

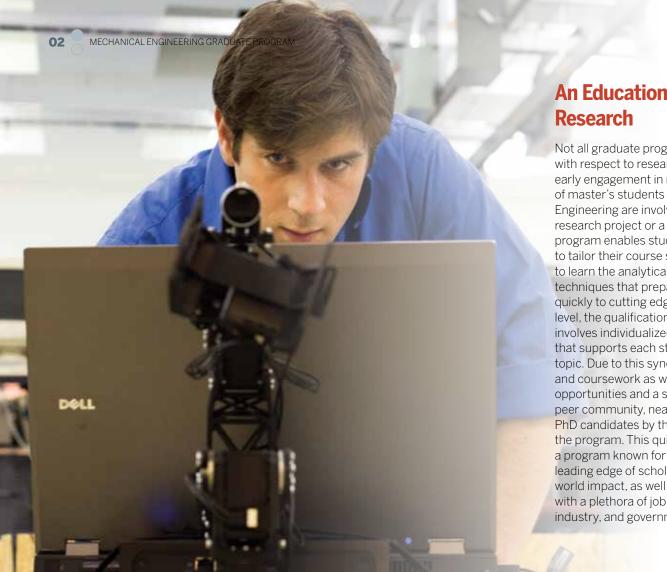


Program!

Mechanical Engineering (ME) at the University of Michigan (U-M) is consistently ranked among the very top programs in the nation and in the world. Based on data analyzed and published by the National Research Council (NRC), our PhD program received an overall #1-2 ranking from the independent website PhDs.org, using weightings of the NRC data for large institutions. Our multidisciplinary approach to research and learning combines trendsetting research with challenging coursework and leadership opportunities. The international reputation of the University of Michigan ensures access to world-class professors and the most up-to-date facilities, and the beautiful town of Ann Arbor is a great place to live and work.

This book will give you a quick overview of our top-notch research and graduate programs, the University of Michigan, and lovely Ann Arbor. Profiles of some of our alumni are included as well. For more detailed information, please visit our website at me.engin.umich.edu. Enjoy your reading!





An Education Program for Research

Not all graduate programs are created equal with respect to research opportunities and early engagement in research. Roughly 50% of master's students in U-M Mechanical Engineering are involved with an independent research project or a thesis. The Master's program enables students conducting research to tailor their course structure to allow them to learn the analytical and experimental techniques that prepare them to contribute quickly to cutting edge research. At the PhD level, the qualification examination process involves individualized graduate coursework that supports each student's particular research topic. Due to this synergy between research and coursework as well as valuable mentoring opportunities and a strong graduate student peer community, nearly all students become PhD candidates by their fourth semester in the program. This quick start is a hallmark of a program known for putting students on the leading edge of scholarly contributions and real world impact, as well as graduating students with a plethora of job opportunities in academia, industry, and government.

Program Overview

Over the years, graduate students have chosen the Michigan program because of its outstanding reputation in research scholarship, innovation and impact, its consistent record of pushing ME frontiers and its exceptional rapport with students. As an ME graduate student, you'll become part of a vibrant community that includes student-run organizations such as the ME Graduate Council, the Graduate Society of Women Engineers, and the National Society of Black Engineers, to name a few. These organizations enable students to leverage professional networks and gain access to a social community that provides support for the rigorous pace of graduate engineering studies.

ECHANICAL ENGINEERING GRADUATE PROGRAM 💛 03

The Michigan graduate program in Mechanical Engineering offers two degrees: a Master of Science in Engineering (MSE) and a Doctor of Philosophy (PhD). You can also pursue dual degrees—for example, in the Engineering Sustainable Systems program with the School of Natural Resources & Environment or with other programs within the Rackham Graduate School. In addition, qualified undergraduates in the College of Engineering can pursue a combined undergraduate/graduate degree in the Sequential Undergraduate/Graduate Studies (SUGS) program.

Master's Degree (MSE)

Students choose to pursue a master's degree because of the opportunity to develop a personalized academic program to strengthen their knowledge of ME fundamentals in a specific area. There are three separate MSE degree program options: coursework only, coursework plus an individual research project. and coursework plus an MSE thesis.

Doctor of Philosophy (PhD)

The goal of the PhD program is to create a culture of scholarship and high-impact research that produces articulate researchers who are called upon first to hold leadership positions in society and academia.

The PhD is the highest degree awarded by the ME Department and is recommended for students who are interested in leadership careers in academia (e.g., as a university faculty member), industry, or government. PhD graduates are trained to be the leaders and best in their fields and have doors open to a wide selection of career tracks. PhD students begin research immediately and have access to courses and networks that support their research progress. ME is also a partner with the Rackham Graduate School, which offers workshops, training sessions, forums, and talks relevant to graduate students.





COMPUTATIONAL SCIENCE & ENGINEERING: Enhancing Phenomenological Predictions

Computational science & engineering applies high-performance computational techniques to a wide range of research. from combustion and biomedical engineering to turbomachinery and energy. Students have focused on nanoparticle interactions with biological systems, self-assembled nanostructures, energy storage materials, the design of biofuel molecules, and the tailored design of molecular structures for combustion performance. Students can also study computational biophysics, which addresses research questions in areas such as DNA mechanics and dynamics, or can perform large-scale computational studies for topics such as cell motility or tumor growth. Other concentrations include computational fluid dynamics, physics, combustion, and phononic design.

CONTROLS: Closing the Loop

Controls research at U-M ME encompasses everything from haptic and prosthetic devices, multi-scale robotics, fuel cells, biofuel energy conversion, and manufacturing automation to vehicle safety and next generation transportation. Research

topics include position tracking of pedestrians or vehicles without GPS, technologies to aid people with disabilities including navigation aids for the blind and those with limited mobility, haptic

interface systems that exploit the sense of touch for rehabilitation or education, micro-mechatronic systems for use in biomedical devices or computers, vehicle safety and handling, powertrain controls, diesel technology and braking methods for heavy vehicles, fuel cell and hybrid vehicles, autonomous ground robots, and reconfigurable manufacturing systems.



Alumni Profile

Sheri Sheppard (PhD ME '85)

Now a professor of mechanical engineering at Stanford University and co-director of the Center for Design Research, Sheri Sheppard chose the U-M ME graduate program for the quality—of the faculty, facilities and reputation—and the breadth of course offerings, from theoretical to practical. Her advisors, who had high expectations and always found time to talk and answer questions, had a strong influence on her, both then as a graduate student, and now as a professor herself.

In the past decade, Sheppard has led several national studies on engineering identity and engineering education.

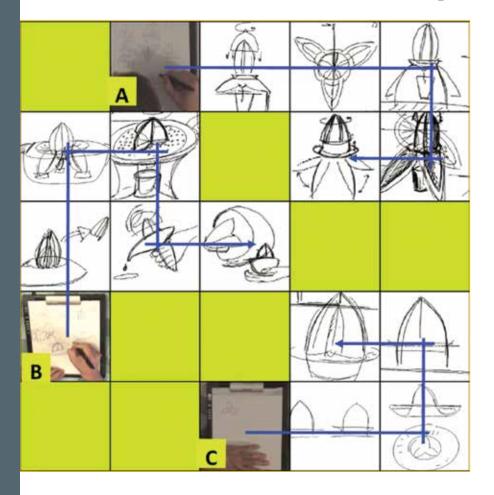


My advisors were stellar; I've tried to model my own advising of graduate students after them. The U-M ME program helped me develop the confidence to ask and answer hard questions, not only about how the physical world works—and how we can make it better—but also about the development and education of engineers themselves.

- Sheri Sheppard

DESIGN: From Engineering Analysis to Better Living

Design is the transformation of fundamental understanding and creativity into the technological change that drives markets and meets societal needs. At U-M, design takes on an analysis driven flavor, using engineering tools and multidisciplinary connections to understand how knowledge of engineering physics, chemistry, and biology can shape tomorrow's solutions to global challenges. A key differentiator of the Michigan program is that with not just engineers, but also experts from fields such as social science, architecture, art, and policy, bridging traditional academic boundaries to understand how technology can best meet people's needs. Students can focus on energy systems and technologies ranging from micro/ nano devices to wind/solar energy conversion and storage, as well as technologies and systems that give rise to advanced products, manufacturing processes, and services. Students also work on challenges for global health, environmental sustainability, smart/efficient mobility, and next generation infrastructures. Design students build on the elements of their engineering undergraduate education and apply the tools of optimization and innovation to meet global challenges.



DYNAMICS AND VIBRATIONS: Shaking it Up

Dynamics and vibrations research studies the fundamentals of rigid and flexible body dynamics, vibrations, acoustics, and controls. Through innovative research, students explore various topics including nonlinear dynamics, structural dynamics, structural health monitoring, vibration controls, microrobotics, novel actuator and sensor systems, and adaptive structural systems. Human hearing and hearing biomimicry studies include the development of MEMS devices that mimic the function of the human inner ear. Sports training systems research includes the use of MEMS inertial sensors for human motion analysis. In other research, students study the dynamics of biomolecular motors and DNA. Students also can concentrate their efforts on fluidstructure interactions to better understand nonlinear structural and aeroelastic behaviors of systems such as turbine bladed disk assemblies. Students are well-positioned to pursue entrepreneurial ventures or lead research programs in academia, industry, or

The spirit and sense of community at Michigan were unlike anything I'd experienced before. Working with my faculty advisor opened up opportunities that I did not think possible. My training at U-M made it possible for me to secure a faculty position as I was defending my thesis and prepared me for the challenges of an academic career.

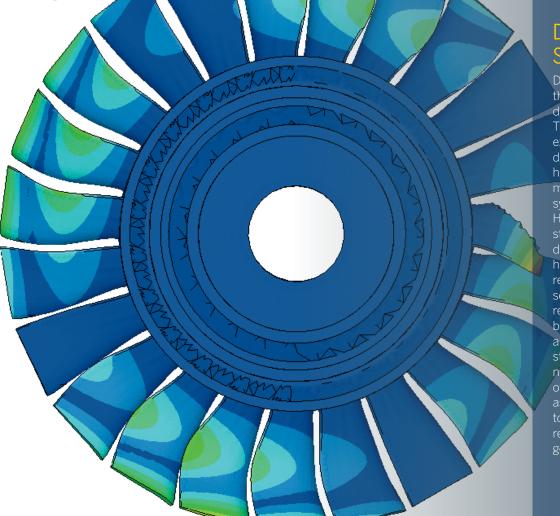
– Alan McGaughey



Mellon University, Professor Alan McGaughey chose U-M Mechanical Engineering for his PhD studies because of its outstanding reputation and extensive resources, including top investigators and cutting-edge research projects in nanoscale heat transfer, his main area of interest.

At U-M, McGaughey interacted with graduate students and faculty from diverse backgrounds in coursework and research. Colleagues and mentors from within the department as well as from Materials Science & Engineering and Physics helped him shape his thesis research into a successful interdisciplinary project. The many seminars he attended on preparing for an academic career helped him get a solid start on finding a faculty position.

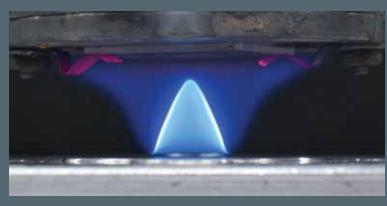
McGaughey enjoyed going to hockey and football games, among other on- and off-campus activities. "The spirit and sense of community at Michigan were unlike anything I'd experienced before," said McGaughey, who also met his wife, an Ann Arbor native, while at U-M.



ENERGY: Multiscale Power

The desire for sustainable energy has created new demands for energy research, and ME graduate students play an integral role in exploring and creating nextarea includes a wide variety of applications from stationary power to transportation. For example, students can focus on macro, micro, or nano devices for energy conversion (such as advanced photovoltaic devices), applying these technologies to solar, wind, or thermal energy. Students can choose to work on alternative fuels design and combustion, which includes new concepts in the development of carbon-neutral vehicles. Students may also focus on energy storage materials and systems, including the development of new materials for hydrogen storage. Additional topics include the design and maintenance of energy systems and the evaluation of government policies that influence technological development.







multidisciplinary approach to their



Carla Bailo (MSME '86)

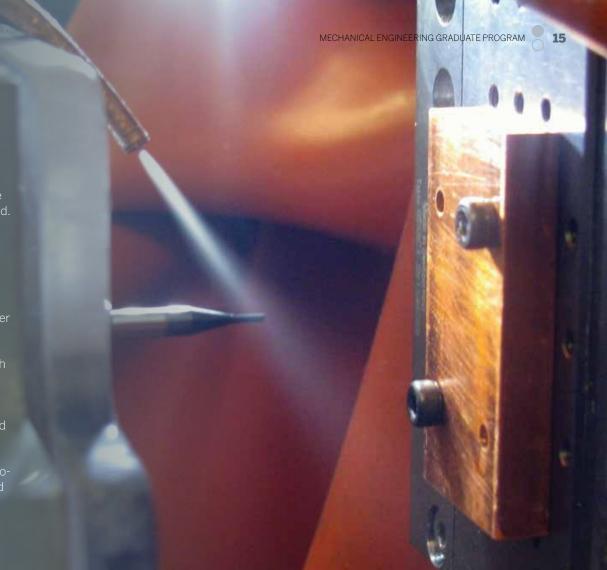
Carla Bailo, now Assistant Vice President
– Mobility Research and Business
Development at The Ohio State University,
and President and CEO – ECOS
Consulting LLC, chose U-M Mechanical
Engineering for its reputation, top-notch
facilities, high caliber of professors, and
research in her main area of interest:
automotive engineering.

Bailo clearly remembers taking an influential course on materials during her graduate study: "In the course we studied the Space Shuttle Challenger explosion and O-ring issue. Actually to solve a reallife problem using theory was amazing—it made me realize the importance of diligence in design and how critical the engineering role is to any mission."

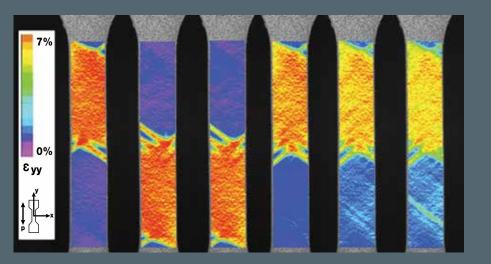


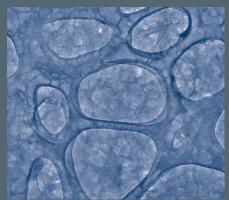
MANUFACTURING: Accelerating Competitiveness

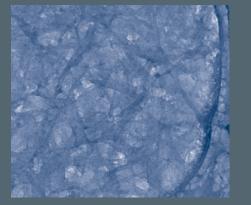
advancing the frontiers of what can be made and what can be commercialized. Students work alongside faculty members to develop innovative manufacturing processes and systems that transform concepts into market solutions. The scope of study available to students ranges from the development of personalized consumer products using reconfigurable and laser-based manufacturing to nanoscale structures and devices. Research extends in scales from precision manufacturing, micro-machining, and micro-forming to product assembly, factory-scale energy conservation, and sustainable manufacturing systems. Students also work on emerging manufacturing systems including nanomanufacturing, biological printing, and

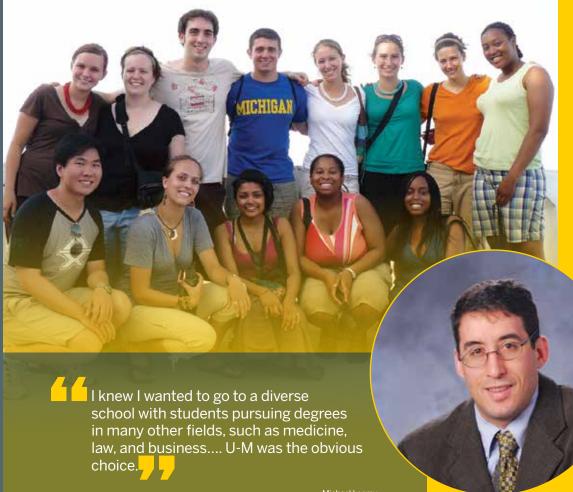


structure of a material and its behavior. This highly interdisciplinary area offers many opportunities for collaboration and focuses on experimental, theoretical, and computational aspects at a wide range of length and time scales. Students can focus on modeling of micro/nano mechanics, fracture, failure, and/or elasticity. Their research can also center on biological, semiconductor, polymer, or nano/active materials such as self-assembled nanostructures; MEMS devices; toughening mechanisms in polymer and dynamics; electrical storage, conduction, and conversion in applications such as batteries, chemical sensors, structural composites, and energy-efficient actuators; or tissue engineering and the mechanics of









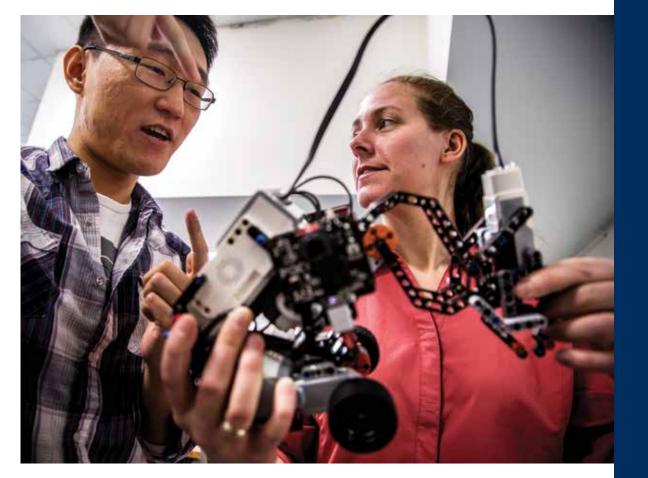
Michael Leamy (MSME '95, PhD ME '98)

Michael Leamy, now a faculty member at the Georgia Institute of Technology, applied to only one graduate program: U-M Mechanical Engineering. At Michigan, Leamy studied under and learned from top researchers in Mechanical Engineering, particularly in vibrations engineering and computational mechanics. He recalls also making great friends from diverse backgrounds: "We did a lot of things outside of the classroom: intramural softball, hiking, and a little road tripping."

After a teaching assistantship his first year, Leamy knew he wanted to pursue an academic career, "Both teaching and research are done at a very high level at Michigan with a great deal of integrity; it's hard not to get sucked in. Having a U-M degree also is highly respected in academic circles, and that helped me ultimately land a position at another great university."

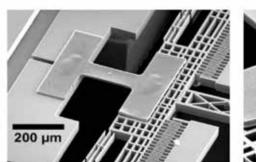
MECHATRONICS: Crossroads of Disciplines

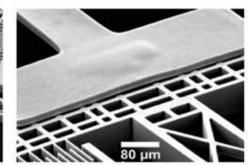
Mechatronics at U-M is at the forefront of designing high-performance machines, structures, devices, and processes. The field provides a hands-on and synergistic integration of mechanical engineering disciplines, encompassing controls electronics and computers. Students connect engineering models and analyses with real-world implementation by focusing their studies in areas such as mobile robots and autonomous vehicles, haptic interfaces, nanomanipulation. nanomanufacturing, and wearable medical monitoring devices. Students also contribute to projects related to smart materials, structural health monitoring, balance prostheses, and energy recovery from human movement.

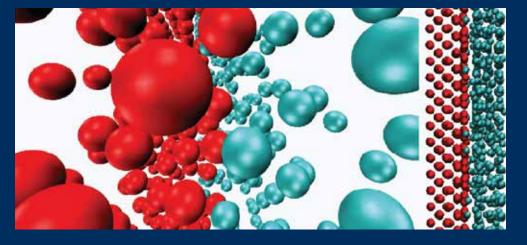


MICRO/NANOENGINEERING: From the Ground Up

The micro/nanoengineering research area offers students the opportunity to examine a broad spectrum of technological and scientific problems related to smallscale materials, devices, and systems. Collaboration across disciplines, departments, and programs is the norm, including top researchers affiliated with the Medical School and the Lurie Nanofabrication Facility. Students may focus on atomic scale and quantum mechanical simulation, which involves modeling nanoscale effects on material properties and designing new materials based on these findings. They may choose to concentrate on MEMS. NEMS. or microrobotics. Students may also work on nano materials and structures, such as thermoelectric devices. optoelectronics, or molecular devices, where they may measure the transport properties of individual molecules. The contributions of U-M micro/nanoengineering students impact everyday life in key areas such as energy, healthcare, and communications.







Stephanie LaCrosse (BSE ME '97, MSME '99)

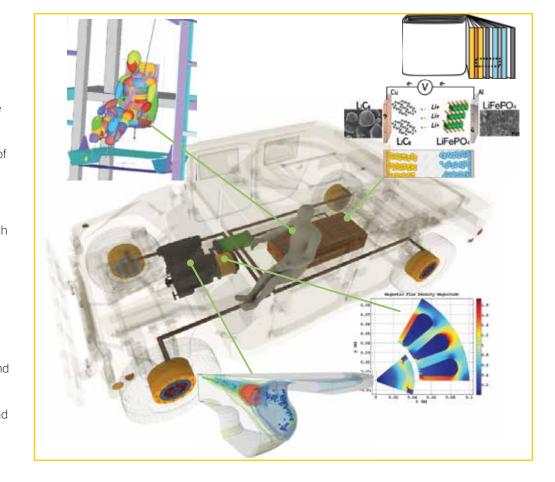
Since earning her master's degree in Mechanical Engineering from U-M, Stephanie LaCrosse's career has taken her from Ford Motor Company and Hyundai to Nissan. Her entrepreneurial spirit, also nurtured at U-M, led her to launch several start-ups including the popular consumer car review website, Honk.com, and most recently served as VP of OEM and Data Solutions at TrueCar.

At U-M, LaCrosse had the opportunity to work closely with her faculty mentor, leading to a teaching assistantship and insightful research experiences in the Lay Automotive Lab. But most importantly, she says, she learned a methodology for solving problems and gained an appreciation for innovative approaches that she can apply to any field or challenge. "My U-M mechanical engineering degree has really given me an edge in knowing how to think through problems."



MOBILITY AND TRANSPORTATION: Collaborating for Innovation

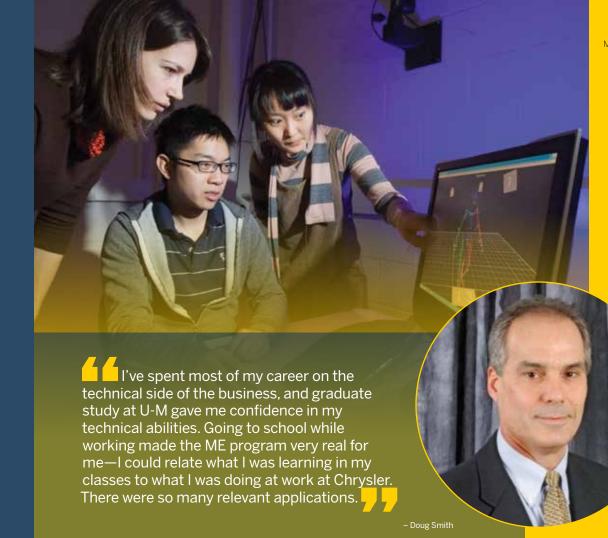
Mobility and transportation research at U-M has a long history of leadership through close collaboration with the automotive industry. It encompasses the internationally renowned Automotive Research Center, a Department of Energy supported Clean Vehicle Consortium, as well as three collaborative industryuniversity research labs. Students acquire a breadth and depth of engineering knowledge and apply it using a multidisciplinary approach to automotive systems research. Those interested in energy and the environment can focus on alternative power sources for sustainability, advanced powertrains for fuel economy, or vehicle system electrification. They may also choose to work on high performance smart materials for vehicle applications or vehicle dynamics and control for safety, including human error modeling and active safety. U-M students drive the design of modern and future vehicle systems, and their work has a marked impact on energy and environmental sustainability, manufacturing, and transportation in the U.S. and abroad.



THERMAL SCIENCES: **Energetic Studies**

MECHANICAL ENGINEERING GRADUATE PROGRAM

Thermal science has applications in automotive engineering as well as many other industries such as biomedicine. chemistry, manufacturing, aerospace, and aeronautics. By studying heat transfer physics and molecular dynamics, students can focus on nanostructuring materials to control how efficiently they conduct heat. Combustion diagnostics research focuses on internal combustion processes and systems, including molecular spectroscopy and laserbased techniques. Microscale heat transfer is an area of active research. as well as diesel engine combustion, hybrid propulsion technology. alternative fuels, and fuel cells. Students can study heat transfer in porous media, fire suppression materials, or combustion engines. They may also study advanced reburn and co-firing technologies as well as pollution mitigation, which involves pollution formation, nanoparticle interactions, and biomolecular systems.



Doug Smith (BSE ME '77, MSME '80)

Doug Smith, chief operating officer at Roush Enterprises, earned his master's degree in mechanical engineering through his participation in Chrysler's Institute of Engineering. With its affiliation with U-M, the Institute enabled Smith to gain valuable work experience in a variety of job functions at Chrysler while earning his graduate degree.

Smith joined the company that is now Roush Enterprises in 1981 and has been with the company ever since, holding positions of increasing scope and responsibility.

About Ann Arbor

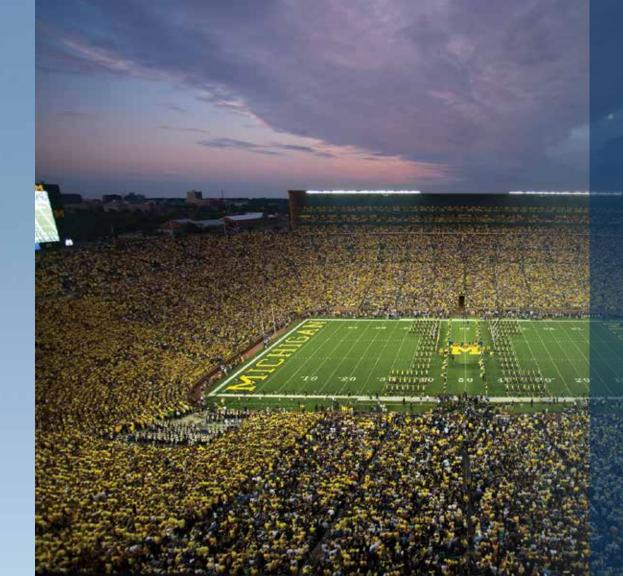
A Top-rated City

Rated the fourth most livable city in America by *Forbes* Magazine (4/29/10), Ann Arbor combines small-town charm with big-city attractions. Restaurants offer Thai, Japanese, Vietnamese, Italian, and more. There are coffee shops aplenty, great shopping, and the world-famous Zingerman's Deli.

Lovers of the outdoors will enjoy the Huron River, the miles of bike trails and paths, and the scenic parkland of "Tree City USA," including U-M's beautiful Arboretum. Aficionados of music, theater, and dance will be amazed by the world-class artists who come to Ann Arbor to perform. Sports fans will be able to experience a football game in "The Big House," Michigan's 107,601-seat stadium or watch any of Michigan's 26 other intercollegiate sports teams.

A low cost of living, lots of things to do, and a lovely place to do them in: that's our town.





About the University of Michigan

Founded in 1817, the University of Michigan is one of the preeminent research universities in the world. Research expenditures in FY 2016 were \$1.39 billion—one of the largest of any U.S. university. Our 19 schools and colleges have produced leaders such as President Gerald R. Ford; Tony Fadell, inventor of the iPod; Larry Page, co-founder of Google; playwright Arthur Miller; actors James Earl Jones, Selma Blair, and Lucy Liu; Antonia Novello, the first female U.S. Surgeon General; and athletes like Tom Brady, Jim Harbaugh, and Desmond Howard.

The University comprises four campuses: Central, North, Medical (including the hospitals), and the Ross Athletic campus. Scenic North Campus is the location for the College of Engineering and the schools of Art & Design, Architecture & Urban Planning, and Music, Theatre & Dance. Free commuter buses run throughout the day to make it easy to travel between campuses.

More Information

Michigan's graduate program in Mechanical Engineering is one of the best in the country, and we'd love to tell you more about it. Our website has detailed information on program prerequisites, degrees offered, application guidelines, and much more. Please email our Academic Services Office at me-aso@umich.edu or call us at 734-764-0863.

me.engin.umich.edu/academics/gsh

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