Soaring Against The Odds

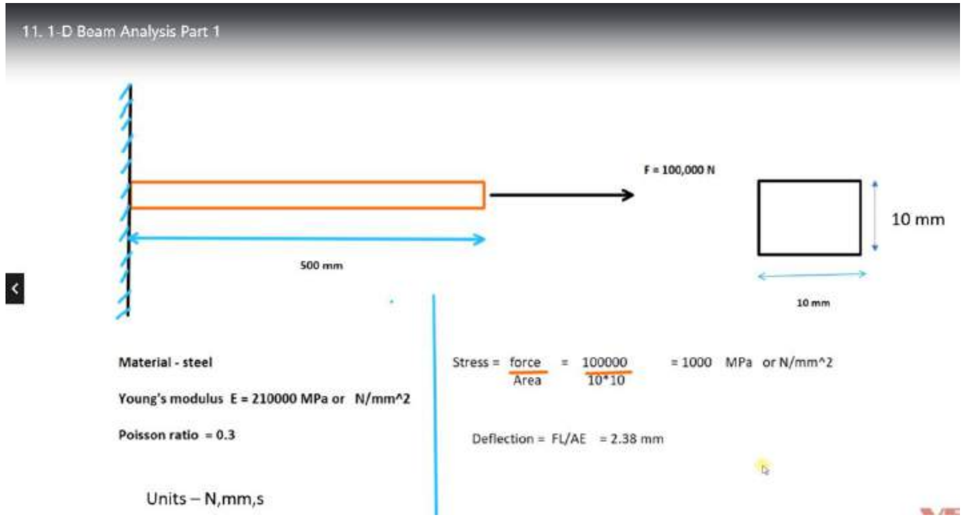
Modelling and Simulation Portfolio

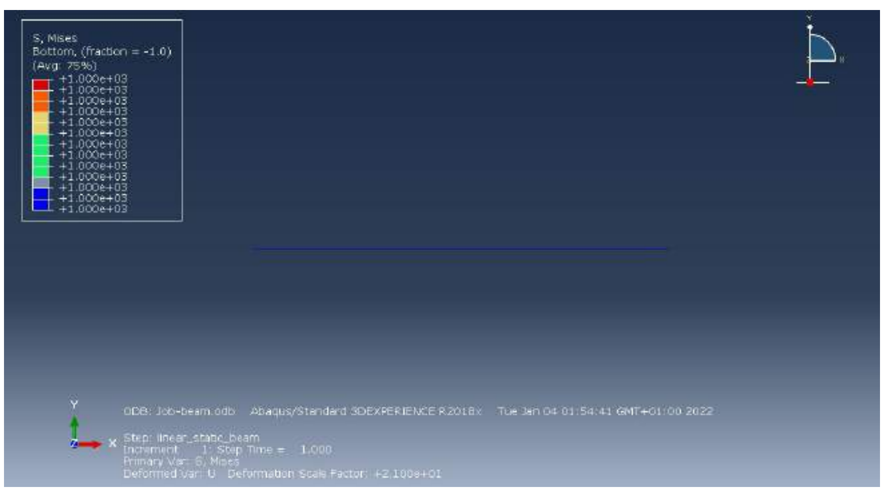
With Abaqus & Ansys

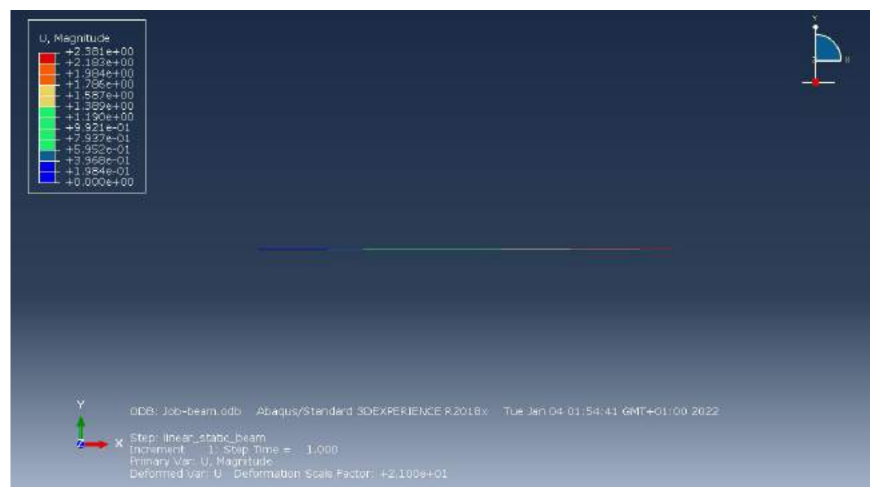
Ajibuwa O. A

Linear Analysis

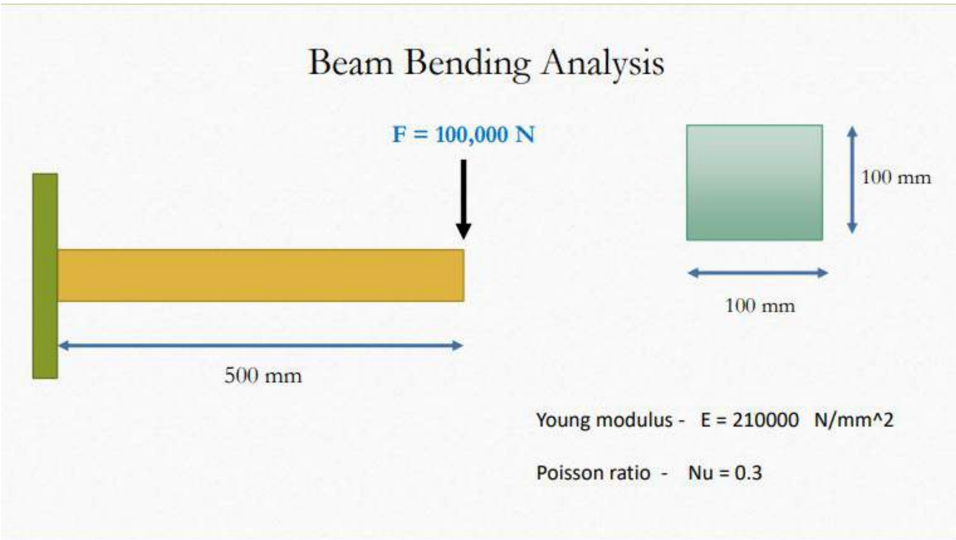
1-D Beam Analysis





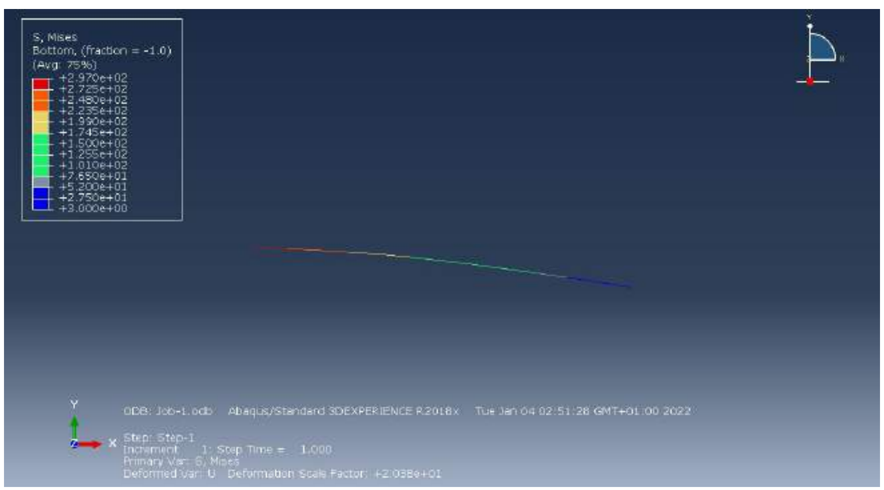


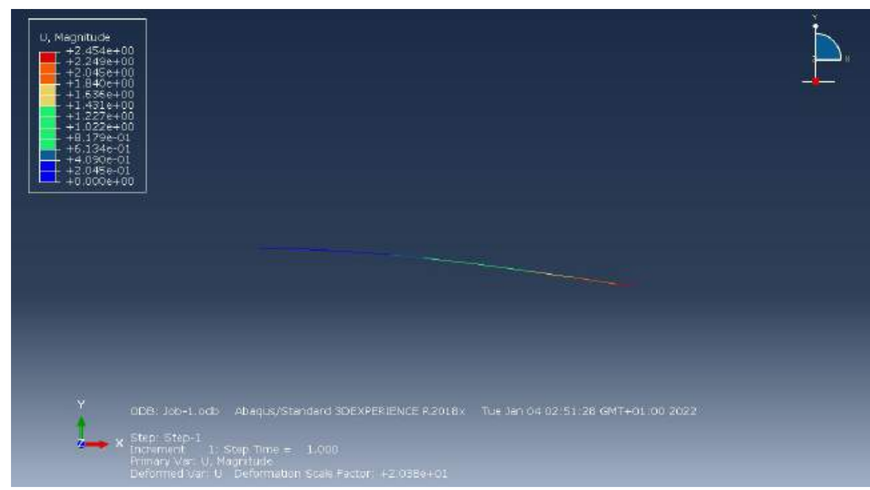
1-D Beam Analysis Assignment



- Stress = MY/I
- Moment = PL/4
- Moment of inertia about neutral Axis I = bd3 /12
- F = 100000 N
- L = 500 mm
- b = 100 mm
- d = 100 mm
- Y = d/2

- Stress = 300 N/mm^2
- Deflection = FL3 /3EI = 2.4 mm

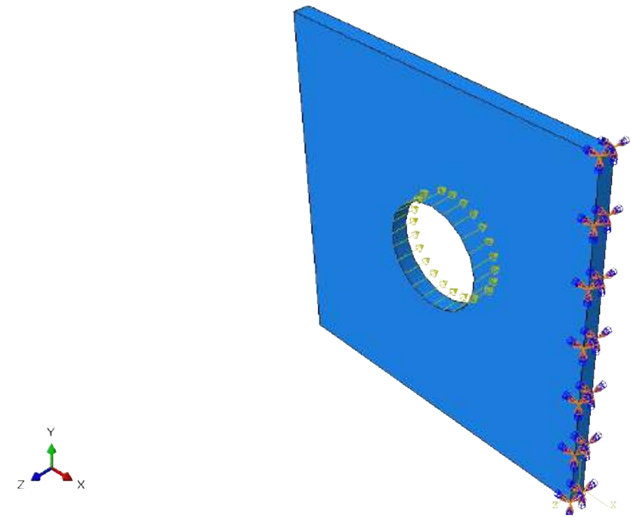


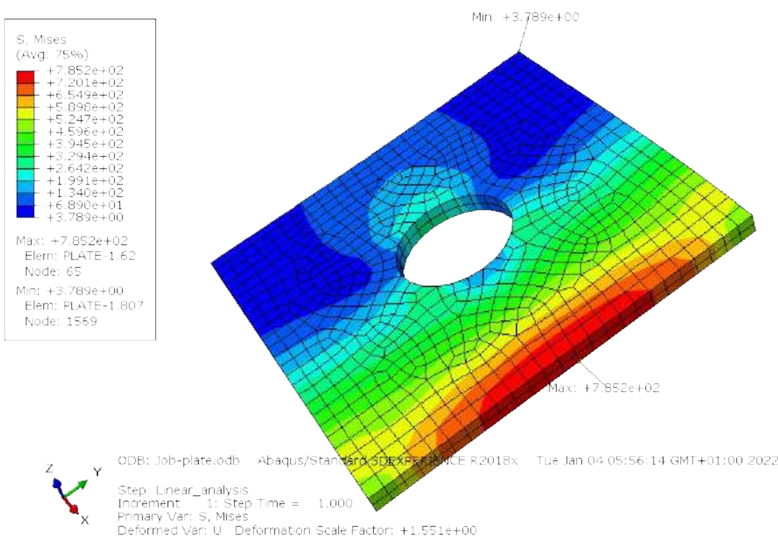


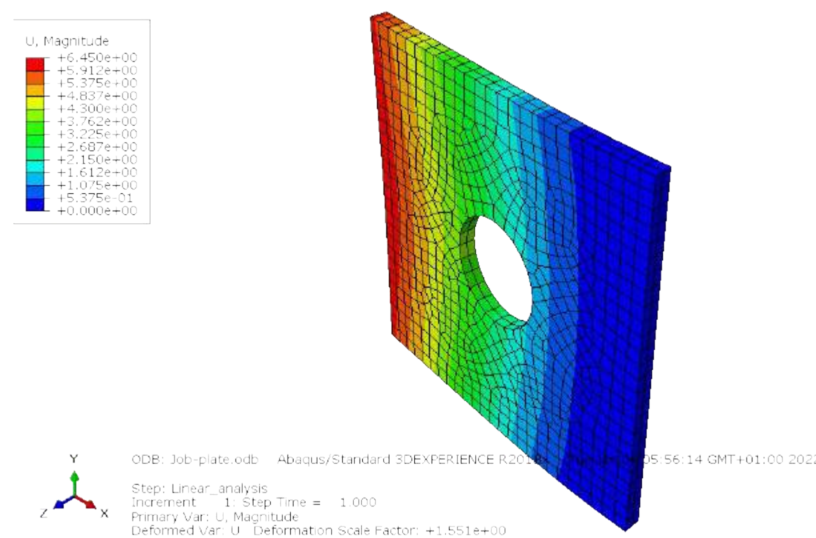
Linear Static Analysis

- Find out stress distribution
- Maximum deflection due to load

- Material = Steel
- F = 10000 N
- depth = 5 mm
- l = 100 mm
- b = 100 mm
- diameter = 30mm



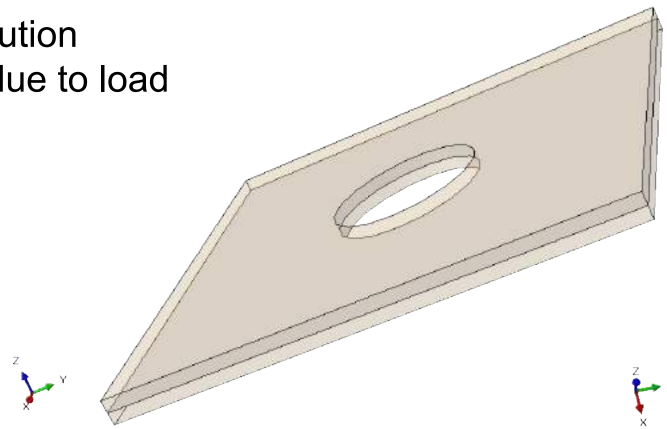


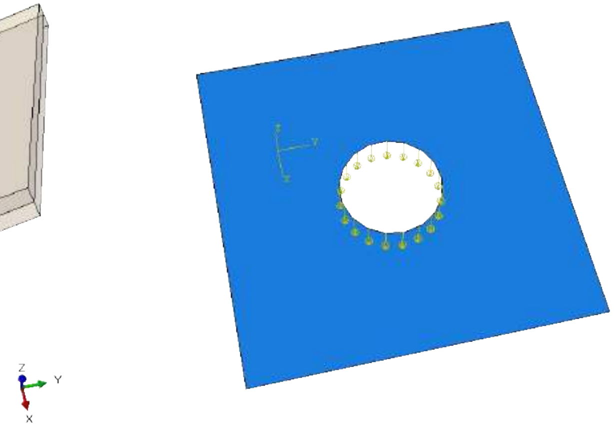


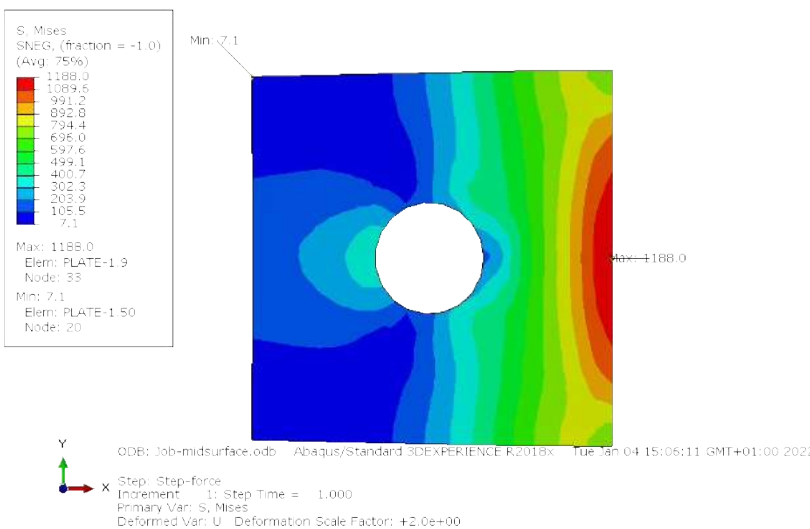
Mid-Surfacing Analysis

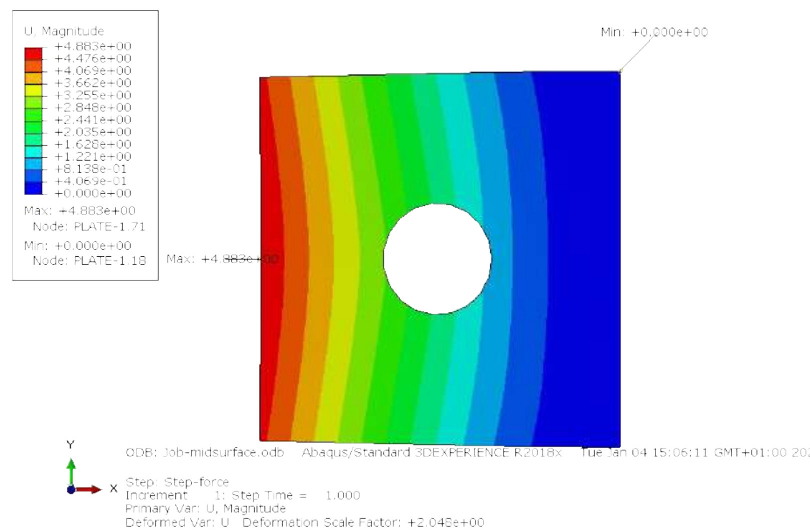
- Find out stress distribution
- Maximum deflection due to load

- Material = Steel
- F = 10000 N
- depth = 5 mm
- l = 100 mm
- b = 100 mm
- diameter = 30mm





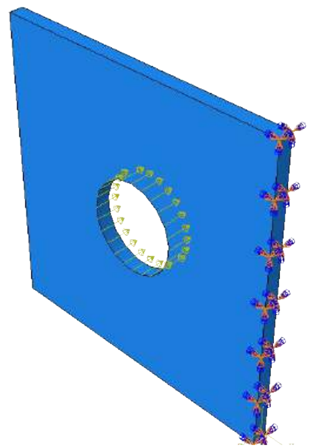


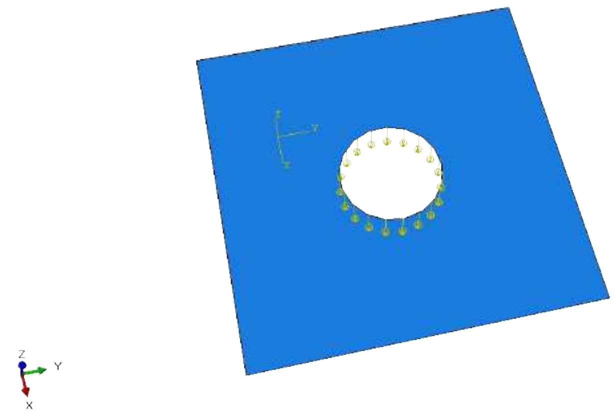


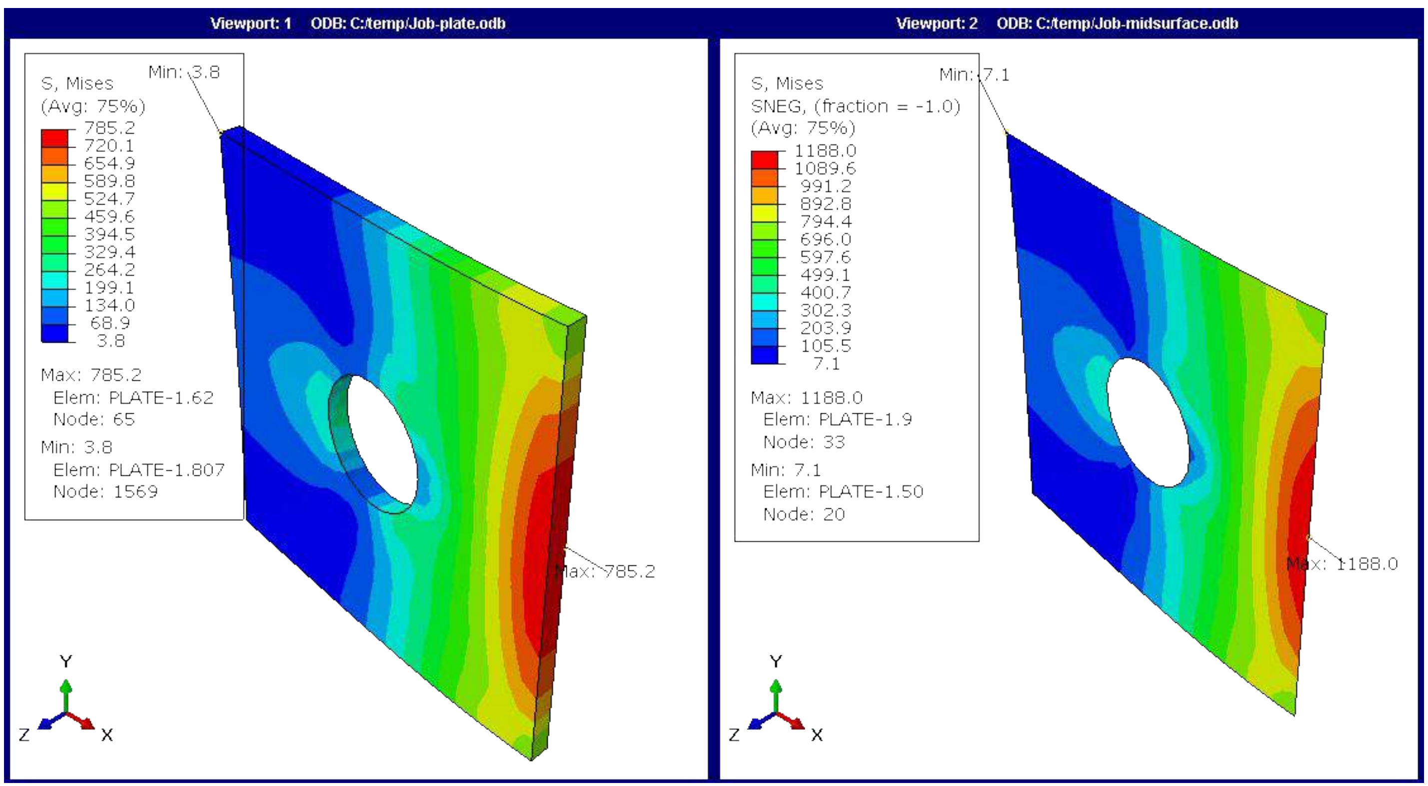
Comparison of 3D-plate and mid-surface-plate

- Find out stress distribution
- Maximum deflection due to load

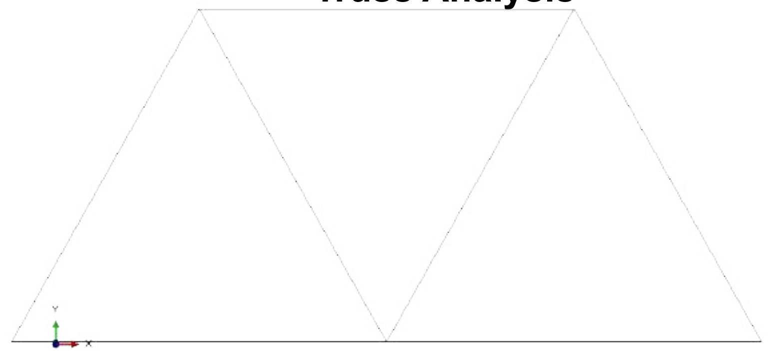
- Material = Steel
- F = 10000 N
- depth = 5 mm
- l = 100 mm
- b = 100 mm
- diameter = 30mm







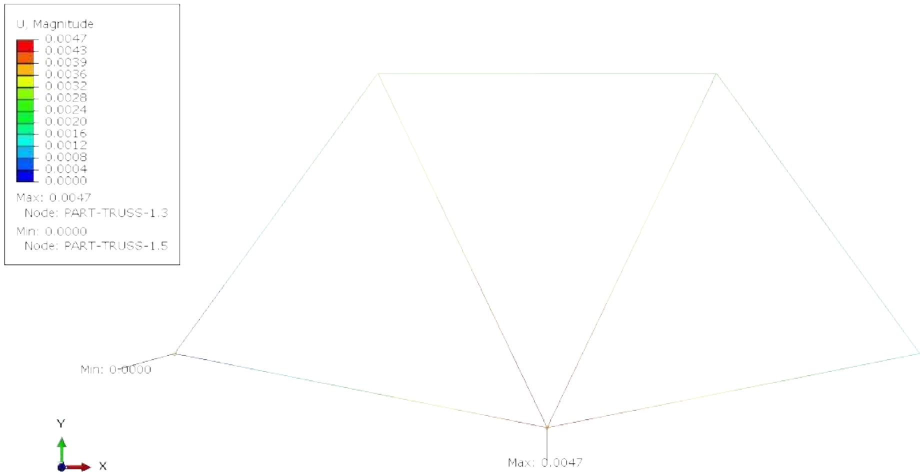
Truss Analysis

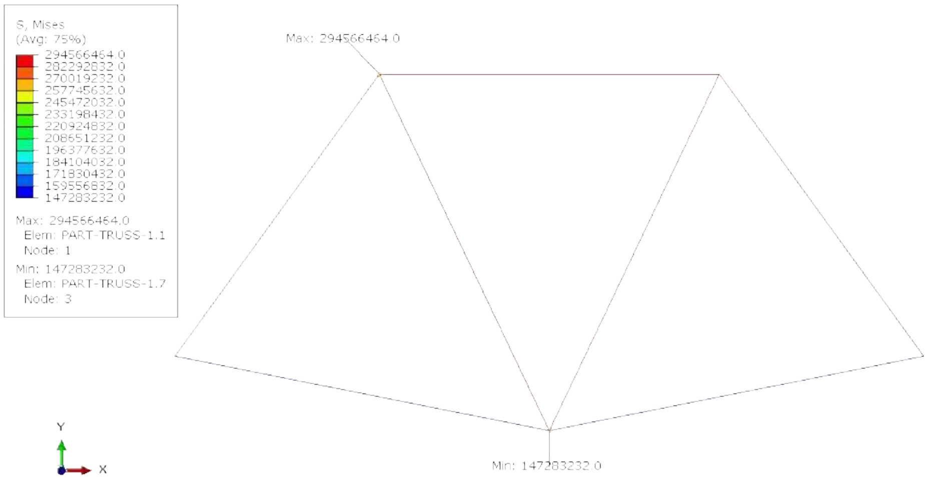


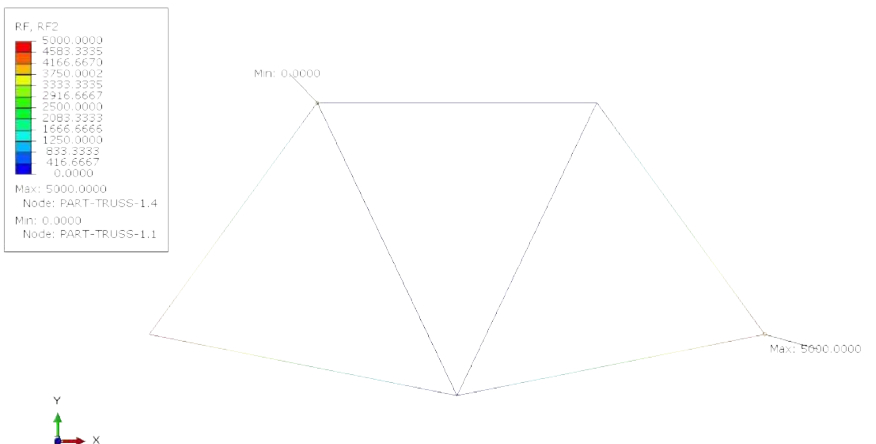
Find:

- Stress
- Displacement
- Reaction force

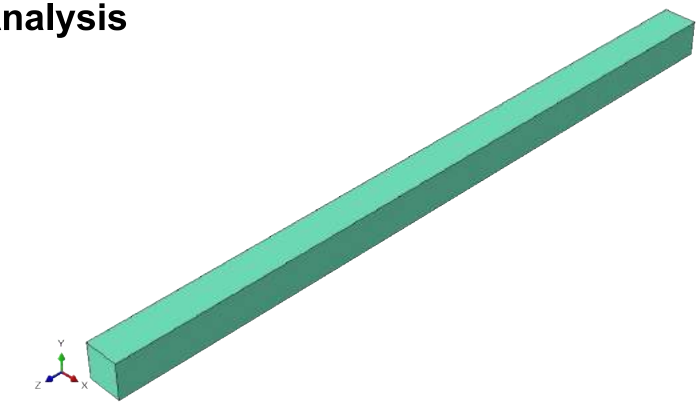
- Material = Steel
- Circular_steel_rods of diameter = 5mm
- E = 200 Gpa (200e9 N/m2)
- F = 10000 N
- l = 1 mm
- b = 1 mm
- density= 7850 kg/m3





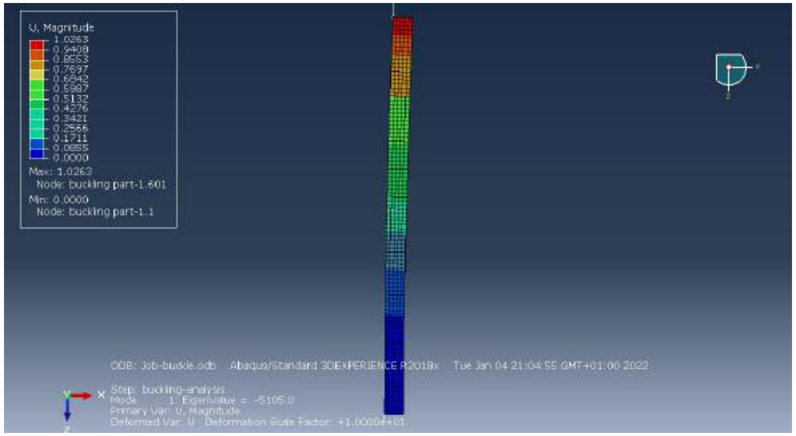


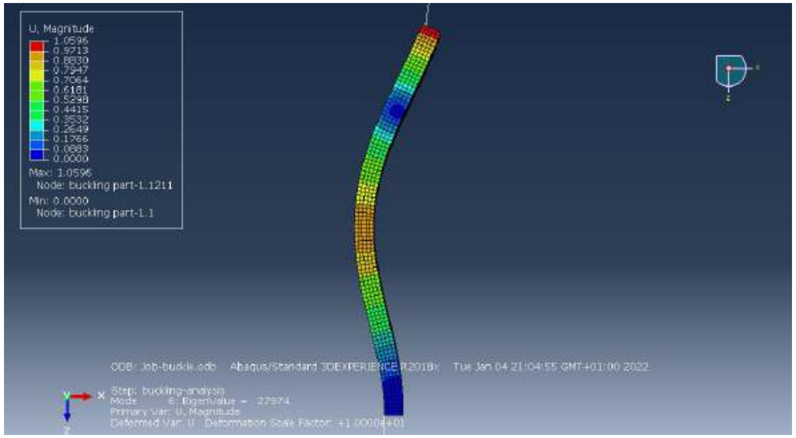
Buckling Analysis

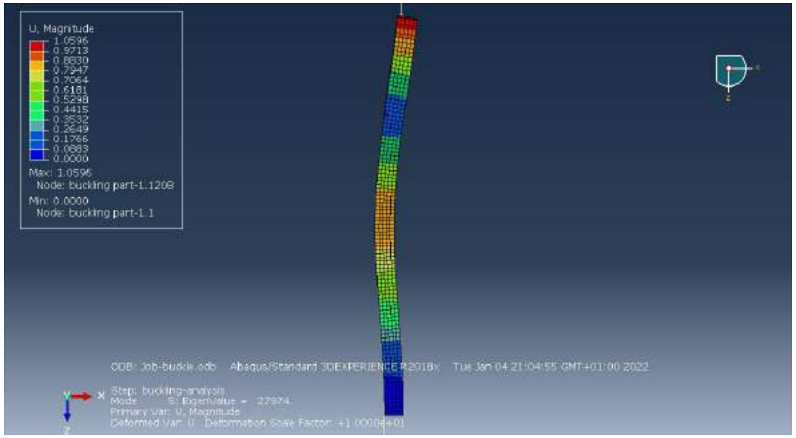


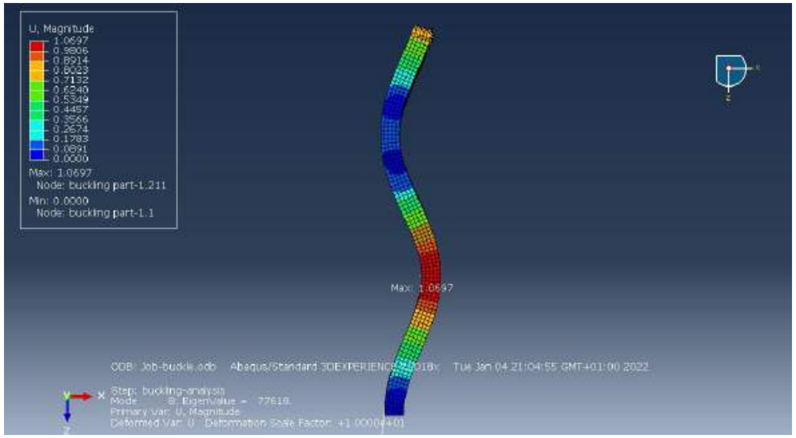
Find:
- critical buckling load

- Material = Steel
- E = 210000 Mpa
- poisson’s ratio= 0.3
- F = 1000 N
- F(ref) = 1 N
- h = 100 mm, l = 5 mm, b = 5 mm





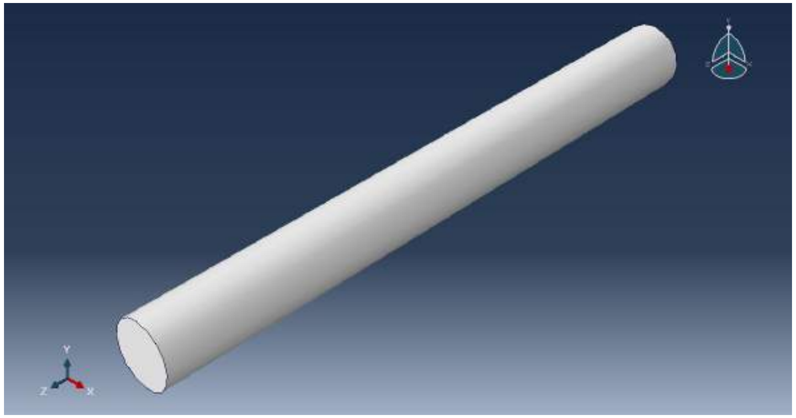


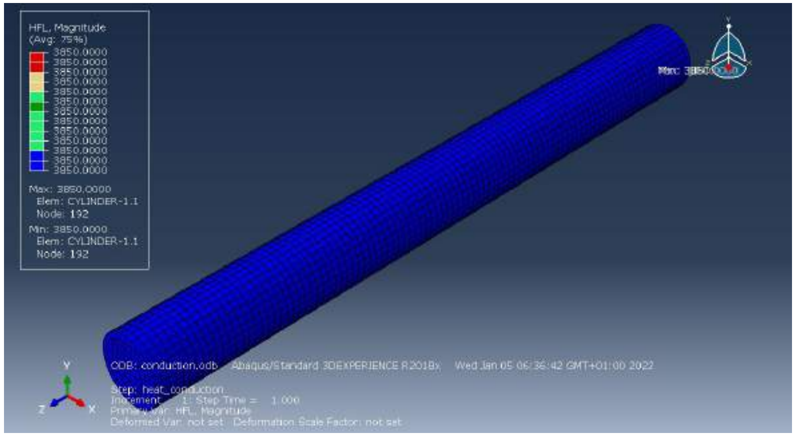


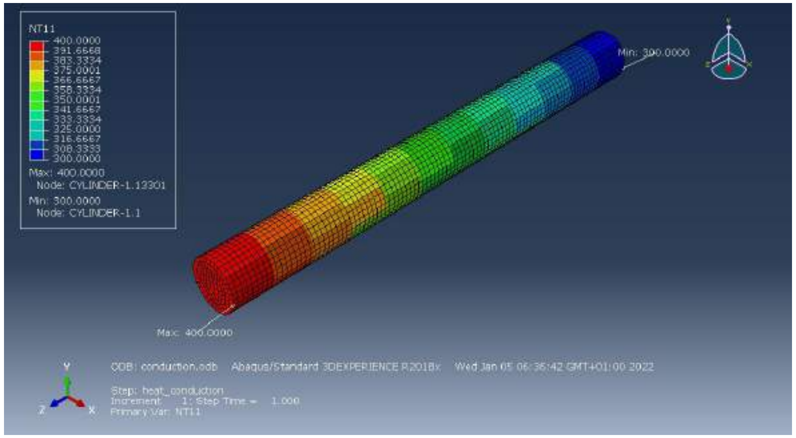
Heat Transfer (conduction) Analysis

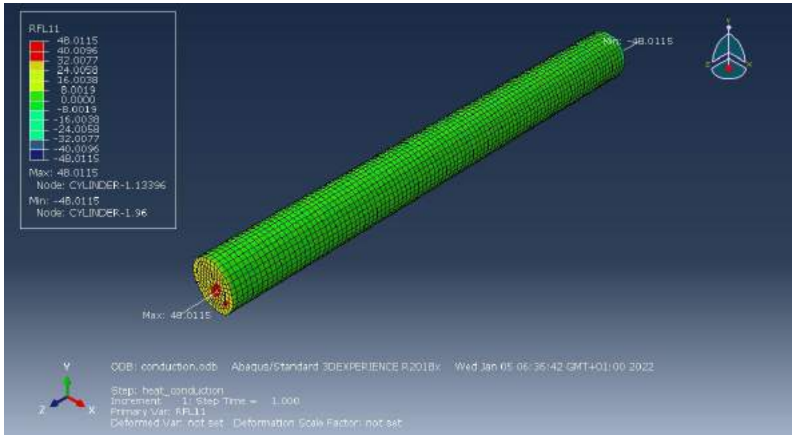
Find:
- temperature distribution in the cylinder

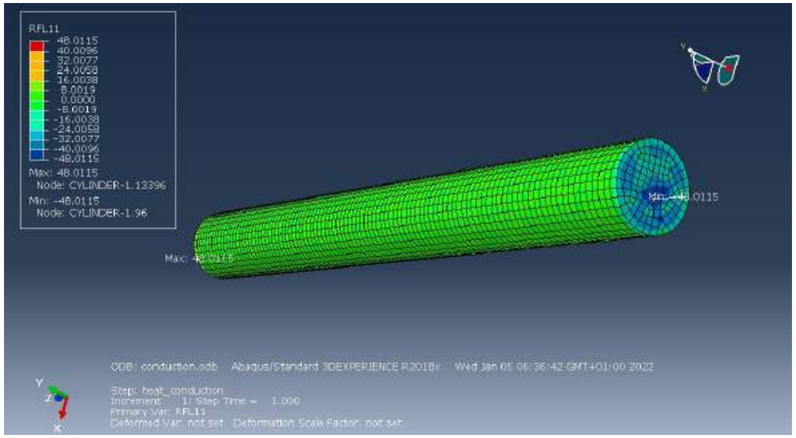
- Material = Copper
- Thermal conductivity = 385 (W/mK)
- T1 = 400 K
- T2 = 300 K
- R = 0.5 m, l = 10 m





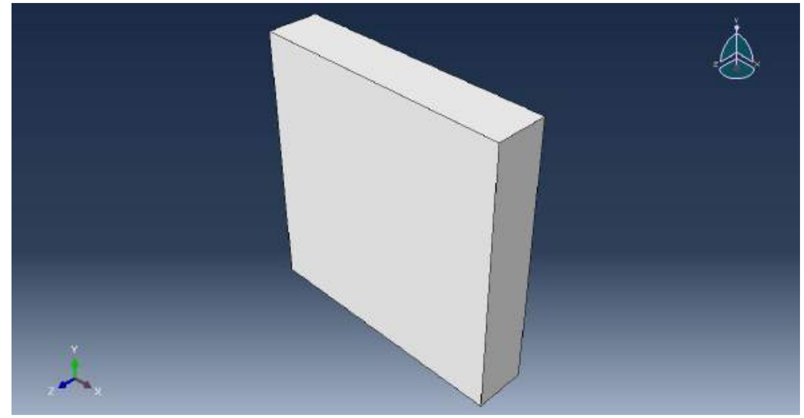


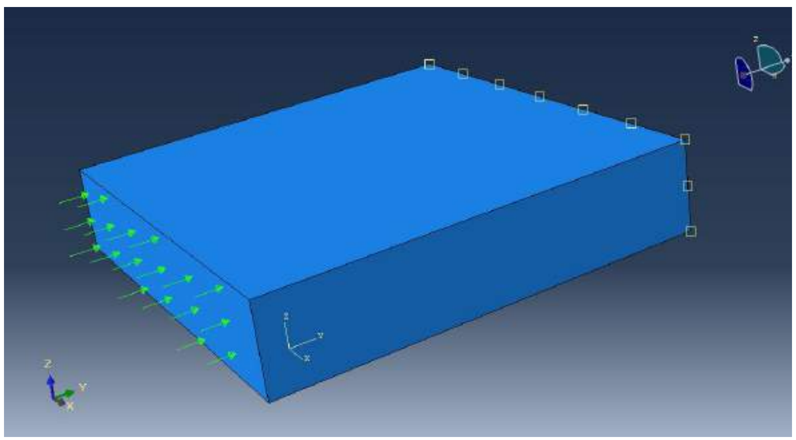


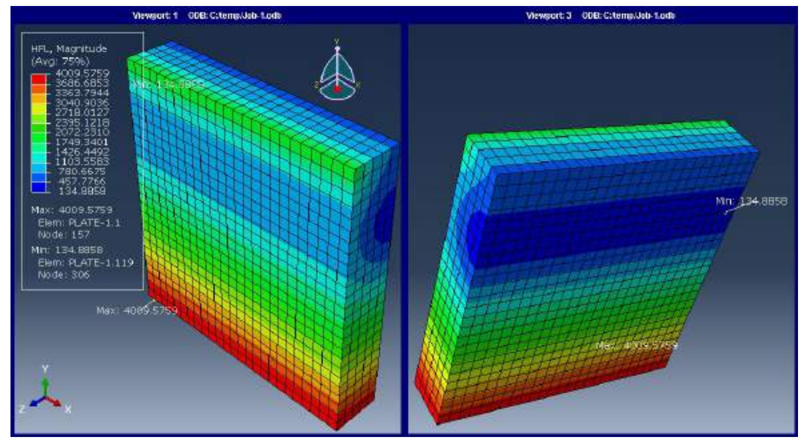


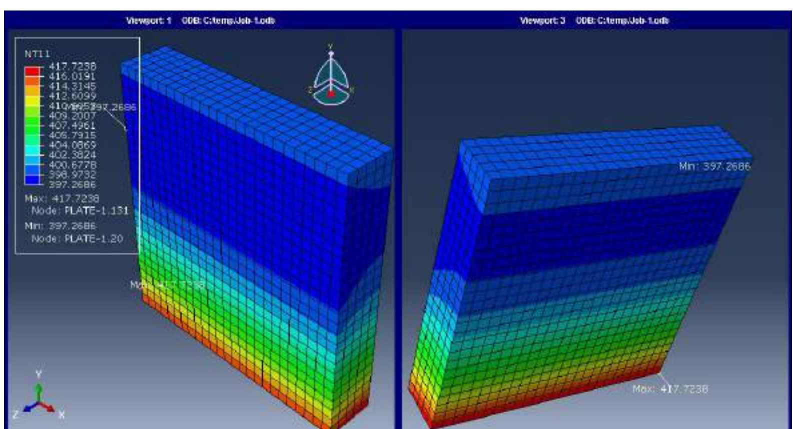
Heat Transfer (convection) Analysis

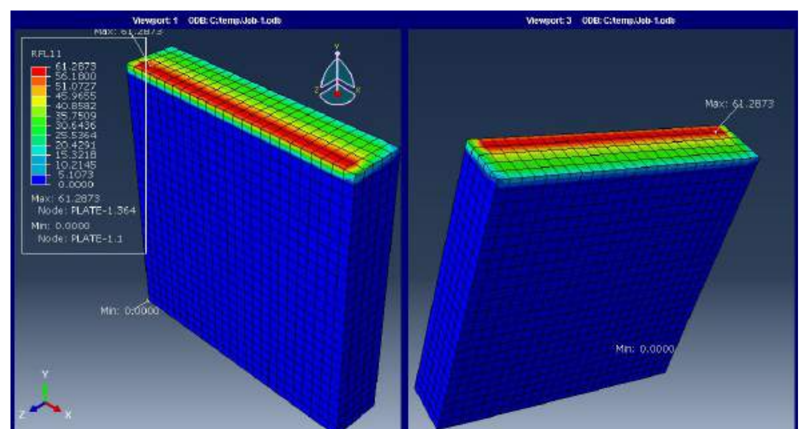
- Find: heat and temperature distribution on the plate
- Material = Copper,
- Fluid = Air, h(Air) = 10 W/m2K
- Thermal conductivity = 385 (W/mK)
- T = 400 K
- Ambient Temperature = 298 K
- Heat flux = 4000 W/m2 = Q
- plate size = (5 * 5 * 1) m3





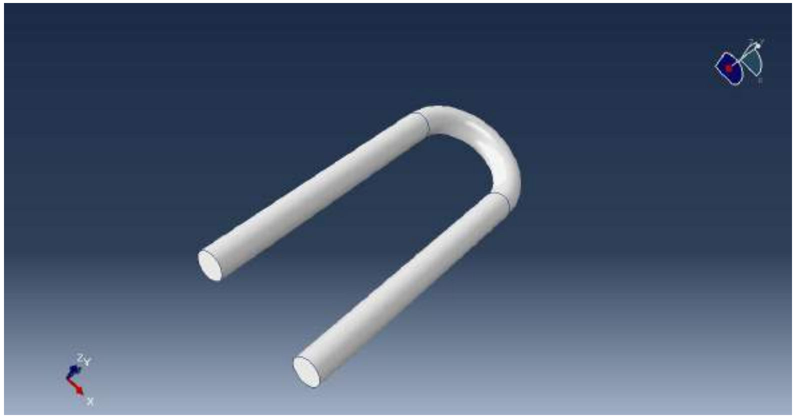


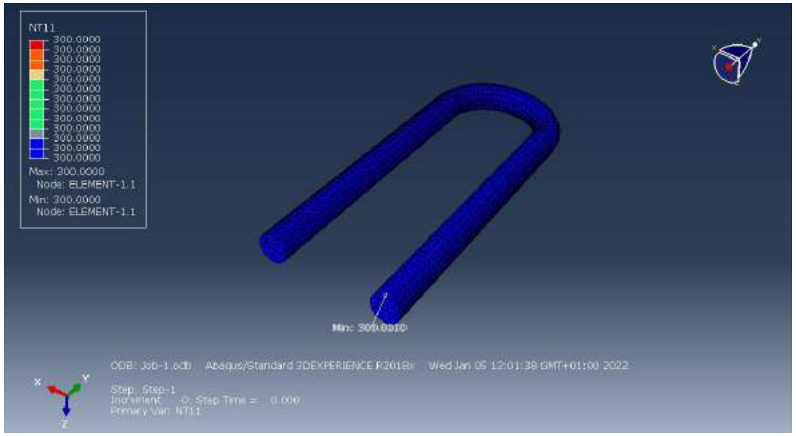


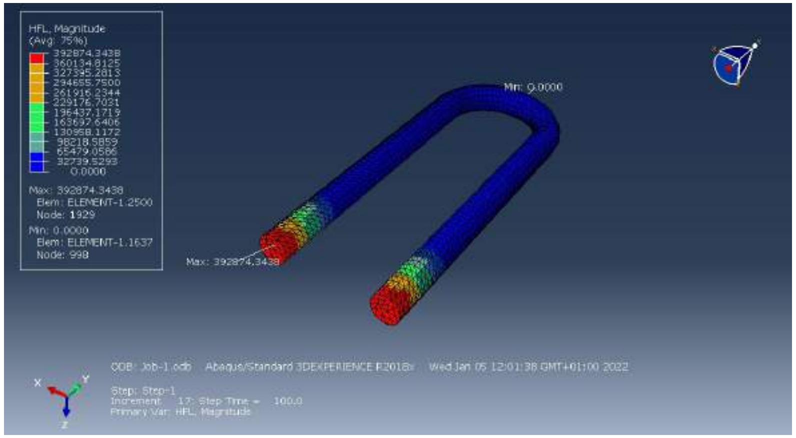


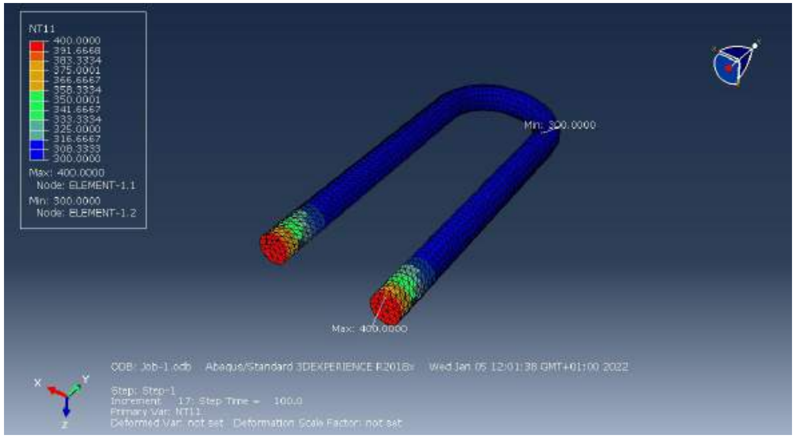
Transient Heat Transfer (conduction) Analysis

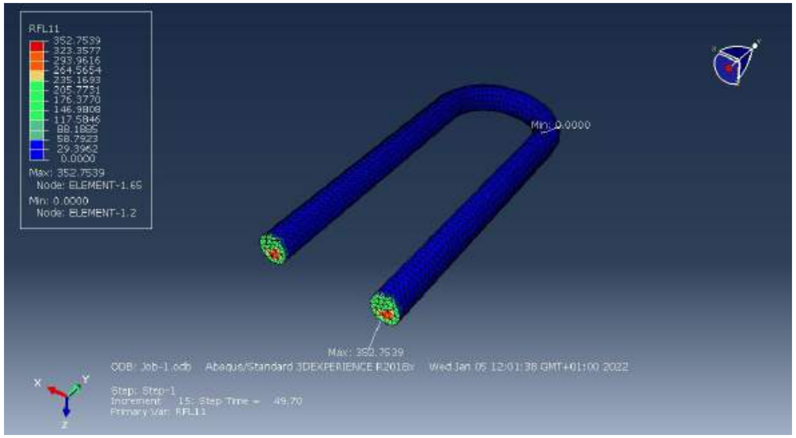
- Find: heat and temperature distribution on the plate
- Material = Copper, l = 1m, b =0.4m, R = 0.05m
- Density = 8800 (Kg/m3)
- Thermal conductivity = 490 (W/mK)
- Temp. = 400 K
- Specific heat = 1000 (J/Kg.K)
- Heat flux = 7500 W/m2
- Initial temp. of body = 300 K







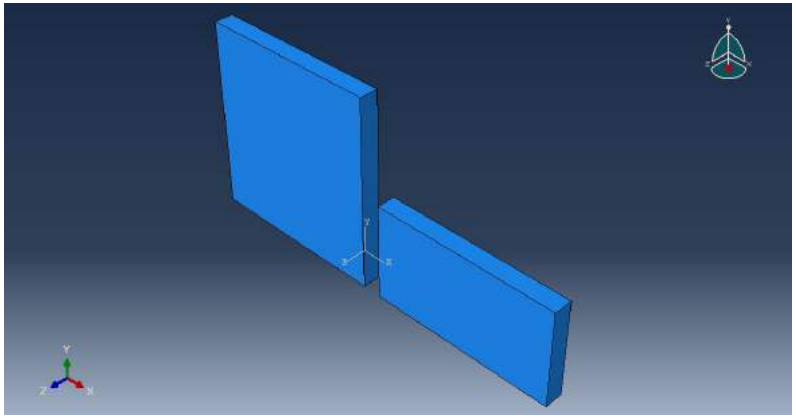


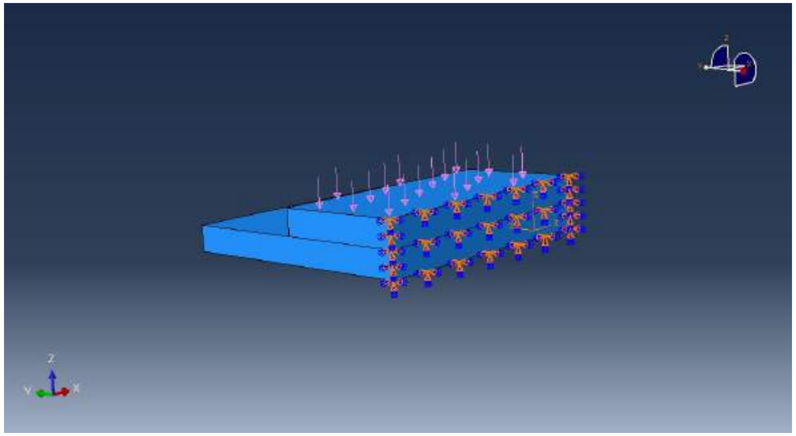


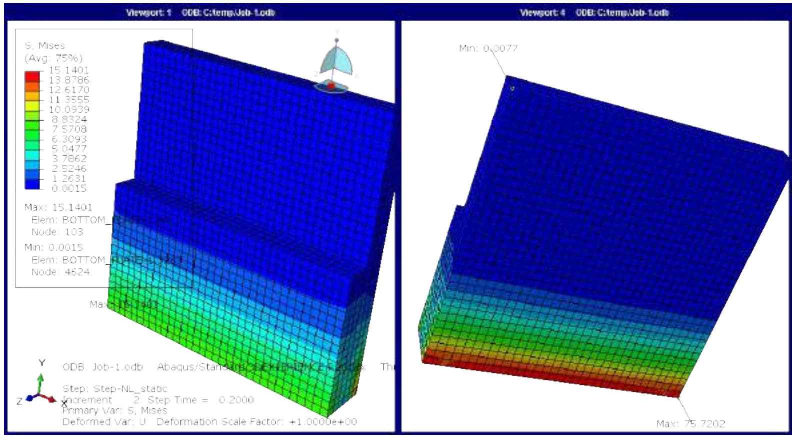
Nonlinear Analysis

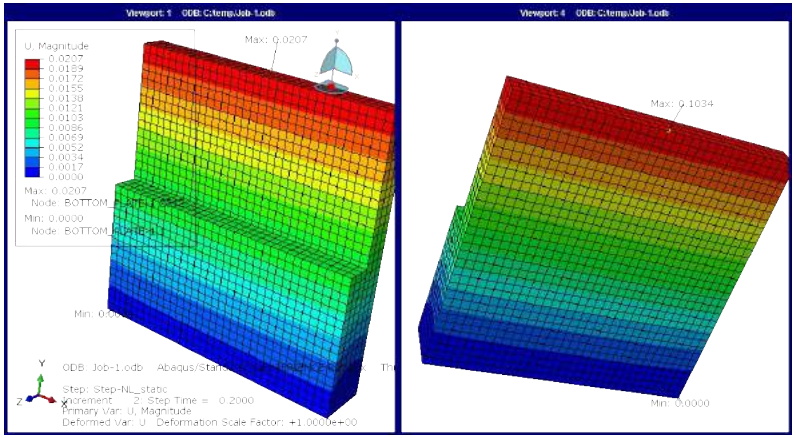
Tie Contact Analysis

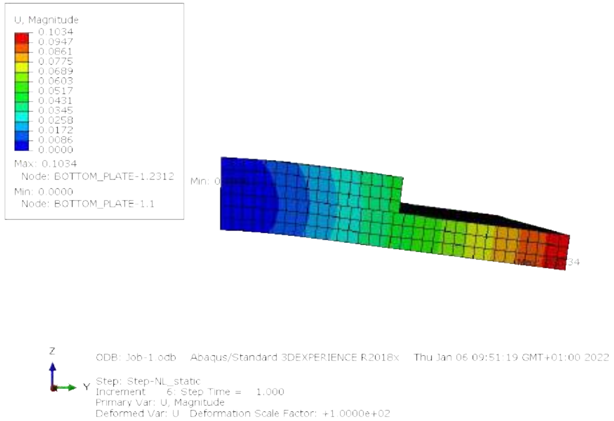
- Find: stress/effect of the top plate to the bottom plate
- Mat.1 = Steel, l = b = 100mm, thickness = 10mm
- Mat.2 = Aluminium, l = 100, b = 50, w = 10
- Pressure = 4 (Mpa)
- BCs = material, geometric and contact nonlinearity
- E(steel) = 210,000 Mpa, E(aluminium) = 70,000 Mpa
- poisson's ratio: steel = 0.3, aluminium = 0.32





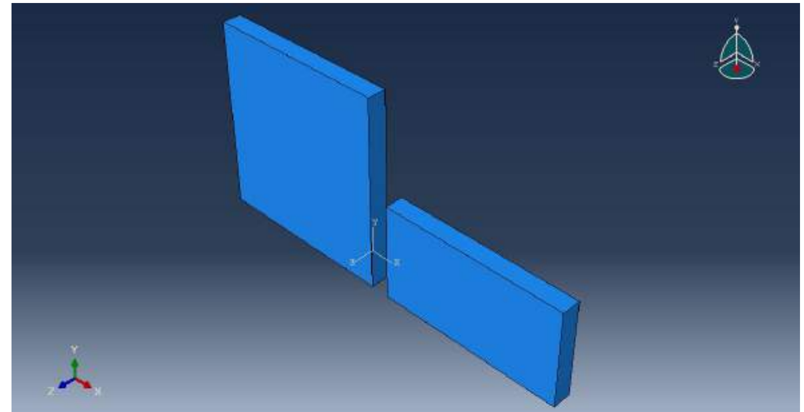


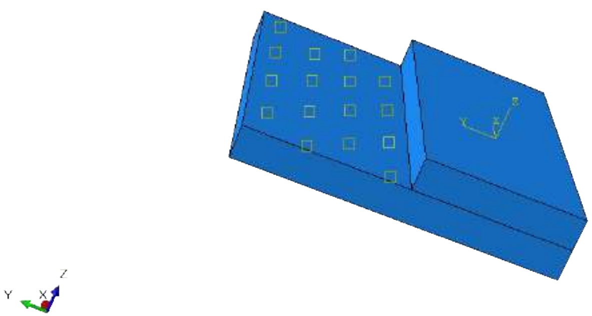


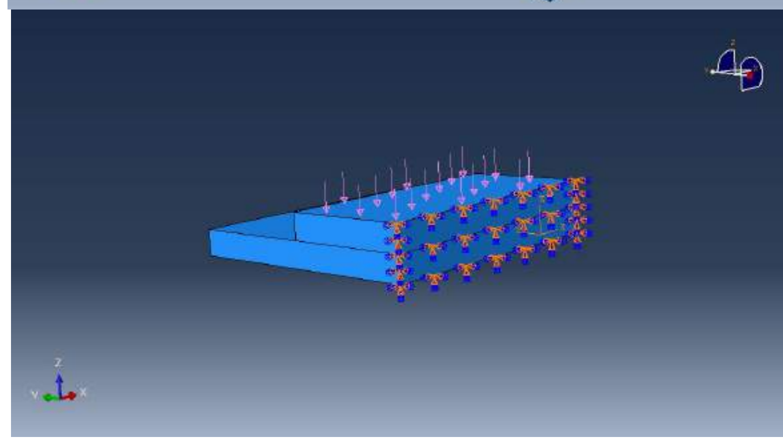


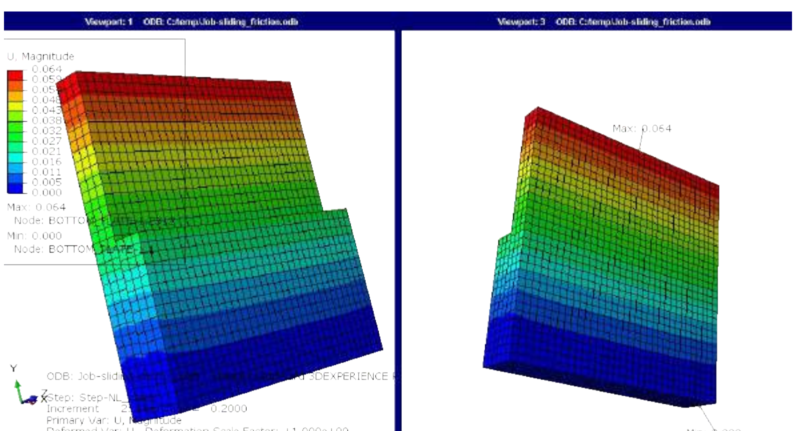
Sliding Contact Analysis

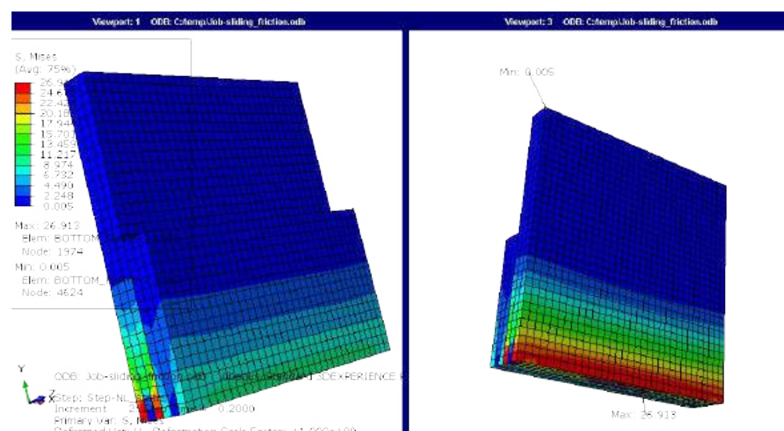
- Find: stress/effect of the top plate to the bottom plate
- Mat.1 = Steel, l = b = 100mm, thickness = 10mm
- Mat.2 = Aluminium, l = 100, b = 50, w = 10
- Pressure = 4 (Mpa), friction = 0.2
- BCs = material, geometric and contact nonlinearity
- E(steel) = 210,000 Mpa, E(aluminium) = 70,000 Mpa
- poisson's ratio: steel = 0.3, aluminium = 0.32





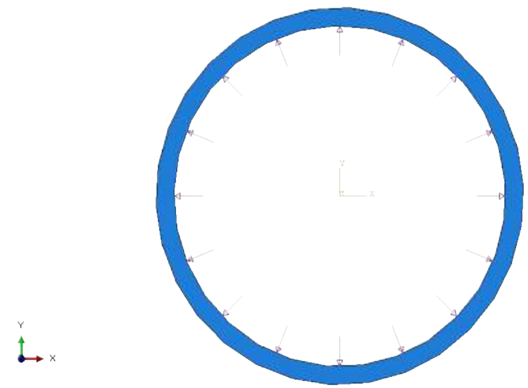


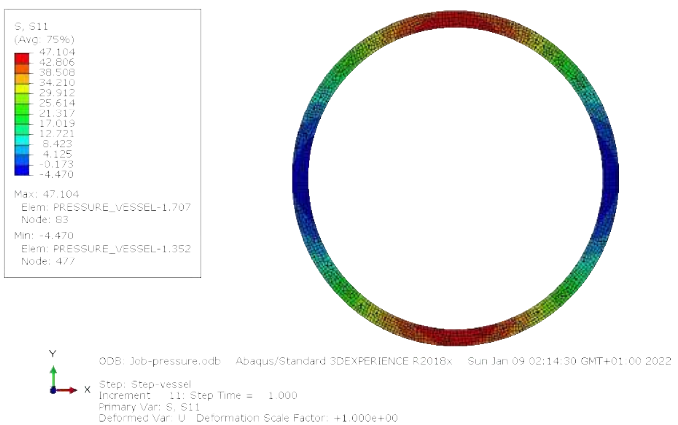


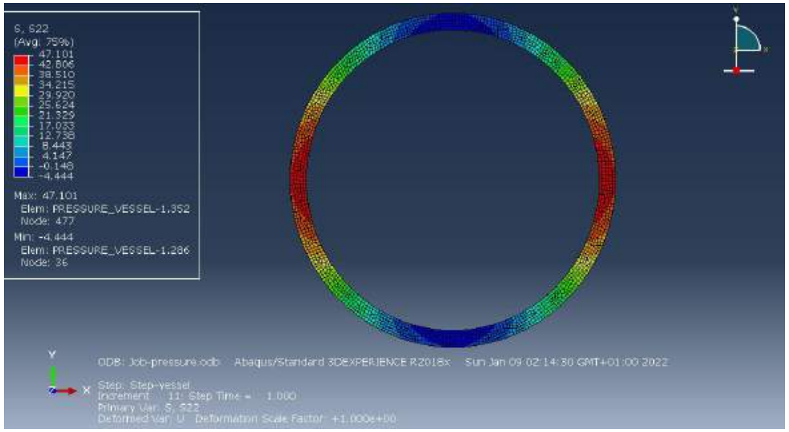


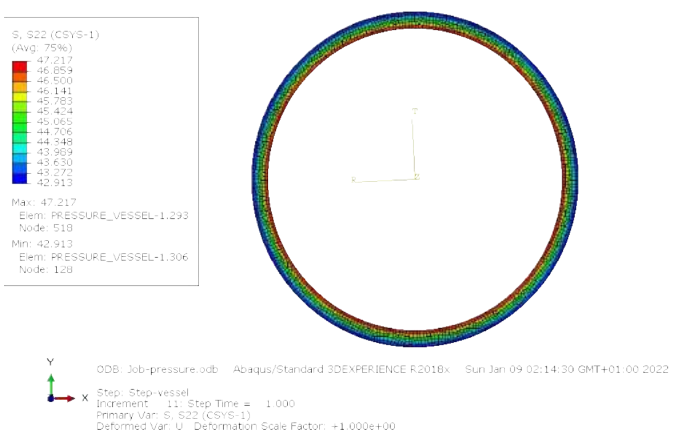
Pressure Vessel Analysis

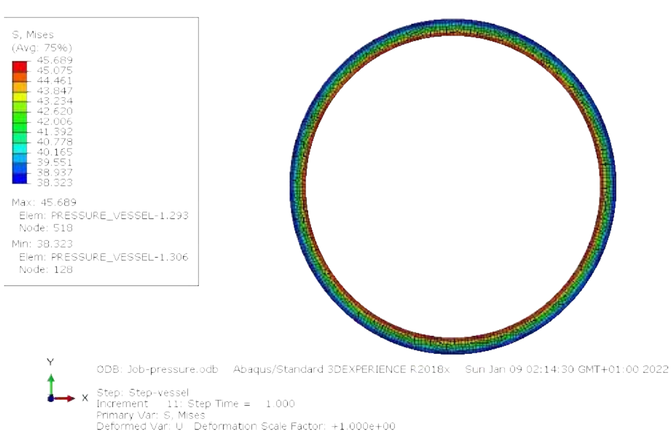
- Find: change in geometry by the pressure
- Material = Steel, outer diameter = 500mm, thickness = 25mm
- Pressure = 5 (Mpa)
- E(steel) = 210,000 Mpa, poisson's ratio: steel = 0.3
- Hoop stress (calculated) = 50 (Mpa)





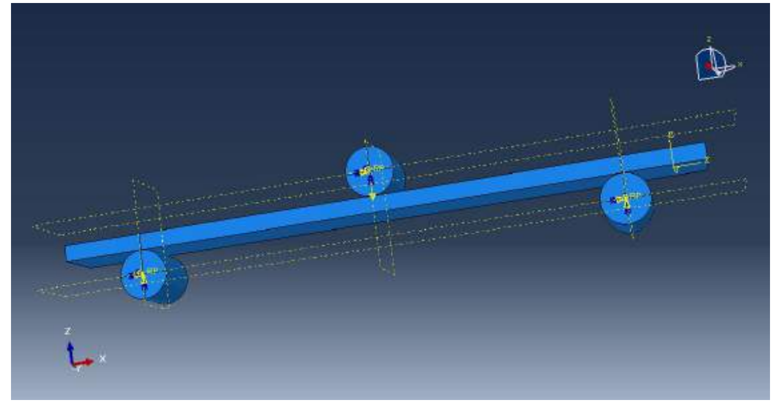


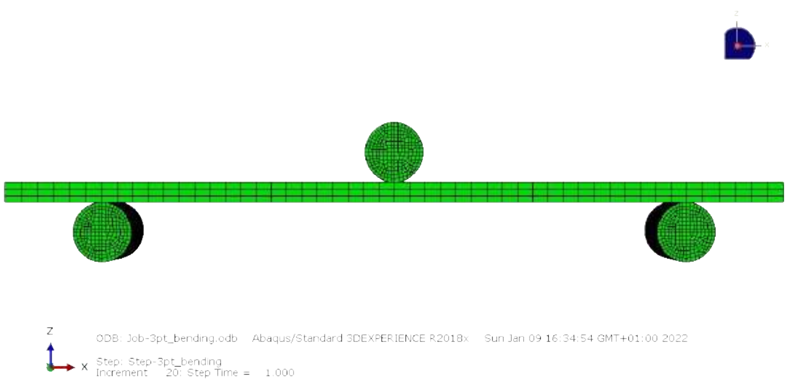


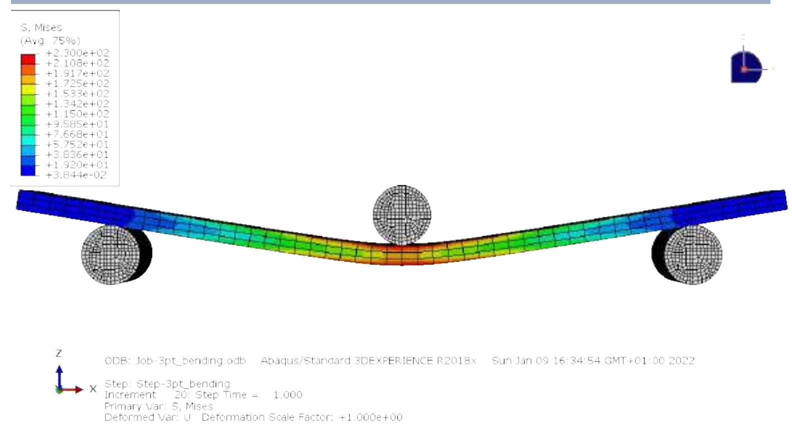


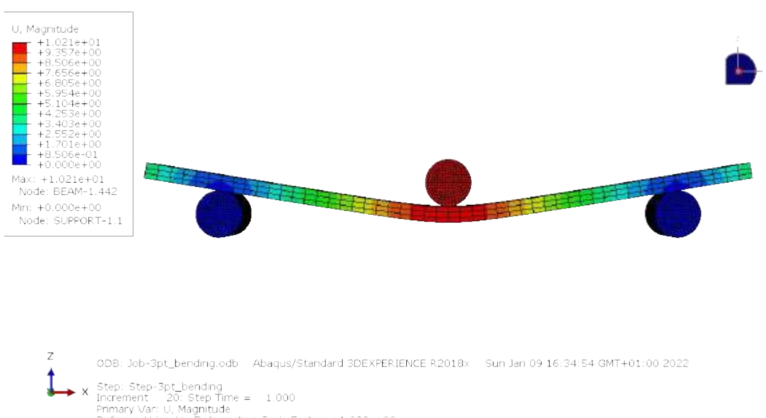
3-point Bending Analysis

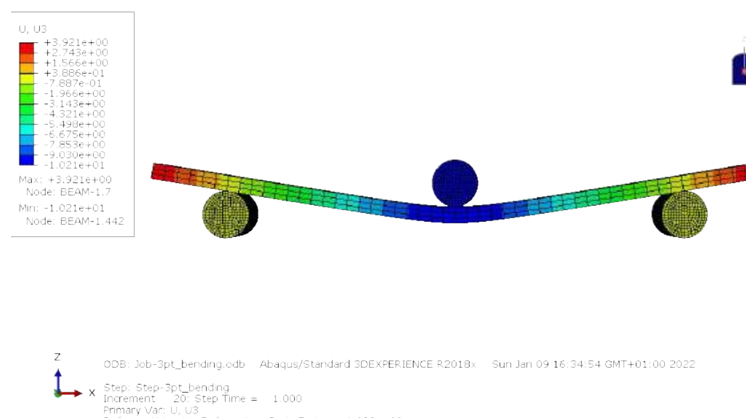
- Find: change in geometry by the pressure
- Material = nonlinear material
- Rigid support diameter = 15mm
- Beam dimensions = 200* 20* 5 mm
- E = 200,000 Mpa, poisson's ratio = 0.3
- Density = 7.85e-6 (Kg/mm3)





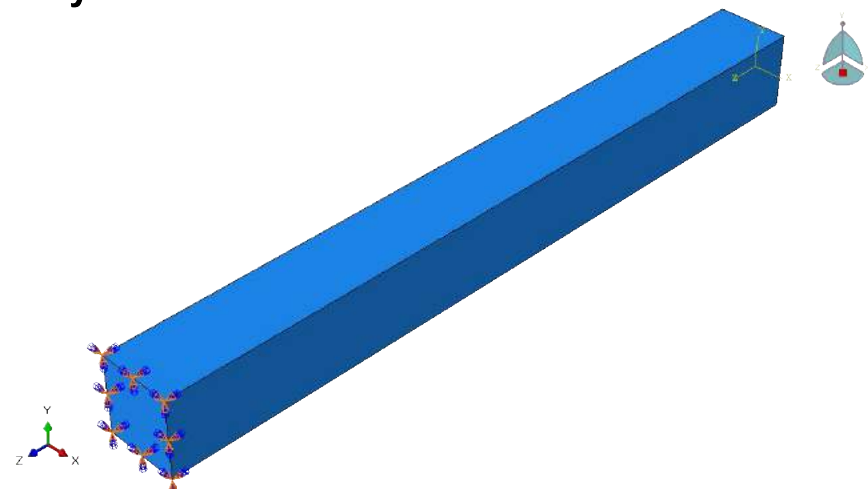


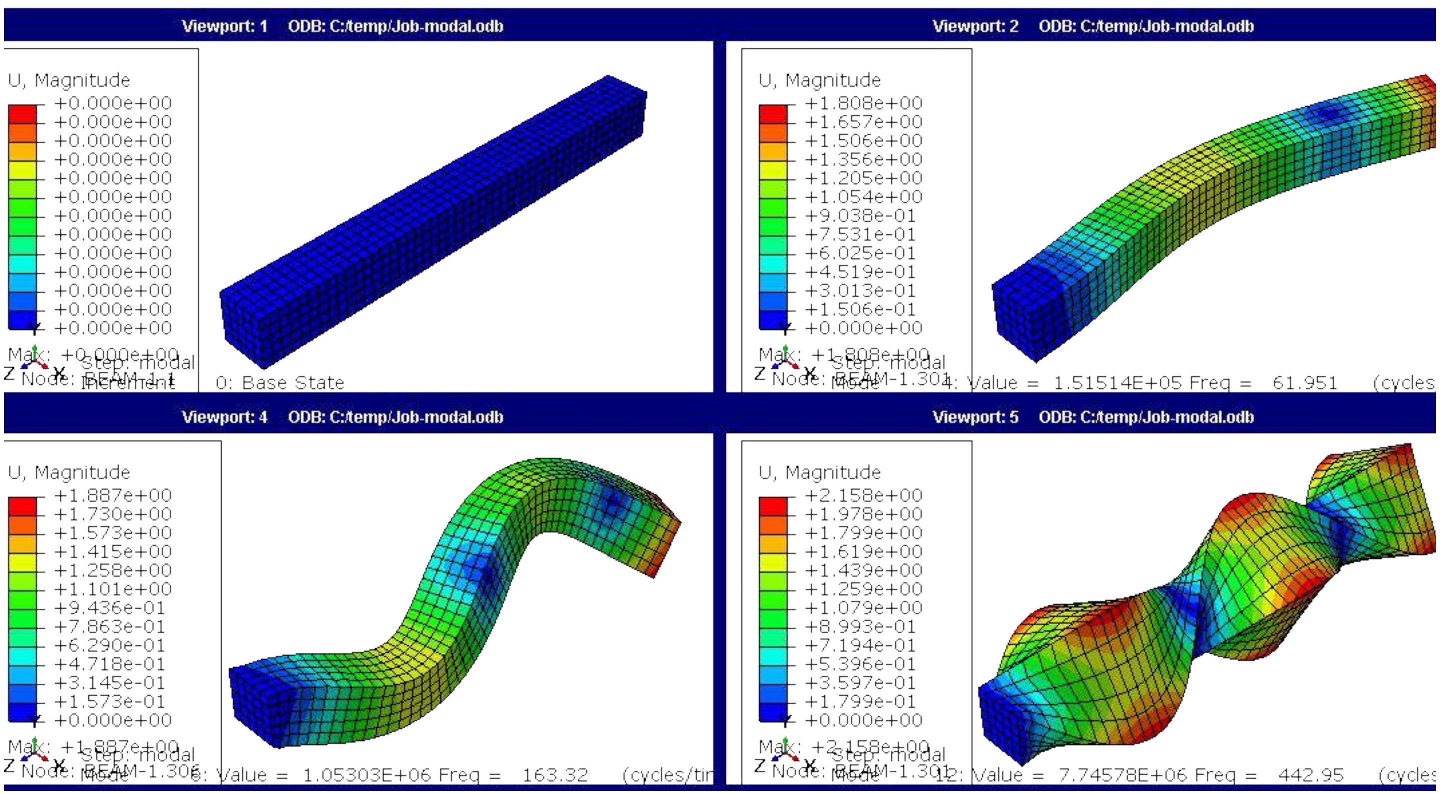




Modal Analysis

- Material = Steel
- Beam length = 250mm
- Cross-section = 25* 25 mm
- E = 210,000 Mpa, poisson's ratio = 0.3
- Density = 7.85e-6 (Kg/mm3)

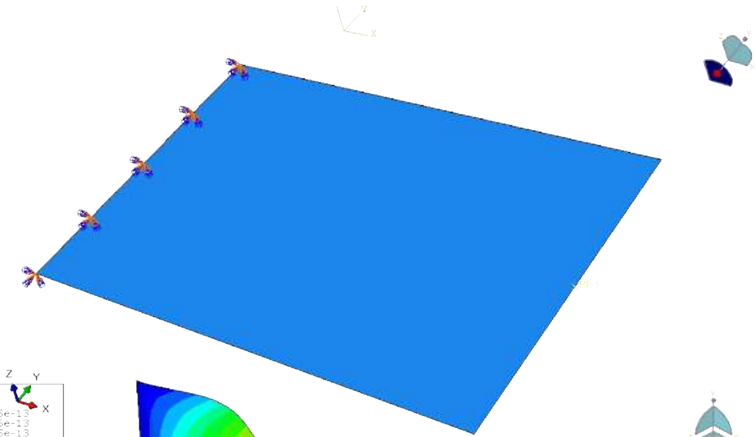


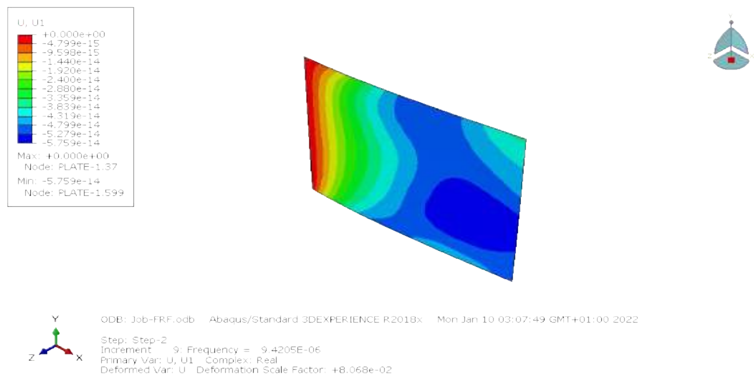


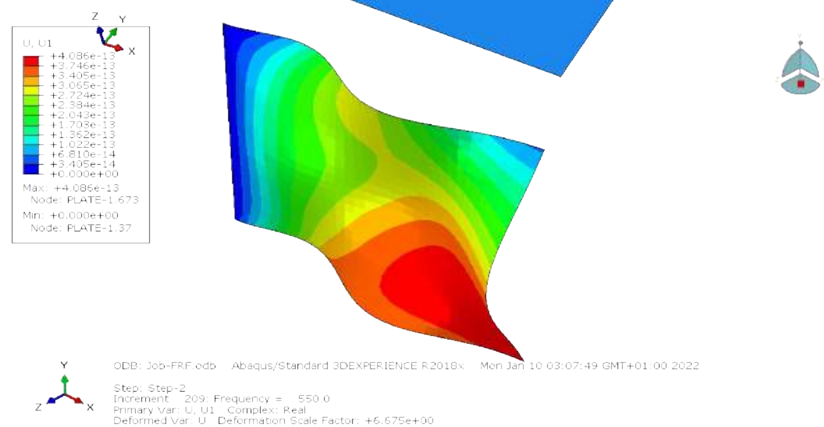
Frequency Response Analysis

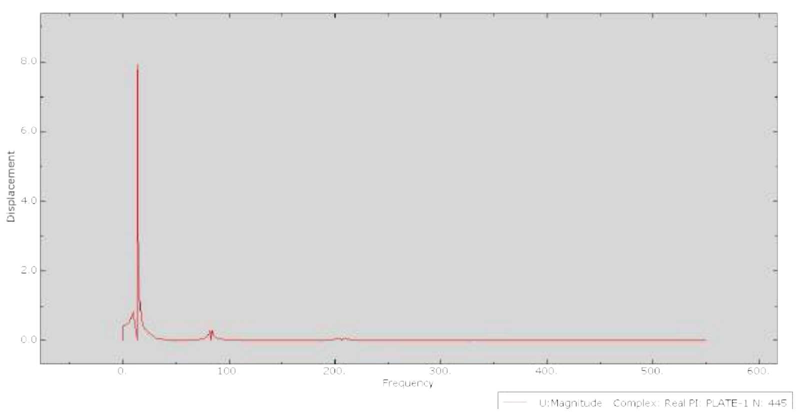
- Material = Steel
- Plate dimensions = 0.36*0.24 m, thickness = 2 mm
- Cross-section = 25* 25 mm
- E = 210,000 Mpa, poisson’s ratio = 0.3
- Density = 7850 (Kg/m3)

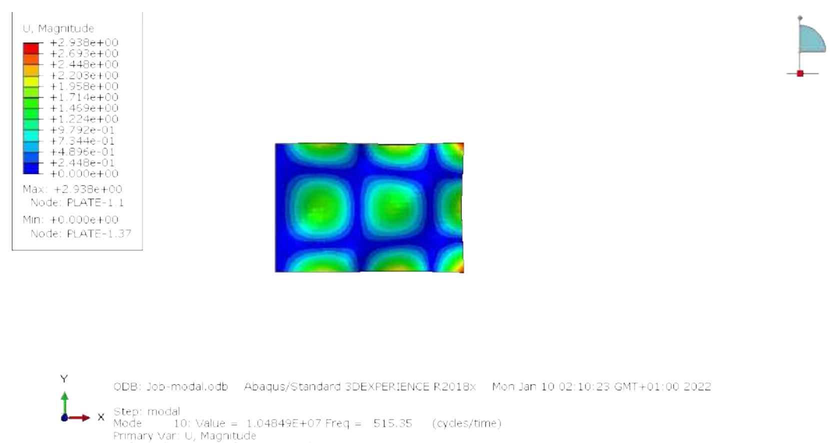
Force = 1000 N



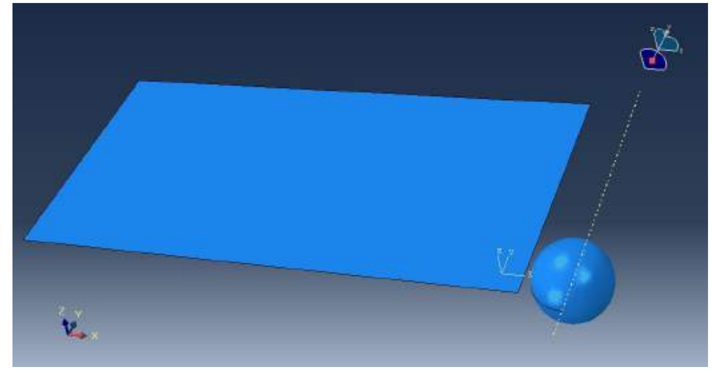




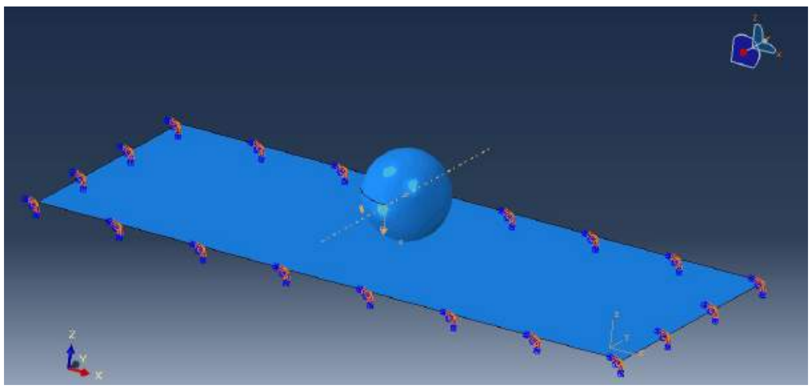


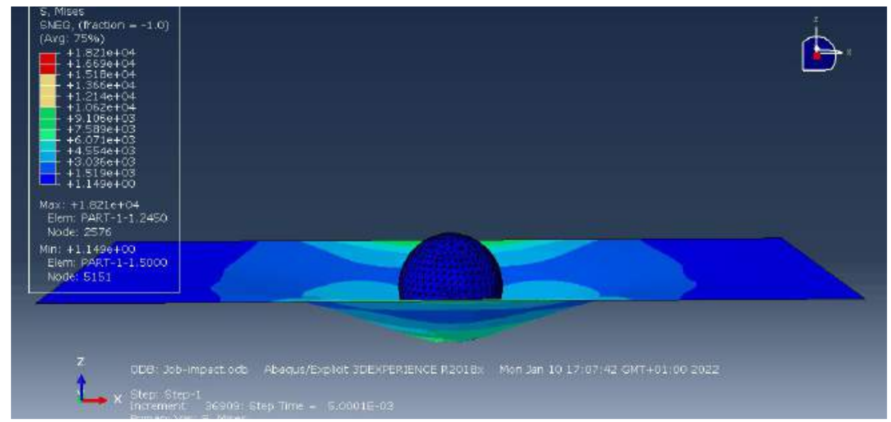


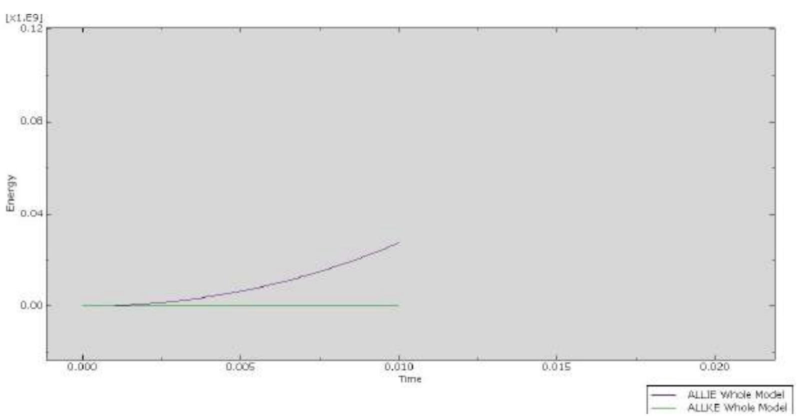
Ball-plate Impact Analysis

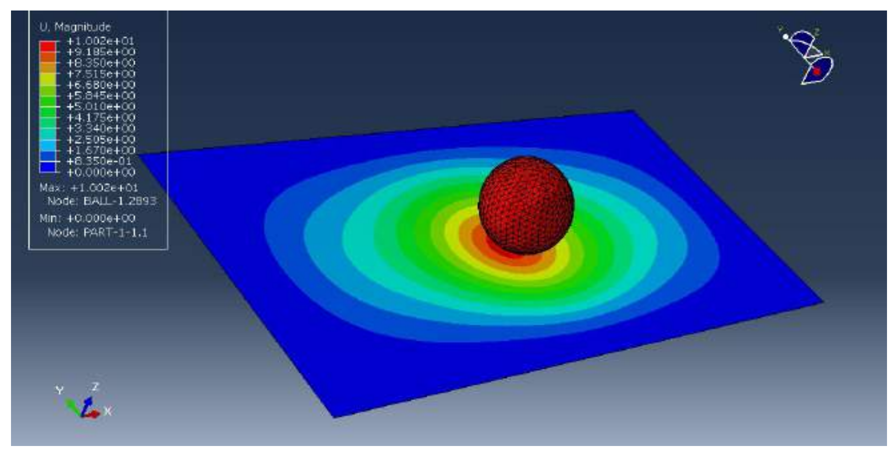


- Plate mat. = Steel, dimensions = 500* 250* 5 mm
- Ball mat. = aluminium, diam. = 70 mm, velocity = 10 m/s
- E (steel) = 210,000 Mpa, poisson’s ratio = 0.3
- E (aluminium) = 70,000 Mpa, poisson’s ratio = 0.33
- Density = 7850 (Kg/m3)

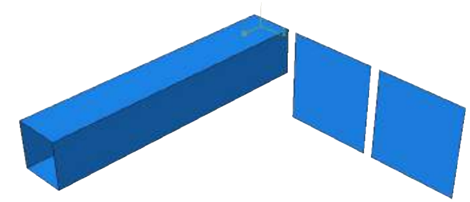




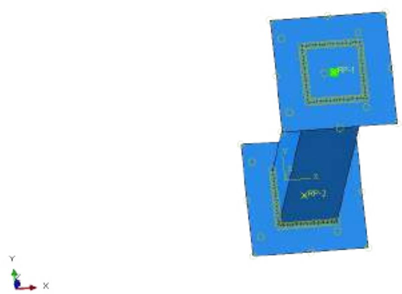


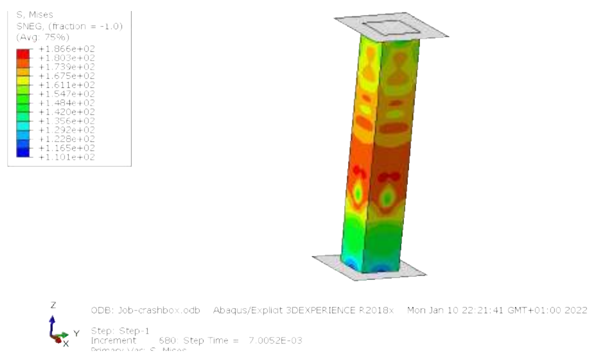


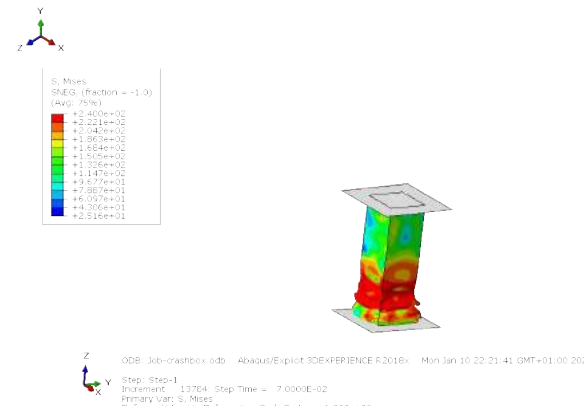
Impact Analysis of Automotive Crash box

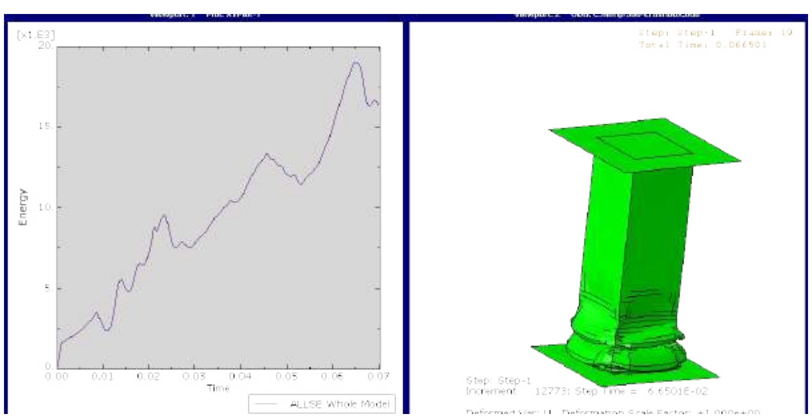


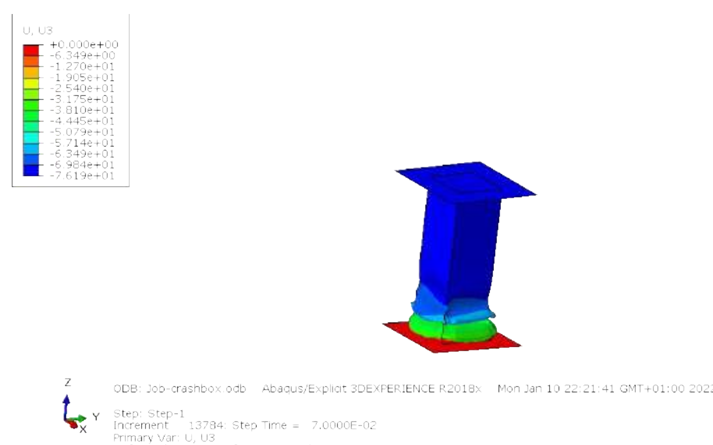
- Crash box mat. = Aluminium, cross-section = 25*25 mm, length = 150 mm
- Rigid-wall, dimension = 50*50 mm, mass = 100 kg
- Thickness = 1 mm
- E (aluminium) = 69,000 Mpa, poisson's ratio = 0.29
- Density = 2900 (Kg/m3)





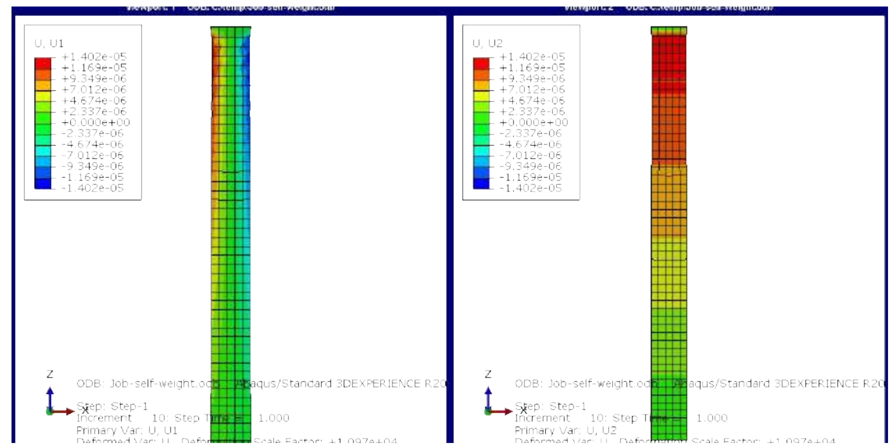


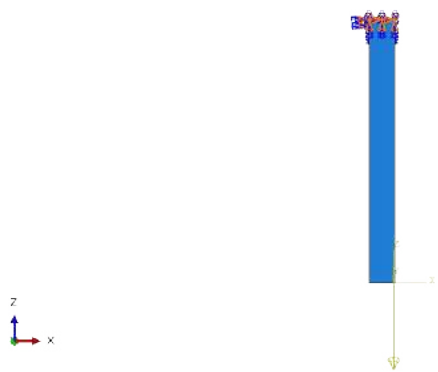


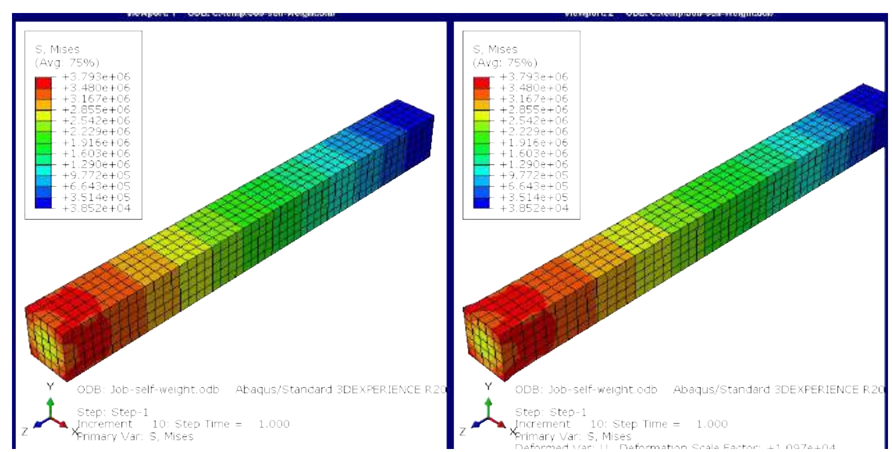


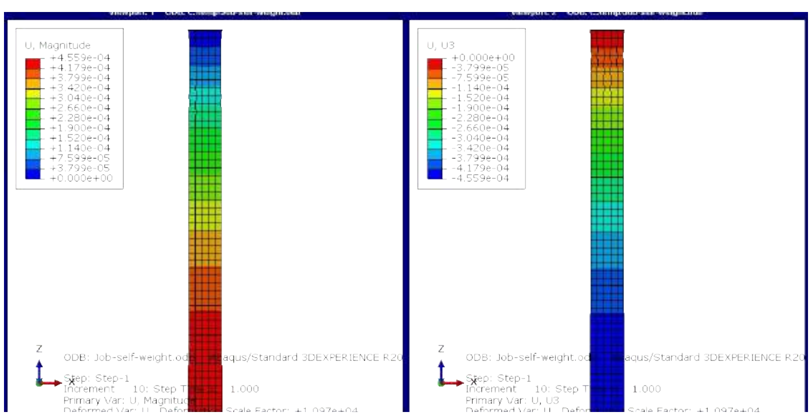
Deflection due to Self-weight

- Beam mat. = Steel, cross-section = 5*5 m, depth =50 m
- mass = 100 kg
- E = 210,000 Mpa, poisson's ratio = 0.3
- Density = 7850 (Kg/m3)



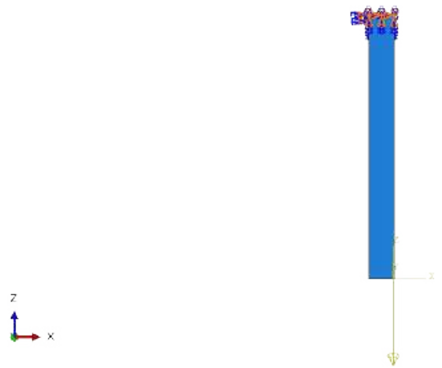


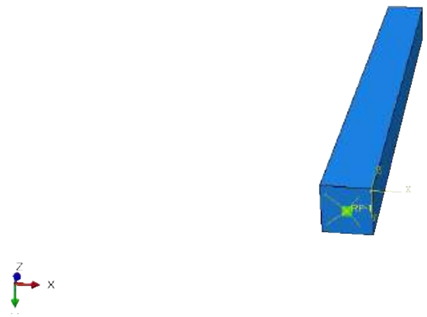


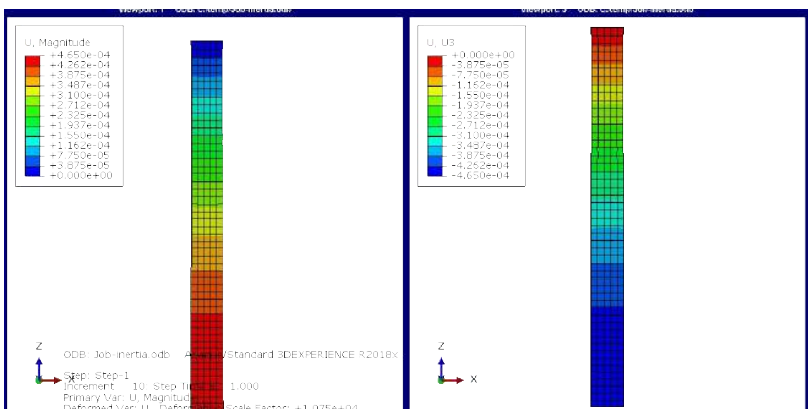


Deflection due to Self-weight 2

- Beam mat. = Steel, cross-section = 5*5 m, depth =50 m
- mass = 100 kg
- E = 210,000 Mpa, poisson's ratio = 0.3
- Density = 7850 (Kg/m3)
- Extra mass = 100,000 Kg







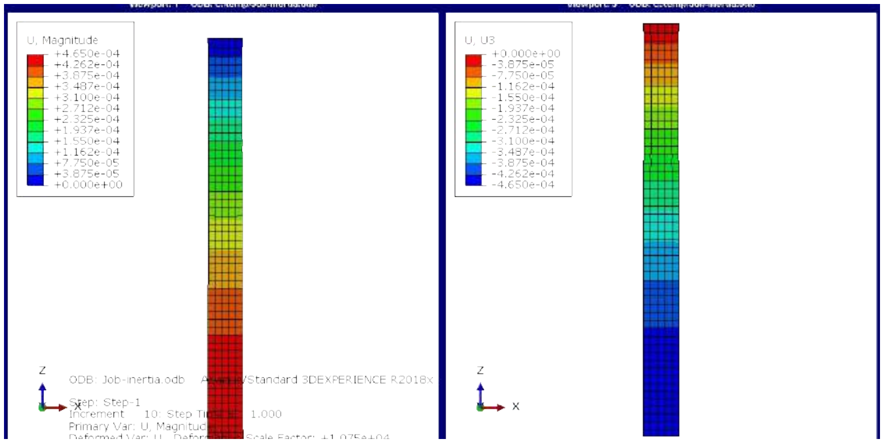
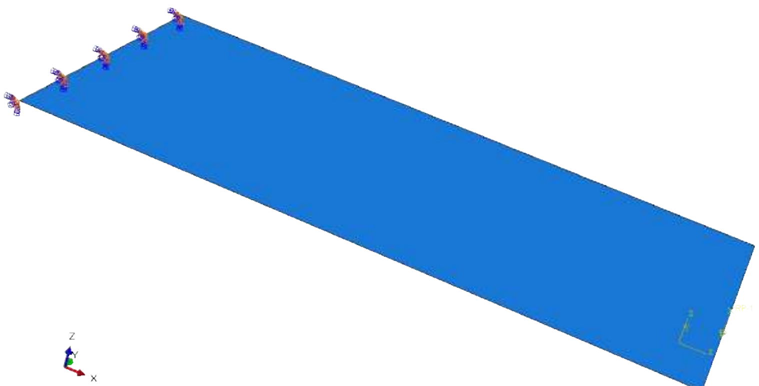
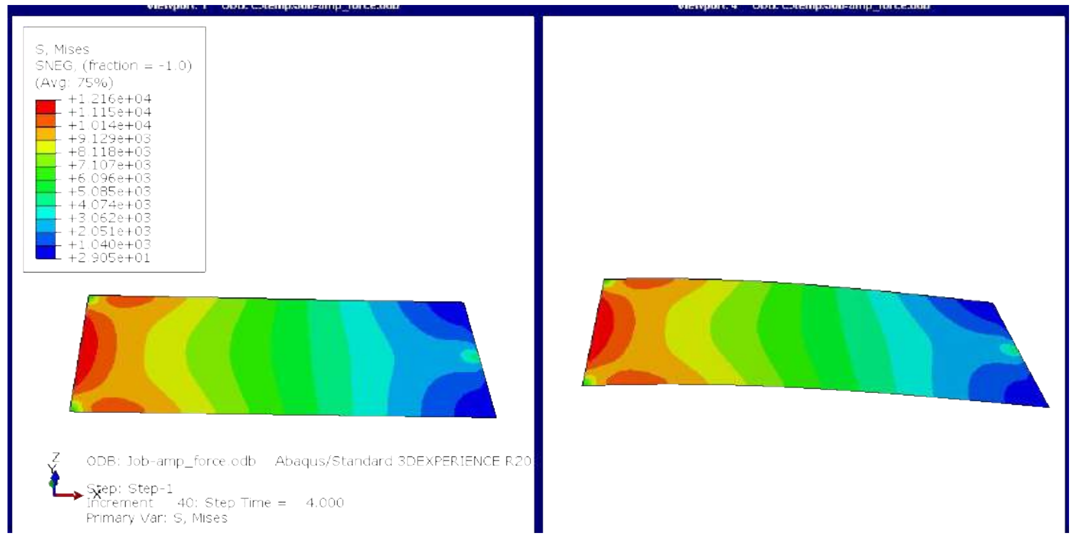


Plate with Time-dependent Load

- Plate mat. = Steel, dimension = 100 * 50 *2 mm
- Force = 1000 N
- E = 210,000 Mpa, poisson's ratio = 0.3
- Density = 7850 (Kg/m3)





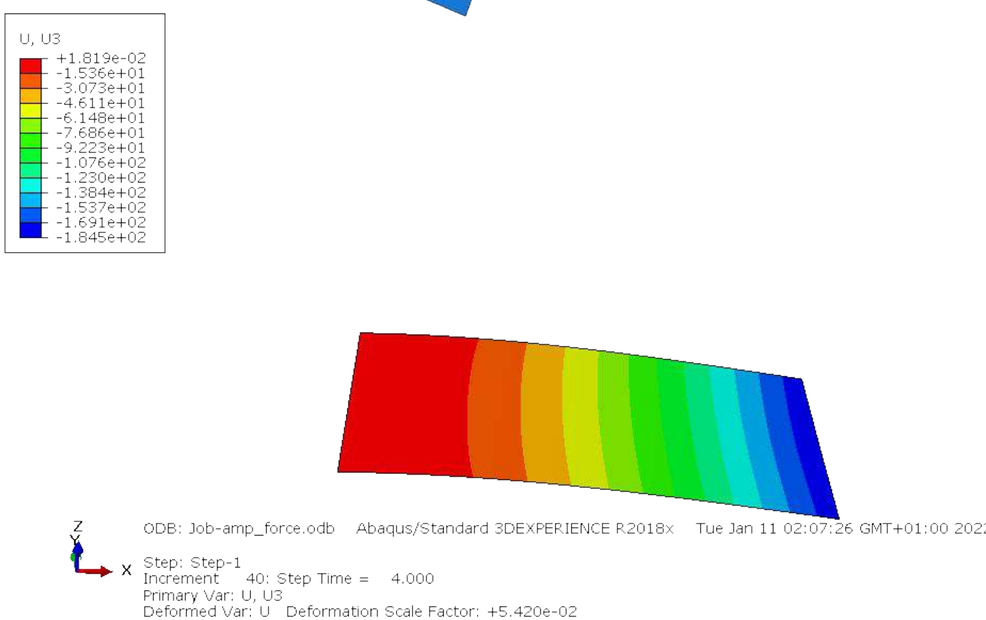
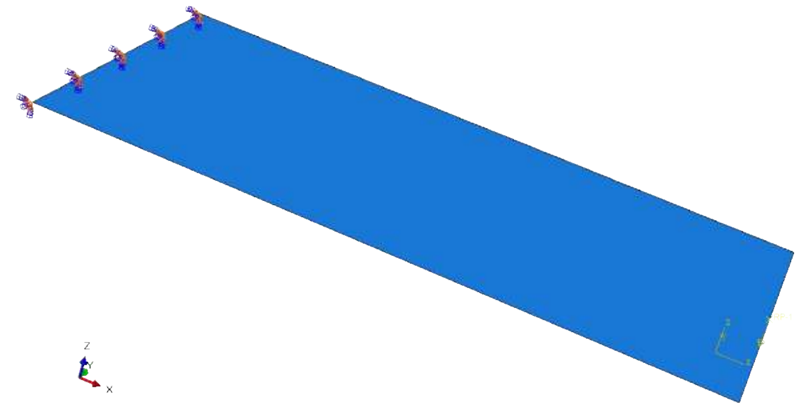
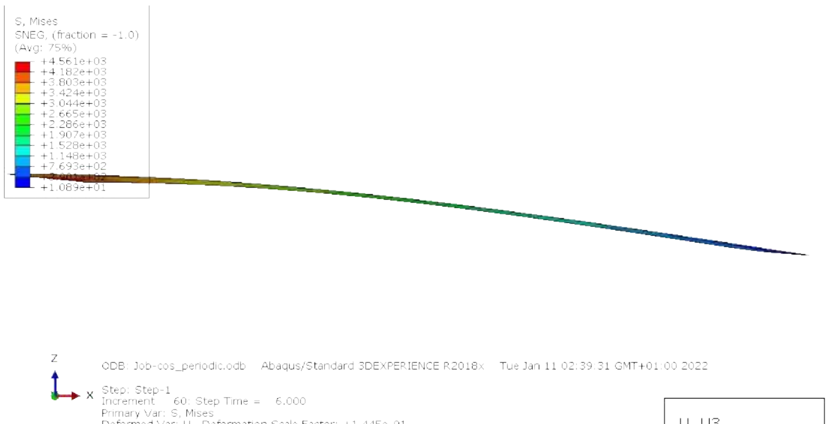
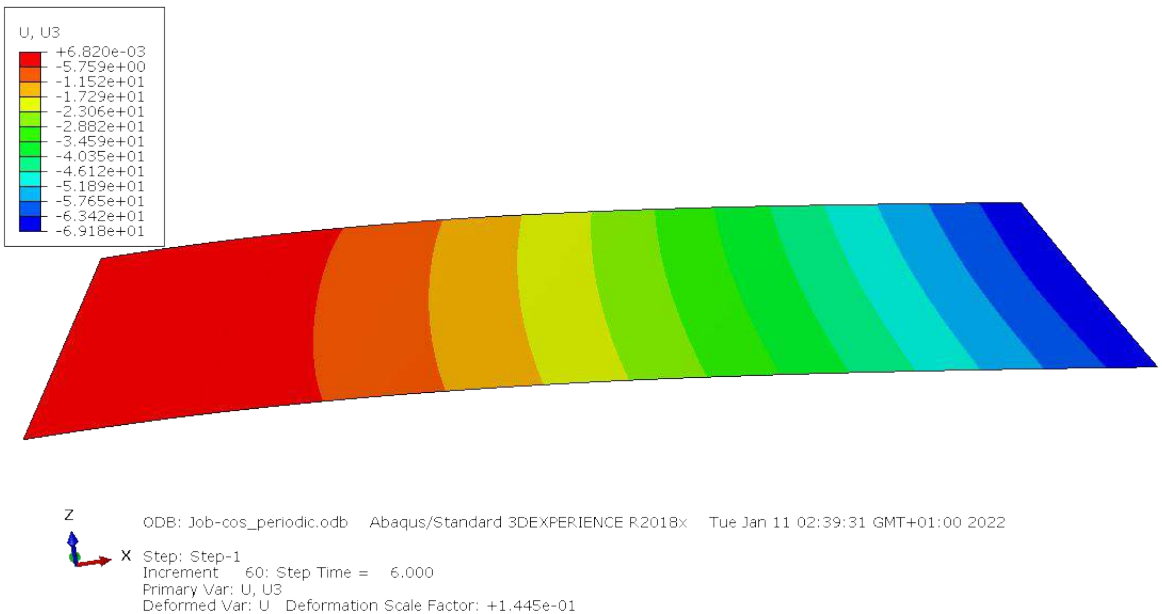


Plate with Time-dependent Load 2

- Plate mat. = Steel, dimension = 100 * 50 *2 mm
- Force = 1000 N
- E = 210,000 Mpa, poisson's ratio = 0.3
- Density = 7850 (Kg/m3)



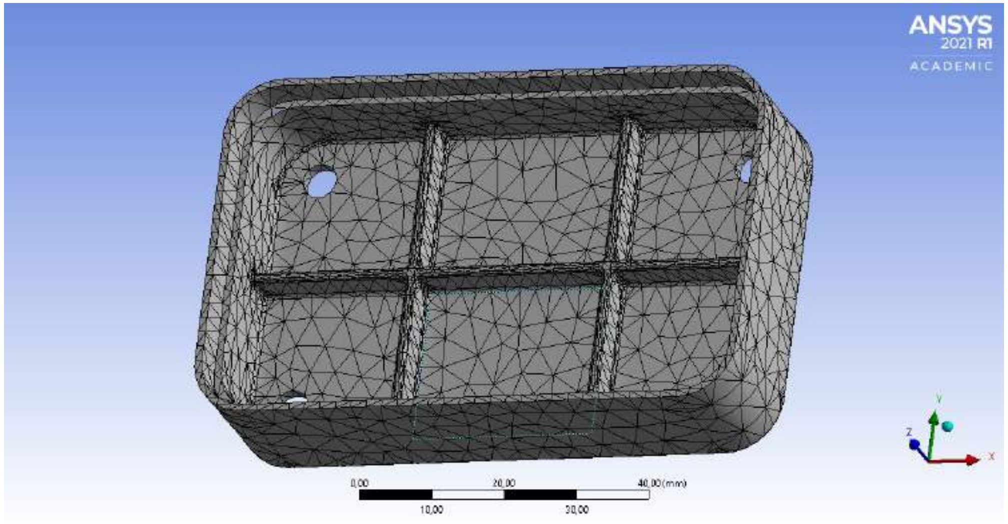


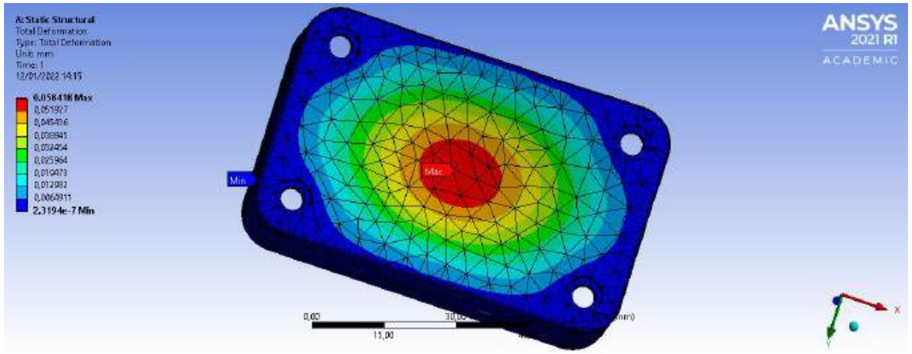


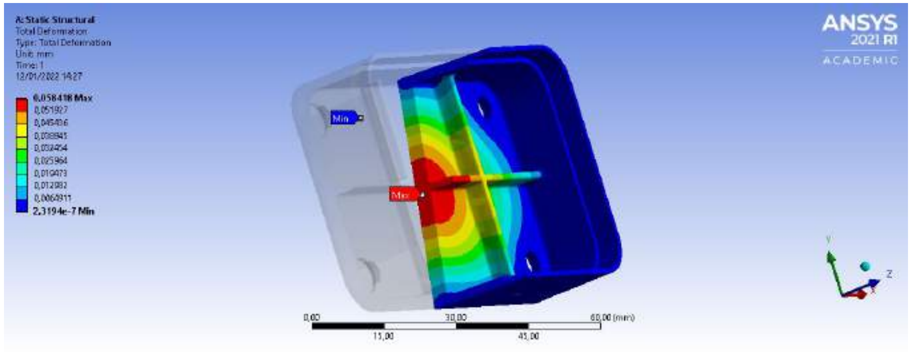
Aluminium Cab Pressure Analysis

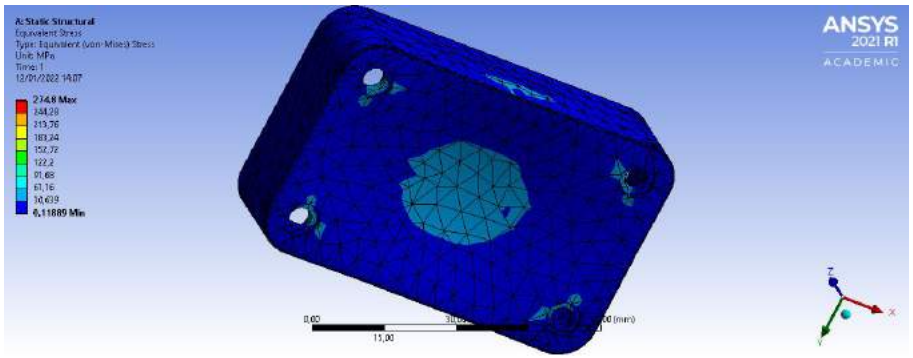
Applied External pressure = 1.0 Mpa

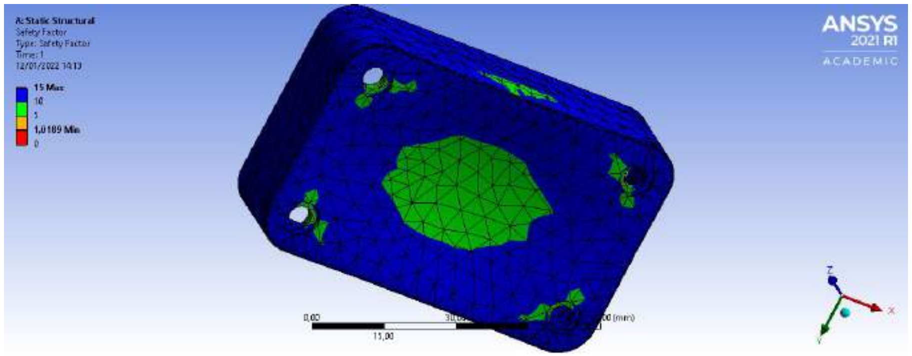
Find: Total deformation
Von Mises Stress
Safety factor







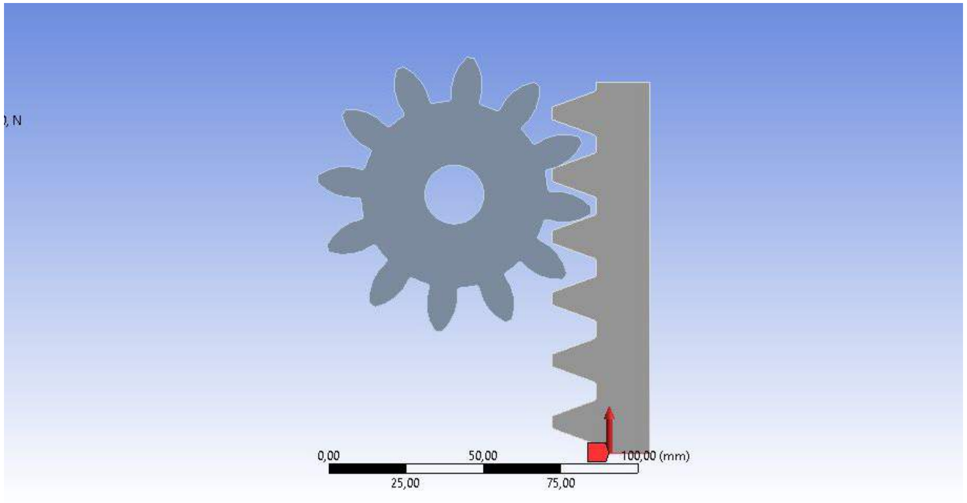


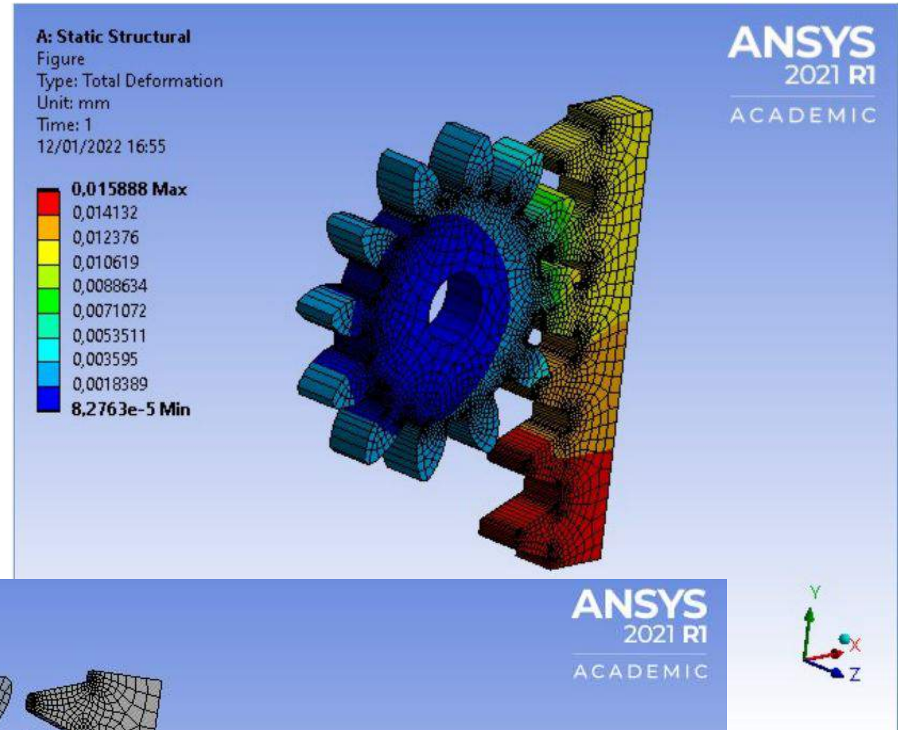


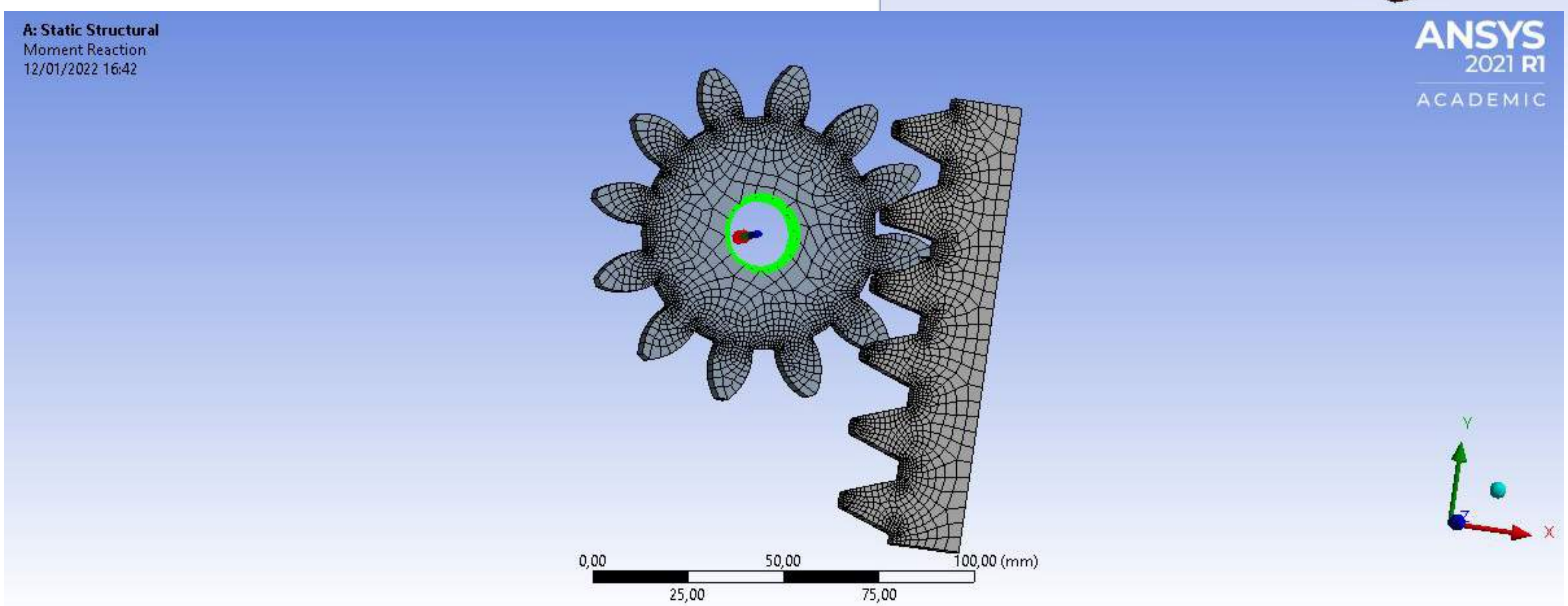
Force Reaction Calculation of a Gear

Force delivered on the Rack is 2500 N

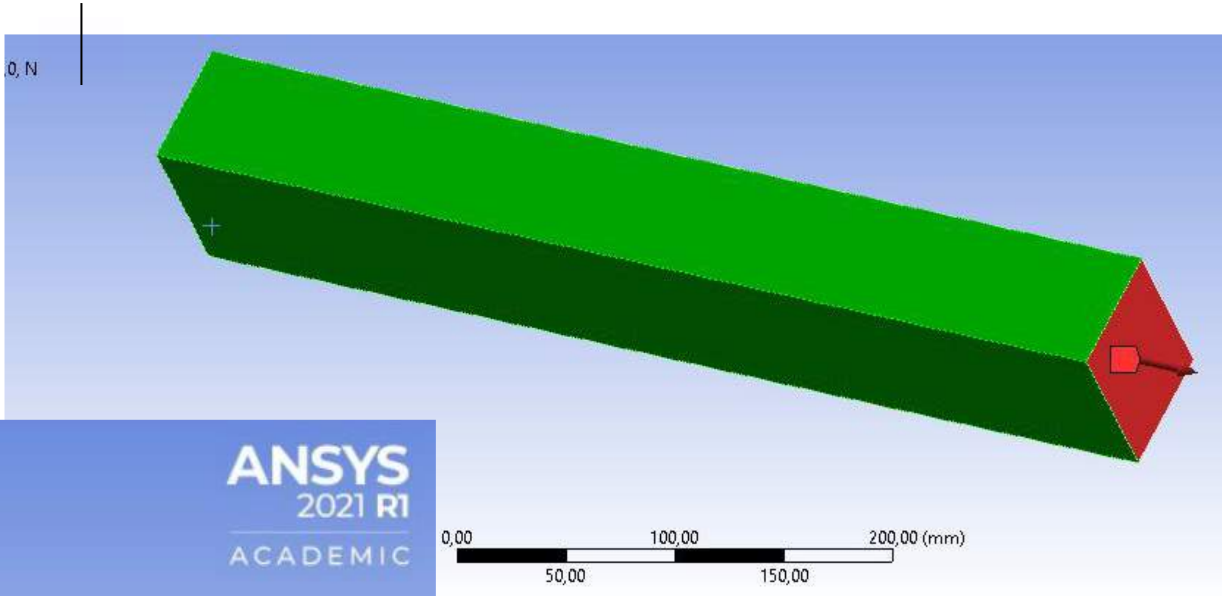
Find: Total deformation & Moment reaction on the gear

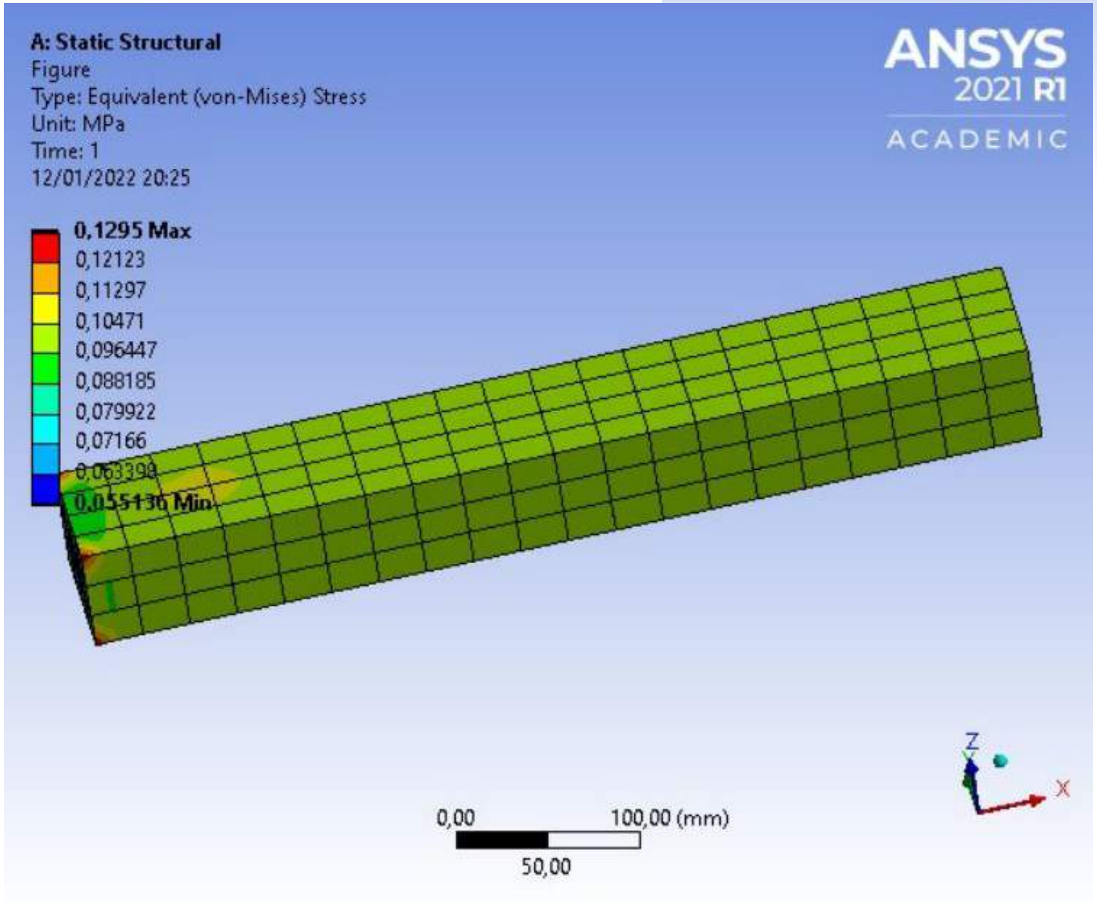






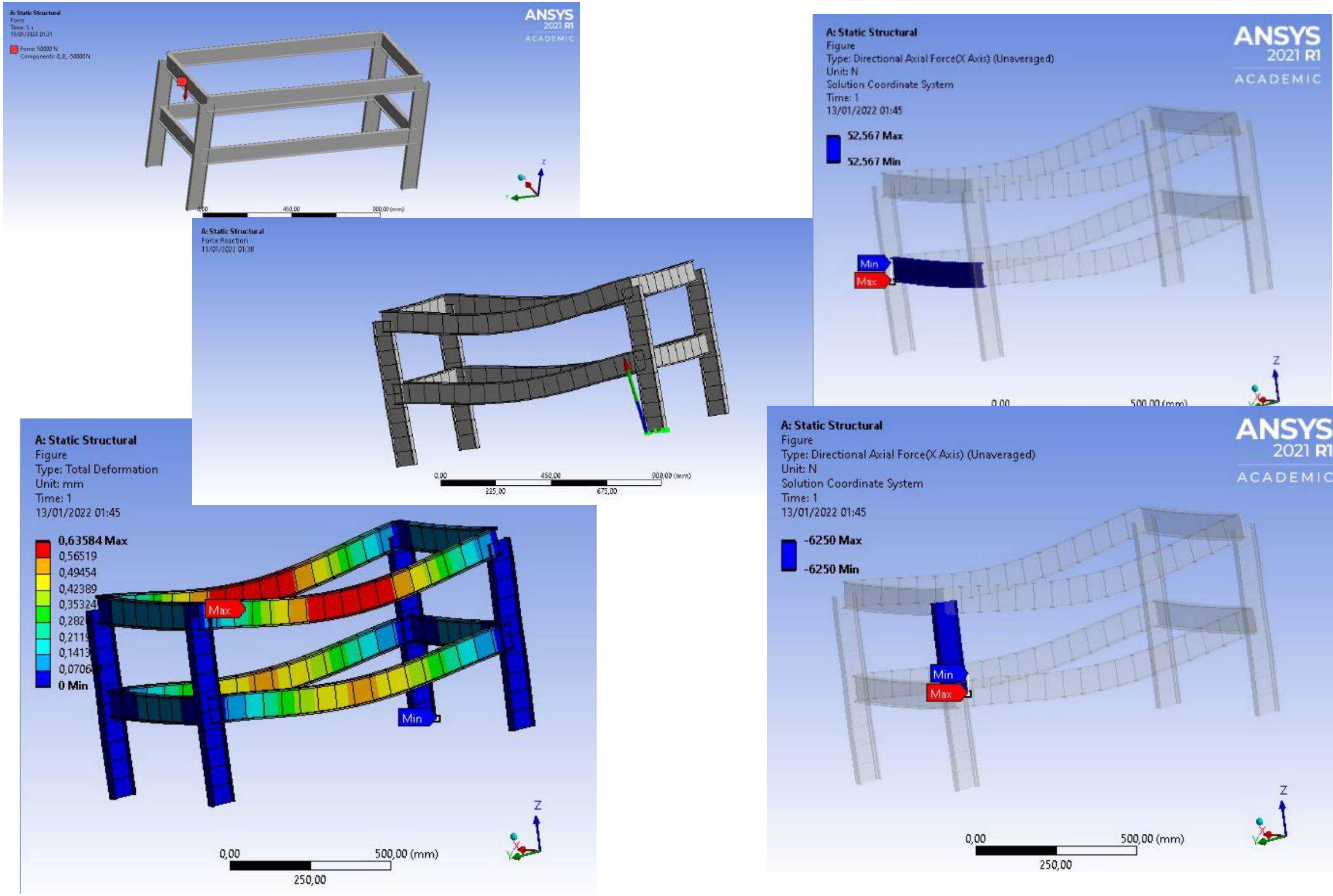
Static structural Analysis of a Beam





Static structural Analysis of a Line -Body Table

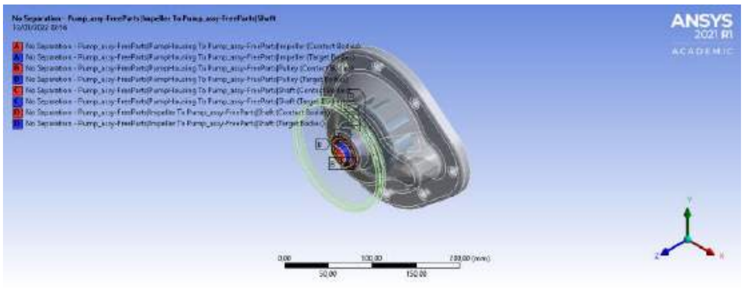
Force delivered in z-direction is 50,000 N | Find: Total deformation, Force reaction & Axial forces

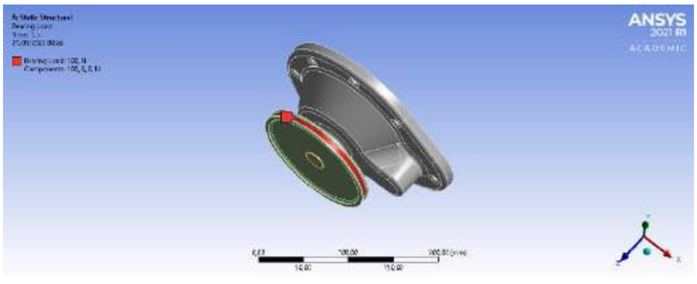


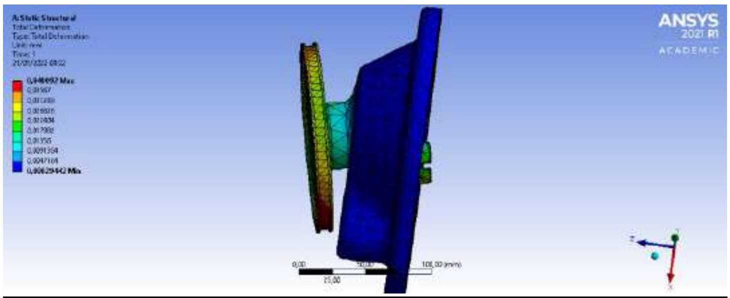
Bearing Load Analysis of Belt Pulley

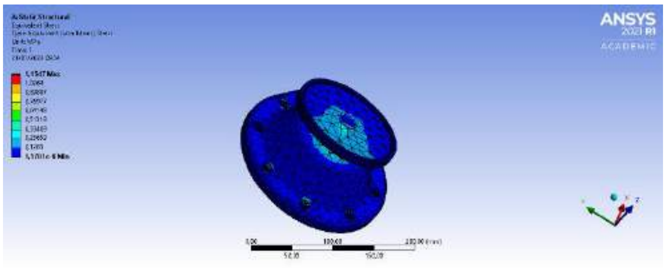
Bearing load (x-component) = 100 N

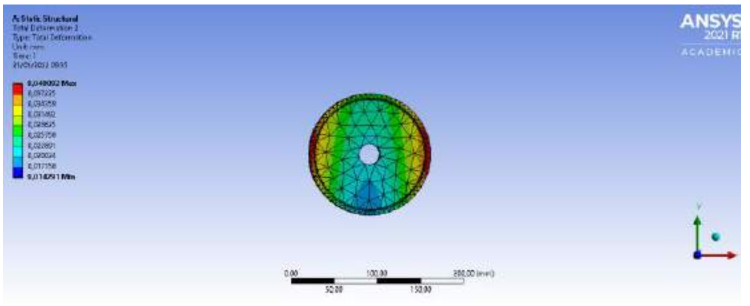
Find: Total deformation (on the: bearing/pulley part and deformed top plate), Equivalent stress.

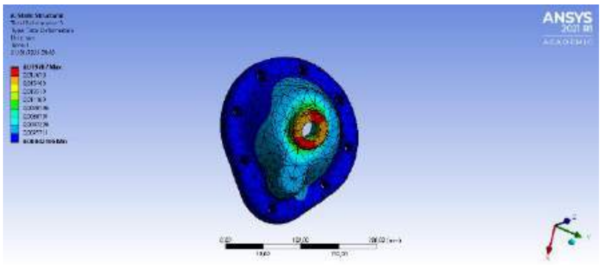






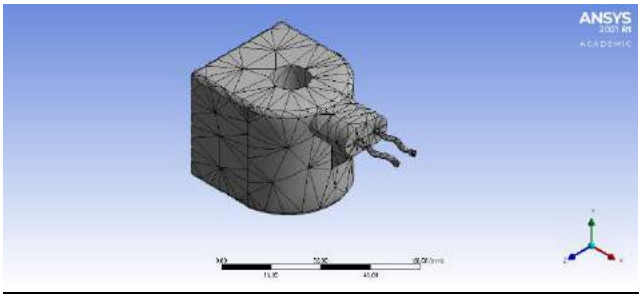


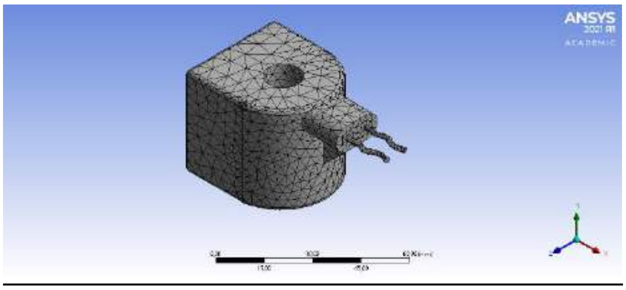


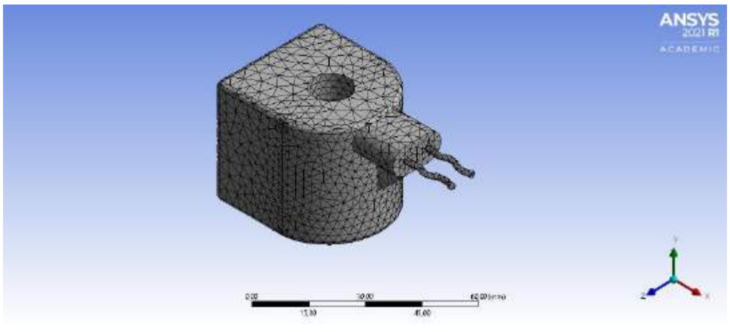


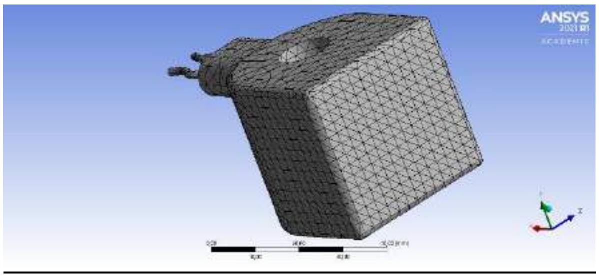
Creating a Mesh Model (Solenoid plug)

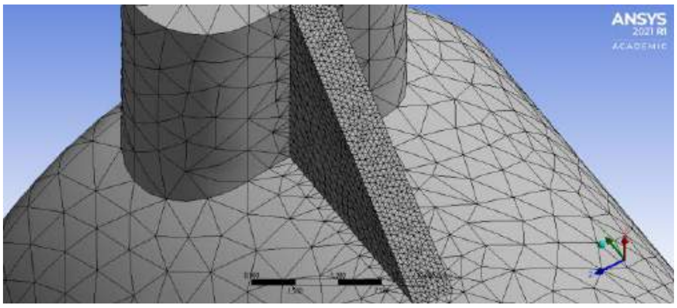
- Improving the mesh model

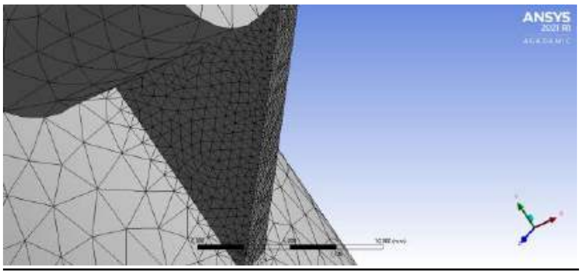






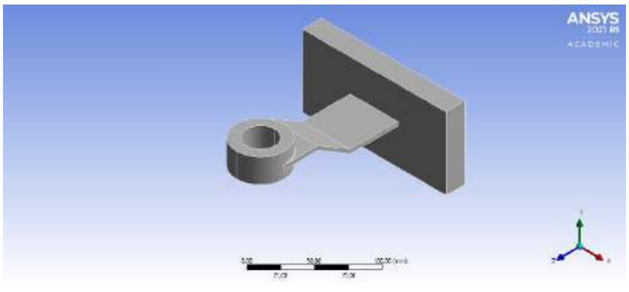


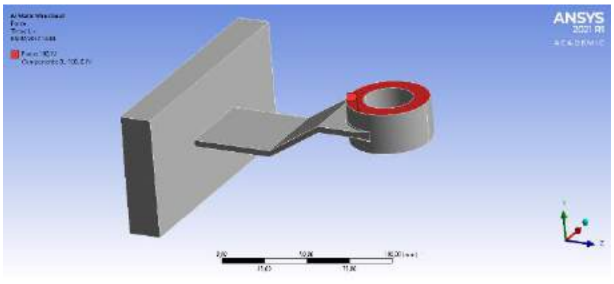


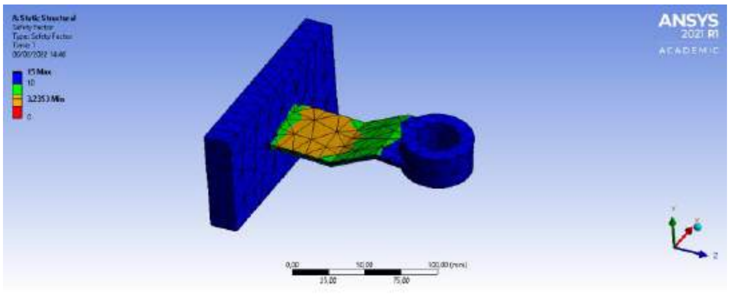


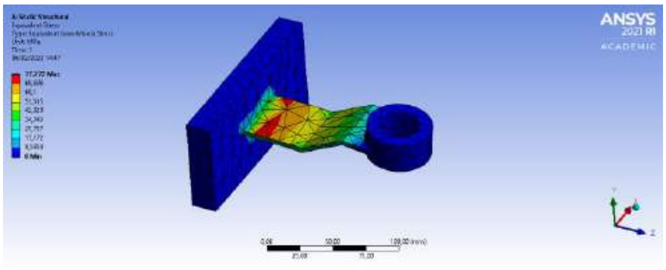
Static Structural Analysis of a Bracket Part

Material = Steel, Yield Strength = 230 MPa | Find: Safety factor, equivalent stress, total deformation.
Force = -100 N (y-component)

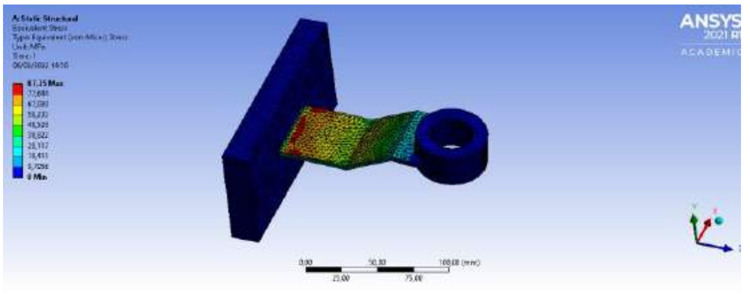




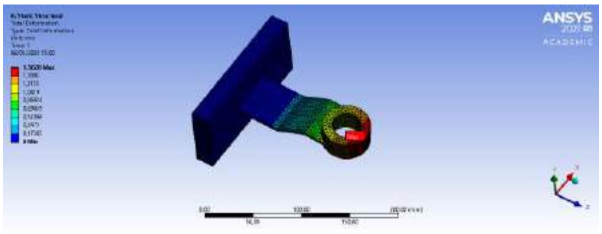




Equivalent stress before mesh refinement



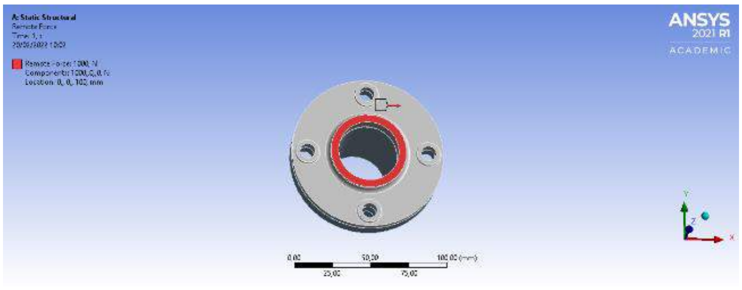
Equivalent stress after mesh refinement

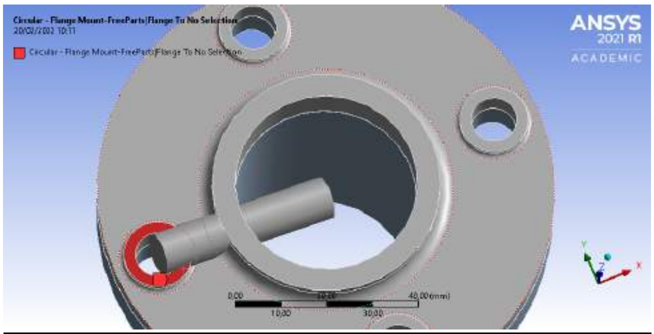


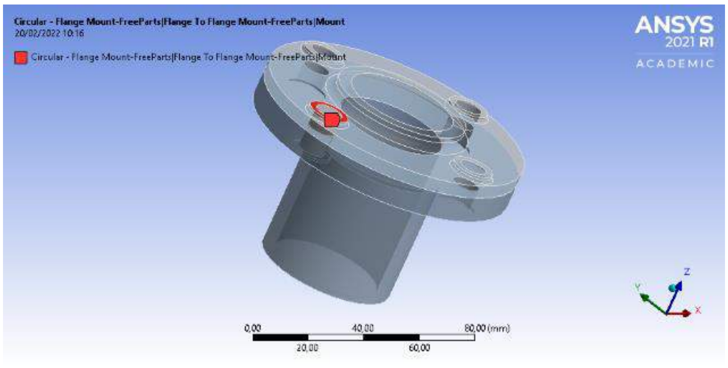
Total deformation after mesh refinement

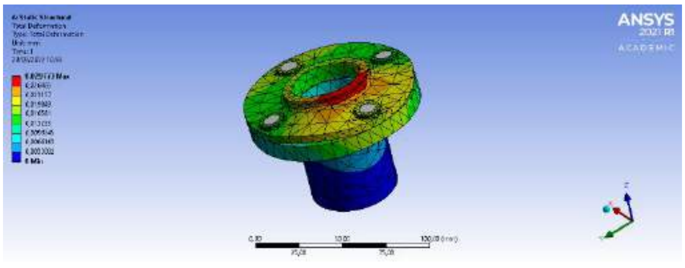
Analysis of Bolt Connection

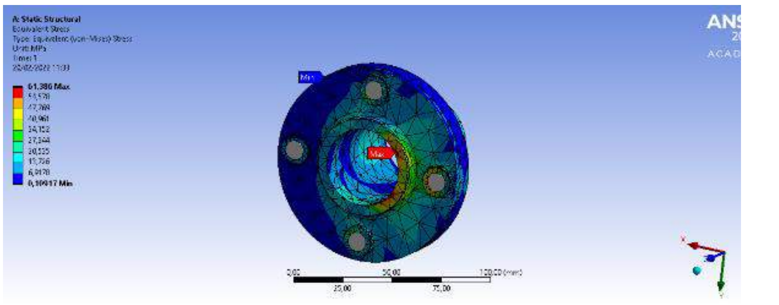
Remote force = 1000 N from Z-direction = 100 mm, Radius = 5 mm | Find: Total deformation, Equivalent stress

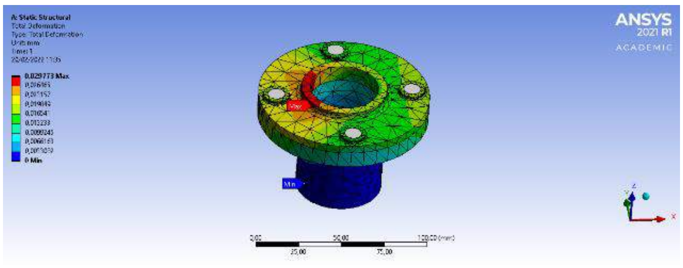












Analysis of Piston Joint Connection

Pressure = = 0,5 MPa | Find: Total deformation, Equivalent stress