Exercice VI.9

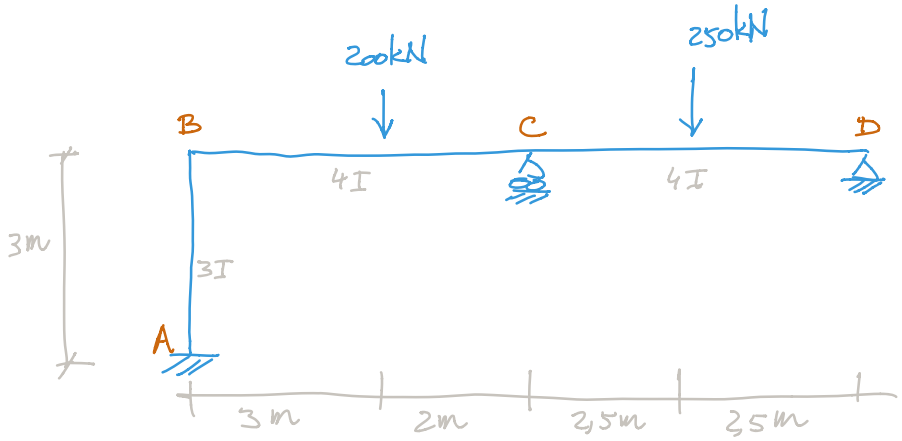


Diagramme des moments ?

Réaction en D ?

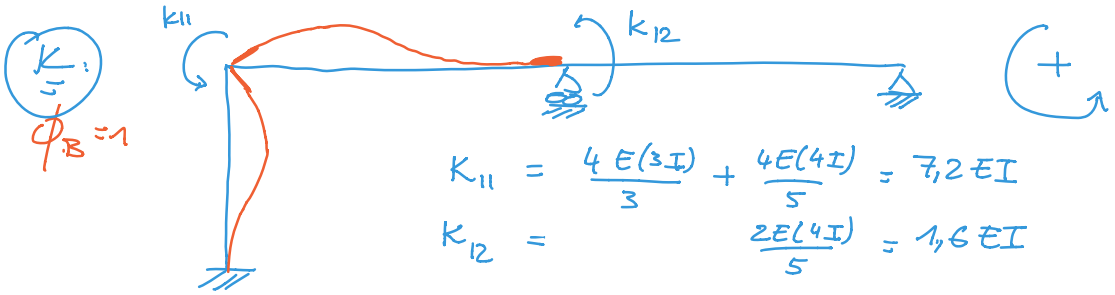
Déformée ? (Esquisse)

Déplacement sous la charge de 250 kN.

$\underline{\underline{k}}\ \underline{u} + \underline{k}_F = \underline{F}$ éq. equil. noeuds.

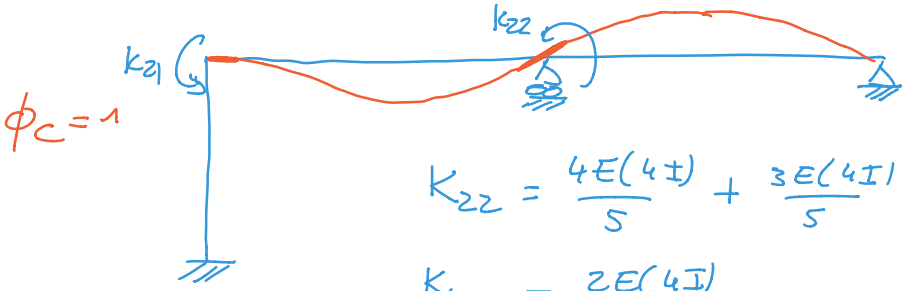
2x2 $\begin{pmatrix}\phi_B \\ \phi_C\end{pmatrix}$ → moments aux noeuds (nuls) $\underline{F}=0$.

→ moments sur éléments.



$K_{11} = \frac{4E(3I)}{3} + \frac{4E(4I)}{5} = 7{,}2\,EI$

$K_{12} = \frac{2E(4I)}{5} = 1{,}6\,EI$



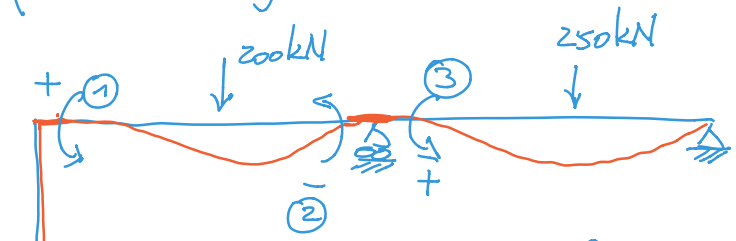
$K_{22} = \frac{4E(4I)}{5} + \frac{3E(4I)}{5} = 5{,}6\,EI$

$K_{21} = \frac{2E(4I)}{5} = 1{,}6\,EI$

$$\underline{\underline{K}} = \begin{pmatrix} 7,2 & 1,6 \\ 1,6 & 5,6 \end{pmatrix} EI$$

$\underline{k_p}$

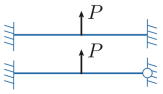
$\phi_B = \phi_C = 0$



① $k_{p,1} = 200.5.0,6.0.4^2 = 96$ kNm

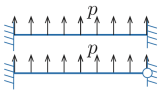
②③ $k_{p,2} = -200.5.0.4.0,6^2 + \frac{3}{16} 250.5$

$= -144 + 234,375 = 90,375$ kNm



$\begin{pmatrix} 0 \\ -\frac{1}{2}P \\ -\frac{1}{8}PL \\ 0 \\ -\frac{1}{2}P \\ \frac{1}{8}PL \end{pmatrix}$

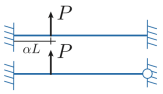
③ $\begin{pmatrix} 0 \\ -\frac{11}{16}P \\ -\frac{5}{16}PL \\ 0 \\ -\frac{5}{16}P \end{pmatrix}$



$\begin{pmatrix} 0 \\ -\frac{1}{2}pL \\ -\frac{1}{12}pL^2 \\ 0 \\ -\frac{1}{2}pL \\ \frac{1}{12}pL^2 \end{pmatrix}$

$\begin{pmatrix} 0 \\ -\frac{5}{8}pL \\ -\frac{1}{8}pL^2 \\ 0 \\ -\frac{3}{8}pL \end{pmatrix}$

$\underline{k_p} = \begin{pmatrix} 96 \\ 90,375 \end{pmatrix}$ kN.m



① $\begin{pmatrix} 0 \\ -P(1-\alpha)^2(1+2\alpha) \\ -PL\alpha(1-\alpha)^2 \\ 0 \\ -P\alpha^2(3-2\alpha) \\ -PL\alpha^2(1-\alpha) \end{pmatrix}$

② $\begin{pmatrix} 0 \\ -P(1-\alpha)\left(1+\alpha-\frac{\alpha^2}{2}\right) \\ -PL\frac{\alpha}{2}(1-\alpha)(2-\alpha) \\ 0 \\ -P\frac{\alpha^2}{2}(3-\alpha) \end{pmatrix}$

$\alpha = 0,6$

$$\underline{\underline{K}}\ \underline{u} = -\underline{k_p} \Rightarrow \underline{u} = \begin{pmatrix} \phi_B \\ \phi_C \end{pmatrix} = \frac{1}{EI} \begin{pmatrix} -10,41 \\ -13,16 \end{pmatrix}$$

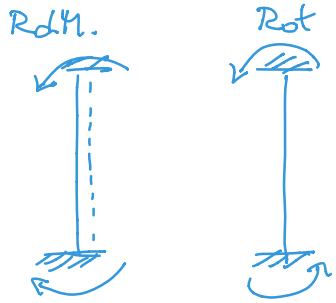
Diagramme des moments.

(AB)

$\phi_B = \frac{-10.41}{EI}$

$M_A = \frac{2E(3I)}{3}\phi_B = -20,8$ kN.m

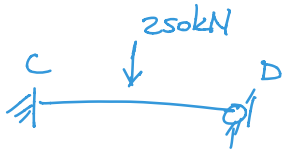
$M_B = \frac{4E(3I)}{3}\phi_B = -41,6$ kN.m



Conv. RdM : $M_A = 20,8$ kN.m

$M_B = -41,6$ kN.m

(CD)



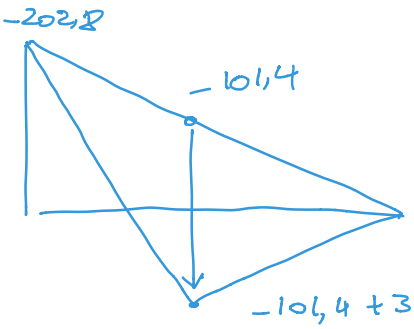
$\phi_C = \frac{-13,16}{EI}$

$M_C = \frac{3E(4I)}{5}\phi_C + 234,375 = 202,8$ kN.m (3)

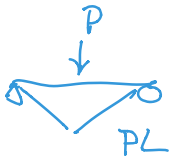
Conv. RdM : $M_C = -202,8$ kN.m

Moments en travée.

CD.

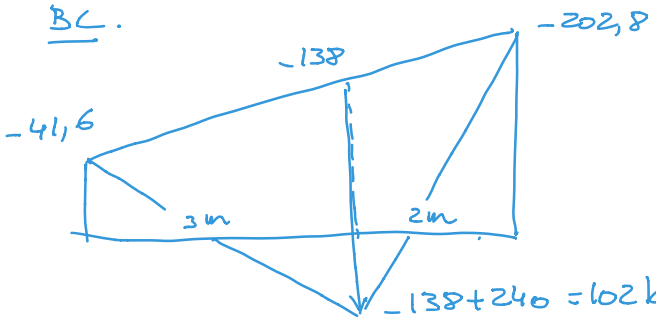


$-101,4 + 312,5 = 211,1$ kN.m

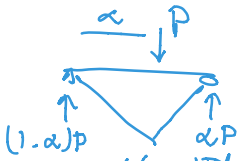


$\frac{PL}{4} = \frac{250.5}{4} = 312,5$ kN.m

BC.



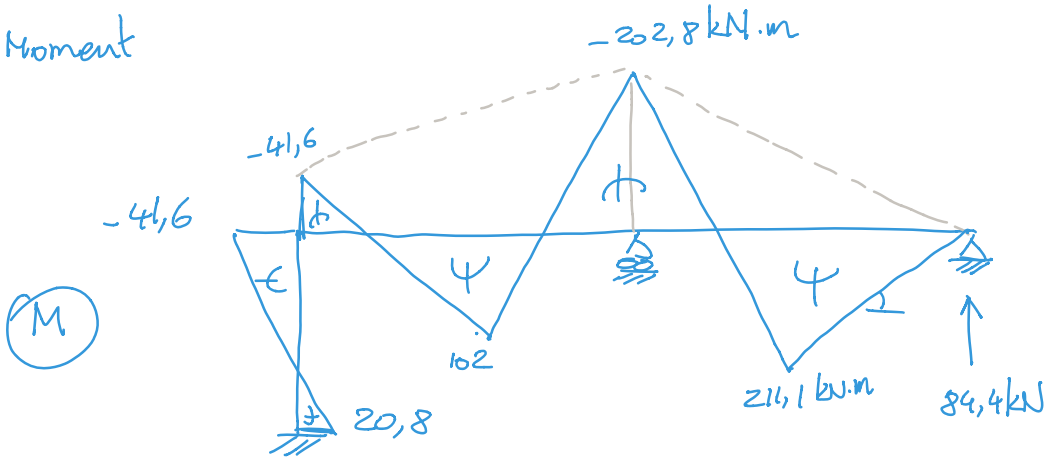
$-138 + 240 = 102$ kN.m



$\alpha(1-\alpha)PL = 0.6.0.4.200.5$

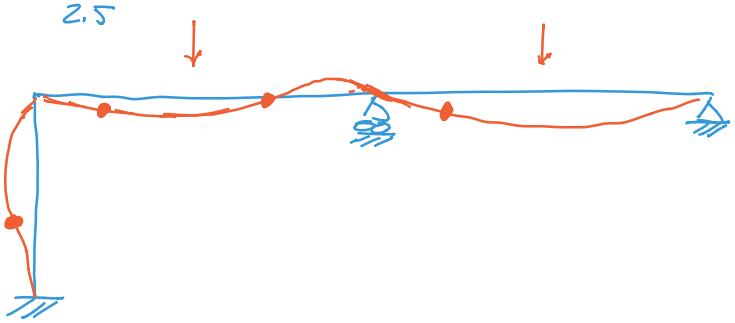
$= 240$ kN.m.

Moment



Réaction : $T = \frac{211,1}{2.5} = 84,4 \text{ kN}$

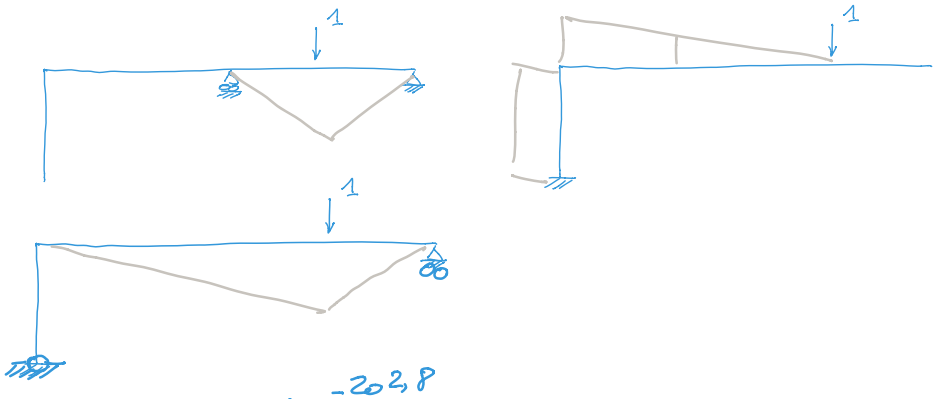
Esquisse



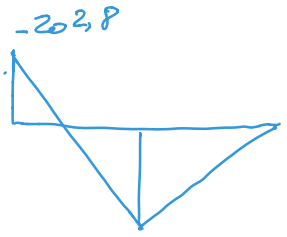
Déplacement sous charge de 250 kN

$$\frac{1}{EI} \int M M_1 \, ds \quad + \text{ Tables de Mohr}$$

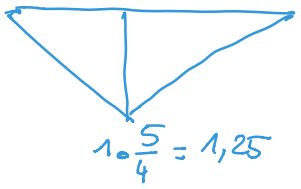
Rendre la structure isostatique



$$\delta = \frac{1}{4EI} \cdot \left(\right.$$



$\times$



$$\left. \right)$$

$$= \frac{1}{4EI} \left(\frac{1}{6} (-202{,}8 + 2 \cdot 211{,}1) \cdot 1.25 \cdot 2{,}5 \right.$$

$$\left. + \frac{1}{3} (211{,}1) \cdot 1.25 \cdot 2.5 \right) = \frac{83{,}5}{EI}$$