ME Bulletin

Vol. 53, No. 2 ME Advising Office • 2560 EB • 355-3338 Spring, 2016

ME Department Welcomes New Chairperson

Fractional Modeling: A New Meta-Discipline

Building a Science of Experimental Skull Fracture Research

Turbulence Ahead — Please Fasten Your Seatbelts!

2016-17 Senior Electives

New ME chairperson, Dr. James Klausner, receives a big MSU welcome when he finds his office filled with green and white balloons, compliments of the ME staff! Read about Dr. Klausner on page 3.
When farm animals return home after a long day of grazing or working in the fields, there is a sense of heightened anticipation as they get close enough to smell the barn. Perhaps it is the aroma of fresh hay or the warm feeling of a familiar place. Whatever the reason, most animals pick up speed as they approach the barn. They have a renewed energy.

As we approach the end of another semester and another academic year, are you picking up speed? Perhaps you are graduating soon. How’s your energy?

It is not unusual to start feeling overloaded at this point and to think to yourself, “I hope I can just get through this semester!” Getting through may seem like a good option; it is probably better than not getting through. But in the long run, just getting through is definitely not in your best interest.

You see, getting a diploma is not the goal. The goal is to acquire the knowledge and skills upon which you can build a successful career. Getting through usually means shortchanging this goal.

The trajectory of your engineering career will depend on how much value you provide to your company, and how much value you are able to contribute depends on what you know (not who you know).

So take a deep breath, and then develop a plan to accelerate your career by mastering the fundamentals of engineering this semester. Be sure to include some sleep and exercise in that plan, and maybe even a little bit of fun.

Finish strong. Smell the barn!

### Department News

- **Dr. John Foss** retired last May after more than 50 years on the ME faculty. Dr. Foss joined the ME faculty in 1964 and received his Ph.D. from Purdue University in 1965. He has taught and conducted research in fluid mechanics, turbulent shear flows, vorticity measurements, and fluids engineering. Dr. Foss was the Director of the Study Abroad Program in Aachen, Germany for many years.

- **Dr. Alex Diaz** has rejoined the ranks of the regular ME faculty after more than 6 years as ME chairperson. Dr. Diaz is currently on sabbatical at the Technical University of Denmark (DTU) where he is pursuing research in the areas of additive manufacturing and nonlinear vibrations and energy management with applications in sensors and MEMS.

- **Dr. Farhang Pourbograt** has left MSU and joined the Ohio State University faculty as a professor with a joint appointment in the Integrated Systems Engineering Department and the Department of Mechanical and Aerospace Engineering, working closely with the Center for Design and Manufacturing Excellence (CDME).

- **Dr. William Resh** has joined the ME department as a professor. This semester he is teaching a senior elective, ME 491/603-Automotive Noise and Vibration and ME371-Mechanical Design 1. He received his Ph.D. from MSU in 1984, and worked at Chrysler (currently Fiat Chrysler Automobiles) for 31 years until his retirement in 2015. While at Chrysler, Dr. Resh held a number of positions in test laboratories, computer aided engineering...
Dr. James Klausner joined the ME department in January as our new chairperson. He comes to us from the University of Florida where he was an Ebaugh Endowed Professor. He was a Program Director at the U.S. Department of Energy, ARPA-E for three years. He is a past chair of the ASME Heat Transfer Division and is currently serving on the ASME Technology Advisory Panel.

Dr. Klausner received his Ph.D. from the University of Illinois Urbana-Champaign in 1989. His research interests focus on thermal, chemical, and fluid transport in a variety of applications including, energy processing, thermal management, desalination, powder flow, cryogenics, and bioengineering. He has done extensive fundamental work on the dynamics of phase change phenomena, including nucleation and bubble dynamics. He is very interested in sustainable engineering processes and is currently working on using sunlight, water, recycled CO2, and biomass as possible inputs to thermochemical reactors for synthetic fuel production, such as hydrogen and higher order hydrocarbons as the output. Highly concentrated solar radiation is used to drive high temperature thermo-chemical conversion processes. He is also working on using low grade waste heat and un-concentrated solar energy for low temperature desalination. He has developed a number of phase-change thermal management processes that operate at unprecedented heat fluxes. He has a strong interest in light metals processing and energy efficient advanced manufacturing. He has nine patents and copyrights that resulted from his research work.

Dr. Klausner enjoys sports, and indeed his first purchase after arriving in Michigan was a pair of skis! He also loves music, mostly rock, and he plays both acoustic and electric guitar.

### IAH/ISS Diversity Requirement

Each IAH and ISS course emphasizes a form of diversity: national diversity (designated “N” at the end of the course title), international and multicultural diversity (designated “I” at the end of the course title), or both (designated “D” at the end of the course title). Students must include at least one “N” course and one “I” course in their Integrative Studies programs. A “D” course may meet either an “N” or an “I” requirement, but not both.
140 Seniors to Graduate in May and August!

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 3. If your name is missing, please contact me immediately at gfore@egr.msu.edu (Tele: 517-355-3338).—Gaile

May Graduates

Zachary Richard Abbott
Nickolas Charles Aguayo
Alexandria Marie Allman
Bashaier Hussein Alsinan
Katherine Perry Arends
Jason Matthew Avedesian
Eric Michael Bargiel
Maxwell Rinehart Bennett
David Richard Bernier
Ryan Gary Blanche
Julia Marie Briggs
Eric Nicholas Buday
Evon Noah Bushman
Naomi Grace Carlisle
Bingchen Chi
Alvin Samuel Chiang
Nick James Chocko
Lindsay Marie Clark
Brian Joseph Cobus
Daniel James Cornelius
Curtis Gerald Coscarelly
James Charles Cuthbert
John Thomas Danielson
Stephanie Renee Dejong
Lucia Teresa DelVillano
Michael Joseph Doa
Dominique Michele Dubay
David Neil Dudley
Max Joseph Dunigan
Nathan Stanley Fedewa
Taylor Renae Forbush
Patrick Louis Frahm
Brice Edward Furr
Rachel Lynn Geary
Elizabet Gojcaj
Junhun Gong
Shannon Paul Grace
Andrew Jacob Gregg
Chase N Gunderud
Shaoyu Han
Richard Allen Harrington
Akiem Alexander Harshman
Blake Steven Hatherley
Reace Michael Head
Zackary Thomas Hickman
Rachel Marie Horstman
Peter Noel Howes
Dingyu Hu
Matthew Stephen Igo
William Ning Kang
Yash Ajit Kankaria
Tyler Aaron Karp
Matthew James Klooster
Matthew Edward Knudtson
Anthony Paul Kobak
Horitsu Bruno Junior Kubata
Kathleen Marie Landwehr
Qin Liu
Steven Andrew Lund
Vikram Abhay Mandelia
Leo Thomas Mclaughlin
Evon Kristopher Meier
Tim Mijnsbergen
Paul R Miller
Hiroya Miyoshi
Connor C P Montgomery
Melanie Lynn Mullet
Jessica Anne O’Brien
Sarah Ecker Parsons
Harsh C. Patel
Sapan Ashokbhai Patel
Gregory Ross Peterson
Zhi Hong Phuah
Steven Patrick Price
Jacob William Pushack
Quinn Joel Putt
Charles Edward Pynninen
Jinyang Qiu
Gerald Robert Rivkin
Lance Alan Roth
Benjamin Michael Rowley
Stephen Jacob Saks
Joseph Peter Savage
Nicholas Myrton Scibilia
Abhimanu Singh
Philip Andrew Skinkle
Andrew Keith Slatin
Aaron Brodsky Smith
Tim Richard James Smith
Logan Mclary Springgate
Andrew Phillip Stanny
Haoceng Sun
Matthew Gilbert Sutter
Alexander Robert Taylor
Lee Alexander Teasley
Cody Douglas Thon
Davis William Trapp
Zachary Louis Tuller
Alexandr G Vartanian
Jason Henry Vismara
Dominic Anthony Waldorf
Eric J Waldron
Hengyun Wan
Haoyu Wang
Robert Allen Warfield
Elisabeth Rose Warner
Ian Maitland Waugaman
Michael Richard Wicker
Kevin David Wilberding
Renee Leigh Wirsing
Benjamin M M Yancho
Nicholas M Younegerman
Tingyuan Zhang
Robert Kyle Zuerlein

August Graduates

Jennifer Elizabeth Jones
Joseph Paul Latorre
James Leung
Haochen Li
Ying-Hung Lou
Matthew David Marchetti
Hayden William May
Natasha Naveen Mital
Robert Lee Morgan
John Mccafferty Neidhart
Casey John Palanca
Prateek Prasad
Sean Robert Raymor
Michael Steven Schwartz
Nicholas George Yukov
Yucheng Wang
Yifan Zhao

Curriculum News

Co-op Students: Before you leave for your Summer or Fall 2016 co-op rotation, please be sure to discuss your schedule for next Fall 2016 / Spring 2017 with your academic advisor.

CSE 231–Intro to Programming I is replacing EGR 102 in the ME program effective Fall 2016. However, current students who have taken, or are taking, EGR 102, may waive the new requirement. If you have a question about your situation, please consult your academic advisor.

ME 300–Professional Issues in Mechanical Engineering is a new requirement for students admitted to ME for Fall 2016 and thereafter. Previously admitted ME students are strongly encouraged to take this 1 credit course.

ME 391– Effective Fall 2016 the prerequisite for this course has been changed from (MTH 235) to (MTH 235 and CSE 231). Students who took EGR 102 prior to the prerequisite change are eligible for a prerequisite override. To request an override, submit the ME Override Request form: http://www.egr.msu.edu/me/form/me-override-request

ME 433–Intro to Computational Fluid Dynamics (3 credits) is a new senior elective for spring, although it has previously been taught as ME 491. ME 433 will be offered every spring semester.

Biomedical Concentration–Effective Fall 2016, the Biomechanical Concentration will be called the Biomedical Concentration.

New Concentrations–Three new concentrations have been added to the ME program: 1) Automotive Powertrain, 2) Computational Design, and 3) Energy. A detailed handout for each new concentration can be found on the ME website and on the rack outside the ME Advising Office.

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: [http://www.egr.msu.edu/me/form/me481-approval-form](http://www.egr.msu.edu/me/form/me481-approval-form). If you do not have an accurate long-term schedule on file, schedule an appointment with Gaile by calling 355-3338 or stopping by 2560 EB.

**ME 489–Technical Communications** (3 credits) is on the spring schedule. Instructor: Craig Gunn, ME Director of Communications. *This course is an Other Elective. It is not a Senior Elective.*

**ME 491/001–Humanitarian engineering** (3 credits) will be offered Fall 2016 as a design intensive Senior Elective. See page 14 for more information.

**• ME 491/602–Biomechanical Analysis of Human Movement** will be offered Fall 2016. It will count as a non-design intensive senior elective, and it will apply to the Biomedical (Biomedical) Concentration. See page 14 for more information.

**ME 491/603–Automotive Noise & Vibration** (3 credits) will be offered Spring 2017 as a non-design intensive Senior Elective. For more information, see page 15.

**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.

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**Did You Ever Think about Going to Graduate School?**

By Dr. Tamara Reid Bush

There are several good reasons to consider earning an advanced degree:

- **Higher salary.** Engineers with advanced degrees earn more money than those with BS degrees only. According to the National Association of colleges and Employers ([http://www.naceweb.org/uploadedFiles/Content/static-assets/downloads/executive-summary/2016-january-salary-survey-executive-summary.pdf](http://www.naceweb.org/uploadedFiles/Content/static-assets/downloads/executive-summary/2016-january-salary-survey-executive-summary.pdf)) entry pay for an MS in engineering is about $10,000 more than that of a BS. So an MS pays for itself in a few years. PhD entry salaries go up even further. Not only that, but you can get paid to attend grad school. That’s right! Many of our PhD students qualify for teaching or research assistantships. An assistantship covers a student’s tuition, health care, and a salary, which together can have a value of over $35,000 per year.

- **You can enter the PhD program right after graduating with your BS degree.** This is called a direct admit program, and students can earn a PhD in 4-5 years. For a MS degree, students can dual-enroll during the last year of their undergraduate program, and complete a MS (coursework only version) with only 1-1.5 years after their BS.

- **Job Quality.** On the whole, the engineers with advanced degrees have more interesting and creative jobs. An advanced degree puts an engineer in positions of greater leadership, and therefore enables an engineer to have more say in his or her responsibilities. Thus, an advanced degree is an effective way to propel an engineer into a flourishing career. If a research oriented career sounds attractive, a PhD may be the way to go.

- **Grad school is fun.** The graduate school experience is a bit different from that of the BS degree. There is a little less emphasis on lectures and exams, although those are still a strong part of the program. But a graduate student also has a chance to do a great deal of research and a little teaching. Most MS students, and all PhD students, do a thesis, whereby the student is involved in a long term project to investigate and discover aspects of a problem associated with areas such as health, automotive, nano-device, manufacturing, composites, etc. Student researchers are members of teams in laboratories, building relationships with their fellow graduate students and their faculty advisors. It usually turns out to be a very meaningful time in a person’s life.

- **Prepare now for graduate school.** Graduate school is a scholarly activity, and to get admitted and to earn an assistantship, it is important to show evidence of scholarly potential and a high level of motivation. So do your best with your coursework, and get good grades. Get connected. As you develop interest in certain technical areas, identify faculty who do research in those areas, and talk to them. Volunteer to help in their research group. Seek paid undergraduate research projects or stay for a summer and participate in the EnSure program (a summer internship program on campus). Applications for graduate school can be made at any time. Although there are stated deadlines, we do take last-minute applications from our MSU undergraduates. The sooner you apply, however, the better your chances of getting an assistantship. For more information, contact Dr. Mukherjee or Dr. Bush.
Department of Mechanical Engineering

Dean’s List

Congratulations to these 426 ME majors who made the Dean’s List after Fall 2015. To be on the Dean’s List, you must have a semester GPA of 3.5 or better. This list is from January 27. For updates, go to: https://reg.msu.edu/ROInfo/GradHonor/DeansList.aspx

NOTE: The italicized names received high achieving student recognition at the recent Evening with Industry Awards Banquet.


Tutoring

• The ME Learning Center, located in 1239 EB, has mentors for ME 201, 222, and 361. The hours for Spring 2016 can be found here: http://www.eegr.msu.edu/me/mechanical-engineering-learning-center

[Click on drop-in 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: http://www.eegr.msu.edu/dpo/academics-guided-learning-center

[Scroll down to REQUEST ASSISTANCE]

• 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. If interested, email Gaile Griffore at Griffore@egr.msu.edu.
MSU-RWTH-Aachen Program by Prof. Brian Feeny, Program Director

Now for something completely different — consider a study abroad program! If you are interested in a summer experience where you can work on an applied engineering project in an advanced facility, tour fascinating sites, savor European foods and beverages, soak in the ambiance of languages and culture, and meet new people, 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 2017), (2) earn 5 credits independent study plus 4 credits German language and culture, and (3) travel in Europe with planned 3-day weekends.

Note: During Spring 2017, before you go to Aachen, you will need to take 4 credits of German (usually GRM 101) and 1 credit of ME 490-Independent Study.

The Aachen experience will involve interaction with fellow engineering students from around the world at RWTH-Aachen, a premier European technical university. Possible project topics include automotive engineering, plastics, composite materials and textiles, manufacturing technology and automation, bio and chemical processing, and aerodynamics.

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 and farmlands. An outstanding rail system provides our students easy access to Munich, Paris, Amsterdam, Zurich, Rome, and many more destinations on their 3-day weekends. Scholarship funds are available through the North American Rockwell Endowment.

A great way to get more information is to talk to former exchange students, who enjoy sharing their experiences with the program. Former Aachen exchange students can be reached through me at feeny@egr.msu.edu or 353-9451. Please contact me if you would like to find out more.

Don’t miss this opportunity!

Photo provided by Dr. Feeny

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)

Academic Advising

1) ME Juniors and Seniors are advised by Gaile Griffore. For an appointment, call 517-355-3338, or go to 2560 EB. Note: There will be some walk-in hours this semester. Call for schedule information.
2) ME Sophomores with a 3.0 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 Elizabeth Clark. Schedule an appointment online during fall and spring semesters: https://www.egr.msu.edu/adcalendar/
4) ME Freshmen are advised in W-8 Wilson Hall on a walk-in basis only.

Photo provided by Dr. Feeny

Figure 1. Frankenburg castle, Aachen, February 2016.
Dr. Mohsen Zayernouri has a joint appointment between the Department of Mechanical Engineering (ME) and the Department of Computational Mathematics, Science, and Engineering (CMSE). Dr. Zayernouri is the director of the Fractional Mathematics for Anomalous Transport and Hydromechanics (FMATH) group, and he is currently working with three PhD candidates: Anna Lischke (co-advised), Mehdi Samiee, and Ehsan Kharazmi. The main focus of research in the FMATH group is to develop and analyze new data-driven methods and algorithms for interesting and challenging anomalous thermo-fluid problems.

Anomalous Transport: refers to non-equilibrium thermo-fluid processes that cannot be described and predicted by the old fashion methods of mathematical and statistical physics.

Non-local models and fractional PDEs (FPDEs) provide a proper modeling framework, in which interesting applications of anomalous transport are investigated. The area of FPDEs is a rapidly growing field at the interface between computational mechanics, differential equations, and probability.

**Go Fractional; It’s Urgent!**

FPDEs are emerging as a powerful tool for modeling multiscale phenomena including overlapping microscopic/macrosopic scales, and long-range time memory or spatial interactions. Although anomalous, such problems are abundant in nature. There is now an extensive amount of experimental evidence indicating that such phenomena occur in reacting turbulent flows, rheology, anomalous transport phenomena in porous/disordered materials, complex fluids, and multi-phase applications (see Figure 1).

**FMATH Group:** aims to formulate robust and efficient data-driven methods for deterministic and stochastic fractional PDEs (FPDEs). This is done through the development of a variety of numerical methods such as finite-difference methods, spectral methods, spectral element methods, and Discontinuous Galerkin (DG) methods. FMATH always welcomes self-motivated students who are passionate about science and engineering.

Dr. Zayernouri obtained his first PhD in ME from the University of Utah in 2010 and his second PhD in applied mathematics from Brown University in 2014. He enjoys reading, watching movies, and traveling; moreover, he is passionate about music and calligraphy.
Blunt force trauma is considered one of the most common forms of homicide worldwide. Blows to the head are often involved, and cranial fractures are a typical finding. In medicolegal death investigations, current techniques for interpreting cranial trauma are often brought into question, as there are limited experimental data that describe mechanisms of cranial fracture. Questions asked of forensic experts typically relate to: (1) the point(s) of impact; (2) the minimum number of blows; (3) the sequence of impacts; (4) the implement involved; and (5) the amount of force and energy used.

A significant amount of research has been conducted on the biomechanics of cranial fracture by the automotive industry and their supported investigators, thus the current research in this area largely reflects industry needs. Cranial impact experiments have been conducted primarily to document impact force-deflection curves and acceleration-time histories to derive head injury criteria for automotive crash testing. Very few studies exist that describe the patterns of cranial fracture resulting from blunt force impacts, and the types of injury scenarios recreated in these studies typically do not account for scenarios of interpersonal violence often encountered in medicolegal death investigations.

At the Orthopaedic Biomechanics Laboratories (OBL) a newly funded research project is undergoing that aims at developing mechanistic-based experimental data that begin to answer the above-mentioned questions using fresh, adult human cadaveric heads. In this effort, cadaver heads are subjected to blunt force trauma, causing cranial fractures that are recorded in time with high-speed photography. The locations of fracture initiation and propagation are documented in these experimental studies. The investigation seeks to show that patterns of fracture will depend on input energy, point of impact, number of blows, as well as implement used to impact. An earlier study by this group has demonstrated that a 3-inch flat impactor generated different fracture patterns (Figure 1, left) than those generated by a 1-inch flat impactor (Figure 1, right). Additionally, these patterns were in concert with the highest tensile stresses (shown in orange/red in Figure 2) predicted by finite element analyses (Figure 2, left is from 3-inch impactor and right is from 1-inch impactor).

The research project is in collaboration with the MSU Forensic Anthropology Laboratory (FAL), directed by Dr. Todd Fenton, and has been funded by the National Institute of Justice. Over more than 8 years the OBL and FAL have collaboratively made efforts in an attempt to understand forensic biomechanics of skull and long bone fractures for medicolegal death investigation experts to more accurately interpret trauma cases. Patrick Vaughan, a current OBL graduate student, has been assigned to the project. Vaughan was a recent senior ME student supported by the EnSURE program to work in the OBL. Recently, Vaughan presented a similar study on long bone fracture at the American Academy of Forensic Sciences 68th annual scientific meeting.
Turbulence is all around us. The air flowing in and out of our lungs, the flows around cars and planes that control the drag, the liquid core of the earth, even the Protoplanetary disk that forms planets, are all turbulent. Turbulence starts from instability in a shear flow, across which the flow velocity magnitude varies; one example is the turbulent boundary layer, where the shear layer is created by the presence of the wall.

The turbulence simulation and modeling group at MSU is studying the realistic turbulent boundary layers using large-scale parallel computing, with a focus on flow acceleration or deceleration, which happens around airfoils or in an atmospheric boundary. In the case of strong acceleration (Figure 1), the boundary layer undergoes a “relaminarization” process, opposite to the classical model prediction that an increase of mean-flow kinetic energy leads to higher turbulent kinetic energy (an assumption used in common turbulence models). High-resolution simulations help identify the underlying physics, and where the models go wrong.

Roughness is another important factor to model for a wide range of engineering and environmental boundary layers, such as wing icing analysis for airplanes, hydraulic turbine design, weather report over (urban) canopies, etc. The roughness models predict friction, so the roughness does not need to be resolved in industrial simulations. Such prediction is based solely on the statistics of the roughness geometry. We analyze its accuracy by resolving the complex rough surface and its effect directly in large-scale simulations (Figure 2a); results from a hydraulic-turbine flow show that the classical models produce up to 500% local errors in friction, due to the lack of model universality among different roughness.

Cont’d on pg 11
ME Students Receive Awards

Congratulations to the following ME students who were honored at the annual Evening with Industry Awards Banquet on February 24! The names of those receiving high achieving student recognition are italicized on the Dean’s List on page 6.

**Outstanding Women in Engineering Member Awards:**
- Brittany Galliers (ME Senior), presented by Bosch.
- Amanda Pfutenreuter (ME Junior), presented by C2AE.
- Alexa Baylis (ME Junior), presented by Fiat Chrysler Automobiles.
- Lindsay Nault (ME Junior), presented by Union Pacific Railroad.
- Kelly Patterson (ME Junior), presented by IBM.

**Outstanding Society of Women Engineers Award:**
- Carly Head (ME Senior), presented by Kohl’s Department Store.

**Frank J. Hatfield “Build it Better” Award:**
- Fred Anthony Smith (ME Sophomore).

**Outstanding Diversity Programs Award:**
- Waithera Chege (ME Senior), presented by Tenneco.
- Chelsea Parson (ME Freshman), presented by ArcelorMittal.
- DeMarcus Gregory (ME Freshman), presented by Ingersoll Rand.
- Amanda Pfutenreuter (ME Junior), presented by Visteon.
- Zirui Wang (ME Junior), presented by Ford Motor Company.
- Lauren Green (ME Sophomore), presented by Mobis North America.
- Andrew Voyd (ME Sophomore), presented by FAAC.

**Exceptional and Distinguished Service Awards:**
- Cody Bradford (ME Senior), nominated by Dr. Gary Cloud.
- Zac Sadler (ME Junior), nominated by Dr. Tamara Reid Bush.
- Kelly Patterson (ME Junior), nominated by Dr. Tamara Reid Bush.

• Network! The U.S. Department of Labor estimates that up to 80% of positions are filled without employer advertising. Networking is important and many are unsure of how to create and use a network. There is a LinkedIn group just for you! Join “Michigan State University Engineering Connection” built to help support and network current and recent Spartan Engineering alumni.
- Join the MSU Alumni Association and start networking with a club in your current town/region or desired destination (i.e. The Chicago Spartans, West Michigan Spartans, Detroit Spartans). They host professional and networking events as well as fun social events.
- Stay persistent and continue to visit us in the Center and allow us to assist you in your search.
  The Center always has an open door to engineering students and would be happy to help you in any way whether you are at the beginning of your career as a Spartan or preparing to depart the “Banks of the Red Cedar.”

Email: careers@egr.msu.edu
Phone: 517.355.5163

Cont’d from page 10

topographies present in the turbine (Figure 2b). Currently, we are developing a novel roughness model that incorporates not only the topographical information, but also the input from the flow above; the adaptability of this new model to surface and flow state/direction translates to accurate prediction in transient and three-dimensional problems, such as weather and air-quality assessment, ocean-flow modeling, and studying moving structures such as bio-propulsion and fluid machinery.
SAE Formula

Every year, students on the Formula SAE Racing team work hard to design, manufacture, and test a small open-wheel racecar. Last year, the team took 11th place out of 120 teams at the largest competition in the United States, Formula SAE Michigan.

Formula SAE is the world’s largest engineering design competition with over 500 schools competing from around the globe. This year, the team will compete in two events: the first is in May at the Michigan International Speedway and the second is in August at the Hockenheimring in Germany. For the first time in team history, State Racing will be competing in Formula Student Germany. FS Germany will hold 75 of the best teams in the world, and we are one of seven from the United States!

Along with registering for Germany, State Racing has been working extremely hard to complete the car nearly two months ahead of the previous season. This extra time will allow for copious amounts of testing and tuning before the first competition in May.

If you would like to learn more about the team, please visit www.msuformularacing.com or contact Jonathan Bianchi at bianch19@msu.edu. Submitted by Jonathan Bianchi, Project Manager.

Baja SAE

Michigan State’s Baja SAE team has been hard at work designing, fabricating, and assembling for this year’s upcoming race season. Lead by Michael Holland, Thomas Sheldon, and Ray Renaud. This year’s car will be an improvement on last year’s car, and potentially the lowest weight car in MSU Baja’s history. With the generous donations by their various sponsors, the Baja team is planning on having their car completed and tested by the end of the school year.

While much of the car is already designed and fabricated, the design cycle still has to be completed through the use of data acquisition. With the help of returning members and new members, the Baja team will be preparing four cars from previous years to compete in a race held each year at Michigan Tech. This race, commonly known as Blizzard Baja, provides new members on the team with driving and competition experience before their SAE races in Tennessee, New York, and California this summer. The new car will be unveiled in early April, and then the team will be headed to Tennessee for our first SAE competition of the racing season. Submitted by Michael Holland, Project Manager.

PHOTO PROVIDED BY JONATHAN BIANCHI

PHOTO PROVIDED BY JONATHAN BIANCHI

PHOTO PROVIDED BY MICHAEL HOLLAND
Have You Asked a Question Lately?
by Craig Gunn, Director of Communications

I could have sworn that at some point I wrote about the need to ask questions. Strangely enough I failed to ask anyone the pertinent question, “Have I ever written an article for the ME Bulletin on the act of questioning?” By not asking, my mental processes simply stopped and I didn’t move ahead on pursuing a very important subject. As I think about it, I realize that I had failed to do what I suggest that everyone does as a daily activity – Ask Questions.

When you were young, you probably didn’t get an enormous amount of instruction, but you certainly spent a great deal of time asking questions. You badgered everyone around you to answer questions like, “What is the moon made of?” Those wonderful people were quick to provide the usual answer – green cheese. And with that, you continued to ask and ask and ask. But now you are an adult and those questions seem to have been relegated to a far back burner and that burner is turned off. You don’t raise your hand and you shy away from asking for any form of help or answer.

I would ask that you return to that time long ago when you were young and innocent and willing to spend your waking hours asking about what you both wanted to know and needed to know. Those days were actually the Days of the Engineer. Days where you delved into the things you didn’t know and with their discovery you became more and more the individual you are today. We learn by the questions that we ask of others and ourselves. We stagnate when we fail to mold those questions about our world that will make us better.

American Society of Mechanical Engineers

The MSU Student Chapter of the American Society of Mechanical Engineers is a non-profit student organization. The main purpose of ASME is to introduce MSU students to the world of engineering. ASME provides an opportunity for students to meet representatives of leading industrial companies; this allows them to learn about these companies as well as possible internship/employment opportunities.

ASME will be hosting a variety of events throughout the 2016-2017 school year: social events, company information sessions, community outreach, and design challenges. Events like these are a great way for ASME members to network with recruiters as well as their fellow classmates. Some of ASME’s non-company partnered events include Junkyard Wars, Career Gallery How-to’s, Impression Five exhibit, and a trip to the North American International Auto Show. Look for events like these and more this coming year!

To learn more about our upcoming events, please visit our Facebook page at https://www.facebook.com/search/top?q=asme%20michigan%20state%20university and our website at http://www.egr.msu.edu/asme/index.html for more information. Submitted by Kyle Hawkins, President.

近くの翼

個体およびプレイヤーがグローバルな環境に感染する。この日があなたがふるさとに生きる場とし、新しい質問と自己を問うことを決して新しいものと質問すること。

Pi Tau Sigma

The Tau Epsilon Chapter of Pi Tau Sigma, the International Mechanical Engineering Society, has had a very busy start to the semester. We held our informational meeting for interested initiates on Feb 23rd and had a great turn out! Also, we were pleased with how many of our members took on the E-week blizzard to contribute their time as volunteers for the Engineering Expo Feb 25th. Our first social event, ‘Wings Night’ at Buffalo Wild Wings was on March 3rd. We enjoyed socializing with one another while enjoying some delicious wings.

We will be hosting a Mechanical Engineering Senior Elective presentation on Tuesday, March 29th at 7:00 pm. This event aims to inform students about their ME senior elective options and gives them a chance to ask questions from those who have already taken the courses. This will be both fun and informative and is open to members and non-members! Once a room location is set for this event, it will be posted on our website.

Later in the semester, we look forward to volunteering with Habitat for Humanity and playing some Euchre and other activities at our game night, one of our fun social traditions. Finally, we will hold initiation at the end of April to induct new members. For more information on Pi Tau Sigma or any of our events, please visit our website at http://www.egr.msu.edu/pts/. Submitted by Abigail Heming, President.
ME Senior Electives for 2016-2017

The following ME Senior Elective list was accurate as of March 4, 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 [http://www.reg.msu.edu/Courses/Search.asp](http://www.reg.msu.edu/Courses/Search.asp)

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 plus ME 371 or concurrently. Online Course.

**FALL SEMESTER**

**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 Engineering Fundamentals. 3(3-0). Prereq: ME 332 or concurrently.

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

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

**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: Humanitarian Engineering. See Override Instruction #1 on page 15. Course Description: Extensive class notes plus web-based material, and a major project requiring students to apply human-centered design methodologies to create and manufacture a sustainable solution to an authentic inter-disciplinary engineering problem in India, Guatemala, or Kenya, or elsewhere, involving people fending for themselves at the margins of life. Prereq: (ME 371) and (Senior-level standing).

**ME 491 Selected Topics in Mechanical Engineering**. Section 602: 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. Biomechanical 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. Biomechanical Concentration Course.

**ECE 491** Special Topics. Section 601: Acoustics. See Override Instruction #4 on page 15. Course Description: Review of Laplace and Fourier transforms, waves in one dimension, the acoustic wave equation, transmission and reflection, radiation and diffraction, absorption and attenuation, cavities and waveguides, resonators and filters. Prereq: (EGR 102 or CSE 131) and (ECE 345).

**MSE 476** Physical Metallurgy of Ferrous & Aluminum Alloys. 3(3-0). Prereq: MSE 250. Recommended background: MSE 310. For more info, see Override Instruction #5 on page 15.
ME 810 Advanced Classical Thermodynamics. 3(3-0). See Override Instruction #6 below. Prereq: ME 412 plus GPA of 3.5+.
ME 812 Conductive Heat Transfer. 3(3-0). See Override Instruction #6 below. Prereq: ME 412 plus GPA of 3.5+.
ME 830 Fluid Mechanics I. 3(3-0). See Override Instruction #6 below. Prereq: ME 332 plus GPA of 3.5+.
ME 860 Theory of Vibrations. 3(3-0). See Override Instruction #6 below. Prereq: ME 461 plus GPA of 3.5+.

SPRING SEMESTER
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 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, plus ME 371 or concurrently.
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 491 Selected Topics in Mechanical Engineering. Section 603: Automotive Noise and Vibration. See Override Instruction #1 Below. Course Description: Automobiles are one of the most complex and expensive machines that an individual will purchase and use. Vibrations in a vehicle can affect vehicle durability, safety, performance, customer comfort, and even the decision of whether or not to purchase the vehicle. This course will focus on the engineering application of mechanical vibrations to vehicles including: different sources of vehicle vibrations, how these can affect different vehicle systems, driver perception of noise and vibration, and engineering approaches to control vehicle noise and vibration.. Prereq: (ME 461 or concurrently).
ME 495 Tissue Mechanics. 3(3-0). Prereq: ME 222. Biomechanical Concentration Course.
ME 497* Biomechanical Design in Product Development. 3(3-0). Prereq: ME 371 or concurrently. Biomechanical Concentration Course.
CHE 483 Brewing and Distilled Beverage Technology. See Override Instruction #7 Below. Location: 2000 Merritt Road, East Lansing. Prereq: (Age 21 or higher) and (Senior standing) and (ME 410-Heat Transfer or concurrently).
BE 444 Biosensors for Medical Diagnostics. 3(3-0). (BS 161) and (CEM 141) and (ECE 345). Biomechanical Concentration Course.
ENE 422 Applied Hydraulics. 3(2-2). Prereqs: ME 332.
MSE 425 Biomaterials & Biocompatibility. 3(3-0) Prereq: MSE 250. Recommended Background: PSL 250. Biomechanical Concentration Course.

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 2017 include ME 814, 825, 861, 872, and 875. See Override Instruction #6 below.

**OVERRIE INSTRUCTIONS**

1) Submit the ME Override Request Form: [http://www.egr.msu.edu/me/form/me-overide-request](http://www.egr.msu.edu/me/form/me-overide-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 at 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) Complete and submit the ECE Override Request Form: [http://www.egr.msu.edu/ce/undergraduate-overide-form](http://www.egr.msu.edu/ce/undergraduate-overide-form)
5) 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.
6) Complete the Graduate Course Override form, available in the ME Advising Office in 2560 EB. This is a paper form.
7) CHE 483—To request an override, submit the CHE Override Request form: [https://www.egr.msu.edu/chems/override/index.php](https://www.egr.msu.edu/chems/override/index.php)
Spring Semester Calendar

March 14  Scheduled appointments begin for enrollment for Summer 2016. Your enrollment access date is posted in StuInfo.
March 28  Senior Send-Off, 5-7 p.m. in the Varsity S Club Room in the Stadium Tower. Sponsored by the Center.
March 29  Senior Elective Night, 7:00 p.m. Location TBA. Sponsored by Pi Tau Sigma.
April 1   Computer enrollment begins for Fall 2016 / Spring 2017.
April 29  Design Day in the EB. See you there!
May 2-6   Final Exams.
May 6     University Undergraduate Student Convocation—1:00 p.m. in Breslin.
May 8     College of Engineering Undergraduate Commencement Ceremony, 12:30 p.m. in Breslin. Lasts about 2 hours.
May 16-June 30  First Summer Session.
July 6-Aug 18  Second Summer Session.
May 16-Aug 18  Full Summer Session.
August 11  Initial Fall 2016 Minimum Tuition & Fee payment due.
August 31  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.