ME-EM

MECHANICAL ENGINEERING — ENGINEERING MECHANICS

2009 ANNUAL REPORT

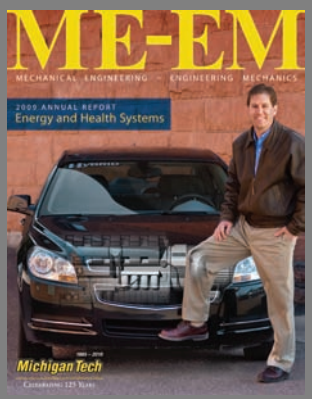
Energy and Health Systems

1885 – 2010

Michigan Tech

Celebrating 125 Years

CONTENTS



ON THE COVER:
Dr. Scott Miers displays two foci from this year's ME-EM annual report: knee joint biomechanics (health systems) and the drive train of a hybrid research vehicle (energy systems).

Message From the Chair

In this annual report, I am pleased to present an overview of the remarkable research that is taking place in both energy systems and health systems, areas in which mechanical engineering has a significant impact. Our researchers have taken on challenges ranging from cancer research and tissue engineering to space propulsion and hybrid electric vehicles. Energy systems and health systems are the 2009-10 focus of Michigan Tech's Strategic Faculty Hiring Initiative (SFHI), which aims to bring in interdisciplinary groups of faculty with expertise in both fields.

The ME-EM department is proud to support the campus-wide SFHI, which promotes an atmosphere of interdepartmental collaboration that is crucial to solving the complex problems facing our world. As Michigan Tech researchers work together, they will develop the innovative solutions that occur at the interfaces between disciplines.

In addition to the SFHI areas, our faculty members continue with cutting-edge research across numerous fields. Our researchers are working to change the face of mechanical engineering with projects in hands-on education and diversity in engineering. To improve education, the ME-EM department is committed to building diversity in our faculty, staff, and student body, as we work to support Michigan Tech's status as an NSF ADVANCE institution.

As always, our students are a credit to the department. Our hard-working, conscientious undergraduate students continue to perform well in academics and extracurriculars. In 2009, student teams placed high in national competitions and created innovative solutions that benefit the local community. Our graduate students are highly sought after, and go on from Michigan Tech to work in industry, academics, and government. The spirit of dedication and determination is truly alive and well.

This year, I would like to extend a special challenge to our alumni and friends. As we continue to make our research and education the best in the nation, we invite you to identify people who will help us advance solutions in energy, health, and beyond. If you know of someone developing technology in these areas, please email me directly at the address below. With your help, Michigan Tech and the ME-EM department will be poised to take the next great steps in engineering research and education.

William W. Predebon

William W. Predebon
Professor and Department Chair
wwpredeb@mtu.edu

Research Overview

A MESSAGE FROM RESEARCH DIRECTOR GORDON PARKER

The past year was one of great change for the ME-EM department. In spring, the faculty voted to formalize our research group structure at the conclusion of its three-year trial period. Faculty are now better able to make long-term plans for research and education.

ME-EM faculty members are pursuing interdisciplinary projects ranging from biodiesel engine development to biomechanical testing. In 2009 we saw an increase in proposals, with ME-EM PIs totaling $86 million and another $20 million in proposals with ME-EM faculty as co-PIs.

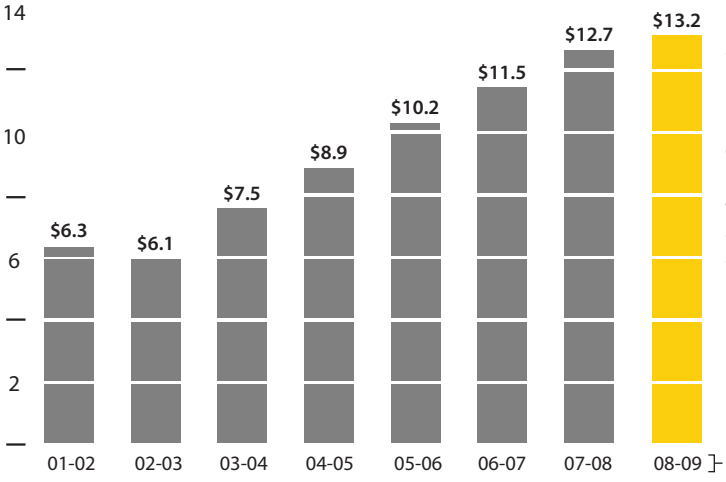
Our research expenditures have risen, and the National Science Foundation ranked us 18th in research expenditures among all mechanical engineering departments in the US in fiscal year 2008. Our current goal is to continue increasing the size of proposals and to promote interdepartmental and interdisciplinary cooperation.

RESEARCH FOR A CHANGING WORLD

Facing global issues in energy, health, and the environment, our researchers are tackling projects that will provide sustainable solutions. Faculty members are incorporating new content into the curriculum and using hands-on research projects to teach core principles.

Students remain an integral part of the research process and participate at all levels. Our graduates enter the workforce well prepared to face the challenges of industries in flux. In fact, our graduate program is ranked 48th nationally among doctoral granting mechanical engineering departments in the US by the 2011 *U.S. News & World Report: America's Best Graduate Schools* (ranked in 2010). Our undergraduate program is ranked 22nd nationally among doctoral granting mechanical engineering departments in the US by the 2008 *U.S. News & World Report: America's Best Colleges.* By challenging our students to solve research problems with their minds, hands and hearts, they, in turn, motivate us to develop our resources and explore innovative approaches to education.

Research Expenditures (in millions)



A balance of single investigator and multidisciplinary research programs with government and industry has fueled the steady growth of our research expenditures.

MISSION
Prepare engineering students for successful careers

VISION
Be a nationally recognized mechanical engineering department that attracts, rewards, and retains outstanding students, faculty and staff—be a department of choice nationally

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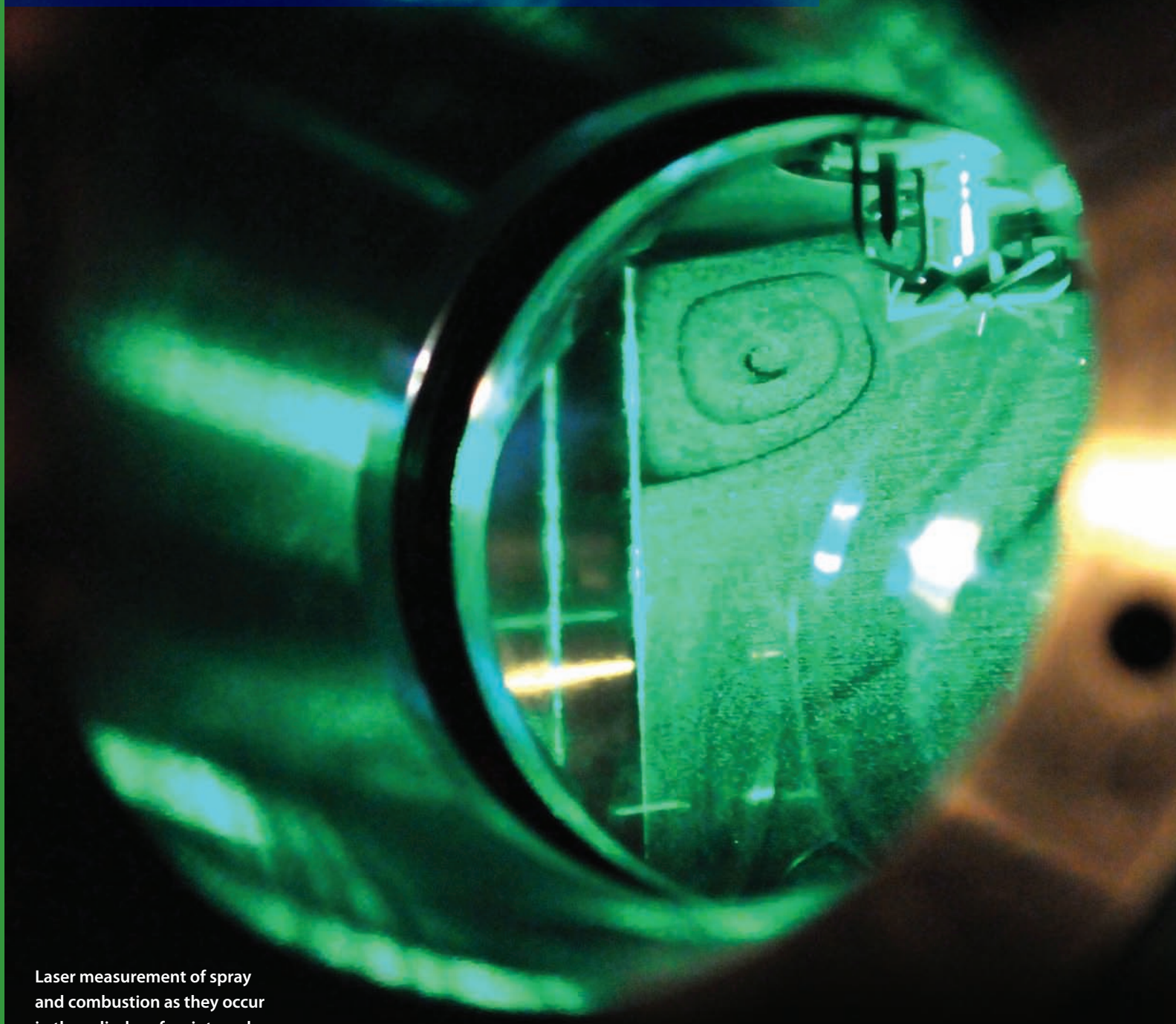
Energy Systems

In the face of growing global energy concerns, ME-EM researchers are developing energy systems at every level, from nano-manufacturing to space propulsion. They are pushing the boundaries of convention, finding new uses for established technologies, and developing cutting-edge systems that will shape the future of energy in the US and worldwide.



Laser measurement of spray and combustion as they occur in the cylinder of an internal combustion engine.

WATER MANAGEMENT IN LOW-TEMPERATURE FUEL CELLS

Jeff Allen

Dr. Jeff Allen's research focuses on capillary flow, interfacial transport phenomena, fuel cells, phase-change heat transfer, and microgravity fluid physics. In order to improve understanding of water movement inside of fuel cells, Allen has developed a new method characterizing and modeling the fuel cell electrodes, which are essentially carbon paper coated with Teflon®. This novel technique characterizes and models the dynamic movement of liquid water in the electrodes and will improve the fuel cell's ability to effectively manage product water through optimized electrode design.

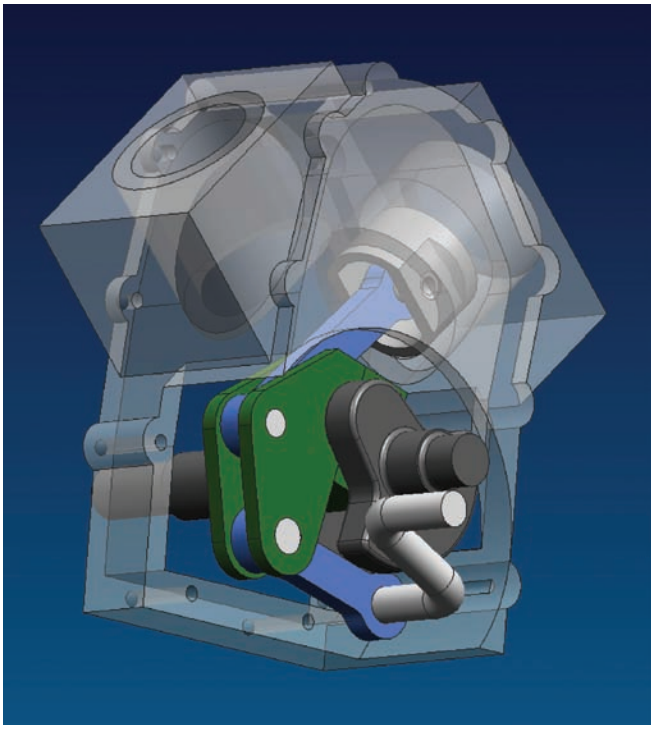
Allen's research team is also developing an optimization tool to allow designers to determine the best shape, size, and number of bends in a flow channel for moving water through a fuel cell. They are also investigating a novel method for moving water through tiny flow channels by imposing a very small amplitude oscillation in the gas flow.

INFRARED TELEMETRY FOR IC ENGINE MEASUREMENT

Carl Anderson

Dr. Carl Anderson's research centers on making measurements on the rotating and reciprocating parts inside an internal combustion engine and transmission, which has long been an engineering challenge. The environment is hostile, exceeding the temperature and g-loading specs of modern electronics. Anderson and his research team have developed two techniques that can be used to make measurements on pistons, connecting rods, crankshafts, and all of the blade elements in the transmission's torque converter. Both the infrared telemetry technique and the microwave telemetry technique work with any conventional sensor: temperature, pressure, strain, and acceleration.

Currently, Anderson is working to correlate the measurements inside the machine with near field acoustic measurements made outside, which are easier and less costly. Once the in situ techniques have characterized certain signatures, such as cavitation in the torque converter, the team will identify them with external microphones.



Michigan Tech Variable Compression Ratio Engine prototype

SLIDER-CRANK LINKAGES IN VARIABLE DISPLACEMENT ENGINES

John Beard

Dr. John Beard's research focuses on synthesizing multi degree-of-freedom linkages to replace a portion of the slider-crank linkage in internal combustion engines. He is examining a mechanism to vary the compression ratio and displacement for use with E50-E100 fuels. The basic mechanism for the study was derived from the Michigan Tech Variable Displacement Engine operating on reformulated gasoline.

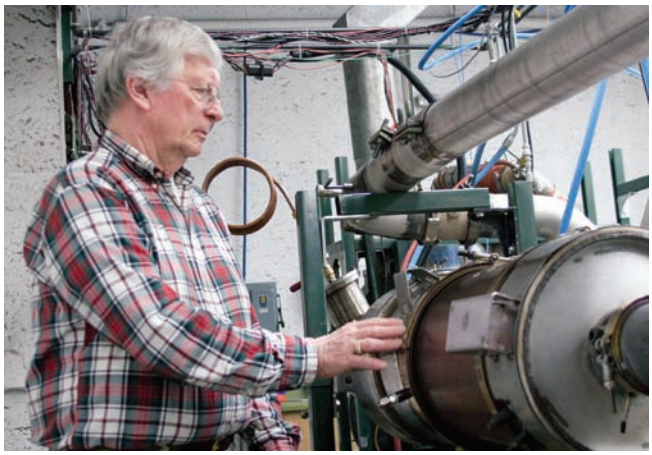
Beard will evaluate the six-link mechanism used in the VDE for use with ethanol and the performance predicted with GT-Power software. He will determine viable mechanisms and use a dynamic/kinematic analysis to eliminate those with high shaking forces or excessive packaging problems. GT-Power will be used to predict actual engine performance and further reduce the number of potential engines, and Beard will build and test the most promising engine using ethanol.

CHARACTERIZATION OF DIESEL ENGINE COMBUSTION PARAMETERS

Jason Blough

Dr. Jason Blough's research focuses on digital signal processing and dynamic measurements. In collaboration with other engine researchers at Michigan Tech, he aims to detect and characterize diesel engine combustion parameters using non-pressure sensing transducers. The goal of this research is to demonstrate that accelerometers or other dynamic transducers can be externally mounted to an engine and provide much of the same information as an in-cylinder pressure transducer, but with more robust and cost-effective results.

In addition, Dr. Blough is exploring how to quantify and understand the noise generated by automotive torque converters. He is involved with the SAE Snowmobile Committee's effort to implement a single noise regulation for use worldwide. Dr. Blough is also working with the US Navy to develop a sensor system for pendulation control in shipboard cranes.



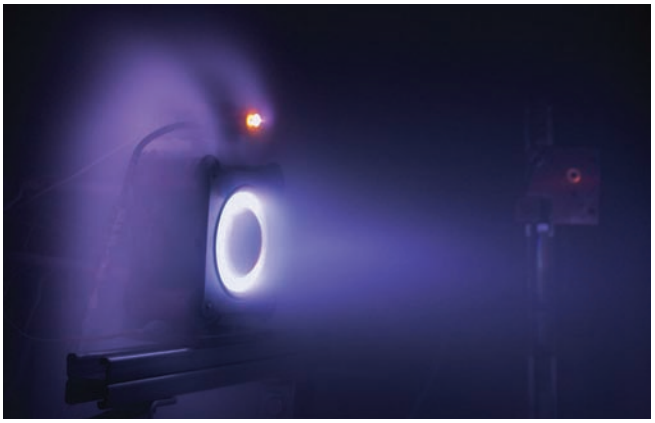
John Johnson's research aims to improve the performance of diesel particulate filters and selective catalytic reduction devices.

ENERGY-EFFICIENT EMISSION CONTROLS AND DIAGNOSTICS FOR DIESEL ENGINES

John Johnson

Dr. John Johnson's research expertise centers on internal combustion engines, diesel engines, air pollution, and emissions modeling. With a three-year, $2.8 million project funded in part through a $1.7 million grant from the US Department of Energy's National Energy Technology Laboratory, Johnson is working with a team of graduate students and faculty to create energy efficient emission control for heavy-duty diesel engines and to develop accurate methods for on-board diagnostics.

Johnson's research team will measure experimental data and create models and methods to improve the performance of diesel particulate filters (DPFs) and selective catalytic reduction (SCR) devices. They will also explore the effects of biodiesel on DPF and SCR functionality, with particular attention to control system impact. The results of this research could have significant influence on the indirect fuel efficiency of diesel engines and biodiesel, thereby reducing US reliance on diesel fuel that comes from foreign crude oil.



A Hall-effect thruster exhausts a beam of high-energy ions to provide gentle, fuel-efficient thrust for spacecraft.

ADVANCED SPACE PROPULSION SYSTEMS

L. Brad King

Dr. L. Brad King's research focuses on electric space propulsion systems. In the Ion Space Propulsion Lab, his research team investigates alternative propellant options for Hall-effect thrusters, which are a type of space propulsion used to change the orientation and orbit of satellites and to propel spacecraft to the farthest destinations ever reached by a manmade vehicle.

Traditional Hall thrusters use inert gases for propellant, but King's study was performed using two metal propellant candidates never before used in the Western Hemisphere: magnesium and zinc. Experiments with both metals were successful and demonstrated early promise for certain mission applications. As an added benefit, lunar and martian studies have shown that magnesium could be harvested in situ, allowing for the possibility of refueling an exhausted propellant supply.

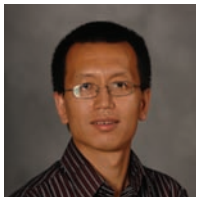
FUEL BURN CHARACTERIZATION FOR ADVANCED ENGINE PERFORMANCE

Seong-Young Lee

Dr. Seong-Young Lee develops methods and technologies to characterize various fundamental and complex flames applicable to internal combustion, gas turbine, and pulse detonation engines. The performance requirement for advanced future engines burning alternative fuels must be achieved with characteristics of fuel burn goals, excellent combustion stability, and significant reduction in emissions from both signature and environmental-impact perspectives.

Lee's research group is considering a variety of alternative fuels, including biofuels, coal-based fuel, jet fuel, and hydrogen-enriched syngas. Their investigation focuses on combustion properties such as the laminar flame speed, ignition, spray combustion dynamics, instabilities, and supercritical fuel combustion. Through his work, Lee seeks to achieve better engine performance with thermal efficiency and zero emissions, as these fundamental concepts can be used in concert with existing transportation sectors.

MULTI-SCALE ENERGY SYSTEMS



Dennis Desheng Meng

Dr. Dennis Desheng Meng's research interest involves micro- and nano-manufacturing. His team is focusing its research efforts on a variety of issues: microfluidic fabrication of self-healing microfibers; high-voltage electrophoretic deposition to prepare nanostructured electrodes for supercapacitors and batteries; self-adaptive thermal management approaches for micro power sources; microfluidic self-regulation of reactants and byproducts for micro fuel cells and hydrogen generators; superhydrophilic antifouling surfaces; production of metal nanoparticles by near-field sputtering technology; and microactuation based on low melting-point alloys.

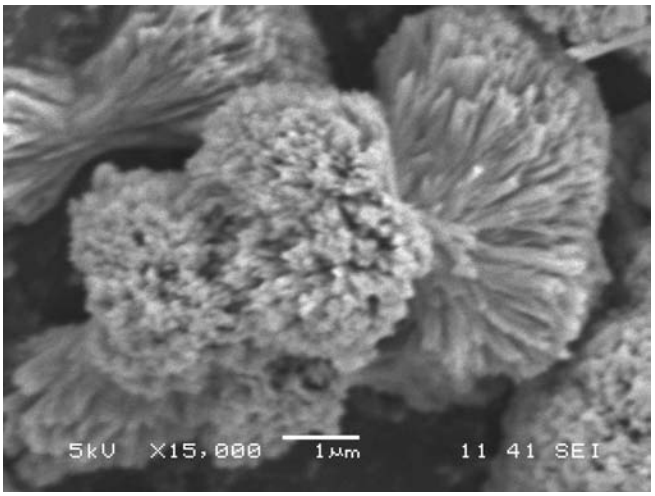
Meng's research and educational activities are supported by the National Science Foundation, the US Department of Energy, and the American Chemical Society. Under his direction, the Multi-Scale Energy System Lab is dedicated to addressing these energy and environmental challenges through interdisciplinary research and education.

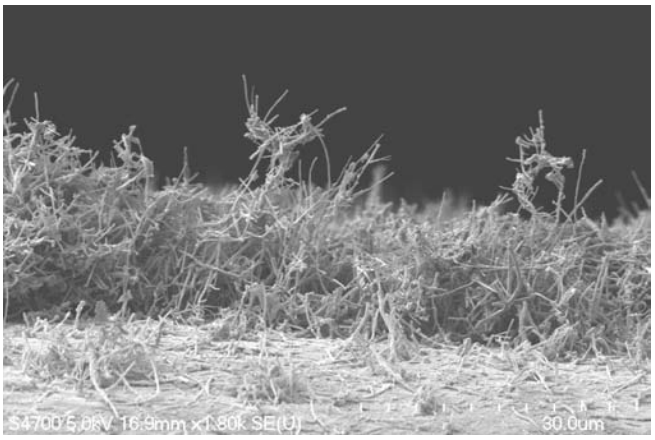
FLUID DYNAMICS IN MULTIPHASE FLUID SYSTEMS

Donna Michalek

Dr. Donna Michalek's research in computational fluid dynamics is focused on the modeling of multiphase fluid systems for automotive, manufacturing, and biomedical applications. Specific examples include nucleate boiling in fuel systems and the atomization process in fuel injection, the formation of mist resulting from the use of metalworking fluids, and fluid flow in bone.

Michalek's most recent research efforts involve sustainable systems: investigating the impact of nanoparticles on workplace air quality and modeling the combustion process of ethanol-blended fuels. She is currently working with a team of researchers to develop a predictive simulation of a spark-ignition, direct-injection, flex-fuel engine. This model will be used to reduce hydrocarbon crank-start emissions and optimize combustion for a partial zero emission vehicle hybrid application.





Top image at right: A dendritic nanomaterial (LiFePO_4) for Li-ion batteries. Bottom image: A vertical carbon nanotube forest deposited under room temperature for micro supercapacitors.

ADVANCED MEASUREMENT TECHNIQUES FOR IC ENGINES

Scott Miers

Dr. Scott Miers conducts research on internal combustion engines ranging from small recreational vehicles to automotive-sized diesels to heavy-duty off-road engines. Miers' research projects focus on improving efficiency and reducing emissions from engines operating on alternative and renewable fuels such as ethanol, butanol, and biodiesel. One such project focuses on reducing hydrocarbon emissions during start-up of high-ethanol content fuel (E85).

Miers is also researching engine cooling systems in order to improve thermal efficiency through implementation of nucleate boiling. He is helping develop a study to investigate the instantaneous piston frictional forces in a heavy duty engine. Miers employs advanced measurement techniques that include wireless data acquisition to study piston heat. Measurement of up to thirty different exhaust components is achieved using a new Fourier Transform Infrared Spectrometer, and an advanced mobile instrumentation lab provides an additional means to analyze the entire vehicle for fuel economy, driveline efficiency, performance, and exhaust emissions.

Mobile emissions analysis system collects emissions and fuel consumption data while the vehicle is "in-use."

WATER MANAGEMENT IN LOW-TEMPERATURE FUEL CELLS

Abhijit Mukherjee

Dr. Abhijit Mukherjee established the Advanced Energy Systems and Microfluidics Laboratory, and is currently conducting research in water management in low-temperature fuel cells. He developed a method to facilitate the removal of excess water droplets from proton exchange membrane fuel cells. He takes his cue from aphids, which secrete a sweet substance known as "honey dew," a powdery, wax-like substance that coats the droplets and converts them into liquid marbles for easy transportation.

Based on this principle, Mukherjee coats the surface of the gas diffusion media (where the water droplets form) and the air supply channel walls of the fuel cells with micronized wax. His experiments have shown that the presence of this powdered wax resulted in significant improvement of water movement inside the channels. He has submitted an invention disclosure based upon this concept.

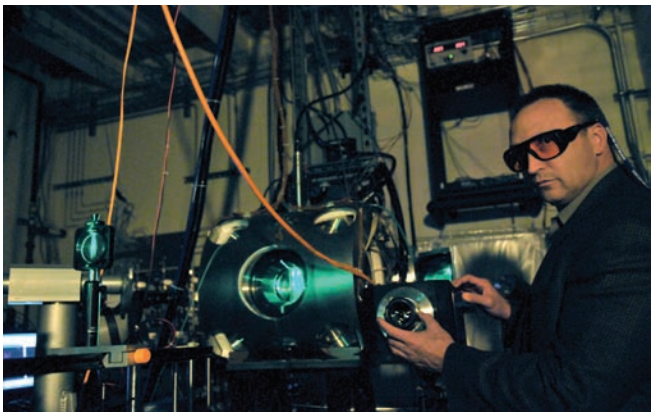
DIESEL PARTICULATE FILTER FUNCTIONALITY

Jeff Naber

Dr. Jeff Naber's research centers on combustion, internal combustion engines, aftertreatment, and the development and application of advanced experimental techniques and analysis methods to characterize thermo-physical processes.

Naber is investigating the effects that engine operation and fuels including biodiesel blends have on the functionality of diesel particulate filters and selective catalytic reduction devices. He aims to enable technologies that will increase engine aftertreatment synergies and improve controls and diagnostics of these systems while facilitating the use of biodiesel fuel blends. The research is part of a $2.8 million project that is funded in part by a $1.7 million grant from the US Department of Energy's National Energy Technology Laboratory.

To provide educational opportunities on-campus and across the nation in hybrid electric drive vehicles, Naber is also developing with a group of multidisciplinary faculty the curriculum for undergraduate and graduate degrees; please see page 14 for more information.



Dr. Jeff Naber recording measurements in the alternative fuels combustion laboratory.

CONTROLS-BASED APPROACH TO WIND TURBINE TECHNOLOGY

Gordon Parker

Dr. Gordon Parker, whose work lies mainly in dynamics and controls, is approaching wind energy from a controls standpoint. Working with Sandia National Laboratories and Dr. Fernando Ponta, Parker is developing the experimental capability for real-time actuation of wind turbine blades. By applying a method of quadratic modes for rotating flexible structures to wind turbines, he hopes to create models that can be run in real time; the models will be used in control system design to increase performance and reduce fatigue due to pulsating loads.

Parker's other major energy-related project involves modeling, state estimation, and control design for SCR and DPF diesel engine after-treatment components. The techniques are being developed with industry partners and will be useful for their future onboard diagnostics and control strategy efforts. Ultimately, this will decrease diesel engine fuel consumption and pollutants.

Dr. Fernando Ponta and Dr. Gordon Parker are developing the experimental capability for real-time actuation of wind turbine blades in order to reduce the uncertainties of wind turbine blade dynamics.

REDUCING UNCERTAINTIES RELATED TO AEROELASTIC TURBINE DYNAMICS

Fernando Ponta

Dr. Fernando Ponta's research aims to reduce the uncertainties related to wind turbine blade dynamics. His research team is creating a virtual test environment where the aeroelastic dynamics of innovative prototype blades and their associated control strategies can be tested at realistic, full-scale conditions. Ponta has combined two advanced numerical models implemented in a parallel HPC supercomputer platform. The first is a model of the unsteady separated flow that simulates the complex dynamics of the vortex-shedding process and associated aerodynamic forces. The second is a model of the structural response of heterogeneous composite blades, which can reduce the geometrical complexity of the blade section and allow accurate modeling of the 3-D blade structure as a 1-D finite-element problem. Both models are solved simultaneously to compute the unsteady aeroelastic problem.

CYCLE-ANALYSIS CODE FOR PARAMETRIC AND PERFORMANCE STUDY

Song-Lin Yang

Dr. Song-Lin Yang's research interest lies in computational fluid dynamics, both in developing it as a tool and in using it to study problems in fluid mechanics, heat transfer, and combustion. He is an expert on KIVA code, having incorporated a conjugate heat transfer model into the code for the study and control of engine knock and the design of an engine cooling system. With his research team, Yang developed a cycle analysis code for a turbofan engine with an interstage turbine burner, both for parametric and performance study.

Yang also works on the development of diesel oxidation catalytic converter code and the modeling and numerical simulation of diesel particulate trap performance during loading and regeneration.

Health Systems

Health systems research in the ME-EM department has developed organically as individual researchers have chosen to dedicate their time, resources, and careers applying mechanical engineering expertise to biological problems. Their investigations are a product of genuine interest and curiosity, and create innovative opportunities for interdisciplinary partnerships.

Fluorescing semiconductor quantum dots are used to excite opto-electronic proteins for a nanosensing system (part of Dr. Craig Friedrich's protein nanosensor research).

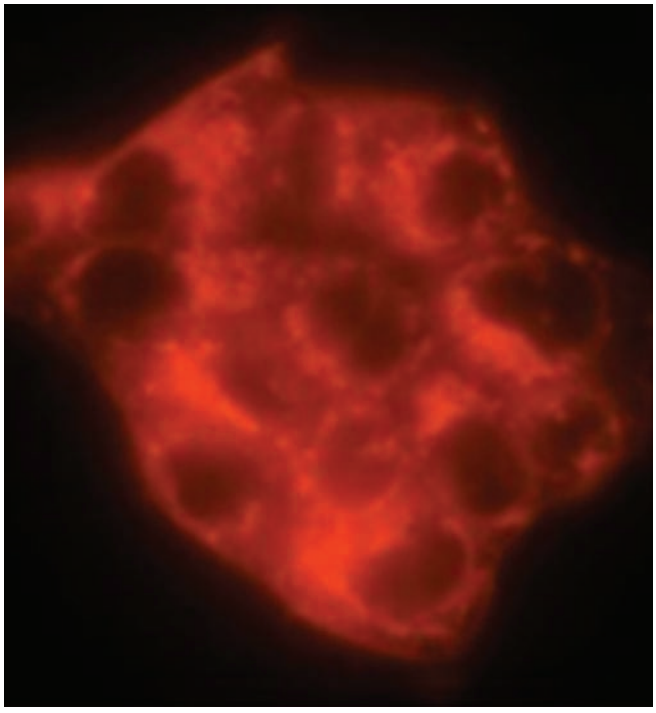
ADAPTIVE MONITORING AND ANOMALY DETECTION

Bo Chen

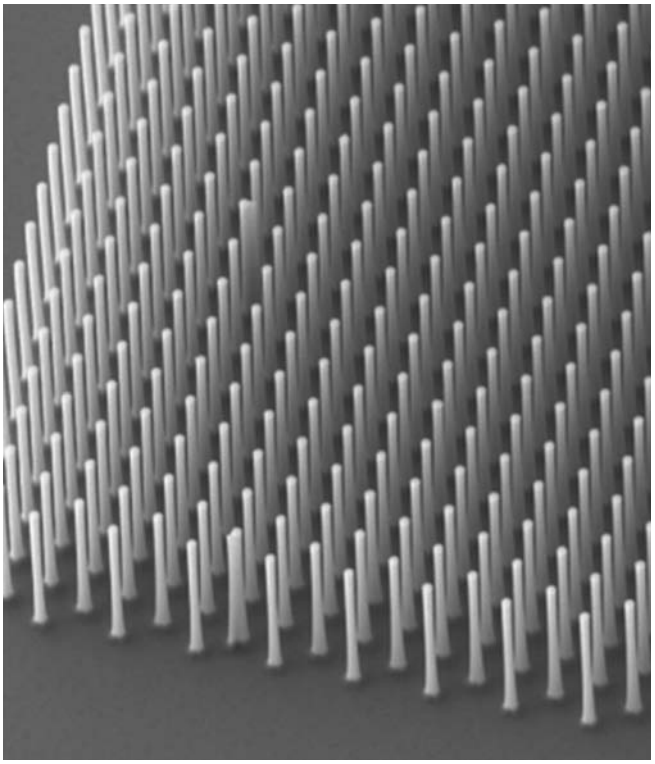
Dr. Bo Chen is conducting research to develop adaptive monitoring networks using immune system concepts and mechanisms. The fundamental research challenge is to establish robust decentralized computing systems that interact with the physical world, are capable of operating under changing environments, and exhibit the desired response behavior under physical constraints.

Motivated by adaptive sensing and emergent pattern recognition capabilities of the natural immune system, Chen's research group employs an approach that achieves adaptive monitoring and anomaly detection by embodying desirable immune attributes, such as adaptation, immune pattern recognition, and self-organization, into monitoring networks.

Chen's team has developed a prototype monitoring network consisting of high computational power sensor nodes, network middleware supporting mobile monitoring agents, and novel damage detection and classification methodologies.



Optical fluorescence image. Stained human colorectal HCT116 cancer cells were used to examine cytotoxicity under the drug (NSAIDs) conditions.



Silicon Post Arrays are used for cell mimics to examine the transport of proteins and DNA. Posts have 100 nm diameter and 4.2 micron height.

BIOSENORS FOR EXTRACTION OF CELL ADHESION EFFECTS

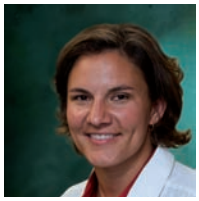
Dr. Chang Kyoung (CK) Choi works primarily with opto-electric biosensors using indium tin oxide (ITO) to examine cellular physiology as well as to detect various substances in the human body. His integrated opto-electric sensing system provides dynamic imaging of cellular motion and growth, and simultaneously measures cellular micro-impedances.

Chang Kyoung (CK) Choi

Choi is developing new biosensors to extract separate adhesion effects of cell-cell and cell-substrate in addition to specific protein/enzyme effects on single cells. Specifically, optically transparent and electrically conductive ITO biosensors will enhance the monitoring of the dynamics of sub cellular, single cellular, and multicellular attachment, proliferation, and apoptosis on functionalized extracellular environments with treatment of non-steroidal anti-inflammatory drugs (NSAIDs).

Choi is also interested in microfluidics, microscopic imaging, nanoparticle/protein tracking, and synthetic biology.

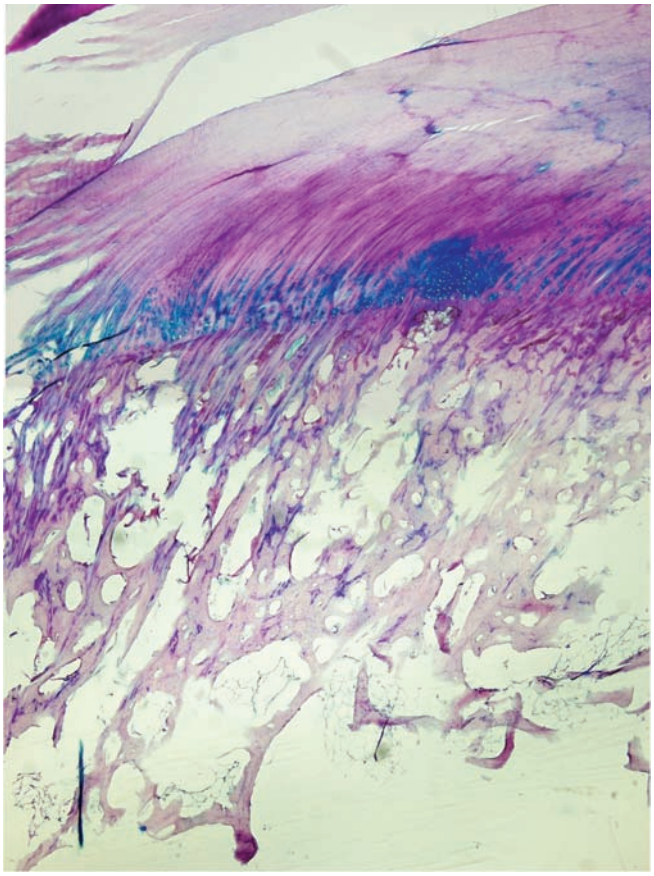
MECHANICAL SOLUTIONS TO ORTHOPEDIC CHALLENGES



Tammy Haut Donahue

Dr. Tammy Haut Donahue's research focuses on mechanical solutions to biological problems. She researches orthopedic challenges, specifically of the knee. In the Soft Tissue Mechanics Laboratory, Haut Donahue investigates the knee joint meniscus and its role in osteoarthritis. The menisci, once thought of as benign structures, are now known to be responsive to traumatic or altered loading, as seen in sports injuries or the aging process. The Laboratory investigates the role of drug-loaded nanoparticles in slowing or preventing osteoarthritis due to meniscal damage.

Additionally, Haut Donahue is investigating the structure, function, and mechanical behavior of meniscal attachments in conjunction with advanced dynamic gait simulation. Her research also includes the design of artificial hearts for pediatric patients and measurement of muscle forces in the human body.



Stained histology slide of the graded interface where the knee joint meniscus inserts into the tibial bone.

OPTO-ELECTRIC NANOSENSORS FOR BIOMOLECULAR SENSING

Craig Friedrich

Dr. Craig Friedrich's research focuses on creating nanosensors for biomarker detection. Friedrich's team is developing several methods to modulate optical protein electrical activity upon molecular binding. One method uses chemically-bound quantum dots for nanoscale illumination of the protein. Binding with the target molecule can cause a change in the quantum dot light output, and therefore a change in the electrical output of the optical protein and transistor.

A second method fuses a sensing protein directly to the optical protein. Binding with an antigen may cause a large shape change in the optical protein, rendering it inactive. This fused protein-sensing material can be mass-replicated by directing E. coli to build the complex molecule. Both methods hold promise for biomolecular sensing of toxins or potential disease biomarkers.

Behavioral and physiological data from MTU's driving simulator are inputs to computation biomechanics models.

HUMAN FACTORS AND SYSTEMS

John Hill

Dr. John Hill's research focuses on human factors engineering, with the primary goal of optimizing system performance in relation to user behavior. In the newly established Human Factors and Systems Modeling Lab, Hill is developing the next generation of vehicle safety systems. Using a state-of-the-art fixed-based driving simulator, he collects and combines driver behavioral and physiological data with

vehicle and roadway data. This data is then integrated into computational biomechanics models to support the development of intelligent safety systems and the next generation of dynamic crash dummies.

In addition, individual driver behavior is integrated into system-level transportation models in order to develop user-centric infrastructure designs. This new approach will support broad-based transportation policy focused on system level performance.

INJURY MECHANISM OF BIO-STRUCTURAL SYSTEMS

Gopal Jayaraman

Dr. Gopal Jayaraman's research focuses on the protection of the human body against injuries due to impacts. He studies the injury mechanism of bio-structural systems such as the head and neck under various impact loading conditions. Further studies include the efficacy of protective mechanical systems, such as lateral knee braces and football helmets, to minimize and prevent injuries due to impacts and loading.

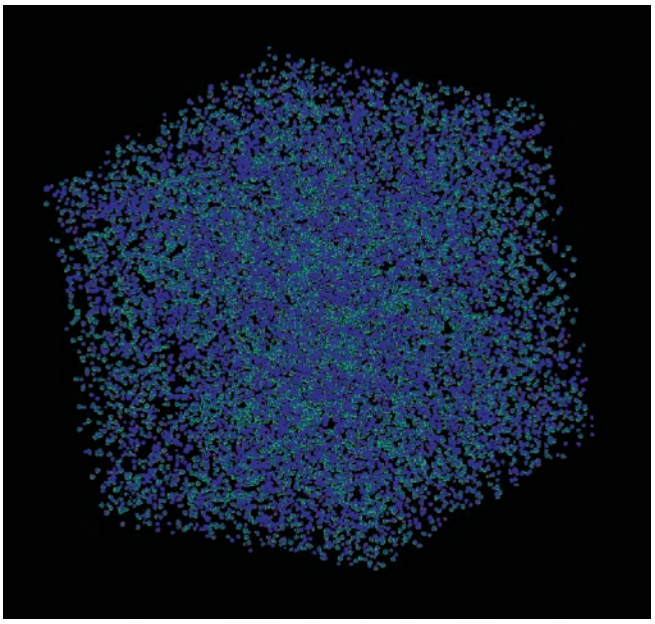
Jayaraman's research interests include biomechanics and solid mechanics. In biomechanics, he investigates injury mechanisms in human joints and the brain due to impact and fatigue, and the prevention of injuries by prophylactic gears and braces. In solid mechanics, he focuses on structural failure and material failure due to buckling, impact and fatigue and on elastic instability of beams and plates subjected to non-conservative follower forces.

MULTISCALE CHARACTERIZATION OF THE MULTIPHYSICS BEHAVIOR OF CELLULAR STRUCTURES

Spandan Maiti

In order to increase the usefulness of cellular materials as engineering materials, Dr. Spandan Maiti is researching multiscale characterization and design space exploration for cellular solids. Maiti's research group is using a synergistic approach that combines experiments and multiscale modeling to span the material and experimental design space. The goal is to develop a comprehensive understanding of multiphysics behavior of cellular structures, to explore defect-tolerant designs using these materials, and to furnish guidelines for their successful deployment.

To date, his major project accomplishments include the development of a unified computational framework for the dynamic response of open cell foams; incorporation of different failure behaviors to simulate brittle, ductile, and elastomeric responses; and the incorporation of hydrodynamic drag and overdamped response to predict the behavior of biological materials.



Molecular model of 18,000 atoms in an aerospace-grade epoxy

BIOMECHANICS AND MULTISCALE COMPUTATIONAL MECHANICS

Greg Odegard

Dr. Greg Odegard's research focuses on biomechanics and multiscale computational mechanics. Currently, he is working on the molecular modeling of polymers and polymer nanocomposites. The goal of this project is to predict the long-term mechanical performance of composite materials used in the aerospace industry.

A second project focuses on the modeling of skeletal muscle tissue and aims to create constitutive and finite element models to predict the mechanical response of muscle during activation. A third project centers on establishing a mechanistic explanation of intraneural ganglia cyst formation and growth using finite element analysis. A fourth project is centered on the finite element modeling and experimental testing of tires used in off-road applications.

New Faculty & Staff

Dr. Chang Kyoung Choi

Assistant Professor, PhD, University of Tennessee

Dr. Choi's research and teaching expertise are in the areas of opto-electric biosensor, micro and nano-fabrication, microfluidics, microscopic optical imaging, synthetic biology, and computer simulation (CFD). His active research programs in multi-scale systems and cellular sensors can create multiple collaborations with our department and across other departments.

Dr. James De Clerck

Professor of Practice, PhD, Michigan Technological University

After an eighteen-year career in the automotive industry, Dr. De Clerck joined the Michigan Tech Department of Mechanical Engineering - Engineering Mechanics in August 2008. His areas of expertise include noise and vibration, structural dynamics, design, modal analysis, model validation, inverse methods applied to design, and advanced measurement techniques.

Dr. John Hill

Assistant Professor, PhD, University of Iowa

Dr. Hill's research focuses on the design of systems that can respond to the evolving needs of the user. This involves experimental assessment of operator behavior, and computational models to assess system level outcomes. Applications include transportation, where a driving simulator is used to assess vehicle and roadway design; service systems, where service providers and customers are modeled to maximize value; and occupational safety, where ergonomic issues are studied.

Karen Bess

Staff Assistant, BA, Michigan State University

Karen Bess joined the department in October. She was previously employed as the administrative assistant to the director of engineering at Porter Hospital in Valparaiso, Indiana, and also holds a BA in Anthropology from Michigan State University.

Faculty & Staff Awards

Our commitment to excellence is reflected through this year's faculty and staff awards, recognitions, and promotions. The Department of Mechanical Engineering-Engineering Mechanics honors the following faculty and staff for their achievements and success.

Dr. Jeffrey S. Allen
Promoted to associate professor with tenure.

Selected to receive a 2009 SAE Ralph R. Teetor Educational Award. The Awards Committee stated: "The credentials and standards of excellence in education of this year's candidates were extremely high and brought about some very keen competition. Your outstanding contributions have distinguished you as one of the top engineering educators." The award recognizes excellence in engineering education, student mentoring, and research.

Dr. Roshan D'Souza
Promoted to associate professor with tenure.

Named to receive a National Science Foundation CAREER Award, a multi-year grant valued at over $400,000. NSF CAREER Awards are designed to promote early career development in junior faculty. They are very competitive and highly prestigious.

Dr. William J. Endres
Awarded a US patent through his company, EMI. The Conformable Ultra High Pressure Portable Storage (CUPPS™) technology promises arbitrary (conformable) tank shape and higher pressure capability for a given tank mass and external volume.

Dr. Craig R. Friedrich
Named to the Robbins Chair in Sustainable Design and Manufacturing. The Chair was established by a donation from Richard Robbins (BSME '56 and Honorary Doctor of Engineering '96) and his wife Bonnie.

Dr. John K. Gershenson
Invited to be the US Embassy to Malta's first "Ambassador's Scholar" to serve as an expert consultant on curriculum development, program design, continuing professional education and/or a special project to the University of Malta's various faculties and departments.

Dr. Tammy Haut Donahue
Selected to participate in the Women's International Research Engineering Summit (WIRES) in Barcelona, Spain, in June 2009. Out of 276 applicants, only fifty US participants were selected.

Dr. John J. Johnson
Testified before the House Subcommittee on Energy and Environment, Committee on Science and Technology on Tuesday, March 23, 2009, as an expert witness. The hearing was part of a review of the US Department of Energy's (DOE) Vehicle Technologies research and development programs.

Dr. Donna J. Michalek
Approved as an ASME/Accreditation Board of Engineering and Technology (ABET) Engineering Program Evaluator. She will soon be receiving training activities. As an engineering program evaluator she will be assigned by the Engineering Accreditation Commission (EAC) of ABET to evaluate a technical engineering or related program for new or renewed accreditation.

Profiled in "ASME Federal Fellows: Engineering the Greater Good," a publication of the American Society of Mechanical Engineers. She recalls her internship in the office of Sen. James Inhofe (R-Okla.), where she served in 2002 as an ASME Federal Fellow.

Selected as Faculty Advisor of the Year. Dr. Michalek is the faculty advisor for the Delta Phi Epsilon Sorority.

Dr. Scott Miers
Received a Lloyd L. Withrow Distinguished Speaker Award from the Society of Automotive Engineers. The award recognizes outstanding presentation skills at SAE technical sessions. The recipient must have received the Oral Presentation Award more than twice; Miers is one of only five presenters to be given the Withrow Award in 2008.

Dr. Jeffrey Naber
Quoted, along with Dr. David Shonnard, in the article "Wood to Wheels: MTU's Drive toward a Greener Future," which appeared in the September edition of Lake Superior Magazine. The story, written by freelancer Tom Wilsowske, provided an overview of current research, including Naber's efforts to develop greener flex-fuel hybrid engines and Shonnard's work developing new biofuel technologies.

Represented Michigan Tech in Detroit on August 5 at the Vice President of the United States' announcement of the $2.98 billion stimulus recipients. He met with Vice President Biden and participated in a round table on technology, education, and powertrain research.

Dr. Gregory M. Odegard
Promoted to associate professor with tenure.

Dr. Mohan Rao
Named a Fulbright Scholar. Rao will teach a course on environmental noise pollution for scientists and engineers at the Indian Institute of Science. His research will focus on traffic and industrial noise pollution in Bangalore, India, and he plans to co-organize a workshop on this topic.

Dr. Sheryl A. Sorby
Elected Fellow of the Society for Engineering Education (ASEE) in recognition of her outstanding contributions to engineering education. Dr. Sorby completed an assignment at NSF as a Program Director for the Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP).

Dr. John W. Sutherland
Recipient of the 2009 Society of Manufacturing Engineering (SME) Education Award. The award states "Sutherland is recognized for his pioneering curricular contributions to the field of environmentally responsible design and manufacturing, for fostering sound training methods and for inspiring students to enter the manufacturing profession."

Dr. Madhukar Vable
Published the second edition of the undergraduate textbook *Mechanics of Materials* online. The textbook can be seen in its entirety at http://www.me.mtu.edu/~mavable/MoM2nd.htm.

Prof. Charles Van Karsen
Named a finalist for the Distinguished Teaching Award in the Associate Professor/Professor Category.

Paula F. Zenner
Director of Operations and Finance in the Department of Mechanical Engineering-Engineering Mechanics.

Selected for induction into the Michigan Tech Presidential Council of Alumnae (PCA). She earned her BSME degree from Michigan Tech in 1987 and her MS in Operations Management also from Michigan Tech in 1993.

Impulsion for Hybrid Propulsion

To provide education in emerging vehicle technologies to students and automotive engineers across Michigan, Dr. Jeff Naber and a team of faculty and staff from the College of Engineering have developed an education program in Advanced Propulsion for Hybrid Vehicles.

The course, which includes on-campus and distance learning options, analyzes the components of a hybrid powertrain in order to promote understanding of the complete system. "The goal of the program is to provide students with the updated skills they will need as the industry's powertrain focus shifts from internal combustion engines to hybrid systems," said Naber, the lead instructor for the program.

The project is an expansion of an ongoing distance learning program that began in the spring of 2009 as a retraining course for displaced automotive engineers in Michigan, in partnership with GM and the Engineering Society of Detroit. Michigan Tech provided full scholarships for the displaced engineers taking the course. In the fall of the same year, the Michigan Academy of Green Mobility provided funding to update content and offer the course to full-time engineers at GM, Ford, Chrysler, Nissan, Denso, Lear and TACOM. In the spring of 2010, the course was opened to Michigan Tech students, displaced engineers, and working engineers with funds coming from the Michigan Works program.

DOE GRANT EXPANDS OUTREACH

Building on the success of the distance learning program, Michigan Tech faculty secured a $3 million grant from the Department of Energy (DOE) to expand the hybrid powertrain content to a full curriculum. With the grant, the ME-EM department will create graduate and undergraduate certificates and a graduate degree. Courses for this program will be available in Fall 2011.

The DOE grant, with support from AVL, also covers the construction of a large, mobile laboratory for on-site education anywhere in North America. The lab will be built in a full size tractor-trailer and will contain laboratories for the powertrain components, including an internal combustion engine, an electric motor/generator, and batteries along with a portable vehicle dyno and hybrid vehicles. The mobile lab, which will be put into action in the spring of 2011, will also be used for outreach to K-12 students. "It's an exciting project that has the potential for hands-on education at the university and professional level, and the ability to increase interest in engineering at all levels," said Naber.

Graduate Seminar Series

A committee of Michigan Tech faculty members organizes the ME-EM Graduate Seminar Series each year, offering graduate students opportunities to expand their knowledge base to areas of study outside their specific research. During academic year 2008-2009, Dr. Ibrahim Miskioglu was the chair of the committee which creates an agenda of compelling topics for both students and faculty. Composed of a diverse mix of renowned leaders representing academia, industry, and government, the 2008-2009 Academic Year Seminar Series featured the following speakers:

EXTERNAL SPEAKERS

Robert White
John Deere
Gear Noise

Bhavani Sankar
University of Florida
Micromechanical Models for Predicting Failure and Fracture in Composite Materials

Teik C. Lim
University of Cincinnti
Modeling Analysis and Control of High-Speed Gear Dynamics

Hamid Garmestani
Georgia Institute of Technology
The Role of Nano-structures in Microstructure Design of Solid Oxide Fuel Cells

Dale R. Tree
Brigham Young University
Oxy-combustion – An Enabling Technology For CO2 Sequestration and Its Role in Reducing Coal-Fired NOX Emissions

Melik Demirel
Penn State
A Bottom-Up Approach of Creating Nanostructured Polymer Films

Mark Ingber
National Science Foundation
Multiscale Modeling of Suspension Flows

Ozden Ochoa
Texas A & M.
Designing in Multifunctionality: A Cellular Perspective

John F. Conley, Jr.
Oregon State University
Atomic Layer Deposition (ALD) Assisted Surface Modification and Directed Growth of Nanomaterials

Dennis A. Siginer
Distinguished University Professor
Assistant Provost Dean, College of Arts & Sciences Petroleum Institute, Abu Dhabi, UAE
Heat Transfer Asymptote In Laminar Flow Of Non-Linear Viscoelastic Fluids In Straight Non-Circular Tubes And Interplay Of Elasticity And Inertia In Heat Transfer Enhancement

Nigel Sammes
Colorado School of Mines
Why Micro-Tubular Solid Oxide Fuel Cells?

Abel (Po-Ya) Chuang
General Motors
PEM Fuel Cell Diffusion Media for Automotive Application

Michael J. Doyle
Principle Scientist with Accelrys, Inc.
Flexible and General. Data Mining and Knowledge Extraction for Analytical and Other Data

Jinjie Shi
Pennsylvania State University
Acoustic Tweezers: Applying Surface Acoustic Waves (SAW) to Microfluidics and Active Plasmonics

Paul Sojka
Purdue University
Secondary Atomization: The Aerodynamic Breakup of Drops

Jeffrey E. Froyd
Texas A & M University
Improving Engineering Education: What is the plan?

Sharnnia Artis
Human Factors Engineering with Aptima, Inc.
Self-Globalization: Strategies in Engineering Education, Research, and Practice

Ed Bryan
Director of IBM Software Group
Solutions for the Industrial Sector Taking Product Development Global

John Simonsen
Oregon State University
Frontiers of Nanotechnology in Bio-Based Material

A. M. Rajendran
Chair of the Mechanical Engineering Department at the University of Mississippi
Research Opportunities in Mechanics and Nano/Biosciences at the Army Research Office and Atomistic Modeling of Ductile Failure

John L. Crassidis
Mechanical and Aerospace Engineering at the State University of New York in Buffalo
Deterministic Relative Attitude Determination of Formation Flying Vehicles

David G. Wilson
Energy Systems Analysis / Wind Energy Technology Departments at Sandia National Laboratories
Sandia National Laboratories Wind Energy Research – SMART Rotor Program and Power Grid Control and Analysis R&D

Mark Horstemeyer
Mississippi State University
Multiscale Modeling and Practical Engineering Applications

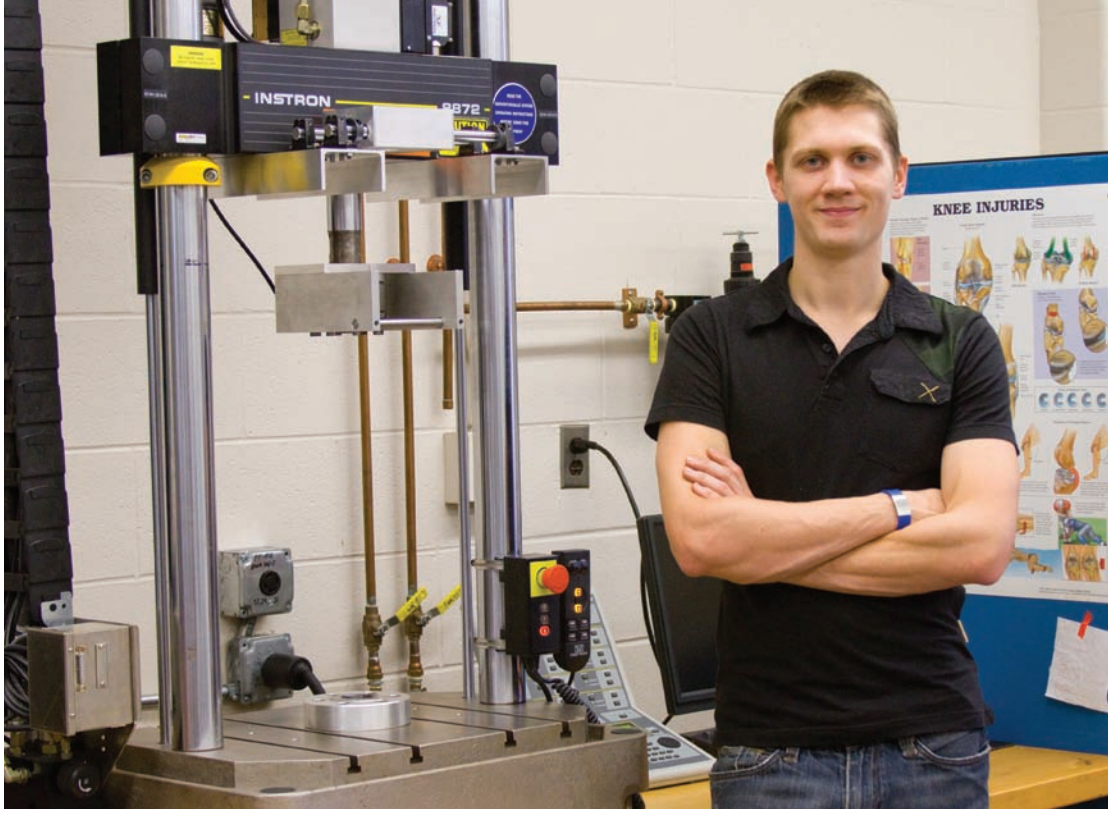
Suhada Jayasuriya
Texas A & M University, Director of the Control Systems Program in the CMMI division of the National Science Foundation
Funding Opportunities at the NSF and Cooperative Control under Hard Constraints and Coupling

Bin Yao
Purdue University
Nonlinear Adaptive Robust Control - Theory and Applications

MICHIGAN TECH SPEAKERS

Scott Miers
(ME-EM)
Alternative and Renewable Transportation Fuel Research to Improve National Security

Madhukar Vable
(ME-EM)
Engineering Triumphs and Disasters: A Mechanics of Materials Viewpoint



Mechanical Principles of the Human Knee

"There is a strong spirit of collaboration and support between departments. It's a great place to study."

—Adam Abraham

During his tenure at Michigan Tech, mechanical engineering graduate student Adam Abraham has tackled projects across the mechanical engineering spectrum. After completing his master's work in digital signal processing, he shifted focus to researching the mechanics of the human knee. "Biomedical work requires a different approach and a different mindset for the science reasoning, but the mechanics are very much the same," said Abraham.

For his doctoral research, Abraham is tackling two projects that involve the application of mechanical principles to biological systems. The first involves the adaptation of a dynamic fatigue test stand to a configuration suitable for testing of human knees. By adding a force actuator to recreate the quadriceps muscle group, Abraham will allow the machine to act like body weight in order to position the knee and subject it to loading. He will also add fiberoptic pressure sensors to allow examination of pressure distribution throughout the loading cycle. This system will be one of the few true dynamic gait simulators in existence and can serve a plethora of functions, including studies of normal healthy human knees, arthritic knees, and knee replacements. It is designed to provide physical verification for the finite element model developed by Abraham's advisor, Tammy Haut Donahue.

Concurrently, Abraham is researching the structure-function characterization of the interface between bone and meniscus in a human knee. "There is a unique structure to this interface, which transitions through four zones in 300 microns, making it difficult to replicate in tissue engineering," he said. In order to understand the interface, Abraham will perform various tests, including nano-indentation, to determine material properties, and quantitative back-scattered electron analysis to determine calcium content. He will correlate the two and will also perform histology tests to determine structural content.

Abraham, who has been at Michigan Tech since beginning his undergraduate studies in 2002, has found the university to be an ideal place to conduct interdisciplinary research. "There is a strong spirit of collaboration and support between departments, which is critical to completing research projects that involve aspects of multiple disciplines. It's a great place to study."

Micro-fluidics in Pumps and Self-healing Materials

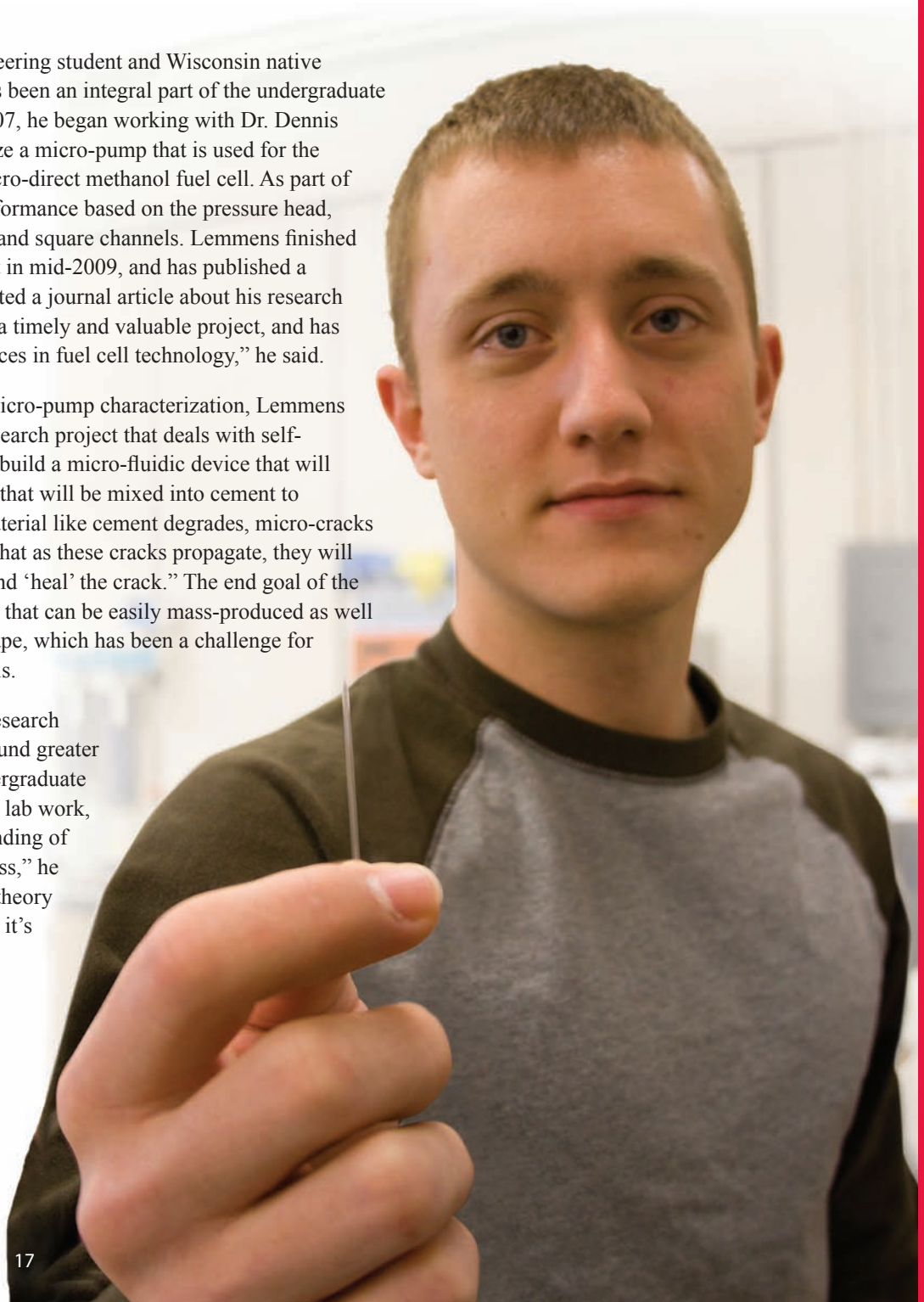
"Because of my lab work, I have a real-world understanding of the principles we learn in class. It allows me to relate theory to potential applications, and it's had a very positive effect on my studies."

—Ryan Lemmens

For senior mechanical engineering student and Wisconsin native Ryan Lemmens, research has been an integral part of the undergraduate experience. In the Fall of 2007, he began working with Dr. Dennis Desheng Meng to characterize a micro-pump that is used for the self-pumping of fuel in a micro-direct methanol fuel cell. As part of the project, he tested the performance based on the pressure head, comparing leakage in round and square channels. Lemmens finished data collection on the project in mid-2009, and has published a conference paper and submitted a journal article about his research results. "The micro-pump is a timely and valuable project, and has the potential to enable advances in fuel cell technology," he said.

With the conclusion of the micro-pump characterization, Lemmens has begun work on a new research project that deals with self-healing material. He aims to build a micro-fluidic device that will produce encapsulated epoxy that will be mixed into cement to improve durability. "As a material like cement degrades, micro-cracks form," he said. "The idea is that as these cracks propagate, they will rupture the micro-capsules and 'heal' the crack." The end goal of the research is to create capsules that can be easily mass-produced as well as fine-tuned for size and shape, which has been a challenge for existing self-healing materials.

As a result of his intensive research experience, Lemmens has found greater depth of meaning in his undergraduate coursework. "Because of my lab work, I have a real-world understanding of the principles we learn in class," he says. "It allows me to relate theory to potential applications, and it's had a very positive effect on my studies." Lemmens will continue his research as he pursues a master's degree after graduation in the spring of 2010.



2009-2010 External Advisory Board

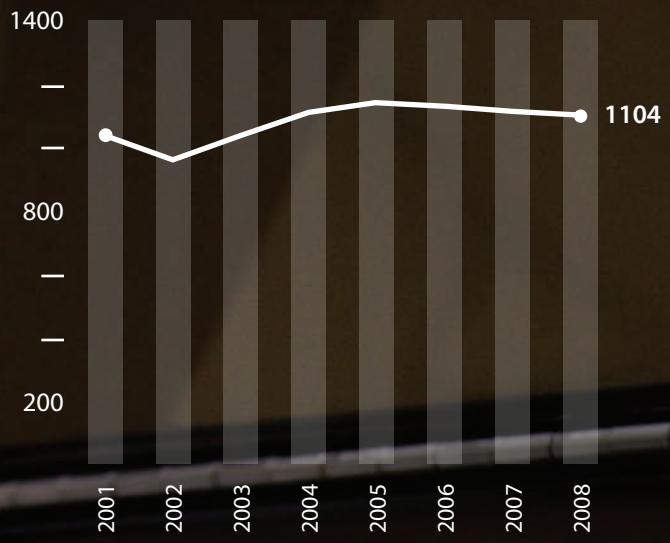
MEMBER	COMPANY	POSITION
Alan Frank	Whirlpool Corporation	Co-chair
Kevin Schlueter	Skilled Manufacturing Inc.	Co-chair
Kirby Baumgard	John Deere	Member
Steven Cook	American Axle & Manufacturing	Member
Michael Hofman	Roush	Member
Brian R. Johnson	Chrysler	Member
Shashi Karna	U.S. Army Research Lab	Member
Roger Keranen	Visteon	Member
John Leinonen	Exponent	Member
Kevin Manor	Toyota	Member
Brenda Moyer	Dana Corporation	Member
Seth Newlin	Kimberly-Clark Corporation	Member
Christopher Oberski	Ford Motor Company	Member
Lei Otterlei	3M Corporation	Member
Paul Rogers	U.S. Army	Member
Peter Sandretto	Chrysler	Member
John Schweikert	General Motors Corporation	Member
James D. Sickinger	Caterpillar Inc.	Member
Thomas Williamson	Kimberly-Clark Corporation	Member
Michelle Zawadzki	Zimmer	Member
Jeffrey Zawisza	Dow Chemical Corporation	Member
Hussein Zbib	Washington State University	Member

ABOUT THE EAB

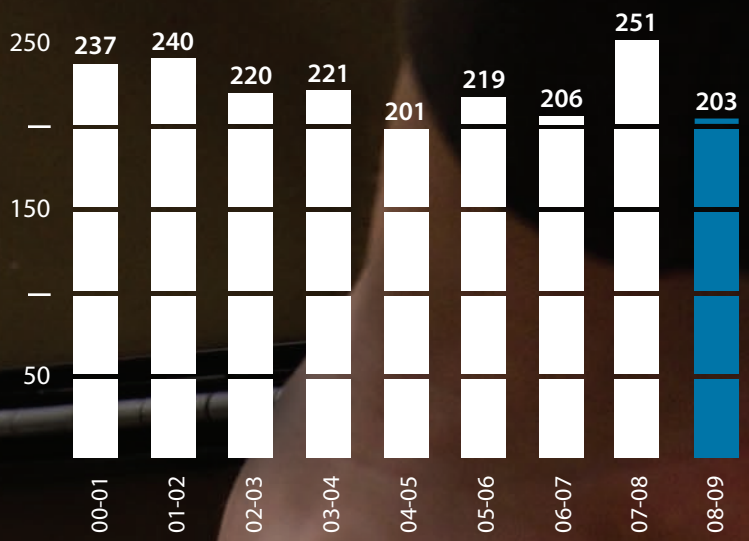
The External Advisory Board (formerly the Industrial Advisory Committee) is a select group of corporate, university, and government leaders, many of whom are Michigan Tech alumni. EAB members share their expertise and provide assistance with curriculum direction, research topics, resource development, and education-and-industry partnerships. They offer professional insight and provide valuable input—shaping the state-of-the-art engineering education that takes place in the ME-EM department.

Department Enrollment and Degrees

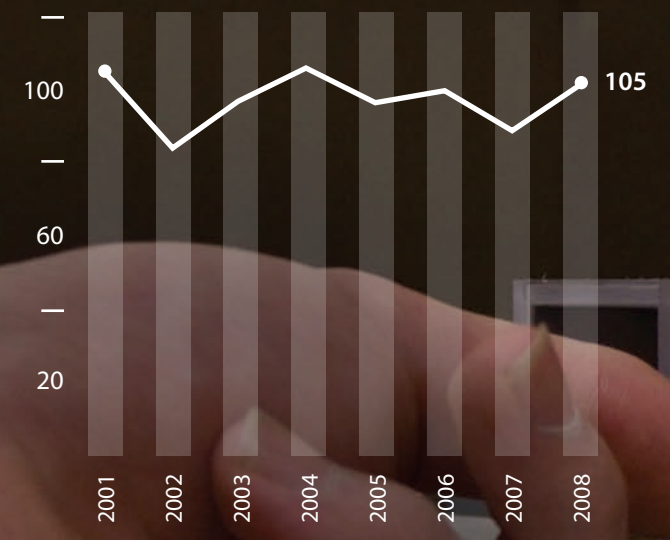
BS Enrollment



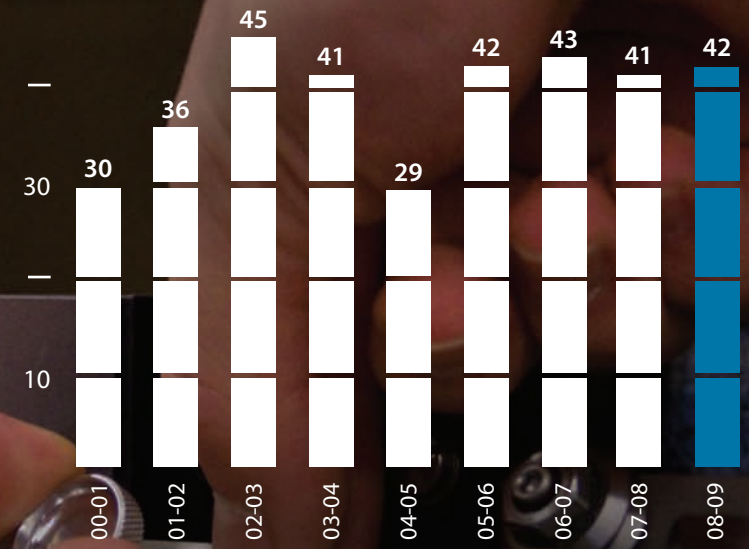
BS Degrees



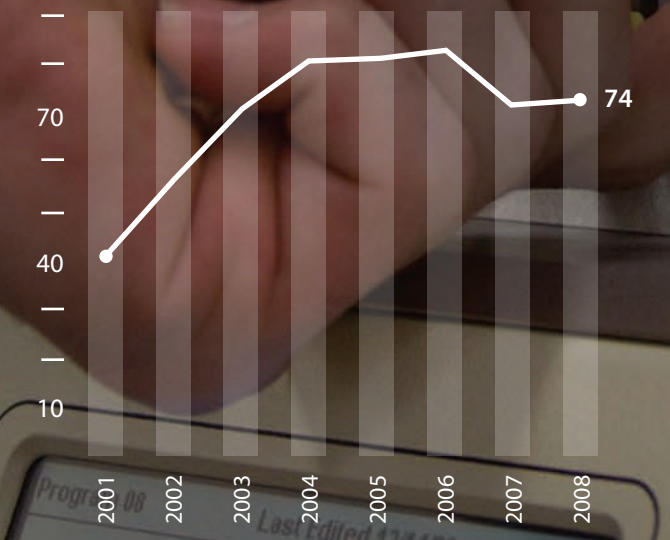
MS Enrollment



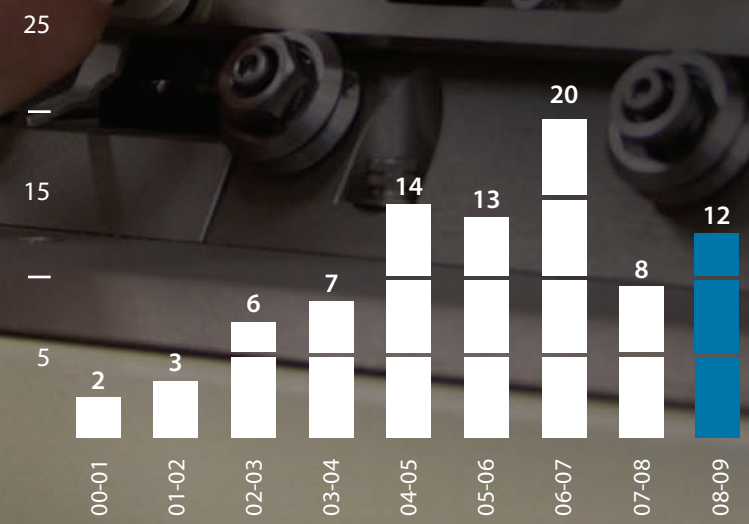
MS Degrees



PhD Enrollment



PhD Degrees



PCA Inductees

Christine R. Roberts and Paula Feira Zenner are the most recent alumni to be inducted into the Presidential Council of Alumnae (PCA) at Michigan Tech. The PCA recognizes successful Michigan Tech women graduates for their educational excellence, past student service, professional accomplishments, and community contributions.

CHRISTINE R. ROBERTS

Christine R. Roberts is a senior executive and technology leader in the telecommunications industry. Currently she is the senior director of Asia Product Operations for Motorola Inc., a Fortune 100 company. As senior director, she manages a complex global team that is responsible for launching more than one hundred different models of mobile phones per year into the Asia Pacific region.

Roberts graduated from Michigan Technological University in 1991 with a bachelor's degree in mechanical engineering. After graduation she accepted a position as a manufacturing engineer with Motorola Inc. She continued her education while working for Motorola, earning an MBA in 2000 in International Business from the Kellstadt Graduate School of Business at DePaul University and a master's certificate in Project Management from George Washington University.

Within five years of starting at Motorola, Roberts had advanced to Production Manager with P&L responsibility for three different product lines. She later accepted a job as international operations program manager which put her in charge of a global multi-million dollar telecommunication infrastructure program with responsibilities in Brazil, Argentina, Colombia, and other Latin American markets.

In 2000, Roberts was promoted to director of engineering and program management where she led a global deployment team in the execution of wireless infrastructure installations and upgrades worldwide. Her achievements led to her promotion to Director of North American Business Operations where she was responsible for business case development, sales, and value added services associated with Motorola Mobile Devices.

Roberts is an active proponent of women in engineering and science and sees starting young as a key to engaging women in the sciences. She has been a four-time presenter at the seventh and eighth grade Math and Science Conference in southwest Michigan and has participated in similar math and science programs for young women through a variety of venues.

She lives in Inverness, Illinois, with her husband Eric and their 5-year-old daughter Kylie.

PAULA FEIRA ZENNER

Paula Feira Zenner earned a bachelor's degree in mechanical engineering from Michigan Technological University in 1987 and worked in industry immediately following graduation. She later returned to Michigan Tech and earned a master's degree in Operations Management in 1993.

She began work at Michigan Tech in the Department of Mechanical Engineering-Engineering Mechanics as an academic advisor in 1991 and has advanced to her current position as director of operations and finance. She directs the financial and operational functions for this nationally-ranked academic department with annual research expenditures of more than $12 million and a salary and wage budget of $7.5 million. Zenner also serves as a member of the department's executive committee and advises the department chair on all matters related to departmental operations (human, financial, and capital); she is the go-to person for many of the high-level projects for the department as a whole.

Additionally, Zenner is responsible for the administrative and logistical functions of the undergraduate and graduate programs and courses, including resource allocation and accreditation. She served as the project manager for two major laboratory and facilities renovations and has co-authored papers providing national and international dissemination of engineering educational advances in the mechanical engineering degree program.

As a student at Michigan Tech, Zenner was an active member in several campus groups such as the Society of Women Engineers (SWE), American Society of Mechanical Engineers (ASME), the Alpine Ski Team, and Ski Coach of the Copper Country Ski Club. She also worked on campus in the Central Ticket Office as a student assistant.

Within the community, Zenner has coached youth athletics, served as a board member of the Houghton All Sports Booster Club, and currently volunteers for a variety of school/service fundraising activities.

She currently resides in Houghton, Michigan, with her husband Mark ('93) and daughters Blaire and Sloane.

Alumni Awards

OUTSTANDING YOUNG ALUMNI AWARD—MICHELLE BOVEN

The 2009 Outstanding Young Alumni Award went to Michelle Boven who graduated from Michigan Technological University with a Bachelor of Science in Mechanical Engineering in 1999. While at Tech, she was active on the women's track and field, cross country, and Nordic ski teams, and the Hockey Club. She was also a coach in the Mathematics Learning Center and a resident assistant in Douglass Houghton Hall.

Since graduating, Boven has pioneered automotive and solar research and development and has been a champion for professional development of engineers. She has continued her education with a Master of Science in Business Administration from Northwood University.

Boven is a senior development specialist for Dow Solar Solutions; prior to that, she was with Dow Automotive. She has received patents on inventions, has published extensively, and is renowned for her devotion to the Society of Women Engineers, where she is president of the Mid-Michigan Section. She also is active in the Society of Automotive Engineers.

Dow Chemical has honored her as North American Implementation Leader for the Women's Innovation Network, and she has received numerous honors from SAE and SWE, including the 2006 Distinguished New Engineer Award and the 2006 New Faces in Engineering Award.

Boven remains involved with Michigan Tech through the Women in Engineering program and the Career Advisory Board. She recruits for Dow and serves as an excellent role model for young women considering the profession.

OUTSTANDING SERVICE AWARD—JOHN CALDER

John Calder was the recipient of the 2009 Outstanding Service Award. He has a Bachelor of Science in Mechanical Engineering (1967) and a Master of Science in Business Administration from Michigan Tech (1976).

After working for Dynapar Corporation, Division of Litton Industries, Calder joined Dorsey-Alexander in 1975, purchasing the company in 1987. Dorsey-Alexander produces motion control, sensing, and machine-guarding safety products. In 1980, he helped found Cincinnati Controls, which distributes microprocessors for motion control and human-machine interfaces.

Calder shares his expertise in controls with Michigan Tech, and he has been heavily involved with the Department of Mechanical Engineering-Engineering Mechanics. With his wife, Joan, he established the Calder Systems and Controls Laboratory in ME-EM.

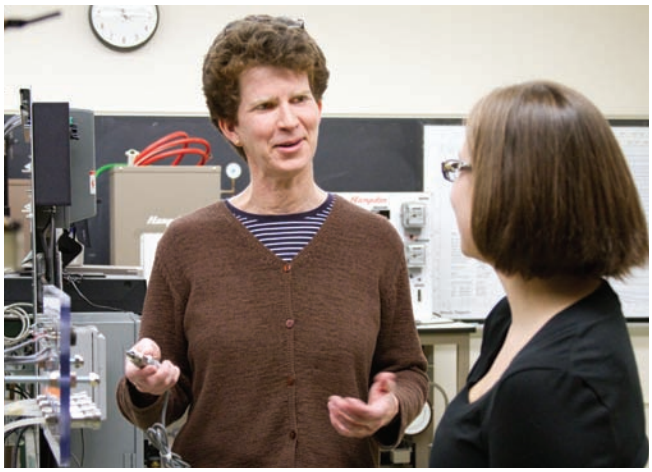
His University involvement began in his undergraduate days, when he was active in Sigma Rho, the Blue Key Honor Society, the Arnold Air Society, the Inter-Fraternity Association, and was chief justice of the Student Judiciary Council.

Today, Calder is a firm believer in tying together his two areas of expertise: engineering and business. To that end, he continues his involvement with Tech, where he is a member of the School of Business National Advisory Board and the Academy of Mechanical Engineering and Engineering Mechanics.

He has also been a member of the Michigan Tech Fund Board of Trustees, a Life Trustee and Past President, and is active on the University Capital Campaign Committee. He has served as an International Advancement Ambassador, is a member of the McNair Society, and is a lifetime member of the Alumni Association. He lives in Cincinnati with his wife Joan and two sons J. Scott and John.

Leading the Curve

Engineering education, according to Dr. Michele Miller, is undergoing great change. “As industry shifts focus to investigate new and sustainable technologies, education must follow suit,” she says. With two National Science Foundation (NSF) grants, Miller seeks to shape the mechanical engineering curriculum while researching student perceptions and attitudes.



THE SHIFT TO SUSTAINABILITY

To prepare students for the challenges of the changing engineering industry, Miller is working on an NSF grant project that aims to implement sustainability fundamentals into the mechanical engineering curriculum. “With the rapid advances in sustainable engineering, our students must be ready to work in emerging technologies,” she explains. The project will add sustainability content into three engineering courses by including applications in which fundamental concepts are applied to sustainability-related problems. Her co-PIs include John Gershenson, Chuck Margraves, Ibrahim Miskioglu, and Gordon Parker.

RESEARCHING HANDS-ON ENGINEERING

While sustainability is a magnetic topic that draws young people into engineering, Miller has further identified a surprising predictor of positive student attitudes toward the field: hands-on aptitude. A second NSF grant supports Miller’s development of measurement methods and survey techniques that are uncovering fascinating correlations. “We’ve seen that students who are successful in hands-on work tend to have a positive attitude about engineering; they find it rewarding and are able to see its real-world value and impact,” she said. Along with co-PIs Leonard Bohmann (Electrical Engineering) and William Helton (Psychology), Miller seeks to understand how students acquire these abilities and how to incorporate practical projects into the engineering curriculum. “Both projects will allow us to tailor course content to better suit the challenges our students will face after graduation,” she said.

Changing the Face of Michigan Tech

With an ADVANCE grant from the National Science Foundation, Dr. Donna Michalek has set out to increase diversity at Michigan Tech. She is working with an interdisciplinary team to attract and retain women and minority faculty members in the fields of science, technology, engineering, and mathematics (STEM).

“Because approximately 80 percent of faculty members at Michigan Tech are in STEM fields, and because the project initiatives will be successful in attracting new faculty in other demographic groups, the university has provided matching funds to expand the project to all faculty members,” said Michalek. “With this support, our efforts will have university-wide benefits.”

Project initiatives include improving the hiring process and establishing a mentoring program for new faculty. The hiring process initiative involves an education program that is designed to make reviewers aware of unintended, unconscious bias. To increase retention rates, the group is currently working with the deans and chairs to implement a mentoring program for untenured faculty. This program will eventually be expanded to include tenured associate professors, as well. “With each of these initiatives, our goal is to make Michigan Tech a better environment for teaching, learning, and research,” said Michalek. “Diversity makes a difference.”

Co-PIs on the project are Chris Anderson, William Predebon, Peg Gale, and Max Seel, and senior staff member, Susan Bagley.

Building the Future

2009 ME-EM Donations

Donors are critical to the success of the Department of Mechanical Engineering-Engineering Mechanics. Their contributions assist ME-EM in Building for the Future, a campaign that promotes the development and expansion of our education and research. Phase II of the campaign, entitled Endowing Excellence, is well on its way to meeting the goal of raising $54 million, having raised about $25 million to date.

The following list encompasses the many people who have generously shared their resources to create an outstanding ME-EM department. We are extremely grateful for their ongoing support. *Those contributing from December 1, 2008 to November 30, 2009 are listed below.*

COMPANIES

$25,000 - $50,000

Bucyrus International Inc
Cummins Inc
Ford Motor Company
Hewlett-Packard Company
John Deere Foundation

$5,000 - $24,999

EMT International Inc
Xerox Corp

$1,000 - $4,999

Aerophysics Inc
Binsfeld Engineering Inc
Innovative Geothermal Options
Integrity Applications Inc
KAM Plastics Corp
Marathon Oil Company

$500 - $999

Canariis Corp
Dayton Foundation Depository Inc
Schwab Charitable Fund

INDIVIDUALS

$10,000 - $25,000

John & Joan Calder
Jane C. Hardwicke
Richard & Elizabeth Henes
Terry & Rochelle Woychowski

$5,000 - $9,999

Frank & Leslee Agosti
Harold J. Gatza, Sr.
Craig & Donna Lazzari
Robert J. Rowe
Rudolph & Judith Shunta
Ronald & Elaine Starr

$1,000 - $4,999

Jean & LaVerne Anderson
William & Wendy Basta
John & Cornelia Butine
Paul V. De Baeke
Arthur & Joanne Disbrow
Dale & Gwen Dunlap
John & Daphne Eggert
Norman & Norma Glomski
Dean & Mary Goldbeck
Gerald & Ann Haycock
Ronald W. Henning
Gerald & Verla Hill
Randolph & Cheryl Hill
W. Donald & Joann Jacobs
Daniel Kapp & Linda Lavastida-Kapp
Robert & Mary Janet Knapp
Karl & Christine LaPeer
Gary & Corliss Lawrey
James & Carolyn Luyckx
Dianne A. Malesko
Raymond & Juliana Marttila
Robert & JoAnn Matheson
Donna J. Michalek
Kristen M. Mikula
Michael J. Molenda
Eric & Vicky Nielsen
Nathalie E. Osborn
Michael & Carol Paradis
Lynn E. Peterson
William & Mary Ann Predebon
Daniel & Eleanor Rivard
Dale & Sarah Roberto
Richard & Jean Rubbo
Peter & Anita Sandretto
Earl & Sylvia Seppala
David & Julee Sipes
Lawrence W. Stewart
Rex D. Stone P.E.
David & Linda Stone
Timothy & Lori Thomas
William & Margaret Trudell
John & Beverly Van Nieuwal
Larry & Deborah Vojtech
Dean & Suzi Waldie
Rodney & Donna Wegner
Klaus & Sigrid Weinmann

$500 - $999

John & Elizabeth Allen
Donald & Lavina Barkel
Donald & Joyce Bouws
Dr. Diana D. Brehob
John & Sharon Campbell
Robert & Patricia Carlson
Antone & Barbara Cavadeas
Brett Chouinard & Brenda Kasper
Robert & Gaylann Cleereman
Louis & Kathy Cristan
Juan & Dorothy Dalla Rizza
Larry & Kathryn Dinkel
Danny & Carol Dodge
Gaylord & Mary Faull
Bernard & Marilyn Finn
Alvin & Janice Gebeau
Karen & Jesse Gwidt
William C. Hamilton P.E.
Paul & Tracy Hewelt
Thomas & Susan Jamar
Gregory & Ellen Katalenich
John & Kathleen Keagle
Arthur J. Koski
Col. Merrily D. Madero
Terrence & Rosalie Maki
Paul & Elsa Miller
Mark Mitchell & Sharon Knowles
Darwin & Margarita Moon
Hugh & Nancy Moore
Michael S. O'Brien
William & Claire Ojala
James & Connie Peterman
Clinton A. Phalen
Peter & Sheila Radecki
Jan & Ellen Rankinen
Charles & Terry Roossien
William & Beth Unaitis
Don & Mary Wacker
Robert & Sandra Westphal
William & Barbara Worman
Sheryl S. Wright
Jeffery & Melissa Zawisza

Contracts & Grants (THROUGH JUNE 30, 2008)

SPACE SYSTEMS $1, 137,076

TITLE	NAME	SPONSOR	AWARD
High Altitude Autonomous Research Platform	PI: Lyon B. King, Co-PI: Nathan Weir	University of Michigan – Michigan Space Grant Consortium	$2,500
PECASE: Spacecraft Interaction Studies of a 20-kw Bismuth-fueled Hall Thruster	PI: Lyon B. King	US Department of Defense	$602, 971
Self-Regenerating Nanotips: Indestructable Field-Emission Cathodes for Low-Power Electric Propulsion	PI: Lyon B. King	US Department of Defense	$324,487
I/UCRC in Space Power and Propulsion	PI: Lyon B. King	National Science Foundation	$10,000
A Nanosatellite Calibration Target for Attitude and Shape Recognition Models	PI: Lyon B. King	US Department of Defense	$134,958
Estimation of Relative Positions and Attitudes of Microsatellites Constellations Using Wireless Local Positioning System	PI: Ossama Abdelkhalik, Co-PI: Seyed Zekawat	University of Michigan – Michigan Space Grant Consortium	$14,792
Metal Nanotip Formation in Zero Gravity Re-Flight	PI: Lyon B. King, Co-PI: Gareth Johnson	University of Michigan – Michigan Space Grant Consortium	$2,500
FRC Translation Experiments for Space Propulsion	PI: Lyon B. King, Co-PI: Carrie Niemela	ERC International	$29,268
Initial Analysis for a Semi-Active Vibration Damping System for Spacecraft in Launch Vehicles	PI: Bo Chen, Co-PI: Ossama Abdelkhalik	University of Michigan – Michigan Space Grant Consortium	$15, 600

MULTI-SCALE SENSORS AND SYSTEMS $9, 296,214

TITLE	NAME	SPONSOR	AWARD
Graduate Research Fellowship Program	PI: Mark Griep, Co-PI: Craig Friedrich	National Science Foundation	$121,500
Active Structural Fibers for Multifunctional Composite	PI: Gregory Odegard	Arizona State University	$28,000
Multiscale Modeling of the Effects of Physical, Chemical, and Hydrothermal Aging on Failure of Graphite/Epoxy Composites	PI: Gregory Odegard	National Aeronautics and Space Administration	$201,254
Finite Element Modeling of Intraneural Ganglion Cysts	PI: Gregory Odegard	Mayo Clinic Rochester	$135,350
Center for Fundamental and Applied Research in Nanostructured and Lightweight Materials	PI: Michael Mullins, Co-PIs: Jeffrey Allen, Tony Rogers, Julie King, Ryan Gilbert	US Department of Energy	$1,544,553
Multiscale Modeling of Failure and Damage of Themosetting Polymer Networks	PI: Gregory Odegard	US Department of Defense	$195,000
Crane Pendulation Control System Development and Demonstration	PI: Gordon Parker, Co-PI: Jason Blough	BMT Designers & Planners Inc.	$181,112
CAREER: Towards Interactive Simulation of Giga-Scale Agent-Based Models on Graphics Processing Units	PI: Roshan D'Souza	National Science Foundation	$523,644
Tire Testing and Computational Design for Improved Performance	PI: Gregory Odegard, Co-PI: Jay Meldrum	Titan International Inc.	$95,784

SGER: Exploring Data-Parallel Techniques for Mega-Scale Agent-Based Model Simulations on Graphics Processing Units	PI: Roshan D'Souza	National Science Foundation	$109,630
Development of a Ship-Launched Aerial Delivery System	PI: Gordon Parker	Craft Engineering Associates	$159,101
Confidential (per clause 16)	PI: Gordon Parker, Co-PI: Jason Blough	Anonymous	$45,389
Crane Pendulation Control System Specification Development	PI: Gordon Parker	BMT Designers & Planners Inc.	$9,713
REF-IE: Acquisition of a Nanorobotic System for Manipulation of Nano- and Micro-Scale Materials in Scanning Electron Microscope	PI: Mark Plicta, Co-PIs: Jaraslaw Drelich, Craig Friedrich, Tammy Haut Donahue, Patricia Heiden, Dennis Meng, Christopher Middlebrook, Owen Mills, Reza Shahbazian Yassar, Yoke Yap, Hu Yun	Michigan Technological University	$50,000
REF-IE: Total Internal Reflection Flourescence Microscopy Imaging Nanoparticles, Biomaterials, and Bio-Nano Hybrid	PI: Craig Friedrich, Co-PIs: Jeffrey Allen, Chang Kyoung Choi	Michigan Technological University	$27,359
REF-RS: Immune-Inspired Design Methodology for Building Autonomous Structural Health Monitoring Systems	PI: Bo Chen	Michigan Technological University	$9,500
Engineering Research Center in Wireless Integrated Microsystems	PI: Robert Warrington, Co-PI: Craig Friedrich	University of Michigan	$5,859,325

MECHANICS OF MULTI-SCALE MATERIALS $1, 733,867

TITLE	NAME	SPONSOR	AWARD
Grain Size Dependence of Fracture Toughness for Geological Materials	PI: Spandan Maiti	American Chemical Society	$141,939
Laboratory Evaluation of Warm Mix Asphalt	PI: Zhanping You, Co-PI: Qingli Dai	Michigan Department of Transportation	$190,001
Microsensor for Intramuscular Pressure Measurement	PI: Tammy Haut Donahue, Co-PI: Gregory Odegard	Mayo Clinic Rochester	$221,000
A Microstructure Based Modeling Approach to Characterize Asphalt Materials	PI: Zhanping You, Co-PIs: Thomas Van Dam, Qingli Dai	National Science Foundation	$216,819
MRI: Acquisition of an In-Situ AFM/STM-TEM System for Interdisciplinary Nano-Research and Education at Michigan Tech	PI: Reza Shahbazian Yassar, Co-PIs: Patricia Heiden, Yun Hang Hu, Gregory Odegard, Yoke Yap	National Science Foundation	$320,090
New Methodologies in Design of Small Blood Pumps	PI: Tammy Haut Donahue	Pennsylvania State University	$46,146
Collaborative Research: Understanding Mechanism of Internal Frost-Induced Damage of Concrete	PI: Zhanping You, Co-PIs: Qingli Dai	National Science Foundation	$189,999

Microfluidic Fabrication of Self-Healing Microfibers for Composite Construction Materials	PI: Desheng Meng, Co-PIs: Qingli Dai, Zhanping You	National Science Foundation	$365,938
Influence of Disuse and Microgravity on Meniscal Tissue	PI: Tammy Haut Donahue, Co-PI: Megan Killian	University of Michigan – Michigan Space Grant Consortium	$5,000
Mechanics of Hydrogen Storage in Nanostructured Materials for Spacecrafts	PI: Reza Shahbazian Yassar	University of Michigan – Michigan Space Grant Consortium	$15,600
Parametric Study of Stress Concentration in Artificial Heart Using Finite Element Analysis	PI: Tammy Haut Donahue, Co-PI: Daniel Dubiel	University of Michigan – Michigan Space Grant Consortium	$2,500
Biomimetric Design of Low Density Foams Subjected to Thermal and Mechanical Shock	PI: Spandan Maiti	University of Michigan – Michigan Space Grant Consortium	$18,835

ENGINEERING EDUCATION INNOVATION $2, 136,789

TITLE	NAME	SPONSOR	AWARD
ADVANCE: Changing the Face of Michigan Tech	PI: Donna Michalek, Co-PIs: Chris Anderson, Susan Bagley, Peg Gale, William Predebon, Max Seel	National Science Foundation	$532,786
IPA Assignment for Sheryl Sorby	PI: Sheryl Sorby	National Science Foundation	$721,994
Hydrogen Education Curriculum Path at Michigan Technological University	PI: Jason Keith, Co-PIs: Jeffrey Allen, David Caspary, Daniel Crowl, Jay Meldrum, Desheng Meng, Abhijit Mukherjee, Jeffrey Naber	US Department of Energy	$482,244
Hands-On Ability: Why It Matters and How to Improve It	PI: Michele Miller; Co-PIs: Leonard Bohmann, William Helton	National Science Foundation	$396,309
Engineering Equity Extension Service Project	PI: Donna Michalek, Co-PI: William Predebon	National Academy of Engineering	$3,456

ADVANCED POWER SYSTEMS $5, 426,856

TITLE	NAME	SPONSOR	AWARD
CAREER: Gas-Liquid Interface Dynamics and Dissipation Mechanisms in Capillary-Scale Two-Phase Flow	PI: Jeffrey Allen	National Science Foundation	$701,921
Development of a Multi-Component Aftertreatment Simulation Environment in MATLAB	PI: Gordon Parker, Co-PI: John Johnson	Navistar Inc. (International Truck and Engine)	$301,810
Visualization of Fuel Cell Water Transport and Performance Characterization	PI: Jeffrey Allen	Rochester Institute of Technology	$991,930
Development of an Improved Efficiency Low Emission DI-SI Ethanol Flex Fuel Powertrain for Hybrid Application	PI: Jeffrey Naber, Co-PI: John Beard, Jay Meldrum, Donna Michalek, Abhijit Mukherjee, Jeremy Worm	Michigan Public Service Commission	$2,575,109
Research Collaboration with Argonne National Laboratories for Graduate Student Research in Internal Combustion Engines	PI: Jeffrey Naber, Co-PI: Scott Miers	Argonne National Laboratory	$102,064

Combustion Pressure Engine Testbed Setup	PI: Jason Blough, Co-PIs: Jeffrey Naber, Jeremy Worm	PCB Piezotronics	$36,347
Prototype Development and Testing of a Combustion Sensing Technology for John Deere Powertrains	PI: Jeffrey Naber; Co-PIs: Jason Blough, John Diebal	University Michigan – Michigan Universities Commercialization Initiative (MUCI)	$193,986
Investigation of Enhancement of Deflagration-to-Detonation Transition Processes Using an Atmospheric RF Plasma in a Detonation Tube	PI: Seong-Young Lee	University of Michigan – Michigan Space Grant Consortium	$19,968
Characterizing Torque Converter Noise Generation at Various Speed Ratios to Enable Vehicle Efficiency Improvements	PI: Jason Blough, Co-PIs: Carl Anderson, Mark Johnson	General Motors Corporation	$60,085
Prototype Development and Testing of a Combustion Sensing Technology for John Deere Powertrains	PI: Jason Blough, Co-PI: Jeffrey Naber	John Deere	$72,400
Validation	PI: Mohan Rao	South Florida Water Management	$44,730
Effects of Dispersed Carbon Nanotubes on Acoustic Properties of Polymer Foams	PI: Mohan Rao, Co-PI: Andrew Willemsen	National Aeronautics and Space Administration	$30,000
Development of a Trilateral Partnership Between Michigan Tech, AVL, and GM with an Integral Laboratory to Explore and Incubate Innovative Powertrain and Instrumentation Concepts	PI: Jeremy Worm, Co-PI: Jason Blough, Jeffrey Naber	University of Michigan – MI Initiative for Innovation and Engineering	$227,100
REF-RS: Investigation of Direct Injection Flash Boiling Spray in a Combustion Vessel	PI: Seong-Young Lee	Michigan Technological University	$5,500
REF-RS: Experimental Investigation of Bio-mimetic Water Management in a Proton Exchange Membrane Fuel Cell	PI: Abhijit Mukherjee	Michigan Technological University	$15,000
Characterization of Combustion in an SI-Engine with Water Injection	PI: Jeffrey Naber, Co-PI: Jeremy Worm	Nostrum Energy LLC	$29,921
REF-RS: Development of a Novel Nucleate Boiling Identification Technique to Optimize Internal Combustion Engine Thermal Management	PI: Scott Miers	Michigan Technological University	$7,000
Investigation of Extreme Inlet Air Temperature on Thermal Efficiency of a Flex-Fueled SI Engine	PI: Jeremy Worm, Co-PIs: Scott Miers, Jeffrey Naber	General Motors Corporation	$11,985

MANUFACTURING AND PRODUCT DESIGN $144,827

TITLE	NAME	SPONSOR	AWARD
Collaborative Research: I/UCRC on Assembly Research	PI: John Sutherland, Co-PIs: Jaime Camelio, John Gershenson	National Science Foundation	$12,600
Next Generation Chamois	PI: John Gershenson	DashAmerica Inc.	$16,956
MTU-CAT Product and Process Commonality Collaborative	PI: John Gershenson	Caterpillar Inc.	$115,271

PhD & MS Graduates

PhD GRADUATES FOR SUMMER 2008, FALL 2008, and SPRING 2009 (12)

Anton, Christopher M. Advisor: Craig R. Friedrich
Photolithography Based Patterning of Bacteriorhodopsin Films

Dreyer, Jason T. Advisors: Sudhakar M. Pandit and Mohan D. Rao
Binaural Index for Speech Intelligibility via Bivariate Autoregressive Models

Griep, Mark H. Advisor: Craig R. Friedrich
Quantum Dot/Optical Protein Bio-Nano Hybrid System Biosensing

Haapala, Karl R. Advisor: John W. Sutherland
Development of Models for Environmental Performance Improvement of Steel Product Manufacturing

Keske, Justin D. Advisor: Jason R. Blough
Investigation of a Semi-Active Muffler System with Implementation on a Snowmobile

Lai, Xiaoxia Advisor: John K. Gershenson
Design Structure Matrix-based Product Represenation for Life-Cycle Process-Based Modularity

Massey, Dean R. Advisor: Lyon B. King
Development of a Direct Evaporation Bismuth Hall Thruster

Patil, Akshay G. Advisor: Ibrahim Miskioglu
Mechanical and Tribological Properties of Ultrafine Grained Zn-3%Cu-9%Al Alloy Obtained by EqualChannel Angular Extrusion

Sommerville, Jason D. Advisor: Lyon B. King
Hall-Effect Thruster-Cathode Coupling: The Effect of Cathode Position and Magnetic Field Topology

Valavala, Pavan K. Advisor: Gregory M. Odegard
Multiscale Constitutive Modeling of Polymer Materials

Walczak, Karl A. Advisor: Craig R. Friedrich
Immobilizing Bacteriorhodopsin on a Single Electron Transistor

Ye, Xiaoli Advisor: John K. Gershenson
Product Family Design and Evaluation Based on the Commonality/Variety Tradeoff

MS GRADUATES FOR SUMMER 2008, FALL 2008, and SPRING 2009 (42)

Abraham, Adam C. Advisor: Jason R. Blough
Development and Validation of a Non-Contact CranePayload Swing Sensor

Arasappa, Rohith Advisor: John H. Johnson and Jeffrey D. Naber
Modeling the Filtration, Oxidation and Pressure Drop Characteristics of a Catalyzed Particulate Filter during Active Regeneration

Braganza, Cris S. Advisor: Craig R. Friedrich
Course work only

Brown, Kari L. Advisor: John W. Sutherland
Course work only

Chen, Qifeng Advisor: Craig R. Friedrich
Course work only

Chilumukuru, Krishna Pradeep Advisors: Jeffrey D. Naber and John H. Johnson
An Experimental Study of Particulate Thermal Oxidation in a Catalyzed Filter during Active Regeneration

Dasgupta, Saurabh S. Advisor: Gordon G. Parker
Course work only

Dingeldein, Joseph C. Advisor: Craig R. Friedrich
Course work only

Farmer, Mary C. Advisors: Gordon G. Parker and Lyon B. King
Oculus Attitude Control System

Fritz, David L. Advisor: Jeffrey Allen
Course work only

Gujarathi, Rohit N. Advisor: Mohan D. Rao
Application of Statistical Energy Analysis for Modeling Interior Noise in Off-Highway Trucks

Gujarathi, Rohit R. Advisor: Craig R. Friedrich
Course work only

Hernandez, Joseph E. Advisor: Jeffrey Allen
Bislug Flow in Circular and Noncircular Channels and the Role of Interface Stretching on Energy Dissipation

Kataria, Anil Advisor: Craig R. Friedrich
Course work only

Kishore, Kunal Advisor: Craig R. Friedrich
Course work only

Kshirsagar, Ketan G. Advisor: Mohan D. Rao
Modeling, Design and Validation of an Exhaust Muffler for a Commercial Telehandler

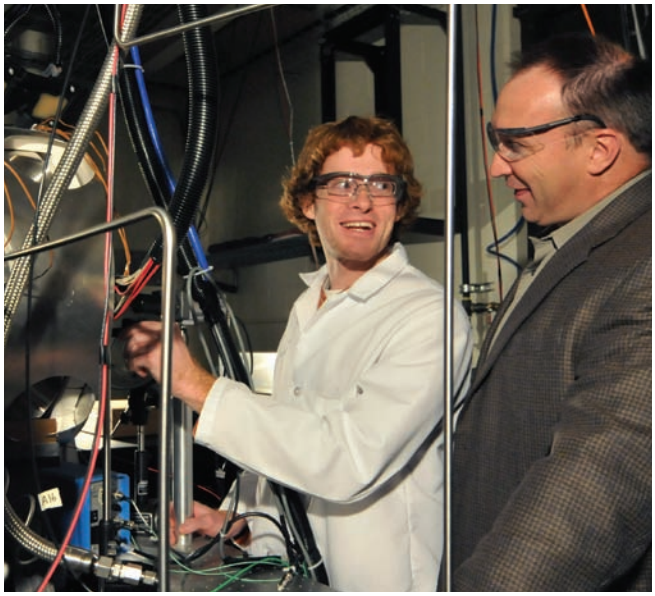
LNU, Abhijit Advisor: Jeffrey D. Naber
Ionization Waveform Characteristics as a Feedback Signal for Spark Ignited Engines

LNU, Amandeep Singh Advisor: Jeffrey D. Naber
Estimating Residual Gas Fraction for SI Engines with Dual Independent Cam Systems

LNU, Reena Thomas Advisor: Gopal Jayaraman
A Finite Element Study of the Human Proximal Femur Bone Fracture Patterns Due to Impact

Law, Mohit S. Advisor: John W. Sutherland
Course work only

Lechnyr, Joseph W. Advisor: Jeffrey Allen
Imaging of Fuel Cell Diffusion Media Under Compressive Strain



Luskin, Luke S. Advisor: Craig R. Friedrich
Course work only

Malpani, Vikas K. Advisor: Craig R. Friedrich
Course work only

Mattson, Steven G. Advisor: Sudhakar M. Pandit
Course work only

Moscherosch, Ben W. Advisor: Jeffrey D. Naber
Combustion and Emissions Characterization of Soy Methyl Ester Biodiesel Blends in an Automotive Turbocharged Diesel Engine

Nande, Abhijeet M. Advisor: Jeffrey D. Naber
Combustion and Emissions Studies in Spark Ignition Engines Fuelled with Hydrogen

Nesbitt, Jaclyn E. Advisor: Jeffrey D. Naber
Combustion Vessel Laboratory Development Focusing on Optical Diagnostic Subsystem Integration through the Dynamic Characterization of Fuel Sprays

Nie, Min Advisor: Desheng Meng
Fabrication of Nanoparticles by Short-Distance Sputter Deposition

O'Shaughnessey, Michael D. Advisor: Craig R. Friedrich
Course work only

Patel, Nitesh Advisor: Craig R. Friedrich
Course work only

Pauken, David M. Advisor: John W. Sutherland
Statistical Modeling of the Ford Superduty Brake Pedal Feel Attribute

Puranik, Anand S. Advisor: Gordon G. Parker
Course work only

Rickli, Jeremy L. Advisor: Jaime A. Camelio
A Modified Hotelling T2 Multivariate Control Chart for Enhanced Assembly Fixture Fault Detection

Salunke, Tejas S. Advisor: Craig R. Friedrich
Course work only

Sikarwar, Sandeep S. Advisor: Amitabh Narain
Recalibration and Modification of a Real Time Optical Fiber and Fluorescence based Liquid Film Thickness Sensor

Syed, Iltesham Z. Advisor: Abhijit Mukherjee
Experimental Study of Forced Convection Heat Transfer to Water Flowing through a Short Micro Duct at the Tip of a Cutting Tool at Turbulent Reynolds Number

Utkur, Aniket D. Advisor: Spandan Maiti
Cohesive Model Based Prediction of Near Threshold Fatigue Crack Behavior

Vu, Kha H. Advisor: Craig R. Friedrich
Course work only

Waisanen, Andrew S. Advisor: Jason R. Blough
The Application of Experimental Transfer Path Analysis to the Identification of Vehicle Sensitivity to Tire Cavity Resonance

Walber, Chad M. Advisor: Jason R. Blough
Course work only

Wells, Lee J. Advisor: Jaime A. Camelio
Enhanced Dimension-Reduction (EDR) Method for Quality and Sensitivity-Free Reliability Assessment

Williams, Cheryl L. Advisor: John W. Sutherland
Optimization of Conversion of North American Left Hand Drive Vehicles for Importation into Right Hand Markets

2008-2009 BS Graduates (203)

SUMMER 2008

Nicholas E Bartman - Summa Cum Laude
Cailee Evelyn Casey
Ryan J Danko
Eric David Elberling
Chanty Autim Marie Gober
Brad A Howard
Nathan Dale Kroodsma - Magna Cum Laude
Frank Campbell Murtland
Brandon Scott Quig
Molly Alice Rehwaldt - Cum Laude
Michael Anthony Ryba
Christopher Lawrence Sherman
Jacob M Stine
Joseph John Studinger
Christopher K Wackerle - Magna Cum Laude

FALL 2008

Alexander Mark Aerts - Magna Cum Laude
Brian Charles Bejcek - Cum Laude
Eric Allen Beyer
Anthony Stephan Bourassa
Andrew Joseph Brinks - Summa Cum Laude
Juan Sebastian Cespedes
Steven Clayton Conley
Kyle Jeffery Cookingham - Cum Laude
Adam B Coursin
Seth Brian DeLand - Magna Cum Laude
Brent Ian Evans
Grant Allen Farrelly
William Steal Ferenc
Alan Michael Fraley
Peter John Garceau - Magna Cum Laude
Lance Jacob Harvala
Brett Thomas Hawkins - Magna Cum Laude
Jason Robert Heering
Dane L Heimerman
Christopher Ryan Hutton - Magna Cum Laude
Alese Genevieve Jahnke
Jerrod Lee Kappers
Bryan Patrick Karl
Trevor Joel Kartes
Adam Paul Kastamo - Cum Laude
Matthew Killeen
Owen Thomas Kingstedt - Cum Laude
David K Kootstra
Patrick John Kurtz
Steven John Kussmaul
Robert Allan Lange
Jonathan J LeCloux - Magna Cum Laude
Jason R Lindenberg - Cum Laude
George Micheal T Lixey - Magna Cum Laude
Aaron Jay Longstreet - Cum Laude
Justin A Loritz
Nicholas C Lowe
Mike S Maier
Justin Ray Makos
Jesse P Manthei
Amber Lynn Marek
Blake James Mason
Nicholas Palma Mastricola
William Levi Merrill
Matthew Robert Michaelson - Cum Laude
Timothy J Miller
Christopher James Morgan - Summa Cum Laude
Sean Michael Morris
Jacob Dean Myers
Heath Armin Nunnemacher
Andrew William Pantke
Ryan Paulson - Cum Laude
Ryan David Penterics
Robert S Prohaska
Niikolas A Rautiola
Andrew Allan Ruddick
Adam Joseph Salmon
Patrick David Schneider - Cum Laude
Kevin H Snyder
Ian Bryce Soule - Magna Cum Laude
Eric Michael St. Ours
Daniel Scott Streberger
Nathan Frederick Thompson
Joseph Leigh Thompson - Cum Laude
James Robert Thunes
Matthew S Tlachac
Andrew M Tuchscherer
Victoria Florine VanCoppenolle
Robert William Vis
Stephen J Warren
Keith B White - Summa Cum Laude

SPRING 2009

Kenneth Victor Abbott
Oleg M Abramovich
Jason James Alcoe - Magna Cum Laude
Matthew Marvin Alt
Matthew P Anderson
Brian Charles Arpke - Magna Cum Laude
Joseph Charles Ault
Daniel Robert Banken
John S Barszcz
Eric Vincent Baum - Summa Cum Laude
Autum M Beadle - Magna Cum Laude
Kevin R Bence
Cameron Jay Biery - Summa Cum Laude
Tyler R Blank - Magna Cum Laude
Jana M Bloom
Eric A Boeckers
Benjamin Alan Burmester
Steven Phillip Carter
Matthew Lee Chamberlain
Ming Kit Chan
Kyle Patrick Codere
Caleb Scott Colyer
Megan Laurel-Allison Cook - Cum Laude
Christopher M Davis - Magna Cum Laude
Timothy Jon Dewey
Jamie Lea Dufner - Magna Cum Laude
Ankhbayar Enkhsaikhan
Tyler J Ethen - Cum Laude
Jeffrey A Eul
Colin P Fay
Nathan Douglas Fetting - Summa Cum Laude
Kyle Dylan Franks
Brett William Friermood
Alexandre Gagne
Jonathan M Gosa
Mark Alexander Graf

Eric Matthew Green
Charles J Grego
Jordan Lee Guitar - Cum Laude
Robert Morris-Aaron Haack - Cum Laude
Robert Nicholas Hambrock - Summa Cum Laude
Spencer Thomas Hanley - Summa Cum Laude
Nicholas Bailey Howe
Alexander E Hoy
Eric Jerome Jacobsen
Daniel Joseph Jacobson
Travis L Jansen - Summa Cum Laude
Andrew E Jaworski
Benjamin David Jensen - Cum Laude
Jeffrey Gardner Johnson
Eric David Joseph
Jeffrey Alan Katalenich - Summa Cum Laude
David J Kennedy
Nathan Richard Kent
Brenton Matthew Kilroy - Magna Cum Laude
Nicholas Joseph Klimas
JoAnn Marie Klobucher
Bradley Scott Konik
Jason Smith Krueger
Alexander A Krueger - Cum Laude
Jeffrey William Lauman
Jonathan William Lee
Stephen Jonlee Lewis
Andrew Robert Lillesve - Magna Cum Laude
Alex Lord
Ryan James Mathues
Scott Michael McElmurry
Brian C McHale
Kevin Daniel McKenna
Ryan D Menze
Christopher A Miller
Mindy J Miller - Cum Laude
Peter Michael Mimnaugh
Mathew S Mitchell
Robert Emrae Mooney
Andrew Joseph Morello
Felipe D Moura
Andrew J Nauta
Kaari Catherine Nevanen
Michael Paul Norconk - Magna Cum Laude
Christopher Louis Olson
Karl H Palm
James Allen Peitzmeier
Brandon Chester Pennala - Cum Laude
Steven Craig Pribyl
Ryan Anthony Pulkrabek
April Marie Rhoden
Andrew Paul Rohr - Cum Laude
Anthony James Santi
Andrew Mark Schafer - Cum Laude
Jeffrey Mark Schwartz
Erik M Selewski
Michael Harrison Senkow
Matthew John Sipiora
Craig Alan Slattery
Samuel John Sokolowski - Cum Laude
Sean Robert Spellman - Magna Cum Laude
Daniel W Stickels
Ryan P Sullivan
Rei Tangko - Summa Cum Laude
Matthew R Tanguay
Kevin Patrick Temple
Andrew William Thom
Lipu Tian
Eddy Howard Trinklein - Magna Cum Laude
Christopher J VanDyke
Matthew B Vetting - Magna Cum Laude
Robert Anthony Viola
Karl Edmund VonderHeide - Summa Cum Laude
David J Walters - Cum Laude
Chance S Weber
James Corey Weber
Jesse E Wills - Magna Cum Laude
Drew M Windgassen - Magna Cum Laude
Richard L Winter
Steven M Worster
Thomas Alan Zettel

GRADUATE FELLOWSHIPS 2008-2009

Cummins Fellowship
Rohith Arasappa
Krishna Pradeep Chilumukuur
Gregory Austin
Christopher Hutton

Henes Fellowship
Julio Rivera

King Chaves Parks
Joseph Hernandez

Marshall Fellowship
Karl Walczak

National Science Foundation
Mark Griep

Winnikow Fellowship
Shantanu Kulkarni

ORDER OF THE ENGINEER Keynote Address Speakers

Spring 2009
Martha N. Sullivan
Chief Operating Officer and
Executive Vice President of
Sensata Technologies Inc.

Fall 2009
Gary R. Lawrey
President & CEO of Saturn
Electronics and Engineering Inc.

Student Societies

Blizzard Baja Enterprise

The Michigan Tech Blizzard Baja Enterprise saw great success in 2009, competing in the three-part Baja SAE Collegiate Design® competition. The team received the Mike Schmidt Memorial Iron Team Award, which is given to the team that earns the most combined points in all three regional events.

The Michigan Tech team placed second in Oregon, sixth in Wisconsin, and eighth in Alabama. In Wisconsin, the competition involved ninety-nine teams and was the largest of the regional events. The Blizzard Baja team had the fastest time in the suspension and traction event and was awarded the First Place Honda Overall Dynamic Award.

In the Baja SAE® competitions, students design, build, test, and race an off-road vehicle that will survive use on rough terrain and water.

http://baja.students.mtu.edu/

SAE Clean Snowmobile Challenge

In 2009, the ME-EM department and the Keweenaw Research Center hosted the SAE Clean Snowmobile Challenge™ for the seventh consecutive year. At the event, held on March 16-21, the Michigan Tech team finished second in the internal combustion category. In addition, they won the Yellowstone National Park Award, the PCB Group Award for the Quietest Snowmobile, the Sensors Inc. Award for Lowest In-Service Emissions, and the BlueRibbon Coalition Award for Most Practical Solution.

The Michigan Tech team also received the Founder's Award for Most Sportsmanlike Conduct, which honors the late Bill Paddleford, the Teton County Commissioner who co-founded the Clean Snowmobile Challenge in 2000. The team received eight nominations from the competing teams, the highest a team has ever received in seven years of this event.

The SAE Clean Snowmobile Challenge™ asks students to re-engineer an existing snowmobile to reduce emissions and noise while maintaining or improving performance.

http://www.mtu.edu/snowmobile/

SAE Aero Design

Michigan Tech's SAE Aero team placed high in both of the national SAE Aero Design competitions in 2008. The team placed first out of fifty-one teams in the Aero Design West competition in Van Nuys, California, and third out of twenty-seven teams in the Aero Design East in Ft. Worth, Texas.

The SAE Aero team competed with schools from around the world. Team members utilized ME-EM facilities to design and fabricate their aircraft.

The SAE Aero Design™ competition challenges engineering students to plan, design, build, and test a radio-controlled aircraft that can take off and land while carrying a maximum amount of cargo. Teams must also give oral presentations and provide written reports.

http://www.me.mtu.edu/saeaero/

Off-road Wheelchairs Increase Access to Recreation

With three innovative off-road wheelchair designs, senior design teams in the ME-EM department have increased access to the Michigan Tech trail system for people with limited mobility.

"Current off-road wheelchairs are not able to navigate the steep grades found on the Tech Trails," said project advisor Dr. John Beard. "Our goal was to make a chair with greater rolling resistance." To that end, the students designed three different models to suit users with varying levels of mobility.

WHEELCHAIR DESIGN

The first chair, which resembles a standard wheelchair, uses robust wheels and a self-powered "rowing" system for people with significant upper body strength. A second model features a sturdy track system and is battery powered for users who can transfer themselves but do not have the strength for self-propulsion. A third model has a tracked platform onto which a standard wheelchair can be rolled and secured, allowing the user to remain in their personal wheelchair while navigating the trails with a joystick control system. To increase the time users are able to spend on the trails, a fourth senior design team is currently working on a hybrid engine for the second chair model.

Each chair is designed to withstand off-road conditions and steep inclines, and has been extensively road-tested. The students, who were responsible for each prototype from design to manufacturing and testing, placed a special emphasis on aesthetics. "The teams wanted the wheelchairs to be something people would be proud to use," said Mike Abbott, Director of Sports and Recreation at Michigan Tech. "They look like they belong on the trails."

MAKING THE NEWS

"The students did a great job with the wheelchairs, which will open up our trail system to people of all abilities," said Mike Abbott, Director of Sports and Recreation at Michigan Tech. Abbott and colleague Joanne MacInnes wrote the proposal for the project grant, which was awarded as part of the Michigan Parks and Recreation Association's Access to Recreation initiative.

The wheelchairs were completed in the spring of 2010, and have been well-received by community members and state government; the original design groups presented their work at the Michigan Disability Rights Caucus Convention and in interviews with Michigan State Senator John Gleason and Representatives Mike Lahti and Judy Nerat in February 2010.

"The project allows students to see the benefits of engineering," said Beard. "In the ME-EM department, we have a history of adapting specialized systems to increase mobility. This project continues that tradition of using mechanical engineering to improve the quality of life in the community."

Journal Articles

MAY 1, 2008 - APRIL 30, 2009

* Please note: **Bold text** indicates ME-EM faculty members and *italicized text* indicates ME-EM students.

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ME-EM Cruise

1. Stuart '57 and Gail Simpson
2. Bernard Finn '55 and Professor Emertus Aubrey Gibson
3. John Calder '67 (2009 Outstanding Service Alumni Award recipient) and Michelle Boven '99 (2009 Outstanding Young Alumni Award recipient)
4. Bill Predebon, ME-EM chair (in yellow), Michelle Boven (in black), and friends
5. David '56 and Beverly Stromquist
6. Father and son, John Lawrey '49 and Gary Lawrey '79

7. Daniel '59 and Carol Rivard enjoy the alumni picnic
8. Larry Doyle '64, Daniel Rivavd '59, Father Michael (Greg) Veneklase '79
9. 2010 Annual ME-EM Alumni Hockey Social. John '64 and Cathi Drake look on as Blizzard T. Husky tries to recruit second generation Tech mechanical engineers. Additional MEs watch from the window.

Tom Fowler

Oil Shale Commercial Lead,
Shell Oil Company

Tom Fowler

After graduating from Michigan Tech in 1981, Tom Fowler joined Shell Oil Company and has worked a number of offshore and onshore engineering assignments in New Orleans, Traverse City, Calgary, and currently Houston. Since 1998, he has worked on unconventional resources for Shell in an attempt to develop the massive oil shale resource in a profitable and environmentally sustainable manner. Fowler has played a key role in six of the Colorado oil shale field tests and was the project manager for a large heavy oil pilot in Alberta.

"Michigan Tech provided a solid engineering foundation that prepared me for a career at Shell," said Fowler. "Graduates have a spirit of dedication that is crucial to the long-term challenging pursuit of sustainable energy solutions."

Jason Maes

Associate Manager of Advanced Quality Engineering, Stryker Instruments

Jason Maes

Jason Maes completed his BS in 2003 and MS in 2004—both at Michigan Tech. He accepted the position of quality engineer at Stryker Instruments, and in 2008 became a supervisor. In 2009 he was promoted to associate manager of advanced quality engineering. Maes' group supports new product development for the Surgical, Neuro Spine ENT, and Interventional Spine businesses, ensuring quality and safety of products before they are released on the market. During his tenure at Stryker, Maes has launched numerous products to the field, including the T5 Personal Protection System and the AutoPlex bone cement delivery system.

"Michigan Tech provided a strong fundamental engineering base that has enabled me to analyze a product and ask challenging questions," said Maes. "The education system and faculty are second to none."

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Michigan Technological University
1400 Townsend Drive
Houghton, MI 49931 - 1295

ME-EM

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Congratulations to our Lady Huskies, who advanced to the Elite 8 after defeating Drury 84-68. Lisa Staehlin (second from right) is majoring in mechanical engineering and Lynn Giesler (far right) is a dual-major in biomedical engineering and mechanical engineering.