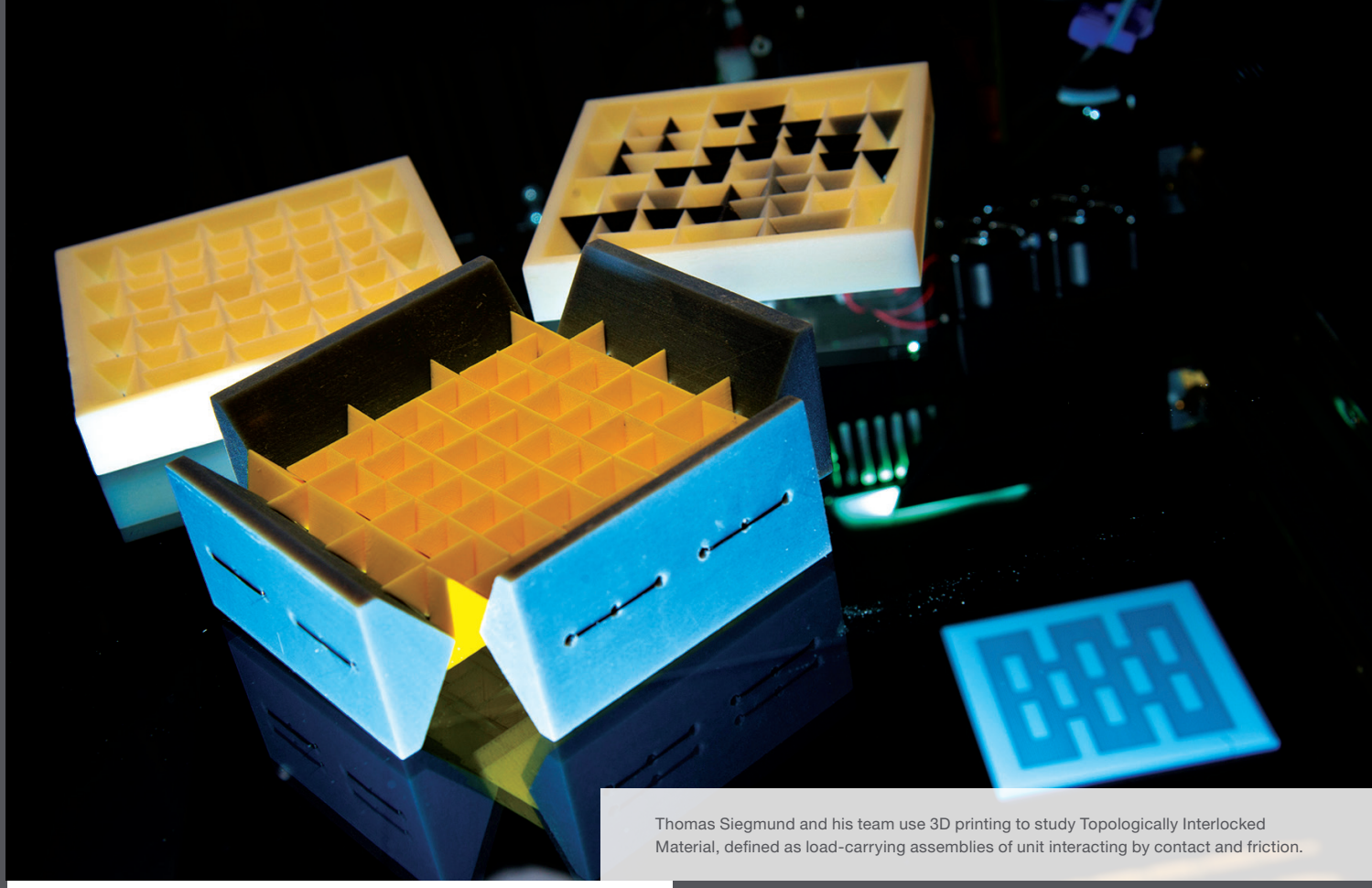


Thomas Siegmund and his team use 3D printing to study Topologically Interlocked Material, defined as load-carrying assemblies of unit interacting by contact and friction.

3D Printing Drives Applied Research

Three-Dimensional World Opens Up To Purdue University Students

“

[Students] love to see what’s on the screen come to life, and because of the iterative nature of the 3D printing process, they can design and build again, which gives them motivation to understand analysis techniques.”

David Cappelleri
Purdue University

stratasys

Case Study

3D Printing Drives Applied Research

Learning to Design Intuitively

3D printing at Purdue University (Purdue) has opened up a world of opportunities to students, taking them beyond 2D concepts to creating tangible, real-world designs.

For Assistant Professor of Mechanical Engineering David Cappelleri, 3D printing with PolyJetTM technology has changed the way his students approach the design process entirely. Cappelleri uses 3D printing to create custom surgical equipment, and found that moving away from an inherently 2D method of laser cutting to a more hands-on approach has profound benefits.

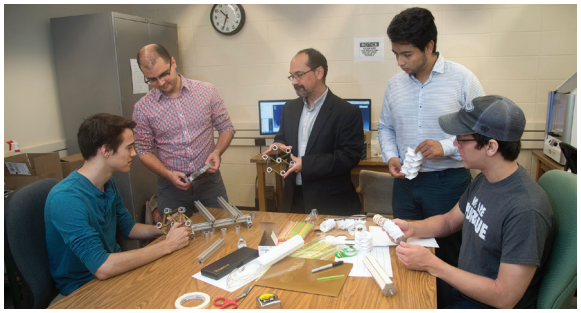
"It's enabled us to start thinking in 3D," Cappelleri said. "Thinking in 3D is a much more intuitive way to design, and that makes everything go faster. When we can design for 3D printing, we can start to get functional designs with structural integrity."

The iterative nature of 3D printing has also fundamentally changed the way Cappelleri's teaches design. He has also noticed a shift in his students' thinking since they have transitioned into 3D printing. While they might enjoy the design and print process, it's the analysis that happens afterward that Cappelleri finds of value for his students.

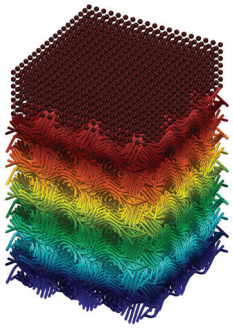
"Students are very enthusiastic," Cappelleri said. "They love to see what's on the screen come to life, and because of the iterative nature of the 3D printing process, they can design and build again, which gives them motivation to understand analysis techniques."

Advancing Research

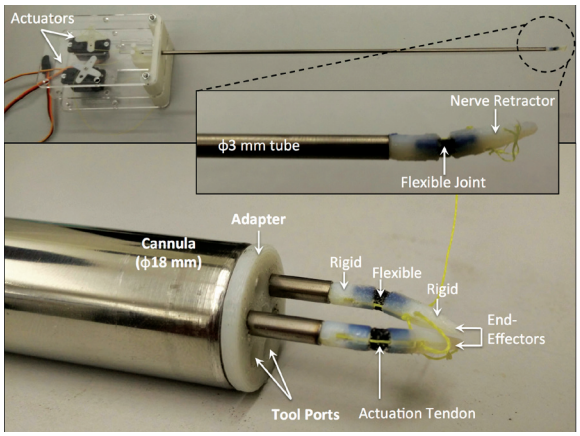
Thomas Siegmund, Professor of Mechanical Engineering at Purdue, and his team of students use 3D printing to research a variety of structures to determine what designs are viable and whether or not they have structural implications. Siegmund and his team have used 3D printing to study Topologically Interlocked Material, defined as load-carrying assemblies of unit interacting by contact and friction. They also have investigated the



From left, civil engineering junior Gordon Jarrold, post-doc student David Restrepo, Professor Pablo Zavattieri, civil engineering senior Cristian Tejedor and aeronautics and astronautics junior John Cleveland.



Pablo Zavatteri and his team researching the mantis shrimp used 3D printing to determine the structural design of the shrimp's club is a composite material containing fibers arranged in a helicoidal structure resembling a spiral staircase. Findings also revealed the fibers are arranged in a herringbone pattern in the appendage's outer layer.



An example of custom surgical equipment created by David Cappelleri and his students at Purdue University.

3D Printing Drives Applied Research

relationship between printed part size and part strength and failure modes.

They've also used 3D printing to research Kinetogami, a reconfigurable, combinatorial and printable sheet folding inspired by the Japanese art of origami. The goal is to determine what kind of internal structures are useful, and what long-term effects they may have. Like Professor Cappelleri, Siegmund uses 3D printing to better understand the possibility of designs, and to inspire students at varying experience levels to push innovation.

From Hypothesis to Applied Research

Associate Professor of Civil Engineering Pablo Zavatteri takes his cues from nature. His team is researching the mantis shrimp, which breaks open the shells of its prey with its strong hammer-like appendage called a dactyl club, achieving an acceleration of a .22 caliber bullet and very high force. With 3D printing, Zavatteri determined the structural design of the mantis shrimp's club could be applied to products that absorb energy or mitigate damage, such as helmets or earthquake protection.

"We found it's a composite material similar to material used for cars and airplanes, but the architecture is very different," Zavatteri said. The team found the architecture contains fibers that are arranged in a helicoidal structure. However, each layer follows a wavy surface making it very difficult to reproduce with any other fabrication technique, except 3D printing. "We tried to understand why nature came up with these designs, which we are testing with 3D printed prototypes. We call these biomimetic composites, and while this is an ongoing investigation, we have already identified many different applications."

The common denominator of all three professor's research is 3D printing. For professors and students at Purdue, 3D printing aids in the learning and research process, whether it's testing hypotheses or determining the feasibility of designs, the benefits of applied research are clear.

"The opportunity to actually make things with a 3D printer, we all see long-term research opportunities in this," said Siegmund.

Stratasys Headquarters

7665 Commerce Way,
Eden Prairie, MN 55344
+1 800 801 6491 (US Toll Free)
+1 952 937-3000 (Intl)
+1 952 937-0070 (Fax)

1 Holtzman St., Science Park,
PO Box 2496
Rehovot 76124, Israel
+972 74 745 4000
+972 74 745 5000 (Fax)

stratasys.com
ISO 9001:2015 Certified