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# SIMULATION LAB

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Lab Report

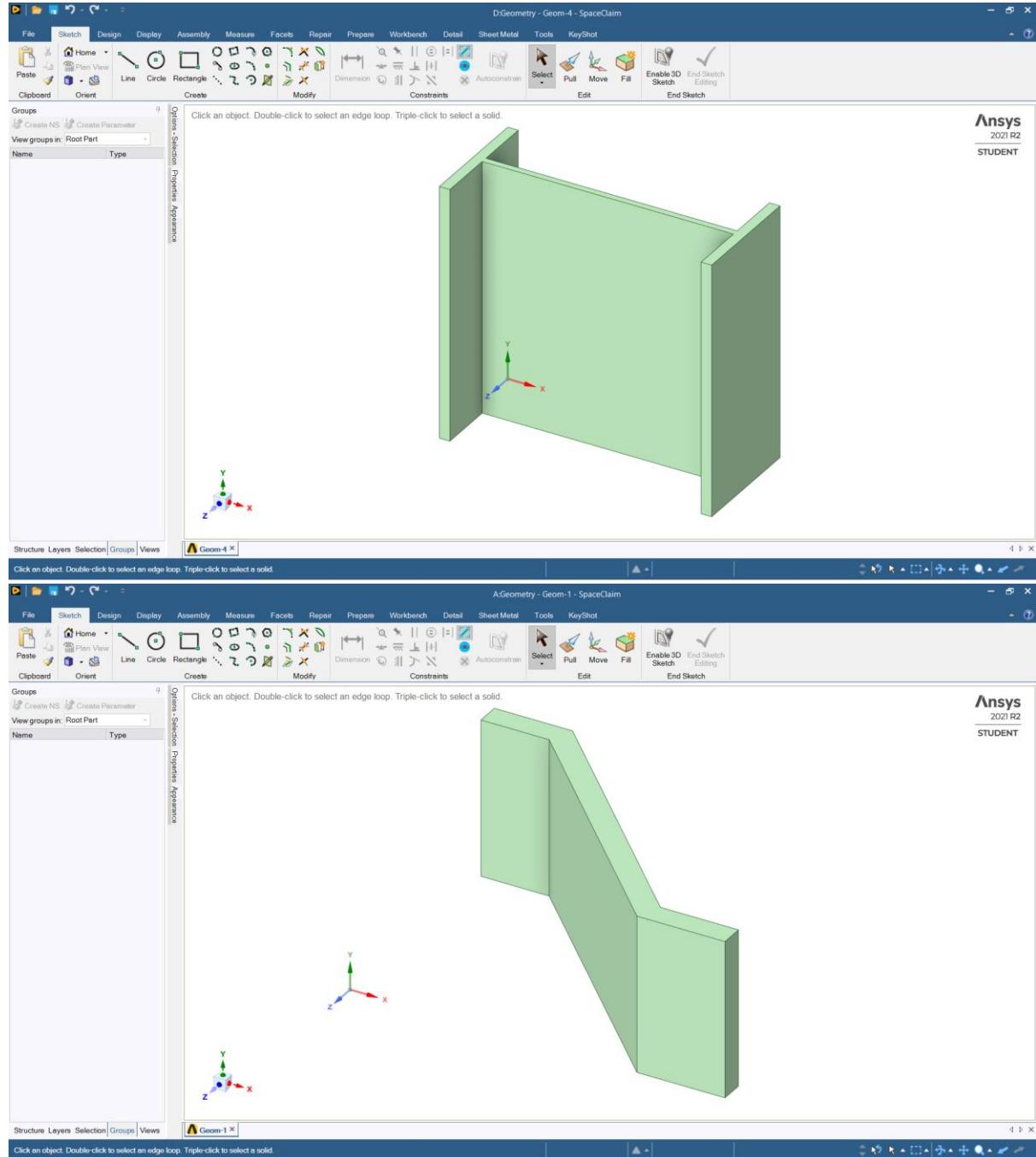


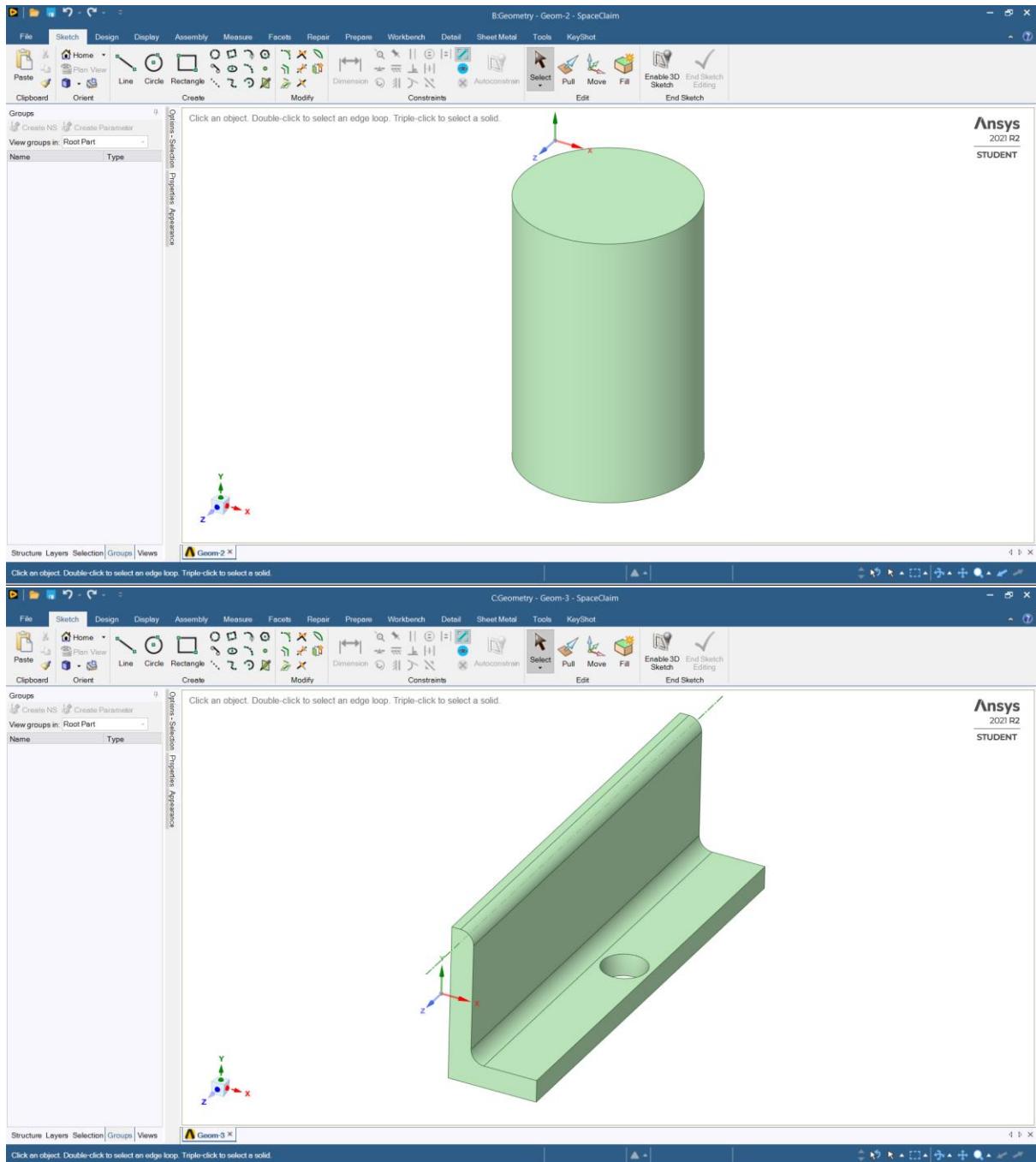
SUBMITTED BY  
NAME :- GUNDA VENKATA SAI JAI HARSHA  
NO :- 190169.

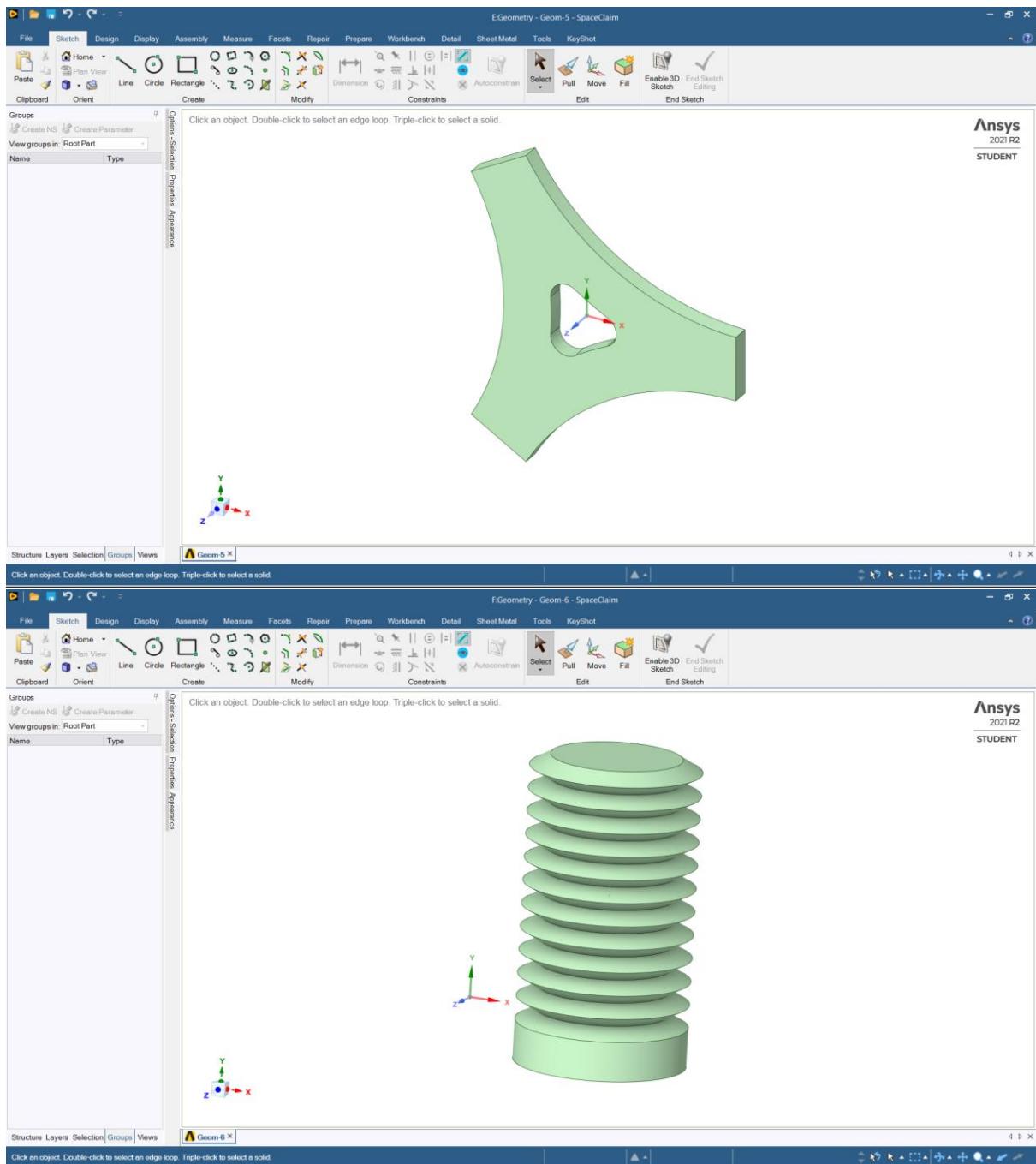
SUBMITTED TO  
DR.NEERAJ KUMAR SHARMA

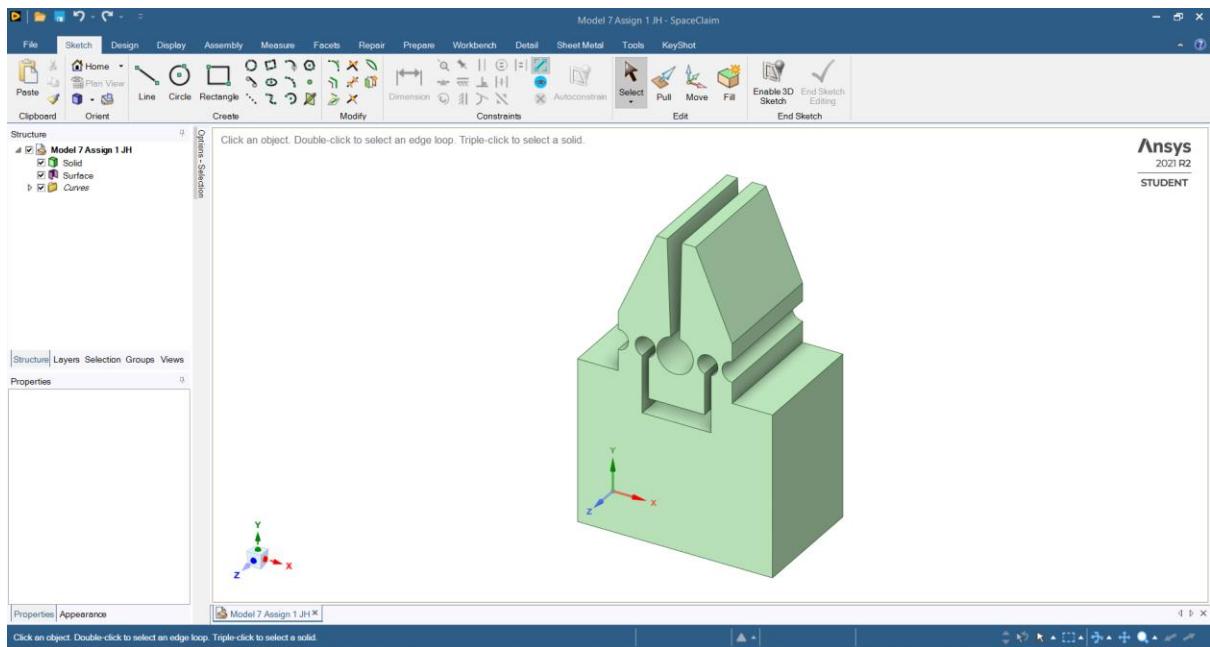
# LAB 1

## Part Modeling-1

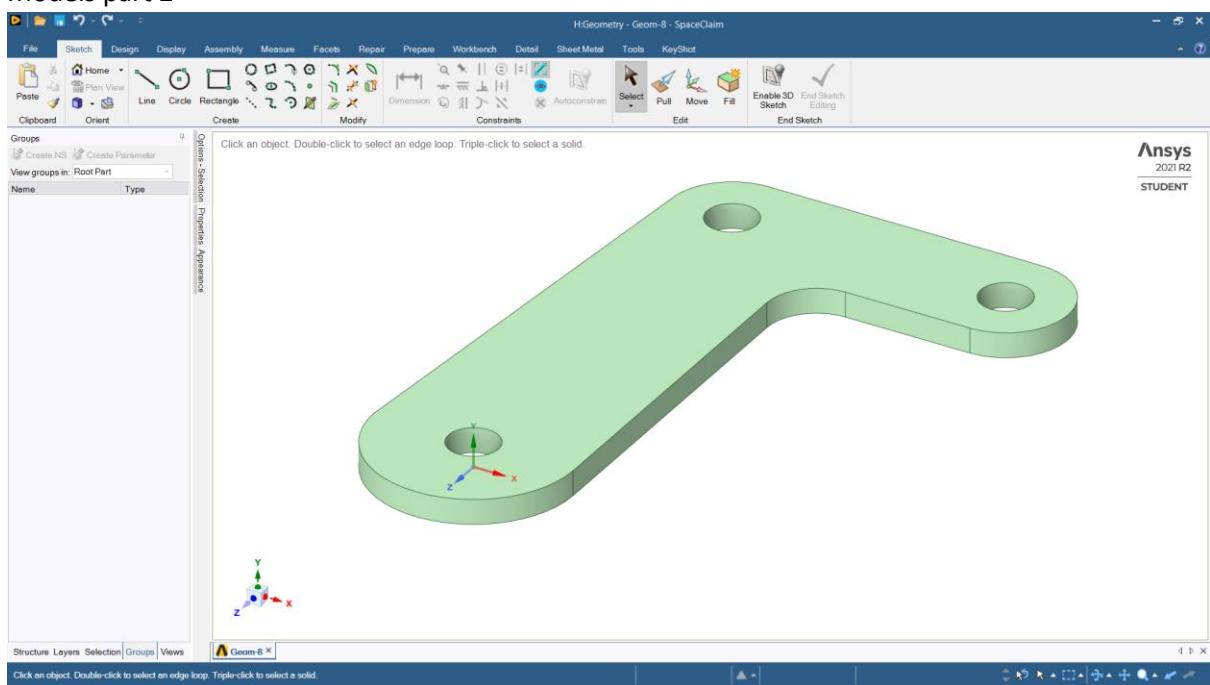


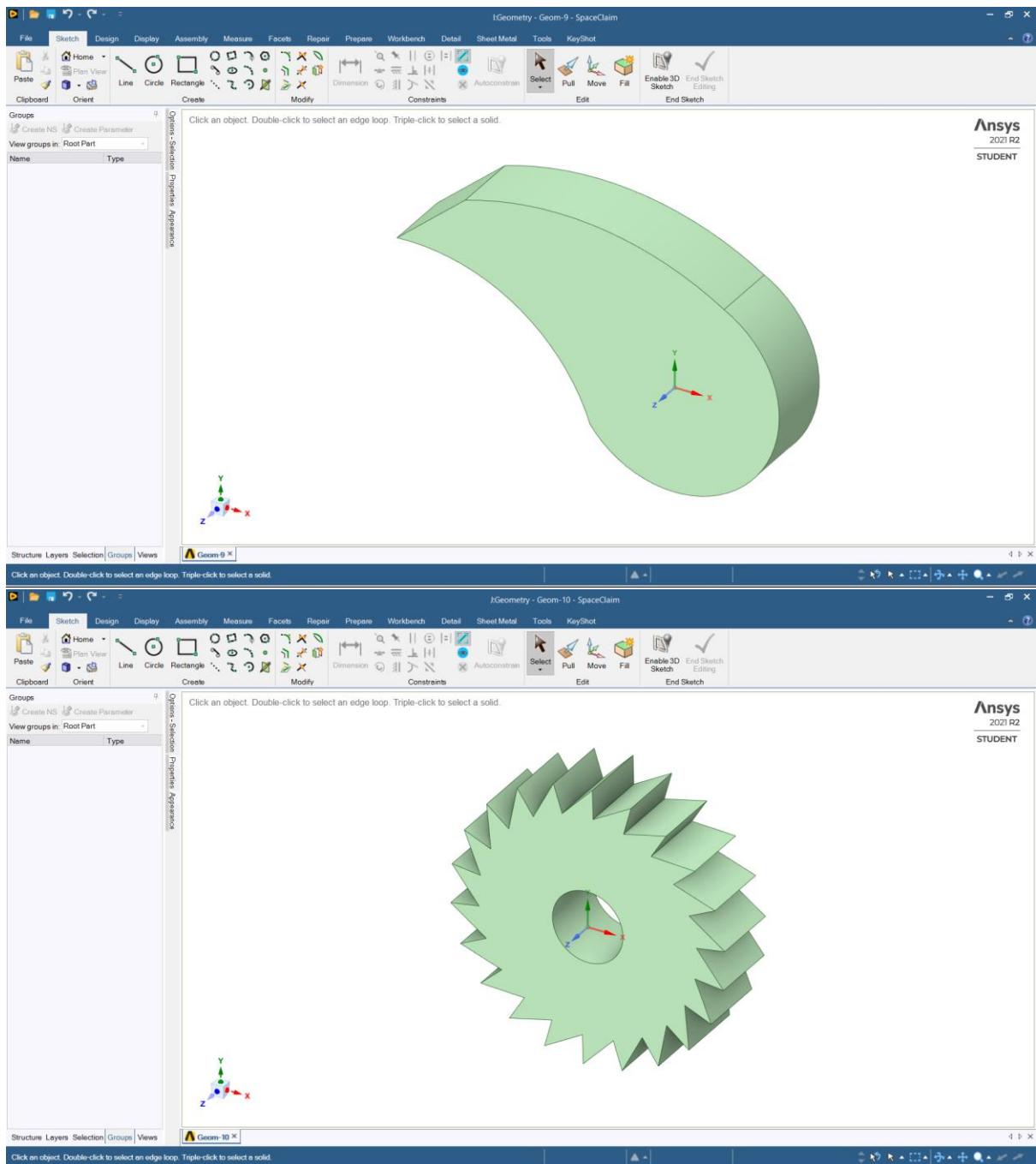


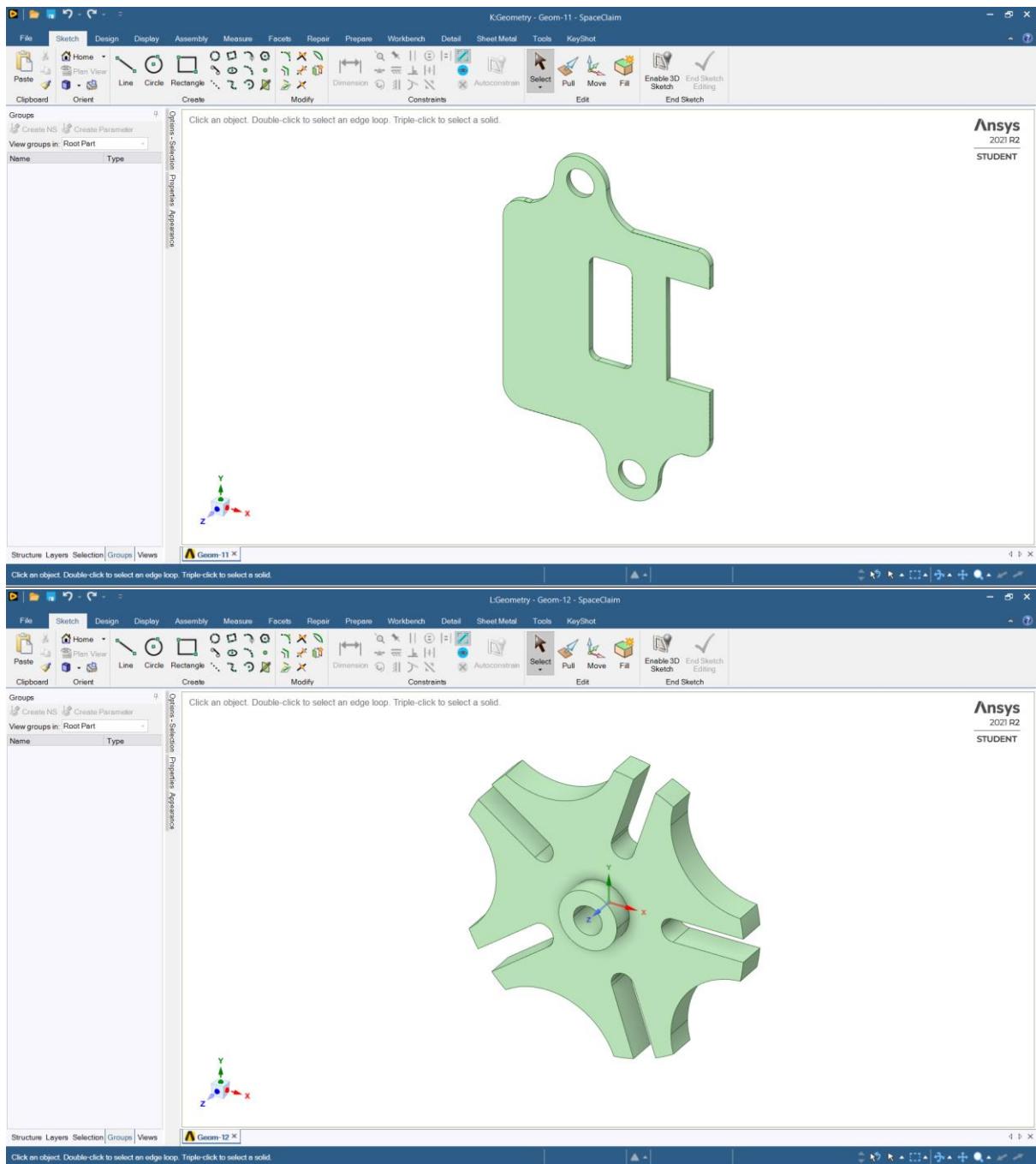




## Models part 2



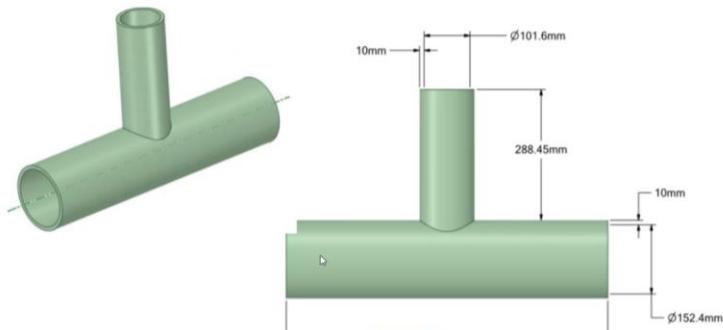
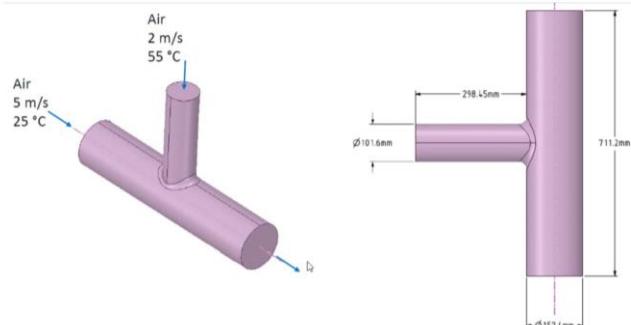
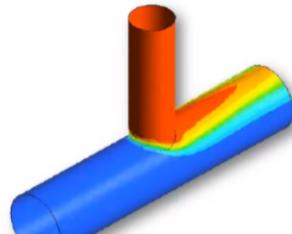




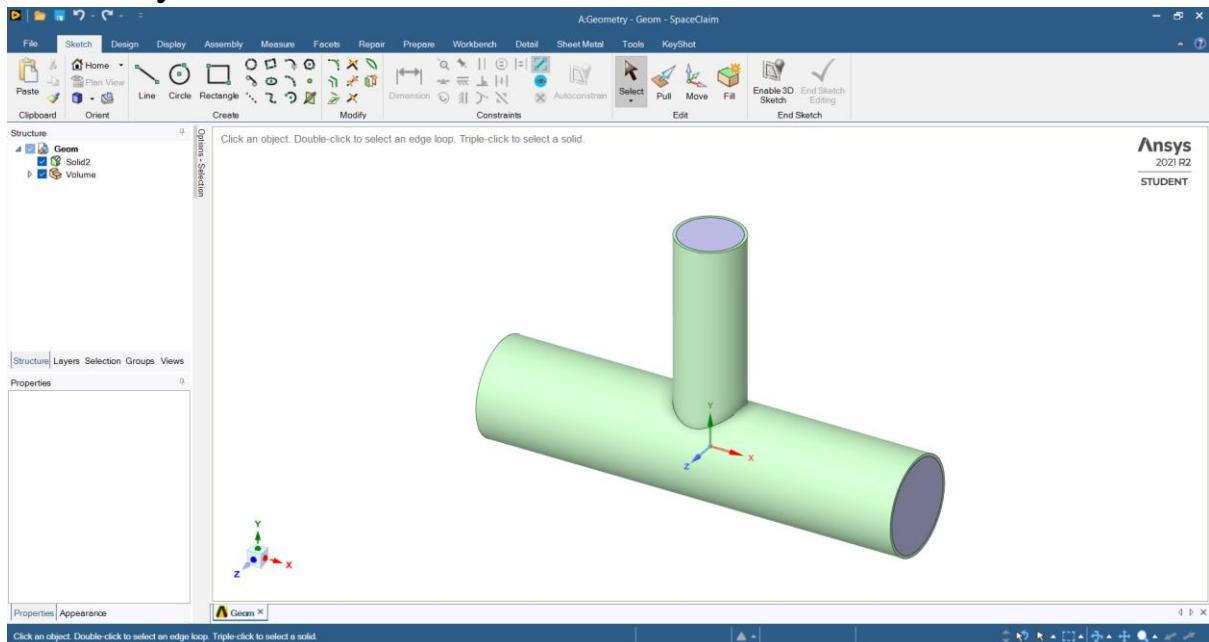
# LAB 2 Mixing Tee Material

## Problem Description

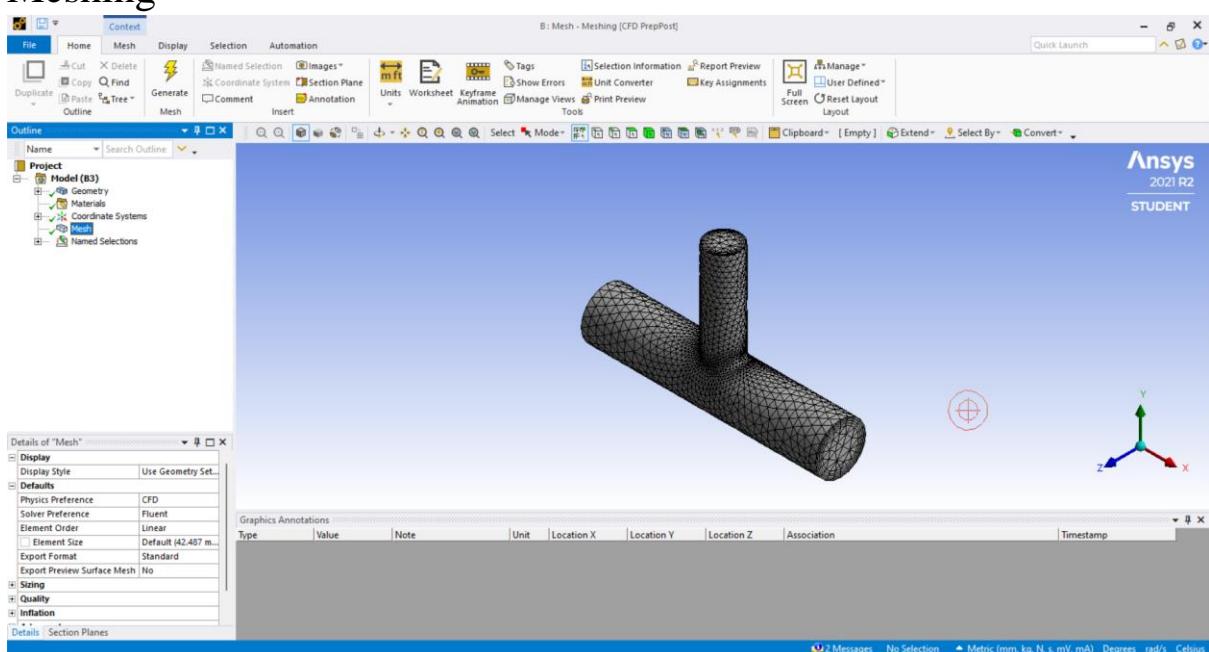
- Mixing tees are commonly used for static mixing of two fluid streams
- In this problem, a mixing tee is used to mix two low speed air streams, one at 25 °C and the other at 55 °C
- The goal of the simulation is to evaluate how effectively the two streams are mixed by examining temperature profile on the cross-section of the tee's exit
- A more uniform profile indicates more effective mixing



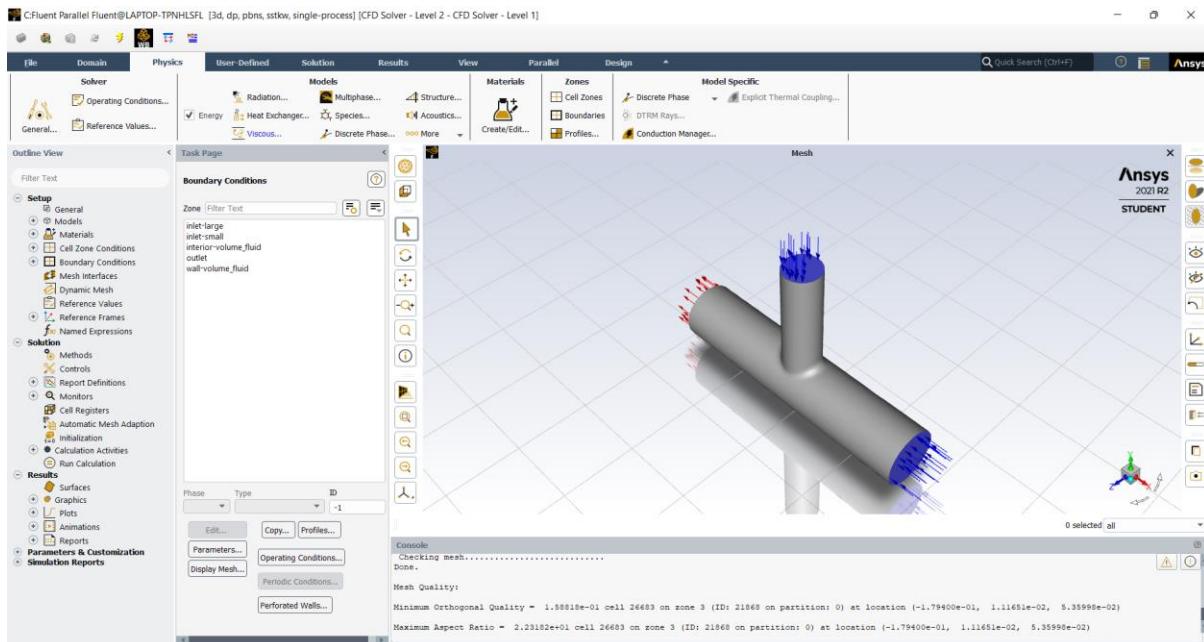
## Geometry



## Meshing

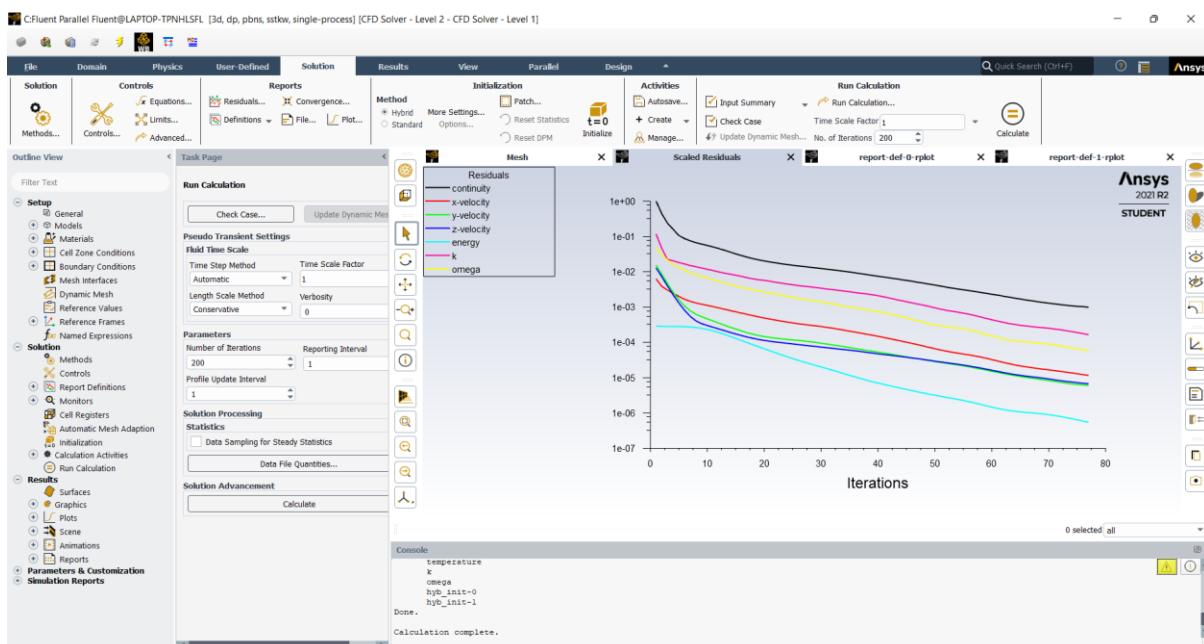


## Fluent

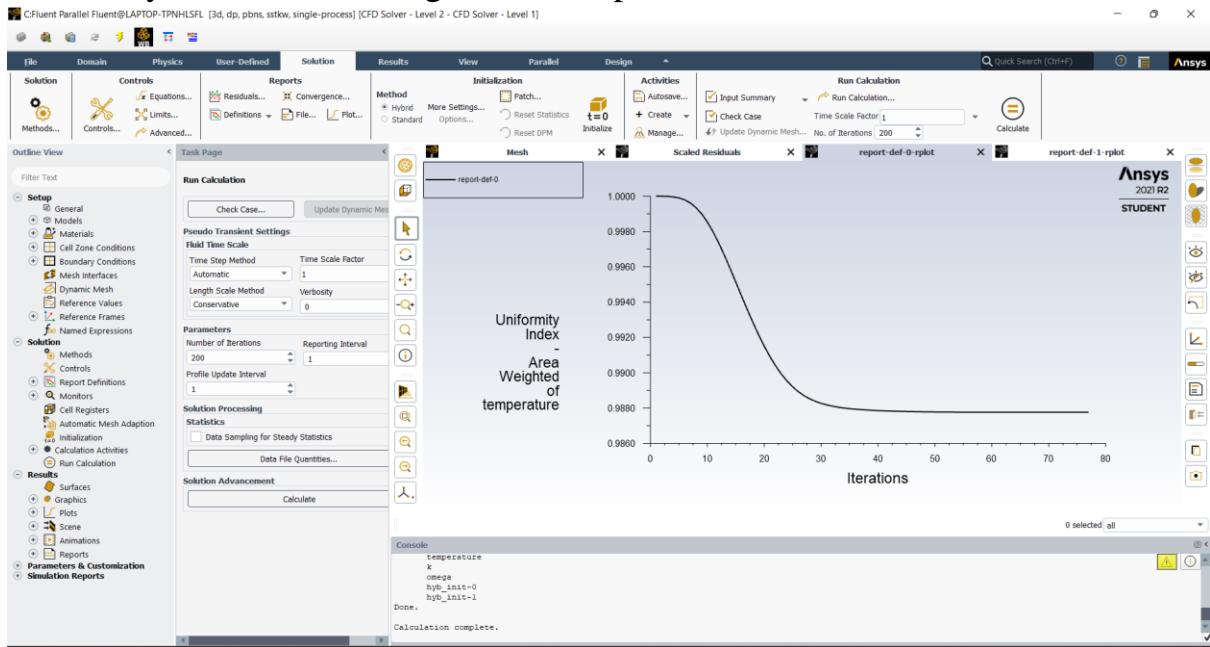


## Scaled Residuals

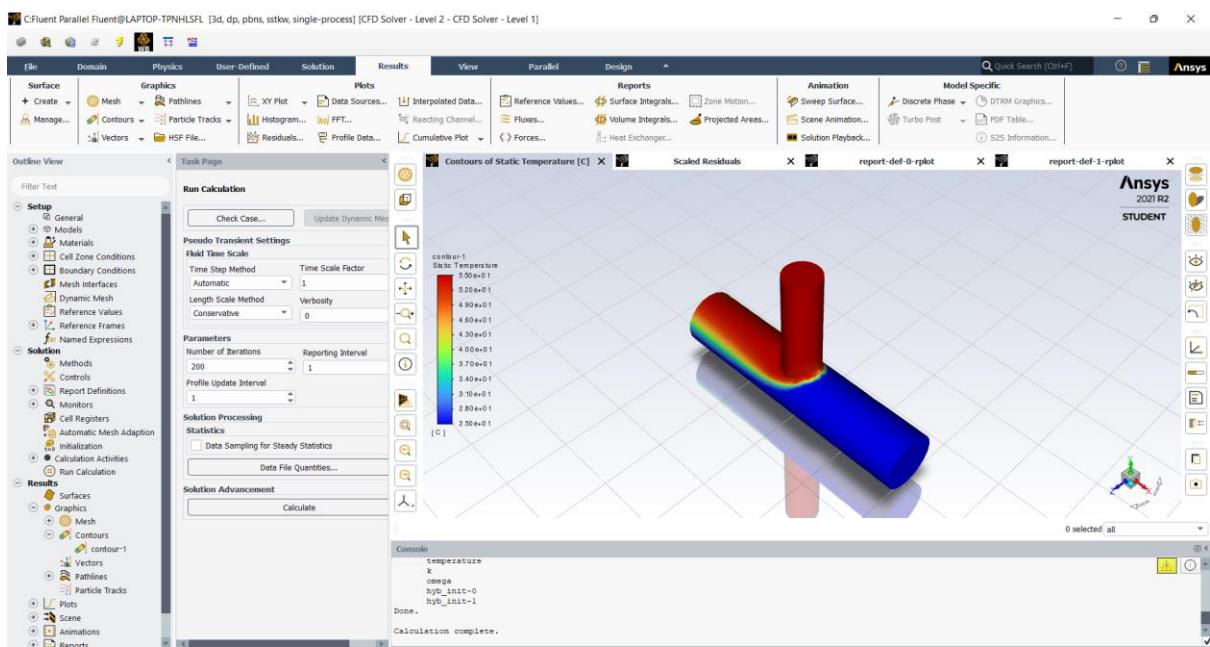
No of iterations = 200



## Uniformly Index- Area Weighted of temperature.



## Counters



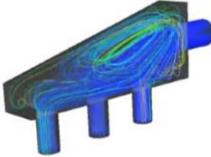
We can observe that at outlet and inlet 2 the temperature is high than inlet 1 .

# LAB 3

## Class problem

**Problem Description**

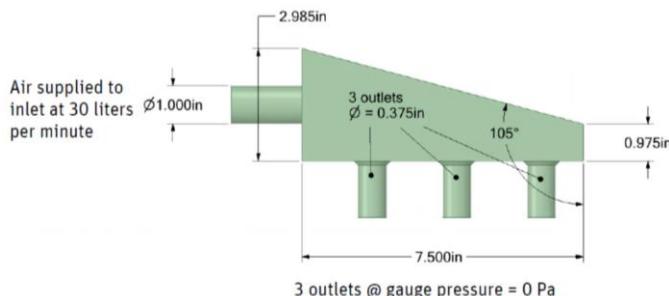
- Manifold is connected to an air supply pumping 30 liters per minute
- Goal is to split the airstream into three streams each at 10 liters per minute
  - Within +/- 5%
- Gauge pressure = 0 Pa at each of the three outlets
- Simulation will predict whether the desired flow uniformity can be achieved with the existing design



It's a good idea to identify the key simulation outcomes from the start. You can use these to monitor progress of solution.

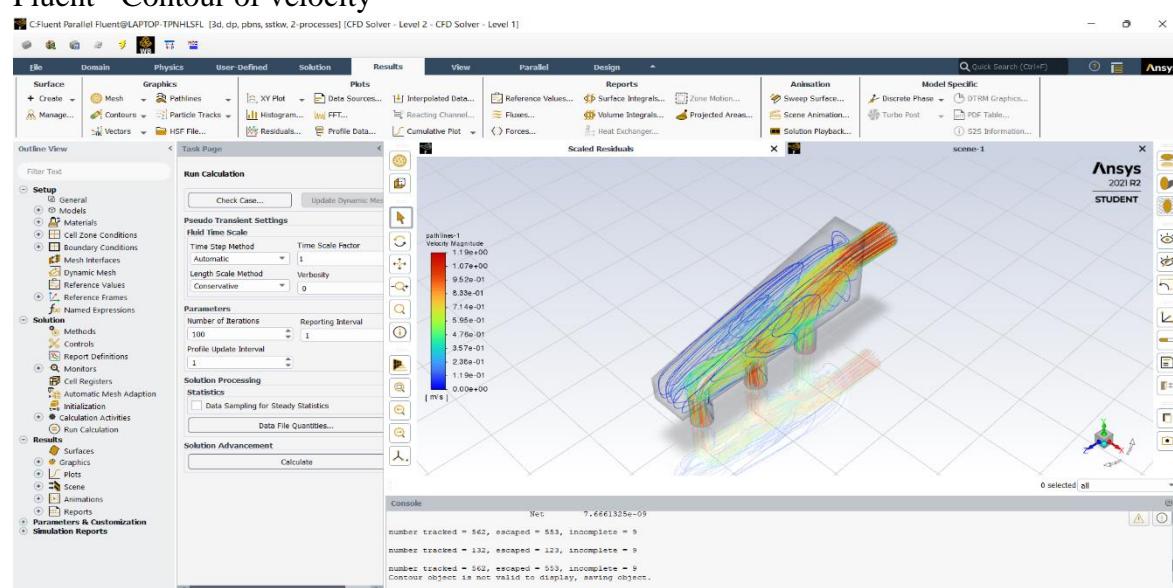
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### GEOMETRY AND OPERATING CONDITIONS



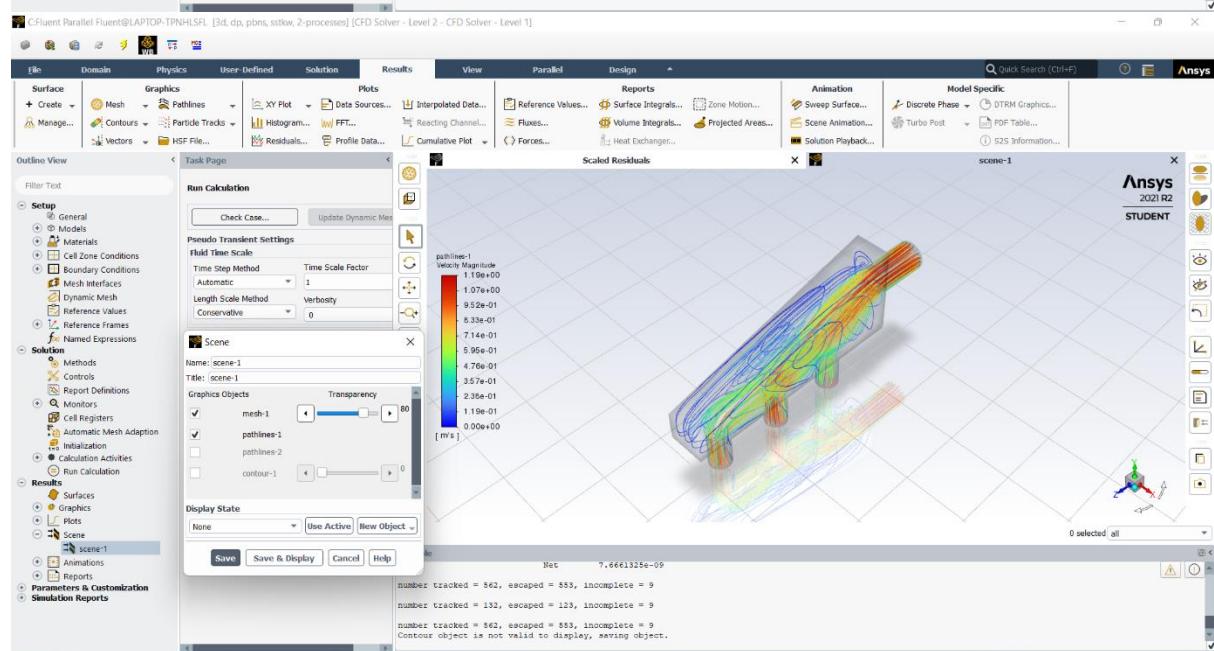
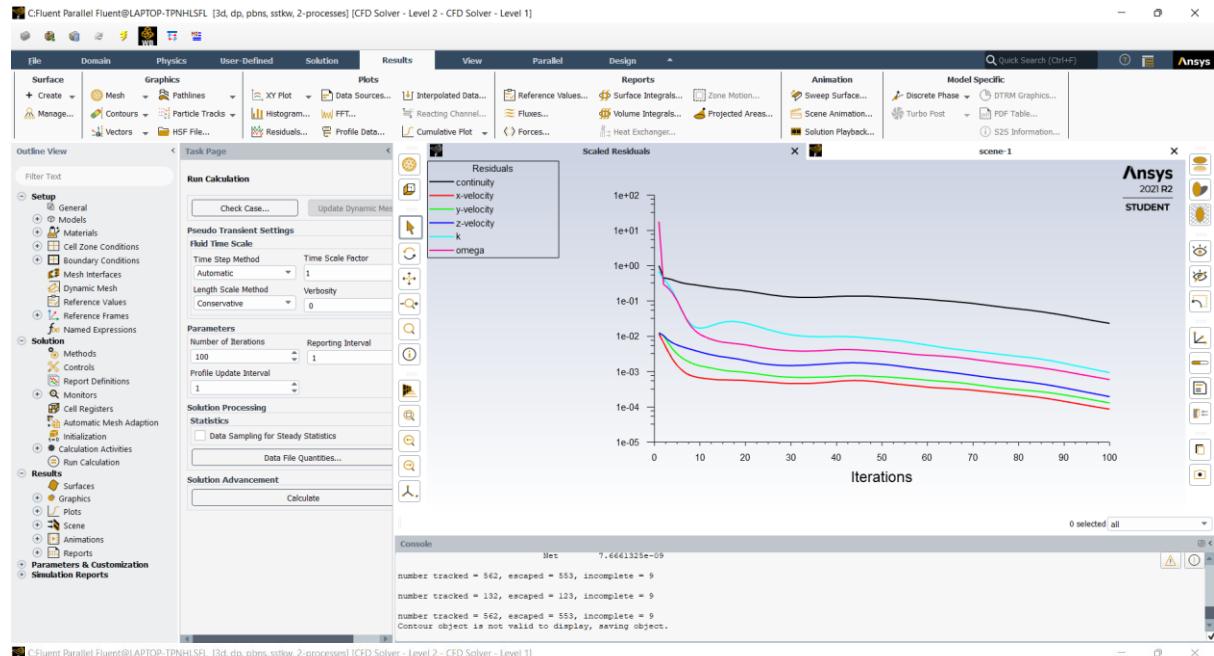
## Solutions

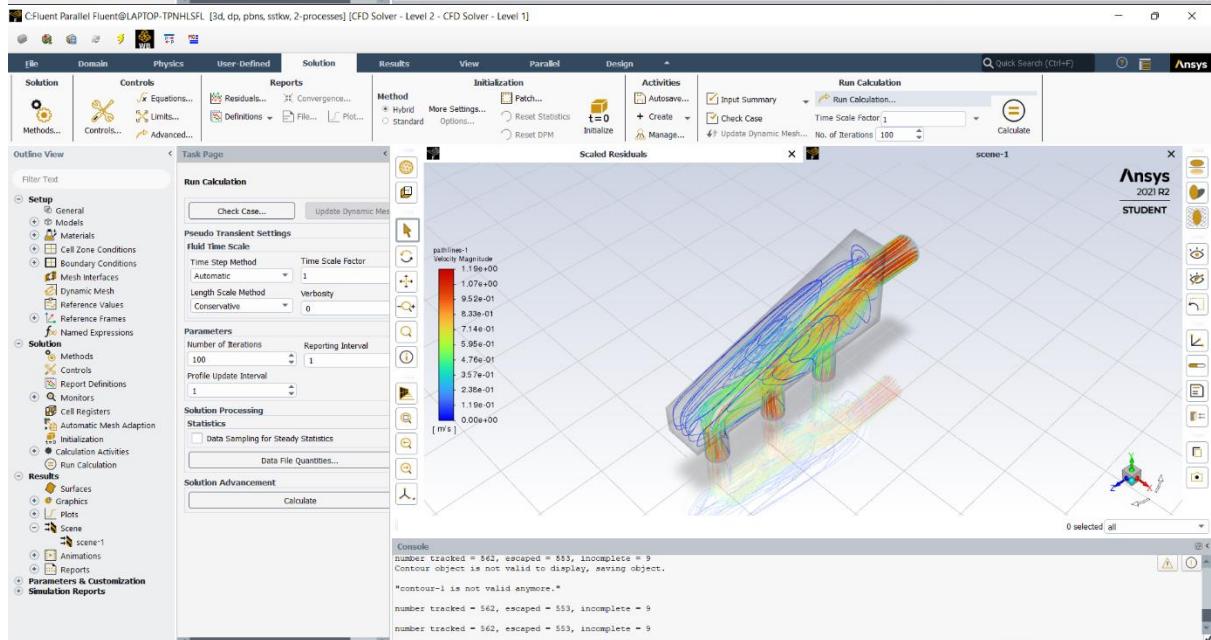
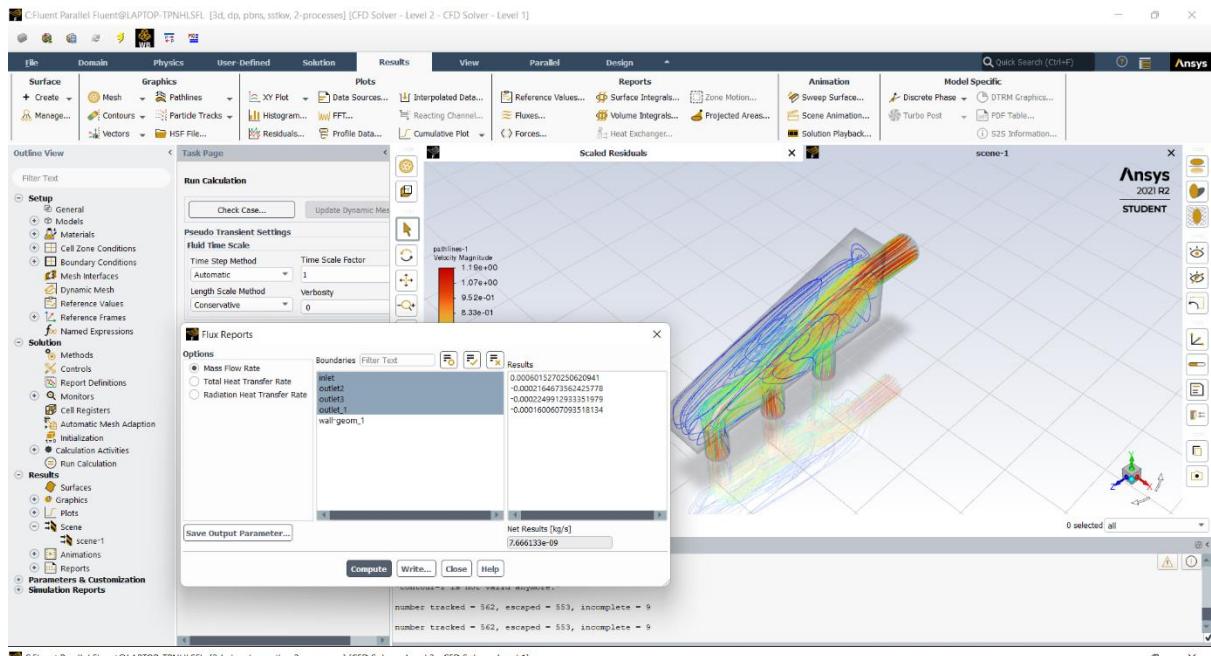
### Fluent - Contour of velocity



# Scaled Residuals

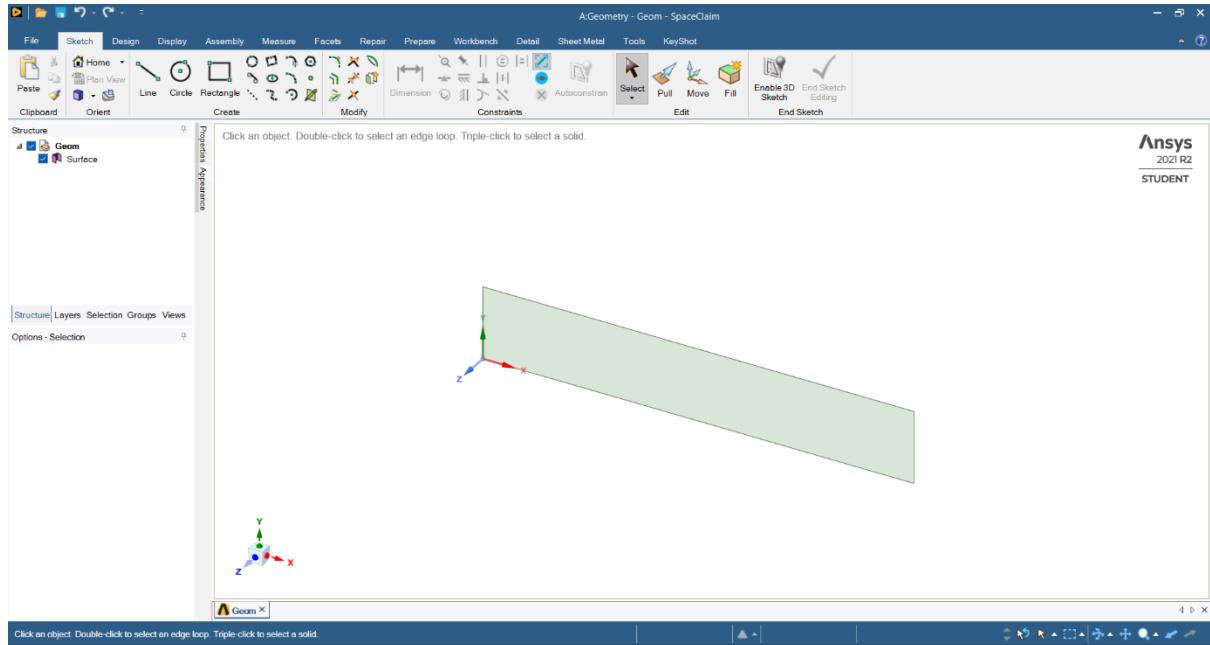
No of Iterations = 100





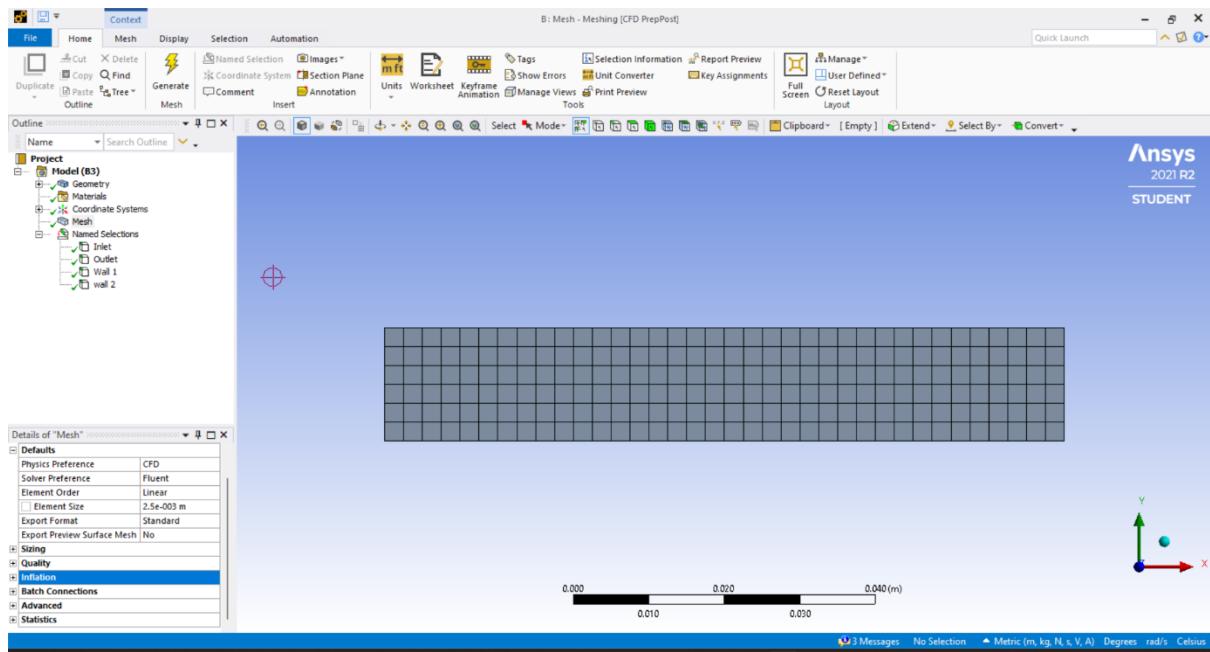
## LAB 3

Model the flow between two parallel plates as 2D Problem.



Dimensions: - length = 90mm, Breadth = 25mm.

## Meshing



## Solution

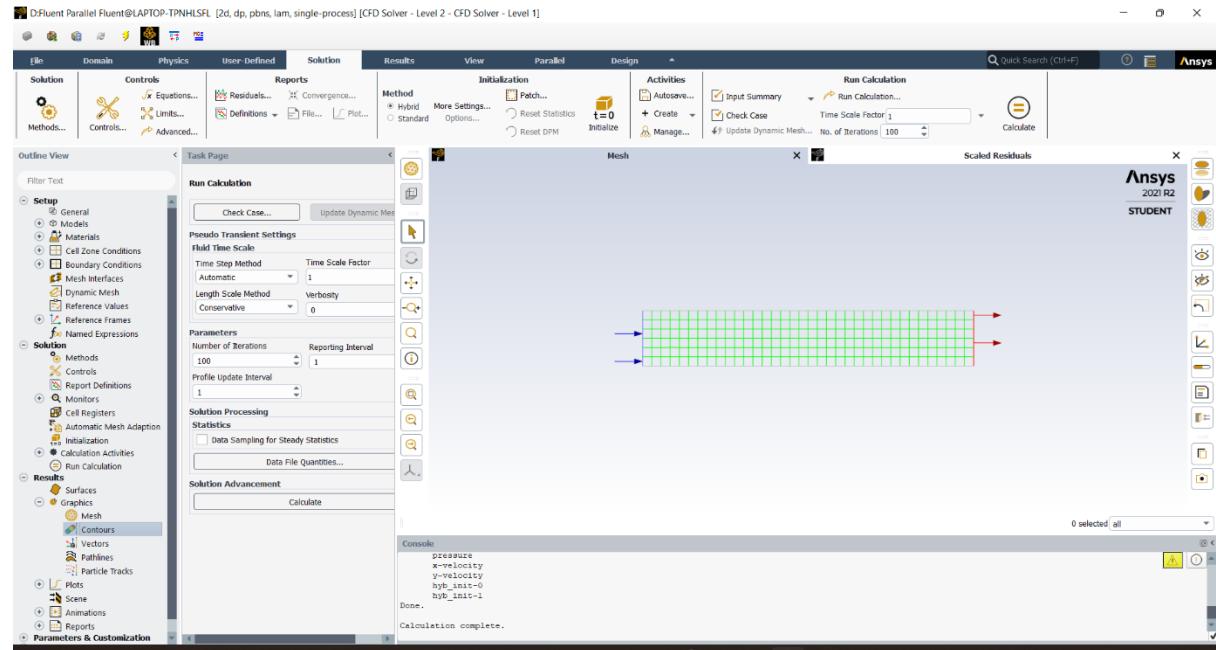
Named Selections: -

Inlet, outlet, Wall 1, Wall 2.

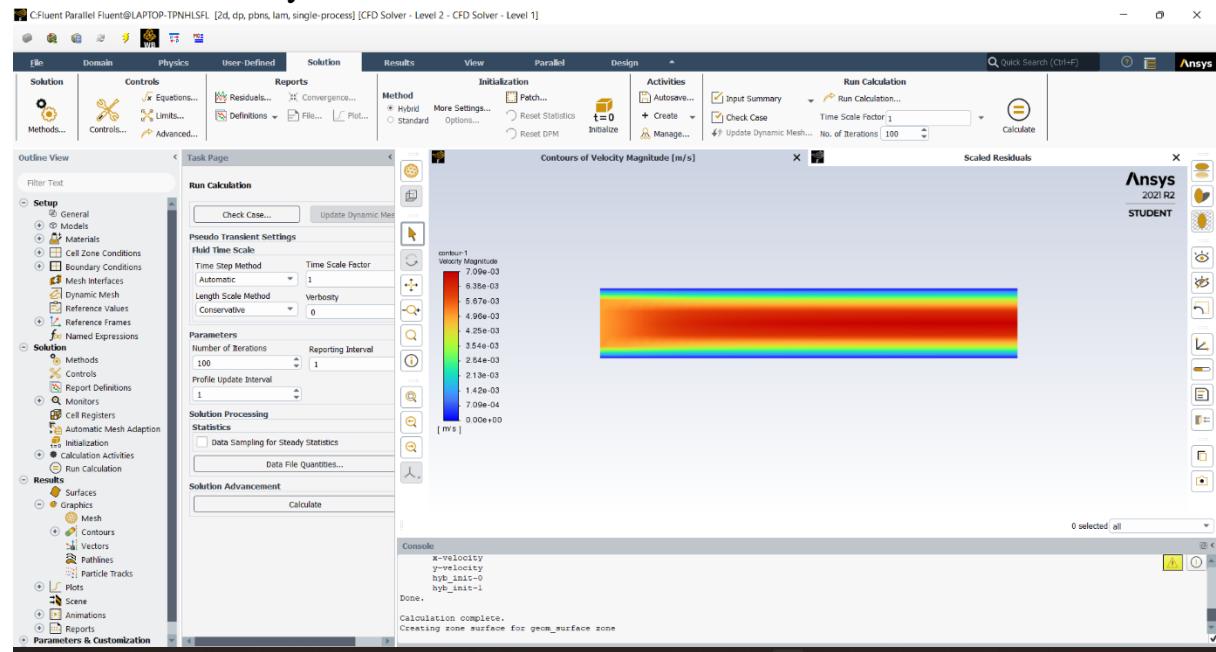
# Fluent

## Low viscous Fluid

### Fluid is water

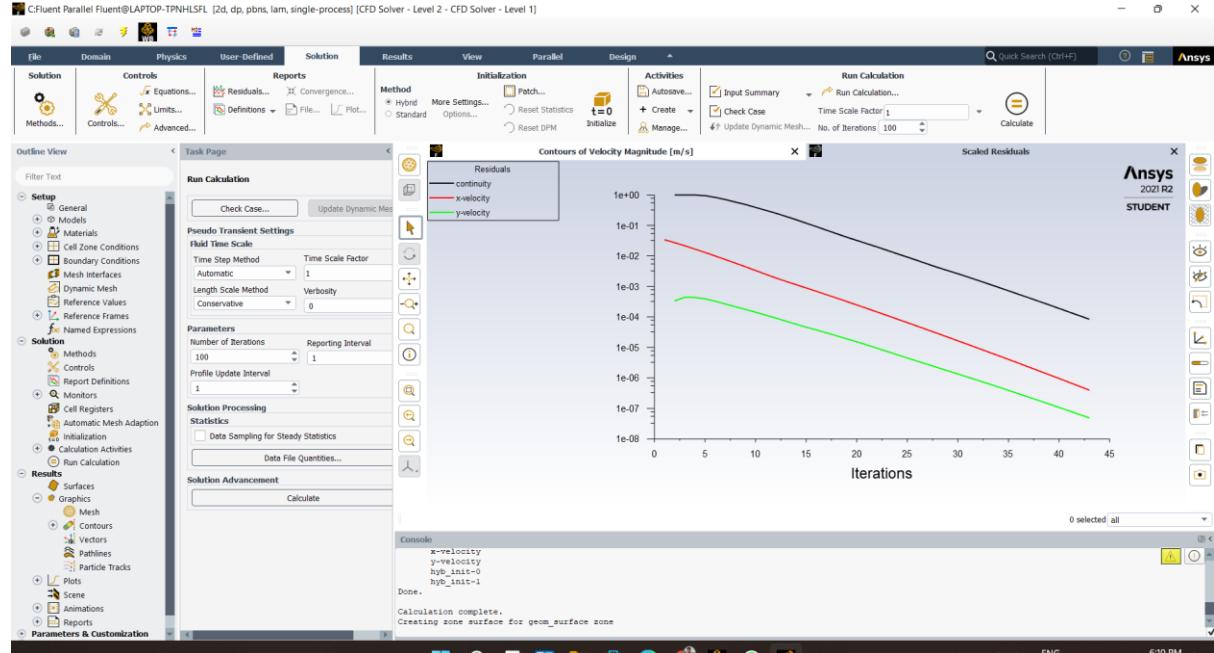


### Contour of velocity.

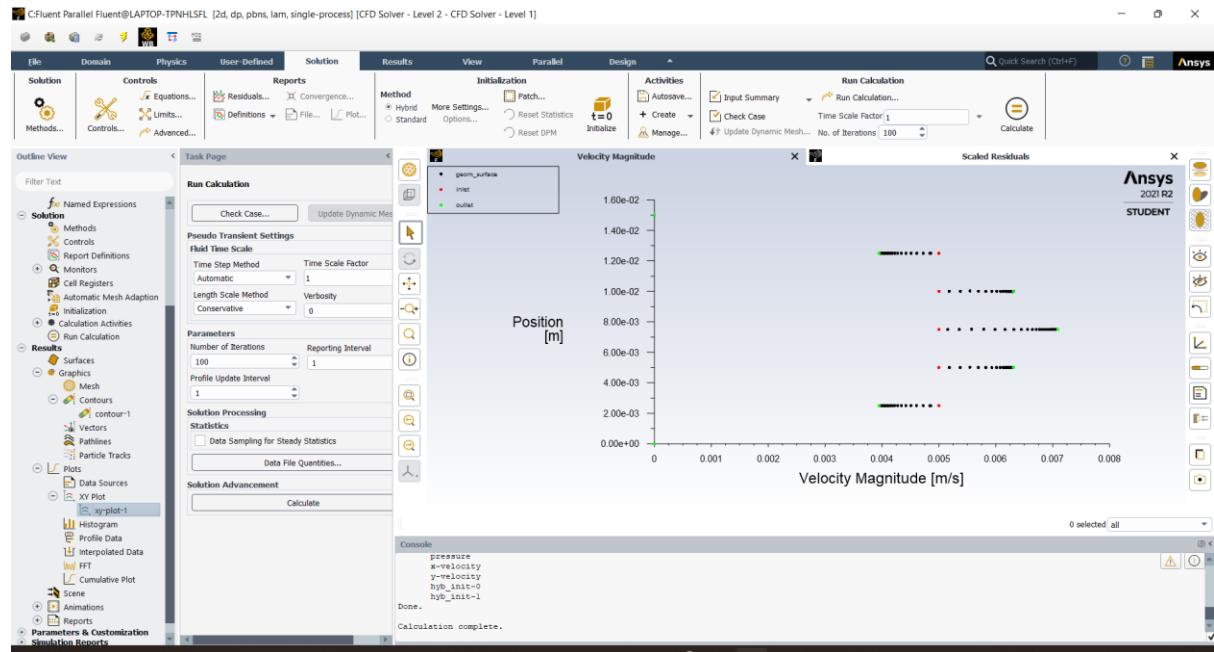


## Scaled Residuals

No of Iterations = 100



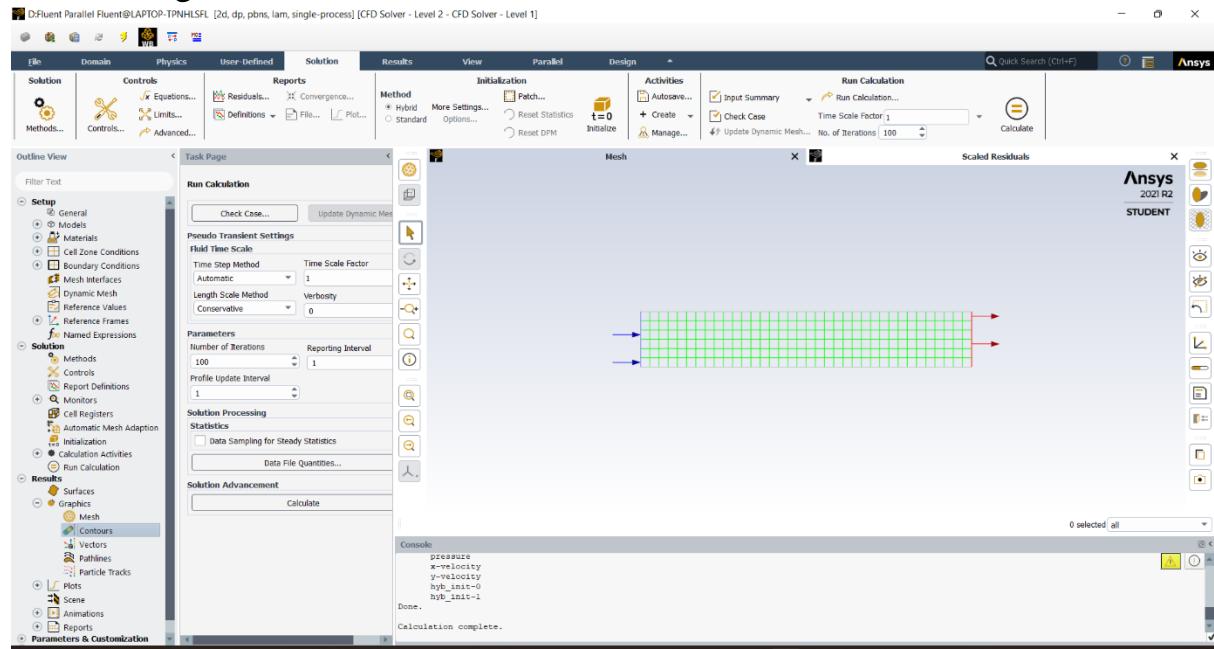
## Velocity Graph.



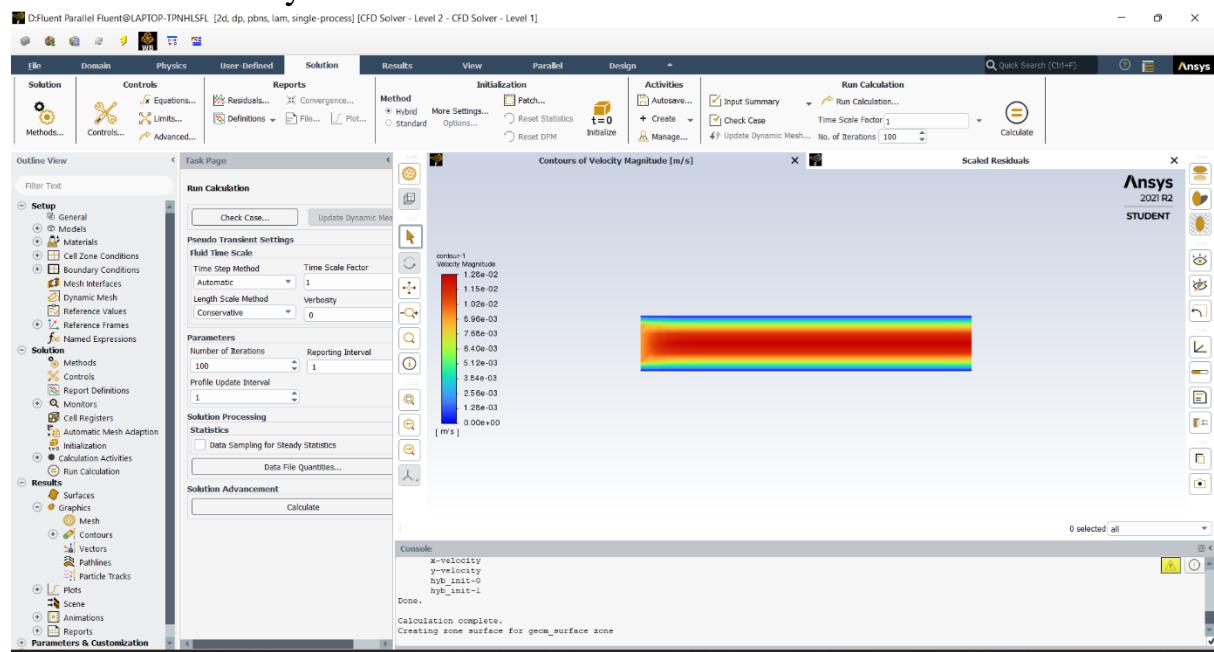
Fluent

High viscous Fluid

Fluid is Engine Oil.

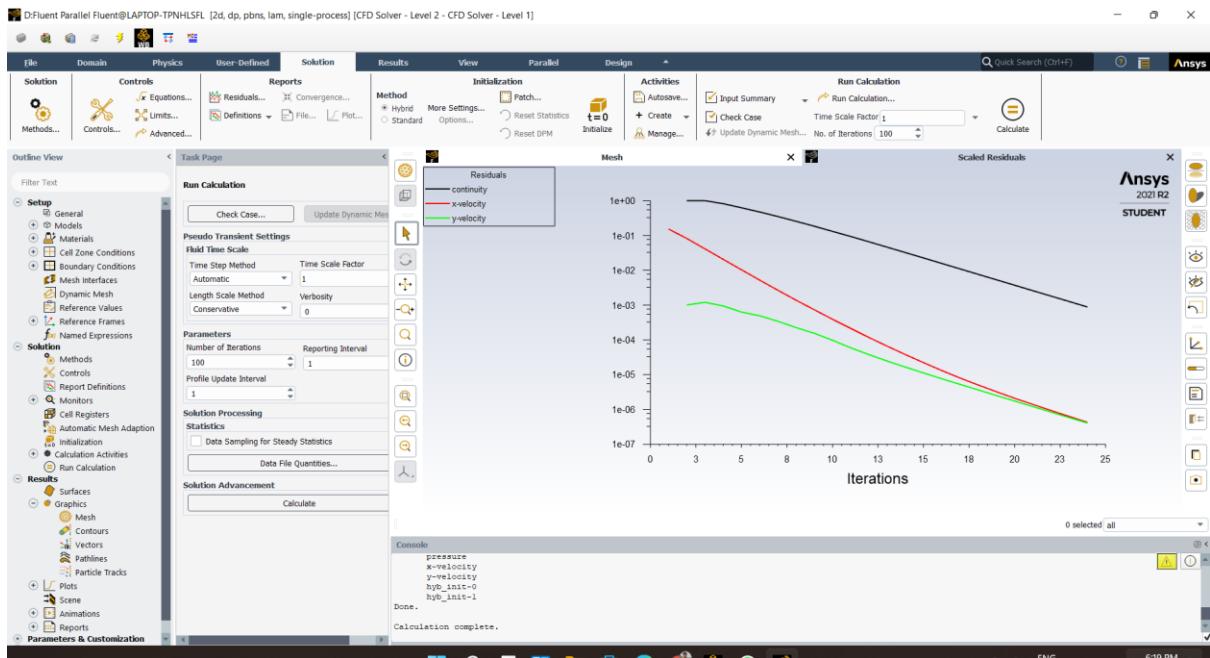


Contour of velocity.

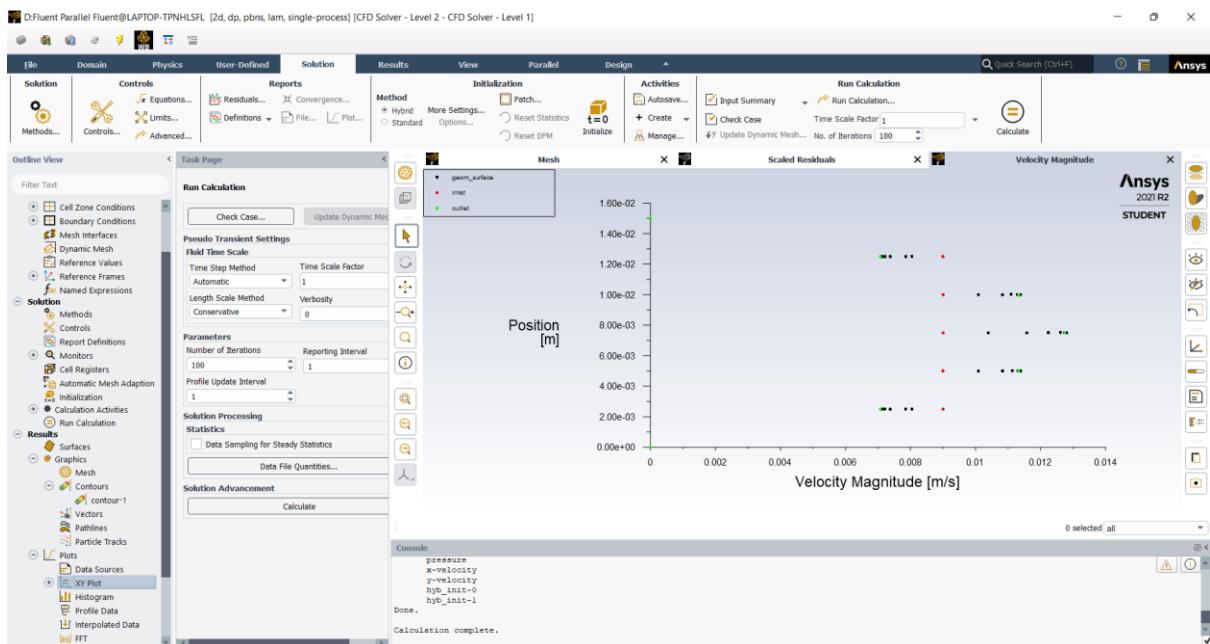


Scaled Residuals

No of Iterations = 100



## Velocity Graph.



We can observe that the velocity is compared between the high and low viscosity, A decrease in viscosity therefore increases the velocity.

## LAB 4

### Approach 1

Problem 1: A simply supported beam of length 1000 mm subjected to a uniformly distributed load of 5 N/mm. Beam is having a square cross section of side 40 mm. Take  $E = 210000 \text{ N/mm}^2$ . Simulate the deformation.

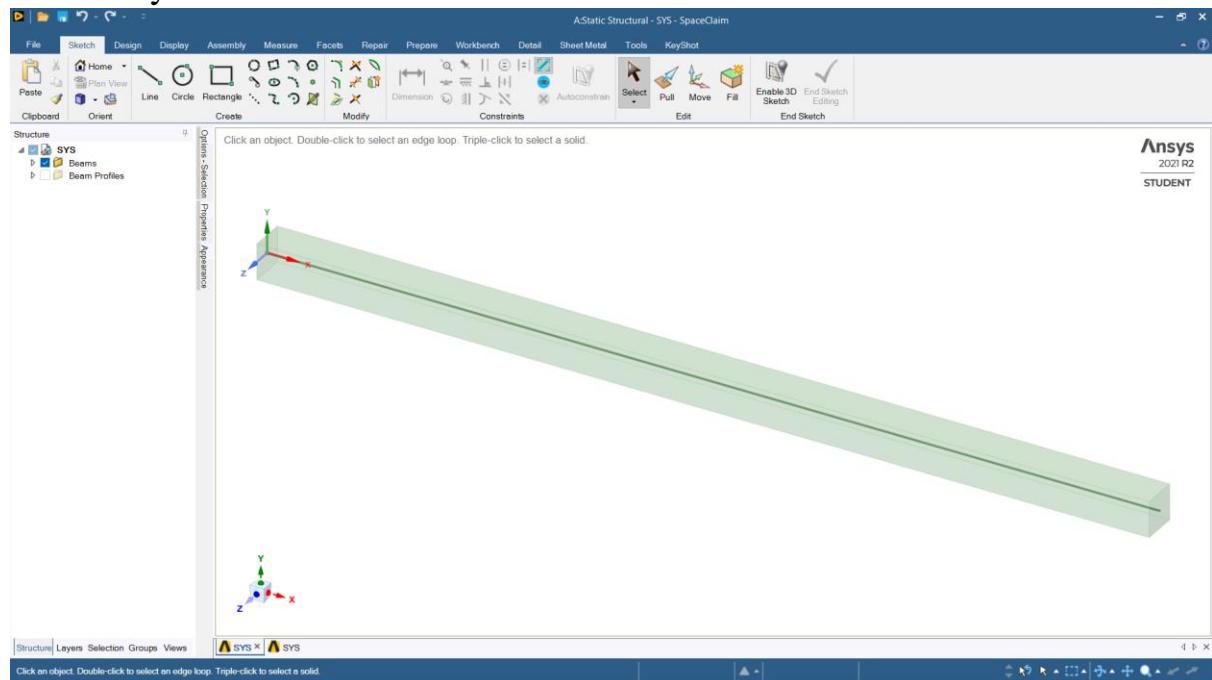
#### Two Approaches:

- Approach 1: As a line body
- Approach 2 : As a 3D body

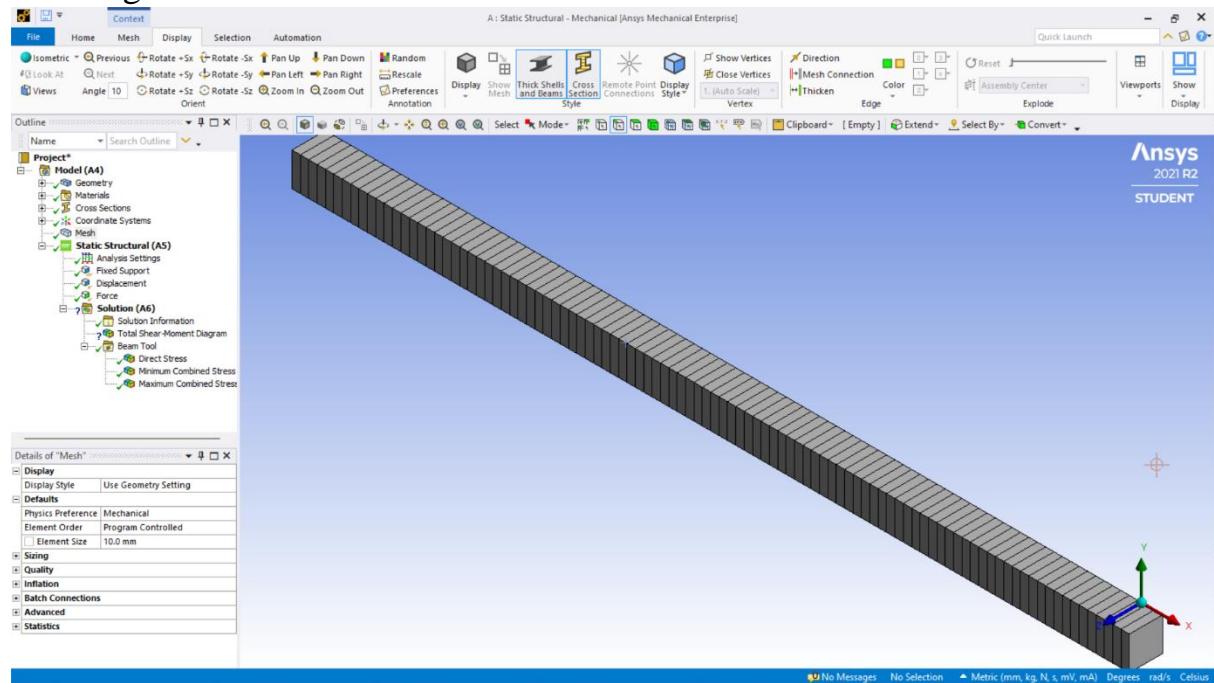
### Approach 1

#### With Fixed support

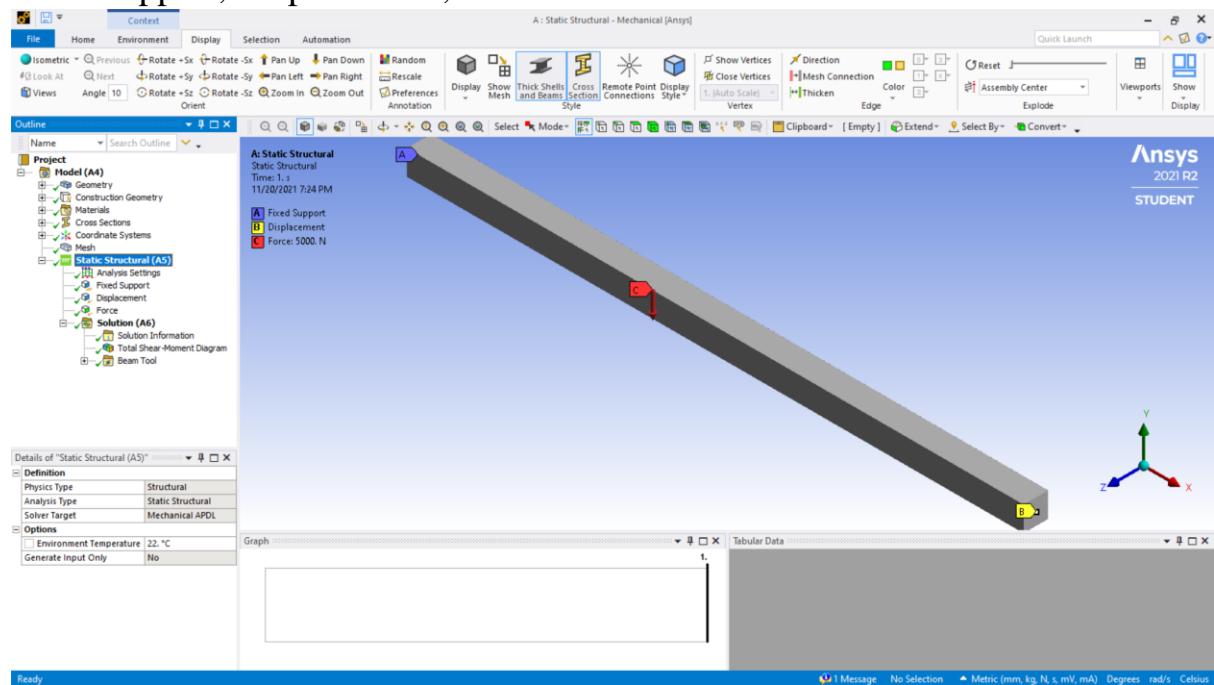
#### Geometry



# Mesher

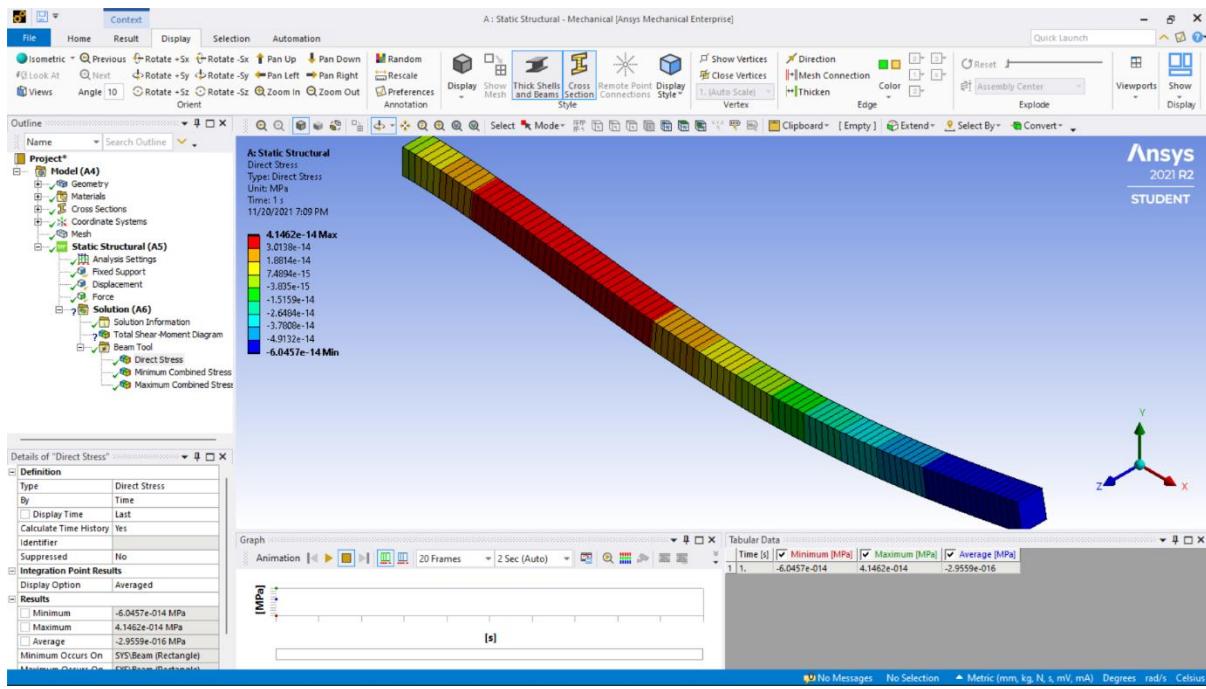


## Fixed support, Displacement, Force 5000N

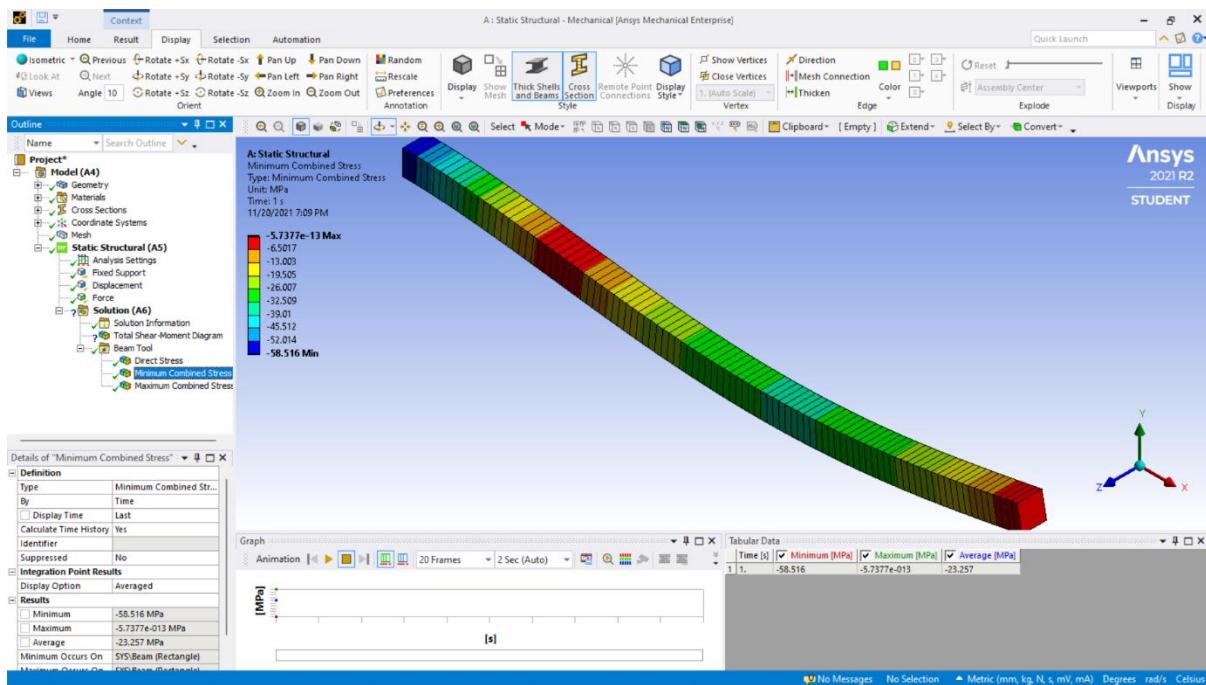


## Solution

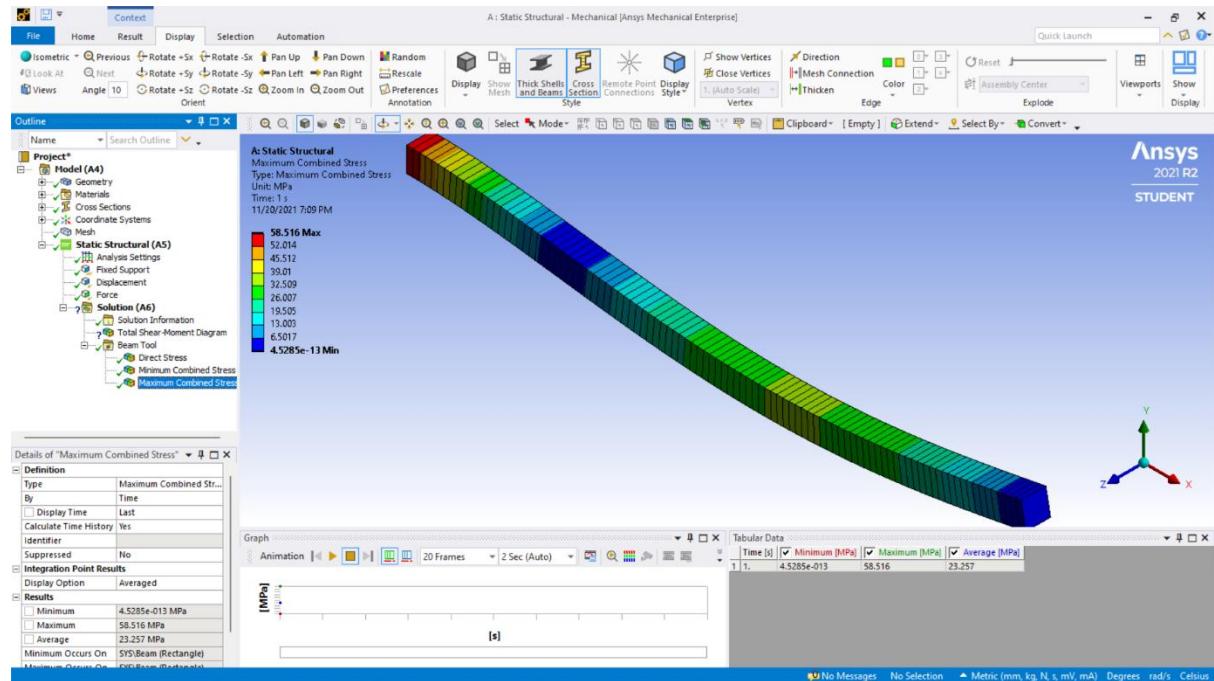
### Direct Stress



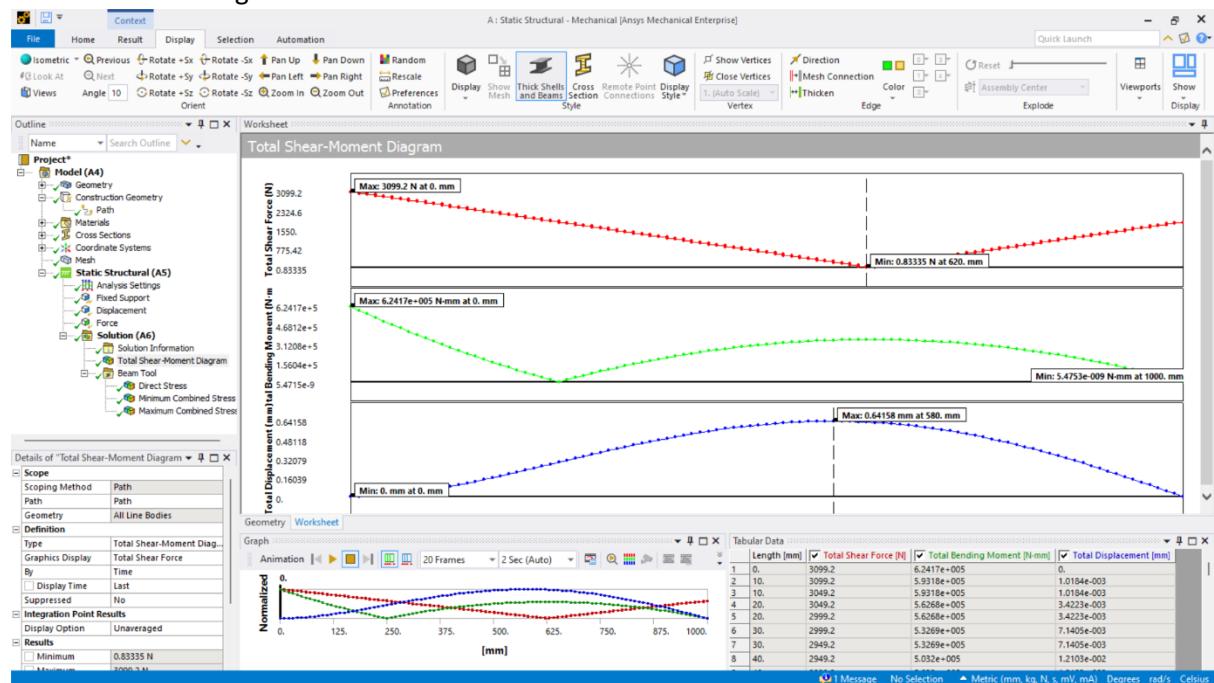
## Maximum combined stress



## Minimum combined stress



## Shear Moment Diagram

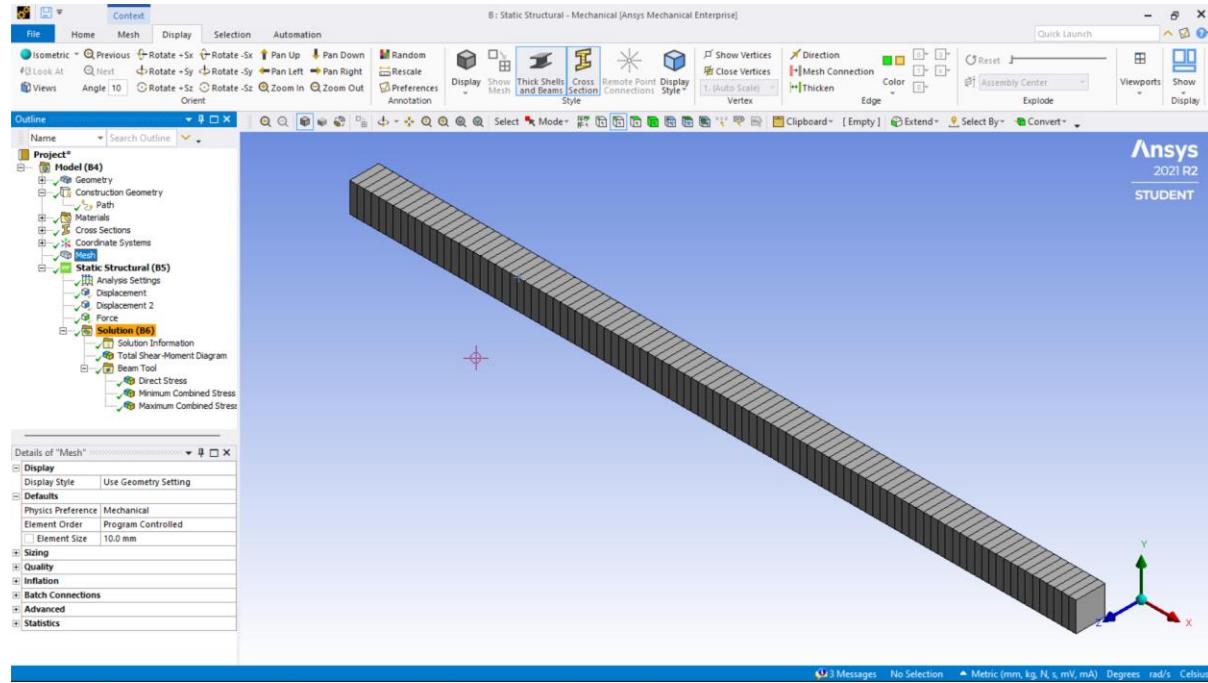


Maximum 3099.2 N at 0mm

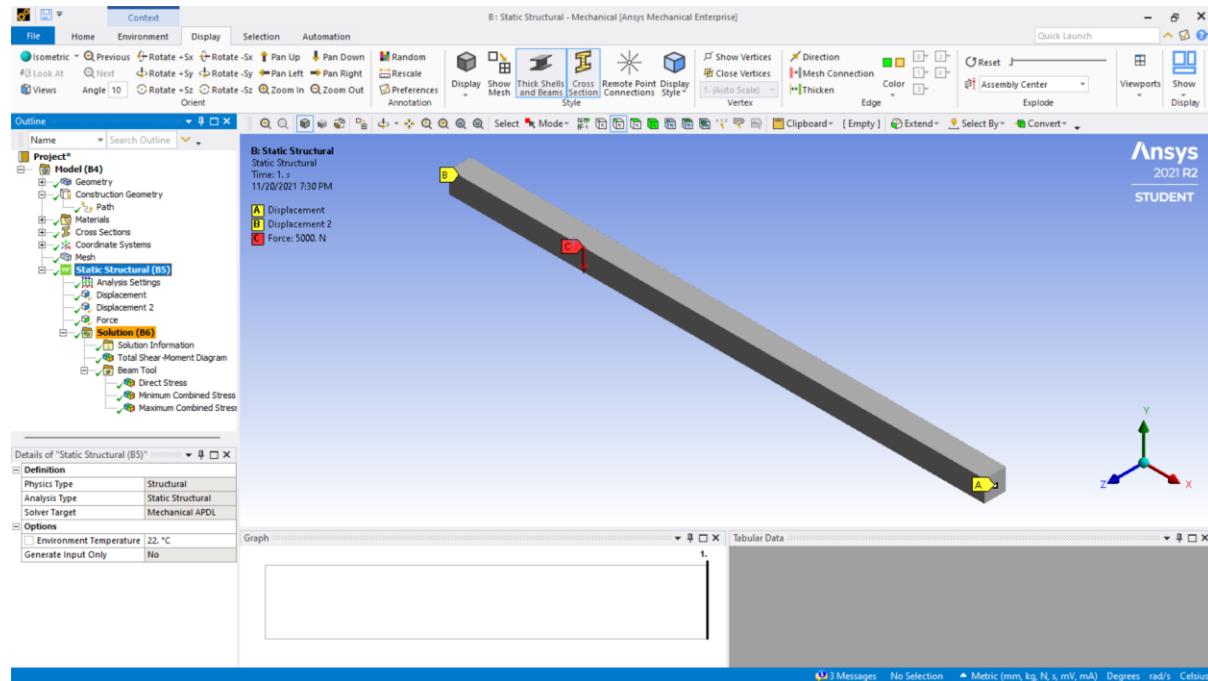
## Approach 1

Without Fixed support.

### Meshing

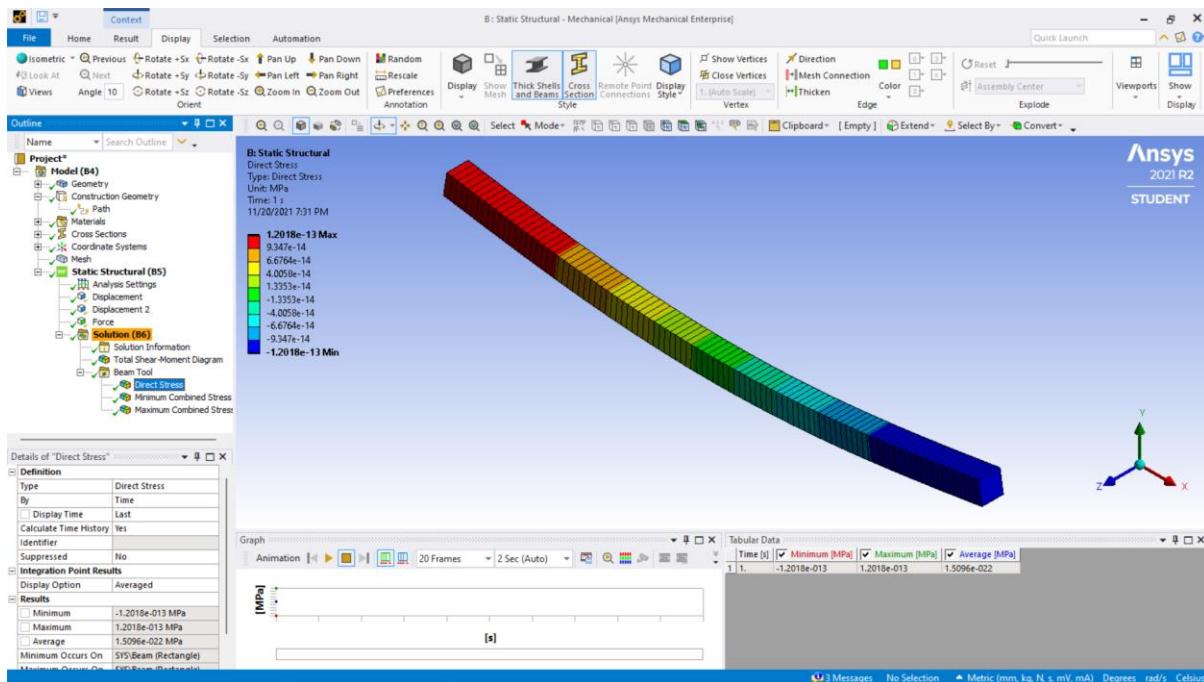


### Displacement 2 , Force 5000N

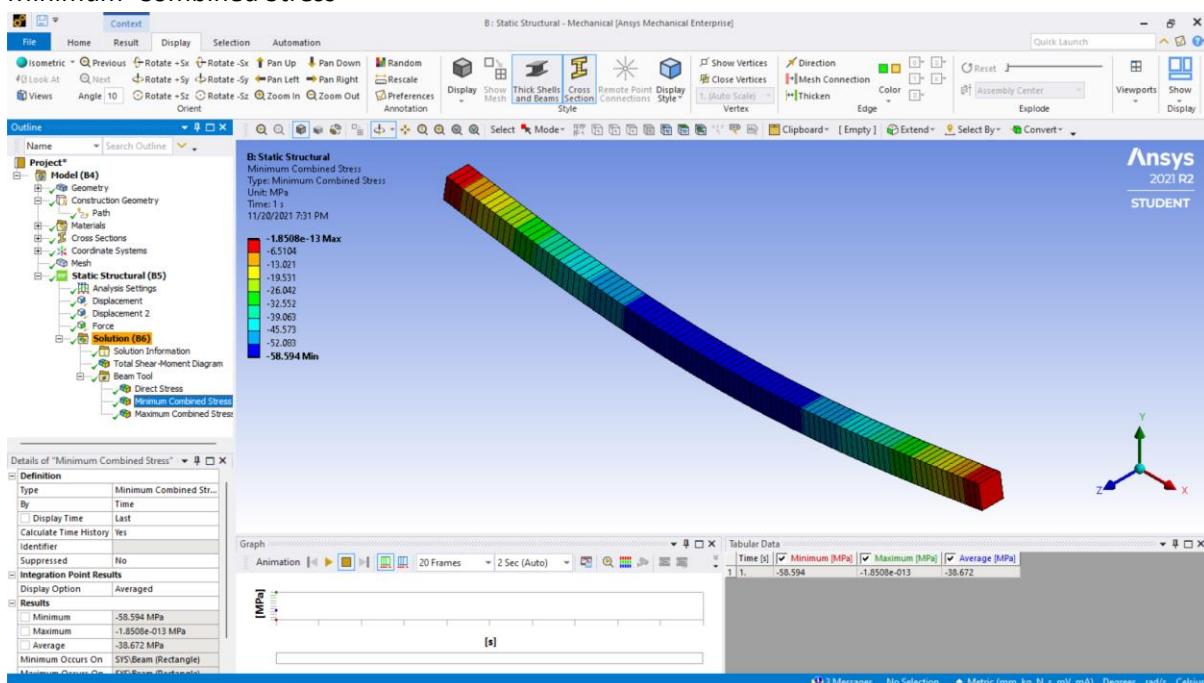


### Solution

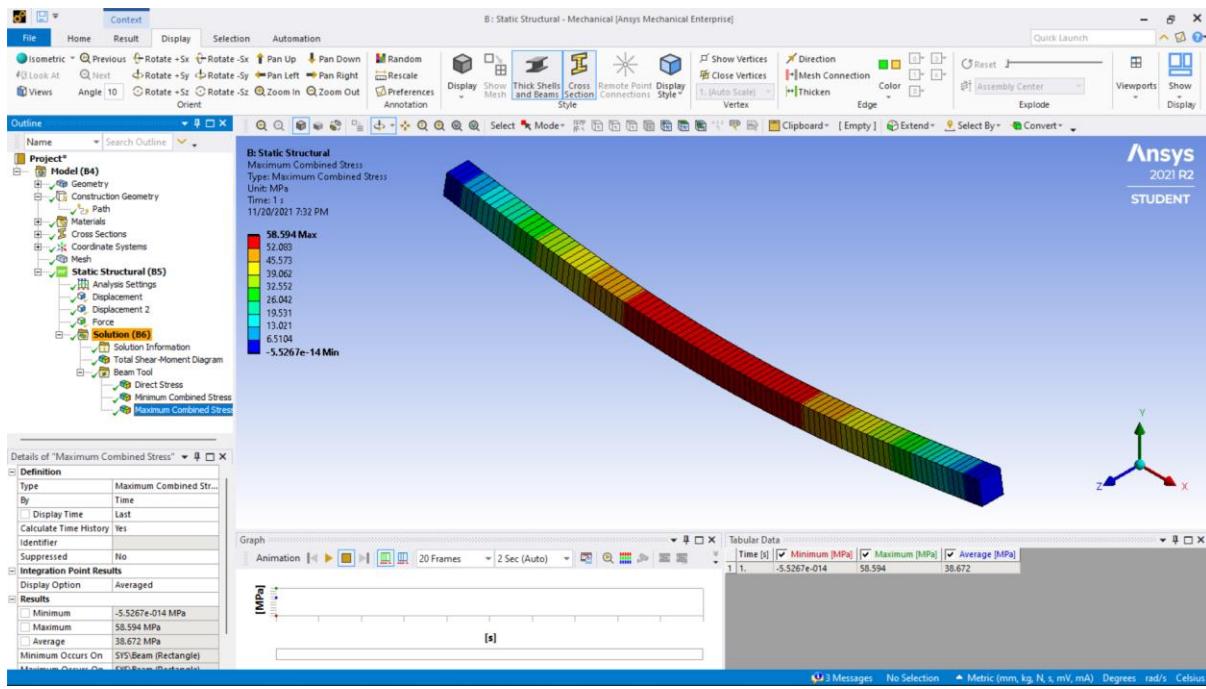
#### Direct Stress



## Minimum Combined Stress

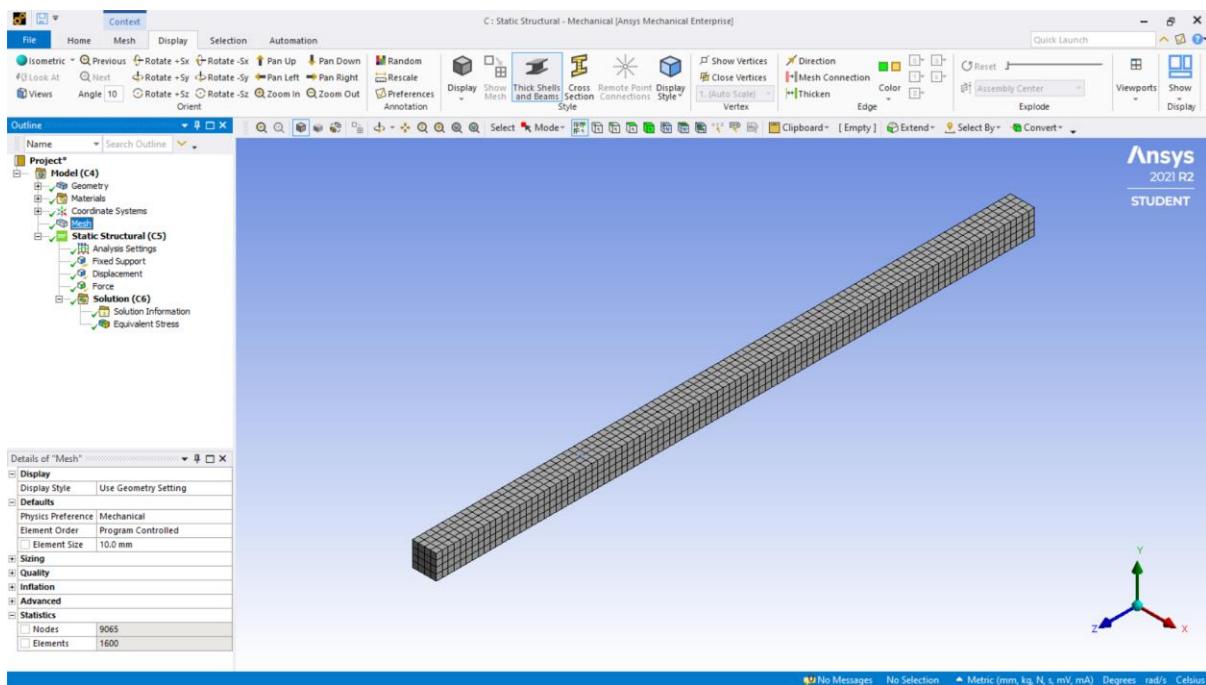


## Maximum Combined Stress

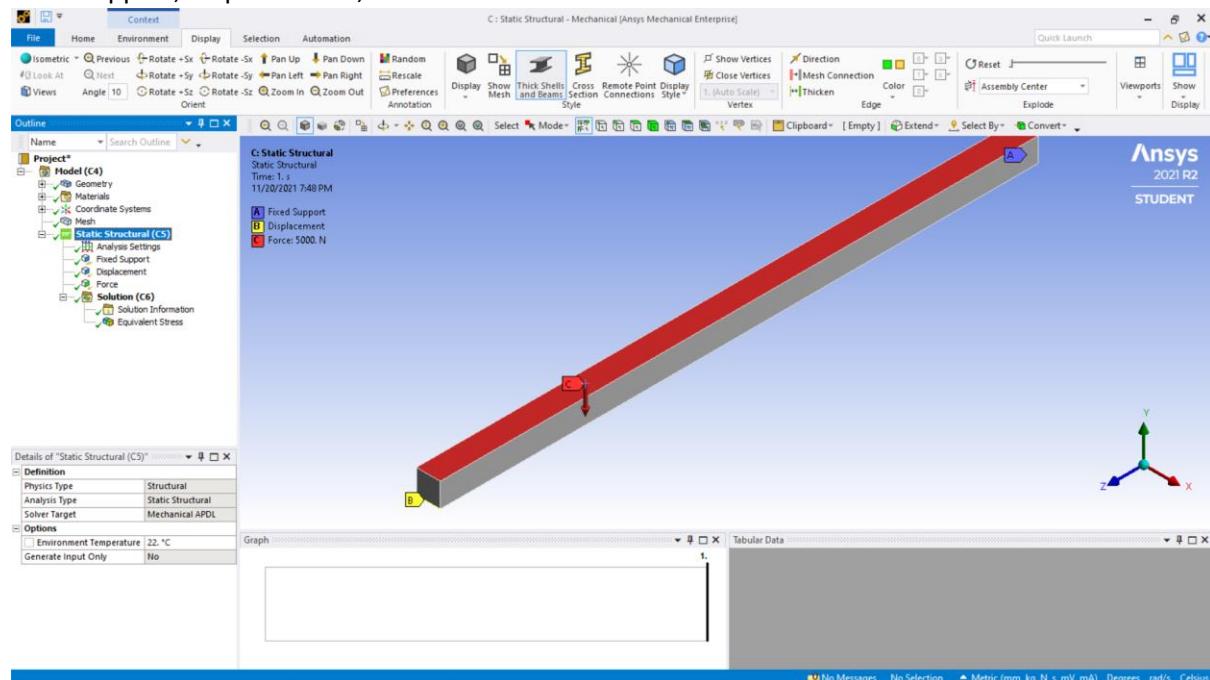


## Approach 2

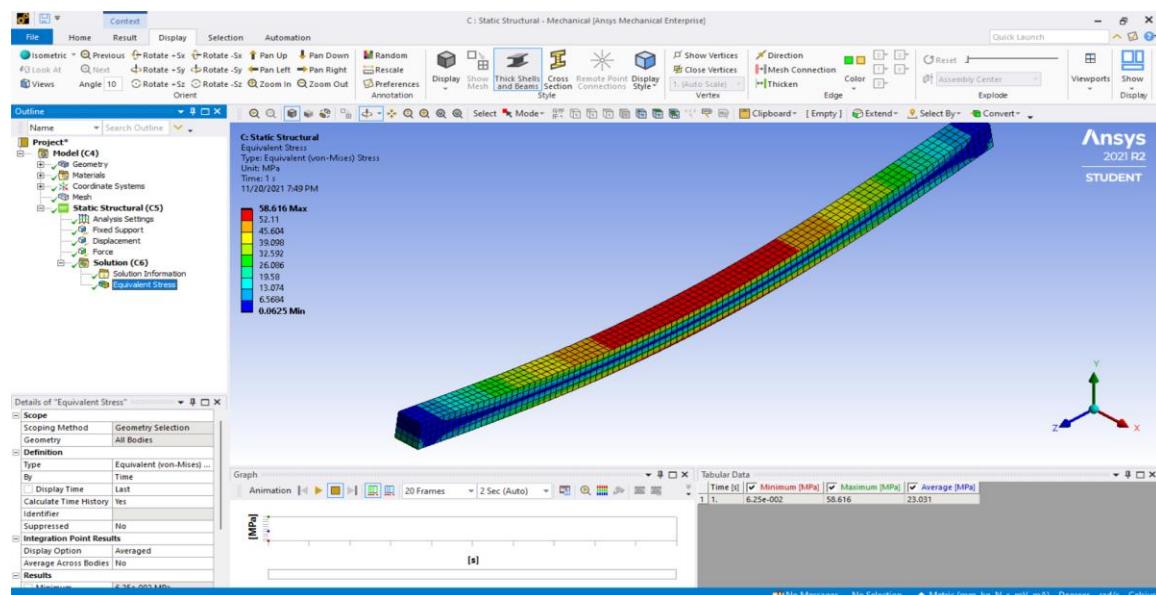
As a 3D body



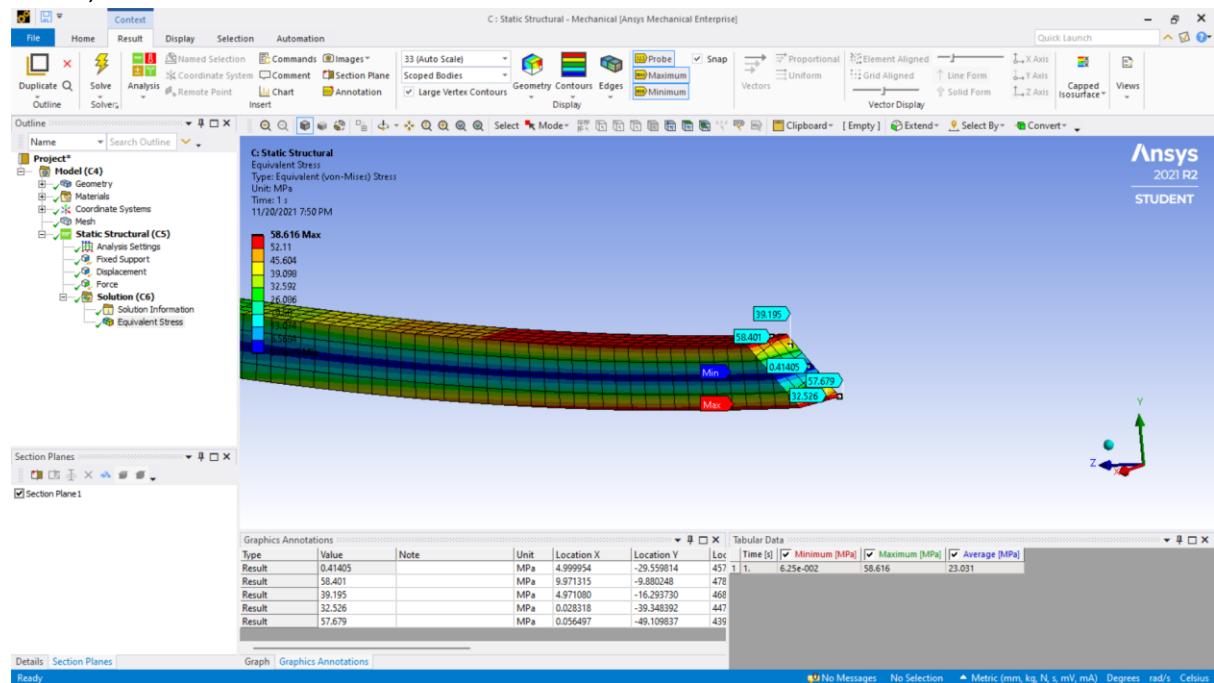
## Fixed support, Displacement , Force =5000N



## Equivalent stress



## Probe , maximum and Minimum



The maximum = 58.616 Mpa

Minimum = 0.0625Mpa

In this picture We can see the different probs in the bar the max is 57.679 and minimum 0.41405.

# LAB5

## Two-story Building Part-1

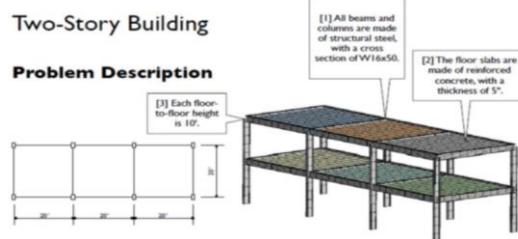
### Modeling a Two-Story Building

**Problem:** A two-story building is constructed for residential usage is to be analyzed for stress distribution.

**Simulation1:** Static Structural Analysis for given load conditions. Check if the deformation and stresses are within safety margin for static loads.

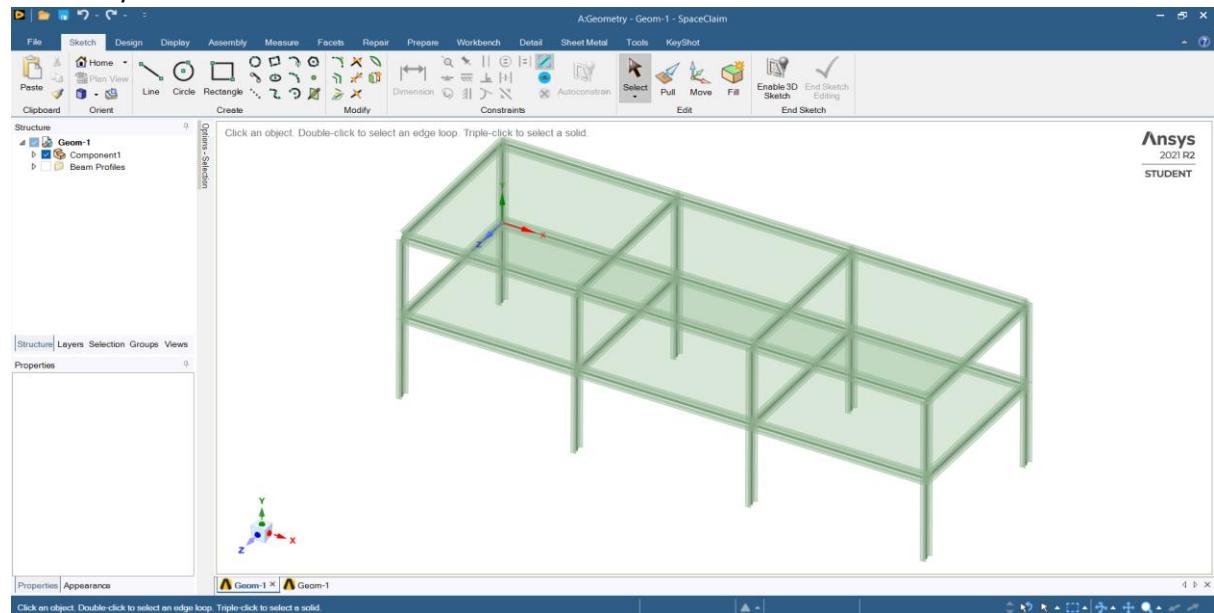
**Simulation2:** Investigate the dynamic behavior of the building. A structure's natural frequencies represent the structure's stiffness: the higher the frequency the stiffer. Local building codes usually require a minimum frequency level so that a building would not be too soft. Both for comfort and safety concerns. Perform a MODAL analysis for this.

**Simulation 3:** Perform a Harmonic Response analysis to check if the Rhythmic loading to the building could be a concern.

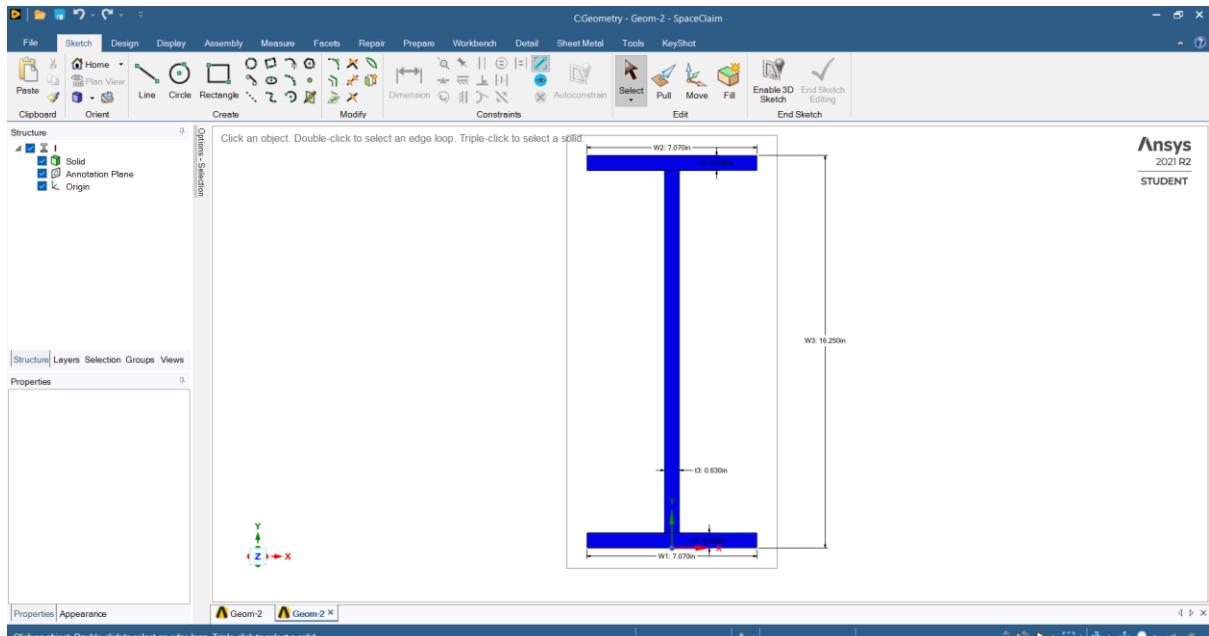


### 1) Arranging the length beams in 90Degree.

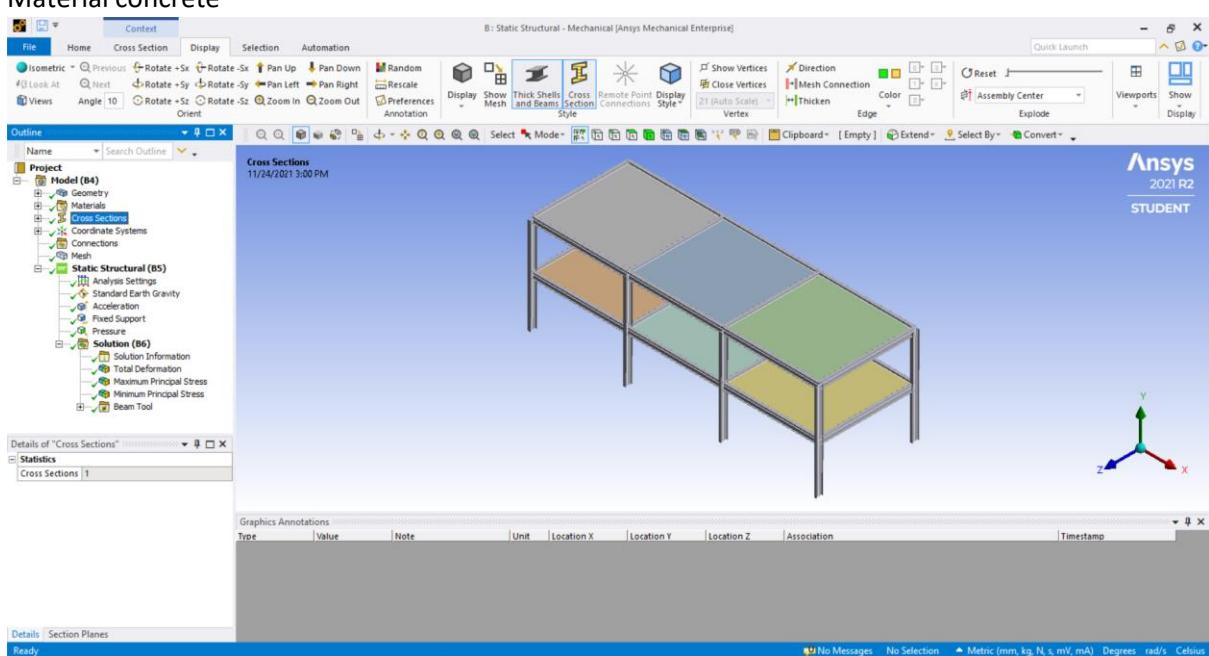
#### Geometry



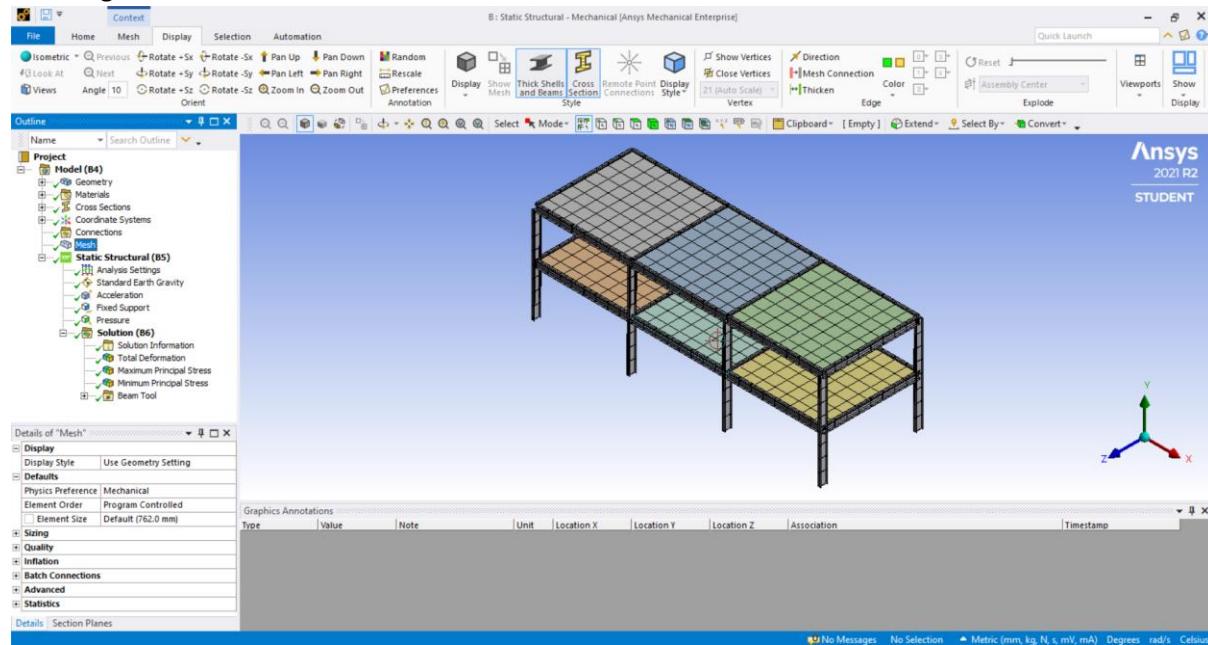
## I-section values



## Material concrete



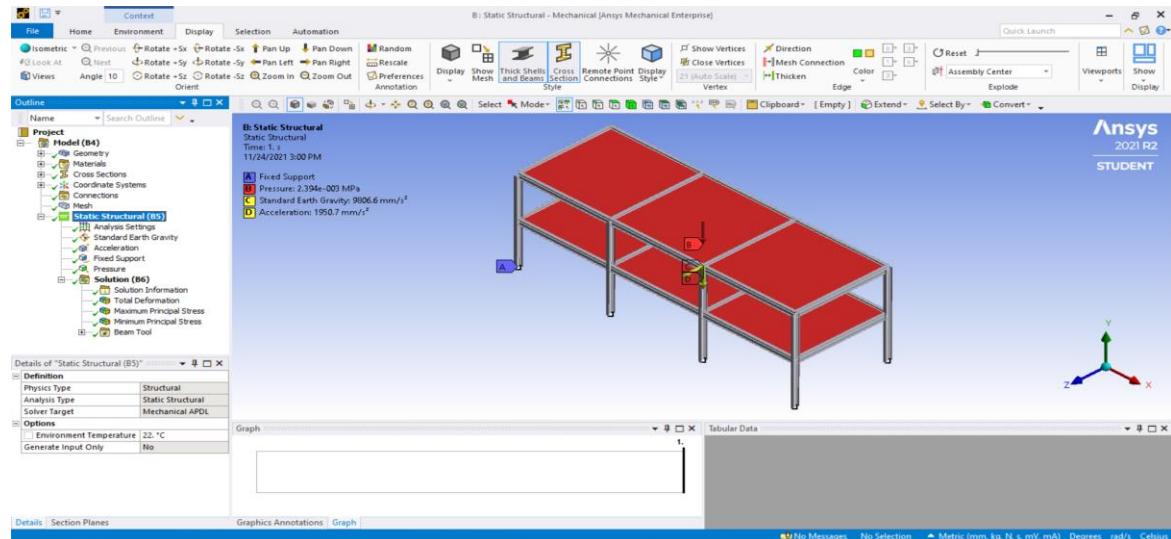
## Mesher



Fixed Support for grounding the building.

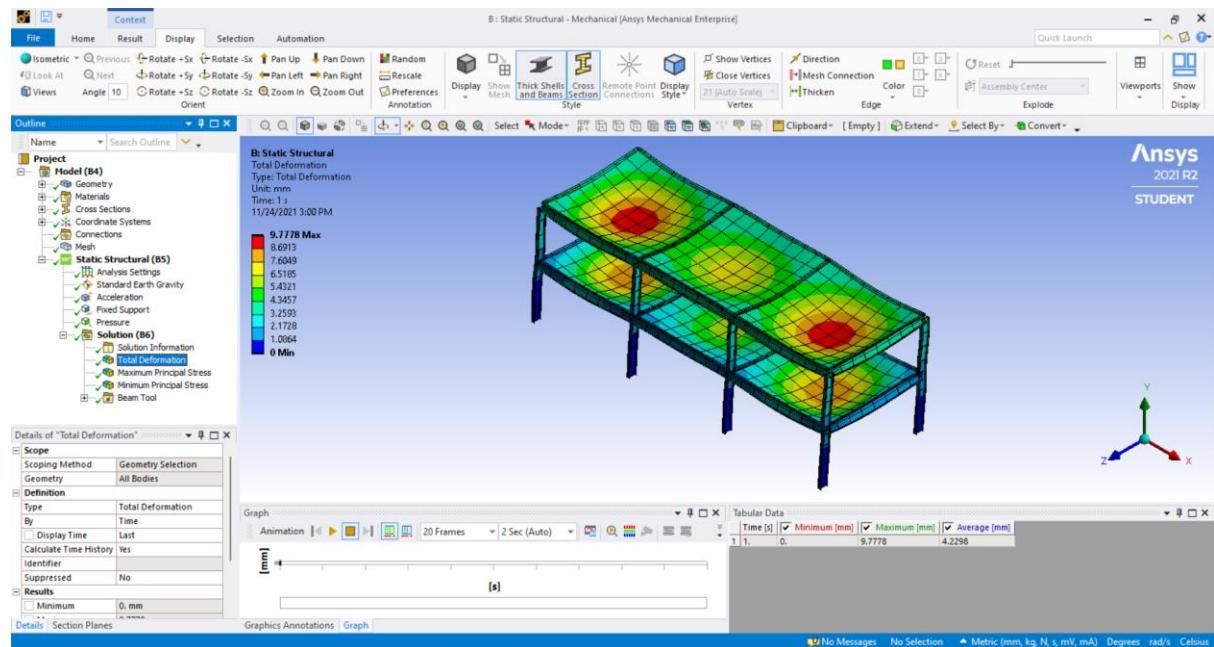
Pressure 50psi

Earth gravity is applied and acceleration 9.6

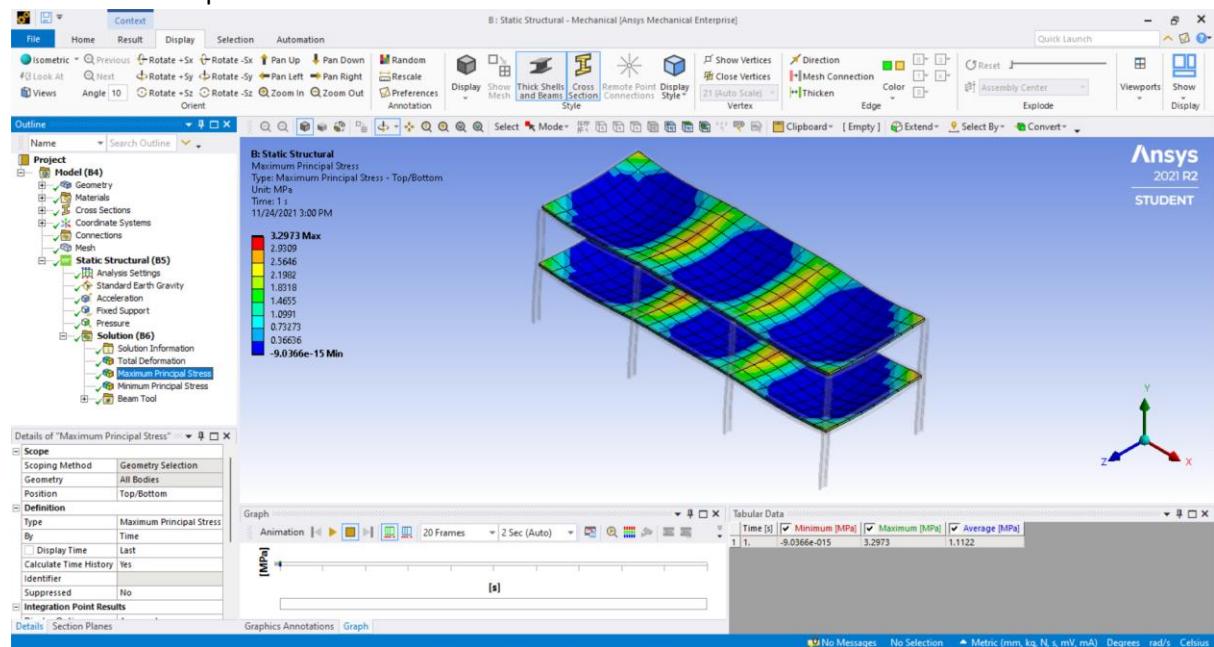


## Solution

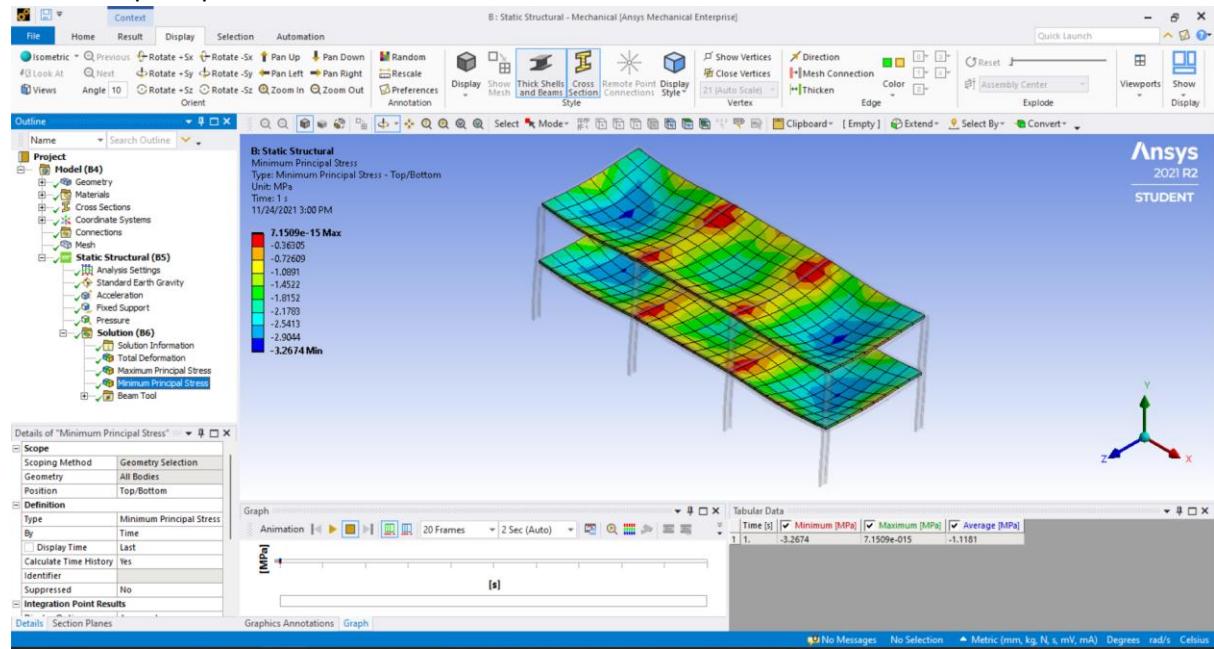
### Total Deformation



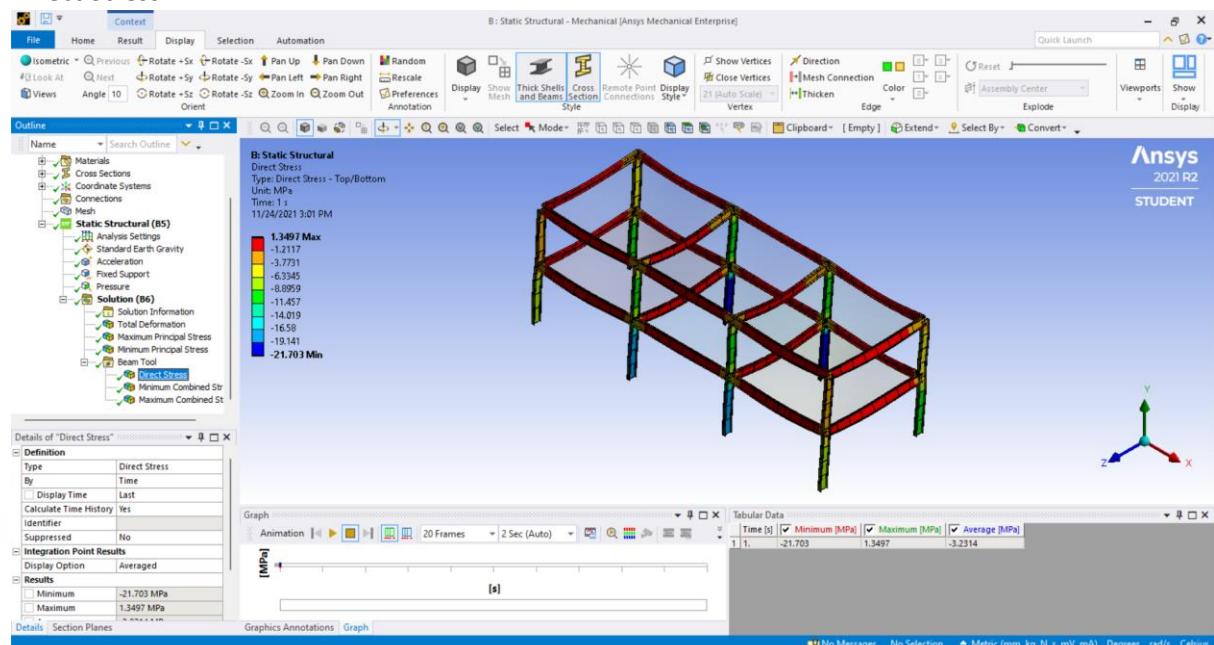
### Maximum Principal Stress



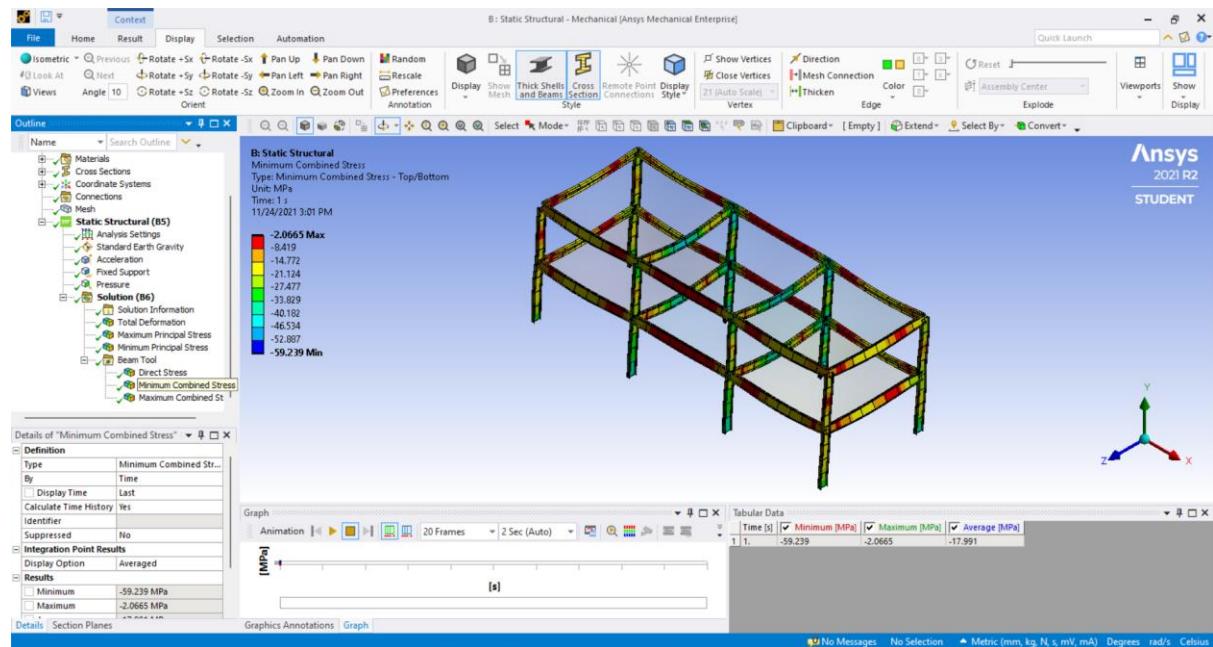
## Minimum principal stress



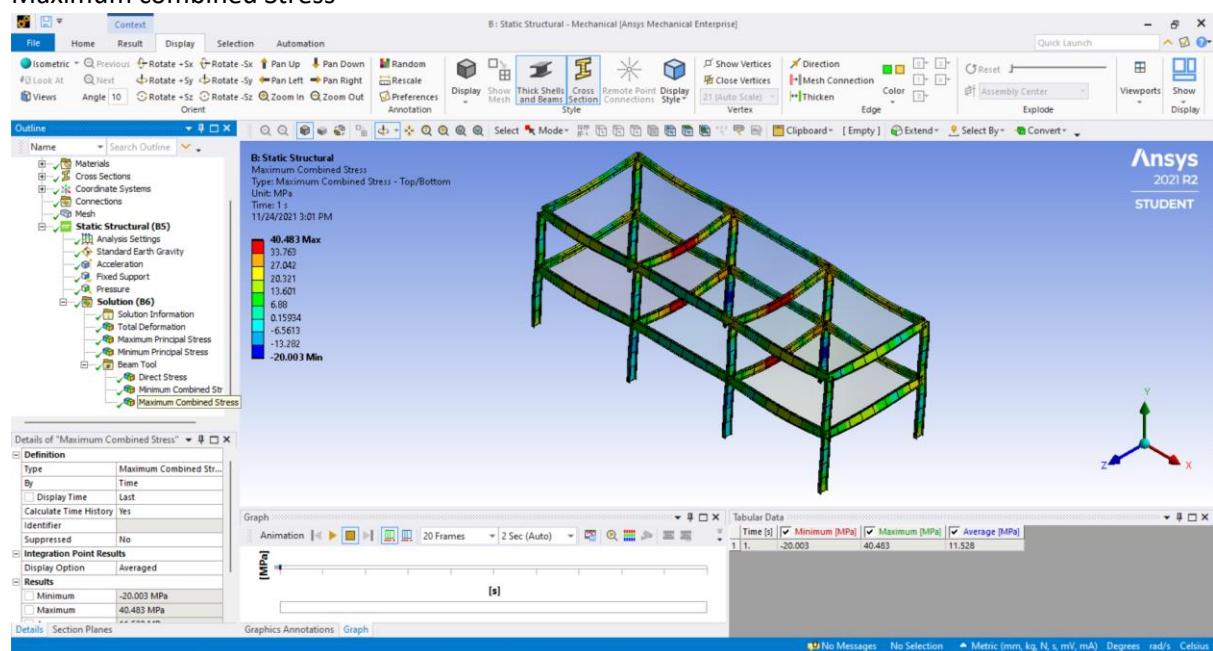
## Direct Stress



## Minimum Combined Stress

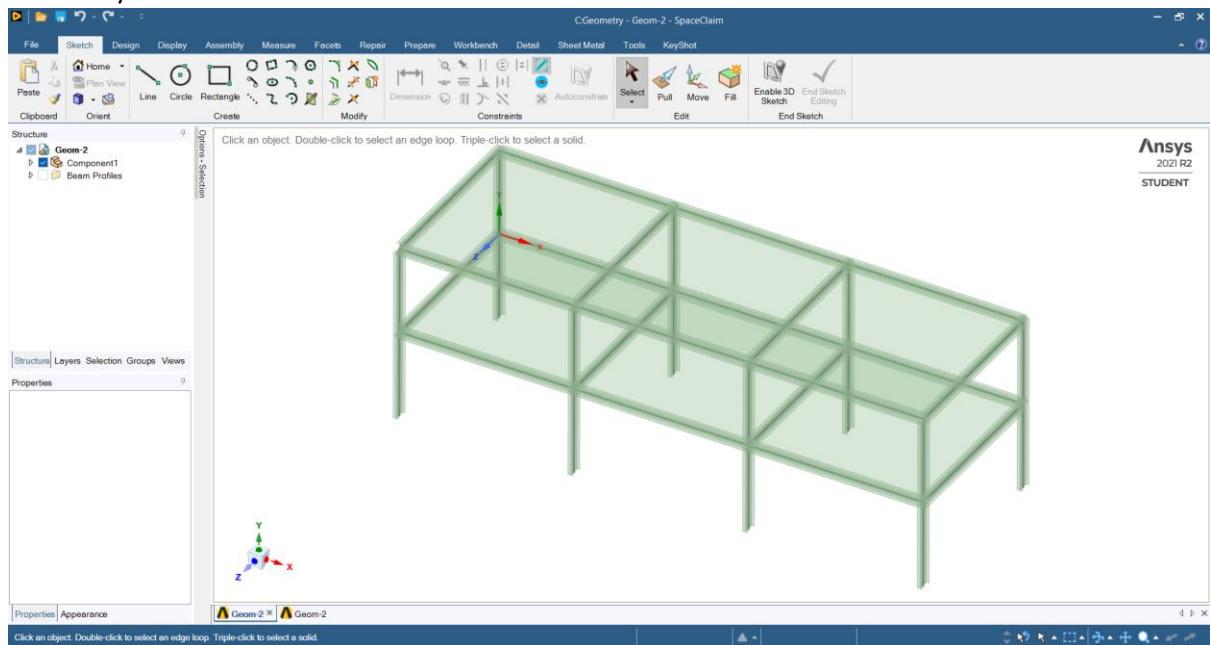


## Maximum combined Stress

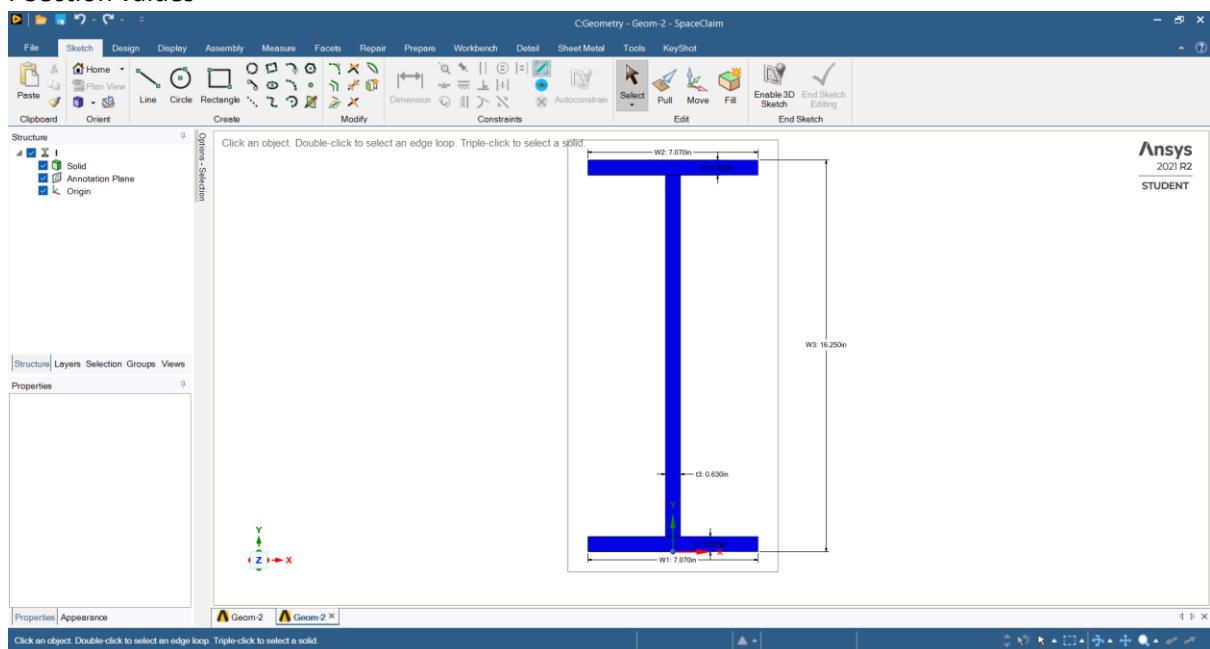


## Arranging the length beams in 0 Degree.

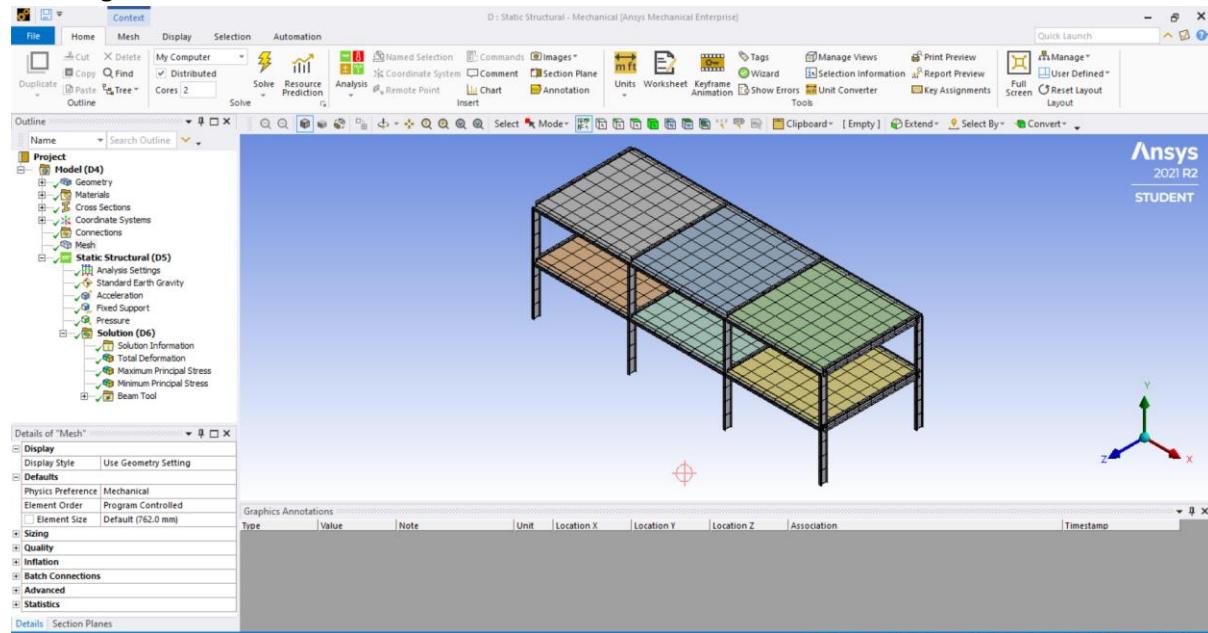
### Geometry



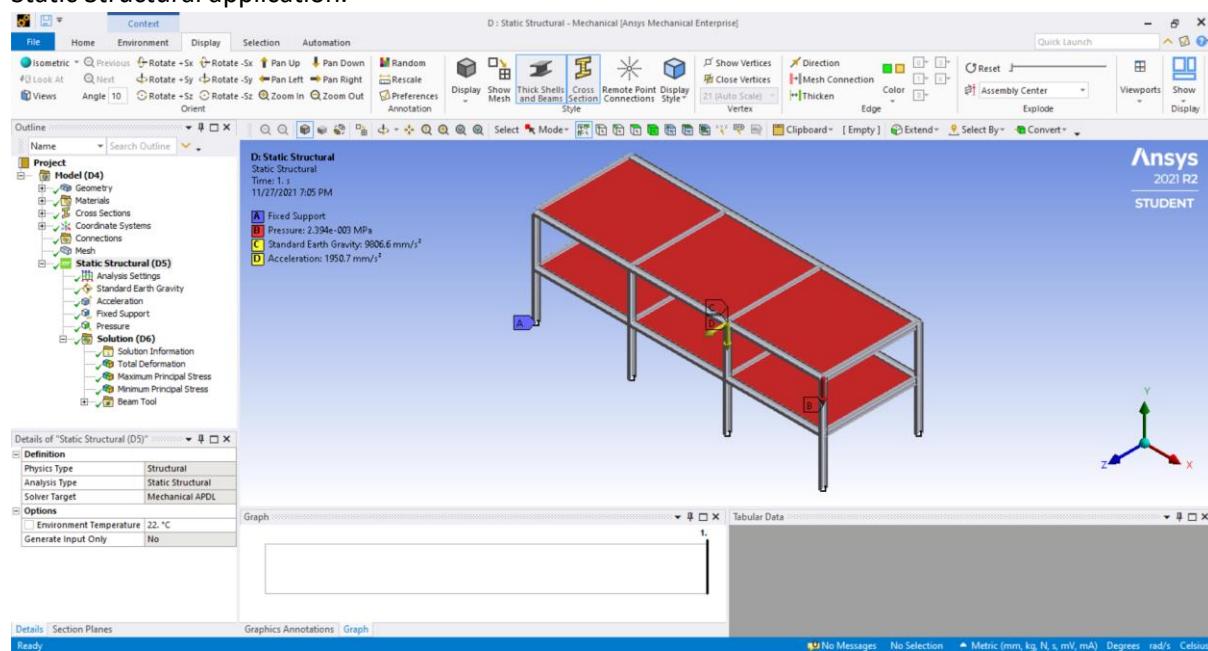
### I-Section values



## Meshing

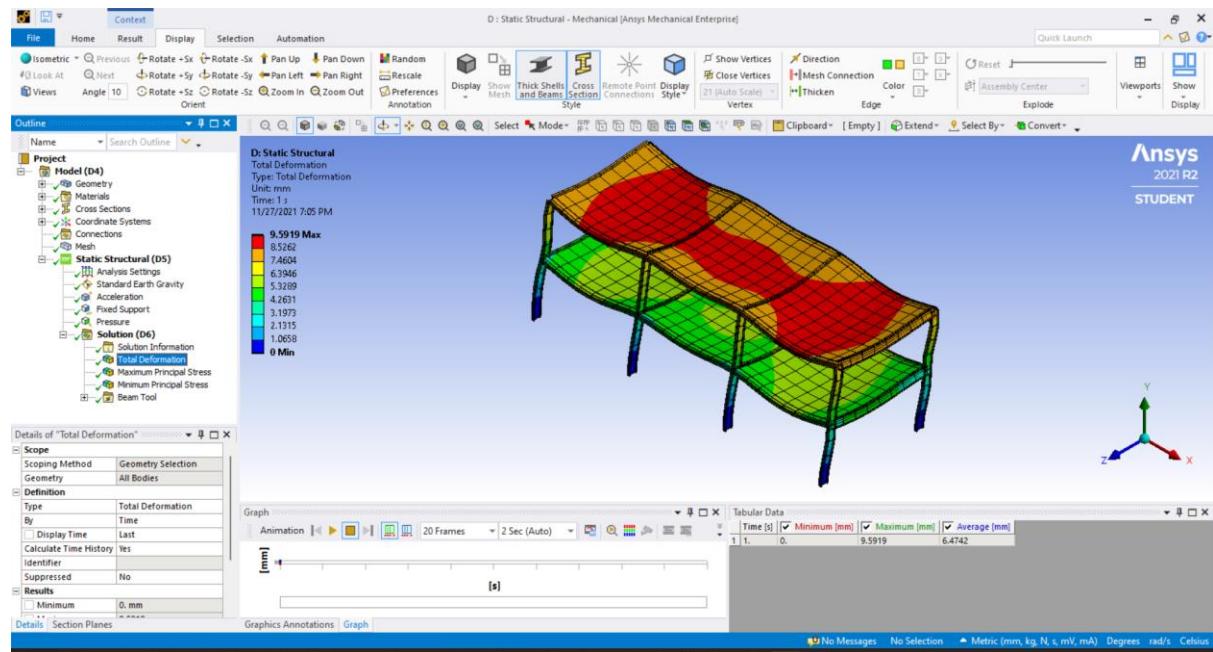


## Static Structural application.

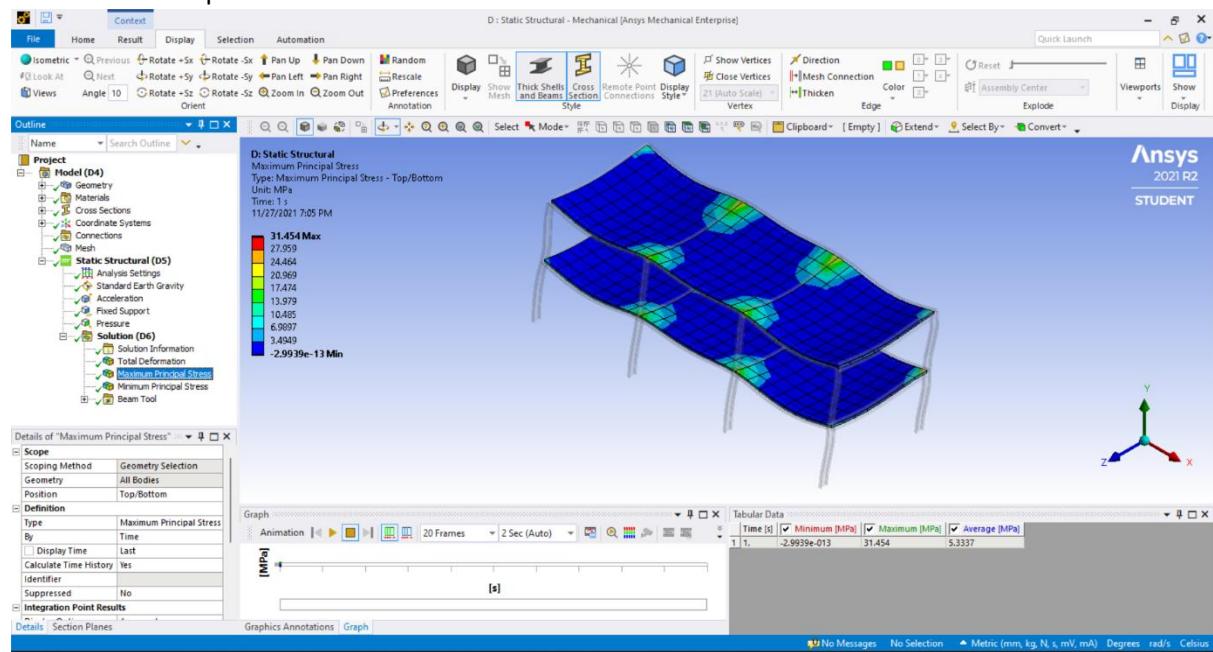


## Solution

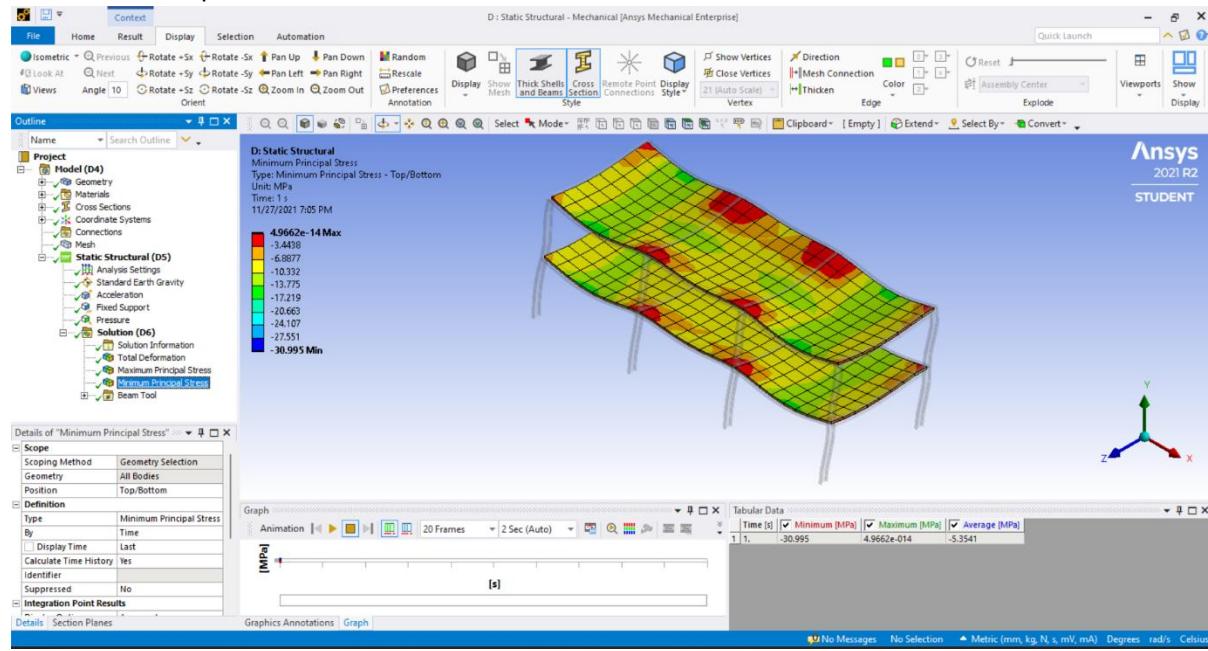
### Total Deformation



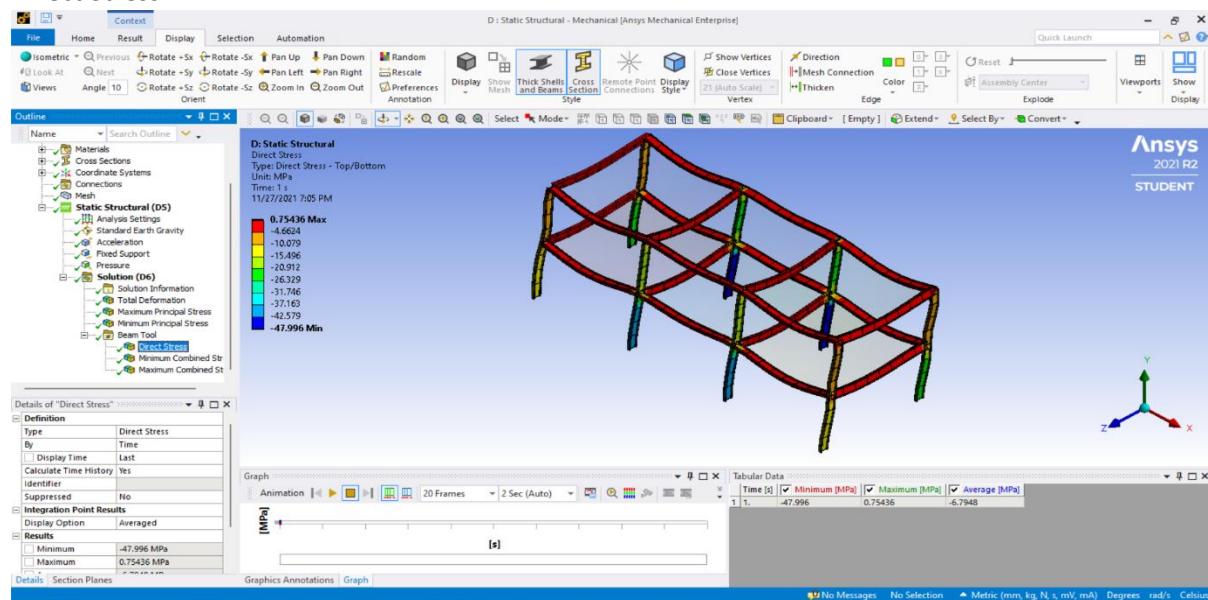
### Maximum Principal Stress



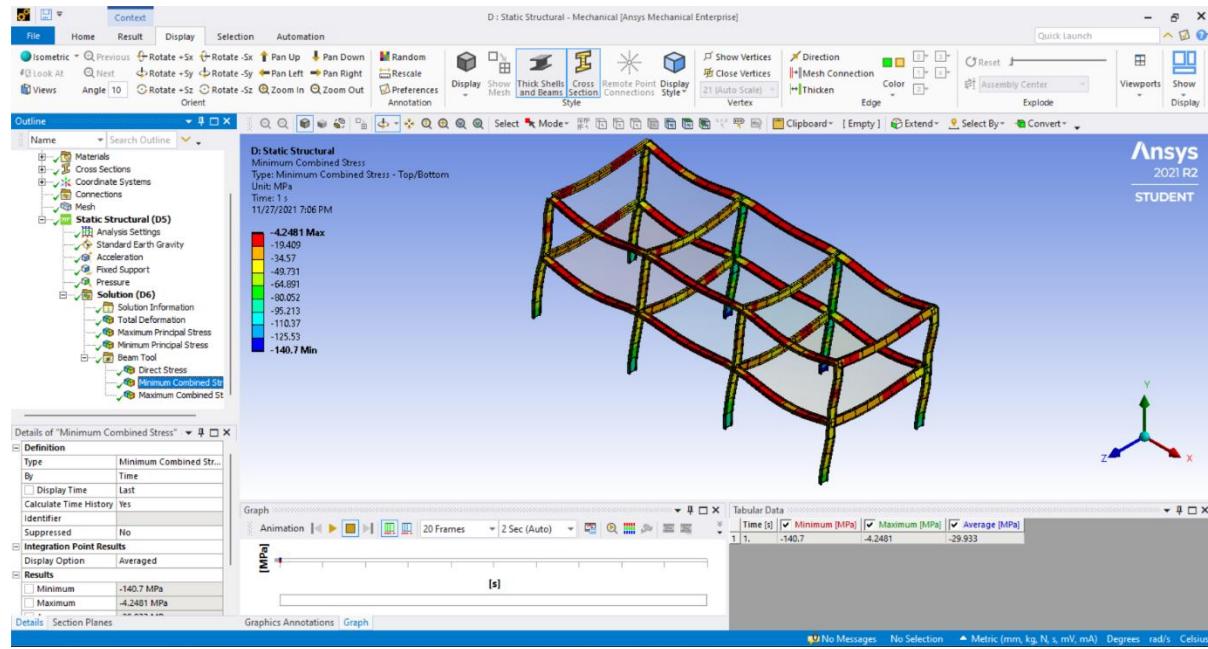
## Minimum Principal Stress



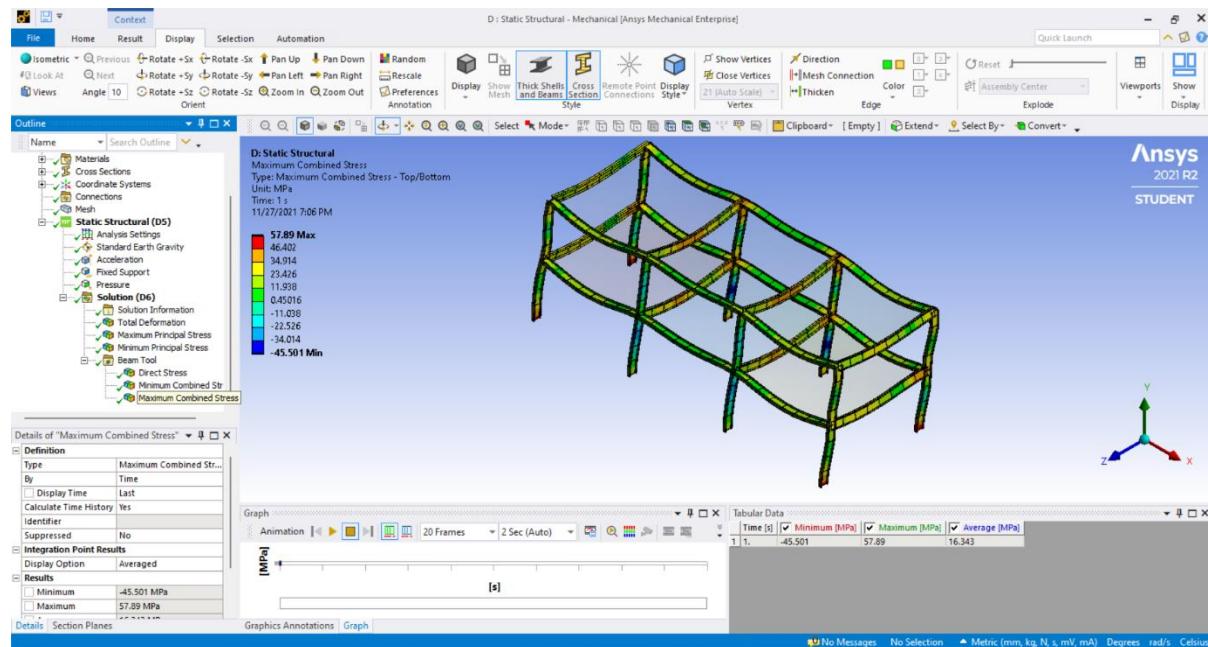
## Direct Stress



## Minimum Combined Stress



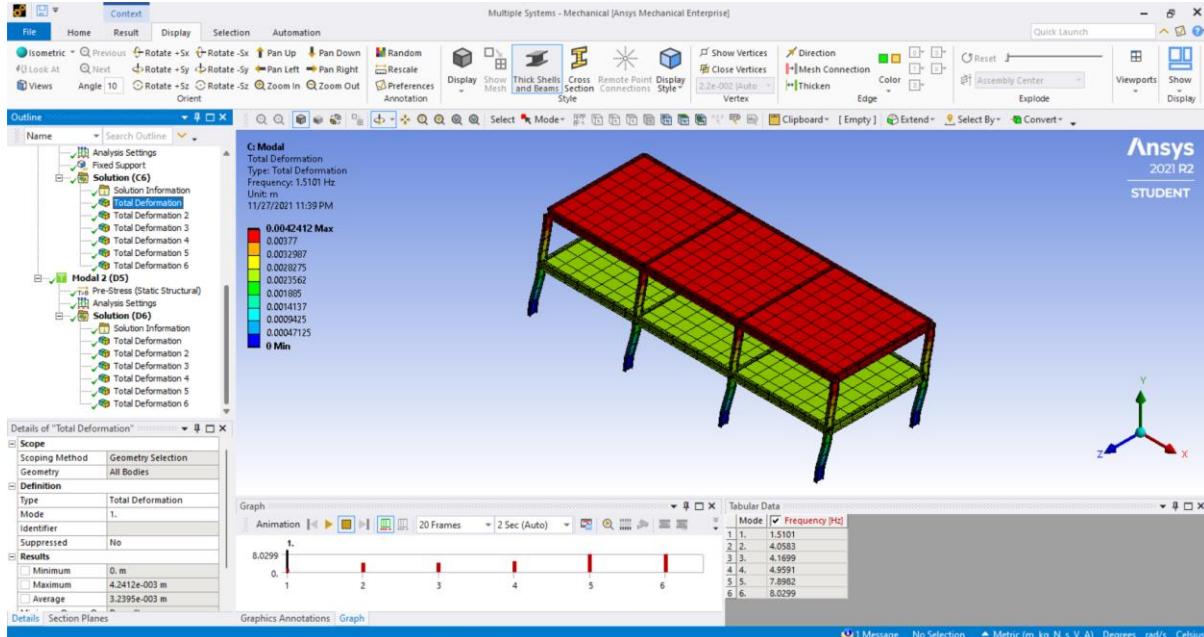
## Maximum Combined Stress



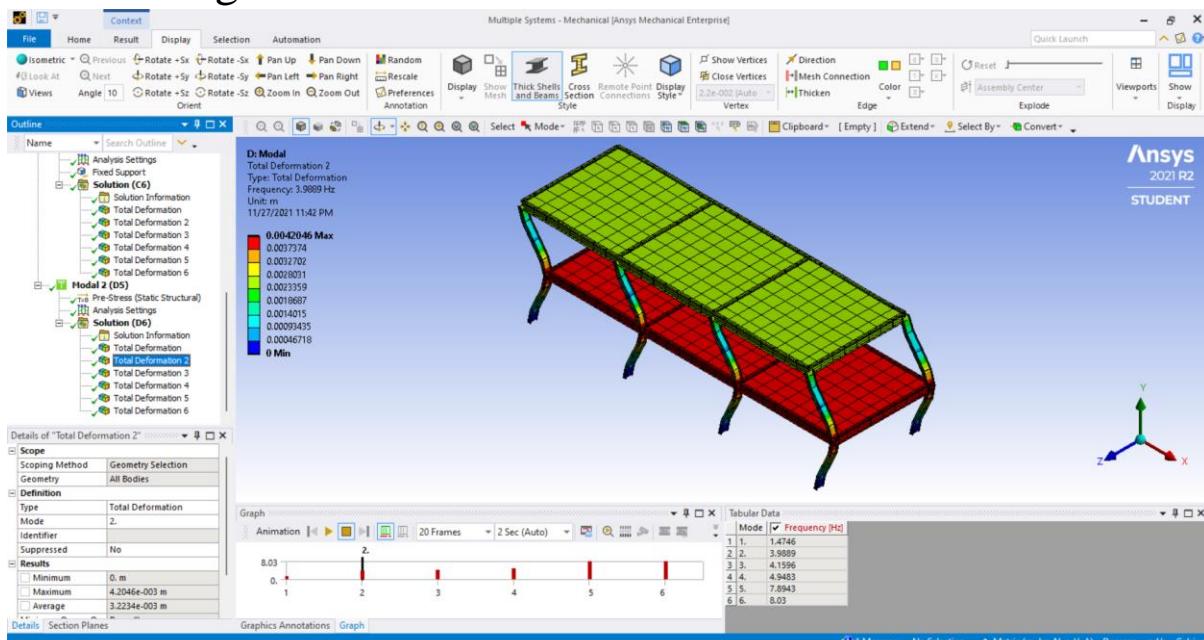
# Lab 6

## Simulation 2

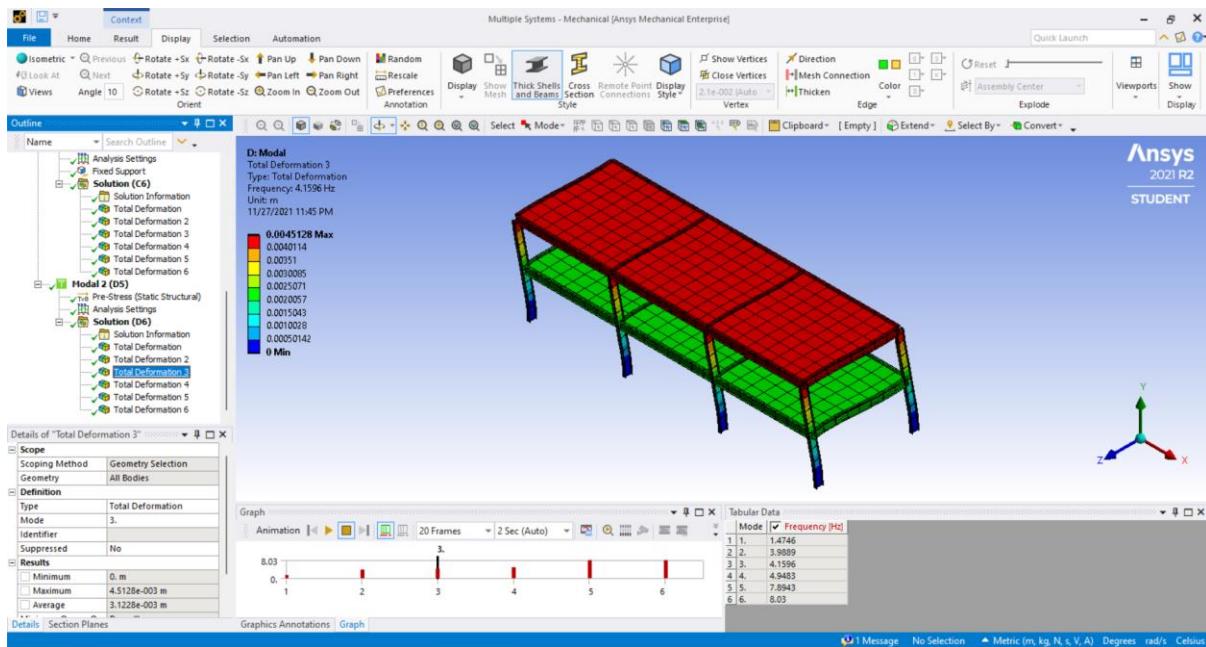
## Model 1 Analysis - 90Degree



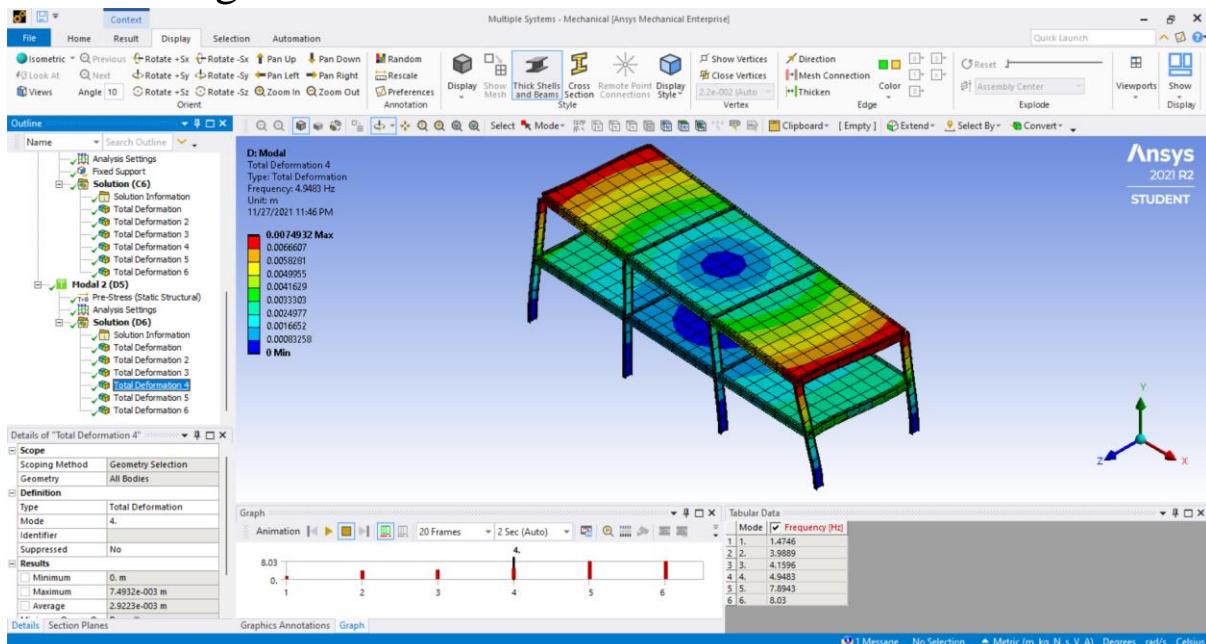
It is moving in X direction



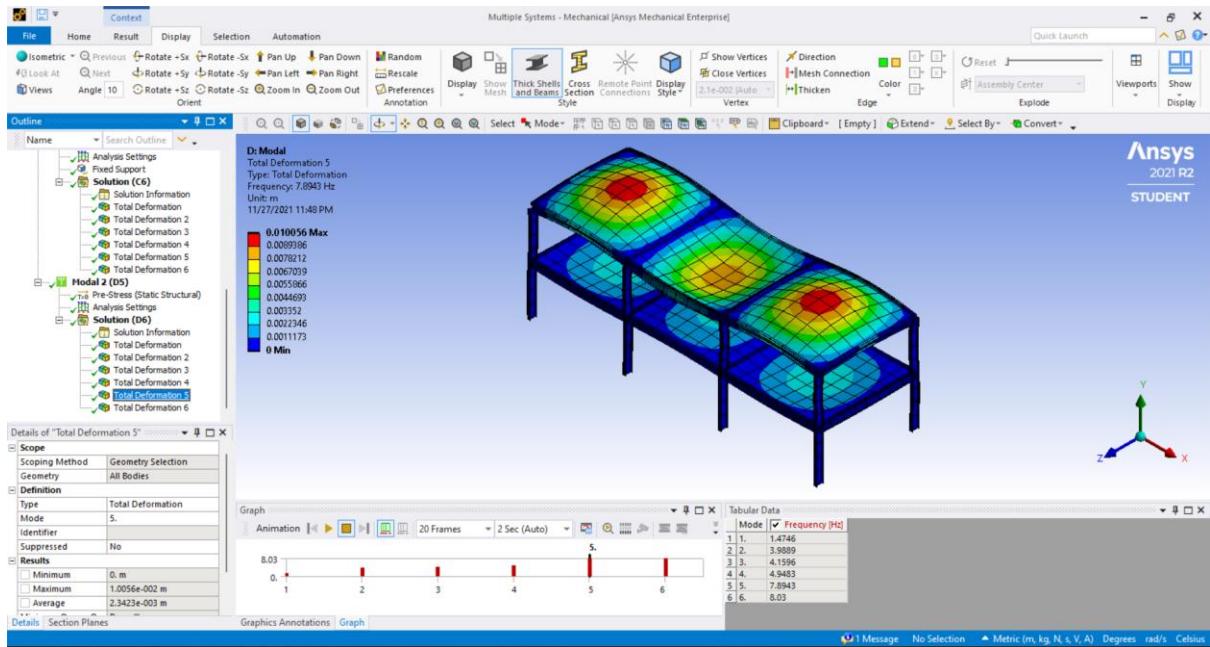
It is moving in X direction



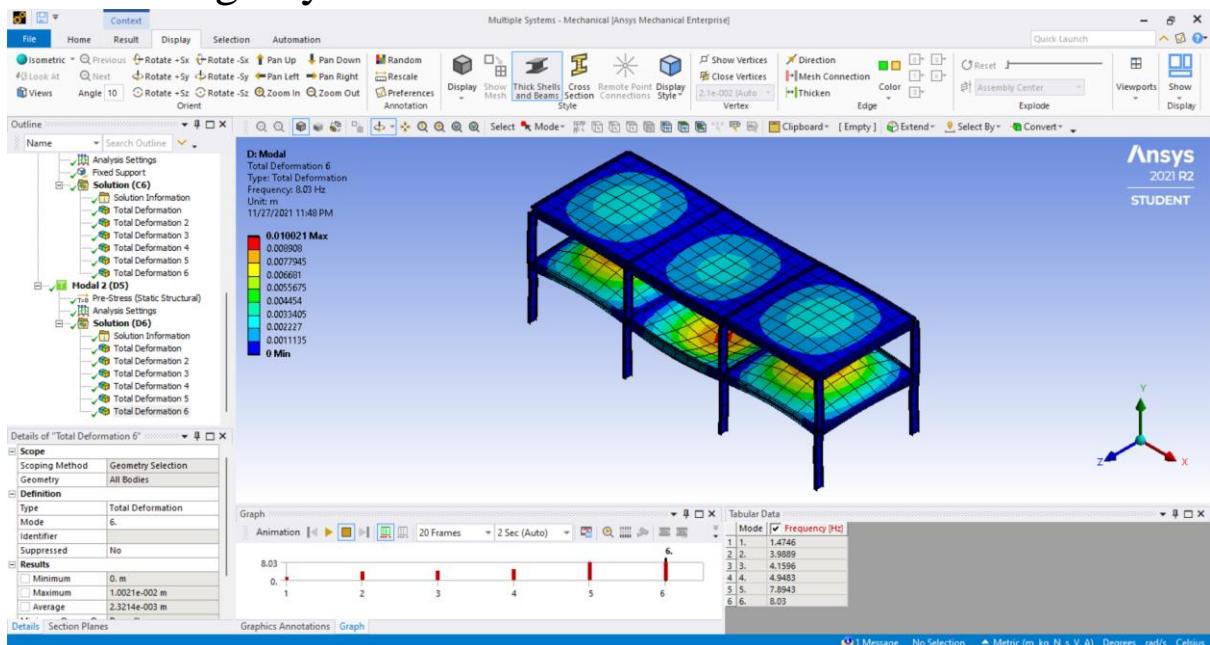
It is moving in Z direction



It twists in x-z direction.

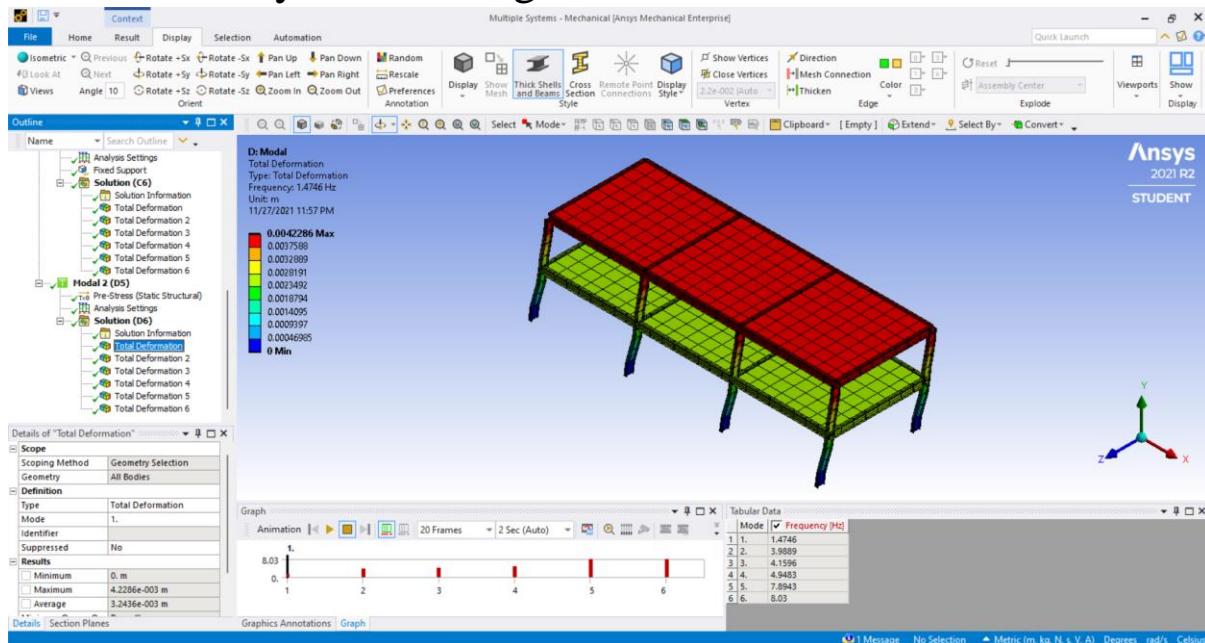


It is moving in y direction.

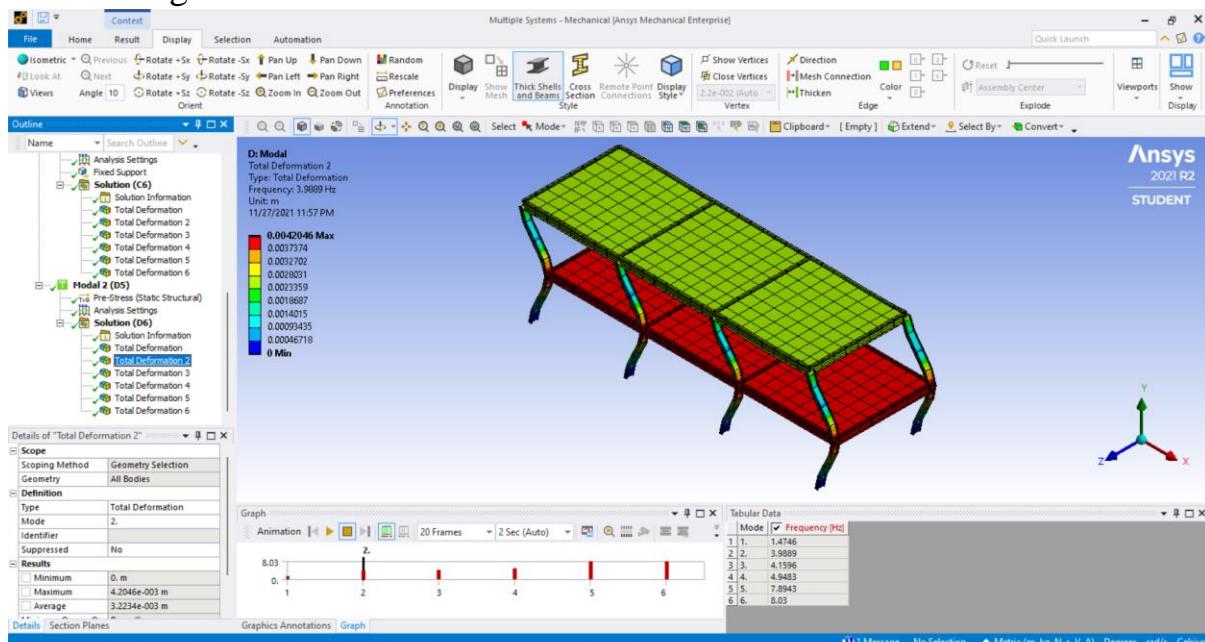


It is moving in y direction.

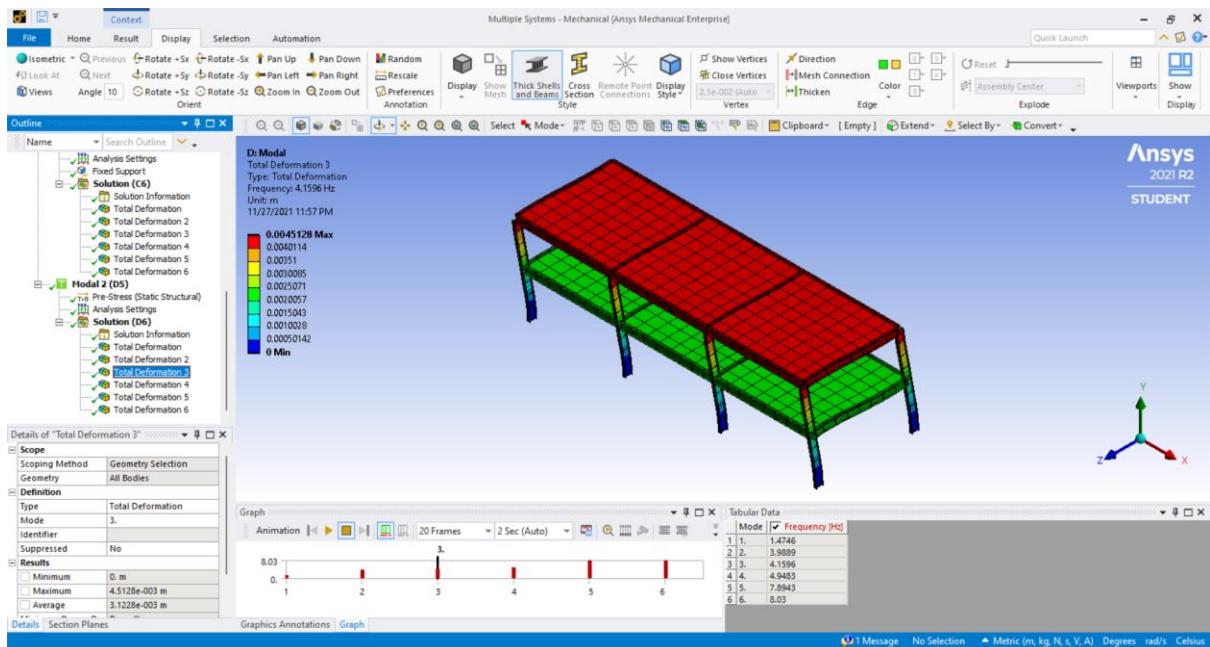
## Model 2 Analysis – 90 Degree



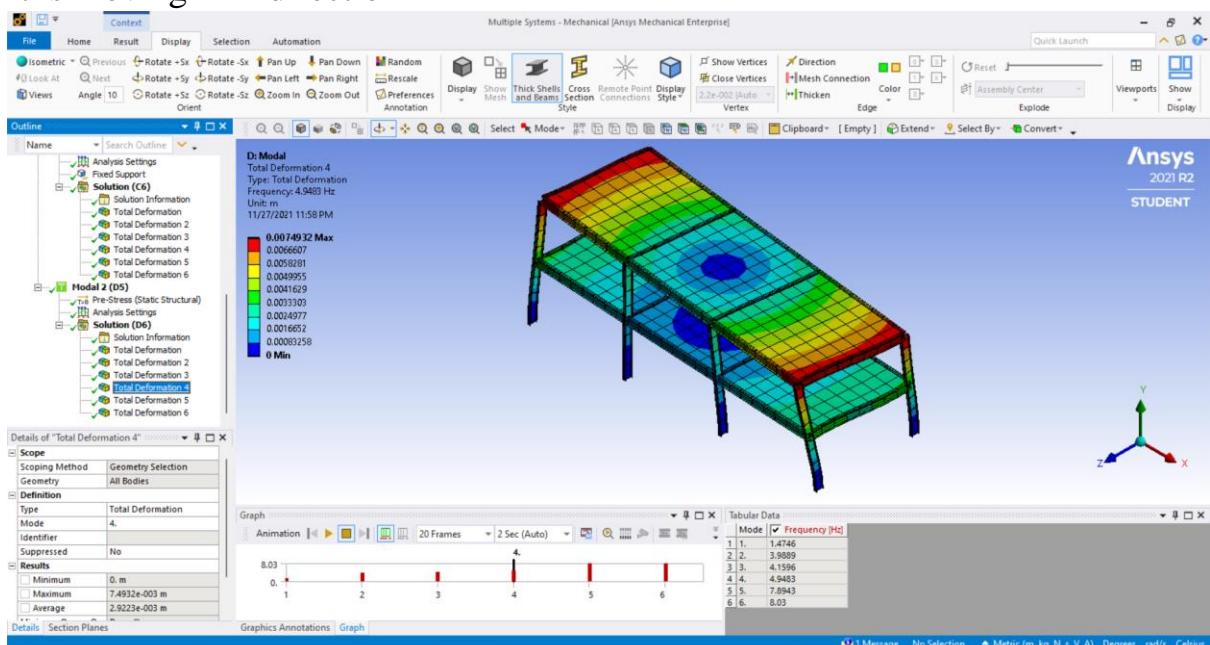
It is moving in X direction.



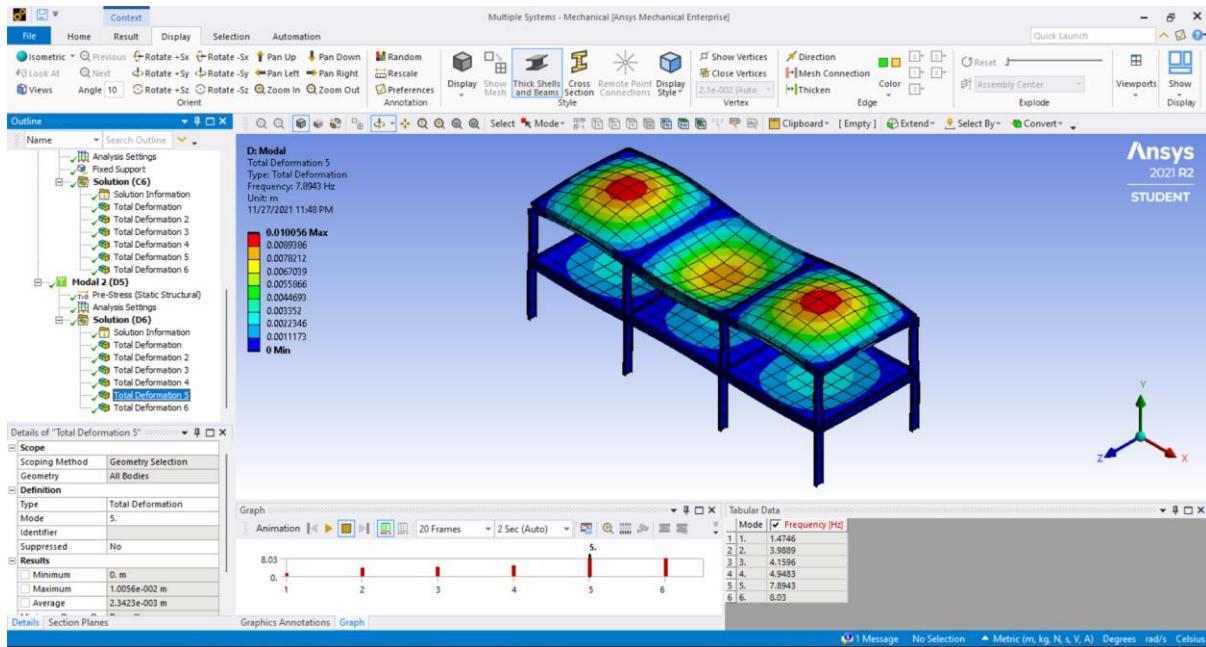
It is moving in X direction.



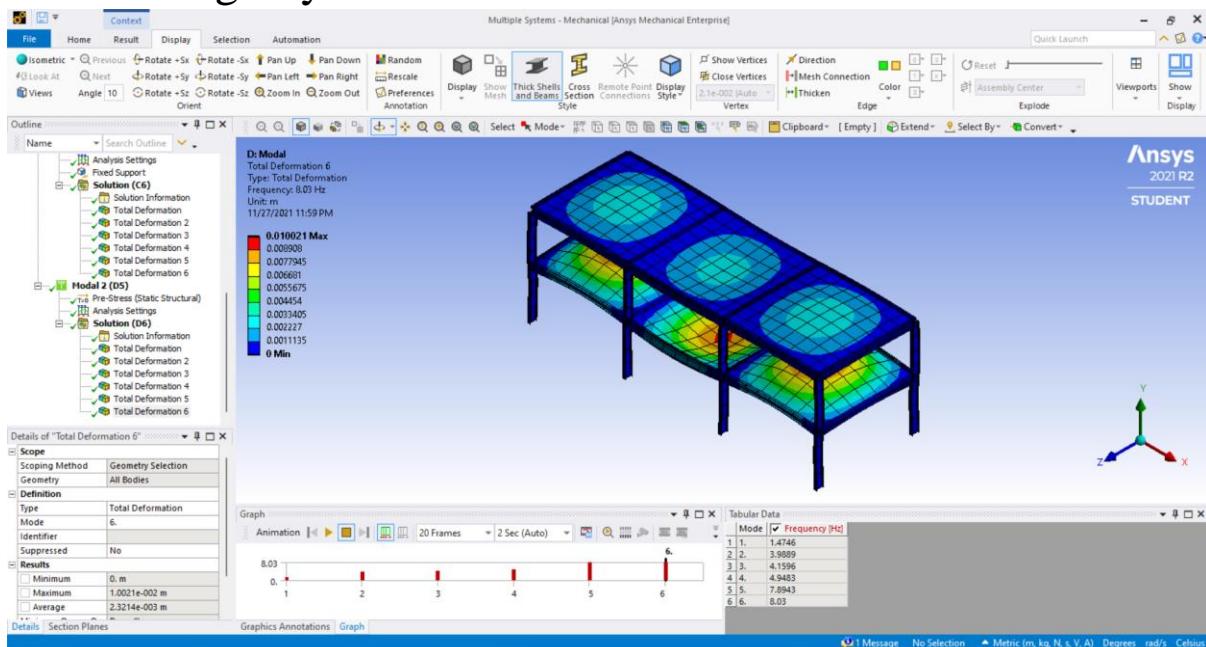
It is moving in Z direction.



It twists in x-z direction.



It is moving in y direction.

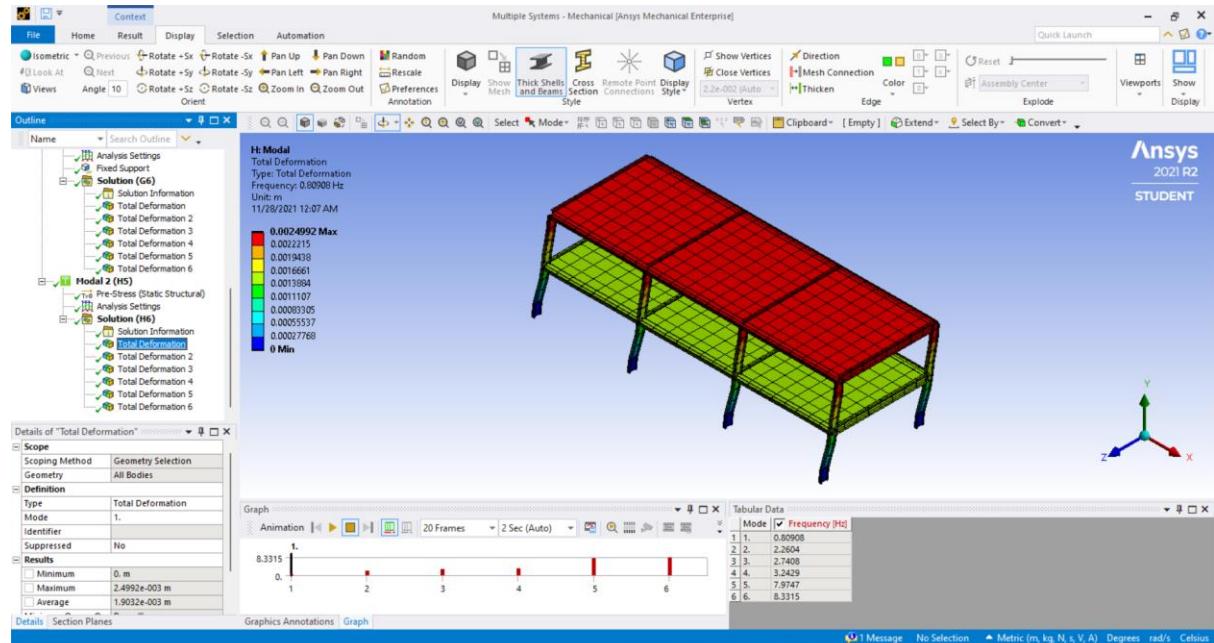


It is moving in y direction.

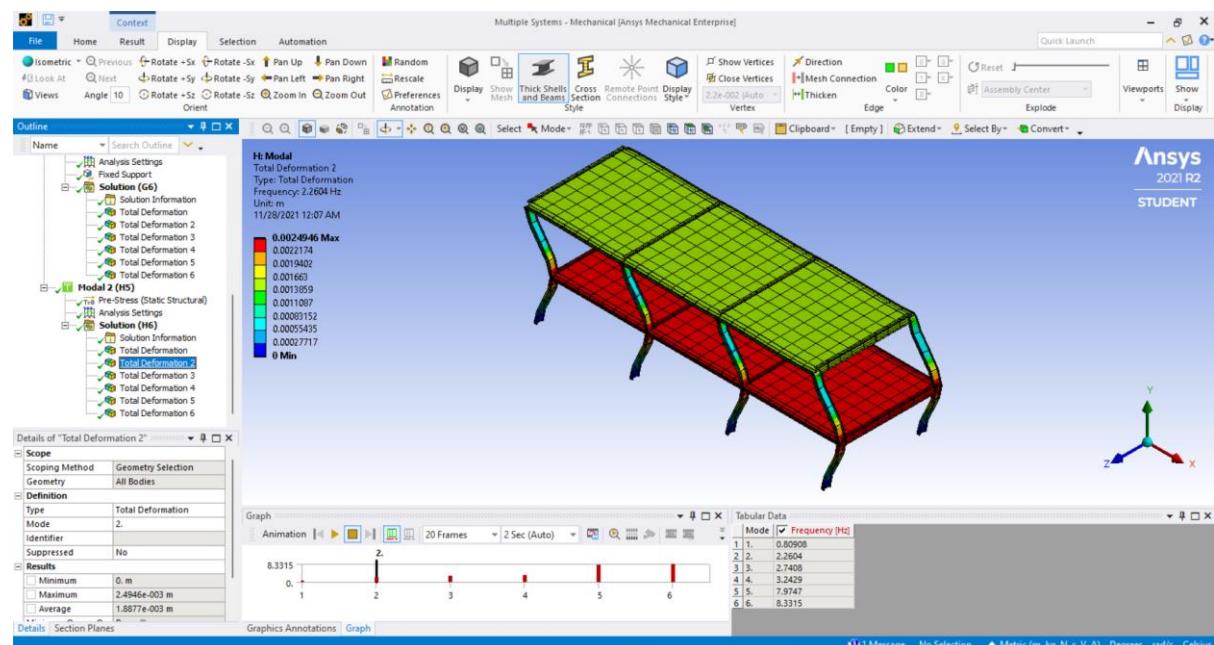
Therefore, the obtained stresses and deformation are well within the limits and the structure is stable and safe

## Simulation 2

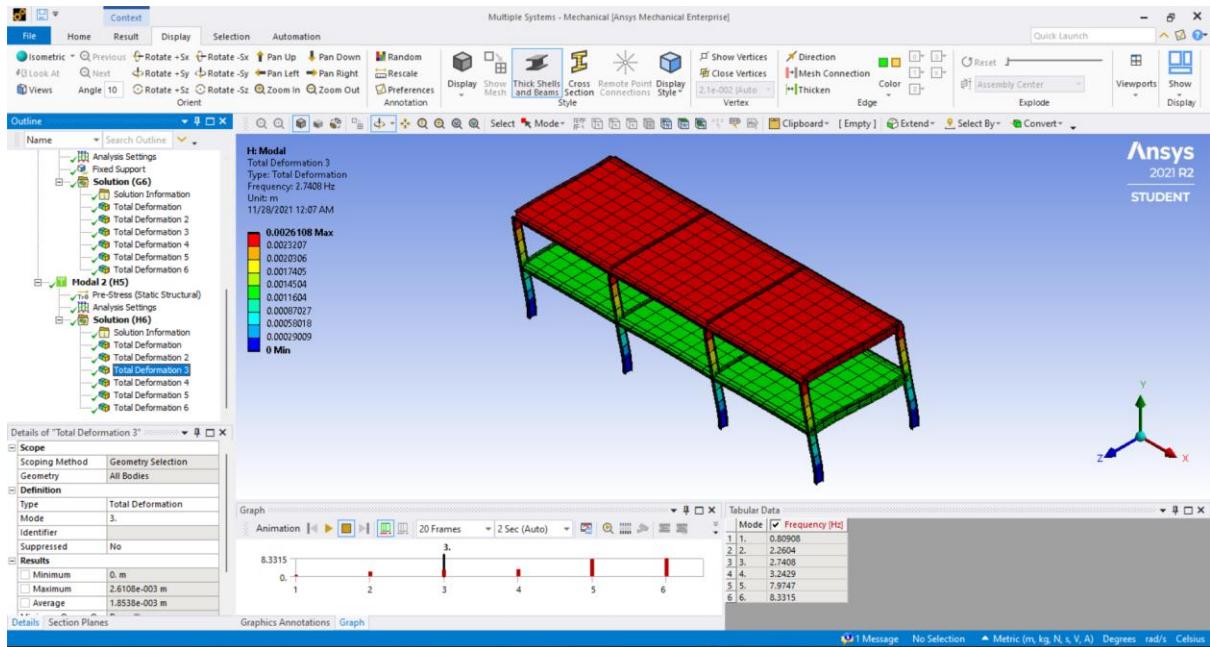
Model analysis 1 – 0 degree



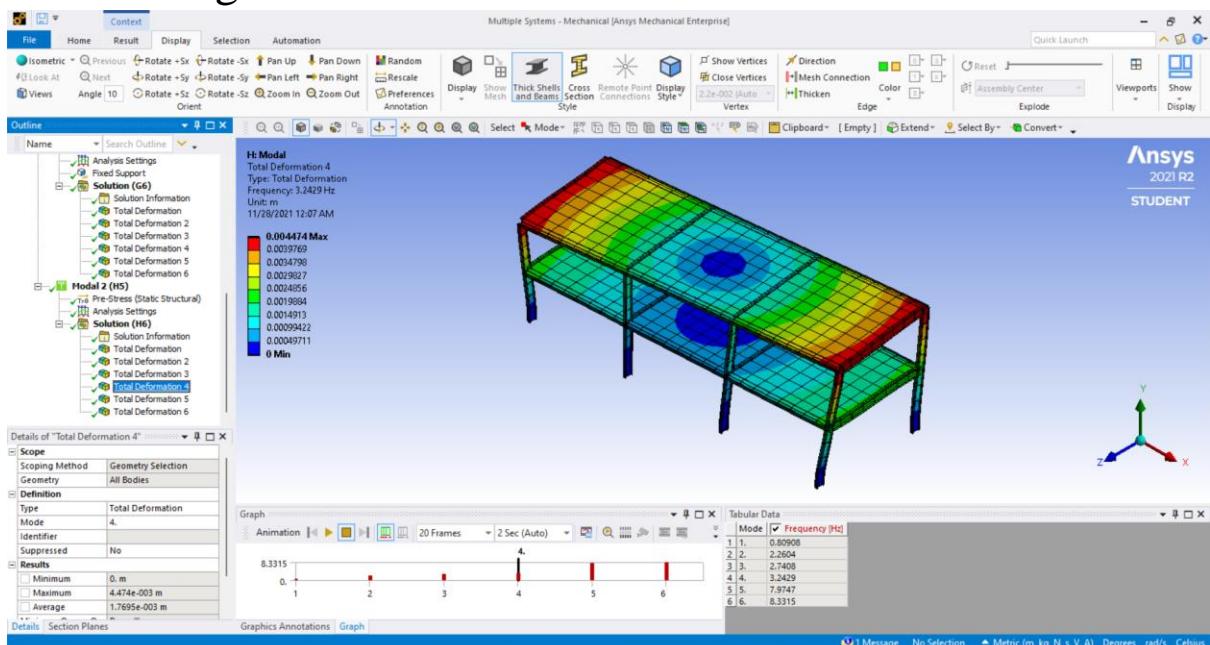
It is moving in X direction.



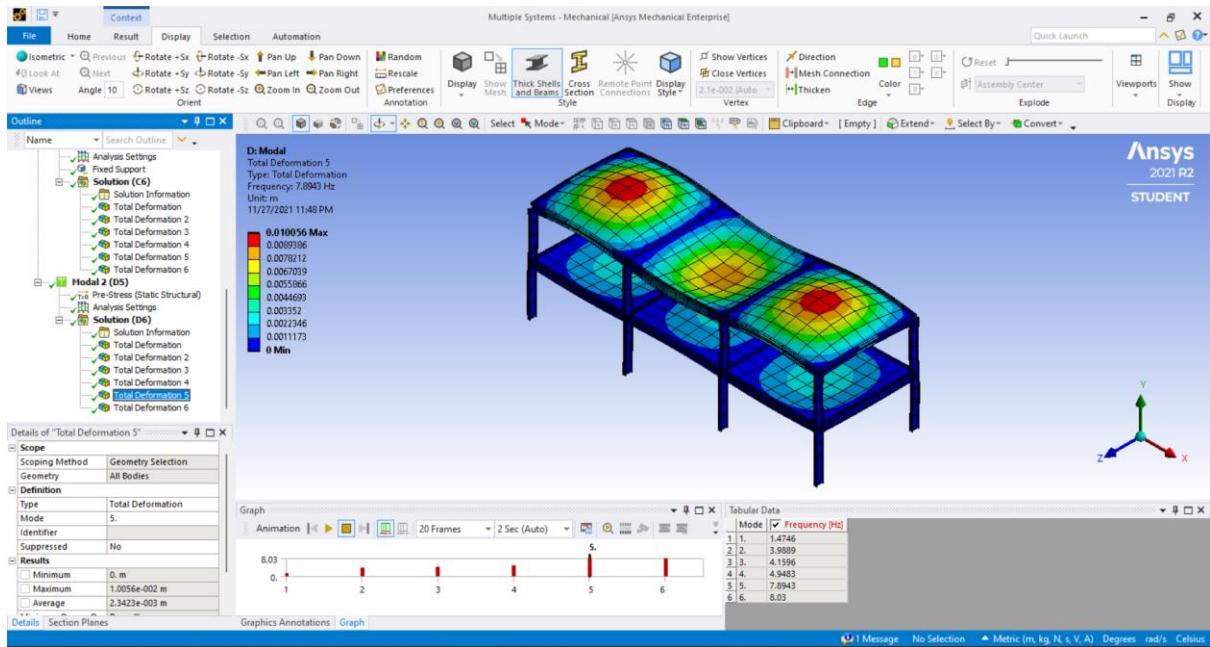
It is moving in X direction.



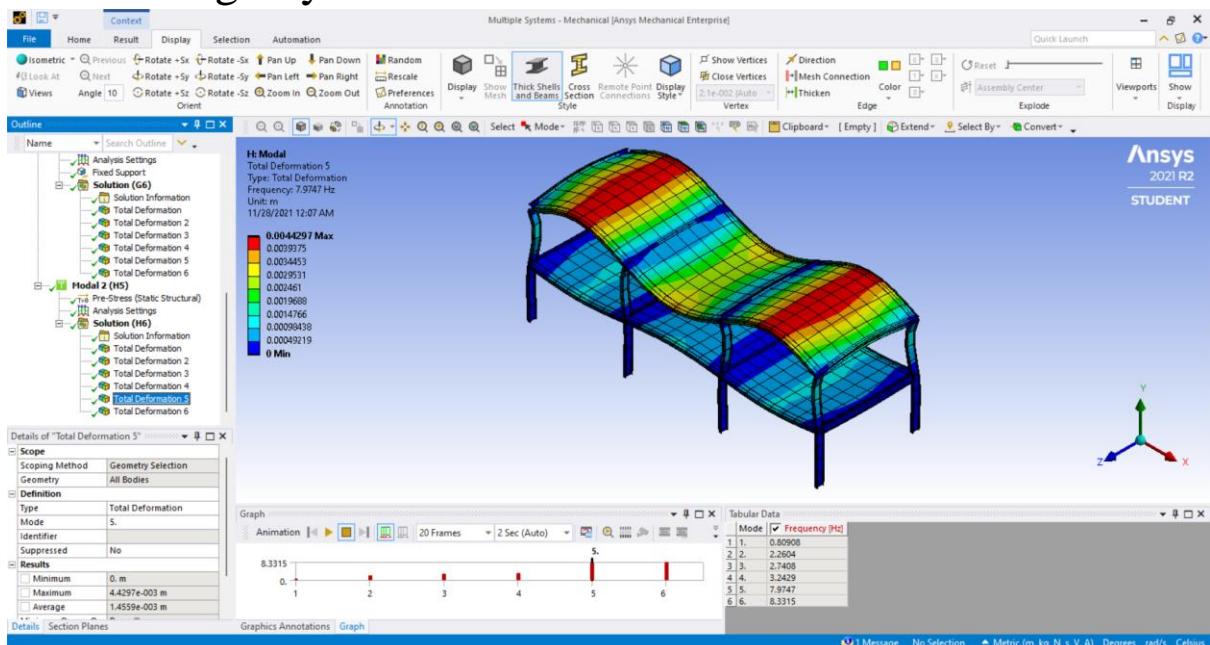
It is moving in Z direction.



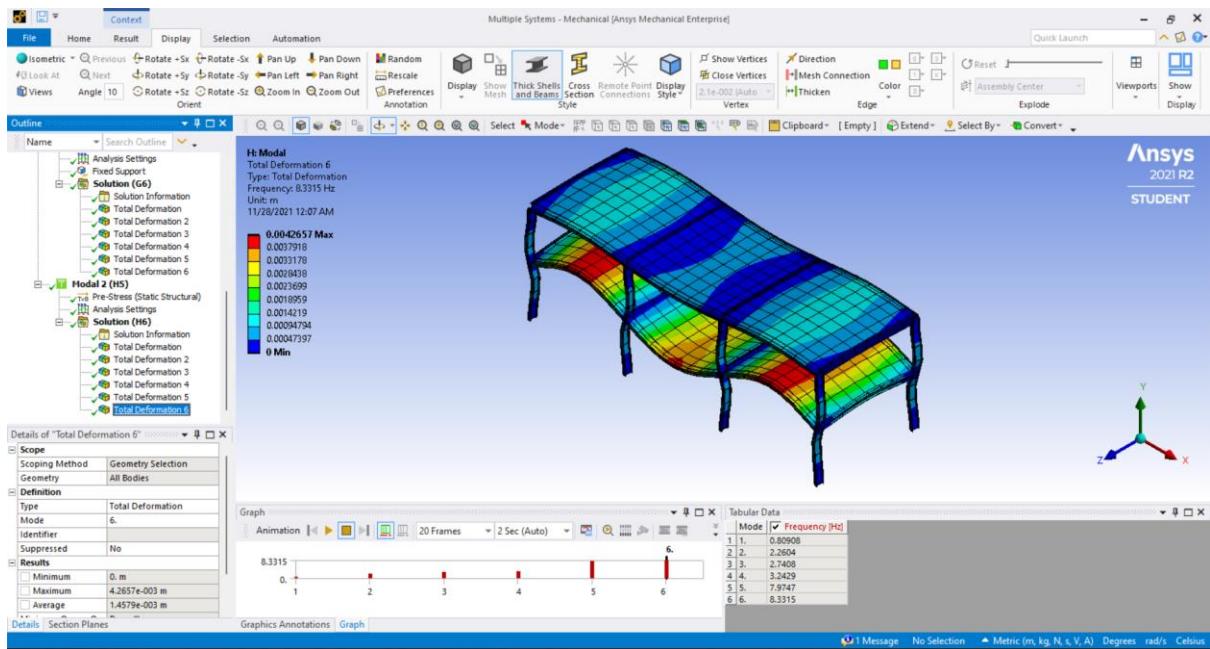
It twists in x-z direction.



It is moving in y direction.

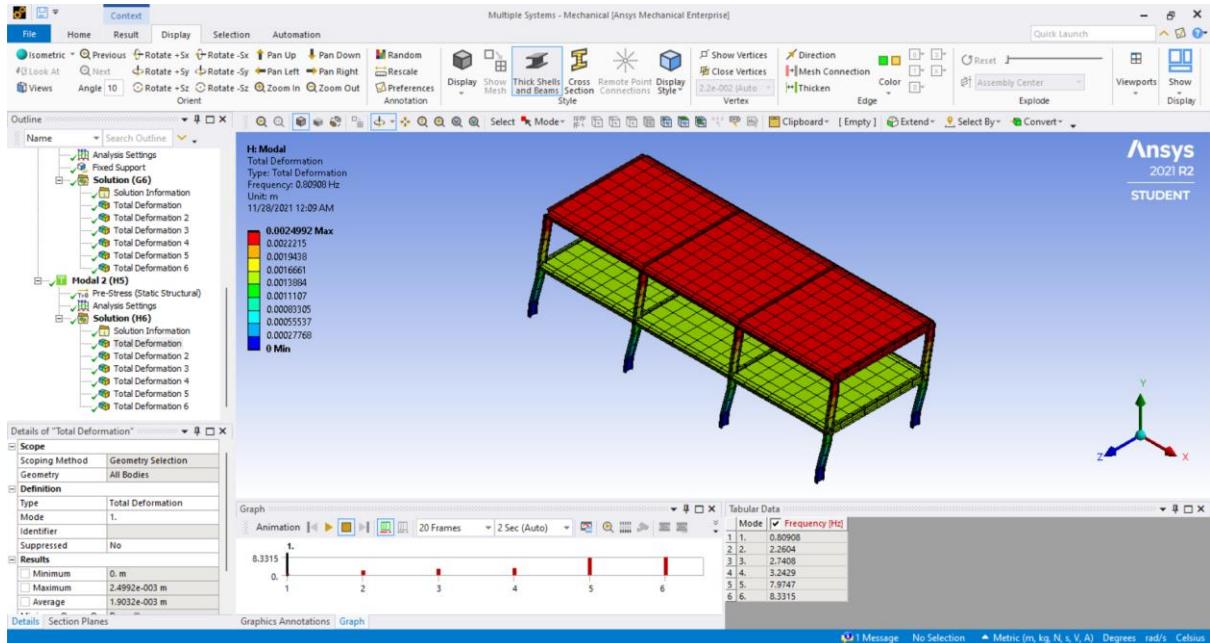


It is moving in y direction.

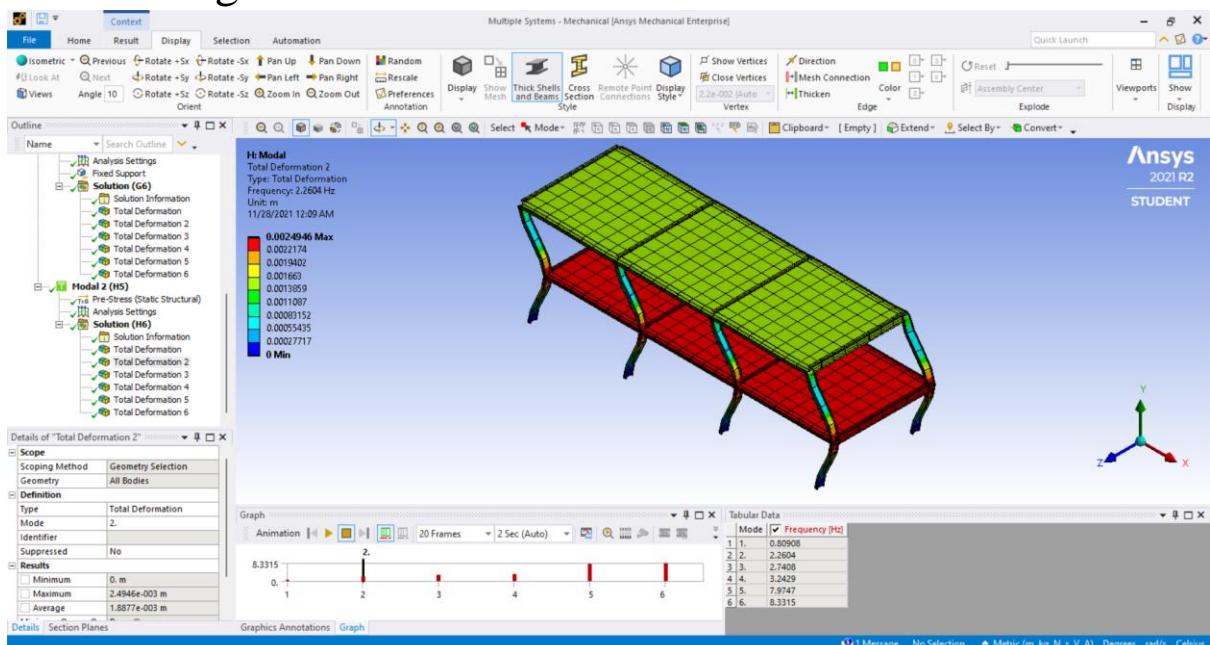


It is moving in y direction.

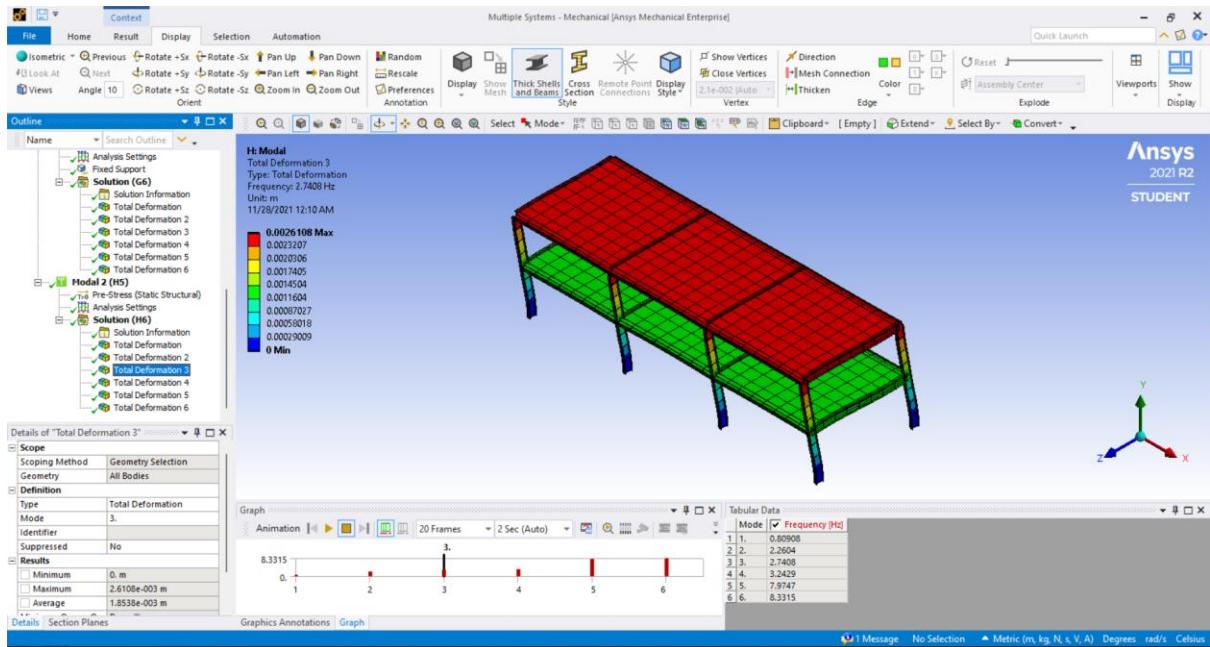
## Model analysis 2 – 0 degree



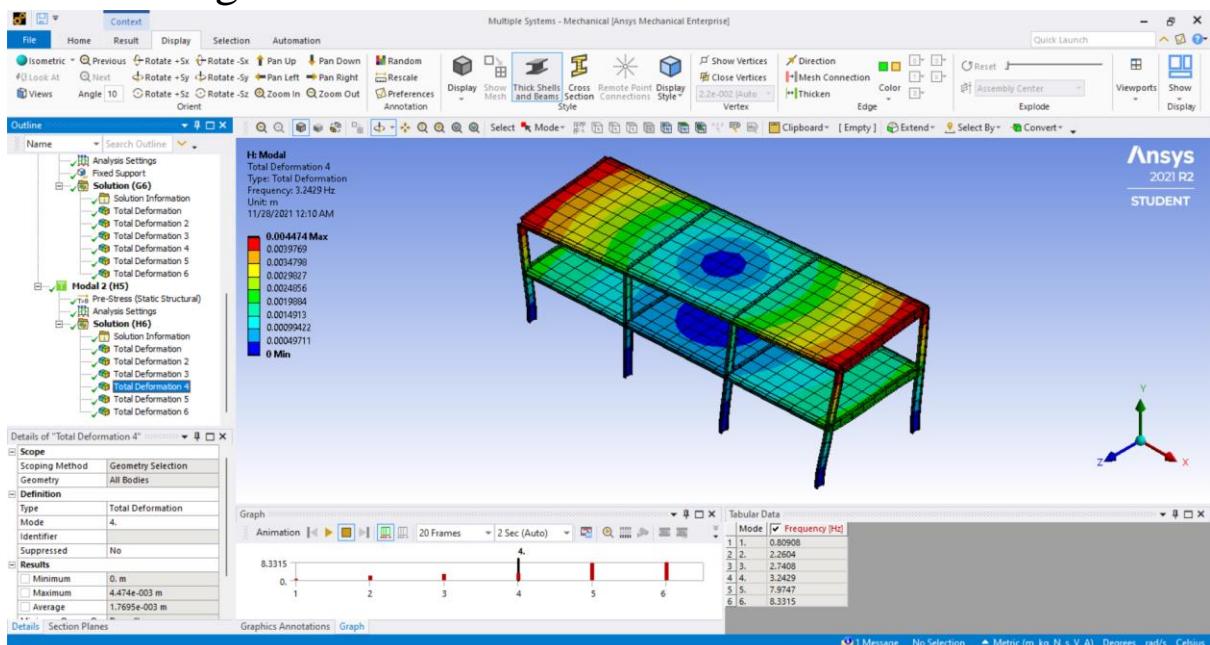
It is moving in x direction.



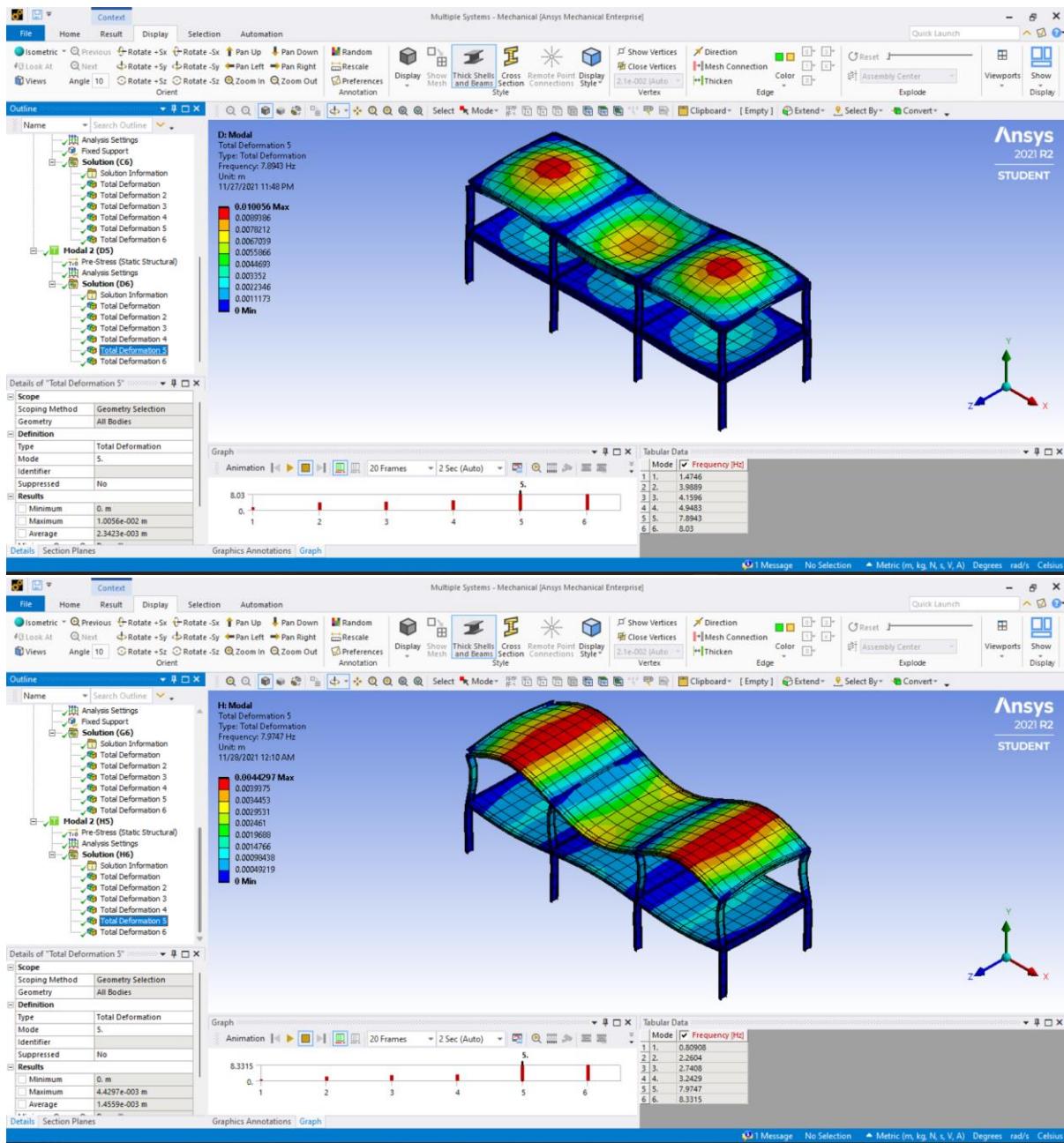
It is moving in x direction.



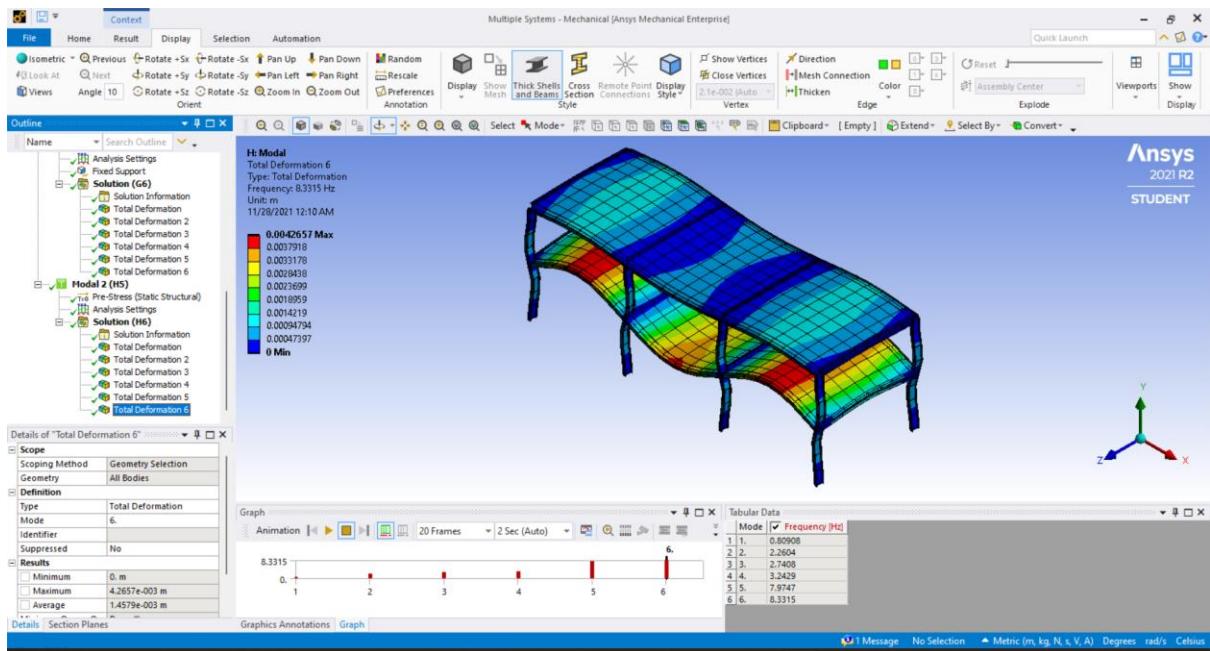
It is moving in z direction.



It twists in x-z direction.



It is moving in y direction.

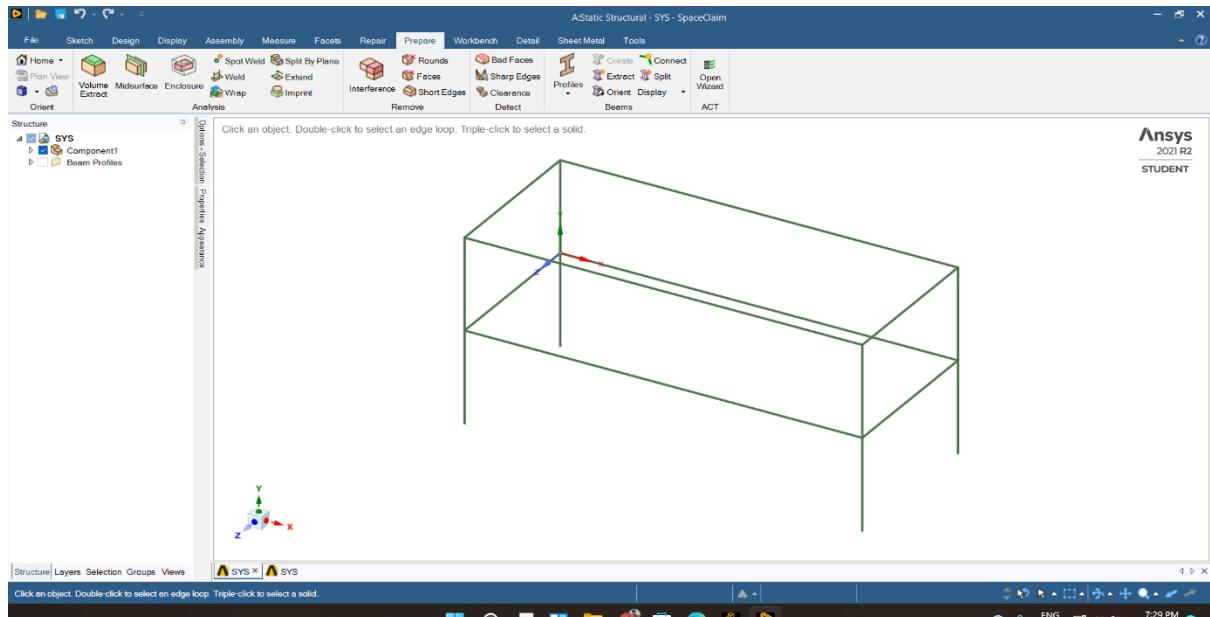


It is moving in y direction.

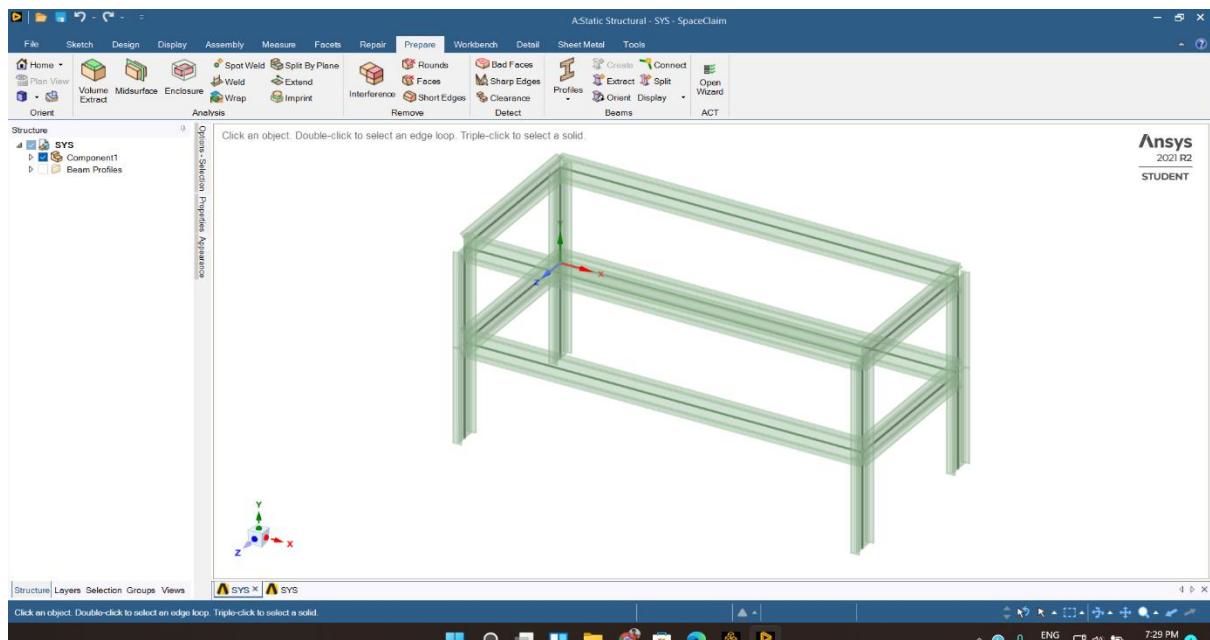
# Home Assignment

Model the frame structure.

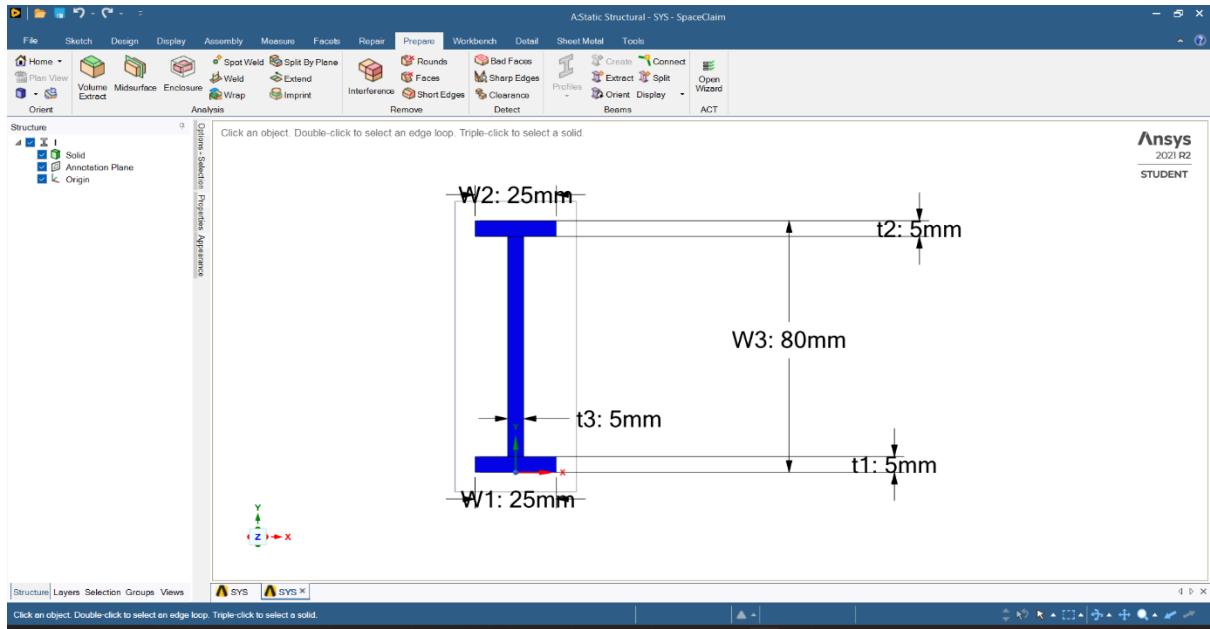
Wire beams



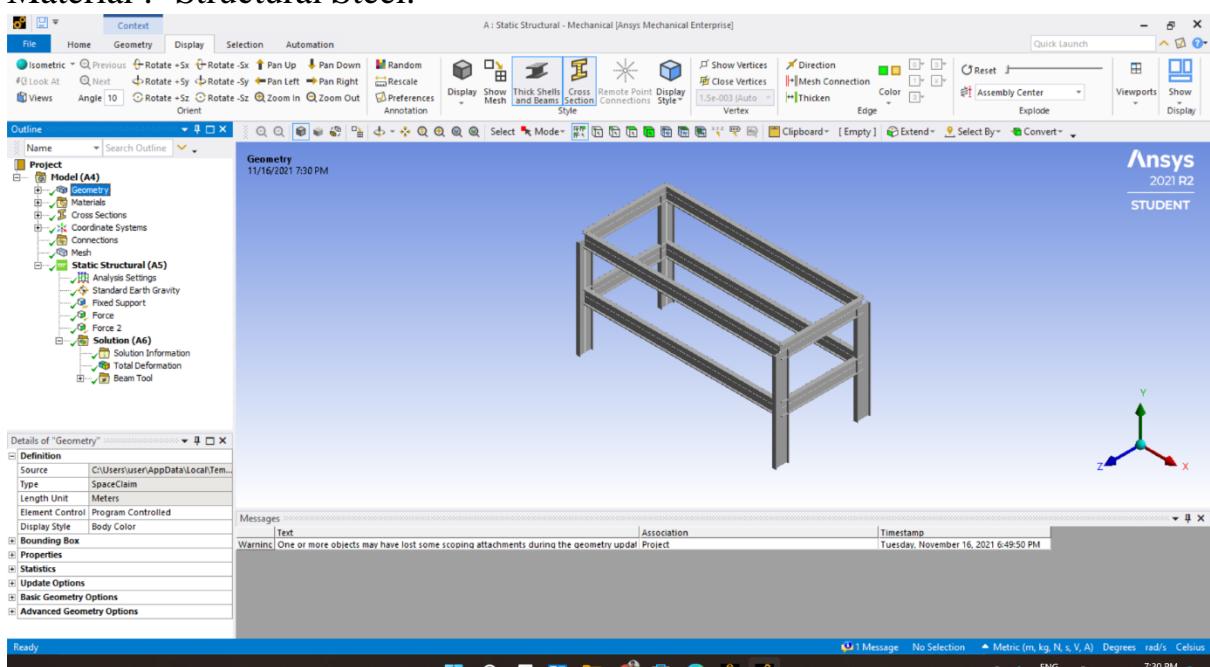
Solid beams



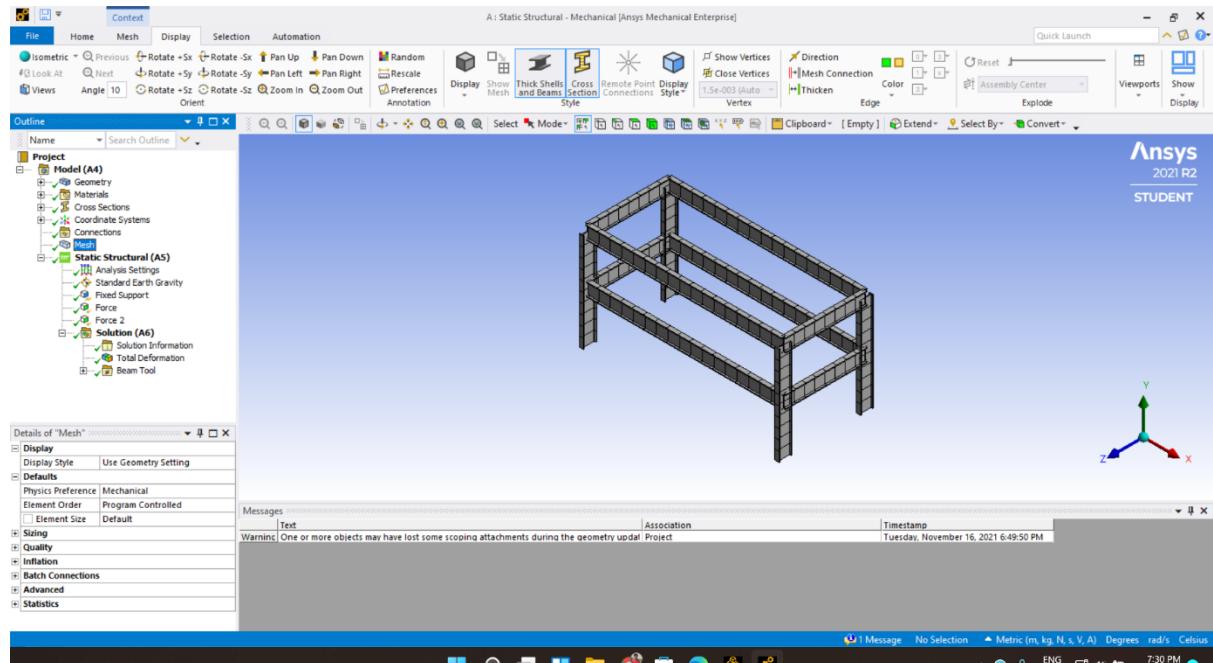
# I Section beam



Material :- Structural Steel.



## MESH

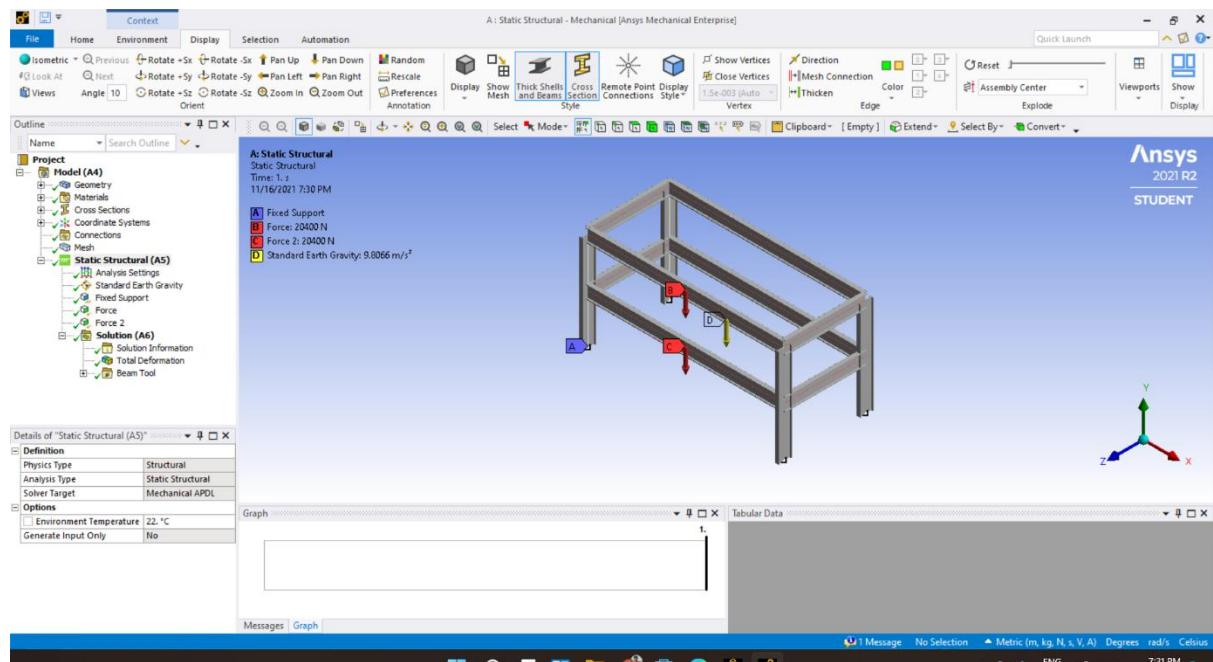


I have applied fixed support too base four beams for ground the Frame

The force for the beam is  $6000 \times 3.4 = 22400\text{N}$  for each floor.

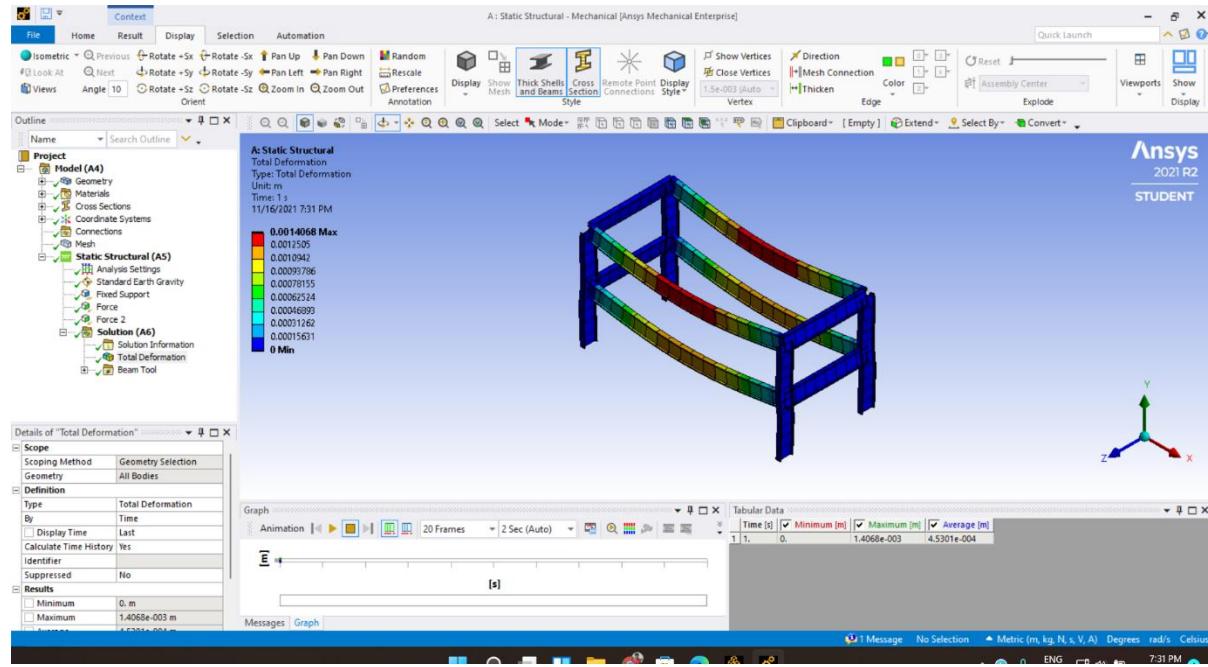
Perimeter of Rectangle =  $2(L+B) = 2(1.2+0.5) = 3.4$ .

I have applied Standard Earth gravity.



The Total Deformation of the Frame is 0.0014068max.

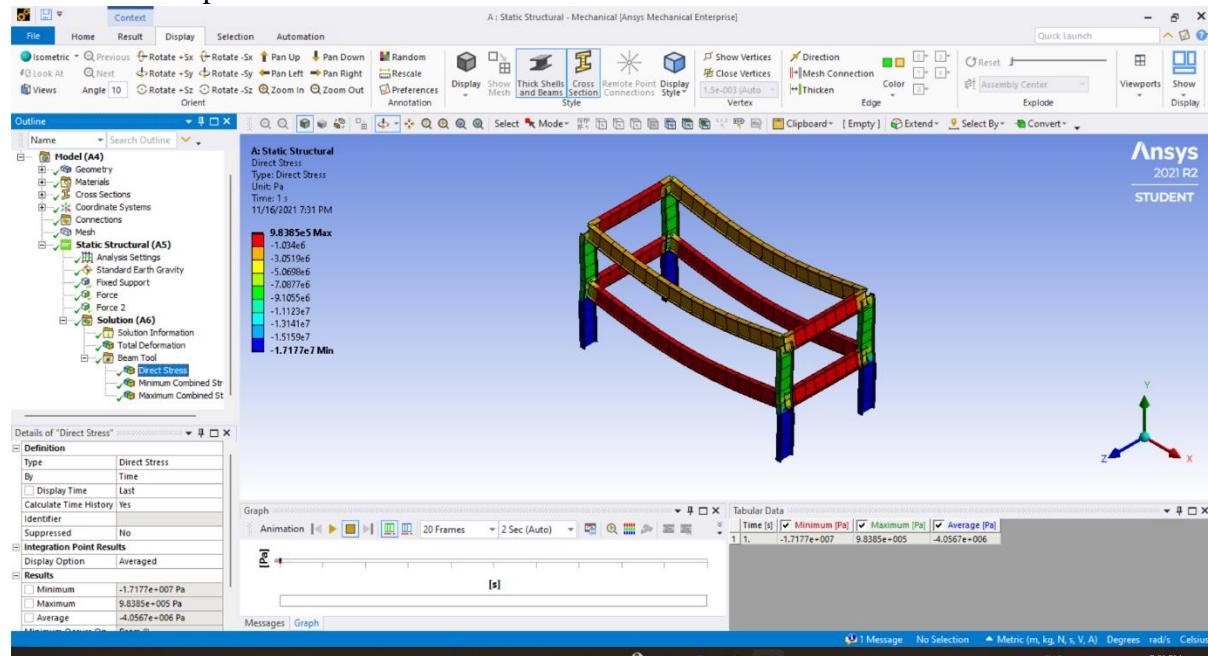
The Deformation is occurring at y axis and centre of the beam it is becoming high. Only on the length of the frame the force is getting deformation. The blue part has no change.



## Direct Stress

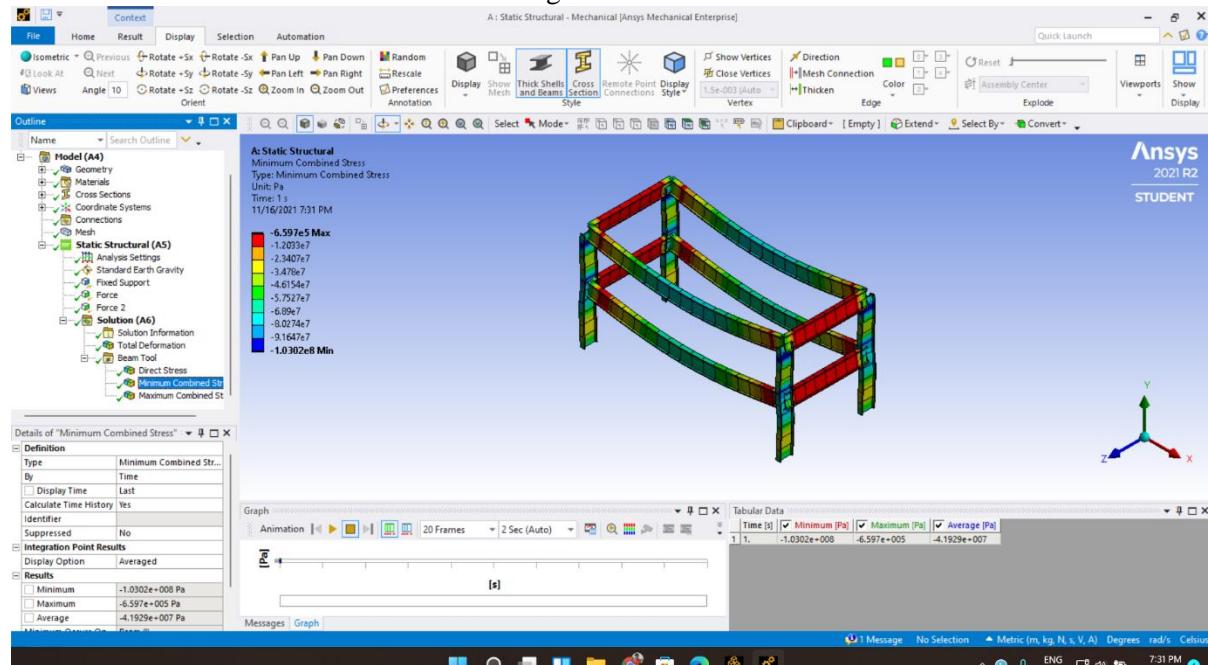
The Direct stress is high at breadth and next length and the base part is less.

The stress component due to the axial load encountered in a beam element is 9.838 max



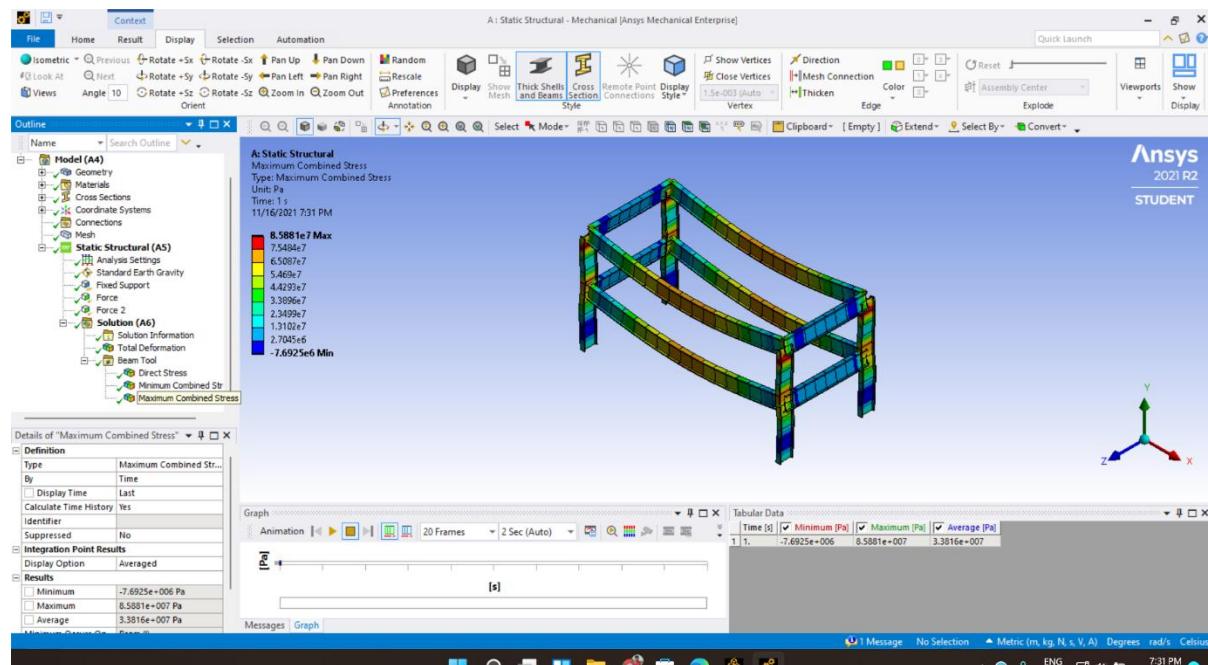
The maximum Minimum combined stress is at breadth -6.59 max

The linear combination of the Direct Stress and the Minimum Bending Stress. The linear combination of the Direct Stress and the Minimum Bending Stress.



The maximum combined stress is 8.588max.

The linear combination of the Direct Stress and the Maximum Bending Stress.



From the above stimulation: -

The tensile strength of structural steel is 400 MPa

Therefore, the obtained stresses and deformation are well within the limits and the structure is stable and safe

**THANK YOU**