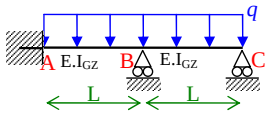
Exemple de résolution de structure hyperstatique utilisation d'un formulaire :

Sujet :

Considérons la structure suivante :

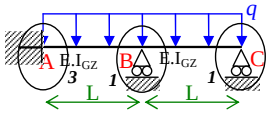


Nous allons rechercher les inconnues de liaisons.

Résolution :

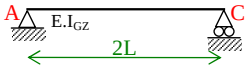
I) Nature :

$$\left.\begin{array}{l} x = 3+1+1 = 5 \\ e = 3\times 1 = 3 \end{array}\right\} \textit{hyperstatique de degré } 2$$

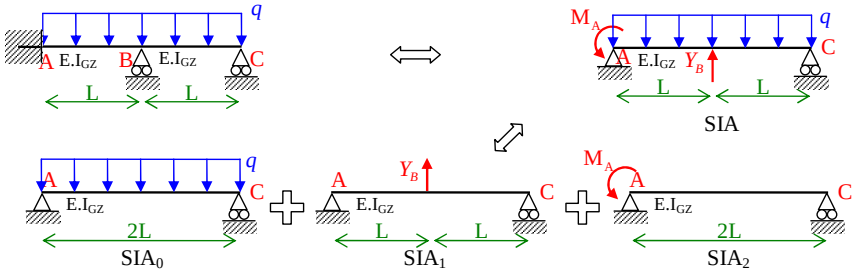


II) Résolution de l'inconnue hyperstatique :

2.1) Choix de la structure isostatique associée :

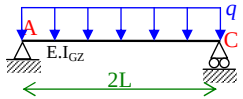
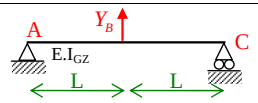
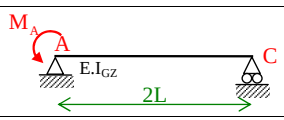


2.2) Condition d'équivalence :



Si : $f_B = 0$ $\omega_A = 0$

2.3) Résolution :

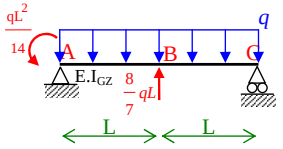
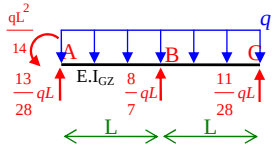
SIA_0		$f_{B0} = -\dfrac{5q(2L)^4}{384EI_{GZ}}$	$\omega_{A0} = -\dfrac{q(2L)^3}{24EI_{GZ}}$
SIA_1		$f_{B1} = \dfrac{Y_B(2L)^3}{48EI_{GZ}}$	$\omega_{A1} = \dfrac{Y_B(2L)^2}{16EI_{GZ}}$
SIA_2		$f_{B2} = \dfrac{M_A(2L)^2}{16EI_{GZ}}$	$\omega_{A2} = \dfrac{M_A 2L}{3EI_{GZ}}$

$$f_B = f_{B0} + f_{B1} + f_{B2} = -\frac{5q(2L)^4}{384EI_{GZ}} + \frac{Y_B(2L)^3}{48EI_{GZ}} + \frac{M_A(2L)^2}{16EI_{GZ}} = 0$$

$$\omega_A = \omega_{A0} + \omega_{A1} + \omega_{A2} = -\frac{q(2L)^3}{24EI_{GZ}} + \frac{Y_B(2L)^2}{16EI_{GZ}} + \frac{M_A 2L}{3EI_{GZ}} = 0$$

$$\begin{cases} -\dfrac{5qL^4}{24EI_{GZ}} + \dfrac{Y_B L^3}{6EI_{GZ}} + \dfrac{M_A L^2}{4EI_{GZ}} = 0 \\ -\dfrac{qL^3}{3EI_{GZ}} + \dfrac{Y_B L^2}{4EI_{GZ}} + \dfrac{M_A 2L}{3EI_{GZ}} = 0 \end{cases}$$

$$\begin{bmatrix} \frac{L^3}{6} & \frac{L^2}{4} \\ \frac{L^2}{4} & \frac{2L}{3} \end{bmatrix} \times \begin{bmatrix} Y_B \\ M_A \end{bmatrix} = \begin{bmatrix} \frac{5}{24}qL^4 \\ \frac{1}{3}qL^3 \end{bmatrix} \Rightarrow \begin{array}{l} Y_B = \frac{8}{7}qL \\ M_A = \frac{1}{14}qL^2 \end{array}$$



III) Résolution des autres inconnues :