Design and Development of Generative Design

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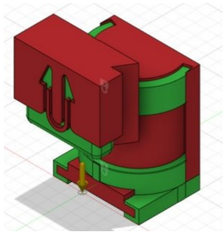
Abstract

Generative implementation on this project had the goal of replacing sheet metal structures previously used to hold relays and electromechanics switches, with 3D printed structures. The generative design software has the benefit of minimizing the mass of the structure, while keeping its structural integrity. The software does this by iterating through designs solving for stresses at each step, deciding where it is better to place a structure and then cutting mass at points where the structural integrity would not be compromised. Although the software creates a design on its own the user must define certain parameters: the preserve geometry (fundamental geometry for operation), obstacle geometry (sections that the software should leave without obstruction), the expected load case, manufacturing method, and material to be used. The end result is that the computer creates most efficient parts, allowing for a plastic 3D printed part to be able to safely replace one made of metal.

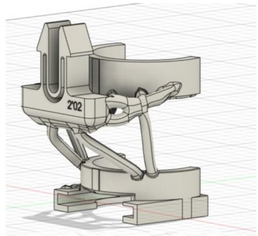
Background

Generative design is a type of artificial intelligence that uses the cloud and machine learning to speed up the design-to-manufacturing process. The reasoning behind using Generative Design to create the parts used in this project was to create optimized complex shapes and joints. The obtained forms and shapes are impossible to make with traditional designing methods. This lets us get 3 models optimized by computer software by setting up the requirements for the model like loads, constraints, material used, and then the software designs according to our requirements.

SP6T/SP4T Relays

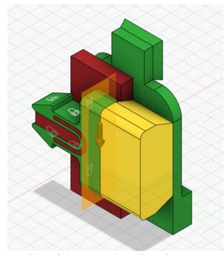


Set Geometries for Study

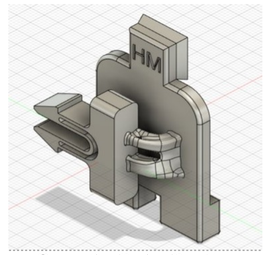


Generative Design Results

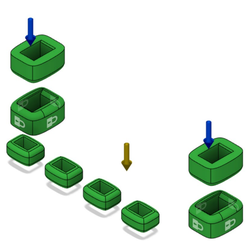
50GHz Microwave Relay



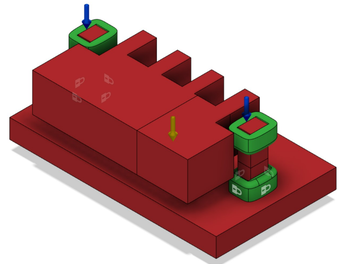
Set Geometries for Study



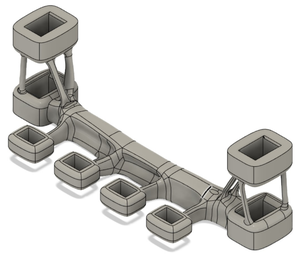
Generative Design Results



Web Geometry Layout with Forces/Constraints Applied



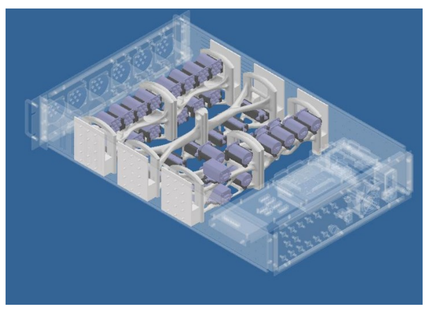
Web Obstacle Geometry



Generative Design Result

Generative Advantages and Disadvantages

Advantages	Disadvantages
Unlimited Choices	Shortlisting Options
No Creativity Barrier	No Manual Intervention
Reduced Product time to Market	Minimal Failure Feedback



Chassis with Webs + Components

SciCom Let's Talk Science

Procedures were created for both 3-D printing and Generative Design Procedures. Generative Design can be used to allow the computer to generate designs based on criteria that the user selects. These procedures were created from a non-technical use standpoint. The goal was to make simple to use procedures that any adult could follow.