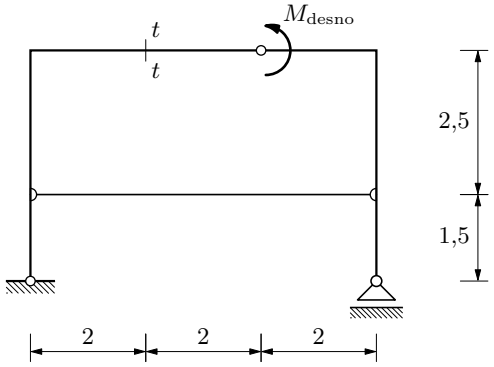
# GS 2. — 7. ožujka 2024.

## Zadatak 2.

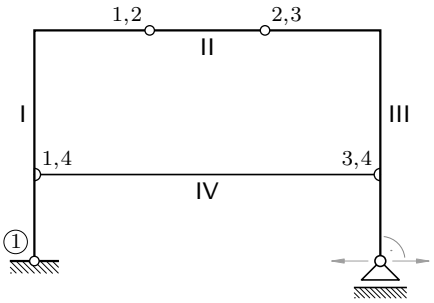
Pomoću utjecajnih linija izračunajte vrijednosti unutarnjih sila u presjeku $t$–$t$!

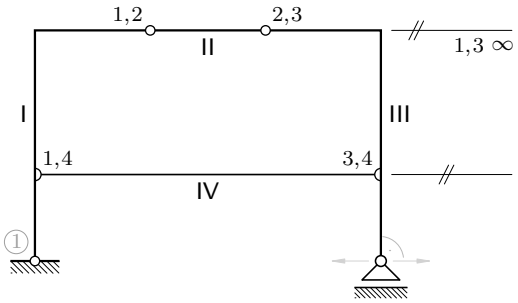
$M_{\text{desno}} = 75$ kNm

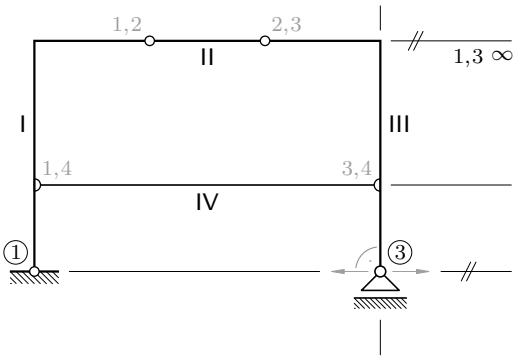


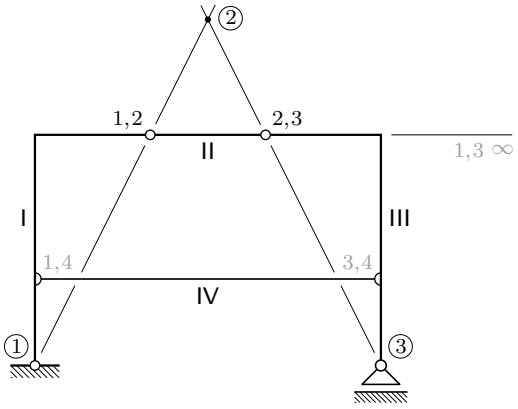

odgovor — (nešto kao) strip (s prikazom korakā nalaženja polova) — počinje na sljedećoj stranici

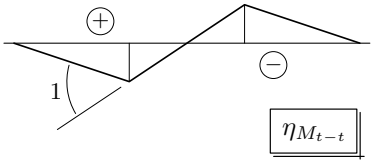
utjecajna linija za moment savijanja u presjeku $t$–$t$:

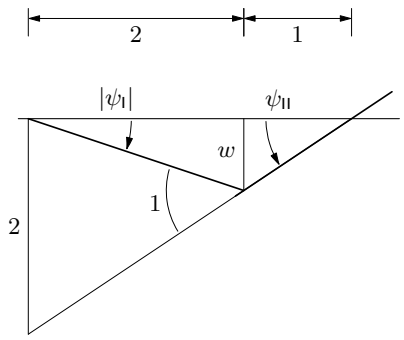



$$\psi_{\mathrm{II}} \;=\; \frac{2}{3}$$

$$w \;=\; \psi_{\mathrm{II}} \cdot 1$$

$$\psi_{\mathrm{I}} \;=\; -\frac{w}{2} \;=\; -\frac{\psi_{\mathrm{II}}}{2} \;=\; -\frac{1}{3}$$

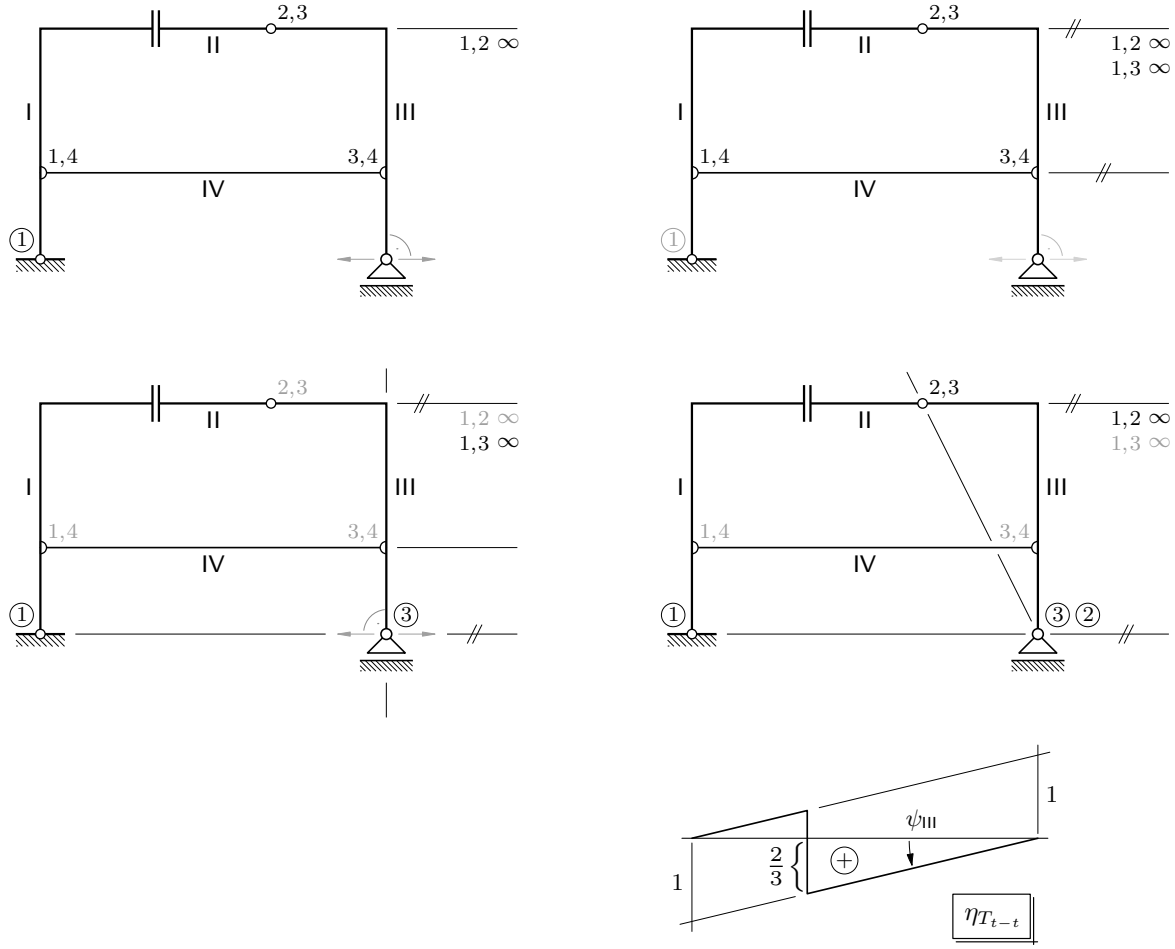
$$\psi_{\mathrm{III}} \;=\; \psi_{\mathrm{I}} \quad (\text{pol } 1,3 \text{ u } \infty)$$

vrijednost momenta savijanja u presjeku $t$–$t$:

$$\alpha_M \;=\; -\psi_{\mathrm{III}} \;=\; \frac{1}{3}$$

$$M_{t-t} \;=\; -\alpha_M \cdot M_{\text{desno}} \;=\; -\frac{1}{3} \cdot 75 \;=\; -25\,\text{kNm}$$

utjecajna linija za poprečnu silu u presjeku $t$–$t$:



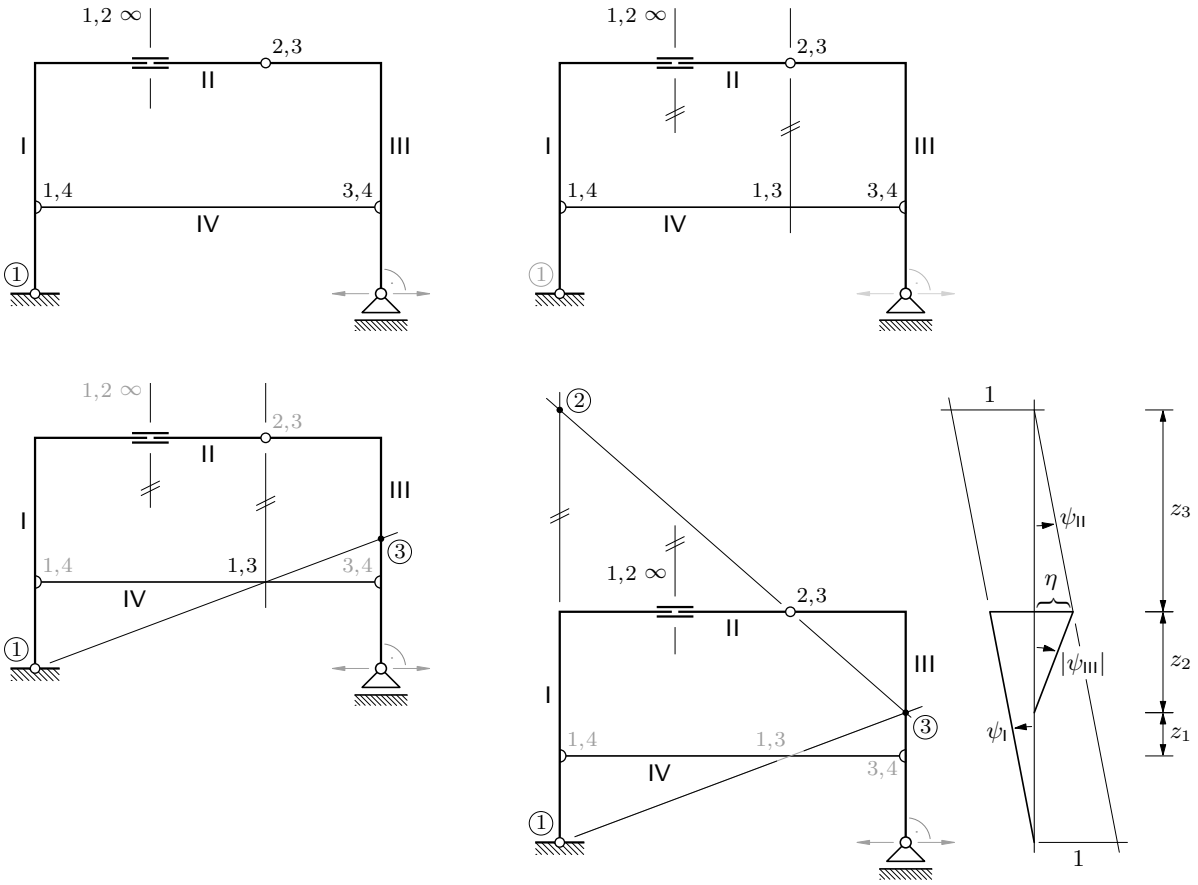

vrijednost poprečne sile u presjeku $t$–$t$:

$$\psi_{II} = \psi_{III} = \frac{\frac{2}{3}}{4} = \frac{1}{6}$$

$$\alpha_M = -\psi_{III} = -\frac{1}{6}$$

$$T_{t-t} = -\alpha_M \cdot M_{\text{desno}} = -\left(-\frac{1}{6}\right) \cdot 75 = 12{,}5\,\text{kN}$$

utjecajna linija za uzdužnu silu u presjeku $t$–$t$:




vrijednost uzdužne sile u presjeku $t$–$t$:

$$\frac{z_1}{2} = \frac{1{,}5}{4} \quad \Rightarrow \quad z_1 = 0{,}75 \quad \& \quad z_2 = 2{,}5 - z_1 = 1{,}75$$

$$\frac{z_3}{4} = \frac{z_2}{2} \quad \Rightarrow \quad z_3 = 3{,}5$$

$$\psi_{II} = \frac{1}{4+z_2} = \frac{1}{4+3{,}5} = \frac{2}{15} \quad \& \quad \eta = \psi_{II} \cdot z_2 = \frac{2}{15} \cdot 3{,}5 = \frac{7}{15}$$

$$\psi_{III} = -\frac{\eta}{z_2} = -\frac{\frac{7}{15}}{1{,}75} = -\frac{4 \cdot \frac{7}{15}}{4 \cdot 1{,}75} = -\frac{4 \cdot \frac{7}{15}}{7} = -\frac{4}{15}$$

$$\alpha_M = -\psi_{III} = \frac{4}{15}$$

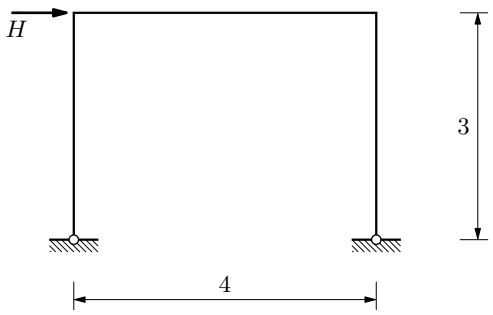
$$N_{t-t} = -\alpha_M \cdot M_{\text{desno}} = -\frac{4}{15} \cdot 75 = -20\,\text{kN}$$

## Zadatak 4.

Postupkom Wernera i Csonke nacrtajte momentni dijagram!

$EI = 162000\,\text{kNm}^2$

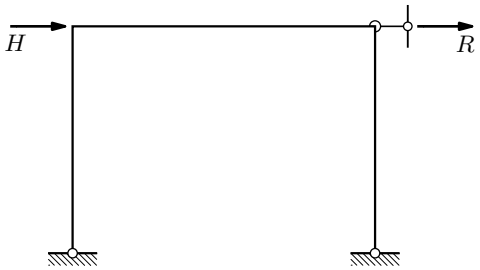
$H = 125\,\text{kN}$




sistem sa spriječenim neovisnim translacijskim pomakom:

sila $H$ djeluje u čvoru $\Rightarrow$ nije potreban (prvi) Crossov postupak

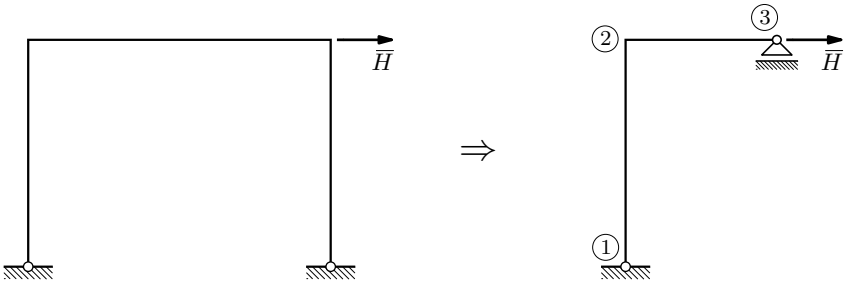
reakcija u zamišljenom spoju:




$$R = -H = 125\,\text{kN}$$

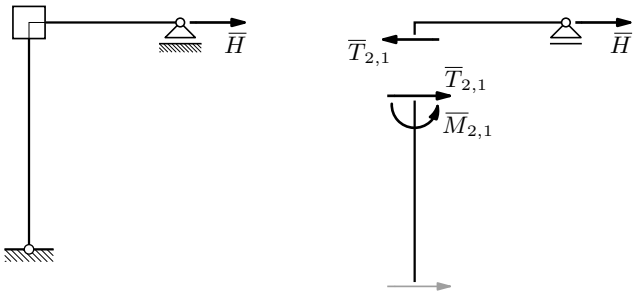
postupak Wernera i Csonke:

poluokvir:




$$\overline{H} = -R = H = 125\,\text{kN}$$

moment upetosti:




$$-\overline{T}_{2,1} + H = 0$$

$$\overline{T}_{2,1} = H = 125\,\text{kN}$$

$$-3 \cdot \overline{T}_{2,1} + \overline{M}_{2,1} = 0$$

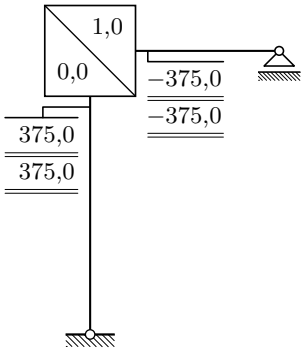
$$\overline{M}_{2,1} = 3 \cdot \overline{T}_{2,1} = 375\,\text{kNm}$$

razdjelni koeficijenti:

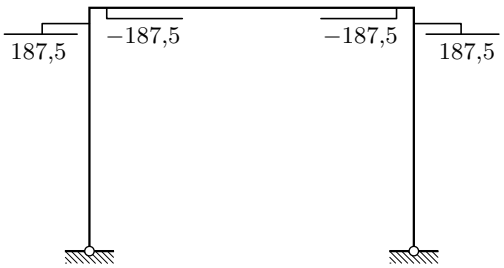
$\mu^{\text{W}}_{2,1} = 0$ pa je $\mu^{\text{W}}_{2,3} = 1$

[ pitanje za usmeni dio ispita: zašto je $\mu^{\text{W}}_{2,1} = 0$? ]

„raspodjela" momenata:




povratak na izvorni okvir:




čvorovi su u ravnoteži ⇒ nije potrebno uravnoteženje Crossovim postupkom

dijagram momenata savijanja: