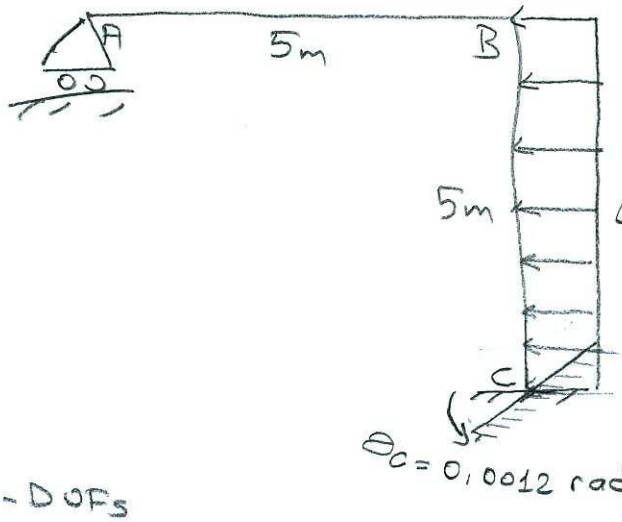
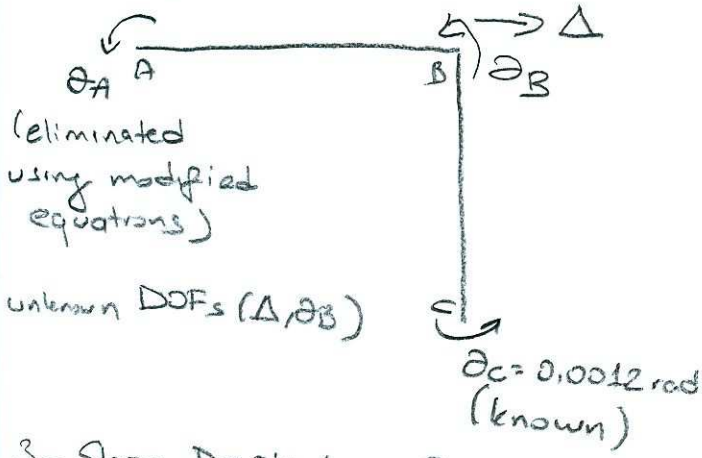
RECITATION-6



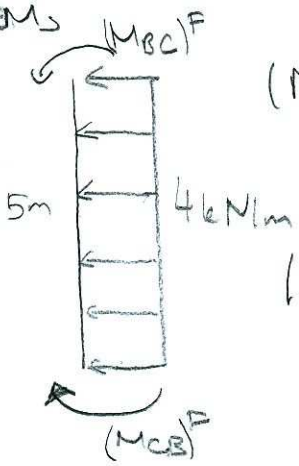
Support C rotates 0,0012 rad CCW

$EI = 36000\ kNm^2$, members are axially rigid. Draw bending moment diagram using Slope-Deflection method

1- DOFs



2- FEMs



$$(M_{BC})^F = \frac{wL^2}{12} = \frac{4(5)^2}{12} = 8,33\ kNm$$

$$(M_{CB})^F = \frac{-wL^2}{12} = \frac{-4(5)^2}{12} = -8,33\ kNm$$

3- Slope-Deflection Equations

$$M_{BA} = \frac{3EI}{5}(\theta_B - \cancel{\psi}^{0}) + (M_{BA})^F \to 0$$

(modified)

$$= 0,6EI\theta_B$$

$$M_{BC} = \frac{2EI}{5}\left(2\theta_B + 0,0012 - \frac{3(-\Delta)}{5}\right) + (M_{BC})^F$$

$$= 0,8EI\theta_B + 17.28 + 0,24\Delta + 8.33$$

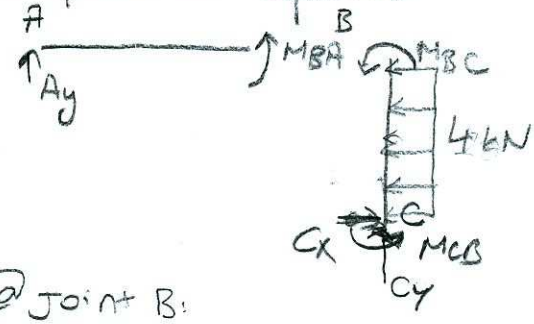
$$= 0,8EI\theta_B + 0.24\Delta + 25,61$$

$$M_{CB} = \frac{2EI}{5}\left(2(0,0012) + \theta_B - \frac{3(-\Delta)}{5}\right) + (M_{CB})^F$$

$$= 34,56 + 0,4EI\theta_B + 0,24\Delta - 8.33$$

$$= 0.4EI\theta_B + 0,24\Delta + 26,23$$

4- Equilibrium Equations:



@ Joint B:

$$M_{BA} + M_{BC} = 0 \quad \ldots (1)$$

From whole FBD

$$\Sigma M_C = 0 \Rightarrow M_{CB} - 5A_y + 4(5)(2.5) = 0$$

$$A_y = \frac{M_{BA}}{5} \text{ (from FBD of member AB)}$$

$$M_{CB} - M_{BA} + 50 = 0 \quad \ldots (2)$$

If we substitute M_{BA}, M_{BC} equations into Eq(1):

$$0.6EI\theta_B + 0,8EI\theta_B + 0,24\Delta + 25,61 = 0$$

$$1.4EI\theta_B + 0,24\Delta + 25,61 = 0$$

If we substitute M_{CB}, M_{BA} equations into Eq(2):

$$0,4EI\theta_B + 0,24\Delta + 26.23 - 0,6EI\theta_B + 50 = 0$$

$$0,24\Delta + 76.23 - 0,2EI\theta_B = 0$$

$$EI\begin{bmatrix} 1.4 & 0,24 \\ -0,2 & 0,24 \end{bmatrix}\begin{bmatrix} \theta_B \\ \Delta \end{bmatrix} = \begin{bmatrix} -25.61 \\ -76.23 \end{bmatrix}$$

$$\theta_B = \frac{31.6375}{EI} \qquad \Delta = -\frac{291.25}{EI}$$

5- Backsubstitution:

$M_{BA} = 0.6EI\theta_B = 18.98\ kNm$

$M_{BC} = 0.8EI\theta_B + 0,24\Delta + 25,61 = -18.98\ kNm$ ($= -M_{BA}$ ✓)

$M_{CB} = 0.4EI\theta_B + 0,24\Delta + 26.23 = -31.02\ kNm$