

A cantilever beam is subjected to a tensile load and is also analyzed for bending. The beam has the following specifications:

- **Applied Load (P):** 1000 N, applied along the **x-axis** (tensile direction)
- **Beam Length (L):** 300 mm
- **Beam Cross-Section Radius (R):** 15 mm (circular cross-section)
- **Material:** Structural Steel
  - **Young's Modulus (E):** Use standard value for structural steel
  - **Poisson's Ratio ( $\nu$ ):** Use standard value for structural steel

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### Objectives:

1. **1D Tensile Load Analysis:**
    - Find the **maximum tensile stress**
    - Find the **total deformation** (elongation)
  2. **3D Bending Load Analysis (Cantilever Configuration):**
    - Treat the load as applied at the free end, perpendicular to the beam z or -y- axis (for bending)
    - Find the **maximum bending stress**
    - Find the **total deformation** (tip deflection)
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### Expected Results:

Provide numerical values for:

- **Maximum Stress** (in MPa or  $\text{N/mm}^2$ )

- **Total Deformation** (in mm)  
results put the screenshots from static structures to results.

Step 1

3d project by hamid - Workbench

File View Tools Units optiSLang Extensions Jobs Help

Project

Import... Reconnect Refresh Project Update Project ACT Start Page

Toolbox

Project Schematic

Static Structural

Static Structural

3d

4 Magnesium Alloy

5 Structural Steel

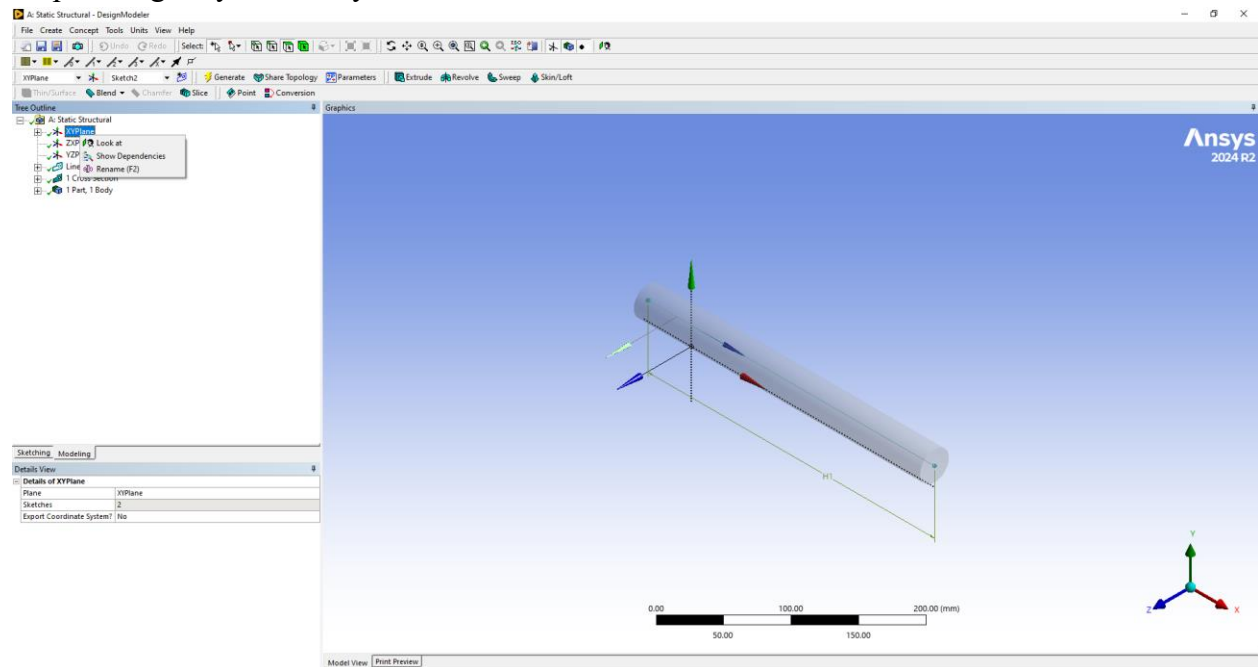
Click here to add a new material

Properties of Outline Row 5: Structural Steel

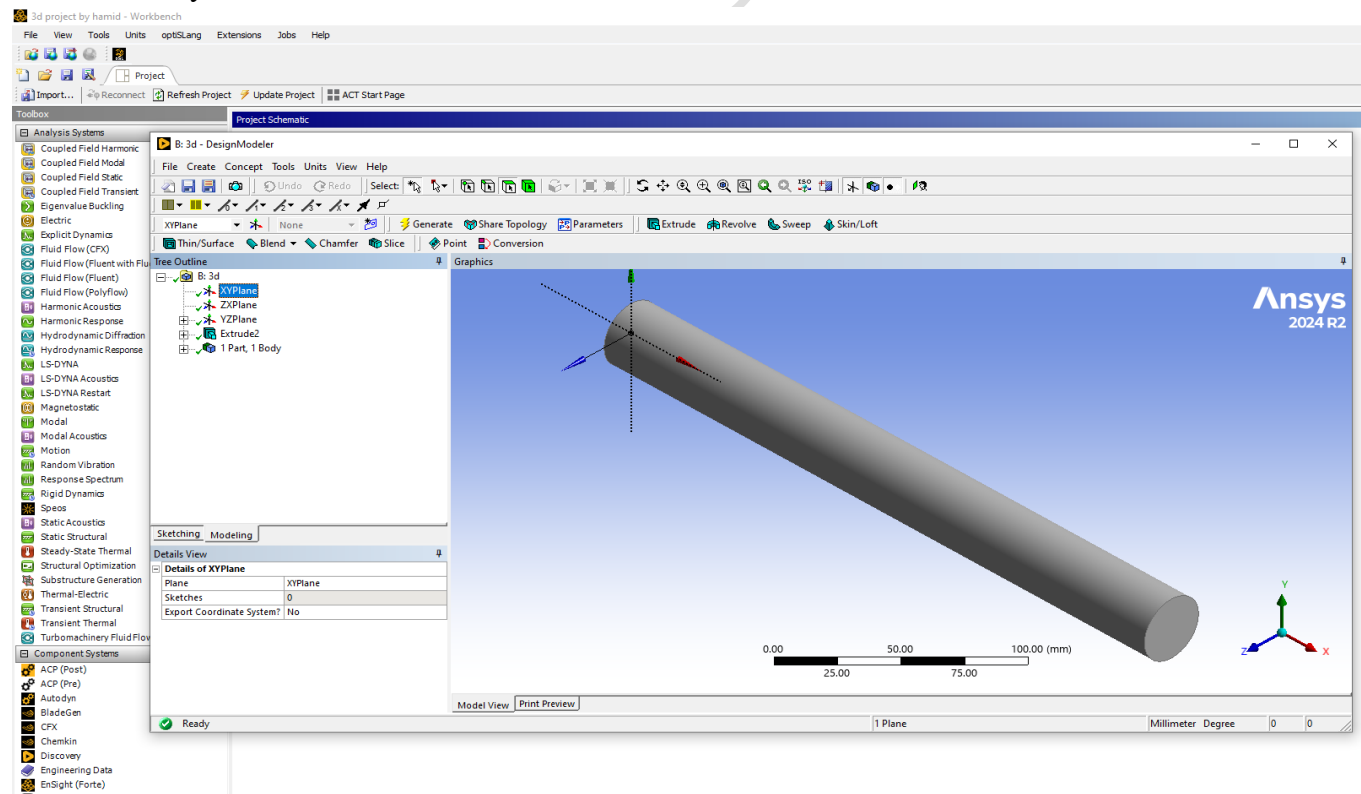
Property	Value	Unit
Material Field Variables	Table	
Density	7850	kg m <sup>-3</sup>
Isotropic Secant Coefficient of Thermal Expansion		
Isotropic Elasticity		
Strain-Life Parameters		
S-N Curve	Tabular	
Tensile Yield Strength	2.5E+08	Pa
Compressive Yield Strength	2.5E+08	Pa
Tensile Ultimate Strength	4.6E+08	Pa
Compressive Ultimate Strength	0	Pa
Isotropic Thermal Conductivity	60.5	W m <sup>-1</sup> C <sup>-1</sup>
Specific Heat Constant Pressure, C <sub>p</sub>	434	J kg <sup>-1</sup> C <sup>-1</sup>
Isotropic Resistivity	1.7E-07	ohm m
Isotropic Relative Permeability	10000	

Chart: No data

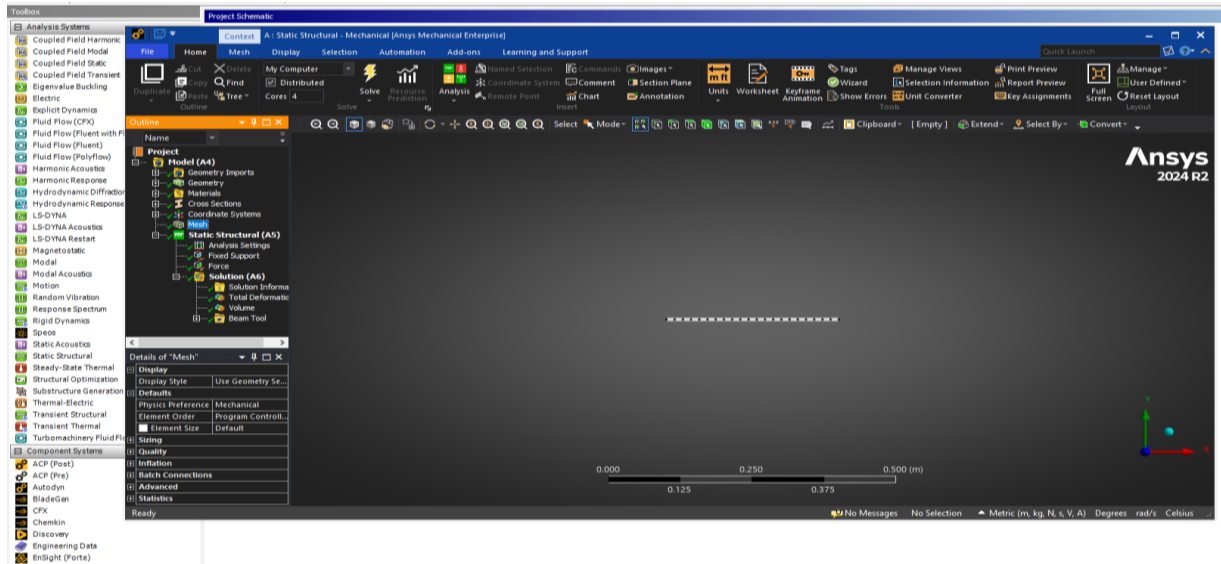
## Step 3 Imaginary Geometry of 1D



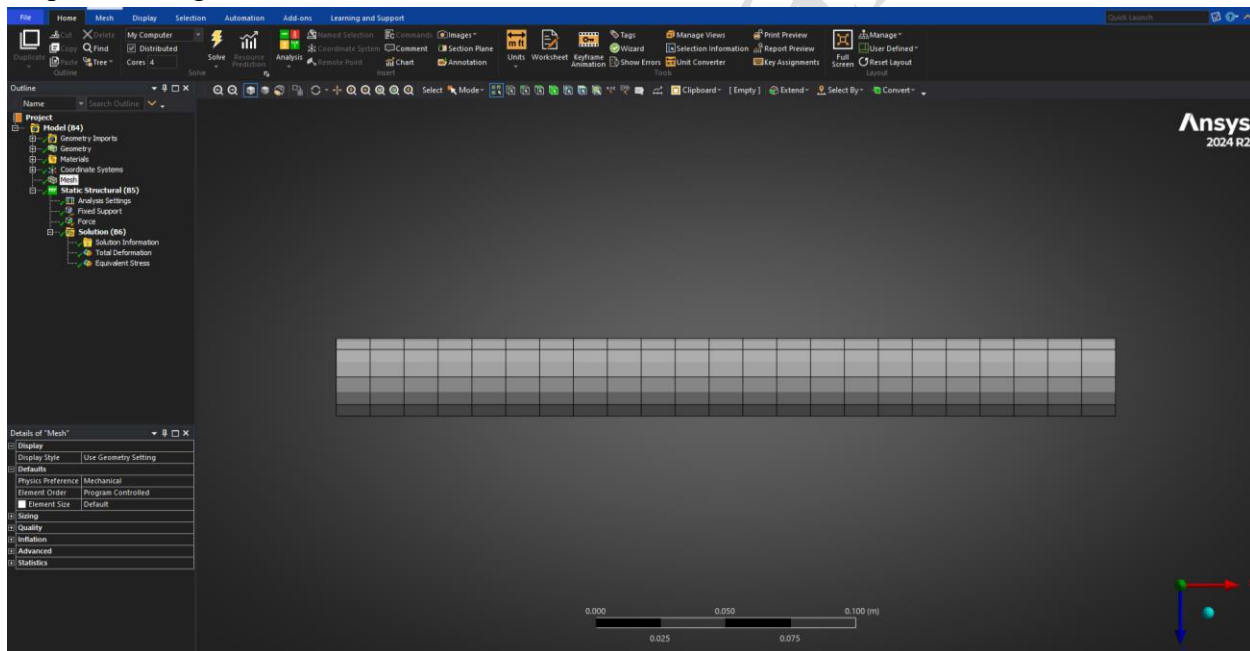
## Real Geometry of 3D



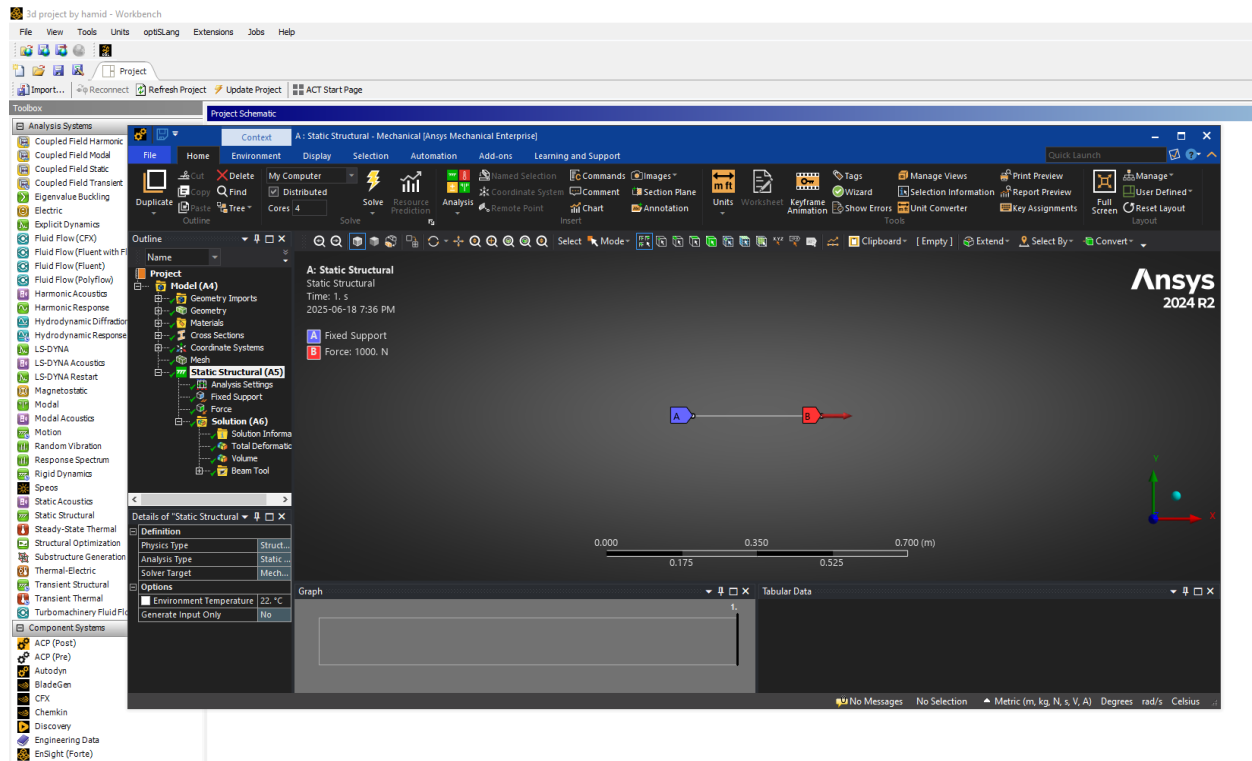
## Step 4 Meshing of 1D Model



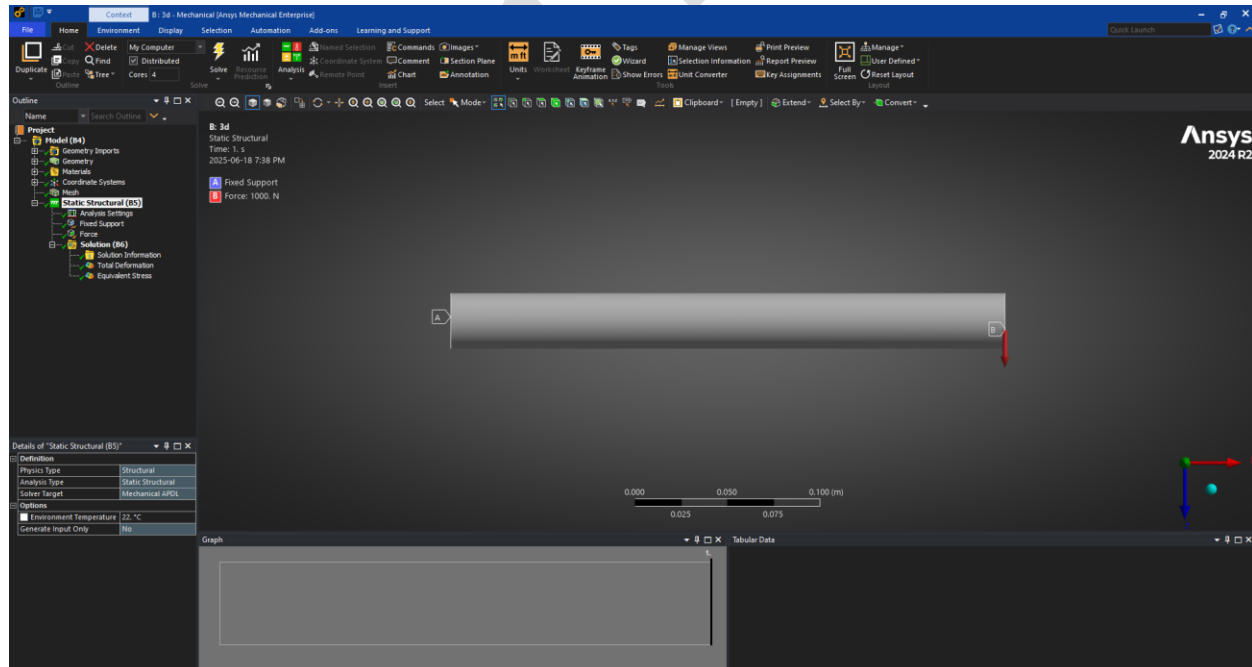
## Step 4 Meshing of 3D Model



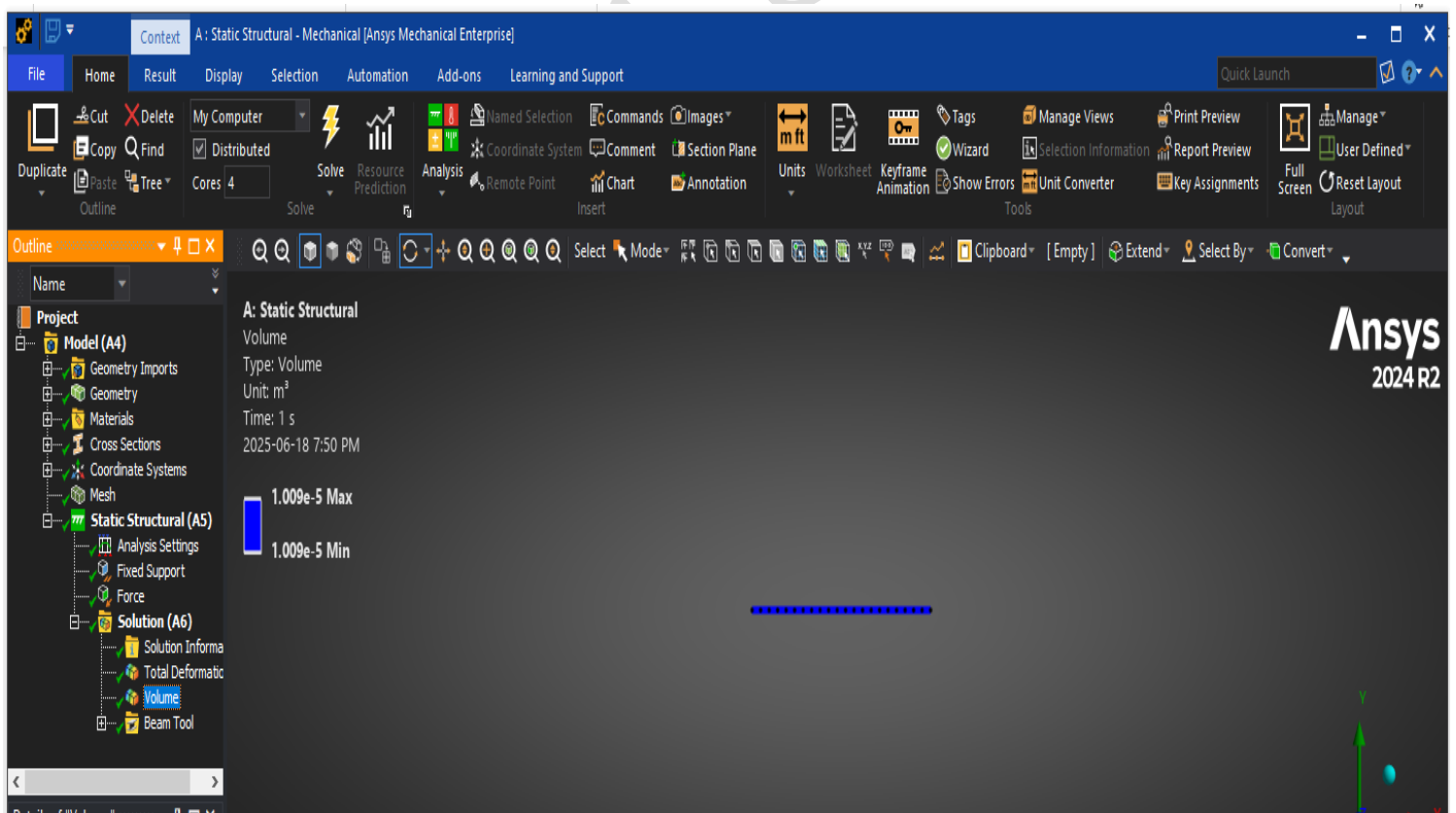
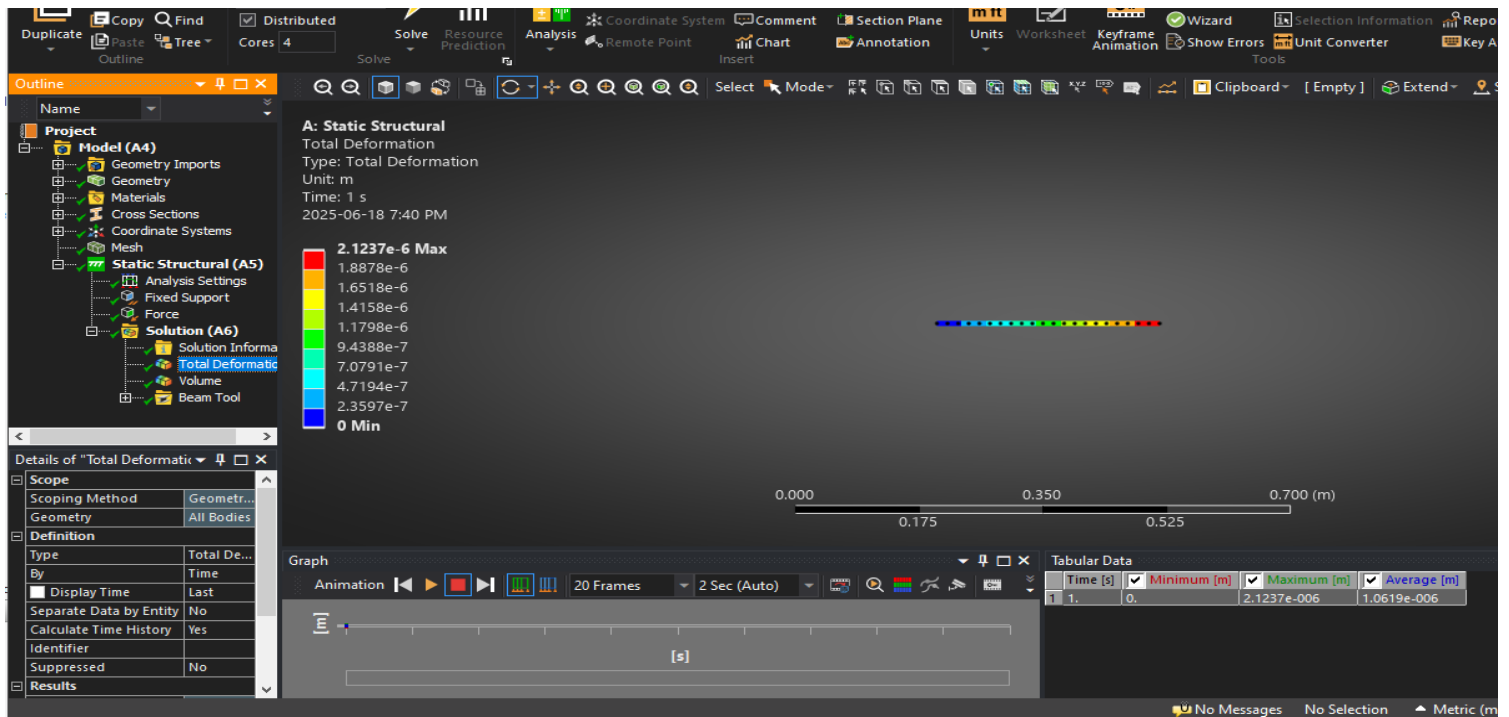
## Step 5 setup for 1D



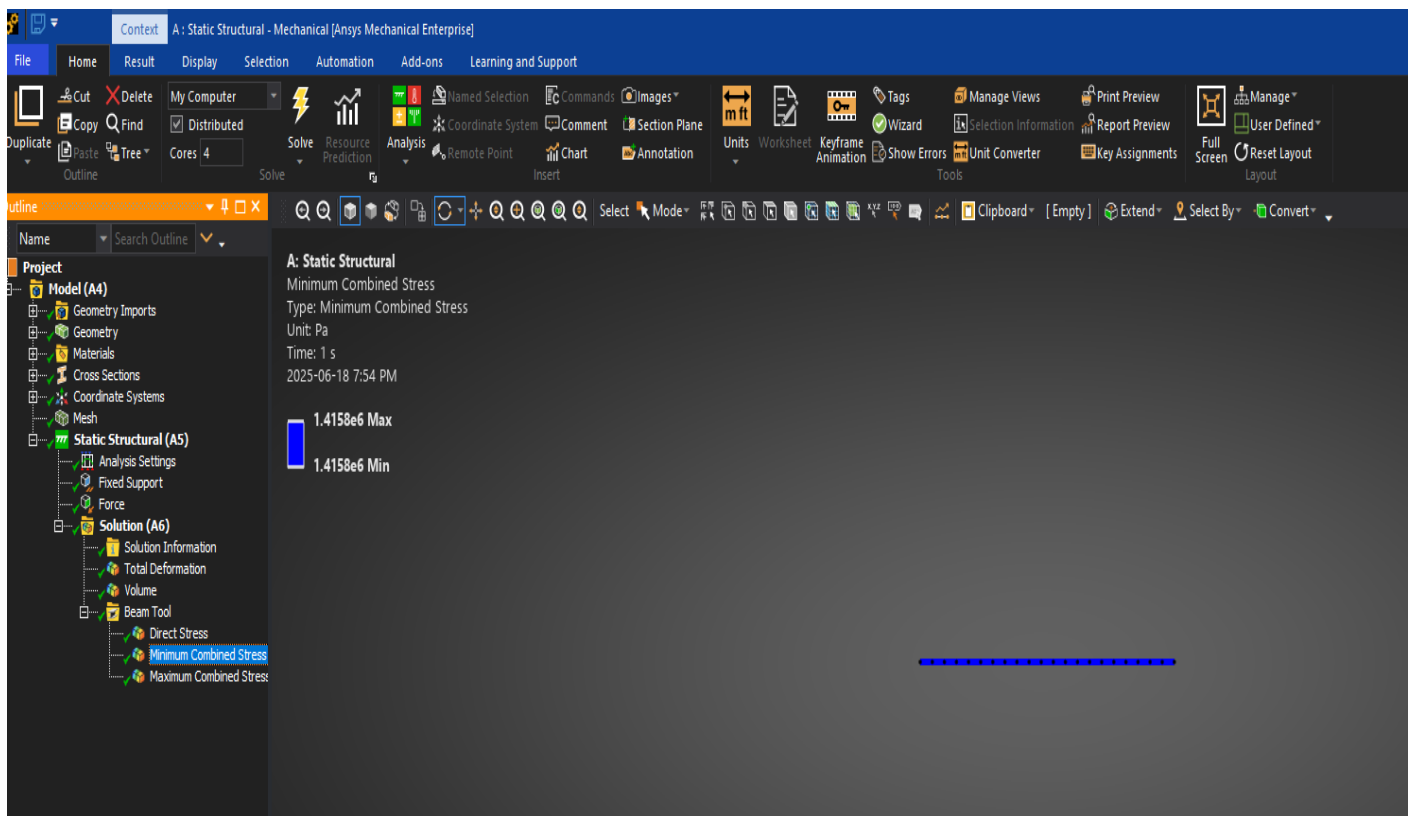
## For 3D for Z-axis load



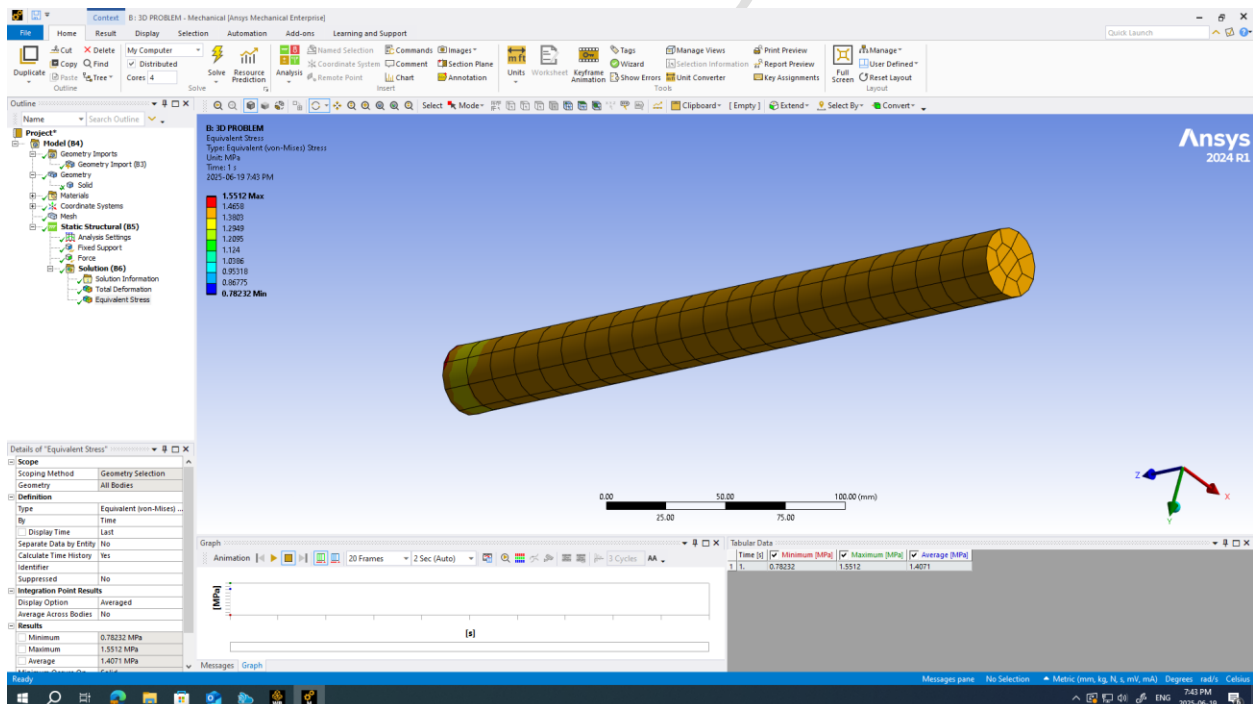
## Solution of 1D Total Deformation, minimum stress and direct stress



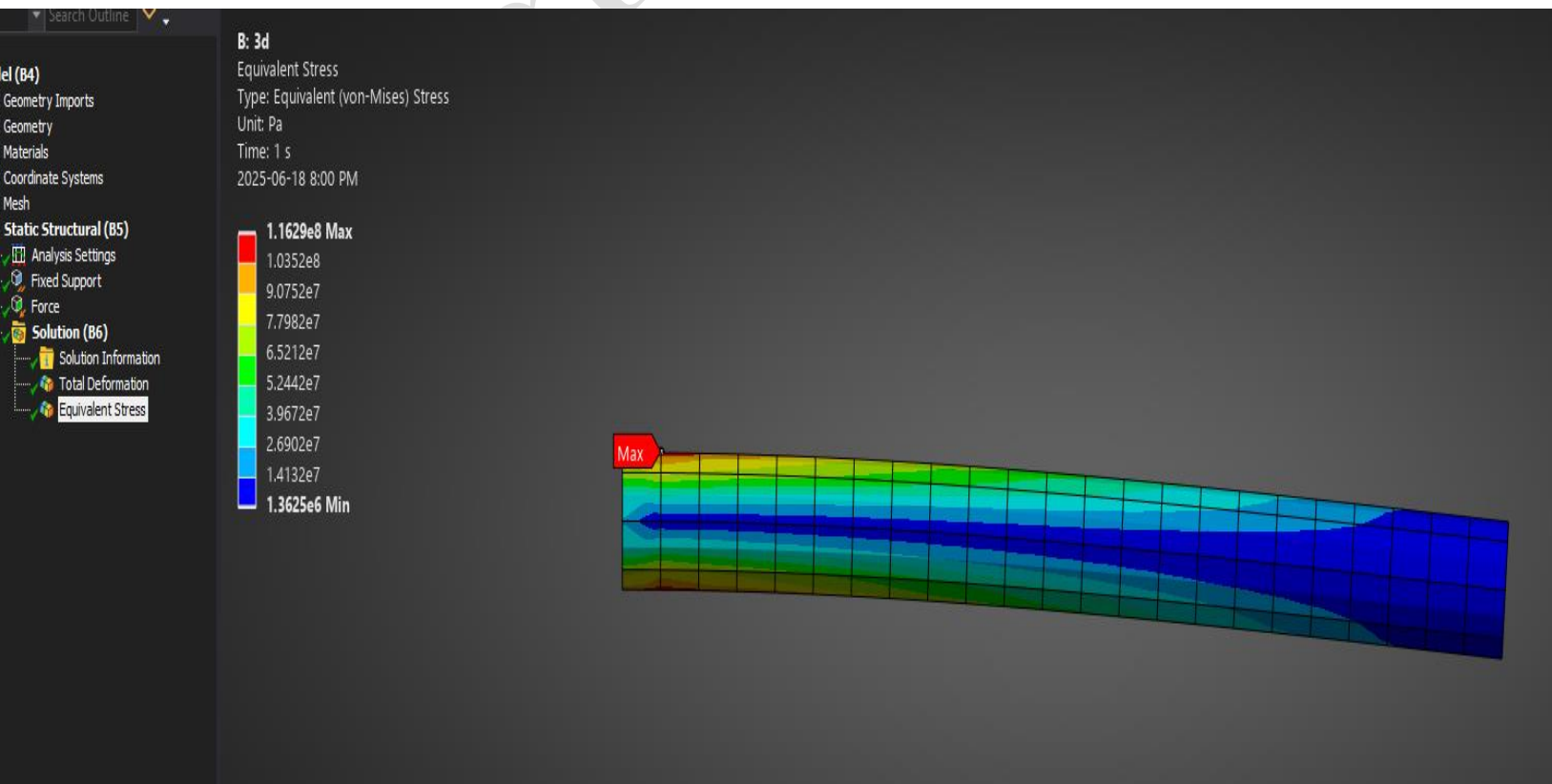
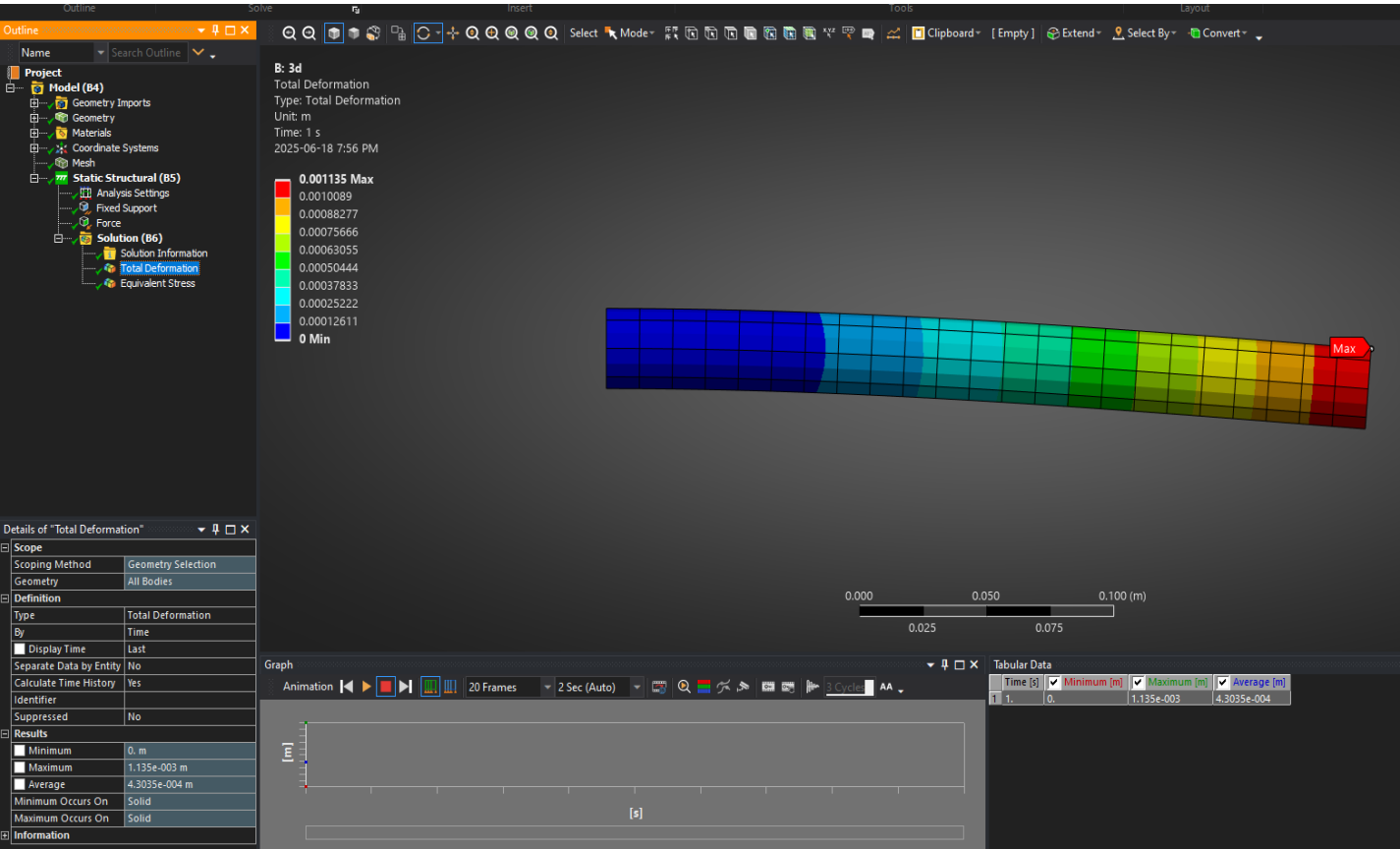
Total deformation in 1D  $2 \times 10^{-6}$



## TOTAL DEFORMATION WITH TENSILE LOAD



# Solution of 3D Total Deformation





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