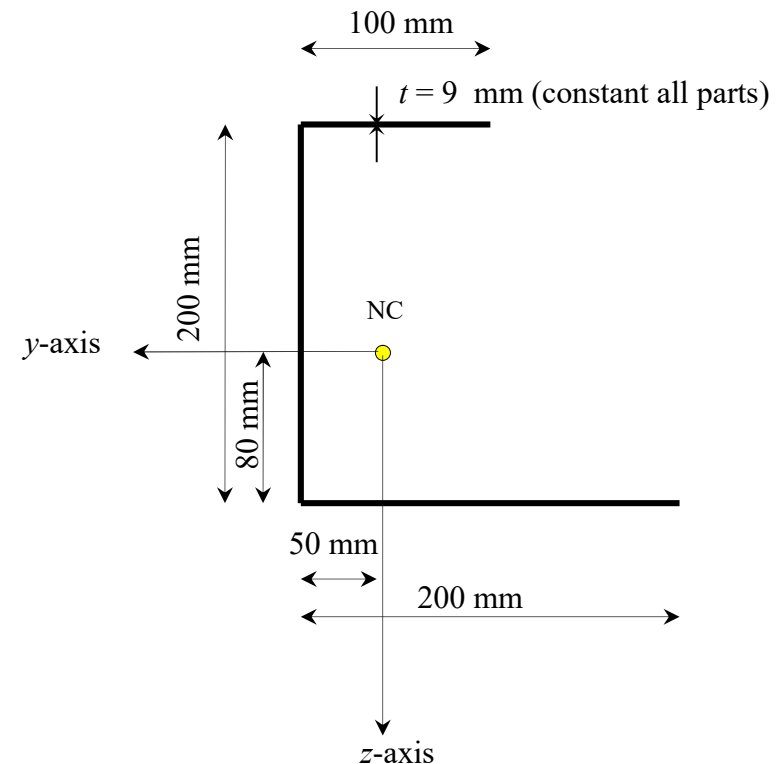
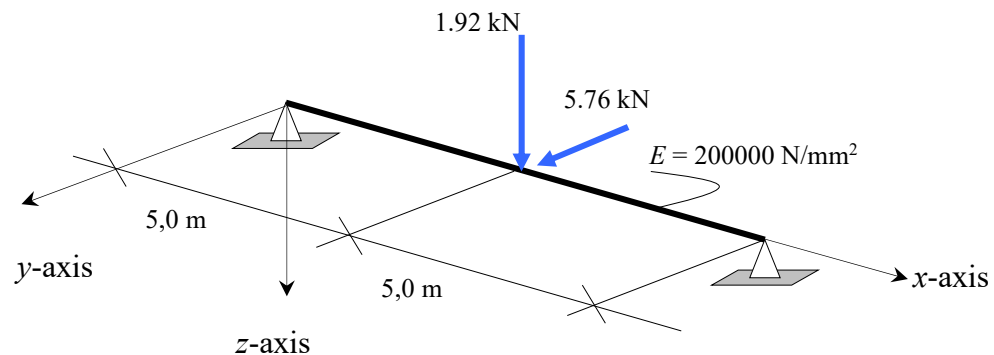


Given : Simply supported beam with homogeneous thin walled prismatic cross section



Assumptions:

- 1) Loads and reactions acts at the Shear Force Centre. The beam is therefore not loaded in torsion.
- 2) Thin walled cross section

Questions

Cross section

- a) Find the location of the NC.
- b) Find the cross sectional properties needed for the constitutional matrix

Check : $I_{yy} = 15.75 \times 10^6 \text{ mm}^4$; $I_{zz} = 31.2 \times 10^6 \text{ mm}^4$; $I_{yz} = -9 \times 10^6 \text{ mm}^4$;

Load

- c) Find the force distribution and draw the M - and V -lines in the x - y and y - z plane.
- d) Find the sectional forces at midspan

Stresses

- e) Find the cross sectional deformations at midspan
- f) Find the normal stress distribution at midspan
- g) Find the shear stress distribution at midspan (directly to the left)
- h) Find the hot spots for the shear stresses
- i) Find the line of action of the shear force for zero torsion.

Load

$$N = 0$$

$$M_y = \frac{1}{4} F_y \times l = 14.4 \text{ kNm}$$

$$M_z = \frac{1}{4} F_z \times l = 4.8 \text{ kNm}$$

Deformation at midspan:

$$\begin{bmatrix} M_y \\ M_z \end{bmatrix} = 2.0 \times 10^5 \begin{bmatrix} 15.75 \times 10^6 & -9 \times 10^6 \\ -9 \times 10^6 & 31.2 \times 10^6 \end{bmatrix} \begin{bmatrix} \kappa_y \\ \kappa_z \end{bmatrix}$$

$$\kappa_y = 6 \times 10^{-6}$$

$$\kappa_z = 2.5 \times 10^{-6}$$

Neutral axis:

$$\varepsilon(y, z) = 6 \times 10^{-6} y + 2.5 \times 10^{-6} z = 0 \Rightarrow 1.2y + 0.5z = 0$$

Stresses:

y	z	σ [N/mm ²]
-50	-120	-120
50	-120	0
50	80	100
-150	80	-140

