

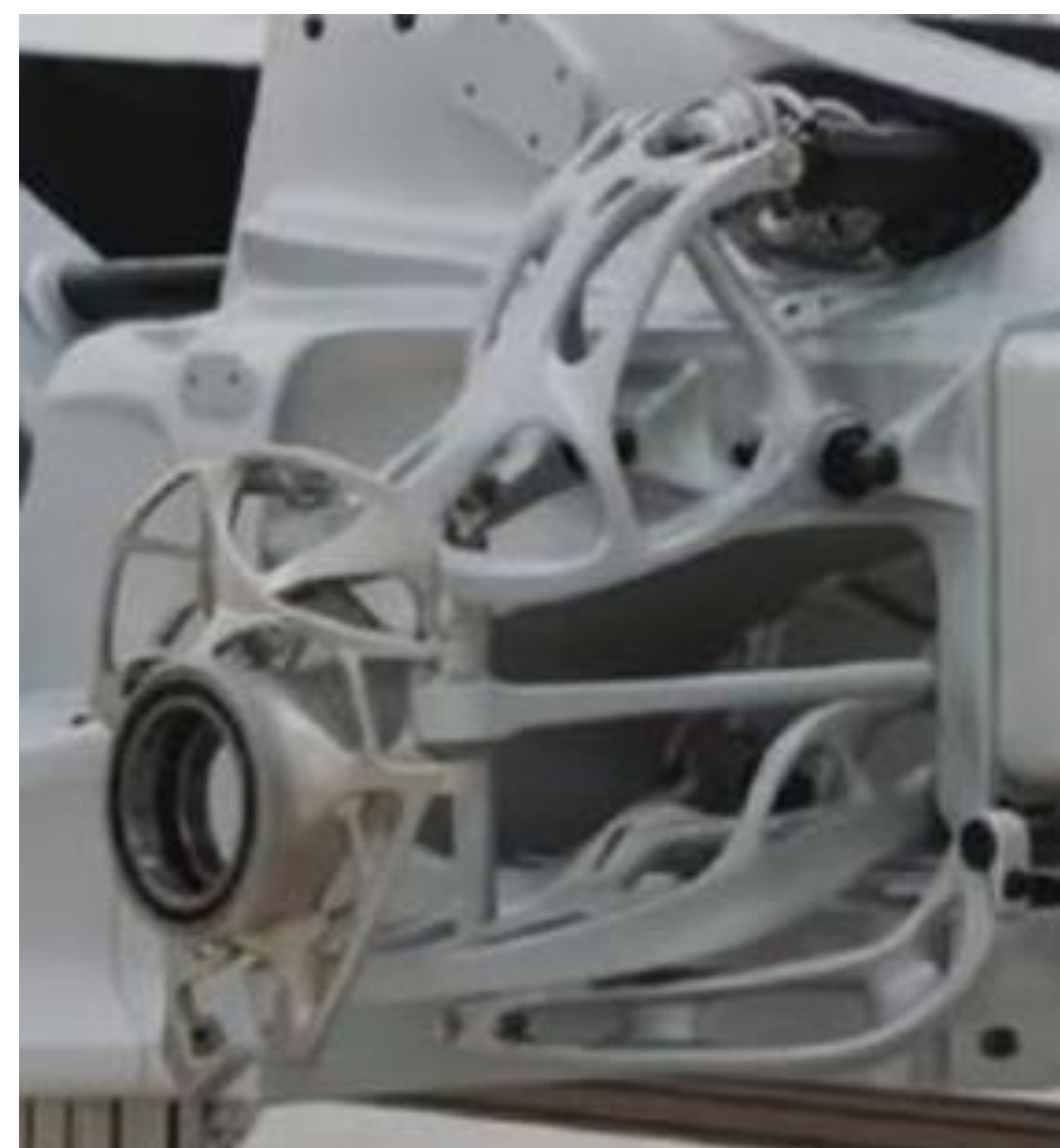
Objective: To develop a design strategy, and associated algorithms, that take advantage of the topology optimization package within SolidWorks to create easily producible parts.

Motivation

Topology optimization (TO) is a numerical procedure that accepts an initial design space, which includes loads and constraints, and produces a part optimized for structural performance. One difficulty with commercial packages, such as SolidWorks, is that the final TO designs are difficult to manufacture without using additive manufacturing due to the organic nature of the TO results. Automating the conversion from TO results to practical design using visual basic coding in SolidWorks will create repeatable designs from the TO results.

Topology Optimization

- The TO objective is maximizing rigidity based on a desired weight percentage, subject to maximum stress.
- Controls set geometrical constraints.
- Produces a material optimized part.

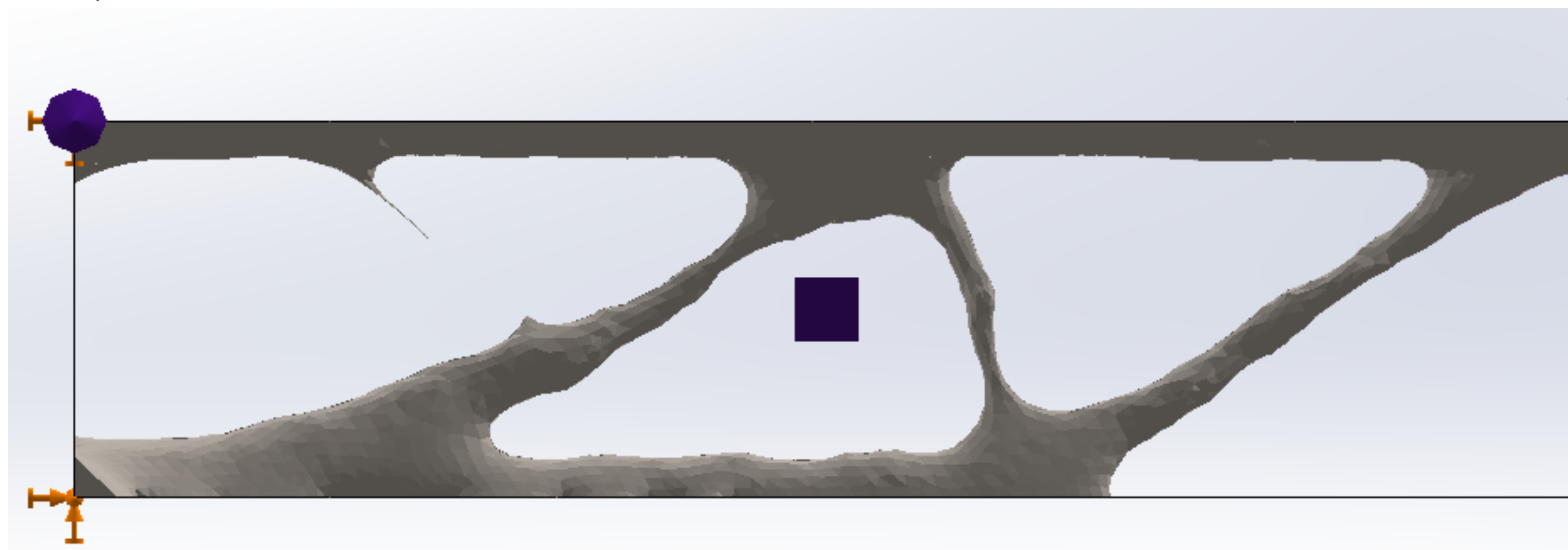


3D printed suspension from the Czinger 21C created with TO

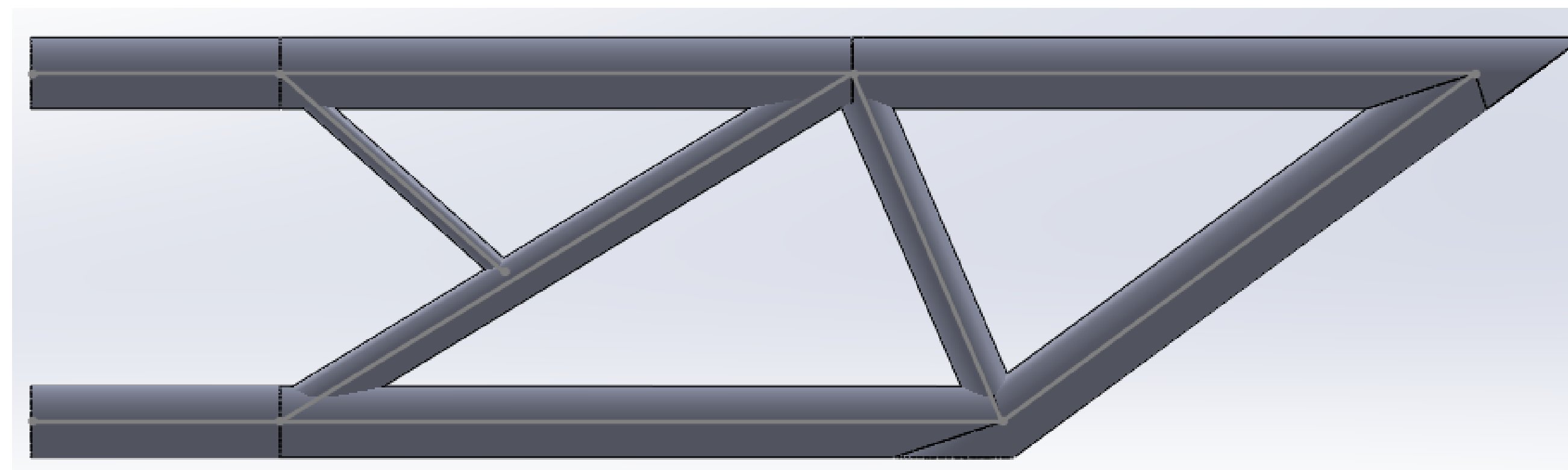
Topology Optimization Used With SolidWorks Macro



An initial model is created, then given the TO is defined with constraints.



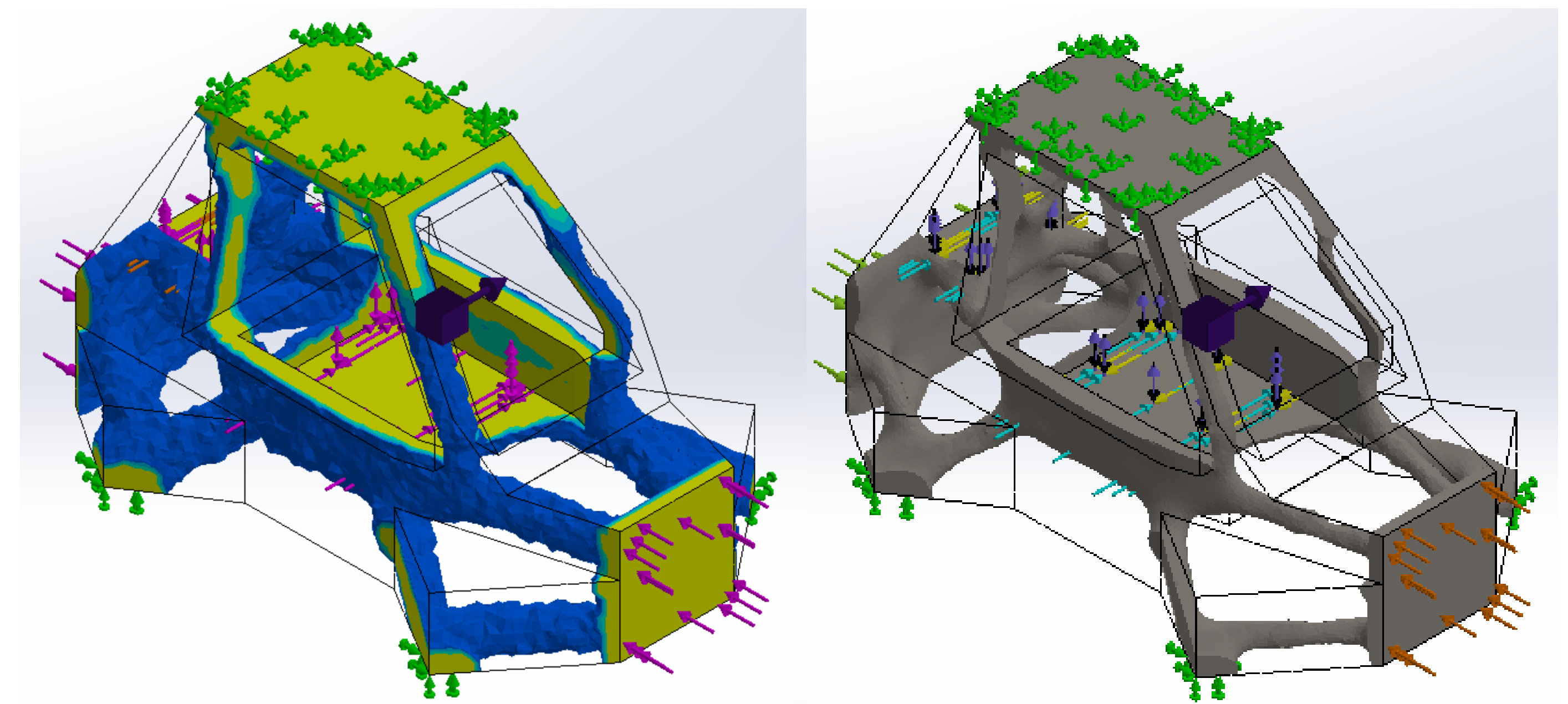
The TO produces the optimized shape. Coordinates and size approximations are taken and input into the macro.



The macro used the weldment feature in SolidWorks to create a design more easily produced by conventional manufacturing methods.

Modeling

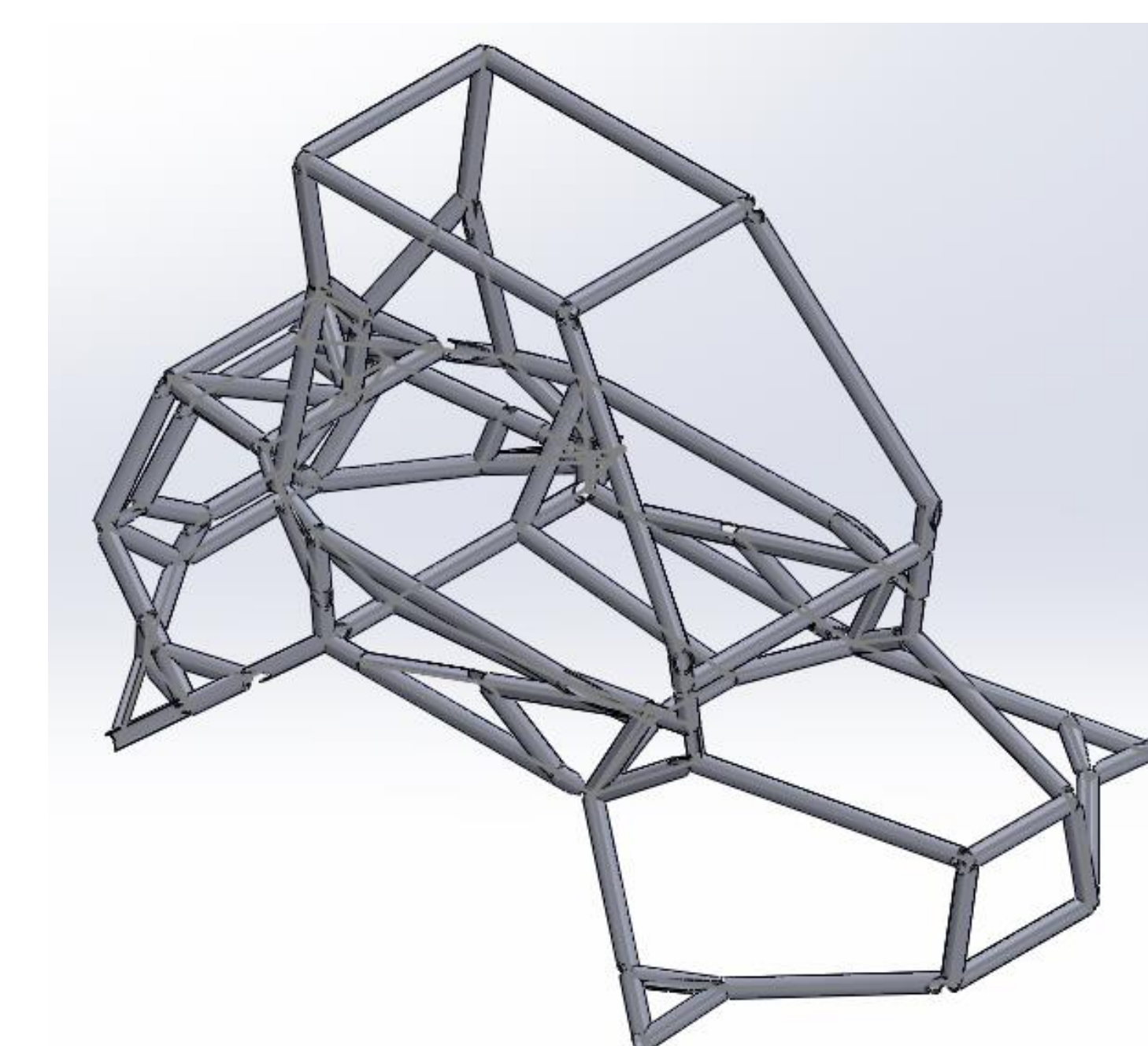
A model of a Baja SAE car was created in to demonstrate the uses of the developed macro in creating a practical design from TO results.



TO Outputs

Future Work

Develop visual processing in Matlab to automatically pull element coordinates and sizes from the TO, particularly for parts that do not sit on a single plane. Also, to link the Matlab visual processing directly into the SolidWorks macro.



Macro Output