University of Michigan

College of Engineering

MECHANICAL ENGINEERING
2004-2005 ANNUAL REPORT

MichiganEngineering

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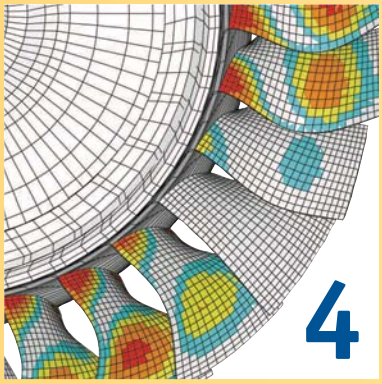
Mechanical Engineering Annual Report • 2004-2005



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Making Their Mark

Earning Accolades

Giving Back

Message from the Chair

It is a real pleasure to invite you to read the ME Department's annual report for the past year. Our department has continued to make great strides in teaching and research, and these contributions have been recognized both internally and externally. As the rapid changes in the world and the economy constantly reinforce the need for the skills and innovative ideas of mechanical engineers, our Department is uniquely positioned to lead the way in addressing grand challenges in the fields of energy and environment, as well as improving the quality of life.

Over the past year, US News ranked our undergraduate program as #3 and our graduate program as #4 in the nation. These rankings consistently reflect the excellent impression that our peers have of the quality of our programs. Recently, our undergraduate curriculum was reviewed by ABET, found to be in full compliance with the applicable criteria, and recommended for accreditation till the next general review in 2011. Last year, we graduated the largest number of Ph.Ds in a decade, almost one per faculty member. A large number of our doctoral graduates accepted academic positions at prestigious academic institutions. Once again, four of our graduate students were selected for the prestigious NSF fellowships. ME continues to focus on global education and research alliances, adding the Technical University of Berlin to our current collaborators in Korea and China. Our faculty and students are also working on generating a strong and diverse pipeline of students interested in engineering, and fostering interest particularly with women and underrepresented minority populations.

The achievements of our students outside the classroom continue to make all of us in the ME Department proud of the mentorship and support we give them to be successful. The College's major vehicle racing teams — Solar, Baja, and Formula — all achieved high levels of success and included many ME undergraduate students. In particular, the Solar Car team Momentum finished first in the North American Solar Challenge, earning its fourth national championship — the most of any university — since competition began in 1990. A special note of appreciation goes to loyal ME alumnus Chuck Hutchins (BS ME 57) for his dedicated support and mentorship

Dennis Assanis in front of Lurie Fountain on the College of Engineering's North Campus

of the team since its formation in 1989. Our students have also worked hard to improve communities and community living, as exemplified by the AWARE@home group who helped consumers improve energy conservation and efficiency in using our natural resources. While we have always known that our students are gold-medal caliber, one of our students, Dan Ketchum (BS ME '04, MSE ME '05), actually won a gold medal at the Athens Summer Olympics in the men's 4x200-meter freestyle relay!

Despite the great challenges that the North American automotive and manufacturing industries are facing, our Department has continued to attract significant funding from both government and industry, and our research expenditures of $27.3M continue to place us among the highest funded ME programs in the nation. A significant portion of the ME Department's research activities has focused on improving the generation, conversion and conservation of energy. Within the Automotive Research Center and the GM Collaborative Research Laboratories, innovative approaches have been aimed at dramatically improving fuel economy of next

message from the chair

generation vehicles while at the same time meeting ultra-stringent emission standards. Under a newly forged, five year strategic alliance with General Electric Transportation, ME researchers are working to lengthen the life of aircraft engine turbine blisks and develop predictive intelligent maintenance processes and sensors to reduce unscheduled machine downtime. The S.M. Wu Manufacturing Research Center is focusing new efforts on the manufacturing of portable power generation systems and fuel cells with a goal of reducing costs to hasten adoption of this alternative energy technology. In addition to the global impact of our NSF ERC on Reconfigurable Manufacturing Systems, two newly founded NSF IUCRCs on Precision Forming and Lasers and Plasmas for Advanced Manufacturing are attracting strong industry interest.

In parallel, ME is continuing to diversify its research portfolio in other emerging areas of mechanical engineering, often inspired by mother nature, with great success. For instance, ME researchers are making fundamental contributions to hearing science through the conceptualization and development of a novel micro-machined device that mimics cochlea function, which has been featured prominently on the NSF web page. Using the principles of mechanics and dynamics, our faculty are shedding light on DNA supercoiling to assist molecular biologists understand how the DNA functions are influenced by its structure. Our faculty are also probing the fundamentals of micro and nano-scale thermal physics, both in the classroom and through their research activities in novel areas such as heat transfer inside electronic and optoelectronic devices and energy transport into organic and inorganic devices.

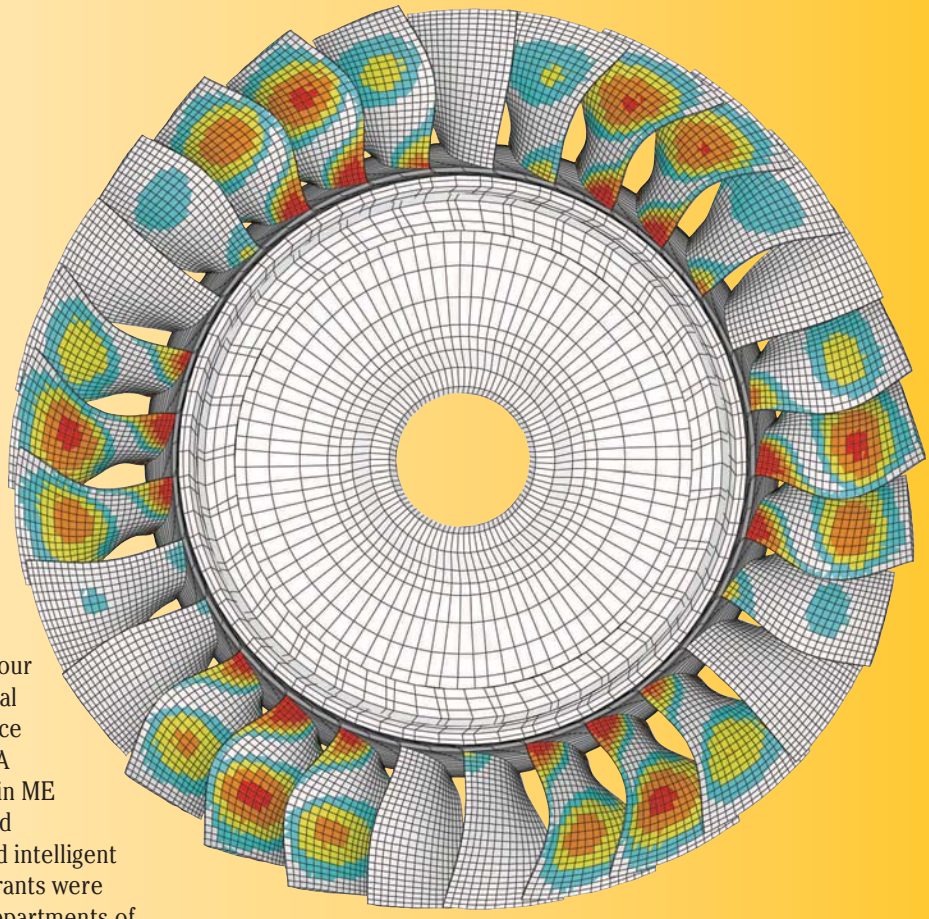
Our faculty were recognized in many ways this year, including a record 10 promotions to higher ranks and prominent University honors. Among them, James Barber joins three other ME colleagues as an Arthur F. Thurnau Professor in recognition of his outstanding contributions to undergraduate education. Anna Stefanopoulou received the Henry Russel Award, given in recognition of her "distinguished scholarship and conspicuous ability as a teacher." Ann Marie Sastry has been selected to receive the University's faculty recognition award and Zoran Filipi has been selected to receive the University's research faculty recognition award. Steven Goldstein, a joint faculty member in Orthopedic Surgery and Biomedical Engineering, was elected to the National Academy of Engineering, the highest professional recognition given to an engineer. Our former colleague and past M.I.T. President Chuck Vest has been honored with the Alumni Society Medal for his distinguished four decade career in teaching and higher education administration.

To complement our distinguished faculty, we added two new highly promising members to the ME faculty ranks — Assistant Professor Angela Violi (January 2006) whose research interest is nano-scale particulate emissions and Assistant Professor Nikolas Chronis (September 2006) whose research interest is bio-MEMS systems. This year also saw the retirement of two long-time colleagues, Professor Wei-Hsuin Yang and Associate Professor Bruce Karnopp who have taught multiple generations of Michigan engineers the fundamentals of applied mechanics and dynamics. Amidst these honors and celebrations, we were deeply saddened this year by the unexpected passing of our colleague Professor Gerard "Jerry" Faeth. His 45 years of teaching and research touched many lives, and under his outstanding mentorship many of his more than 50 Ph.D. students chose to emulate his foot steps and pursued their own academic careers. We will gravely miss Professor Jerry Faeth and will always cherish him as a colleague, teacher, mentor and friend.

A great Department is a reflection of its excellent students, alumni, faculty and staff. Indeed, this annual report epitomizes the spirit of the ME Department and is a tribute to the energy, teamwork and dedication of our ME community. As we move forward, I know that great things will continue to happen and I am grateful to all of you for your enthusiastic support of our mission.

Dennis N. Assanis
Professor and Chair, Mechanical Engineering
Jon R. and Beverly S. Holt Professor of Engineering

U-M - GE Transportation Partnership Improves Aircraft Engine Design



Vibration mode shape of a blisk obtained from finite element analysis.

The U-M College of Engineering has received $5 million in research funding, distributed among four thrust areas over a five-year period, through General Electric Transportation's University Strategic Alliance (USA) Program. This makes the College the GE USA program's largest member. The scope of research in ME encompasses two thrust areas focused on advanced methodologies for modeling, testing, machining and intelligent maintenance of turbine engine rotors. Additional grants were awarded to College of Engineering faculty in the Departments of Aerospace Engineering and Materials Science and Engineering.

Manufacturing variation and non-uniform wear cause small differences in the natural frequency of each blade of a bladed disk in a turbine engine. These small differences, called mistuning, can lead to immense changes to the system's vibration and can result in premature fatigue and blade cracking.

From a computational standpoint, modeling such systems poses huge challenges. Associate Research Scientist Matt Castanier is leading one of the thrust areas to model the structural dynamics of turbine engine rotors, the culmination of 12 years of research on modeling vibration in systems with parameter uncertainties. Much of the previous research was done through the GUIde consortium on Blade Durability, a government, university and industry effort.

Castanier continues to collaborate with former ME Professor Christophe Pierre (see related story, page 56) and ME Professor Steve Ceccio in developing experimental methods and system identification techniques to capture the vibration response of bladed disks and one-piece bladed disks ('Blisks'). Their goal is to implement an experimental system for identifying blade mistuning and predicting blisk reliability in GE's Cincinnati facility.

Also in ME, Professor Jun Ni and Associate Professor Albert Shih co-lead the thrust area focused on manufacturing research, namely the modeling and optimization of five-axis end milling processes for Blisk machining; machine health monitoring and performance prediction; and micro-blasting for surface preparation.

Bladed disks have many cost and performance advantages compared to conventional blade assembly, but there are also significant challenges to their cost-effective manufacture. In the first project, Ni and his graduate students will investigate the machining process and cutting tool performance optimization for titanium Blisks. This research will model the complex five-axis end milling process, predict chip evacuation and optimize tool designs.

The second project will leverage the extensive research program currently being pursued by the National Science Foundation-sponsored Industry/University Cooperative Research Center for Intelligent Maintenance Systems. Ni, along with Assistant Research Scientist Dragan Djurdjanovic and their graduate students, will develop multi-sensor-based predictive tools for the monitoring, diagnosis and prognosis of machine tool health condition. The ultimate goal is to predict degradation of critical machine subsystems so that intelligent, predictive maintenance measures can minimize unscheduled machine downtime.

Surface irregularities can have critical impact on rotor durability. Professor Albert Shih and his graduate students will investigate various fundamental aspects of micro-blasting processes and their impact on surface generation and modification. His team will conduct both theoretical and experimental research to model process mechanisms, evaluate critical parameters and apply this new process to selected aerospace components.

Automotive Research Center Addressing Energy Challenges

The global energy situation creates an imperative to improve energy utilization in transportation, which now accounts for one third of the energy used in the U.S. Given that almost all of this energy is supplied by petroleum, the need to work on alternative fuel options is paramount. The impact on powertrain architectures can be immense, and solutions including clean diesel, hybrid and fuel cells need to be developed ahead of time.

The Automotive Research Center (ARC), in its second year of a five year, $40 million U.S. Army grant, is focusing a large portion of its research on significantly improving fuel economy for the next generation of military and civilian ground vehicles. With increasing uncertainty of petroleum reserves, the ARC is focusing research and education in the important area of energy.

The ARC, a seven-university consortium led by U-M and sponsored by the National Automotive Center at the U.S. Army Tank-Automotive and Armaments Command (TACOM) in Warren, Michigan, works closely with government and industry partners.

"To tackle immense challenges at the interface of various disciplines," said Professor Dennis Assanis, ARC director. "It's this type of collaboration that enables the ARC's success, making it the most sophisticated university-based automotive research center in the country. There is tremendous interest in our powertrain and fuels projects from both the commercial sector and the military since we take a systems approach to developing dual-use strategies to address problems." A range of related issues, including vehicle dynamics and control, advanced materials and light weight structures, human modeling, optimal design and reliability are addressed too.

The Center allows us to investigate concepts and components that aren't readily available — how much can we reduce consumption if the powertrain is hybridized? What if we use an advanced light weight design? Beyond petroleum fuels for vehicle propulsion, other candidates include natural gas, ethanol, bio-diesel, synthetic Fischer-Tropsch fuel and gas-to-liquid fuels. Hydrogen is considered the ultimate renewable energy carrier, and promises highly efficient propulsion in combination with a fuel cell. However, there are many unanswered questions with regards to hydrogen generation and storage. Fundamental research aims to develop controls and management strategies tailored for alternative powertrains and fuels to meet future performance/emissions targets. Assessments analyzing a large number of powertrain and fuel options enable ARC to serve as an honest broker in evaluating their true potential.

U-M President Mary Sue Coleman and Dennis Assanis.

One of the novel approaches in developing clean and fuel efficient vehicles of the future consists of 'engine-in-the-loop' methodology. It links real-world powertrain hardware with virtual objects simulated on the test-cell computer. The foundation for this work was laid through collaboration between the advanced propulsion team, developing a state-of-the-art engine testing facility in the W.E. Lay Automotive Laboratory, and the vehicle dynamics and controls team. "We are pursuing systematic model-reduction techniques to ensure real-time performance of the hybrid driveline while preserving appropriate fidelity" said Professor Jeffrey Stein, ARC associate director. "We can mix and match various powertrain components and obtain accurate fuel consumption and transient emissions data in the test cell under realistic in-vehicle conditions. This type of data may otherwise be difficult or costly to obtain from a vehicle prototype test," said Zoran Filipi, research associate professor and ARC assistant director.

The breadth of the current research in the ARC and the already established collaborative links with government and industry make the center uniquely positioned to address complex research issues related to the energy options for the future. "The ARC is indeed one of the cornerstones of the campus-wide energy initiative that promises the development of energy sources and energy policies that will promote the responsible use of the environment, and economic prosperity," said University of Michigan President Mary Sue Coleman.

From Collaboration to Innovation

Novel engine and manufacturing concepts continue to spur research initiatives in the two collaborative research laboratories between General Motors and the Department of Mechanical Engineering at the University of Michigan. "This partnership brings together an impressive group of top notch minds to help GM tackle some important issues around engine efficiencies and vehicle manufacturing," said Dr. Alan Taub, executive director of GM Research Laboratories. "The work in both GM CRLs represents true collaboration. We have made significant strides toward resolving the research issues critical for realizing our partner's vision about future technologies" said ME Department Chair and Professor Dennis Assanis.

In the GM CRL for Engine Systems Research (ESR), "the drivers are improving fuel economy dramatically while at the same time satisfying ultra-stringent emissions standards that will go into effect in 2007/2010," according to Assanis, who co-directs the GM CRL-ESR. Work in four thrust areas includes development and application of optical diagnostics techniques for direct-injection gasoline engines, thermal characterization of direct-injection engines, premixed diesel combustion and aftertreatment, and modeling of engine systems.

In the area of optical diagnostics, planar laser-induced fluorescence, OH chemiluminescence, and fast exhaust gas analysis have been used to better understand the formation of the pollutant nitric oxide in spray-guided gasoline direct-injection engines. "We now have indications of how to suppress NOx formation, thanks to the combination of all three techniques," said Professor Volker Sick, co-leader of the optical diagnostics area. Work in this area also included fundamental studies of spectroscopic properties of fluorescence tracers, as well as tracer interaction with fuel.

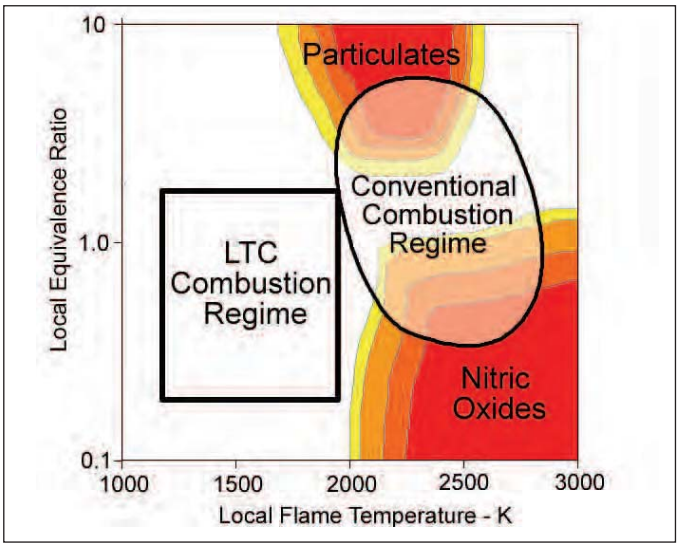
In the area of thermal characterization of direct-injection engines, researchers have completed a fundamental study and developed a model of heat transfer in homogeneous charge compression ignition (HCCI) engines. "The next step is to understand the formation and role of combustion chamber deposits across a range of realistic operating conditions," according to Research Associate Professor Zoran Filipi, a thrust area co-leader.

Assanis and his research group continue their work toward innovative fuel management strategies for diesel engines, including low-temperature combustion (LTC), premixed diesel combustion, and development of novel catalysts. "We have demonstrated near-zero NOx and soot emissions from LTC diesel combustion," said Assanis." Assistant Research Scientist Stani Bohac is focusing on the characterization of the unburned hydrocarbons resulting from this novel mode of combustion, which will be critical for the development of suitable aftertreatment devices.

In the GM CRL for Advanced Vehicle Manufacturing (AVM), where research thrust areas include advanced forming, welding and joining, and assembly and manufacturing systems, "the spirit of innovation continues to be evident in the work that has been done this year," said Professor S. Jack Hu, co-director. "At the same time, as we finish the third year of the GM CRL-AVM, many of the research results are moving closer to implementation into GM products and manufacturing." For example, feasibility tests have been completed on the use of the GM C-Flex robotic part fixturing system to control dimensional quality in auto body assembly. In addition, U-M contributors used a combination of the latest techniques in variation modeling and statistical methods to assist the GM Metal Fabrication Team in determining the root cause of variation and identifying corrective actions for the problems that were being experienced in the plant.

A significant accomplishment of the GM CRL-AVM over the past year is the award-winning assembly modeling project. Each year GM presents the People Make Quality Happen Award to three teams that have significantly improved the quality of a product through the implementation of sustainable quality programs. This year the Engine Cradle Project, which was a collaborative effort of GM Metal Fabrication Division and the GM CRL-AVM, was selected from among 1000 entries as one of 10 finalists for this award.

"The collaborative research environment of the GM CRLs provides a unique training ground for students, several of whom are hired by GM after they earn their degrees. GM has had success in hiring the cream of the crop," said Rodney Rask, GM manager of Engine Research and co-director of the CRL-ESR. The new additions to the GM R&D team are Drs. Nicole Wermuth, Ronald Grover and Junseok Chang.



Low Temperature Combustion is the key to clean diesel technology. Researches in the GM/UM CRL are developing advanced fuel injection and Exhaust Gas Recirculation strategies required to achieve premixed diesel combustion. The goal is to avoid forming rich pockets in the combustion chamber responsible for soot emission, and hot pockets responsible for NOx emission.

High-Speed Laser Imaging Highlights Fuel Plume Flow

Professor Volker Sick and Ph.D. student James Smith, also an ME graduate student instructor, have developed a technique for high-speed imaging of fuel distribution and have applied it for studies around the spark plug of an optical direct-injection gasoline engine. Their demonstration at such a high level of temporal detail is the first worldwide.

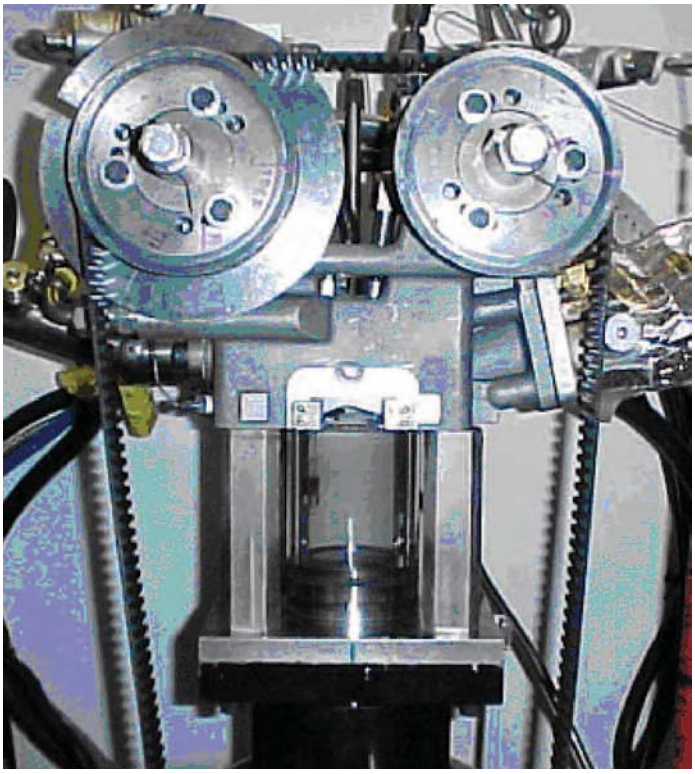
The technique, using laser-induced fluorescence (LIF) with a biacetyl tracer, has the capability to image 12,000 frames per second for 400 to 500 engine cycles (at speeds of 2,000 RPM). Their work allows for the observation of critical engine processes such as fuel injection, ignition and combustion—which occur in micro- and milliseconds—at sub-millimeter resolution.

LIF techniques have been used for more than a decade to track fuel distribution in internal combustion engines and other combustion devices. But these techniques can only acquire images on the order of a few frames per second, a frequency slower than many of the phenomena of interest. Improvements have been made that increase frame speeds, but these advances are still limited by the need to pause to read camera chips and/or by the limited number of pulses emitted by lasers.

At U-M, the team used a CMOS (complementary metal oxide semiconductor) camera lens-coupled to an image intensifier and a frequency-tripled, diode-pumped Nd:YAG laser to excite the biacetyl fuel tracer to track the fuel plume. Biacetyl was chosen because its evaporation characteristics are similar to those of gasoline and because it does not change the way the fuel burns, explained Smith. But the main reason for choosing biacetyl, he said, was for its photo-physical properties. "We needed a tracer that could be 'illuminated' by the ultraviolet light produced by our high-speed laser. The normal selection of tracers is not sensitive to light at this wavelength. So far, our measurements show promise that this biacetyl imaging setup can provide quantitative gas-phase equivalence ratio measurement at kHz rates, which is very significant."

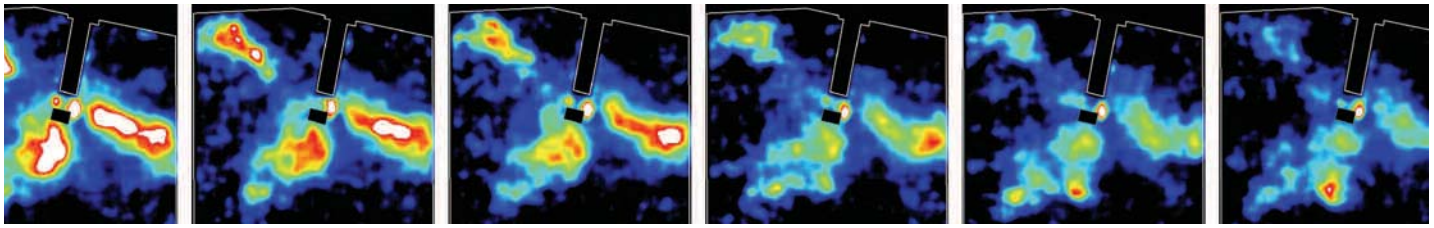
With their novel approach, the group has been able to observe changes from engine cycle to engine cycle resulting from, for instance, exhaust gas remaining in the cylinder or when fuel hits the spark plug at the wrong angle and doesn't ignite. The technique has application in the area of engine performance optimization in terms of fuel economy, emissions and driver experience and perception. In addition the team, which includes Aerospace Engineering Professor James Driscoll and ME Professor Steven Ceccio, will look to apply the method to supersonic combustion engines and for improving understanding of cavitation phenomena.

"We know it works," said Sick. "Now we just have to refine the technique. We need more signal to improve optical quality and we have to investigate what happens to fluorescence that's emitted at high temperatures and pressures in order to better quantify it. We also would like to evaluate different tracers. With the improvements we envision, we'll also be able to get good benchmarking data for validating CFD (computational fluid dynamics) models that others in the department are working on."



Optical direct-injection engine for advanced imaging studies.

The project was funded by General Motors Corporation. The laser, provided by the Air Force Office for Scientific Research, was made available by Professors Driscoll and Ceccio.



A fuel jet impinges on the spark plug electrodes. Crank-angle resolved LIF images show the fuel dispersion and mixing process.

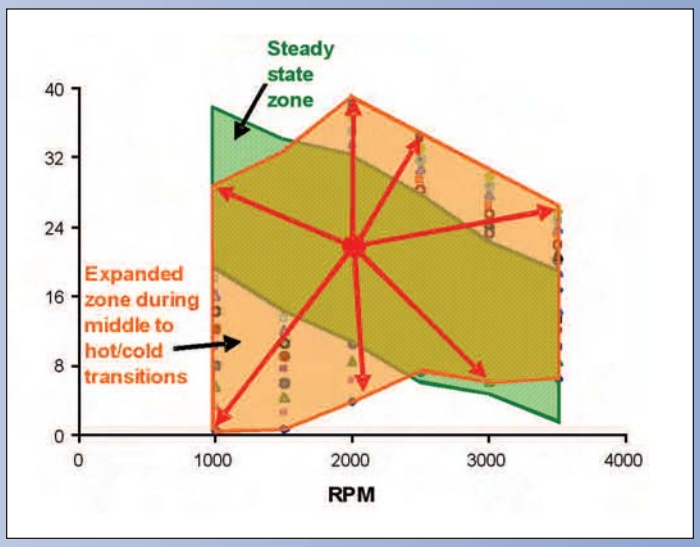
Low Temperature Combustion Consortium: Paving the Road to Clean and Efficient Engines

A new university consortium, funded by DOE and led by U-M, will begin in 2006 and will focus on Low Temperature Combustion (LTC). The LTC concept is utilized in Homogeneous Charge Compression Ignition (HCCI) and Partially Premixed Compression Ignition (PPCI) engines, and allows for dramatic engine-out emissions reduction while maintaining or improving current fuel economy.

Under LTC conditions, combustion occurs by auto-ignition at low temperature, resulting in ultra-low NOx and soot emissions for both diesel and gasoline applications. Moreover, ultra-lean mixtures and high compression ratio can provide diesel-like fuel economy with gasoline fuel. To date, LTC has been feasible only in a relatively small mid-load operating region. Operation outside this region has been hindered by control, stability, and harshness issues, thus limiting the practical benefits of this technology.

The objective of researchers at U-M and partner schools MIT, Stanford, and the University of California at Berkeley, is to investigate the fundamental processes determining the boundaries of LTC and develop methods to extend those boundaries to further take advantage of the LTC characteristics. The approach will include state-of-the-art experimental work in all partner schools, as well as a full array of modeling techniques, ranging from engine system level simulations to detailed chemistry and fluid dynamics models. Studies will focus on a number of promising enablers for real-life implementation of LTC to production vehicles, such as advanced fuel injection and boosting strategies, thermal management, and alternative fuels.

Graduate student Brad Zigler, Research Fellow Dr. Aris Babajimopoulos, and Professor Margaret Wooldridge discuss application of the near-infrared spectroscopy for diagnostics in an optical HCCI engine.



Initial work at U-M revealed that combustion chamber wall temperature has a large effect on HCCI combustion limits. This performance map shows augmented HCCI range during transient operation (orange) from an initial medium load point (red circle) to other speed load conditions, while the green area shows the steady state operating range. Normal changes of wall temperature that occur during driving can shift the boundaries significantly and will have to be part of a successful implementation of technology.

This work will be the continuation of the U-M led HCCI consortium, now in its fourth and final year. In the past three years, an enormous amount of knowledge has been gained about this novel, high fuel economy engine concept. In particular, two of the key challenges of the HCCI concept, namely practical control of combustion timing and limited operating range, are being effectively addressed. U-M researchers and their partners have demonstrated successful control of HCCI engines on several test beds as well as with model simulations and control algorithms. At the same time, modeling work has shown the importance of thermal management in extending the HCCI operating range.

Furthermore, shock tube and rapid compression machine experiments provided valuable insight into combustion kinetics and supported the development of advanced physics-based models.

The new LTC consortium will capitalize on the experience and knowledge gained during the previous HCCI consortium. Past interactions have already established effective and efficient methods for data exchange and integration of results. The U-M led LTC team is now poised to make rapid progress towards realizing the full potential of the LTC concept.

U-M President Mary Sue Coleman at SJTU signing the joint institute agreement.

S.M. Wu Manufacturing Research Center Launches Three Initiatives

Three major initiatives were launched during the 2004-2005 academic year, in addition to numerous other activities, according to Professor Jun Ni, who directs the S.M. Wu Manufacturing Research Center.

Under a $6 million National Institute of Standards and Technology Advanced Technology Program grant, Principal Investigator Ni and co-principal investigator Associate Professor Albert Shih are working with industry partners to develop rapid ultra-precision direct metal deposition techniques. Researchers at U-M are specifically responsible for developing control strategies for machine accuracy and for thermal drift. They are also developing a dry Electrical Discharge Machining (EDM) process to perform finishing operations for dies and molds.

In Phase II of a DARPA-funded program, Wu Center researchers are working with Powerix Technologies, LLC, of Ann Arbor on MICSE-based (Micro Internal Combustion Swing Engines) portable power generation systems. The team is addressing specific challenges, particularly micro and mesoscale manufacturing of miniaturized features required by MICSE systems and strategies for onboard engine control.

Under a grant from the Semiconductor Research Corporation, a university research management consortium, researchers are developing predictive modeling and intelligent maintenance tools for high-yield, next-generation fabrication, including both station-level and end-of-line level yield optimization. The Wu Center is working with Intel, Advanced Micro Devices, Inc., and Taiwan Semiconductor Manufacturing Company Limited on this project.

Fuel cell manufacturing work at the center continues and is focused on four main areas of manufacturing for energy applications: bipolar plates, stack assembly, metrology and system performance. The goal is to reduce the costs of manufacturing since associated expenses have been the bottleneck to widespread adoption of these technologies for alternative energy and other applications.

The center also co-organized the sixth biennial Wu Symposium U-M & International Conference on the Frontiers of Design and Manufacturing with Xi'an Jiao Tong University in Xi'an, China. More than 650 representatives from industry, academia and government attended Asia's largest manufacturing conference. Numerous U-M faculty and students participated.

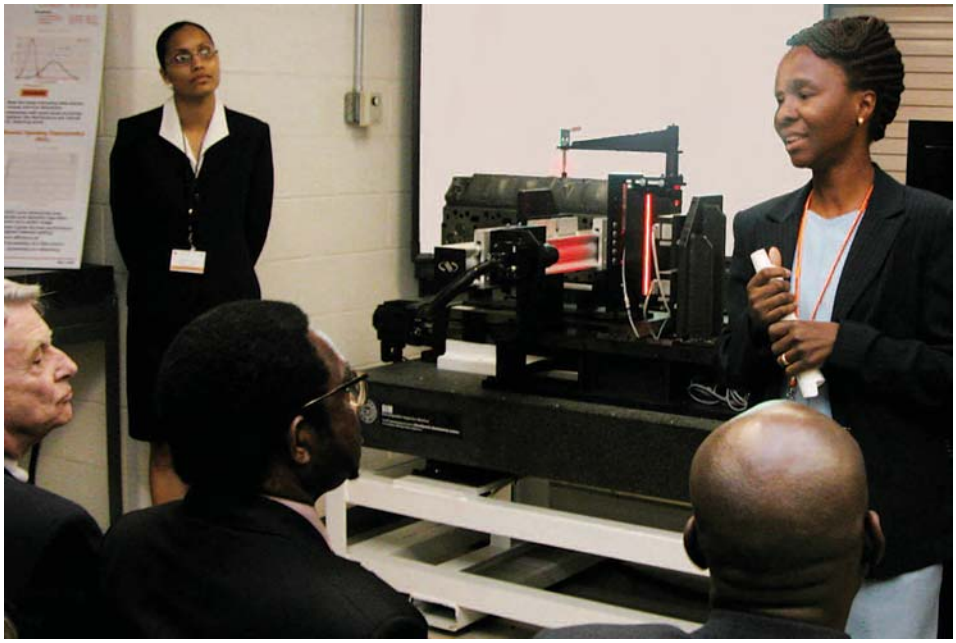
Under the sponsorship of U-M's Office of Vice Provost, Ni also led a group of 16 U-M undergraduate students to Shanghai, China, as part of the Global Intercultural Experience for Undergraduates (GIEU). Through benchmarking various multinational corporations, state-owned enterprises and private companies, the students gained an in-depth knowledge of the culture, society and issues related to operating a global engineering firm in China. Recently, U-M President Mary Sue Coleman and Shanghai Jiao Tong University (SJTU) President Sheng-wu Xie finalized an agreement with SJTU for a Joint Institute that will manage and direct degree-granting programs offered by both universities to students of both countries. In addition to U-M's Department of Mechanical Engineering, other engineering disciplines and other colleges within the University will participate. "The new entity will serve as a base for U-M students to gain global experience and for faculty to explore new research frontiers," said Ni.

Finally, the center is organizing an inaugural manufacturing science and engineering conference for the American Society of Mechanical Engineers Manufacturing Engineering Division to take place in Ann Arbor in October 2006.

"It's definitely been a busy and productive year," said Ni. "And we're looking forward to making even greater strides toward our research objectives and in our collaborations with industry and university partners in the coming year."

ERC-RMS Disseminates its Pioneer Research and Makes Strong Impact

Reconfigurable Manufacturing Systems (RMS) is a relatively new research discipline, introduced by the NSF Engineering Research Center for RMS at U-M. Within just a few years, it has emerged as an important research topic supported by research grants in Europe, Canada, Japan and China. The past academic year has been filled with success stories for the ERC-RMS which saw the fruits of its research efforts disseminated to many global partners from industry, government and academia.



Arlene Cole-Rhodes (right) presents joint research to the 2005 Site Visit Review team as Donna Robertson assists.

In May 2005, the ERC hosted at U-M the 3rd International Conference on Reconfigurable Manufacturing, an event sponsored by the Paris-based International Institute for Production Engineering Research (CIRP), which attracted over 180 attendees from 17 countries around the world. Professor Yoram Koren, director of the ERC-RMS, opened the conference plenary session with an address on reconfigurable manufacturing systems that highlighted not only the characteristics and applications of these systems but their increasing role in the competitiveness of manufacturing organizations.

Roman Krygier, group vice president for Global Manufacturing and Quality at Ford Motor Company, delivered the primary keynote address during which he outlined the company's powertrain manufacturing strategy. The strategy includes the 'commonization' of equipment and processes — and strong leadership from top management. The ERC-RMS has had impact on efficiency at the Ford Windsor Engine Plant, according to Krygier. "Working with the University of Michigan ERC, we were able to apply the Streams of Variation Methodologies. This research helped us understand and confirm the linkage of features and characteristics. Based on U-M analysis results, we have changed our coordinate measuring machine gauging strategy to measure only representative features. This has led to a 60 percent reduction in measurements through the first three operations, with only a 4 percent loss of data."

Other conference highlights included sessions that addressed topics in RMS applications, business models, system design, controls and ramp-up. Participants presented more than 80 research papers in 18 sessions and sparked passionate discussions. "Panel discussions were excellent examples of interactions between universities, government labs and industry," said Pulak Bandyopadhyay, research & development manager at General Motors Research Center. "We're fortunate that NSF had the foresight to support the RMS vision 10 years ago."

In May 2005, the ERC-RMS also co-sponsored a symposium on "Mass Customization: Keys to Competitiveness in Textile-Based Industries." The two-day event was the result of a collaborative effort among the ERC-RMS, the Textile Research & Training Institute at Eastern Michigan University and the Department of Management of Grand Valley State University.

The focus of the conference, conceived by Zbigniew Pasek, former ERC operations manager and associate research scientist, was to engage industries indigenous to Michigan that rely on textiles in their final products and connect them with university researchers. The symposium was "especially crucial for our state — Michigan leads the country in the automotive industry, is second in furniture and in the top ten in apparel," according to Julie Becker, director of the Textiles Research and Training Institute.

The ERC-RMS is reviewed annually by a site visit team composed of 10 reviewers from industry, academia and the NSF. The outstanding ERC research efforts for the year culminated in a successful NSF site visit in May 2005, which for the first time in NSF history was held at the site of an ERC partner, Morgan State University (MSU), a HBCU (historically black colleges and

Ford Motor Company Group Vice President Roman Krygier speaking at the RMS conference.

universities) institution, which graduates the largest percentage of industrial engineers in the state of Maryland. The collaboration with U-M's ERC-RMS has been in place since 2003 and is based on complementary long-term goals. The partnership is transforming MSU, a primarily undergraduate teaching institution, into a teaching- and research-focused university; and it has allowed ERC to transfer some of its technologies and educational materials for adoption in MSU undergraduate curricula.

Two projects were selected for technical demonstrations during the visit: the Reconfigurable Factory Testbed (RFT) and Reconfigurable Inspection Machine (RIM). The RFT demonstration involved two labs at MSU and U-M connected via the Internet, jointly executing a manufacturing process. Teams on each end worked closely: Associate Professor Dawn Tilbury led the U-M group, including Associate Research Scientist James Moyne and Assistant Research Scientist Jonathan Luntz. Hargrove led the MSU team; former Associate Research Scientist Zbigniew Pasek coordinated the U-M team.

The RIM demonstration relied on a portable prototype machine developed at U-M under Reuven Katz, associate research scientist and chief engineer at the ERC-RMS. The machine was moved to MSU so students there could more readily explain their work, done under the guidance of Arlene Cole-Rhodes, a professor of Electrical Engineering (see photo on facing page). U-M post-doctoral research fellows Gil Abramovitch and Pat Spicer and their students ensured that the complex equipment worked without a glitch.

The immense joint effort paid off. "It is to the credit of the ERC-RMS that the University of Michigan and Morgan State University have developed an impressive and truly partnered relationship. Through the use of Internet/communication technologies a well-coordinated agenda was executed during this visit," states the NSF site visit report. And MSU students gained so much confidence from the experience that they asked, "When are we doing the next one?" The enthusiasm the U-M faculty took to Baltimore inspired eight more MSU students — there are 16 now at U-M — to express interest in reconfigurable manufacturing. This site visit was so successful that NSF decided to cancel the 2006 site visit "due to the favorable reviews the ERC-RMS received at the 2005 site visit."

New Center for Precision Forming Attracts Strong Industry Interest

The University of Michigan and Ohio State University have formed the Center for Precision Forming, a National Science Foundation Industry/University Cooperative Research Center. The center will conduct scientifically challenging and industrially relevant research to develop innovative, cost-effective and environmentally friendly metal forming processes, tooling and equipment.

At a planning meeting held in March 2005, representatives from automotive, aerospace, heavy truck, electronics and medical device sectors expressed strong interest in working with the center. Companies in attendance included General Motors, General Electric Company, Toyota, DaimlerChrysler, Nissan, Kia, Boeing, The Timken Company, Dana Corporation, Delphi, Flextronics Corporation, Ladish Co., Inc., and International Truck and Engine Corporation, among others.

"With increasing competition from overseas, U.S.-based manufacturers want to increase their competitiveness with innovation and low-cost products," said Muammer Koç, ME assistant research scientist and co-director of the center with Ohio State University Professor Taylan Altan. "In order to do this efficiently, companies from different sectors are looking for ways to leverage their know-how and investment. The interest shown by these companies in the center is due to its strong research program, which offers near-term applied results to member companies, with their early input and intensive involvement."

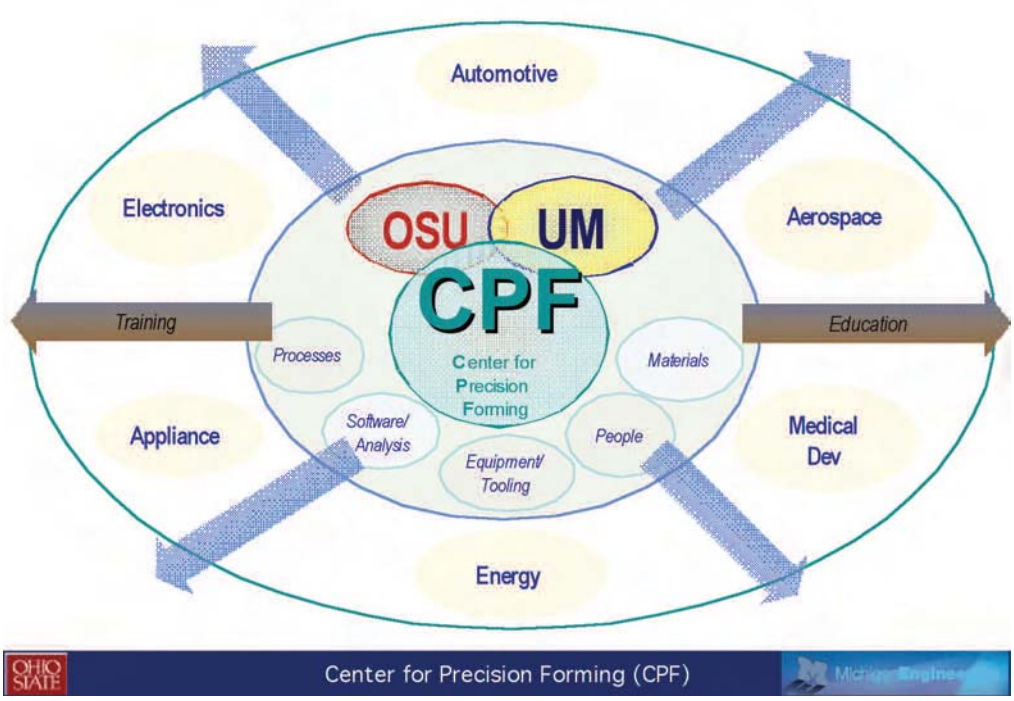
Research areas include: testing and modeling of advanced materials; tribology issues in advanced forming processes; innovative forming process technologies such as electromagnetic forming, hydroforming, warm forming and microforming; and fabrication techniques and issues in manufacturing of functional structured surfaces for fuel cells, micro-reactors, and medical devices.

Collaborating U-M faculty members include Koç and ME Professors Jun Ni, Noboru Kikuchi and Jack Hu. Ohio State University colleagues include Professors Altan, Gary Kinzel and Glen Daehn.

Both universities are well-suited for the joint venture: Ohio State has housed the Engineering Research Center for Net Shape Manufacturing for more than 15 years; U-M houses large and concentrated manufacturing research initiatives in forming, precision machining, machine tools, metrology and process controls under the auspices of the S.M. Wu Manufacturing Research Center, the NSF Engineering Research Center for Reconfigurable Manufacturing Systems, the Dimensional Control & Measurement Center and Center for Intelligent Maintenance Systems. Faculty and facilities of these centers are also available to the Center for Precision Forming.

The first set of research projects will begin in fall 2005, with the center's official launch scheduled for January 2006.

National Science Foundation Industry/University Cooperative Research Centers are intended to develop long-term partnerships among industry, academia and government. More information on the Center for Precision Forming can be found at http://www.cpforming.org.



The Center for Precision Forming is expected to be launched in January 2006. Research areas of the CPF will be (1) Testing and modeling of advanced materials, (2) Tribology issues in advanced forming processes, (3) Innovative forming process technologies such as electromagnetic forming, hydroforming, warm forming, microforming, etc., (4) Fabrication techniques and issues in manufacturing of functional structured surfaces for fuel cells, micro-reactors, and medical devices.

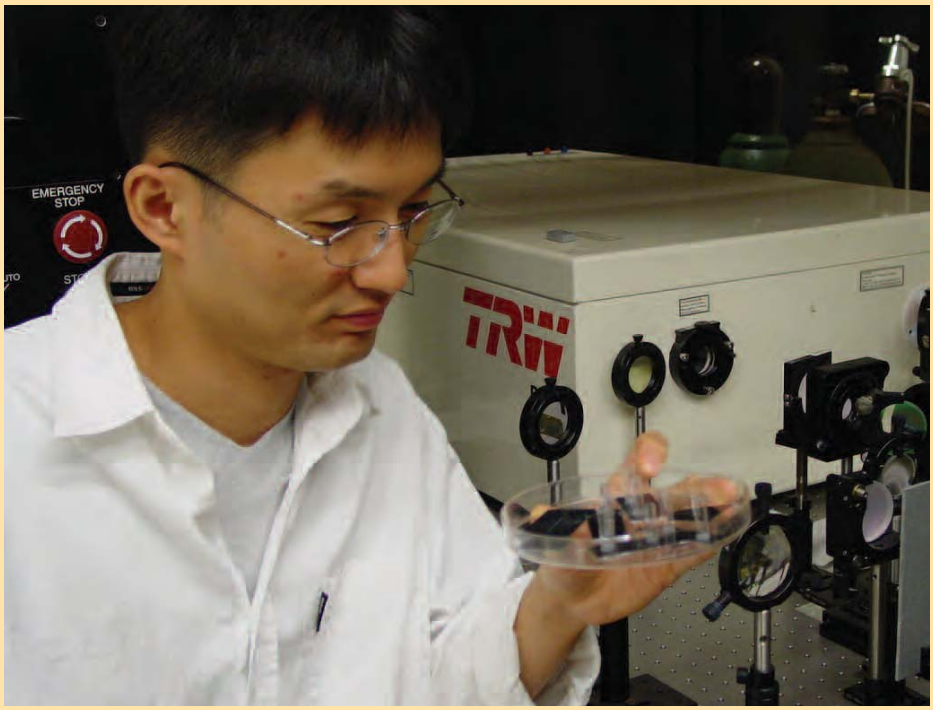
research

U-M Establishes Center for Lasers and Plasmas for Advanced Manufacturing

The U-M Center for Lasers and Plasmas for Advanced Manufacturing opened under the auspices of the Mechanical Engineering department in September 2004. Jyotirmoy Mazumder, Robert H. Lurie Professor of Engineering, serves as the center's first director. The center is funded by the National Science Foundation and industry partners, including General Electric Global Research, IMRA USA, Nuvonyx Inc., General Electric Transportation Group and Toyota Motor Manufacturing North America Inc. The center's focus is gaining a fundamental understanding of and applying lasers in manufacturing to reduce the time from concept to product. University of Virginia and Southern Methodist University are University partners.

According to Mazumder, work done at the center will establish a scientific base for laser material processing. Research projects will lead to the production of materials with novel properties and the development of efficient processing methods. Technology developed will be transferred through an incubator to avoid the need for heavy industry investment. In addition, the education of students and industry representatives about the latest technologies and the effects of globalization is a priority.

One ongoing project includes work to improve welding of galvanized steel, which "has been a problem for the auto industry for the last 60 years," said Mazumder. While some earlier studies carried out by General Motors indicate that laser welding galvanized steel can increase vehicle structural strength by 30 percent, it also creates problems. The low boiling point of zinc means it evaporates at the weld interface and results in high-porosity joints. "Until now, there hasn't been a production-friendly solution available," he said. An alloy based technique recently developed prevents induced porosity and maintains the weld's anti-corrosion properties. Researchers also have developed a spectroscopic sensor to monitor the quality of the laser welds. "Any company that uses this system now has a fool-proof method," said Mazumder.



Graduate student Dong Hyuck Kam examining the Nd:YAG laser micromachined samples for microfluidic testing.

A second project involves the manufacture of nanocrystalline surfaces of various metals by high brightness diode-pumped Nd-YAG lasers by rapid melt and quench technique. The one of a kind, high brightness, diode pumped Nd-YAG laser was developed under a project funded by the DARPA. The work, which includes experimentally quantifying the microstructure of various materials to understand the catalytic effect on the gas phase using detailed chemistry models, is headed by Professor Arvind Atreya. Applications include improved combustion of hydrogen and have implications for rocket design.

Also in development, in conjunction with industry partner General Electric Aircraft Engines, is a single crystal super alloy thin film coating for aircraft blades. The single crystal nickel superalloy, comprised of ten elements, prevents mechanical failure known as creep, or slippage between grain boundaries. Researchers are working to understand the atomic-level interactions and ideal parameters for achieving a single crystal.

With industry partner IMRA America Inc., scientists are developing a process for one-step laser microfabrication of vascular networks. The process includes Nd:YAG lasers for rough machining with a femto-second laser for fine machining of 3-D channels. Researchers from the Medical School and Department of Biomedical Engineering are incorporating the process into their work on an artificial lung.

Mazumder is extremely pleased with the progress the center has made in its first year. He hopes to continue adding new industry partners and to increase awareness of the benefits of laser technology among U.S. manufacturers. "If you're stamping a steel part, you need a special tool. If you're using lasers, you just need to change the programming. They exhibit amiability for computerization and for interfacing with robots. The tool life is infinity — there's nothing to wear down."

Rod Theory Sheds Light on DNA Supercoiling

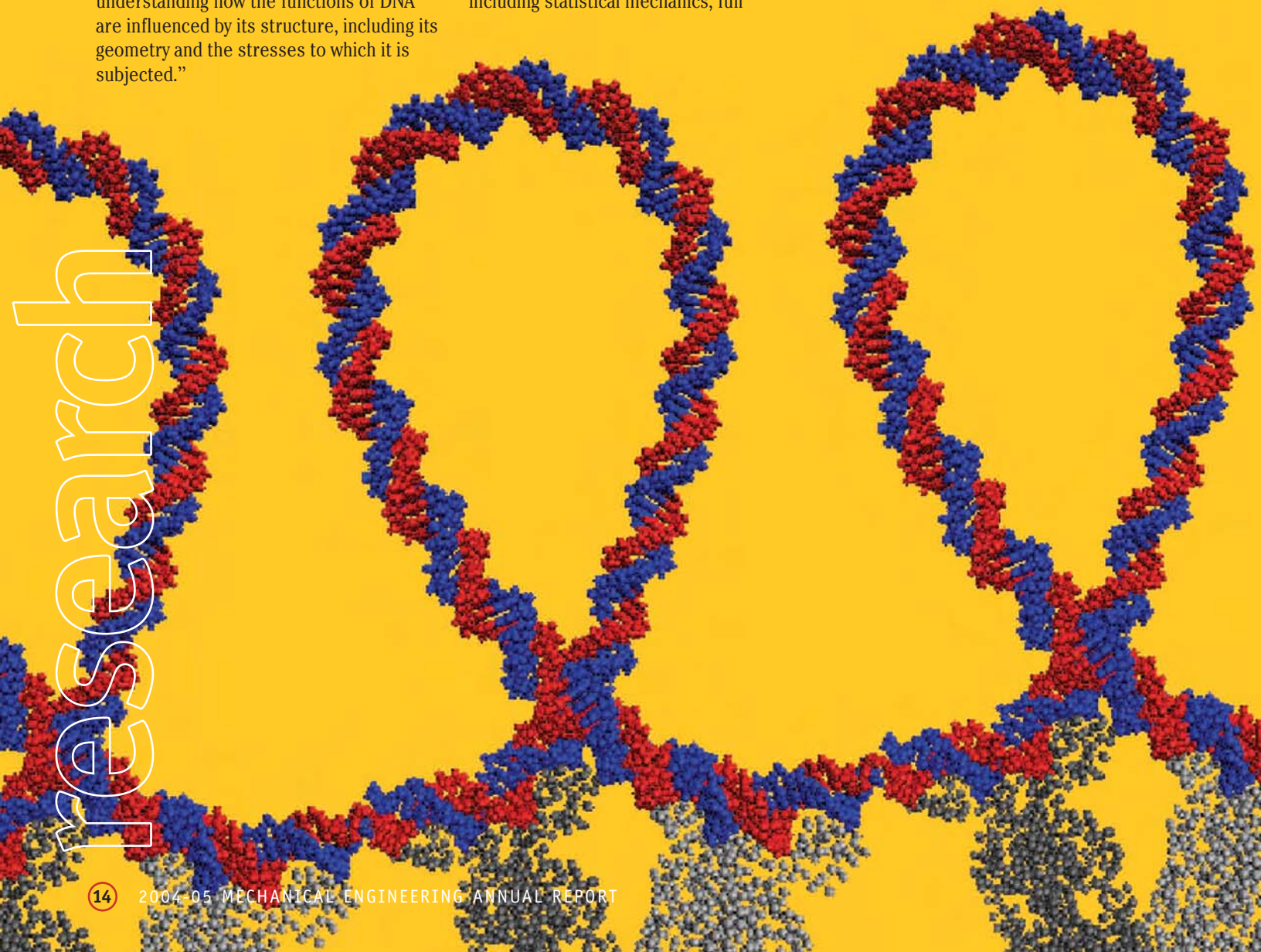
Without DNA, or deoxyribonucleic acid, life as we know it would not exist.

The long chain biopolymer molecule that's packed into the nuclei of our cells is responsible for providing blueprints to cells for the manufacture of essential proteins through a process called transcription. DNA also transfers these blueprints from one cellular generation to the next ensuring our survival through a process known as replication.

How this all happens is as much a mechanical process as a chemical one, explained Professor Noel Perkins, "and molecular biologists wrestle with understanding how the functions of DNA are influenced by its structure, including its geometry and the stresses to which it is subjected."

Perkins and ME Associate Professor Edgar Meyhöfer, along with doctoral students Sachin Goyal and Todd Lillian, are using rod theory to understand the mechanics of DNA on long-length scales, that is, between one helical turn — about three nanometers — to the millimeter scale. They also collaborate with research groups from biophysics (Professors Chris Meiners and Alexei Tkachenko and doctoral students Seth Blumberg and David Oros), biochemistry (Professor Ioan Andricioaei and doctoral student Jeff Wereszczynski) and cellular and molecular biology (doctoral student Troy Lionberger), who are employing complementary methods including statistical mechanics, full molecular dynamics, and experimental techniques for exploring the mechanics of single molecule DNA.

At these scales, strands of DNA form loops and supercoils. Supercoiling allows for an organized means of compacting DNA molecules — by as much as 10^5 — so that they fit within the cell nucleus. Supercoiling also plays key roles in transcription and replication. For example, the formation of simple loops of DNA on long-length scales is known to regulate the expression of certain genes. Likewise, the winding of DNA on spool-like proteins (histones) leads to an organized compaction of the molecule.



research

Results from early collaboration with Lawrence Livermore National Laboratories illustrating the evolution of an interwound supercoil (a plectoneme) under slowly increasing twist applied at left end.

Supercoiling also induces stresses in the molecule that may help initiate transcription and replication at specific sites along the molecule.

Using the rod models, multiple effects at long-length scales can be captured, including: large deformations and rotations of the molecule; base-pair or 'sequence-dependent' mechanical properties; electrostatic 'self-contact' and interwinding; and dissipation and thermal excitation from the aqueous environment.

To date the team has modeled how an interwound supercoil may evolve and the bifurcations it experiences through a build up of twist. More recently, the group has created a computational model to describe the DNA looping that occurs in a well-known experimental model system for gene regulation, the bacterial lac operon of *E. coli*. In the lac operon transcription of several contiguous genes that encode key enzymes and transport proteins for the metabolism of lactose is regulated by the lac repressor protein. The repressor is a tetrameric protein that functions as a genetic switch by binding to two specific DNA binding sites (operator sites) just upstream of the structural genes. Repressor binding forces the flexible DNA strand into a tight loop with a radius of about 10 nm, and thereby prevents transcription of the lac structural genes. However, the presence of lactose in *E. coli's* medium leads to the creation of allulactose (a side product of the metabolism of lactose), which induces transcription of the lac operon by binding to the repressor protein and dissociating it from the operator sites.

"The lac-repressor protein acts as a biological 'switch.' In the absence of lactose it turns the process off, but if lactose is available as energy the required enzymes can be generated within a couple of minutes," explains Meyhöfer. Perkins adds, "Our work demonstrates that rod theory is well-suited to model the looping process, in particular the energetics, and quantitatively predicts and confirms previous mutational analysis of this system. Knowing how much energy it takes to form this loop in turn will enable molecular biologists to better understand both the likelihood and stability of this fundamental gene regulation mechanism."

The work was initially sponsored by Lawrence Livermore National Laboratory; more recently funding has come from the National Science Foundation. There are several major next steps to pursue, said Perkins. One is to explore the dynamics of these molecules experimentally in Meyhöfer's lab by dynamically manipulating single DNA molecules using laser traps. Another is to construct true multi-scale models of DNA by knitting together the methods from molecular dynamics, rod theory and statistical mechanics. Efforts in these and other directions are currently underway.

"Our work demonstrates that rod theory is well-suited to model the looping process, in particular the energetics, and quantitatively predicts and confirms previous mutational analysis of this system."

Predicted loop of DNA caused by binding to the lac repressor protein (shaded in grey). Rod theory is used to predict the energy and topology of the loop which cannot yet be studied by existing experimental methods.

Nature Inspires MEMS Cochlea

When it comes to modeling complex phenomena, nature may make the best instructor. Associate Professor Karl Grosh and recent graduate Robert White (Ph.D. '05), along with graduate students Lei Cheng and Robert Littrell, have built a micromachined hydromechanical model that mimics the cochlea in mammals.

Named for the Latin term meaning 'snail shell,' the spiral-shaped cochlea sits in the inner ear. Coiled, it's about the size of a pea; uncoiled, it stretches roughly 3.5 centimeters long and contains a complex structure of fluid filled ducts separated by membranes and populated by hair cells and other microstructures. The cochlea translates their vibrations into neural impulses, which the auditory nerve carries to the brain and we 'hear' as sound. With the capacity to separate audio signals into some 3,500 channels of frequency information, the cochlea is a highly sensitive real-time transducer. Grosh's efforts to build a cochlear analog sensor stemmed from his group's research aimed at understanding the biological cochlea.

Other research groups have been doing similar work, but Grosh and White's model is novel in the life-size dimensions achieved with a scalable microfabrication process.

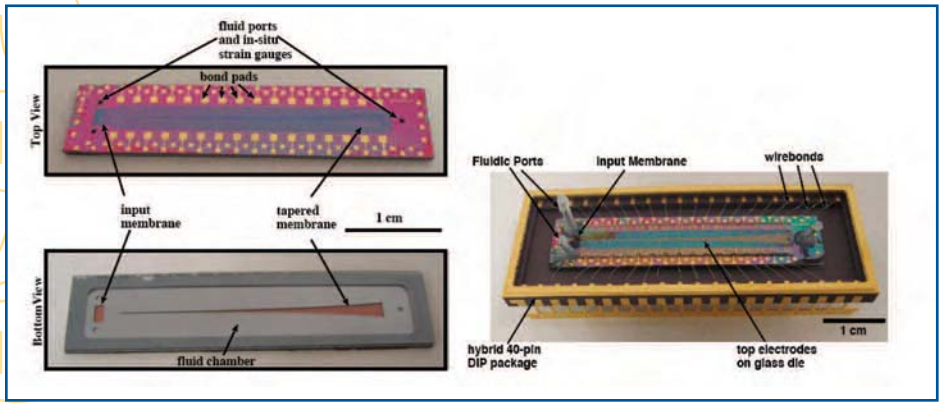
Grosh and White produced the silicon-and-glass model using MEMS fabrication techniques, including photolithography, deep reactive ion etching to define structures, and deposition and patterning of composite materials to create the membrane. The work was done at the Michigan Nanofabrication Facility, a College of Engineering lab. These procedures allow for the careful tailoring of the mechanical properties of the membranes and fluid-filled ducts necessary for proper function, mimicking the biological entity.

Near term applications for a device based on the model could include those for low-power signal processing, such as hydrophones to detect submarines, in unattended autonomous vehicles to reveal mines or other uses that require real-time frequency analysis with minimal hardware. Funding for the research has come from the U.S. Navy, National Science Foundation and U-M.

From left to right: Robert Littrell, Lei Cheng, Niranjan Deo, Dr. Sripriya Ramamoorthy, Prof. Karl Grosh, Dr. Xiao-Ai Jiang, and Professor Robert White.

The next step is to incorporate sensors and active feedback mechanisms. "Microfabrication opens up all kinds of possibilities for economically building more interesting structures," said White, who recently joined the Tufts University Department of Mechanical Engineering as an Assistant Professor (see related story, page 49). In the future, the device could also be incorporated into a cochlear implant that might overcome some of the limitations of available systems.

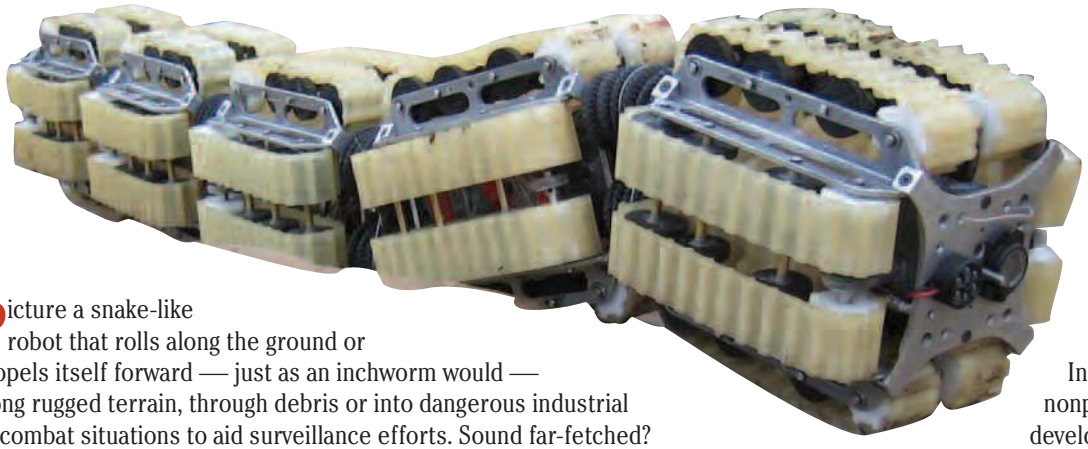
In the interim, there are still lessons to learn from nature's model. "I think it's been surprising not only to us but to all of the groups trying to do this," said Grosh, "how difficult it is to controllably fabricate a device that replicates what biology does so seemingly effortlessly."



Left: Components of the multichannel MEMS cochlea. Right: The packaged device.

research

Over, Under, Around and Through



Picture a snake-like robot that rolls along the ground or propels itself forward — just as an inchworm would — along rugged terrain, through debris or into dangerous industrial or combat situations to aid surveillance efforts. Sound far-fetched?

Research Professor Johann Borenstein and his team in the ME Mobile Robotics Lab have built such a robot. While his OmniTread Serpentine Robot is not the first serpentine robot, it does employ several novel technologies. His work has received wide media attention.

The OmniTread weighs 26 lbs. and includes five segments, each about eight inches long and almost completely covered by tracks, allowing the robot to be indifferent to roll-overs. The tracks also create propulsion wherever they touch the environment, especially useful in navigating rubble or dense underbrush.

Pneumatic bellows actuate the joints between segments, giving the OmniTread "tremendous force" there, explained Borenstein. It also allows complete control of the stiffness of each joint–maximum stiffness is best-suited for spanning wide gaps, while minimum stiffness allows the robot to conform to terrain. Conventional serpentine robot design incorporates electrically driven, rather than pneumatically actuated joints, and it's difficult, if not impossible, to control the stiffness in such joints during motion, he said. "If you can't control that, it's generally set to the maximum stiffness, but then it doesn't conform naturally to the terrain and has less traction and propulsion."

Using bellows instead of other pneumatic actuators makes optimal use of limited space. "Whether the bellows are fully expanded or compressed, they always fit exactly into the joint space. They change their shape in the same way the joint changes its shape. That leaves other spaces, like those within the segments, free for other components."

Yet another innovation is a single motor in the center segment that powers a central drive shaft spine and provides torque to all of the tracks. Having a single on-board motor, rather than one per segment as conventional designs do, optimizes weight distribution and reduces energy consumption.

During rigorous testing at the Southwest Research Institute, an independent nonprofit applied research and development organization, the OmniTread crossed railroad tracks and maneuvered rocky ground, dense grasses, an 18-inch curb, a two-foot trench and a flight of stairs.

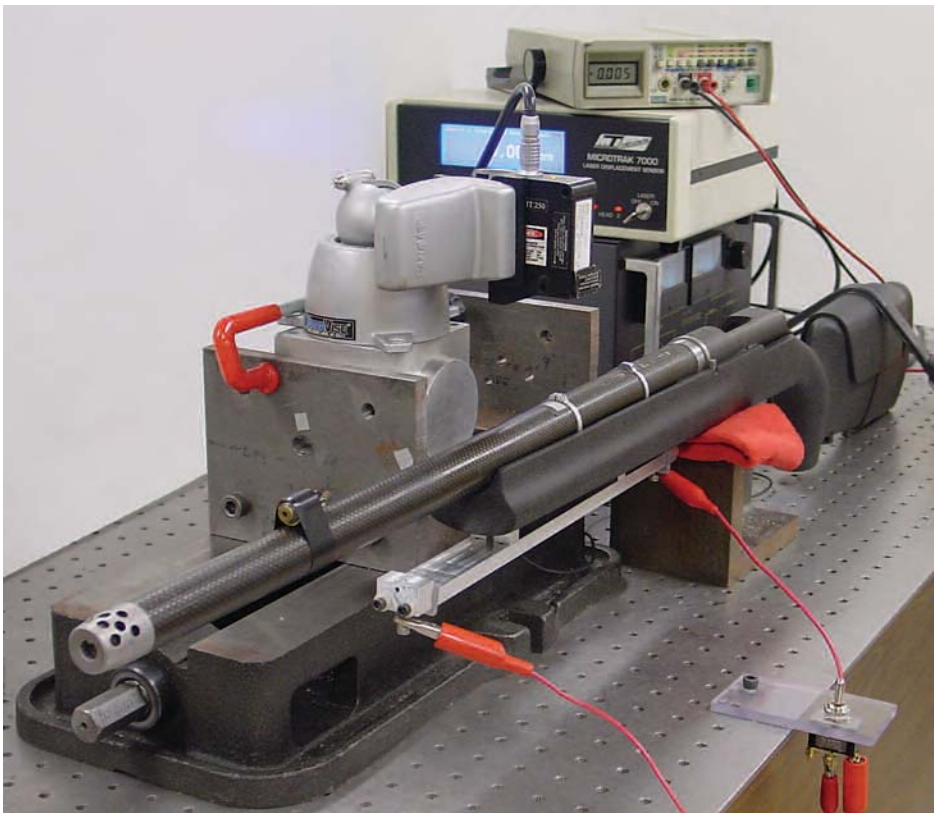
The current robot requires a tether for electric power and compressed air, but a new model in development will have wireless capabilities and on-board CO2 cartridges that provide pneumatic power. The OT-4 can pass through a four-inch diameter hole, in contrast to its predecessor, which can fit through one with a minimum diameter of eight inches. It can latch on to and travel along narrow linear objects, such as pipes or wires. It can also selectively disengage individual tracks from the drive shaft spine, saving power. Even with the improvements, it weighs significantly less.

The OmniTread serpentine robot is designed to traverse extremely difficult terrain, such as the rubble of a collapsed building. It can drive over sand and rocks, as well as pass through small holes and climb over tall obstacles.

DIANN BREI DESIGNS ACTUATOR FOR RIFLE STABILIZATION

Good marksmanship, particularly over long distances, requires skill, concentration and the ability to remain almost perfectly still. Even the slightest shooter-induced disturbance — rapid breathing, vibration caused by a racing pulse, fatigue, stress — coupled with urban combat settings that don't allow shooters the time to properly stabilize their bodies before taking aim, can cause soldiers to miss their mark.

Working with the U.S. Army at Picatinny Arsenal under a Defense Advanced Research Projects Agency program, Associate Professor Diann Brei led a national team (Penn State, Virginia Tech, TechnoSciences) that developed a piezoelectric actuator for a stabilization system to minimize shooter-induced movements known as jitter. The INertially STAbilized Rifle system, known as INSTAR, is comprised of an active suspension system, including power supply, controller, sensors and a piezoelectric actuator based on active compliant transmission, installed between the stock and barrel. INSTAR was designed for the M24 sniper rifle.



INertially STAbilized Rifle (INSTAR) demonstration article used in benchtop testing.

There were many challenges to designing the actuator. The system required high performance (large strokes, high forces, quick speed), while heavily constraining the weight, volume and power source. In response, the team designed a novel integrated amplification technique with regenerative power electronics. They successfully demonstrated a proof-of-concept INSTAR system with potential to raise the shooter accuracy a full qualification level.

This innovative work led to a Small Business Innovation Research program grant from the U.S. Army and conducted in collaboration with Techno-Sciences, Inc., to design a similar system using shape memory alloys (SMAs) to address the Army's concerns about the brittleness of ceramics, since rifles are used in ways other than shooting, for instance to break down a door with the butt.

Though SMAs provide high forces and strokes and are very reliable in adverse environments, they tend to be slow, Brei explained. It is also hard to achieve proportional control, and performance degrades over cycles, a problem referred to by materials scientists as 'creep.' Brei's team, ME Assistant Research Scientist Jonathan Luntz and graduate student Brian Barnes, devised methodologies to resolve these issues: a conditioning process that reduced creep from the typical 50 to 70 percent down to less than one percent; encasing the actuator in a thermal cooler and finding a unique duty cycle with partial transitioning, which increased the speed to the required ten-hertz range.

Her team has recently received Phase II funding to build a working demonstration system based upon the SMA actuation for a more widely used rifle. She expects that once in use, both systems will improve soldier survival rates and accuracy, reduce ammunition requirements, cost and logistics burdens and reduce the time needed for infantry training.

A Better Fly Cast

Professor Noel Perkins was selected for the 2005 Academic Challenge Award for his MEMS-based Fly Casting Coach/Analyzer. The award was sponsored by the Technical University of Munich and ISPO, an international sports equipment exposition.

Professor Noel Perkins with partner Bruce Richards casting a 'long' line on a warm Michigan day. Notice the large loop of flyline set against a brilliant sky.

Preliminary research work on the Flycasting Coach/Analyzer began about four years ago when, not surprisingly, Perkins took up fly fishing. "Casting is where the bottleneck lies in this sport," said Perkins, who experienced firsthand the all-too-common problems of tailing loops, which entangle the line, and rod creep, which results from inadvertently moving the rod between forward and back casts. Learning to cast became "a bit of an addiction," he said, "especially for a dynamicist like myself."

To perfect their casting technique fly fishers typically take lessons or courses, where they have an instructor watch, and even video record, the rod and line as they cast. "But those methods are qualitative and a bit subjective." In response, he and his student Caroline Gatti-Bono (Ph.D. ME, 2002) did computational work trying to model fly casting, "but we needed to know the boundary conditions in order to be able to do that." So they utilized a MEMS rate gyro mounted on a fly rod to measure the angular velocity of the rod in the plane of the cast. The angular velocity of the fly rod represents approximately 90% of the input given to the rod by the fly caster.

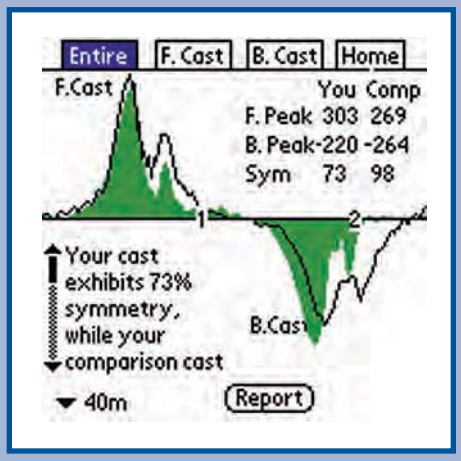
This signal, known as the fly casting 'signature,' was captured and stored on a hand-held computer (PDA) using a miniature A/D converter that communicated through the PDA hotsync cable. To accompany the hardware, the team including recent ME graduate Chris Joseph and Bruce Richards of Scientific Anglers, created a companion software application, CastAbility, compatible with devices running Palm OS.

The software records and analyzes the casting signature by comparing it with those of expert casters. Their research studies of casting signatures have revealed key metrics that distinguish skill levels and identify common problems, explained Perkins. The software automatically evaluates these metrics and provides instantaneous feedback and customized instruction to the fly caster on the PDA. "Now you can break the cast down into discrete parts and separately hone one skill before moving on to the next. It's a systematic way of evaluating and learning."

A MEMS angular rate gyro housed in a capsule. The capsule attaches to the bottom of the fly rod.

The Academic Challenge Award carries with it a €2,500 prize, and Perkins was invited to present the Flycasting Coach/Analyzer at the ISPO February 2005 trade show in Munich. His fly casting demonstrations received overwhelmingly positive reactions from novice and world-renowned fly casters alike. The system has received wide coverage in trade, consumer and news media.

A patent is pending for the system, which will go into production this fall as a partnership between the new company,



Graph showing the comparison between a intermediate and an expert fly caster.

CastAnalysis started by Perkins and Richards, and Sage Manufacturing, an industry-leading manufacturer of fly rods. Perkins has commercial partners who represent other sporting industries too, including golf, baseball and hockey. In particular, his doctoral student Kevin King is advancing their wireless six degrees-of-freedom system for measuring golf swings. Firms manufacturing water skiing and rowing equipment have also expressed interest. "Giving this instrument to an instructor, coach or student for any of these sports is like giving a carpenter a tape measure," he said. "Now you have something in your hand to quantify what you're trying to achieve during practice."

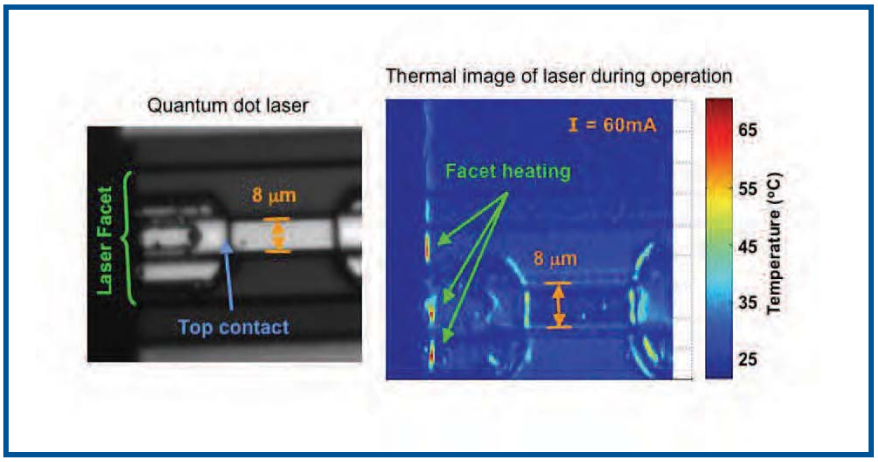
Kevin Pipe Explores Nano-Scale Thermal Physics

During his first 18 months at U-M, Assistant Professor Kevin Pipe has already undertaken several important research projects and multi-disciplinary collaborations. In addition to teaching ME 235, Thermodynamics, and ME 631, Statistical Thermodynamics, Pipe conducts research in the area of micro and nanoscale thermal physics. His work focuses on heat transfer inside electronics and optoelectronic devices such as transistors, semiconductors and lasers in order to improve their reliability and performance. Some of his other research interests include thermoelectrics and nanoscale energy transport in inorganic and organic devices.

For a project funded by the Defense Advanced Research Projects Agency, he has worked with Professor Pallab Bhattacharya of Electrical Engineering and Computer Science to fabricate and operate the first room-temperature InGaAs quantum dot lasers on a silicon substrate. Self-organized quantum dot lasers hold promise for high performance, reliable electrically-injected light sources in a CMOS-compatible processes, as evidenced by a June 2005 paper in *Electronics Letters*.

With Assistant Professor Max Shtein of Materials Science and Engineering, he has been working on energy transfer in inorganic/organic hybrid composites for high-efficiency photovoltaics and nanoscale organic light emitters. The Office of Naval Research and the National Science Foundation are funding this work.

He is also looking at quantum dot superlattices for thermoelectrics applications, including microscale cooling and power generation. The National Science Foundation is funding the work, and Associate Professor Rachel Goldman of Materials Science and Engineering is collaborating.



In conjunction with the Massachusetts Institute of Technology Lincoln Laboratory, Pipe is also exploring heat transfer and thermal management in high-power semiconductor lasers in order to improve efficiency for long-distance communications. In work presented at the 2005 International Mechanical Engineering Congress & Exposition, researchers in his group used microscale temperature measurements to examine the mechanism that leads to catastrophic optical damage in lasers by profiling — for the first time — the spatial variation of current density injection across the laser top contact surface as it varies in time.

With Associate Professor Albert Shih, he is working with a new class of lightweight material–graphite foam with a novel pore structure and ultra-high thermal conductivity. The foam was developed at Oak Ridge National Laboratory, and Pipe and Shih are applying it to the cooling of power electronics in automotive applications. The team is targeting the electronics systems of hybrid and fuel cell vehicles, which must incorporate effective heat spreaders into heat sink design to prevent hot spots and insure that silicon-based electronic components do not overheat.

Originally from Michigan, Pipe joined the U-M faculty in January 2004 after completing his undergraduate studies and earning his doctoral degree in electrical engineering from the Massachusetts Institute of Technology (2003). Of his time spent at U-M to date, he says "It's been great so far. I've been collaborating with a number of people in different departments and meeting people with quite varied research interests. It's been very productive."

research

From Lab to Museum

A design concept developed by Graduate Student Mohammed Shalaby and Associate Professor Kazuhiro Saitou will soon make its way into a museum exhibition at The Tech museum of Innovation in San Jose, California. The exhibit, entitled "Green by Design," focuses on designing products, buildings and cities to be sustainable right from their very start.

Eric Yuan, the museum's exhibit developer, came across Shalaby and Saitou's work on 'design for disassembly' (DFD) online, during his search for innovative recycling developments to feature in the exhibit.

Yuan found their work on DFD "easy to grasp but also very insightful," precisely what's needed for such an exhibit.

"Shouldn't products be designed to come apart just as easily as they come together?" he asked. "This seemed like an interesting challenge to present to museum visitors — how do you design a cell phone, for instance, that stays together during it's roughly two-year lifespan, but comes apart easily when you're ready to recycle it? To take it a step further, what if our products were intentionally designed to be recycled?"

One of the concepts featured in "Green by Design" will include a heat-reversible snap design, a conventional locator-snap system comprised of a catch and snap, developed under the sponsorship of Toyota Motor Company. Upon the application of heat at certain points, the fastener changes shape due to thermal expansion. This causes the snap and catch to disengage. In automobiles, heat-reversible snap design allows for vehicle components to maintain their strength and integrity during their useful life; afterward, it makes possible the easy detachment of internal frames and external panels without damage to either, and increases recyclability.

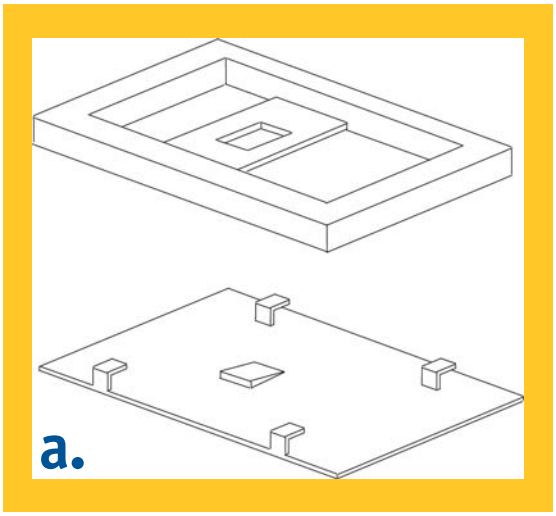
The design requires no special material, such as shape-memory alloys. In fact, the prototype Shalaby and Saitou provided to the museum is made of Plexiglas, which Shalaby purchased at a home improvement store. "The design only utilizes the thermal expansion and elastic deformation of materials, properties that exist in virtually any material. Plastics, however, are some of the best-suited given their relatively large thermal expansion ratio and low stiffness," Saitou said.

The museum currently is experimenting with the prototype to make it "rugged enough for the exhibit environment — sure, a product may be designed for a two-foot drop onto concrete, but can it withstand 400,000 kids a year for five years?" said Yuan. He expects that visitors will use a hair dryer to heat up a product utilizing the design and watch it come apart.

The exhibit will open in June 2006, and Saitou is excited about the "rare and ideal opportunity to disseminate university research to the general public." As to what he hopes visitors take away from the displays, "I hope they realize that designing eco-friendly products does not have to be complicated and that products designed with a few simple — but good — ideas can have a huge impact on our future environment when mass-produced."

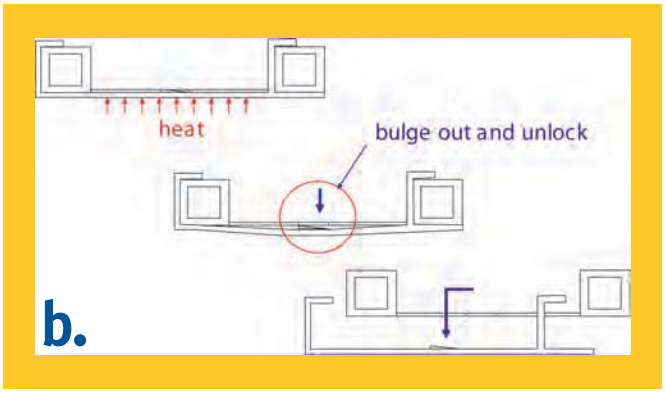
News of the inclusion of his work in "Green by Design" came to Saitou while he was on sabbatical. During the fall 2004 semester, he worked with colleagues at Delft University of Technology in the Netherlands to develop a computational method for rapidly generating alternative product shapes and evaluating their structural responses during conceptual design.

He spent the winter and spring 2005 semesters at Kyoto University in Japan working with colleagues on structural optimization for product development. Throughout the year he has presented seminars at numerous conferences and universities around the world.



(a) Design concept of heat-reversible snap joint.

(b) Its disassembly action.



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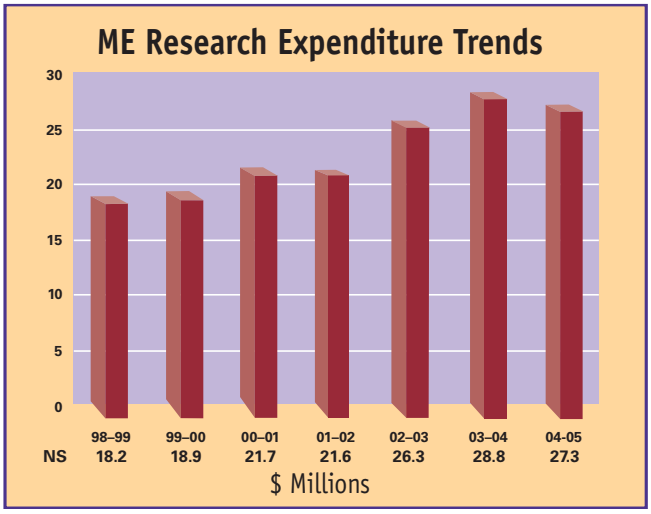
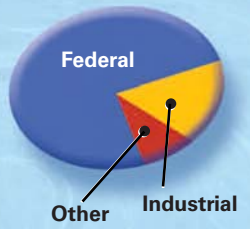
trends & expenditures



ME Research Expenditures



Distribution by Source
May 1, 2004–April 30, 2005

	%	$
Federal	71.20	19,419,315
Industrial	21.80	5,944,966
Other	7.00	1,909,182
	100.00%	**27,273,493**

ME Departmental Expenditures

Distribution by Source*
May 1, 2004–April 30, 2005

	%	$
Academic Support[1]	5.56	2,082,164
Instructional[2]	18.54	6,945,552
Scholarships and Fellowships	3.11	1,165,885
Research[3]	72.79	27,273,493
	100.00%	**37,467,094**

1 Funds used to support the academic mission of the department (infrastructure)
2 Funds used to support teaching and classroom activities
3 Funds from external (federal and industrial) and internal sources used for research support and generation

James R. Barber Named Thurnau Professor

James R. Barber, Professor of Mechanical Engineering and Applied Mechanics and Professor of Civil and Environmental Engineering, has been named a 2005 Arthur F. Thurnau Professor. This prestigious professorship recognizes and rewards faculty for outstanding contributions to undergraduate education.

Mr. Thurnau attended the University of Michigan from 1902 to 1904, and the professorship is now funded by the Thurnau Charitable Trust. Every year the university designates five or six tenured faculty members as Thurnau Professors for a term of three years. Each professor receives a $20,000 grant to support teaching activities.

Newest Thurnau Professor James Barber (third from left) joins three other ME Thurnau Professors (from left): Alan Wineman, Noel Perkins and ME Department Chair Dennis Assanis.

Barber has been a member of the U-M faculty since 1981. He said his reaction upon learning of his appointment to the professorship was one of "satisfaction and pleasure." It was also one of humility. "Many of the recipients of the Thurnau Professorship have instituted substantial teaching innovations. I'm not that kind of person — I just go into the classroom and talk."

While his approach may sound simplistic, it is effective, not to mention popular with students. "I tell it like it is," he said, "and I have a sense of humor. Because I've done quite a lot of engineering consulting work over the years, I can use example problems with obvious engineering relevance and I can convincingly explain which parts of the material are particularly useful in practice."

Barber actively discourages his students from excessive memorization. "Anything scientific and mathematical flows from an extremely limited number of initial assumptions. Understanding this, and learning to trust their own reasoning rather than looking to authority, can be an empowering experience for the student."

That's likely why students and researchers alike — from Chile to Iran — visit his web site, www.elasticity.org. The site includes a series of Maple and Mathematica files to solve 200-plus boundary value problems presented in his widely used textbook *Elasticity*.

The ability to understand and convey fundamental principles is at the heart of his approach to education and to his own research. Recently, Barber has presented some preliminary ideas for determining the minimum coefficient of friction needed for an elastic system to be capable of getting into a 'wedged' state. The findings have application in sophisticated automated assembly systems and robotics.

"I like to be able to work on a level that's simple enough to see what's really going on. Especially these days where we have the ability to do such complex calculations — you can easily lose sight of what's happening in the physical system."

ME TEACHING INCENTIVE FUND AWARDEES

(with the course for which award was received)

CORE COURSES:

Matt Parkinson	ME 350, Fall '03
Kazu Saitou	ME 250, Winter '03
Alan Wineman	ME 211, Fall '03
Claus Borgnakke	ME 235, Fall '03
Edgar Meyhöfer	ME 211, Fall '03
Dian Brei	ME 350, Winter '03
Suman Das	ME 250, Fall '03

TECHNICAL ELECTIVES:

Dragan Djurdjanovic	ME 461, Fall '03

‘New and Improved’ Course Sparks ‘New and Improved’ Cell Phone Designs

At the end of the winter semester, students in the newly redesigned ME 495, ME’s Senior Laboratory, had done more than earn their grades. The class of 113 used a code developed as a Ph.D. thesis project to improve cell phone battery design. Students were asked to survey U-M undergraduates on cell phone usage, and then improve the power supplies for four commercially available cell phones, creating smaller and lower-cost systems.

Professor Ann Marie Sastry redesigned the new course, and taught it for the first time in W’05, supervising a team of graduate student and professional instructors. Though laboratory classes are seldom popular, this course received the highest evaluations in its history, as students sharpened their statistical skills and applied them to ‘real world’ problems. As one student wrote in an end-of-semester evaluation, “[Sastry] was absolutely the best professor I have had here...I liked how the focus was much more on professionalism than getting the grade. I also appreciated the introduction to statistical analysis.”

Students worked in groups and didn’t have unlimited time in the lab, said Sastry. “They had to zero in on experiments that were most important for their particular user profiles and they were responsible for conducting the surveys to inform their work. For instance, some found that IM (instant messaging) was not as popular among college students as the media would have you think. Since it was a low component of power usage, some groups eliminated it from their testing. On the other hand, student users used many more talk minutes than other surveys had estimated.”

The class was also tasked with battery testing, which meant they needed to learn a new set of terminology and testing protocols. The doctoral work of Kimberly Cook (Ph.D., U-M BME ’04, under Sastry’s supervision), was the basis for the project, said Sastry. “She built test rigs for the students, and they used codes developed during her doctoral work for data analysis. It turned into a real-world engineering problem. Not everyone gets to see their research used in such an immediate and accessible way, and I’m really proud of Kim’s accomplishments and the mentorship she demonstrated.” The research work was supported by the NSF Engineering Research Center for Wireless Integrated MicroSystems led by Professor Ken Wise (U-M EECS), in which Sastry is a co-PI.

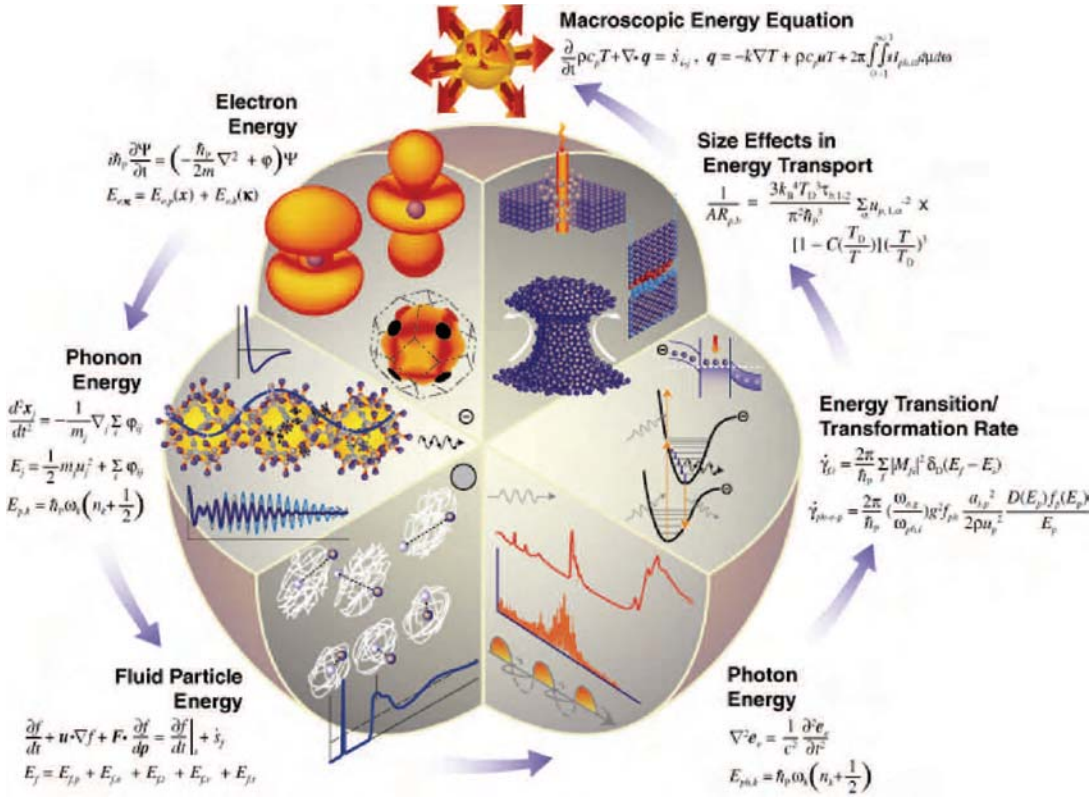
Professor Ann Marie Sastry (center) with Chris Cadotte (left) and Fabio Albano.

By the end of the semester, 27 of 28 student groups had found better, lower-cost designs, including using hybrid power, changes in phone casing to accommodate a larger battery and decreasing capabilities — in line with how students use their phones — to draw less power. “They came up with many different and creative ideas on how to satisfy their cohort,” she said, “and they also learned to apply statistics in a meaningful, logical way. The point we kept drilling home was that unlimited experimentation in engineering is not possible: you have to design experiments, and apply rigorous analysis of your data, to efficiently solve problems.”

For Cook, the exercise represented coming full circle in her own education. “Having been an undergraduate student in the department (B.S. ME, 1994), I admit that I didn’t love lab. But as an instructor, it was really a wonderful opportunity to work with Sastry to renovate and teach it, the way that I would have liked to have taken it!” Cook, who recently joined the faculty of Mechanical Engineering at Drexel University, continues, “I am looking forward to using what I learned in my teaching at Drexel.”

Student instructors Fabio Albano and Chris Cadotte and former ME Assistant Research Scientist Yun-Bo Yi, who recently accepted a faculty appointment at the University of Denver, were also “terrific, and crucial to the success of the class,” said Sastry, and Albano will be using the code that students developed as part of his thesis work. The course, she said, was a winner all-around: “in significantly improving a key course, in mentoring graduate students, in applying research done in our own department, and in having undergraduates solve a real engineering problem. I’m very proud of what everyone accomplished. We set the bar high, and the class met us there.”

ME 599 Heat Transfer Physics



The design of new thermal processes and devices require a strong understanding of heat transfer and energy conversion at the atomic level. Toward that end, Professor Massoud Kaviany has developed a new course, Heat Transfer Physics (ME 599). "The emergence of micro- and nanotechnologies offers even more opportunities to ME graduates, and we have to continuously refine our courses and instructions to prepare our students," he said.

Applications of heat transfer and energy conversion are wide-ranging and include thermoelectric cooling, solid and gas-phase lasers, laser cooling of solid and gas, thermal photovoltaics, nano and micro-thermo-electro-mechanical devices, molecular design of thermal superinsulating and superconducting solids and heat transfer fluids, including nanofluids.

This course draws on several disciplines, from solid-state and statistical physics to molecular dynamics and radiation-optics. As a result, it is a challenging course to teach — and to take, said Kaviany. "It is a combination of survey and more complete treatments; some subjects are quickly reviewed while we cover others in great detail." Topics include the fundamentals of atomic presentation of energy and its transport and conversion, through the four microscale energy carriers, namely, phonon, electron, fluid particle and photon.

Kaviany's own research and experience informed the development of the course. His work examines the transport and transformation of thermal energy. Currently, his research group is investigating the role of molecular and macro pores on these phenomena, with innovative use of porous media in new technologies. Much of the group's work is done using molecular dynamics simulations and theoretical analysis. However, they also perform experiments on synthesis, characterization, and process measurements (recent efforts include collaborative experimental work with Chemistry, Electrical Engineering and Physics).

Despite the demanding syllabus of Heat Transfer Physics, students in the first class were pleased with the course. One evaluator commented on Kaviany's "unique vision for how engineering should evolve closer to science. I really enjoyed and was enriched by the philosophical discussions." Another said the class was "one of the most inspiring courses I was exposed to at Michigan." And, in what may be the strongest — if not surprising — endorsement, one student praised the assignment of a final paper as a "great addition to the course."

Heat Transfer Physics (ME 599) will be taught again in winter 2006.

New Summer Exchange Program Receives Funding

ME Professor Volker Sick and colleague Frank Behrendt, a professor in the Institute of Energy Engineering at Technische Universität Berlin, have received funding to develop a summer program for students. The grant comes from Deutscher Akademischer Austausch Dienst (DAAD), or the German Academic Exchange Service, which promotes German universities to promising international students and faculty.

The four to six week program, "Summer School Projektingenieurwissenschaften," developed by Behrendt and Sick, will give U-M engineering students the opportunity to live abroad and work on research in small teams at TU Berlin, one of Germany's largest technical institutes. Participants will choose from among 10 projects and work with just three to five other students. "The beauty of this program," said Sick, "is that students will work very closely in U.S.-German teams." In addition, students will be exposed to German culture, history and language. The program may include a travel component too, where U-M students tour other parts of Germany and Europe.

Unlike other exchange programs which target students in their junior or senior years, the professors are hoping to recruit first-year and early-second-year students from departments throughout U-M's College of Engineering. "In ENGIN 100, a first-year engineering required course, students learn essential tools for engineering practice — communication, teamwork, research skills. To that, we want to add international experience. We want to expose students to an overseas experience early in their academic careers so that they become more aware of additional international opportunities, like summer internships, during their time in Berlin."

About 15 students will participate during the summer of 2006, and they will gain much more than technical know-how, added Sick. They will be exposed to different approaches to engineering education and to solving research problems. "The largest benefits will be the exposure early on to different ways of thinking and approaching engineering — students need to develop an understanding of these differences — and the long-lasting professional contacts they'll make."

Sick plans to teach accompanying courses in Germany that he and Behrendt intend to develop. Recruitment for the first group of students will begin in fall 2005. Behrendt will visit U-M to assist with the effort.

The new summer exchange program expands existing collaborative efforts that the college has with TU Berlin through a formal cooperative agreement. Master's- and faculty-level exchanges have been underway for several decades already, and faculty from both institutions often jointly supervise students.

In addition to his colleague, Sick credits Melissa Eljamal, director of the International Programs in Engineering Office, and Stella Pang, associate dean for Graduate Education, for getting the summer school program going.

A view of the campus of Technical University of Berlin.

Inspiring Girls to Learn About Science

Associate Professor Dawn Tilbury has helped inspire girls in grades five through eight to explore the world of science by participating in two Sally Ride Science Festivals. The objective of the festivals is to increase the number of girls who have a foundation for and interest in further education in science, math and engineering.

The festivals are named for astronaut Sally K. Ride, the first American woman to orbit the earth, and take place around the U.S. They feature lectures and workshops for girls as well as activities for their parents and teachers about how to support girls' interests in the sciences and math. Sally Ride gave the keynote address, answering questions about her experiences in space-meeting a real astronaut was a highlight of the day. A street fair with hands-on activities, music and food contributed to the festival atmosphere.

During the Ann Arbor festivals, students from the NSF Engineering Research Center for Reconfigurable Manufacturing Systems demonstrated the operation of the Reconfigurable Factory Testbed, giving the girls a firsthand look at how two wax blocks are turned into a small toy train.

After the demonstration, girls who attended the workshop also learned how to program robots to pick up a racquetball and drop it into a funnel. Each girl teaches one point in the path, and then the instructors replay the path on automatic, demonstrating how it can be sped up or slowed down. "They see the benefits of automation--how fast the robot can move," said Tilbury. "Of course sometimes the ball falls out of the fixture, but the robot doesn't notice and just keeps moving. So they also get to see the limitations."

Tilbury plans to assist again at the next Ann Arbor festival to be held in fall 2005. "I think it's important for girls to get interested in science at a young age," she said, "and that's why I support the program."

Professor Tilbury demonstrates how to program the robot from the teach pendant.

Professor Tilbury holds the teach pendant while a young attendee enters robot commands.

Robot programming is fun!

academic

THREE STUDENTS EXPLORE ME OPTIONS THROUGH TRIBAL COLLEGES AND UNIVERSITIES PARTNERSHIP

Students in the U-M/TCUP program, Jerrod Begaye (New Mexico State) and Michael Daugomah (Haskel Indian Nations University) teamed up with students from FAMU on a project for the REU program last summer.

The NSF Engineering Research Center for Reconfigurable Manufacturing Systems (ERC-RMS) recently hosted three students participating in the center's Tribal Colleges and Universities Partnership (TCUP). The TCUP program was developed by ERC-RMS faculty and staff to increase the enrollment of Native American students in undergraduate and graduate studies in the College of Engineering at U-M.

One student attends New Mexico State University, one is from Mendocino College in California and the third is enrolled at Haskell Indian Nations University in Lawrence, KS. They spent summer 2005 in Ann Arbor as participants in the university's Research Experience for Undergraduates program, one component of TCUP. "They're really here to get a sense of the research that's going on," said Lenea Howe, education coordinator for the ERC-RMS. "We're working now with admissions to get them ready to transfer, which they plan to do within the year."

In addition to conducting research alongside faculty and graduate students — "it's phenomenal what they're working on," added Howe — students attended numerous seminars on presenting their work and other topics. They put their skills to the test with several weekly departmental, college, and university-wide presentations. "We do a lot with them — their days are packed," said Howe. Still, the group found time to tour the Ford Rouge Factory in Dearborn, which "was a hit," she said. The Society of Minority Engineering Students graduate component also addressed participants, who said the session was one of the best all summer.

They didn't realize how versatile a degree in ME is. But that's something they need to know, and now they're seeing it for themselves."

The National Science Foundation funds the TCUP program. The students are applying for transfer to U of M to finish their last two years of undergraduate studies here. Those two years will be funded by the grant. Upon graduation and acceptance into a U-M graduate engineering program, students receive full funding through the Ph.D. level. The long-term goal of the TCUP program is to contribute to the development of a diverse, well-prepared workforce of scientists and engineers, explained Howe.

"The students have said that they wondered what they would do when they graduated. 'I never thought about manufacturing before, but now I know that's what I want to do,' they've told me. When I hear that, I think to myself, Wow, it's working. They really didn't know the options. They didn't realize how versatile a degree in ME is. But that's something they need to know, and now they're seeing it for themselves."

Outstanding Student Leader Recognized

Each year, the Office of Student Activities and Leadership presents its annual Michigan Leadership Awards to recognize outstanding university students, faculty and organizations for their accomplishments in both academic and extracurricular endeavors and for their contributions to the vitality of U-M. The awards have been tailored to recognize the true spirit of leadership at the University of Michigan that values integrity, initiative, stewardship reciprocity and respect. This year, thanks to his exemplary record of achievement in and out of the classroom, ME alumnus Daniel Tan received an Outstanding Student Leader honor.

Tan, a native of Singapore, was the president of the Singapore Students' Association (SSA) prior to his graduation in April 2005. In that role, he was instrumental in formulating a new vision for the organization — to foster stronger cohesion within the Singaporean community, as well as to reach out to the wider U-M community. In addition to working on improving the events that have been conventionally organized to build stronger bonds between the organization's 150 members, he led the effort to identify new events to facilitate the formation of interest groups within the community and jumpstart a self-renewing process to bring the community closer together.

Tan's efforts were designed to benefit the greatest number of people in and out of the university community as possible. Among his achievements, he arranged for SSA members' parents to have the option of applying to the alumni society in Singapore as associate members, with the intention of starting a support group back at home. He also worked on developing new strategic partnerships with diverse groups on campus to create win-win situations for everyone involved.

"I worked on developing closer relationships between the Southeast Asian (SEA) student groups," said Tan. "This included the Indonesian Students' Association (PERMIAS), the Malaysian Students' Association (UMIMSA) and the Thai Students' Association (TSA). Our goal was to establish networking opportunities for all our members and to promote the SEA culture to the U-M community. To this end, I founded a new student group, the Southeast Asian Network, in consultation with the presidents of these groups."

That effort led to the establishment of a SEA Culture Night in March 2005 that showcased the region's unique cultures to the U-M community through food, performances and exhibitions. The event was so successful that it was awarded the Outstanding Collaboration Award at the APA Awards 2005.

Tan was also actively involved in SERVE, the student-run unit at U-M that works to provide students with opportunities to address serious social issues through community service and social action. The goal is to heighten campus awareness of social issues, increase student involvement in the community, address community problems and raise social consciousness.

"I served on the Leadership Team of the Alternative Spring Break (ASB) program within SERVE as the only returning member from last year. I worked with the rest of the team to plan 35 service trips to different sites across the country. More than 400 students across campus went on these trips during spring break in 2005 for an immersive community service experience. My specific role entailed planning education and training sessions throughout the whole year for our 72 student leaders so that they were fully prepared to lead their respective groups on the trips. I'm pleased to say that for ASB's work, we received the Outstanding Campus Impact award at the 2005 Ginsberg Awards for Community Service and Social Action."

In addition to winning the Outstanding Student Leader honor, Tan had earlier received Michigan Campus Compact's "Commitment to Service" award at the Outstanding Student Service Awards 2004-2005.

"I was thankful, touched and deeply humbled," said Tan of receiving the award.

Daniel Tan with the Hmong student he worked with at Wellstone Elementary in St. Paul, Minnesota, during the Alternative Spring Break.

"It is one of the highest honors to be recognized as a student leader among the 'leaders and best' and that it must be shared with everyone I have worked with and from whom I have learned so much. I think that this honor is not just about what I have done, but also about what I can do from now on."

Tan recently completed an internship with BMW in Landshut, Germany, and he'll be working toward a master's degree in management science and engineering at Stanford.

Outstanding New Members Recognized

Two ME students, Jason Moscetti and Christopher Worrel, have received recognition as Outstanding New Members in April 2005.

The two were recognized for their work with the M-Racing Team and Habitat for Humanity, respectively.

The Outstanding New Member Award recognizes students who have exhibited enthusiasm and initiative, and who have provided formal or informal leadership and service to the U-M community.

Gold Medal Student Athlete

Dan Ketchum (B.S. ME '04, MSE ME '05), an ME alumnus, has earned something few people ever do: an Olympic gold medal.

Ketchum was a member of the 4x200-meter freestyle U.S. Olympic relay team at the 2004 Olympics in Athens. (The team also included six-time gold medalist Michael Phelps and Peter Vanderkaay, both U-M students.)

Olympic gold medalist and ME student Dan Ketchum.

Ketchum began swimming when he was seven years old. Living in Florida at the time, "it was the popular thing to do," he said. His friends were on a club team, so he tried out. "I didn't do very well the first couple of times I swam, but by the third practice I was doing 200 laps. I didn't like being the only one who couldn't do it."

Training for the Olympics was intense, he said, but not much more so than his regimen for the U-M team as swimming and diving senior captain, under the direction of Coach Jon Urbanchek: at least five hours of training daily, four of them in the water, five days each week. On Saturdays he'd swim for two hours. Sunday was his day off.

Winning the gold was always a dream for Ketchum, but not necessarily a goal. "I didn't start out planning to make the Olympics and earn a gold medal. Over the last four or five years it started to become a goal. And a more realistic one in the last year or two."

The experience "made 15 years of competing all worth it. There was this overwhelming sense of 'Wow, you did it. You've been working for this for so long — you've achieved your dreams, your goals, everything,'" Ketchum said.

After earning his bachelor's degree, Ketchum interned at General Electric Global Research Center with fellow Michigan alumnus Marshall Jones (B.S. ME '65) in the Laser Processing Laboratory. The two met when Jones was on sabbatical from GE in 2004 and conducting research at U-M; Ketchum was wrapping up his undergraduate career and ready to find a job.

"Conducting research was not top of mind, for sure," said Ketchum. But after talking with his advisor, Associate Professor Albert Shih, and Jones about "being on the cutting edge of engineering technologies, it sounded exciting enough to give a shot." He enrolled in the master's program and applied for an internship with GE.

Ketchum said he gained invaluable experience working with Jones. He not only learned to use a direct-write machine to sinter microscale conductive lines on chips but also got a sense of how to plan projects long-term.

"Working with Marshall was pretty incredible. He's one of the premier engineers out there — he knows what he's talking about, he does it right, and he's always willing to answer questions."

Jones, a self-described "sports addict" who won the intramural wrestling championship in his weight class while at U-M, speaks just as highly of Ketchum. "He jumped in to his work here head first and didn't back away."

Jones also noted Ketchum's maturity and worldliness. "I'd mention a place I traveled to, and Dan would say, 'Oh yeah, I swam there in...' He's a well-rounded individual and sensitive to others, especially youth. He got involved in the community in Ann Arbor, and he got involved here and in other places, talking to students about his experiences. He's always willing to share of himself."

That impressed Jones, who serves as a mentor to U-M students and others around the country himself. "On top of that, to devote at least five hours a day to be at the pinnacle of his sport and to do as well as he did at U-M in an engineering program ranked second in the nation, that's really saying something."

"To devote at least five hours a day to be at the pinnacle of his sport and to do as well as he did at U-M in an engineering program ranked second in the nation, that's really saying something."

Chuck Hutchins is pictured with grandson Eric C. Montague (far left), son of Linda A. Hutchins, (M '78 B.S.E CO ENG) and John T Montague, a Stanford EE; grandson Eli S. Skeggs, age 10, son of Beth L. Hutchins, (M '82 AB LSA), and Peter Skeggs; and his wife Ann, (M '57 B.S. DES). Eric was born during the 1990 Solar Car race that Michigan won. Chuck reports: "When I called Linda to announce the win, I said, 'When you are nursing Eric, whisper in his ear — Michigan first, Stanford seventh.' So now at age 15, this is Eric's fourth time attending a solar car race: 2 days in 1997 at age 7, a week in 1999, two weeks in 2001, and 19 days in 2005. Eric now feels like a team veteran, and from my standpoint he couldn't find a better group of role models. Will he and Eli ever become Wolverines? Only time will tell."

Charles S. Hutchins Wins Distinguished Service Award

Whether it's traveling to Australia for a 3,000-km World Solar Challenge race or calling fellow alumni to inspire their support of the ME department, the college or the university in some way, Charles S. Hutchins doesn't think twice. In recognition of his dedication he earned the 2004 Alumni Society Distinguished Service Award.

Hutchins graduated with a bachelor's degree in Mechanical Engineering and Applied Mechanics in 1957. A visionary who saw the need for open architecture computer numerical control and real-time data collection on the factory floor, he is recognized as a pioneer of computer aided manufacturing (CAM). Hutchins lead the development of Compact II, a programming language for numerically controlled machine tools, and twice co-founded companies named Manufacturing Data Systems, Inc., both leaders in the CAM field.

In addition to having served on the Alumni Society Board of Directors and the Executive Advisory Board of the ME department, Hutchins has been a sponsor of every Solar Car team since the Solar Car Team's formation in 1989. From waving a Michigan flag at the finish line of a race or facilitating teamwork among students to resolving a technical problem, he consistently shares his time, resources, expertise and access to an accomplished network of colleagues and friends, according to Michael Brackney, the team's project manager.

For Hutchins, winning the Alumni Society Distinguished Service Award is "like icing on the cake."

"You see the challenges that these kids face, and the pressure of a racing deadline — it's really a sophisticated car — and how well they pull it all together," he said. "It's fun to watch and cheer! Each year the car only gets better. To win four first-place American Solar Challenge trophies in eight races, that's no small feat."

Team MomentUM

Team MomentUM took third place in the 2005 World Solar Challenge. The four-day event finished in Adelaide, Australia, in September. The 3,000-kilometer race, which traverses the continent from north to south, kept participants and spectators alike rapt; competition was dramatic, with the U-M team alternating between second and third place throughout the race. On the final day, a piece of metal road debris sliced and lodged into MomentUM's leading edge. "Luckily our strong composite body stopped it from entering the inside of the car and only cut a few inches into the body and did very minimal damage," reads an entry on the team's race blog. The driver was not injured, and MomentUM continued to the next checkpoint.

Teams from 11 countries participated in the competition, sponsored by the U.S. Department of Energy, its National Renewable Energy Laboratory, and Natural Resources Canada.

"Our students should be commended not only for their technical abilities but also for their stamina and GO BLUE spirit," said Professor Dennis Assanis, department chair, who also credited faculty co-advisors Bob Culver and Brian Gilchrist and the team's loyal sponsors and supporters.

Sun-sational! U-M TEAM WINS SOLAR CAR RACE

Driving from Austin, Texas to Calgary, Alberta is a snap if you have the time and money for fuel. It's more of a challenge if you're counting on the sun for fuel, as did the solar-powered cars in the 2005 North American Solar Challenge (NASC). But it really helps if you have MomentUM.

"This victory is the fourth for the University in the 15-year history of the event — the most of any school. I know you share my pride in this tremendous accomplishment that reflects well on the interdisciplinary strength of the College and the University," wrote Ronald Gibala, interim dean of the U-M College of Engineering, in announcing the results to the College of Engineering community.

Finishing first proved that MomentUM, U-M's latest-generation solar car, clearly met the challenges inherent in the 2,500-mile race held in July 2005. The length of the race exceeds the two previous races by over 100 miles and is the longest held anywhere in the world. This year's race attracted some 40 teams, including 10 from Canada.

ME is proud to have played a significant role in the team's success. Race Crew Chief Peter Balogh, who just finished his third year at ME, oversaw all of the engineering on the vehicle. The ME team was headed up by ME junior Max Ross and was one of the larger teams with over 20 participants. Other key ME students involved were junior Mike Adams, and sophomores Brian Ignaut, Doug Lambert and Joe Belter, who was driving when MomentUM crossed the finish line.

In addition to the ME team, other teams contributing to the solar car's overall program include the power team (overseeing power systems, microcontrollers, and real-time telemetry data), the business team (fundraising, logistical and infrastructure issues), and the strategy team (energy conservation and strategic use of power). Balogh also noted the significant contributions made by former team members and the team's advisors.

"We've also worked with graduate student Chris Churchill and several solar car alumni who are now working within the engineering industry. We also have two faculty advisors, Brian Gilchrist and Bob Culver, and Chito Garcia, an experienced machinist and also a team mentor."

One of the strongest motivations this time was the team's desire to improve on previous attempts that were unsatisfactory. That effort encompassed both design/engineering and team coordination.

"Several of us were involved in the last solar car project," said Balogh, "which did not qualify for this race. There's been a great deal of improvement. We've also passed the qualifier race — the Formula Sun Grand Prix — where we finished second.

"Still, it's a completely different environment during the race, since there is little time for actual engineering development, and the strengths of the individual teams are what determines winners and losers. Since no car runs perfectly, it is the behavior of the team as a whole that determines how much time is spent on the track, and what happens if the car has to stop racing. The best team solves the problems the most quickly, and this is what keeps the car going. Therefore, what I like to say is that the engineering is the easy part. Anyone with the right education can crunch numbers. The hard part is making a very unique group of individuals work together effectively to achieve a common goal."

This year's design featured a three-wheel configuration to help meet the goal of operating a solar-powered car at approximately the same speed as a normal car. The three-wheeled concept emerged from a tradeoff study that the team members did, where they found that they could reduce the weight and aero drag of a three-wheeled car, while maintaining the simplicity of the design. The team took MomentUM, which weighs just under 650 lbs with the driver in it, up to 80 mph. It's about three times as aerodynamic as a normal truck, enabling it to go at its top speeds using approximately the same power as a toaster oven.

Bragging rights aside, significant engineering advances can emerge from the race. The most practical applications have to do with the intelligent systems that the car uses to drive down the road. MomentUM incorporated a microcontroller system that is similar to one used on some military helicopters. It runs code that can provide such things as intelligent cruise that takes input from the motor itself to reduce energy while maintaining speed, and other power management and power safety ideas that are or can be used in hybrid-electric vehicles that are in production today.

On or Off the Road, SAE Leaves Its Mark

The membership of the Society of Automotive Engineers numbers more than 84,000, comprised of engineers, entrepreneurs, executives, educators and students from nearly 100 countries. They represent a variety of disciplines but share a strong interest in the design and operation of self-propelled vehicles used on land, sea and in the air. The U-M student chapter, MSAE, and its MRacing Formula SAE and Mini Baja racing teams are no exception.

"The dedication our students have just blows you away," said Professor Volker Sick, who serves as faculty advisor for the chapter and the Formula SAE MRacing team. "We're not lenient here at U-M with students in terms of their workload, and they spend a lot of additional time on SAE activities. The amount of effort and talent is mind-boggling. From presentation skills to technical knowledge, they're unbelievable. They benefit, too, from very attractive internship and study- or work-abroad opportunities and good job offers when they graduate."

Winning Big at SAE World Congress

When several ME students from the SAE chapter returned to campus from the SAE World Congress, held at Cobo Center in Detroit in spring 2005, they came home with more than sleep deprivation and new professional contacts: the chapter won first prize in the annual Detroit Section Student Exhibit Competition. The victory brought with it a financial award of $1,250.

All student chapters were eligible to compete, and participants "came from as close as five minutes away from Cobo Hall to halfway around the world. That was kind of cool," said Kelly Karakashian, the chapter's immediate past president.

In their allotted exhibit space in the Congress' exhibition hall, the U-M students displayed posters depicting MSAE events held over the past year and vehicle team accomplishments. The Formula SAE 2004 Wolverine was on display as well.

Exhibits were judged on technical content, teamwork, project management and overall quality. Each chapter also made a brief presentation to a panel of judges. That took place "bright and early," one morning of the Congress, said Karakashian, who spoke for the chapter. By mid-afternoon winners had been announced.

Karakashian was excited when she heard the news, but not terribly surprised. "Everyone did such a great job. Our events coordinator did tons of work — everyone did — and we were hoping this would be the year we'd take first," she said. "We took third last year, and we decided we were going for everything this year since the chapter really grew."

That growth is no accident, but rather part of the board's strategy to increase membership. The chapter organizes many activities with that objective in mind: a lecture series, a trip to the North American International Auto Show, tours of the U-M Transportation Research Institute and joint activities with other groups, including the University Minority Mechanical Engineers, the campus chapter of the American Society of Mechanical Engineers and the SAE Detroit Section.

The $1,250 prize will be split with the Formula SAE team and put in the chapter's general fund to pay for such activities as an expanded lecture series and car show.

After earning her bachelor's degree in ME, Karakashian began working for DaimlerChrysler and will pursue a master's degree. In addition to making many professional contacts and increasing her technical knowledge, she said that participating in the campus chapter gave her the opportunity to learn how to be a leader. Winning the student competition wasn't any less rewarding. "It was a great way to end the year — it capped off all our efforts to make the chapter bigger and better."

Kelly Karakashian in the Formula SAE 2004 Wolverine.

A Drive to Lead

In January 2005, then ME senior Eric Rybczynski honed his leadership skills with SAE movers and shakers in the organization's first SAE Leadership Development Program. He was nominated by Professor Volker Sick.

Rybczynski had been active in the student chapter, serving on the executive committee as treasurer and on the MRacing team. When Sick learned of the

new leadership program, he thought this "engaged student, who's well-organized in his involvement" would be a great fit.

So did SAE. Rybczynski was one of just 25 students chosen for the two-day program, which took place in San Antonio, Texas. The event was designed to further develop leadership skills in younger members to foster high-level participation in SAE as well as in the mobility industries. Training sessions covered presentation skills, career development and mentoring. The cost of the program and related travel expenses were paid for by SAE.

Rybczynski said the program was "a great experience. It was incredibly beneficial to interact with students who are excited and motivated to be a part of the automotive industry. The highlight of the program was just getting to interact on an informal basis with fellow students from around the country who have strong desires to improve the industry and who are as crazy about cars as I am."

Rybczynski has been involved with MSAE since freshman year, when he joined the MRacing team. In 2003-04, he served as engine group leader, responsible for overseeing the race car's design, purchasing, organization, manufacturing and testing of the engine and related components. In the 2004 Formula SAE Competition, the team placed fourth in design and improved 16 positions from the previous year's race.

Rybczynski earned his bachelor's degree and is now pursuing a master's in ME with a focus on fluid mechanics and thermodynamics. He spent a summer working for Volkswagen Research and Development in Wolfsburg, Germany as part of a team researching alternative modes of combustion for gasoline engines.

His experience on the Formula SAE team and with the U-M SAE student chapter has been "by far the most rewarding here at the university." It takes a lot of time, he added, "but in the end I wouldn't have had it any other way."

MRacing Car Shows What It's Made Of

In May 2005, MRacing Formula SAE car number 129 had the chance to strut its stuff, and it did. The car, fully designed, built and tested by members of the MRacing team, placed so well it will be featured in the November issue of Road & Track magazine.

The four-day competition held at the Pontiac Silverdome is one of seven international competitions, but the Detroit-area event is the most popular, according to Dan Campbell, team captain and project manager. Approximately 140 teams from all over the world compete. "Australia, South Korea, Brazil, Germany, Italy, Sweden...it's unbelievable to see what college students are capable of building on their own," said Campbell, who has participated in three competitions.

MRacing Formula SAE car.


Team members prepare the MRacing car for the competition.

Unbelievable, especially since restrictions on the car frame and engine challenge students' knowledge, creativity and imagination, he added. Work on each year's formula-style car begins over the summer with design and simulation work that includes research on an engine dynamometer and running data acquisition on the previous year's vehicle. The remaining months are spent manufacturing on campus and outsourcing some parts to professional machine shops. Throughout the year, the team "pays close attention to time- and money-management and turning out a professional product," said Campbell.

In 2004-05, under the direction of chief engineer Jason Moscetti, project manager Jeff Lovell and faculty advisor Professor Volker Sick, the team of almost three dozen students designed a car with a dry sump oil lubrication system, custom six-piston brake calipers, a carbon fiber steering wheel and launch and traction control, noted Campbell.

At the competition, the car placed fifth in the category of acceleration, skid pad and autocross. It also took third place for best suspension system design and development, including outstanding performance, manufacturing and aesthetics. Overall it placed 40th among 139 participating teams.

To place high in the competition, teams need experience and motivation, Campbell said. "A unique design may score points in the static judging events, but a fast and reliable car is needed in the dynamic events," he said. "MRacing has always done well in both types, and it's proven itself one of the top five dynamic Formula SAE teams in the world."

SAE continued

Sick is currently developing a course to coincide with the design and development of the Formula SAE car. "Students spend a lot of time building a new car each year. Why not make their work part of the curriculum and give them credit for their extraordinarily high level of engagement?"

Mini Baja: Best in Ten

The U-M Mini Baja Team had their best finish in ten years at the 2005 Mini Baja East competition, held in May at the Rochester Institute of Technology. The off-road vehicle, designed and built by the team, placed first in acceleration, top speed, hill climb and cost events; second place in land maneuverability; and third place in design. It placed third overall among 73 participating teams.

Of the three SAE Mini Baja competitions held each year, the East competition is perhaps the most challenging. "We had to design a car that's capable of floating/propelling/steering across a deep body of water," explained Michael Michaud, team project manager. "Essentially we were required to drive through about 100 yards of deep water in every lap of the four-hour endurance race."

The team's strong finish is even more impressive considering this was only the second time it participated in the East event in recent history. "We consider our performance particularly exceptional because we were armed only with the knowledge gained from one year of experience," he said.

Michaud attributes the results to the time spent on the car's flotation system and the continuously variable transmission that was customized to power train requirements, something few other teams do, he said. A custom spur gear reduction final drive also helped. But the real challenge was time. "Getting the car designed, built and tested between September and May requires a lot of planning, hard work and compromise in order to get projects finished."

Numerous sponsors supported the team, including GM, DaimlerChrysler, Denso Corporation, Polaris Industries, The Timken Company, NSK Ltd., Exhaust Gas Technologies and others. Faculty advisor Assistant Professor Brent Gillespie also contributed to the team's success, as did ME Lecturer Donald Geister, who directs the Wilson Student Team Project Center.

Closeup of the SAE Mini Baja car (top) and team (bottom).

The team placed fifth overall in the Mini Baja 100, hosted by Caterpillar Inc. in Green Valley, Arizona, and third overall in the Mini Baja Midwest competition, hosted by the SAE Dayton, Ohio, Section.

"Baja has been my life for the past four years," said Michaud, who was offered a job by one of the team's sponsors at a Mini Baja competition. "I've learned more about dealing with real-world engineering challenges from being on this team than I ever could learn in a classroom."

ME STUDENTS REFLECT MLK'S SPIRIT OF GIVING

The MLK Spirit Awards are presented annually to north campus students whose leadership and service exemplifies the spirit of Dr. Martin Luther King, Jr. Three ME students received this prestigious honor in April 2005.

April Bryan is a doctoral candidate, having received her M.S. from ME (2004) and her B.S. in Aerospace Science Engineering from Tuskegee University (1999).

The Trinidad-native was nominated by ME Associate Research Scientist Zbigniew Pasek for her active involvement in the Mechanical Engineering section of the Detroit Area Pre-College Engineering Program (DAPCEP). The program works to interest middle-school minority students from Detroit in mechanical engineering careers.

"Martin Luther King Jr. was selfless and single-minded in his commitment to improving the status of minorities in this country," said Bryan. "While it is always nice to win awards, I believe that it is the spirit of MLK, more than the award, that is the most important."

April Bryan

Vernon Newhouse

Vernon Newhouse, who also received the GEM Award in 2005 (see related story below), earned his master's degree in 2005. He previously received a bachelor's degree in Mechanical Engineering from U-M.

The native of Mount Morris, Michigan, was nominated by Derrick Scott, program director of the Minority Engineering Program Office, in recognition of Newhouse's contributions to the Unified Minority Mechanical Engineers organization, for which he served as president.

"I was very humbled by the recognition from the College," said Newhouse. "I didn't make contributions to the College of Engineering community to gain recognition, but it means a lot that the school makes it a priority to recognize the work people have done."

Undergraduate student Lander Coronado-Garcia was also recognized with a 2005 MLK Spirit Award.

VERNON NEWHOUSE NAMED GEM AWARD WINNER

For the third consecutive year a U-M student has received the prestigious GEM Black Engineer of the Year Student Leadership Award. Master's degree recipient Vernon Newhouse earned the recognition for outstanding leadership in engineering and his continuing dedication to education for young minorities.

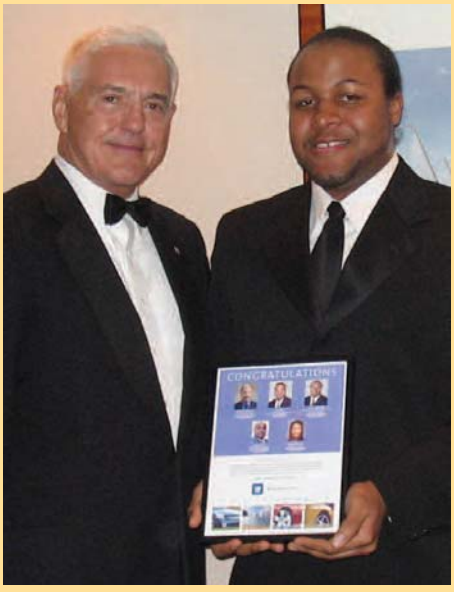
He received the award at the 2005 Black Engineer of the Year Awards conference held in Baltimore in February 2005.

"I was honored to receive this award since it was recognition on a national level for contributions during my internship at General Motors," Newhouse said.

Newhouse's supervisor at GM, Martin Monte, recognized the exceptional skills and dedication that Newhouse demonstrated during his internship and nominated him for the award. His work in the community has been equally exemplary; Newhouse serves as a tutor for other ME students at the Unified Minority Mechanical Engineers study jams and has also tutored high school athletes.

Newhouse has also received the Minority Engineering Program Office Undergraduate Student Achievement Award on two occasions; the Amoco/BP Mechanical Engineering Scholarship; and the Dow Chemical Mechanical Engineering Scholarship. He's been recognized as a U-M James B. Angell Scholar.

GEM, the National Consortium for Graduate Degrees for Minorities in Engineering and Science, is a nonprofit network of universities, companies, government agencies, alumni and faculty. Its mission is to help students succeed in their quest for graduate degrees and to increase the participation of underrepresented minorities at the master's and doctoral levels in engineering and science.



Vernon Newhouse (right) with GM Vice Chairman Bob Lutz.

Increasing AWAREness

When a half-dozen students from ME 589, EcoDesign and Manufacturing, and ME 450, the capstone design and manufacturing course, headed to an awards ceremony held at the National Academy of Sciences in May, little did they suspect that they would take center stage. The U-M team won the Environmental Protection Agency's P3 Award for sustainable design. The term 'P3' represents the three components of sustainability: people, prosperity and the planet.

The team won for its AWARE@home system, a user-friendly, inexpensive tool for households to monitor their consumption of electricity, water and natural gas wirelessly via a home computer.

After installing software on the computer, consumers enter the maximum amount they're willing to spend each month on utilities. When it becomes apparent to the AWARE@home system that this amount will likely be exceeded, the system triggers a pop-up window or e-mail notice. Consumers can then make changes, including for example, using less water while washing dishes or turning their heat down a few degrees.

The system works using standard wireless 'WiFi' networks. If a home does not have a WiFi network already in place, an inexpensive USB antenna/transmitter is included with the system that is plugged in to the home computer.

AWARE@home is also compatible with new digital utility meters that are being sent to the field to eliminate the need for in-person readings. Once marketed, the system will likely be of interest to property managers and consumers wanting to control their monthly expenses.

In addition to students from the two ME courses, other participants included students from Civil and Environmental Engineering, Electrical Engineering and Computer Science, and the Ross School of Business.

Sixty-five teams from around the country competed for $10,000 grants to research and develop their projects during the 2004/2005 academic year. On May 16, 2005, all P3 grant recipients set up a display featuring their project on the National Mall in Washington, D.C. The National Academies convened a panel of judges — unidentified to participants and who mingled among the crowds asking questions of each group — to evaluate the projects and recommend award winners to the EPA, which made the final decision.

As for the students' reactions upon receiving the award, "It was a blur, a shock," said Assistant Professor Steven Skerlos, the faculty advisor to the project. "They went there with lots of pride and confidence, and they knew it was a great project, but they didn't go in expecting to win."

AWARE@home has been covered widely in the media and is currently being prepared for testing in consumers' homes. "AWARE@home has a real chance. The software is easy and attractive; the hardware is robust. The system is getting closer to becoming a market reality."

The AWARE@home team poses with their display at the National Academy of Sciences.

BLUElab Wins 2005 Elaine Harden Award

For a student-run organization just three years old, BLUElab (Better Living Using Engineering) has already been recognized for having had an impact. This year the group earned the 2005 Elaine Harden Award, which honors engineering student societies that best exemplify leadership and service. BLUElab, formerly Engineers Without Borders, is dedicated to sustainability in both developed and developing regions of the world. Though an independent organization, it works closely with Engineers Without Borders and Engineers for a Sustainable World.

The award was well-deserved, according to Assistant Professor Steven Skerlos, BLUElab faculty sponsor and recipient of the 2004 College of Engineering Outstanding Student Group Advisor. "The programs these students are carrying out serve as models for changing the relationship between the engineer and the greater society he or she serves," he said. "I'm glad they were recognized. For a young organization it means they're on the right track."

One of the group's main ongoing projects is taking place in the Dominican Republic and involves testing novel water purification technologies, looking at how they can be manufactured locally and understanding how the involved communities use and interact with them. The project goes beyond engineering and cost concerns, considering the relationship created between the technological design and the user.

BLUElab members are also involved in designing educational programs closer to home. "They're working to introduce sustainable design principles into all of the engineering disciplines," said Skerlos. Case in point: a seminar series and certificate program on socially responsible engineering that included lectures by faculty from U-M as well as other universities on sustainable development, the role of the engineer in society, eco-design, engineering ethics and environmental justice.

U-M students from LS&A, School of Public Health, Medical School and CoE all participated in a week-long trip to assess and improve the health conditions in the village of Rancho al Medio in the southern Dominican Republic.

BLUElab's education committee is also developing modules to be incorporated into introductory engineering classes to train students to see the strong connection between the decisions they make as engineers and the environment. One such module demonstrates the linkages between vehicle design-mass and aerodynamic coefficient, for example-and air pollution levels in different parts of the city of Ann Arbor. The model shows students how the levels fluctuate with design changes, current weather conditions and other factors. "The example shows how even modest changes in engineering design, and the vehicles people buy, can have a significant impact on the air we breathe on campus and in town."

The $500 cash stipend that accompanies the Elaine Harden Award will assist the group with its programs. Other fundraising activities include events such as the One World, One Slice pizza fundraiser and donations from a Pfizer, Inc., matching grants program, Michigan alumnus Kevin Olmstead, the College of Engineering and the University.

CoE students investigate a possible drinking water source for the community of Rancho al Medio in the Dominican Republic.

But it's not about the prize, said Skerlos. "They would have done all of this anyway. In a time when there is a lot of societal interest in environmental and sustainable design, but not much financial support from government, the recognition of their leadership is a nice boost — it's a reaffirmation of their passion."

NSF Recognizes ME Students

Four ME students have earned Graduate Research Fellowships from the National Science Foundation. The Graduate Research Fellowship program provides three years of support for graduate study leading to research-based master's or doctoral degrees. Awards include an annual stipend of $30,000 and a cost-of-education allowance of $10,500 per academic year.

Kiran D'Souza

Kiran D'Souza received his B.S. in ME and has just completed his second year in the Ph.D. program. He's carrying on a family tradition as his three brothers, Vinay, Deepak and Arun, all received their bachelor's degrees at U-M in Mechanical Engineering.

D'Souza's decision to specialize in nonlinear dynamics and vibrations, specifically damage detection in nonlinear systems using vibration-based methods, originated when he took ME240 (Dynamics and Vibrations) as an undergraduate with Professor Noel Perkins. His senior design project was a flycasting robot he worked on with two other students.

His current research focus is an augmented linear system to model a trajectory of a nonlinear system using analysis techniques and theories he developed with current advisor Assistant Professor Bogdan Epureanu. "We have used our methodology successfully with nonlinear systems containing Coulomb friction and cubic spring nonlinearities," D'Souza said.

Prior to receiving the NSF grant this year, D'Souza received an honorable mention in 2004. He also has been recognized with the 2003 Mildred and Steele Bailey Prize from the College of Engineering, for academic excellence and outstanding leadership and service to the college and community, and the 2002 A.D. Moore Award. He received the 2002 Melvin R. Green Scholarship from ASME International and a 2001 ASME Foundation Scholarship.

D'Souza, from Troy, Michigan, credited Epureanu for his success in receiving the fellowship. "Professor Epureanu helped me revise my 2005 application, and his drive to have me excel in my research in general was very helpful in giving me a shot at the award."

Scott Green

Scott Green is returning to academic life after several years as a design engineer for Kalamazoo-based Stryker Instruments, a leading manufacturer of medical devices. Previously he received his B.S.ME from the Rose-Hulman Institute of Technology in Terre Haute, Indiana. In addition to graduating Summa Cum Laude, he received the Heminway Medal for highest cumulative GPA and the Cummins Award for outstanding graduating mechanical engineer.

Although Green originally received the NSF Graduate Fellowship in 2003, he waited until 2005 to begin his studies. "After graduating I decided to accept an offer from Stryker to see if being a design engineer truly appealed to me. A few months after I accepted the offer, I was notified by the NSF that I had received the fellowship."

Green's research focus is MEMS/Microsystems. "For the past four years every engineering situation I have been in has been or could be augmented profoundly with the use of an appropriate MEMS device. The technology is fundamentally cross-disciplinary, which aligns well with my desire to expand my knowledge beyond the mechanical engineering world."

Green acknowledged the assistance of many people—faculty, researchers and peers—who he said "unknowingly" helped him fashion and fine tune his vision for graduate study. He also reserved praise for a trusted professor who critiqued his application and the writers of his letters of recommendation. "These outstanding scholars helped illustrate my potential in a way I never could have expressed."

As for his decision to attend the University of Michigan, the choice was simple for the native of Davison, Michigan. "The University of Michigan is my choice first and foremost because of its outstanding cross-disciplinary MEMS/Microsystems program. Secondly, as a native Michigander, I have always been partial to U-M. Go Blue!"

Danese Joiner

Danese Joiner is heading into her second year in the ME Ph.D. program after earning a bachelor's in mechanical engineering from Rutgers University. Her decision to come to U-M was prompted in part by the wealth of interdisciplinary research and academic opportunities.

"The university has a great reputation, and when I visited I felt the administrators really wanted me here and were willing to make an investment in me."

Joiner plans to focus her research in biomechanics, particularly orthopedics. She first became interested in orthopedic research during high school, when she worked part-time in an extended care facility.

"I witnessed countless bedridden and wheelchair-bound patients who needed to be escorted by an aide to perform basic daily tasks," said Joiner. "I wished there were something I could do to improve their quality of life. During my undergraduate academic career, I took courses in biomechanics and biomechanical systems and realized that there is something I can contribute. While a great deal of research has been conducted on fracture fixation, bone remodeling and bone deterioration, important aspects of these areas remain unexplored."

A native of St. Louis — she grew up in Tinton Falls, NJ — Joiner has received other prestigious awards in addition to the NSF Fellowship. She has been named a GEM Research Fellow and received a Rackham Engineering Fellowship. She was also named a Ronald E. McNair Scholar, a Douglass College Scholar and a James Dickson Carr Scholar. Joiner participated in the Douglass Project for Women in Math, Science and Engineering and graduated Magna Cum Laude.

In addition to crediting her advisors and colleagues for their assistance, Joiner noted that her mother helped prepare her application. "My mom read over my essays to make sure someone with a non-technical background could understand them. That helped me make sure that what I wanted to say was clear."

Erin Macdonald

Erin Macdonald is returning to school following a five-year hiatus, during which she worked as a product developer at an outdoor gear company designing tents and sleeping bags. It was there that she noticed the challenges of designing products from different perspectives and in combining quantitative and qualitative approaches in product design. She became determined to return to graduate school in order to find better ways.

After receiving her master's in mechanical engineering in 2004, she is now a pre-doctoral candidate. Her primary research will be on interdisciplinary and eco-friendly design of consumer products.

"Optimizing products in an interdisciplinary and holistic fashion leads to better products," said Macdonald, who works in the Optimal Design Lab headed by Professor Panos Papalambros. "I am approaching the design process from a number of different disciplines—engineering, marketing and psychology—simultaneously in a quantitative fashion."

Macdonald, who received her B.S. with honors in Materials Science and Engineering from Brown University in 1998, is the recipient of numerous awards and honors. She was a member of team that won one of seven awards at the recent Environmental Protection Agency's P3 (People, Prosperity and the Planet) competition. In 2003 she received a Rackham Engineering Award and earned an honorable mention from the NSF.

Macdonald holds a patent on a sleeping bag accessory that extends the size of the bag to larger girths. She received the President's Award from American Recreation Products/Sierra Designs in 2002 and the Composite Material Design Award from the Metals, Minerals, and Materials Society in 1998.

Macdonald, who grew up in Vestal, New York, noted that this was the third time she had applied for the NSF Fellowship, and she gave credit to her advisors, Papalambros, ME Assistant Professor Steven Skerlos, and Richard Gonzalez, psychology department chair and professor. "Like one of my professors told me, persistence is the key in academia."

GRADUATE STUDENT AWARDS AND FELLOWSHIPS

DEPARTMENT AWARDS

GRADUATE STUDENT SYMPOSIUM

symposium Posters
Mohammed Shalaby, 3rd/KAIST Award

symposium Presentations
Design & Manufacturing:
Karlin Hamza, 1st/Session IA
Honghai Zhu, 2nd/Session IA
Mohammed Shalaby, 1st/Session IB
Shingo Takeuchi, 2nd/Session IB

BioMechanics:
Jiro Doke, 2nd/Session I
Sachin Goyal, 1st/Session I

Materials & BioMaterials
Sung-Tae Hong, 1st/Session I

Solid Mechanics & Materials
Jiayin Li, 1st/Session I
Jonathan Kadish, 2nd/Session I

Fluid Mechanics & Heat Transfer:
Aristotelis Babajimopoulos, 1st/Session I
Amit Dhingra, 1st/Session II
Jonathan Hagena, 2nd/Session II
Xiulin Ruan, 2nd/Session II

Dynamics, Systems & Controls:
Dongsoo Kang, 3rd/Session IIA
Denise McKay, 1st/Session IIB
Bryon Sohns, 1st/Session IIA
Ardalan Vahidi, 1st/Session I
Kyung Won Suh, 2nd/Session II
Jing Zhou, 2nd/Session I

FELLOWSHIPS AWARDED BY ME

Departmental Fellowship
Kagya Amoako
Christopher Churchill
Baoling Huang
Serge Li Hoi Foo-Gregory
Todd Lillian
Robert Littrell
Jeremy Mayer
Patrick Owens

Rackham Engineering Award
William Harrison
Danese Joiner
Erin McIntyre
Scott Norby-Cedillo
Tahira Reid
Violeta Tayeh
Diane Wiener

Dean's Fellowship
Stephen Busch
Bart Frischknecht
Jerry Fuschetto
Amit Jain
David Pekarek
David Twardowski

Regent's Fellowship
Richard Hill
Hui Wang

Recruitment Fellowship
Li Jiang
Andrew Madden
Brendan O'Connor
Ryan Vignes
Abhishek Yadav
Yuanyuan Zhou

Block Grant Fellowship
Ross Mackenzie

Medtronics Foundation Fellowship
Gregory Sommer

Robert M. Caddell Memorial Award for Graduate Student & Faculty Member
Katsuo Kurabayashi and Yi-Chung Tung

Toyota Fellowship
Jason Martz

FELLOWSHIPS AWARDED BY RACKHAM

Barbour Fellowship
Shiyao Bian

Predoctoral Fellowship
Kyoo-Sil Choi
Sachin Goyal
Yi-Chung Tung

FELLOWSHIPS AWARDED BY THE COLLEGE OF ENGINEERING

International Exchange Tuition-Fellowship
Fabian Schulze
Bin Shen
Jia Tao

Ford Fellowship through CEW
Jessamyn Margoni

EXTERNAL FELLOWSHIPS

Fulbright Scholarship
Luis Izquierdo

Microsystems & Engineering Sciences Applications Fellowship
Troy Lionberger

National consortium for Graduate Degrees for Minorities in Engineering & Science Fellowship
Rapheal Bollar
Brian Conser
Joseph Cullen
Jessica Garrett
Vera Simms

National Science Foundation Fellowship
Kiran Dsouza
Danese Joiner
Troy Lionberger
Robert Littrell
Erin MacDonald

Ronald E. McNair Fellowship
Hung Nguyen

Vietnam Education Foundation Fellowship
Van-Xuan Tran

RACKHAM AWARDS

Distinguished Dissertation
Alan McGaughey

COLLEGE OF ENGINEERING AWARDS

Distinguished Achievement
Xiulin Ruan

Distinguished Leadership
Honghai Zhu

Elaine Harden Award
BLUELab (Assistant Professor Steve Skerlos, advisor)

MINORITY ENGINEERING PROGRAM OFFICE AWARDS

Master Achievement
April Bryan
Brian Conser
Claudia Fajardo
Nia Harrison
Serge Li Hoi Foo-Gregory
Vernon Newhouse
Adrianne Prysock

UNDERGRADUATE STUDENT AWARDS AND RECOGNITION

BP America
Daniel Minnich

Caterpillar
Karan Seth
Joseph Ypma

Daimler Chrysler
Kenya Agee
Amy Kopin
David Ohrin

DeVlieg Fellowship
Angela Engel

Eli Lilly Scholarship
Hamed Bazaz
Joseph Cheng
Dannielle Sita
Rebecca Stoloff

GM Engineering
Kenya Agee
Laura Stojan

GM Vehicle Based Engineering
Michael Michaud

Guidant Foundation
Lisa Radak

Honeywell Scholarship
Danielle Boyle

Lubrizol Scholarship
Mark Ang
Thomas Eason

Michael Korybalksi Endowment Fund
Dannielle Sita

NASA Glen
Lander Coronado-Garcia

R&B Machine Tool Award
Cristiana Diehr
Dennis Lee
Nicholas Sochacki

Robert M. Caddell Memorial Award for Undergraduate Student
Portia Peters

COLLEGE OF ENGINEERING HONORS AWARDS & PRIZES

Cooley Writing Prize
Andrew Becker (fiction)
Jonathan Yung-Hsin Ho (essay)

Distinguished Achievement Award
Azwan Ashari

Distinguished Leadership Award
Steve Dockstader
Alberto Lopez
Danielle Sita

Hugh Rumler Distinguished Class Prize
Lisa Radak

J.A. Bursley Prize
Laura Stojan

Outstanding New Member
Jason Moscetti (Habitat for Humanity)
Christopher Worrel (M-Racing Team)

Roger M. Jones Fellowship
Adam Dick

Tau Beta Pi First-Year Student Award
Daniel Gally

William H. Mack Memorial Engineering Prize
John Nanry

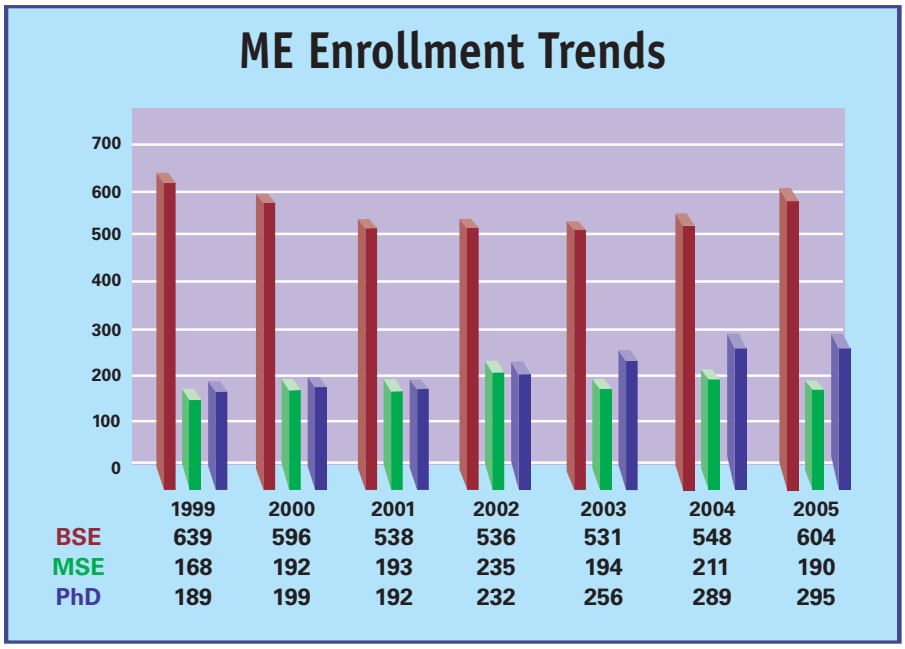
MINORITY ENGINEERING PROGRAM OFFICE AWARDS

Undergraduate Achievement
Kenya Agee
Elliot Alvarez
Andrew Bishay
Danielle Cendrowski
Lander Coronado-Garcia
James Forehand
Rory Fraga
Michele Goe
Tommaso Gomez
Ian Hanna
Alberto Lopez
David Ohrin
Portia Peters
Jonathan Quijano
Danielle Sita
Raymond Smith II

Rising Student Achievement
Darrell Ford
Sophia Reyes

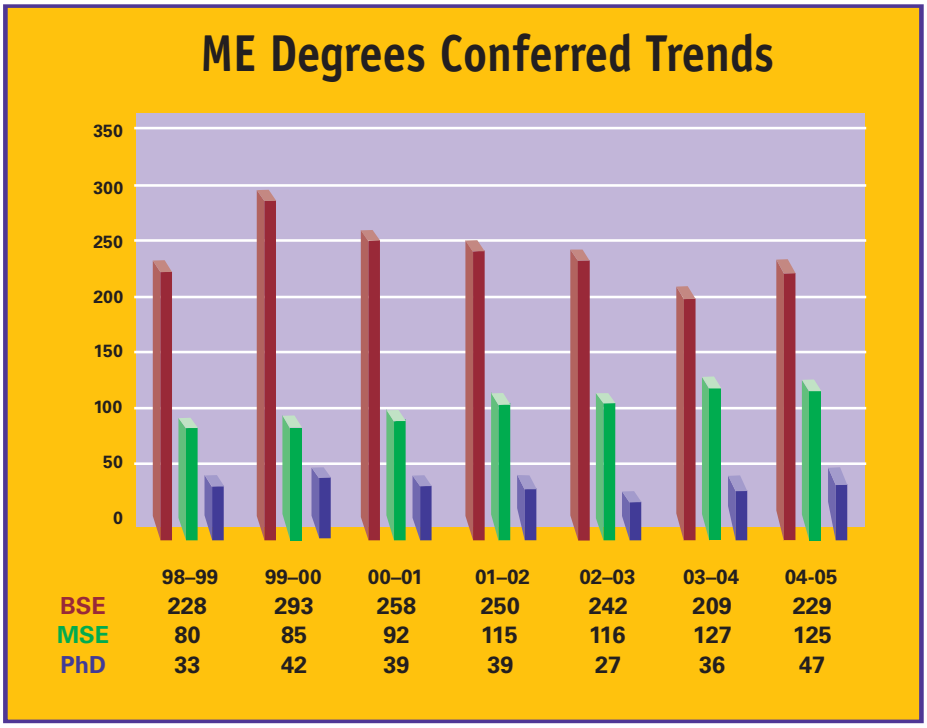
New Student Achievement
Rennel Melville
Iyabo Williams

enrollment & degree trends



Following a few years of steady enrollments, our undergraduate population is currently experiencing a significant growth. With incoming freshmen declaring ME as their most preferred choice among the CoE programs, we expect that the increase in our undergraduate enrollment will continue in the future. In parallel, we continue to see high interest in our Master's and PhD programs, which has bucked the overall national trend of declining admissions in such programs. The popularity of our programs reflects both the strong job prospects for our graduates and the excellent quality of our programs.

Degree production surged in 2004-05. We expect this trend to continue at the Bachelor's level. Last year, we also graduated the largest number of PhDs in a decade, almost one per faculty member. A large number of our doctoral graduates accepted academic positions at prestigious academic institutions (see pages 46-49). The foundation laid in our curriculum has allowed our graduates to be successful beyond their Michigan experience, and we wish all of them well in their new endeavors.



Ph.D. Degrees Conferred

Fall 04

Junseok Chang
Thermal Characterization and Heat Transfer Study of a Gasoline Homogeneous Charge Compression Ignition Engine Via Measurements of Instantaneous Wall Temperature and Heat Flux in the Combustion Chamber
Co-chairs: Dennis Assanis & Zoran Filipi

Joseph Clement
Smart Attachment Mechanisms
Chair: Diann Brei

John Harder III
Controlling Thermally Induced Bearing Loads to Improve Spindle Performance
Co-chairs: Jeffrey Stein & Sinan Badrawy

Brian Jensen
Multi-Physics Modeling and Experimental Investigation of Low-Force MEMS Switch Contact Behavior
Chair: Katsuo Kurabayashi

Hashem Mahmoud
A Continuum Approach to the Modeling of Microstructural Evolution in Polycrystalline Solids
Chair: Krishna Garikipati

Sripriya Ramamoorthy
Passive and Active Structural Acoustic Filtering in Cochlear Mechanics — Analysis and Applications
Chair: Karl Grosh

Ramanan Sankaran
A Computational Study of Auto-ignition and Flame Propagation in Stratified Mixtures Relevant to Modern Engines
Chair: Hong Im

Prabhjot Singh
A Framework for Reverse Engineering Using Feature-Based Geometry Reconstruction and Multi-Directional Layered Manufacturing
Chair: Debasish Dutta

Paul Tortora
Electrical-Impedance Tomography for the Quantitative Measurement of Solids Distributions in Gas-Solid Riser Flows
Chair: Steven Ceccio

Bing-Shiang Yang
Control of Frontal-Plane Balance on a Laterally-Compliant Raised Structure
Chair: James Ashton-Miller

Winter 05

Aristotelis Babajimopoulos
Development of Sequential and Fully Integrated CFD/Multi-zone Models with Detailed Chemical Kinetics for the Simulation of HCCI Engines
Chair: Dennis Assanis

Melinda Chin
Electrical Contact Resistance of Anisotropic Conductive Adhesive (ACA) Assemblies in Micro-Scale Packaging
Co-chairs: Jack Hu & Kaushik Iyer

Luciana DaSilva
Integrated Micro Thermoelectric Cooler Theory, Fabrication and Characterization
Chair: Massoud Kaviany

Ronald Grover
A Methodology for CFD Predictions of Spark-Ignition Direct-Injection Engine Conical Sprays Combining Improved Physical Submodels and System Optimization
Chair: Dennis Assanis

Youngwon Hahn
Development of Mixed Shell Element for 7-Parameter Formulation and Identification Methods of Lowest Eigenvalues
Chair: Noboru Kikuchi

Sung-Tae Hong
Mechanical Behavior of Aluminum Honeycombs Under Multiaxial Loading Conditions
Chair: Jwo Pan

Timothy Jacobs
Simultaneous Reduction of Nitric Oxide and Particulate Matter Emissions From a Light-Duty Diesel Engine Using Combustion Development and Diesel Oxidation Catalyst
Chair: Dennis Assanis

Hamed Khalkhali
Modeling and Design of Compact Thermosyphons for Electronic Cooling
Chair: Katsuo Kurabayashi

Taeyong Kim
The Role of Jelly Coats in Sea Urchin Egg Fertilization: A Combined Experimental and Numerical Investigation
Chair: Ann Marie Sastry

Sang-Ho lim
Dynamic Analysis and Design Strategies for Mistuned Bladed Disks
Co-chairs: Christophe Pierre & Matthew Castanier

Jie Luo
Machining of Elastomers
Chair: Albert Shih

Yuan-Hung Ma
Operation of Manufacturing Systems With Work-in-Process Inventory and Production Control
Chair: Yoram Koren

Jeremy Michalek
Preference Coordination in Engineering Design Decision-Making
Chair: Panos Papalambros

Tiffany Miller
Combustion Synthesis of Metal/Metal Oxide Nanocomposite Materials
Chair: Margaret Wooldridge

Volkan Patoglu
Guaranteed Stability for Collision Detection and Simulation of Hybrid Dynamical Systems
Chair: R. Brent Gillespie

Huan Qi
Synthesis of Designed Materials by Laser-Based Direct Metal Deposition Technique: Experimental and Theoretical Approaches
Co-chairs: Noboru Kikuchi & Jyotirmoy Mazumder

Zimin Yang
Dynamic Maintenance Scheduling Using Online Information About System Condition
Chair: Jun Ni

Cetin Yilmaz
Analysis and Design of Uniaxial Passive Vibration Isolators Considering Stiffness and Bandwidth Limitations
Chair: Noboru Kikuchi

Fu Zhao
Microfiltration Recycling of Semi-Synthetic Metalworking Fluids: Models, Formulation, and System Design
Chair: Steven Skerlos

2004-05 Graduates Receive Faculty Appointments

ME alumni have been appointed to faculty positions at prestigious institutions around the country, and the world. Recruited for their achievements in theoretical as well as experimental research and industry experience, they now have the opportunity to educate the next generation of engineers.

KIMBERLY COOK

Assistant Professor
Drexel University

Kimberly A. Cook assumed a faculty position as an assistant professor of Mechanical Engineering at Drexel University on September 1, 2005. She earned her bachelor's in ME from U-M in 1994, a master's in ME from Stanford in 1995 and a Ph.D. in Biomedical Engineering from U-M in 2005.

Cook's attraction to Drexel was threefold, she said: its strong academic reputation in engineering; its location in a major urban center that affords numerous opportunities for collaboration; and the co-op programs it offers students. "This type of learning environment not only equips students with a tool set for working in industry; it also makes them fun and challenging to teach," she said.

Cook's research focuses on the design of homogeneous and hybrid power supply solutions for applications that span micro to macro scales, specifically applications for power generation and regeneration, storage and distribution of energy via implementation of alternative regenerative energy and design optimization techniques. She currently is researching power supply design strategies for wireless and portable electronics, locomotives for public transportation and power grids.

"My years as a student at U-M molded me into the person and engineer I am today," she said. "My professors, including my research advisor Professor Ann Marie Sastry, taught me that teaching difficult material in a manner that challenges and inspires young people is crucial during the early stages of undergraduate education. My professors helped me navigate a rigorous engineering curriculum by being accessible and dedicated. They fostered my respect for talent from all walks of life and cultivated my desire to perform research to solve problems that benefit society as a whole."

BRIAN JENSEN

Assistant Professor
Brigham Young University

Brian D. Jensen (Ph.D. ME '05) has joined the faculty of Brigham Young University, where he earned his bachelor's and master's degrees in mechanical engineering. He assumed the position of assistant professor in January 2005.

"I was attracted by the department's and university's commitment to high-quality undergraduate education while performing and publishing high-quality research," he said. "I love teaching and research, so this emphasis on both is satisfying to me." Jensen will teach courses in mechanical design, optimization, computer-aided engineering and dynamic system modeling.

He will also test and expand some of the ideas he developed while at U-M working with his advisor, Assistant Professor Katsuo Kurabayashi, on the design and development of micro-electro-mechanical systems, particularly micro-switches. The focus of his work has been on finding ways to improve the reliability of micro-switches and to understand the physics and chemistry of micro-switch contacts. At Brigham Young, he has already started new programs focused on developing low-friction-factor microchannels for fluid flow and high-resolution micro-force sensors.

Jensen credits his time at U-M, where he earned a second M.S. in electrical engineering and a Ph.D. in ME, for having had such a "strong effect on the direction and quality of my work" and for the sense of confidence he gained in investigating new research problems and areas.

SANGWON LEE

Research Assistant Professor
Sungkyunkwan University, South Korea

Sangwon Lee earned his Ph.D. in ME from the University of Michigan in 2004 and a bachelor's and master's degree in mechanical design and production engineering from Seoul National University in Seoul, South Korea. Currently he is a research assistant professor of CREDITS (CREative Design and Intelligent Tutoring Systems) Research Center of Sungkyunkwan University in Suwon, South Korea. He will assume an appointment as an assistant professor in the school of mechanical engineering beginning in March 2006. Lee will teach courses such as Creative Engineering Design, Design for Manufacturing, Manufacturing Process and Systems, and Mechanical Vibration.

"I have dreamed of life as a teacher and researcher ever since I graduated from high school," said Lee. "This is a perfect job to realize my long-cherished dream. As a teacher and researcher in engineering, I enjoy digging up new and challenging research areas, which can be used to improve the quality of human life. In addition, Sungkyunkwan University is one of the top five universities in South Korea and rapidly growing."

Lee's research focus has been micro manufacturing, specifically the design and development of a meso-scale machine tool system and novel geometric error measurement system using lasers. During a post-doctoral research fellowship at U-M, he studied the feasibility of a new dry electrical-discharge machining (EDM) technology for the manufacture of micro-scale components.

Working in the S.M. Wu Manufacturing Research Center at U-M, and with Jun Ni, center director and professor, gave Lee "lots of valuable knowledge and experience. "He helped me mature as a researcher and teacher. As a matter of fact, life at U-M prepared me for successfully starting my new career in academia."

KERR-JIA LU

Assistant Professor
George Washington University

Kerr-Jia Lu (Ph.D. ME '04, M.S. ME '99) has joined the faculty of George Washington University in the School of Engineering and Applied Science. Her appointment as an assistant professor in the Department of Mechanical and Aerospace Engineering began in fall 2004.

Lu teaches introductory courses in mechanical engineering as well as several design courses. She says she accepted the position with George Washington University because of the size of its engineering program, which allows for close interaction between students and faculty. And its location "provides great opportunities for collaboration with many nearby federal research labs. I'm looking forward to inspiring my students and to developing exciting research here."

She will continue her research in the area of nature- and bio-inspired designs, smart structures and compliant mechanism synthesis, which she began while a graduate student at U-M and research assistant to Professor Sridhar Kota. In the Compliant Systems Design Laboratory, Lu developed and implemented a systematic approach for morphing compliant mechanisms involving discrete/continuous optimization, finite element analysis and basic pattern recognition methods. She also developed a novel parameterization scheme using load paths to represent various structural topologies and ensure structural connectivity.

Teaching isn't new to Lu, who served as a graduate student instructor for three ME courses while at U-M: Design and Manufacturing III (ME 450); Mechanism Design (ME 551); and Design for Manufacturability (ME 452). "I learned a lot from those experiences and found helping the students learn very fulfilling. That's part of the reason why I decided to pursue a career in academia."

ALAN MCGAUGHEY

Assistant Professor
Carnegie Mellon University

Alan McGaughey (Ph.D. ME '04) began an appointment as an assistant professor in the Mechanical Engineering department at Carnegie Mellon University in August 2005.

His research interests are the atomic-level modeling of the transport of heat, mass and momentum in solid and fluid phases. The ME department at CMU is strong, he says, with increasing emphasis on diverse and non-traditional areas of research. "I feel its collaborative and multidisciplinary nature suit me very well."

His work in this area began while a master's candidate at the University of Toronto working with Professor Charles Ward and while earning his Ph.D. at U-M with thesis advisor Professor Massoud Kaviany. "My advisors gave me a significant amount of freedom to explore, which helped me to develop the ability to do research independently while still benefiting from the expertise of a mentor." His Ph.D. dissertation, "Phonon transport in molecular dynamics simulations: Formulation and thermal conductivity prediction," was awarded the Distinguished Dissertation Award from Rackham for 2004.

Between earning his Ph.D. and beginning his appointment at CMU, McGaughey conducted post-doctoral work at the University of Florida, Gainesville, in the Materials Science and Engineering department. With researchers at the University of Pittsburgh, he worked on the development of molecular dynamic simulations that will allow for the modeling of different materials — metals, oxides, covalent structures — at the same time. The availability of such techniques is limited, and "I saw this as both an excellent opportunity to learn something new and also as a way to gain a collaborator in Pittsburgh before even moving there."

JEREMY "J." MICHALEK
Assistant Professor
Carnegie Mellon University

Jeremy "J." Michalek (M.S. ME '01; Ph.D. ME '05), assumed a faculty appointment at Carnegie Mellon University as an assistant professor in fall 2005.

Michalek completed post-doctoral work in the Optimal Design Laboratory in U-M's ME department, where he coordinated models of stakeholder preferences with models used in engineering design decision-making. He served as education chair for BLUElab, formerly Engineers Without Borders.

Michalek says it was his advisor, Professor Panos Papalambros, who "encouraged me to push disciplinary boundaries" and who encouraged working with experts in other fields. Michalek's cross-disciplinary interest in design optimization and social, economic and policy perspectives on design led to his decision to join the Carnegie Mellon faculty. "It's a wonderful fit for my interests. CMU has a strong respect for design research, a tradition of interdisciplinary research and teaching, and research centers for complex engineered systems, computational design, the environment, and engineering and public policy."

Plenty of teaching experience in the ME department also influenced his decision to join CMU. Michalek co-developed a new interdisciplinary course, Engineering for Community (ENGR 490), which earned an MLK Spirit Award in 2004, and Analytical Product Design (ME 499/599), which grew in part out of techniques developed in his dissertation. He has served as course aid, graduate student instructor and GSI mentor. "I hope that through teaching I can encourage my students to continuously consider the impact of their decisions within the context of the society around them."

TIFFANY A. MILLER
Assistant Professor
Drexel University

Tiffany A. Miller has been appointed an assistant professor of mechanical engineering and mechanics at Drexel University. She earned her bachelor's (2001), master's (2002) and doctoral (2005) degrees in Mechanical Engineering from U-M.

Miller will teach MEM 320: Fluid Dynamics I during the fall and spring terms and co-teach TDEC 202: Energy II, which covers the application of conservation-of-energy principles to the analysis of engineering problems, in the winter term. Her research program will expand on work begun at U-M with her advisor, Associate Professor Margaret Wooldridge, on the development of nanocomposite powders using techniques such as combustion synthesis and the examination of scaling possibilities for such systems.

"I also have a strong interest in developing materials such as biosensors and sensor arrays, catalysis development and pollution mitigation, and energy storage and conversion," she said. "To name a few, materials for toxic gas sensors, solar cells, and hydrogen storage, transport and delivery systems, all can be advanced — and revolutionized — by the application of nanoscience.

"Drexel is a smaller institution than Michigan, with both strong undergraduate, graduate and research programs. The college and university are both experiencing a period of growth and development, which I know will allow for many unique research and teaching opportunities in my areas of interest."

KATHERINE S. PETERSON
Assistant Professor
Purdue University

Katherine S. Peterson joined the faculty of Purdue University in June 2005 as an assistant professor in the School of Mechanical Engineering. She is teaching ME 575: Control Theory and Design, a first-year graduate course.

An interdisciplinary approach to research and plans for several new research facilities are what drew Peterson to the job, she said. "My time at U-M taught me the importance of collaboration. During my Ph.D. work I had the good fortune to work closely with several faculty members in addition to my advisor, Associate Professor Anna Stefanopoulou. Even though I have just started here at Purdue, other faculty and I have already begun talking about possible collaborations."

The focus of Peterson's research at U-M was on developing controllers for valve timing. Her work resulted in one patent and several citations in the academic and popular presses. After earning her Ph.D., she spent time in Australia, where she worked on control of active magnetic bearings and flexible structures, and she worked with researchers in Sweden on extremum seeking control. Currently she is looking at the control of medical devices, specifically how to control a self-propelled endoscope.

ARDALAN VAHIDI
Assistant Professor
Clemson University

Ardalan Vahidi accepted an appointment as an assistant professor of mechanical engineering at Clemson University, where he will teach control and automotive courses and continue his research on automotive and energy systems. He earned his Ph.D. in ME in 2005.

One of Vahidi's research interests is in the application of modern control techniques to resource management of energy-generating and storage devices. In automotive and transportation systems, his focus has been on active safety and driver-assist system design, and he continues to work in this area on devices and methodologies that enable deployment of active safety systems.

Vahidi says it was his experiences at U-M that led him to Clemson. "Working with an excellent body of students and faculty, including my advisors Professors Anna Stefanopoulou and Huei Peng, broadened my vision about research. Excellent classes, and being a graduate student instructor, gave me a good start in teaching here at Clemson. The interactions with researchers from other universities was also a fantastic opportunity."

He expects that new opportunities await, including those resulting from an international automotive research center that Clemson is establishing in close collaboration with BMW, Michelin, Timken and other automotive companies. "This has created a lot of interest in the university and nationwide," he said. "When I interviewed here I really liked the momentum."

DUNG-AN WANG
Assistant Professor
National Chung Hsing University, Taiwan

Dung-An Wang has joined the faculty of National Chung Hsing University in Taichung, Taiwan, as an assistant professor in the Institute of Precision Engineering. He will be teaching courses in precision manufacturing, the design of MEMS and the Engineering sciences in MEMS.

Wang earned his Ph.D. in ME from U-M in 2004. He worked as a teaching and research assistant in the ME department while pursuing his degree and held the position of project engineer of advanced engineering analysis at National Steel near Detroit.

Wang says he chose National Chung Hsing University for its top-notch experimental facilities and motivated student body. He has already established research projects in the areas of bulk assembly and disassembly of micro-scale components, where he is developing a new method for on-substrate fine positioning of microscale and mesoscale discrete components; failure mechanisms of friction stir spot welding; and the constitutive modeling of foams.

From his time at U-M, Wang says he gained insightful research experience working with his advisor, Professor Jwo Pan, and an invaluable "dedication to work."

ROBERT WHITE
Assistant Professor
Tufts University

Robert White, who earned his Ph.D. in ME in 2005, recently joined the mechanical engineering faculty of Tufts University. He will teach graduate and undergraduate courses on dynamics, vibration, acoustics and MEMS. His research interests include the design, modeling and fabrication of micro- and nanosystems, and he has already started projects in the areas of MEMS acoustics sensing, thin film material characterization and chaos in MEMS.

White chose a career in academic teaching and research because of the chance to interact with students, stay current in his field and "be part of the advancement of engineering science in areas I find interesting and important." He says he chose Tufts specifically because of its commitment to "cutting-edge research in a variety of disciplines and its involvement of both undergraduates and graduates in research. Tufts is committed to effective and relevant teaching and really cares about its students."

White is excited to move forward in his areas of expertise, honed through work with his advisor at U-M, Associate Professor Karl Grosh. "Earning my Ph.D. at U-M was critical in developing skills in microfabrication, acoustic and multiphysics numerical modeling and acoustics/vibration testing. I also gained an interest in cochlear mechanics and RF MEMS systems and had the opportunity to participate in many academic conferences and seminars that helped me develop public speaking and technical writing skills."

OTHER RECENT APPOINTMENTS

Jamie Camelio (Ph.D. 2002), Assistant Professor, Michigan Technological University

Theodore Freiheit (Ph.D. 2003), Assistant Professor, University of Calgary, Canada

Mahmoud I. Hussein (Ph.D. 2004), Research Associate, University of Cambridge

Harrison Kim (Ph.D. 2001), Assistant Professor, University of Illinois at Urbana-Champaign

Valerie Maier-Speredelozzi (Ph.D. 2003), Assistant Professor, University of Rhode Island

Two New Faculty Join ME

Nikolas Chronis has been appointed Assistant Professor of Mechanical Engineering. He will join the department in fall 2006.

Chronis' research focuses on the development of bio-MEMS systems. He has developed and demonstrated for the first time novel polymer micromachined 'amphibious' actuators that operate in both air and physiological media. Using these actuators, he fabricated polymer microgrippers for single cell manipulation, which can be used in various applications, including as microsurgical tools inside the body.

He has also developed a TIR — or total internal reflection — based biochip utilizing silicon micromirrors and polymer-filled cavities integrated with microfluidics. The resulting micro-optical system has potentially single-fluorescent molecule detection capabilities for ultrasensitive, high-throughput screening applications.

To explore how information is processed in complex neuro circuitry, from the sensory to the interneuron and motor neuron levels, Chronis fabricated a new microfluidic 'worm trap and fluidic delivery' chip that enables researchers to record activity from interneurons in the worm *C.elegans.* His work has yielded detailed data about the role and function of specific neurons involved in the worm's olfactory circuit.

A faculty position at U-M "offers two elements that a junior faculty member is looking for," said Chronis of his decision to accept the job at U-M: "an excellent academic environment with well-established faculty, an outstanding student body and top-notch facilities and infrastructure, such as state-of-the-art MEMS/NEMS fabrication labs for high-end research."

He is also excited about the myriad opportunities for multidisciplinary work and plans to establish an interdisciplinary bio-MEMS laboratory that focuses on system integration of micro-optical and microfluidic elements for lab-on-a-chip applications and point-of-care diagnostics. "The top-rated departments of biology and bioengineering and the University of Michigan Medical School will provide the chance to develop unique and successful collaborations," he said.

Given his research interests, Chronis will teach graduate courses in MEMS/NEMS and bio-MEMS/NEMS as well as undergraduate courses in fluid dynamics and heat transfer.

Currently Chronis is completing post-doctoral work at Rockefeller University. He earned his doctoral degree from the University of California at Berkeley (2004) and his bachelor's degree from Aristotle University in Thessaloniki, Greece (1998).

Angela Violi has been appointed Assistant Professor of Mechanical Engineering. She will assume the position in January 2006. Currently she serves as an adjunct professor in the ME department.

Violi's research focuses on nanoparticle growth and self-assembly, nanoparticle interactions with biomolecular systems, molecular modeling of complex systems using atomistic models, applied chemical kinetics and aerosols.

Particulate emissions on the nanoscale relate to two pressing environmental problems: the health impact of fine particles and global warming, according to Violi. The goal of her research is to characterize organic pollutants of high molecular mass both chemically and physically and to study their interaction with the environment and living organisms.

She is working toward the development of a theoretical nano-science program through the use of novel simulation methodologies at disparate spatial and temporal regimes such as Molecular Dynamics and Monte Carlo. The objective is to develop atomistic approaches to study the formation and fate of carbonaceous material since size, chemical functionalities and water solubility play a role in the interactions of aerosols with human lung tissue. Also as nanoparticles age, cyclodehydrogenation reactions lead to the

From left to right:
Nikolas Chronis and Angela Violi

formation of 'graphitic' domains that further enhance absorption, a process relevant to understanding global warming.

Since her research has evolved from experimental combustion to molecular modeling of complex systems using atomistic methodologies and nanoparticle interactions with biomolecular systems, she plans to teach a graduate course at U-M that draws on these areas with respect to molecular dynamics and applied chemical kinetics.

Violi earned her B.S. (1994) and Ph.D. (1999) in chemical engineering from the University of Naples Federico II. She conducted post-doctoral research at the University of Utah, where she currently serves as joint research assistant professor in the Departments of Chemical Engineering and Chemistry.

She is looking forward to continuing her work at U-M. "The University of Michigan has one of the strongest engineering schools in North America. I'm excited by the opportunity to work with such high quality students and faculty. Ann Arbor is a great place to live, and I'll be close enough to industry and other top institutions that I expect to have no difficulty cultivating rewarding collaborative relationships both on and off campus."

Wei-Hsuin Yang Retires

Wei-Hsuin Yang, professor of applied mechanics, retired from active faculty status on May 31, 2004.

A native of Taiwan, Yang received his B.S.c degree from National Cheng Kung University in 1958, his MSc degree from the University of Washington in 1962, and his Ph.D. degree from Stanford University in 1965. He joined the U-M faculty in 1965 as an assistant professor and was promoted to associate professor in 1969 and professor in 1975.

Yang's research focused on the mathematical foundation of plasticity theory, and he played a large role in introducing numerical methods into mechanics. In the later years of his career, he was very proud of his association with the distinguished Professor L. Cesari at the University of Perugia, Italy, on theorems for variational calculus.

He developed a generalization of the well-known Hölder inequality and applied this generalization to problems of minimal surfaces, plasticity and optimal designs. The practical impact of this research to industrial manufacturing processes and structural designs is only now being realized. His research interests extend further to solid mechanics, applied mathematics, numerical analysis, structural optimization, manufacturing process optimization, structural crash worthiness, optional design of wheels and welding, and resulted in more than 65 publications.

Yang was a member of the American Society of Mechanical Engineers, the Society of Industrial and Applied Mathematics, and the scientific research society, Sigma Xi. He served on numerous departmental, College and University committees, including the Senate Assembly, the College's Coordinating Committee on Mechanics, and the Department's graduate, curriculum, admissions and financial aid committees.

A popular teacher, Yang mentored 19 Ph.D. students. He was also a visiting scholar at many institutions, including the Courant Institute of Mathematical Science at New York University, Stanford University, the University of Stuttgart in Germany and the University of Perugia.

Yang and his wife have retired to the Bay Area to be with family and friends.

FACULTY PROMOTIONS

Ellen Arruda, ME, from Associate Professor to Professor with Tenure

David Dowling, ME, from Associate Professor to Professor with Tenure

Hong Im, ME, from Assistant Professor without Tenure to Associate Professor with Tenure

Huei Peng, ME, from Associate Professor to Professor with Tenure

Ann Marie Sastry, ME, from Associate Professor to Professor with Tenure

Volker Sick, ME, from Associate Professor to Professor with Tenure

Nick Vlahopoulos, NA ME, from Associate Professor to Professor with Tenure

Zoran Filipi, from Associate Research Scientist to Research Associate Professor

Michael Kokkolaras, from Assistant Research Scientist to Associate Research Scientist

Zheng Dong Ma, from Associate Research Scientist to Research Scientist

Zbigniew Pasek, from Assistant Research Scientist to Associate Research Scientist

Bruce Karnopp Retires

After a four-decade career, Associate Professor Bruce Karnopp is retiring. Sort of. While Karnopp was named Associate Professor Emeritus of Mechanical Engineering at the end of August 2004, he adds "and counting" when tallying the years he's spent teaching — 38 of them at U-M. He will continue to serve the ME department and College of Engineering.

Karnopp joined the ME faculty in 1968 after spending three years as an assistant professor at the University of Toronto. He earned his bachelor's degree from Massachusetts Institute of Technology, his master's from Brown, and his Ph.D. in Engineering Mechanics from the University of Wisconsin. He has distinguished himself in the field of dynamics, written the widely published textbook, "Introduction to Dynamics," and developed software to solve problems in dynamics, strength of materials, applied mathematics and vibrations. The focus of his own research has been vibrations and vibration analysis and damping capacity.

At U-M, Karnopp was promoted to associate professor in 1973 and was granted tenure in 1974, a milestone that still stands out in his mind among numerous professional accomplishments.

Associate Professor Emeritus Bruce Karnopp with family members during a celebration held in honor of his retirement.

Another, he says, was being named assistant dean of the college in 1983. He held that position for six years, during which time he developed and instituted recruiting programs for underrepresented students. He recruited minority students through the Ford Fairlane Mansion in

Over the years, some 15,000 students have benefited from Karnopp's commitment to education and learning.

Dearborn and students from rural areas through his Alpena Project. He served on the university's Admission's Advisory Committee from 1987 to 1996 and, as chair, drafted a mission statement galvanizing the university's commitment to diversity.

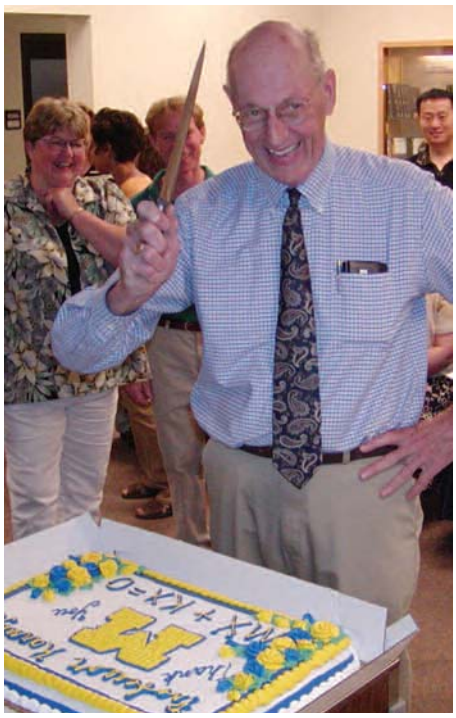
But Karnopp didn't stop with recruiting students and writing mission statements. He put principles into action by participating in the College's Summer Engineering Academy, where he helped prepare incoming students to enter — and excel in — the college's engineering programs. For more than 15 years, he's also served as the faculty contact for the college orientation program, in which each entering class of about 1,000 students and their parents participate. "These students are fresh out of high school and have little or no understanding of the engineering field," says Karnopp, which is why "it's important to give them an idea of the courses they'll take and the opportunities available to them. The experience they get at orientation motivates them."

In the classroom, where Karnopp taught introductory and intermediate dynamics at both the graduate and undergraduate levels, his teaching evaluation score averaged 4.71/5.0. Over the years Karnopp says students have told him they've appreciated his punctuality and preparedness. Recently a student from 1979 sent Karnopp an email after finding an old faculty directory. "I enjoyed your course and text immensely. (I still refer to the text many times.) It was all laid out so beautifully and clearly, and all we had to do was study." The former student, John Moskwa, also fondly remembers Karnopp's musical quips.

Fifteen years ago Moskwa founded the Powertrain Control Research Laboratory at the University of Wisconsin. The lab develops variations of high bandwidth transient test systems and does control and modeling research with these tools. And he credits Karnopp with providing him "the solid foundation in dynamics, which is indispensable to the work we do."

Karnopp has been formally recognized as an outstanding educator several times. He is a recipient of the Amoco Teaching Award, the Arthur F. Thurnau Professorship, the College of Engineering Teaching Excellence Award and the Michigan Association of Governing Boards of State Universities Distinguished Faculty Award. He also was selected as the Professor of the Term six times by the U-M chapter of Pi Tau Sigma.

Karnopp has seen plenty of changes since he began teaching at U-M in 1968. "Decades ago, many students came from working class or farm backgrounds. They had life experiences that dovetailed with engineering. Today our students are smart but often have never held a drill or wrench in their hands. All too often, these students are unsure what a career in engineering would entail." The change in technology, he adds, is "dramatic. We've gone from slide



Professor Karnopp prepares to cut the cake.

rules to personal computers, from rotary phones to omnipresent cell phones."

Karnopp is likely to continue to see more changes on campus since, despite his "emeritus" title, he will remain active in the department and plans to finalize a set of computer programs to be incorporated into his second book.

Over the years, some 15,000 students have benefited from Karnopp's commitment to education and learning. It's a commitment, and philosophy, that he applies to his own life as well. In addition to looking forward to spending more time with his wife, children and grandchildren now that he has less of a workload, he's also anxious to learn a new skill. "It's often said that engineers should look forward to lifelong learning if they are to remain in the profession. My wife gave me a 4x5 super-graphic camera for my 66th birthday and retirement. Going from roll film, which I have used for 50 years, to sheet film has put me on the earliest part of the learning curve. This is both exciting and frustrating, but to have the time to work on it gives me a great deal of enjoyment."

As Moskwa joked in his email to Karnopp, "You are much more than a one-dimensional engineer."

Celebrating the Life of Professor Gerard M. Faeth

Professor Gerard M. Faeth unexpectedly passed away in his home on Monday, January 24, 2005.

Faeth was known internationally for his numerous, diverse and lasting research and educational contributions to engineering and the sciences. His research involved multiple disciplines — physics, chemistry, and aerospace and mechanical engineering — and advanced the work of other researchers and practicing engineers.

Gerard M. Faeth

Faeth was the Arthur F. Modine Distinguished University Professor, a Professor of Aerospace Engineering and Mechanical Engineering and Head of the Gas Dynamics Laboratories at U-M. Since 1959, he had enjoyed a stellar career in teaching and research on combustion, transport, and fluid dynamics at two of the nations' premier universities, Penn State and U-M. He was a highly devoted teacher and an excellent research mentor who graduated more than 50 Ph.D. students and 30 post-doctoral research fellows. Greatly influenced by his outstanding mentorship, many of his students have emulated his footsteps and have pursued their own academic careers.

Faeth's seminal research contributions to the fundamentals of combustion and heat transfer are of exceptionally high quality. He is widely recognized as the leading and most cited researcher in the area of spray breakup and soot formation fundamentals. He has also made broader impact through the application of his fundamental findings to practical industrial problems, such as those found in gas turbine combustors, internal combustion engines and paint sprays. He was the author or co-author of more than five hundred journal articles and papers, which have shaped the field.

Faeth dedicated a great deal of his energy to render extensive and truly outstanding service to academia and his professional community, where he served as editor-in-chief of the three most prestigious journals: the *AIAA Journal, Combustion and Flame*, and the *ASME Journal of Heat Transfer*. Faeth received numerous honors throughout his career, culminating with his election as a member of the National Academy of Engineering in 1991. In 1993 he received the College of Engineering's Stephen S. Attwood Award, the highest honor the college can bestow on a faculty member. He was scheduled to give his lecture as the Arthur B. Modine Distinguished University Professor of Aerospace Engineering. The Distinguished University Professorship is one of the highest honors a Michigan faculty member can receive.

The ME Department will gravely miss Professor Faeth as a colleague, teacher, mentor and friend.

TEAMWORK LEADS TO OUTSTANDING ACHIEVEMENT

ME Professor Huei Peng and ME Associate Professor Anna Stefanopoulou have earned 2004-2005 Outstanding Achievement Awards.

Peng has been working on a three-year project funded by the National Science Foundation, the National Institute of Standards and Technology and Daimler-Chrysler on the water management of fuel cell stacks. He is using relative humidity sensors and neutron beam techniques to detect dryness and moisture respectively. The measurements obtained will enable predictive modeling and control strategies for the fuel cell stack humidity.

Stefanopoulou has been working on the development of controllers, fault detection methodologies and diagnostic algorithms for the regulation of reactant flow and pressure, and temperature in fuel cell stacks and fuel processors for hydrogen generation. The work is funded by the National Science Foundation and leveraged through summer internships from United Technologies Corporation.

Working as a strong team, the two established the Fuel Cell Control Systems Laboratory in 2001, with support from the National Science Foundation and the U-M Automotive Research Center. The laboratory is unique among academic institutions, and the models and controllers developed there are already used by many academic and industrial research groups worldwide. The Fuel Cell Control Laboratory "fills in the critical gap of experimental verification and availability of public-domain data," Stefanopoulou said.

Professor Huei Peng and Associate Professor Anna Stefanopoulou with their research group. From left (front) are Stefanopoulou, Denise McKay, Katherine Peterson (now at Purdue), Ardalan Vahidi (now at Clemson), Kyung-Won Suh, Ming-Joon Kim, Peng, Vera Simms; and (back) Ray Chiang, Vasilis Tsourapas, Vernon Newhouse (now at GM), Jeff Everett.

Prized Professor

Anna Stefanopoulou at Manly Beach, Sydney, Australia — 3rd IFAC symposium on Mechatronics.

Associate Professor Anna Stefanopoulou has earned the 2005 Henry Russel Award, conferred in recognition of "distinguished scholarship and conspicuous ability as a teacher." The award is one of the highest honors the University grants to faculty with less than six years' tenure.

The Henry Russel Award and the Henry Russel Lectureship were established with a bequest from the late Henry Russel, a U-M alumnus and former vice president of the now-defunct Michigan Central Railroad.

Stefanopoulou's work focuses on automotive powertrain control systems and architectures, vehicle and transportation control, the control of advanced automotive engines, fuel cell power and hydrogen reforming, control of breathing through valves, vanes, and membranes and development of modular controller architectures.

She has earned numerous honors, including the Society of Automotive Engineers' 2002 Ralph R. Teetor Educational Award, which recognizes engineering educators for teaching and curriculum and professional development. She is the recipient of four Ford Innovation awards and was named one of the 'World's Top 100 Young Innovators' by MIT Technology Review. She holds eight patents.

Upon learning she earned the Henry Russel Award, Stefanopoulou said she "felt indebted to all of the colleagues who worked hard to gather the material necessary for the award nomination. During the award ceremony I looked at the list of former recipients with awe."

The greatest reward, however, remains the interaction with students and "their transformation into confident, curious researchers and well-respected engineers and educators at top academic institutions."

GOLDSTEIN ELECTED TO THE NATIONAL ACADEMY OF ENGINEERING

Professor Steven A. Goldstein has been elected to the National Academy of Engineering, the highest professional recognition to be bestowed upon an engineer. Membership in the academy honors engineers for their contributions to engineering research, practice or education.

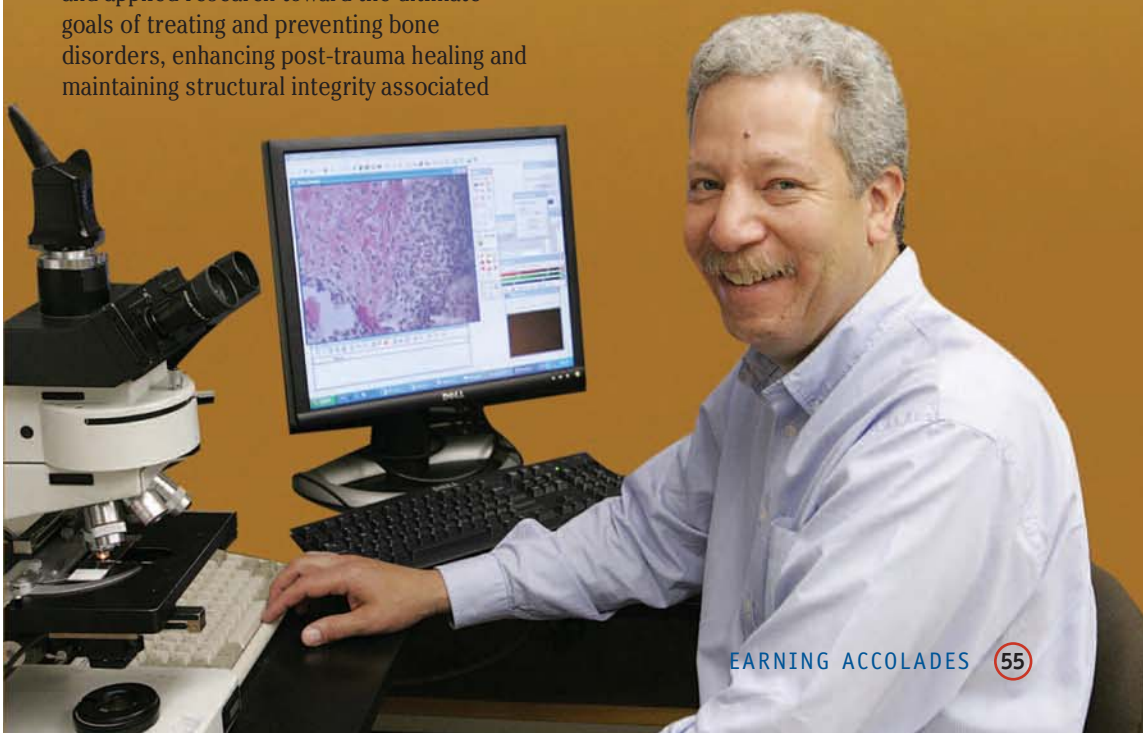
Goldstein serves as Henry Ruppenthal Family Professor of Orthopaedic Surgery and holds joint appointments as Professor of Biomedical Engineering and Professor of Mechanical Engineering. He was recognized for furthering the profession's understanding of bone micromechanical and remodeling behaviors and their translation into new therapies for repair and regeneration.

Goldstein's work examines how both mechanical and biologic factors influence bone formation, repair and adaptation. "Bone is a truly smart material," he explained. "It has the ability to continuously sense its chemical, biological, and most importantly, its mechanical environment." That ability to sense the mechanical environment and react appropriately, he said, is at the root of normal bone function, and "if we understood the fundamental control mechanisms, we could then identify the biofactors and genes that might be dysfunctional in disorders and design rationale strategies for their repair or replacement."

His research has included both fundamental and applied research toward the ultimate goals of treating and preventing bone disorders, enhancing post-trauma healing and maintaining structural integrity associated with the aging process. He has designed new surgical instruments and a unique artificial joint that can be biologically anchored in bone, which increases longevity and functionality. He also co-developed a methodology for using gene therapy to alter the wound healing response in bone as well as other tissues, including skin, cardiac muscle and tendon. A clinical trial using the technique for healing diabetic ulcers is underway.

Goldstein said he was both excited and humbled by his election to the NAE. But it may be the accomplishments of the students he has worked with since he joined the U-M faculty in 1981 of which he's most proud. "I have had the privilege of working with a fabulous group of trainees. Many of my graduates are doing spectacularly well in industry while a large number hold appointments at prestigious universities around the world, performing pioneering science and publishing outstanding papers. Sometimes what you're most proud of are your children."

Goldstein credits mentor Professor Emeritus Larry Matthews of the Department of Orthopaedic Surgery, with having influenced how he approaches his bioengineering work. "He taught me to step back and to try and simplify the problems, to approach them more straightforwardly. That often works and lets you unravel complex phenomena."



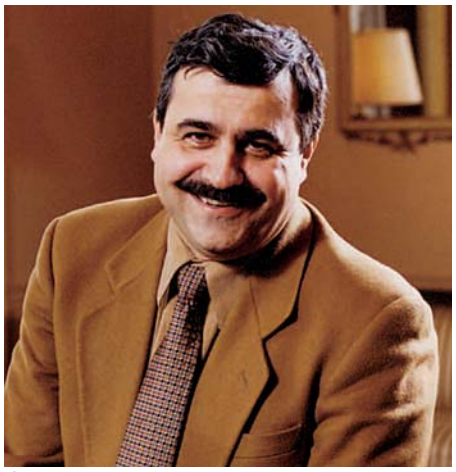
CHRISTOPHE PIERRE NAMED DEAN AT MCGILL UNIVERSITY

Christophe Pierre, formerly the Stephen P. Timoshenko Collegiate Professor of Mechanical Engineering, has joined the faculty of McGill University in Montreal as dean of the faculty of engineering, professor in the Department of Mechanical Engineering, and holder of the Canada Research Chair in Structural Dynamics and Vibration.

Pierre joined the U-M faculty in 1985, after earning his Ph.D. from Duke University. He held a joint appointment as associate dean in the Horace H. Rackham School of Graduate Studies and served as associate director of the Automotive Research Center. He was the director of the Structural Dynamics Laboratory in the ME department, where his research focus has been aerospace and automotive applications of structural and nonlinear dynamics, localization in disordered structures, mid-frequency vibration transmission in complex structures, nonlinear modal analysis and dynamics of mistuned bladed-disks and dry-friction damped systems.

Pierre is excited about his new role at McGill, particularly because of its international reputation for academic excellence. "I think McGill is ideally positioned to leverage its location in such a multicultural city to build productive partnerships with institutions in both the United States and Europe," he said.

During his Michigan tenure, Pierre earned awards for excellence in teaching, research and service, and plans to maintain some of his collaborations. He has built strong relationships with companies such as Pratt and Whitney, General Electric, and Snecma and will continue working with U-M's Associate Research Scientist Matt Castanier on the modeling of structural dynamics of turbine engine bladed disks (see story on page 4) through GE Transportation's USA Program.



Christophe Pierre

Pierre says that although he will miss Ann Arbor and U-M, he's pleased both personally and professionally to move with his family to Montreal. "It's a truly vibrant city — coming here, and to McGill, is a great opportunity."

STEVEN L. CECCIO APPOINTED TO OVPR

Steven L. Ceccio

Professor Steven L. Ceccio has been appointed Associate Vice President for Research in the Office of the Vice President for Research (OVPR) for a three-year term.

Among his chief responsibilities will be acting as OVPR liaison to other U-M units involved in scholarly and creative activities in the natural and physical sciences and engineering, according to Vice President for Research Fawwaz Ulaby. Ceccio will also lead task forces, develop initiatives, study policy issues and evaluate research proposals.

One year into his term, he is enthusiastic about his role, particularly "the opportunity to have a broader, bird's eye view of all the multidisciplinary activity that's going on throughout the research community here. It's always exciting to experience firsthand the breadth of the university."

Ceccio joined the U-M faculty in 1990 and became a professor in 2003. He holds a joint appointment in Naval Architecture and Marine Engineering, and his research focus is fluid mechanics and understanding multiphase flow processes. He currently heads two large multidisciplinary studies on the dynamics of cavitation and the reduction of flow-induced friction drag. His efforts span several departments within the College.

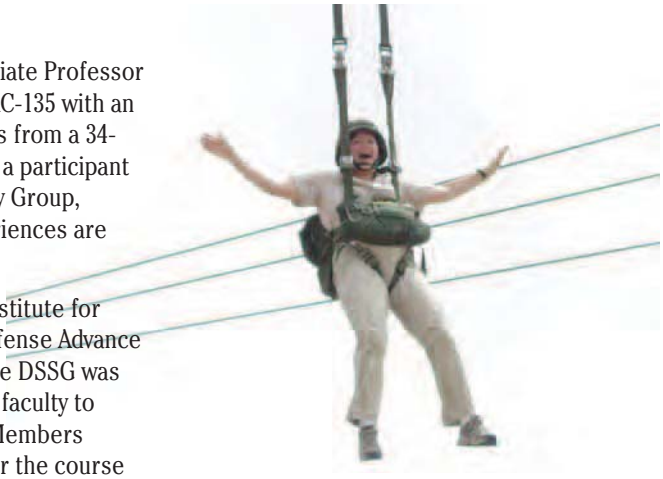
"Professor Ceccio has devoted himself to promoting collaboration in his department and the college. He will now be able to help foster more cooperative ventures on a larger scale, both across campus and with other institutions," said Ulaby.

Not a Typical Day:

DEFENSE SCIENCE STUDY GROUP TEACHES THROUGH EXPERIENCE

It's not everyday that Associate Professor Dawn Tilbury travels in a KC-135 with an F-14 Tomcat escort. Or jumps from a 34-foot tower at Fort Bragg. For a participant in the Defense Science Study Group, however, such unusual experiences are the norm.

Under the auspices of the Institute for Defense analysis and the Defense Advance Research Projects Agency, the DSSG was designed to introduce young faculty to issues of national defense. Members spend more than 20 days over the course of eight sessions learning the ins and outs of national security. They interact with senior officials from government agencies and tour military bases, defense labs and industrial facilities to learn about defense-related research, development and manufacturing.



Associate Professor Dawn Tilbury jumps from a 34-foot tower at Fort Bragg during activities with the Defense Science Study Group.

In 2004-2005, 14 faculty representing institutions around the U.S. covered a lot of territory, stopping in ten states from Alaska to Washington, D.C. The group boarded the USS Saipan, a Norfolk, Va.-based amphibious assault ship; took target practice with the Army National Guard at the Battle Command Training Center at Fort Leavenworth; flew a Super Cobra helicopter simulator; and toured the Naval Submarine Base in Kings Bay, Georgia, among other activities.

"We all learned so much about national defense and the challenges," said Tilbury. "And getting to know the other 13 professors from a wide range of science and engineering disciplines only added to an incredibly valuable experience."

BREI TOURS STATE WITH MICHIGAN ROAD SCHOLARS PROGRAM

This spring Associate Professor Diann Brei boarded a bus with 23 University of Michigan colleagues. The group was bound for a five-day tour of the state as part of the Michigan Road Scholars Program.

Developed and run by the University's Office of State Outreach, the program gives participants firsthand experiences of the state's economy, politics, culture, history and geography to increase mutual understanding among the U-M community and residents. Faculty learn how they can address state issues through their research, scholarship and creative work.

Day one had participants touring Detroit, nonprofit organizations and the GM Truck and Bus Plant; day two, the Michigan State Capitol in Lansing; day three, a furniture manufacturing plant and correctional facility near Grand Rapids; day four, a cherry farm in northern Michigan. On day five, the group met with The Sault Tribe of Chippewa Indians in the Upper Peninsula.

The experience impressed Brei. "Everyone we met was just so inspiring."

Equally inspiring were conversations with fellow travelers, "musicians, a poet, an architect, nurses, engineers. You had 24 different perspectives. You learn about other projects going on at the University, things you have in common with others and areas that present unique challenges. You learn where you can bridge the gaps."

Associate Professor Diann Brei (front row standing, far left) with colleagues participating in the Michigan Road Scholars Program.

Brei also gained an appreciation of some of the challenges facing the state. "People are losing their jobs, and its clear that innovation and new technology are needed. We're the perfect people to help." She plans to emphasize that message with students too. "As part of the profession they can do something–they don't even have to wait until they're out of college."

STAFF EXCELLENCE RECOGNIZED IN ME

Once again, a member of the ME staff has been recognized for exceptional service to the College of Engineering. In May 2005, Technical Services Supervisor Steve Erskine received an Excellence in Staff Service Award from former College of Engineering Dean Steven Director.

CoE's Excellence in Staff Service Award Program was established to recognize the vital contributions staff make to the College's success and prominence. Recipients are chosen for exemplary work and/or special achievements and receive both a cash award and a citation.

Erskine has been a member of the ME staff for more than 21 years and had previously been recognized with an Engineering Research Center Staff Award.

Steve Erskine with former ME Associate Research Scientist Zbigniew Pasek (left) and NSF ERC-RMS Director Professor Yoram Koren.

In making the presentation, Director noted that Erskine has ensured the steady functioning of the NSF Engineering Research Center for Reconfigurable Manufacturing Systems through his exceptional problem-solving and interpersonal skills and willingness to take initiative. He cited the time Erskine coordinated the disassembly, transportation and reassembly of the ERC's Reconfigurable Machine Tool for demonstration at the International Manufacturing Technology Show in Chicago. This was no small feat — the machine is 12-1/2 feet tall and weighs 12,000 lbs.

Erskine remained characteristically modest about the award. "It was an unexpected surprise," he said. "I thought it must be a mistake."

MEET SIMMI ISAAC, GRADUATE ADMISSIONS COORDINATOR

Since Smriti, also known as Simmi, Isaac joined the ME department in December 2004, she has had a full plate. The new graduate admissions coordinator in the Academic Services Office came on board in the midst of the fall 2005 application review process, which she coordinated before hosting two groups of prospective students. At present she is developing the next orientation program for 160 students. "It's been a busy time," she said.

Isaac earned a master's degree in higher education administration from U-M and has worked at the University since 1998. Prior to joining the Mechanical Engineering department, she worked in the International Center for six years where she assisted the University's large population of international students, scholars, faculty and staff with employment and immigration advising and adjustment issues. Earlier in her career, she worked in admissions and recruiting at King College and Carson-Newman College in Tennessee.

Isaac manages the recruitment and admissions process, including related events for promising domestic and international students. The efforts generate between 800 and 1,000 applications annually to the department's masters and doctoral programs. She helps students connect with appropriate faculty for research and fellowship opportunities. In addition, Isaac watches application and enrollment trends and conducts benchmarking with other institutions.

Simmi Isaac

This spring, Isaac introduced the email Peer Mentor program where new students were matched with mentors who serve as a resource for information and advice. "Such measures," says Isaac, "go a long way in providing critical information in a timely manner and allow for a smoother adjustment to campus upon arrival.

"Our graduate program has been ranked fourth in the nation by *US News and World Report*. We have some stiff competition, and I want to do my best to make Michigan the number one choice."

Faculty Honors and Awards

James Ashton-Miller
- Fellow, American Institute for Medical and Biological Engineering, 2005

James Barber
- Arthur F. Thurnau Professorship, 2005

Diann E. Brei
- Michigan Road Scholar, 2005
- Invitee to National Academy of Engineering Frontiers in Engineering Program, 2004

Suman Das
- Invitee to National Academy of Engineering Frontiers in Engineering Program, 2005
- Listed in *Who's Who Among America's Teachers*, 2005
- Article, "Bone Tissue Engineering Using Polycaprolactone Scaffolds Fabricated via Selective Laserintering," (co-authored by a collaborative effort between the research groups of Das and Professor Scott Hollister) featured as a top 25 article by the *Journal of Biomaterials*, 2005
- Literati Club 2005 Highly Commended Award for the article "Direct-Write Deposition of Fine Powders Through Miniature Hopper-Nozzles for Multi-Material Solid Freeform Fabrication" published in the *Rapid Prototyping Journal*, Vol. 10, No. 1, 2004

Bogdan Epureanu
- Invitee to National Academy of Engineering Frontiers in Engineering Program, 2004

Zoran Filipi
- University of Michigan Research Faculty Recognition Award, 2005

Steven A. Goldstein
- Member, National Academy of Engineering

Tom Gillespie
- Outstanding Distant Learning Faculty Award, GM Technical Education Program

Charlie Hasselbrink
- Article, "Rapidly Prototyped Three-Dimensional Nanofludic Channel Networks in Glass Substrates," featured on the cover of *Analytical Chemistry*, 2005

Scott Hollister
- Article, "Bone Tissue Engineering Using Polycaprolactone Scaffolds Fabricated via Selective Laserintering," (co-authored by a collaborative effort between the research groups of Hollister and Assistant Professor Das) featured as a top 25 article by the *Journal of Biomaterials*, 2005

Gregory M. Hulbert
- Fellow, International Association for Computational Mechanics, 2004

Yoram Koren
- Paper, "Manufacturing Investment and Allocation in Product Line Design Decision-Making," (co-authored with Jeremy Michalek, Oben Ceryan and Panos Papalambros) was selected to receive the ASME 2005 Design Automation Best Paper Award. The work is based on Michalek's Ph.D. work at the ERC-RMS

Katsuo Kurabayashi
- Robert Caddell Memorial Award, 2005
- Co-author of SPIE Best Student Paper (with Yi-Chung Tung), "Nano-Imprinted Strain-Controlled Elastomeric Gratings for Optical Wavelength Tuning with Visible Light," 2004

Jwo Pan
- Certificate of Recognition for organizing various symposiums, Society of Automotive Engineers, 2004

Panos Y. Papalambros
- Distinguished Achievement Award in Systems and Design, Japan Society of Mechanical Engineers Fifth International symposium on Tools and Methods of Competitive Engineering, 2004
- Paper, "Manufacturing Investment and Allocation in Product Line Design Decision-Making," (co-authored with Jeremy Michalek, Oben Ceryan and Yoram Koren) was selected to receive the ASME 2005 Design Automation Best Paper Award. The work is based on Michalek's Ph.D. work at the ERC-RMS

Huei Peng
- Best Paper Award, 7th International Symposium on Advanced Vehicle Control, 2005

Ann Marie Sastry
- University of Michigan Faculty Recognition Award, 2005
- Fellow, American Society of Mechanical Engineers, 2004
- Presidential Citation for Outstanding Achievement, University of Delaware, 2004

Anna Stefanopoulou
- Outstanding Young Investigator, American Society of Mechanical Engineers International Dynamic Systems and Control Division, 2005
- Henry Russel Award, 2005

Jeffrey L. Stein
- Fellow, American Society of Mechanical Engineers, 2005

Michael Thouless
- Joint work (with Shu Takayama from Biomedical Engineering) on "Fabrication of reconfigurable protein matrices by cracking" appeared on the cover of *Nature Materials*, 2005
- Professor-of-the-term, Pi-Tau-Sigma, 2005
- David E. Liddle Research Excellence Award, 2004

Galip A. Ulsoy
- Outstanding Investigator Award, American Society of Mechanical Engineers Dynamic Systems & Control Division, 2004

Charles M. Vest Honored with Alumni Society Medal

Charles M. Vest earned the 2004 Alumni Society Medal for his distinguished four-decade career in teaching and higher education administration. Most recently Vest served as the 15th president of Massachusetts Institute of Technology. He stepped down in December 2004 after a 14-year tenure. He is also a member of the mechanical engineering faculty at MIT with research interests in the areas of thermal sciences, lasers and coherent optics.

Prior to assuming the presidency of MIT in 1990 Vest was provost and vice president for academic affairs at U-M. He held the position of dean of engineering from 1986 to 1989. He joined the ME faculty in 1967, after earning both his master's and Ph.D. in ME at U-M. He received his bachelor's degree from West Virginia University and holds seven honorary doctorates.

Since stepping down as president, Vest continues to serve on the President's Council of Advisors on Science and Technology, which he has done since 1994. In early 2005, he completed service as a member of the Robb-Silberman Commission on Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction.

In fall 2005, he will visit U-M for two weeks as Towsley Policy Maker in Residence at the Gerald R. Ford School of Public Policy, where he will offer a mini-course on the impact of the events of September 11, 2001 on U.S. science policy.

Vest also works with three committees of the National Academy of Engineering and the National Academy of Science and serves on two corporate boards. "It hasn't been the quiet year of contemplation and writing I had anticipated, but it has been very interesting, and I'm certainly learning a lot," he said.

U-M played a key role in his success. "My education, teaching and administrative experiences there and my interactions with many colleagues and friends across the University taught me how to analyze problems, value diversity of people and ideas, and to occasionally take the 'road less traveled'."

The Alumni Society Medal is the highest honor bestowed by the Engineering Alumni Society Board of Governors. It recognizes College of Engineering graduates who have attained extraordinary achievement and who have brought distinction to themselves and the College.

Former College of Engineering Dean Stephen Director (left) congratulates Chuck Vest on winning the Alumni Society Medal.

"My education, teaching and administrative experiences there and my interactions with many colleagues and friends across the university taught me how to analyze problems, value diversity of people and ideas and to occasionally take the 'road less traveled'."

alumni

TIMOTHY M. MANGANELLO RECEIVES 2005 ALUMNI SOCIETY MERIT AWARD

Timothy M. Manganello, who earned both his bachelor's and master's degrees in ME in 1972 and '75 respectively, has won the 2005 Alumni Society Merit Award from the department for outstanding professional achievement. Manganello has been the chairman and chief executive officer of BorgWarner Inc. since 2003. The company, founded in 1928, designs and produces advanced powertrain components and systems.

Timothy M. Manganello

Manganello has held a variety of positions with BorgWarner since he joined the company in 1989, including president and general manager of BorgWarner TorqTransfer Systems and vice president of operations for BorgWarner TorqTransfer Systems' Muncie, Indiana facility. Prior to joining the company, Manganello held product engineering management positions at Chrysler Corporation and sales management positions at PT Components-LinkBelt.

It was his education at U-M, said Manganello, that prepared him for the breadth of positions he has held. "When it comes to my education as a mechanical engineer, the analytical thought process, the approaches and tools I learned while at the College of Engineering have remained priceless. It is difficult to stay at the top of your field as a practicing engineer--science, discovery and innovation move too fast. Over time I evolved from a practicing engineer into other career areas such as sales, manufacturing and senior management. But it was my engineering foundation, created at U-M, that gave me the skills to be equally or more successful in these other occupational areas."

In addition to chairing the board of directors of BorgWarner, Manganello is a member of the board of directors of Bemis Company, Inc. He also serves on the executive committee of the Manufacturers Alliance/MAPI and is a member of the Society of Automotive Engineers and of the Governor's Board of the World Economic Forum. He serves on the University of Michigan College of Engineering National Advisory Committee.

Winning the Alumni Society Merit Award from the Department "creates a great sense of pride for me," he said. "My wife and I are both U-M graduates, and for me to be recognized with this award is totally unexpected and one of the top highlights of my career."

ALUMNI AWARD NOTES

Jianmin Gu (Ph.D. 2000), was a member of a Ford Motor Company team that received the 2004 SAE Henry Ford II Distinguished Award for Excellence in Automotive Engineering. For his exceptional contributions, he was promoted by Ford in June 2005 to the position of Technical Expert for Vehicle Shift Quality CAE. He was previously recognized by Ford as the Engineer of the Month, CAE and Durability Engineering, (March 2005) and received the Vehicle Evaluation and Verification Achievement Award in 2004.

Mahmoud I. Hussein (Ph.D. 2004), received the top prize in the 17th annual Robert J. Melosh Medal competition for the Best Student Paper on Finite Element Analysis at a ceremony at Rensselaer in April 2005. The competition is sponsored by Department of Civil and Environmental Engineering at Duke University, the Scientific Computation Research Center at Rensselaer Polytechnic Institute and Elsevier.

John R. (Chip) Keough (B.S.E. ME and B.S.E. MM '77), has earned an Alumni Society Merit Award from the department of Materials Science and Engineering, University of Michigan, for his exceptional professional accomplishments. Keough is the chief executive officer and owner of Applied Process, Inc., a heat treating facility specializing in the Austempering process.

Wei Li (Ph.D. ME '99), assistant professor of Mechanical Engineering at the University of Washington, Seattle, has been awarded a prestigious 2004 Presidential Early Career Award for Scientists and Engineers. The award was presented at a ceremony at the Department of the Treasury in Washington, D.C.

Jeremy Michalek (M.S. ME '01; Ph.D. ME '05), co-authored a paper, "Manufacturing Investment and Allocation in Product Line Design Decision-Making," (with Oben Ceryan, Yoram Koren and Panos Papalambros) that was selected to receive the ASME 2005 Design Automation Best Paper Award. The work is based on Michalek's Ph.D. work at the ERC-RMS.

ME Welcomes Perspectives from External Advisory Board

ME's External Advisory Board is designed to provide insights from industry professionals to help guide the department's efforts to prepare students for careers in the field. The most recent additions to the EAB, Ashok Nayak, Paul Nuyen and Alan Woodliff are welcome contributors to the continual improvement process for ME.

Dr. Ashok L. Nayak

Since joining Alcoa as a Director at the Alcoa Technical Center in 1997, Dr. Ashok L. Nayak has advanced rapidly in the company. In the first four years since he joined Alcoa, he held positions of increasing responsibility, including Vice President of Business Development of Alcoa Mill Products and General Manager of Alcoa's Automotive Closure Panel Operations. He was elevated to the position of Executive Director, Development & Applied Engineering, Alcoa Technical Center in 2001, and he is currently the Director, External Innovations and Technology Strategy at the Alcoa Technical Center.

Prior to joining Alcoa, Nayak had been Director of Technology at Corning Incorporated, where he worked in several of the company's business units. In his role as Director of Technology, he was responsible for many of the firm's product, process, and manufacturing developments. During his career at Corning, he was recognized with several awards, including the company's Best Idea Award in 1986. He also holds three patents.

These and other honors are evidence of his ability to see a problem and solve it. Nayak has been recognized throughout his career for innovation, and it is this blend of solid engineering and creative approaches that make him a valuable member of the EAB.

Nayak completed his undergraduate work at the Indian Institute of Technology. He earned his M.S. in Mechanical Engineering from the University of Hawaii and a Ph.D. in Mechanical Engineering from the University of California at Berkeley.

Paul D. Nuyen

In his role as Director-Auburn, Paul Nuyen is responsible for manufacturing operations at the Auburn, Washington site, which is part of the Boeing Commercial Airplane company's Fabrication Division. In this role, he oversees the Emergent Manufacturing Facility, Integrated Aerostructures, Auburn Machining, and Tube and Duct Center Manufacturing Business Units. These Manufacturing Business Units produce components and assemblies for all current Boeing Aircraft in production. While his Boeing position might seem to tie him more closely to aerospace engineering than mechanical engineering, he sees it as an excellent opportunity to build on the interconnections between several engineering disciplines.

"Of course, Boeing is known for its aviation expertise," said Nuyen, "and ME's historical expertise has been in automotive, but we hire many mechanical engineers, and it's important to us as a company and to me as an individual that we work together as closely as possible to prepare students for their professional careers."

Nuyen's ties to U-M — he earned a B.S. in Mechanical Engineering 1980 — made him a natural choice to be Boeing's representative to U-M. In that role, he visits the campus regularly, and has led the partnership in several areas.

"Boeing has had many interactions with ME over the years and most recently became an industry partner with the [NSF] Engineering Research Center for Reconfiguarable Manufacturing Systems," said Nuyen. "We also have been providing scholarships to the College of Engineering, so as a company, we are quite familiar with the quality of the students here."

Being asked to join the EAB was an obvious extension of the existing relationship, and a welcome one for Nuyen. "I was quite pleased and honored to be invited to join the EAB," he said. "It's a honor to be able to give back to a school that has given me so much. On a professional level, I appreciate the opportunity to present Boeing's views about what ME can do to make the program even stronger. I think it's always important to be able to see and hear different perspectives in order to determine the best course of action."

That course of action, in his eyes, should be all encompassing. "We need to talk about how ME can contribute in areas like energy, the environment and ecology," he said. "Most important, we need to concentrate on educating students not only in technical terms, but also in the need to have a continuing thirst to learn and to put that knowledge to work in practical terms."

In addition to his degree from U-M, Nuyen also completed the Executive Program at the HAAS School of Business at the University of California at Berkeley in 1992.

Dr. Alan Woodliff

Dr. Alan Woodliff, Director of Advanced Business Development at Visteon, has been actively involved in maintaining a tight connection between ME and the automotive design and engineering firm. Since 2003, he has been instrumental in building the relationship between ME and Visteon through the company's program to support its connections to leading university automotive departments. He welcomed the invitation to serve on the EAB as a way to further develop that relationship.

"We are involved in working with and recruiting from many universities," said Woodliff. "We determined that we should focus on working with the best, and, naturally, that led us to concentrate on schools like the University of Michigan."

The 2005 ME External Advisory Board: Chuck Hutchins, Richard Heglin, Roger McCarthy, Roberta Zald (seated), Marshall Jones, Professor Dennis Assanis, Walt Bryzik, Paul Kern, Ward Winer, Paul Nuyen, David Pekarek (ME student), Alan Woodliff, Mike Korybalski, and Eric Dayringer (ME student).

Woodliff's relationship with the university dates from his student days. When Visteon established its corporate/university relationships committee, of which he is the co-chair, he was a natural choice for role of "executive champion" for the U-M Steering Committee. He credits Daryl Weinert, Visteon's Director of Corporate Relations/College of Engineering, and ME Chair Dennis Assanis for their work in helping him achieve his goal of strengthening the ties between the two organizations.

"I was quite honored when Dennis asked me to join the EAB," said Woodliff. "I see commonality in how Visteon moves forward in its business growth and how the ME Department moves forward in its growth. I see my role as being a bridge for both organizations to grow together."

In his role at Visteon, Woodliff leads a global team responsible for ensuring that the company's key new technology developments are customer driven and become commercialized with an emphasis on speed to market. This provides him with a focus that emphasizes the practical aspects of mechanical engineering and the way students are prepared to enter the field.

"I see my role as one of advisor and mentor," he said. "As an advisor, I expect to be able to help guide the ME department in terms of future roles, curriculum and research in terms of what industry would expect. As a mentor, I expect to be able to offer direct help from Visteon in terms of initiatives in the ME department, and the College of Engineering as an extension of that.

"Ultimately, I would like to see the ME department continue to be regarded as one of the premium programs in the country, if not the world, and to see its students continue to excel in their ability to contribute to technical development, whether in industry, academia or elsewhere. I am proud to be able to help in that effort."

Woodliff holds a B.S. in Aerospace Engineering, an M.S. and Ph.D. in Mechanical Engineering, and an M.S. in Business Administration, all from U-M.

Fourth Annual KAIST — U-M Joint Workshop a Success

The Fourth Korea Advanced Institute of Science and Technology-University of Michigan Joint Workshop on Emerging Technologies in Mechanical Engineering drew nearly two dozen faculty and staff from both universities. The group met in San Francisco to discuss common research areas and opportunities for continued collaboration.

"It was a great experience for everyone," said ME Associate Professor Hong Im, program coordinator along with Professor Sang Yong Lee in the KAIST Mechanical Engineering Department. The format of this year's meeting facilitated the high degree of interaction and learning. Each participant joined forces with at least one colleague from the other institution to present an overview of state-of-the-art research. During the course of the two-day workshop, eleven presentations were made.

Papers presented were: *Combustion Characteristics in Near-Extinction Conditions for Micro-Combustor Application* by Associate Professor Sejin Kwon (KAIST) and Associate Professor Hong G. Im (U-M); *Fuel Cells and Fuel Processing: Research Opportunity and Current Research at KAIST and U-M* by Associate Professor Joongmyeon Bae and Professor Jing Sun (KAIST) and Professor Huei Peng and Associate Professor Anna Stefanopoulou (U-M); *Vibrations, Acoustics and Microsystems* by Professor Yang-Hann Kim (KAIST), Assistant Professor Katsuo Kurabayashi and Associate Professor Karl Grosh (U-M); and *Recent Advances in Electrokinetic Pumping for Microfluidic Systems* by Professor Sungjin Kim (KAIST) and Assistant Professor Charlie Hasselbrink and Professor William Schultz of U-M.

One of the most significant results of the annual events, explained Im, is that several active, meaningful collaborations have developed among faculty and their graduate students from both schools. "I'm getting more and more feedback from colleagues these days about how mutually beneficial their work together has been. The program began just a little over four years ago, and I think those comments reflect great success."

Another emerging opportunity is the forthcoming launch of the Automotive Technology and Management Program at KAIST. "In our department at U-M, we have the perfect model of an interdisciplinary program (InterPro) specialized in the automotive engineering, so this is a chance for us to offer the experience and expertise that we've developed in distance learning and other areas."

Students from both universities will organize a joint graduate symposium for the second time, to be held at U-M in October 2005. "It's an entirely student-led conference, which is an excellent learning experience for them about taking the leadership in a scientific community," Im said.

Im expects active collaborations will continue on many levels. "We've come to the point where we can all see the tangible outcomes of our synergistic efforts."

Participants in the Fourth Annual KAIST–U-M Joint Workshop.

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