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Choose Your Own Simulation Adventure

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Learning Objectives

- Learn how to use simulation most effectively.
- Explore design optimizations.
- Gain confidence in design decisions.
- Learn how generative design can shorten this process.

Description

Sometimes design changes can produce counterintuitive changes to the performance of a design. In this interactive session, we'll explore different design changes, all the while using simulation to determine the right direction to take a design. In the end, we'll explore how generative design can provide a shortcut in this sometimes-arduous task.

Speaker

Aaron Magnin is a Technical Marketing Manager for Fusion 360 at Autodesk. He attended the University of Nevada, Reno, where he obtained a degree in Mechanical Engineering. In industry he had a focus on safety products, recreational sports equipment, and computer peripherals. He then found his way to application engineering where he focused on simulation products, training, & technical presentations. At Autodesk --and for Fusion 360 specifically-- he creates QUICK TIPS, "What's New Videos", along with a wide array of other marketing content.

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Intro to Simulation in Fusion 360

Finite element analysis (FEA) is a computerized method for predicting how a product reacts to real-world forces, vibration, heat, fluid flow, and other physical effects. Finite element analysis shows whether a product will break, wear out, or work the way it was designed.

The Simulation workspace allows you to perform stress (static, nonlinear static, and event simulation), modal, buckling, thermal, thermal stress and shape optimization analyses. Each analysis type can provide you different results, or details related to failure criterion.
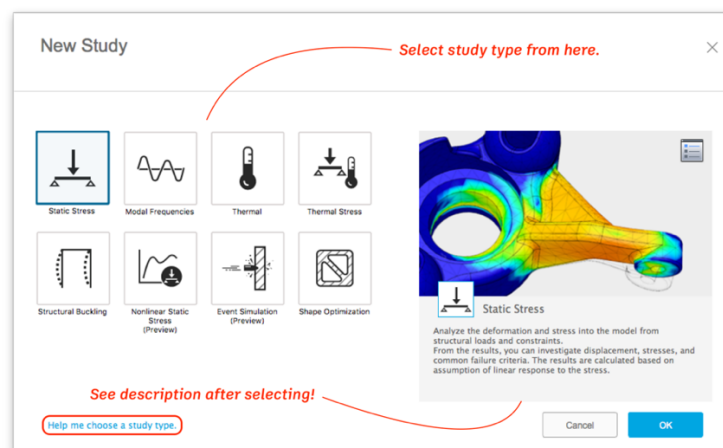
Simulation Use Cases

In practice, the majority of simulations are run with one of two goals in mind: to validate a design, or to optimize a design.

While both can provide valuable information to designers, in my opinion, more value can be gained from the latter. Why? It takes a highly trained specialist hours to validate real-world conditions, but even the greenest of simulation users can improve a design based on trending information.

EVALUATING DESIGN ALTERNATIVES   OPTIMIZING STRENGTH   LIGHTWEIGHTING   MATERIAL SELECTION

By performing an analysis early in the design phase, you can substantially improve the overall engineering process. Whereas design changes made to finished or near-finished products (where 'validations' often happen), changes are costly, and/or difficult to implement.

Capitalize on the Cloud

Cloud Solve

Fusion 360s connection to the cloud provides many unique benefits over other simulation tools, but as it relates to simulation, we cannot **overstress** the importance of cloud solving.

Cloud solve overcomes three major hurdles experienced when creating and running simulations:

1. Hardware limitations -- by using the cloud, you'll have access to high quality, advanced simulation results without losing sleep or requiring expensive hardware.
2. Removes the burden of the local solve -- when you solve a simulation locally, there's not much else you can do but watch and wait.
3. Simultaneous solve – combine both benefits above, then multiply it. Solve 10's or 100's of simulations at the same time.
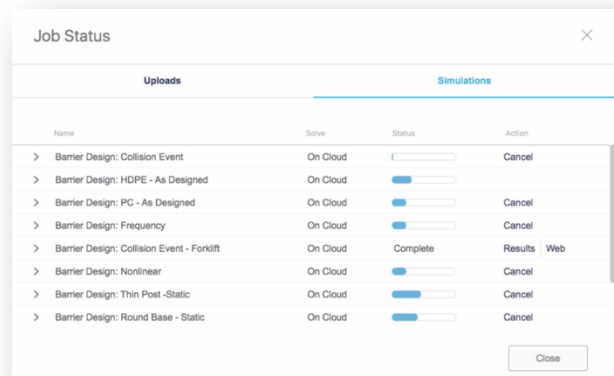

Sharing Results & Collaboration

Product development typically requires multiple people to take a product to market. This Collaborate section covers how to work with others on your Fusion 360 project.

Problem Setup

Created in 1998, Eurobot is an international amateur robotics contest open to teams of young people. One such club, CVRA (Club Vaudois de Robotique Autonome-

https://www.cvra.ch/) is a group of students and engineers passionate about robotics based in Switzerland. They shared a part of one of their robots, Debra 5, on GrabCAD.

Our in software goal of this exercise is to determine the best material, then iterate on the best design decisions.
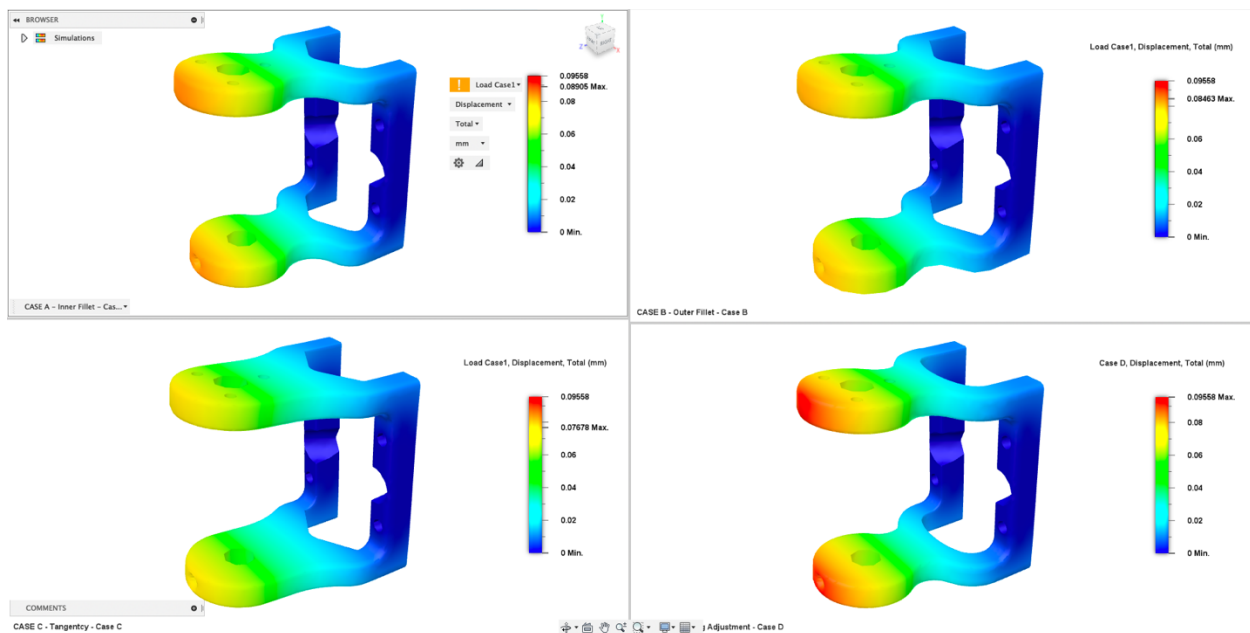
	Mass Δ	Disp Δ	Material Price	Price Δ*
Al-7075	-	-	$ 0.08	-
Al-6061	-4%	-4%	$ 0.06	-19%
Ti 6-4	58%	37%	$ 2.24	2716%
304 SS	185%	63%	$ 0.25	215%

Conclusions

We hope that the teachings of this class will highlight some of the many advantages of using a simulation tool during the design process. From determining the best material selection, to shaping the next design decision, FEA can help with design optimization. Further to that, generative design considers all of what FEA can, plus more −such as cost, manufacturing process, and more!