Digital Manufacturing (MECE 4606)

with Professor Hod Lipson

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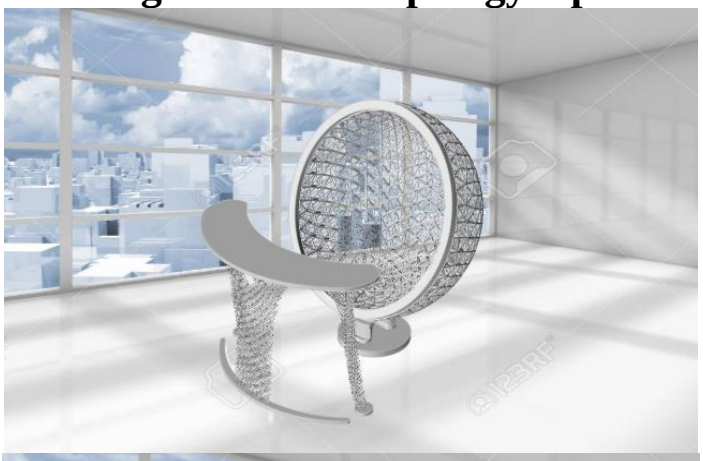
Late Hours: 1 Used, 113 Hours Remaining
Submitted: Sunday 3.21.2021

Project Assignment #4: Topology Optimization



Desk Design and Optimization

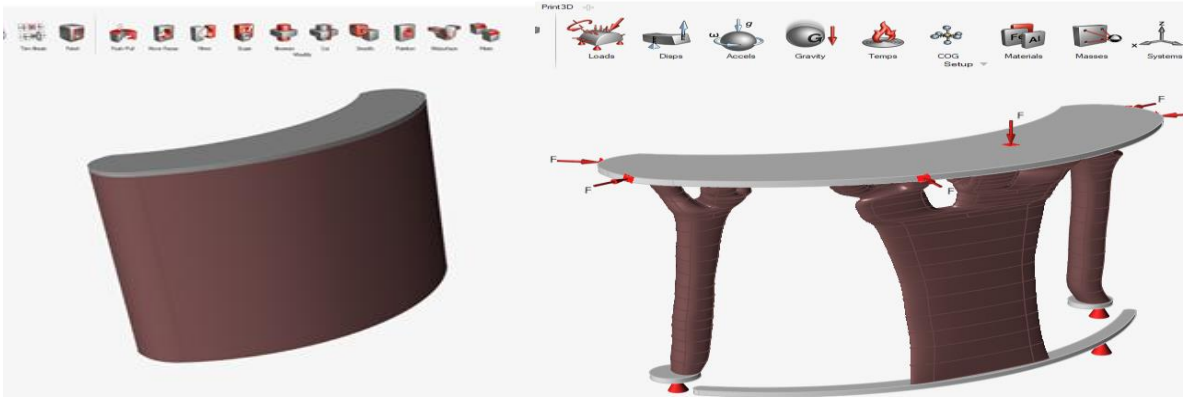
Section 1

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



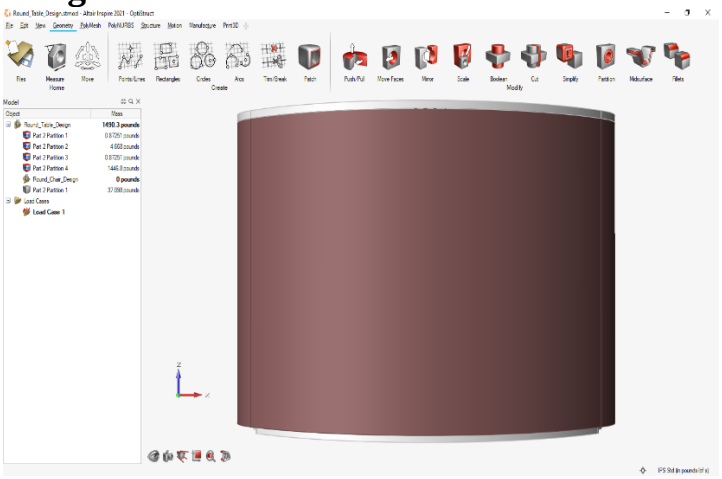
- The first image shows the original design and the second is the topology
- The design space was the entire body of the table
- It cannot be seen in the first image but you can see in the topology picture the supports and the forces on the table
    - I set the bottom frames as supports
        - I 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

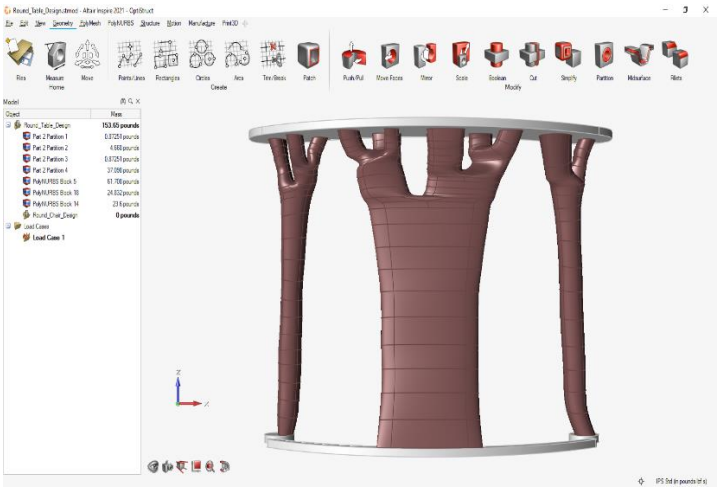
Final Result

Section 4

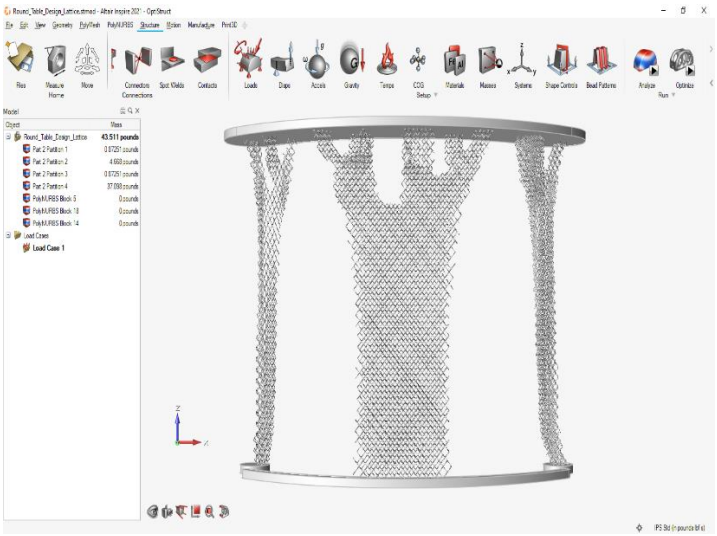
Weight



First Weight = 1490.3 lbs



Second Weight = 153.65 lbs



Final Weight = 43.511 lbs

Chair Design and Optimization

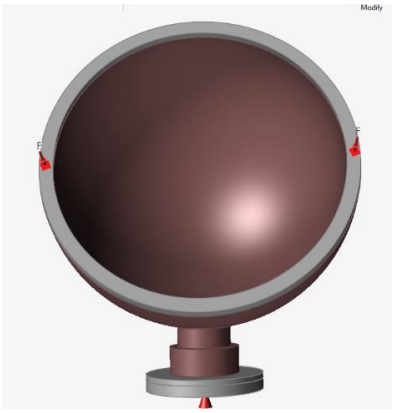
Section 1

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

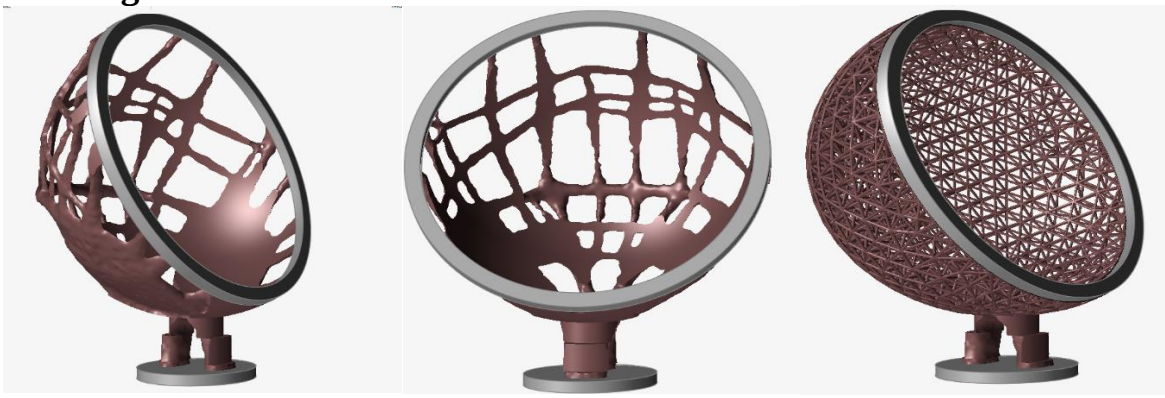
Design Space and Constraints



- 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.

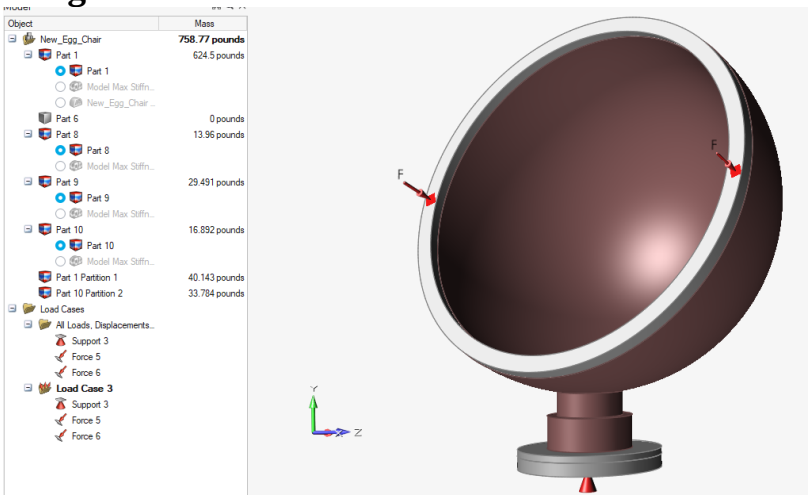
Section 3

Final Design

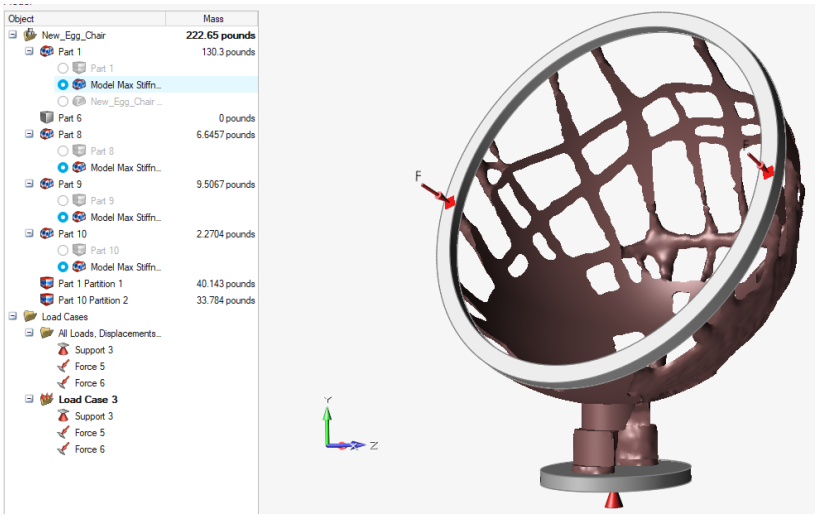


Section 4

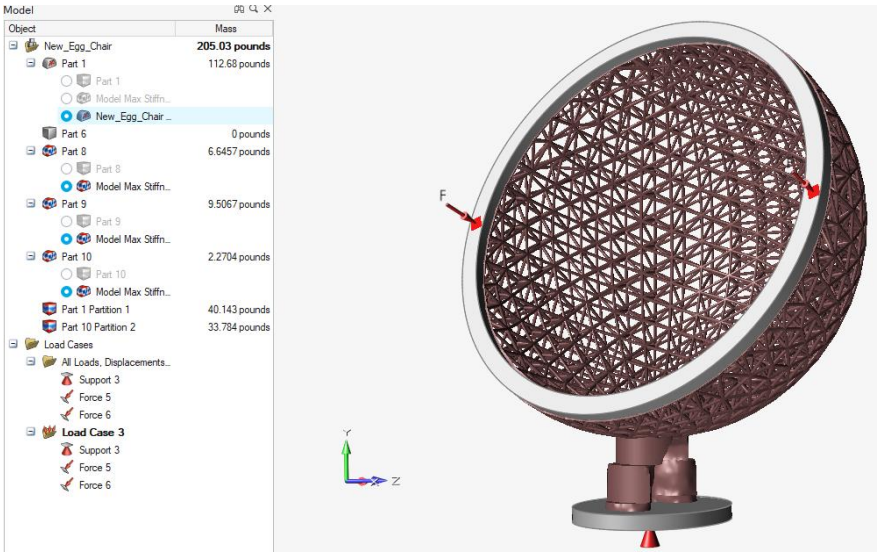
Weight



First Weight = 758.77 lbs



Second Weight = 222.65 lbs



Final Weight = 205.03 lbs