

1999

**Mechanical Engineering
and Applied Mechanics**

2000

Annual Report



Assistant Professor Margaret S. Wooldridge uses the laser pictured above in her particle research, as seen on the cover and page 27.

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LEADERSHIP
Innovation
IMPACT



From the Chair

Although Ann Arbor is home to many faculty and students in the Department of Mechanical Engineering and Applied Mechanics (MEAM) at the University of Michigan (U-M), Detroit Metro Airport is often a second home of sorts. Whether it's national awards, keynote and plenary lectures at international destinations, service on advisory committees, involvement in start-up companies, global teaching assignments, consulting engagements, or research collaborations worldwide, the members of our academic community are constantly in demand and constantly on the go.

Their activities, in turn, help make Ann Arbor a world center for new directions in mechanical engineering; a center that last year attracted over 1,000 VIP visitors—including CEOs, presidents, vice presidents, government officials, and deans—from the world over to our Department. During the past academic year, MEAM faculty also organized four major national conferences, each of which attracted hundreds of participants to the Ann Arbor area during the summer of 2000. In this *1999–2000 Annual Report* for the Department, which covers a time frame extending from May 1 of 1999 through April 30 of 2000, we highlight some of the many national and international activities that demonstrate the innovative, high-impact leadership of our faculty and students.

In recent years, mechanical engineering has been redefining itself in ways that are simply amazing. As you look through this report, you will read about the synthesis of nanoparticles, compliant mechanisms for micro-electromechanical systems (MEMS), self-assembly of MEMS devices, “active velcro” for docking satellites, cochlear implants for the hearing impaired, and the mechanics of fibrous materials in sea urchins. Even in the traditional mechanical engineering domains, things are quite different from what they once were. Cars are hybrid electric, powered by fuel cells and with computer-vision based co-pilots. Machine tools use laser-beams for



material processing, are designed to be reconfigurable and have smart tooling with embedded lasers for high-precision.

It is definitely an exciting time to be a mechanical engineer and, in this report, we're proud to share some of the remarkable advances that are originating in our Department. In keeping with this ongoing redefinition of the field, the Department will change its name from Mechanical Engineering and Applied Mechanics to simply Mechanical Engineering, effective July 1, 2000.

The 1999–2000 Academic Year was marked by important and noteworthy changes within the faculty. We welcomed six new faculty members, all of whom are introduced in this report, and we bid farewell to Vennema Professor of Engineering **Albert B. Schultz** who retired after 40 years of world leadership in biomechanics. Former Department Chair **Panos Y. Papalambros** was appointed to an endowed chair professorship established recently by one of our outstanding alumni, **Donald C. Graham** (BSE '55, MSE '56). You will find that story on page 28, as well as on page 15, along with features on other distinguished graduates such as MIT President **Charles M. Vest** (MSE '64, PhD '67), in a special section devoted to alumni achievements.

In this *Annual Report* you will also find a variety of other information regarding our activities. Please note that during 1999–2000, undergraduate and graduate enrollments and degrees awarded both increased slightly, as did our research expenditures. Also, in this past year more undergraduates matriculated than ever before in the Department's history.

As you read this year's report, I feel that you cannot help but be impressed with the creativity and innovation of the faculty and students within the Department, and with the national and international leadership they provide in mechanical engineering education and research. Please enjoy!

—**A. Galip Ulsoy**, MEAM Department Chair

A. Galip Ulsoy, William Clay Ford Professor of Manufacturing, stands in front of a mural created by U-M art students for the Integrated Manufacturing Systems Laboratory (IMSL).

Innovation and Impact

New Global Product Development Course Introduced

As manufacturing operations become increasingly global, students must have a working knowledge of environmental issues, trade regulations and rules governing intellectual property. They must also be able to work comfortably and effectively within multicultural teams.

To help prepare the next generation of technical leaders in design and manufacturing, Associate Professor **Debasish (Deba) Dutta** is working with colleagues at the Technical University of Delft in The Netherlands and Seoul National University in Korea to develop a new graduate-level course. Beginning in the fall of 2000, Global Product Development will be co-taught by professors from all three universities and will be offered simultaneously to students on each campus.

In this project-based course, as Professor Dutta explains, “international student teams will develop a global product which will then be customized for local markets. During the

semester, the student teams will work remotely via the Internet and video conferencing. Final presentations and prototypes will be judged by a jury of three professors and three industry representatives.” The site of final presentations will be rotated among the three participating institutions, with University of Michigan (U-M) hosting the first event at the end of Fall Term 2000.

Reconfigurable Manufacturing Named Top Priority

Two major national reports have recognized manufacturing and reconfigurability as critical technologies for the future. In a report commissioned by Congress and entitled *New Forces at Work: Industry Views Critical Technologies*, the Office of Science and Technology Policy (OSTP) cited advanced manufacturing technologies as being of great concern across all industry sectors.

In addition, Professor **Yoram Koren**, Director of MEAM’s National Science Foundation (NSF) Engineering Research Center for Reconfigurable Machining Systems (ERC/RMS),

participated in a study conducted by the National Research Council (NRC), the operating agency of the National Academy of Sciences (NAS). The group’s final report, *Visionary Manufacturing Challenges for 2020*, offers six grand manufacturing challenges, one of which is Reconfigurable Enterprises, and ranks reconfigurable manufacturing systems as the top priority among all emerging manufacturing technologies.

“The NRC report is based on a Delphi study,” Professor Koren explains. “The final outcome is refined in multiple rounds of questionnaires sent to over 1,000 experts worldwide. Reconfigurability was not even mentioned in the first round of the survey. After I submitted it as a critical technology, it caught fire, and in the end reconfigurable manufacturing systems and their theoretical foundations were ranked priority number one.”

This multimedia classroom, one of two such facilities located in the Chrysler Center and operated by the Center for Professional Development (CPD), is specially equipped to accommodate distance learning, teleconferences, and continuing education courses.



Ceccio Recruited to Defense Science Study Group

Every two years, the Institute for Defense Analysis (IDA) solicits nominations from major universities and government agencies for membership in the Defense Science Study Group (DSSG), an organization that seeks to develop links between the national security community and young, emerging leaders in science and technology. Associate Chair **Steven L. Ceccio** was one of 15 individuals accepted into the DSSG class of 2000–02. As part of the program, Ceccio will visit military installations around the country, meet with senior commanders, tour defense laboratories and industrial facilities, and help prepare studies on national security issues. DSSG alumni have continued opportunities for involvement with the Department of Defense (DoD), serving as advisors, consultants, and members of boards, study groups, and task forces that address technological issues of national significance.

On April 20, 2000, the College of Engineering (CoE) hosted a visit from **Congressman Joseph Knollenberg**, who represents Michigan's 11th district. Speaking to an audience that included **Stephen W. Director**, the **Robert J. Vlasic** Dean of Engineering, and **MEAM Chair A. Galip Ulsoy**, the congressman spoke on the subject of "The Energy Supply for the United States and the Role of Nuclear Energy." Knollenberg is pictured here touring the ERC/RMS with Assistant Research Scientist **Derek Michael Yip-Hoi**.

Associate Professor **Steven L. Ceccio** has been named to the DSSG, a program sponsored by the DoD that introduces outstanding young professionals in science and engineering to the technical dimensions of national security issues.



THE ANNUAL RANKINGS ARE IN...

In April of this year, *U.S. News & World Report* issued its annual guide to America's best graduate schools. Among the nation's 219 graduate engineering programs, the University of Michigan (U-M) occupied the #4 slot. This marks the third year in a row that the College of Engineering (CoE) has been ranked in the top five. Also, within the category of specialty engineering programs, Mechanical Engineering was rated #5 by engineering school deans. (The Department has ranked among the top five since 1996.) As **Robert J. Vlasic** Dean of Engineering **Stephen W. Director** noted, "Overall, according to these rankings, the College remains extremely strong, and we can all take great pride in what we have been able to accomplish."

LEADERSHIP: STUDENT NEWS

MECHANICAL ENGINEERING STUDENT LEADER BOARD (MESLB)

Academic Year 1999–00
(F99 and W00)

Frederick Barrigar (SAE)

Stacey Durham (ASME)

Mari Endo (ASME)

Michael Forbis (ASME)

Timothy Jacobs (GRIME)

Jonathan Keener (IITΣ/PTS; MEAM Planning Committee Representative)

Kristalyn Mack (UMME)

Kristin Miller (IITΣ/PTS)

Tiffany Miller (SAE)

Julie A. Reyer (GRIME)

STUDENT LEADERS

May 1, 1999–April 30, 2000
(Sp/Smmr99, F99 and W00)

Eren Anlar

Pi Tau Sigma (IITΣ/PTS) Initiate of the Term (W00).

Frederick Barrigar

President (F99), Epeians Leadership Honor Society; CoE Distinguished Leadership Award (99–00); Special CoE award in appreciation of his outstanding service and commitment to the CoE and U-M; Mechanical Engineering and Applied Mechanics (MEAM) Marshall, Winter Term Commencement.

Sara Bernal

Secretary (99–00), Society of Hispanic Professional Engineers (SHPE).

Mechanical Engineering Student Leader Board (MESLB) for the 1999–00 Academic Year. Back row (l.–r.): Jon Keener, Kristalyn Mack, Fred Barrigar, Stacey Durham. Front row (l.–r.): Mari Endo, Mike Forbis, MEAM outreach activities manager Anna Babbitt, and Tiffany Miller.



Felicia Brittmann

Vice Chair (99–00), Society of Manufacturing Engineers (SME).

Shawn Burney

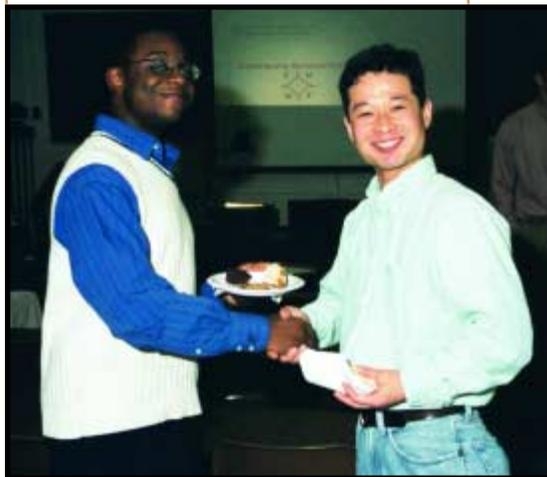
Co-Secretary (W00), Pi Tau Sigma (IITΣ/PTS); Treasurer (W00), American Society of Mechanical Engineers (ASME).

Sergio Camarillo

Treasurer (99–00), Society of Hispanic Professional Engineers (SHPE).

Connie Cheung

Secretary (F99); Vice President (W00), American Society of Mechanical Engineers (ASME).



National Society of Black Engineers (NSBE) Benefits from MEAM Student Leadership

MEAM senior **Jason Morris** has been named National Business Diversity Chair for the National Society of Black Engineers (NSBE). This is not the first time that Morris has filled a leadership slot within the organization. Since joining NSBE in 1996, he has served as regional and, more recently, national Finance Chair, working directly with the organization's many

corporate supporters. As National Business Diversity Chair, he is responsible for expanding the opportunities for contact between corporate affiliates and student members, identifying new venues for students to network, learn, and access entrepreneurial concepts.

As Jason is quick to point out, "The College of Engineering (CoE) has strong ties to NSBE through its membership as well as a long tradition of supplying student leaders to the organization." He goes on to note that Michigan engineering students and alumni currently hold a variety of regional and national leadership positions. Established in 1976,

NSBE is an international student- and professional-based organization dedicated to increasing the number of culturally responsible black engineers who excel academically, succeed professionally, and positively impact the community. With over 10,000 members, the organization maintains an active presence in Canada, the U.S., Jamaica, and Ghana.

Jason Morris, ME undergraduate and National Business Diversity Chair for NSBE, greets Assistant Professor Kazuhiro (Kazu) Saitou, one of many guests attending a Unified Minority Mechanical Engineers (UMME) faculty/staff/student mixer.

Diversity of Program Enrollment

as a percentage of total population

Undergraduates	F98	F99
Female	18.7	20.2
Under Represented Minorities	7.2	8.7
Graduates	F98	F99
Female	13.0	13.6
Under Represented Minorities	3.2	2.7

Sandhya Clarke

Pi Tau Sigma (ΠΤΣ/PTS) Initiate of the Term (F99).

Aimée Constantine

CoE Distinguished Leadership Award.

Vinay A. D'Souza

Treasurer (F99), American Society of Mechanical Engineers (ASME).

Stacey Durham

Secretary (F99), University of Michigan Engineering Council (UMEC).

Carlin Early

Secretary (99–00), Unified Minority Mechanical Engineers (UMME).

Mari Endo

Internal Vice President (F99), University of Michigan Engineering Council (UMEC).

Michael Farina

CoE Distinguished Leadership Award (MEAM).

David Fedewa

Secretary (99–00), Society of Manufacturing Engineers (SME).

Michael Forbis

President (99–00), American Society of Mechanical Engineers (ASME).

Robert Gifford

Secretary (99–00), Society of Automotive Engineers (SAE).

Ronald Grover

Coordinator, MEAM Detroit Area Pre-College Engineering Program.

Jennifer Gruits

Secretary of Affairs (W00), Pi Tau Sigma (ΠΤΣ/PTS).

Doria Hickman

Vice Chair (99–00), National Society of Black Engineers (NSBE) Regional Executive Board.

Mahmoud Hussein

President (99–00), U-M Egyptian Student Association.

Ekenem Isichei

Overall winner, 1999 Paper Airplane Contest, U-M Department of Aerospace Engineering (AeroE).

Ami Kapadia

Vice President (99–00), Society of Automotive Engineers (SAE).

Samir Karamchandani

Representative for Pi Tau Sigma (ΠΤΣ/PTS) (W00), University of Michigan Engineering Council (UMEC).

Jonathan Keener

President (F99), Pi Tau Sigma (ΠΤΣ/PTS); Representative (99–00), MEAM Planning Committee; CoE Distinguished Leadership Award.

Ryan Kennel

Co-Secretary (F99), Vice President (W00), Pi Tau Sigma (ΠΤΣ/PTS).

Dual degree candidate Hiroumi Kitajima was one of the speakers at a CoE reception held in Wilson Student Project Center to celebrate the achievements of the MaizeBlue solar car team.



SUNNY NEWS FROM DOWN UNDER

Although engineering students engage in any number of annual design competitions, the **World Solar Challenge** is probably the best known and most anticipated of all competitive events. The 1999 race was held from November 17 through 26 in Australia, along a grueling 3,100 km (1,800+ miles) course that traversed the country north to south, beginning in Darwin and finishing in Adelaide. The U-M entry, MaizeBlaze, finished ninth in a field of 40, just six hours behind the lead vehicle.

Although the prospect of funding, designing, building, transporting, and racing a solar car attracts students from a wide range of disciplines and departments, MEAM is always well represented. This past year was no exception. **Vik Sahney**, one of two drivers, also assisted with design, manufacturing and testing. Joining him were **Heather Nettle**, responsible for the car's solar array; **Hiroumi Kitajima** (BSE '00), in charge of Australian logistics; **Nader Shwayhat**, head of operations and new team leader for 2001; and **Sean Kennedy**, Web master, photographer, and semi-trailer construction assistant.

According to team leader Jed Christiansen, "To take ninth place against international teams with funding in the multi-million-dollar range is amazing. We also finished just hours away from first place, when usually the top three are separated by days. All five of our mechanical engineers were very involved in making this happen."

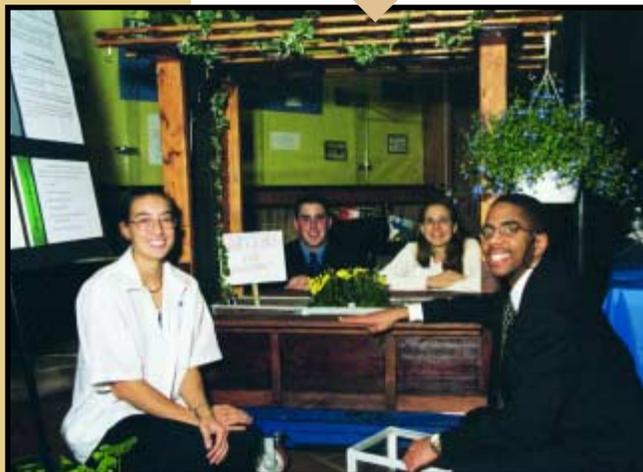
PROGRAM FOR COMMUNITY ENGAGEMENT IN ENGINEERING DESIGN (ProCEED) RECEIVES NATIONAL GRANT

Several years ago, with funding from the W.K. Kellogg Foundation, student members of the Pi Rho (ΠP) chapter of Pi Tau Sigma ($\Pi T \Sigma / P T S$), the national mechanical engineering honor society, established the Program for Community Engagement in Engineering Design (ProCEED). Every semester, ProCEED contacts community service and nonprofit agencies throughout the region, seeking out service projects of a technical or engineering nature. Members of ProCEED then confer with engineering course instructors, who may assign students to work on a specific project.

In November of 1999, the Edward Ginsberg Center for Community Service and Learning awarded the organization a grant of \$2,000 to be used for expanding the work of ProCEED into other departments of the College. In the Winter 2000 Term, student representatives made presentations to faculty members in the fields of mechanical, electrical, and civil engineering.

On a related note, Pi Tau Sigma won the Most Outstanding Chapter Award at the PTS National Convention, held in Georgia during the Fall 1999 Term.

ME450 students (l.-r.) Melinda Ball, Adam Silver, Amy Ladwig, and Craig Williams designed and built an adjustable-height garden for seniors and children at Ann Arbor's Jewish Community Center. The project was sponsored by ProCEED.



Hiroumi Kitajima

Representative for Pi Tau Sigma ($\Pi T \Sigma / P T S$) (99–00), University of Michigan Engineering Council (UMEC)

David Kupferer

Treasurer (F99), Pi Tau Sigma ($\Pi T \Sigma / P T S$).

Christopher Leja

Secretary (W00), American Society of Mechanical Engineers (ASME); Board Member, U-M Chapter of the International Association for the Exchange of Students for Technical Experience (IAESTE).

Kristalyn Mack

President (99–00), Unified Minority Mechanical Engineers (UMME).

Jonathan Malkovich

President (F99), University of Michigan Engineering Council (UMEC); President (99–00), Senior Class.

Kevin McNeil

Treasurer (F99), Society of Automotive Engineers (SAE).

Larry Mercier

Secretary (W00), Epeians Leadership Honor Society.

Kristin Miller

Vice President (F99), President (W00), Pi Tau Sigma ($\Pi T \Sigma / P T S$).

Tiffany Miller

President (99–00), Society of Automotive Engineers (SAE).

Jason Morris

National Finance Chair (99–00), National Society of Black Engineers (NSBE); Representative for Unified Minority Mechanical Engineers (UMME) (99–00), University of Michigan Engineering Council (UMEC); CoE Distinguished Leadership Award.

Cynthia Phillips

Secretary of Affairs (F99), Pi Tau Sigma ($\Pi T \Sigma / P T S$).

David Joseph Piech

Representative for Pi Tau Sigma ($\Pi T \Sigma / P T S$) (F99), University of Michigan Engineering Council (UMEC).

Carrie Presdorf

Vice President (F99), American Society of Mechanical Engineers (ASME).

Julie A. Reyer

The Spirit of Martin Luther King, Jr. (MLK) Student Recognition Award.

Jeffrey Roselli

CoE Distinguished Leadership Award.

Julie Sanchez

External Vice President (F99), University of Michigan Engineering Council (UMEC).

Jeff Sawka

Chair (99–00), Society of Manufacturing Engineers (SME).

Brett Thompson

Treasurer (99–00), Unified Minority Mechanical Engineers (UMME).

Adam Weber

Treasurer (W00), Pi Tau Sigma ($\Pi T \Sigma / P T S$).

STUDENT HONORS AND AWARDS

UNDERGRADUATE STUDENT SCHOLARSHIPS AND AWARDS

F99 and/or W00

**American Society of Mechanical Engineers (ASME) Board on Engineering Education—
John and Elsa Gracik Scholarship**
Vinay D'Souza

Garland Duncan Scholarship
Anastasios John Hart

**BP Amoco Foundation Inc.—
Outstanding Student Scholarship**
Brock Partee

Scholarships
Bobby Johnson
Nkechiye Okwumabua
Jason Twymon

David Aspland Scholarships
Regina Bousson
Arthur Geldres
Matthew Middleton

William E. Bandemer Scholarships
Stephen Kim
Jason Kline
Nkechiye Okwumabua
Ariel Schuger

Charles F. Barth, Jr. Prize
Elena Marin

George H. Benzenberg Scholarship
Brian McMillon

Joseph Boyer Scholarships
William Kasiske
Holly Mann

J.A. Bursley Prize
Jonathan Weinert

**Robert M. Caddell Memorial Awards—
Undergraduate Scholarship**
Anastasios John Hart

**Darl F. and Lorene O. Caris—
Dean's Scholar Awards**
Dawn O'Sullivan
David Vander Werp

**CoE Class of 1912E
Memorial Scholarship**
Raymond Zondervan

CoE Class of 1931E Scholarships
Patrick Goleski
Anastasios John Hart
Crystal Kornak
Andrew Leutheuser
Katharine Polasek

CoE Class of 1934E Scholarship
James Henahan

CoE Class of 1939E Scholarships
Christopher Grimmer
Samir R. Karamchandani

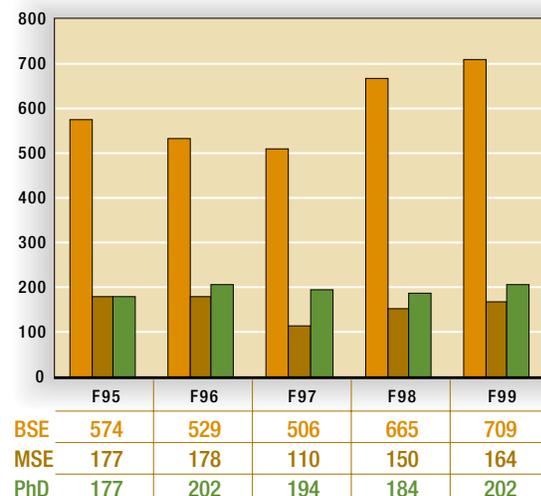
**CoE Distinguished
Achievement Award**
Anastasios John Hart

Lawrence D. Corlett Scholarships
Andrew Ickes
Jean Kang
Ryan Shea
William Shurtliff
Erin Worrell

**Harland P. Dodge and Russell A.
Dodge Memorial Scholarship Fund**
Sterling Imfeld

**Cornelius and Margaret Donovan
Scholarships**
Kenneth Fleck
Kendra Lohrmeyer
Peggie Sayre

MEAM Enrollment Trends



Dow Chemical Scholarships
Samir R. Karamchandani
Joseph Klamo
Elena Marin
Jason Mayol
Nicholas Post
Aleta Sutterfield

Richard Earhart Scholarships
Sara Bernal
Robert Billington
Alan Fortunate
Elizabeth Oatley
Ryan Schrieber

**James M. Edmunds
Scholarship Fund**
Margaret McArthur

**John P. and Nora B. Everett
Recognition Fund**
Kevin Clements

**Alvah B. and Salome K.
Frederick Scholarship**
Matthew Weber

**James W. Freeman Memorial
Scholarship Fund**
Karmen N. Lappo

STUDENT HONORS AND AWARDS

Mechanical Engineering Students Flying High... with NASA

Earlier this year, a team of CoE undergraduates became the first people in the world to create carbon nanotubes in zero gravity. The group included two MEAM undergraduate students, **James Karlavage** and **Julie Stahmer**, as well as Aerospace Engineering (AeroE) students Erik and Kristian Waldorff and Edward A. Van Cise, who served as project manager. In November of 1999, the team submitted a proposal to the Texas Space Grant Consortium to fly an experiment on National Aeronautics and Space Administration (NASA)'s KC-135A reduced gravity aircraft. The consortium administers the NASA Reduced Gravity Student Flight Opportunities (RGSFO) Program, which enables undergraduates to gain real-world engineering research experience.

In early March, the experiment was flown from the NASA Johnson Space Center in Houston, Texas, with Karlavage and Stahmer on board. For details, visit the group's Web site at <http://aoss.engin.umich.edu/umseds/kc135/nanotubes>.



MEAM undergraduate students **Julie Stahmer** and **Jim Karlavage** on board NASA's KC-135A reduced gravity aircraft. The two were part of a team of CoE students attempting to produce nanotubes in space.

Robert Campbell Gemmell Memorial Scholarship Fund

Alicia Vogel

Professor and Mrs. William P. Graebel Top Scholar Awards

Donald B. DeSander
Ryan P. Schrieber

Walter Graves Scholarship

Steven Spencer

Clarence E. Groesbeck Memorial Scholarships

Daniel Davis
Marietsa Edje
Brian Goldstein
Constantine Hatzis
Fernando Olave
Wesley Scharmen
Ami Shah
Phillip Shaltis
Kent Spencer
Michael Van Belle

H. Earl Hoover Scholarships

Robert Hooker
Joel Jamison
Andrew Lee
Vikram Sahney

Eveleen Harriet Hunt Scholarship Fund

Katherine Eggleton

Albert Kahn Undergraduate Scholarship Fund

Irina Feldman

Andrew A. Kucher Award

Mari Endo

Simon Madlebaum Scholarship Fund

Daniel Marin

Donald and Lucille Malloure Scholarship Fund

William Shurtliff

Lieutenant Michael Patrick McCarthy Memorial Fund

Kyle Sprecher

Mechanical Engineering Spirit Award

Nader J. Shwayhat

George H. Miller Memorial Scholarship

Alison Wise

Minnesota Mining and Manufacturing (3M) Scholarships/Internships

Amy Denault
Kimberly (Tittijung) Klein

A.D. Moore Award

Ryan Majkrzak

F. Ernest Newbery Scholarship Fund

Amy Denault

William J. Olcott Fund

James Matthews

Burke E. Porter Foundation Scholarship

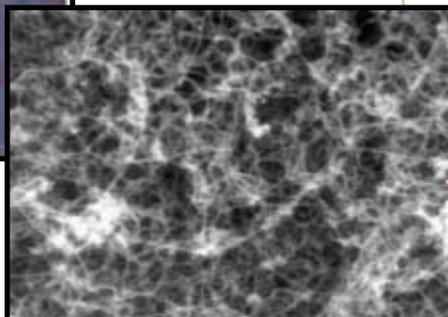
Christopher Leja

R & B Machine Tool Company Scholarships

Tiffany A. Miller
Alicia J. Vogel

Schmidt Family Scholarships

Michael Eickholt
Alan Yee



These samples, collected at the end of the second day of flight, prove the team's success in producing microgravity nanotubes. This image was photographed through a Scanning Electron Microscope.

**Howard W. and Ruth Hoff
Sheldon Scholarships**

Douglas Adams
Jesse Field
Paul Hanna
William Harrison
David Hsai
Patrick Kostun
Farid Muhammad
Gregory Sims
Joseph Vidricksen

**Society of Women Engineers
(SWE) Awards—**

Lucent Scholarship

Ami Shah

Motorola Scholarship

Brianna Thomson

**Outstanding Junior SWE
Member Award**

Tiffany Viant

Pratt and Whitney Scholarship

Amy Denault

Senior Service to SWE Award

Diana Bitleris

**Jane Morris Soop
Engineering Scholarships**

Aimée Constantine
Bernard Drew

**Matthew J. Spence, Jr. and Sarah
Patterson Spence Scholarship Fund**

Jason Gauss

**Tau Beta Pi (TBPi/TBP) National
Chapter Fellowship**

Suzanne Volkman

**Frank H. and Matilda M. Tranzow
Scholarship Fund**

Kevin Kwiatkowski

**Pearl Wheeler Scholarship
in Engineering**

Ryan Majkrzak

**GRADUATE STUDENT
FELLOWSHIPS
AND AWARDS**

F99 and/or W00

**American Society for Engineering
Education (ASEE), Student Chapter—
Outstanding Graduate
Student Instructor Award**

Mahmoud Hussein

**Robert M. Caddell Memorial Awards—
Graduate Student Research
Achievement Award**

Qingda Yang

**CoE Distinguished Achievement
Award (MEAM)**

Shiyu Zhou

**CoE Fellowships—
Dwight F. Benton Fellowships**

Leslie Berhan
Michael Donovan
David Hall
Brian Jensen

**Lawrence D. Corlett
Fellowships**

Jeremy Michalek
Andrew Sievers

Regents' Fellowships

Gregory Aloe
Jarrod Beglinger
William Cook

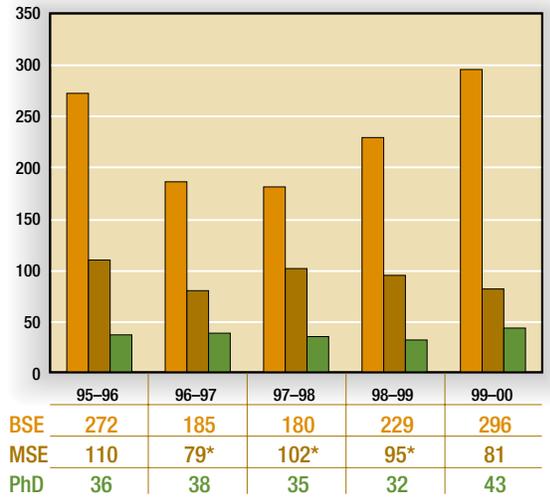
DeVlieg Fellowship

Jeremy Michalek

**James A. and Hazel Lee
Hughes Fellowship**

David Hall

MEAM Degrees Conferred—Trends



* includes both MSE and MEng AutoE.

Ivor K. McIvor Memorial Awards

Kurt DeGoede
Xi Zhao

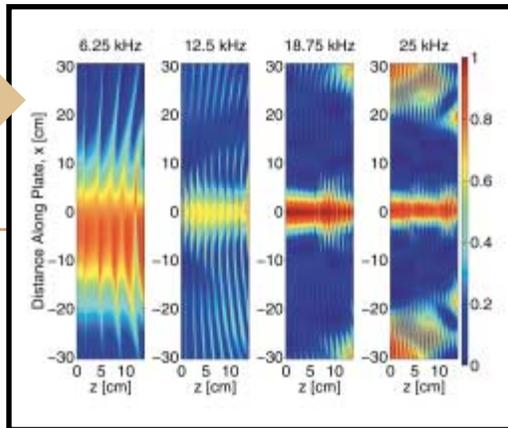
MEAM Departmental Fellowships

Aristotelis Babajimopoulos
Gautam Baksi
Sudin Bhattacharya
Michael Fisher
Charles Funk
Timothy Jacobs
Chan-Chiao Lin
Glenn McCabe
Marcus Megerle
Jeremy Michalek
Brian Mooney
Volkan Patoglu
Leslie Pipe
Jeffrey Sanko
Andrew Sievers
Micah Steele
Jing Wang
Fu Zhao

William Mirsky Memorial Awards

Christopher D. Depcik
Jeffery M. Glodich

*Bartlett Matched Field Processor output for measurements from four microphones and a 10^{-5} cm³/s leak. Combining these results determines a single, unambiguous leak location. Read more about Associate Professor **David R. Dowling** and doctoral student **Serdar Yönak**'s research below.*



National Aeronautics and Space Administration (NASA) Graduate Student Researchers Program Award/Training Grant

Melissa (Anderson) Chernovsky

The National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc.—Graduate Engineering Minorities (GEM) Fellowships

Adriana Holguin
Vil Johnson

National Science Foundation (NSF)—Fellowship

Brian Jensen

Traineeship

Lonnell Peters

National Science Foundation (NSF) Engineering Research Center for Reconfigurable Machining Systems (ERC/RMS)—Student of the Year Award

Osman Ozdoganlar

Horace H. Rackham—Dean's Fellowship

Brian Jensen

Distinguished Dissertation Award

Stephen Dyer

Engineering Fellowships

Melissa (Anderson) Chernovsky
Wendy (Hudson) Gendler
Sara Kelly
Leslie King
Michelle Liedtke
Lonnell Peters
Tershia Pinder

Pre-Doctoral Fellowship

Kurt DeGoede

Sloan Summer Fellowships

Maria Alvarez-Sanz
Laila Guessous
Kerr-Jia Lu
Katherine Patek

U.S. Association for Computational Mechanics (USACM)—Fifth U.S. National Congress on Computational Mechanics Scholarship

Jianmin Gu

Whirlpool Fellowship

Christopher Deyer

*Doctoral student **Serdar Yönak** (W00) and Associate Professor **David R. Dowling** (l.-r.) make a presentation during an External Advisory Board (EAB) tour of Dowling's laboratory in the fall of 1999. The two have recently applied for a patent on a device that has successfully tested leaks as small as 10^{-6} standard cubic centimeters per second. Most ME graduate students are actively involved in research, and many of them work closely with faculty on projects that ultimately lead to patents and wide-spread use in real-world applications.*



DOCTORAL DEGREES CONFERRED

Spring/Summer (August) 1999

Judy Che

Numerical Simulations of Complex Multiphase Flows: Electrohydrodynamics and Solidification of Droplets
Cochairs: G Tryggvason, SL Ceccio

Xin Cheng

Transport in Porous Fibrous Networks: Simulations and Experiences in NiMH Batteries
Chair: AM Sastry

Wei-Chong Chiu

An Investigation of Machining Amorphous Brittle Materials
Chair: WJ Endres

Nolan Dickey

A Time Domain Approach for Acoustic Analysis of Perforated Tube Silencers
Cochairs: H Merte Jr, A Selamet

James Ervin

Design, Characterization, and Assessment of the Recurve Actuation Architecture
Chair: DE Brei

Ronald Kalnas

Mechanical System Design Incorporating Non-Gaussian, Non-Parametric Uncertainty during the Conceptual Stage
Chair: S Kota

Wonsuk Kim

Vibration of a Rotating Tapered Composite Shaft and Applications to High Speed Cutting
Chair: RA Scott

Chen-Jung Li

Tool-Tip Displacement Measurement, Process Modeling and Chatter Avoidance in Agile Precision Line Boring
Cochairs: AG Ulsoy, WJ Endres

Byung-Kwon Min

Modular Diagnostics of Computer-Controlled Machine Tools and Mechatronic Systems
Chair: Y Koren

Roy Schimmel

Analyzing and Modeling the Effects of Tool Edge Geometry in Machining
Cochairs: J Ni, WJ Endres

Narasimhan Seshadri

Process Monitoring for Sheet Metal Stamping Using Force and Strain Signatures
Chair: SJ Hu

Yi Sun

Kinematics-Driven Modeling and Grinding Path Generation
Chair: J Ni

Paris von Lockette III

Experimental, Analytical and Computational Investigation of Bimodal Elastomer Networks
Chair: EM Arruda



An ASME meeting is addressed by **Chris Leja**, a student member of the U-M chapter of IAESTE. The organization links engineering students with summer internship opportunities abroad.

Chung-Sheng Wu

Correlation of Thermal Expansion to Surface Roughness of Workplace Cut in Turning
Chair: W-J Yang

Jeonghoon Yoo

Structural Optimization in Magnetic Fields Using the Homogenization Design Method
Chair: N Kikuchi

STUDENTS PARTICIPATE IN INTERNATIONAL SUMMER EXCHANGE PROGRAM

With globalization an ever-larger reality, MEAM students are learning skills that will serve them well in international settings. And with the help of the International Association for the Exchange of Students for Technical Experience (IAESTE), some of those students are going beyond the classroom setting, to spend their summers working abroad.

Each IAESTE member country has local committees that look within their communities for companies or universities willing to hire an international intern. At an annual international conference, the committees exchange available internships, most of which are related to engineering and other hard sciences. The University of Michigan (U-M) IAESTE committee was among the first group of its kind to be started in the United States.

With the help of IAESTE, **April Nelson** (BSE '00) spent the spring and summer of 1999 at the Technical University of Lodz, Poland, testing steel samples and researching the properties of hard coatings such as vanadium and titanium. **Erik**

Chubb (BSE '00) worked at Ulster Carpet Mills in Portadown, Ireland, while **Michelle Rogers** served as a university intern in Gotheburg, Sweden.

We salute these young people for their initiative and sense of adventure.

Fall (December) 1999

Chien-Ming Chen

An Enhanced Asymptotic Homogenization Method of Elastic Composite Laminates
Chair: N Kikuchi

Ching-Hui Chiang

Long Term Effects of the Friction Behavior in a Sliding Lip Seal
Chair: KC Ludema

Laila Guessous

A Pseudo-Spectral Numerical Scheme for the Simulation of Natural Flows
Chair: VS Arpaci

Joel Hetrick

An Energy Efficiency Approach for Unified Topological and Dimensional Synthesis of Compliant Mechanisms
Chair: S Kota

Deanna Winton Hoffman

In-Line Internal Combustion Engine Dynamics and Vibration
Chair: DR Dowling

Hui-Min Huang

Plastic and Fracture Analyses of Sheet Metal Forming and Metal Cutting Processes
Chair: J Pan

Per Tomas Larsson

Controller Design for Linear Systems Subject to Actuator Saturation
Chair: AG Ulsoy

Sejoong Oh

Dynamic Stability of Interacting Spur Gears
Cochairs: JR Barber, K Grosh

Osman Ozdoganlar

Stability of Single- and Parallel-Process Machining Including Geometry of Corner-Radiused Tooling
Chair: WJ Endres

Craig Scholar

Modeling Tracked Vehicle Dynamics Using Vibration Modes
Chair: NC Perkins

Elizabeth Smith

Monitoring Laser Weld Quality Using Acoustic Signals
Chair: E Kannatey-Asibu Jr

Winter (April/May) 2000

Emad Al-Regib

Machining Systems Stability Analysis for Chatter Suppression and Detection
Cochairs: J Ni, J Yuan

John Batteh

A Study of the Heat Transfer and Fluid Flow Phenomena in Laser Drilling
Chair: MM Chen

Bernard Bunner

Numerical Simulation of Gas-Liquid Bubbly Flows
Chair: G Tryggvason



MEAM doctoral students are actively involved in research. In this photo, taken in the ARC, doctoral students (l.-r.) **Stani Bohac** and **Kukwon Cho** discuss sampling locations for a pair of fast FID exhaust gas analyzers.

William Corpus

An Added Stability Phenomenon in Machining Processes with Periodic Time Variation
Chair: WJ Endres

Jin-Young Jung

Numerical Simulation of Solidification
Chair: MM Chen

Sunny Khosla

Performance Analysis of an Acoustic Time Reversal System in Dynamic and Random Oceanic Environments
Chair: DR Dowling

Heewook Lee

An Optimal Design Method for Brake Squeal Noise Based on Complex Eigenvalue and Sensitivity Analysis and Response Surface Methodology
Chair: N Kikuchi

Yufeng Long

Variation Simulation for Compliant Sheet Metal Assemblies with Applications
Chair: SJ Hu

Yuhai Mei

Stress Evolution in a Conductive Adhesive during Curing and Cooling
Cochairs: AS Wineman, A Yee

Yong-Mo Moon

Reconfigurable Machine Tool Design: Theory and Application
Chair: S Kota

Eric Pesheck

Reduced Order Modeling of Nonlinear Structural Systems Using Nonlinear Normal Modes and Invariant Manifolds
Cochairs: C Pierre, S Shaw

Stephen Riley

Model Reduction of Multibody Systems by the Removal of Generalized Forces of Inertia
Chair: JL Stein

Fayyaz Saleem

Multiple Criteria Structural Topology Optimization for Automotive Structure Design
Cochairs: GM Hulbert, N Kikuchi

He Tang

Machine Mechanical Characteristics and their Influences on Resistance Spot Welding Quality
Chair: SJ Hu

Fan-Chung Tseng

Multibody Dynamics Simulation in Network-Distributed Environments
Chair: GM Hulbert

Qingda Yang

Fracture Analyses of Plastically-Deforming Adhesive Joints
Chair: M Thouless

Serdar Yönak

Characterization and Matched-Field Processing Localization of Photo-acoustic Signals
Chair: DR Dowling

IMPACT: ALUMNI

Graham Creates Endowed Chair Professorship

It was in 1960 that **Donald C. Graham** (BSE '55, MSE '56) founded Graham Engineering, operating from an office in the basement of his rural Pennsylvania farmhouse. Today, Graham Companies is a billion-dollar enterprise with worldwide industrial interests in machinery, building products and plastic packaging, and a fast-growing investment business focused on equity and marketable securities.

Mr. Graham's civic and philanthropical interests are wide ranging. In addition to serving on numerous boards for colleges, secondary schools, banks, nonprofit organizations, and corporations, he has been involved with several business organizations including World Presidents' Organization, Chief Executive Organization, and American Business Council. He established the York Opportunity Program, which provides scholarships and mentors for minority youth seeking a college education.

Over the years, Mr. Graham has maintained close ties with the College, serving on its National Advisory Committee (NAC) from 1994 to present and co-endowing a fund with his brother, **Robert** (BS NAM '45, MSE '48), to support the recruitment efforts of U-M's Tauber Manufacturing Institute (TMI). In May of 1999, he strengthened those ties even further through an endowed chair professorship that made Professor **Panos Y. Papalambros** the first Donald C. Graham Professor of Engineering (see related story, page 28).



Donald C. Graham

Tichy Heads Up Mechanical Engineering at Rensselaer Polytechnic Institute

Since 1996, **John Alfred Tichy** (BS '66, MS '67, PhD '70) has been Professor and Chair of the Department of Mechanical Engineering, Aeronautical Engineering and Mechanics at Rensselaer Polytechnic Institute in Troy, New York. A Fellow of the American Society of Mechanical Engineers (ASME) and the Society of Tribologists and Lubrication Engineers, he serves as editor of the *ASME Journal of Tribology* and is a past recipient of the ASME Board of Governors Award and the ASME Award for Best Paper in Tribology. In 1991, he received the Key Research Achievement Award from the U.S. Army Research Office and currently pursues a vigorous research program. A faculty member at Rensselaer since 1976, Tichy also maintains an active consulting practice, working with clients that have included Pratt and Whitney and the U.S. Department of Energy (DoE).

Dr. Tichy is also something of an icon to rock and roll aficionados, who remember his work in the 1960s and '70s as singer, songwriter, and guitarist for Commander Cody and His Lost Planet Airmen. He is listed in *Who's Who in Rock & Roll* (1996) and the *Rolling Stone Encyclopedia of Rock & Roll* (1998).

"Serving now as a department chair for a competing institution," he says, "I am constantly reminded of the esteem in which the University of Michigan's College of Engineering and Department of Mechanical Engineering and Applied Mechanics are held. At Rensselaer, we try to attract Michigan graduates to join our faculty, we try to avoid losing our best bachelor's degree graduates to your master's and doctoral programs, and we look to MEAM for the latest trends in research and educational pedagogy."

CURRENT ENDOWED PROFESSORSHIPS

Dionissios (Dennis) N. Assanis

Arthur F. Thurnau Professor
Term: 07/01/99–05/31/02

Steven A. Goldstein

(The First) Henry Ruppenthal Family Professor of Orthopaedic Surgery and Bioengineering
Term: 06/99–open

Bruce H. Karnopp

Arthur F. Thurnau Professor
Term: 07/01/96–06/30/99

Yoram Koren, PE

Paul G. Goebel Professor of Engineering
Term: 09/01/93–08/31/03

Jyotirmoy (Jyoti) Mazumder

Robert H. Lurie Professor of Engineering
Term: 09/01/96–05/31/01

Panos Y. Papalambros

(The First) Donald C. Graham Professor of Engineering
Term: 01/01/00–12/31/04

Albert B. Schultz

Vennema Professor of Engineering
Terms: 09/01/83–12/31/99

A. Galip Ulsoy

William Clay Ford Professor of Manufacturing
Term: 01/01/96–12/31/01

Vest Continues to Build Illustrious Career

Charles M. Vest (MSE '64, PhD '67) is a name that's familiar to many Michigan alumni. Prior to becoming President and Professor of Mechanical Engineering at Massachusetts Institute of Technology (MIT) in 1990, Dr. Vest served the University of Michigan (U-M) as Professor of Mechanical Engineering, Dean of the College of Engineering (CoE), and U-M Provost and Vice President for Academic Affairs.

While a faculty member in MEAM, Dr. Vest received the College of Engineering 1938E and Research Excellence Awards. Regarded as a pioneer in the use of optical techniques for diagnostics in combustion, he has authored numerous papers and his book, *Holographic Interferometry*, has been widely used throughout the world.

Intent on helping to build public support for higher education and research, Dr. Vest serves as a member of the President's Committee of Advisors on Science and Technology (PCAST), the Massachusetts Governor's Task Force on Economic Growth and Technology, and the National Research Council Board on Engineering Education. He is Vice Chair of the Council on Competitiveness and has chaired the President's Advisory Committee on the Redesign of the Space Station. Dr. Vest is slated to receive the MEAM Alumni Society Merit Award for 2000–01.

Established in 1994, the Mechanical Engineering External Advisory Board (EAB) meets twice a year to offer guidance on a wide range of issues impacting the Department. Pictured here are EAB members for 1999–00. Standing (l.–r.): Charles Hutchins, Michael E. Korybalski, John B. Heywood, Carroll J. Haas, Sr., Richard T. Heglin, Robert Transou, and Roger L. McCarthy. Sitting (l.–r.): Eugene A. DeFouw, EAB chair, and A. Galip Ulsoy, MEAM chair.

Wallace Setting a Brisk Pace at University of Toronto

James S. Wallace (MSF '74, PhD '78) continues to lead the Department of Mechanical and Industrial Engineering at the University of Toronto. He assumed the post of departmental chair in 1998, 20 years after joining the faculty, and has since presided over a major strategic planning exercise and led a successful proposal that resulted in the introduction of new undergraduate programs in mechatronics and information engineering.



James S. Wallace

His recent research projects, focused on combustion in engines and the reduction of exhaust emissions through alternative fuel usage, have received funding from British Gas, the National Science and Engineering Research Council, GM Canada, and Natural Resources Canada. In conjunction with C.J. Green, he holds a patent for an electrically actuated gaseous fuel timing and metering device.

Dr. Wallace is a member of the Society of Automotive Engineers (SAE), the American Society of Mechanical Engineers (ASME), and the International Association of Hydrogen Energy. He serves on the Board of Directors, Canadian Section, of the Combustion Institute.



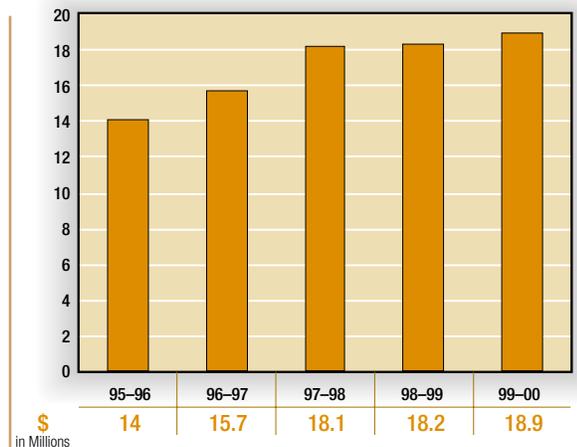
Donors

May 1, 1999–April 30, 2000

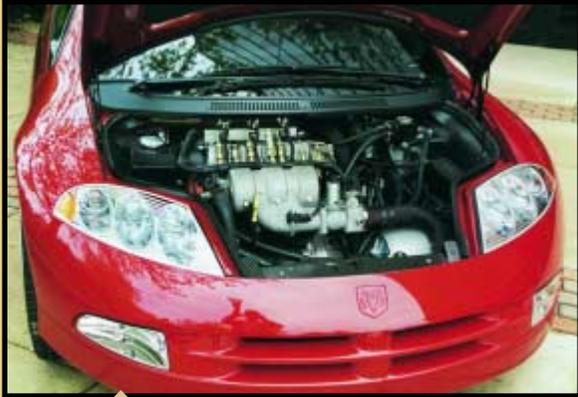
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MEAM Research Expenditure Trends



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Shown here is the engine compartment of Dodge Intrepid ESX2, DaimlerChrysler's hybrid electric concept car. The vehicle was on exhibit at the ARC Conference on Critical Technologies for Modeling and Simulation of Ground Vehicles, sponsored by MEAM.

Tim Faricy, MEAM Program Associate II, discusses a student project with consultant and retired General Motors (GM) executive **Larry Streng**. Sponsored by ERC/RMS, this mock-up model of a novel metal-cutting machine will be used by students studying reconfigurable machine design.



Donors, continued

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May 1, 1999–April 30, 2000

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General Motors Corporation (GMC)

International Business Machines Corporation (IBM)

Minnesota Mining and Manufacturing Company (3M)

Motorola, Inc.

Navistar International Transportation Corporation

Raybestos Products Company

Sandia National Laboratories

Daisy Wu stands beside a likeness of her late husband, Professor **Sam Wu**, which she commissioned for the CoE WuMRC.



The Enduring Legacy of Professor Shien-Ming (Sam) Wu

When Professor **Sam Wu** died unexpectedly in 1992, the Department lost not only an outstanding research scientist and teacher but also a beloved mentor and an innovative, often visionary leader. Professor Wu came to Michigan in 1987, following a highly successful 25-year career at the University of Wisconsin–Madison. His wife, **Daisy**, who recently retired from her post as Director of the Engineering and Science Libraries, notes that her husband arrived in Ann Arbor with the goal of “making Michigan a mecca of manufacturing, determined to shift the research environment from theory to practice and to make research relevant to the specific needs of industry.”

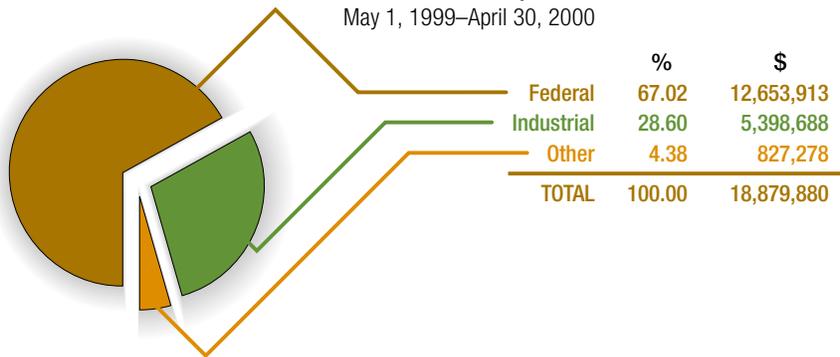
Professor **Jun Ni** concurs with Mrs. Wu, adding that “Professor Wu’s most significant contribution was his leadership role in rebuilding Michigan’s manufacturing research programs. He had a vision of transforming manufacturing from an art to a science and recognized the importance of developing a healthy collaborative relationship with industry. He not only helped change the culture within the Department and College, but also earned the trust from industry which greatly helped the reputation of Michigan’s manufacturing research programs.”

Professor Ni goes on to note that under Dr. Wu’s leadership, the National Science Foundation (NSF) established an Industry/University Cooperative Research Center (NSF-I/UCRC) at the University of Michigan (U-M) in 1990. “This Center has since become the cornerstone of two other much larger entities, one of them being the S.M. Wu Manufacturing Research Center (WuMRC). Today, thanks in no small part to the efforts of Professor Wu, Michigan is the world’s indisputable leader in manufacturing research programs.”

Happily, Professor Wu’s influence can still be seen and felt in tangible ways throughout the College. During his lifetime, Professor Wu established an endowed fund to benefit scholars and students in manufacturing. Later, following her husband’s untimely death, Mrs. Wu created an endowed memorial fund in his name within the Department. In addition, scholars from throughout the world flock to an annual symposium on manufacturing held in Professor Wu’s honor. We are grateful for the many contributions that Sam Wu made to the Department and the College during his life and for the generosity that has created a legacy for generations to come.

MEAM Research Expenditures

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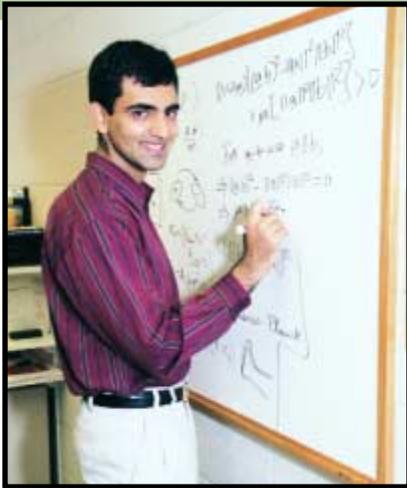
MEAM Departmental Expenditures

May 1, 1999–April 30, 2000



Leadership and Innovation:

NEW FACULTY



Krishna Garikipati

Krishna Garikipati received his MS and PhD in Aeronautics and Astronautics from Stanford University, where he also completed a postdoctoral research fellowship in the Division of Mechanics and Computation. Prior to joining the Mechanical Engineering and Applied Mechanics (MEAM) faculty as assistant professor in January 2000, he served as a research associate in Stanford's Center for Integrated Systems. For the past several years, he has also carried out research in collaboration with several major semiconductor manufacturers in Silicon Valley.

Professor Garikipati's current research is focused on theoretical and computational aspects of nonlinear solid mechanics, with an emphasis on multiscale phenomena. He sees his work as following two major tracks. "One involves applying the principles of mechanics and computational methods to problems in microelectronics and semiconductor processing," he says. "Within the semiconductor industry, coupled problems involving electric fields, reactions, diffusions through media, and mechanics are ubiquitous. The industry is turning to mechanics to model these phenomena and increasingly using computational methods to solve the models and design new processes."

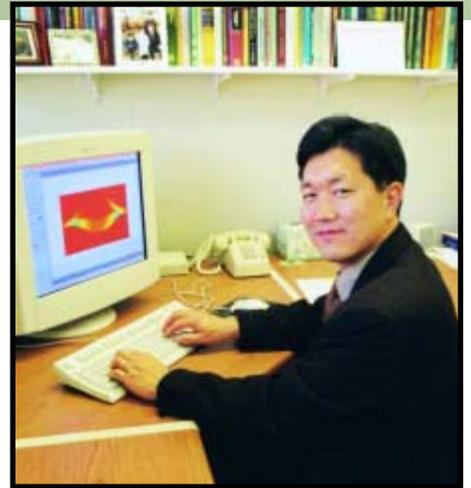
The second major track has to do with bridging length scales. "All materials have phenomena that occur at various scales, from the macroscopic down to the atomic domain," he says. "Taking a macroscopic perspective, I hope to improve continuum descriptions of material behavior by incorporating information from so-called fine scales."



R. Brent Gillespie

Not long after receiving an MM degree in piano performance from the San Francisco Conservatory of Music, **R. Brent Gillespie** was awarded an MS in Mechanical Engineering from Stanford University. He then went on to earn a PhD, also from Stanford. It was his dual abilities in music and engineering that led to what is now one of his major research interests: the design and analysis of robotic devices for human-computer interaction. Professor Gillespie has developed a haptic interface for synthesizers that replicates the physical qualities of a piano keyboard. He has also assisted in the creation of cobots—robotic devices intended explicitly to work in collaboration with human beings.

Building on his past expertise, Gillespie, who joined the Department in January of 2000 as an assistant professor, hopes one day to establish a cobot engineering center at the University of Michigan (U-M). "Thus far," he says, "robots really haven't lived up to their promise. They can't assemble parts or do other tasks that are relatively simple for human beings. The solution is to create devices that share control by augmenting human capabilities." Another area of interest is creating haptic interfaces that could, among other things, help in the training of surgeons by replacing animal models with "a virtual human."



Hong G. Im

Hong G. Im, who joined the MEAM faculty in January of 2000 as assistant professor, received his MS in Mechanical Engineering from Seoul National University and earned a PhD in Mechanical and Aerospace Engineering from Princeton University. He completed a research fellowship in the Center for Turbulence Research at Stanford University and, most recently, was a postdoctoral researcher in the Combustion Research Facility at Sandia National Laboratories.

Professor Im's research interests are focused primarily on combustion, computational methods for reacting flows, direct numerical simulation, large eddy simulation, reacting flows in microsystems, and pollutant reduction and control. "The main thrust of my research is environmental concerns," he says, "and the ultimate goal of my work is to reduce greenhouse gases by developing engines with higher thermal efficiency, and to reduce pollutant formation by controlling the reacting flow conditions, as opposed to after-treatments such as catalytic converters. Rather than relying on empirical models, I'm using what I call a high-fidelity numerical method to resolve every detail of the fundamental physics involved in the mechanisms of combustion and pollutant formation processes."



Katsuo Kurabayashi

Katsuo Kurabayashi, an assistant professor since January 2000, received his MS and PhD in Materials Science and Engineering from Stanford University. Before joining the MEAM faculty, he was a research associate in the Mechanical Engineering Department at Stanford University and participated in a micro-machined electrokinetic cooler project funded by Defense Advanced Research Project Agency (DARPA). He also transferred a technology for characterizing the thermal properties of dielectric thin films from Stanford to Intel Corporation. This technology is now being used as an experimental tool for studying self-heating of circuits on the Pentium microprocessor chip.

Professor Kurabayashi's research interests are in thermal transport in MOS transistors and microelectro mechanical systems (MEMS), thermal management of electronic packaging, design and fabrication of low-voltage, low-power microactuators, and integrated micro-optical electro mechanical systems (MOEMS) for microfluidic detection. "Mechanical engineers, who design very tiny mechanical structures like MEMS, really need to understand physics governing micro-scale mechanics, fluid dynamics, and heat transfer," he says. "The micro- and nano-scale mechanical structures could behave in a quite different manner than macroscopic objects we see everyday. Besides making mechanical transducers, I want to make micro-structures that can be used as experimental tools for studying microscopic mechanical phenomena and may help future mechanical engineers develop a better design for micro- and nano-scale machines."



Jonathan E. Luntz

While completing his dissertation on *Distributed Manipulation with Actuator Arrays* at Carnegie Mellon University,

Jonathan E. Luntz supervised undergraduate and graduate research projects in the area of robotics and developed graphic design tools for discrete time control systems. All of these topics are reflected in his current research interests, which focus on distributed manipulation, controls, robotics, and mechatronics. "Orienting small parts properly on assembly lines is an ongoing challenge for manufacturers," he says. "I'm interested in developing distributed manipulation technology that can move, position, and orient objects by applying force over a whole area. One possible solution, for example, might be to equip workers with hand-held, palm-sized plates that enable them to orient and grab parts using air flow fields." Luntz, who joined the faculty in January of 1999 as an assistant professor, is also conducting research in the development of prehensile robots—snake-like and elephant trunk mechanisms for potential use in search and rescue missions.

As a teacher, one of his goals is to introduce more lab experiments, augmenting classroom lectures in control theory with hands-on experience that will enable students to learn by doing. In collaboration with Assistant Professors **R. Brent Gillespie** and **Diann Brei**, he has also begun concept work on a new senior-level course in smart product design and a mechatronics project competition.



Steven J. Skerlos

Since joining the MEAM faculty in January, Assistant Professor **Steven J. Skerlos** has founded the Environmental and Sustainable Technology (EAST) Laboratory in pursuit of his mission: to reduce the environmental impact and health hazards associated with products and manufacturing processes. "The inspiration for the lab was twofold," he says. "First, to focus on the design of environmentally responsible products and, second, to develop technology that reduces the environmental impact of manufacturing them."

According to Professor Skerlos, metal-working fluids are a major environmental problem currently confronting manufacturers. "The fluids are expensive and, over time, lose their ability to perform. They contain microorganisms that can pose health hazards, and disposal is problematic. Our approach to this multi-faceted problem has been to develop membrane-based solutions that, by removing the factors responsible for spoilage, avoid health hazards, improve performance, and save money by making the product fully recyclable." The EAST Laboratory has also been researching microchip technology to quantify microbial contamination.

Skerlos received a BS in Electrical Engineering with highest honors and a PhD in Industrial Engineering from the University of Illinois—Urbana-Champaign. While there, his efforts to improve environmental performance in the machine tool industry earned him two fellowships from the General Motors Corporation (GMC) Lever Foundation.

Leadership and Innovation:

FACULTY AND STAFF NEWS

May 1, 1999–April 30, 2000

NEW PRIMARY RESEARCH STAFF (PRS)

Loucas S. Louca

Assistant Research Scientist, (effective 03/13/00), formerly a Mechanical Engineering and Applied Mechanics (MEAM) Research Fellow.

Zbigniew J. Pasek

Assistant Research Scientist, (effective 07/14/99).

Pasek also continues his 50% staff appointment as Project Manager, NSF Engineering Research Center for Reconfigurable Machining Systems (ERC/RMS).



Zbigniew J. Pasek



Loucas S. Louca

Staff

Denise Burrell

Academic Secretary III, to Office Assistant IV (01/19/00).

Susan Clair

Administrative Assistant II, to Administrative Associate I (10/01/99).

Claudia M. Hill

Administrative Associate I, to Associate II (effective 05/01/99).

Kathy Hoover

Academic Secretary II, to Office Assistant III (effective 03/06/00).

Aleda Thomas

Administrative Assistant II, to Administrative Associate I (effective 10/08/99).

Teresa Camille Young

Administrative Assistant I, to Administrative II (effective 05/01/99).



Marcy Brighton

New Administrative Manager for MEAM

In January 2000, MEAM welcomed **Marcella (Marcy) A. Brighton** back to the Department as its new Administrative Manager. A 1987 graduate of the University of Michigan (U-M), her career in administration has included posts with Oxford Housing, the School of Nursing, and the School of Information (SI). Marcy's arrival was actually something of a homecoming, since she served as the Department's personnel administrator from 1994 to 1996. As Administrative Manager, she is responsible for management of the budget as well as oversight of daily operations, personnel, facilities, machine shops, and academic and student services.

In the coming year, Marcy will be spearheading two major administrative projects. The first involves shifting clerical and financial support services to a more decentralized model by establishing satellite office clusters or "pods" located throughout the G.G. Brown Building and W.E. Lay Automotive Laboratory. She will also be working with key people in the Department to create business units for several MEAM laboratories and establish related fee structures for non-Departmental users.

PROMOTIONS

Faculty

Ellen M. Arruda

Assistant Professor, to Associate Professor with tenure (effective 09/01/99).

Johann Borenstein

Associate Research Scientist, to Research Scientist (effective 09/01/99).

David R. Dowling

Assistant Professor, to Associate Professor with tenure (effective 09/01/99).

Jwo Pan

Associate Professor, to Professor with tenure (effective 09/01/99).

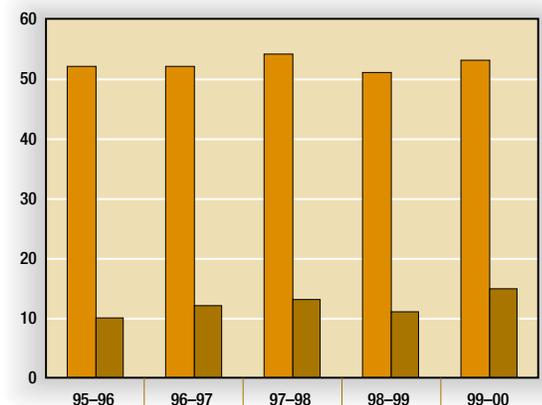
Huei Peng

Assistant Professor, to Associate Professor with tenure (effective 09/01/99).

Noel C. Perkins

Associate Professor, to Professor with tenure (effective 09/01/99).

MEAM Faculty Trends



	95-96	96-97	97-98	98-99	99-00
Instructional Faculty	52	52	54	51	53
Primary Research Scientists	10	12	13	11	15

MEAM Faculty Diversity as a percentage of total population

	F98	F99	F00
Female	11.1	13.0	12.7
Under Represented Minorities	3.7	3.7	3.6



*MEAM Professor **Noboru Kikuchi** (r.) discusses his wide-ranging international research projects with MEAM External Advisory Board (EAB) member **Michael E. Korybalski**.*

New Administrative Appointments

Steven L. Ceccio (BSEME '85)

Associate Professor, was appointed Mechanical Engineering and Applied Mechanics (MEAM) Associate Chair (09/01/99–06/30/01).

Dariusz (Darek) J. Ceglarek (PhD '94)

Assistant Research Scientist, was appointed Assistant Director, National Science Foundation (NSF) Industry/University Cooperative Research Center for Dimensional Measurement and Control in Manufacturing (NSF-I/UCRC), (01/99–present).

Maria Comninou (JD '96)

Professor, was appointed Patent Advisor for the NSF Engineering Research Center for Reconfigurable Machining Systems (ERC/RMS), (09/99–present).

Debasish (Deba) Dutta

Associate Professor, was appointed Director, Interdisciplinary Professional Graduate Programs (InterPro), (09/01/99–08/31/01).

Donald E. Geister (BSEAA '57, MSE '63)

Lecturer (jt.), was appointed Director of the College of Engineering's new Walter E. Wilson Student Team Project Center, (09/01/99–present). The Center is named for the late **Walter E. Wilson** (BSEME '33), whose generous gift provides a workspace for student teams to develop projects for engineering and society competitions.

S. Jack Hu (MSE '86, PhD '90)

Associate Professor, was appointed MEAM Graduate Programs Chair (09/01/99–06/30/01).

Noel C. Perkins

Professor, was appointed MEAM Undergraduate Program Director (09/01/99–08/31/01).

Christophe Pierre

MEAM Associate Chair, was appointed Associate Dean of Academic Programs and Initiatives in the Horace H. Rackham School of Graduate Studies (09/01/99–present).

Staff U-M Anniversaries

Twenty Years:

Kevin Morrison

Senior Engineering Research Associate (11/19/79).

Martha (Marti) I. Smith

Academic Secretary IV (01/11/80).

Fifteen Years:

Aleda Thomas

Administrative Associate I (01/15/85).

Ten Years:

Betty J. Alperovitz

Academic Secretary III (04/16/90).

Marvin Cressey

Senior Engineering Technician (02/21/90).

Pamela Fitzgerald

Executive Secretary (11/16/87).

William Kirkpatrick

Senior Engineering Technician (01/29/90).

Linore Latham

Office Assistant IV (08/21/89).

Charles Wiykovics

Senior Computer Systems Specialist (01/08/90).

CROSS-DISCIPLINARY PROJECTS UNDERSCORE CHANGES IN MECHANICAL ENGINEERING

Describing his work as “the softer side of mechanical engineering,” Professor **Noboru Kikuchi** notes that, depending on the venue and the task at hand, he functions as a traditional engineer, a mathematician, and a business consultant.

This past year, Kikuchi spent approximately two months working with fellow mathematicians on joint projects at the University of Paris, Stüttgart University, the Technical University of Denmark, the Technical University of Lisbon, and the Imperial College and Technical University of Munich, helping colleagues translate pure mathematics into real-world applications.

Equally at home in the world of business, Kikuchi also spent a month in the Pacific Rim, consulting for companies such as Toyota, Fujitsu, Suzuki Motor Corporation, Subaru, and various software manufacturers. “Typically,” he says, “I help corporations decide on new directions for R&D, establish supporting organizational structures, and identify methods for measuring outcomes and evaluating designs from a management point of view.”

Back in the States, Professor Kikuchi functions primarily as a researcher and engineer, focusing on the application of computer-related technologies to the design of new structures and manufacturing methods. Among his many projects, most of which are federally funded, he is developing materials to prevent thermal deformation of substrates during microchip manufacture. Other projects include new materials for applications ranging from scar reduction in soft-tissue wounds to bulletproof vests, textiles, and cosmetics.

KEY TO ABBREVIATIONS USED:

jt.— joint
adj.— adjunct
emer.—emeritus

Retirement

ALBERT B. SCHULTZ RETIRES AS PROFESSOR EMERITUS

During his career at the University of Michigan (U-M), **Albert B. Schultz** compiled a remarkable record of achievement, not only in the field of mechanical engineering but also in biomedical engineering and geriatrics research. In addition to being the Vennema Professor of Mechanical Engineering and Applied Mechanics (MEAM), he was a professor of biomedical engineering in the College of Engineering (CoE), and a research scientist in the Institute of Gerontology. He joined the Michigan academic community in 1983, having previously served on the faculties of the University of Delaware and the University of Illinois at Chicago.

Internationally recognized for his research on biomechanics of the human musculoskeletal system, which is recorded in more than 130 publications, Schultz's early work focused on the mechanics of idiopathic scoliosis and low back pain. More recently, he explored the use of engineering mechanics in assessing, treating, and preventing physical problems common in older populations.

When asked to describe the high points of his career at Michigan, Professor Schultz noted, "My entire time at Michigan was a high point. I enjoyed being there and working with so many fine colleagues. But one of the best things was being able to cooperate closely with geriatric medicine and gerontology researchers on some very challenging problems."

Upon his retirement, effective December 31, 1999, Schultz was named by the Board of Regents: the Vennema professor emeritus of Mechanical Engineering and Applied Mechanics, and of MEAM; professor emeritus, Biomedical Engineering; and research scientist emeritus, Institute of Gerontology.



*Vennema Professor of Mechanical Engineering and Applied Mechanics **Albert B. Schultz***

In Memoriam

Faculty

Hadley J. Smith (BSEME '40, PhD '57) Professor Emeritus (pictured below), died November 14, 2000, in Ann Arbor, MI, at the age of 81. He served on the MEAM faculty for 30 years, retiring in 1985. His primary research areas included fluid mechanics, heat transfer, and dynamics. His avid research activities were highly published and supported by NASA and the Army's Land Locomotion Laboratory. He served at the Los Alamos Scientific Laboratory as a Harvard University Fellow sponsored by the National Science Foundation (NSF). Professor Smith also actively served the University and CoE. He was a member of the committee that developed the Dearborn Campus. He is survived by his wife, Maureen, and their six children.



Staff

Milo Kaufman

Retired Technician, died September 13, 1999, in Ann Arbor, MI, at the age of 92.

He served the MEAM faculty and students as an engineering technician from 1945 to 1970. Professor Emeritus **Walter R. Debler**, (BSEME '50, PhD '59) who says Kaufman was extremely well liked and respected by both students and faculty, wrote an article at the time of Kaufman's retirement: "Milo was quite a guy; he still is. In my opinion, he represents the type of person who, having joined the University for reasons unknown, eventually takes on its image and distills its very essence...Milo was the kind of person who, upon seeing that a job needed doing, would go ahead and do it—even if he had to teach himself a few things beforehand."

FACULTY, STAFF, AND ALUMNI HONORS AWARDED BY THE UNIVERSITY OF MICHIGAN (U-M) AND AFFILIATES

May 1, 1999–April 30, 2000

Department of Mechanical Engineering and Applied Mechanics (MEAM)

Alumni Honors

Robert H. Transou (MSE '67)

Retired Group Vice President of Manufacturing at Ford Motor Co. Automotive Operations, and MEAM External Advisory Board (EAB) Member, was awarded the 1999–00 MEAM Alumni Society Merit Award, Oct. 1999, by the College of Engineering (CoE).



Robert H. Transou

Faculty Honors

Vedat S. Arpaci

Professor, received a Teaching Incentive Fund Award, MEAM (1998–99).

Dionissios (Dennis) N. Assanis

Professor, received a Teaching Incentive Fund Award, MEAM (1998–99).

David R. Dowling

Associate Professor, received a Teaching Incentive Fund Award, MEAM, U-M (1998–99).



*Using an interactive laser-cladding process, **Jyotirmoy (Jyoti) Mazumder**, Robert H. Lurie Professor of Mechanical Engineering, developed a patented technology for rapid prototyping that is resulting in a new generation of metals for use in mold making. In the process, he moved beyond the domain of labs and classrooms and into the world of venture capitalism and start-up companies. Above, Mazumder discusses a prototype with MEAM EAB members Eugene A. DeFouw and Carroll J. Haas, Sr.*

S. Jack Hu (MSE '86, PhD '90)

Associate Professor, was awarded an Outstanding Accomplishment Award for MEAM, by the CoE, Feb. 2000. Hu was recognized for his contributions to research.

Elijah Kannatey-Asibu, Jr.

Professor, received a Robert M. Caddell Memorial Faculty Research Achievement Award (1999–00).

Bruce H. Karnopp

Associate Professor, received a Teaching Incentive Fund Award, MEAM (1998–99).

NEW MOLD MAKING TECHNOLOGY LAUNCHES START-UP FIRM

“When you consider that nearly 85% of consumer products use molds of some sort and that \$1.3 trillion of the American economy depends on manufacturing processes that involve injection, stamped or die-cut molds, you begin to appreciate the fundamental importance of mold making,” says **Jyotirmoy (Jyoti) Mazumder**, Robert H. Lurie Professor of Mechanical Engineering. Several years

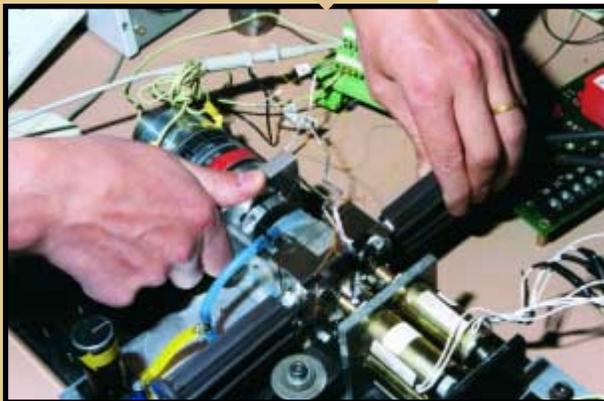
ago, Mazumder, who describes his work as “making materials that Mother Nature can’t produce,” was asked by General Motors (GM) to develop a rapid prototyping alternative capable of making metal prototype components directly from CAD dimensions. Mazumder, who also directs the University of Michigan (U-M) Center for Laser Aided Intelligent Manufacturing (CLAIM), has developed a variety of non-equilibrium alloys using laser-assisted direct metal deposition.

Ultimately, it was venture capitalist Shrik Mehta who provided the research funding that enabled Professor Mazumder to devise an interactive, laser-cladding process capable of producing a new generation of metals which, according to several prominent industry journals, could revolutionize mold making. In January of 1999, Mazumder’s invention launched Precision Optical Manufacturing Inc., a start-up firm in Plymouth, Michigan. Although Mazumder holds the title of CEO, his interests and energies remain firmly rooted in academia. “My real work is here at the University,” he affirms, “coming up with new technologies. This is where I can be most useful to people.”

NI RECEIVES ENDOWED PROFESSORSHIP AT SHANGHAI JIAO TONG UNIVERSITY

In March 1999, Professor **Jun Ni** was appointed by the Ministry of Education of the People's Republic of China to serve as an Endowed Changjiang Scholar Professor. This was the first such endowed professorship ever established by the Chinese government. Dr. Ni will work with Shanghai Jiao Tong University to provide strategic guidance on the development of its manufacturing research and educational programs. He is one of only three endowed professorship holders who are from outside China.

Professor Jun Ni's research on a micro internal combustion swing engine, located in the MEAM Stamping Lab, could contribute to future development of portable high-density power generation devices.



Massoud Kaviany

Professor, received a Teaching Incentive Fund Award, MEAM (1998–99).

Arthur D. Kuo

Associate Professor, received a Teaching Incentive Fund Award, MEAM, (1998–99).

Kenneth C. Ludema (BSEIE '55, MSE '56, PhD '63)

Professor Emeritus, received a Robert M. Caddell Memorial Faculty Research Achievement Award (1999–00).

Noel C. Perkins

Professor, received an Outstanding Accomplishment Award for MEAM, by the College of Engineering (CoE), Feb. 19, 2000. He was recognized for his achievements in research, teaching, and service.

Richard A. Scott

Professor, was named Pi Tau Sigma (ΠΤΣ/PTS) Professor of the Term for Winter Term 2000.

Volker Sick

Associate Professor, received a Teaching Incentive Fund Award, MEAM, (1998–99).

Michael Thouless

Professor, received a Teaching Incentive Fund Award, MEAM (1998–99).

Alan S. Wineman

(BSEEM '59) Professor, was named Pi Tau Sigma (ΠΤΣ/PTS), Professor of the Term for Fall

Term 1999. He also received a Teaching Incentive Fund Award, MEAM (1998–99).

Margaret S. Wooldridge

Assistant Professor, received a U-M Career Development Award from the Michigan Agenda for Women, May 1999. She also received a Teaching Incentive Fund Award, MEAM (1998–99).

College of Engineering (CoE)

Faculty Honors

Dionissios (Dennis) N. Assanis

Professor, was awarded a CoE Teaching Excellence Award (1999–00).

Dariusz (Darek) J. Ceglarek (PhD '94)

Assistant Research Scientist, was awarded the CoE Outstanding Research Scientist Achievement Award (1999–00).

Yoram Koren, PE

Professor, continued his endowed professorship as the Paul G. Goebel Professor of Engineering (09/01/93–08/31/03).

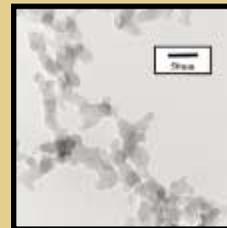
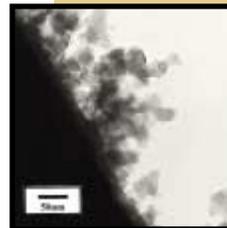
Jyotirmoy (Jyoti) Mazumder

Professor, continued his endowed professorship as the Robert H. Lurie Professor of Engineering (09/01/96–05/31/01).

Panos Y. Papalambros

Professor, was the first-time recipient of a new endowed professorship; he is now distinguished as the Donald C. Graham Professor of Engineering (01/01/00–12/31/04). The endowment was established by MEAM alumnus, **Donald C. Graham** (BSEIE '55, MSE '56), Chairman of The Graham Companies, member of the CoE National Advisory Committee (NAC), and past member of the MEAM External Advisory Board (EAB).

Assistant Professor **Margaret Wooldridge** researches combustion phenomena and combustion synthesis systems. These images—transmission electron micrographs (TEM) of nanosized silica (SiO_2) particles sampled from a hybrid flame—show the changing morphology of the particles as they are formed and grow throughout the flame. The black regions are TEM grid bars. a) sampling location = 26mm above the surface of the burner, b) 36mm, c) exhaust region (>100mm).



Noel C. Perkins

Professor, was the first-time recipient of the Ruth and Joel Spira Outstanding Teaching Award. The award was presented to Perkins at the American Society for Engineering Education (ASEE) Outstanding Student Instructor Awards Ceremony, April 12, 2000. Perkins was also named Professor of the Year by the University of Michigan (U-M) chapter of Tau Beta Pi (TBPi/TBP), Apr. 2000.

Albert B. Schultz (emeritus)

Professor, continued his endowed professorship as the Vennema Professor of Mechanical Engineering and Applied Mechanics (1983–12/31/99).

Grétar Tryggvason

Professor, received the College of Engineering (CoE) Service Excellence Award (1999–00) on Feb. 19, 2000.

A. Galip Ulsoy

Professor, continued his endowed professorship as the William Clay Ford Professor of Engineering (01/01/96–12/31/03).

University of Michigan (U-M)

Faculty Honors

Dionissios (Dennis) N. Assanis

Professor, received an endowed professorship; he is now distinguished as an Arthur F. Thurnau Professor (06/01/99–05/31/02).

Diann E. Brei

Assistant Professor, received a U-M Career Development Award from the Michigan Agenda for Women, May 1999.

Maria Comninou (JD '96)

Professor, served as judge for the 76th Annual Henry M. Campbell Moot Court Competition at the U-M Law School, Nov. 16, 1999.

Steven A. Goldstein (MS '77, PhD '81)

Professor, was the first time recipient of a new endowed professorship; he is now distinguished as the Henry Ruppenthal Family Professor of Orthopaedic Surgery and Bioengineering (06/14/99–open). The Ruppenthal Professorship was established through the generosity of Alma and Rena Ruppenthal to honor the keen interest of their late brother, Norman, in medical engineering.

Karl Grosh

Assistant Professor, received the Order of Omega's Panhellenic Teaching Excellence Award, for 1999–00.

Bruce H. Karnopp

Associate Professor, continued as an Arthur F. Thurnau Professor (07/01/96–06/30/99).

Ann Marie Sastry

Assistant Professor, received the 1999–00 CoE 1938E Award for outstanding teaching, counseling and mentorship of students, and scholarly integrity, Feb. 19, 2000.

Margaret S. Wooldridge

Assistant Professor, received a U-M Career Development Award from the Michigan Agenda for Women, May 1999.

Staff Honors

Linore Latham

Office Assistant IV, received a "UMatter!" award, Aug. 1999, for outstanding initiative and contribution to the CoE S.M.Wu Manufacturing Research Center (WuMRC), and to MEAM.

WOOLDRIDGE RECEIVES PI TAU SIGMA (ΠΤΣ/PTS) GOLD MEDAL

Assistant Professor **Margaret S. Wooldridge** was awarded the Pi Tau Sigma (ΠΤΣ/PTS) Gold Medal at the 1999 International Mechanical Engineering Congress and Exposition. Established in 1938 by PTS in conjunction with the American Society of Mechanical Engineers (ASME), the award recognizes outstanding achievement by a young graduate in mechanical engineering within ten years of receiving the baccalaureate degree.

Dr. Wooldridge received her bachelor's degree in mechanical engineering from the University of Illinois–Champaign-Urbana in 1989 and went on to earn a doctorate degree from Stanford University in 1995. During her two years at the University of Michigan (U-M), she has maintained an active research program focused primarily on combustion phenomena and combustion synthesis. Her work has resulted in the generation of nanostructured materials and high-surface-area materials for applications such as fuel cell catalysts, flame retardants, and electrodes. She is also working to develop non-intrusive, optical-based system diagnostics for high-temperature, multi-phased, and chemically reactive environments. In 1998, her research earned her the National Science Foundation (NSF) CAREER Award.

Among her numerous accomplishments as a teacher, Professor Wooldridge has, in collaboration with Professor **Michael M. Chen**, revitalized and restructured a graduate-level course in advanced heat transfer. She also initiated an educational outreach program that has introduced more than 220 middle school students to engineering through workshops and competitions.

Leadership and Innovation:

FACULTY HONORS AND AWARDS

FACULTY AND STAFF PROFESSIONAL HONORS

July 1, 1999–June 30, 2000

Faculty Honors

Ellen M. Arruda

Associate Professor, continued as recipient of a National Science Foundation (NSF) CAREER Award (06/01/97–05/31/01). Arruda also continued the 3M Untenured Faculty Research Grant Award (06/97–05/99).

James A. Ashton-Miller

Research Scientist, was elected President-Elect (1999–00) of the American Society of Biomechanics (ASB), Oct. 1999. He assumed the position of President (2000–01) thereafter.

Diann E. Brei

Assistant Professor, was invited to be included in the National Academy of Engineering's (NAE) Celebration of Women in Engineering Web site at www.nae.edu/cwe, "Gallery of Women Engineers."

Steven L. Ceccio (BSEME '85)

Professor, was one of only 15 people in the country appointed to the Defense Science Studies Group (DSSG) of the Institute of Defense Analyses (IDA) and the U.S. Department of Defense (DoD). The group consults on national security issues and is sponsored by the Defense Advanced Research Project Agency (DARPA).

David E. Cole (BSEME '60, BSEM '60, MSE '61, PhD '66)

Professor, received the Horace H. Rackham Award from the Engineering Society of Detroit, MI, May 31, 1999, for humanitarian service. He also was awarded the Chevalier of Merit from the French Government for services rendered through their Trade Commissioner in Detroit. The honor was bestowed at a reception in Detroit, MI, March 6, 2000.

William J. Endres

Assistant Professor, continued as recipient of a National Science Foundation (NSF) CAREER Award (04/15/98–03/31/02).

Thomas D. Gillespie, PE

Adjunct Professor, received the General Motors Corporation (GMC) Outstanding Distance Learning Faculty Award, May 1999, for courses taught via the College of Engineering (CoE) Center for Professional Development (CPD), for GM.

Karl Grosh

Assistant Professor, continued as an Office of Naval Research (ONR) Young Investigator (05/01/99–04/30/02). He also continued as a recipient of a National Science Foundation (NSF) CAREER Award (09/99–08/03).

Gregory M. Hulbert

Associate Professor, was elected a Fellow of the American Society of Mechanical Engineers (ASME), Dec. 1999.

Yoram Koren, PE

Professor, received the 1999 American Society of Mechanical Engineers (ASME) William T. Ennor Manufacturing Technology Award for his outstanding research contributions in the field of manufacturing and production engineering. The award was presented at the American Society of Mechanical Engineers International Mechanical Engineering Congress and Exposition (ASME-IMECE), Las Vegas, NV, Sept. 1999.

Nestor F. Michelena

Assistant Research Scientist, received the Ford Motor Company University Research Program Award (1999–01).

Double Honors for Papalambros

Panos Y. Papalambros was the recipient of the 1999 Machine Design Award, conferred at the Design Engineering Technical Conference in Las Vegas in September. Since 1958, the award has recognized eminent



Professor Panos Y. Papalambros, is shown here wearing a medallion commemorating the newly endowed Donald C. Graham Professorship of Engineering.

achievement and distinguished service in the field of machine design. In the case of Professor Papalambros, the honor was bestowed for leadership in bridging academia with industry and for research in design optimization that has paved the way for new paradigms in machine design and improved protocols in the automotive industry.

In reflecting on the award, Papalambros notes that his work has always been directed toward making the design process quantifiable and amenable to research. "I've tried to study design as a process that can be defined in rigorous ways and to conduct research that is meaningful for those involved in design and manufacturing as well as those who value scholarship. In pursuit of that goal, I have worked extensively and closely with automotive manufacturers in order to understand the problems they face, translate those problems into scholarly pursuits, and help devise effective methods and tools."

In May of 2000, Papalambros will receive another major honor, becoming the Donald C. Graham Professor of Engineering. "As a faculty member," he notes, "I appreciate the recognition that this represents. From my administrative experience, I'm grateful for alumni such as **Donald Graham** (BSE '55, MSE '56) who understand the vital importance of endowed chairs to the overall caliber of the MEAM Department."

Jun Ni

Professor, continued the Changjiang Endowed (visiting) Professorship from the Ministry of Education in the People's Republic of China (02/99–02/04). He also continued as a recipient of a National Science Foundation (NSF) Presidential Faculty Fellows Award (10/94–09/00).

Nicolae (Nick) V. Orlandea (PhD '73)

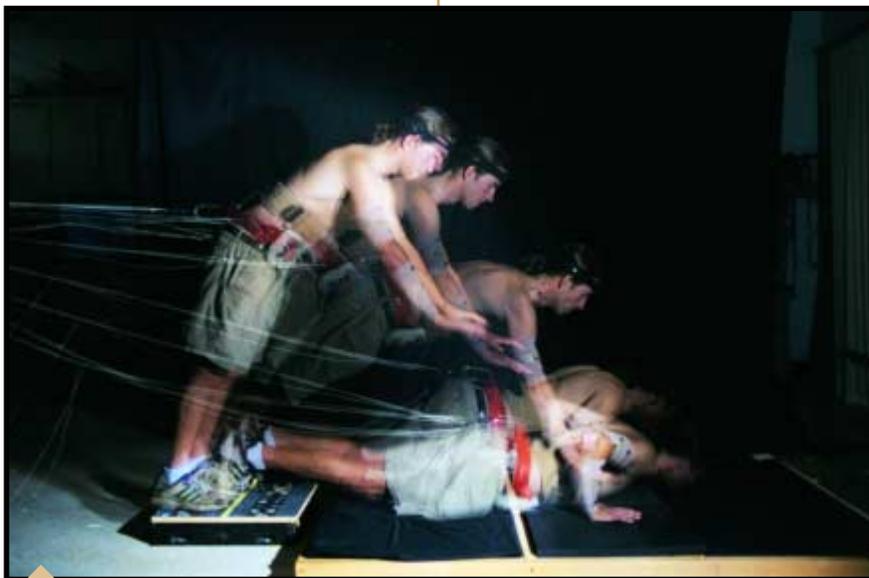
Adjunct Professor, received an honorary doctorate degree from Technical University Cluj-Napoca, Romania, June 1999, for his contributions to computer aided dynamic analysis of mechanical systems, and his role in the development of the Automatic Dynamic Analysis of Mechanical Systems (ADAMS) software.

Zbigniew J. Pasek

Assistant Research Scientist, was co-leader along with Mechanical Engineering and Applied Mechanics (MEAM) faculty members, **Yoram Koren, PE**, and **A. Galip Ulsoy**, on the Boring for Optimum Accuracy (BOA) project, which was named one of *Industry Week* magazine's Top 25 Technology Developments for 1999 as published in the Dec. 6, 1999 issue. BOA is a collaboration between MEAM and Lamb Technicon Machining Systems, and was funded by the National Institute of Standards and Technology's (NIST) Advanced Technology Program (ATP).

Huei Peng

Associate Professor, continued as recipient of a National Science Foundation (NSF) CAREER Award (05/98–04/02).



James Patrick "J.P." Boylan (BSE '96, MSE '99) participated in an experiment conducted by *Mechanical Engineering (ME) doctoral student Kurt DeGoede*. Much of the research in the *Biomechanics Laboratory*, directed by Research Scientist **James Ashton-Miller**, is focused on physical challenges of the elderly.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

MEAM Faculty Members Elected as Fellows in 1999–00

Gregory M. Hulbert

(Fellow of ASME, 1999)

William W. Schultz

(Fellow of ASME, 2000)

Alan S. Wineman

(Fellow of ASME, 1999)

American Society of Mechanical Engineers (ASME) Fellows

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

Ann Marie Sastry

Assistant Professor, was invited to be included in the National Academy of Engineering's (NAE) Celebration of Women in Engineering Web site at www.nae.edu/cwe, "Gallery of Women Engineers". She also continued as recipient of a National Science Foundation (NSF) Presidential Early Career Award for Scientists and Engineers (PECASE, 01/98–09/00), as well as an NSF CAREER Award, augmented by PECASE (06/97–09/00).

William W. Schultz

Professor, was elected a Fellow of the American Society of Mechanical Engineers (ASME), Feb. 2000, for his outstanding contributions to research and education in fluid mechanics.

Volker Sick

Associate Professor, received the Forest R. McFarland Award from the Society of Automotive Engineers (SAE) Engineering Meetings Board (EMB), Mar., 2000, in recognition of his leadership and organizational contributions in the division for Fuels and Lubricants.

Michael Thouless

Associate Professor, continued as a recipient of a National Science Foundation (NSF) CAREER Award (07/01/96–06/30/00).

Dawn M. Tilbury

Assistant Professor, received a National Science Foundation (NSF) CAREER Award (09/99–08/03).

Grétar Tryggvason

Professor, was appointed a Visiting Scientist, U-Paris VI, Paris, France (04/19/98–05/08/99).

A. Galip Ulsoy

Professor, received the Ford Patent Incentive Award from Ford Motor Company (07/26/99).

Juris Upatnieks

Adjunct Associate Research Scientist, was presented the Grand Medal from the Latvian Academy of Sciences, in Riga, Latvia, July 5, 1999, for the development of optical holography and its applications in the world.

Alan S. Wineman (BSEEM '59)

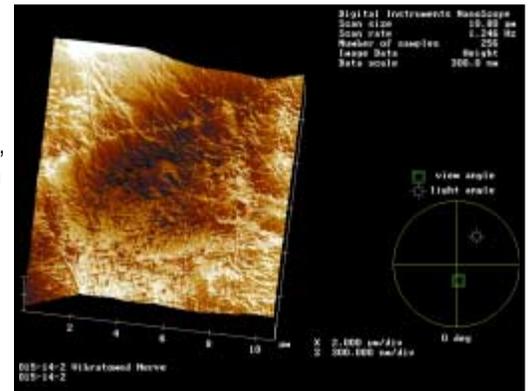
Professor, was elected a Fellow of the American Society of Mechanical Engineers (ASME), June 1999.

Margaret S. Wooldridge

Assistant Professor, continued as recipient of a National Science Foundation (NSF) CAREER Award (05/98–04/02) and was invited to be included in the National Academy of Engineering's (NAE) Celebration of Women in Engineering Web site at www.nae.edu/cwe, "Gallery of Women Engineers."

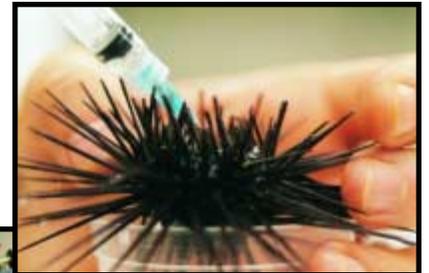
Wen-Jei Yang (MSE '56, PHD '60)

Professor, was named an honorary member of the Combustion Institute, Taiwan (R.O.C.), 1999.

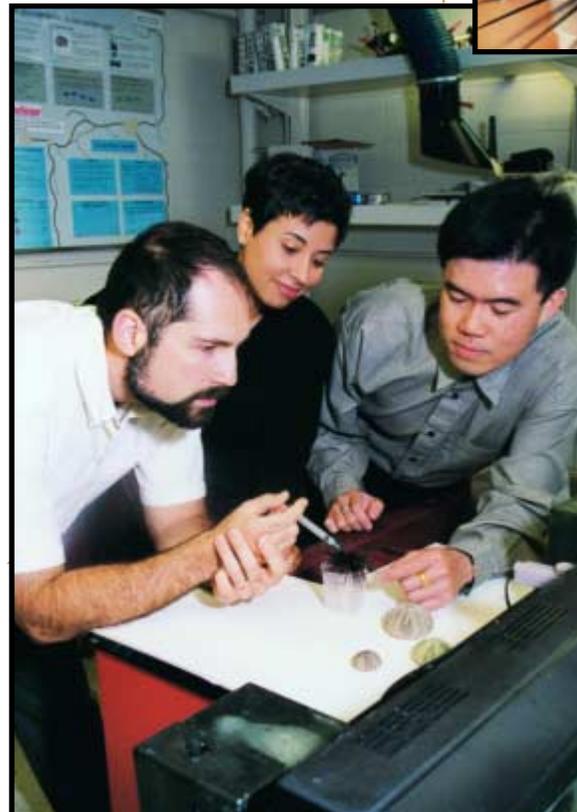


Section of a healthy rat's sciatic nerve, with collagen fibers imaged via atomic force microscope.

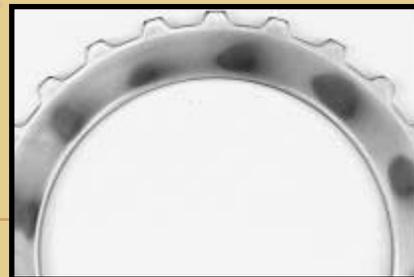
What do sea urchin eggs, rat nerves, and batteries have in common? Each is comprised of fibrous networks with interpenetrating particles that form mechanically stiff and strong "cages" for other constituent materials.



*Assistant Professor **Ann Marie Sastry** and her students in the Composite and Fibrous Mechanics Laboratory have developed microscale models for these diverse systems. The basic research of doctoral student **Chiawei Wang** on improved battery materials has advanced the understanding of the complexity of the sea urchin egg and the importance of collagen morphology. **At left**, graduate student **John Parmigiani** (l.) injects a solution of KCl into a female *Arbacia punctulata* (Atlantic purple sea urchin) to induce spawning of eggs as **Chiawei Wang** (r.) and **Sastry** (center) look on. **The inset photo above** shows a close-up of the injection process.*



At right, a transmission clutch disk after a single engagement. The dark areas correspond to regions in which high local temperatures (hot spots) have been experienced, resulting from an unstable interaction between frictional heating and thermoelastic deformation. Read more about Professor Barber's research below.



FACULTY KEYNOTE AND PLENARY PRESENTATIONS

May 1, 1999–April 30, 2000

Ellen M. Arruda

“Characterizing and Modeling Hyperelastic and Viscoelastic-Viscoplastic Elastomers at Low and High Strain Rates,” (keynote) Third Intl. Symp. Finite Element Analysis of Rubber and Rubber-Like Materials, Akron Rubber Development Laboratory, Akron, OH, May 19–20, 1999.

James R. Barber, C Eng

“Thermoelasticity and Contact,” (plenary) Third Intl. Congr. on Thermal Stresses, Cracow, Poland, June 13–17, 1999.

“Thermoelastic Instabilities in Brakes and Clutches,” (plenary) 1999 Colloquium on Friction Materials and Braking Systems, Southern Illinois U–Carbondale, Carbondale, IL, June 19–20, 1999.

Steven Goldstein (MS '77, PhD '81)

“Mechanical and Biologic Stimulation of Bone Repair,” First Jack Pushkin Lecturer (keynote), Visiting Professor, Dept. of Orthopedics, West Virginia U, Morgantown, WV, May 21, 1999.

Massoud Kaviany

“Design of Heat Transfer Media” (keynote), Congr. SFT '99, French Thermal Sci. Soc., Arcachon, France, May 17–19, 1999.

“Combustion in Porous Media” (keynote), Symp. Energy Engrg. in 21st Century (SEE 2000), Hong Kong U of Sci. and Technol., Hong Kong, People's Republic of China, Jan. 9–13, 2000.

Yoram Koren

“‘M’ Reconfigurable Manufacturing Systems” (keynote paper), (Y Koren, U Heisel, F Jovane, T Moriwaki, G Pritschow, H Van Brussel, AG Ulsoy, coauthors), 49th Col. Intl. pour l'Étude Scientifique des Techniques de Production Mecanique, Montreux, Switzerland, Aug. 1999. (As published in *CIRP Annals* 48 (1–2): 527–40, 1999.)

Herman Merte, Jr., PE (emeritus) (BSNAM '50, BSEME '51, MSE '56, PhD '60)

“Pool Boiling in Microgravity: How is it Different?” (keynote) 17th Canadian Congr. of Appl. Mechs., McMaster U, Hamilton, ON, Canada, June 1999.

Jun Ni

“Recent Trends in Manufacturing Research” (keynote), Intl. Conf. on Adv. Mfg. Technol. '99, Xian, People's Republic of China, June 1999.

Noel C. Perkins

“Nonlinear Cable Dynamics and Role of Internal Resonances,” (keynote) Intl. Symp. Cable Dynamics, Trondheim, Norway, Aug. 1999.



BARBER ADDRESSES INTERNATIONAL CONGRESS

Professor **James R. Barber** delivered a plenary lecture at the Third International Congress on Thermal Stresses, hosted by the Cracow University of Technology in Poland from June 13–17, 1999. At the conference, which drew participants from around the world, Professor Barber spoke on the subject of thermoelasticity and contact. Following a summary of research spanning the past three

decades, he discussed recent results of analytical and numerical perturbation methods, which, as he noted, “enable us to make good predictions of the conditions under which unstable thermoelastic deformations occur.”

The inevitable microscopic roughness of contacting surfaces causes incomplete contact, interposing a thermal contact resistance. Interaction between this resistance and thermoelastic deformation of the contacting bodies can be unstable, leading to non-uniform con-

tact pressure. The figure above shows a section cut from an interrupted continuous casting process for aluminum alloy. The sinusoidal perturbation in the solidification boundary was caused by thermoelastic instability associated with the mold/casting contact interface. The resulting non-uniform temperature field can cause thermal stresses, material damage and undesirable spatial variation in alloy composition.

KEY TO ACRONYMS USED:

PLEASE REFER TO THE APPENDIX ON PAGE 52.

Professor **Yoram Koren** in the ERC/RMS testbed of the Integrated Manufacturing Systems Laboratory (IMSL), located in the H.H. Dow Building. Koren is director of the Center for Reconfigurable Machining Systems.

INTERNATIONAL RECOGNITION FOR KOREN

Last year, **Yoram Koren**, Paul C. Goebel Professor of Engineering, continued to garner international acclaim for his expertise in the domain of computerized controls for manufacturing systems. Professor Koren was chosen to receive the 1999 William T. Ennor Manufacturing Technology Award. Established in 1990 by the American Society of Mechanical Engineers (ASME) Manufacturing Engineering Division and the Alcoa Company, the award is intended to recognize an individual or team for developing or contributing significantly to an innovative manufacturing technology, the implementation of which has resulted in substantial economic or societal benefits. Also in 1999, Professor Koren presented a keynote paper on the subject of reconfigurable manufacturing systems for the CIRP general assembly, held in Switzerland. CIRP is the acronym (from the French) for the International Institution for Production Engineering Research. The paper was co-authored by six additional researchers from four countries, including **A. Galip Ulsoy**, Chair of MEAM. An ASME Fellow since 1990, Professor Koren serves as director of the NSF-funded Engineering Research Center for Reconfigurable Machining Systems (ERC/RMS).



FACULTY INVITED PRESENTATIONS

May 1, 1999–April 30, 2000

Faculty Honors

James A. Ashton-Miller

"Effect of Age and Attention on Obstacle Avoidance," Intl. Soc. of Biomech., Calgary, AB, Canada, Aug. 1999.

"Anatomy of Urethra and the Pelvic Floor. Morphology and Function," 1999 OBSLUT, Biennial Norwegian Urogynecol. Soc. Wkshp. on the Pelvic Floor, Oslo, Norway, Nov. 1999.

"Effective Age on Human Obstacle Avoidance," Inst. of Geront. Colloq., Wayne State U, Detroit, MI, Dec. 14, 1999.

Ellen M. Arruda

"Constitutive Modeling and Characterization of the Finite Deformation Response of Nearly Incompressible Hyperelastic Materials," Paulstra, Grand Rapids, MI, Aug. 1999.

"Material Selection, Characterization and Modeling for High Rate Polypropylene Applications," Dow Chemical Company, Southfield, MI, Aug. 1999.

"The Mechanics of Crystal Deformation in Polypropylene," (W Xu, coauthor) 36th Annl. Tech. Mtg. Soc. Engrg. Sci., Austin, TX, Oct. 1999.

"Micromechanics, Meso-Scale Modeling and Molecular Dynamics Simulations of Polymers," (MC Boyce, coauthor) NSF Wkshp. Nano and Micromechanics of Solids for Emerging Sci. and Technol., Palo Alto, CA, Oct. 1999.

KEY TO ACRONYMS USED:

PLEASE REFER TO THE APPENDIX ON PAGE 52.

Arvind Atreya

"Sprinkler Measurements," NIST Seminar, May 1999.

Diann E. Brei

"Piezoelectric Actuators," Technical Director's Conf.: Future Challenges in Precision Munitions-Actuators and Power, Picatinny, NJ, Aug. 18–19, 1999.

"Smart Piezoelectric Actuators," DARPA Flow Actuators Wkshp., Arlington, VA, Oct. 25, 1999.

Maria Comninou (JD '96)

"New Issues in Intellectual Property," U-M Law School, Ann Arbor, MI, May 17, 1999.

"ERC/RMS Intellectual Property Assets and Their Protection," ERC/RMS Sem., MEAM, U-M, Ann Arbor, MI, Sept. 29, 1999.

"The Importance of Diversity," Martin Luther King, Jr. (MLK) Panel Discussion, U-M, Ann Arbor, MI, Jan. 21, 2000.

"Product Liability," ME 450 class lecture, MEAM, U-M, Ann Arbor, MI, Feb. 24, 2000.

David R. Dowling

"Methods of Sound Source Localization," Naval Surface Warfare Center, Carderock Div., West Bethesda, MD, May 5, 1999.

"Photoacoustic Detection and Localization of Small Gas Leaks," Graduate Aeronautical Lab., California Inst. of Technol. (CIT), Pasadena, CA, Oct. 22, 1999.

Steven Goldstein (MS '77, PhD '81)

"Mechanical and Biological Influences on Bone Formation, Repair and Adaptation," Visiting Professor—Cannon Sem. Series, Carolinas Medical Ctr., June 25, 1999; Beth Israel Deaconess Med. Ctr., Harvard Institutes of Med., Oct. 20, 1999.

Gregory M. Hulbert

"Network-Distributed Multibody Dynamics: Gluing Algorithms and Implementations," Fifth U.S. Congr. Computational Mechs., Denver, CO, Aug. 1999.

"Quasi-Static Mode Compensation for Transient Dynamic Analysis and Dynamic Data Recovery," Fifth U.S. Congr. Computational Mechs., Denver, CO, Aug. 1999.

"An Experimental Study of Radial-Torsional Coupling in Elastomeric Bushings," Elastomer—Service Life Prediction '99, Akron, OH, Oct. 1999.

Massoud Kaviany

"Transport in Porous Media," Bergles Lecture Series in Thermal Science, Iowa State U of Sci. and Technol., Ames, IA, Nov. 1999.

"Heat Transfer in Porous Media: Technology and Fundamentals," Southwest Mechs. Lecture Series—U-Oklahoma, Norman, OK, Feb. 2000; Oklahoma State U, Stillwater, OK, Feb. 2000; Southern Methodist U (SMU), Dallas, TX, Feb. 2000; Tulane U, New Orleans, LA, Feb. 2000; U-Texas—Arlington, Arlington, TX, Feb. 2000.

Sridhar Kota

"Automotive Applications of Complaint Mechanisms," Innovation Zone, General Motors (GM), Warren, MI, June 1999.

"Automotive Trends in Product Design and Development," gathering of CEOs of various Mexican automotive firms, Baan—Mexico, Mexico City, Mexico, June 9, 1999.

"Design of Compliant Mechanisms—Applications to Primary Flight Controls," AFOSR Wkshp. on Smart Actuation Systems for Primary Flight Controls, Washington, DC, Sept. 1999.

"Design for No-Assembly," Innovation Wkshp., Delphi Automotive Systems, Warren, MI, Oct. 20, 1999.

"Adaptive Compliant Wing—Concept and Applications," Center of Excellence on Multidisciplinary Design Technologies, Wright Patterson Air Force Base, OH, Oct. 1999.

"Design of Compliant Mechanisms—Applications to MEMS," College of Engineering, Tennessee Technological U, Cookeville, TN, Nov. 1999.

"Mechanical Compliance—Design for No-Assembly," Innovative Technologies session, ASME Winter Annl. Mtg., Nov. 1999.

Liwei Lin

"MEMS Research at MEAM—the University of Michigan"—Sem., Honeywell, Inc., Minneapolis, MN, May 11, 1999; Sem., Seagate Technology, Minneapolis, MN, May 11, 1999; Dept. Sem., Mech. Engrg. Dept., University of Minnesota—Twin Cities, Minneapolis, MN, May 12, 1999.

"Microencapsulation Shells for MEMS Packaging," IMAPS Advanced Wkshp. on Packaging of MEMS Microsystems, Chicago, IL, Oct. 24, 1999.

"MEMS Post-Packaging by Localized Heating," Sem., Analog Devices, Inc., Boston, MA, Dec. 14, 1999.



Assistant Professor **Diann Brei** researches smart materials and structures. Brei is shown here in the Auto Lab high bay area with lab equipment she helped to secure for ME students.

BREI ON SMART STRUCTURES

Students in the Smart Material and Structures Design Laboratory, under the direction of Assistant Professor **Diann Brei**, are developing smart attachment mechanisms (SAM) driven by smart material, shape memory alloys.

The SAM pictured here is a distributed actuation surface nicknamed "Active Velcro." The **top image** shows the SAM as being capable of active connection (engagement, retention, and release) as well as relative planar motion (translation and rotation) during connection. The **triangular image** indicates prototype motion, while the **image below** it shows the motion and retention topology. Potential

applications include autonomous docking of microsatellites, material handling in manufacturing, and the creation of adaptable medical sutures or connections for prosthetics/orthotics.

Jyotirmoy (Jyoti) Mazumder

"Laser Materials Interaction: Theory and Applications in Materials Processing," First Michigan Maters. Res. Symp., Dept. of Mater. Sci. and Engrg. (MSE), U-M, May 1999.

Jun Ni

"Real-Time Active Balancing of High-Speed Rotor," Korean Adv. Inst. of Sci. and Technol., Taejon, Korea, June 11, 1999.

"Control of Process Variations in Manufacturing," Seoul Natl. U, Seoul, Korea, June 1999.

"New Emerging Directions for Advanced Manufacturing Research," Natl. Sci. Foundation of China, Beijing, People's Republic of China, Aug. 23–25, 1999.

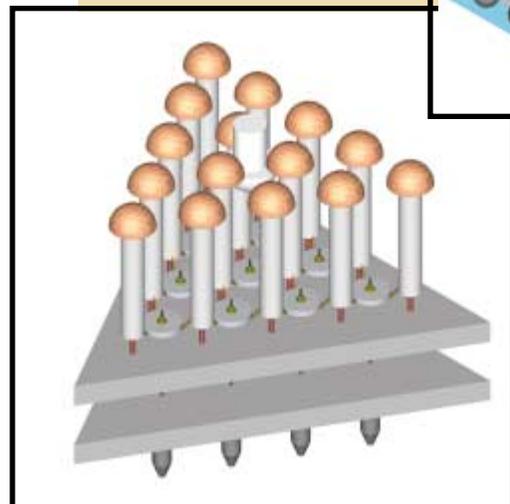
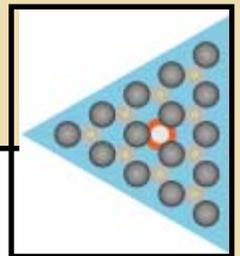
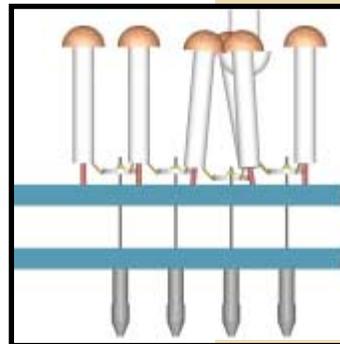
Jwo Pan

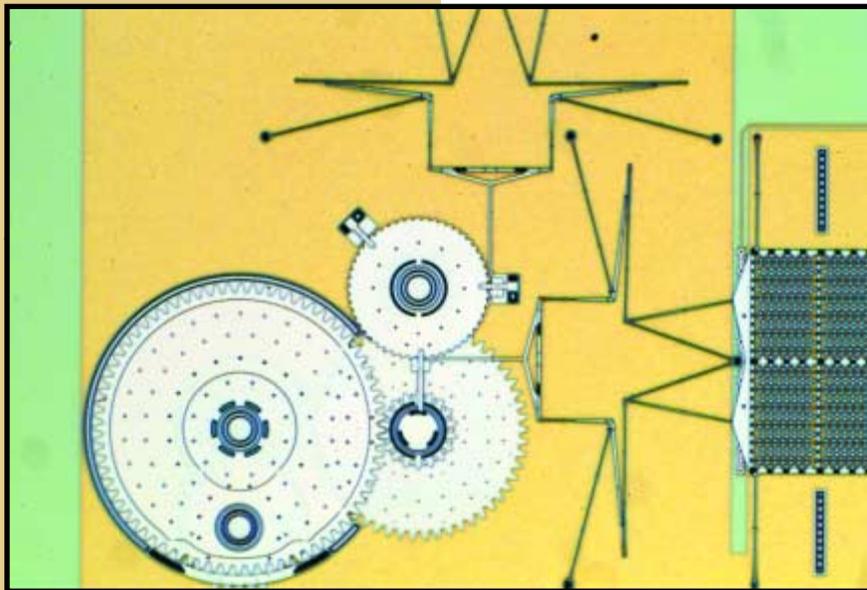
"Analysis of Small Edge Cracks and its Implications to Multiaxial Fatigue Theories," (Y Wang, coauthor), Advances in Life Prediction Methodology, ASME-PVP, Boston, MA, Aug. 1–5, 1999.

"Prediction of Sheet Metal Failure under Bending/Unbending Conditions," (HM Huang, PA Friedman, SC Tang, coauthors), Fourth Intl. Conf. and Wkshp. Numerical Simulation of 3-D Sheet Forming Processes, Besancon, France, Sept. 13–17, 1999.

Noel C. Perkins

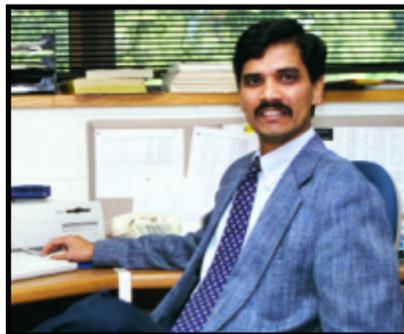
"A Survey of Nonlinear Mechanisms Controlling Elastic Cables," Dept. of Mech. Engrg. and Aeronautical Engrg. and Mechs., Rensselaer Polytechnic Inst. (RPI), Troy, NY, Dec. 3, 1999.





SRIDHAR KOTA: DESIGN FOR COMPLIANT MECHANISMS IN MEMS

One of the most urgent challenges facing the telecommunications industry today involves finding a way to provide users with faster access to the Internet and other communication media. In collaboration with colleagues at Sandia National Laboratories, MEAM Associate Professor **Sridhar Kota** has helped to solve this problem by developing compliant stroke amplifier systems, essential components within a microelectromechanical beam steering mirror—known as the Sandia Mirror—that will allow the telecommunications industry to switch increasing amounts of data between fiber optic cables. When coupled with Sandia's new high-force actuators, the amplifier systems provide the necessary driving force and displacement. The micro engine developed by Professor Kota and featured in this **photo above** is driven by two electrostatic actuators, each connected to a compliant transmission. The output of the compliant transmissions are then connected through a system of ratchet-pawl mechanisms to a series of compound gears. The entire assembly (patent pending) occupies approximately one-half square millimeter. Using the same drive voltage, the compliant transmissions generate 50 times more torque than the actuators by themselves. The project is being sponsored by Sandia National Laboratories' Intelligent Micromachine Initiative.



Associate Professor Sridhar Kota

Christophe Pierre

"Preventing High Cycle Fatigue in Turbine Engine Components," Capitol Hill Exhbt. on Univ. Res. for the Natl. Defense, Cannon Caucus Rm., U.S. House of Representatives, Washington, DC, May 13, 1999.

"Modal Reduction of a Nonlinear Rotating Beam through Nonlinear Normal Modes," Eighth ARO Wkshp. on Aeroelasticity of Rotorcraft Systems, Pennsylvania State U—State College, State College, PA, Oct. 20, 1999.

"Approximations of Low- to Mid-Frequency Power Flow in Complex Structures," sem., General Motors (GM) Proving Grounds, Milford, MI, Nov. 18, 1999.

"Normal Modes and Model Size Reduction for Nonlinear Structural Vibrations, NASA Langley Res. Ctr., Hampton, VA, Dec. 8, 1999.

"Efficient Reduced-Order Modeling of Vibration of Complex Structures, with Applications to Mid-Frequency Power Flow," at Sem., General Motors (GM) Proving Grounds, Milford, MI, Mar. 27, 2000.

Kazuhiro (Kazu) Saitou

"Conformational Switching as in an Assembly Instructions in Self-Assembling Mechanical Systems," AI Sem., U-M, Ann Arbor, MI, Feb. 15, 2000.

"Computational Design of Structural Products," a Special Sem. in Arch. 821 Doctoral Progr. in Arch. and Orientation Sem., Col. of Arch. and Urban Planning, U-M, Ann Arbor, MI, Feb. 17, 2000.

Ann Marie Sastry

"From Batteries to Nerves: Understanding the Mechanics of Fibrous Structures," College of Engrg. Alumni Board Mtg., Camp Michigania, Walloon Lake, MI, May 1999.

"Analysis and Application of Porous Materials for Battery Technology," Ultralight Metals Study Progr. of the ONR MURI, Williamsburg, VA, Sept. 1, 1999.

"Challenges for the Student Instructor/Scholar," Engrg. GSI Orientation, Ctr. for Learning on Res. and Teaching (CLRT), U-M, Ann Arbor, MI, Sept. 1999.

"Porous, Stochastic Materials: Use in Power Supplies," Dept. Sem., Dept. of Maters. Sci., U-Virginia, Charlottesville, VA, Nov. 30, 1999.

"Battery Power in Synthetic Multifunctional Materials," U-Cambridge, Cambridge, U.K., Dec. 20, 1999.

"From Particle to Fiber to Network: Analysis, Design and Assembly of Fibrous Microstructures," Dept. Sem., Dept. of Mech. and Aerospace Engrg., Princeton U, Princeton, NJ, Apr. 5, 2000.

"Fibers, Particles and Connectivity: Understanding the Role of Reinforcement in Biological Materials," Dept. Sem., Dept. of Mech. Engrg., Rutgers: the State of New Jersey, Piscataway, NJ, Apr. 19, 2000.

William W. Schultz

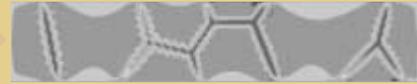
"An Experimental and Numerical Investigation of Nonisothermal Viscoelastic Glass Fiber Drawing and Annealing," (EM Arruda, X-Y Lu, coauthors) Highlight: Transport Phenomena in Mater. Processing and Mfg., IMECE-WAM, Nashville, TN, Nov. 1999.

"A Two-Dimensional Viscous Model of Crescent Forming," (E-J Chen, NC Perkins, coauthors), Kimberly-Clark Corp., Neenah, WI, Sept. 1999.

Volker Sick

"Linear Laser-Based Diagnostics beyond its Limits for Engine Diagnostics?" Gordon Res. Conf. on Laser Diagnostics for Combustion, Il Ciocco, Italy, June 1999.

*Stress contours from atomic diffusion and thermal mismatch in an aluminum interconnect line are shown in the figure at right. Interconnects, typically a micron in width, form the “wires” of modern integrated circuits. Read more about Assistant Professor **Garikipati**'s research below.*



Michael Thouless

“Fracture of Adhesive Joints,” First Michigan Maters. Res. Symp., Maters. Sci. and Engrg. (MSE) Dept., U-M, Ann Arbor, MI, May 1999.

“Effects of Plasticity in Measuring Adhesion,” Engrg. Foundation Conf. Mech. Properties of Films, Coatings and Interfacial Composites, Il Ciocco, Italy, June 1999.

“Elastic-Plastic Peeling of Thin Films,” (QD Yang, coauthor) Second Intl. Symp. on Adhesion Measurement of Thin Films and Coatings, Newark, NJ, Oct. 1999.

Grétar Tryggvason

“Direct Numerical Simulations of Atomization,” 12th Annl. Conf. Liquid Atomization and Spray Systems, Indianapolis, IN, May 16–19, 1999.

“Direct Simulations of Multiphase Flows”—Interfaces for the 21st Century, Monterey, CA, Aug. 16–18, 1999; Inst. for Multiphase Sci. and Technol. (IMuST) Annl. Mtg., Santa Barbara, CA, Mar. 12–14, 2000.

“Computations of Atomization,” (W Tauber, coauthor), Eighth Intl. Symp. CFD (ISCFD), Bremen, Germany, Sept. 5–10, 1999.

“Direct Numerical Simulations of Multiphase Flows”—Dept. of Mech. Engrg., U-California–San Diego (UCSD), La Jolla, CA, Jan. 14, 2000; Dept. Sem., Johns Hopkins U, Baltimore, MD, Feb. 17, 2000.

A. Galip Ulsoy

“Reconfigurable Manufacturing Systems,” Jervis B. Webb Company, Farmington Hills, MI, Sept. 1999.

“Control Issues in Reconfigurable Manufacturing”—Distinguished Lecture Series, Mech. Engrg. Dept., Penn State U–State College, State College, PA, Feb. 2000; Feddersen Distinguished Lecture, Mech. Engrg. Dept., Purdue U–West Lafayette, West Lafayette, IN, Feb. 2000.

Juris Upatnieks

“Research at United States Universities and Research Institutes,” Latvian Acad. of Sciences, Rigo, Latvia, July 5, 1999.

Alan S. Wineman (BSEEM '59)

“Torsion of a Polymer Rod Undergoing Microstructural Changes,” ASME Mechs. and Maters. Conf., Virginia Polytechnic Inst. and State U (Virginia Tech.), Blacksburg, VA, June 1999.

“Some Comments on Constitutive Equations with a Strain Clock,” Fourth Intl. Conf. Constitutive Laws for Engrg. Maters., Rensselaer Polytechnic Inst. (RPI), Troy, NY, July 1999.

“A Model for Stress Evolution during Thermo-set Cure,” (Y Mei, A Yee, coauthors) SOR 71st Annl. Mtg., Madison WI, Oct. 1999.

“The Pressurized Sphere Problem for Nonlinear Viscoelastic Materials with a Strain Clock,” (J-H Min, coauthor) SES 36th Annl. Mtg., U-Texas–Austin, Austin, TX, Oct. 1999.

“A Shear Lag Approach for Stress Transfer in a Fibril-Proteoglycan Model of Tendon,” (A Waas, coauthor) SES 36th Annl. Mtg., U-Texas–Austin, Austin, TX, Oct. 1999.

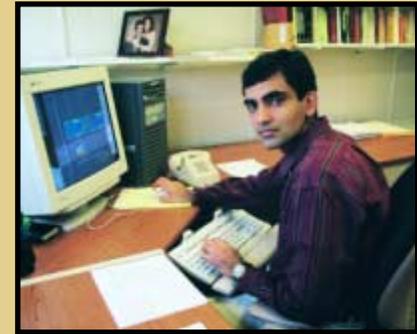
“Changes Due to Scission in an Elastomeric Cylinder Undergoing Circular Shear and Heat Conduction,” ASME-IMECE, Nashville, TN, Nov. 1999.

Margaret S. Wooldridge

“Combustion Synthesis,” Dept. of Mech. Engrg., U-California–Irvine, Irvine, CA, Oct. 21, 1999.

Jingxia Yuan

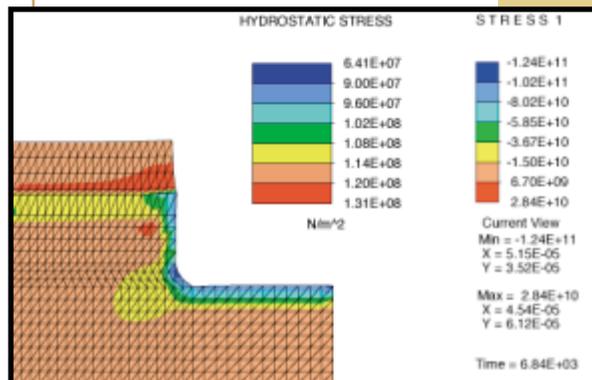
“Real-Time Error Compensation (RTEC) Technique on CNC Machine Tools,” Shanghai Jiaotong U, Shanghai, People’s Republic of China, Nov. 13, 1999.



GARIKIPATI AND MICROMECHANICS

Macromechanics and micromechanics have traditionally occupied separate realms of research. The former is concerned with the behavior of large objects and structures seen in the macroscopic world, while the latter focuses on microscopic—and even nanoscopic—features and phenomena in the materials that make up these structures. The research of Assistant Professor **Krishna Garikipati** reflects a growing interest in modeling large structures (bridges, aircraft, ship hulls, etc.), while suitably accounting for the fine-scale physics governed by micromechanics. Among other things, this requires the development of mathematical and computational frameworks to allow “micromechanical embedding.” While

working at the scale of microns, Professor Garikipati also incorporates the influence of the atomic structure on continuum theories. He is particularly interested in building such formulations for coupled problems of mechanics and diffusion in microsystems. The calculations on the aluminum interconnect (**bottom image**) are an example of this.



Leadership and Innovation:

1999 FACULTY PUBLICATIONS

DESIGN AND MANUFACTURING

Area Coordinator: Jun Ni

Contributing Faculty: Dionissios (Dennis) N. Assanis; Diann E. Brei; Michael M. Bridges; Dariusz (Darek) J. Ceglarek; Debasish (Deba) Dutta; William J. Endres; Zoran S. Filipi; Scott J. Hollister (jt.); S. Jack Hu; Gregory M. Hulbert; Elijah Kannatey-Asibu, Jr.; Noboru Kikuchi; Yoram Koren, PE; Sridhar Kota; Katsuo Kurabayashi; Robert G. Landers; Liwei Lin; Zheng-Dong Ma; Jyotirmoy (Jyoti) Mazumder; Mostafa (Moses) G. Mehrabi; Nestor F. Michelena; Jun Ni; Panos Y. Papalambros; Zbigniew J. Pasek; Huei Peng; Kazuhiro (Kazu) Saitou; William W. Schultz; Michael Thouless; A. Galip Ulsoy; Jingxia Yuan; Hongyan Zhang.

Journal Articles

Agnes G, Brei DE, Hyde T. "Adaptive Structures," *Aerospace Amer.*, Dec. 1999.

Assanis DN, Delagrammatikas G, Fellini R, Filipi ZS, Liedtke J, Michelena NF, Papalambros PY, Reyes D, Rosenbaum D, Sales A, Sasena M. "Optimization Approach to Hybrid Electric Propulsion System Design," *Mechs. of Structures and Machines* 27 (4): 393-421, 1999.

Ceglarek DJ, Khan A, Shi J, Ni J, Woo TC. "Sensor Optimization for Fault Diagnosis in Single Fixture Systems: A Methodology," *ASME J. Mfg. Sci. and Engrg.* 121 (1): 109-17, 1999.

Ceglarek DJ, Shi J. "Fixture Failure Diagnosis for Sheet Metal Assembly with Consideration of Measurement Noise," *Trans. ASME, J. Mfg. Sci. and Engrg.* 121 (4): 771-77, 1999.

Dutta D, Ghosh A, Kikuchi N, Mazumder J. "Design, Representation and Layer Manufacture of Designed Materials," *Trans. ASME-P Mfg. and Svcs.*, paper ETCE99-6622, 20 pp., ASME, Fairfield, NJ, 1999.

Dyer SW, Ni J. "Adaptive Influence Coefficient Control of Single-Plane Active Balancing Systems for Rotating Machinery," *Trans. ASME, J. Mfg. Sci. and Engrg. (Sensors and Controls for Mfg.)*, JW Sutherland (ed.), ASME-MED-10: 747-56, 1999.

Gong C, Yuan J, Ni J. "A Self-Calibration Method for Robotic Measurement System," *ASME J. Mfg. Sci. and Engrg. (Recent Advances in Machine Tools)*, JW Sutherland (ed.), ASME-MED-10: 879-88, 1999.

Hetrick J, Kota S. "An Energy Efficiency Formulation for Parametric Size and Shape Optimization of Compliant Mechanisms," *Trans. ASME, J. Mech. Design* 21: 229-34, June 1999.

Hu SJ, Wu B. "Quality in Manufacturing and Design," *Chinese J. Mechatronics*, 1999.

Huh IY, Koren Y. "Systematic Machine Tool Error Identification and Compensation through Test Parts," *ASME J. Dynamic Systems and Control* 67: 915-22, 1999.

Hulbert GM, Papalambros PY, Michelena NF, Ma Z-D, Tseng F-C, Fellini R, Scheffer C, Choi KK, Tang J, Ogarevic V, Hardee E. "A Case Study for Network-Distributed Collaborative Design and Simulation: Extended Life Optimization for M1 Abrams Tank Road Arm," *Mechs. of Machines and Structures* 27 (4): 423-52, 1999.

Ju YS, Kurabayashi K, Goodson KE. "Thermal Characterization of Anisotropic Thin Dielectric Films Using Harmonic Joule Heating," *J. Thin Solid Films* 339 (1-2): 160-64, 1999.

Khan A, Ceglarek DJ, Shi J, Ni J, Woo TC. "Sensor Optimization for Fault Diagnosis in Single Fixture System: A Methodology," *Trans. ASME, J. Mfg. Sci. and Engrg.* 121 (1): 109-17, 1999.

Koh CKH, Shi J, Williams WJ, Ni J. "Multiple Fault Detection and Isolation Using the Haar Transform—Pt. 1: Theory," *ASME J. Mfg. Sci. and Engrg.* 121 (2): 290-94, 1999.

Koh CKH, Shi J, Williams WJ, Ni J. "Multiple Fault Detection and Isolation Using the Haar Transform—Pt. 2: Application to the Stamping Process," *ASME J. Mfg. Sci. and Engrg.* 121 (2): 295-99, 1999.

Koren Y, Heisel U, Jovane F, Moriwaki T, Pritschow G, Ulsoy AG, Van Brussel H. "M Reconfigurable Manufacturing Systems," *CIRP Annals (Mfg. Technol.)*, 48 (2): 527-40, 1999. (As presented at the 49th General Asmbly, Col. Intl. pour l'Étude Scientifique des Techniques de Production Mecanique.)



Diann E. Brei



Dariusz (Darek) J. Ceglarek



Debasish (Deba) Dutta



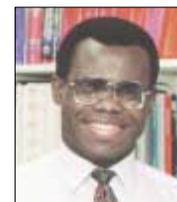
William J. Endres



Donald E. Geister



S. Jack Hu



Elijah Kannatey-Asibu, Jr.



Yoram Koren, PE



Sridhar Kota



Katsuo Kurabayashi



Robert G. Landers



Hank Lenox, PE

KEY TO ACRONYMS USED:

PLEASE REFER TO THE APPENDIX ON PAGE 52.

KEY TO ABBREVIATIONS USED:

jt.— joint
adj.— adjunct
emer.— emeritus



Liwei Lin



Mostafa (Moses) G. Mehrabi



Nestor F. Michelena



Jun Ni



Panos Y. Papalambros



Zbigniew J. Pasek



Kazuhiro (Kazu) Saitou



Shawn Sarbacker



Steven J. Skerlos



Derek Michael Yip-Hoi



Jingxia Yuan



Hongyan Zhang

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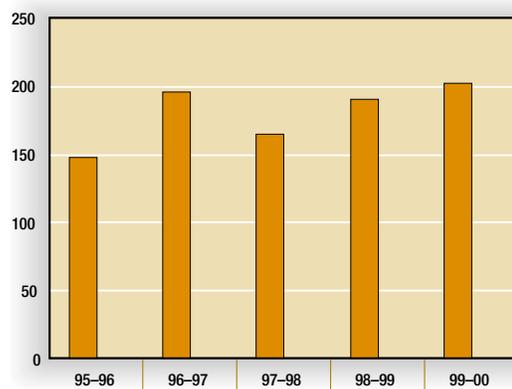
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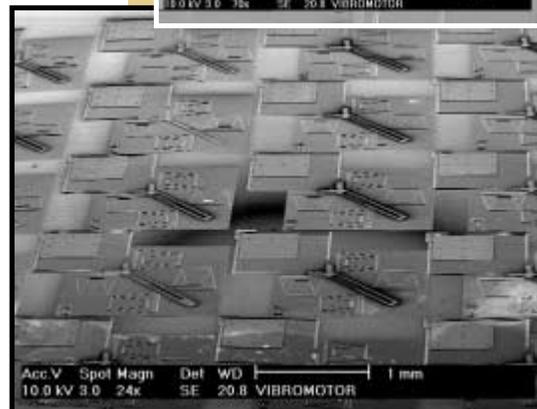
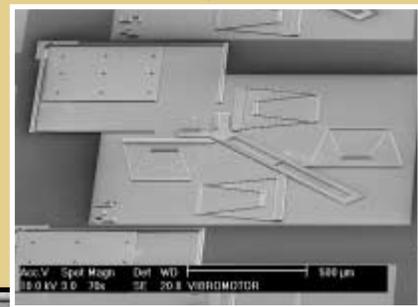
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SAITOU DEVELOPS BULK ASSEMBLY OF MICRO-SCALE COMPONENTS IN MEMS

MEAM Assistant Professor Kazuhiro (Kazu) Saitou is currently working to develop the foundation for a novel assembly/disassembly method of micro- and meso-scale components. His investigations involve a combination of vibratory palletization for gross positioning and on-substrate micro-mechanical linear micromotors for fine positioning and positive fastening. The micro-assembly device shown here uses external ultrasonic vibration to facilitate vibratory palletization and overcome electrostatic sticking among components. A micromechanical linear vibromotor is activated by selectively resonating micro-cantilever beam impactors. The research aims to demonstrate the potential effectiveness of bare-chip interconnection as a method for multi-chip module (MCM) assembly and disassembly. A digital movie of the prototype in motion can be viewed at <http://www-personal.engin.umich.edu/~kazu/mems.htm>. Professor Saitou is also a visiting researcher at the University of Tokyo's Molecular Computer Project.



DYNAMICS, SYSTEMS AND CONTROLS

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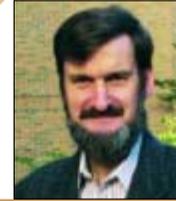
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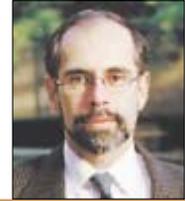
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Robert D. Ervin



R. Brent Gillespie



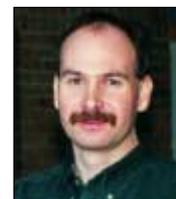
Thomas D. Gillespie, PE



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Loucas S. Louca

KEY TO ACRONYMS USED:

PLEASE REFER TO THE APPENDIX ON PAGE 52.

KEY TO ABBREVIATIONS USED:

jt.— joint
adj.— adjunct
emer.— emeritus



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Zheng-Dong Ma



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Nicolae (Nick) V. Orlandea



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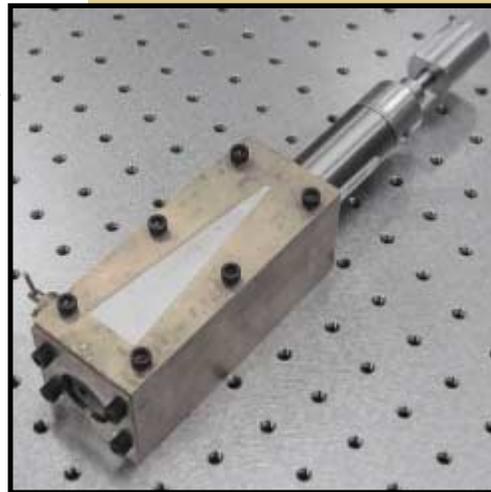
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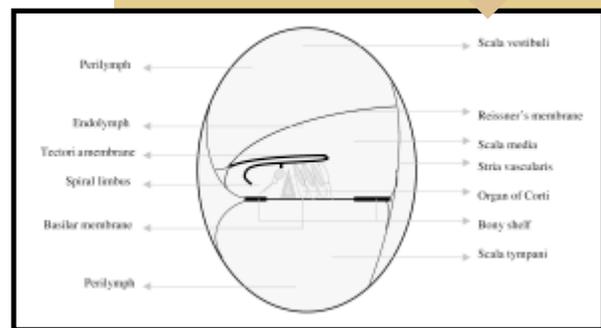
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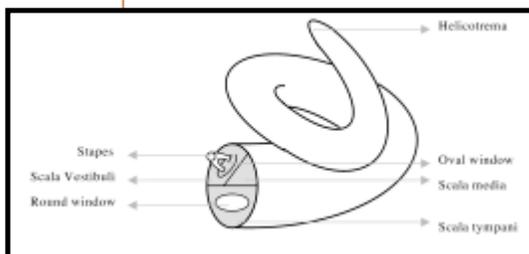


GROSH'S COCHLEAR MECHANICS AND BIOMIMETICS RESEARCH

Through research funded by an Office of Naval Research (ONR) Young Investigator Award and a NSF Career Award, Assistant Professor **Karl Grosh** is adapting the evolutionary design of the mammalian inner ear or cochlea to develop novel engineering devices. If he can match even a portion of the amazing sensitivity and dynamic range of mammalian hearing, his work could revolutionize transducer design. Closely linked with this biomimetic engineering device design is Grosh's research in cochlear mechanics. In an National Institutes of Health (NIH)-funded project focused on the biomechanics of hearing, he is seeking to better understand the micro- and macro-mechanical response of the cochlea, the central hearing organ. The image below shows a radial cross section of the cochlea and its complex microstructure.



At left is a schematic of the cochlea, where roughly 3,000 sensory cells and nearly 10,000 active force-generating outer hair cells necessary for normal hearing are embedded in a package one-fifth the size of a thimble. Large-scale computational tools are used to investigate the macroscopic response of the cochlea to acoustic and electric stimulation. Working with physiologists, **Grosh is seeking to quantify the contributions of outer hair cells to the hearing process.**



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Faculty Numbers Comparison

	Full Professors	Associate Professors	Assistant Professors	Total Professors
University of California, Berkeley	40	10	1	51
Georgia Institute of Technology	33	25	14	72
Massachusetts Institute of Technology	35	14	12	61
Purdue University	28	17	9	54
Stanford University	28	10	7	45
University of Illinois at Urbana-Champaign	18	13	12	43
University of Michigan	24	15	15	54

Engineering Index (EI) Publications per Faculty Comparison

EI number reflects the career average of total publications per faculty member (1970–present).

	Average Number of Publications in EI			
	Full Professors	Associate Professors	Assistant Professors	All Professors
University of California, Berkeley	74	23	28	63
Georgia Institute of Technology	58	1	17	41
Massachusetts Institute of Technology	70	41	9	52
Purdue University	57	26	10	39
Stanford University	58	27	12	44
University of Illinois at Urbana-Champaign	57	25	12	34
University of Michigan	82	32	10	48

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MATERIALS AND SOLID MECHANICS

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KEY TO ACRONYMS USED:

PLEASE REFER TO THE APPENDIX ON PAGE 52.

KEY TO ABBREVIATIONS USED:

jt.— joint
adj.— adjunct
emer.— emeritus

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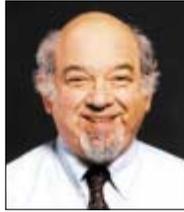
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KEY TO ACRONYMS USED:
PLEASE REFER TO THE APPENDIX ON PAGE 52.

KEY TO ABBREVIATIONS USED:

jt.— joint
adj.— adjunct
emer.— emeritus

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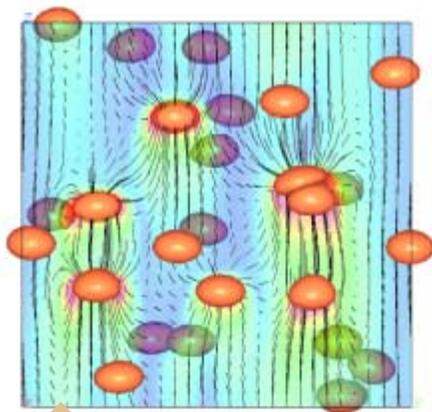
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APPENDIX: ACRONYMS KEY

The following key defines the acronyms used in the Presentations and Publications sections of this annual report.

AAM	American Academy of Mechanics	-ICE	Internal Combustion Engine	ICMF	International Conference on Multiphase Flows <i>And its division:</i>
AAPMR	American Academy of Physical Medicine and Rehabilitation	-MAT	Materials	-ISC	International Scientific Committee
ABA	American Bar Association	-ME	Manufacturing Engineering	ICS	International Continence Society
ACC	American Control Conference <i>[sponsored jointly by AIAA, AiChE, AISE, ASCE, ASME, IEEE, ISA and SCS.]</i>	-MEMS	Micro-Electro-Mechanical Systems	IEEE	International Institute of Electrical and Electronics Engineers, Inc. <i>And its division:</i>
ACM	Association of Computing Machinery	-NCA	Noise Control and Acoustics	-CSS	Control Systems Society <i>And its conferences:</i>
ACS	American Chemical Society	-ND	Nonlinear Dynamics	-EMBS	Engineering in Medicine and Biology
AGS	American Gerontological Society	-P	Petroleum	-ISCAS	International Symposium on Circuits and Systems
AIAA	American Institute of Aeronautics and Astronautics	-PVP	Pressure Vessels and Piping	IESET	Institute for Environmental Sciences, Engineering, and Technology
AIAS	Italian Association for Stress Analysis <i>[Non-English acronym]</i>	-TRIB	Tribology	IFAC	International Federation of Automatic Control
AIP	American Institute of Physics	AUGS	American Urogynecology Society	IIE	Institute of Industrial Engineers
AISI	American Iron and Steel Institute	AWS	American Welding Society	IMechE	Institute of Mechanical Engineering (U.K.)
ANS	American Nuclear Society	BMES	Biomedical Engineering Society	IMSL	Integrated Manufacturing Systems Laboratory
ARC	Automotive Research Center	CAD	Computer-Aided Design	ISSMO	International Society of Structural and Multidisciplinary Optimization
ASA	Acoustical Society of America	C Eng	Certified Engineer (British)	ITSA	Intelligent Transportation Society of America
ASB	American Society of Biomechanics	CIRP	International Institution for Production Engineering Research <i>[French acronym]</i>	JSME	Japanese Society of Mechanical Engineers
ASCE	American Society of Civil Engineers <i>And its division:</i>	CLAIM	Center for Laser-Aided Intelligent Manufacturing	LACEA	Laser Applications for Chemical and Environmental Analysis
-EM	Engineering Mechanics	CoE	College of Engineering	LIA	Laser Institute of America <i>-And its division:</i>
ASEE	American Society for Engineering Education	ERC/RMS	NSF Engineering Research Center for Reconfigurable Machining Systems	-ICALEO	International Conference on Application of Lasers and Electro-Optics
ASME	American Society of Mechanical Engineers <i>And its conference:</i>	FSMER	Federation of Sports Medicine, Exercise and Rehabilitation	MBA	Michigan Bar Association
-IMECE	International Mechanical Engineering Congress and Exposition	GSA	Gerontological Society of America	MEAM	Department of Mechanical Engineering and Applied Mechanics
<i>And its divisions:</i>		GSU	Galatasaray University, Istanbul, Turkey	MIT	Massachusetts Institute of Technology
-AM	Applied Mechanics	IACM	International Association for Computational Mechanics	MR	Magnetic Resonance
-BE	Bioengineering	IAESTE	International Association for the Exchange of Students for Technical Experience	MRS	Materials Research Society
-DE	Design Division	IAVSD	International Association of Vehicle System Dynamics	NAC	National Automotive Center
-DETC	Design Engineering Technical Conference	ICAMT	International Conference on Advanced Manufacturing Technology	NAE	National Academy of Engineering
-DSC	Dynamic Systems and Control	ICLASS	International Conference on Liquid Atomization and Spray Systems		
-FD	Fluid Dynamics				
-FE	Fluids Engineering				
-HT	Heat Transfer				