

Corrigé Type



Université Med BOUDIAF M'sila
Faculté de Technologies
Département de Génie mécanique



Examen de **Elements Finis** : Session Normale (2017/2018)

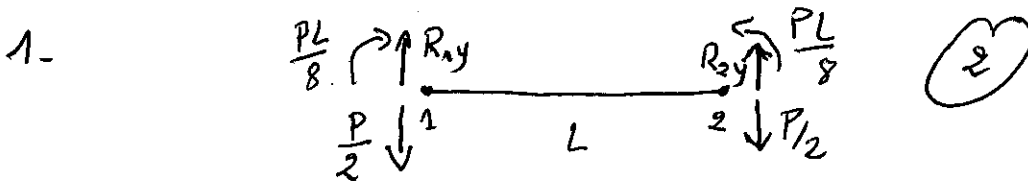
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1^{ère} Master Materiaux

ص 9/10

Correction

Exercice 1 (10 pts):



2-

$$\frac{EI}{L^3} \begin{bmatrix} 12 & 6L & -12 & 6L \\ 6L & 4L^2 & -6L & 2L^2 \\ -12 & -6L & 12 & -6L \\ 6L & 2L^2 & -6L & 4L^2 \end{bmatrix} \begin{Bmatrix} V_1 \\ \beta_1 \\ V_2 \\ \beta_2 \end{Bmatrix} = \begin{Bmatrix} -P/2 \\ -PL/8 \\ -P/2 \\ PL/8 \end{Bmatrix} + \begin{Bmatrix} R_{1y} \\ 0 \\ R_{2y} \\ 0 \end{Bmatrix}$$

3- Les déplacements nodaux

$$\begin{matrix} \textcircled{1} & \textcircled{1} & \textcircled{1} & \textcircled{1} \\ V_1 = V_2 = 0 & \beta_1 = -\beta_2 = \frac{PL^2}{16EI} \end{matrix}$$

4-

$$\begin{matrix} R_{1y} = R_{2y} = P/2 \\ \textcircled{1} & \textcircled{1} \end{matrix}$$

Exercice 2 (10 pts)

Exercice 2 (10 pts):

$\alpha = 45^\circ$

$$K_{B-A} = \frac{ES}{\sqrt{2}L}$$

$$\begin{bmatrix} \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \\ -\frac{1}{2} & -\frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ -\frac{1}{2} & -\frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{bmatrix}$$

$$\begin{Bmatrix} U_B \\ V_B \\ U_A \\ V_A \end{Bmatrix} \quad (1)$$

$\alpha = -90^\circ$

$$K_{A-C} = \frac{ES}{L}$$

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 1 \end{bmatrix}$$

$$\begin{Bmatrix} U_A \\ V_A \\ U_C \\ V_C \end{Bmatrix} \quad (1)$$

2 - Matrice de rigidité du système

$$K_S = \frac{ES}{L}$$

(2)

$$\begin{bmatrix} \frac{1}{2\sqrt{2}} & \frac{1}{2\sqrt{2}} & -\frac{1}{2\sqrt{2}} & -\frac{1}{2\sqrt{2}} & 0 & 0 \\ \frac{1}{2\sqrt{2}} & \frac{1}{2\sqrt{2}} & -\frac{1}{2\sqrt{2}} & -\frac{1}{2\sqrt{2}} & 0 & 0 \\ -\frac{1}{2\sqrt{2}} & -\frac{1}{2\sqrt{2}} & \frac{1}{2\sqrt{2}} & \frac{1}{2\sqrt{2}} & 0 & -1 \\ -\frac{1}{2\sqrt{2}} & -\frac{1}{2\sqrt{2}} & \frac{1}{2\sqrt{2}} & \frac{1}{2\sqrt{2}} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 2 \end{bmatrix}$$

$$\begin{Bmatrix} U_B \\ V_B \\ U_A \\ V_A \\ U_C \\ V_C \end{Bmatrix} = \begin{Bmatrix} R_{Bx} \\ R_{By} \\ F \\ 0 \\ R_{Cx} \\ R_{Cy} \end{Bmatrix}$$

3 - Les déplacements nodaux

$$U_B = V_B = U_C = V_C = 0 \quad (2)$$

$$\frac{ES}{L} \begin{bmatrix} \frac{1}{2\sqrt{2}} & \frac{1}{2\sqrt{2}} \\ \frac{1}{2\sqrt{2}} & 1 + \frac{1}{2\sqrt{2}} \end{bmatrix} \begin{Bmatrix} U_A \\ V_A \end{Bmatrix} = \begin{Bmatrix} F \\ 0 \end{Bmatrix} \quad (1)$$