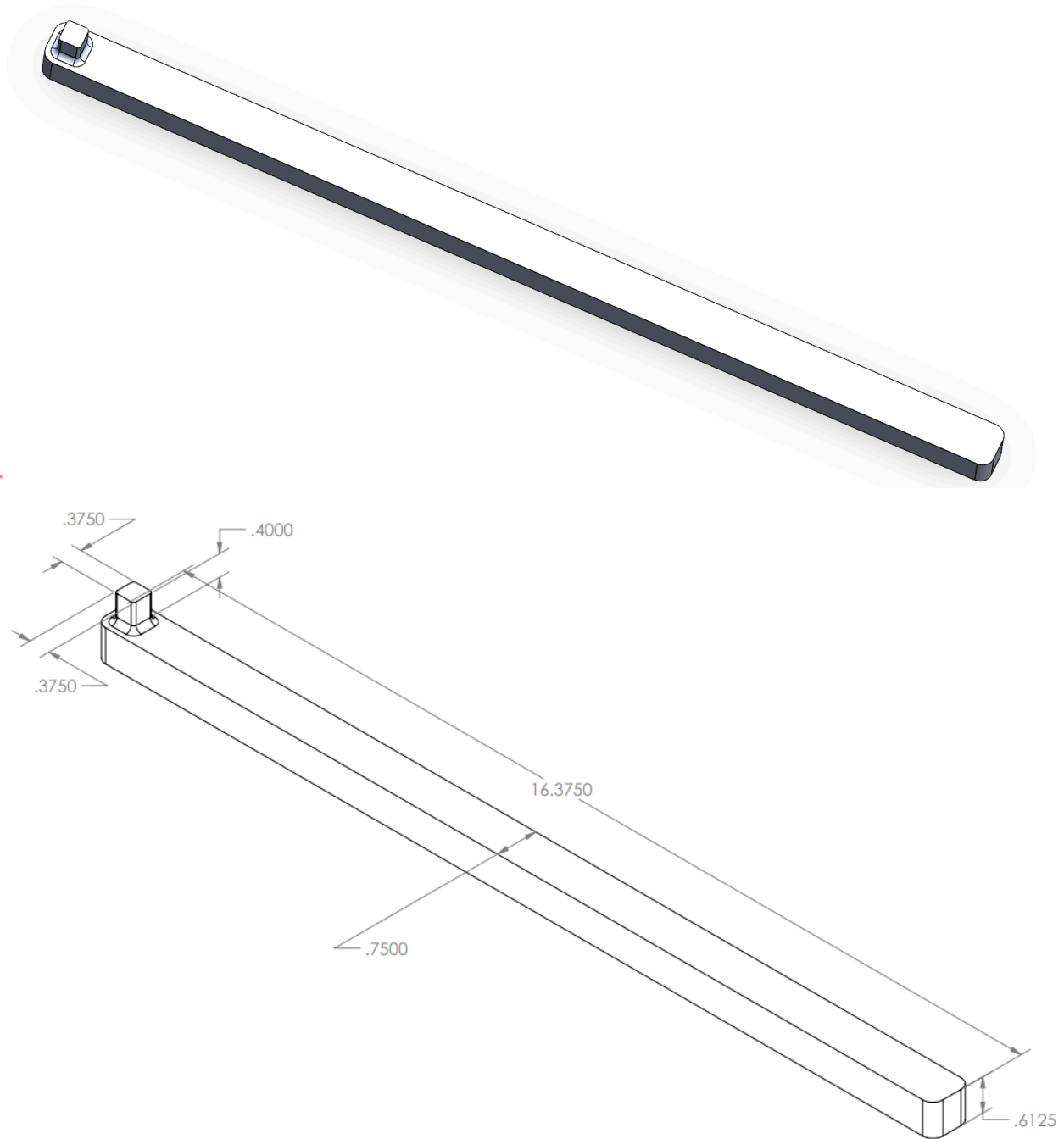


5.2 Your Design

5.1.2 Reflections

1. Images of your CAD Model



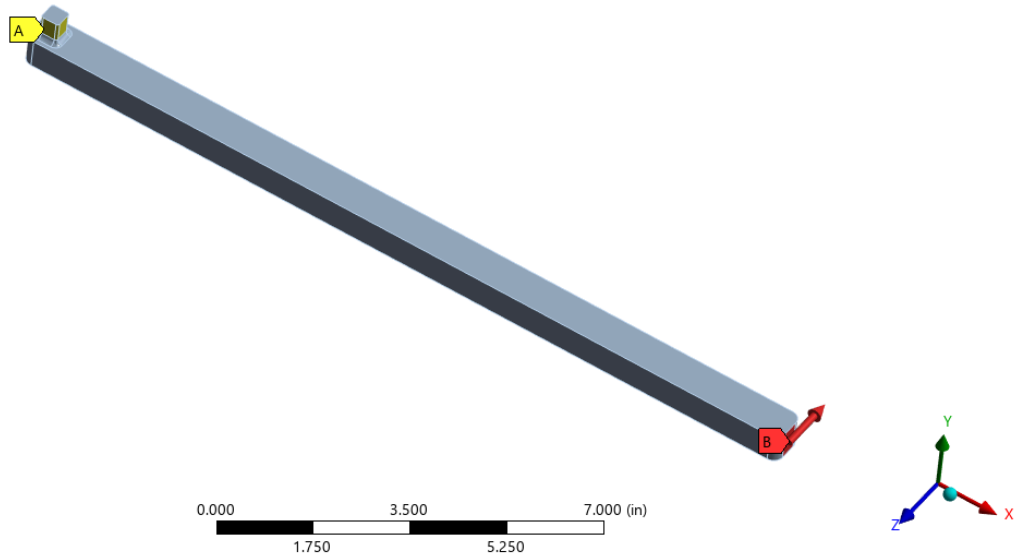
2. Describe material used and its relative mechanical properties

Aluminum 6061 T6 was chosen, a common aluminum alloy with a relatively high modulus and yield strength. This alloy's properties were acquired from Granta – elastic modulus: 9.66×10^6 psi; poisson's ratio: 0.325; yield strength: 42.1×10^3 psi. The rest of the material properties are in the above Matlab script.

3. Diagram communicating how loads and boundary conditions were applied to your ANSYS model

B: Actual Design
Static Structural
Time: 1 s
12/5/2025 6:54:40 PM

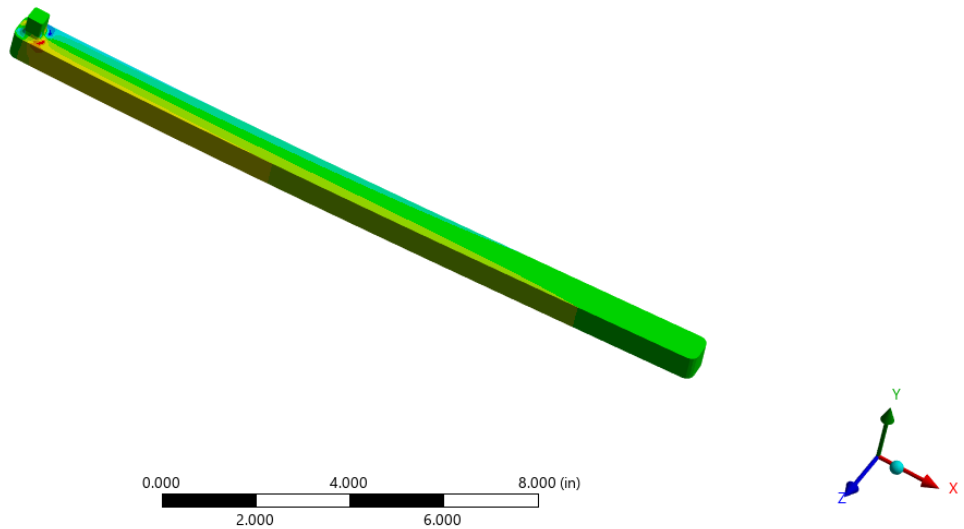
A Displacement
B Force: 37.5 lbf



4. Normal strain contours

B: Actual Design
Normal Elastic Strain
Type: Normal Elastic Strain(X Axis)
Unit: in/in
Global Coordinate System
Time: 1 s
12/5/2025 6:50:34 PM

0.0021568 Max
0.0016647
0.0011726
0.00068045
0.00018834
-0.00030378
Automatic
-0.001288
-0.0017801
-0.0022722 Min

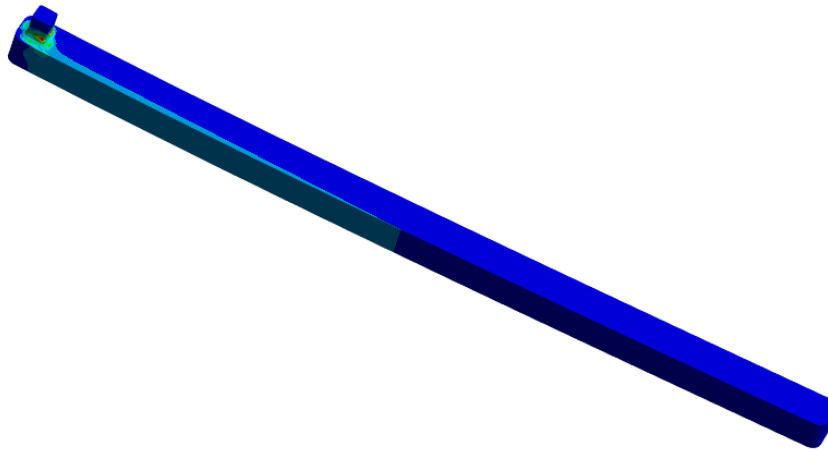


5. Contour plot of maximum principal stress

B: Actual Design

Maximum Principal Stress
Type: Maximum Principal Stress
Unit: psi
Time: 1 s
12/5/2025 6:53:48 PM

54566 Max
48438
42310
36181
30053
23925
17796
11668
5539.7
-588.65 Min

**6. Summarize results from FEM**

FEM Results	
Strain at Gauge Location [microstrain]	988.7
Maximum Normal Stress [psi]	25064
Maximum Deflection [in]	0.3423

7. Torque wrench sensitivity

$$\begin{aligned}\text{Sensitivity [mV/V]} &= \text{gauge_strain [microstrain]} / 1000 \\ &= 988.7 / 1000 \\ \text{Sensitivity [mV/V]} &= 0.9887\end{aligned}$$

8. Strain gauge selected

A rosette strain gauge will be used (0°, 45°, 90°) since it will provide accurate reading of the torque wrench in multiple directions. The gage dimensions are 3mm by 1.7mm and the carrier dimensions are 11mm by 11mm (0.433 inches) which will easily fit on the strain gauge and the gauge can be bonded onto the flat surfaces of the shaft. Gauges with these dimensions are sold by DwyerOmega.