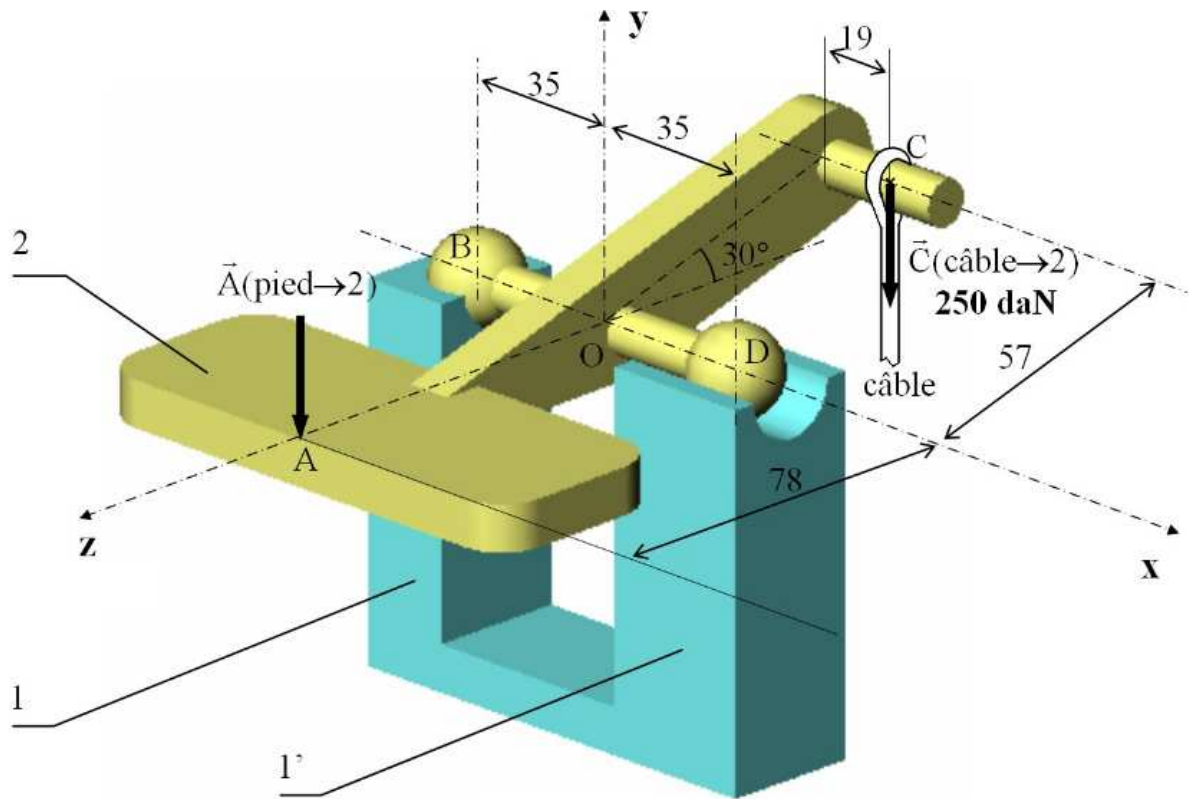


Palonnier d'hélicoptère 2



Questions 1, 2, 3 et 4

Liaison ponctuelle de normale \vec{y}

$${}_A\{\boldsymbol{\tau}_{p \rightarrow 2}\} = \begin{Bmatrix} 0 & 0 \\ Y_{p2} & 0 \\ 0 & 0 \end{Bmatrix}_A$$

Liaison rotule de centre B

$${}_B\{\boldsymbol{\tau}_{l \rightarrow 2}\} = \begin{Bmatrix} X_{12} & 0 \\ Y_{12} & 0 \\ Z_{12} & 0 \end{Bmatrix}_B$$

Liaison ponctuelle de normale \vec{y}

$${}_C\{\boldsymbol{\tau}_{c \rightarrow 2}\} = \begin{Bmatrix} 0 & 0 \\ Y_{c2} & 0 \\ 0 & 0 \end{Bmatrix}_C$$

Liaison linéaire annulaire d'axe \vec{x}

$${}_D\{\boldsymbol{\tau}_{l' \rightarrow 2}\} = \begin{Bmatrix} 0 & 0 \\ Y_{1'2} & 0 \\ Z_{1'2} & 0 \end{Bmatrix}_D$$

Questions 5, 6 et 7

$${}_A\{\boldsymbol{\tau}_{p \rightarrow 2}\} = \begin{Bmatrix} 0 & 0 \\ Y_{p2} & 0 \\ 0 & 0 \end{Bmatrix} \Rightarrow {}_B\{\boldsymbol{\tau}_{p \rightarrow 2}\} = \begin{Bmatrix} 0 & \|Y_{p2}\| \cdot 78 \\ Y_{p2} & 0 \\ 0 & -\|Y_{p2}\| \cdot 35 \end{Bmatrix}$$

$${}_B\{\boldsymbol{\tau}_{l \rightarrow 2}\} = \begin{Bmatrix} X_{12} & 0 \\ Y_{12} & 0 \\ Z_{12} & 0 \end{Bmatrix} \Rightarrow {}_B\{\boldsymbol{\tau}_{l \rightarrow 2}\} = \begin{Bmatrix} X_{12} & 0 \\ Y_{12} & 0 \\ Z_{12} & 0 \end{Bmatrix}$$

$${}_C\{\boldsymbol{\tau}_{c \rightarrow 2}\} = \begin{Bmatrix} 0 & 0 \\ Y_{c2} & 0 \\ 0 & 0 \end{Bmatrix} \Rightarrow {}_B\{\boldsymbol{\tau}_{c \rightarrow 2}\} = \begin{Bmatrix} 0 & -\|Y_{c2}\| \cdot 57 \cdot \cos 30^\circ \\ Y_{c2} & 0 \\ 0 & -\|Y_{c2}\| \cdot (35+19) \end{Bmatrix}$$

$${}_D\{\boldsymbol{\tau}_{l' \rightarrow 2}\} = \begin{Bmatrix} 0 & 0 \\ Y_{1'2} & 0 \\ Z_{1'2} & 0 \end{Bmatrix} \Rightarrow {}_B\{\boldsymbol{\tau}_{l' \rightarrow 2}\} = \begin{Bmatrix} 0 & 0 \\ Y_{1'2} & -\|Z_{1'2}\| \cdot 70 \\ Z_{1'2} & \|Y_{1'2}\| \cdot 70 \end{Bmatrix}$$

$$\sum_B \{\tau_{p \rightarrow 2}\} + \sum_B \{\tau_{l \rightarrow 2}\} + \sum_B \{\tau_{l' \rightarrow 2}\} + \sum_B \{\tau_{c \rightarrow 2}\} = 0$$

Questions 8 et 9

(1)

$$X_{12} = 0$$

(2) $Y_{p2} + Y_{12} + Y_{1'2} + Y_{c2} = 0 \Rightarrow Y_{p2} + Y_{12} + Y_{1'2} - 250 = 0$

(3) $Z_{12} + Z_{1'2} = 0 \Rightarrow Z_{12} = -Z_{1'2}$

(4) $\|Y_{p2}\| \cdot 78 - \|Y_{c2}\| \cdot 57 \cdot \cos 30^\circ = 0$

$$\|Y_{p2}\| \cdot 78 - 250 \cdot 57 \cdot 0,866 = 0$$

$$\|Y_{p2}\| \cdot 78 - 12341 = 0$$

$$\|Y_{p2}\| = \frac{12341}{78}$$

$$\|Y_{p2}\| = 158 \text{ daN}$$

$$Y_{p2} = -158 \text{ daN}$$

$$(5) \quad -\|Z_{1'2}\| \cdot 70 = 0 \quad \Rightarrow \quad \|Z_{1'2}\| = 0 \quad \Rightarrow \quad \boxed{Z_{1'2} = 0}$$

$$(3)+(5) \quad \Rightarrow \quad \boxed{Z_{12} = 0}$$

$$(6) \quad -\|Y_{p2}\| \cdot 35 - \|Y_{c2}\| \cdot 54 + \|Y_{1'2}\| \cdot 70 = 0$$
$$-158 \cdot 35 - 250 \cdot 54 + \|Y_{1'2}\| \cdot 70 = 0$$
$$-5530 - 13500 = -\|Y_{1'2}\| \cdot 70$$

$$\|Y_{1'2}\| = \frac{19030}{70} = 271 \text{ daN} \quad \Rightarrow \quad \boxed{Y_{12} = 271 \text{ daN}}$$

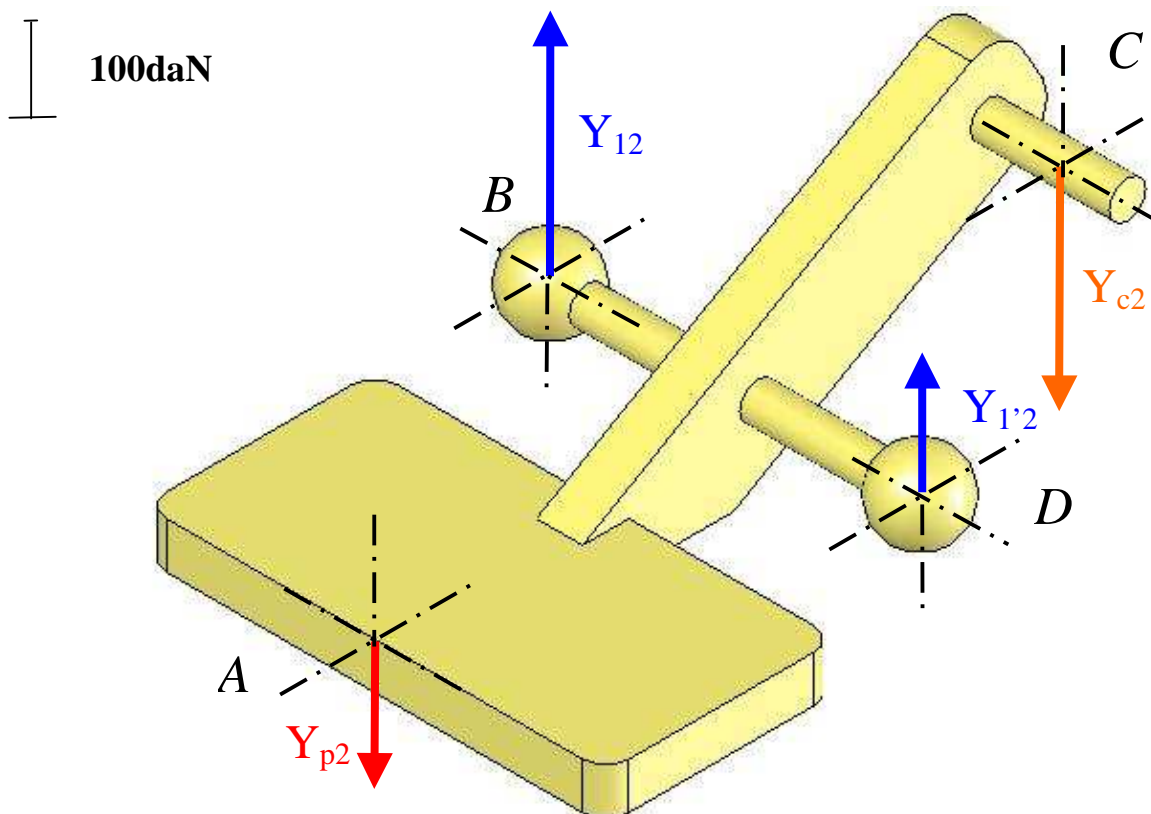
$$(2)+(4)+(6) \quad Y_{p2} + Y_{12} + Y_{1'2} - 250 = 0$$

$$Y_{1'2} = 250 - Y_{p2} - Y_{12}$$

$$Y_{1'2} = 250 + 158 - 271 \quad \Rightarrow \quad \boxed{Y_{1'2} = 137 \text{ daN}}$$

Questions 10

Vecteurs résultantes : 1 cm = 100 daN



$${}_A \left\{ \boldsymbol{\tau}_{p \rightarrow 2} \right\} = \begin{Bmatrix} 0 & 0 \\ -158 & 0 \\ 0 & 0 \end{Bmatrix}_A$$

$${}_B \left\{ \boldsymbol{\tau}_{I \rightarrow 2} \right\} = \begin{Bmatrix} 0 & 0 \\ 271 & 0 \\ 0 & 0 \end{Bmatrix}_B$$

$${}_C \left\{ \boldsymbol{\tau}_{c \rightarrow 2} \right\} = \begin{Bmatrix} 0 & 0 \\ -250 & 0 \\ 0 & 0 \end{Bmatrix}_C$$

$${}_D \left\{ \boldsymbol{\tau}_{I' \rightarrow 2} \right\} = \begin{Bmatrix} 0 & 0 \\ 137 & 0 \\ 0 & 0 \end{Bmatrix}_D$$