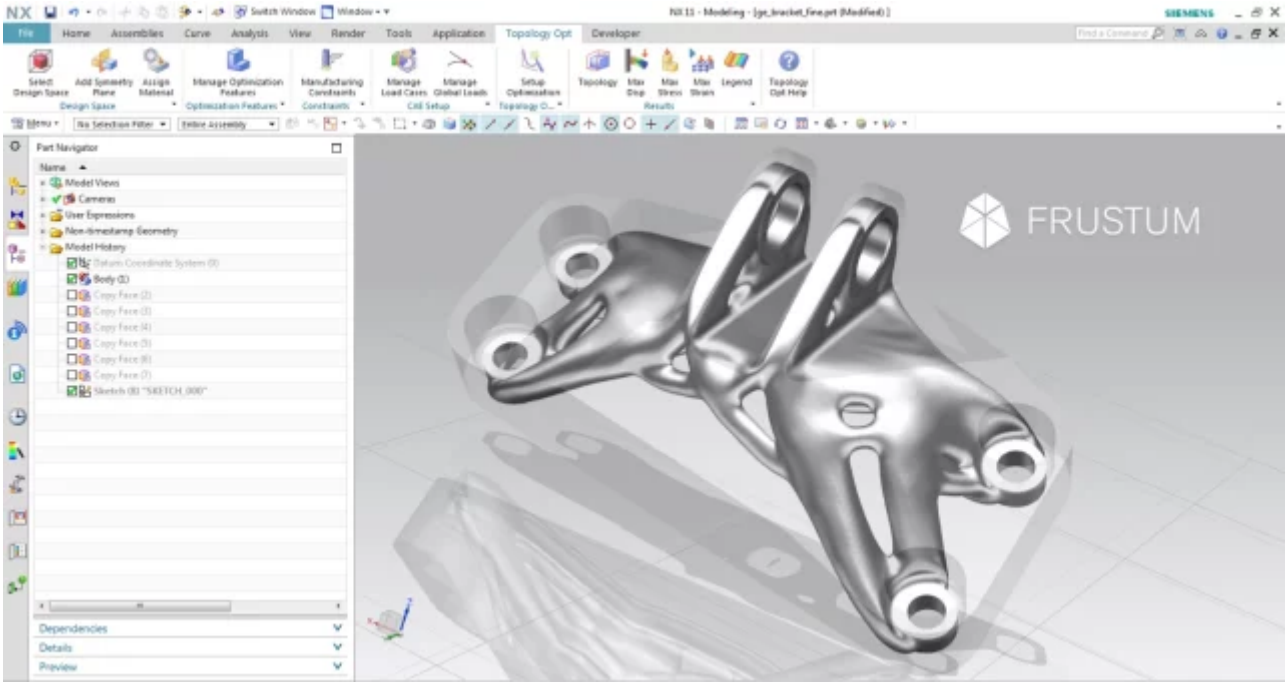
Frustum Topology Optimization Integrated into Siemens NX for 3D Printing

Last year, Siemens announced that it was officially developing solutions designed for 3D printing with an additive manufacturing (AM) software suite meant to address every step of the AM process, from design to simulation and production.

Key to the design of 3D printing is understanding the constraints of various AM processes, as well as how to create a part that takes advantage of AM's unique abilities. Siemens has just made this process that much easier by partnering with Frustum to incorporate the startup's generative design and topology optimization software into Siemens NX.



A screenshot of Frustum's geometry kernel within Siemens NX 11. (Image courtesy of Frustum.)

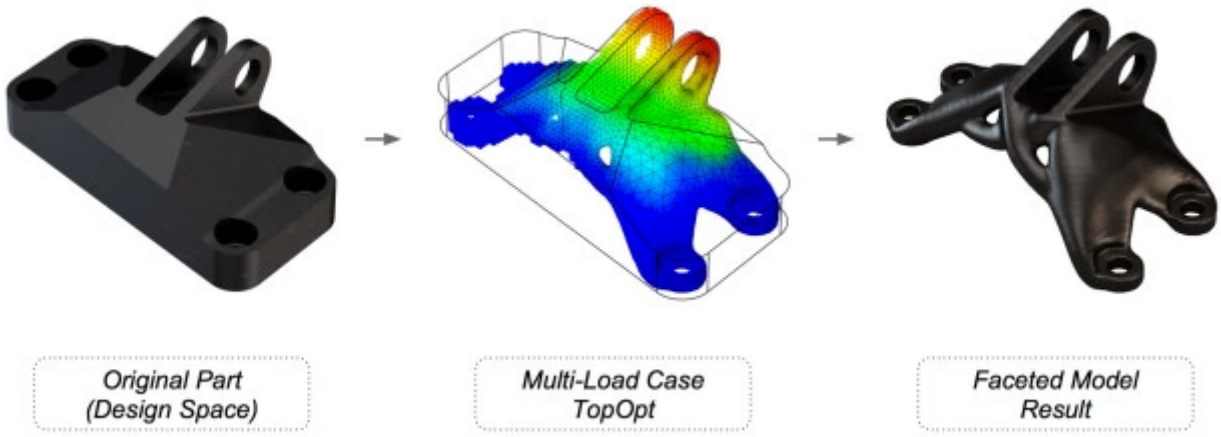
Frustum's geometry kernel—which also takes the form of a cloud-based app called Generate —combines finite element analysis and the company's voxel-based design algorithm to generate multiple iterations of a topology optimized design. The kernel is now a part of Siemens NX as an integrated module that allows engineers to blend topology optimization with traditional CAD data to create parts that can only be manufactured with 3D printing.

"Siemens, as you know, makes a CAD platform that is widely used by original equipment manufacturers and suppliers around the world," Frustum CEO Jesse Coors-Blankenship told ENGINEERING.com. "As Siemens makes the push to get AM to the industrial enterprise level (and on the factory floor), it has sought to complete an end-to-end tool chain, which topology optimization is a key component of. The company sees, like we do, that AM without generative design methodology is not fully taking advantage

of the technology. To design parts for AM in 2D—the way my grandfather did—would diminish the value of AM. Siemens liked our approach to geometry and felt that it fit with its convergent modeling capabilities. So now with convergent modeling and our generative geometry kernel output, topology optimization can be fully utilized by the designer in an effective and time-efficient way."

A key component of Siemens NX as an AM solution is the introduction of convergent modeling, which makes it possible to combine traditional CAD data, precise geometry based on mathematical functions, with mesh-based facet geometry. Whereas mechanical engineers may be more accustomed to the precise geometry associated with CAD software, mesh data is becoming increasingly popular and is particularly useful when it comes to such technologies as 3D scanning and 3D printing.

Frustum's module allows users to input certain design parameters—such as weight, cost, material and function—and generate a mesh that, through Siemens NX, can be incorporated into precise geometry. The resulting parts are watertight, with no intersecting polygons or other errors typically associated with free-form 3D modeling, and are instantly ready for 3D printing.



The above part is optimized for 3D printing with Generate. (Image courtesy of Frustum.)

Other important features include the ability to run multiple design scenarios in parallel, with Frustum's module calculating and generating a variety of options simultaneously, allowing the designer to then validate and choose the best one. This includes the ability to add force application points and load cases to understand how each iteration will perform in the real world.

Though Frustum relies heavily on simulation to generate these scenarios, the company has not yet validated how its simulations match up to real-world parts with empirical testing. For this reason, Frustum is open to partners to aid in the validation process.

Coors-Blankenship pointed out that the tool will be beneficial both with designers experienced with AM and those who are not. "Both new and experienced designers will benefit greatly from this partnership, as this tool is designed for designer's topology optimization, and not for stress analysis," said Coors-Blankenship. "This is the first time topology optimization has been really made useful for a designer to use effectively beyond experimentation. Aside from the easy-to-use interface, the geometry output made possible by our generative geometry kernel is of high enough quality for the designer to work on without time-consuming remodeling. New users will have a necessarily quick but not too steep learning curve,

while experienced users of topology optimization may have to be flexible in how they are used to this technology workingin order to fully take advantage of our contributions to topology optimization.”

AM is also only one aspect of Frustum’s overall goal for its software. The kernel can already handle constraints for CNC milling, and the startup aims to handle other manufacturing technologies as well. As a part of Frontier, the Siemens/next47 startup partner program, the company is likely to have plenty of support as it moves forward in advancing its platform.

To learn more about Frustum and Siemens NX, visit their websites.