Read about Dr. Haseung Chung’s research in the development of Magnetic-Field Assisted Finishing (MAF) and its application to Additive Manufacturing (AM) on pages 8 & 9! ALSO, be sure to read about the ME curriculum changes on pages 4 & 5!
The results of many scientific studies on learning help to shed light on the best (and worst) ways to study. It turns out that what seems like a good way to study may in fact not be very effective.

For example, it is commonly believed that a long-duration study session (e.g., cramming for a test) is a good way to learn a topic. But in fact this is one of the least productive study strategies, resulting in very little long term retention of the knowledge or skill that was practiced. Cramming “feels” like it works because you may temporarily become more fluent with the topic. But your ability to retrieve or use that information at a later time has not increased much at all.

It is much better to space out your studying and problem solving practice over multiple days and even weeks. Why? The basic reason is that you will have forgotten some of the information and solution techniques between study sessions, so you will have to work harder to retrieve the concepts and skills you are trying to practice. That’s right. Real learning requires that you repeatedly struggle to recall and use the knowledge that you hope to acquire.

The brain stores information as connections between neurons. Every time you retrieve information after a break from thinking about it, you strengthen the neural pathways associated with that knowledge, making it easier to retrieve the next time. The brain is not really a muscle, but its neural connections do get stronger when you practice.

So if you’re looking for a way to improve your performance this semester, try rearranging your study schedule so that you have more frequent and shorter study sessions for each course. A good place to start is 60-90 minute sessions 5-6 days per week, not counting class time.

This means that on most days you will spend some time studying and solving practice problems for all of your courses. The approach of mixing study topics in this way is called interleaving, and studies show this strategy also leads to better learning. If it feels difficult to retrieve the various concepts as you switch from topic to topic throughout the day, then you are on the right track. The more effort it takes, the better you learn it.

The best learning strategies are certainly non-intuitive. But the results justify the required extra work.

For many more details on learning strategies, see the book Make It Stick: The Science of Successful Learning by Peter C. Brown, Henry L. Roediger III and Mark A. McDaniel (2014).
Curriculum News

Curriculum Changes: Please read Dr. Averill’s article on pages 3 & 4, which describes the changes and how they may affect you.

Co-op Students: BEFORE you leave for your Summer or Fall 2018 co-op rotation, please be sure to discuss your schedule for next Fall 2018/ Spring 2019 with your academic advisor.

ME 285–Computer Aided Design Tools (3 credits) is changing to ME 385, and it will only be available to engineering juniors and seniors. Note: ME 385 has a temporary number of 399 until the new number receives final approval.

ME 371 & 471 are changing to ME 370 & 470 as of Fall 2018.

ME 410–Heat Transfer (3 credits) will be offered both on campus and online this summer. The on-campus version is a First Session course, and the online version is a Full Session course.

ME 413–Cryogenic-Thermal Systems & ME 414–Mechanical Design of Cryogenic Systems are new senior electives. They are also part of the new Cryogenic Engineering Concentration.

ME 440–Aerospace Engineering Fundamentals is being renamed Aerospace Propulsion. It is also part of the new Aerospace Concentration.

ME 441–Aerodynamics and Aircraft Performance is a new spring semester senior elective. It is also part of the new Aerospace Concentration.

ME 451–Control Systems requires department approval before you can enroll. If you have an accurate long-term schedule on file in the ME Advising Office, request approval by submitting the ME 451 Approval Form: https://me.msu.edu/me-451-enrollment-approval-form If you do not have an accurate long-term schedule on file, schedule an appointment with Gaile by calling 517-355-3338 or stopping by 2560 EB.

ME 478–Product Development which is a spring semester course, has been approved as a design intensive senior elective. Please note that ME 477 is the prerequisite for this course.

ME 481–ME Design Projects requires department approval before you can enroll. If you have an accurate long-term schedule on file in the ME Advising Office, request approval by submitting the ME 481 Approval Form: https://me.msu.edu/me481-approval-form If you do not have an accurate long-term schedule on file, schedule an appointment with Gaile by calling 517-355-3338 or stopping by 2560 EB.

Class Standing. ME juniors and seniors can obtain this information in 2560 EB. Sophomores should go to W-8 Wilson. Be prepared to show your MSU I.D.

Job Search Advice: The Center is available to answer questions about your job search. To ask a question or schedule an appointment, go to 1340 EB or call 517-355-5163. Or, you can email the office at careers@egr.msu.edu

Prerequisites: The ME department expects all students, including members of the Honors College, to observe all course prerequisite requirements. If you have a question about prerequisites, contact the ME Advising Office.

ME Students Honored at Networking With Executives Event on Feb 21!

Women in Engineering Awards:
• Lauren Green (ME Senior).
• Samantha Pfeiffer (ME Junior).
• Lindsay Goodrich (ME Sophomore).
• Heidi Theisen (ME Sophomore).
• Gabriella Kelsch-Bledsoe (ME Freshman).
• Sophia Miller (ME Junior).

Outstanding Diversity Programs Award:
• Lauren Green (ME Senior).
Frank J. Hatfield “Build it Better” Award:
• Neil Haakenson (ME Sophomore).

College of Engineering Service Awards:
• Michael Bigelow (ME Senior).
• Colton Knopf (ME Senior).
• Brandon Miller (ME Senior).

High Achieving Student Recognition:

Design Day

Friday, April 27, 2018
Engineering Bldg
Come and see our students lead, create, and innovate

- Competitions
- Demonstrations
- Presentations
- Awards
Important Changes to the Mechanical Engineering Curriculum!

The Mechanical Engineering curriculum is continuously being improved, and some significant changes will become effective in fall semester 2018. Be sure to read these announcements in detail before setting your course schedule for next year.

Restructured Mechanical Design Courses:

ME 371: Mechanical Design I is being replaced by ME 470: Mechanical Design and Manufacturing II
ME 471: Mechanical Design II is being replaced by ME 370: Mechanical Design and Manufacturing I

From a curricular viewpoint, the main effect of this change is that the structural design topics will now be taught prior to the kinematic design topics. The significant design project will be kept in the senior course, ME 470.

Important scheduling information:
If you were planning to take ME 371 in Fall 2018, you should sign up for ME 370 instead.
If you were planning to take ME 471 in Fall 2018, you should sign up for ME 370 instead. If you have taken ME 371 already, it will be considered equivalent to ME 470.

So ME 470 will not be offered in Fall 2018. Instead, there will be extra sections of ME 370 during the transition period of this change.

New Cryogenics Engineering Courses:

New course. ME 413-Cryogenic Systems Analysis
Low temperature properties of materials and fluids. Introduction to cryogenic liquefaction and refrigeration cycles, separation and purification systems, instrument systems for low temperature measurement, fluid storage and distribution, vacuum technology.

New course. ME 414-Cryogenic Systems Mechanical Design  (this course is design-intensive)
Engineering mechanical design of cryogenic refrigeration fluid systems. Design, analysis and introduction to ASME codes pertaining to piping systems/components, vacuum insulated transfer-lines, cold boxes, and super-conducting magnet cooling.

New and Modified Aerospace Engineering Courses:

Modified course. ME 440-Aerospace Engineering Fundamentals is being renamed Aerospace Propulsion
Fundamentals of thrust and propulsion systems, including gas turbines, ramjets, rockets and electric devices. Compressible flow through nozzles and shocks. Cycle analysis of air breathing jet propulsion and chemical rocket propulsion. Performance and design of propulsion components.

New course. ME 441-Aerodynamics and Aircraft Performance
Solutions to inviscid and viscous fluid dynamical equations. Aerodynamics of airfoils, wing and fuselage. Aircraft performance parameters and basics of flight, including cruise, turning, takeoff and landing. Introduction to stability, including control surfaces, longitudinal and lateral stability and power effects.
New and Modified Concentrations:

Concentration in Aerospace Engineering

Students who meet the requirements of this concentration will have expertise in aerodynamics, propulsion and structures, supplemented by other strengths in the core Mechanical Engineering degree program. To complete a Bachelor of Science degree in mechanical engineering with an aerospace engineering concentration, students must complete the following:

All of the following courses (9 credits):

- ME 440 Aerospace Propulsion 3
- ME 441 Aerodynamics and Aircraft Performance 3
- ME 475* Computer Aided Design of Structures 3

One of the following courses (3 credits):

- ME 422 Introduction to Combustion 3
- ME 426 Introduction to Composite Materials 3
- ME 433 Computational Fluid Dynamics 3
- ME 442 Turbomachinery 3
- ME 464 Intermediate Dynamics 3

Concentration in Cryogenic Engineering

A mechanical engineering degree with the cryogenic engineering concentration recognizes the expertise of students in thermal and mechanical analysis and design techniques as applied to cryogenic engineering applications. To complete a Bachelor of Science degree in mechanical engineering with a cryogenic engineering concentration, students must complete the following:

- ME 413 Cryogenic Systems Analysis 3
- ME 414* Cryogenic Systems Mechanical Design 3
- ME 416 Computer Assisted Design of Thermal Systems 3
- ME 442 Turbomachinery 3

Concentration in Manufacturing Engineering

To earn a Bachelor of Science degree in Mechanical Engineering with a manufacturing engineering concentration, students must complete the following:

All of the following courses (7 credits):

- ME 372 Machine Tool Laboratory 1
- ME 477 Manufacturing Processes 3
- ME 478* Product Development 3

One of the following courses (3 credits):

- CHE 472 Composite Materials Processing 3
- ECE 415 Computer Aided Manufacturing 3
- MSE 426 Introduction to Composite Materials 3

One of the following courses (3 credits):

- ACC 230 Survey of Accounting Concepts 3
- EC 201 Introduction to Microeconomics 3

*These courses are design intensive.
Cryogenic system applications are found in aerospace, industrial gas and energy processes, and particle physics experimental facilities. This includes space-vehicle propulsion systems, space-simulation facilities, air-separation plants, liquid-natural-gas systems, and helium cryogenic systems for particle accelerators.

As part of the MSU Cryogenic Initiative, the Mechanical Engineering Department is offering a new design intensive 3-credit senior elective for Fall 2018: ME 414-Mechanical Design of Cryogenic Systems. The pre-requisite is ME 370-Mechanical Design and Manufacturing I. (Note: Students who will have completed ME 471 by next fall, or who take ME 491/201 this summer, may take ME 414 but they will need a prerequisite override. To request an override, submit the ME Override Request form: https://me.msu.edu/me-override-request)

ME 414 will introduce the engineering mechanical design of cryogenic refrigeration systems, and an introduction to American Society of American Engineers (ASME) codes pertaining to pressure vessels and process piping system design. This design-intensive course is intended to provide students a basic foundation for the mechanical design of these systems, in which material properties vary considerably.

For Spring 2019 a new companion course is planned, ME413-Cryogenic Thermal Systems. The prerequisite is ME 410-Heat Transfer or concurrently. This course is an introduction to the thermal and fluid aspects of cryogenic systems, including low-temperature properties of materials and fluids, an introduction to cryogenic liquefaction and refrigeration cycles, separation and purification systems, instrument systems for low temperature measurement, fluid storage and distribution, and vacuum technology.

For more information about the courses, contact:
Dr. Rao Ganni
ganni@frib.msu.edu
or
Dr. Pete Knudsen
knudsen@frib.msu.edu

The MSU Cryogenic Initiative is a collaboration between the MSU College of Engineering and the Facility for Rare Isotope Beams at MSU. It combines classroom education with training on the cutting-edge technologies and advancements in the cryogenic field that will exist at FRIB.
Communication is a very fickle creature at times. We say something and people take it the wrong way. We make what we think is a joke and no one laughs. We use words that we think we understand and the response is silence. Communication is not easy and it was never meant to be that way. From the earliest days of man’s existence communication has had its hurdles.

If you take time to read the accounts in the Old Testament you find that early man had a real problem with communicating with his fellow human beings and his God. Adam and Eve tried to communicate themselves out of a run in with their God. It didn’t work. If they had discussed the story that they got from the snake, things would have been different. But there was no discussion and God tossed them out of the Garden of Eden, and this turned into a long history of getting back into His favor. The children of Adam and Eve didn’t fare any better. Cain killed Able because Cain thought that Able had better communication skills with God. Able died because his brother failed to understand how communication works.

Communication requires a lot of talking and a lot of listening. If you take that period of time in the existence of man and plow your way through political upheavals to religious wars to disasters created by man you will find communication at the core of the problems. It would be wonderful if everyone understood what is being said and carried on with simple discussion of those words and their complete meanings, but that is not what happens in reality. Here is where each of us and especially the up

Cont’d on pg 9
Additive manufacturing (AM) technique has no theoretical limitation to geometrical complexity, which is very difficult or almost impossible to achieve by conventional manufacturing processes. However, AM components suffer from their rough surface finishes, which is inherent to AM processes. Therefore, there is a need for an appropriate post-finishing process to improve the surface finish of AM parts. Magnetic-field assisted finishing (MAF) is a promising candidate for such purposes. MAF utilizes a flexible brush composed of ferrous metal and abrasive particles typically in a liquid medium, which can be capitalized to enhance the surface quality of AM components. The brush is attached to a rotating spindle with a permanent or electro-magnet. As the spindle rotates, translates and/or oscillates against the work surface in a standard CNC machine, surface finishing is achieved by the abrasive particles in the brush. Although MAF is capable of significantly improving surface quality of AM parts, there are still limitations in its applications due to the narrow range of material removal rate (MRR) and tool wear. The objective of this research is to transform MAF into a surface finishing technique that is capable of improving any freeform surface of any roughness quality to an ultrafine condition.

In concordance with the research objective, nano-scale solid lubricant is introduced to improve the low MRR of MAF and extend tool life. It is well known that nano-scale solid lubricant such as exfoliated graphite nanoplatelets (xGnP) can enhance the tribological and thermal effect at a very low volume concentration. It has been applied extensively to machining processes such as grinding, milling, turning and drilling. It is also established that nano-ball bearing effect of spherical nanoparticles and the interlayer sliding of nano-platelets can improve the surface quality of the workpiece and reduce wear on the cutting tools. Figure 1 shows selected instances of the sizes and shapes of abrasives, iron particles, and platelet types of nano-scale solid lubricant. It is observed that various scenarios involving abrasives, iron particles, and nano-platelets are possible and appropriate combination can guarantee the benefit of MAF’s performance such as a better surface quality and an extension of tool life.

Preliminary experiments were conducted using the brush consisting of iron particles, cubic boron nitride (cBN), and silicon oil. The brush was combined with a nano-scale solid lubricant, xGnP. Figure 2 (a) shows various surface qualities obtained after MAF processes were performed with different combinations of experimental conditions. Figure 2 (b) displays the surface roughness for each run. Two significant results are demonstrated: (1) the surface quality is improved with an increase in magnetic force, and (2) the introduction of xGnP as nano-scale solid lubricant significantly enhances the performance of MAF. It is also observed that the effect of xGnP is more prominent with a higher magnetic force. On the other hand, the size effect of the abrasive cBN particles is not significant even though there is a slight improvement in surface quality with smaller abrasive particles. Even though the edge area along the tool path is not shown, this area displays a better surface finish quality in comparison to the center area, which was affected by the radial-dependent movement of abrasive particles by the rotational movement of spindle. In order to obtain a more conclusive result, other systematic experiments and theoretical investigations will be planned and conducted.

**Figure 1.** Schematic description of the hypothesis of the interaction between various particles in the MAF brush

![Figure 1. Schematic description of the hypothesis of the interaction between various particles in the MAF brush](graphic)
this purpose, other MAF experiments with varying abrasive particles and nano-scale solid lubricants in terms of size, properties, and concentration will be performed. Detailed analysis on surface quality, MAF force, wear of abrasive particles, and chemical composition of the polished workpiece will also be completed using scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS) and dynamometer. At the same time, numerical simulation models such as solid-liquid two-phase flow and magnetic field distribution according to the geometrical change of brush will also be conducted, which is essential to the understanding of the physical mechanisms among various constituents of the brush in MAF.

MAF has displayed excellent potential not only for academic research but also for industrial applications, such as surface finishing of additively manufactured parts, mold surface, ceramic, glass, etc. Recently, Dr. Chung and Dr. Kwon submitted a collaborative proposal to the NSF regarding their MAF process and plan to collaborate with LG electronics to improve the surface quality of molds for home appliances.

![Figure 2. Workpiece surface quality results after MAF process](image)

**Integrated System Design (ISD) Experience: The Electric Commuter Bike Project**

by Dr. William Resh

Imagine during your undergraduate education, that you could work on a design project that runs from sophomore year until graduation. As you go through the core ME courses, you can use what you learn in classes on the design project. You will also see how the concepts learned in different courses interact in a design. As the product comes together, you begin to understand how successful designs become integrated engineering systems, and what roles design, analysis, and testing play in creating successful products.

In the Fall semester of 2017, the ME department started a multi-year undergraduate integrated system design (ISD) experience. The ISD experience is the first major activity of the new MSU Mechanical Engineering Design Consortium, a group linking MSU ME Design and interested industry partners. The key objective of this consortium is to improve the integration of design in undergraduate education, including increased exposure to and integration of industry design tools, practices, and personnel.

The students participating are working on the design of an electric commuter bicycle. Over three years, the ISD team will benchmark competitors, develop product specifications, and design, analyze, build, and test 3 levels of prototypes. Team members will learn how to not just create a design but how to test and improve it, using industry design and development tools such as benchmarking, Pugh charts, Failure Modes Effects Analysis (FMEA), and design verification testing (DVP&R). In Spring semester 2018 the ISD team is creating its first prototype – a concept (or “mule” level) prototype - to check out some product architecture selections.

The initial ISD team is made up of mechanical engineering students in the Honors College. The plan is to grow the program to allow all interested mechanical engineering students to participate. If you are interested in participating in the Integrated System Design experience, send an email to ME faculty members William Resh (reshwill@egr.msu.edu) or Geoff Recketenwald (gdr@egr.msu.edu).

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and coming engineers need to think about the words that are used on paper and in the verbal arena. Everyone should carefully analyze the way that they construct their conversations and their texts.

I will leave you with one idea when it comes to COMMUNICATION. Think about the phrase, “If you See something, Say something.” Now think about it for a second. Do you understand that maybe this phrase is incomplete? Shouldn’t it really say, “If you See something, Say something, AND THEN DO SOMETHING!” That’s real communication!
Department of Mechanical Engineering

Dean’s List

Congratulations to these 507 ME majors who made the Dean’s List after Fall 2017. To be on the Dean’s List, you must have a semester GPA of 3.5 or better. This list is from January 25. For updates, go to: https://reg.msu.edu/ROInfo/GradHonorDeansList.aspx.

Congratulations and best wishes to all ME graduates! On behalf of the faculty, I wish you the greatest happiness and success in your careers, graduate studies, and personal lives. The following students had applied for graduation by March 2. If your name is missing, please contact me immediately at griffore@egr.msu.edu (Tele: 517-355-3338). — Gaile

May Graduates

Farhan Ahmed
Shwan M S Al-Howrami
Yamen Almahmoud
Mojtaba N Almiskeen
Majed Abdullah Almughair
Matthew Scott Auvenshine
Thomas Michael Baldwin
Payton Dale Bauman
Megan Christine Beisser
Michael Joseph Bigelow
Andrew Albert Biggie
Pranob Biswas
Ryan Michael Boutet
Christopher Charles Brenton
Samantha Anne Brown
Kole Julian Brunsman
Jacob Andrew Bullard
Daniel Adam Burchart
Leonel P Calaj
Madison Nicole Case
Matthew Ryan Cassiday
Robert Wesley Chaney
Yibin Cheng
Alex Steven Clark
Edward John Clark
Stephanie Marie Close
Drew Thomas Daily
Sawyer J Dmooch
Xincheng Dong
Geena Maureen Duff
Tristan R Egegenberger
Phillip Bruce Erickson
Anthony Charles Ethridge
Aaron Matthew Feinauer
Nicholas James Flannery
Lance Tyler Frahm
Jackson Ryan Garber
Andres M Garcia Salazar
James Hanen Garrett
Grant James Gibson
Nathanael W K Ginnodo
Reison Gjolaj
Grant Marcus Gjolaj
Samuel Joseph Greenwald
Charles James Guidarini
William Scott Hartnagel
Yuhao He
Lindsay Ann Hoard
Jonathon Winslow Howard
Hunter Jacob Jenuwine
Brandon Michael Jett
Adri Johari
Meredith Jean Jonik
Do-Hyung Kim
Jean Marie Klochko-Bull
Austin David Klump
Colton James Knopf
Ryan Joseph Kruzel
Jack Arthur Kuerbitz
Zachary Michael Lapinski
Matthew Enloe Lawrence
Jack Louis Leckner
Quanjing Li
Evan James Lile
Ian Rex Lindley
Shuang Liu
Xiaonan Liu
Ryan Robert Loveland
Krishnan Raj Luhan
Kris Huffman Magidsohn
Ian Daniel May
Brandy Lynn Mazzella
Daniel John McCarty
Daniel Geoffrey Middleton
Owen Sarver Middleton
Austin Gregory Miller
Brandon A Miller
Spencer Guire Miller
Noro Shafiq Mohd Noor
James Bernard Moran
James Edward Morey
Kanshu Mori
Shane Kenneth Neal
Justin Ngo
Duy Nguyen
Tracey Lynn Nguyen
Tyler McAuliffe Nicolay
Maria Bianca Osinski
Nathan Patrick Osullivan
Vincent Reza Pahl
Andrew Frank Palucci
Bram Charles Parkinson
Kelly Suzanne Patterson
Evan Matthew Paupert
Zexi Peng
Brian Gary Pieciak
Robert Vincent Pizzimenti
Chase Michael Quencer
Tess Evelyn Reed
Li Ren
Vincent Louis Rende
Bebecka Ann Reneker
Jacob J Richter
Jonathan Robert Ristola
Zachary John Sadler
Mirza Ali Amin Saiful Bahri
Jason Paul Sammut
Nickolas Caesar Santi
John Atam Schumaker
Justin M Slagter
Tyler Mathew Smith
Andrew William Stamm
Kayla Ann Starr
Kathryn Marie Stimetz
Justin Su
Spencer Allen Thompson
Andrew Michael Tran
Mark A Vanpoppelen,
Anuj B Vyas
Michael James Walicki
Lingfeng Wang
Jonathan Andrew West
Miranda Rae Whah
Henry Thomas Wikol
Michael A Williams,
Reed Carson Williams
Jacob Henry Wilson
Zhe Xu
David Amos York
Chun-Kit Caleb Yung
Jiaji Zhang
Qilin Zhu
Adam John Ziembra
Courtney Bianca Zimmer

August Graduates

Abdullah Ahmed Bo Shgeia
Mohammed S M Bomoza
Peter Roger Chew

RWTH Aachen Program

by Dr. Brian Feeny, Program Director

Study abroad can be an awesome experience, build a strong resume, and provide a great talking point for interviews. If you are interested in a summer experience where you can work on an applied engineering project in an advanced facility, learn German and meet new people, while immersed in an interesting environment with winsome customs, delicious foods, and intriguing approaches to everyday life, then check out the exchange program with RWTH Aachen.

MSU ME students with a 3.0 GPA or higher have the extraordinary opportunity to (1) live in Aachen, Germany (mid-May to end of July 2018), (2) earn 9 credits via a 5-credit independent study plus a 4-credit German class, and (3) travel in Europe on 3-day weekends. The experience will involve interaction with fellow engineering students from around the world at RWTH-Aachen, a premier European technical university. Significant scholarships through the North American Rockwell Endowment can help defer the cost.

Project topics include automotive engineering, plastics, advanced and composite materials, textiles, manufacturing technology and automation, bio and chemical processing, wind energy, and aerodynamics. The program enjoys a cooperation with RWTH’s Undergraduate Research Opportunities Program, through which you will have access to tours, trips, and workshops.

The city center is a blend of an old, historic European city and a modern college town. A well-maintained bike path allows easy intimate access to the nearby small towns, forests and farmlands. An outstanding rail system provides our students easy access to Munich, Paris, Amsterdam, Zurich, Rome, the Alps, the Mediterranean, and many more cultural and natural destinations on their 3-day weekends.

To find out more, please contact me at feeny@egr.msu.edu or 353-9451. This is truly a great opportunity—don’t miss it!

Michigan State University

Spring 2018 | ME Bulletin 11
3D printing is turning visions into reality in mechanical engineering! Each semester, dozens of design groups are printing components from CAD, for research, capstone and design day projects. This technology, not only reduces the time it takes to fabricate parts, but it also minimizes cost. A new 3D printing board created by Academic Specialist, Kathy Stevenson is now available in the shop to provide students with physical examples of basic design techniques and best practices, including; design fits, printed threads, appropriate wall thicknesses, anti-rotation options and strengthening ribs. These examples will allow students to “see” potential design flaws before utilizing unnecessary shop and/or printer resources. Each board also contains printer and printing specifications.

Kathy Stevenson 3D prints a miniature scale model of the MSU autonomous vehicle for the North American International Auto Show dinner reception hosted by the College of Engineering and Eli Broad College of Business, in January. The car took 4 ½ days to print and a combination of printers to complete the task. Stevenson used an innovative method in NX called “convergent modeling” which allows one to design in context of the assembly using an STL file. This amazing new technology will reshape the future in design by reducing lead times and costs across the spectrum of users from manufacturers to research. “It was an exciting opportunity to utilize this technology and produce a great product for the University,” says Stevenson.
**Baja SAE**

The MSU Baja Racing Team is an official SAE Collegiate Design Team which designs, builds and competes with an off-road Baja buggy each year. The team, which is student led, provides a unique opportunity for engineers to develop crucial hands on designing and manufacturing experience preferred by many companies, as well as leadership opportunities. The team has been hard at work this year and will soon be unveiling our car for this year. Starting in the fall, students have learned how to use NX and FEA on a real world application and consider the manufacturing methods to make each part. After that, students are taught how to operate the machines in our shop to make their parts and how to interact with companies to order parts. The Baja team is a great opportunity for developing skills learned in the classroom and for building a professional network. *Submitted by Zac Brei, Project Manager.*

**PHOTO PROVIDED BY ZAC BREI**

**Pi Tau Sigma**

Pi Tau Sigma is a Mechanical Engineering Honor Society at Michigan State, with the goal of promoting integrity, leadership, scholarship, and service in the engineering community. We serve to connect mechanical engineers who best represent these traits. Our organization participates in a variety of events, including Introduce a Girl to Engineering Day and Habitat for Humanity. We also host internal events such as buffalo wild wings night and game night.

As a service to the mechanical engineering community, we host a ‘senior elective night’ where we will review the senior electives available for next fall. Senior electives are a great opportunity to make your class schedule fit your interests. We gather comments from past students and professors on the content and difficulty of the courses. Our aim is to guide our fellow students to the electives that best suit them. *Submitted by Michael Powers, President.*

**Study Abroad in France (ECAM in Lyon) by Professor André Bénard**

The Department of Mechanical Engineering offers a month-long study abroad program for junior-level students in Lyon, France each summer. The students stay at ECAM, a French engineering school located in the old part of Lyon, for the entire month of June.

Students can take the equivalent of ME 201 or ME 410, both taught in English. They also take a French language course (taught in French). If you are interested in this program, please contact: Ms. Maggie Blair-Ramsey (blairram@egr.msu.edu) or Professor André Bénard (benard@egr.msu.edu)

**Tutoring**

- The ME Learning Center, located in 1237 EB, has mentors for ME 201, 222, and 361. The hours for Spring 2018 can be found here: [https://me.msu.edu/me-learning-center](https://me.msu.edu/me-learning-center) [Click on scheduled hours]

- The Guided Learning Center (GLC), located in 1108 EB, offers free drop in tutoring for MTH 234 and 235 and many core engineering courses. To request assistance, go to: [https://www.egr.msu.edu/dpo/academics/guided-learning-centered](https://www.egr.msu.edu/dpo/academics/guided-learning-centered]

- The Cornerstone & Residential Experience (CoRe) program provides tutoring in G24 Wonders Hall in courses required for admission to the College of Engineering. Their “drop-in” hours are Sunday through Thursday from 6 - 10 pm.

- ME graduate student and Pi Tau Sigma undergraduate tutors can be contacted through the ME Advising Office. These tutors charge a fee, which you can negotiate with them. Email Gaile if interested: griffore@egr.msu.edu.
Department of Mechanical Engineering

ME Senior Electives for 2018-2019

• The following ME Senior Elective list was accurate as of March 2, but it is subject to change. Important changes will be emailed to you with “ME Bulletin Update” on the subject line.
• Design Intensive courses have an asterisk (*) after the course number.
• Descriptions are provided for courses that are not in the catalog. All others can be found by going to https://reg.msu.edu/Courses/Search.aspx.
• The ME department cannot overfill a required course or section to solve a Senior Elective schedule conflict.
• Instructor assignments had not been finalized when the newsletter went to press. They will be posted later on the Schedule of Courses website.
• Course override instructions can be found in the shaded box on page 15.

SUMMER SEMESTER

ME 490 Independent Study. 1-4 credits. See Override Instruction #2 on page 15. You may reenroll for a maximum of 6 credits.

ME 465*: Computer Aided Optimal Design. 3(3-0). Prereq: (ME 222 and ME 280) and (ME 371 or concurrently). Online Course.

FALL SEMESTER

ME 414*: Mechanical Design of Cryogenic Systems. 3(3-0). Prereq: (ME 470 or concurrently) or (ME 371).

ME 416*: Computer Assisted Design of Thermal Systems. 3(4-0). Prereq: (ME 410 or concurrently).

ME 422 Introduction to Combustion. 3(3-0). Prereq: (ME 332 or concurrently).

ME 423 Intermediate Mechanics of Deformable Solids. 3(3-0). Prereq: (ME 222).

ME 425 Experimental Mechanics. 3(2-3). Prereq: (ME 222).

ME 440 Aerospace Propulsion. 3(3-0). Prereq: (ME 332).

ME 444 Automotive Engines. 3(3-0). Prereq: (ME 410 or concurrently).

ME 475*: Computer Aided Design of Structures. 3(3-0). Prereq: (ME 370) or (ME 471).

ME 477 Manufacturing Processes. 3(3-0). Prereq: (ME 222 and MSE 250).

ME 490 Independent Study. 1-4 credits. See Override Instruction #2 on page 15. You may reenroll for a maximum of 6 credits.

ME 491 Selected Topics in Mechanical Engineering. Section 001: Biomechanical Analysis of Human Movement. See Override Instruction #1 on page 15. Course Description: Experimental methods used in the biomechanics of human movement. Topics will include equipment used for capturing movement (e.g., motion capture, force plates, EMG), data analysis techniques, and reviews of important studies in the biomechanics literature. Emphasis will be on writing code in MATLAB for data analysis. Applications of these techniques to human movement from different contexts (e.g., gait, sports, ergonomics) will be discussed. Prereq: (ME 371). Biomechanical Concentration Course.

ME 494 Biomechanics and Heat Transfer. 3(3-0). Prereq: (ME 410 or concurrently). Biomedical Concentration Course.

CHE 472 Composite Materials Processing. 3(2-3). Prereq: (ME 332).

ECE 415 Computer Aided Manufacturing. 3(2-3). Prereq: (ME 451). See Override Instruction #3 on page 15.

ECE 445 Biomedical Instrumentation. 3(2-3). Prereq: ECE 345. Biomedical Concentration Course.

MSE 425 Biomaterials & Biocompatibility. 3(3-0) Prereq: (MSE 250). Recommended Background: (PSL 250). Biomedical Concentration Course. For more info, see Override Instruction #4 on page 15.

MSE 476 Physical Metallurgy of Ferrous & Aluminum Alloys. 3(3-0). Prereq: (MSE 250). Recommended background: MSE 310. For more info, see Override Instruction #4 on page 15.

ME 812 Conductive Heat Transfer. 3(3-0). See Override Instruction #5 on page 15. Prereq: (ME 412 plus GPA of 3.5+).

ME 830 Fluid Mechanics I. 3(3-0). See Override Instruction #5 on page 15. Prereq: (ME 332 plus GPA of 3.5+).

ME 860 Theory of Vibrations. 3(3-0). See Override Instruction #5 on page 15. (Prereq: ME 461 plus GPA of 3.5+).
SPRING SEMESTER

ME 413 Cryogenic-Thermal Systems. 3(3-0). Prereq: (ME 410 or concurrently).
ME 417 Design of Alternative Energy Systems. 3(3-0). Prereq: (ME 410 or concurrently).
ME 426 Introduction to Composite Materials. 3(3-0). Prereq: (ME 222).
ME 433 Introduction to Computational Fluid Dynamics. 3(3-0). Prereq: (ME 410 or concurrently).
ME 441 Aerodynamics and Aircraft Performance. 3(3-0). Prereq: (ME 332).
ME 442 Turbomachinery. 3(3-0). Prereq: (ME 332).
ME 445 Automotive Powertrain Design. 3(3-0). Prereq: (ME 444).
ME 464 Intermediate Dynamics. 3(3-0). Prereq: (ME 361).
ME 465 Computer Aided Optimal Design. 3(3-0). Prereq: (ME 222 and ME 280) and (ME 370 or concurrently) or (ME 371). Online Course.
ME 477 Manufacturing Processes. 3(3-0). Prereq: (ME 222 and MSE 250).
ME 478 Product Development. 3(3-0). Prereq: (ME 477).
ME 490 Independent Study. 1-4 credits. See Override Instruction #2 below. You may reenroll for a maximum of 6 credits.
ME 495 Tissue Mechanics. 3(3-0). Prereq: (ME 222). Biomedical Concentration Course.
ME 497 Biomechanical Design in Product Development. 3(3-0). Prereq: (ME 370 or concurrently) or (ME 371). Biomedical Concentration Course.
BE 444 Biosensors for Medical Diagnostics. 3(3-0). (BS 161) and (CEM 141) and (ECE 345). Biomedical Concentration Course.

CHE 483 Brewing and Distilled Beverage Technology. See Override Instruction #6 Below. Class meeting on Mondays is scheduled in ANH 1279 and the hours arranged are located at MBI, 3815 Technolgoy Blvd., Lansing, MI. Pre-req: (Age 21 or higher) and (Senior standing) and (ME 410 or concurrently).

ENE 422 Applied Hydraulics. 3(2-2). Prereqs: (ME 332).

Graduate Level Courses: Honors College members and/or students with 3.5+ GPAs might consider taking a graduate course as a senior elective. Before enrolling, several signatures, including that of the instructor, are required. Possible choices for Spring 2018 include ME 825, 861, 872 and 875. See Override Instruction #5 below.

OVERRIDE INSTRUCTIONS

1) Submit the ME Override Request Form: https://me.msu.edu/me-override-request

2) ME 490—Independent Study Enrollment Procedure: Find a professor who is willing to supervise your independent study, and discuss your plans with him/her. Complete an ME 490/490H Enrollment Contract (independent study form), available in the ME Advising Office in 2560 EB. After you and your professor have completed and signed both sides, return the form to the ME Advising Office for the remaining signatures, override, and enrollment.

3) Six seats in ECE 415 have been allocated for MEs who are on record as Manufacturing Concentration students. To be “on record,” you must meet with Gaile to plan a long-term schedule. To request an override, email Gaile griffore@egr.msu.edu and be sure to include your PID number with your request. NOTE: A prerequisite override will be given to students who will need to take ECE 415 & ME 451 concurrently.

4) ME majors do not need to have taken the Recommended Background courses, but you will probably need to do some additional background reading. Contact the instructor for more information.

5) Complete the Graduate Course Override form, available in the ME Advising Office in 2560 EB. This is a paper form.

6) CHE 483—To request an override, submit the CHE Override Request form: https://www.egr.msu.edu/chems/override/index.php

Academic Advising

1) ME Juniors and Seniors are advised by Gaile Griffore. For an appointment, call 517-355-3338, or go to 2560 EB.

2) ME Sophomores with a 3.1 or higher GPA who will be juniors at the end of this semester are advised by Gaile Griffore. For an appointment, call 517-355-3338, or go to 2560 EB.

3) ME Sophomores who do not fit the criteria in number 2 above are advised by Jeffrey Tsang. Schedule an appointment online during fall and spring semesters: https://msu.campus.eab.com

4) ME Freshmen are advised in W-8 Wilson Hall on a walk-in basis only.
Spring Semester Calendar

March 12  Scheduled appointments begin for enrollment for Summer 2018. Your enrollment access date is posted in StuInfo.
March 28  Senior Elective Night, 7-9 p.m. in 2400 EB. Sponsored by Pi Tau Sigma.
April 27  Design Day in the EB. See you there!
April 30-May 4 Final Exams.
May 4  University Undergraduate Student Convocation–1:00 p.m. in Breslin.
May 6  College of Engineering Undergraduate Commencement Ceremony, 12:30 p.m. in Breslin. Lasts about 2 hours.
May 14-June 28 First Summer Session.
July 2-Aug 16  Second Summer Session.
May 14-Aug 16  Full Summer Session.
August 10  Initial Fall 2018 Minimum Tuition & Fee payment due.
August 29  Fall Semester classes begin.

MSU is an affirmative action, equal opportunity employer. MSU is committed to achieving excellence through cultural diversity. The university actively encourages applications and/or nominations of women, persons of color, veterans and persons with disabilities.