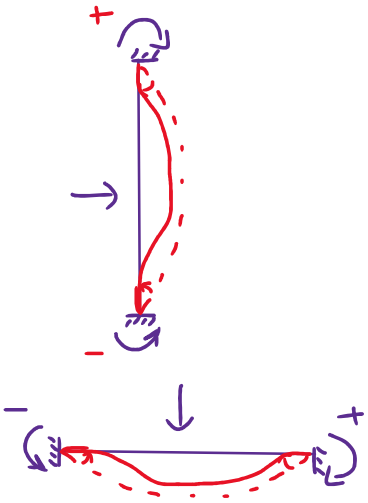
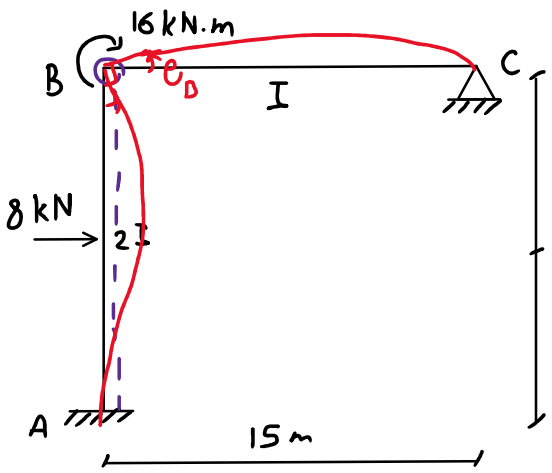
Slope-Deflection 4

Monday, February 19, 2024 8:26

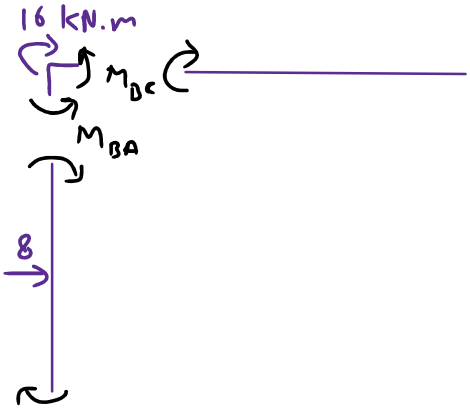
مثال: لنگرهای M_A و M_B را در تاب شکل زیر به دست آورید.





مجهول: θ_B

معادله: $\Sigma M_B = 0$



$$\begin{cases} M_{BA} = \frac{2(2EI)}{20}(2\theta_B) + \frac{8(20)}{8} = 0.4EI\theta_B + 20 \\ M_{BC} = \frac{3EI}{15}(\theta_B) = 0.2EI\theta_B \end{cases}$$

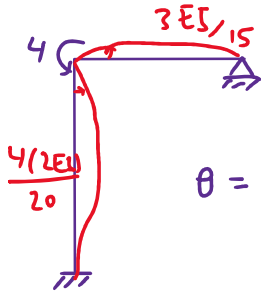
$$\rightarrow M_{BA} + M_{BC} - 16 = 0$$

$$0.6EI\theta_B + 20 - 16 = 0 \rightarrow \boxed{EI\theta_B = -6.6}$$

$$M_{BC} = 0.2(-6.6) = -1.33 \text{ kN.m}$$

$$M_{BA} + (-1.33) - 16 = 0 \rightarrow \boxed{M_{BA} = 17.33}$$

$$M_{AB} = \frac{2(2EI)}{20}(\theta_B) - 20 = -21.33$$

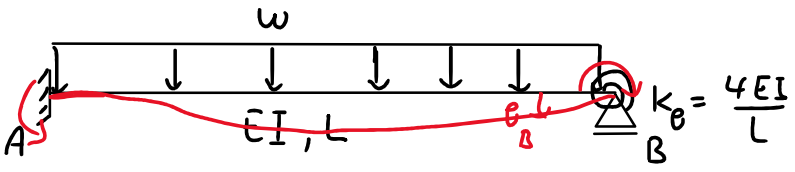


$$\theta = \frac{M}{\Sigma k_\theta} = \frac{4}{\left(\frac{3}{15} + \frac{8}{20}\right)EI} = 6.66$$

مثال: لنگرهای دو سر تیر را به دست آورید.

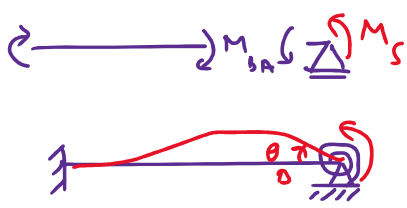
مجهول: θ_B

معادله: $\Sigma M_B = 0$



$$\begin{cases} M_{BA} = \frac{2EI}{L}(2\theta_B) + \frac{wL^2}{12} \\ M_S = k_\theta\theta_B = \frac{4EI}{L}\theta_B \end{cases}$$

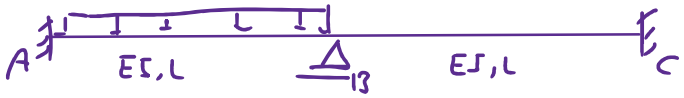
$$\rightarrow M_{BA} + M_S = 0$$



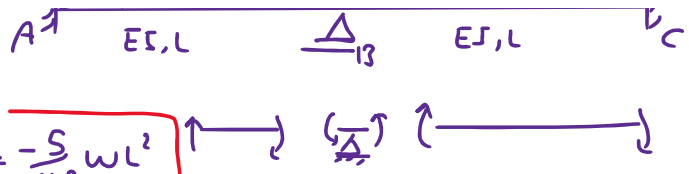
$$M_S = +k_\theta\theta_B$$

$$\frac{8EI}{L}\theta_B + \frac{wL^2}{12} = 0 \rightarrow \boxed{\theta_B = \frac{-wL^2}{96EI}}$$

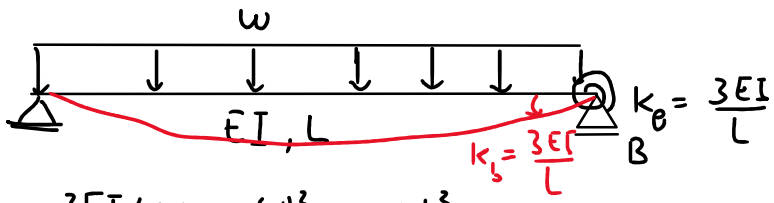
$$M_S = \frac{4EI}{L}\theta_B = \frac{wL^2}{24}$$



$$M_S = \frac{4EI}{L}\theta_B = \frac{wL^2}{24}$$

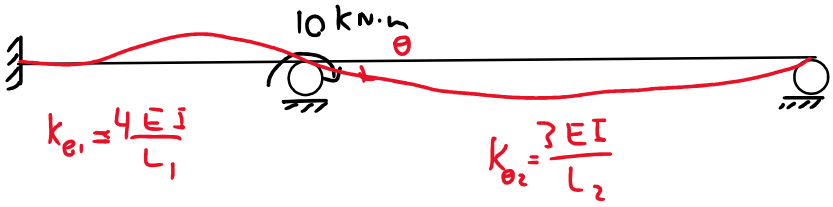


$$M_{AB} = \frac{2EI}{L}(\theta_B) - \frac{wL^2}{12} = -\frac{1}{48}wL^2 - \frac{1}{12}wL^2 = \frac{-5}{48}wL^2$$



$$\begin{cases} M_{BA} = \frac{3EI}{L}(\theta_B) + \frac{wL^2}{12} - \frac{1}{2}\left(\frac{-wL^2}{12}\right) \\ M_S = \frac{3EI}{L}\theta_B \end{cases} \rightarrow \frac{6EI}{L}\theta_B + \frac{wL^2}{8} = 0 \rightarrow \theta_B = \frac{wL^2}{48EI}$$

$$M_S = \frac{wL^2}{16}$$



$$\theta = \frac{M}{\Sigma k_\theta}$$