"GrabCAD Voxel Print has the potential to transform traditional product development. We are creating new design syntheses and automation paradigms to answer different questions and exploit this game-changing technology."

Associate Provost for Research Martin Dunn / Singapore University of Technology and Design, Digital Manufacturing and Design Center

The final 3D printed table is a functional and aesthetically pleasing composition that can withstand structural loads and requires no mechanical fasteners.

CASE STUDY

Unlocking New Levels of Design

RESEARCHERS EXPLORE GROUNDBREAKING DESIGN AT A MICROSCOPIC SCALE WITH GRABCAD VOXEL PRINT

The unique mission of Singapore University of Technology and Design (SUTD), a contemporary university that launched in 2012, is to nurture technically grounded leaders through hands-on learning and technology-based design.

Researchers at SUTD's Digital Manufacturing and Design Center (DManD) are specifically focused on the intersection of digital design and advanced manufacturing, developing new ideas and methods that combine computational and engineering sciences, industrial engineering, technology-intensive design, architecture and art.

“There are three major themes in that direction we’re focused on,” said Professor Martin Dunn, Associate Provost for Research and Co-Director of SUTD DManD. “One is around additive manufacturing with multiple materials and creating multifunctional components, parts and products. Another is around the 3D manufacturing of composite structures and the third is around 3D digital textiles.”

Exploring Designs at the Voxel Level

As the team’s research goes deeper into material properties and new ways of design, they are exploring possibilities beyond predefined digital materials. Using the GrabCAD Voxel Print™ utility on the Stratasys J750™ multi-material 3D Printer, DManD researchers create products by manipulating materials and structures at precise, point-by-point locations in space, down to the volumetric pixel, or voxel, level.

“Voxel-controlled 3D printing allows us to create microstructure and macroscopic products at a scale and resolution that’s unprecedented. It’s really driven our work to develop new tools that enable people to design with this rapidly emerging manufacturing capability,” said Dunn.

With GrabCAD Voxel Print, DManD researchers can create entirely new digital materials designed for specific functional or aesthetic needs of very specialized research projects.

“Voxel control technology really changes the way we think about design,” said Sayjel Patel, Research Associate at SUTD DManD. “Now, we can scan textures from the immediate environment, and create textures and microstructures from these images. We can look at properties in terms of touch, acoustics, structural corrugation or thermal properties, allowing us to prototype very quickly a range of design options.”

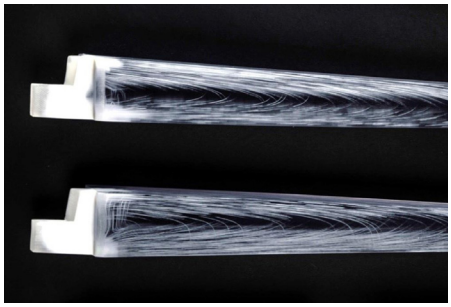
Researchers create their own model layer slicer, manipulate attributes voxel by voxel and generate bitmap or PNG files. GrabCAD Voxel Print is the communication tool between the sliced digital data and the 3D printer, producing the 3D models that hold specific properties unachievable any other way.

Multi-scale Structure and Material Design

DManD researchers used this new method to construct an interlocking table to study the structural behavior of traditional timber joinery systems. Crafting an interlocking table is very challenging, so Dunn, with his team of researchers, programmed a custom slicer to assign materials layer by layer, 3D printing the joinery systems on the Stratasys J750 using GrabCAD Voxel Print.

“Selective material deposition offers opportunities to design and fabricate objects with heterogeneous properties potentially exhibiting superior functional performance characteristics compared to objects comprised of homogeneous material distributions,” said Patel.

With the custom slicer and GrabCAD Voxel Print, researchers 3D printed the interlocking table with gradients of VeroClear™, Vero PureWhite™ and TangoPlus™.



DManD researchers explored the structural behavior of traditional timber joinery systems using a custom slicer and the GrabCAD Voxel Print utility.

DManD researchers 3D printed the interlocking table in VeroClear, Vero PureWhite and TangoPlus.

DManD researchers created multi-material soft-lattice structures for this footwear prototype using a custom slicer to control stiffness and behavior of the material.

“The project is a manifestation of future design work where designers not only create geometry, but also design material at a microscopic scale to achieve better integration of function and aesthetics,” said Dunn.

DManD researchers also created multi-material soft-lattice structures that experience large non-linear deformation. The soft lattices have curved components that conform to freeform geometries with spatially-variable thickness and materials. Using another custom slicer to control stiffness and behavior of the material, the researchers were able to materialize the exact soft lattices they desired to optimize performance and design.

“GrabCAD Voxel Print has the potential to transform traditional product development. We are creating new design syntheses and automation paradigms to answer different questions and exploit this game-changing technology,” said Dunn.

stratasys

STRATASYS.COM

ISO 9001:2008 Certified

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)