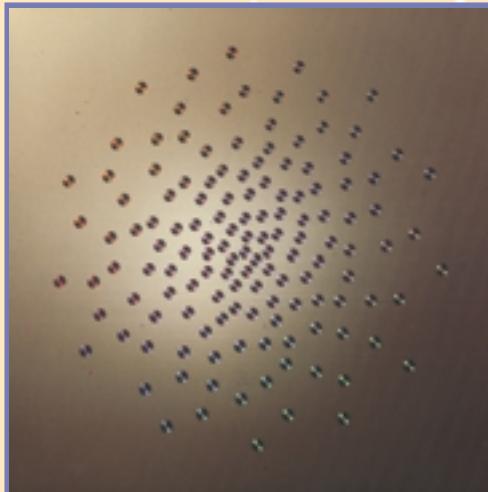


MECHANICAL ENGINEERING
ANNUAL REPORT
2000-2001

ALUMNI SOCIETY MERIT AWARD WINNER: WEN-YING TSAI



Each of us has been struck by the ineffable beauty of sunlight streaming through forest leaves. Wen-Ying Tsai's gift to the world has been to capture and recreate such splendor in the astonishing art form he pioneered: cybernetic sculpture.

Tsai's works have been displayed all over the world, from one-man shows in the galleries of New York to museums in Paris, London, Tokyo, and Hong Kong. They shimmer and vibrate, recreating the sensory impressions of nature in metal, fiberglass, and light - and they respond to music and the movements of viewers as well.

The sculptures are the offspring of Tsai's extraordinary artistic vision and the knowledge of technology he gained as a master's student in mechanical engineering at Michigan in the early 1950s. For his achievements, Tsai, 72, has been selected to receive the ME Alumni Society Merit Award for 2001.



Tsai came to the U.S. to study soon after the Chinese revolution of 1949. At Michigan his heart was in art, not engineering. "Engineering study was not my choice," he says. "It was my family's choice." Yet in the artistic endeavors he chose, "knowledge of technology is very important - the stress and strain of the material, what kind of material gives you the maximum flexibility."

By day he became an engineer, working for more than ten years with such renowned architects as Walter Gropius and Eero Saarinen. By night he pursued his vocation as an artist. In 1965, during an art fellowship at the prestigious MacDowell Center in New Hampshire, he realized that his expertise in engineering might allow him to express his awe of nature in new artistic forms.

"I have exploited only a narrow aspect of material means," he said in 1986. "But I have used what I know to express what I like. I think I make people happy when they see my work, and I hope I enhance their enjoyment of the natural and technological worlds."

Examples of Tsai's work are shown on this page and on the cover.

MECHANICAL ENGINEERING ANNUAL REPORT 2000-2001



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MESSAGE FROM THE CHAIR:

DEFINING THE FUTURE OF MECHANICAL ENGINEERING EDUCATION AND RESEARCH

I have been thinking recently about what mechanical engineering (ME) is, and propose the following definition:

Mechanical Engineering is the branch of engineering that serves society through the analysis, design, and manufacture of systems, at all size-scales, that convert a source of energy to useful mechanical work.

Compare this to some traditional definitions of mechanical engineering:

1. *The branch of engineering dealing with the design and production of machinery (Random House Dictionary, unabridged, 1965)*
2. *The branch of engineering that encompasses the generation and application of heat and mechanical power and the design, production and use of machines and tools (American Heritage Dictionary, 1985)*
3. *The design, testing and fabrication of all sorts of machines, from engines, turbines and vehicles to instruments and controls or from bulldozers to food processors (University of Michigan, College of Engineering Web Site, 2000)*

de•fin•i•tive (deh-fin-uh-tiv) adj.

The proposed definition emphasizes awareness of societal issues, and energy conversion in systems of all types and at all size-scales. While not radically different from the traditional definitions, this new one includes many activities that would not have been captured by the traditional definitions - including many you will read about in this 2000-2001 Annual Report for the Mechanical Engineering Department at the University of Michigan. For example: environmental sustainability in mechanical design and manufacturing; design of microelectromechanical systems; nanosystem mechanics; and the biomechanics of tissues, cells, and molecules.

ME Department Chair A. Galip Ulsoy (far right), College of Engineering Alumni Society Board President Les Loomis (left), and CoE Dean Stephen W. Director (second from left) congratulate MIT President Charles M. Vest (MSE '64, PhD '67), for receiving the 2000 Alumni Society Merit Award. A reception was held in Vest's honor in October 2000.



It has been another great year in the department. You will read in this report about the excellent new faculty we have recruited, and about the pioneering efforts that are helping redefine ME. The U.S. News and World Report ranked our undergraduate program fourth and our graduate program fifth in the nation. This past year we awarded 265 BS, 98 MS, and 39 PhD degrees in ME. Our research expenditures, which support our graduate program, increased by 6% to \$21.7 million. Our faculty, as well as our students and alumni, continue to be recognized at the highest levels for their professional accomplishments and their innovations.

Quite simply, the activities in this department help define the future of mechanical engineering education and research. I think you will enjoy reading about some of our cutting-edge accomplishments in this report.

A. Galip Ulsoy, Chair
Department of Mechanical Engineering
William Clay Ford Professor of Manufacturing

BIG TEN PLUS: NATIONAL WORKSHOP TO REDEFINE MECHANICAL ENGINEERING

The workshop will not only address the discipline's dynamic nature but it will also attempt to redefine the field by focusing on how current trends are likely to affect the future of mechanical engineering research and education.

To address the rapid changes occurring in the field of mechanical engineering, ME Department Chair A. Galip Ulsoy has joined forces with mechanical engineering department heads in the Big Ten Plus Group, which has submitted a proposal to the National Science Foundation to hold a Workshop in January 2002 on *Redefining Mechanical Engineering*.

The Big Ten Plus Group includes all eleven Big Ten Conference schools (except Indiana University) - plus Carnegie Mellon, Cornell, Georgia Tech, MIT, Stanford, UT Austin, and UC Berkeley.

The workshop will not only address the discipline's dynamic nature but it will also attempt to redefine the field by focusing on how current trends are likely to affect the future of mechanical engineering research and education. In biomechanics, for instance, ME faculty members now routinely investigate the mechanics of tissues, cells, and molecules along with the more traditional inquiries pertaining to whole body biomechanics. Similarly, environmental concerns have shifted the mechanical engineering focus from remediation to sustainable design and manufacturing.

Computational mechanics, distributed design, and network-based automation have likewise been greatly influenced by evolving information technologies, while problems with micro/nano-scales have required new models and theories of mechanics.

Workshop coordinators will ask influential speakers from both industry and academia to address their particular areas of concern. Breakout sessions will delve into important details concerning the discipline's current trends, as well as the various ways in which these changes may impact mechanical engineering in the near and distant future. Lessons learned at the workshop are expected to result in a report and presentation at the Spring 2002 Education Conference sponsored by the American Society of Mechanical Engineering.

dy•nam•ic (dy-nam-ik) adj.

ME Ranked 5th in Nation; College Ranked 4th

In March 2001, *U.S. News & World Report* published its annual rankings of graduate engineering programs, and for the second straight year the University of Michigan's College of Engineering received 4th place honors, with Mechanical Engineering ranked 5th.

This year the survey assessed the quality of the academic programs of 221 engineering schools. Rankings of the colleges' individual programs placed nine of the University of Michigan's individual programs among the nation's top ten, five in the top five, and two in the top two:

Environmental Engineering, and Industrial and Operations Engineering.

Among mechanical engineering departments, ME's graduate program was ranked fifth behind MIT, Stanford, Berkeley, and University of Illinois. The University of Michigan's undergraduate engineering program was also ranked 5th in the nation, while ME's undergraduate program was ranked 4th.

MICROSYSTEMS: THINKING SMALL IN A BIG WAY

MEMS Actuators

"The impact of clever mechanical design on MEMS technology" is one of the goals Assistant Professor Katsuo Kurabayashi hopes to achieve with the micro-machined electrostatic actuators that he and his team of researchers are currently developing.

Noting that "micro-machined resonators are very attractive sensing elements in various MEMS transducers, such as acceleration, mass, force, and temperature sensors," Kurabayashi explains that achieving a precise resonance frequency for these micro-resonators is crucial but often difficult because of fabrication errors. This is where Kurabayashi's research is making a difference: "Our actuator can allow us to adjust the resonant frequency for the micro-resonators by applying a DC bias to it after fabrication," he says.

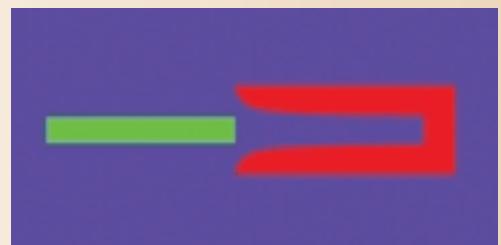
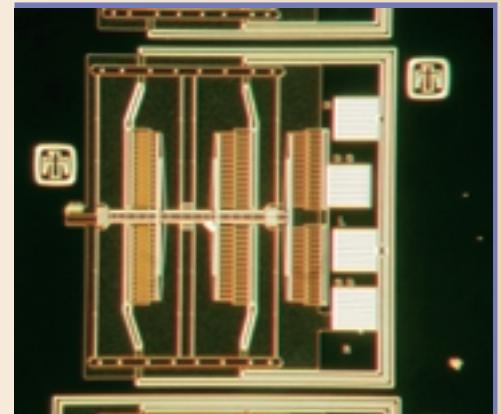
Brian Jensen, one of Kurabayashi's Ph.D. students, has designed an actuator with a unique comb shape. The actuator, designed in collaboration with Sandia National Lab, consists of multiple polysilicon layers and has been fabricated using a silicon micro-machining technique developed at Sandia,

called the Sandia Ultra-planar, Multi-level MEMS Technology (SUMMIT).

The actuator, now being studied in Kurabayashi's research lab, is integrated with other silicon micro-machined structures that are mechanically supported by suspension springs on a chip. The actuator can partially compensate for the mechanical restoring force due to the action of the springs. This in turn produces large displacements of motion, or tuning resonance frequencies for MEMS devices.

The comb drives empty rectangular fingers that produce a stable force output as they engage. Over a wide range of finger engagement, these rectangular comb electrodes produce a constant driving force for a given voltage, making it possible to apply a desired drive force regardless of comb displacements.

The team is expecting that its design will allow its resonator to be operated with a more than three times less tuning bias than existing resonators. The research is funded through an NSF grant and an OVPR Discretionary Award.



Compliant Mechanisms

In the Compliant Systems Design Laboratory, Professor Sridhar Kota and his team are developing the ingenious devices known as compliant mechanisms, which are crucial for MEMS applications. These are single-piece, flexible mechanisms that elastically deform without joints in order to generate force and motions.

Compliant mechanisms maximize the design-for-assembly methodology. They are becoming increasingly popular for the savings they generate in both manufacturing and assembly. But they are also essential in the infinitesimal workings of MEMS machines, since in MEMS, batch fabrication demands minimal or no assembly; the requirements of joint clearance and backlash would be too large to meet the requirements of precision motion.

Kota says compliant mechanisms mimic many designs found in nature.

"Traditionally, engineered artifacts are designed to be strong and rigid," he writes.

"Designs in nature, on the other hand, are strong and compliant.... Use of compliance to convert available energy into useful and sophisticated movements can be seen in many living organisms. For instance, the muscles of a flea simply would not be able to release energy quickly enough to jump if it were not for the specialized compliant design of its legs.... Many insects rely upon compliance to flap their wings."

Man-made compliant structures can be similarly tiny yet powerful. As just one example, Kota's group, working in collaboration with Sandia National Laboratories, has developed a micro engine that occupies a space no more than half a millimeter square. The engine is driven by two electrostatic actuators, with each connected to a compliant transmission. The transmissions' output is connected to a series of compound gears through ratchet-paul mechanisms. For the same drive voltage, the compliant transmissions generate fifty times more torque than the actuators alone.

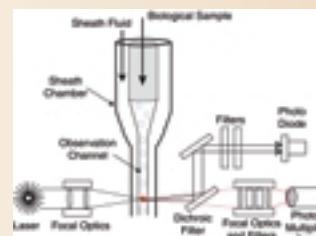


Figure 1. To detect water-polluting microbes more effectively and at a lower cost, ME Professors Steven J. Skerlos and Katsuo Kurabayashi and several CoE colleagues are developing a MEMS-based micro-integrated flow cytometer (MIFC). Microscopic bioparticles in a fluid sample are tagged with fluorescent labels, and as the sample fluid flows through a tiny observation channel in the MIFC, a laser detects light signals from the bioparticles.

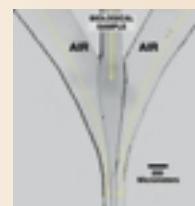


Figure 2. The team has successfully tested a prototype microchannel made of poly(dimethylsiloxane) (PDMS). The channel focuses the aqueous sample aerodynamically, which is an improvement over current technology because it eliminates the need for a large amount of sheath liquid while reducing the required power, and the MODIFICATION of polymer surface chemistry enhances the focusing process. PDMS is disposable, low-cost, non-toxic, and optically transparent.



Figure 3. Here, fluorescent beads passing through the prototype microchannel generate spectrometric voltage readings. Future research will focus on the integration of multiple lasers, micro-optics, electronics, and micro-devices to prepare the samples. Ultimately, the engineers plan to make an MIFC no larger or more costly than a portable CD player.

INSTRUCTIONAL TECHNOLOGY (IT) INITIATIVES

The External Advisory Board (EAB) for the Mechanical Engineering department discussed the role of information technologies (IT) in mechanical engineering during its October 2000 meeting. Out of the exciting discussions from that day grew the ME department's IT initiatives. These include a state-of-the-art survey of IT technologies for ME instruction, and seed funding of two research concepts that bring IT to bear on ME problems. These are described in the IT Initiatives articles grouped here.

State-of-the-Art in ME Instructional Technology

In order to strengthen the case for the enhanced use of instructional technology in the Mechanical Engineering department, Associate Professors Dawn M. Tilbury and Karl Grosh joined with two undergraduate students - Robert Gifford and Thomas Varghese - to survey the quality and utility of instructional technologies used at other universities across the country and around the world. These various uses were divided into five categories - visual aids, software, Web tutorials, books-on-the-Web, and resource lists - and examined from the perspective of both faculty and students in this comprehensive review.

Most of the information compiled in this study was gathered through searches of university Web pages, educational databases and applet libraries, recent conference proceedings, and evaluation of commercially-published CD-ROMs.

Results of this survey were published in a final report used to direct future initiatives in ME and presented at the department's Spring External Advisory Board meeting.

IT Initiatives: The Virtual Teacher

Assistant Professor R. Brent Gillespie and Associate Professor Arthur D. Kuo are putting their fascinating work in virtual environments and haptic interfaces to innovative use. This summer, Gillespie and Kuo have enlisted the support of an ME graduate student dedicated to adding a new component to the traditional form of virtual instruction they call the virtual teacher.

Surgeons, astronauts, and other specialists favor using virtual instruction because of its repeatable, flexible, and economical means of training and testing various skills. Haptic interface - which enables users to feel and mechanically interact with virtual objects - is an integral part of this process. Traditionally, only the task itself (simulated on the practice field) is

created for benefit of the user. The virtual teacher project proposes to add the other part of the training scenario: the instructor. Similar to a coach's attempt to share a technique's "feel" by guiding a pupil's hand through a motion, the virtual teacher is designed to instruct through mechanical demonstration.

The research combines human subject experiments with a modeling/analysis/simulation study to predict and explain results. A pilot study using an apparatus and controller has already been designed to teach certain crane operations. Other tasks, such as balancing a ball on a beam and bouncing a ball on a paddle, as well as various rehabilitation applications, are also being pursued.



PRODUCT REALIZATION GOES GLOBAL

Design For Facility Over the Internet

Another important project recently funded by ME's Initiative in Information Technology is Assistant Professor Kazuhiro Saitou's work to develop an Internet-based environment that facilitates the design of parts to be manufactured by production facilities within or outside an organization.

The development of this design methodology - which Saitou has termed Design for Facility (DFF) - mirrors the growing trend in the manufacturing industry to outsource production facility design. This research initiative focuses on the development of a DFF methodology as well as the implementation of a prototype of an Internet-based DFF system for a family of mass-produced commodity parts - such as automotive engine connecting rods - that have traditionally been manufactured within a dedicated facility.

Saitou says that DFF can be considered a special form of Design for Manufacturability (DFM). Saitou's research differs from previous work on DFM: it targets the design of a single part and a part family for a dedicated facility for high production volume, which DFM for machined parts has not fully addressed.

Saitou's research is especially welcome at a time when global competition and changing consumer demands has made forecasting the volume of necessary production increasingly difficult, which has made manufacturers reluctant to establish dedicated production facilities. Though using existing facilities for new designs is fast becoming the more attractive alternative, designers must understand and incorporate their partners' manufacturing capabilities (within and outside the company) at the earliest stage of the design process in order to maximize use of existing facilities - which is what Saitou's DFF is intended to accomplish.

This fall, the graduate course that ME Professor Debasish Dutta worked to develop for nearly three years finally went global - and was taught nearly around the clock.

Motivated by industry's increasing development of products for a world market - and relying on the use of such technological advancements as video-conferencing, e-mail, and Web tools such as E-Viz and Placeware - Dutta's "Global Product Realization" (GPR) course featured teams of students from North America, Europe, and Asia cooperatively designing a coffee maker for a worldwide market. ME students in Ann Arbor gathered twice each week in the Media Union, where the university's most advanced teaching and learning technologies are available. It was 8:00 a.m. in Ann Arbor, 2:00 p.m. in Delft, and 10:00 p.m. in Seoul.

Dutta worked with colleagues Imre Horvath at the Technical University in Delft in the Netherlands and Jongwon Kim at Seoul National University in Seoul, Korea to develop and present the prototype for a worldwide product course that appears to make the future of global education look extremely promising. Instructors took turns presenting case studies from their local industries, and they also arranged for experts in their respective countries to speak on product development topics in the fields of law and the environment as well as business.

Dutta stresses that since most major corporations have global operations, supplier bases, and markets, it is increasingly important that students learn to work together to gain a deeper understanding of global marketplaces through direct interaction with others in remote locations. During the last week of class students from Delft and Seoul traveled to Ann Arbor for a highly anticipated face-to-face meeting and to publicly present the coffee maker project they worked on together throughout the semester from across the globe.

Dutta says that many of his students understood they were guinea pigs, but they also recognized the importance of the program and were quite forgiving of its few minor glitches. Surveys taken at the end of the semester indicated that 97 percent of the students would recommend the course to a friend, and it is expected that there will be more classes of its kind to follow.



ME TAKES THE LEAD: ENVIRONMENTAL EDUCATION AND RESEARCH

ME is taking the lead in a college-wide initiative to train students in the methods of an important new approach in engineering - environmental sustainability.

Master's students in ME may now elect to take a concentration in that area, selecting from courses in eco-design, energy conversion, and sustainable manufacturing. Concepts in environmental sustainability also are being woven into undergraduate courses throughout ME.

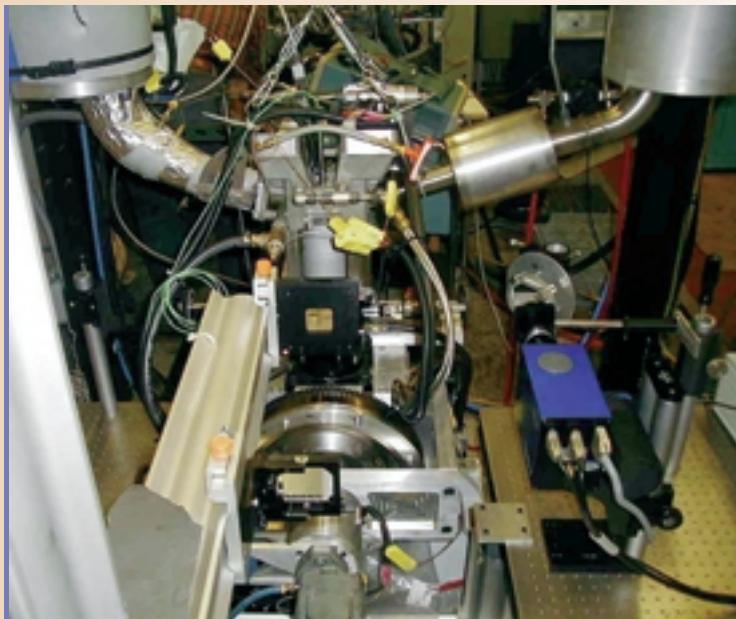
Such curricular innovations spring from a broad new approach to environmental engineering, says Assistant Professor Steven Skerlos. Traditionally, engineers have thought of anti-pollution measures as extra costs - devices, such as the catalytic converter, that must be added to a process to "clean" pollutants before they are emitted into the environment.

But engineers such as Skerlos, who specializes in aqueous systems, are working on ways to prevent or reduce such emissions in the first place, not only to help the environment but also to save money. Such methods include reuse of lubricants; better methods of filtration; recycling of materials such as steel; and research into the basic processes of combustion so as to reduce harmful emissions into the air.

"The most cost-efficient way to deal with environmental problems is to prevent them in the first place," Skerlos says.

Skerlos also says students are eager to learn how they can help to solve pressing environmental problems. And he believes Michigan is among the leaders in offering such opportunities to students.

"A lot of schools will offer some token course," Skerlos says. "But this is such a pervasive problem - and it affects every decision that engineers have to make - that we need to integrate it throughout the relevant curriculum. And I think we're farther along in integrating this into the curriculum than anybody."



A single-cylinder research engine with transparent piston and cylinder in the Quantitative Laser Diagnostics Laboratory of Professor Volker Sick is used for in-situ studies of fundamental internal combustion engine processes. Laser-based imaging diagnostic techniques are being developed and applied to understand the performance of engines and microscopic details of pollutant formation. Images of the fuel mixing process, the flow field, and more are used to assist the development of advanced models that aim at a mathematical description of internal combustion engines.

STRATEGIC PARTNERSHIP FORMED WITH SHANGHAI JIAO TONG UNIVERSITY

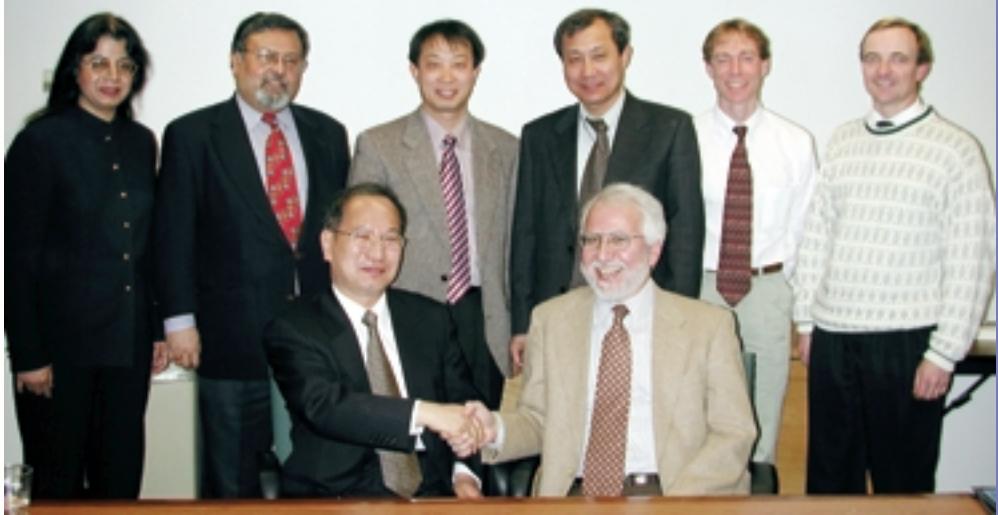
As the world becomes smaller, the ME department has been doing more than its share to connect some of its still distant parts. Since last fall term, ME has been working with Shanghai Jiao Tong University (SJTU) in Shanghai, China to assist as needed in reshaping the manner in which Chinese colleges of engineering will educate its students.

Since the two universities formally agreed to form a strategic partnership in August 2000, SJTU has used an ME model to restructure its undergraduate curriculum. A pilot class of 60 students was admitted into the new program last fall as ME faculty members began their first set of lectures at SJTU. Professor Michael Thouless taught the pilot class ME 211 and Professor Deba Dutta offered ME 250.

Beyond collaborative teaching, faculty members from both universities have combined their efforts on such projects as Professor Dutta's and SJTU Professor Zhongqin Lin's successful development of a joint educational program for integrating CAD/CAM/CAE, which won a PACE Program award co-sponsored by General Motors, Sun Microsystems, EDS, and Unigraphics Solution Systems. Professors Jun Ni and Jack Hu also collaborated with their SJTU counterparts on a research program that led to the establishment of a GM Satellite Research Lab on Automotive Body Design and Manufacturing at SJTU that will work with U-M's GM Collaborative Research Laboratory on Automotive Body Design and Manufacturing.

For its part, SJTU has marketed the Program in Manufacturing interdisciplinary degree program to students working for U.S. corporations in China. And to enhance the educational experiences of ME students - as well as provide them with a rare global perspective - SJTU has agreed to host Michigan students who plan to study in China for a semester or two. In addition to engineering courses taught by ME faculty in Shanghai, humanities courses will also be available, as will other opportunities to gain a greater understanding of Chinese culture, language, and history through special internships and other offerings.

*College of Engineering
Dean Stephen W.
Director and ME
Professor Jun Ni (left)
are pictured at the
August 2000 signing
ceremony at Shanghai
Jiao Tong University in
which SJTU and the ME
department formed a
strategic partnership.*



KAIST Collaboration

In February 2001, the ME department signed a Memorandum of Understanding on Collaborative Program with the ME department of the Korea Advanced Institute of Science and Technology (KAIST). The agreement creates a formal relationship between the two schools, which plan to exchange students and faculty members for research and academic purposes of common interest, including joint workshops/short courses; publications co-authored by the two parties; and exchange of scholars and academic staff, as well as visits to industry and research establishments. KAIST is one of the best universities in Asia, and was ranked number one in the June 30, 2000, issue of AsiaWeek magazine.

ME ON COURSE FOR ABET REQUIREMENTS

Undergraduate engineering programs around the country are routinely evaluated by the Accreditation Board for Engineering and Technology (ABET) in order to receive accreditation of bachelor's degrees granted in mechanical engineering. The last time ABET representatives were in Ann Arbor for an accreditation visit was the fall term of 1999, and ME received an accreditation for a six year period, which is the maximum under ABET rules.

The 1999 review was conducted under the ABET's 2000 Criteria, and Noel Perkins, professor and director of the ME Undergraduate Program, says he is pleased with the current state of the department's preparedness under the newer guidelines. The most significant change under 2000 Criteria is that departments must define the objectives and outcomes of the entire program together with the objectives and outcomes of its core (or required) courses - and must also demonstrate to ABET that it is achieving those objectives and outcomes. According to Perkins, the intense preparation by ME faculty members during the ABET's last visit firmly established ME's current course, which "has set us up nicely for future visits." The next ABET visit will be in 2005.

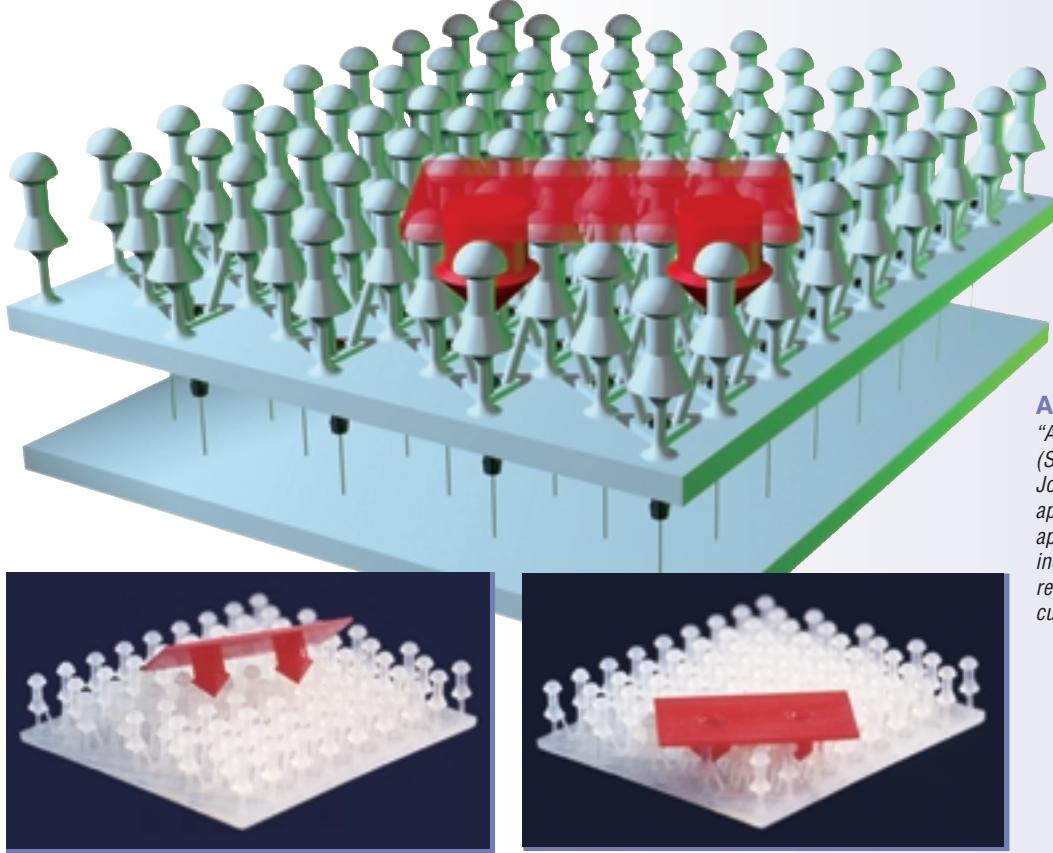
ME's detailed assessment of the objectives and outcomes of the undergraduate program and its core courses is based on a two-pronged approach. First, its thorough evaluation of the program relies in large part on the itemized surveys that

administrators have been conducting with ME alumni for nearly a decade. Overwhelmingly, department graduates have said that the three competencies they most need in the workplace are teamwork, technical communication, and engineering problem solving skills. Based on this feedback, significant changes have been made since 1995, with threads of learning in both teamwork and technical communication skills being incorporated among five different course curricula.

Second, the same kind of annual scrutiny is being given to the objectives and outcomes of ME's core courses through assessments conducted by eleven different course leaders. This process has also led to a number of changes, including those recently made to ME 395, the junior level required laboratory course. The number of labs conducted in this course has been reduced, and the lab experiences have been greatly improved by adding instruction in technical communication into the process. This is especially true of the lab statement, or "scenario letter," which students are asked to write as if they were employed by an engineering firm with clearly defined expectations for the laboratory report. Based on other feedback from students, the course package now includes notes on teamwork skills as well.

Efforts are also underway to systematically incorporate engineering ethics and an awareness of environmental concerns into the core curriculum. "I feel we are well positioned for the future," Perkins says.

ac•cred•it•ed (a-kred-i-tid) *adj.*



Active Velcro

"Active Velcro," a new Smart Attachment Mechanism (SAM) developed by Professor Diann Brei and student Joseph Clement, is being tested for its possible application to perform onorbit satellite docking. In this application, the SAM could capture and position an incoming satellite, which would repair damage, replenish expendables, or upgrade components of a currently orbiting host satellite.

Design Expo

Members of the U-M Formula SAE Car Lift team displayed their racecar in the Department's Spring Design Exposition. The lift they designed makes the 500-pound car portable in the "down" position and stable in the "up" position. Listed alphabetically are team members Nate Barber, Jason Bauer, James Chapman, Kori Martini, Clint Vigus, and Bill Wisniewski. Dr. Nicolae Orlandea was their instructor. First held in 1992, the Expo showcases design work of senior students in ME 450 Design and Manufacturing III. At the beginning of each term, students choose their projects from a pool of industrial, community service, and University projects.

Student teams research the problem, create several concepts, and engineer a validated design. The culmination of their efforts is Design Expo, where they present their work for course instructors, sponsors, and the general public.



TILBURY RECEIVES AACC ECKMAN AWARD



Only six years out of graduate school, Associate Professor Dawn Tilbury is helping to redefine the field of control systems research. For her contributions to both theory and practical applications on factory floors, she has received the American Automatic Control Council's (AACC) Donald P. Eckman Award, which recognizes outstanding scholars under 35. She joins a very distinguished list of past recipients, and is the first woman to receive the award since its inception in 1964.

Tilbury's challenge is to improve the systems that make production machines operate in the appropriate order - an enormously complex task in processes that often involve some 10,000 variables. Solving control problems involves highly theoretical work in logic systems as well as down-to-earth evaluations of how systems function in real factories. Indeed, the AACC subcommittee that awarded the Eckman prize noted: "The strength of Professor Tilbury's record lies in the balance that she has achieved between theory and practice."

She and her research assistants and colleagues are developing better and easier ways for production facilities to write and change control codes. She has helped develop control systems at General Motors Corp., Ford Motor Co., and companies that build control systems, including Nematron and Group Schneider.

Among Tilbury's many awards are citations for outstanding research as well as teaching. These include the prestigious NSF Career Award (1998) and the Undergraduate Computational Engineering and Science Education Award, given by the U.S. Department of Energy (1995).

Tilbury received her B.S. from the University of Minnesota in 1989 and her Ph.D. in electrical engineering and computer science from Berkeley in 1994. She joined the Department of Mechanical Engineering in 1995. She will spend the 2001-2002 academic year working on problems of logic control in Milan, Italy.

out•stand•ing (out-stand-ing) adj.

Distinguished Research Scientist Award - Ashton-Miller



A pioneer in the field of biomechanics, Dr. James Ashton-Miller has gained world renown for his groundbreaking research on the mobility problems of older adults, women's health issues, human spinal disorders, and orthopedic sports medicine. In recognition of his contribution to science - and specifically to the prevention of injuries and disabilities, as well as his outstanding service to the University of Michigan - Ashton-Miller was recently awarded the Distinguished Research Scientist Award.

An ME faculty member since 1983, Ashton-Miller directs the Biomechanics Research Laboratory, one of the nation's leading research laboratories studying balance, falls, and fall-related injuries. Among his landmark works is the study of biomechanical factors that limit the ability of an older adult to halt a fall. He has also pioneered statistical methods to study the body's ability to detect changes in joint angle, and has used his findings to quantify the extent to which advancing age reduces the threshold for joint motion detection.

As a member of the world-renowned research team concerning the biomechanics of female pelvic floor function, Ashton-Miller is an inventor of devices that measure pelvic floor muscle strength and methods to quantify and treat stress incontinence. And his collaborative efforts in the study of birth-related injuries using a three-dimensional computer model of the pelvic floor have won him international recognition.

A prolific researcher, writer, and academic, Ashton-Miller has authored 85 papers in numerous journals, is a reviewer for the National Institutes of Health and more than 15 other publications, and has served the University as an academic advisor and member of the Department of Biomedical Engineering executive and graduate education committees.

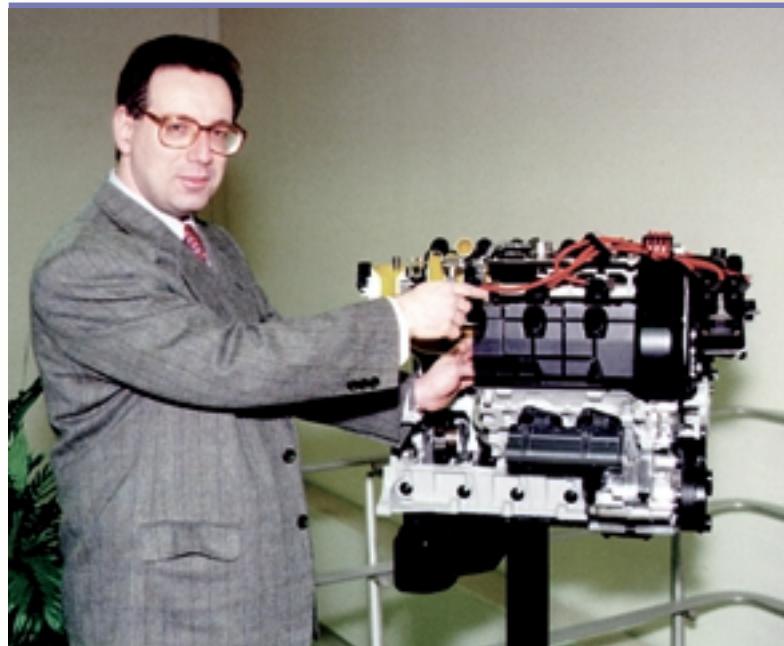
Ashton-Miller is president of the American Society of Biomechanics and has served as a consultant to the National Research Council, the National Collegiate Athletic Association, and the Swedish Strategic Research Foundation.

DENNIS N. ASSANIS IS FIRST RECIPIENT OF HOLT PROFESSORSHIP

A ceremony and reception was held on April 5 to honor and recognize Professor Dennis N. Assanis as the first Jon R. and Beverly S. Holt Professor of Engineering. Assanis, an innovative educator and accomplished researcher, presented a typically provocative lecture - playfully titled "Does the Internal Combustion Engine Have a Future?" - for the occasion.

The newly endowed professorship has been established to benefit instructors who demonstrate an outstanding commitment to undergraduate education. Since joining ME in 1994, Assanis has brought a refreshing new sensibility to the department's teaching techniques and research procedures. Recognized as an instructor committed to getting his students intimately involved in sophisticated subject matter, Assanis regularly utilizes experiential teaching methods to impart his own scholarly achievements to students in ways they can readily understand. Assanis has infused a renewed vitality into the Walter E. Lay Automotive Laboratory, and has thereby been instrumental in ushering ME into the forefront of automotive engineering education.

In recognition of his vast contributions to undergraduate education, Assanis had earlier been named the University of Michigan's Arthur F. Thurnau Professor for 1999-2002. He has also made inroads into graduate school endeavors by founding and directing its interdisciplinary master's degree program in Automotive Engineering. Assanis' research efforts and accomplishments have been honored with acclaim as well. As director of the Lay Automotive Laboratory and the Automotive Research Center as well as Michigan's associate director of the General Motors Collaborative Research Laboratory, his work has been recognized by the American Society of Mechanical Engineers, the National Science Foundation, and the Society of Automotive Engineers.



MLK Spirit Awards

Six Mechanical Engineering students were among 13 throughout the College of Engineering to be honored with Martin Luther King Spirit Awards. Pictured, left to right, are awardees Vil Johnkin, second-year graduate student; Marietsa Edje, junior; McAllister Daniel Jr., B.S.E. '00 and ME research assistant; Tershia Pinder, second-year graduate student; and ME graduate student Ronald Grover. The sixth winner, Bernard Drew, a junior in the ME department, is not pictured.



GRADUATE STUDENT FELLOWSHIPS AND AWARDS

Fall 2000 or Winter 2001

American Society for Engineering Education (ASEE)-

Outstanding Graduate Student Instructor Award
Mahmoud Hussein
Minas Mezedur

Robert M. Caddell Memorial

Stephen Dyer

College of Engineering Fellowships-

Dean's/Named Fellowship

Neha Gandhi
Anne Godwin
Mehmet Haliloglu
Robert White

Distinguished Leadership Award (2000)

Michael Farina

Distinguished Leadership Award (2001)

Mahmoud Hussein
Gullu Kiziltas

Regents Fellowship

Amy Patt
Brian Trease
Jinzhong Wang

CIC (Committee on Institutional Cooperation/General Electric)

Predoctoral Fellowship

Tershia Pinder

Departmental Fellowship

Jay Anderson
Charbel Assaf
Jeremy Cavagnolo
Xichu Chen
Christos Chryssakis
Berrin Daran
Nazmi Cem Dincer
Jiro Dokeh
Doug Frieden
Carlos Garciamoreno
Sachin Goyal
Joshua Hamel
Nikhil Joshi
Haitham Mahmoud
Laura Mantela
Kristen Mills
Hashem Mourad
Paul Otanez
David Pell
Katherine Peterson
Ramanan Sankaran
Szabolcs Sovenyi
Li Tang
David Vaughan
Bin Wu
Cetin Yilmaz
Hakan Yilmaz
Haining Yu

GEM (The National Consortium for Graduate Degrees for Minorities in Engineering and Science)

Felicia Brittman
Nia Harrison
Carlos Monserrate

Kodak Scholarship

Nia Harrison

Susan Lipschultz Award

Caroline Gatti

Ivor K. McIvor Memorial Award

Wei-Yi Chien

ME Distinguished Achievement Award

Hemant Munekar

William Mirsky Memorial Award

Selim Buyuktur
Ozgur Karagozoglu

MLK Spirit Award 2001

Ronald Grover
Vil Johnikin
Tershia Pinder

Rackham Graduate School

Distinguished Dissertation Award
Kurt DeGoede

Rackham Engineering Awards

Felicia Brittman
Cari Bryant
Dongmei Che
Kimberly Cook
Nia Harrison
Jean Hosford
Michelle Kramer
Alan McGaughey
Carlos Monserrate
James Santosa

Society of Women Engineering Teaching Award

Rebecca McGrew

Whirlpool Fellowship

Bart Johnson

dis•tin•guished (dih-stin-gwɪst) adj.

UNDERGRADUATE STUDENT SCHOLARSHIPS AND AWARDS

Fall 2000 or Winter 2001

3M Scholarship

Amy Denault

The Clare Boothe Luce Scholars Program

Kristin Myers

BP Amoco Mechanical Engineering Minority Scholarship

Laura Ellison
Vernon Newhouse
Brian Rhodes

BP Amoco Outstanding Mechanical Engineer Scholarship

Kevin Egan

Robert M. Caddell Memorial Awards for 2001-2002

Crystal Kornak
Brock Partee
Adam Webber

CoE Distinguished Leadership Awards

Aimee Constantine
Michelle Imbault
Tiffany Viant

D. J. McDonald Memorial Scholarship

Tom Martin

Dow Chemical Company Scholarship for 2000-2001

Robert Bartz
Andrew Corbishdale
Michael Pearson Jr.
Brian Walby

J. A. Bursley Prize

Shamita Shah

James B. Angell Scholars

(a.k.a. Seven-Term Angell Scholars)

Ryan Majkrzak
Ryan Schrieber

ME Distinguished Achievement Awards

Ryan Majkrzak

ME Spirit Award

Kwame Ofori

MLK Spirit Award 2001

McAllister Daniel Jr.
Bernard Drew
Marietsa Edje

Professor and Mrs. William P. Graebel Top Scholar Award

Joseph Klamo

R & B Scholar

Jessica Connor
Charles Vogel

SWE Corporate Scholarship (Compaq)

Janet Pien

SWE Corporate Scholarship (EDS)

Amy Denault

SWE Scholarships

Outstanding Female Senior
Shamita Shah

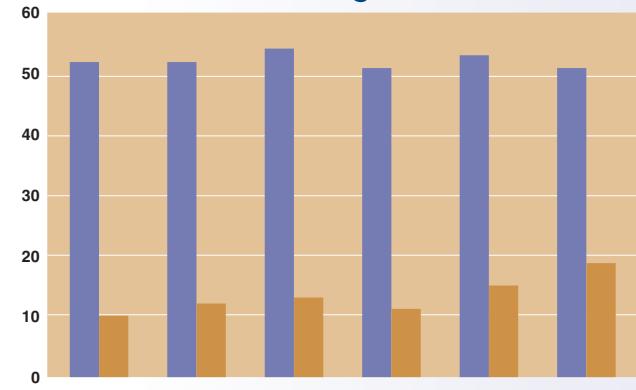
Outstanding Junior
Kirsten Thomas

Outstanding Senior
Michelle Imbault

Service Award
Aimee Constantine

honored (on-urd) adj.

ME Faculty Trends



NEW FACULTY

ME welcomed six talented new members to its faculty during 2000-2001.



Dr. Suman Das, who joined ME as an assistant professor in the fall of 2000, has achieved distinction in the exploration of freeform fabrication and high-performance metals. He is pursuing a broad range of research interests. These include solid freeform fabrication; rapid prototyping and manufacturing; machine design; the modeling and control of direct manufacturing processes; laser processing and fabrication of high-performance, functionally tailored components; powder metallurgy; vacuum metallurgy; and transport phenomena in materials processing. Das did postdoctoral work in the University of Texas' Laboratory of Freeform Fabrication after acquiring his Ph.D. at Texas in 1998. His dissertation investigated direct selective laser sintering of high performance metals. He took his bachelor's degree in mechanical engineering at the Indian Institute of Technology of Madras, India, in 1990.



Dr. Robert G. Dennis comes to ME from MIT's Artificial Intelligence Laboratory, where he designed, built, and tested the world's first muscle-actuated robot. He co-founded the MIT lab's biomechatronics group to develop muscle-based actuators and hybrid prosthetic devices. He is now at work on several bioengineering investigations, including the engineering of nerve tissue in biological actuators. Dennis is returning to familiar ground. He took his Ph.D. in biomedical engineering at the University of Michigan in 1996. Since 1998, he has held a concurrent research appointment in U-M's Institute of Gerontology, where he led a new program in muscle tissue engineering. While in graduate school at Michigan, he ran his own instrumentation firm, making custom instruments for automotive, energy, and medical concerns.



Dr. Ernest F. "Charlie" Hasselbrink, Jr., a specialist in the development of microdevices, joins ME after postdoctoral work at Sandia National Laboratories. In two years at Sandia, he was a prolific inventor. His innovations include a means for manufacturing extremely low-cost microfluidic control devices, such as microvalves, sub-nanoliter syringes and pipettes, check valves, and a flow meter; an electrochemical method to stabilize the performance of electrokinetic micropumps; and refinements of microfluidic diagnostic imaging methods and apparatus. He also helped to develop a self-contained hand-held biotoxins sensor based on chromatographs on a silica microchip. Hasselbrink took his Ph.D. at Stanford University in 1999. He is a 1992 *summa cum laude* graduate of the University of Houston.

tal•ent•ed (tal-ent-id) adj.

ME Faculty Diversity as a percentage of total population				
	W98	W99	W00	W01
Female	11.1	13.0	12.7	13.7
Under Represented Minorities	3.7	3.7	3.6	2.0



Dr. Wei Lu works in the emerging fields of nanostructures and “smart” materials, studying how such structures self-assemble and evolve. He holds two Ph.D. degrees - one in materials science and engineering from Princeton University (2001), the other in solid mechanics from Tsinghua University in Beijing. Lu is already responsible for significant advances in the nanostructures field. He has identified the significance of surface stress in the formation of ordered nanostructures; revealed how atoms on the surface can self-organize into various patterns; and proposed ways in which the evolution of nanostructures can be controlled by the manipulation of macroscopic properties. Among his awards are the Robert J. McGrattan Literature Award of the ASME and the Sayre Prize from Princeton’s mechanical and aerospace engineering department. He was also honored as both the outstanding graduate student and the outstanding student at Tsinghua University.



Dr. Edgar Meyhöfer is probing the mechanisms that propel molecular motors. These cellular protein molecules, using energy from the hydrolysis of ATP, are essential elements in nearly every cellular function, including cellular transport processes, cell division, and cell locomotion. Meyhöfer is using *in vitro* assays to characterize the cells’ mechanical properties at the level of single molecules. He is also developing single molecule detection methods and improved microscope systems to improve the measurement and manipulation of molecular systems. Since 1995, Meyhöfer has been an associate professor in the department of molecular and cellular physiology at the Medical School Hannover in Germany. He acquired his Ph.D. in biomechanics from the department of zoology at the University of Washington in 1991.



Dr. Anna Stefanopoulou is at work on a critical frontier - the development of innovative technology to improve automotive fuel economy and reduce toxic emissions. Her research embraces a wide array of improvements to conventional technologies. Among them are the design of low complexity controller architecture for advanced technology powerplants; enhancement of diesel engines equipped with variable geometry turbochargers and exhaust gas re-circulation; new flow-assist mechanisms such as electric turbochargers and superchargers; and the optimization of fully variable camless actuation to increase engine performance. Before joining ME, Stefanopoulou was an assistant professor in the department of mechanical and environmental engineering at the University of California at Santa Barbara. She took her Ph.D. in EECS at the University of Michigan in 1996 after receiving two M.S. degrees, in naval architecture (1992) and EECS (1994), also at Michigan. She took her diploma in naval architecture and marine engineering from the National Technical University of Athens, Greece, in 1991.

FACULTY INVITED AND PLENARY PRESENTATIONS

Ellen M. Arruda

"The Mechanics of Active and Passive Soft Tissue," Continuum Mechanics Seminar Series, The Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, April 2001.

"The Large Deformation Mechanics of Annealed and Quenched Isotactic Polypropylene," Department of Engineering Mechanics, University of Nebraska-Lincoln, May 2000.

James Ashton-Miller

"Biomechanics of Mobility and Fall Arrests in Older Adults," Rehabilitation Engineering Society of North America, June 2000.

Arvind Atreya

"An Experimental and Theoretical Investigation into Pyrolysis and Ignition of Wood," Symposium on Reactive Flow and Transport, The Institute of Mathematics and its Applications, University of Minnesota, 2000.

"Simultaneous Measurements of Drop Size and Velocity in Large-Scale Sprinkler Flows Using Laser-Induced Fluorescence," Emmons Symposium on Fire Research, 15th U.S.-Japan National Resources Meeting on Fire Research, 2000.

Suman Das

"Direct Laser Fabrication of High Performance Components-From Cermets to Metals," Symposium on Powder Metal Processes, ASM Materials Solutions Conference and Exposition, October 2000.

David R. Dowling

"Airborne Noise-Source Identification and Abatement," National Fluid Power Association's Annual Issues Seminar, Milwaukee, May 2001.

S. Jack Hu

"Assembly Modeling for Quality and Productivity," Columbia University, September 2000.

"Compliant Assembly Modeling and Systems," IMECE, November 2000.

"Mechanical Engineering Research and Graduate Education at the University of Michigan," Hope College, February 2001.

Gregory M. Hulbert

"Current Trends and Advances in Finite Element and Other Engineering Analysis Methods," Turbomachinery Lab, Michigan

State University, June 2000.

Massoud Kaviany

Distinguished Lecturer, Southwest Mechanics Lecture Series, 2000.

"Phonon Transport in Low-Conductivity Solids," ONR Workshop on Thermal Materials, Cambridge, United Kingdom, May-June 2001.

Arthur D. Kuo

"Mechanics and Control of Human Walking," Marquette University Biomedical Engineering Seminar, Milwaukee, 2000.

"Mechanics and Control of Human Walking," Northwestern University/ Rehabilitation Institute of Chicago Sensory Motor Performance Program Seminar, Chicago, 2000.

Katsuo Kurabayashi

"Approaches to Improving MEMS Actuator Performance: Material Design and Micromechanical Design," Xerox Palo Alto Research Center, Palo Alto, California, October 2000.

"Self-Heating in Nanoscale CMOS Transistor Gate Channel," Keio University, Yokohama, Japan, June 2000.

Zheng-Dong Ma

"Topology Optimization for Vibrating Structures," US Army TACOM, March 2001.

"Modeling and Simulation of Tracked Vehicles," Department of Mechanical Engineering, Tokyo Institute of Technology, July 2000.

"Modeling and Simulation of Tracked Vehicles," Chinese Academe of Rail, June 2000.

"New Developments in NVH Modeling and Analysis," College of Automotive Engineering, Jilin University of Technology, June 2000.

Jun Ni

"Meso-scale Machining," National Taiwan University, Taiwan, December 2000.

"Meso-scale Machining," Industrial Technology Research Institute (ITRI)/ MIRL, Taiwan, December 2000.

"Research on Precision Machine Tools," National Cheungkong University, Taiwan, December 2000.

Jwo Pan

"Modeling of Spot Welds under Combined

Loading Conditions," Ford, Dearborn, Michigan, June 2001.

Noel C. Perkins

"Modeling and Simulation of Tracked Vehicle Dynamics," Department of Mechanical Engineering, Carnegie-Mellon University, November 2000.

"Research on Modeling Tracked Vehicles," United Defense, Ltd., Santa Clara, California, August 2000.

"Cable Modeling," N.V. Bekaert S.A., Kortrijk, Belgium, September 2000.

Volker Sick

"Flows, Sprays and Flames; Why Do We Need Lasers to Understand Them?" Massachusetts Institute of Technology, Cambridge, Massachusetts, 2000.

"Benzindirekteinspritzung - Details im Laserlicht," University of Duisburg, Germany, 2000.

"Characterization of a Fan-Type Spray," General Motors Corporation, Warren, Michigan, 2000.

"Lean Combustion in IC engines: What are the Diagnostics Needs?" Engineering Foundation, Santa Fe, 2000.

Michael Thouless

"Fracture and Deformation of Adhesive Joints," Gordon Research Conference-Adhesion, Tilden, New Hampshire, August 2000.

"Prediction of the Strength of Plastically-Deforming Adhesive Joints," 2nd International Symposium on Adhesive Joints: Formation, Characteristics and Testing, Newark, May 2000.

"Fracture and Plastic Deformation of Adhesive Joints," General Motors, Warren, Michigan, 2000.

Dawn Marie Tilbury

"Modular Logic Control for Machining Systems: Formal Representation and Analysis using Petri Nets," IBM T. J. Watson Research Center, Technical Seminar, June 2000.

"Design and Analysis of Networked Controllers for Mechanical Systems," Honeywell Technical Center, Technical Seminar, May 2000.

A. Galip Ulsoy

"Some Topics in Control Research for

FACULTY AWARDS, HONORS

Reconfigurable Manufacturing Systems," Department of Mechanical Engineering, Michigan State University, East Lansing, Michigan, January 2001.

Plenary Lecture, "Reconfigurable Machine Tools and Reconfigurable Systems," 9th International Machine Tool Engineers' Conference, Tokyo, October 2000.

"Reconfigurable Manufacturing Systems," Lucky-Goldstar Production Research Center, Seoul, August 2000.

Wen-Jei Yang
Keynote Lecture, Fifth International Symposium on Heat Transfer, Beijing, August 2000.

Alan S. Wineman
"Network Scission and Healing Effects in an Elastomeric Body due to Deformation and High Temperatures," ICTAM2000, International Conference on Theoretical and Applied Mechanics, Chicago, August 2000.

"Some Comments on an Integral Constitutive Equation for Nonlinear Viscoelasticity with a Strain Clock," 37th Annual Technical Meeting, Society for Engineering Science, University of South Carolina, October 2000.

"Some Comments on an Constitutive Equation for Polymer Networks Undergoing Stress Relaxation and Scission," 37th Annual Technical Meeting, Society for Engineering Science, University of South Carolina, October 2000.

"Network Scission and Healing Effects in an Elastomeric Body due to Deformation and high Temperatures," 37th Annual Technical Meeting, Society for Engineering Science, University of South Carolina, October 2000.

"Coupled Mode Response Model for Elastomeric Bushings," with J. Kadlowec and G. Hulbert, 37th Annual Technical Meeting, Society for Engineering Science, University of South Carolina, October 2000.

Margaret S. Woolridge
"Flame Synthesis of Materials: Modeling Combustion Synthesis Systems," 2nd International Workshop on Chemkin in Combustion, Edinburgh, Scotland, July 2000.

"Combustion Synthesis of Nanostructured Materials," Pennsylvania State University, Fuel Sciences Department/Mechanical Engineering Department, State College, Pennsylvania, October 2000.

Vedat S. Arpacı

Teaching Incentive Fund Award, 2000-2001.
Max Jacob Heat Transfer Award, 2001.

James Anthony Ashton-Miller

Distinguished Research Scientist Award, University of Michigan, 2000.

Dionissios (Dennis) N. Assanis

Teaching Incentive Fund Award, 2000-2001.

Arvind Atreya

Service Award from The Office of Industrial Technologies, Department of Energy, 2001.

James R. Barber

Teaching Incentive Fund Award, 2000-2001.

Claus Borgnakke

College of Engineering Teaching Excellence Award, 2000-01.

Diann Brei

Ruth and Joel Spira Outstanding Teaching Award, 2001.

ASEE Best Paper Award, 2000.

National Academy of Engineering Gallery of Women Engineers.

David Dowling

ME Award for Outstanding Accomplishment, 2000-2001.

Student Paper Award in Underwater Acoustics: K. G. Sabra and D.R. Dowling, "Broadband Performance of a Time Reversing Array in Shallow Water," 140th Meeting of the Acoustical Society of America, Newport Beach, California, 2000.

Debasish Dutta

College of Engineering Service Excellence Award, University of Michigan, 2000-01.

R. Brent Gillespie

Best paper award nomination, International Institute of Electrical and Electronics Engineers Journal of Robotics and Automation, 2000.

Steven A. Goldstein

Fellow of the American Society of Mechanical Engineers, elected 2001.

Elijah Kannatey-Asibu, Jr.

Fellow of the Society of Manufacturing Engineers, elected 2001.

Massoud Kaviany

Teaching Incentive Fund Award, 2000-2001.
Distinguished Lecturer, Southwest Mechanics Lecture Series, 2000.

Jun Ni

Robert M. Caddell Memorial Award (Faculty Research Achievement Awards) with Jianjun (Jan) Shi of Industrial and Operations Engineering, 2001.

Advisory Professor, Xi'an Jiao Tong University, 2000-present.

Visiting Chair Professor, Hong Kong Polytechnic University, 2001-02.

Huei Peng

Teaching Incentive Fund Award, 2000-2001.

Noel C. Perkins

Fellow of the American Society of Mechanical Engineers, elected 2000.

Ann Marie Sastry

2000 Caddell Memorial Faculty/Graduate Student Achievement Award (with Ph.D. Student Bradley E. Layton).

William Wendell Schultz

Teaching Incentive Fund Award, 2000-2001.
ASEE Best Paper Award, 2000.

Jeffrey L. Stein

Teaching Incentive Fund Award, 2000-2001.

Alan Stuart Wineman

Teaching Incentive Fund Award, 2000-2001.

Margaret S. Wooldridge

ME Award for Outstanding Accomplishment, 2000-2001.
2001 Society of Automotive Engineers Ralph R. Teetor Educator Award.

Wen-Jei Yang

Awarded a golden key of the City of Bangkok, Thailand by Bangkok Metropolitan Administration, November 2000.

ex•cep•tion•al (x-sep-shun-ul) adj.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ME Faculty Members Elected as Fellows in 2000-2001

Elijah Kannatey-Asibu, Jr. (2001)
Noel Perkins (2000)
Steven A. Goldstein (2001)

ASME Fellows

ME Faculty Member	Inaugural Year	ME Faculty Member	Inaugural Year
Vedat S. Arpacı	1996	Jwo Pan	1997
Jay A. Bolt, PE (emeritus)	unknown	Panos Y. Papalambros	1995
Michael M. Chen	1983	J. Raymond Pearson (emeritus) .	unknown
John A. Clark (emeritus) Elected Life Fellow	unknown	Christophe Pierre	1999
Maria Comninou	1993	Leland J. Quackenbush (emeritus)...	unknown
David K. Felbeck, PE (emeritus) ...	unknown	Albert B. Schultz (emeritus)	1986
Gregory M. Hulbert	1999	William W. Schultz	2000
Elijah Kannatey-Asibu, Jr.	1995	Leonard Segel (emeritus)	unknown
Massoud Kaviani.....	1992	Richard E. Sonntag (emeritus) Elected Life Fellow	1996
Yoram Koren, PE.....	1990	A. Galip Ulsoy	1993
Edward R. Lady (emeritus) Elected Life Member	1991	Alan S. Wineman	1999
Herman Merte, Jr., PE (emeritus) Elected Life Fellow	1996	Wen-Jei Yang, PE	1983

CURRENT ENDOWED PROFESSORSHIPS

Dionissios (Dennis) N. Assanis

Arthur F. Thurnau Professor
Term: 7/1/99-5/31/02

(The First) Jon R. and Beverly S. Holt Professor of Engineering

Term: 9/1/00-8/31/05

Steven A. Goldstein

(The First) Henry Ruppenthal Family
Professor of Orthopaedic Surgery and
Bioengineering
Term: 11/20/98-11/19/03

Yoram Koren, PE

Paul G. Goebel Professor of Engineering
Term: 9/1/93-8/31/03

Jyotirmoy (Jyoti) Mazumder

Robert H. Lurie Professor of Engineering
Term: 9/1/96-8/31/06

Panos Y. Papalambros

(The First) Donald C. Graham Professor
of Engineering
Term: 1/1/00-12/31/04

Noel C. Perkins

Arthur F. Thurnau Professor
Term: 7/1/01-6/30/04

Albert B. Schultz

Vennema Professor of Engineering
Emeritus

A. Galip Ulsoy

William Clay Ford Professor of
Manufacturing
Term: 1/1/96-8/31/03

Alan S. Wineman

Arthur F. Thurnau Professor
Term: 7/1/00-6/30/03

PROCEED PAPER RECEIVES AWARD

If you were confined to a wheelchair with a paralyzing spinal-cord injury and you lived by yourself, how would you get into bed?

That's one of the many important and practical engineering problems ME students have solved in a student-run teaching project called ProCEED - Program for Community Engagement in Engineering Design. One of its lessons is that engineering does not exist only for industry. Engineers are also instrumental in solving down-to-earth problems in the lives of people in need.

ProCEED was launched in 1998 by Professors William Schultz and Diann Brei. Their report on the program, co-authored with several undergraduate students, was honored with the 2000 Best Paper Award of the American Society for Engineering Educators (ASEE). The paper was presented by the lead student in the project, Michael Farina.

Other schools have tried community-based engineering programs. What makes ProCEED unique is that students, not faculty, are the prime movers. Schultz and Brei only oversee and advise.

Members of Pi Tau Sigma, the ME undergraduate honor society, scout the community for engineering challenges, then find places for those challenges in ME courses. Students work in teams to design and build solutions.

The results have been remarkable. They include:

- A device with which a person with a spinal-cord injury can lift and transport himself from his wheelchair to a couch or bed.

- A child's wheelchair that can be reconfigured as the child grows.
- A gardening platform that can be raised and lowered. This project was built for a local senior center where seniors and small children work together on gardening projects. The platform can be raised for seniors who have trouble stooping, then lowered for kids.
- A device for diabetics, who often have vision problems, that automatically fills a syringe with the proper dose of insulin.
- A rainfall monitoring system that allows residents of a neighborhood with many ponds to predict flooding. This helped residents comply with a new Michigan law requiring pond owners to warn neighbors of impending floods.

ProCEED has begun to reach across departmental boundaries. Several projects have involved students in computer science and civil engineering. Organizers hope to establish this program throughout the College of Engineering.

prac•ti•cal (prak-tik-ul) adj.

MARIA COMMINOU RETIRIES



Valued colleague, mentor, and teacher Maria Comninou retired from the ME department effective June 30, 2000.

During her distinguished 25-year career at the University of Michigan, Comninou

earned international renown as a pioneer in the field of micromechanics. Her groundbreaking work on interface cracks earned her the Henry Hess Award and Alfred Nobel prize in 1978.

A professor of mechanical engineering and applied mechanics, Comninou's work on wave propagation, elastic contact, fracture, and friction problems

and thermoelasticity earned her the Northwestern University Alumnae Award, the presidency of the Society of Engineering Science, and the status of fellow in the ASME and in the American Academy of Mechanics. ME also recognized her with its "Jiminy Cricket" Ethics Award in 1993 and the Excellence in Service Award in 1996, and she received the University's Sarah Goddard Power Award in 1998.

Comninou joined the University of Michigan faculty in 1974 as an assistant professor in the Department of Applied Mechanics and Engineering Science and was promoted to associate professor in 1979 in the Department of Civil Engineering. In 1983 she joined the Department of Mechanical Engineering and Applied Mechanics (MEAM) and was promoted to professor in 1985. She earned her J.D.

degree from the University of Michigan in 1996, was admitted to the Michigan Bar in 1997, and was registered to practice before the US Patent and Trademark Office in 1999.

In 1999, Comninou combined her engineering and law skills to serve as patent advisor for the Engineering Research Center for Reconfigurable Machining Systems and to develop new graduate courses in patent law and product liability. Her "retirement" really represents a transition to a new career in patent law.

Upon her retirement, the University's Board of Regents named Comninou professor emerita of mechanical engineering and applied mechanics.

NSF CAREER AWARDS



Katsuo Kurabayashi

Mechanical Engineering Assistant Professor and National Science Foundation (NSF) Faculty Early Career Development (CAREER) grant recipient Katsuo Kurabayashi says he hopes one day to "push the scientific frontier in micro/nano-scale technology."

Kurabayashi, who joined the ME faculty in January 2000, received the NSF Career Award this year for his investigation into High-Temperature Thermal Transport in LPCVD Polysilicon for microelectromechanical systems (MEMS).

The five-year grant, which commenced January 1, 2001, focuses on the impact of high-temperature microstructural changes in Low Pressure Chemical Vapor Deposited (LPCVD) polysilicon for MEMS.

Kurabayashi explains that a majority of MEMS transducers consist of LPCVD polysilicon, and that the performance of these MEMS relies heavily on the physical properties of the material. Since the operational temperature of polysilicon-based MEMS thermal actuators and gas sensors often far exceeds room temperature, the current lack of an instrument suitable for high temperature thermal characterizations at micro/nanometer length scales limits how much can be learned about high-temperature thermal transport in LPCVD polysilicon.

Kurabayashi says he will continue to work toward his career goal of not only studying MEMS thermal energy transport but also combining it with curriculum development targeted at MEMS design education that utilizes cutting-edge information technology.

"My original educational background in Materials Science and Electrical Engineering will be fully exploited to develop new MEMS design curriculums in the Mechanical Engineering Department at University of Michigan in order to address the strong demands on interdisciplinary engineering education in the 21st century," says Kurabayashi.

Kurabayashi hopes that by emphasizing the physics that governs micro-scale mechanics, fluid dynamics, and heat transfer, he will be helping students in his design and manufacturing courses to develop future products for the automotive and emerging MEMS industries.



Steven J. Skerlos

Reducing the environmental impact and health hazards associated with products and manufacturing processes has long been the mission of Assistant Professor Steven J. Skerlos.

The founder of the Environmental and Sustainable Technology (EAST) Laboratory, Skerlos recently received an NSF CAREER grant. The grant, which commenced January 2001 and continues through December 2005, totals more than \$375,000 and provides funding for the development of a research and education program in environmentally benign design and manufacturing (EBDM).

The EBDM research program will focus on metalworking fluids (MWF), which are ubiquitous in manufacturing, contain significant environmental and health hazards, and comprise a major percentage of process costs. Noting that the metal fabricated products industry is critical to aerospace, automotive, electronic, defense, and several other industries that form the backbone of the national economy, Skerlos explains that many of the manufactured products associated with these industries are major contributors to air, land, and water pollution in the United States. Much of this pollution is concentrated in the Midwest, especially Michigan.

The goal of the research program is to achieve cost-effective and environmentally benign MWF systems. The educational component of this NSF-funded program will develop two EBDM courses, two Web-based EBDM educational tools, and a modular EBDM sequence for undergraduate design and manufacturing programs.



Kazuhiko (Kazu) Saitou

Assistant Professor Kazuhiko (Kazu) Saitou received an NSF CAREER award, which was also accompanied by a \$200,000 grant covering a four-year period that commenced in May 2000. The grant will fund Saitou's development of an integrated research and education program on discrete modeling and optimization in design and manufacturing.

Saitou has been a member of the ME faculty for three years, and one of his goals has long been the development of just this kind of program as a means of filling the gap between discrete optimization in operation research and the growing research interests in concurrent engineering.

Saitou acknowledged that his thesis advisor at MIT, Associate Professor Mark Jakielka (BSE ME '83, MSE '84, PhD '88), provided inspiration for his pursuit of the NSF CAREER Award. "He had won one of these awards, so I was very much aware of them. I dreamed of winning one, and I'm happy that I did so at Michigan, where Mark was a student."

Saitou also was aided in the development of his proposal by the research he conducts in consultation with Toyota Motor Corp. The objective of the research component of this program is the development of a systematic method for synthesizing feasible assemblies of bi-structural products: those with external enclosures reinforced by internal structural supports. This will not only provide a theoretical base for assembly synthesis of bi-structural products via decomposition, but it will also afford applications for the automotive, aerospace, and ship building industries.

The educational portion of this program will provide students with a unique ability to consider complex engineering problems. Decisions must be made among discrete choices, and to help them better understand these options, students will be taught to design and utilize discrete modeling and optimization methods and apply them to certain problems. Classroom work will be combined with mentoring and outreach efforts as well.

vision•ar•y (vi-shun-air-ee) adj.

NSF CAREER AWARDS



R. Brent Gillespie

Virtual reality is one of the most exciting emerging fields in technology, with critical applications in fields as varied as space exploration and surgery. A crucial element in making virtual reality authentically real, though, is the sense of touch - which is where Professor R. Brent Gillespie has been making his mark. Gillespie has been working on understanding, measuring, and eventually replicating the complicated sensations of physical contact.

The promise of Gillespie's work in the new field of haptic interfaces has earned him an NSF CAREER award, given annually to support outstanding young engineering faculty. He began his inquiry in graduate school at Stanford, where, as a trained pianist, he worked on making the keys of a synthesizer keyboard feel like the keys of a grand piano. This led to further haptic work in post-doctoral studies at Northwestern University, and then at Michigan, where he joined ME as an assistant professor in 1999. He is 37 years old.

His goal - and a key step toward providing haptic interfaces in virtual reality - is to build a haptic probe, a device to measure the sensations of touch. "The idea," he says, "is to have some kind of mechanized device go up to a real object, like a piano key, press on it, and extract all it needs to know to build a model that will run in simulation." With such a probe, for example, a robot on Mars could pick up a rock, create a model of how the rock "feels," and transmit the model back to Earth, where a scientist could "feel" the model. But Gillespie must first develop a theoretical framework for such a probe. That's the focus of his current work.

In the meantime, he watches his toddler son, Booker, for clues. "He's feeling," says Gillespie. "He's interacting. He's doing the haptic probe thing, building internal models of what the world is."



re•cog•nized (rec-ug-nizd) adj.

NSF FELLOWSHIP AWARD WINNER ROBERT WHITE

Jonathan Luntz

Most people think of a robot as a mechanical human. But Professor Jonathan Luntz invokes a different image to describe his work in robotics. He thinks of it as an ant colony, an array of "little cooperating robots." Each is programmed only to know enough to help its neighbors. But together they can accomplish a great deal.

Luntz's plan to design and build such devices has won him a coveted NSF CAREER award, a major validation of the research direction he began as a doctoral student at Carnegie Mellon University. He joined the Department of Mechanical Engineering in January 2000.

A traditional robot grasps and moves an object at only a couple of points, which limits the shape and size of the objects it can manipulate. Luntz, however, became interested in the idea of "distributed manipulation," by which objects are moved about through many simultaneous points of contact that constitute a force field.

Luntz, 30, is working on several such force fields. One consists of an array of small, motorized wheels that act in concert to manipulate flat objects. Another is similar to an air-hockey table, with jets of air controlling the objects' movement. Such devices turn fluid mechanics to their advantage, dramatically reducing the need for sensing and feedback.

A key question in his research is how to design such force fields so that objects can be moved to a predetermined position and orientation no matter what their shape or size. Applications will likely be widespread, including in the area of microelectromechanical systems (MEMS), in which parts are far too small to be gripped.

Luntz's work places him in the emerging area called mechatronics - the integration of mechanical, electronic, and computer engineering techniques. He is currently making plans to introduce mechatronics design into the college's undergraduate and graduate curricula.



Robert White came to Ann Arbor in the fall of 2000 to build things too small to be seen with the human eye - the infinitesimal machines known as microelectromechanical systems, or MEMS, in which a human hair is ten times as thick as the average object.

Born in 1976 in the United Kingdom, White grew up on the East Coast, then attended MIT for his B.S. and M.S. in mechanical engineering. He discovered MEMS during an internship at Draper Labs, and soon decided it was for him.

When he decided to pursue the Ph.D., White considered Michigan because of its leading reputation in MEMS, as well as the University of California at Berkeley. He liked Ann Arbor and the welcoming attitude of members of the department.

White is attending U-M on an NSF Fellowship, and the grant will cover White's expenses for three years of graduate study. He is working with ME Professor Karl Grosh on cochlear mechanics, the functioning of the inner ear. They hope that by reaching a better understanding of the ear, they will be able to design more effective microscopic microphones and hydrophones (microphones for underwater use). The knowledge they gain in that work may lead, in turn, to new insights on human hearing.

"The size of the things in the ear is pretty much the size of the things in MEMS," White said.

Support for the project comes in part from the Office of Naval Research and the National Science Foundation.

MEMS has developed into a thriving specialty over the last 20 years. Its roots are in the semiconductor industry, where researchers realized that microelectronic technology could be used to create new microsensors, microactuators, and medical devices.

Continuing Their NSF CAREER Awards...

Ellen M. Arruda	6/97-5/01
Karl Grosh	9/99-8/03
Huei Peng	5/98-4/02
Ann Marie Sastry	6/97-9/00
Michael Thouless	7/96-6/00
Dawn M. Tilbury	9/99-8/03

ME STUDENTS PACE SOLAR CAR RACE VICTORY

(below) the U-M Solar Car Team poses with M-Pulse during the car's unveiling;

(right) M-Pulse crosses the finish line at the 2001 American Solar Challenge, winning first place.



ME students and alumni played critical roles in the come-from-behind, 56-hour victory of the solar car M-Pulse, the Engineering College's entry in the 2001 American Solar Challenge, a 2,300-mile race along historic Route 66 from Chicago to Claremont, California.

M-Pulse, the third Wolverine winner in the six times the race has been run, came back from what seemed a fatal setback less than a month before the race. On June 18, a test run over the race route ended in a crash in a roadside ditch near Oklahoma City. The driver was unhurt, but the wreck severely damaged sophisticated components and the vehicle itself. The prospect was grim. Building M-Pulse had taken eighteen labor-intensive months, and the team's advisors, Kenneth Kohrs, MSE ME '66 (Ford Motor Company vice-president, and former chair of ME's External Advisory Board) and Brian Gilchrist (professor of Electrical Engineering and Computer Science), saw little chance of the team completing a successful repair in time to qualify for the July 15 start.

Yet in just seventeen days, working around the clock under Team Captain Nader Shwayhat, MSE ME '00 (currently a student in Industrial and Operations Engineering), the students brought the car back to racing condition. The team includes ME undergraduates Alicia Frostick and Ahmir Rashid.

From the start of the race on July 15, M-Pulse was among the leaders, consistently cruising near the 55-mph speed limit. Then came a string of mechanical setbacks that kept the Michigan team in second place for four days, behind the University of Missouri-Rolla. But on day five, M-Pulse finally raced past the Missouri car to take the lead for good. A 30-minute lead had lengthened to an hour and a half when the racer crossed the finish line on the morning of July 26.

Also accompanying the team was current External Advisory Board member Chuck Hutchins, reputedly one of the team's biggest fans.

Department Reorganization Improves Efficiency

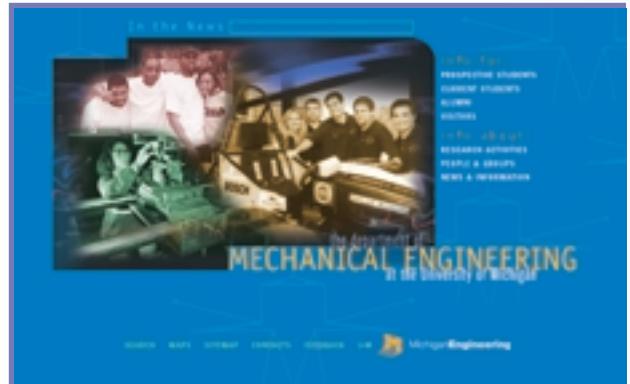
The Department of Mechanical Engineering continues to make staffing and other administrative decisions intended to optimize efficiency and enhance the workplace environment for all members of the department. This year, ME Administrative Manager Marcy Brighton undertook a number of projects intended to make the department more productive, and a strategic redistribution of the staff support structure was primary among them.

Implementation of this plan involved shifting members of the clerical and financial support services staff from a central location into a trio of satellite office clusters, or "pods," located throughout the G.G. Brown Building and W.E. Lay Automotive Laboratory. There is now one staff support cluster in the Auto Lab, one on the second floor of GG Brown, and one on the third floor of GG Brown.

Brighton believes that this decentralized staffing model has enabled the department to more readily support the varied needs of students as well as faculty members, since both financial and clerical staff members are now located very near the faculty members they serve within each new staffing support cluster. According to Brighton, this arrangement has allowed staff and faculty to get better acquainted, increased overall business efficiencies, and provided a consistent level of staffing near the faculty.

As part of the overall reorganization of services provided in ME, the Communications & Publications Office was also dissolved last year, and a new Webmaster, Chris Africa, was hired to oversee digital communications and marketing of the ME program.

WEB SITE UNDERGOES REDESIGN



Hired in December 2000 to serve as ME's first full-time Webmaster, Chris Africa - who came to the department from the U-M Law School and holds a 1997 B.S. from Eastern Michigan University - says her primary goal is to improve the way the Department communicates with prospective students.

"Given the technical savvy of today's prospective students, the Internet is the first place many of them look for information," says Chris. "This means that our Web site is our instrument of first impression, and in the highly competitive top-10 academic arena, first impressions can mean everything."

Chris says she is not interested in overwhelming visitors with gimmicks or technical superiority. She wants to create a welcoming atmosphere - a pleasant experience that engages visitors, makes them want to visit the campus, and

ultimately convinces them to apply. Chris' first priority has been to not only improve the look of the site (pictured at left) but to also enable visitors to more easily navigate its contents.

Chris leads a capable and enthusiastic ME Web Team, which worked diligently all summer to give the ME Web site its new look and feel. The Team includes May ME graduate Joseph Ardayfio; Industrial and Operations Engineering Ph.D. Pre-Candidate Brian Lewis; Vicki Murley, a May U-M graduate with a B.S. in Creative Disciplines in Technology; and Uma Natarajan, a database developer and programmer with a BS in mathematics from University of Madras, India (1983). The team is advised by Professor Dawn Tilbury (who previously served as part-time Webmaster), Department Chair A. Galip Ulsoy, and Administrative Manager Marcy Brighton.



Chris Africa

Margie Lesser

Among the staff members who arrived in 2000 was Margie Lesser, who left her ten-year position as Senior Financial Analyst for the U-M's Information Technology division in July to become Business Manager II at ME. With a BBA in accounting from EMU as well more than two years as Senior Financial Analyst at U-M's School of Information before her stint at Information Technology, Margie brings a wealth of knowledge and experience to her duties at ME. Primary among those responsibilities are the supervision of all financial and administrative matters, and oversight of the department's financial infrastructure.

Sought out and hired by ME's Administrative Manager Marcy Brighton, who used to work with Margie at the School of Information, Lesser's first task has been to train and add structure to a department that had

TWO NEW ADMINISTRATIVE STAFF JOIN ME

been understaffed for a while and thus needed reorganization and new direction. In addition to her myriad day-to-day responsibilities - such as preparing budgets, approving expenditures, and timely preparing and filing numerous financial and administrative reports - Lesser provides advice to Brighton on all fiscal issues. She also oversees the department's sponsored research funds, and assures compliance with their numerous regulations.

"I've enjoyed the challenge of coming to a large department, with many different things to do," says Lesser. "Having newly hired financial staff members has provided us with a good opportunity to train and create a new structure where one could not have been built before."

Christina (Chris) Africa also joined the Department in December 2000 as its first full-time Webmaster/Coordinator, Information Services. Chris was previously a web assistant at the Law School and a reporter and editor at her hometown newspaper in Celina, Ohio.

In addition to organizing a full-scale redevelopment of the ME Web site, Chris is coordinating ongoing print publications, helping to streamline information-handling systems, and moving the Department from a print-based operation toward an increased use of digital publications. She and the ME Web Team recently completed a visual redesign of the Web site (see above), and are now working to develop systems that will provide more dynamic and interactive ways of exchanging information and viewing data on the Web.

CHUCK S. HUTCHINS INDUCTED INTO THE MACHINIST'S HALL OF INNOVATORS



Chuck Hutchins is pictured with College of Engineering Dean Stephen W. Director. Hutchins demonstrated his ongoing commitment to the College and ME Department by touring with U-M's Solar Car Team, which won the American Solar Car Challenge in July 2001.

A pioneer in the field of computer aided manufacturing and an expert in Numerical Control, U-M alumnus Charles (Chuck) S. Hutchins (BSE ME '57) has been an innovator of machine tool and NC technology for nearly half a century.

Hutchins joined Buhr Machine Tool Company in Ann Arbor immediately following graduation. During his nine years there, Hutchins made Buhr a pioneer in the application of NC to the production of machine tool parts. As he became increasingly aware of the need to make NC programming accessible to the average machinist, Hutchins used Comshare's 1966 foray into computer timesharing technology to begin the development of the Compact II NC programming language. Over the ensuing 15-year period, more than 20,000 machinists around the world were trained in metal cutting manufacturing processes using programs created through Compact II.

Though he had officially retired at age 45, Hutchins' continuing passion for machine tools and NC technology led him to continue the pursuit of an idea that became the basis in 1985 for the new MDSI: open architecture control. Today, MDSI's Open Computer Numerical Control (CNC) is still the only machine control that offers a pure software solution using off-the-shelf technology. MDSI has controls at Dana, Ford, Cessna, Boeing, Textron, and approximately 800 other facilities across the United States.

Among the colleagues Hutchins credits for helping him make CNC so accessible are classmate and long-time friend Richard (Dick) B. Jones (BSE EECS '57) and U-M alumnus Larry Schultz (BSE IOE '69).

Hutchins and his wife Ann have long been generous supporters of ME, the School of Music, the Business School, and the department of OB-GYN in the Medical School, and in 1998 they each received the University of Michigan Distinguished Alumni Service Award.

Hutchins was inducted into the Machine Design Magazine CAD/CAM Hall of Fame in 1999. In September 2000, Hutchins and colleagues Jim Fall and Bruce Nourse were also inducted into the American Machinist's Hall of Innovators as Outstanding Innovators of the last decade of the Twentieth Century.

ROBERTA ZALD THRIVES ON CHALLENGE



Roberta Zald is pictured with some of the many products she has developed at Nematron Corporation, Ann Arbor.

Whether working on a plant design for Proctor & Gamble in Germany or marketing a new product concept in her current position as Vice President of Product Management at Nematron Corporation in Ann Arbor, Roberta Zald (BSE ME '78) has thrived on the various challenges she has faced in her 25 years in the automation industry.

Zald's experience at Proctor & Gamble and later at Fanuc Robotics, based in Auburn Hills, gave her insight into team management as well as equipment design and installation and materials handling. But it is at Nematron Corporation, she says, where Zald has worked for the past five years, where she has confronted some of her most intriguing professional challenges.

Nematron was a pioneer in the development of the industrial workstation in 1983. But as competition grew throughout the 1990s - there are now at least 250 other companies marketing industrial workstations - Zald says that Nematron remade itself to become a leader in PC-based control solutions for automation.

Zald says that only about 5 to 10 percent of the ME students were female when she was in attendance from 1974-78. U-M didn't even have its first women's varsity sports team until 1973. Zald was an avid athlete - she earned six varsity letters through her participation in field hockey, basketball, softball, and track - and she says that team sports were an invaluable asset during her college years. With academics focused on individual achievement, Zald says sports helped her gain perspective on teamwork.

Zald has an MS in the Management of Technology from MIT, and she keeps her ties to ME through the Engineering Alumni Society Board of Governors, to which she was elected last fall as well as representing Nematron in the Engineering Research Center for Reconfigurable Machining Systems, where it is an industrial member. She is an incoming member of the ME Department's External Advisory Board.

cre•a•tive (kre-a-tiv) adj.

DOCTORAL DEGREES CONFERRED

August 2000

Guiquan Chen

Rapid Volumetric Error Mapping and Compensation for a Three-Axis Machining Center
Co-chairs: J. Yuan, J. Ni

Kurt Michael DeGoede

Arresting Forward Falls with the Upper Extremities: Biomedical Analyses of Factors Affecting Impact Forces in Young and Old Humans
Chair: J. Ashton-Miller

Chunhe Gong

Robot Measurement System: Self-Calibration, Real-Time Error Compensation and Path Planning
Co-chairs: J. Ni, J. Yuan

Jianmin Gu

Efficient Model Reduction Methods for Structural Dynamics Analyses
Chair: G. Hulbert

Peter J. Halliday

Modeling and Analysis of Complex Structural-Acoustic Systems
Chair: K. Grosh

Cheng-Wei Hsu

Analysis, Design, and Experiments for Punch Force Control in Sheet Metal Forming
Chair: A. G. Ulsoy

Sunny Rajendra Khosla

Performance Analysis of an Acoustic Time Reversal System in Oceanic Environments
Chair: D. Dowling

Chi-Ying Liang

Traffic-Friendly Adaptive Cruise Control Design
Chair: H. Peng

Sung-Yong Son

Configuration Generation Methodologies for Reconfigurable Machining Systems
Co-chairs: D. Yip-Hoi, T. Olsen

Yi-Feng Tsai

Real-Time CNC Interpolators for Precision Machining of Complex Shapes with Pythagorean-Hodograph Curves
Co-chairs: K. Saitou, R. Farouki

November 2000

Bing-Chung Chen

Optimal Design of Material Microstructures and Optimization of Structural Topology for Design-Dependent Loads
Chair: N. Kikuchi

Claudia O. Iyer

An Experimental and Numerical Study on Cavitating Shear Flows
Chair: S. Ceccio

Yuan Lin

Large-Scale Computation and Optimization for Ultrasound Acoustic Transducers
Chair: K. Grosh

Scott Gayton Liter

Pool-Boiling Enhancement and Liquid Choking Limits within and above a Modulated Porous-Layer Coating
Chair: M. Kaviany

Kudijiang Mijit

Design, Analysis, and Experimentation of a Micro Internal Combustion Swing Engine
Chair: J. Ni

Chan-Woo Park

Modeling Thermal Regeneration in Reciprocating, Reacting Streams with Applications in Thermoelectric Power Generation and in Internal Combustion Engines
Chair: M. Kaviany

Julie A. Reyer

Combined Embodiment Design and Control Optimization: Effects of Cross-Disciplinary Coupling
Chair: P. Papalambros

Khaled A. Sbeih

Vortex Sheet Modeling of High Reynolds Number Shears Layers
Co-chairs: W. Dahm, G. Tryggvason

Bai Zhang

Design for the Dimensional Integrity of Automobile Body Assemblies
Chair: J. Ni

April 2001

Jan Ronnie Bladh

Efficient Predictions of the Vibratory Response of Mistuned Bladed Disks by Reduced Order Modeling
Co-chairs: M. Castanier, C. Pierre

Bo-Chiuan Chen

Warning and Control for Vehicle Rollover Prevention
Chair: H. Peng

John Marshall Dodson II

Efficient Finite Element Methods/Reduced-Order Modeling for Structural Acoustics with Applications for Transduction
Chair: K. Grosh

Sijun He

Formability Enhancement for Tailor-Welded Blanks
Co-chairs: S. Hu, X. Wu

Ilkyu Huh

Systematic Part Accuracy Improvement in Integrated Machining Systems by Machine-Part Error Mapping Based on Part Measurement
Co-chairs: Y. Koren, J. Yuan

Dohoy Jung

A Multi-Zone Direct-Injection Diesel Spray Combustion Model for Cycle Simulation Studies of Large-Bore Engine Performance and Emissions
Chair: D. Assanis

Wanjun Kim

Coupled Cross-Flow and In-Line Vortex-Induced Vibration of Elastic Cable Systems
Chair: N. Perkins

Huifang Li

Modeling, Analysis and Performance Optimization for Material Handling of Compliant Sheet Metal Parts
Co-chairs: D. Ceglarek, J. Shi

Min Ling

Patterning Algorithms for Operation Clustering for Reconfigurable Machining Systems
Co-chairs: Y. Koren, D. Yip-Hoi

Youji Ma

Sensor Placement Optimization for Thermal Error Compensation on Machine Tools
Co-chairs: J. Ni, J. Yuan

Scott D. Mishler

A Quantitative Molecular Model for the Nonlinear Rheology of Polydisperse Linear Polymer Melts
Co-chairs: J. Barber, R. Larson

George O'Neal

An Analytical Approach to Integrated Structural and Control Design
Co-chairs: Y. Koren, Z. Pasek

Kwang-Keun Shin

Adaptive Control of Active Balancing Systems for Speed-Varying Rotating Machinery
Chair: J. Ni

Allen S. Sun

Multiple Sensor Monitoring of Laser Welding
Chair: E. Kannatey-Asibu Jr.

Yung-Chang Tan

Efficient Modeling of Low- to Mid Frequency Vibration and Power Flow in Complex Structures
Chair: C. Pierre

Yun-Bo Yi

Thermoelastic Instabilities in Automotive Disk Brakes and Clutches
Chair: J. Barber

John Keunha Yook

Modeling, Analysis, and Design of Distributed Control Systems for Improved Performance
Chair: D. Tilbury

Guohua Zhang

Analysis and Optimization of Sheet Metal Flanging and Hemming Processes
Co-chairs: S. Hu, X. Wu

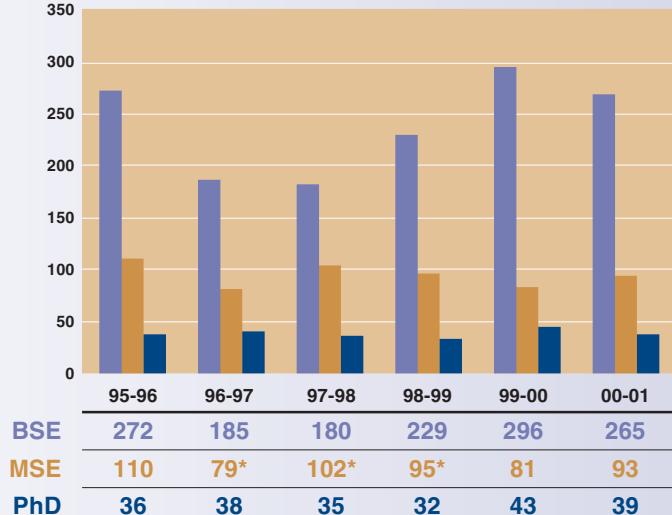
Mingxing Zhou

A Unified Approach to Assessing the Mechanical Performance of Resistance Spot Welds
Co-chairs: S. Hu, H. Zhang

Shiyu Zhou

Modeling, Estimation, and Active Balancing of Speed-Varying Rotor Systems
Chair: J. Shi

ME Degrees Conferred—Trends



*Includes MSE, ME, and MEng AutoE.

EAB WELCOMES THREE DISTINGUISHED MEMBERS

The three new members invited this year to serve on ME's External Advisory Board (EAB) were John W. Collins, III, a vice president of Alcoa; Marshall G. Jones, who has been with General Electric Corporate Research and Development since 1974; and Lieutenant General Paul J. Kern, who currently serves as Military Deputy to the Assistant Secretary of the Army for Acquisition, Logistics and Technology.



John Collins

The EAB, which was established in 1993 by then ME Chair Panos Papalambros, consists of distinguished ME friends and alumni who are willing to contribute their skills and influence to assure ME's continued success and provide invaluable guidance and advice to the ME Chair.

Following John Collins' graduation from the University of Michigan's College of Engineering, he joined Alcoa Technical Center as a development engineer in its packaging group. After a series of assignments and promotions that included becoming president of both the Specialty Metals Division and the Extrusion/Tube System, Collins now heads Alcoa's Mill Products business unit, which produces sheet and plate for the aerospace, defense, automotive, construction, and many other industrial and consumer markets. Collins holds five U.S. patents and is the recipient of three Alcoa Technical Awards.

Marshall Jones (BSE ME '65) has enjoyed a similarly lengthy and successful career with General Electric. Following a stint at Brookhaven National Laboratory from 1965 to 1969, Jones joined General Electric Corporate Research and Development in 1974, became Manager of the Laser Technology Program in 1981, and by 1985 his research on laser/fiber optic/robot systems was voted one of the nation's top 100 innovations of the year by Science Digest. This turned out to be the first in a long and impressive string of honors and awards bestowed upon Jones over the years, including the 1994 Black Engineer of the Year Award for "Outstanding Technical Contribution in Industry," the ASME's Dedicated Service Award, and election to the National Academy of Engineering in 2001.



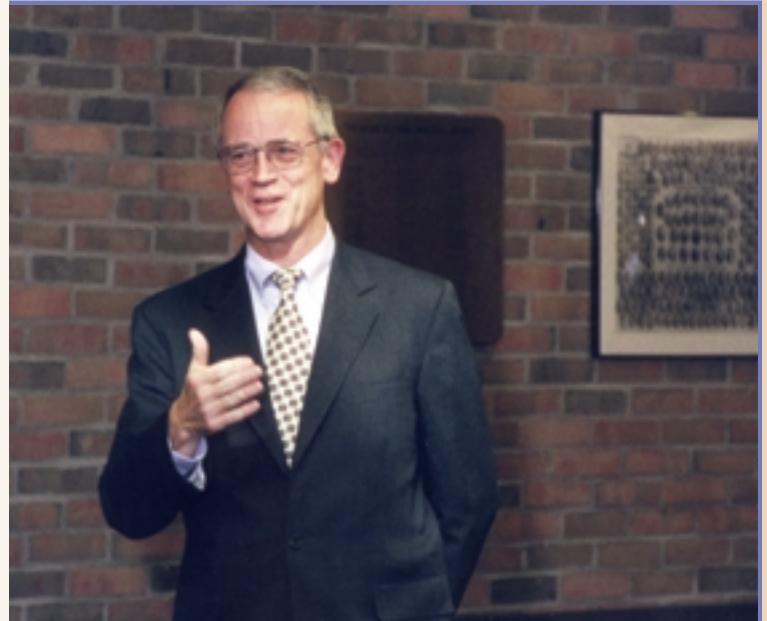
Marshall Jones



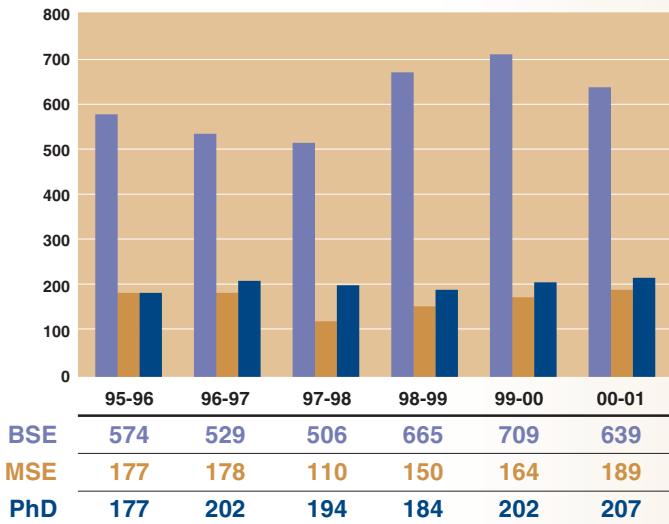
Paul Kern

As Military Deputy to the Assistant Secretary of the Army for Acquisition, Logistics and Technology, the third new EAB member (non-voting), Lieutenant General Paul Kern (MSE ME '73), is the senior military advisor to the Army Acquisition Executive and the Army Chief of Staff on all research, development, acquisition programs, and related issues. General Kern has a long and distinguished record of military service that includes two tours in Vietnam with the 11th Armored Cavalry Regiment as a platoon leader and troop commander, and as a battalion operations officer with the 3rd Armored Division in Germany. Among his many positions and duties throughout his career, General Kern has taught weapon systems and automotive engineering at the United States Military Academy and was the department's research officer. General Kern's awards and decorations include the Defense Distinguished Service Medal; the Army Distinguished Service Medal; Silver Star; Defense Superior Service Medal; two awards of the Legion of Merit; two awards of the Bronze Star Medal with "V" Device; three awards of the Bronze Star Medal; five awards of the Meritorious Service Medal; and the Army Commendation Medal.

A fall reception honored Charles M. Vest (MSE '64, PhD '67), the ME Alumni Society Merit Award winner for 2000. Vest is President and Professor of Mechanical Engineering at Massachusetts Institute of Technology (MIT).



ME Enrollment Trends



Diversity of Program Enrollment as a percentage of total population

Undergraduate Enrollment	AY98	AY99	AY00
% Women	17.9	18.5	18.7
% Under Represented Minorities	9.0	10.3	10.7
BSE Degrees Granted	AY98	AY99	AY00
% Women	11.7	17.1	20.4
% Under Represented Minorities	7.4	6.6	8.6

LAB CREATES ACADEMIC/CORPORATE PARTNERSHIP



Researchers in the department's General Motors Collaborative Research Laboratory are forging the next generation of academic/corporate partnerships.

Launched in 1998, the lab (formerly called the GM Satellite Research Laboratory) is applying advanced scientific research to questions that GM regards as crucial to its global competitiveness - and that U-M researchers find intellectually challenging and important.

The lab already has become a model for research partnerships between the corporate and academic sectors. GM has plans underway for similar labs in different research areas that will imitate the structure established at Michigan. Professor Panos Y. Papalambros, executive director of the Automotive Research Center and co-director of the new lab, says this effort is unique in that it applies the latest engineering methods in the development, design, and testing of new products.

For example, Papalambros says, "We look at how a product would fare in the marketplace if its engineering characteristics were different. We can make a car that's fast, with a lot of pep, but it consumes a lot of gas. Where is the trade-off as far as the consumer goes?" These are the sorts of questions the lab is exploring, with the aid of precise modeling tools that create better fits between the design process and business decision-making.

"There's lots of work on this in the business schools," Papalambros says, "but they have no engineering background. The engineers who deal with simulation models having to do with the vehicle don't think much about the user at the other end. What's special about what we're trying to do here is to link both ends and, through computer simulations and decision tools, to study these trade-offs in an analytical way. We are grounded in bona fide engineering techniques, but our human modeling side is also strong." Areas of investigation include:

- Advanced powertrains. Researchers are exploring direct-injection engines and transmissions and associated fuels and lubricants. Projects include laser-based imaging diagnostics; heat transfer and emissions in direct-injection gasoline engines; and the effects of oil formulation and surface treatment on engine friction, fuel economy, and emissions in high-speed, direct-injection diesel engines.
- Body design and manufacturing. Engineers in this area are developing analytical tools for body shop processing, fixture process and design, material handling, and simulation of body assembly systems.
- Systems. Papalambros has already led a successful effort to improve design methods for hybrid vehicle systems by using models that allow engineers to predict fuel economy, emissions, and performance. Another team is searching for better ways to solve a crucial question for major automakers - how to maximize brand differentiation while increasing the cost-efficient sharing of parts across a family of vehicles.

The ME-GM partnership offers enormous benefits, tangible and intangible, to both parties. The department's reputation for cutting-edge collaborative relationships with industry is enhanced, and this increases its ability to attract world-class students and faculty. The students, in turn, have opportunities to become involved in pioneering research-and-development at work - and are afforded a direct pipeline to attractive careers. GM is assisted by the best minds in the field, and benefits from the enhanced prestige that comes from an association with the College of Engineering, which increases the company's ability to attract top engineers.

The laboratory is funded by General Motors, ME, and the U.S. Army's Dual Use Science and Technology Program.

MESLB Learning Center renovation:

The Learning Center recently became the William N. Findley Mechanical Engineering Learning Center, thanks to a gift from William N. Findley. The MESLB coordinated the recent room renovation, which included accessibility improvements for handicapped students, new carpet, tables, and marker board, and adding the UMME logo to the wall. Pictured, left to right, are MESLB Winter 2001 members (front): Tiffany Miller, Vinay D'Souza, Kristin Miller, Chuck Bartus; and (back) Rob Gifford, Mark Christian, Adam Weber.



JON R. AND BEVERLY S. HOLT ENDOW NEW PROFESSORSHIP



Jon R. and Beverly S. Holt

Jon R. Holt, who earned his BSE in industrial engineering from the University of Michigan in 1968, joined with his wife Beverly this spring to endow the Jon R. and Beverly S. Holt Professorship of Engineering.

Those who are appointed as Jon R. and Beverly S. Holt Professors of Engineering will be honoring the family's impressive four-generation legacy at the University of Michigan. Jon's grandfather, Clarence, was the first Holt to attend the University of Michigan, receiving a BA degree in 1913. Beverly also earned a BA from the College of Literature, Science, and the Arts in 1968 - the same year Jon earned his BSE - and together they have proudly watched their son, Rob (BSE IOE, '96) and daughter, Kari (BSE IOE, '99) become ME graduates.

Jon and Beverly have directed that their generous gift be provided for either the Department of Mechanical Engineering or the Department of Industrial and Operations Engineering. The Holts have also required that appointments be made based on a determination of a candidate's outstanding commitment to undergraduate education.

Jon and Beverly Holt have a long history of philanthropic activity and other means of involvement in the day-to-day operations of the College of Engineering. In addition to their support of this professorship, they have served as co-leaders of the College of Engineering's Parent Program, which is a fundraising subcommittee of the Michigan Engineering Fund. Jon Holt has also served a three-year term as Michigan Engineering Fund chair, and he has been a member of the Tauber Manufacturing Institute Industry Advisory Board. He has also served on the College of Engineering's Design for Impact Campaign Executive Committee.

Jon is president and chief executive officer of Superior Radiator Coils, Ltd. of Chaska, Minnesota. He currently sits on the College of Engineering's National Advisory Committee.

EAB board photo

During its regular spring meeting, the ME External Advisory Board welcomed new members, conducted regular business, and heard updates from staff and faculty on instructional technology in the department. Left to right, the board includes (front row) Robert H. Transou, Michael E. Korybalski, Roger L. McCarthy, A. Galip Ulsoy, Richard T. Heglin; (back row) Marshall G. Jones, Charles S. Hutchins, John W. Collins III, Ward O. Winer, Paul J. Kern, and Carroll J. Haas Sr.



DONORS

Alfred P. Sloan Foundation

Andrew J. Eleazar

BP Amoco Foundation

Brian N. Nobunaga

C.M. Doterrer, Jr.

Carl H. Popelar

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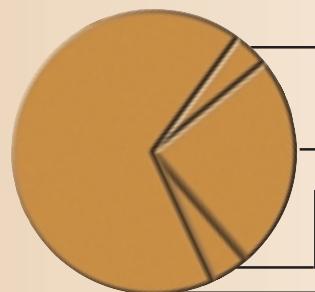
William Paul Graebel

William W. Yuan

Yukio Amano Living Trust

ME Departmental Expenditures

May 1, 2000-April 30, 2001



	%	\$
Academic Support ¹	4.20%	1,353,752
Instructional ²	25.28%	8,156,037
Scholarships and Fellowships	3.41%	1,100,108
Research ³	67.12%	21,656,376
	100.00%	32,266,273

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

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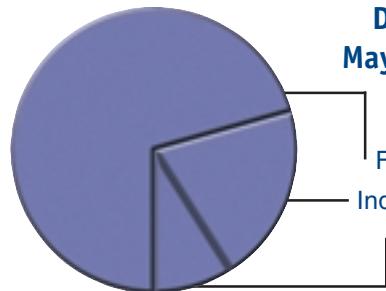
May 1, 2000 - April 30, 2001

A2 Automation	INCO, Ltd.	State of Michigan Economic Development Corporation
Aetna Corporation	Institute for Manufacturing Technology	Technologies Research Corporation
Alfred P. Sloan Foundation	Institute of Museum and Library Services	Tecnomatix
American Honda Motor Company	International Business Machines Corporation	Toyota Motor Company, Ltd.
Boeing Commercial Airplane	Kennametal	TurboTek
The Boeing Company	Kister Instrumente AG	U.S. Department of Commerce
Bquad Engineering, Inc.	L & W Engineering Company	U.S. Department of Defense
Cargill Detroit	Lamb Technicon	U.S. Department of Defense, Air Force
Caterpillar	Livernois Engineering	U.S. Department of Defense, Army
Cellular Concepts	Lucas Varity, PLC	U.S. Department of Defense, Advanced Research Projects Agency
Chevron Corporation	Masco Machine	U.S. Department of Defense, Navy
Chrysler Corporation	MDSI	U.S. Department of Energy
Cincinnati Machine	Mobil Technology Company	U.S. Department of Health and Human Services, National Institutes of Health
Clemson University	NCMS	U.S. Department of Transportation, Federal Highway Administration
Comau Pico	Nematron	U.S. Environmental Protection Agency
Cross Huller	Nippon Steel Chemical Company, Ltd.	U.S. National Aeronautics and Space Administration
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Daimler Chrysler	Oakland University	University of Alaska
Dell Computer	OG Technology	University of Iowa
Delphi Automotive Systems	Perceptron	University of Michigan
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Ford Motor Company	Sekisui Chemical Co., Ltd.	
General Motors Corporation	Societe Nationale D'Etude Et De Construction De Moteurs	
HelpMate Robotics		

ME Research Expenditures

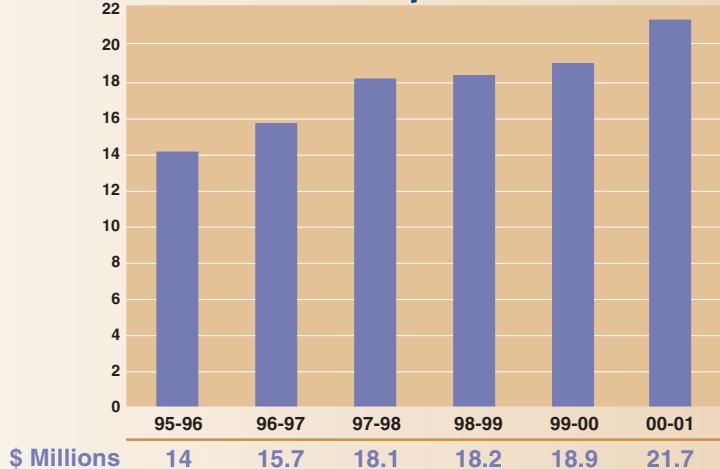
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May 1, 2000-April 30, 2001



*Internal Faculty Research funds of \$600,000 were moved this year from academic support to research

ME Research Expenditure Trends





**University of Michigan
College of Engineering
Department of Mechanical Engineering**

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