Michigan Technological University

1885

COLLEGE OF ENGINEERING
ADVANCED MANUFACTURING
INITIATIVES

Hands in. Join us.

Advance the Future of Advanced Manufacturing

Michigan Technological University is an Equal Opportunity Educational Institution/Equal Opportunity Employer that provides equal opportunity for all, including protected veterans and individuals with disabilities.

Engineering Solutions

SHAPING OPPORTUNITIES

From the classroom to the lab, maker space, shop, or foundry—we're dedicated to shaping tomorrow.

At Michigan Tech, continuous improvement is a top priority. In particular, lab facilities are critical to our success, especially as we develop newer, stronger, and lighter materials. A wide range of sophisticated tools and technology inspires and enables our success.

We process a wide range of materials, view and analyze their resulting structure, and evaluate their properties and performance.

This happens every day in our labs, maker spaces, machine shops, and foundry, where components are designed, cast, machined, heat-treated, 3D-printed, tested, analyzed, and more.

Help us to update the equipment we use to make materials that are sustainable, reliable, and tolerant of extreme environments.

Imagining Possibilities

ADVANCING MATERIALS DEVELOPMENT

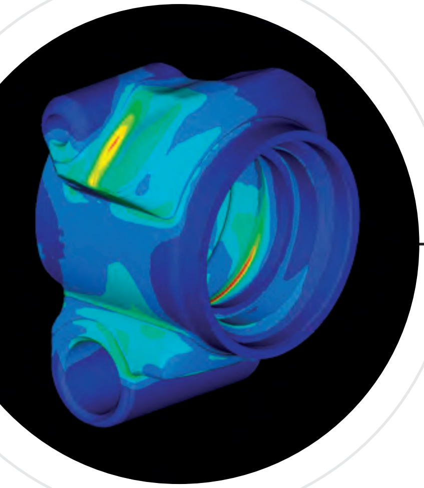
From biomechanics to energy innovations, deep space missions, and more—we design and develop materials that make a difference.

Direction of impact matters. To reduce risk of goalie head injury in hockey, we use 3D printers to develop a new type of foam padding tailored to an individual's morphology.

As climate change, oil accessibility, and sustainability work their way to the forefront of our energy decisions, we've begun to explore energy infrastructure for power plants from a materials perspective. Work is being done to 3D print monolithic, sintered, silicon carbide heat exchangers that meet the exacting permeability and density requirements of these facilities.

Along similar lines, we're modeling what happens to composites when exposed to corrosive and high temperature environments to improve performance.

We're collaborating with NASA and industrial partners to develop a novel composite material from carbon nanotubes to support human exploration in deep space—with additional applications in automotive and wind energy. The work may also pioneer a revolutionary way to manufacture high-performance parts, while simultaneously increasing durability.



To develop innovative new materials, we need computational power to support intensive modeling and data, as well as state-of-the-art sensor technologies used for testing and validation.

Printing Power

UNLEASHING ADDITIVE MANUFACTURING

At the core of our mission is ensuring our graduates are productive on the job from day one.

A group of alumni provided generous donations for the purchase of a high resolution, state-of-the-art 3D metal printer at Michigan Tech. It has opened new doors for our faculty, staff, and students.

The new printer is able to create intricate components that are capable of isolating vibrations. This will enable the testing of advanced dynamic properties.

To build bigger, we turn to wire-feed additive manufacturing, where we use metal wire as supply material for printing 3D print components—typically components large in size. To make the wire we need, we use a resistance melting step to achieve the desired composition, then move to an extrusion process to produce the wire. We are adapting this system to develop alloys suitable for use in outer space.

Metal fusion print powders come with a hefty price tag. To reduce this cost, we hope to build an atomizer and start making our own powders.

To advance material development through additive manufacturing, we need funding for equipment—particularly 3D printing technology for our students. This includes a wire drawing machine and an atomizer.

Processing Potential

PERFECTING COMPUTATIONAL MATERIAL DESIGN

Conducting research in the virtual realm enables much faster development of new materials through simulation, training, and optimization.

Integrated computational materials engineering enables us to establish a material design objective—and then determine its material processing requirements, turning it into a utility function. Next, we transition to commercial software in order to link the new utility function with a database, employing Bayesian optimization virtually, then bring those results into the lab to validate simulation performance.

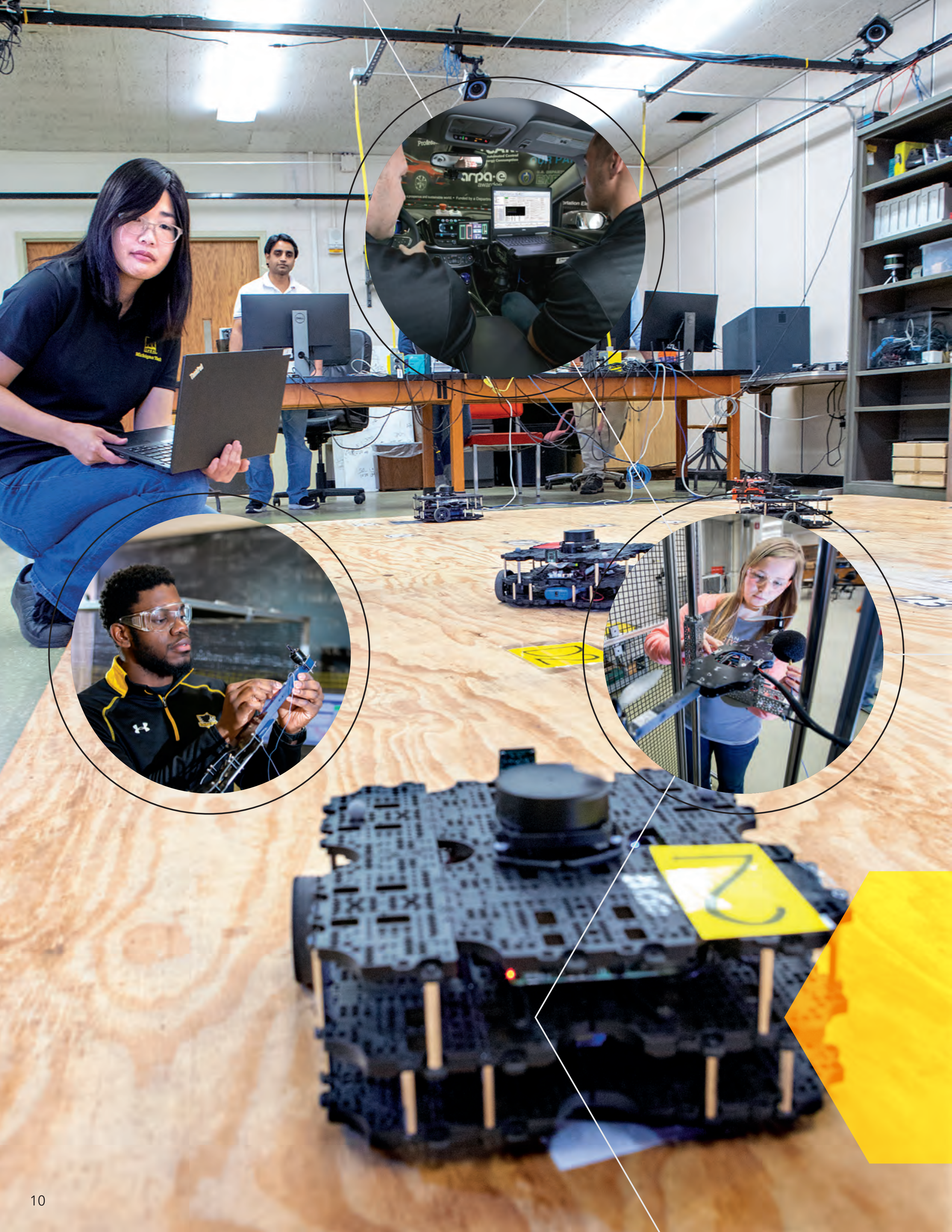
During materials research we often employ machine learning principles: we design the interface between composite materials in order to optimize load transfer to fiber components. We look for patterns in parameters of manufacturing—temperature to chemistry, pressure, time, and shear—that may possibly contribute to the final properties of a material.

We also conduct heavy computational work for the advanced material development needed for deep space applications. Virtual manufacturing and molecular modeling are involved in this process and require advanced computing power.

Computer simulations help us define the ideal behaviors of the final material. Computer simulations track chemical reactions during composite manufacturing, fully optimizing the system before it is transitioned to a manufacturing facility for panel testing.

Support is needed to expand our computational infrastructure from adding processors to licensing more nodes on a network. This support will lead to improved simulation capabilities and enable manufacturing of high-performance materials.

Graduate student support for computational material design is needed, too. Students with experience running advanced molecular models are in short supply in the talent pool.



Integrated Learning

ADAPTING CURRICULUM & LAB EQUIPMENT

We ensure that our students learn current concepts and work on industry-standard equipment.

In courses and labs, our students work through the engineering process from finite element analysis, computer-aided design, prototyping with 3D printing, and manufacturing. By prototyping and testing their designs, they integrate strong modeling and prototyping skills early on, something that helps prepare them to lead from the earliest stages of their careers.

Along with curriculum revisions, a growing number of our new courses, certificates, and majors focus on manufacturing engineering. With the advancements of Industry 4.0 and big data, we also fine-tune individual courses to bring even more data into the classroom and labs.

The tools and environment our students can access for research and design are essential for their success. In one project, we develop new instrumentation, accomplished with wireless sensors placed on foundry equipment. The result: better characterization of material processes. Accurate information ultimately creates a more reliable product.

Our Materials Science and Engineering Department (MSE) serves many other departments across campus with its facilities. We seek to modernize and renovate existing MSE lab spaces.

We need funding to purchase industry-standard sensors, transmission networks, data storage, and data visualization tools. Also needed: new, modern lab spaces located adjacent to faculty research labs to help increase opportunities for collaboration between our students and faculty members.

Hands on.
Hands in.

Advance mobility, empower space travel, efficiently heat and cool, monitor and optimize processes, and more—through research in materials and manufacturing processes.

Tomorrow needs Michigan Tech. Tomorrow needs *you*.

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