medical Devices
Session Chair: Jonathan Luntz
Room: 3350 GGB
1:30 PM - 2:30 PM

Poster Session and Reception
BorgWarner Galleria
(Open to ME students participating in Design Expo or MEUS)
4:00 PM - 5:30 PM
RISE: Research, Innovation, Service, 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.
RISE Sessions
Session 1. Dynamics and Controls
Session Chair: David Dowling
Room: 2636 GGBA

10:40 AM  Harris Recon Drone
STUDENT: Sean Flemming
INSTRUCTOR: Kira Barton

11:00 AM  Running Controller for a Bipedal Robot in Simulation and Hardware
STUDENT: Kevin Green
INSTRUCTOR: C. David Remy

11:20 AM  Closed-Loop Position Control of an Automated Treadmill
STUDENT: Oles Synyutka
INSTRUCTOR: C. David Remy

11:40 AM  Implementation of the Continuum Approximation and Splash Dynamics of a Vertical Cylinder in Water
STUDENT: Jalil Alidoost
INSTRUCTOR: Eric Johnsen

12:00 PM  DE Self-Folding Origami
STUDENT: Anna Buzolits
INSTRUCTOR: Diann Brei
Session 2. Gas and Engines
Session Chair: Claus Borgnakke
Room: 3350 GGB

12:00 PM  Substitution of Natural Gas for Electrical Industrial Drying: A Cost Saving Strategy
STUDENT: Hayden Youngs
INSTRUCTOR: Claus Borgnakke

12:20 PM  Fuel Research with IQT and Low Temperature Combustion Characteristics of Pentane Isomer
STUDENT: Iljin Eum
INSTRUCTOR: Andre Boehman

12:40 PM  DoE SCRE Boosted Engine and Methods for Improving Knocking Threshold via DI and PI
STUDENT: Evan Harris
INSTRUCTOR: Andre Boehman
Session 3. Advanced Manufacturing I
Session Chair: Chinedum Okwudire
Room: 2636 GGBA

1:30 PM  Nanofluidic Analysis of Air Bubble Defects in
Nanoimprint Lithography
STUDENT: Nan Li
INSTRUCTOR: Xiaogan Liang

1:50 PM  Commercial FDM to E-Jet Conversion
STUDENT: Thomas Brown
INSTRUCTOR: Kira Barton

2:10 PM  3D Printing for Prototypes of Thin-Film PZT/
Polymer Microstructures
STUDENT: Clark Teeple
INSTRUCTOR: Kenn Oldham
Session 4. Medical Devices
Session Chair: Jonathan Luntz
Room: 3350 GGB

1:30 PM  Modeling Motion of Micro-Mirrors Used in Medical Endoscopes
STUDENT: Eric Harding
INSTRUCTOR: Kenn Oldham

1:50 PM  Electrode Insertion Success with Focus on Geometric and Material Considerations
STUDENT: Shaun Marshall
INSTRUCTOR: Albert Shih

2:10 PM  Cell Phone Based Miniaturized Coagulation Monitoring Platform for Point-of-Care Diagnosis
STUDENT: David Peyer
INSTRUCTOR: Jianping Fu
5. Advanced Manufacturing II
Session Chair: Gabor Orosz
Room: 3590 GGB

3:00 PM  
Conversion of Commercial 3D Printer to E-Jet  
STUDENT: Ryan Tepper  
INSTRUCTOR: Kira Barton

3:20 PM  
An Investigation of Compliant Electrodes for Application in Dielectric Elastomers  
STUDENT: Samuel Gregory  
INSTRUCTOR: Diann Brei

3:40 PM  
Secure Cloud Manufacturing Multidisciplinary Design Project  
STUDENT: Aleyna Kapur  
INSTRUCTOR: Kira Barton
Poster Session and ME Reception
BorgWarner Galleria
4:00 PM—5:30 PM

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

ME 290 Posters

**Modularity**
STUDENT: Gregory Cunningham  INSTRUCTOR: Bogdan Epureanu

**Powertrain Strategies for the 21st Century**
STUDENT: Kunal Haria  INSTRUCTOR: Margaret Wooldridge

**Analysis of Equine Motion and Gait Using Camera Based Kinematics and Wearable Sensing Technology**
STUDENT: Annika Stoldt  INSTRUCTOR: C. David Remy

ME 390 Posters

**Magnetic Field Effects on C. elegans Locomotive Behavior**
STUDENT: Syeda Maisa  INSTRUCTOR: Bogdan Epureanu

**DE Self-Pumping Peristaltic Hose**
STUDENT: Kaitlyn Sharon Holmstrom  INSTRUCTOR: Diann Brei

**Predict Tipping Point of Physiological Critical Illness**
STUDENT: Minqi Lin  INSTRUCTOR: Bogdan Epureanu

**Heat Exchanger Design for Experimental Studies of EGR Cooler Fouling**
STUDENT: Archit Gupta  INSTRUCTOR: Andre Boehman

**Ideation Flexibility**
STUDENT: Jennifer Wenger  INSTRUCTOR: Steve Skerlos
RISE Awards

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

**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 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 MEUS 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.
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.
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 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 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 12:00 pm - 4:00 pm.
ME 450 Sponsors

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

Mr. Roy Anderson   Professor Roy Clarke
Professor Neil Dasgupta   Mr. Steven Donoghue
Dr. Ben Dwamena   Professor Brent Gillespie
Dr. Grant Kruger   Professor Mark Moldwin
Coach John Paul   Professor Johannes Schwank
Ms. Nancy Senabulya   Professor Kathleen Sienko
Professor Martin Strauss   Ms. Brenda Vyletel

U-M Laboratory for Innovation in Global Health Technology
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Maps

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