

MFG240168-L

Generative Design Hands-On Workshop

Aaron Magnin, Bryce Heventhal, Lars Christensen, and Varun Heta



Learning Objectives

- Understand what generative design is, how it is different from traditional geometry creation methods, and how it is so much more than simply light-weighting or topology optimization.
- Experience the role that generative design plays in product development and real-world problem-solving.
- Understand (through multiple hands-on exercises) the foundational concepts that you need in order to succeed when defining, generating, and exploring solutions.

Description

This 1-day workshop will gather a small exclusive group of talented engineers and designers for a special hands-on look at Autodesk's Generative Design technology. You will walk away with the ability to increase your innovation capacity by exploring solution domains beyond the single concept of traditional design tools. This hands-on session will complete an entire generative workflow, from defining requirements to editing results.

Speakers

Aaron Magnin is a Technical Marketing Manager for Fusion 360 out of San Francisco.

Bryce Heventhal is a Sr. Technical Marketing Manager for Fusion 360 out of San Francisco.

Lars Christensen is a Technical Marketing Manager for PDMC and YouTube superstar.

Varun Heta is a Technical Product Evangelist for Fusion360 based in India.

What is Generative Design?

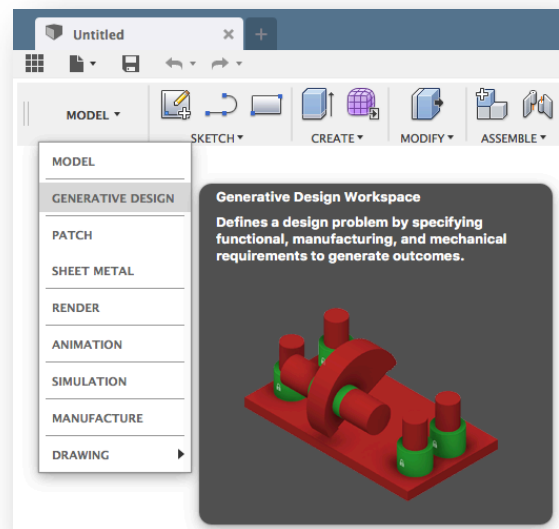
Generative design mimics nature's evolutionary approach to design. Designers or engineers input design goals into generative design software, along with parameters such as loads, materials, and manufacturing methods.

How do you get access to Generative Design?

Generative design is available to Fusion 360 commercial subscribers, and Product Design and Manufacturing Collection subscribers.

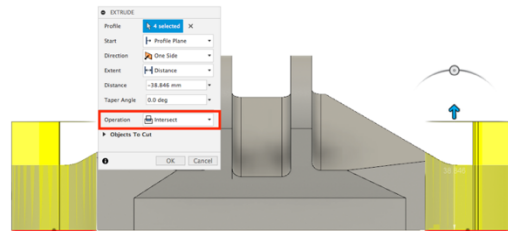
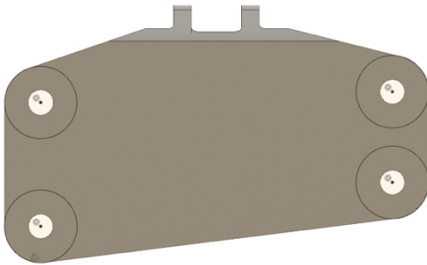
What are the basic steps in setting up a Generative Design?

1. Open or create the model in Fusion 360.
2. Enter the 'Generative Design' workspace.
3. If needed, modify the geometry in the 'Edit Model' workspace to prepare the preserve, obstacle, and starting shape geometries to be defined in the next step.
4. Define design space, including Preserves, Obstacles, and/or Starting Shapes.
5. Define loading conditions and constraints.
6. Define objectives.
7. Define manufacturing method, including unrestricted, additive, or 3/5-axis milling.
8. Define material options (up to 10).
9. Generate outcomes – if converged, the outcome satisfies all design requirements specified.
10. Explore outcomes & export the optimal solution.

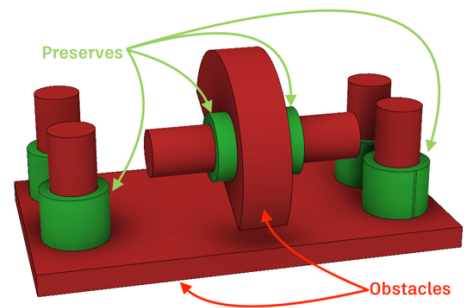


Hands on Example 1- GE Bracket Key Steps

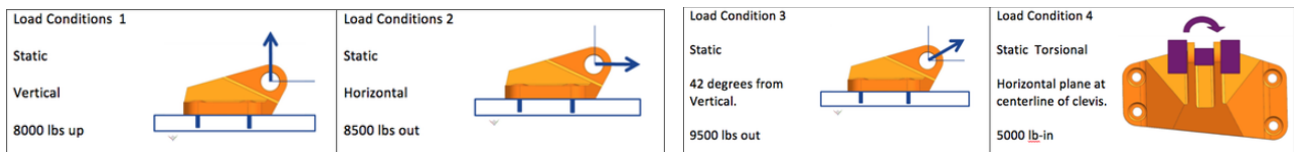
1. Go directly to the Generative Design Workspace, and then to 'Edit Model'
2. Create Preserve regions for 4 bolts:
 - i. Sketch 4 circles on bottom face (see below left);
 - ii. Extrude fully through body with operation set to intersect (see below right);
 - iii. Remove ramp faces by control-selecting/box selecting and hitting 'Delete' key.



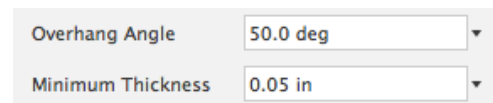
3. Show both "Obstacles" and "Preserve Regions" components.
4. Define 6 preserve regions, and 2 obstacles as denoted in the image to the right.



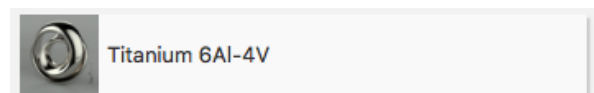
5. Define load cases. In each case, make sure the 4 bolt locations are 'Fixed'.



6. Objective is to **minimize mass** at a **FOS of 2**.
7. Manufacturing method is set to unrestricted and additive. In the additive setup, ensure that the "**Overhang Angle**" is set to **50** degrees, and "**Minimum Thickness**" is **.05in**.



8. Material is **Ti-6Al-4V**.



Hands on Example 2- Caster Wheel Key Steps

1. Go directly to Generative Design Workspace & then to 'Edit Model'
2. Replace the wheel and cap **components** with primitives.
3. Pull off the axle and bearing mounting faces (using **offset surface**) from the fork component, then **thicken** those surfaces to -0.125in. (see Figure 1)
4. Remove surfaces and fork.
5. Check for **interference** and remove any found. Ensure the 'primitive bodies' are set as target/cut.
6. Exit 'Edit Model' mode, and define Preserves and Obstacles.
7. Define 4 load cases:

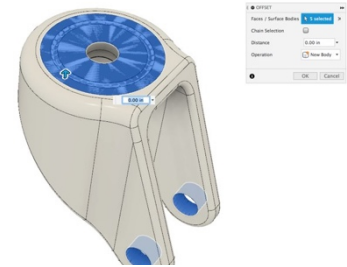
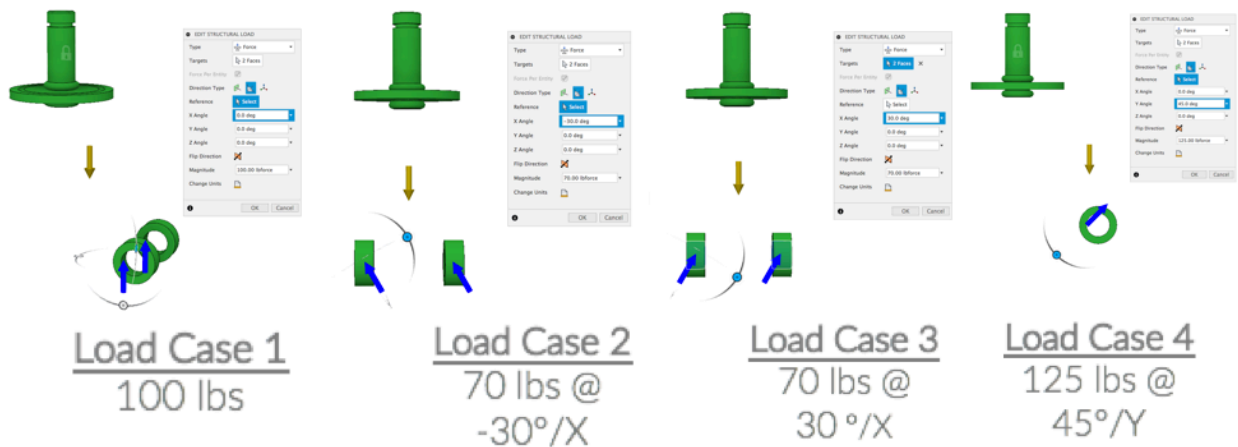


Figure 1- Step 3 showing offset surfaces.



8. Set the **Objective** to minimize mass at a **FOS of 3**.
9. Manufacturing set to **unrestricted**.
10. Materials: Ti-6Al-4V; 6061 Aluminum Alloy; Steel; & any other you want to try!
11. (Optional) Reduce synthesis -found in the settings- which may result in faster results and more iterations.
12. Generate. This will solve on the cloud, freeing you to explore other setups or problems.
13. (Optional) While generating, clone the model setup and solve another with different settings/geometry/manufacturing methods!