

Şekilde verilen sistemi "AĞI" yöntemi ile çözerek M, V, N diyagramlarını çiziniz.

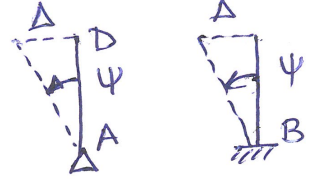
Gözüm: sistemde yanal öteleme önlenmemiştir.

Bilinmeyenler: θ_D, θ_E, ψ

Ankastrelik Momentler:

C \downarrow $10t$ \rightarrow $3 \cdot 10 \cdot 8 = 15tm$ $\overline{M}_{DC} = -15tm$

$16tm$ \rightarrow $3t/m$ \rightarrow $3 \cdot 8^2 = 16tm$ $\overline{M}_{DE} = 16tm$ $\overline{M}_{ED} = -16tm$



Çubuk Uç Momentleri

$$M_{DC} = \frac{3E(4I)}{8} (\theta_D) - 15 = 1,5EI\theta_D - 15$$

$$M_{DE} = \frac{2E(4I)}{8} (2\theta_D + \theta_E) + 16 = 2EI\theta_D + EI\theta_E + 16$$

$$M_{ED} = EI(2\theta_E + \theta_D) - 16 = EI\theta_D + 2EI\theta_E - 16$$

$$M_{DA} = \frac{3E(2I)}{4} (\theta_D - \psi) = 1,5EI\theta_D - 1,5EI\psi$$

$$M_{EB} = \frac{2EI}{4} (2\theta_E - 3\psi) = EI\theta_E - 1,5EI\psi$$

$$M_{BE} = \frac{EI}{2} (\theta_E - 3\psi) = 0,5EI\theta_E - 1,5EI\psi$$

Denge denklemleri

D düğümünde $\sum M_D = 0$ $M_{DC} + M_{DA} + M_{DE} = 0$

$$(1,5\theta_D - \frac{15}{EI}) + (1,5\theta_D - 1,5\psi) + (2\theta_D + \theta_E + \frac{16}{EI}) = 0$$

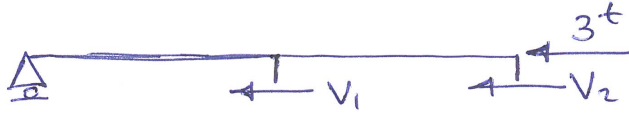
$$\boxed{5\theta_D + \theta_E - 1,5\psi = -1/EI} \text{ ①}$$

E düğümünde dege $\sum M_E = 0$ $M_{ED} + M_{EB} = 0$

$$\left(\theta_D + 2\theta_E - \frac{16}{EI}\right) + (\theta_E - 1,5\psi) = 0$$

$$\boxed{\theta_D + 3\theta_E - 1,5\psi = 16/EI} \quad (2)$$

Kesme kuvveti degeri



$$V_1 = \frac{M_{DA}}{4} \quad V_2 = \frac{M_{EB} + M_{BE}}{4}$$

$$\sum F_x = 0 \quad 3 + V_1 + V_2 = 0$$

$$M_{DA} + M_{EB} + M_{BE} = -12$$

$$(1,5\theta_D - 1,5\psi) + (\theta_E - 1,5\psi) + (0,5\theta_E - 1,5\psi) = -12/EI$$

$$1,5\theta_D + 1,5\theta_E - 4,5\psi = -12/EI$$

$$\boxed{\theta_D + \theta_E - 3\psi = -8/EI} \quad (3)$$

$$\begin{bmatrix} 5 & 1 & -1,5 \\ 1 & 3 & -1,5 \\ 1 & 1 & -3 \end{bmatrix} \begin{bmatrix} \theta_D \\ \theta_E \\ \psi \end{bmatrix} = \begin{bmatrix} -1/EI \\ 16/EI \\ -8/EI \end{bmatrix}$$

$$\left[\begin{array}{ccc|c} 5 & 1 & -1,5 & -1/EI \\ 0 & 2,8 & -1,2 & 16,2/EI \\ 0 & -2 & -1,5 & -24/EI \end{array} \right] \quad \left[\begin{array}{ccc|c} 5 & 1 & -1,5 & -1/EI \\ 0 & 2,8 & -1,2 & 16,2/EI \\ 0 & 0 & -2,3571 & -12,4286/EI \end{array} \right]$$

$$-2,357 \psi = -12,4286/EI$$

$$\boxed{\psi = \frac{5,273}{EI}}$$

$$2,8\theta_E - 1,2 \cdot \frac{5,273}{EI} = \frac{16,2}{EI}$$

$$2,8\theta_E = 22,5396/EI$$

$$\boxed{\theta_E = \frac{8,05}{EI}}$$

$$5\theta_D + \frac{8,05}{EI} - 1,5 \cdot \frac{5,273}{EI} = -\frac{1}{EI}$$

$$5\theta_D = -1,1405/EI$$

$$\boxed{\theta_D = -\frac{0,2281}{EI}}$$

Gubuk us Moment leri

$$M_{DC} = 1,5 \cdot (-0,2281) - 15 = -15,34 \text{ tm}$$

$$M_{DE} = 2(-0,2281) + 8,05 + 16 = 23,59 \text{ tm}$$

$$M_{ED} = 2 \cdot 8,05 - 0,2281 - 16 = -0,13 \text{ tm}$$

$$M_{DA} = 1,5(-0,2281) - 1,5 \cdot 5,273 = -8,25 \text{ tm}$$

$$M_{EB} = 8,05 - 1,5 \cdot 5,273 = 0,14 \text{ tm}$$

$$M_{BE} = 0,5 \cdot 8,05 - 1,5 \cdot 5,273 = -3,88 \text{ tm}$$

