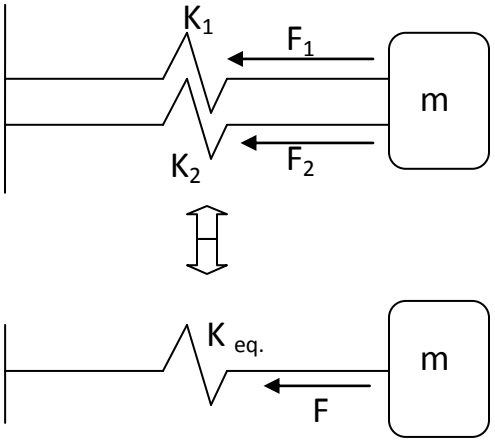
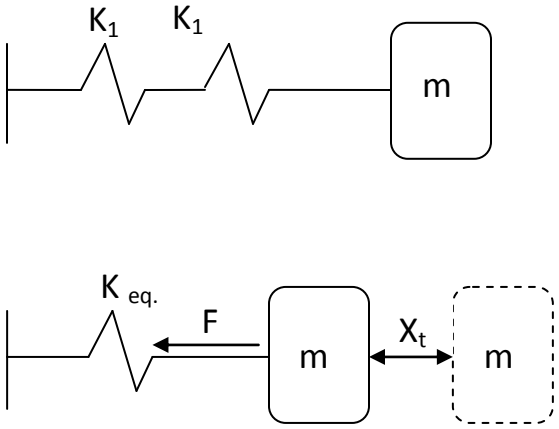
Exercices 7 (Propriétés des matières)

1)





$F_1 = -K_1X$

$F_2 = -K_2X$

$F = F_1 + F_2 = -(K_1+K_2)X$

$\boxed{K_{eq.} = K_1+K_2}$

$$F_1 = -K_1X_1 \Rightarrow X_1 = \frac{-F_1}{K_1}$$

$$F_2 = -K_2X_2 \Rightarrow X_2 = \frac{-F_2}{K_2}$$

$$F = -K_{eq.}X_t \Rightarrow X_t = \frac{-F}{K_{eq.}}$$

$$X_t = X_1 + X_2 \Rightarrow \frac{-F}{K_{eq.}} = \frac{-F_1}{K_1} + \frac{-F_2}{K_2}$$

Si $F_1 = F_2 = F$

$$\boxed{\frac{1}{K_{eq.}} = \frac{1}{K_1} + \frac{1}{K_2}}$$

$$2)i\ ]\omega^2 = \frac{K}{m} = \frac{60}{0.6} = 100 \Rightarrow \omega = 10$$

$$\dot{X} = V = \pm\omega\sqrt{x_{\max}^2 - x^2}$$

$$\Rightarrow x_{\max} = \pm\sqrt{\left(\frac{V}{\omega}\right)^2 + x^2} = \pm\sqrt{\left(\frac{0.5}{10}\right)^2 + (0.2)^2} = \pm\frac{\sqrt{17}}{20} = \pm 0.2064$$

$$x = x_{\max}Cos(\omega t + \varphi)$$

$$\Rightarrow Cos(\omega t + \varphi) = \frac{x}{x_{\max}} = \frac{-0.2}{\frac{\sqrt{17}}{20}} \Rightarrow \omega t + \varphi = 166 \Rightarrow \varphi = 164.5$$

$$\frac{x}{x_{\max}} = \frac{-0.2}{-\frac{\sqrt{17}}{20}} \Rightarrow \omega t + \varphi = 14 \Rightarrow \varphi = 12.5$$

$$ii\ ]x(t) = \pm\frac{\sqrt{17}}{20}Cos(10t + 164.5)$$

$$iii\ ]Cos(\omega t + \varphi) = \frac{x}{x_{\max}} = \frac{\pm 0.2}{\sqrt{17}/20}$$

$$\omega t + \varphi = 14.03 \Rightarrow t = \frac{14.03 - 12.5}{10} = 0.153$$

$$Cos(\omega t + \varphi) = \frac{x}{x_{\max}} = \frac{-0.2}{\sqrt{17}/20}$$

$$\omega t + \varphi = 165.9 \Rightarrow t = \frac{165.9 - 164.5}{10} 0.14$$

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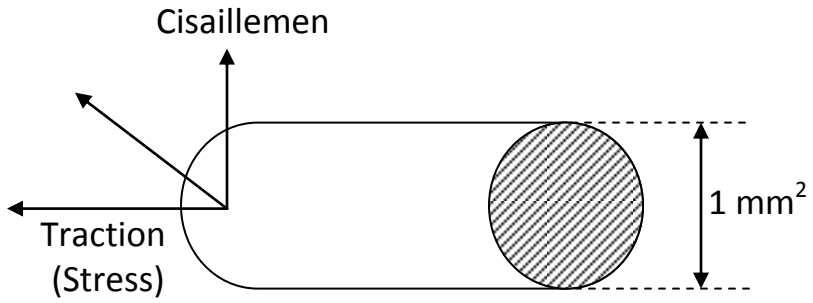
3)



F = 49 dans la limite d'élasticité

$$\frac{E}{V} = ?$$

$$\frac{E}{V} = \frac{W}{V} = \frac{E_p}{V} = \frac{\frac{1}{2}Kx^2}{V} = \frac{1}{2} \times \frac{k.x}{A} \times \frac{x}{\ell} = \frac{1}{2} \times \frac{F}{A} \times \frac{x}{\ell} = \frac{1}{2}(\text{Traction}) \times (\text{Cisaillement})$$

$$\text{Traction } \alpha \text{ Cisaillement} \Rightarrow \text{ Traction = Cte} \times \text{Cisaillement}$$

$$Traction = \frac{F}{A} = \frac{49}{10^{-6}}$$

$$\frac{E}{V} = \frac{(\text{Traction})^2}{2C} = \frac{\left(\frac{49}{10^{-6}}\right)^2}{2C} = \frac{1.2005 \times 10^{15}}{C}$$