



Digital Manufacturing (MECE 4606)

with Professor Hod Lipson

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Late Hours: 1 Used, 113 Hours Remaining

Submitted: Sunday 3.21.2021

Project Assignment #4: Topology Optimization



Desk Design and Optimization

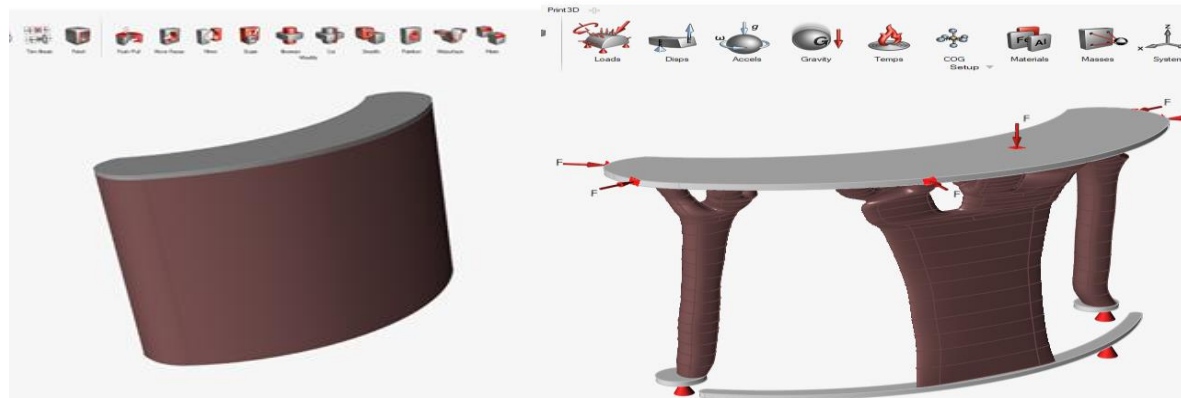
Section 1

Requirement for Design

- I followed the design constraint of a desk that is 30" high, 24" deep and 60" wide
- It is made of nylon and can support over 300 lbs
- I designed a curved table with three supports at the bottom
 - Two stubs and one long support that covers the front of the desk as seen with the topology image below

Section 2

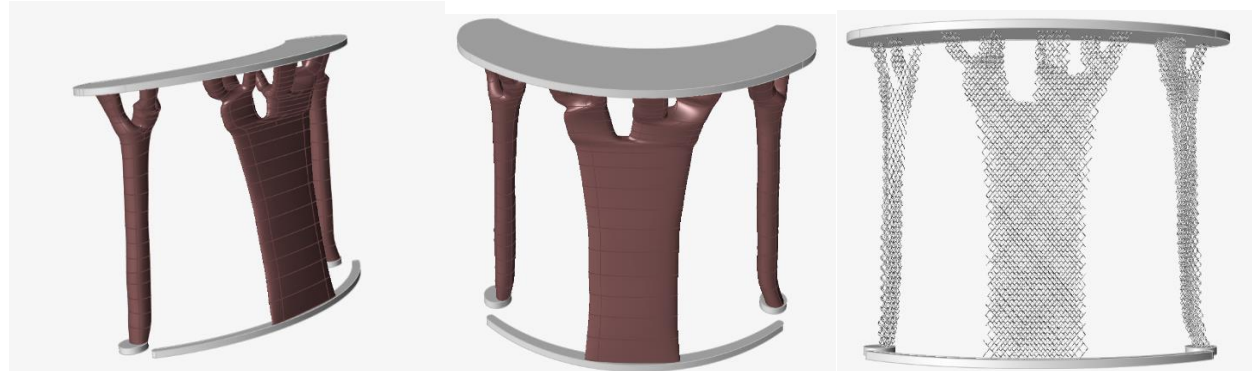
Design Space and Constraints



- The first image shows the original design and the second is the topology
- The design space was the entire body of the table
- It cannot be seen in the first image but you can see in the topology picture the supports and the forces on the table
 - I set the bottom frames as supports
 - I have three in total at the bottom
 - I also put a force of 300 lbs on the top of the table as well as around the table
- I set Inspire at 15% design space and calculate for max stiffness

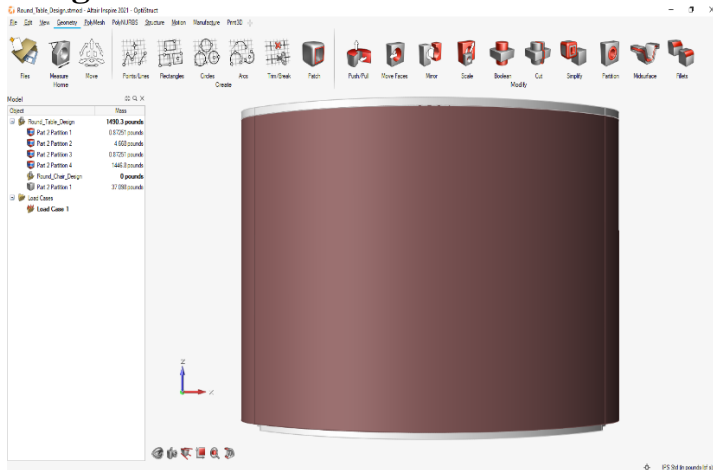
Section 3

Final Result

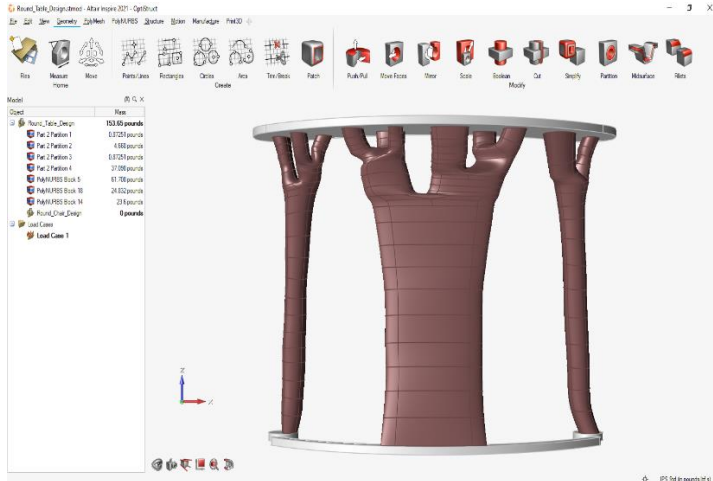


Section 4

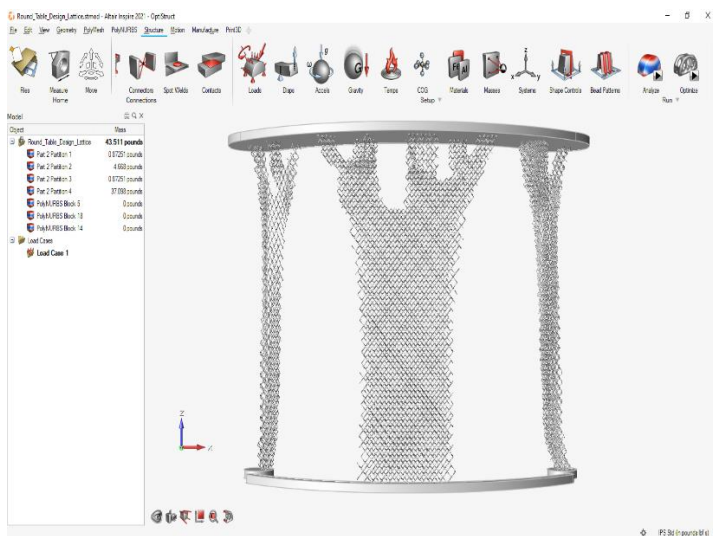
Weight



First Weight = 1490.3 lbs



Second Weight = 153.65 lbs



Final Weight = 43.511 lbs

Chair Design and Optimization

Section 1

Requirements for Design

- Chair had to fit the dimensions of the table (which was 60" x 24" x 30")
 - Chair dimensions were 60" tall, 50" wide at the widest points, and 30" deep from front to back
- It is made of nylon
- It can support over 300 lbs and has a back

Section 2

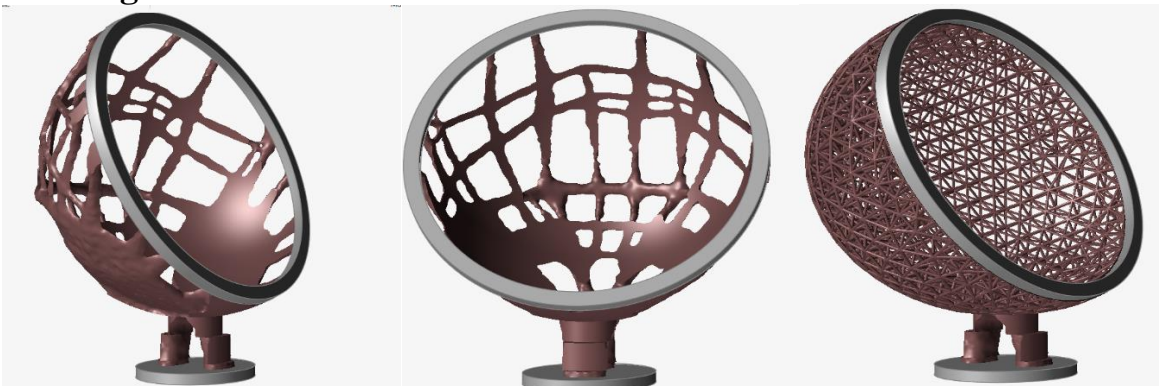
Design Space and Constraints



- Support was added at the bottom of the chair as seen with red icon below the chair
- Forces were added to the side of the chair as seen in the photo below
 - I had to do this because forces on a curved surface were giving weird topology and ran into too many errors
 - I applied about 200 lbs force on each to account for forces downwards and forces backwards
 - Doing this gave a more reasonable topology and better stress analysis
- The design space that I used is colored dark red. I kept the ring and the bottom support as my constraint and allowed Inspire to maximize stiffness of the sphere and the supports above the bottom support.

Section 3

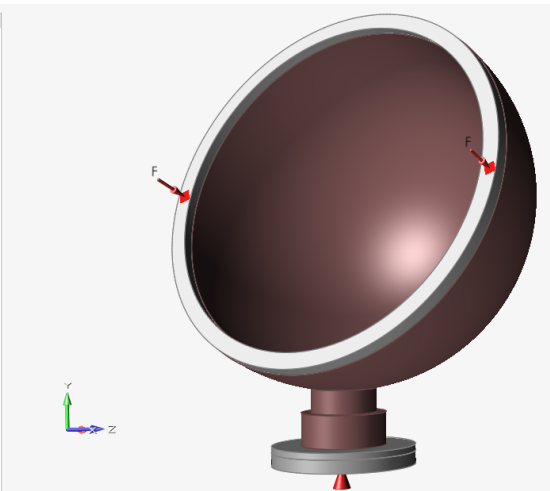
Final Design



Section 4

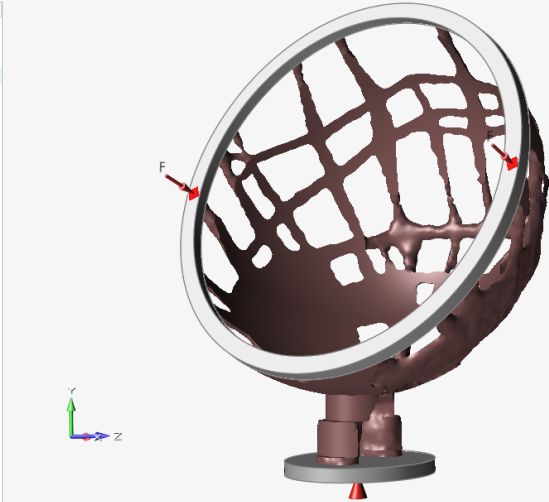
Weight

Object	Mass
New_Egg_Chair	758.77 pounds
Part 1	624.5 pounds
Part 1	
Model Max Stiffn...	
New_Egg_Chair ...	
Part 6	0 pounds
Part 8	13.96 pounds
Part 8	
Model Max Stiffn...	
Part 9	29.491 pounds
Part 9	
Model Max Stiffn...	
Part 10	16.892 pounds
Part 10	
Model Max Stiffn...	
Part 1 Partition 1	40.143 pounds
Part 10 Partition 2	33.784 pounds
Load Cases	
All Loads, Displacements...	
Support 3	
Force 5	
Force 6	
Load Case 3	
Support 3	
Force 5	
Force 6	



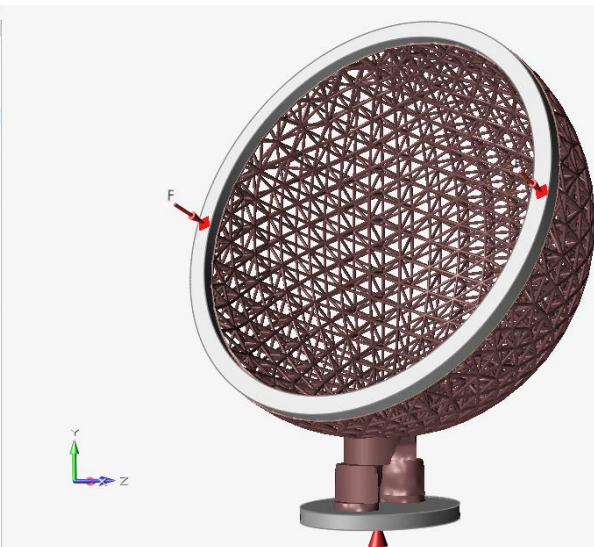
First Weight = 758.77 lbs

Object	Mass
New_Egg_Chair	222.65 pounds
Part 1	130.3 pounds
Part 1	
Model Max Stiffn...	
New_Egg_Chair ...	
Part 6	0 pounds
Part 8	6.6457 pounds
Part 8	
Model Max Stiffn...	
Part 9	9.5067 pounds
Part 9	
Model Max Stiffn...	
Part 10	2.2704 pounds
Part 10	
Model Max Stiffn...	
Part 1 Partition 1	40.143 pounds
Part 10 Partition 2	33.784 pounds
Load Cases	
All Loads, Displacements...	
Support 3	
Force 5	
Force 6	
Load Case 3	
Support 3	
Force 5	
Force 6	



Second Weight = 222.65 lbs

Object	Mass
New_Egg_Chair	205.03 pounds
Part 1	112.68 pounds
Part 1	
Model Max Stiffn...	
New_Egg_Chair ...	
Part 6	0 pounds
Part 8	6.6457 pounds
Part 8	
Model Max Stiffn...	
Part 9	9.5067 pounds
Part 9	
Model Max Stiffn...	
Part 10	2.2704 pounds
Part 10	
Model Max Stiffn...	
Part 1 Partition 1	40.143 pounds
Part 10 Partition 2	33.784 pounds
Load Cases	
All Loads, Displacements...	
Support 3	
Force 5	
Force 6	
Load Case 3	
Support 3	
Force 5	
Force 6	



Final Weight = 205.03 lbs