ANSYS PROJECT

ME 352
MACHINE DESIGN SESSIONAL

STRUCTURE ANALYSIS OF L SHAPED BEAM WITH UNIFORM CIRCULAR CROSS SECTIONAL AREA

PRESENTED BY -

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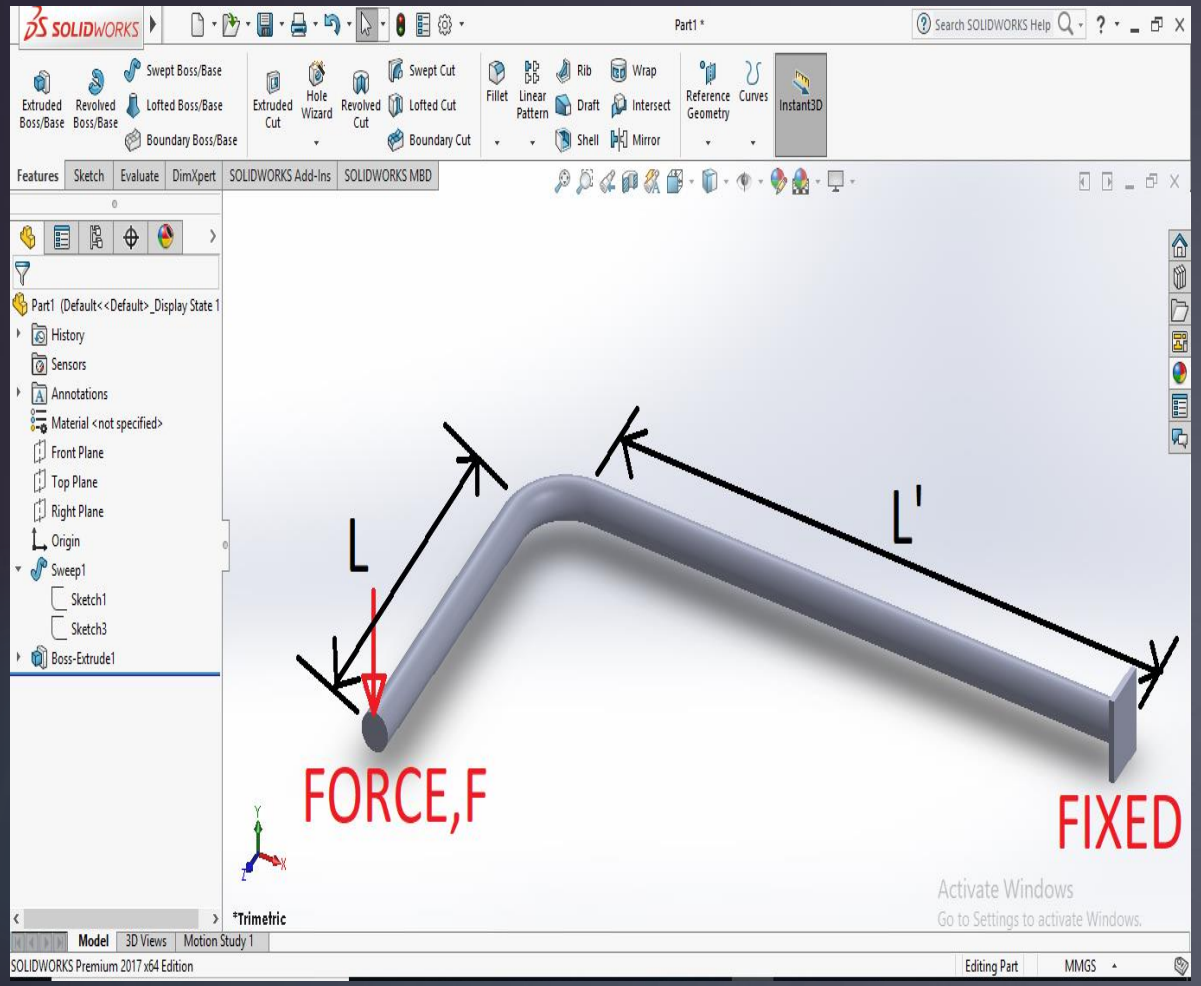
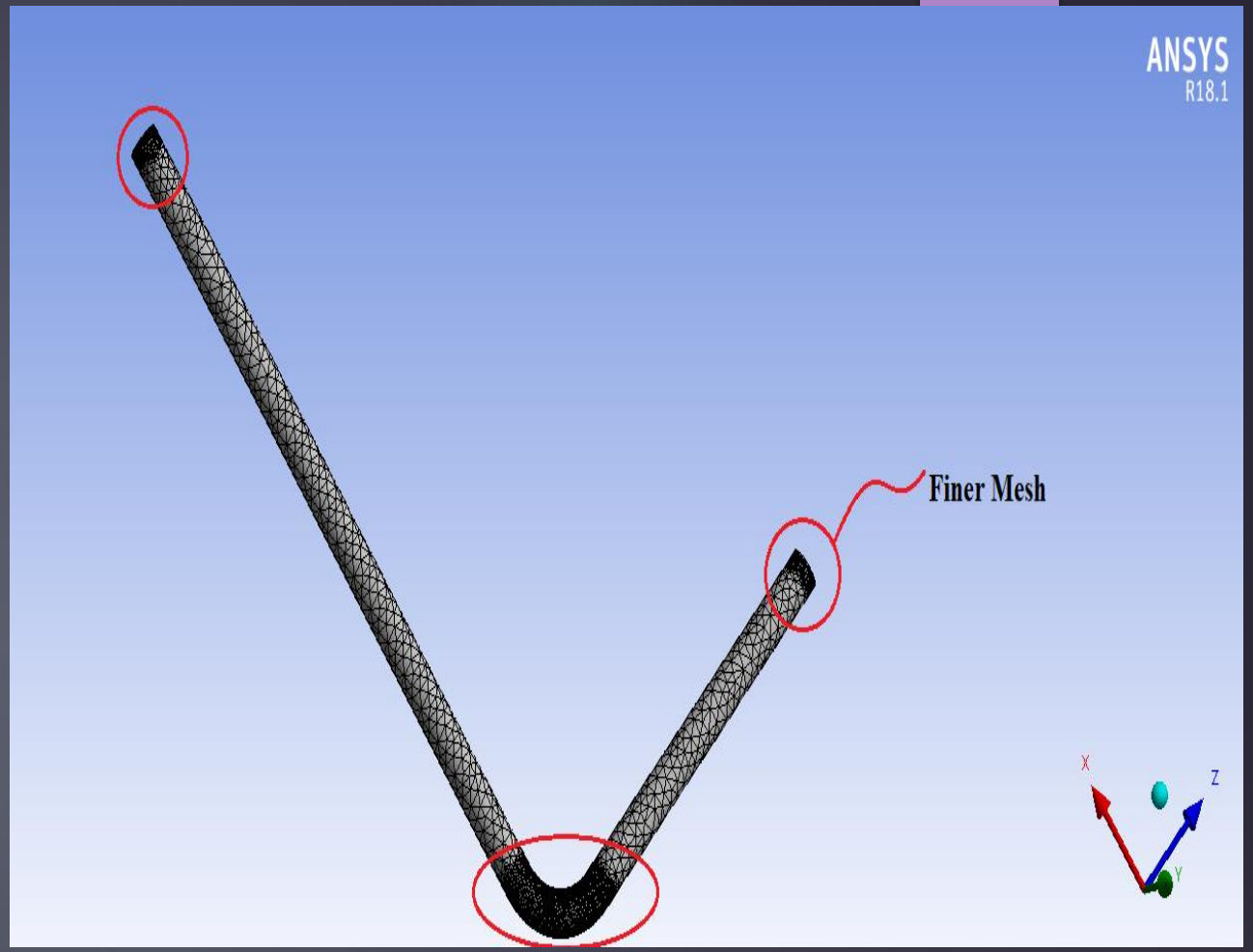
OBJECTIVES :

- Stress strain analysis of L shaped beam with uniform circular cross sectional area.
- Variation of equivalent stress with various aspect ratios (L’ / L) .
- Variation of equivalent stress with forces.
- Variation of equivalent stress with temperature.
- Variation of equivalent stress with different materials.





GEOMETRY

MESHED GEOMETRY

Minimum mesh size used is 0.015 and for finer mesh, refinement value is 3

CONSTITUTIVE EQUATION :

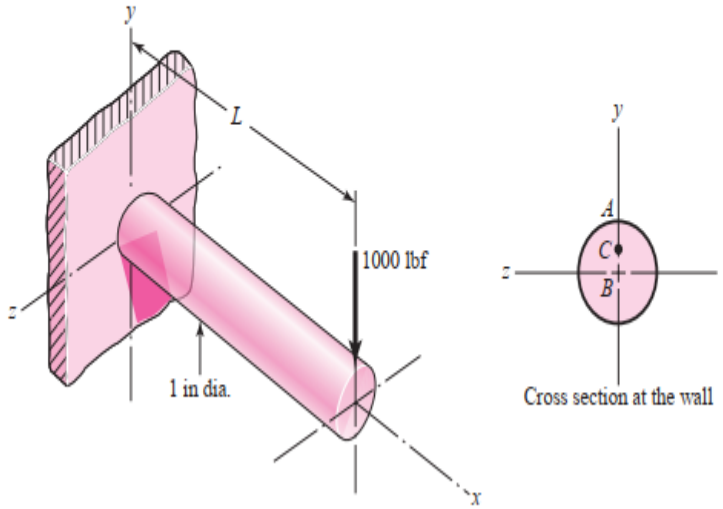
Von Mises Stress,

$$\sigma' = \frac{1}{\sqrt{2}}\left((\sigma_x - \sigma_y)^2 + (\sigma_y - \sigma_z)^2 + (\sigma_z - \sigma_x)^2\right)^{1/2} + 6\left(\tau_{xy}{}^2 + \tau_{yz}{}^2 + \tau_{zx}{}^2\right)^2$$

VALIDATION :

For validation , problem no 3-45 from Shigley's Mechanical Engineering Design is taken .

3–45 A cantilever beam with a 1-in-diameter round cross section is loaded at the tip with a transverse force of 1000 lbf, as shown in the figure. The cross section at the wall is also shown, with labeled points A at the top, B at the center, and C at the midpoint between A and B. Study the



blem 3–45

3-45 **(a)** $L = 10$ in. Element A:

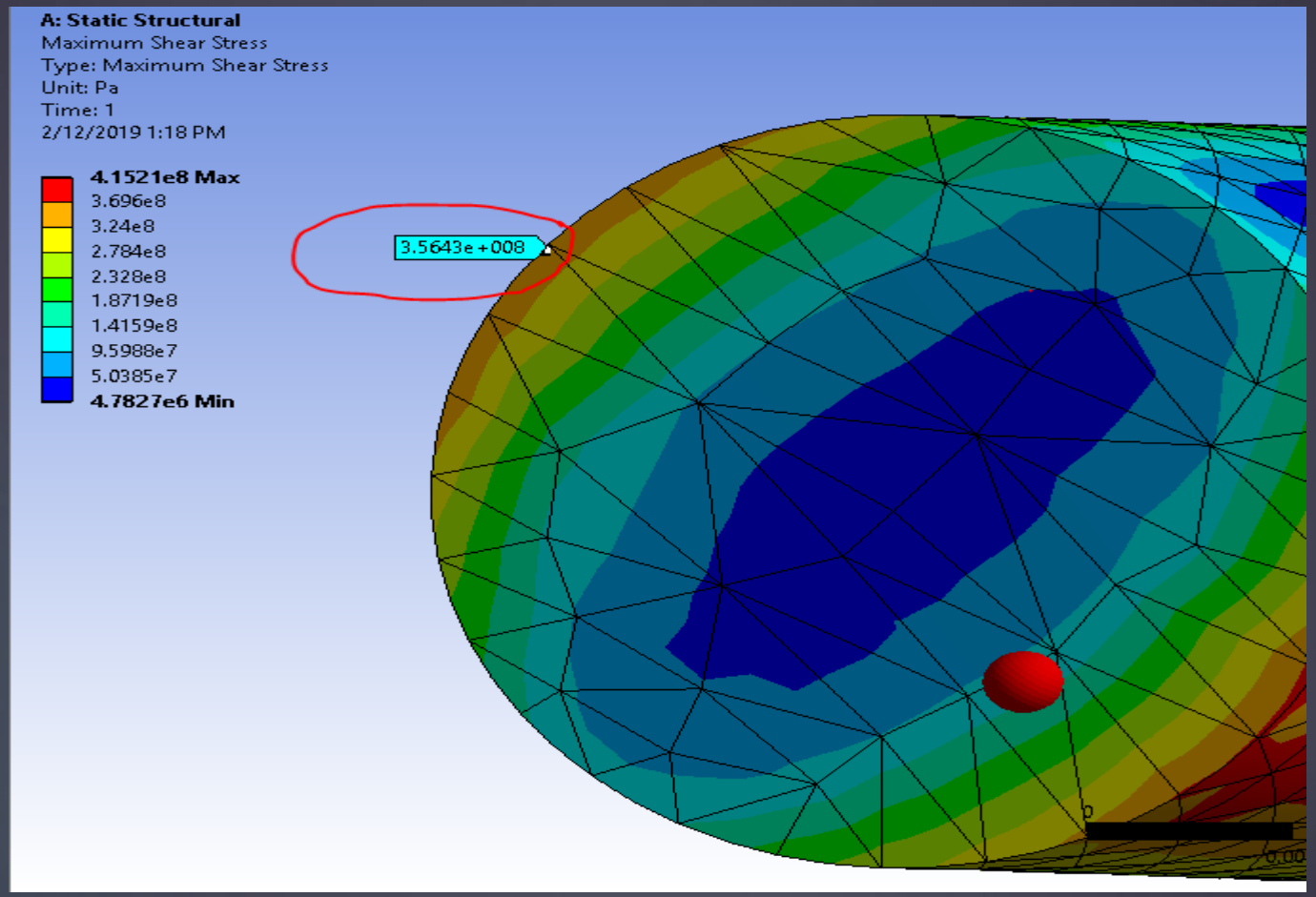
$$\sigma_A = -\frac{My}{I} = -\frac{-(1000)(10)(0.5)}{(\pi/64)(1)^4}\left(10^{-3}\right) = 101.9 \text{ kpsi}$$

$$\tau_A = \frac{VQ}{Ib}, \quad Q = 0 \;\Rightarrow\; \tau_A = 0$$

$$\tau_{\max} = \sqrt{\left(\frac{\sigma_A}{2}\right)^2 + \tau_A^2} = \sqrt{\left(\frac{101.9}{2}\right)^2 + (0)^2} = 50.9 \text{ kpsi} = 351 \text{ MPa}$$

Maximum Shear Stress Here in point A is found 351 MPa .

From Ansys Simulation the result is around 356 MPa.



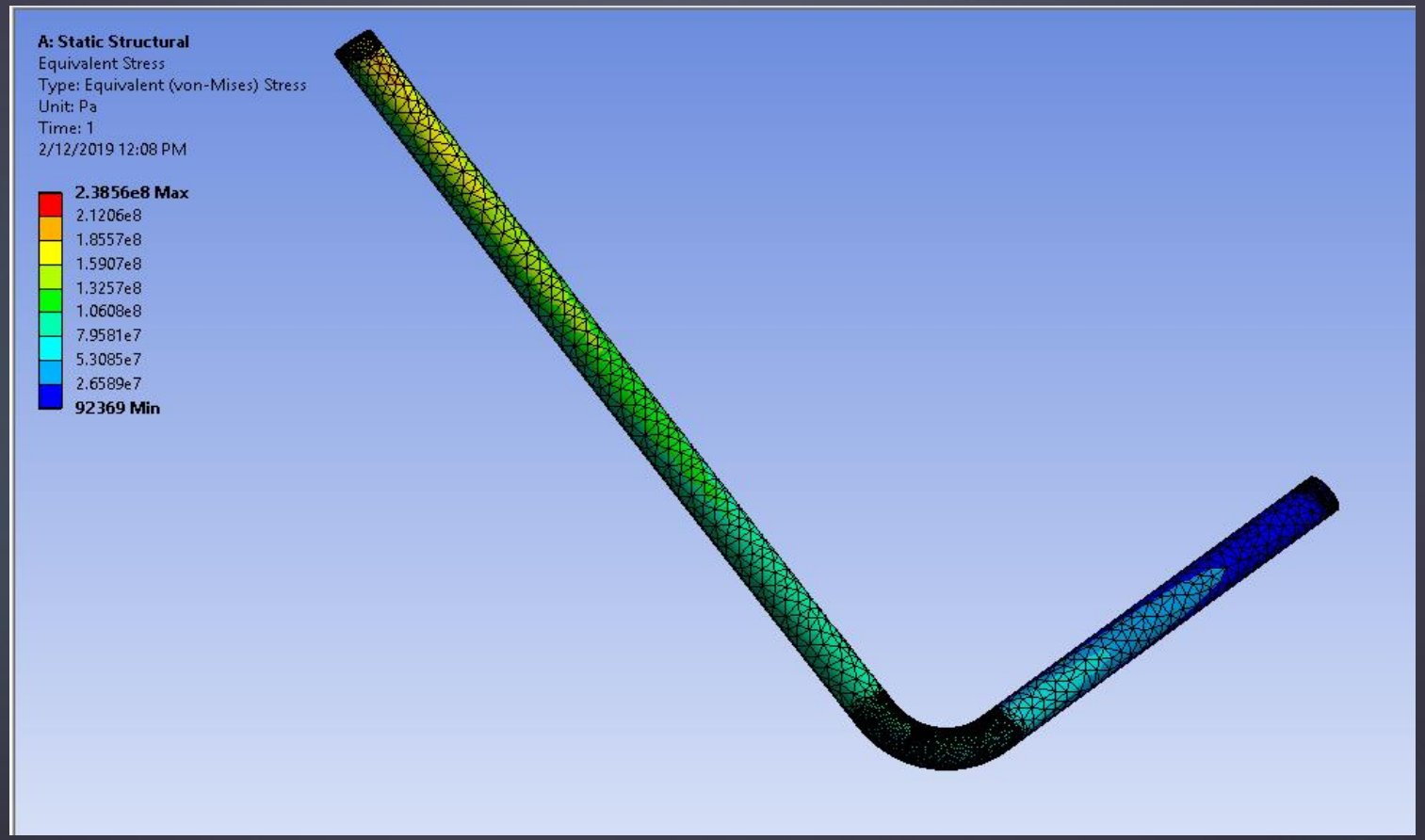
So , the simulation procedure and simulation code is correct.

RESULT & DISCUSSION : FOR SAFETY FACTOR 01

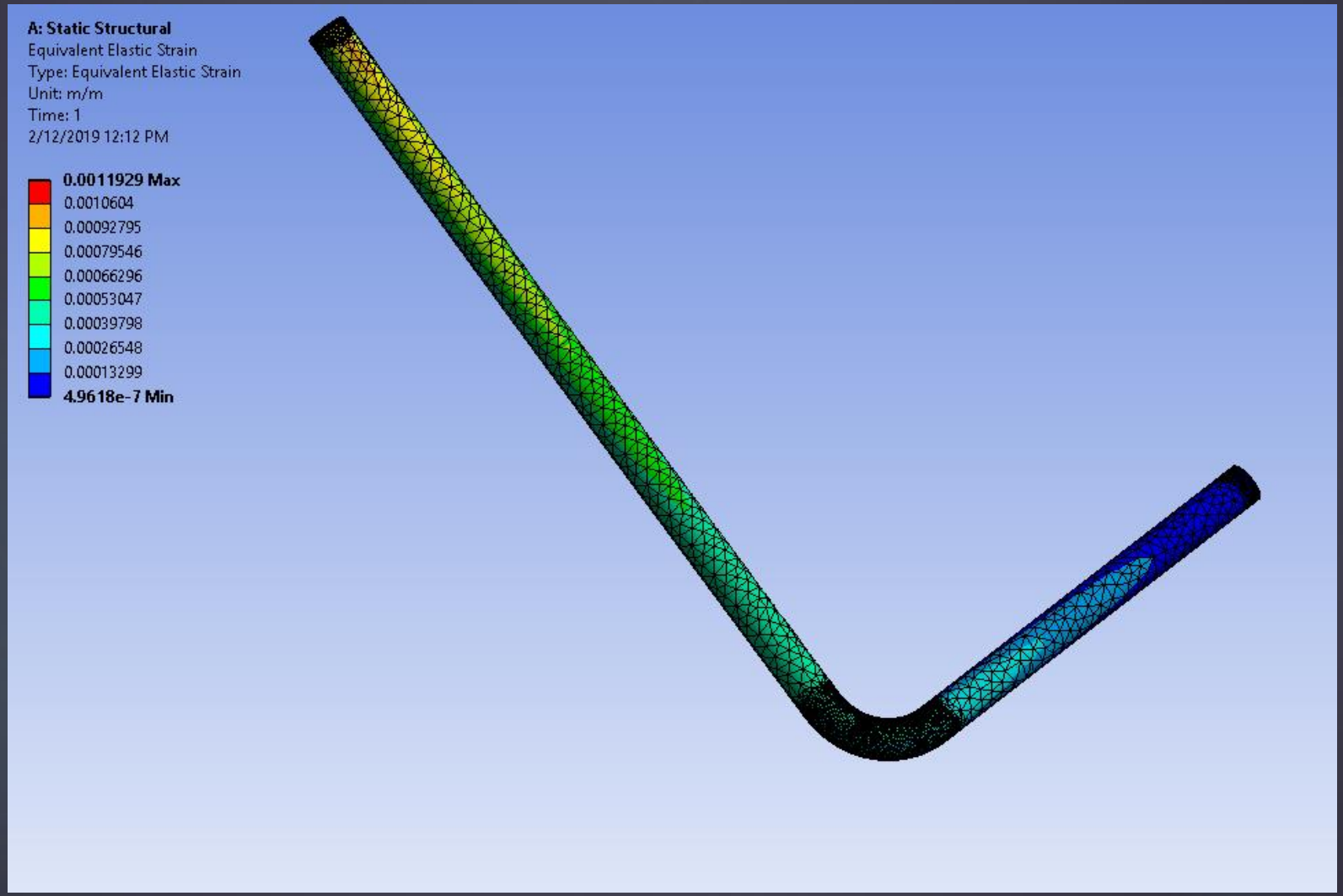
1) STRUCTURE ANALYSIS :

ASPECT RATIO (L'/L) : 02 , MATERIAL : STRUCTURED STEEL

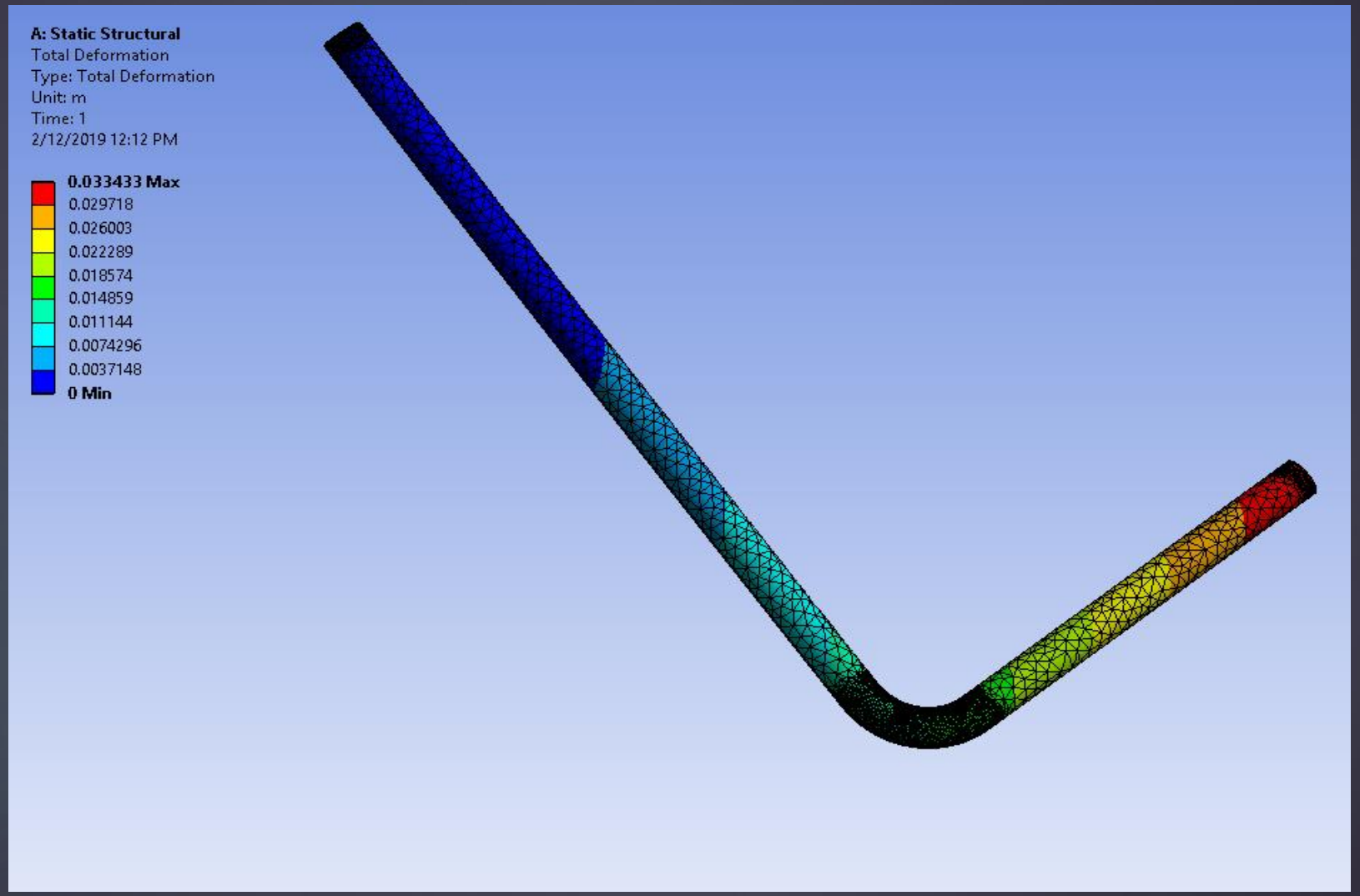
ANSYS simulation result for equivalent (von mises) STRESS :



ANSYS simulation result for equivalent STRAIN :

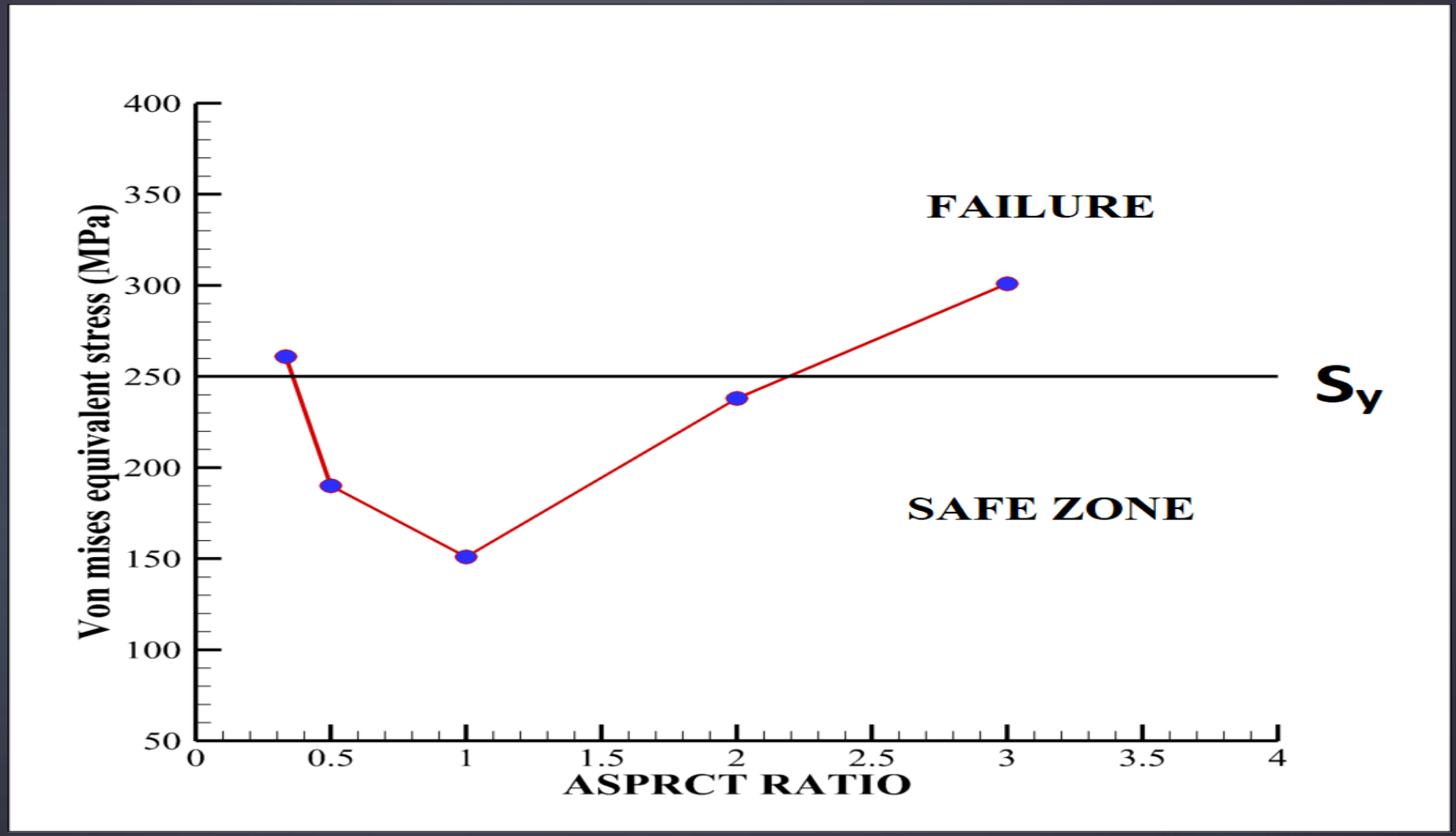


ANSYS simulation result for total DEFORMATION:



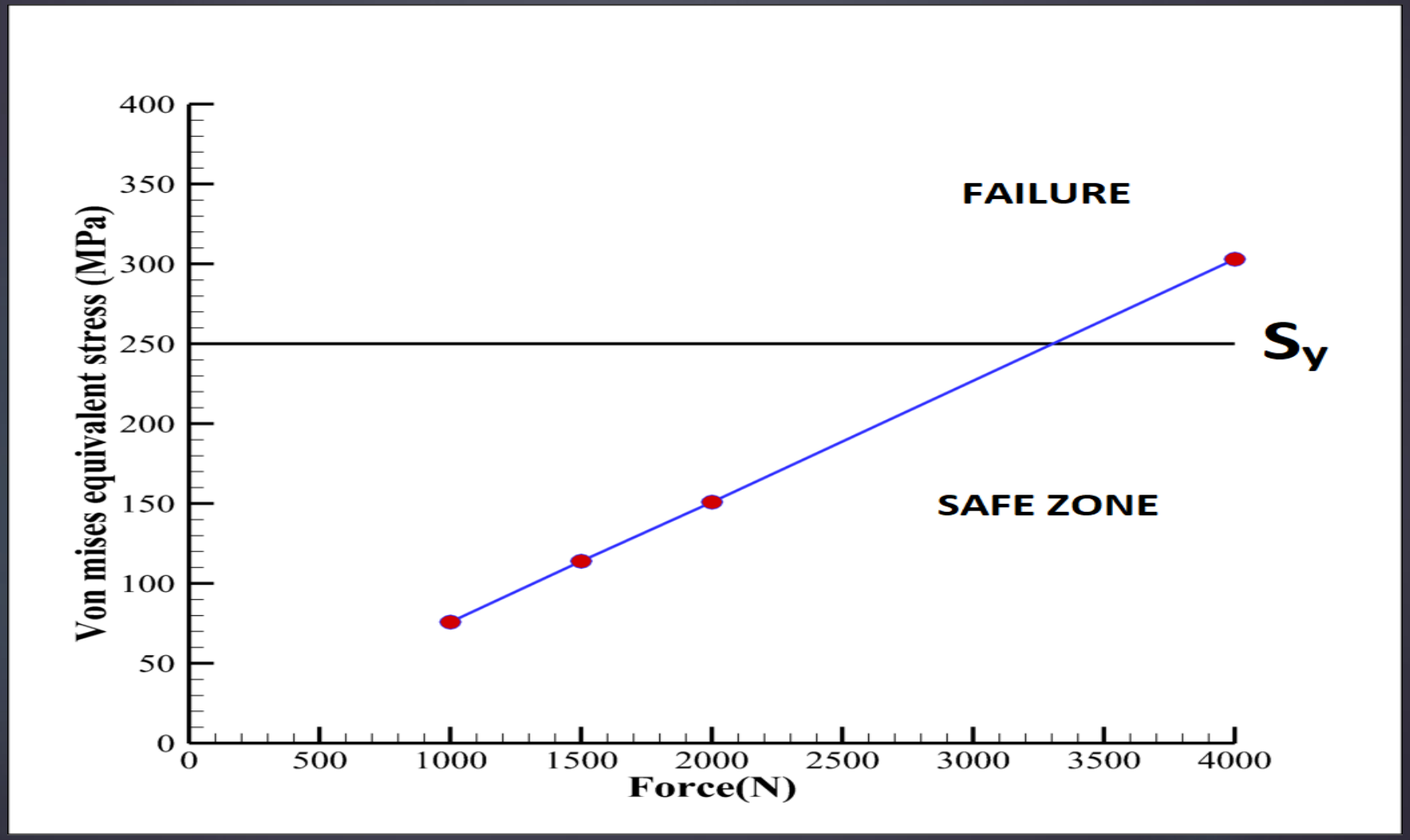
2) Variation of equivalent stress with various aspect ratios (L' / L) :

MATERIAL : STRUCTURED STEEL



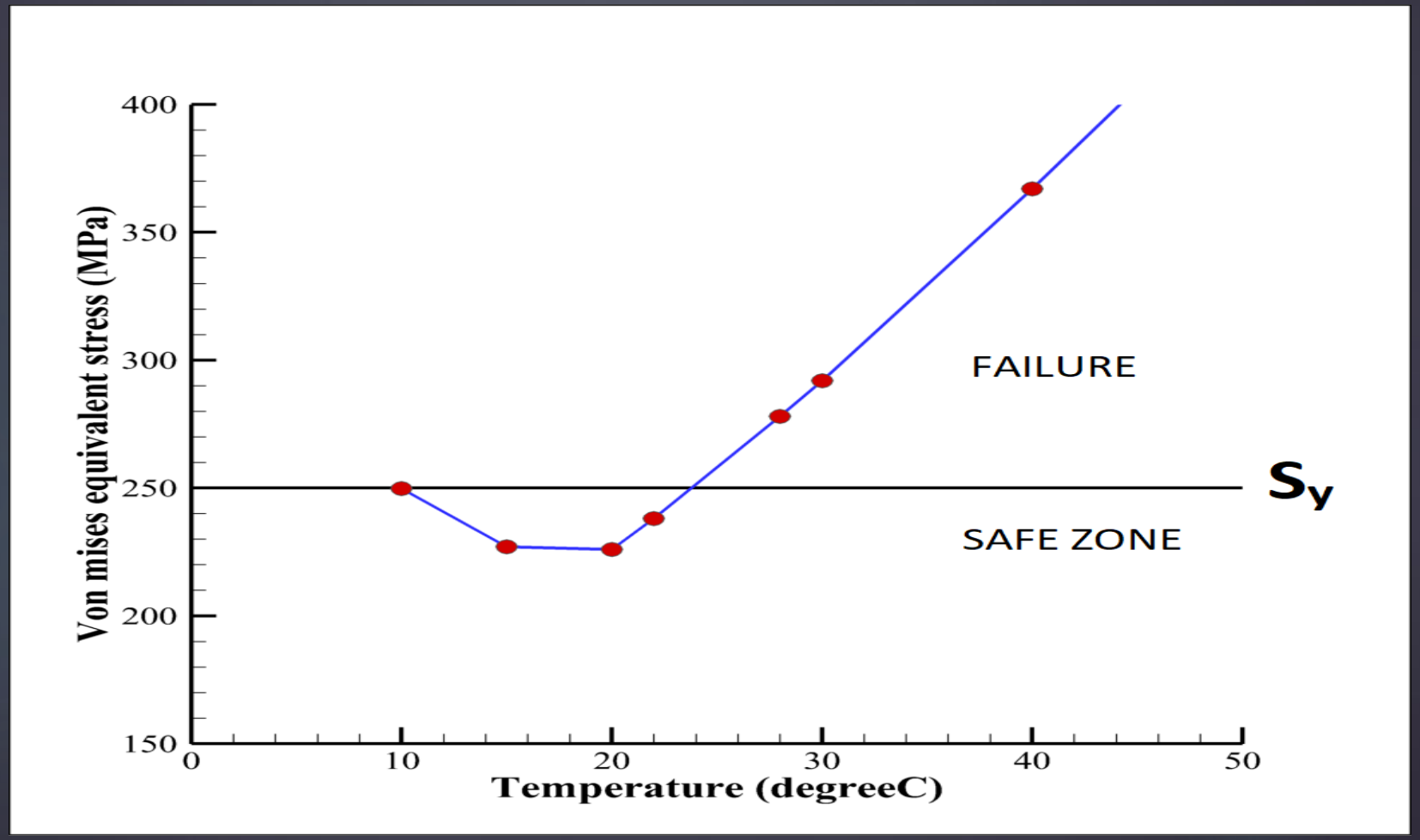
3) Variation of equivalent stress with FORCES :

ASPECT RATIO (L'/L) : 02 , MATERIAL : STRUCTURED STEEL



4) Variation of equivalent stress with TEMPERATURE :

ASPECT RATIO (L'/L) : 02 , MATERIAL : STRUCTURED STEEL



5) Variation of maximum equivalent stress with different MATERIALS :

ASPECT RATIO (L'/L) : 02

MATERIALS	MAX. EQUIVALENT STRESS	S_y
Stainless steel	200.8 MPa	207 MPa
Aluminium Alloy	201 MPa	280 MPa
Copper Alloy	202.46 MPa	280 MPa
Structure Alloy	238 MPa	250 MPa

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Lecturer , ME , BUET.

THANK YOU ALL !