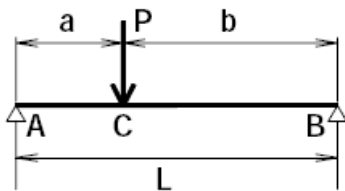
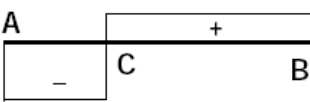
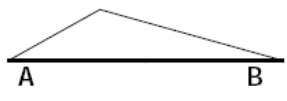

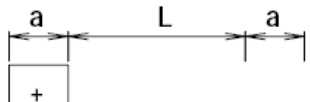
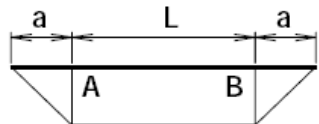


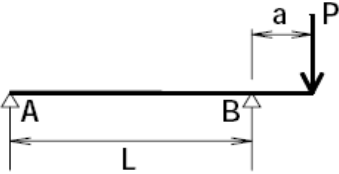
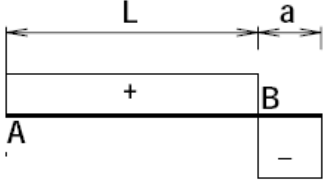
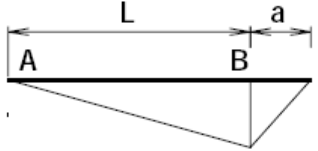

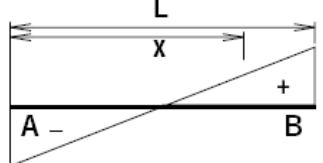
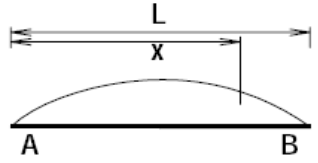
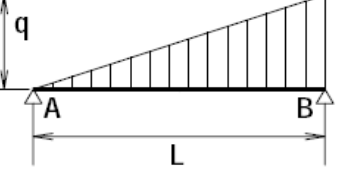
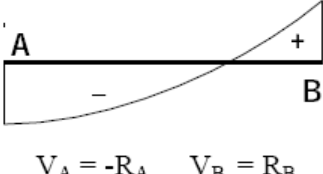
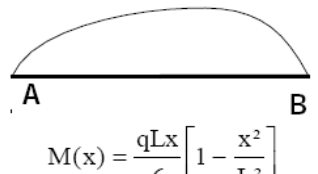
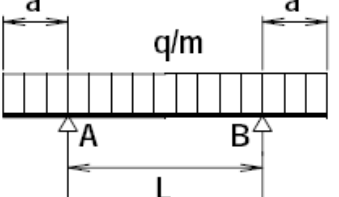
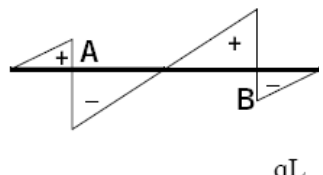
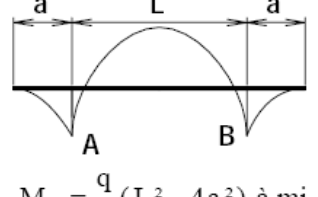
I/ Notations

A	Appui de gauche
B	Appui de droite
Droite (AB)	Ligne moyenne continue représentative des centres de surface des sections le long de la poutre
P	Intensité de la charge concentrée appliquée
q	Intensité de la charge répartie appliquée
C,D	Points d'application des charges
a,b	Distance entre un des appuis et la charge
R_A, R_B	Réactions des appuis A et B sur la poutre AB
V_A, V_B	Efforts tranchants aux appuis A et B
V_{AB}	Effort tranchant entre les points A et B
V_{dA}	Effort tranchant à droite du point A
V_{gA}	Effort tranchant à gauche du point A
x	Abscisse d'une section courante
x_0	Abscisse de la section dans laquelle s'exerce le moment de flexion maximal
$M(x), V(x)$	Moment de flexion et effort tranchant dans la section d'abscisse x
M_0	Moment de flexion maximal dans la poutre AB
θ_A, θ_B	Rotation des sections en A et B
f	Flèche

II/ Poutre sur deux appuis simples

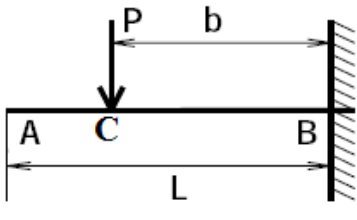
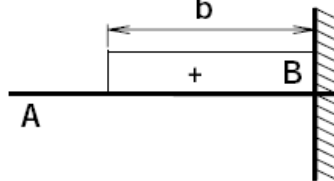
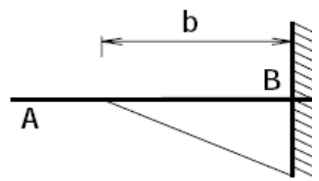
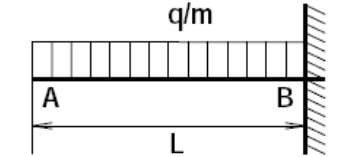
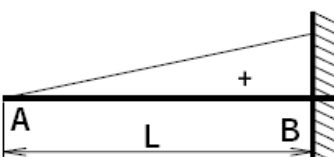
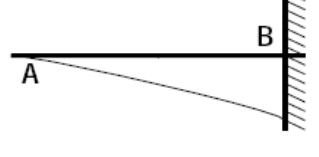
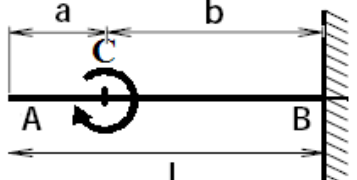

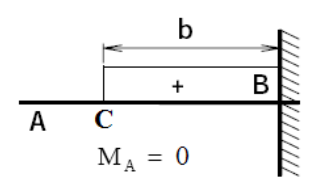
	Effort tranchant	Moment de flexion	Observations
 <p> $R_A = \frac{P \cdot b}{L}$ $R_B = \frac{P \cdot a}{L}$ Charge concentrée P </p>	 <p> $V_{AC} = -R_A$ $V_{CB} = R_B$ </p>	 <p> $M_0 = \frac{P \cdot a \cdot b}{L}$ pour $x_0 = a$ </p>	La flèche est maximale pour $x = \sqrt{\frac{L^2 - b^2}{3}}$ $f = -\frac{Fb(L^2 - b^2)^{3/2}}{9\sqrt{3}E.I.L}$ $\theta_A = \frac{F \cdot a \cdot b \cdot (L + b)}{E.I.L}$ $\theta_B = \frac{F \cdot a \cdot b \cdot (L + a)}{E.I.L}$
 <p> $R_A = P$ $R_B = P$ Charges concentrées sur porte-à-faux </p>	 <p> $V_{gA} = P$ $V_{dB} = -P$ $V_{AB} = 0$ </p>	 <p> $M_0 = -P \cdot a$ </p>	Moment constant de A à B.

FORMULAIRE DES CAS DE CHARGES COURANTS EN FLEXION

 $R_A = -\frac{P.a}{L};$ $R_B = \frac{P.(L+a)}{L}$ <p>Charge concentrée sur un porte-à-faux</p>	 $V_{AB} = -R_A \quad V_{dB} = P$	 $M_0 = M_B = -P.a$	<p>Sens des actions aux appuis :</p> <p>R_A : vers le bas.</p> <p>R_B : vers le haut.</p>
 $R_A = \frac{qL}{2} \quad R_A = R_B$ <p>Charge uniformément répartie</p>	 $V_A = -\frac{qL}{2} \quad V_B = \frac{qL}{2}$ $V(x) = \frac{q.L^2}{2} - q.x$	 $M_0 = \frac{q.L^2}{8} \text{ pour } x_0 = \frac{L}{2}$ $M(x) = \frac{q.x}{2}(L-x)$	<p>Flèche</p> $f = \frac{5}{384} \cdot \frac{qL^4}{EI}$ <p>pour $x = \frac{L}{2}$</p> $-\theta_A = \theta_B = \frac{q.L^3}{24EI}$
 $R_A = \frac{qL}{6} \quad R_B = \frac{qL}{3}$ <p>Charge à répartition variable</p>	 $V_A = -R_A \quad V_B = R_B$ $V_0 = 0 \text{ pour } x = \frac{L}{\sqrt{3}}$	 $M(x) = \frac{qLx}{6} \left[1 - \frac{x^2}{L^2} \right]$ $M_0 = \frac{qL^2}{9\sqrt{3}} \text{ pour } x_0 = \frac{L}{\sqrt{3}}$	<p>Avec $P = \frac{qL}{2}$</p> $R_A = \frac{P}{3} \quad R_B = \frac{2}{3}P$ $M_0 = \frac{2PL}{9\sqrt{3}}$
 $R_A = q \frac{(L+2a)}{2} \quad R_A = R_B$ <p>Charges uniformément réparties</p>	 $V_{gA} = qA \quad V_{dA} = -\frac{qL}{2}$ $V_{gB} = \frac{qL}{2} \quad V_{dB} = -qA$	 $M_0 = \frac{q}{8}(L^2 - 4a^2) \text{ à mi portée.}$ $M_A = M_B = -q \frac{a^2}{2}$	

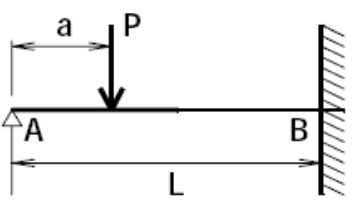
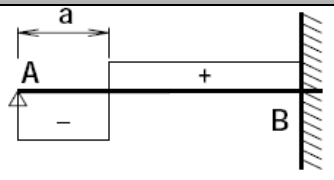
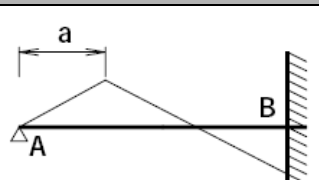
FORMULAIRE DES CAS DE CHARGES COURANTS EN FLEXION

III/ Poutre encastree à une extrémite, libre à l'autre extrémite.

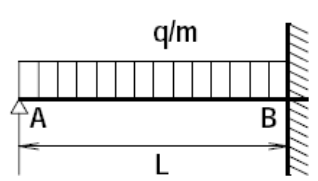
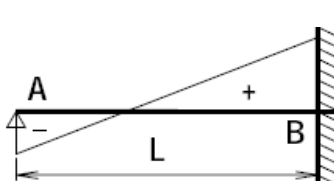
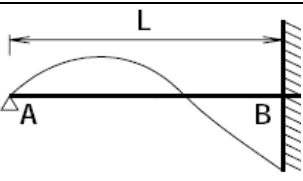
	Effort tranchant	Moment de flexion	Observations
 <p>$R_B = P \cdot b \quad M_B = -P \cdot b$ Charge concentrée</p>	 <p>$V_A = 0 \quad V_{CB} = P$</p>	 <p>$M_B = -Pb$</p>	Flèche en A : $f = \frac{P \cdot b^2}{6EI} (3L - b)$ Flèche en C : $f = \frac{P \cdot b^3}{3EI}$ $\theta_A = \theta_C = \frac{P \cdot b^2}{2EI}$
 <p>$R_B = q \cdot L \quad M_A = -\frac{q \cdot L^2}{2}$ Charge uniformément répartie</p>	 <p>$V_B = qL$ $V(x) = px$</p>	 <p>$M_B = -\frac{qL^2}{2}$ $M(x) = -q \frac{x^2}{2}$</p>	Flèche en A : $f = \frac{qL^4}{8EI}$ $\theta_A = \frac{q \cdot L^3}{6EI}$
 <p>Moment de flexion M_f</p>	 <p>$V(x) = 0$</p>	 <p>$M_A = 0$ $M_{CB} = M_f$</p>	Flèche en A : $f = \frac{M_f \cdot b}{EI} (L - \frac{b}{2})$ Flèche en C : $f = \frac{M_f \cdot b^2}{2EI}$ Rotations : $\theta_A = \theta_B = \frac{M_f \cdot b}{EI}$

IV/ Poutre encastree à une extrémite et appuyée à l'autre extrémite.

(Hyperstatique de degré 1)

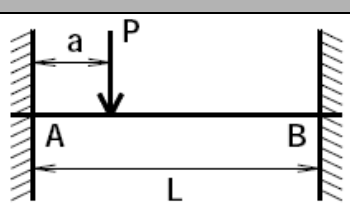
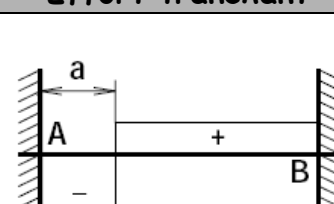
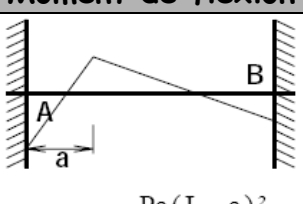
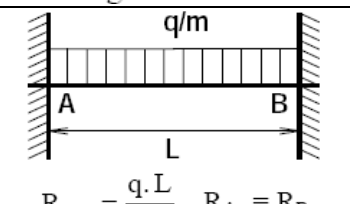
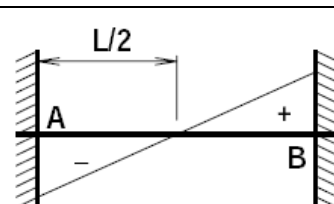
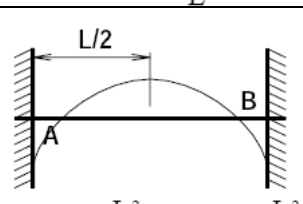
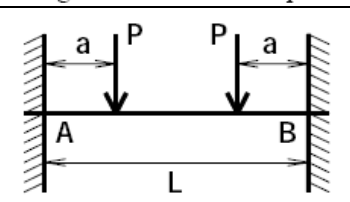
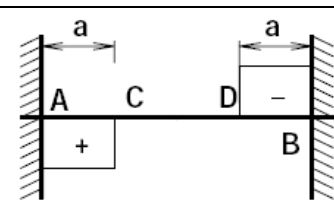
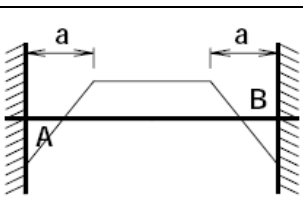
	Effort tranchant	Moment de flexion	Observations
 <p>Charge concentrée P</p>	 <p>$V_B = \frac{Pa(3L^2 - a^2)}{2L^3} = -R_b$ $V_A = -\frac{P(L-a)(2L+a)}{2L^3} = R_A$</p>	 <p>$M_A = 0$ $M_B = -\frac{Pa(L^2 - a^2)}{2L^2}$</p>	Pour $x_0 = a$: $M_0 = \frac{Pa(L-a)(2L+a)}{2L^3}$

FORMULAIRE DES CAS DE CHARGES COURANTS EN FLEXION

 <p style="text-align: center;">q/m</p> <p style="text-align: center;">$R_A = \frac{3}{8}q \cdot L \quad R_B = \frac{5}{8}q \cdot L$</p> <p>Charge uniformément répartie</p>	 <p style="text-align: center;">$V(x) = -(R_A - qx)$</p> <p style="text-align: center;">$V_A = -R_A \quad V_B = R_B$</p>	 <p style="text-align: center;">$M_A = 0 \quad M_B = -\frac{qL^2}{8}$</p> <p style="text-align: center;">$M_0 = \frac{9}{128}qL^2$ pour $x_0 = \frac{3L}{8}$</p>	<p style="text-align: center;">$V = 0$ pour $x_0 = \frac{3L}{8}$</p> <p style="text-align: center;">$M = 0$ pour $x_0 = \frac{3L}{4}$</p> <p style="text-align: center;">$\theta_A = \frac{5qL^3}{384EI}$</p>
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III/ Poutre encastree à chaque extremité.

(Hyperstatique de degré 5 dans l'espace 3 dans le plan)

	Effort tranchant	Moment de flexion	Observations
 <p style="text-align: center;">Charge concentrée P</p>	 <p style="text-align: center;">$V_A = -R_{Ay} \quad V_B = R_{By}$</p>	 <p style="text-align: center;">$M_A = -\frac{Pa(L-a)^2}{L^2}$</p> <p style="text-align: center;">$M_B = -\frac{Pa(L-a)^2}{L^2}$</p>	<p style="text-align: center;">Pour $x_0 = a$ $V = 0$</p> <p style="text-align: center;">$M_0 = -\frac{2Pa(L-a)^2}{L^3}$</p>
 <p style="text-align: center;">Charge uniformément répartie</p>	 <p style="text-align: center;">$V_A = -R_{Ay} \quad V_B = R_{By}$</p>	 <p style="text-align: center;">$M_A = -\frac{qL^2}{12}; \quad M_B = -\frac{qL^2}{12}$</p>	<p style="text-align: center;">Pour $x=L/2$: $V = 0$</p> <p style="text-align: center;">$M_0 = \frac{qL^2}{24}$</p> <p style="text-align: center;">$f = \frac{qL^4}{384EI}$</p>
 <p style="text-align: center;">Deux charges concentrées P</p>	 <p style="text-align: center;">$V_A = -R_{Ay} \quad V_B = R_{By}$ $V_{CD} = 0$</p>	 <p style="text-align: center;">$M_A = -\frac{Pa(L-a)}{L} = M_B$</p>	<p style="text-align: center;">Entre C et D : $M = \frac{Pa^2}{L}$</p>