Fusion 360 Introduction to Generative Design

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Section Break

About the speaker

Robert Savage

Robert Savage is a Senior Education Specialist at IMAGINiT Technologies. He is a 30-year design veteran who has designed everything from molds and molded parts to robots. At Remotec, a division of Northrop Grumman Corporation, he spent 5 years as a lead designer in the research and development group, as well as CAD and Vault Administrator. He is an Autodesk Certified Instructor and a Certified Inventor Professional. He has used Inventor software since its inception, as well as being well-versed in a variety of other design software. He has 20 years of experience teaching 3D design software, including AutoCAD Electrical, Product Design Suite Ultimate software, Factory Design Suite Ultimate software, Simulation Moldflow software, Fusion 360, Nastran In-CAD and Vault Professional software.

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Fusion 360 Introduction to Generative Design

Last year I did an “Introduction to Fusion 360 Generative Design” lecture so this year I think it is time to give the users a chance to see how it works. This time I want to do a hands-on lab where I will break it down in to three areas The Setup, The Analysis and The Results. I hope this will allow the users that are not sure what Generative Design does a chance to walk through the process and see how it works. This will give users who don’t currently use Generative Design but are interested a chance to try out a part and see not just what it does but how it is used.

Fusion 360 Introduction to Generative Design

DEFINE WHAT GENERATIVE DESIGN IS.

It is a tool for optimizing a part by defining the pertinent information the using cloud processing to produce multiple variations to evaluate.

GO THROUGH A SETUP FOR A PART.

Setting up the part can start at an empty screen or with a predefined model, either can be used to do a generative design. If you are starting with a blank design, then you are starting from scratch but will need to know what to consider for the designs this can be how is it mounted or where are the loads placed on the model. If I am applying this to an existing Model, then I can use existing geometry and features to help define the loads and control points.

RUN THROUGH AN ANALYSIS.

This will look at the 5 steps that are used to prepare the generative design content for upload.

REVIEW THE RESULTS.

The results are shown in several ways it will allow you to look at weight in comparison to the part strength and material.

Define what Generative Design is.

FUSION 360

This is the tool we will use to setup and configure the part information.

FUSION TEAM

Fusion Team is the tool that is used to store and collaborate with other team members.

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 materials, manufacturing methods, and cost constraints.

Go through a setup for a part.

MODEL THE PART

If you have an existing model, then you have already completed this step. This would be used as a starting shape in generative design.

MODEL THE OBSTACLE AND PRESERVE GEOMETRY

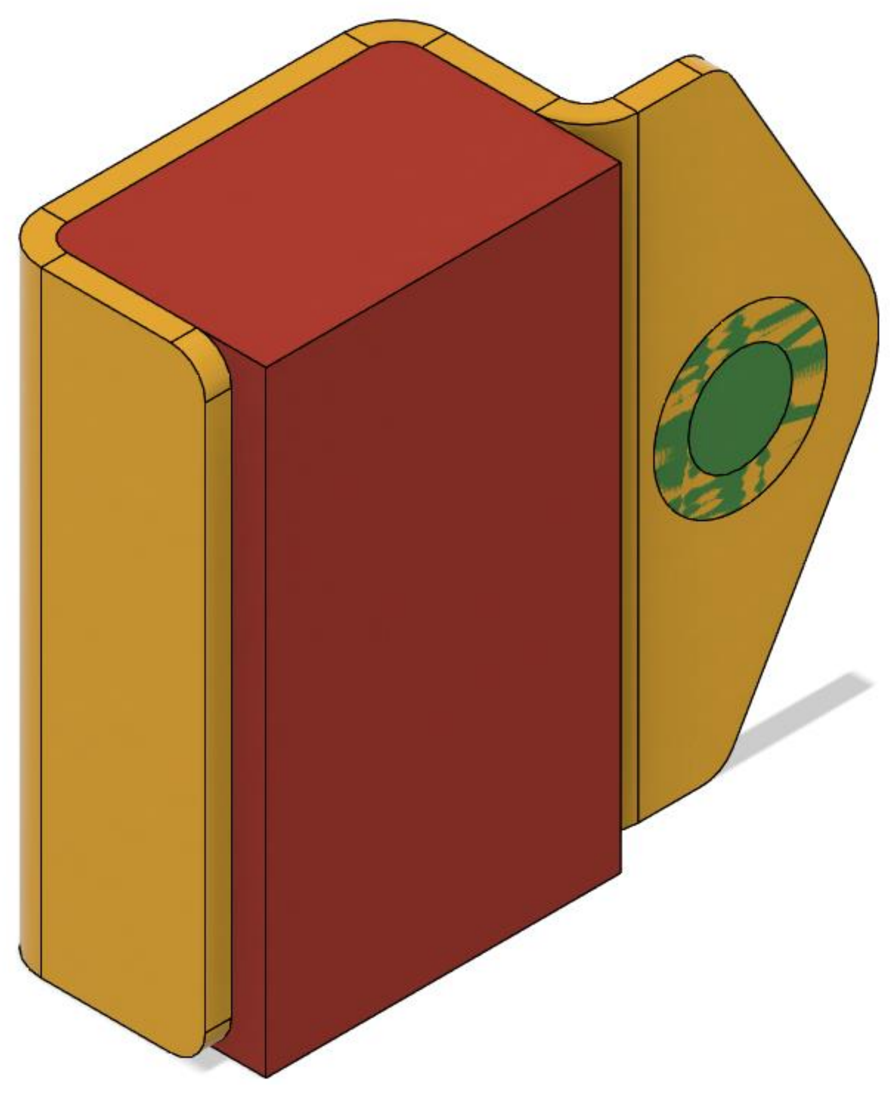
When you have completed building your model (if required) you will want to create new bodies to represent two sets of information.

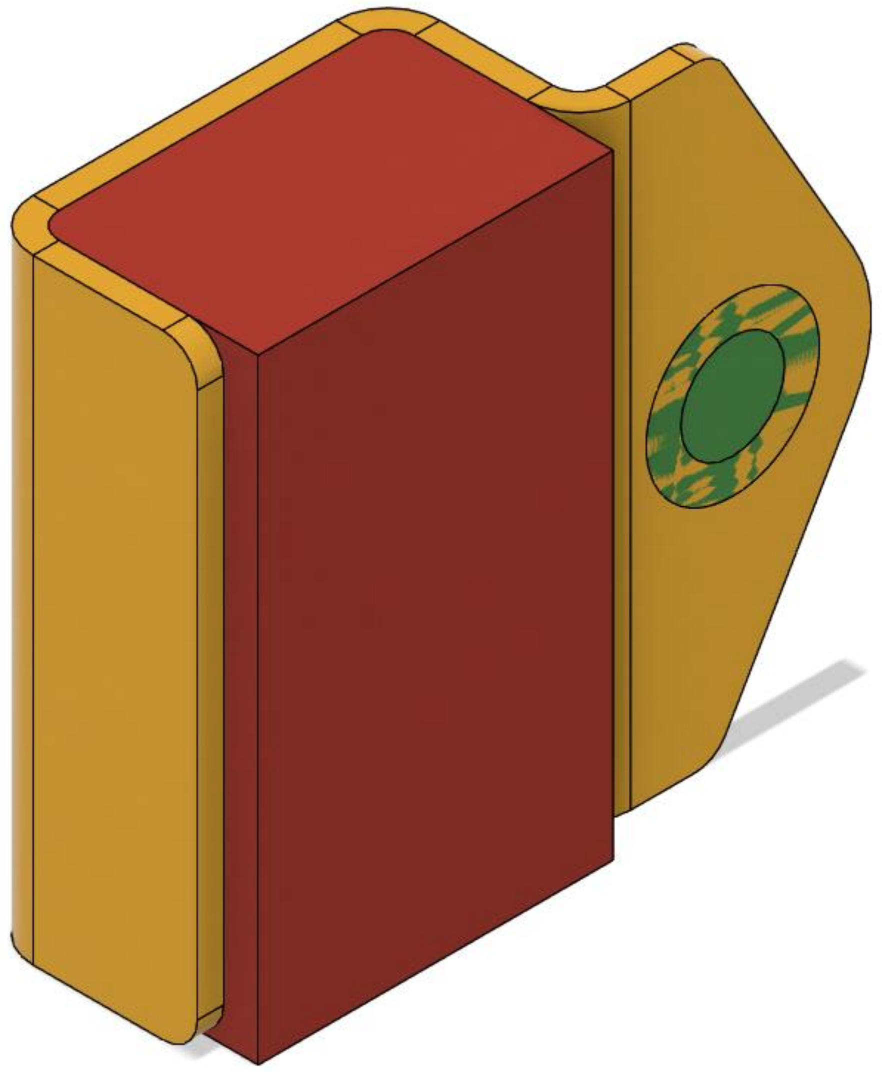
CONFIGURE THE MODEL

There are a couple things we want to look at in the model before we start the Generative design process.

Analysis Steps

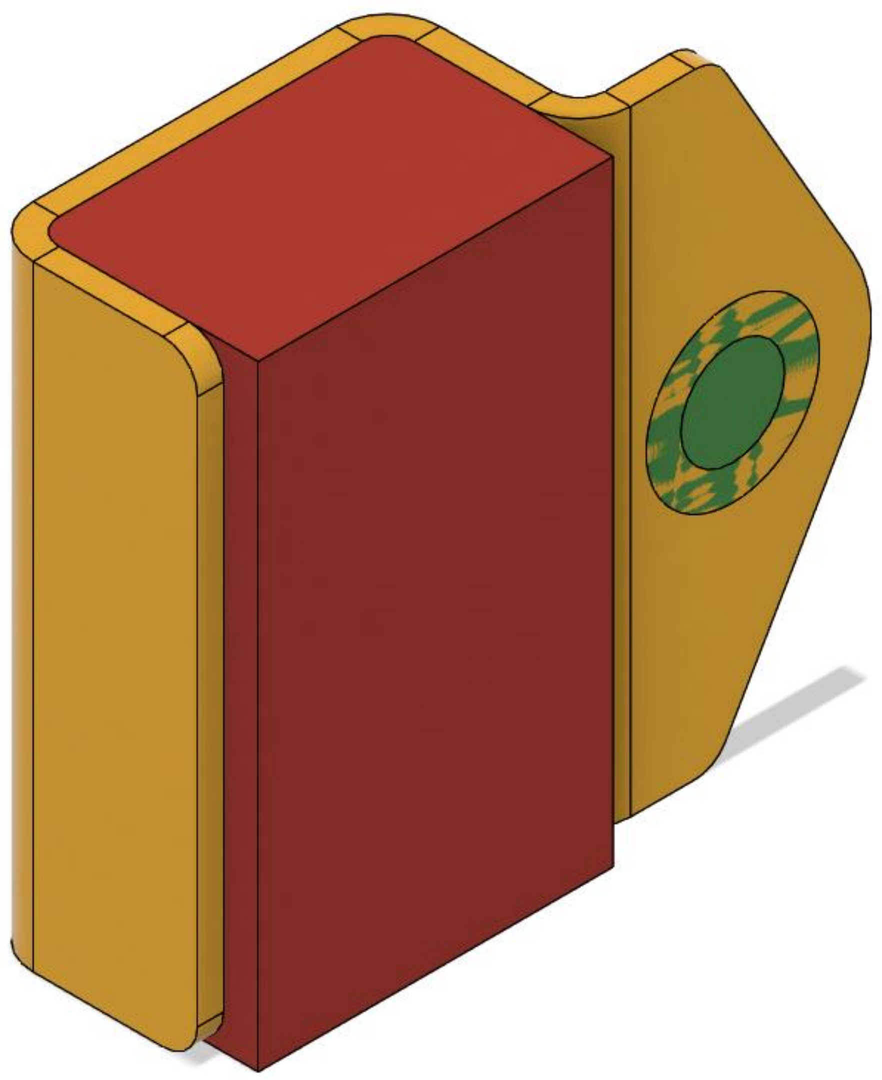
- Identify the problem domain and gather information
- Creating preserve geometry
- Creating obstacle geometry
- Setup your boundary conditions
- Run your studies





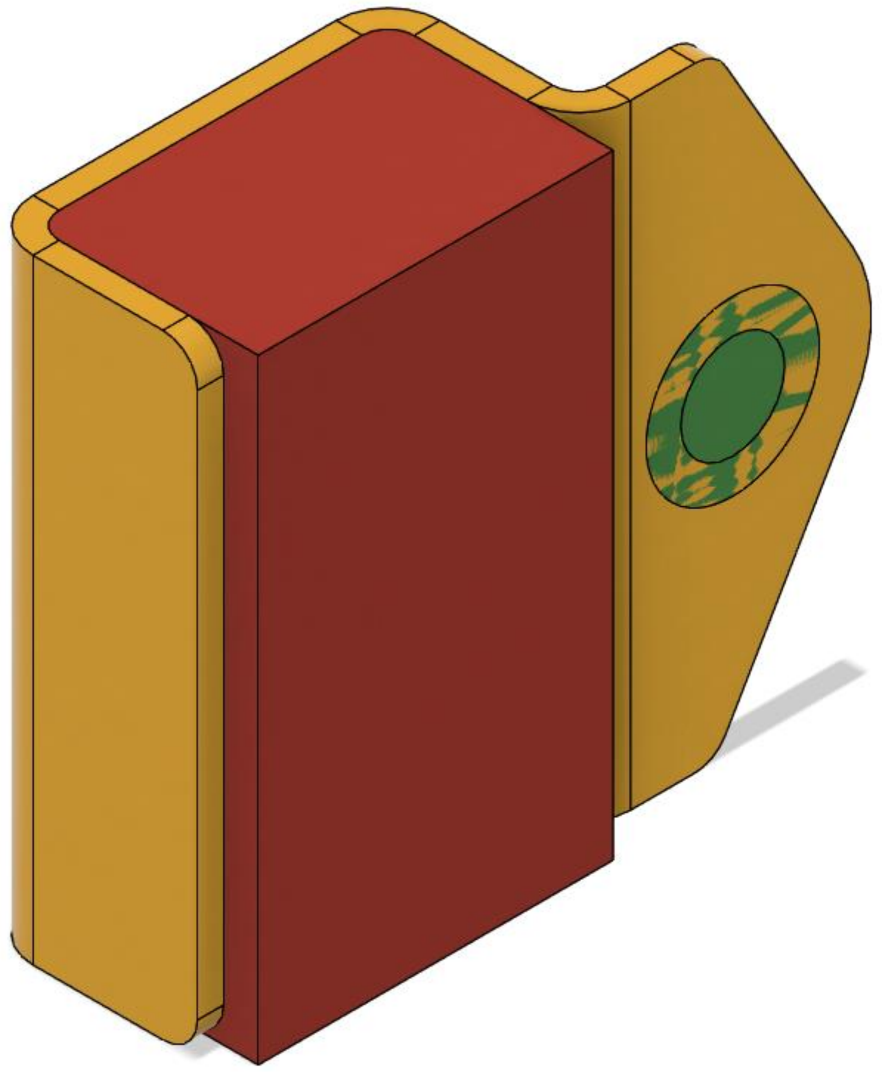
Identify the problem domain and gather information

Spend some time thinking about the problem and the greater context that it fits in. How does the new part(s) interact with the greater assembly? What kind of manufacturing, assembly, or other practical considerations are present?



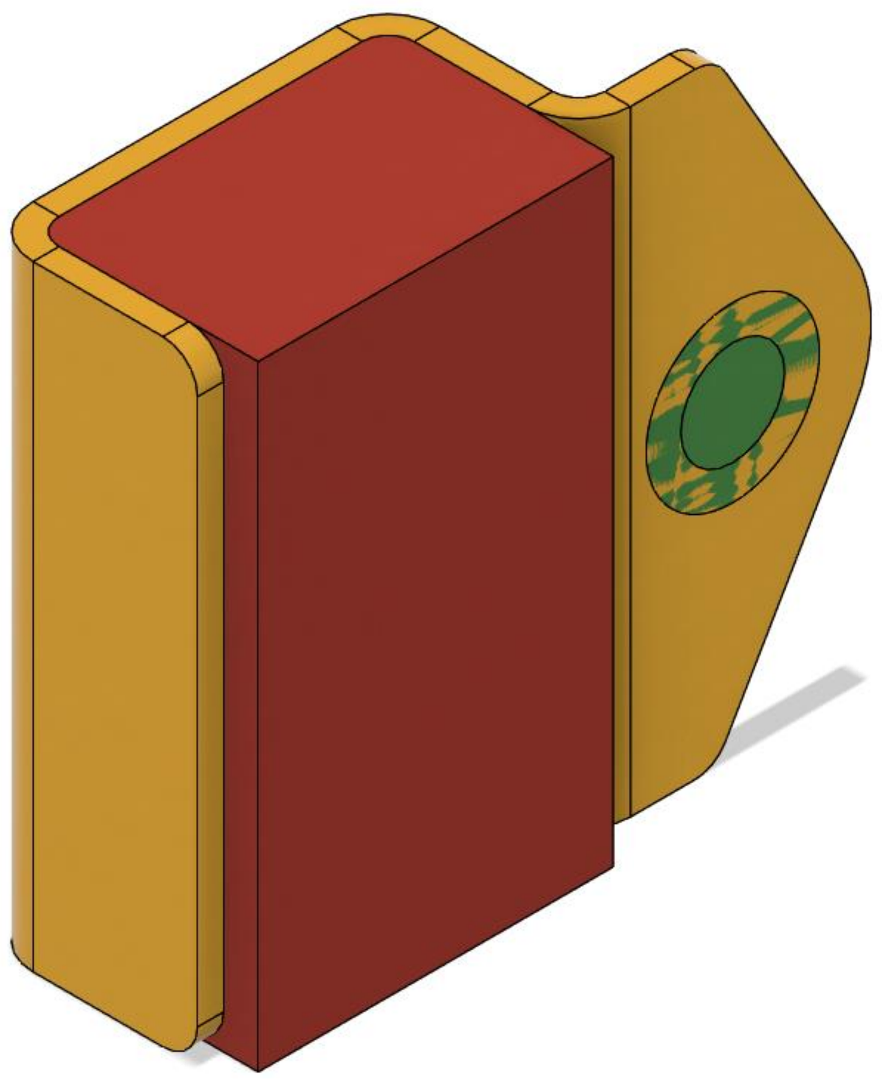
Creating preserve geometry

Start with the existing base model, be it a single part or an assembly. Create the interface geometry (e.g. bolt bosses, flanges, etc.) as new bodies to be used by the generative process. Be sure to include any needed extra grind/machine stock, fluid containment walls, or other "oddball" preserves.



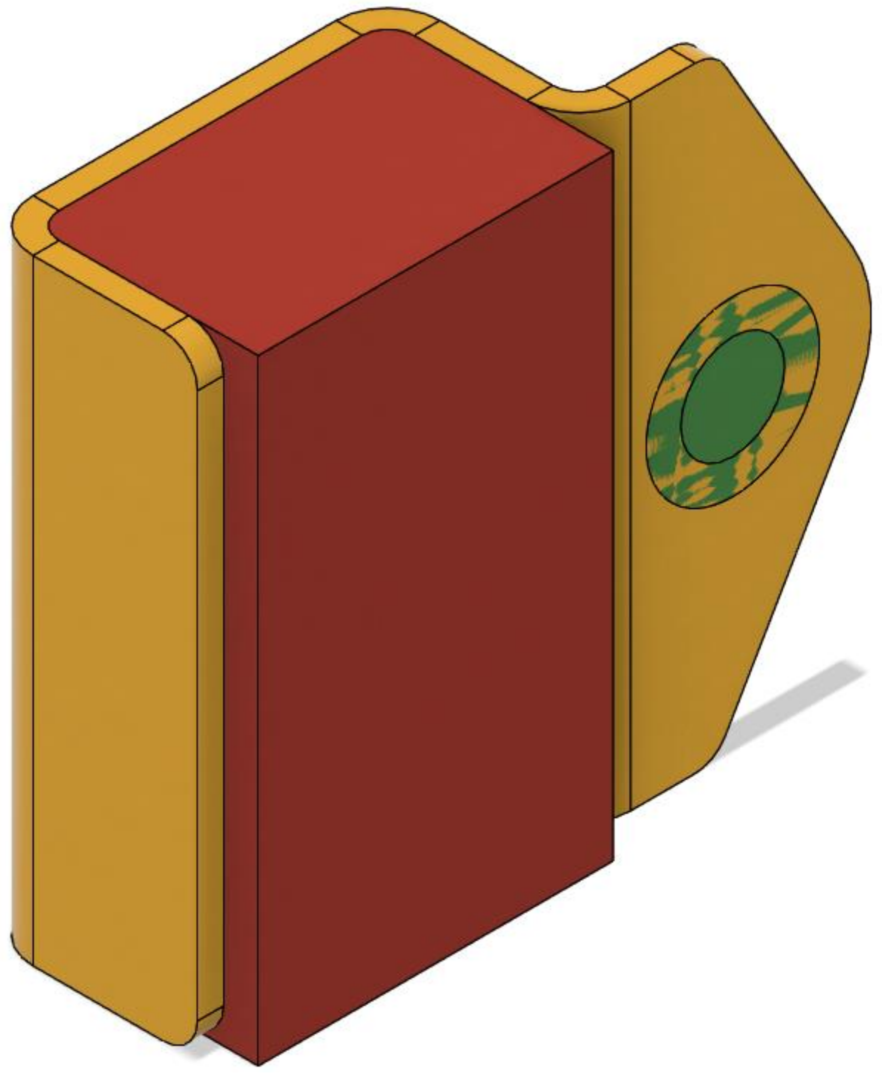
Creating obstacle geometry

Again, working with the base model, create any obstacle geometry needed. This might include fasteners (nuts, bolts, screws, pins, etc.). It also might include more complicated geometry like swept solids (e.g. the path a toggle clamp makes as it swings into position).



Setup your boundary conditions

Specify the constraints, loads, manufacturing details, and materials into the system. Be sure to build your load cases based on any dynamic motions that may be involved (for example, a part of a car suspension may experience braking, acceleration, turning, or stasis).

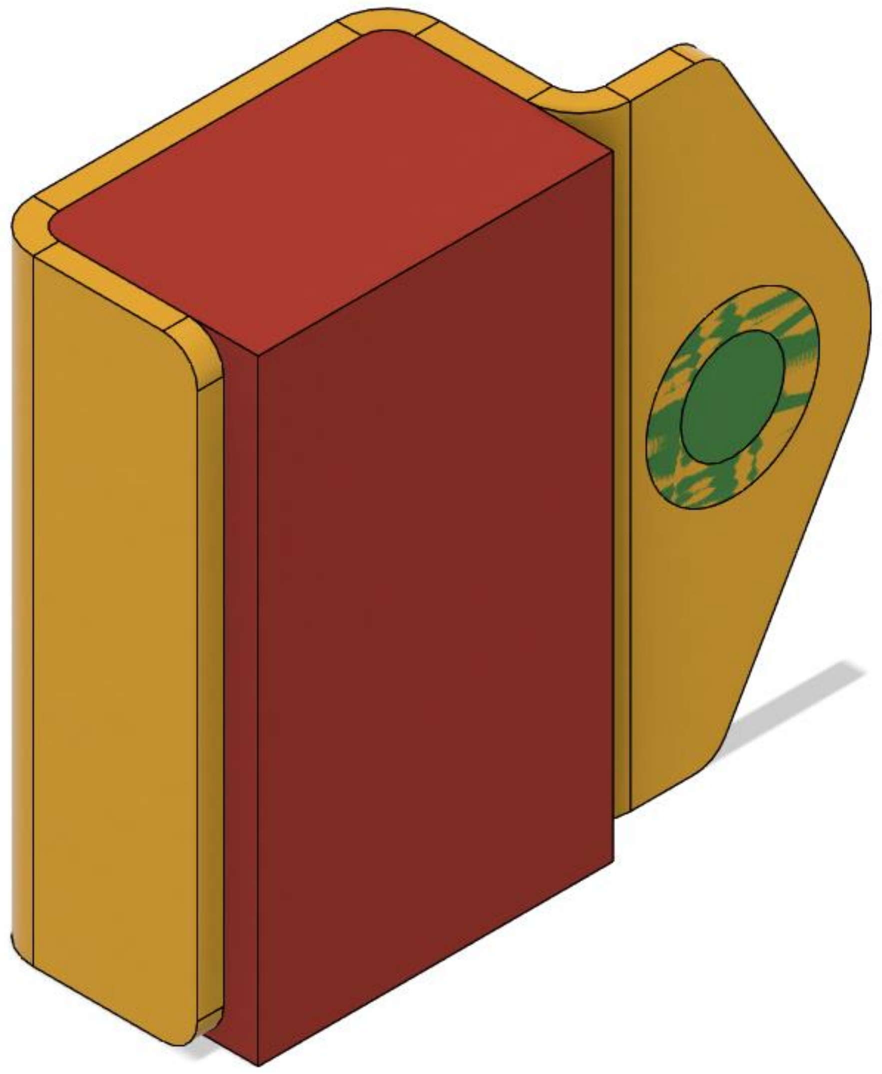


Run your studies

At this point, run your various studies. Pay attention to early results to ensure that you're getting expected kinds of results. You'll notice fairly early on if an obstacle is too short or you forgot some specific detail.

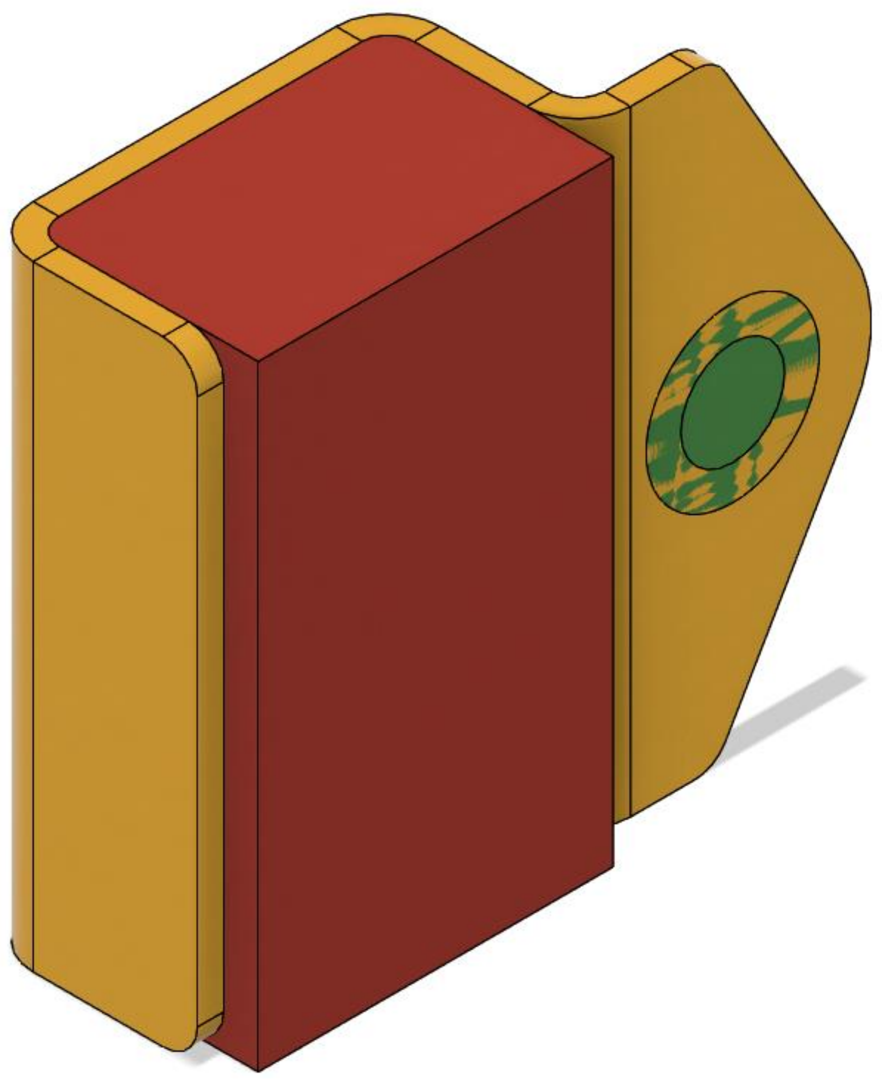
Review the Results

- Examine your results
- Compare results to initial expectations
- Integrate back into the base
- Take next steps
- Rinse and repeat



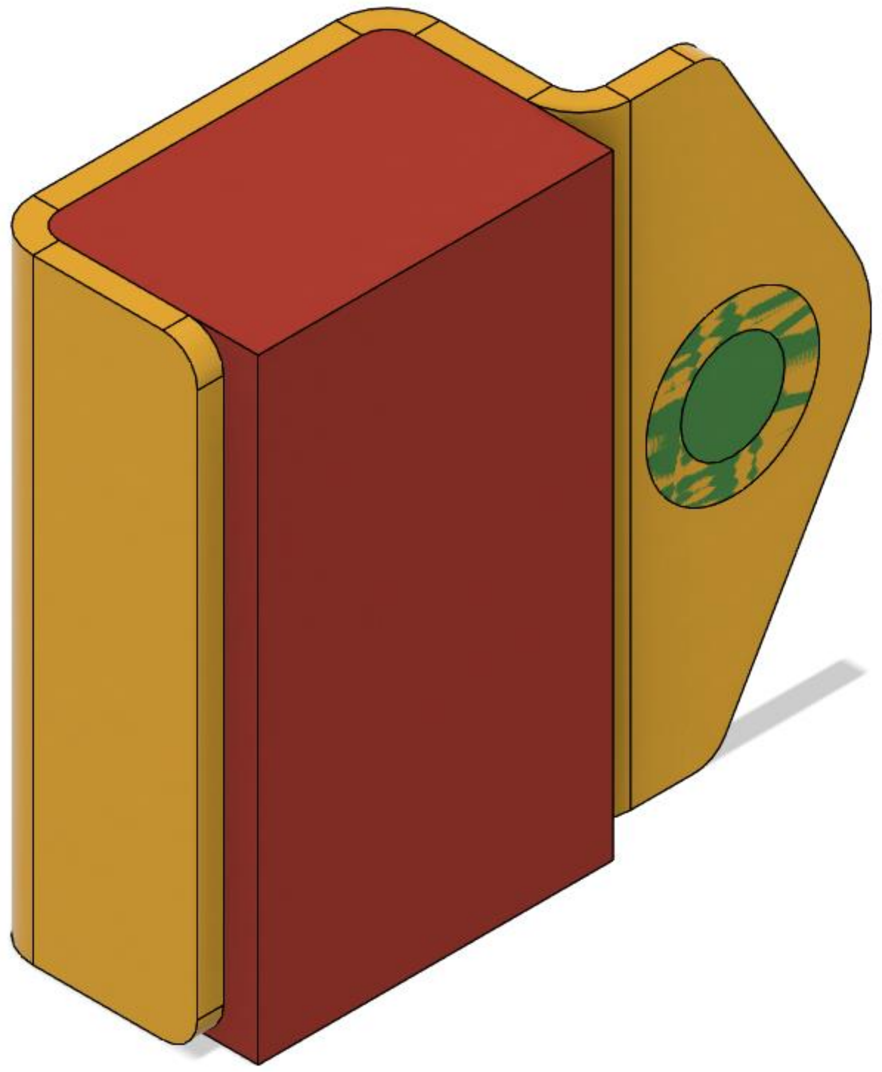
Examine your results

As your results complete, use the tools available to determine which solutions are worth further investigation. This may be a matter of using the scatter plots, visually comparing results, or inspecting the model stress visualizations.



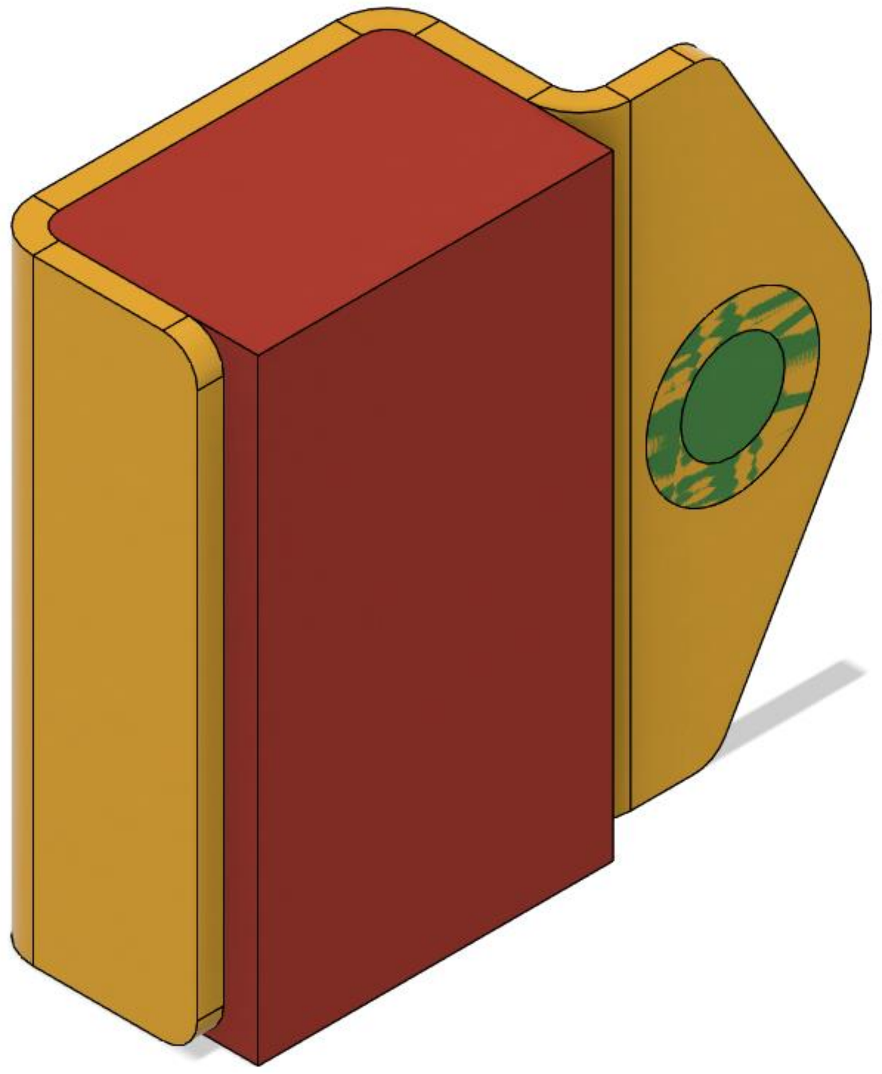
Compare results to initial expectations

Once your results are in, loop back to step one and validate what was generated against what you expected/desired.



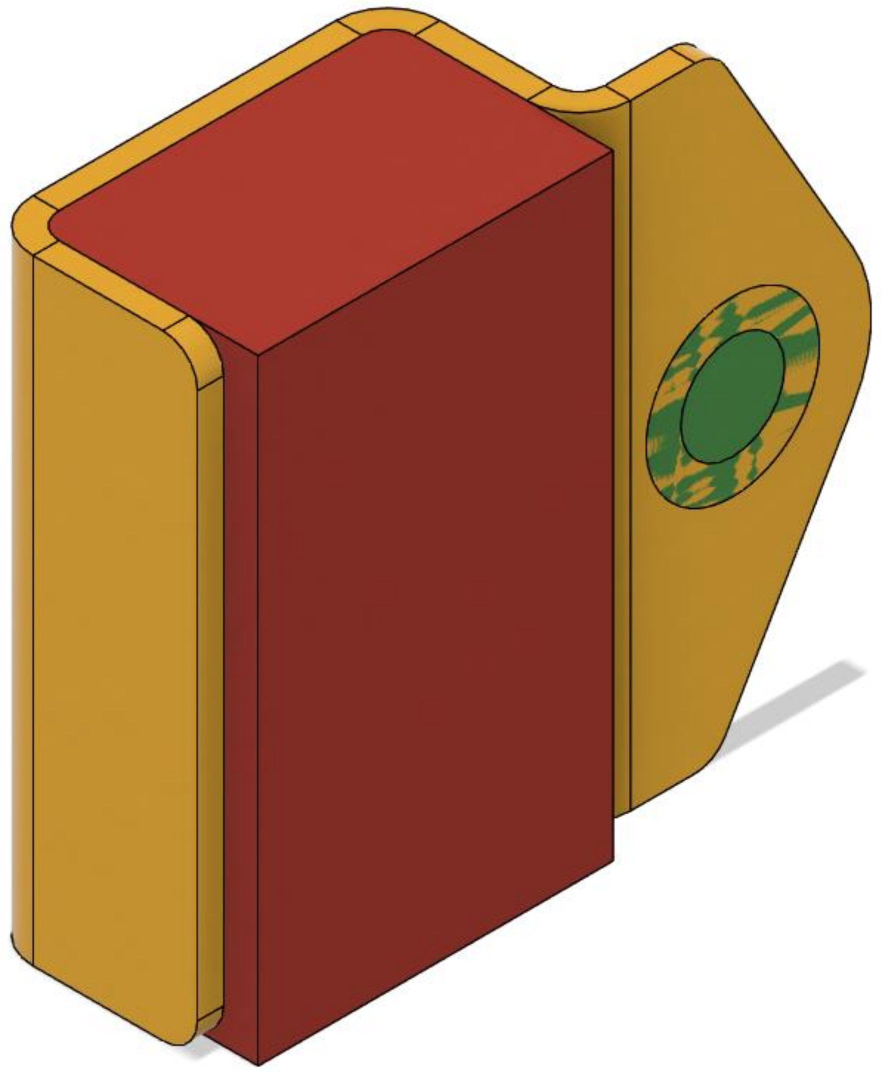
Integrate back into the base

Once you've generated a result that you're satisfied with, export it as a BRep/TSpline and place it back into the base model to inspect the context again. Begin thinking about next steps with regards to CAM, 3D printing, CAE validation, etc. Add in required features like machining operations or modify the TSpline as needed to achieve your contextual requirements.



Take next steps

Take your final model out to CAM, CAE, 3D printing software, or whatever the next stage is for your design.



Rinse and repeat

Continue working through this process iteratively to further refine your designs.

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