

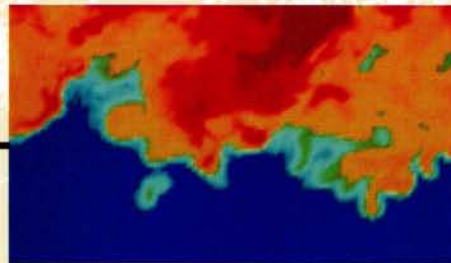
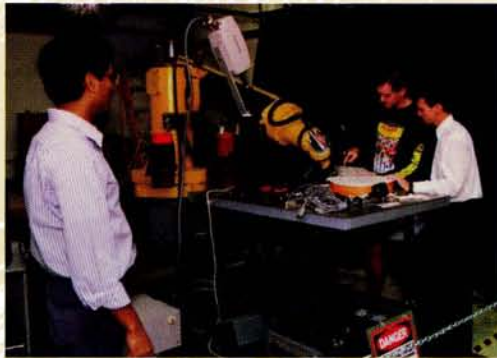
1996-97



Annual Report

The Department of
*Mechanical Engineering and
Applied Mechanics*

University of Michigan College of Engineering





A Message from the Chair

Last century, Cardinal John Henry Newman, founder of the Catholic University of Dublin, proposed the definition of the ideal university that became an instant and sustained success. In Newman's definition the university is a place where the pursuit of knowledge and truth takes place for its own sake, separated from mankind's daily necessities. It is not surprising then that the advent—some have called it the intrusion—of corporate jargon into academic institutions in recent years has been applauded in some quarters and vilified in others.

While discussing the lack of research into certain geometry problems in Plato's Republic, Socrates argues: "There are two causes of that; first, inasmuch as no city holds them in honour, these inquiries are languidly pursued owing to their difficulty. And secondly, the investigators need a director, who is indispensable for success and who, to begin with, is not easy to find, and then, if he could be found, as things are now, seekers in this field would be too arrogant to submit to his guidance." Of course, Plato was the director of his Academy.

So against this backdrop, our Department developed a three-year Planning Document in 1993 that included principles as well as numbers. Unexpectedly, the document was not forgotten, and this past year we spent a fair amount of effort and time revisiting what we said three years before, checking what happened against our expressed goals. Then, we even went ahead and revised this document for yet another three years, to take us to year 2000. An ever changing draft, to be sure.

This exercise is the main theme in the present annual report. Its value is not the numbers or the statements themselves but the fact that all the constituents of the Department—students, faculty, staff, alumni, friends and employers—had a chance to ponder and debate what we all collectively strive for, in addition to our individual efforts and aspirations; to agree on what is common to us all and to celebrate the differences. I welcome you to share in this exercise along with us.

With best regards,

*Panos Y. Papalambros
Professor and Chair*

1996-97

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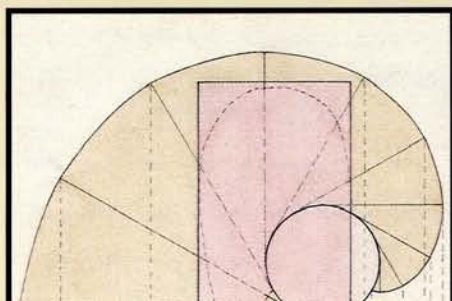
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Ernest H. Jacobs.

Within this publication are drawings by Mechanical Engineering alumnus Ernest H. Jacobs. They are part of a collection of his student work during the 1890s under Professor Charles Simeon Denison. The Department would like to thank his son, Dr. Eugene C. Jacobs, for allowing us to share these with you.

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Ernest H. Jacobs, c. 1897

Toward the Next Millennium

Educating engineers to thrive in a fast-paced, technology-rich global marketplace.

Blurring traditional engineering boundaries through ground breaking, multidisciplinary research.

Helping to shape the profession and to make the world a better place to be.

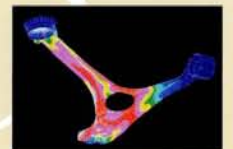
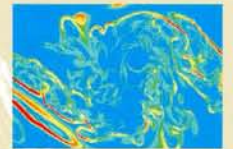
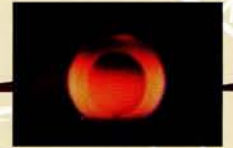
Dreaming the unexpected and making it possible.

As the world we live and work in continues to change dramatically, the University of Michigan (U-M) Department of Mechanical Engineering and Applied Mechanics (MEAM) stands poised to greet the next millennium.

With a concrete planning document firmly in place, and momentum from many new initiatives, MEAM is moving toward the year 2000 with great strength and anticipation.

While MEAM has already made significant changes in the past few years—the addition of many nationally renowned faculty members, the influx of millions of dollars of prestigious new research funding, to name just two—the 1996-97 academic year was a time of continued planning and development. With many new resources now in hand, we're focusing on using these resources to achieve the best possible quality in all our activities.

MEAM—with extensive input from faculty, staff, students, and External Advisory Board members—undertook an important process this year to review the Planning Document developed for 1993-1996, assess its impact on our progress, and look to the future. The result is a revised plan to take MEAM to the next century—and beyond.



Like most plans, MEAM's 1997-2000 Planning Document is a guide. Its greatest feature is that it is a flexible, living document that depicts a Department unified in its direction but fluid enough to adapt as opportunities and challenges present themselves.

Our goal continues to be to achieve recognition as the best mechanical engineering program at a public university in the nation. MEAM has already experienced some outstanding successes. Most notably, for the past two years, U.S. News and World Report ranked MEAM's Graduate Programs fourth in the country.

This annual report highlights MEAM's achievements for 1996-97, especially those that mark our path to the 21st century. As you read this report, you'll not only learn about MEAM's accomplishments for the year, but our exciting, bold plans for the future.

MEAM is a Department on the move. We're moving toward the next millennium with deliberation, determination, and a deeply rooted commitment to excellence and discovery.

The MEAM Planning Document 1997-2000

Striving to be the very best in research and academics

*MEAM'S mission is to serve society and all its members by:
(i) providing the highest quality benefits emanating from the discovery and communication of knowledge on mechanical engineering theory and practice; (ii) developing leaders of high achievement in the global world of higher education, research, and industry.*

During 1996–97, MEAM updated its 1993–1996 *Planning Document*, creating a new plan for 1997–2000 to take the Department into the next century. The *Planning Document* is a road map that charts MEAM's future in the areas of academics and research—with an overall strategic goal to be recognized as one of the top three departments in the country.

By reaching the top three, MEAM can attract the very best—students, faculty, staff, business, industry and government partners, university collaborators, and research funding. The goal is not the ranking itself, but the process for fostering excellence and creativity in learning and research.

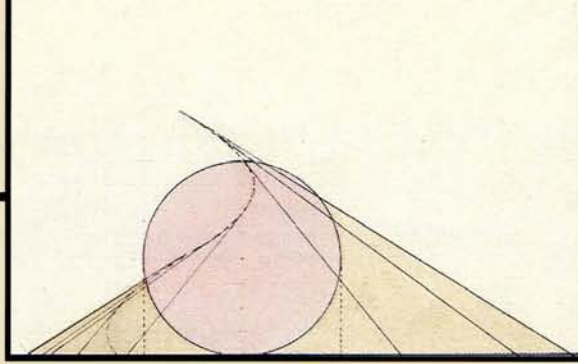
The Department has a standing Planning Committee, which includes faculty, administration, staff, and a student representative. This group, charged with crafting the new document, wrote a new draft plan, which was then circulated to the Department's key stakeholders: the faculty, the students—through our Mechanical Engineering Student Leader Board (MESLB), the External Advisory Board (EAB), and the support staff. Their comments were reviewed and integrated into the *Planning Document*.

MEAM faculty were especially involved in the creation of the updated *Planning Document*. They met at a special faculty retreat and more than half of the faculty had direct input into the written text, including the “research” and “faculty” sections.

MEAM's 1997–2000 *Planning Document* is far-reaching, detailing specific tactical goals for improving curriculum, including our undergraduate and graduate programs, faculty, research, development and outreach, facilities, and support staff. All of these goals are based on a common vision and set of values for the Department shared by all.

MEAM has undergone tremendous change during the past five years. The previous *Planning Document* has given shape and context to these changes, while the planning process has drawn members of the MEAM family closer together. Developing this true team effort is central to MEAM's competitive advantage.

With the 1997–2000 *Planning Document*, MEAM has clearly charted its course, pioneering new territory in a changing global environment. As the Department moves confidently into the future, it remains steadfastly committed to its pursuit of academic scholarship and intellectual curiosity.



This elegant spiral form from Ernest Jacobs' collection is a synergy of hard-edged basics and sinuous energy. A creative blend of rock-hard science and creative inspiration describes the Department's course *toward the next millennium.*

Shared Values

- Collaboration and teamwork
- Creativity and willingness to take risks
 - Diversity
 - Excellence in scholarship
- Indisputable leadership in automotive and manufacturing engineering
 - Public consciousness and good citizenship
- Relevance and positive impact on the world around us

Strategic Goal

To be recognized as one of the top three mechanical engineering and applied mechanics departments in the nation, as reflected by excellence in both our research and our educational activity at all levels.

Competitive Advantage

The national and international working environment for academics that will continue to prevail during the next 10 years will require a true team effort by university faculty to take strategic advantage of research, educational, and funding opportunities. The MEAM faculty by established tradition, intellectual affinity, conviction, and training continue to be well positioned to compete successfully in this new environment.

The MEAM External Advisory Board Helps Shape Department's Future

An interview with Chair Kenneth K. Kohrs

Under the leadership of Kenneth K. Kohrs (MSE, ME '66), MEAM's External Advisory Board (EAB) has played an instrumental role in the development of the 1997–2000 *Planning Document*. Its input and support have significantly helped guide the Department in its efforts to create a plan that is timely and meaningful.

During the year, the Board held focus groups with faculty, administration, support staff, and graduate and undergraduate students about the *Planning Document*. Board members then reflected on their findings, offering a series of recommendations to the Department.

Kohrs, chair of the EAB since its inception in 1993, is vice president of the Large and Luxury Car Vehicle Center for Ford Motor Co. in Dearborn, Michigan. He has been a member of the College of Engineering (CoE) National Advisory Committee (NAC), the Engineering Campaign Executive Committee, and Ford's designated U-M liaison since 1989.

Here, Kohrs talks about MEAM's *Planning Document* and the Board's involvement in the strategic planning process.



U-M MEAM CPO / Rodney Hill



"The Planning Document is important because it establishes the future direction of the Department. It also identifies new faculty who must be hired to achieve MEAM's goals. For MEAM to become one of the top three departments in the country, it needs to focus on—and become the best in—a few key areas. This excellence can be accomplished by nurturing existing faculty and by hiring outstanding new faculty."

George S. Springer
Member,
MEAM External Advisory Board;
Paul Pigott Professor of
Engineering and Chair,
Department of Aeronautics and
Astronautics,
Stanford University

MEAM: Why is the *Planning Document* important to MEAM?

Kohrs: For any organization to move forward and stay competitive, whether academic or industrial, it must have a well-thought out strategy and communicate that strategy to the people who will be most affected by it. MEAM has a very aggressive goal to be ranked consistently as one of the top three programs nationally. MEAM must plan, stretch, develop, and achieve a competitive advantage among peer institutions. In industry, a strategic planning approach is how we operate and grow.

MEAM: The Department has undergone tremendous change in the past several years, with the addition of new faculty and research dollars as well as curriculum changes. How have these changes positioned MEAM for the future?

Kohrs: Under the leadership of Department Chair Panos Y. Papalambros, and with a clear goal to be among the very best in the nation, the Department has revamped its undergraduate program, recruited and retained the best master's and doctoral candidates, and set a clear target to excel in teaching and research. To rise to a leadership position, you must invest heavily in people, new processes, and new ways of thinking and doing business. By following the *Planning Document* and striving to improve—with an emphasis on academics, research, and communication—MEAM is well positioned for the future.

MEAM: In light of these changes, what are MEAM's strengths and what challenges does it face?

Kohrs: MEAM's major strengthenings from 1992 to the present are the growth in the number and quality of master's and doctoral candidates, growth in research funding and endowed fellowships, and a better balance between



The MEAM External Advisory Board, 1996–1997:

(clockwise from front) Panos Y. Papalambros, Professor and Chair, MEAM; Kenneth K. Kohrs, (EAB Chair) Vice President, Ford Motor Co.; Eugene A. DeFouw, President, DeFouw Corp.; Roger L. McCarthy, Chairman of the Board, Failure Analysis Associates, Inc.; Jay Schultz, Director of Technology, World Wide Automotive, Alcoa; Richard T. Heglin, President and CEO, Leybold Vacuum Products; George S. Springer, Paul Pigott Professor of Engineering and Chair, Department of Aeronautics and Astronautics, Stanford University; Hugo Pomrehn, Vice Chairman, American Technologies Group, Inc.; Robert J. Buckler, Executive Vice President, The Detroit Edison Co.; James G. Samra, Metal Fabrication Engineering, Texas Instruments. Not pictured, Carroll J. Haas, Sr., Chairman of the Board, Colonial Engineering, Inc.; Hank Lenox, Director, Ford Production System and Process Leadership, Ford Motor Co.; John Psarouthakis, Founder and Chairman, JPE, Inc.



U-M MEAM GPO / Rodney Hill

undergraduate and graduate enrollment. The Department also has a strong history of excellence in research. MEAM’s reputation, combined with its plan for the future, is one of its strongest attributes.

By its very nature, the Department’s change brings some challenges with it. In industry, organizations that make significant changes, must pause and let that change settle in and become common practice. In addition, many of MEAM’s goals will require extended effort by faculty beyond their previous responsibilities. Another challenge will be the Department’s ability to communicate how it is succeeding in accomplishing its goals. Finally, MEAM’s goals must be consistent over time if it is going to be the best.

MEAM: What role does the EAB play in MEAM’s strategic planning process and ability to fulfill its goals?

Kohrs: The External Advisory Board, as the name implies, should play a strong support role, principally to the Department Chair, but also to the faculty as well. The EAB has been a sounding board for the Department Chair to test the *Planning Document*, to offer innovative approaches as might be done in industry, and to support key elements of the plan. For example, the Board is working with the U-M Business School to devise and implement a plan to externally market MEAM’s strong attributes.

MEAM: You have been EAB Chair since it was formed. What is the biggest change you’ve seen in MEAM since then? What are the changes you’ve seen in the EAB? What has been the Department’s greatest strength?

Kohrs: One of the most apparent changes is a much younger faculty with new ideas working side by side with more senior faculty. There is more openness and a willingness to discuss and debate future strategy. There is also a greater sense of team work to achieve Department goals.

The EAB has changed, too. When I first started on the Board, it was highly oriented to Michigan and the automobile industry. Since then, it has expanded to its maximum size of 12, gone literally coast to coast in representation, and

(continued on next page)



"The External Advisory Board plays a role in the planning process by offering good suggestions and ideas. We give input based on what works in our companies. We're another set of eyes and ears to look at what's being planned. It makes the Planning Document richer and more practical."

Robert J. Buckler
Member,
MEAM External Advisory Board;
Executive Vice President,
Detroit Edison

now has members from both industry and academia. We have active Board members who put in their own time to help MEAM. We enjoy and encourage different viewpoints. I also believe that the Board is viewed by the faculty as a group of individuals who are interested in MEAM's success and supportive of the changes now taking place.

One of the strengths in the College, and in particular in MEAM, is the tremendous emphasis on mechanical engineering fundamentals complemented by a willingness to expand the linkage with other engineering disciplines. This focus on fundamentals, with a willingness to try new things, really multiplies the Department's effectiveness.

MEAM: What is your vision for MEAM in the year 2000? Will MEAM be prepared to graduate students who have the skills to work in a global, technologically-rich marketplace?

Kohrs: My vision would be to see MEAM realize the metrics outlined in the *Planning Document*. My hope is that we would meet these targets—that undergraduate education continues to be one of the best in the nation and that our graduate program would be attracting the very best candidates in the nation.

Industry is evolving very rapidly. As a result, the expectations of new graduates from the University at all levels continue to expand. There's virtually no job that doesn't emphasize cross-discipline teamwork, evolving computer simulation, and new processes in manufacturing and design. We want our graduates from the U-M to step in and accept continuous change as a standard course. I am confident that if we achieve the goals in the *Planning Document* MEAM will graduate students for either academia or industry who will be the best in the world.



U-M MEAM CPO / Rodney Hill



U-M MEAM CPO / Shekinah Errington

1996-97 Mechanical Engineering Student Leader Board: (above) Front Row-Greg Zonca, Mike Bailey, Angela Cottingham, J.W. Rossow, Cathy Ruf. Back Row-Anna L. Babbitt, Jon Bixler, Dave Messih, Melanie Leitzel, Jennifer Liedtke.

Top center-MEAM's Learning Center is open 24 hours a day. Left-Students enjoy a lighter moment at the weekly MEAM TEAM Coffee Machine.



U-M MEAM CPO / Rodney Hill



Creating Partners for the Future

MEAM reaches out and builds base of support

Building a strong sense of family within MEAM and reaching out to form new partnerships and alliances are important ways that MEAM is solidifying its support for the future. Through a variety of development and communications activities, MEAM devoted a lot of time and resources during 1996–97 to support the culture change taking place within the Department and to strengthen and expand its ties with alumni and industry/university partners.

As MEAM makes extensive curricular changes to meet the challenges of an evolving profession, it is crossing traditional boundaries—from team teaching within the Department, to new joint master's degrees with other engineering disciplines, to broadening relationships with Pacific Rim universities to attract new students to U-M.

During 1996–97, the Mechanical Engineering Student Leader Board (MESLB) continued to develop. The group, which meets weekly, serves in an advisory capacity to the Department Chair and works to foster cooperation among its student groups, administration, and faculty. It is comprised of the presidents and/or representatives of MEAM's student organizations and the Department's administrative associate. The MESLB also established group e-mail addresses for all undergraduate and graduate students, making it the first time a mechanism was available to reach all students at the same time.

MEAM has continued the MEAM TEAM Coffee Machine, an informal weekly gathering hosted by the MESLB to which all faculty, undergraduate and graduate students, staff, and visitors are invited to attend. MEAM and the MESLB also established the Learning Center, a room that is open 24 hours a day where undergraduate and graduate students can meet or study, either alone or in groups.

The Department has also continued to expand its publication program, with MEAM's newsletter *Mechanica* now distributed to all donors, alumni, faculty, staff, business leaders and partners, students, and parents of undergraduate students. The World Wide Web (WWW) has emerged as an important medium for MEAM. This year, MEAM continued to refine its own Web pages, adding the Department's publications to its on-line resources.

Development and fundraising activities have continued to grow as well, advancing the educational and research agenda of the Department. MEAM's endowed accounts have increased from two to seven since 1992, and the Department is working to establish additional endowed accounts. MEAM has received increased donations to the Department through annual giving efforts.

MEAM has reached out to other constituents as well by participating in special activities for minority high school students. The Detroit Area Pre-College Engineering Program (DAP-CEP) gets students excited about science and engineering by introducing them to aspects of manufacturing. MEAM also has extensive involvement with Focus: HOPE, which offers nontraditional high school students an opportunity to receive associate or bachelor degrees. Students attend classes at Focus: HOPE and work at its Center for Advanced Technology, a machine tool training facility. Through the Greenfield Coalition, which is comprised of six Michigan university partners, several MEAM faculty members help develop course curriculum and many MEAM students serve as tutors.



A rendering study involving the juxtaposition of various simple forms, by Ernest H. Jacobs, 1897.

MEAM Graduate Programs Receive Major Recognition

When students attend MEAM's Graduate Programs, they discover a unique balance of rigorous fundamentals, multidisciplinary research, and engaging real-world applications that allow them to be analytical thinkers who successfully integrate and synthesize theory and new knowledge.

As MEAM strives to set these new standards in mechanical engineering, the Department's graduate programs are already receiving significant recognition. For two years in a row, our program was ranked fourth in the nation by *U.S. News and World Report* (March 18, 1996, and March 10, 1997). MEAM was also selected to receive Rackham fellowship funds that were awarded to only 15 percent of all U-M programs.

In Fall 1996, MEAM enrolled 409 graduate students—178 were in the Master of Science program, 202 were in the doctoral program, and 29 students were in the Master of Automotive Engineering program. In addition, there were 45 students in the CoE's Master of Engineering in Manufacturing program, which has strong ties with MEAM.

MEAM's long-term strategy is to moderately increase the size of the overall graduate program while improving quality. One area targeted for growth is our student population in the Master's programs, particularly in the professional Master of Automotive Engineering degree program.

"Our highest priority is recruiting very high quality PhD and master's students," says Professor Christophe Pierre, graduate program chair. "We already have some truly outstanding students, and we want to continue our momentum in attracting top level students. This is critical to the continued quality of our graduate education and research programs."



U-M MEAM CPO / Shekinah Errington

"MEAM's graduate program is one of the top five in the country and the Fluid Mechanics area is very strong. The University also has excellent research facilities and its computing facilities are among the best in the country."

Judy Che,
MEAM PhD student

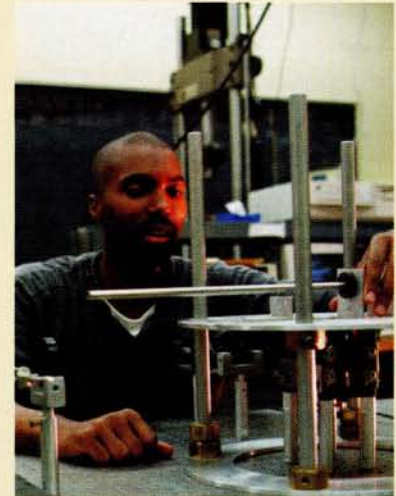
Goal: To achieve recognition as one of the top three graduate programs in Mechanical Engineering in the nation, in terms of both research and education.



During 1996–97, MEAM began several new efforts aimed at continuing to improve both the educational curriculum and applicant pool:

- Development of a well-defined, systematic process for application review, with increased emphasis on financial aid offers for PhD-bound students and communication with potential students as early as possible in the application process.
- Expansion of the master's program to include a restructured graduate curriculum in which paths of study are created for individual disciplines. Design and Dynamics/Vibrations were the first areas to complete these changes, with other disciplines to be gradually implemented.
- Increase in involvement by MEAM faculty, graduate students, and alumni to make personal contact with potential students and continuously promote the Graduate Programs.
- Development of a strategic marketing campaign to reach potential students, including advertising, career fairs, a new *MEAM Graduate Programs Handbook* and poster, a Web page, and broadening ties with other universities and colleges.
- For the first time, a prospective graduate student weekend for 35 of the top students in the country in Spring 1997—with more than 40 percent of those attending accepting admission. Nearly all of the remainder accepted admission to one of the other top five mechanical engineering graduate programs in the nation, an indication of the high caliber of these students.

MEAM's initiatives to improve the Graduate Programs will evolve over time. "With extensive input from faculty and students, we have developed many ambitious ideas to take our curriculum and recruitment efforts to the next level," says Pierre. "This will ensure that we maintain—and improve—the quality of our graduate program."



U-M MEAM CPO / Shekinah Errington

"I was drawn to the University of Michigan by its excellent ranking, emphasis on hands-on research, and well-known faculty. MEAM has tremendous resources, facilities, and connections to industry."

Paris von Lockette,
MEAM PhD student

Master of Engineering Degree in Automotive Engineering (MEng AutoE)

Under the auspices of MEAM, the Master of Engineering Degree in Automotive Engineering (MEng AutoE) continues to be a young, dynamic program that is experiencing intensive growth and development. During 1996–97, the program had an enrollment of 29 students, with a 1997–98 projection of 42 students.

The goal of the MEng AutoE program is to develop technical leaders in automotive technology and management. It is especially designed for working engineers who cannot be away from work full time and is flexible to accommodate the needs of both full-time and part-time students. Several initiatives are underway to continue to attract high quality students in the U.S. and around the world.

After two years of planning, the program is ready to launch a new Master of Automotive Systems Engineering Degree through Ford Motor Co., with the University of Aachen in Germany, Loughborough University in the United Kingdom, and the U-M Ann Arbor and Dearborn campuses.

MEng AutoE is also working to create a joint degree program between the National University of Singapore (NUS) and the U-M that is scheduled to begin in 1998.

To meet the needs of its part-time students, the program has expanded the number of courses it offers both in the evening and through the U-M Center for Professional Development's Distance Learning Format.

MEAM Undergraduate Program Prepares Students for a Changing Workplace

When members of industry talk about the kinds of skills that engineers need to be successful in a fast-paced, global, high-tech marketplace, mechanical engineering fundamentals and application aren't the only important tools they tell you about.

They also want candidates who have extensive backgrounds in teamwork, communication skills, creative problem solving, and adapting to change. In fact, having these skills can often make the difference between a smooth transition and a bumpy one as graduates enter the work force.

With this in mind, MEAM has been working on a series of significant changes in its undergraduate curriculum over the past five years, based on the findings of a 1992 in-depth study of the undergraduate program, including surveys of faculty, students, alumni, and members of the External Advisory Board.

"We learned we are attracting a broader cross-section of students who have less hands-on engineering experience and more computer experience," says Professor Grétar Tryggvason, MEAM associate chair for planning and chair of the undergraduate curriculum revision committee. "In addition, our graduates face different challenges and demands in the world of work."

The findings led to a series of recommendations that said students should get hands-on design experience and teamwork/communication skills every semester. And rather than have students practice these skills in a limited way in every course, students should have one concentrated course each term in which to develop these skills.

As a result, MEAM created the Design and Manufacturing I, II, III sequence (ME 250, ME 350, and ME 450) and the Laboratory sequence ME 395 Thermal-Fluid Science Laboratory and ME 396 Mechanical Science Laboratory. Starting Winter 1998, these will become the ME 395 Junior Laboratory and the ME 495 Senior Laboratory. All five classes are required.

"With the design sequence, our students are better prepared to handle large industry-sponsored senior design projects, in part, because of their early exposure to design and manufacturing techniques and working in groups," says Associate Professor Debasish Dutta, a member of the Design faculty.

"The labs are devoted to the study of basic science and theory and understanding how different engineering disciplines work together," says Associate Professor Steven L. Ceccio, co-chair of the instructional laboratories committee. "They show students how book knowledge connects to real-world applications. It's important for students to have hands-on engineering experience with real engineering systems."

During 1996-97, the Department also completed work on several other study recommendations. These include:

- Restructuring the required curriculum into five integrated streams: design and manufacturing, laboratories, dynamics and controls, thermal sciences,



U-M MEAM CPO / Shekinah Errington

"ME 450 was a great learning experience—the closest I'd come to real-world application. There were lots of deadlines. We had to use common sense and apply what we had learned in theory. I especially learned to work with outside suppliers and sponsors, which is experience I use every day in my job."

Wendy Gendler, graduated April 1997, now a Chrysler supplier quality engineer

Students being timed by a teaching assistant on a ME 350 project.



U-M MEAM CPO / Shekinah Errington



and materials and structures, each consisting of two or three required courses. A planned deployment is underway.

- Repackaging the program into four-credit hour courses so students take four, four-credit hour courses per semester, making the program more coherent and easier to complete on time.
- Increasing electives to allow students to better prepare themselves for diverse career objectives.

In addition to the curriculum changes, MEAM is creating a new combined bachelor's/master's degree program, which is expected to be in place during 1997-98.

MEAM is also making efforts to improve its undergraduate student services. In Fall 1997, a new peer counseling program will be introduced in which professionally trained students are available to help other students with their course planning and career choices. The Mechanical Engineering Student Leader Board (MESLB) originally proposed the program and has been very involved in its development.

In addition, MEAM has started Web-based counseling, a homepage information resource that answers frequently asked questions about undergraduate MEAM academic requirements. The Web counseling system is expected to address routine questions, giving MEAM's academic advisors more time to address students' personal counseling needs.

"As engineering work continues to change and become even more global, MEAM must prepare students to meet the demands they will encounter once they graduate," says Tryggvason. "We've laid the foundation for significant change and once we fully make the transition, we believe our new curriculum will help them to do just that."

Undergraduate Program Mission

MEAM seeks to prepare its graduates for diverse careers in both engineering and non-engineering fields. A strong core of rigorous engineering sciences and extensive laboratory and design experience provides the necessary foundation for entry level engineering positions or further engineering degrees. The core also provides an integrated introduction to team work, communications, ethics, and environmental awareness needed to prepare the graduates for successful engineering careers and leadership positions. A program of technical electives and extracurricular activities offers the students the opportunity to deepen their technical understanding in a particular subject or obtain a broader introduction to engineering.

MEAM expects its graduates to exhibit superb engineering knowledge, outstanding problem solving skills, continue their education throughout their careers, and become leaders in their fields.



U-M MEAM CPO / Shekinah Errington

"The Design sequence courses were my favorite classes. I hope to go into product design and ME 450 was a great exercise in creativity. The most valuable part for me was learning to work on a team and interacting with other people to get the job done."

Mike Brewer, Fall '96 Pi Tau Sigma (PTS) President and current graduate student

Students work on a project in the ME 250 Student Shop.



U-M MEAM CPO / Rodney Hill

Student Societies Bring Fun, Friendship, and Leadership

During 1996–97, MEAM undergraduate and graduate students had a lot of fun taking part in the many service, academic, professional, and social activities offered throughout the year by the engineering student societies and organizations in MEAM. Students met other students, learned more about the field of mechanical engineering, helped the Department and other service organizations, and broadened what they studied in the classroom. Through these experiences, students learned valuable skills in leadership, team building, and communication.



Mechanical Engineering Student Leader Board (MESLB)

The MESLB is represented by the presidents and/or representatives of MEAM's five student organizations (ASME, Pi Tau Sigma, SAE, UMME, and GRIME) as well as at-large members from the student body. The Board's goal is to enhance the overall educational experience of MEAM students by improving communication and fostering a greater sense of community and cooperation among various student groups. The Board acts in an advisory capacity to the MEAM Chair and has a student representative on the Department's Planning Committee which determines budget allocations and makes other policy decisions. The MESLB hosts the MEAM Team Coffee Machine. It also meets with faculty members and disseminates information between the Department and the general membership of each organization. The Board sponsors the MEAM Suggestion Box in the Learning Center and the bulletin board across from the Academic Services Office (ASO). 1996–97 MESLB Members: Mike Bailey (SAE), Jon Bixler (Pi Tau Sigma), Angela Cottingham (UMME), Dan Griffin (SAE), Anthony HooSang (UMME), Chih-mao Hsieh (Pi Tau Sigma), Jennifer Liedtke (at-large), Melanie Leitzel (ASME), David Messih (SAE), Julie Reyer (GRIME), J.W. Rossow (ASME), Cathy Ruff (at-large), Greg Zonca (at-large), and Anna Babbitt, administrative associate.



American Society of Mechanical Engineers (ASME)

U-M Student Chapter

ASME's goal is to advance and disseminate the theory and practice of mechanical engineering and related fields. The society holds weekly meetings that include pizza and pop (sometimes free), important information to members, and usually guest speakers from industry. The group also coordinates student attendance at various ASME conferences, competitions, and other activities. ASME plans a variety of social events. 1996–97 Officers: J.W. Rossow, president; Michael R. McGuire/Alan Yengoyan, vice presidents; Alan Yengoyan, secretary; and Cathy Hedding, treasurer. The faculty advisor is Associate Professor William W. Schultz.



Pi Tau Sigma (ΠΤΣ/PTS)

National Mechanical Engineering Honor Society, U-M Pi Rho Chapter

Pi Tau Sigma members include juniors who rank in the top 25 percent of their class and seniors in the top 33 percent of their class as well as graduate students. PTS hosted the 1997 National Convention in Ann Arbor in October 1997. Chapter members tutor undergraduate students, sponsor a semi-annual design competition, inform members of employment opportunities, serve the Ann Arbor Hunger Coalition, sponsor a North Campus Red Cross Blood Drive, hold an Engineering Inter-Society Volleyball Tournament, and raise money by selling bratwurst on the North Campus Diag. Each term, PTS elects new officers and holds a banquet for the new initiates that features a prominent speaker and honors a Professor of the Term and an Initiate of the Term. 1996–97 Executive Officers: Mike Brewer (F96) / Chih-mao Hsieh (W97), president; Jennifer Liedtke (F96) / Brian Forster (W97), vice president; Chih-Mao Hsieh (F96) / Brandon Johnson (W97), corresponding secretary; Andrea Ryan (F96) / Jaime Roehrig (W97), secretary of affairs; and Kevin Vernagus (F96) / Scott Benigni (W97), treasurer. The faculty advisor is Professor Massoud Kaviany.

Conference Proceedings:

Bey, M.J.; Elders, G.J.; Huston, L.J.; Kuhn, J.E.; Blasler, R.B.; Soslowky, L.J.; "Creation of SLAP Lesions in a Dynamic, Biomechanical Model of the Shoulder: The Role of Inferior Subluxation," *Annl. Mtg. Orthopaedic Res. Soc.*, Atlanta, GA, Feb. 1996.

Derwin, K.A.; Soslowky, L.J.; "Tendon Fascicle Mechanical Properties: A Study Toward Elucidating Structure-Function Relationships in a Transgenic Model," *Annl. Mtg. Orthopaedic Res. Soc.*, vol. 21, Atlanta, GA, Feb. 1996.

Flanagan, C.L.; Soslowky, L.J.; Carpenter, J.E.; Thomopoulos, S.; Yian, E.H.; "A Biomechanical Investigation into the Effects of Overuse Coupled with Intrinsic or Extrinsic Modifications on Rotator Cuff Tendons," *1996 ASME Int. Mech. Engrg. Congr. and Expo.* 33:249–250, Atlanta, GA, Nov. 17–22, 1996.

Flanagan, C.L.; Soslowky, L.J.; Thomopoulos, S.; Yian, E.H.; Carpenter, J.E.; "The Effects of Overuse Coupled with Intrinsic or Extrinsic Modifications on Rotator Cuff Tendons," *Annl. Mtg. Orthopaedic Res. Soc.*, Atlanta, GA, Feb. 1996.

Kuo, A.D.; "Adaptive Sensorimotor Control of Posture," *Case Western Reserve Univ. Biomedical Engrg. Sem.*, Cleveland, OH, 1996.

Kuo, A.D.; "A Model for Optimal Sensory Integration and Control of Posture," *Vestibular Compensation Satellite Mtg., Barany Soc.*, Sydney, Australia, 1996.

Kuo, A.D.; "Beyond Bi-Articular Muscles: The Distribution of Forces Between Multi-DOF Muscles," an invited paper at the *Amer. Soc. of Biomechanics, Satellite Workshop*, Atlanta, GA, 1996.

Kuo, A.D.; "Sensorimotor Control of Posture," *NASA Johnson Space Ctr. Neural Control Sem.*, Houston, TX, 1996.

Kuo, A.D.; "Stability and Control of Passive Locomotion in 3-D," *Engrg. Foundation Conf.*, Mt. Sterling, OH, 1996.

Kuo, A.D.; "Stability and Control of Passive Walking in 3-D," *Cornell University Theoretical & Appl. Mech. Sem.*, Ithaca, NY, 1996.

Kuo, A.D.; Speers, R.A.; Peterka, R.J.; Horak, F.B.; "Altered Sensory Conditions Induce Multivariate Changes in Postural Sway," *Barany Soc. Mtg.*, Sydney, Australia, 1996.

Soslowky, L.J.; Carpenter, J.E.; DeBano, C.M.; Banerji, I.; Moalli, M.R.; "Mechanisms of Rotator Cuff Tendinosis in an Animal Model," *Annl. Mtg. Amer. Acad. of Orthopaedic Surgeons*, Atlanta, GA, Feb. 1996.

Soslowky, L.J.; Carpenter, J.E.; Flanagan, C.L.; Thomopoulos, S.; Yian, E.H.; "Effect of Overuse Coupled with Intrinsic or Extrinsic Modifications on Rotator Cuff Tendons," *Annl. Mtg. Amer. Shoulder and Elbow Surgeons*, vol. 3, Amelia Island, FL, Oct. 1996.

Speers, R.A.; Kuo, A.D.; Peterka, R.J.; Horak, F.B.; "Multivariate Measures of Postural Sway under Altered Sensory Conditions," *Soc. for Neuroscience Abstracts* 641 (13), Washington, DC, 1996.

Thomopoulos, S.; Carpenter, J.E.; Flanagan, C.L.; Yian, E.H.; DeBano, C.M.; Soslowky, L.J.; "Rotator Cuff Defect Healing: A Biomechanical and Histologic Analysis in an Animal Model," *Annl. Mtg. Orthopaedic Res. Soc.*, in press, 1996.

Yang, P.P.T.; Yang, W.-J.; "Design Principle of a Filter/Reabsorber Type Bioartificial Kidney," an invited keynote presentation in *Proc. 9th Int. Conf. on Mech. in Medicine and Biology*, D. Miklavcic, T. Bajd, U. Stanic, M. Munih (eds.), 375–378, 1996.

Book Chapters:

Arnoczky, S.P.; Soslowky, L.J.; "Shoulder Anatomy: Form Reflecting Function," in *Operative Arthroscopy*, J.B. McGinty, R.B. Caspari, R.W. Jackson, G.G. Poehling (eds.), 603–624, Raven Press, New York, 1996.

Ateshian, G.A.; Soslowky, L.J.; "Quantitative Anatomy of Diarthrodial Joints," in *Basic Orthopaedic Biomechanics*, chap. 7, V.C. Mow, W.C. Hayes (eds.), Raven Press, New York, in press, 1996.

Horak, F.B.; Kuo, A.D.; "Postural Adaptation for Altered Environments, Tasks, and Intentions," an invited contribution in *Biomechanics and Neural Control of Movement*, J. Winters, P. Crago (eds.), 1996.

Montoya, J.P.; Yang, W.-J.; "Determination of Lung Dysfunction Using a Model for Gas Exchange (Theory)," in *Advances in Heat and Mass Transfer in Biotechnology*, L.J. Hayes, S. Clegg (eds.), ASME HTD-337/BED-34:31–33, 1996.

Soslowky, L.J.; Blasler, R.B.; (section eds. for "Basic Science,") in *Orthopaedic Knowledge Update: Shoulder and Elbow*, T. Norris (ed.), AAOS Press, Rosemont, IL, in press, 1996.

Combustion and Heat Transfer

Contributing Faculty: Vedat S. Arpacı, Dennis N. Assanis, Arvind Atreya, Claus Borgnakke, Michael M. Chen, David E. Cole, David R. Dowling, Zoran S. Filipi, Elijah Kannatey-Asibu, Jr., Massoud Kaviani, Ho Sung Lee, Herman Merte, Jr., Donald J. Patterson (Emeritus), Richard E. Sonntag, Grétar Tryggvason, Wen-Jei Yang.

Journal Articles:

Kudo, K.; Kuroda, A.; Tanaka, T.; Yang, W.-J.; "Effect of Support Rod on Surface-Tension Driven Convection within a Droplet," *Trans. Japan Soc. of Mech. Engrs.* 62 (594-B): 763–769, 1996.

Lee, H.S.; Merte, Jr., H.; "Hemispherical Vapor Bubble Growth in Microgravity: Experiments and Model," *Int. J. Heat and Mass Transfer* 39 (12): 2449–2461, 1996.

Lee, H.S.; Merte, Jr., H.; "Spherical Vapor Bubble Growth in Uniformly Superheated Liquids," *Int. J. Heat and Mass Transfer* 39 (12): 2427–2447, 1996.

Papageorgakis, G.; Assanis, D.N.; "An Improved Spray Breakup Model for Low Injection Pressures," *Int. Communications in Heat and Mass Transfer* 23 (1): 1–10, 1996.

Park, Y.M.; Sonntag, R.E.; "Thermodynamic Properties of Ideal Gas Air," *Int. J. Energy Res.* 20:771–785, 1996.

Park, K.; Sonntag, R.E.; Borgnakke, C.; "Generalized Volumetric Behavior of Polar and Non-Polar Refrigerants Based on a New Four-Parameter Corresponding States Principle," *Int. J. Energy Res.* 20:811–828, 1996.

MEAM's Faculty and Staff Reflect Highest Standards

As the foundation of MEAM's standard of excellence, the Department's internationally renowned group of faculty creates an academic atmosphere dedicated to learning and investigation. MEAM has worked diligently to assemble a special group of researchers and educators who are leaders in their field and deeply committed to student success and involvement.

Since 1993, MEAM has expanded to 55 faculty members and seven joint faculty, with the addition of seven new faculty members in the past two years alone. In addition, MEAM now has 12 research faculty and four joint or adjunct research scientists.

With this large influx of talent, MEAM has completed the large wave of recruitment that commenced in 1992. To keep the number of faculty in the Department steady at 55 members, MEAM plans to continue to recruit a small number of new faculty members each year.

In 1996–97, MEAM successfully recruited three faculty members in the areas of materials/solid mechanics and design/manufacturing. MEAM was pleased to welcome Robert H. Lurie Professor of Engineering Jyotirmoy (Jyoti) Mazumder, Assistant Professor Liwei Lin, and Assistant Professor Kazuhiro (Kazu) Saitou.

Attracting Women and Minority Faculty

Increasing the number of MEAM faculty members from underrepresented groups, especially minorities and women, is another important faculty goal. During 1996–97, MEAM continued to put more strategies into place to reach this goal.

MEAM faculty members are being asked to actively recruit women and minority candidates when they travel to professional conferences and give presentations at other universities.

In addition, the MEAM Advisory Committee reviews all women and minority faculty candidate files to make sure they receive appropriate attention as part of the applicant review process. The MEAM Faculty Director of Resource Development also contributes to the women and minority search process by identifying potential candidates, reviewing applicant files, and contacting potential candidates.

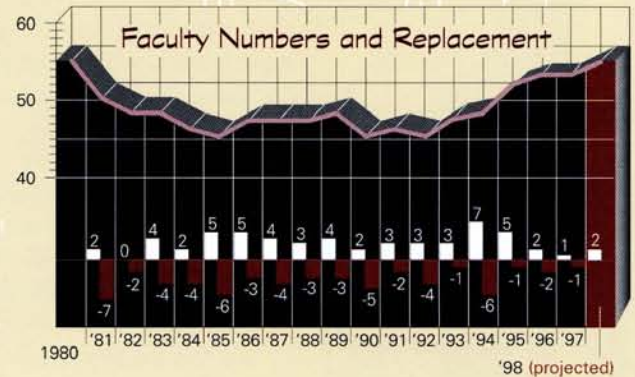


As part of ME 450 Senior Mechanical Design, Professor Rida Farouki, second from right, evaluates the Solar Car Structure team project, as graduate student instructor Jairam Manjunathaiah, far right, looks on.



Recruiting and Maintaining Faculty Leaders

Maintaining faculty leadership is an important goal of the Planning Document. Outstanding senior faculty are important role models for younger faculty, and provide leadership in team research activities. The Department would like to create at least four new endowed professorships during 1997–2000 to attract faculty of high stature or to recognize its excellent existing members.



Support Staff Reorganized to Reinforce Growth

To support the tremendous growth in MEAM, the Department has adopted a new support staff organizational structure that includes the addition of four new senior positions during 1996–97.

The goal of the new matrix organization structure is to provide dedicated expertise in finance, operations, personnel, and development/external relations to MEAM faculty and students at large as well as to new and expanding research centers.

“As MEAM’s research activities have grown in the past five years, staffing levels have not kept up. Some new federally imposed regulations have also led to the need for additional staffing,” says Douglas M. Kennedy, MEAM’s administrative manager.

“At the same time, we are also making a conscious effort to improve the quality of our support to faculty and students by becoming more customer-oriented,” says Kennedy. “To this end, we have increased our expectations of staff members, upgraded several positions, and offered additional professional development opportunities, with emphasis on communication and interpersonal skills.”

The annual summer faculty and staff tug-of-war (the staff won again).



U-M MEAM CPO / Rodney Hill

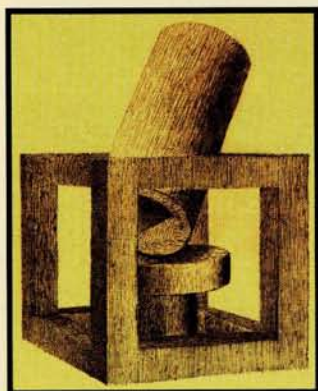


U-M MEAM CPO / Marlene Rodriguez

Facilities Expand to Keep Pace with MEAM's Growth

As MEAM's faculty has grown and research dollars have more than doubled in the past few years, the Department's need for additional classroom, laboratory, and office space has also increased significantly.

As a result, MEAM, with the support of the CoE, undertook a comprehensive evaluation and reorganization of its space resources during 1996-97. Many renovation projects were begun, with expected completion during 1997-98. The Department, through its Facilities Task Force, also began to investigate a process for determining future space allocation needs.



This project included a study of how cast shadows would appear within a complex assembly, Ernest H. Jacobs, 1897.

"One of our major long-term goals is to gradually reorganize MEAM laboratories and offices so that faculty members with common interests are located close to each other," says Professor Elijah Kannatey-Asibu, Jr., MEAM associate chair and director of laboratories and facilities. "We also are continuing to modernize our offices and laboratories."

MEAM's major facilities projects include:

New Manufacturing Complex

Through the relocation of the NSF Engineering Research Center for Reconfigurable Machining Systems (ERC/RMS), NSF Industry/University Cooperative Research Center (I/UCRC), and S. M. Wu Manufacturing Research Center (WuMRC) to the Herbert H. Dow Building, MEAM is creating a 24,000 square-foot, state-of-the-art Integrated Manufacturing Research Facility.

The ERC/RMS, I/UCRC, and WuMRC are currently headquartered in the G.G. Brown Laboratory, with research activities in laboratories in G.G. Brown and the Electrical Engineering and Computer Science (EECS) buildings. The move is expected to take place in late 1997 or early 1998.

The ERC/RMS was established in 1995-96 to develop a new type of manufacturing system, the reconfigurable manufacturing system. This future system will allow flexibility not only in producing a variety of parts, but also in changing the system itself.

The I/UCRC is a nationally recognized program that investigates the use of measurement techniques to improve quality in manufacturing. Dedicated to manufacturing research and education, the WuMRC's seven laboratories focus on dimensional measurement, machining, assembly and joining, stamping and dies, and intelligent workstations.



This artist rendering depicts the factory of the future, as envisioned by the ERC/RMS.

U-M MEAM CPO / Rodney Hill



"Since 1992, our faculty head count has grown from 45 to 55, with the estimated percentage of experimentalists growing from 51 to 67 percent. Over the same period, our research expenditures have more than doubled, and are expected to have tripled, compared to the 1991-92 figures, for the financial year 1996-97."

Facilities Section, MEAM 1997-2000 Planning Document

One of the most exciting aspects of the renovation is the construction of experimental test beds to demonstrate the technology-base of reconfigurable machining systems and how enabling technologies can be easily integrated into the system.

Walter E. Lay Automotive Laboratory

Changes throughout the Lay Automotive Laboratory have upgraded the facility for teaching and research activities for use by faculty and students.

On the first floor, offices were remodeled to house several faculty members and the technicians' office was reorganized and renovated. In addition, the "High Bay" area was refurbished to house the Instrument Shop from G.G. Brown, a newly organized Graduate Student Machine Shop, a relocated Society of Automotive Engineers (SAE) Shop, and some open space for miscellaneous use. On the second floor, two rooms were converted into a new conference room.

Engine test cells at the Auto Lab, an important research site for the Automotive Research Center (ARC), were also renovated and upgraded, with improvements in its transient testing capabilities, computerized data acquisition and control of experiments, and full combustion and emission diagnostic capabilities.

Center for Laser-Aided Intelligent Manufacturing (CLAIM)

State-of-the-art lasers are the focal point of CLAIM, allowing MEAM researchers to play a major role in the development of the emerging technology of optical engineering.

The laboratory, located in G.G. Brown, is phase one of a three-stage plan. It houses an impressive collection of lasers for use in understanding laser material interaction and applying this fundamental knowledge to manufacturing in collaboration with local, national, and international industry.

Phase one of the CLAIM Laboratory is funded by the Advanced Research Project Agency (ARPA), National Science Foundation (NSF), General Motors Corp., and the U.S. Navy.



CLAIM features state-of-the-art lasers for use in optical engineering.

U-M MEAM CPO / Rodney Hill



James A. Ashton-Miller



Arthur D. Kuo



Steven A. Goldstein



Albert B. Schultz



Scott J. Hollister



Louis J. Soslowsky

MEAM faculty perform a broad range of biomechanics research, ranging from the cellular level to the whole body level.

At the cellular level, progress has been made in using the principles of orthopaedic tissue engineering to introduce a biocompatible matrix carrying DNA into a bony defect to stimulate new bone to fill the defect. To improve the treatment of fractures and osteoporosis, and design better artificial joint implants, computational as well as in vivo biomechanical and biologic studies of bone are helping to quantify how bone responds to specific mechanical loads.

At the organ level, experimental and image-based computational micro-mechanics investigations of bone adaptation to implants and bone tissue replacements are being used for craniofacial and orthopaedic applications using rapid prototyping. Biomechanical analyses and experiments are being used to study urethral function and the underlying causes of a common form of incontinence that affects more than one-third of older women. With the goal of reducing hearing loss, hybrid finite element models are being used to study the nonlinear, and acoustic response of the fluid-loaded basilar membrane and attached structures in the human ear.

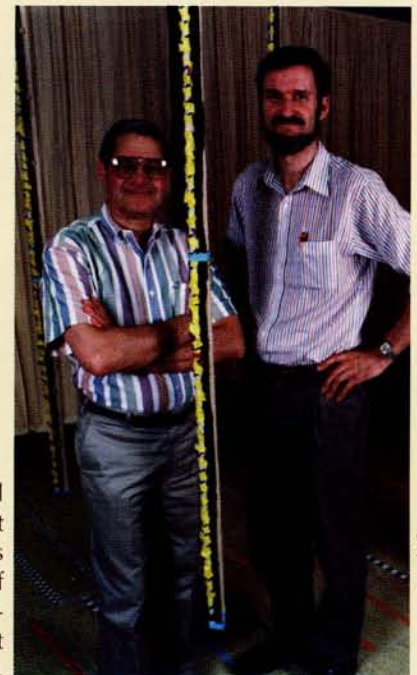
At the whole body level, biomechanical analyses are being used to understand the underlying causes of fall-related injuries and mobility impairments in the elderly. Control and estimation theory are being used to study how humans combine and use sensory information from vision, the inner ear, and body sensors to maintain human balance stability during stance and locomotion.

State-of-the-art finite element tools are being used to develop and refine improved ultrasonic phased arrays for tissue ablation and cardiac and cancer therapy. Biofluids computational research even includes the simulation of fish locomotion.

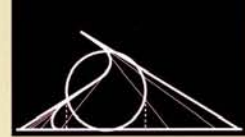
FACULTY

James A. Ashton-Miller
 Steven A. Goldstein (jointly with Medical School and Biomedical Engineering)
 Karl Grosh
 Scott J. Hollister (jointly with Medical School)
 Arthur D. Kuo
 Albert B. Schultz
 Louis J. Soslowsky (jointly with Medical School)
 Wen-Jei Yang, PE

Venemma Professor of Mechanical Engineering and Applied Mechanics Albert B. Schultz and Research Scientist James Ashton-Miller are analyzing the effects of age on obstacle avoidance. They are standing next to poles that light up to signal test subjects to suddenly turn.



Larime Photographic / Cheri Smith



Combustion and Heat Transfer

MEAM faculty perform a broad range of research in combustion and heat transfer pertinent to the generation and transmission of energy in engineering processes.

Current research activities focus on the application of fundamentals of convection, conduction, and radiation heat transfer to manufacturing processes, including welding, casting, spray forming, and laser processing. A detailed experimental and computational approach is used to understand the underlying physical processes. Particular attention is devoted to the keyhole mode of welding and spray formation of metal-matrix composites.

Heat transfer research to understand boiling and two-phase heat transfer includes both in-house and space-borne experiments of boiling heat transfer in collaboration with NASA; boiling on composite surfaces; liquid removal from compact condensers to improve their performance; flow visualization; and gas turbine heat transfer.

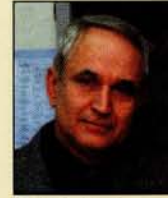
Research for understanding transport phenomena and chemical reactions in porous media includes investigations into flow, heat transfer, phase change, and fabrication of porous materials by combustion synthesis. Fundamental studies of thermomechanical aspects of removal of multicomponent binders from an injection-molded specimen are also underway.

Fundamental studies of combustion are related to flame inhibition and growth in IC engines; in-cylinder heat transfer and fluid mechanics; development of transient combustion models for multicylinder heavy duty diesel engines; microscales of turbulent combustion; fundamentals of pollutant formation processes in industrial combustion; investigation of NO, OH and PAH formation in laminar flames using advanced laser-based diagnostics; development of quantitative laser diagnostic tools for combustion engines; experimental and theoretical studies of transient radiating flames; basic research on fire suppression for finding new suppression agents for the replacement of halons; ignition and extinction of diffusion flames with radiation; and the study of interaction of flame radiation with chemistry in microgravity.

FACULTY

Vedat S. Arpaci
Dennis N. Assanis
Arvind Atreya
Michael M. Chen
David D. Cole
David A. Everest
Zoran S. Filipi
Massoud Kaviany

Ho Sung Lee
Jyotirmoy Mazumder
Herman Merte, Jr., PE
Volker Sick (as of F97)
Gene E. Smith
Richard E. Sonntag
Wen-Jei Yang, PE



Vedat S. Arpaci



Dennis N. Assanis



Arvind Atreya



Michael M. Chen



David D. Cole



David A. Everest



Zoran S. Filipi



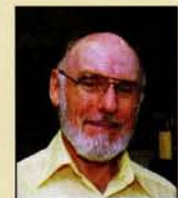
Massoud Kaviany



Ho Sung Lee



Jyotirmoy Mazumder



Herman Merte, Jr., PE



Gene E. Smith



Richard E. Sonntag



Wen-Jei Yang, PE

Control Systems and Measurement



Johann Borenstein



Huei Peng



Michael M. Bridges



Jeffrey L. Stein, PE



Robert R. Ervin



Dawn M. Tilbury

The Control Systems and Measurement area is composed of eight professors and several faculty members whose interests include transportation, manufacturing, machine tools, computer-aided design/engineering (CAD/CAE), robotics, rehabilitation engineering, and biomechanical engineering. Research in these diverse interests intersect around the academic disciplines of systems and control engineering. This area typically focuses on large systems (many components) and is more concerned with overall performance than the performance of any specific component. In addition, the spectrum or diversity of components is typically large. So, for example, a system may have mechanical, electrical, thermal, fluid energetic components as well as extensive control and sensing logic components.

A major research focus is to find models representing these diverse components that can be easily integrated to form a system model. In addition, the resultant system model must be able to integrate with other system models and be numerically tractable within a given engineering context. Another major research focus is to discover efficient ways to alter the system performance with computer-based controls, in particular, designing real-time control systems for nonlinear, distributed systems. Thus, the system and controls area focuses on the disciplines of the linear and nonlinear systems analysis, modular control, hybrid control (continuous and discrete systems), distributed real-time control, system identification, estimation, signal processing, automated modeling, and bond graph theory.

FACULTY

James Ashton-Miller
Johann Borenstein
Michael M. Bridges
Robert R. Ervin
Yoram Koren
Arthur D. Kuo
Jun Ni
Huei Peng
Jeffrey L. Stein, PE
Dawn M. Tilbury
A. Galip Ulsoy

Graduate student Iwan Ulrich demonstrates the GuideCane, a computerized, sonar-equipped navigation aid for the blind which detects obstacles in the user's path and automatically steers around them.



U-M MEAM CFO / Rodney Hill

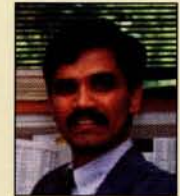


The design faculty of MEAM teach and conduct research in all areas of mechanical design. State-of-the-art facilities are available in the Design Laboratory for computational work and in the Department's Machine Shop for prototyping and fabrication.

The research areas covered by the design faculty span kinematics and machine design, microelectromechanical systems (MEMS) and smart materials, design optimization, and computer-aided design (CAD). A variety of research projects, funded by federal and industrial grants, deal with design methods, analysis and simulation tools, and fabrication planning techniques for mechanical products in automotive, aerospace, biomedical, and other applications.

Some examples of current projects include design and synthesis of compliant mechanisms; model-based decomposition methods for the design of large complex systems; methods for distributed simulation-based design; chemical kinetics-based methods for mass aggregate assembly; design, analysis, and fabrication of microsensors, microactuators, micromechanical fasteners, and microelectrical connectors; characterization and design of novel actuators based on smart materials (piezoelectrics); methods for real-time CNC interpolation and basic computational and geometrical utilities in CAD systems.

The design faculty participate in several interdisciplinary research projects within the CoE and outside, including the Engineering Research Center for Reconfigurable Machining Systems (ERC/RMS) and the Automotive Research Center (ARC).



Sridhar Kota



Liwei Lin



Nestor F. Michelena



Panos Y. Papalambros



Kazuhiro Saitou



Diann E. Brei



Debasish Dutta



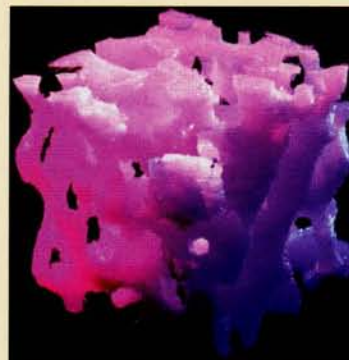
Rida T. Farouki



Donald E. Geister

FACULTY

- Diann E. Brei
- Debasish Dutta
- Rida T. Farouki
- Donald E. Geister
- Sridhar Kota
- Liwei Lin
- Nestor F. Michelena
- Panos Y. Papalambros
- Kazuhiro Saitou



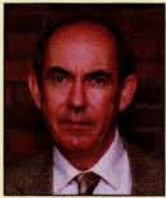
MEAM CPO / Rodney Hill

This layer-manufactured model shows a 100x version of human trabecular bone structure.



U-M MEAM CPO / Rodney Hill

A novel double-dwell Stirling Engine Mechanism.



James R. Barber



Zheng-Dong Ma



Matthew P. Castanier



Noel C. Perkins



Karl Grosh



Christophe Pierre



Gregory M. Hulbert



Richard A. Scott



Bruce Karnopp

The Dynamics faculty support a very active research program that spans the field of vibrations, acoustics, and multi-body dynamics. The majority of these studies are associated with the Dynamics Laboratory, while others are with the Biomechanics, Computational Mechanics, and Fluid Mechanics laboratories. The diverse research projects in dynamics relate to four research themes: vibrations of structures, nonlinear dynamics, acoustics, and multi-body dynamics.

Vibrations may degrade the performance of mechanisms and structures, and the early prediction of such vibrations is recognized to be a critical step in many design analyses. Studies in structural vibrations focus on bladed disk assemblies and model localization, joined structures, transmissibility in continuous systems, vibration of tracked vehicles, mid- and high-frequency vibration, and transient engine vibrations.

The vibration of structures can, at times, be controlled by nonlinear effects deriving from overall large deformations, from the action of dry-friction and clearances, and from fluid-structure interactions. The description of nonlinear response remains a significant technical challenge which is being addressed with recent advances in nonlinear modal analysis and internal resonances. Examples of systems being evaluated include cable structures, dry-friction damped bladed disk assemblies, engine accessory drive systems, and impacting systems.

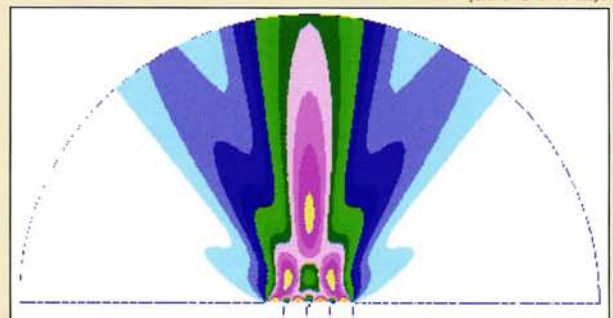
The Department has substantially grown its research capabilities in acoustics and now features several major initiatives spanning applications in structural acoustics, bio-acoustics, and fluid acoustics (refer to Fluids research summary).

Motivated by automotive and biochemical applications, several research projects advance the methods of multi-body dynamics as a primary simulation environment. These include problem formulation and solution techniques as applied to human gait studies, component load and stress predictions, extreme dynamic loading (e.g. crashes, blasts), and overall vehicle/powertrain models.

FACULTY

James R. Barber
 Matthew P. Castanier
 David R. Dowling
 Karl Grosh
 Gregory M. Hulbert
 Bruce Karnopp
 Arthur D. Kuo
 Zheng-Dong Ma
 Noel C. Perkins
 Christophe Pierre
 Albert B. Schultz
 Richard A. Scott

The computed acoustic pressure field generated by a four element piezoelectric array wherein the yellow areas show the focus regions for a target application in cardiac and cancer therapy (at 0.5 MHz).



U-M/MEAM / Karl Grosh



Fluid Mechanics

The modern world has a critical need to both understand and exploit fluid phenomena. Most materials made and used by people exist in a fluid state at some point. Modern systems for power generation, propulsion, climate control, and transportation all depend on proper engineering of fluid motions and properties.

Fluid mechanics research in MEAM covers hydrodynamics, turbulence, multiphase flows, complex fluid flows, fluid acoustics, and a range of interdisciplinary topics. All three approaches to fluids research—state-of-the-art experiments, leading-edge computations, and theoretical efforts—are exploited based on government and industry sponsorships in excess of \$1 million annually.

Current hydrodynamics research projects involve fish swimming, nonlinear standing and traveling water waves, gravity-capillary waves and surfactants, elasto-hydrodynamics of oil seals, analyses of journal bearings, and experimental studies of cavitation. Research in turbulence and turbulent mixing focuses on small-scale processes, including subgrid scale modeling, wall and free-surface bounded flows, fractal and multifractal scaling, and turbulent reacting flows. A wide variety of multiphase flow investigations are also underway in MEAM. Electrical Impedance Tomography, and cinemagraphic Particle Imaging Velocimetry are used to study “drop-by-drop” manufacturing and complex three-phase flows. Computational investigations include numerical method development and simulations of bubbly systems, atomization and sprays, wave generation, boiling, solidification, and micromanufacturing by droplet impingement and solidification. Complex fluids research in MEAM focuses on polymer rheology and flows. Efforts are underway to develop molecular constitutive models for entangled polymers, and mixing rules for polydisperse systems. Flows of lyotropic liquid crystals and viscoelastic suspensions are also studied. The influence of injection modeling and fiber forming on final mechanical properties are also under investigation. Current fluid acoustic research includes pulsating-flow noise control of hydraulic power systems, automotive wind noise, retrofocusing of underwater sound, and photoacoustic leak quantification.



Rayhaneh Akhavan



Claus Borgnakke



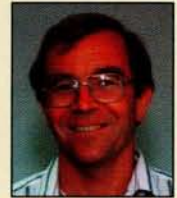
Steven L. Ceccio



David R. Dowling



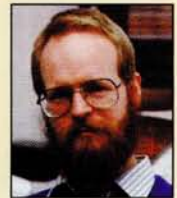
Stanley J. Jacobs



David W. Mead



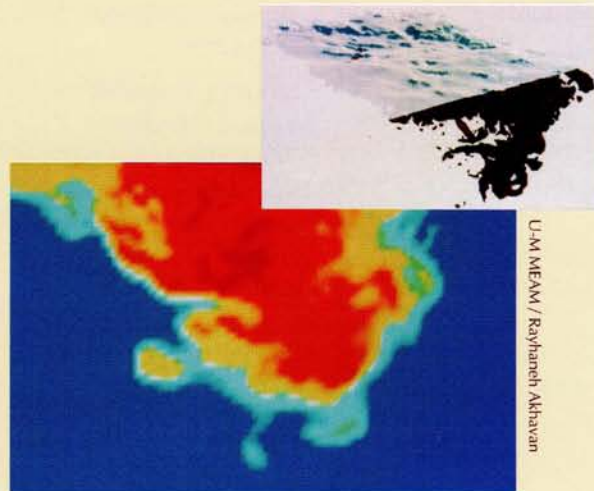
William W. Schultz



Grétar Tryggvason

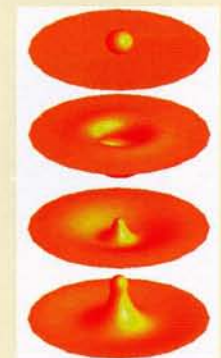
FACULTY

- Rayhaneh Akhavan
- Claus Borgnakke
- Steven L. Ceccio
- David R. Dowling
- Stanley J. Jacobs (jointly with Atmospheric, Oceanic and Space Sciences)
- David W. Mead
- William W. Schultz
- Grétar Tryggvason



At right and inset-Dynamics of free surface turbulence is studied using a jet issued below a surface.

U-M MEAM / Rayhaneh Akhavan



U-M MEAM / Grétar Tryggvason

Computational model of the collision of a fluid drop with a surface.



Dariusz J. Ceglarek



William J. Endres



S. Jack Hu



Elijah Kannatey-Asibu



Yoram Koren, PE



Robert G. Landers



Jun Ni



A. Galip Ulsoy



Xin Wu



Jingxia Yuan



Hongyan Zhang

In the area of assembly and joining, "Stream of Variation" theory is being investigated, focusing on the development of assembly models for predicting and diagnosing variation in multi-leveled assembly systems, in particular, automotive body assembly systems. Work is also being done on knowledge-based diagnostics methodology using hierarchical groups of assemblies. MEAM faculty members are working to develop intelligent process monitoring and control techniques for resistance spot welding. Dual beam laser welding techniques are also being developed for tailored blanks.

In the area of sheet metal forming, a team of MEAM faculty is conducting research to improve the accuracy of stamped sheeting metal parts and the speed for stamping die/press development. The "Agile and Precision Sheet Metal Stamping" program has projects in design for stamping and assembly, die design and tryout, and process monitoring and control in production.

Research is also underway for in-process feedback control to improve dimensional accuracy and stability of stamping. The approach under study is the control of punch force by manipulation of binder (or blank holder) force.

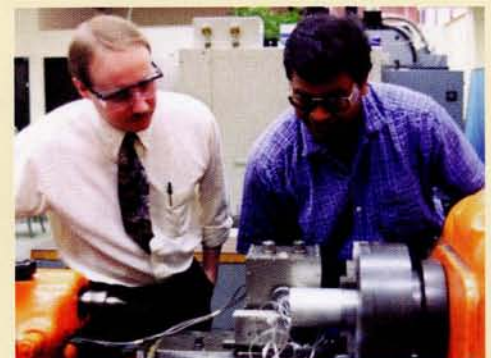
In the area of machining and machine tools, MEAM faculty have completed the development of an innovative real-time error compensation system which is capable of compensating for geometric, thermal, and cutting force-induced errors during machining. The team has also developed a new chatter detection and suppression technology based on spindle speed variation. Research in drilling is also being conducted.

In the area of material handling, the project, "An Omnidirectional AGV without Guide Wire" has led to the development of a sophisticated automated guided vehicle (AGV) called "OmniMate." Omnimate has full omnidirectional motion capabilities and a unique, patented method for detecting and correcting odometry errors.

Techniques are also being developed to integrate material handling with press motion during the die design stage. The objective is to maximize press line throughput and minimize part distortion by developing methodology to optimize the placement of end effector tooling and part motion curves at the design stage.

FACULTY

Dariusz J. Ceglarek
William J. Endres
S. Jack Hu
Elijah Kannatey-Asibu
Yoram Koren, PE
Robert G. Landers
Jun Ni
A. Galip Ulsoy
Xin Wu
Jingxia Yuan
Hongyan Zhang



Assistant Professor William J. Endres, left, and graduate student Jairam Manjunathaiah conduct machine tool cutting process modeling research.

U-M MEAM CPO / Rodney Hill



Solid Mechanics and Materials

In a broad sense, the research performed by members of the Materials and Solid Mechanics group focuses on how to process materials and how to improve or predict the life of materials used in engineering components. Research topics span many technical fields, ranging from automotive, aerospace, and biomedical engineering to mechanical design and engineering ethics.

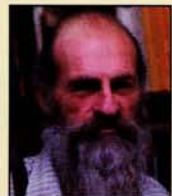
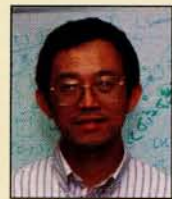
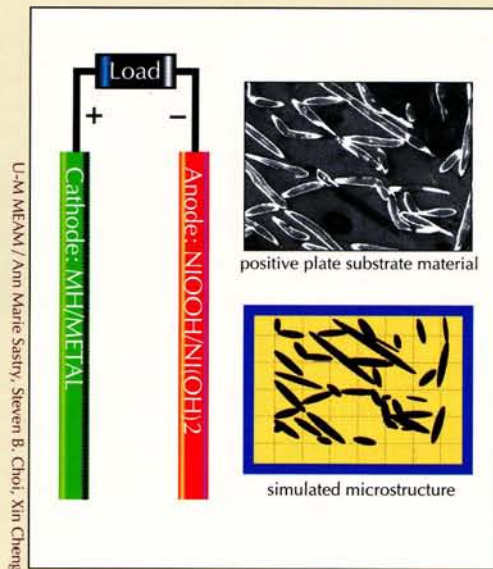
Although the group as a whole is involved in a rich spectrum of research topics, the research of individuals within the group is typically related by a common thread. For example, group members are involved in research that focuses on characterizing and modeling the response of polymeric systems. This work has many applications in the automotive industry. In addition to providing the models required to improve automotive comfort and durability, the research is of critical importance in the design of automobiles for crash worthiness.

Several group members collaborate on various problems related to the friction and wear of materials used in automotive and aircraft braking systems. The ultimate goal of this work is to improve the reliability of friction materials. A majority of the group members are involved in projects related to the fatigue and fracture of engineering materials. The group has developed very unique experimental facilities for fatigue research, including one-of-a-kind multi-axis load frames and high frequency test machines.

Other examples of research conducted within the group include: studies of how to improve the efficiency of fuel cells for next-generation electric vehicles; developing techniques to understand and improve the reliability of thin films and adhesive joints; and mechanics and material modeling of sheet metal forming processes.

FACULTY

- Ellen M. Arruda
- James R. Barber
- Maria Comninou
- John W. Holmes
- Noboru Kikuchi
- Kenneth C. Ludema
- Jwo Pan
- Ann Marie Sastry
- John J. Taylor
- Michael D. Thouless
- Alan S. Wineman
- Wei-Hsui Yang



In the Composite and Fibrous Mechanics Laboratory, Assistant Professor Ann Marie Sastry and her students investigate the performance of fibrous materials ranging from batteries to human nerves. Image analysis is used to recreate observed microstructures. Statistical techniques are used to generate structures for prediction of the effect of material variability on NiMH batteries.

Research Interests

MEAM
INSTRUCTIONAL
FACULTY

	Biomechanics				Cont. Systems & Meas.				Dynamics				Design								
	Structural Analysis	Biomechanical Models	Movement Analysis & Control	Prosthetics	Automated Modeling / CAE	Control Systems	Microelectromechanical Sys.	Modeling & Identification	Robotics	Sensing, Signal Processing	Structural Dynamics	Multi-body Dynamics	Nonlinear Dynamics	Vehicle Dynamics	Acoustics & Vibration	Kinematics	AI & Design Methodology	CAD/CAE Geometric Mod.	Design Optimization	Innovative Systems	Tribology
Akhavan, Rayhaneh																					
Arpaci, Vedat S.																					
Arruda, Ellen M.																					
Assanis, Dennis																					●
Atreya, Arvind																					
Barber, James R.																					●
Borgnakke, Claus																					
Brei, Diann E.						●		●	●				○					○	○		
Bridges, Michael M.						●		●	●	○											
Ceccio, Steven L.	○																				
Chen, Michael M.																					
Cole, David E.												○									
Comninou, Maria																					
Dowling, David R.										○				●							
Dutta, Debasish																					
Endres, William J.						○		●		○											
Farouki, Rida T.															○						
Goldstein, Steven A.	●	○		●																	
Grosh, Karl	○	●				●	●	●	●	●	●		●								
Hollister, Scott J.	●	●		●																	
Holmes, John W.																○					
Hu, S. Jack							●		○												
Hulbert, Gregory M.										●	●	●	●	●	●						●
Jacobs, Stanley J.																					
Kannatey-Asibu, Jr., Elijah									●												
Karnopp, Bruce H.										●				●							
Kaviany, Massoud																					
Kikuchi, Noboru	●	●					○			●		○	○							○	○
Koren, Yoram						●	●	●	●	●					○						
Kota, Sridhar							●								●	●				●	
Kuo, Arthur D.		●	●			●	●	●	○	●		○	○	○	●				○		
Lin, Liwei							●	●		●	●	○	○	○	○					●	●
Ludema, Kenneth C.																					●
Mazumder, Jyotirmoy																					
Mead, David									●												○
Merte, Jr., Herman																					
Ni, Jun							○		○												
Pan, Jwo		○																			
Papalambros, Panos Y.						○		○							●	●	●				
Peng, Huei						○	●	○	●				●	○							
Perkins, Noel C.						○		○		●		●	●	●							
Pierre, Christophe								●		●		●	●	●							
Saitou, Kazuhiro						○		●	○	○	○				○	○	●	●	●		
Sastry, Ann Marie	●	●																			
Schultz, Albert B.	●	●	●							○				○	○						
Schultz, William W.											○			●							●
Scott, Richard A.										●		●		●							
Smith, Gene E.																					
Sonntag, Richard E.																					
Soslowky, Louis J.	●	●	○																		
Stein, Jeffrey L.						●	●	●		○	●		●		●					●	
Taylor, John E.	●									○		○								●	
Thouless, Michael																					
Tilbury, Dawn							●	○		●			○	●							
Tryggvason, Grétar																					
Ulsoy, A. Galip						○	●		●	○			●	●							
Wineman, Alan S.	●	●					●	●													
Yang, Wei-Hsuin																					
Yang, Wen-Jei		●						○													

● Active in the field, conducts research, teaches courses, contributes papers; ○ Interest in the field, small research grants, sometimes teaches courses

Research Interests

MEAM
INSTRUCTIONAL
FACULTY (continued)

	Manufacturing					Solid Mechanics & Materials										Combustion							
	CAM / NC Process Planning	Machining & Welding	Metal Forming / Assembly	Non-trad. Manufacturing	Process Control & Monitoring	FEM & Comp. Mechanics	Fracture Mech. & Fatigue	Viscoelasticity	Composites (CMC & PMC)	Plasticity	Plates and Shells	Thermomechanics	Elasticity	Contact Mechanics	Chemistry & Kinetics	Instabilities	Multiphase Reacting Flows	Energy Conversion	Environmental	Materials Processing	Fund.	Appls.	
Akhavan, Rayhaneh														○	○								
Arpaci, Vedat S.															●	●						○	
Arruda, Ellen M.			●			●		●	●				●										
Assanis, Dennis						●								○		●	●	●					
Atreya, Arvind														●	○	●	●	●	●			○	
Barber, James R.																							
Borgnakke, Claus			○											○		●	●	●					
Brei, Diann E.	●		●	●		●		○		●			●										
Bridges, Michael M.	●			○																			
Ceccio, Steven L.				●												●						○	
Chen, Michael M.	●			●	○																		
Cole, David E.																		○	○				
Comninou, Maria						●						●	●										
Dowling, David R.														○			○						
Dutta, Debasish	●	○	○	○																			
Endres, William J.	●	●	○	○	○	○	○	○		○													
Farouki, Rida T.	○																						
Goldstein, Steven A.								○	○														
Grosh, Karl						●				●		●	○										
Hollister, Scott J.						●		○	●														
Holmes, John W.						●		●				●											
Hu, S. Jack	○	●	●	○	●																		
Hulbert, Gregory M.						●				●			●										
Jacobs, Stanley J.																							
Kannatey-Asibu, Jr., Elijah	●			●	●																		●
Karnopp, Bruce H.																							
Kaviany, Massoud																○							
Kikuchi, Noboru		○	●			●		●	●	●	●	●	●										
Koren, Yoram	●	●		○	●																		
Kota, Sridhar			●																				
Kuo, Arthur D.																							
Lin, Liwei				●	●	●	●					●		●									
Ludema, Kenneth C.	○	○																					
Mazumder, Jyotirmoy	●		●	●																			●
Mead, David																							●
Merte, Jr., Herman																							
Ni, Jun	●	●	●	○	●																		
Pan, Jwo		●	●			●	●	●	●	●	●	●	●										
Papalambros, Panos Y.	○		○	○		○																	
Peng, Huei		●			○																		
Perkins, Noel C.						●							●	●									
Pierre, Christophe						●																	
Saitou, Kazuhiro			●	●		○																	
Sastry, Ann Marie			●	●		●	●	●	○	○	○	●											●
Schultz, Albert B.																							
Schultz, William W.	○		●					●															●
Scott, Richard A.						●																	
Smith, Gene E.																							●
Sonntag, Richard E.																							●
Soslowsky, Louis J.								●	●			○	○										
Stein, Jeffrey L.					●									○								○	
Taylor, John E.						●		●		●		○	○										
Thouless, Michael				●				●	●			●											
Tilbury, Dawn					●																		
Tryggvason, Grétar															●	○	○						●
Ulsoy, A. Galip	○	○			●																		
Wineman, Alan S.				●	●			●	●			●	●										
Yang, Wei-Hsuin		●	●			●				●													
Yang, Wen-Jei		●																					

● Active in the field, conducts research, teaches courses, contributes papers; ○ Interest in the field, small research grants, sometimes teaches courses

Research Interests

MEAM
INSTRUCTIONAL
FACULTY (continued)

	Combust. (cont.)					Fluid Dynamics							Heat Transfer							
	Appls.					Fundamentals				Applications			Fundamentals			Applications				
	Microgravity	Transportation	Complex Fluids	Multiphase	Numerical Techniques	Turbulence	Waves & Instabilities	Biomedical	Cavitation	Mats. Process. & Manf.	Transportation	Convection	Molecl. & Small Scales	Phase Chg. & Multiphase	Radiation	Energy Conversion	Environmental	Mats. Process. & Manf.	Microgravity	Transportation
Akhavan, Rayhaneh		●	●	●	●	●	○		●		●	●	●	●			○			
Arpaci, Vedat S.	●		●		●	●				●	●	●	●			○		●		
Arruda, Ellen M.									●								●			
Assanis, Dennis		●	●	●	○				●					●	●					●
Atreya, Arvind	●	●			○					●	○	○	●	●	●	○	○	○		
Barber, James R.																				
Borgnakke, Claus		○	○	●	●				●		●		●	○	●					
Brei, Diann E.																				
Bridges, Michael M.																				
Ceccio, Steven L.	●	○	●	●	●		●	●	●	●		●				●	●			
Chen, Michael M.			○	●	○				●		●	○	●	○			●			
Cole, David E.																				
Comninou, Maria																				
Dowling, David R.		○	●		●	●			●	●										
Dutta, Debasish																				
Endres, William J.																●				
Farouki, Rida T.																				
Goldstein, Steven A.	○						●													
Grosh, Karl																				
Hollister, Scott J.																				
Holmes, John W.																				
Hu, S. Jack																				
Hulbert, Gregory M.																				
Jacobs, Stanley J.		●			●	●														
Kannatey-Asibu, Jr., Elijah																				
Karnopp, Bruce H.																				
Kaviany, Massoud									●	○	●	○			●		●			
Kikuchi, Noboru				●			○	●								○				
Koren, Yoram																				
Kota, Sridhar																				
Kuo, Arthur D.																				
Lin, Liwei											●	●								
Ludema, Kenneth C.																				
Mazumder, Jyotirmoy																				
Mead, David		●	●	●		●			●							●				
Merte, Jr., Herman												●		●	●	●	●	●	●	●
Ni, Jun																				
Pan, Jwo																				
Papalambros, Panos Y.	●													○	○					○
Peng, Huei																				
Perkins, Noel C.																				
Pierre, Christophe																				
Saitou, Kazuhiro																				
Sastry, Ann Marie				○					●								●			
Schultz, Albert B.																				
Schultz, William W.		●	●	●		●	○		●		○		●			●				
Scott, Richard A.																				
Smith, Gene E.	●			○											●					●
Sonntag, Richard E.											○	○		●	●					○
Soslowky, Louis J.																				
Stein, Jeffrey L.																				
Taylor, John E.																				
Thouless, Michael																				
Tilbury, Dawn																				
Tryggvason, Grétar		●	●	●		●	○	●	●	●			●		●	●	●			●
Ulsoy, A. Galip																				
Wineman, Alan S.		●	●						●											
Yang, Wei-Hsuin																				
Yang, Wen-Jei			●	●	○		●	○	●		●	○	●	●	●	○	●	●	●	●

● Active in the field, conducts research, teaches courses, contributes papers; ○ Interest in the field, small research grants, sometimes teaches courses.

Research Interests

MEAM
RESEARCH
FACULTY

	Biomechanics				Control & Measurement				Dynamics				Design							
	Structural Analysis	Biomechanical Models	Movement Analysis & Control	Prosthetics	Automated Modeling/CAE	Control Systems	Electromechanical Sys.	Modeling & Identification	Robotics	Sensing, Signal Processing	Structural Dynamics	Nonlinear Dynamics	Vehicle Dynamics	Acoustics & Vibration	Kinematics	AI & Design Methodology	CAD/CAE Geometric Mod.	Design Optimization	Innovative Systems	Systems Integration
Ashton-Miller, James	●	●	●	○		○	●	○	○	○				○						○
Borenstein, Johann							●		●			○								
Castanier, Matthew P.									●	○	○	●								
Ceglarek, Dariusz								○	○						○					
Ervin, Robert D.				○	●	●	●	●			●								●	
Everest, David A.								○												
Filipi, Zoran								○		○	○							●		
Geister, Donald E.			○		○	○			○					●	●					
Landers, Robert G.				○	○	●	●	○	○	○			○				○			○
Lee, Ho Sung					○				○				○							
Ma, Zheng-Dong					○		●	●		●	○	●	●	○	○		●		●	●
Michelena, Nestor F.				○				○						●		●		○		●
Wu, Xin																				
Yuan, Jingxia				○	○	○	●		●	○	○		○	●				○		
Zhang, Hongyan		○																		

	Manufacturing							Solid Mechanics					Thermal / Fluid Science							
	Automotive Assembly	Statistical Process Control	CAM/NC Process Planning	Machining & Welding	Metal Forming/Assembly	Non-trad. Manufacturing	Process Control & Monitoring	FEM & Comp. Mechanics	Fatigue	Fracture Mechanics	Plasticity	Elasticity	Contact Mechanics	Combust. Chemistry & Kinetics	Energy Conversion	Environmental	Fluid Flow & Turbulence	Heat Transfer	Matls. Process. & Manf.	
Ashton-Miller, James							○													
Borenstein, Johann																				
Castanier, Matthew P.																				
Ceglarek, Dariusz	●	●	○		●		●													
Ervin, Robert D.																				
Everest, David A.							○					●	○	○	●	●				
Filipi, Zoran												●	●	●	●	○				
Geister, Donald E.			●																	
Landers, Robert G.			○	●	○	○	●													
Lee, Ho Sung												○	●	○	●	●				○
Ma, Zheng-Dong							●	○			●	●								
Michelena, Nestor F.			○				○													
Wu, Xin				●	●	●			●	●										
Yuan, Jingxia		○		●	●	●		○												
Zhang, Hongyan	●			●	○		●			○	○									●

● Active in the field, conducts research, teaches courses, contributes papers; ○ Interest in the field, small research grants, sometimes teaches courses.

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July 1, 1996 to June 30, 1997

MEAM gratefully acknowledges the contributors to our Department who support our ongoing quest for excellence. Their generous investment in MEAM allows us to continue to attract the very best faculty and students and to conduct groundbreaking research.

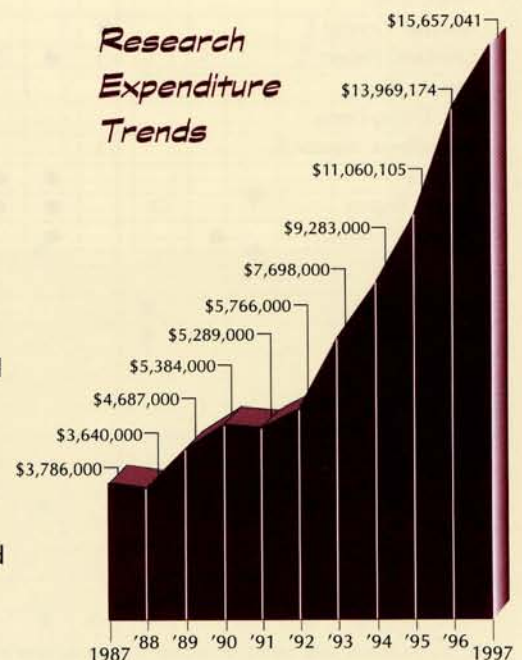
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Raybestos Products Company
Ricardo North America, Inc.
Saginaw Machining Systems-Advanced Research Project Agency
Sandia National Labs
Société Nationale d'Etude et de Construction
Society of Manufacturing Engineers Education Foundation
State of Michigan
TASC Inc.
Tauber Manufacturing Institute
Technical Association of the Pulp and Paper Industry
Technology Research Center
Toyota Technical Center, U.S.A., Inc.
Transitions Research Company
TRW / Advanced Research Project Agency
TRW: Vehicle Safety Systems, Inc.
U.S. Air Force
U.S. Air Force Office of Scientific Research
U.S. Army
U.S. Army Corps of Engineers
U.S. Army Tank Automotive and Armaments Command
U.S. Army Tank Automotive Command
U.S. Department of Defense
U.S. Department of Energy
U.S. Federal Highway Administration
U.S. National Aeronautics and Space Administration-Lewis
U.S. National Institute of Standards and Technology

U.S. Navy
U.S. Navy Office of Naval Research
U.S. Naval Research Laboratory
University of Illinois / National Aeronautics and Space Administration
University of Michigan Center for Research on Learning and Teaching
University of Michigan College of Engineering
University of Michigan Horace W. Rackham School of Graduate Studies
University of Michigan Office of the Vice President for Research
USCAR
Variation System Analysis
Vescor Corporation
Wayne State University / Greenfield Coalition / National Science Foundation
Whirlpool Corporation
Whitaker Foundation
Yardney Technical Products

Research Expenditure Trends



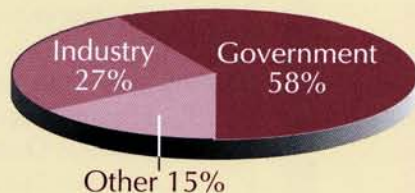
Mechanical Engineering and Applied Mechanics

Donors

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Yukio Amano	Ford Motor Company	Rheometric Scientific
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Exxon Corporation	The Proctor & Gamble Fund	Thomas and Andrea Woo
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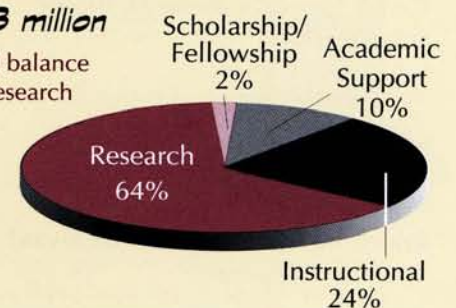
New Research Funding Distribution by Source \$22.7 million

The partnership between government and industry remains strong.



Total Expenditures Distribution by Use \$24.3 million

MEAM enjoys a good balance in funding between research and learning.



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 MEAM, University of Michigan College of Engineering,
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MEAM Student News

Student Leaders

Michael Brewer	President (F96), Pi Tau Sigma (PTS)
Brian Forster	Vice-President (W97), Pi Tau Sigma (PTS)
Dan Griffin	Vice-President, Society of Automotive Engineers (SAE)
Anthony HooSang	Underrepresented Minorities in Mechanical Engineering (UMME)
Chih-mao Hsieh	President (W97), Pi Tau Sigma (PTS)
Stephanie LaCrosse	Secretary-Treasurer, Senior Class
Jennifer Liedtke	Vice-President (F96), Pi Tau Sigma (PTS)
Michael R. McGuire	Vice-President, American Society of Mechanical Engineers (ASME)
Oreste Prada	Society of Hispanic Professional Engineers
Julie Reyer	Graduates In Mechanical Engineering (GRIME)
J.W. Rossow	President, American Society of Mechanical Engineers (ASME)
Mira Sahney	President, Society of Women Engineers (SWE)
Alan Yengoyan	Vice-President, American Society of Mechanical Engineers (ASME)

Mechanical Engineering Student Leadership Board (MESLB)

Mike Bailey, (SAE)	Chih-mao Hsieh, (PTS)	Julie Reyer, (GRIME)
Jon Bixler, (PTS)	Melanie Leitzel, (ASME)	J.W. Rossow, (ASME)
Angela Cottingham, (UMME)	Jennifer Liedtke, (PTS)	Cathy Ruf, At large (SWE)
Dan Griffin, (SAE)	David Messih, (SAE)	Greg Zonca, At large
Anthony HooSang, (UMME)		

Undergraduate Student Scholarships and Awards

Amoco Foundation Inc. Scholarship John Whitehead	Cummins Engine Award Jessica Gabourie	George H. Miller Scholarship Amy Cazeault
David Aspland Scholarship Michael R. Farina	John Deere Award James Driscoll IV	Minnesota Mining and Manufacturing Scholarships Amy K. McMahon, Senior Alan Yengoyan, Senior Jaime Roehrig, Junior
William E. Bandemer Scholarships Kellie Durling McAllister Daniel, Jr. Oreste Prada	CoE Distinguished Achievement Award Yanjie Sun	PTS Initiate of the Term Steven Kaman (W97) Michelle Sanborn (F96)
Carl A., Jr. and Isabelle M. Brauer Scholarship Ismai'l Curtis	Dow Chemical Scholarships Christopher Marroquin Benjamin Sabo	R&B Machine Tool Company Scholar Robbie Bruno
J.A. Bursley Prize Alan Yengoyan	Richard Earhart Scholarships James J. Driscoll IV Leo C. McAfee III	Society of Women Engineers Awards Outstanding Sophomore Carolyn Dodge Outstanding Female Senior Engineer Mira Sahney
Robert M. Caddell Memorial Award Alan Yengoyan	Clarence E. Groesbeck Scholarship John Barrientos	Jay Wetzel Quality Scholarship for Excellence Kevin A. Vernagus
CoE Class of '31E Scholarship Jason DeWeerd	Martin Luther King, Jr. Awards Mike Arciniaga Anthony HooSang David Messih	
CoE Opportunity Awards Khari Burrell Fernando Jimenez	Oreste Prada Andrea Ryan	

Enrollment and Degrees Granted

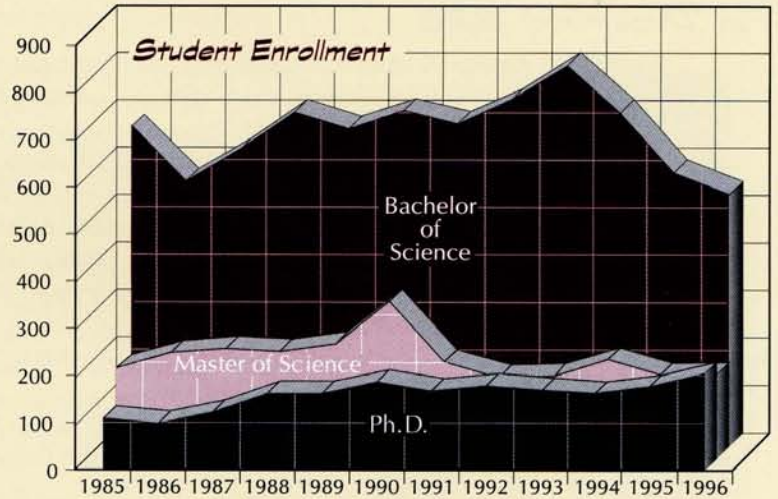
Numbers do not include students jointly enrolled in ME and other disciplines.

Enrollment, Fall 1996

Doctor of Philosophy	202
Master of Science in Engineering	178
Bachelor of Science	529
Total	909

Degrees Awarded, Fall 1996–Summer 1997

Doctor of Philosophy	42
Master of Science in Engineering	81
Bachelor of Science	239
Total	362



Graduate Student Fellowships and Awards

American Society for Engineering Education (ASEE), Student Chapter, Outstanding Student Instructor Awards

Apoorva Agarwal
Amir A. Oliveira

AT&T Fellowship
Daniel Apley

Automobile & Transportation Interiors Award
Andrew Argersinger

Benton Fellowship
David Orton

CoE Fellowships
Jonathan Cherry
Scott Mishler

CoE Distinguished Achievement Awards
Shyue-Yuh Leu
Emilio Carlos Nelli Silva

Dean's Fellowship
Claudia Iyer

DeVlieg Fellowships
Thomas Bress
Elizabeth Smith

Graduate Degrees for Minorities in Engineering and Science (GEM) Fellowships

Luis Buitrago
Charles Hoffler II
Jason Lee

Ivor K. McIvor Awards
Wen-Jen Chang
Emilio Carlos Nelli Silva

MEAM Departmental Fellowships
Paul Alexander
Jianmin Gu
Hyung Kim
Sung Kim
Karen J. Lee
Hemant Mungekar
Daniel Ogbonna

William Mirsky Memorial Awards
Karen J. Lee
George O'Neal

National Science Foundation (NSF) Fellowships
Jennifer Green
Laila Guessous

NSF Traineeships
Yiqiao Chang
Chad Darr
Min Ling
Andrew Park
Samuel Sprik

Rackham First Year Fellowship
Charles Cadle

Rackham Merit Fellowships
Waheed Alashe
Yvonne Alsandor
Sean Berhan
Daphne Joachim
Nnaemeka Nwoso
Ronke Olabisi
Paris VonLockette

Rackham Outstanding Teaching Assistant Award
Ronald Kalnas

Regents Fellowships
Kurt DeGoede
Nataliya Pukhlik

Whirlpool Fellowship
Gregory Quist

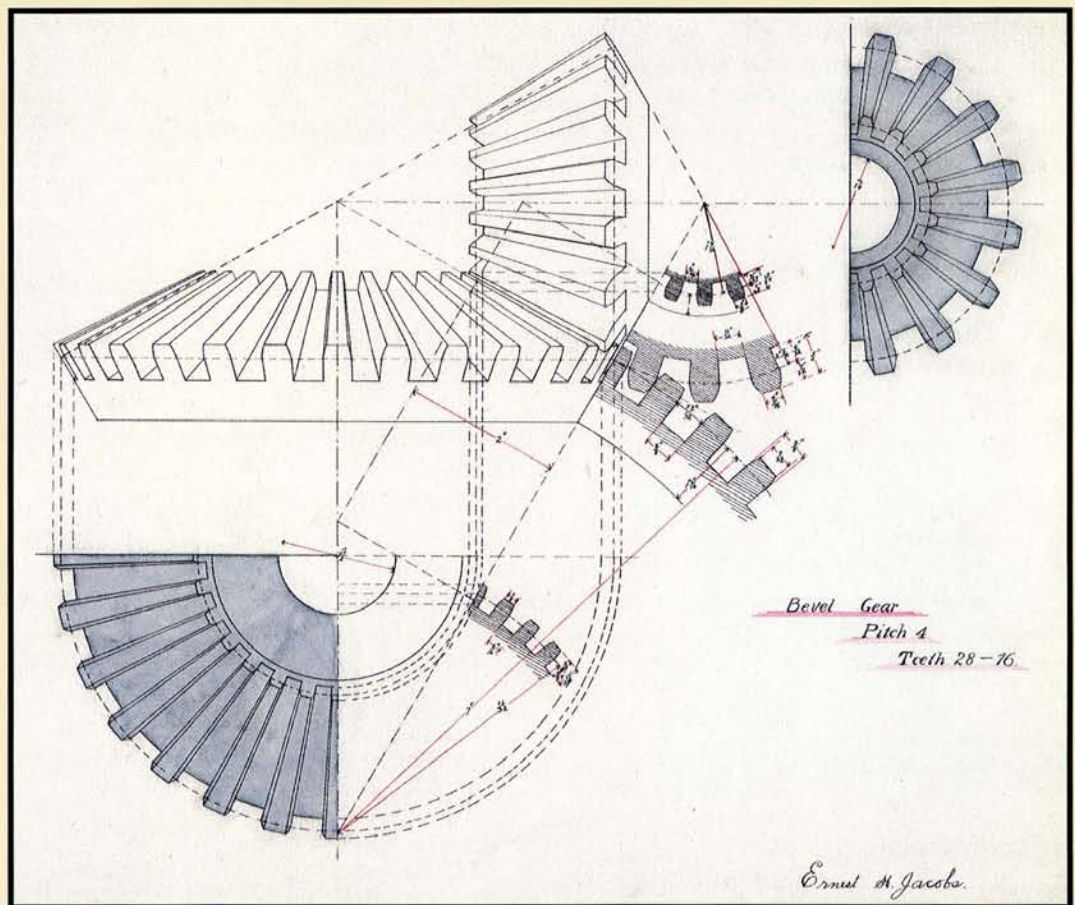
Whitaker Fellowship
Laura Wojcik

Doctoral Degrees Conferred

Fall (December) 1996

- Foued Ben Amara** *Adaptive Sinusoidal Disturbance Rejection in Linear Systems with Application to Noise Cancellation*; Co-Chairs: A.G. Ulsoy and P. Kabamba
- Cheng Cao** *Biomechanics of Forward Momentum Arrest When Walking: Age and Gender Differences*; Co-Chairs: A.B. Schultz and J.A. Ashton-Miller
- Tien-Ching Chen** *Thermocapillary Convection in the Weld Pool for Single and Dual Beam Laser Welding Systems*; Co-Chairs: E. Kannatey-Asibu, Jr. and M.M. Chen
- Ravishankar Gundlapalli** *Dynamics of a Turbulent Jet Interacting with a Free-Surface*; Chair: R. Akhavan
- Davoud Khorzad** *Model Based Optimization for Auto Body Dimensional Control in Design and Assembly*; Co-Chairs: J. Ni and J. Shi
- Ramprasad Krishnamachari** *A Decomposition Synthesis Methodology for Optimal System Design*; Chair: P.Y. Papalambros
- Marlin Kruse** *Dynamics of Mistuned Bladed Disks: Modeling and Experiment*; Chair: C. Pierre
- Ann Leger** *Experimental Examination of the Flow Near the Leading Edge of an Attached Cavity*; Chair: S.L. Ceccio
- Meng-Yen Li** *Simulation of Heat Affected Zone Microstructure During Laser Processing*; Chair: E. Kannatey-Asibu, Jr.
- Hyun Peck** *Nonlinear Control of Rigid-Link Flexible-Joint Robotic Manipulators with Harmonic Drive Transmissions Using Integrator Backstepping*; Chair: M. Bridges
- Radha Sarma** *NC Tool Path Synthesis*; Chair: D. Dutta
- Boon-Wai Shiu** *Modeling of an Automotive Body Assembly System for Dimensional Control*; Co-Chairs: D.J. Ceglarek and J. Shi
- Xiaobo Sun** *Experimental and Modeling Studies of Hydrocarbon Emissions from Automotive and Small Utility Engines*; Chair: D. Assanis
- Haiyan Zhang** *Chatter Modeling, Analysis and Control for CNC Machining Systems*; Chair: J. Ni

In this remarkable piece, Jacobs blends a technical mastery of descriptive geometry with an eye for the aesthetic. The formal harmony of the orthogonal composition brings out the intrinsic beauty of the pen-and-ink rendering style.



Ernest H. Jacobs, c. 1897

Winter (May) 1997

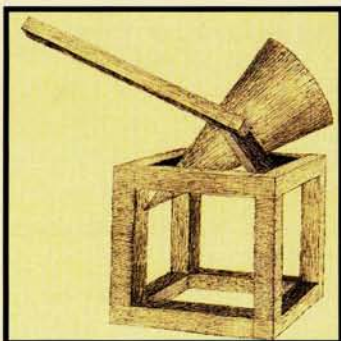
- Mohammad B. Nejad** *Wave Propagation in Elastic Cables with and without Fluid Interaction*; Chair: N.C. Perkins
Pei-Kuang Chen *Punch Condition Monitoring in Sheet Metal Stamping under Progressive Stamping Environments*; Chair: S.J. Hu
- William W. Finch** *Predicate Logic Representations for Design Constraints on Uncertainty Supporting the Set-Based Design Paradigm*; Chair: A.C. Ward
- Jun Fonseca** *Design of Microstructures of Periodic Composite Materials*; Chair: N. Kikuchi
Mary Frecker *Optimal Design of Compliant Mechanisms*; Co-Chairs: S. Kota and N. Kikuchi
Shuxin Gu *Stationary and Non-Stationary Process Condition Monitoring and Fault Diagnosis and Its Application to Drilling Processes*; Chair: J. Ni
- Lei He** *Diffusion Bonding Modeling and Ductile Fracture in Materials with Distributed Porosity*; Chair: M. Haghi
- Shih-Wei Hsiao** *Numerical Analysis and Optimal Design of Composite Thermoforming Process*; Chair: N. Kikuchi
- Shu-Hsin Kao** *Radiation Affected Marangoni Chaotics*; Chair: V.S. Arpaci
- Robert G. Landers** *Supervisory Machining Control: A Design Approach Plus Chatter Analysis and Force Control Components*; Chair: A. G. Ulsoy
- Jinkoo Lee** *Set-based Design Systems for Stampings and Flexible Fixture Workspaces*; Co-Chairs: A.C. Ward and S.J. Hu
- Kuo-Chi Liao** *Yield and Damage Criteria for Sheet Metal Forming Simulations*; Chair: J. Pan
Chia-Shang Liu *Disturbance Estimation and Parameter Identification Algorithms for Vehicle Systems*; Chair: H. Peng
- Byron L. Newberry** *Resonant Tangential Response in Laterally Excited Fluid-Loaded Cable Suspensions*; Chair: N.C. Perkins
- Hee-Jin Park** *Multi-Phase Flow in Gas Stirred Ladle Systems with and without Throughflow Including Slag Layer Effects*; Chair: W. J. Yang
- Thomas E. Pilutti** *Lateral Vehicle Co-Pilot to Avoid Unintended Roadway Departure*; Chair: A. G. Ulsoy
Nallan C. Suresh *A Local Integral Moment Method to Simulate Flow, Mixing, and Chemistry in Complex Flows*; Chair: G. Tryggvason
- Laura A. Wojcik** *A Biomechanical Analysis of the Mechanisms of Fall Recovery in Young and Elderly Adults*; Co-Chairs: A.B. Schultz and J.A. Ashton-Miller

Spring/Summer (August) 1997

- Daniel Apley** *Supervisory Adaptive Control: Monitoring, Diagnostics and Model Uncertainty*; Co-Chairs: J. Ni and J. Shi
- Jose Castillo** *Dynamic Changes of Surface Film Under Boundary Lubrication: A Study using Ellipsometry*; Chair: K.C. Ludema
- Wen-Jen Chang** *Effects of Pressure Sensitive Yielding on Crack-Tip Fields and Cavitation Instabilities*; Chair: J. Pan
- Sung Choi** *Statistical Energy Methods for Vibration Transmission Analysis of Complex Structures*; Chair: C. Pierre
- Wu-Hsing Chou** *Temporal Variation of Drop Properties and Formation Rates During Secondary Breakup*; Co-Chairs: V.S. Arpaci and G. Faeth
- Shuqin Du** *Thermoelastic Effects in Automotive Brakes*; Co-Chairs: J.R. Barber and G.M. Hulbert
Lei Jiang *Nonlinear Gravity-Capillary Water Waves*; Co-Chairs: W.W. Schultz and M. Perlin
- Seong Beom Lee** *A Study of a Nonlinear Viscoelastic Model of Elastomeric Bushing Response*; Chair: A.S. Wineman
- Juan Lin** *The Vortical Structure of Capillary-Gravity Waves: An Experimental Investigation*; Co-Chairs: W.W. Schultz and M. Perlin
- Seungjae Min** *Optimum Structural Topology Design for Multiobjective, Stability, and Transient Problems Using the Homogenization Design Method*; Chair: N. Kikuchi
- Tariq Shamim** *A Study of Transient Counterflow Diffusion Flames with Radiation*; Chair: A. Atreya

Faculty and Staff Honors

- Ellen M. Arruda** Assistant Professor, received a 1996–97 NSF CAREER Award. She also was awarded a 3M Untenured Faculty Research Grant.
- James J. Ashton-Miller** Research Scientist, was honored with the Dantek Best Paper Award at the 1996 International Continence Society meeting in Athens, Greece.
- Anna L. Babbitt** Administrative Associate II, was a recipient of the CoE's Excellence in Staff Service Award.
- Steven L. Ceccio** Associate Professor, was presented with the DoE Young Scientist and Engineering Award (Defense Program).
- John W. Holmes** Associate Professor, was a recipient of the NSF Young Investigator Award.
- Rodney Hill** Graphic Artist II, won a silver award in the University and College Designers Association (UCDA) competition for his illustration depicting the ERC/RMS featured on the cover of the *CoE Engineer*, Spring/Summer issue.
- S. Jack Hu** Assistant Professor, received a 1996 NSF CAREER Award.
- Bruce H. Karnopp** Associate Professor, was named a Thurnau Professor in 1996. This program was established to recognize outstanding contributions to undergraduate education. The award extends for three years. He also received the Winter term, 1997 Pi Tau Sigma Professor of the Term Award.
- Yoram Koren** Professor, received the 1997 Robert M. Caddell Memorial Award. This award acknowledges outstanding research contributions in materials and/or manufacturing by a faculty member. He also continued as a Distinguished Collegiate Professor and the Paul G. Goebel Endowed Professor of the University of Michigan College of Engineering.
- Kenneth C. Ludema** Professor, was elected a Fellow of the Society of Tribologists and Lubrication Engineers.
- David W. Mead** Associate Professor, was honored with a research fellowship from the Japanese Society for the Promotion of Science (JSPS).
- Jyotirmoy Mazumder** Professor, was named the Robert H. Lurie Professor of Mechanical Engineering and Applied Mechanics in 1996.
- Herman Merte, Jr.** Professor, rose to the grade of Life Fellow of the American Society of Mechanical Engineering (ASME).
- Christophe Pierre** Associate Professor, was elected a Fellow of the American Society of Mechanical Engineering (ASME).
- Ann Marie Sastry** Assistant Professor, received a 1996–97 NSF CAREER Award. She also was presented with a University of Michigan Career Development Award.
- Albert B. Schultz** Vennema Professor of Mechanical Engineering and Applied Mechanics, was given the 1996 Stephen S. Attwood Excellence in Engineering Award by the University of Michigan College of Engineering and the Borelli Award of the American Society of Biomechanics.
- Michael D. Thouless** Associate Professor, received a 1996 NSF CAREER Award.
- A. Galip Ulsoy** William Clay Ford Professor of Manufacturing, was elected a Fellow of the Society of Manufacturing Engineers (SME).
- Alan S. Wineman** Professor, was honored with the 1997 College of Engineering Teaching Excellence Award at the University of Michigan. He was also named Professor of the Term by the student chapter of Pi Tau Sigma for the Fall term of 1996.
- Wen-Jei Yang** Professor, was presented with a Foreign Special Visiting Professorship by Monbusho, the Japanese Ministry of Education.



This rendering study involved foreshortened perspective by Ernest H. Jacobs, 1897.

MEAM Departmental Awards

Alumni Society Merit Award

Charles S. Hutchins (BSE ME '57) for his innovation in machine tool and numerical control technology for nearly 40 years, and his avid support of our students, the CoE, and U-M Solar Car Teams.

Excellence in Teaching

Rida T. Farouki Professor, in recognition of his outstanding teaching of design at both the undergraduate and graduate levels.

Michael D. Thouless Associate Professor, for his leadership in developing the junior/senior lab sequence, his participation in both the Graduate and Undergraduate Curriculum Committees, and his outstanding teaching of mechanics and materials at both the undergraduate and graduate levels.

Excellence in Research

Vedat S. Arpaci Professor, for his sustained commitment to research excellence in the study of combustion and heat transfer.

James R. Barber Professor, for his sustained commitment to research excellence in the field of solid mechanics.

Excellence in Service

Elijah Kannatey-Asibu, Jr. Professor, for his service as chair of the MEAM Laboratory, and membership in the Department's Advisory, Faculty Search, and Planning Committees, as well as membership in the College Disciplinary Committee, and chairing the Faculty Rules Committees.

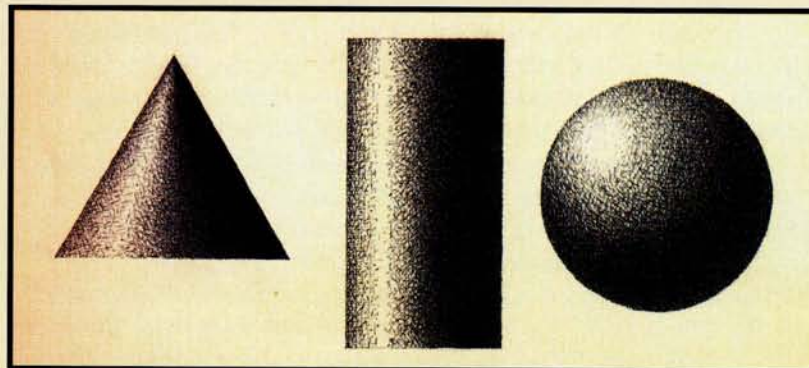
Grétar Tryggvason Associate Professor, for leadership in developing the undergraduate curriculum at both the Departmental and College level as well as contributions to the Department's Planning, and Curriculum Committees, and membership on the Rackham Divisional Board.

Staff Excellence

Anna L. Babbitt Administrative Associate II, for exceptional service to the faculty, staff, and students of this Department, leadership of the Communication/Publication Office, the Mechanical Engineering Student Leader Board (MESLB), and the MEAM External Advisory Board.

Susan Clair Office Assistant IV, for exceptional service to the students, faculty, and staff of the S.M. Wu Manufacturing Research Center including assistance in a major accounts reconciliation project.

Rendering the cone, cylinder and sphere is a fundamental problem in any illustrator's curriculum. Mr. Jacobs' execution of these classic forms demonstrates a mature and disciplined hand with a crow quill pen, Ernest H. Jacobs, 1897.



Faculty Professional Service

July 1, 1996 to June 30, 1997

For brevity's sake, this list omits Departmental, College, and University of Michigan service activities for the faculty, nor does it include their technical review contributions to authoritative journals.

- Ellen M. Arruda** Co-Organizer, Characterization and Modeling of Polymeric Material Systems Symp., Joint ASME/ASCE/SES Summer Meeting, 1997, Symp. on Solid Mechanics in Viscoelastic and Plastic Materials, 33rd Annual Technical Meeting, Society Engineering Science, 1996; Guest Editor, *J. Engrg. Materials and Technology*, 1997–present; Panelist, Marian Sarah Parker Scholars Career Panel, 1997.
- James A. Ashton-Miller** Board of Editors, *Clinical Biomechanics*, 1994–present, *European J. Musculoskeletal Research*, 1991–present, *J. Orthopaedic Research*, 1992–present.
- Dennis Assanis** Associate Editor, *ASME J. Gas Turbines and Power*, 1996–1999; Chair, ARC Annual Conf.; Session Co-Chair, SAE Int. Congr. and Expo; Faculty Advisor, SAE Formula Car Program, 1997; Member, Technical Program Comm., VTMS-3 Int. Conf., Program Review Comm., 26th Int. Symp. on Combustion; Session Organizer, ASME-ICE Spring Technical Conf.
- Arvind Atreya** Associate Member, U.S.-Japan Panel on Fire Research; Member, Program Subcommittee, Int. Symp. on Combustion, ASME K-11 Subcommittee for Fire and Combustion, Ad Hoc Mathematical Fire Modeling Group, NIST.
- James Barber** Associate Editor, *ASME J. Applied Mechanics*; Editorial Board, *J. Thermal Stresses*; Organizing Comm. and Papers Chair, Thermal Stress '97.
- Claus Borgnakke** Member, SAE Motor Vehicle Council, SAE Passenger Car Activity Engine Comm.
- Diann Brei** Chair, ASME Symp. on Adaptive Structures and Material Systems; Co-Organizer, Int. Program Comm., Mechatronics 1996.
- Michael Bridges** Session Chair, IEEE Int. Symp. on Intelligent Control, 1996.
- Steven L. Ceccio** Member, ONR Cavitation Comm., 1992–present, ASME Multiphase Flow Comm., 1992–present.
- Dariusz J. Ceglarek** Member, Executive Comm., S.M. Wu Manufacturing Research Center, 1995–present.
- David E. Cole** Advisor, Army's National Automotive Center; Assistant Chair, Fundraising Comm. for Ann Arbor Hands-On Museum; Member, Board of Directors, Automotive Hall of Fame, Board of Trustees, Hope College.
- David R. Dowling** Member, ASA Underwater Sound Technical Comm., 1997–present; Session Chair, Reacting Flows Symp., 49th Meeting of the American Physical Society, Fluid Dynamics Div., Special Session on Time Reverse Acoustic Propagation, 133rd Meeting ASA, 1997.
- Debashish Dutta** Associate Editor, *ASME Trans. J. Mechanical Design*, *J. Manufacturing Systems*; Chair, 1997 Design Automation Conf., Int. Program Comm. Seventh IMA Conf. Mathematics of Surfaces, 1996, IEEE Int. Conf. Robotics and Automation, 1997; Invited Participant, NIST Workshop on Layered Manufacturing, 1996, NSF-CNRI Wkshp HPC and Layered Manufacturing, 1997; Member, NSF Delegation to S. African Univ., 1997; Review Chair, 1996 Design Automation Conf.
- William J. Endres** Co-Chair, ASME IMECE Symp. on Quality of Traditionally Machined Surfaces, 1997; Session Co-Organizer, Symp. on Engineering Mech., in Manufacturing Processes and Materials Processing, Joint ASME, ASCE, SES Summer Meeting, 1997.
- Robert D. Ervin** Session Co-Chair, Saab-Scandia, Sodertalje, Sweden, 1996.
- Rida T. Farouki** Vice Chair, SIAM Activity Group on Geometric Design, 1993–present.
- Steven A. Goldstein** Member, Executive Comm., ASME Bioengineering Div. 1989–present, Subcommittee on Orthopaedic Basic Science Evaluation, 1995–present, Executive Comm., U.S. Natl. Comm. of Biomechanics, 1993–present.
- Karl Grosh** Organizer, Symp. on Computational Methods for Dynamics and Acoustics, 16th Biennial Conf. on Noise and Vibration, 1997.
- Scott J. Hollister** Editorial Board, *Computer Methods in Biomechanics and Biomedical Engineering*.
- S. Jack Hu** Chair, Technical Comm. on Materials Processing, ASME Manufacturing Engineering Div., 1996; Co-Organizer, Symp. on Assembly Modeling, ASME IMECE, 1997.

- Gregory M. Hulbert** Associate Editor, *ASME J. of Pressure Vessel Technology*; Editor, *ASME Pressure Vessels and Piping Div. Newsletter*; Editorial Board, *Finite Elements in Analysis and Design*; Member, Junior Awards Comm. ASME, Applied Mechanics Div.; Secretary, Comm. on Computing in Applied Mechanics, SME Applied Mechanics Div., Computer Technology Comm., ASME Pressure Vessels and Piping Div.
- Elijah Kannatey-Asibu, Jr.** Chair, Executive Comm., ASME Manufacturing Engineering Div.; Member, Program Comm., Third Africa-U.S. Int. Conf. on Mfg. Technology, 1996, Planning Comm., NSF-ERC Annl. Meeting, 1997.
- Massoud Kaviani** Associate Editor, *ASME J. Heat Transfer*, 1996–present; Chair, ASME Theory and Fundamental Research Comm. Heat Transfer Div., 1995–present; Guest Editor, *Advances in Water Resources*, 1996.
- Noboru Kikuchi** Member, ASME Comm. on Computing in Applied Mechanics, 1981–present, ASCE Comm. on Mathematical Methods, Engineering Mechanics Div., 1982–present, SES Executive Comm. on Computational Mechanics, 1981–present, IACM Int. Advisory Comm., 1992–present.
- Yoram Koren** Editorial Board, *SME J. Manufacturing Systems*, 1986–present, *Proc. of the CIRP, Manufacturing Systems Div.*, 1991–present.
- Sridhar Kota** Member, ASME Design Engineering Honors and Awards Comm., 1997; Panelist, NSF Design Engineering Div., 1996.
- Liwei Lin** Co-Organizer, ASME IMECE MEMES Symp., 1997; Section Chair, ASME IMECE MEMS Symp. 1996; Vice Chair, ASME MEMS Panel, DSC Div., 1996–1997.
- Kenneth C. Ludema** Chair, ASME Research Comm. on Tribology 1994–1996, ASME Tribology Div. Publication Comm., 1997–; Editor (N. American Region) *J. Wear*.
- Jyotirmoy Mazumder** Member, Board of Governors Laser Inst. of America, Chapman and Hall Advisory Board on Lasers and Electro-Optics; Senior Editor, *J. Laser Applications*.
- David W. Mead** Editor, *J. Polymer Plastics Technology and Engrng.*, 1997; Organizer and Session Chair, Society Plastics Engr. Annl. Meeting, ANTEC Conf., 1997, Society of Rheology Annl. Meeting, 1997; Session Chair, World Congr. of Rheology, 1996.
- Herman Merte, Jr.** Member, Advisory Comm. on Engineering Curriculum, State of Michigan, Board of Professional Engineers, 1989–present.
- Nestor F. Michelena** Review Coordinator, ASME Design Automation Conf., 1996.
- Jun Ni** Associate Editor, *J. Manufacturing Systems*; Editor, *ASME Manufacturing Engineering Div. Newsletter*; Int. Editorial Board, *Coordinate Measuring Machines and Systems*; Member, Focus: HOPE, Greenfield Coalition for Manufacturing Education.
- Jwo Pan** Member, ASME Fracture Mechanics Comm., 1995–present, ASME Metallic Materials Comm., Materials Div. 1996–present, ASME PVP Fabrication and Materials Comm., 1996–present, SAE Ferrous Materials Comm., 1996–present.
- Panos Y. Papalambros** Editorial Boards, *J. Integrated Computer Aided Engineering*, 1993–present, *J. Artificial Intelligence in Design and Manufacturing*, 1987–present, *Int. J. Engineering Design*, 1989–present, *J. Structural Optimization*, 1997–present; *J. Engineering Optimization*, 1992–present; Board of Directors, R&B Machine Tool Co.
- Huei Peng** Co-Organizer, ASME Transportation Symp., ASME Int. Congress and Exposition, 1996, ASME Vehicle Control Symp., American Control Conf., 1997.
- Noel C. Perkins** Associate Technical Editor, *ASME J. Applied Mechanics*; Member, ASME Design Engineering, Technical Comm. on Vibration and Sound, Technical Comm., 16th Biennial Conf. on Mechanical Vibration and Noise, 1997; Member, ASME Honors and Awards Comm.
- Christophe Pierre** Associate Editor, *ASME J. Vibration and Acoustics*, 1992–present; Member, ASME Advisory Board, Nonlinear Dynamics Div., 1994–present, ASME Structures and Dynamics Comm., Int. Gas Turbine Inst., ASME Technical Comm. on Vibration and Sound.

Faculty Professional Service (continued)

- Ann Marie Sastry** Member, ASME Composites Comm., Materials Div., ASME Composite Materials Comm., Applied Mechanics Div.
- Albert B. Schultz** Advisory Panel, Duke University Center on Aging, 1993–present; Editorial Board, *J Biomechanics*, 1981–present.
- William W. Schultz** Faculty Advisor, ASME Student Chapter, 1995–present.
- Louis J. Soslowsky** Member, U.S. National Comm. on Biomechanics, 1996–present, ASME Solid Mechanics Comm. Bioengineering Div., 1993–present, Grants Review Comm., Orthopaedic Research and Education Foundation, 1995–2000, ASES Charles S. Neer Award Committee, 1996–present, ASES Closed Meeting Program Comm., 1996; Adjunct Member, Orthopaedic Research Society, Program Comm., 1995–present; Calendar Coordinator, ASME J. Biomechanical Engrg.
- Jeffrey L. Stein** ASME Secretary, 1995–1998; Member, ASME Executive Comm., 1995–1998, ASME Honors Comm., 1993–1996, ASME Long Range Planning Comm., 1993–present, Organizing Comm. NAMRAC 1996.
- Michael Thouless** Associate Editor, *J. American Ceramic Society*, 1990–present.
- Dawn M. Tilbury** Mailing List Coordinator, Women in Control, IEEE Control Systems Society, 1995–present.
- Grétar Tryggvason** Associate Editor, *J. Computational Physics*, 1992–present; Co-Organizer, Open Forum for Multiphase Flow, and Symp. on Advances in Numerical Modeling of Free Surface and Interface Fluid Dynamics, ASME Fluid Dynamics Div. Summer Meeting, 1996; Member, ASME Multiphase Flow Comm.
- A. Galip Ulsoy** Editor, *IEEE/ASME Transactions on Mechatronics*, 1995–present; Editorial Board, *GSU Engineering and Technology J.* (Istanbul, Turkey), 1996–present; Int. Expert Evaluator, Technologically Integrated Mfg. Engrg. Program, Swedish Nat. Board for Industrial and Technical Development, 1996; Member, External Proposal Review Comm., Mfg. Research Center, Georgia Inst. Technology, 1995–present, Honors Comm. ASME Dynamic Systems and Control Div., 1992–1997, Organizing Comm., Japan-U.S. Symp. on Flexible Automation, 1996, Executive Comm., ASME Dynamic Systems and Control Div., 1994–present, Advisory Comm. Turkish Mechanical Engrg. Congress, 1997.
- Alan S. Wineman** Board of Directors, Society of Engineering Science, 1997–2000; Co-Organizer, Symp. on Solid Mechanics in Viscoelastic and Plastic Materials, and Macromolecular Science and Engineering Symp. 33rd Meeting, Society of Engineering Science.
- Xin Wu** Deputy Technical Director, NIST-STP Near Zero Stamping Program; Member, Autobody Consortium.
- Wen-Jei Yang** Co-Organizer, Int. Conf. on Mechanics in Medicine and Biology, Ljubljana, Slovenia, 1996, Int. Symp. on Transport Phenomena and Dynamics in Rotating Machinery, Honolulu, HI, 1996, Int. Symp. on Transport Phenomena, Singapore, 1996.



This drawing involved circular forms in perspective proved a particular challenge for Ernest H. Jacobs, 1897.

Faculty and Staff News

New Faculty

Kazuhiro Saitou Assistant Professor, received his PhD degree in Mechanical Engineering from the Massachusetts Institute of Technology (MIT) in May. His general research interest is biologically inspired engineering design, and he is especially interested in distributed information processing in biological systems, in mathematical analysis of such processes, and in applying such distributed architecture to various aspects of engineering design.

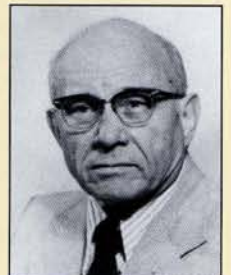


Promotions

Jun Ni Associate Professor, to Professor with tenure
Christophe Pierre Associate Professor with tenure, to Professor with tenure
Grétar Tryggvason Associate Professor with tenure, to Professor with tenure

In Memoriam

Joseph Akerman Associate Professor Emeritus, died February 12, 1997, in Ann Arbor, MI. Akerman came to the University of Michigan from the University of Wisconsin in 1956 where he had been on the faculty since 1947. He served on the faculty as an associate professor of Mechanical Engineering (and Mechanical Engineering in Architecture) until his retirement in 1980. He received the rare and prestigious Distinguished Fellow of ASHRAE in 1996. He was 86.



R. (Richmond) Clay Porter Professor Emeritus, died December 14, 1996, in San Jose, CA. Porter joined the faculty in 1940 as an assistant professor and retired a full professor in 1973. He was an examiner on the State Board of Registration for 20 years. In 1968, he was elected a Fellow of the American Society of Mechanical Engineers. A member and faculty advisor to the Michigan Gamma Chapter of Tau Beta Pi, Porter had an award created in his name "...to honor those who give unselfishly of themselves in his manner." He was 94.



Chia-Shun Yih Distinguished University Professor Emeritus of engineering, died April 24, 1997, in Tokyo, Japan. Before coming to the University of Michigan in 1956, Yih had taught at University of Wisconsin, Colorado State University, British Columbia, and University of Iowa. Among his list of honors, he was named Stephen P. Timoshenko Distinguished University Professor of Engineering in 1967. He was a Henry Russell Lecturer and received the Theodore von Karman Medal of ASME/ASCE, in 1981. He was a member of the National Academy of Engineering and a Fellow of the American Physical Society. He was 78.



Faculty Publications

1996

Biomechanics

Contributing Faculty: Rayhaneh Akhavan, James A. Ashton-Miller, Steven A. Goldstein, Scott J. Hollister, Arthur D. Kuo, Albert B. Schultz, Louis J. Soslowsky, Wen-Jei Yang.

Journal Articles:

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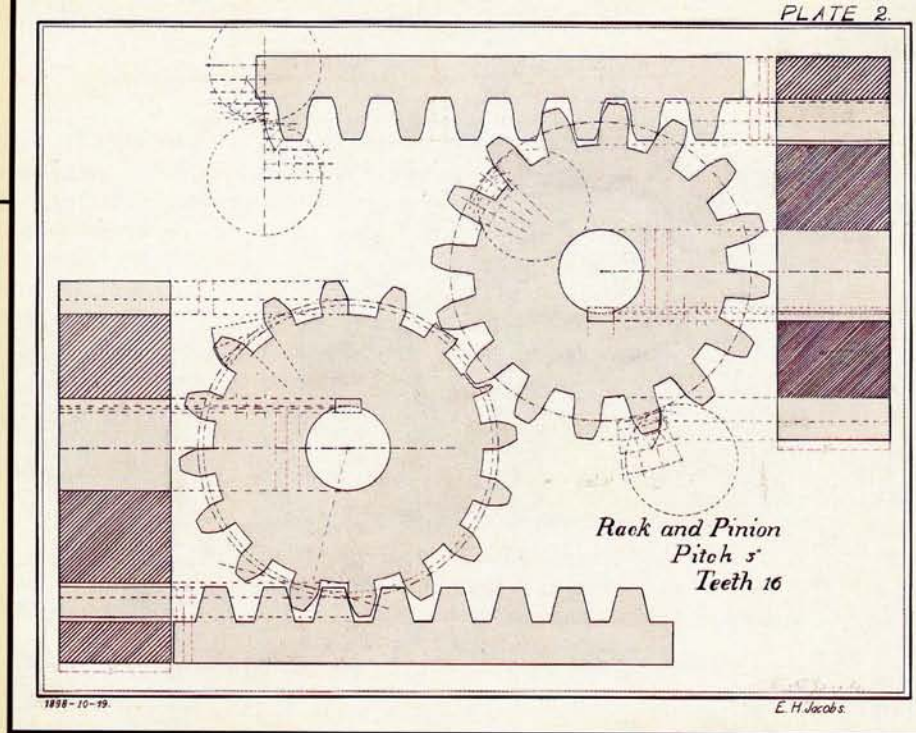
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This complete drawing includes the outline and labeling conventions that evolved into the "engineering block" format that is used today, Ernest H. Jacobs, 1898.

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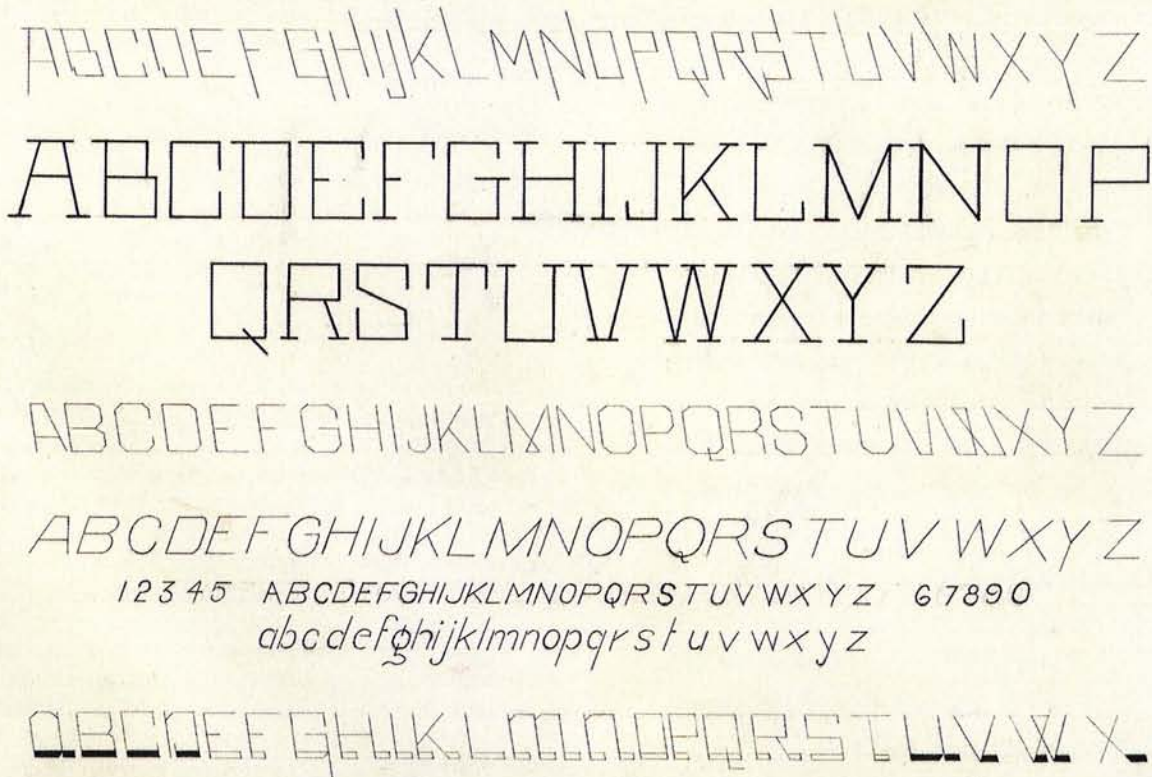
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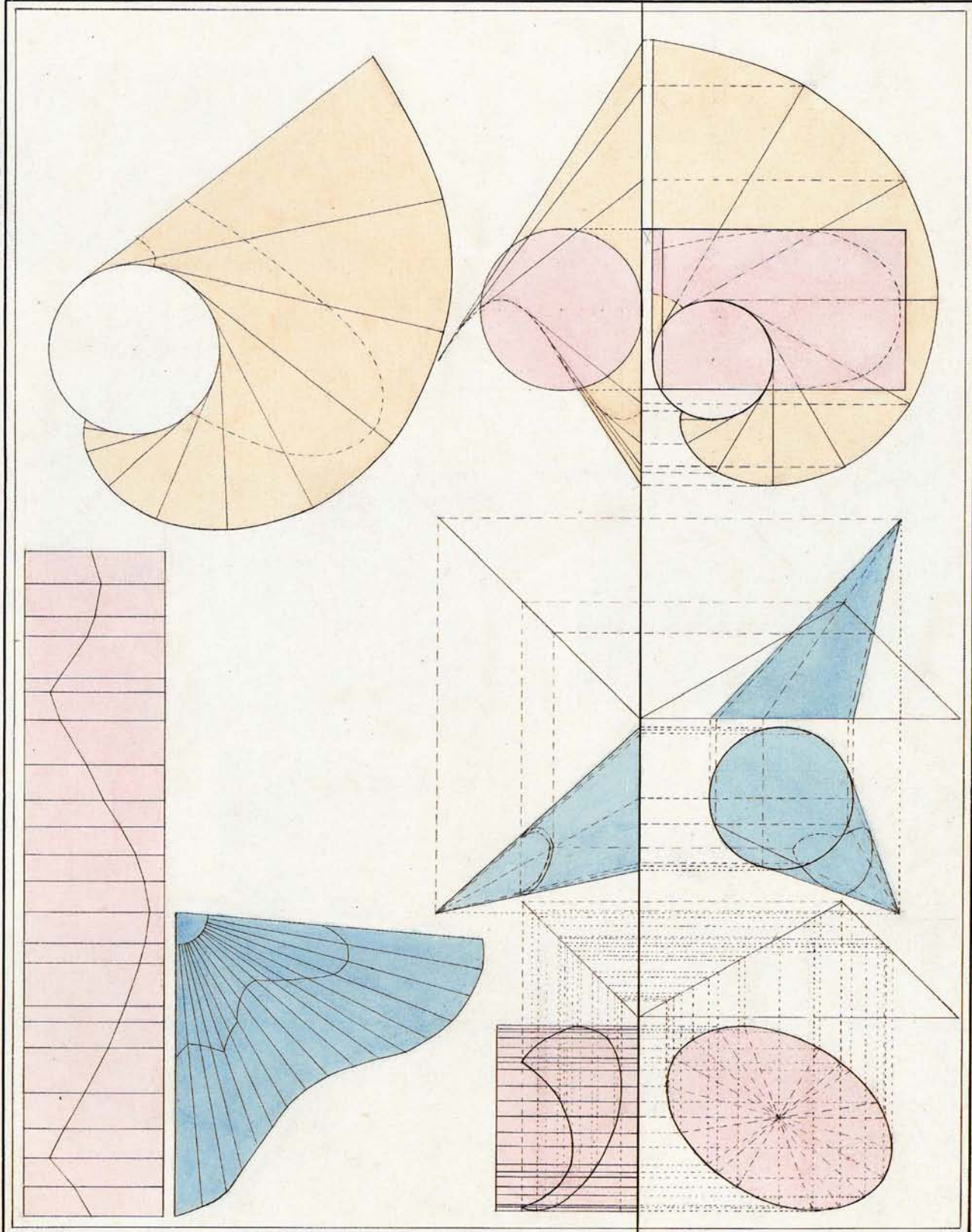
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