

University collaboration

Hands-on education with automated 3D printing

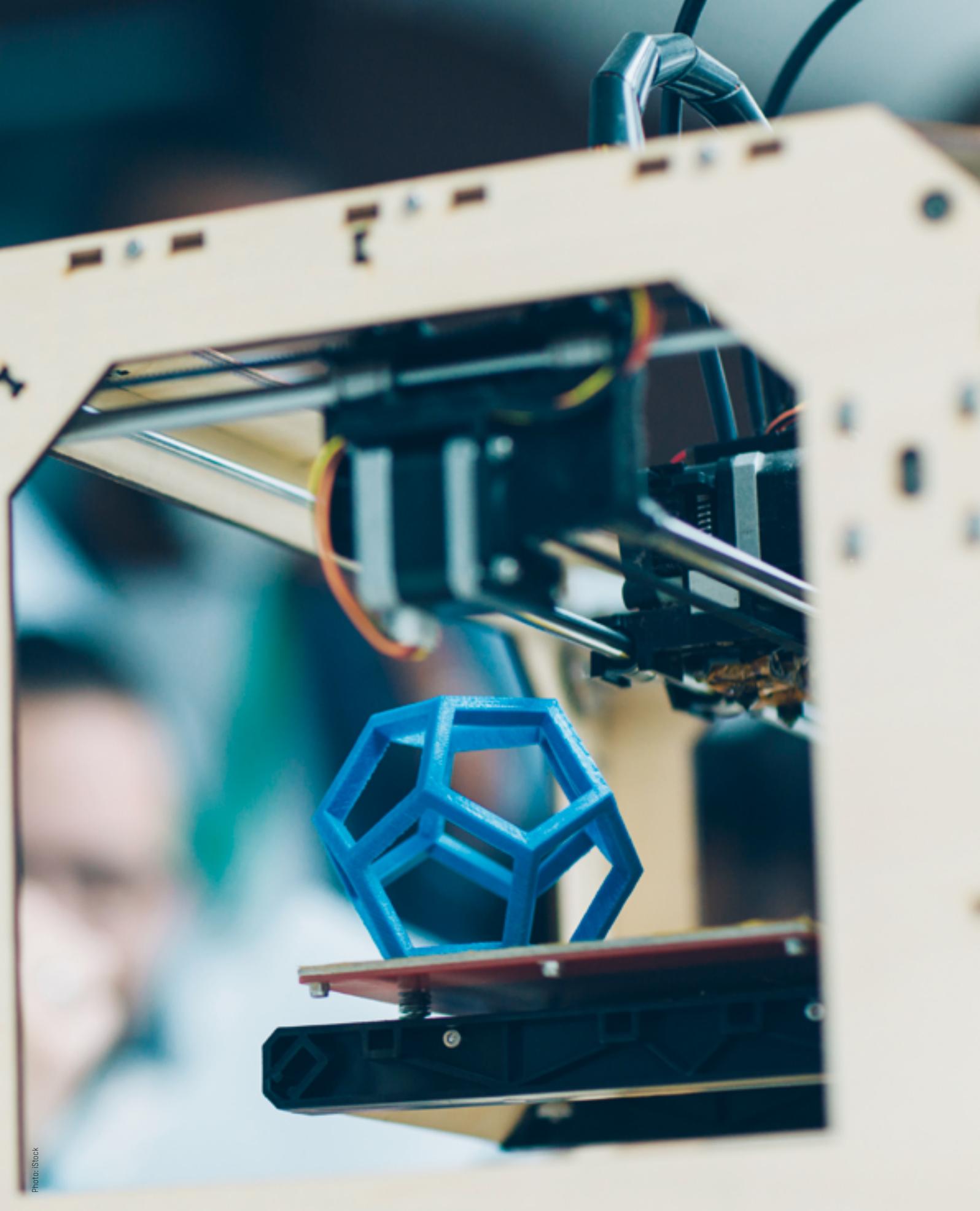


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The University of Wisconsin-Madison is a renowned and highly ranked teaching and research institution. Its College of Engineering produces some of the nation's best mechanical engineers. In the fall of 2015, the department took the opportunity to further enhance its core curriculum with more comprehensive real-world applications, equipping its laboratories with state-of-the-art 3D printers and innovative automation technology from B&R.



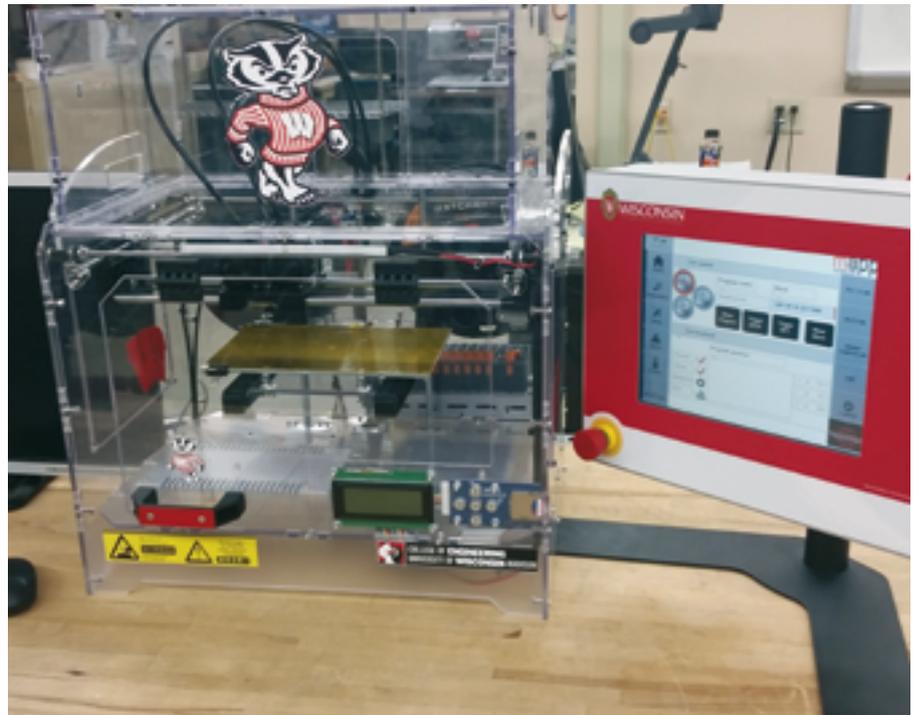
Mechanical engineers require an incredibly diverse set of knowledge and skills and work with equipment ranging from jet engines to medical instruments. It is therefore no surprise that the University of Wisconsin-Madison's mechanical engineering course Manufacturing Fundamentals is so multifaceted – covering areas of the manufacturing process such as CNC, control theory, motion control, automation and programmable logic, in addition to metrology and engineering economics.

The course has always taught this broad range of concepts. Yet, in the past, each was treated separately in its own laboratory setting, sometimes making it difficult to fully grasp how they relate to one another in a real-world situation. The mechanical engineering departmental team therefore took the opportunity of its increased enrollment to restructure the course in a way that provides students with a more cohesive presentation of the engineering concepts as well as more hands-on training. The newly designed course integrates additive manufacturing into the core undergraduate curriculum. Laboratory activities are now centered around a single physical plant – an experimental setup of a 3D printing platform.

Reduced development time and complexity

The mechanical engineering department equipped each laboratory workbench with its own fused deposition modeling 3D printer running sophisticated indus-

trial automation software. When Erick Oberstar, Associate Faculty & Mechatronics Lab Manager, saw potential to further enhance the program by implementing new automation technology



Using a B&R Power Panel and the flexible X20 I/O system that combine control, visualization and motion control technology into a single system, students can easily implement machine logic, CNC motion control and advanced temperature control functions and leverage a sophisticated touch-screen HMI for machine interaction.



In a close partnership that dates back to 2010, the University of Wisconsin - Madison's Mechatronics Laboratory uses solutions from B&R to help achieve its goal of affording students access to cutting-edge automation equipment and techniques.



The University of Wisconsin - Madison mechatronics laboratory is equipped with 3D printers featuring automation control technology from B&R.

equipment, he decided to contact B&R. In a close partnership that dates back to 2010, the University of Wisconsin-Madison's Mechatronics Laboratory has used solutions from B&R to help achieve its goal of affording students access to cutting-edge automation equipment and techniques. B&R's ability to provide CNC control as well as general purpose machine control within one system made B&R an ideal partner for the laboratory's requirements. "The level of hardware and software support that B&R provided us made development and implementation of the new laboratory format simple and painless," says Oberstar.

By implementing solutions from B&R, the laboratory was able to accomplish more with fewer resources. The university's mechanical engineering team faced what could otherwise have been the daunting feat of switching over all their equipment to a new additive manufacturing setup with all new hardware and a complete software solution from the ground up. Yet, program development was easy thanks to the availability of CNC libraries and B&R's mapp technology (a development solution that drastically reduces the time it takes to create machine soft-

ware through the use of modular software components). Standard G Code commands were already embedded in mapp components, saving the team development time and allowing them to instead focus on configuring the mapp library to utilize their own set of sensors and actuators. "The software development and deployment effort was very fast-paced," says Oberstar. "We started active development in the end of the fall semester and deployed by the midpoint of the spring semester."

In the mechatronics laboratories, the automation control technology is integrated with the 3D printers to provide students more hands-on interaction with the hardware in a real-world scenario. When they write code in the Automation Studio software environment, they are truly programming and will produce actual printed parts on the same machines they program. To further tie in its commitment to training based on real-world applications, B&R sends an automation expert to the mechatronic laboratory each semester to discuss today's market for industrial automation and present trends in technology, employment and industry as they relate to machine control.

Flexible all-in-one control solution

Using a B&R Power Panel and the flexible X20 I/O system that combine control, visualization and motion control technology into a single system, students can easily implement machine logic, CNC motion control and advanced temperature control functions and leverage a sophisticated touch-screen HMI for machine interaction. This advanced capability to have a single system for all the main control-related functions is ideal for the lab environment - where students are exposed to numerous topics in the span of only a few months.

The students are well pleased with their new lab. The 3D printer system has been such a success that the mechanical engineering department has plans to introduce a new medical lab application featuring B&R automation technology into the 2016 curriculum. "We have made a huge impact on hundreds of students," explains Oberstar, "and we want to continue to nurture our program by adding even more real-world applications and comprehensive introductions to the concepts covered by pairing our mechanical engineering automation projects with B&R's control solutions." ←