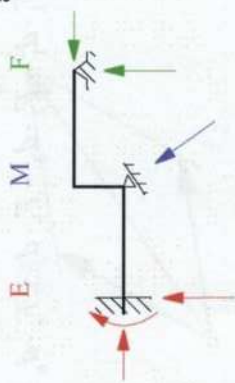


REACTIONS D'APPUIS

Encastrement **E** 3 liaisons
 appui fixe **F** 2 liaisons
 appui mobile **M** 1 liaison



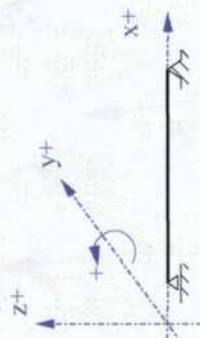
CONDITIONS DE STABILITE

Système isostatique (en plan):

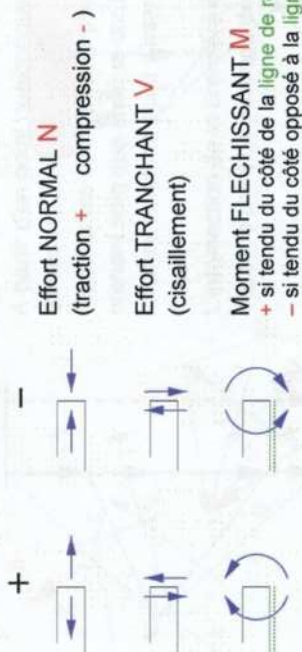
$$\sum M_y = 0$$

$$\sum F_x = 0$$

$$\sum F_z = 0$$



EFFORTS INTERIEURS



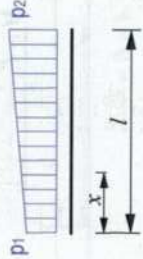
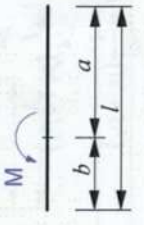
		$A = \frac{P \cdot b}{l}$ $B = \frac{P \cdot a}{l}$ $M = \frac{P \cdot a \cdot b}{l}$
	$B = P$ $M_B = -P \cdot b$ $f = -\frac{1}{6} \frac{P}{EI} (3 \cdot l \cdot b^2 - b^3)$ $f = -\frac{1}{3} \frac{P \cdot l^3}{EI}$ si $b = l$	$A = \frac{P \cdot b}{l}$ $B = \frac{P \cdot a}{l}$ $M = \frac{P \cdot a \cdot b}{l}$
	$B = P$ $M_B = -\frac{P \cdot l}{2}$	$A = B = \frac{P}{2}$ $M = \frac{P \cdot l}{4}$ $f = \frac{1}{48} \frac{P \cdot l^3}{EI}$
	$B = 2P$ $M_B = -P \cdot l$	$A = B = P$ $M = P \cdot c$
	$B = (n-1) \cdot P$ $M_B = -\frac{P \cdot l}{8} \left(n - \frac{1}{n} \right)$	$A = B = \frac{n-1}{2} \cdot P$ $M = \frac{P \cdot l}{8} \left(n - \frac{1}{n} \right)$
	$B = n \cdot P$ $M_B = -\frac{n^2}{2} \cdot P \cdot c$	$A = B = \frac{n}{2} \cdot P$ $M = \frac{P \cdot l}{8} \left(n + \frac{1}{n} \right)$

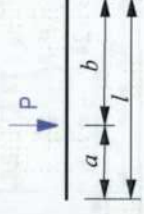
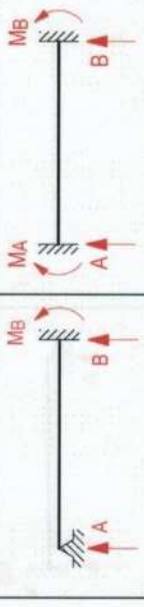
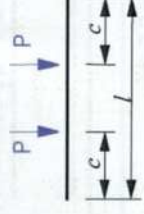
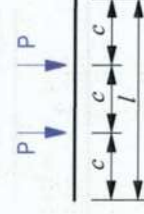
		$B = p \cdot l$ $M_B = -\frac{p \cdot l^2}{2}$ $f = \frac{1}{8} \frac{p \cdot l^4}{EI}$	$A = B = \frac{p \cdot l}{2}$ $M = \frac{p \cdot l^2}{8}$ $f = \frac{5}{384} \frac{p \cdot l^4}{EI}$	
	$B = p \cdot c$ $M_B = -\frac{p \cdot c \cdot l}{2}$	$A = B = \frac{p \cdot c}{2}$ $M = \frac{p \cdot c}{8} (2 \cdot l - c)$		
	$B = p \cdot c$ $M_B = -p \cdot b \cdot c$	$A = \frac{p \cdot b \cdot c}{l}$ $M = \frac{pbc}{2 \cdot l^2} [l \cdot (2a - c) + bc]$ $\rightarrow x = d + \frac{A}{p}$	$A = B = \frac{p \cdot a \cdot c}{l}$	
	$B = 2 \cdot p \cdot a$ $M_B = -p \cdot a \cdot l$	$A = B = p \cdot a$ $M = \frac{p \cdot a^2}{2}$		
	$B = 2 \cdot p \cdot c$ $M_B = -p \cdot c \cdot l$	$A = B = p \cdot c$ $M = \frac{p \cdot c}{2} (l - a)$		

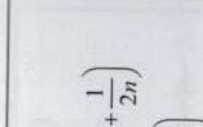
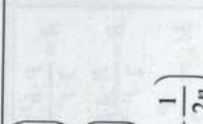
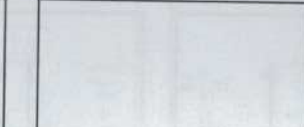
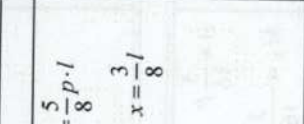
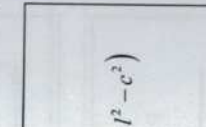
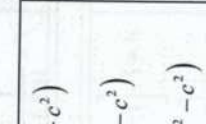
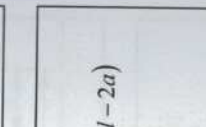
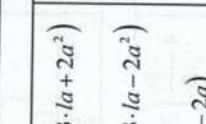
		$B = \frac{p \cdot l}{2}$ $M_B = -\frac{p \cdot l^2}{6}$ $f = \frac{1}{30} \frac{p \cdot l^4}{EI}$	$A = \frac{1}{6} \cdot p \cdot l$ $B = \frac{1}{3} \cdot p \cdot l$ $M = \frac{p \cdot l^2}{9\sqrt{3}}$ $f = 0.00652 \cdot \frac{p \cdot l^4}{EI}$	
	$B = \frac{p \cdot l}{2}$ $M_B = -\frac{p \cdot l^2}{3}$ $f = \frac{11}{120} \frac{p \cdot l^4}{EI}$	$A = \frac{1}{3} \cdot p \cdot l$ $B = \frac{1}{6} \cdot p \cdot l$ $M = \frac{p \cdot l^2}{9\sqrt{3}}$ $f = 0.00652 \cdot \frac{p \cdot l^4}{EI}$		
	$B = \frac{p \cdot c}{2}$ $M_B = -\frac{p \cdot c^2}{6}$	$A = \frac{p \cdot c^2}{6 \cdot l}$ $B = \frac{p \cdot c}{6 \cdot l} (3 \cdot l - c)$ $M = \frac{p \cdot c^2}{6l} \left(l - c + \frac{2}{3} \sqrt{\frac{c}{3l}} \right)$		
	$B = \frac{p \cdot c}{2}$ $M_B = -\frac{p \cdot c^2}{3}$	$A = \frac{p \cdot c^2}{3 \cdot l}$ $B = \frac{p \cdot c}{6 \cdot l} (3 \cdot l - 2c)$ $M = \frac{p \cdot c^2}{3} \left(\sqrt{1 - \frac{2c}{3l}} \right)^3$		

		$B = \frac{p \cdot c}{2}$ $M_B = -\frac{p \cdot c}{6} (3 \cdot l - c)$	$A = \frac{p \cdot c}{6 \cdot l} (3 \cdot l - c)$ $B = \frac{p \cdot c^2}{6 \cdot l}$ $M = \frac{p \cdot c^2}{6 \cdot l} \left(l - c + \frac{2}{3} c \sqrt{\frac{c}{3 \cdot l}} \right)$
		$B = \frac{p \cdot c}{2}$ $M_B = -\frac{p \cdot c}{6} (3 \cdot l - 2c)$	$A = \frac{p \cdot c}{6 \cdot l} (3 \cdot l - 2c)$ $B = \frac{p \cdot c^2}{3 \cdot l}$ $M = \frac{p \cdot c^2}{3} \left(\sqrt{1 - \frac{2c}{3l}} \right)^3$
		$B = \frac{p \cdot l}{2}$ $M_B = -\frac{p \cdot l^2}{4}$	$A = B = \frac{p \cdot l}{4}$ $M = \frac{p \cdot l^2}{12}$
		$B = \frac{p \cdot l}{2}$ $M_B = -\frac{p \cdot l}{6} (l + b)$	$A = \frac{p}{6} (l + b)$ $B = \frac{p}{6} (l + a)$ $M = \frac{p \cdot (l + b)}{27} \sqrt{3a \cdot (l + b)}$ $\rightarrow x = \sqrt{\frac{a \cdot (l + b)}{3}} \rightarrow a > b$

		$B = \frac{p \cdot l}{2}$ $M_B = -\frac{p \cdot l^2}{4}$	$A = B = \frac{p \cdot l}{4}$ $M = \frac{p \cdot l^2}{24}$
		$B = p \cdot a$ $M_B = -\frac{p \cdot a \cdot l}{2}$	$A = B = \frac{p \cdot a}{2}$ $M = \frac{p \cdot a^2}{6}$
		$B = \frac{l}{4} (p_1 + p_2)$ $M_B = -\frac{l^2}{24} (5p_1 + p_2)$	$A = \frac{l}{24} (5p_1 + p_2)$ $B = \frac{l}{24} (p_1 + 5p_2)$ $M = \frac{l^2}{48} (p_1 + p_2)$
		$B = \frac{2}{3} p \cdot l$ $M_B = -\frac{p \cdot l^2}{3}$	$A = B = \frac{p \cdot l}{3}$ $M = \frac{5}{48} p \cdot l^2$
		$B = p \cdot (l - a)$ $M_B = -\frac{p \cdot l}{2} (l - a)$	$A = B = \frac{p}{2} (l - a)$ $M = \frac{p}{24} (3 \cdot l^2 - 4a^2)$

		$B = \frac{l}{2}(p_1 + p_2)$ $M_B = -\frac{l^2}{6}(2p_1 + p_2)$ $M_X = xA - \frac{x^2}{6} \left[3p_1 + (p_2 - p_1) \frac{x}{l} \right]$ $\rightarrow x = \frac{l}{p_2 - p_1} \left[-p_1 + \sqrt{\alpha} \right]$ $\alpha = \frac{1}{3}(p_1^2 + p_1 p_2 + p_2^2)$
	$B = 0$ $M_B = -M$	$A = +\frac{M}{l} \quad B = -\frac{M}{l}$ $M = -M \frac{b}{l} \quad \text{si } a < b$ $M = +M \frac{a}{l} \quad \text{si } a > b$
	$B = 0$ $M_B = M_1 - M_2$	$A = \frac{M_2 - M_1}{l}$ $B = \frac{M_1 - M_2}{l}$ $M = \frac{M_1 + M_2}{2}$

		$A = \frac{P \cdot b^2}{2 \cdot l^3} (2l + a)$ $B = \frac{P \cdot a^2}{2 \cdot l^3} (3l^2 - a^2)$ $M_B = -\frac{P \cdot a \cdot b}{2 \cdot l^2} \cdot (l + a)$
	$A = B = \frac{P}{2}$ $M = -M_{A,B} = -\frac{P \cdot l}{8}$ $f = \frac{1}{107.3} \cdot \frac{P \cdot l^3}{EI}$	$A = \frac{P \cdot b^2}{l^3} \cdot (3 \cdot l - 2b)$ $B = \frac{P \cdot a^2}{l^3} \cdot (3 \cdot l - 2a)$ $M_A = -\frac{P \cdot a \cdot b^2}{l^2}$ $M_B = -\frac{P \cdot a^2 \cdot b}{l^2}$ $M = -\frac{2P \cdot a^2 \cdot b^2}{l^2}$
	$A = P \cdot \left[1 - \frac{3}{2} \cdot \left(\frac{c}{l} \cdot \frac{c^2}{l^2} \right) \right]$ $B = P \cdot \left[1 + \frac{3}{2} \cdot \left(\frac{c}{l} \cdot \frac{c^2}{l^2} \right) \right]$ $M_B = -\frac{3P \cdot c}{2 \cdot l} (l - c)$	$A = B = P$ $M_{A,B} = -\frac{P \cdot c}{l} (l - c)$ $M = \frac{P \cdot c^2}{l}$
	$A = \frac{P}{8} \cdot \left(3n + \frac{1}{n} - 4 \right)$ $B = \frac{P}{8} \cdot \left(5n - \frac{1}{n} - 4 \right)$ $M_B = -\frac{P \cdot l}{8} \cdot \left(n - \frac{1}{n} \right)$ $n \equiv$ nombre de forces P	$A = B = \frac{n-1}{2} \cdot P$ $M_{A,B} = -\frac{P \cdot l}{12} \cdot \left(n - \frac{1}{n} \right)$ $M = \frac{P \cdot l}{24} \cdot \left(n - \frac{1}{n} \right)$

 $n \equiv$ nombre de forces P	 $A = B = \frac{P}{2}$ $M_{A,B} = -\frac{P \cdot l}{12} \left(n + \frac{1}{2n} \right)$ $M = \frac{P \cdot l}{24} \left(n + \frac{2}{n} \right)$
 $A = B = \frac{P \cdot l}{8}$ $M_B = -\frac{P \cdot l^2}{8} \rightarrow x = \frac{3}{8} l$ $f = \frac{1}{185} \cdot \frac{P \cdot l^4}{EI}$ $\rightarrow x = 0.4215 \cdot l$	 $A = B = \frac{P \cdot l}{2}$ $M_{A,B} = -\frac{P \cdot l^2}{12}$ $M = \frac{P \cdot l^2}{24}$ $f = \frac{1}{384} \cdot \frac{P \cdot l^4}{EI}$
 $A = B = \frac{P \cdot c}{16 \cdot l^2} (5 \cdot l^2 + c^2)$ $B = \frac{P \cdot c}{16 \cdot l^2} (11 \cdot l^2 - c^2)$ $M_B = -\frac{P \cdot c}{16 \cdot l} (3 \cdot l^2 - c^2)$	 $A = B = \frac{p \cdot c}{2}$ $M_{A,B} = -\frac{P \cdot c}{24 \cdot l} (3 \cdot l^2 - c^2)$
 $A = \frac{pa}{4 \cdot l^2} (4 \cdot l^2 - 3 \cdot la + 2a^2)$ $B = \frac{pa}{4 \cdot l^2} (4 \cdot l^2 + 3 \cdot la - 2a^2)$ $M_B = -\frac{pa^2}{4 \cdot l} (3 \cdot l - 2a)$	 $A = B = pa$ $M_{A,B} = -\frac{pa^2}{6 \cdot l} (3 \cdot l - 2a)$

	$A = pc - \frac{pca}{8 \cdot l^3} (12 \cdot l^2 - 4a^2 - c^2)$ $B = \frac{pca}{8 \cdot l^3} (12 \cdot l^2 - 4a^2 - c^2)$ $M_B = -\frac{pca}{8 \cdot l^2} [4(l^2 - a^2) - c^2]$	
	$A = \frac{pca}{8 \cdot l^3} (5l^2 + 3a^2 + c^2)$ $B = \frac{pca}{8 \cdot l^3} (11l^2 - 3a^2 - c^2)$ $M_B = -\frac{pca}{8l} [3 \cdot (l^2 - a^2) - c^2]$	
	$A = \frac{7}{30} p \cdot l$ $M_B = -\frac{1}{10} p \cdot l^2$	
	$A = \frac{pbc}{l} + \frac{M_B - M_A}{l}$ $B = \frac{pac}{l} + \frac{M_A - M_B}{l}$ $M_A = -\frac{pc}{12 \cdot l^2} [\alpha \cdot (4 \cdot l^2 - c^2) - 4\eta]$ $\alpha = 2b - a \quad \eta = 2b^3 - a^3$ $M_B = -\frac{pc}{12 \cdot l^2} [\beta \cdot (4 \cdot l^2 - c^2) - 4\xi]$ $\beta = 2a - b \quad \xi = 2a^3 - b^3$	
	$A = B = p \cdot c$ $M_{A,B} = -\frac{pc}{12 \cdot l} [3 \cdot (l^2 - a^2) - c^2]$	
	$A = B = \frac{1}{3} p \cdot l$ $M_{A,B} = -\frac{1}{15} p \cdot l^2$	
	$A = \frac{3}{20} p \cdot l$ $M_A = -\frac{1}{30} p \cdot l^2$ $M_B = -\frac{1}{20} p \cdot l^2$ $f = 0.001309 \cdot \frac{p \cdot l^4}{EI}$	
	$A = \frac{3}{20} p \cdot l$ $M_A = -\frac{1}{30} p \cdot l^2$ $M_B = -\frac{1}{20} p \cdot l^2$ $f = 0.001309 \cdot \frac{p \cdot l^4}{EI}$	
	$A = \frac{3}{20} p \cdot l$ $M_A = -\frac{1}{30} p \cdot l^2$ $M_B = -\frac{1}{20} p \cdot l^2$ $f = 0.001309 \cdot \frac{p \cdot l^4}{EI}$	

	$A = \frac{11}{40} p \cdot l \quad B = \frac{9}{40} p \cdot l$ $M_A = -\frac{7}{120} p \cdot l^2$ $f = 0.0030475 \cdot \frac{p \cdot l^4}{EI}$
	$A = \frac{7}{20} p \cdot l \quad B = \frac{3}{20} p \cdot l$ $M_A = -\frac{1}{20} p \cdot l^2$ $M_B = -\frac{1}{30} p \cdot l^2$ $f = 0.001309 \cdot \frac{p \cdot l^4}{EI}$

	$A = \frac{pc^3}{40 \cdot l^3} (15 \cdot l - 4c)$ $B = \frac{pc}{2} - \frac{pc^3}{40 \cdot l^3} (15 \cdot l - 4c)$ $M_A = -\alpha (40 \cdot l^2 - 45 \cdot lc + 12c^2)$ $\alpha = \frac{pc^2}{120 \cdot l^2}$
	$A = \frac{pc^3}{20 \cdot l^3} (15 \cdot l - 8c)$ $B = \frac{pc}{2} - \frac{pc^3}{20 \cdot l^3} (15 \cdot l - 8c)$ $M_A = -\frac{pc^3}{20 \cdot l^2} (5 \cdot l - 4c)$ $M_B = \alpha (10 \cdot l^2 - 15 \cdot lc - 6c^2)$ $\alpha = \frac{pc^2}{30 \cdot l^2}$

	$A = \frac{pc^3}{40 \cdot l^3} (5 \cdot l - c)$ $B = \frac{pc}{2} - \frac{pc^3}{40 \cdot l^3} (5 \cdot l - c)$ $M_B = -\alpha (20 \cdot l^2 - 15 \cdot lc + 3c^2)$ $\alpha = \frac{pc^2}{120 \cdot l^2}$
	$A = \frac{pc^3}{20 \cdot l^3} (5 \cdot l - 2c)$ $B = \frac{pc}{2} - \frac{pc^3}{20 \cdot l^3} (5 \cdot l - 2c)$ $M_A = -\frac{pc^3}{60 \cdot l^2} (5 \cdot l - 3c)$ $M_B = -\alpha (10 \cdot l^2 - 10 \cdot lc + 3c^2)$ $\alpha = \frac{pc^2}{60 \cdot l^2}$

$A = \frac{pc}{2} - \frac{pc^3}{20 \cdot l^3} (10 \cdot l^2 - c^2)$ $B = \frac{pc^3}{40 \cdot l^3} (10 \cdot l^2 - c^2)$ $M_B = -\frac{pc^2}{120 \cdot l^2} (10 \cdot l^2 - 3c^2)$	$A = \frac{pc}{2} - \frac{pc^3}{20 \cdot l^3} (5 \cdot l - 2c)$ $B = \frac{pc^3}{20 \cdot l^3} (5 \cdot l - 2c)$ $M_A = -\alpha (10 \cdot l^2 - 10 \cdot lc + 3c^2)$ $\alpha = \frac{pc^2}{60 \cdot l^2}$ $M_B = -\frac{pc^3}{60 \cdot l^2} (5 \cdot l - 3c)$	$A = \frac{13}{64} p \cdot l \quad B = \frac{19}{64} p \cdot l$ $M_B = -\frac{3}{64} p \cdot l^2$
		$A = \frac{pc}{2} - \frac{pc^3}{10 \cdot l^3} (5 \cdot l^2 - c^2)$ $B = \frac{pc^2}{10 \cdot l^3} (5 \cdot l^2 - c^2)$ $M_B = -\frac{pc^2}{30 \cdot l^2} (5 \cdot l^2 - 3c^2)$
		$A = \frac{pc}{2} - \frac{pc^3}{20 \cdot l^3} (15 \cdot l - 8c)$ $B = \frac{pc^3}{20 \cdot l^3} (15 \cdot l - 8c)$ $M_A = -\alpha (10 \cdot l^2 - 15 \cdot lc + 6c^2)$ $\alpha = \frac{pc^2}{30 \cdot l^2}$ $M_B = -\frac{pc^3}{20 \cdot l^2} (5 \cdot l - 4c)$
		$A = B = \frac{p \cdot a}{2}$ $M_{A,B} = -\frac{pa^2}{12 \cdot l} (2 \cdot l - a)$

		$A = \frac{P}{20 \cdot l^2} [\alpha \cdot l^3 + \varphi \cdot l + \mu]$ $B = \frac{P}{20 \cdot l^2} [\xi \cdot l^2 - \varphi \cdot l - \mu]$ $\alpha = a + 9b \quad \xi = 9a + b$ $\varphi = a^2 - b^2 \quad \mu = a^3 - b^3$ $M_A = \rho [7l^3 - 7l^2 \beta + 3l\varepsilon + 3\gamma]$ $M_B = \rho [7l^3 + 7l^2 \lambda - 3l\psi - 3\delta]$ $\rho = -\frac{P}{180l}$ $\beta = a - 2b \quad \lambda = 2a - b$ $\varepsilon = a^2 - 2b^2 \quad \gamma = a^3 - 2b^3$ $\psi = 2a^2 - b^2 \quad \delta = 2a^3 - b^3$
		$A = \frac{11}{64} pl \quad B = \frac{21}{64} pl$ $M_A = -\frac{5}{64} p \cdot l^2 \quad M_B = \frac{p \cdot l^2}{96}$
		$A = \frac{l}{40} (9p_1 + p_2)$ $B = \frac{l}{40} (p_1 + 3p_2)$ $M_A = -\frac{l^2}{960} (23p_1 + 7p_2)$ $M_B = -\frac{l^2}{960} (7p_1 + 23p_2)$

		$A = \frac{l}{40} (11p_1 + 4p_2)$ $B = \frac{l}{40} (9p_1 + 16p_2)$ $M_A = -\frac{l^2}{120} (7p_1 + 8p_2)$
		$A = \alpha \cdot \left[(2 \cdot l - a)^2 - l^2 + a^2 - \frac{a^3}{l} \right]$ $B = \alpha \cdot \left[(2 \cdot l - a)^3 + l^2 - 3a^2 + \frac{a^3}{l} \right]$ $\alpha = \frac{P}{8 \cdot l}$ $M_A = -\frac{P}{8} \left(l^2 - 2a^2 + \frac{a^3}{l} \right)$
		$A = B = \frac{P}{2} (l - a)$ $M_{A,B} = -\frac{P}{12} \left(l^2 - 2a^2 + \frac{a^3}{l} \right)$
		$A = +\frac{3M}{2 \cdot l^3} (l^2 - a^2)$ $B = -\frac{3M}{2 \cdot l^3} (l^2 - a^2)$ $M_B = +\frac{3M}{2 \cdot l^2} (l^2 - 3a^2)$
		$A = +\frac{6Mab}{l^3} \quad A = -\frac{6Mab}{l^3}$ $M_A = -\frac{Mb}{l^2} (3a - l)$ $M_B = +\frac{Ma}{l^2} (3b - l)$
		$A = B = 0$ $M_{A,B} = -\frac{3EI}{h} \Delta\theta \cdot \alpha$