

City University of New York (CUNY)

**CUNY Academic Works**

---

Publications and Research

New York City College of Technology

---

2022

## **Exploring SolidWorks Simulation and Structural Analysis Tools to Predict Real-World Physical Behaviors**

Itay Rubin

*CUNY New York City College of Technology*

[How does access to this work benefit you? Let us know!](#)

More information about this work at: [https://academicworks.cuny.edu/ny\\_pubs/911](https://academicworks.cuny.edu/ny_pubs/911)

Discover additional works at: <https://academicworks.cuny.edu>

---

This work is made publicly available by the City University of New York (CUNY).

Contact: [AcademicWorks@cuny.edu](mailto:AcademicWorks@cuny.edu)



# Exploring SolidWorks Simulation and Structural Analysis Tools to Predict Real-World Physical Behaviors

Author: Itay Rubin    Mentor: Professor Feng Gao

Department of Mechanical Engineering, CUNY NYC College of Technology

## Abstract

Computer Aided Design (CAD) Software can optimize the product design process prior to manufacturing. This project examines engineering solutions using CAD software called *SolidWorks*. It simulates how the product will behave under a variety of engineering constraints. These simulations allow designers to optimize performance, cost, and speed efficiencies. The project uses simulations and finite element analysis to replicate real world behavior. It presents high-level capabilities in the design process, exposing new engineers to simulation tools that are available and relevant in mechanical engineering design. This project required independent research to obtain an advanced understanding of the software interface and capabilities.

## Introduction

The design process of any part begins with a basic concept sketch of the parts, incorporating any constraints such as dimensions, as well as all forces acting on the part. After the initial design is created, the design behavior is tested through a simulation. (Fig. 1) *SolidWorks* allows the designer to optimize the part after the initial validation. The designer can add additional constraints at this point, such as reducing the weight, or increasing the strength, without compromising the defined requirements of the part. This process is called a topology study. (Fig. 2,3,4) The software suggests an optimized geometry of the part that can be quickly converted to a finalized and validated redesign.

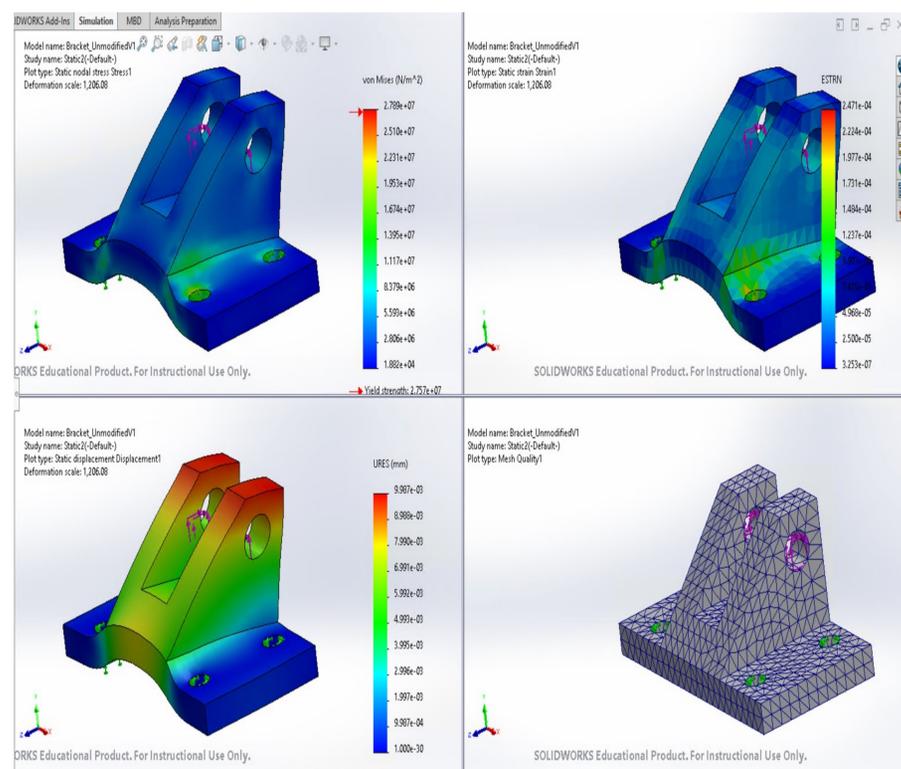


Fig. 1

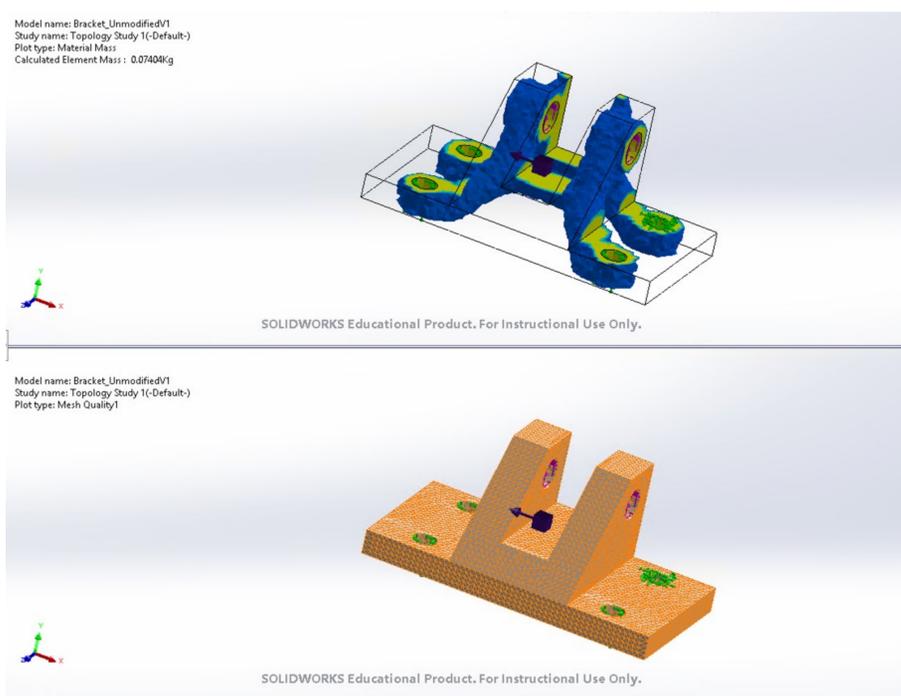


Fig. 2

## CAD Software

CAD software is the link which connects the design to the manufacturing process. By using CAD software, engineers are able to plan and simulate different configurations for the parts. Using *SolidWorks* allowed me to explore how different simulation tools can increase a designer's productivity. Additionally, having a materials library accessible allows the engineer to iterate the simulation with variety of materials.

## Procedure

In this project, I used *SolidWorks* to sketch a simple design of a bracket. I then used *SolidWorks* static study to evaluate the stress, strain, and displacement resulting from the acting forces on the bracket that were considered in the study. (Fig.1)

Next, I ran a topology study on the bracket to optimize the weight to strength ratio. (Fig.2) I observed how much weight could be reduced from the part without compromising strength, or changing the initial dimensions of the bracket. The last step was applying the results of the study to create the final design. (Fig. 3,4)



Fig. 3

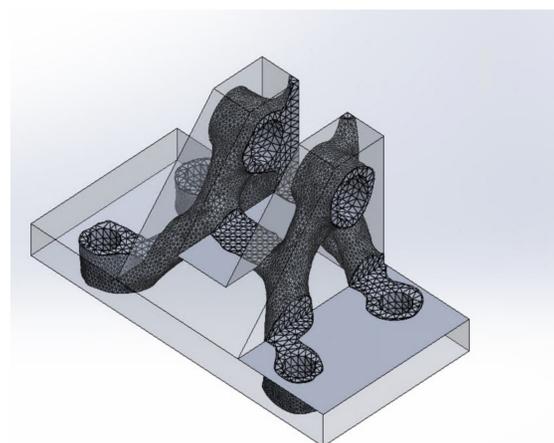


Fig. 4

## Findings

- *SolidWorks* allows designers to run simulations prior to manufacturing to address the initial parameters and avoid costly mistakes.
- An important design consideration is the time and efficiency to manufacture a part.
- Selecting the proper material to address a particular constraint also affects costs.
- Simulation studies for more complex parts require stronger computational power or longer computing time. If the geometry of the part is symmetrical, it is possible to shorten computing time by running the study on only one half, or a specific section, of the design.
- Weight reduction or strength can also be achieved by altering the material used for the part.

## References

- Slavov, Stoyan, and Mariya Konsulova-Bakalova. "Optimizing Weight of Housing Elements of Two-Stage Reducer by Using the Topology Management Optimization Capabilities Integrated in SOLIDWORKS: A Case Study." *MDPI*, Jan. 2019.
- *Topology Optimization with SOLIDWORKS Simulation*. [www.youtube.com](https://www.youtube.com/watch?v=vzoR--Zrb3w&list=PL4qtQq6A_ZdUYBM_ZbJ1oBL0dyVeQK2r_&index=5), [https://www.youtube.com/watch?v=vzoR--Zrb3w&list=PL4qtQq6A\\_ZdUYBM\\_ZbJ1oBL0dyVeQK2r\\_&index=5](https://www.youtube.com/watch?v=vzoR--Zrb3w&list=PL4qtQq6A_ZdUYBM_ZbJ1oBL0dyVeQK2r_&index=5). Accessed 25 Apr. 2022.

## Acknowledgement

- Thanks to Professor Feng Gao for his guidance and mentorship.
- Want to know more? Email: [itay.rubin@mail.citytech.cuny.edu](mailto:itay.rubin@mail.citytech.cuny.edu)