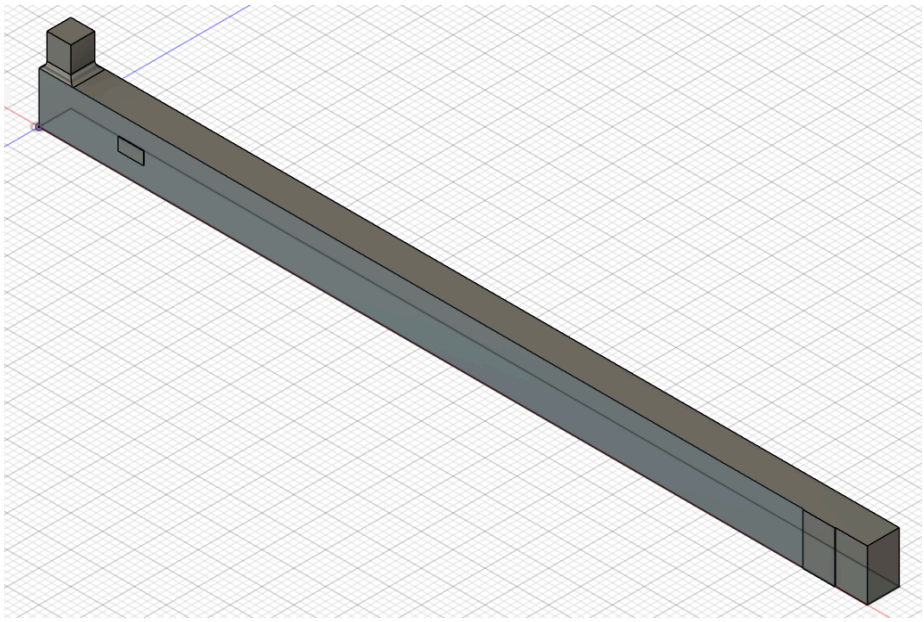
MAE 3270 Final HW

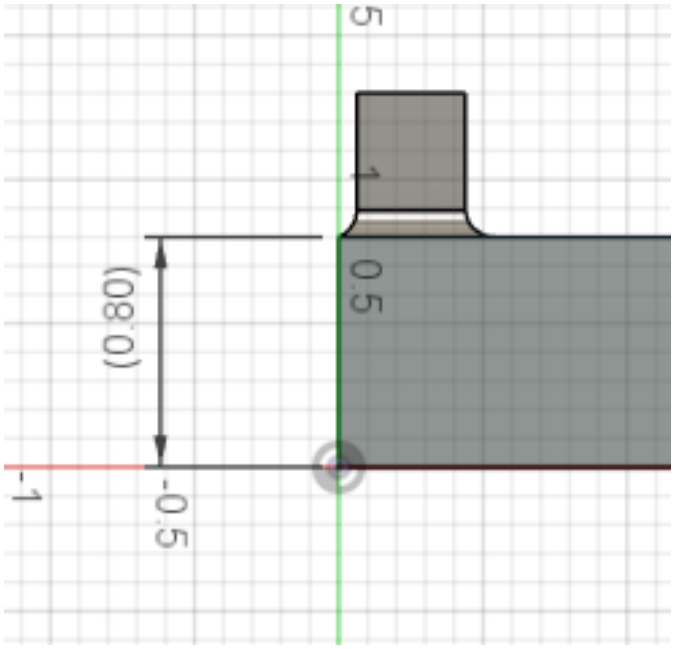
Michael Wywrocki

5.2 - Your Design, Upload to Portfolio

5.2.1 - Results

1)

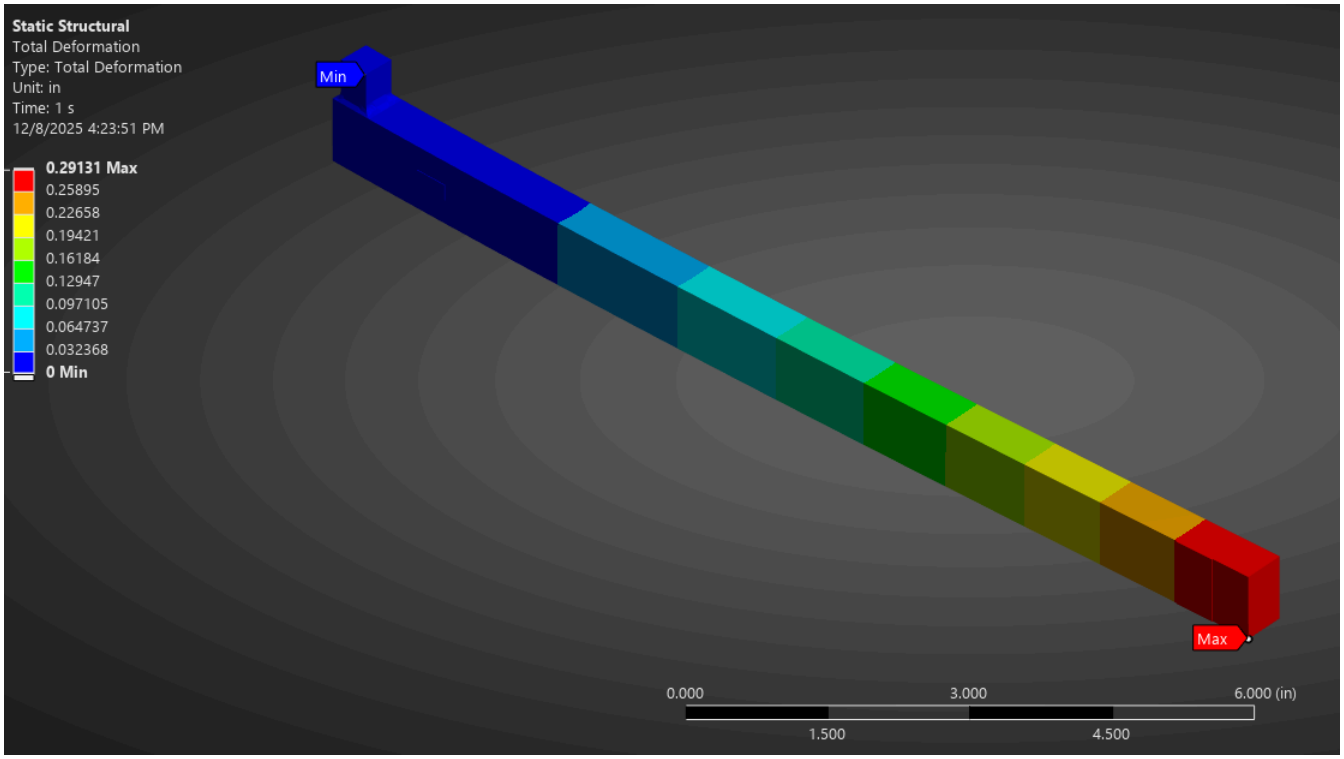




2)

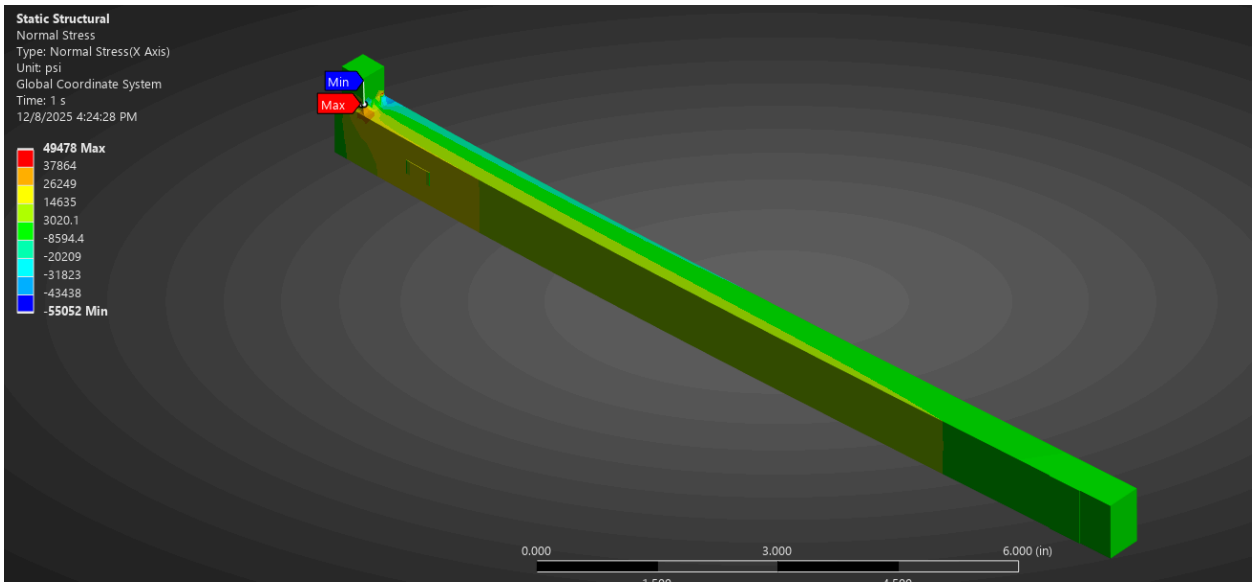
For our design we used Titanium alloy Ti-6AI-4V because it has a really great combination of high strength, low density, and corrosion resistance which is great for demanding and high performance applications. It has a tensile strength of about 130,000 psi, meaning it is capable of withstanding substantial mechanical loads without permanent deformation. Also, its low density relative to steel enables meaningful weight reduction while maintaining structural integrity, which results in a lighter and more durable component that helps have both usability and effectiveness.

3)

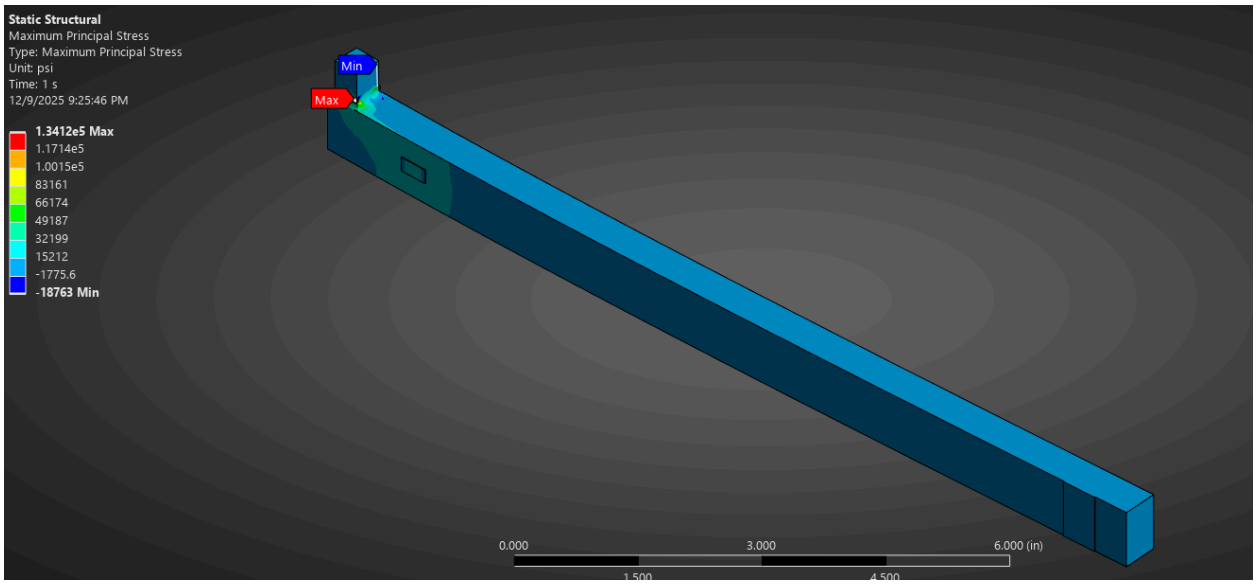


The drive end of the design was sent constant by setting the displacement components to 0 so therefore it wouldn't move. Then there was an applied 50 lbf = Torque/Length at the end face in the y-direction.

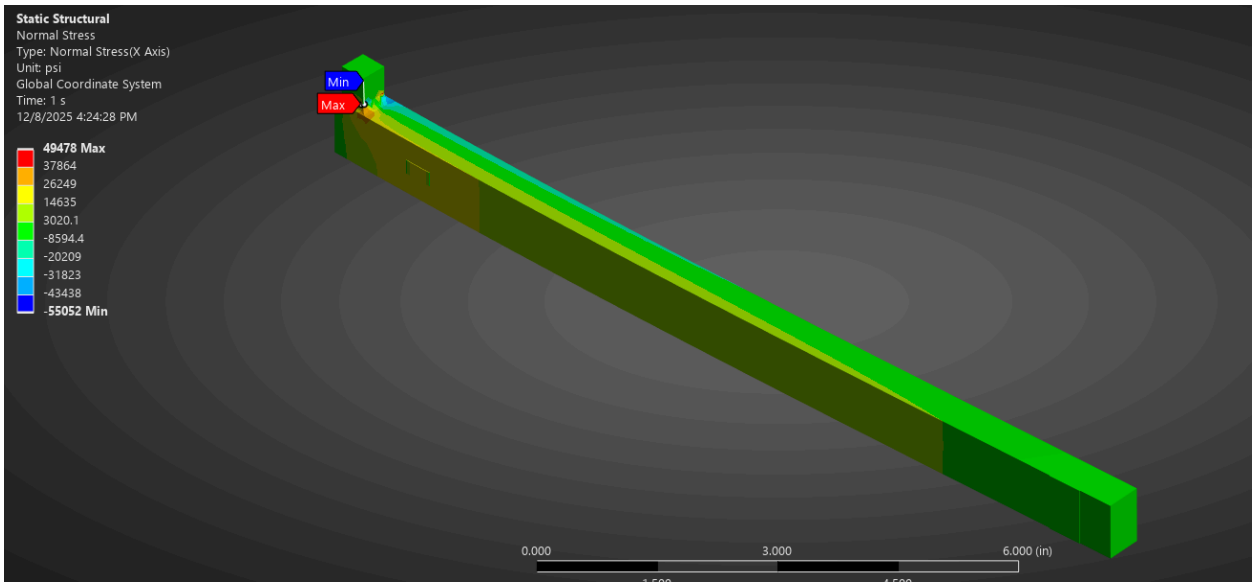
4)


Static Structural
Normal Stress
Type: Normal Stress(X Axis)
Unit: psi
Global Coordinate System
Time: 1 s
12/8/2025 4:24:28 PM
49478 Max
37864
26249
14635
3020.1
-8594.4
-20209
-31823
-43438
-55052 Min
Min
Max
0.000
3.000
6.000 (in)

5)


Static Structural
Maximum Principal Stress
Type: Maximum Principal Stress
Unit: psi
Time: 1 s
12/9/2025 9:25:46 PM
1.3412e5 Max
1.1714e5
1.0015e5
83161
66174
49187
32199
15212
-1775.6
-18763 Min
Min
Max
0.000
3.000
6.000 (in)

6)



Our maximum normal stress reaches about 55,052 psi, and the maximum deflection at load point is about 0.265 inches. At the strain gauge location, the FEM predicted a stress of about 1180.1 microstrain, and for titanium alloy Ti-6A1-4V is about 19,480 psi, which is close to the matlab estimate of about 1030.9 microstrain which is about 17,027.4 psi.

7)

$$\frac{V_{out}}{V_{in}} = \frac{2kε}{4}$$

Strain gauge factor: $k = 2$

Strain gauge: $ε = 0.001180$

$$mV/V = 1000 \cdot ε = \boxed{1.18}$$

8)

Cross-area is 0.4 by 0.25 for where the strain gauge will be put.

Strain gauge selected: SGD-2/350-LY11

Normal resistance: 350 omega
Gauge Factor: 2
Active grid length: 0.118 inches
Active grid width: 0.098 inches
Matrix length: 0.299 inches
Matrix width: 0.228 inches