Final Portfolio

ME127 Spring 2023
May Levin

ME 127: Design for Additive Manufacturing, is a mechanical engineering course taught at Stanford University, that combines the fields of Design for Manufacturability (DfM) and Additive Manufacturing (AM). *Topics include: design for rapid prototyping, material selection, post-processing and finishing, CAD simulation, algorithmic modeling, additive tooling and fixtures, and additive manufacturing at scale.*

3D printed bag

Prompt: Create a functional 3d printing prototype as a final project for ME127

Function: A purse that is able to hold the weight of a phone and not break

User/Use Case: Me! To be able to use functionally as a bag, and carry around light objects.

Materials/Process: Chain was made out of PLA using the Ender V2. 5-long chain links where connected via mid print inserts.

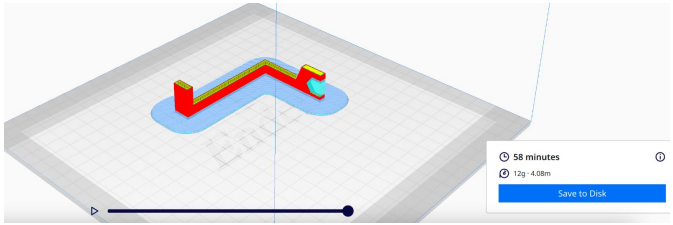
The bag was made out of TPU infill material on the Ultimaker s5, and assembled using a 3D printer pen.

Space Wrench

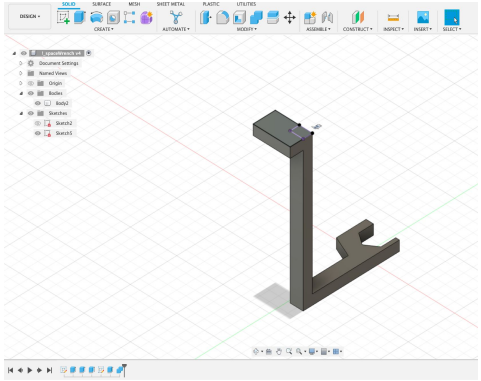
Prompt: Create a 3D printed wrench that is able to screw in a nut inside obstructed platform using thick “space” gloves

Materials/Process: Printed using PLA on an Ender V2. Optimized to print with minimal supports.

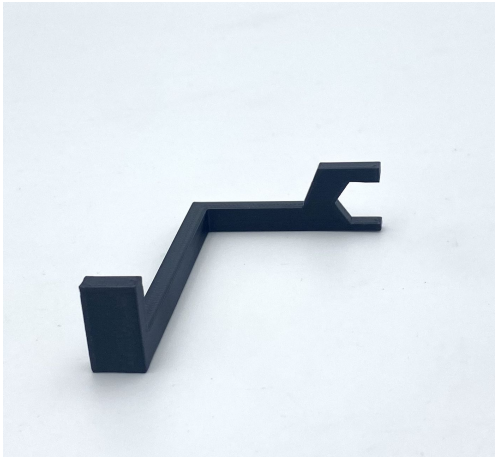
CURA 3D print model



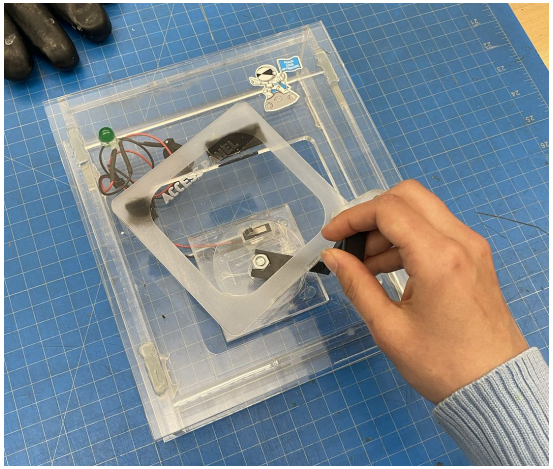
CAD model



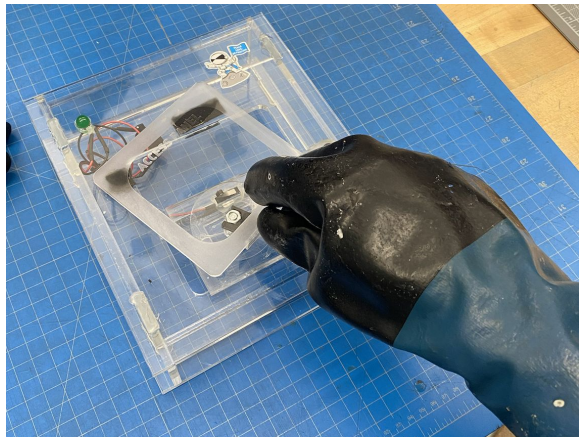
Printed Product



Trying it out without gloves



Trying it out with gloves



3D printed F1 Car

Prompt: Work with a group to explore 3D printed material properties to build a functional product.

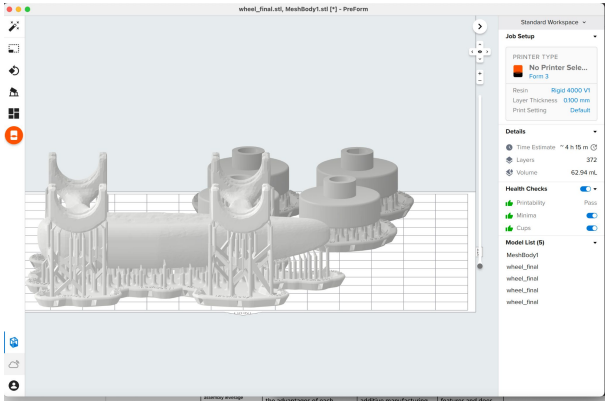
Function: To roll across a desk in a single push

User/Use Case: Anyone who enjoys having a toy car as a fun desk ornament

Materials/Process:
Tires where made out of Flex 80 on the formlabs and stretch over the wheel.

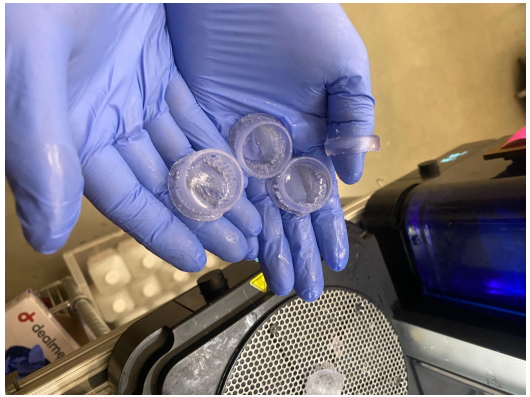
Wheel and Car body where made out of rigid 4k on the formlabs. The car body was formed using generative design.

3D Slicer on preForm



Car Body

Printed Tires



Final Product

Magnetic Box Tiles

Prompt: Utilize either:

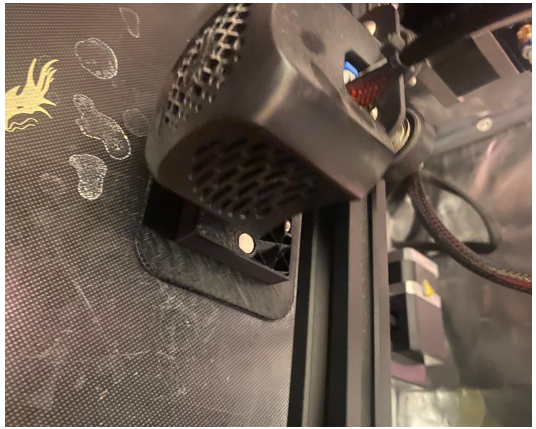
- Print in Place Joints/Mechanisms
- **Embedded/ Captured/Mid-Print Inserts**
- Multi-Material* (Dual Extrusion) Parts

to create unique product that highlights the use of Additive manufacturing.

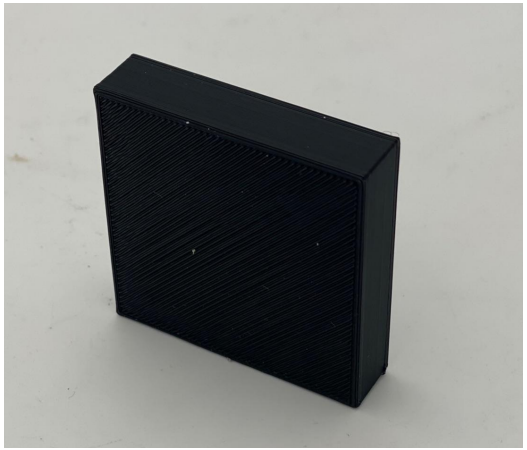
Function: The intended purpose of my design is to 3D print magnetic box tiles that can connected together to create structures.

Materials/Process:
Magnet tiles were made out of PLA on the Ender V2, and where stopped mid place to insert magnet tiles.

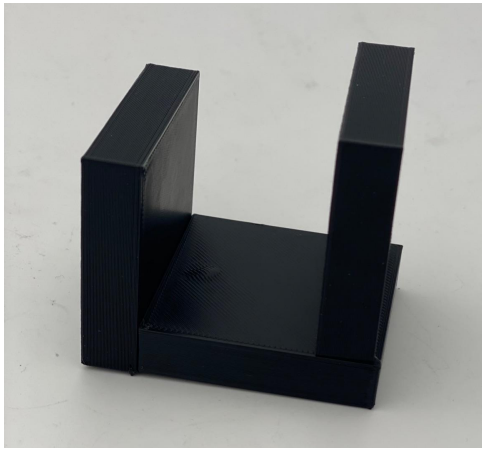
Mid-print magnet insert



Single Tile



In different configurations

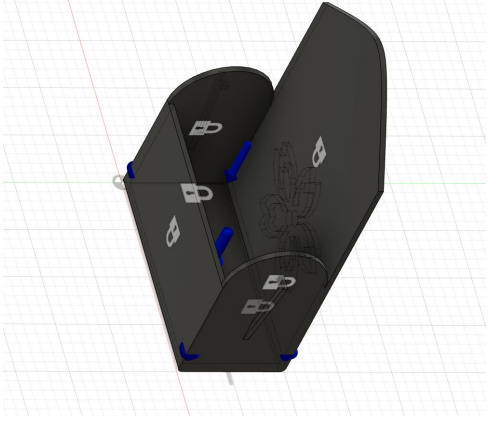


Takeaways + Skills Learned

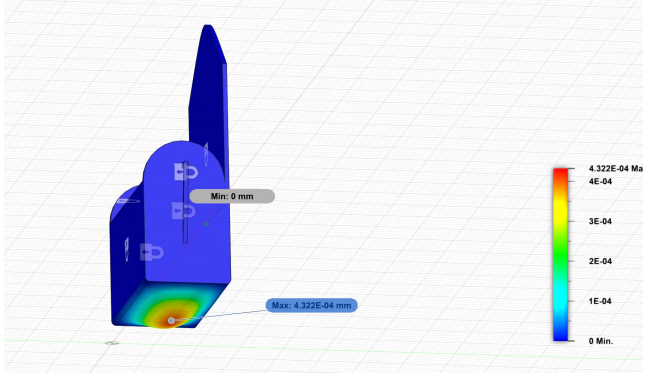
1) Load case analysis

I learned how to do force simulations on Fusion 360, which is great for trying out different load cases. Below, is an analysis of forces pushing down on the bag for the 3D printed bag project.

Constraints on outwall, and 2lb force pushing down

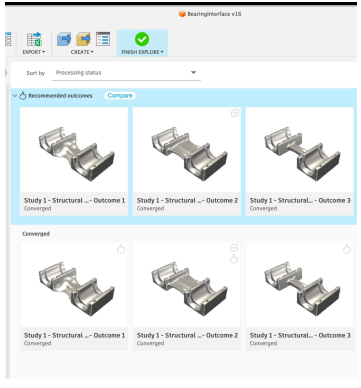


Displacement analysis



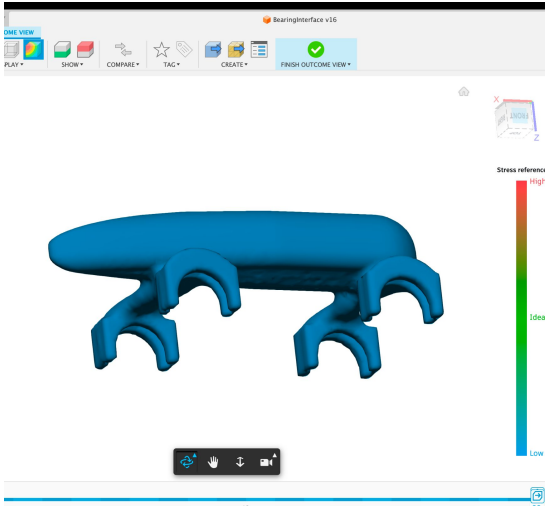
2) Generative design and shape optimization

Generative design results



I learned how to create generative designs and shape optimized models using Fusion 360. For our F1 car model project, we created the model and bearing holders using a generative design simulation.

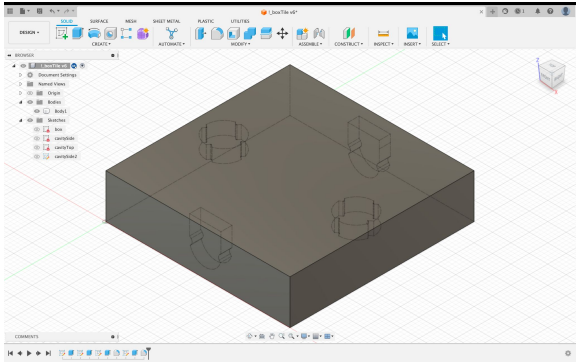
Final car model

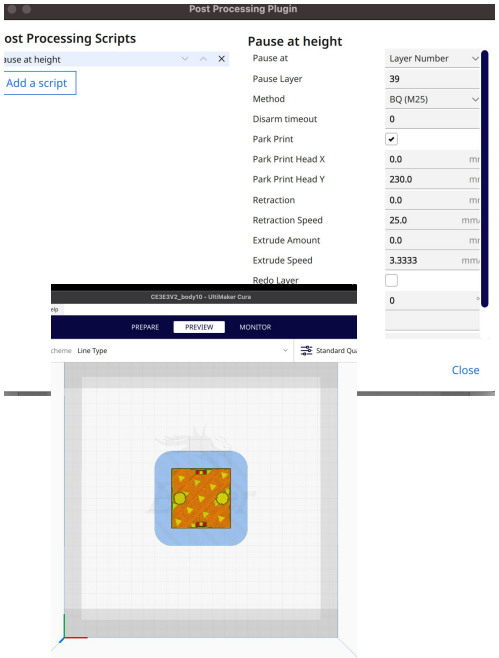


Takeaways + Skills Learned

1) Mid-print inserts + print in place mechanisms

I got to improve my methodology in additive manufacturing by learning how to utilize mid-print inserts (magnets, chains) and also print in place mechanisms (the moving chains) in my 3D printing repertoire. For my magnet box tile projects, I added pausing into my gcode script to be able to add magnets into the tile.





2) Improved prototyping and design

I honed in my ability to properly plan and prototype my wanted designs. I learned the importance of trying to create simple prototypes and draw several ideas before starting to “print”. Below are some sketches from my space wrench projects.

Wrench designs