

Figure 1 – Schéma de la ligne d'arbre étudiée (cotes en mm)

$$\vec{OA} = \begin{pmatrix} 300 \\ 125\frac{\sqrt{2}}{2} \\ 125\frac{\sqrt{2}}{2} \end{pmatrix} \quad \vec{OB} = \begin{pmatrix} 300 \\ -125\frac{\sqrt{2}}{2} \\ -125\frac{\sqrt{2}}{2} \end{pmatrix} \quad \vec{OC} = \begin{pmatrix} 700 \\ 150 \\ 0 \end{pmatrix} \quad \vec{OD} = \begin{pmatrix} 700 \\ -150 \\ 0 \end{pmatrix} \quad \vec{OE} = \begin{pmatrix} 850 \\ 0 \\ 0 \end{pmatrix}$$

$$\vec{OO} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

$$\vec{PA} = \begin{pmatrix} 0 \\ 46\frac{\sqrt{2}}{2} \\ -46\frac{\sqrt{2}}{2} \end{pmatrix} \quad \vec{PB} = \begin{pmatrix} 0 \\ 310\frac{\sqrt{2}}{2} \\ -310\frac{\sqrt{2}}{2} \end{pmatrix} \quad \vec{PC} = \begin{pmatrix} 0 \\ 0 \\ 50 \end{pmatrix} \quad \vec{PD} = \begin{pmatrix} 0 \\ 0 \\ 220 \end{pmatrix} \quad \vec{PE} = \begin{pmatrix} X_E \\ Y_E \\ Z_E \end{pmatrix}$$

$$\vec{PO} = \begin{pmatrix} X_o \\ Y_o \\ Z_o \end{pmatrix}$$

on peut écrire

$$\vec{OO} \wedge \vec{PO} + \vec{OA} \wedge \vec{PA} + \vec{OB} \wedge \vec{PB} + \vec{OC} \wedge \vec{PC} + \vec{OD} \wedge \vec{PD} + \vec{OE} \wedge \vec{PE} = \vec{0}$$

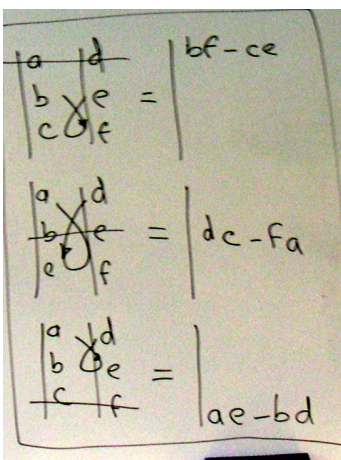
$$\vec{OO} \wedge \vec{PO} = \vec{0} \quad \text{car} \quad \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} \wedge \begin{pmatrix} X_o \\ Y_o \\ Z_o \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

donc

$$\vec{OA} \wedge \vec{PA} + \vec{OB} \wedge \vec{PB} + \vec{OC} \wedge \vec{PC} + \vec{OD} \wedge \vec{PD} + \vec{OE} \wedge \vec{PE} = \vec{0}$$

$$\begin{pmatrix} 300 \\ 125 \frac{\sqrt{2}}{2} \\ 125 \frac{\sqrt{2}}{2} \end{pmatrix} \wedge \begin{pmatrix} 0 \\ 46 \frac{\sqrt{2}}{2} \\ -46 \frac{\sqrt{2}}{2} \end{pmatrix} + \begin{pmatrix} 300 \\ -125 \frac{\sqrt{2}}{2} \\ -125 \frac{\sqrt{2}}{2} \end{pmatrix} \wedge \begin{pmatrix} 0 \\ 310 \frac{\sqrt{2}}{2} \\ -310 \frac{\sqrt{2}}{2} \end{pmatrix} + \begin{pmatrix} 700 \\ 150 \\ 0 \end{pmatrix} \wedge \begin{pmatrix} 0 \\ 0 \\ 50 \end{pmatrix} + \begin{pmatrix} 700 \\ -150 \\ 0 \end{pmatrix} \wedge \begin{pmatrix} 0 \\ 0 \\ 220 \end{pmatrix} + \begin{pmatrix} 850 \\ 0 \\ 0 \end{pmatrix} \wedge \begin{pmatrix} X_E \\ Y_E \\ Z_E \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

rappel de calcul



on commence par le moment en Z

$$300 \times 46 \frac{\sqrt{2}}{2} + 300 \times 310 \frac{\sqrt{2}}{2} + 850 \times Y_E = 0$$

$$\frac{-300 \times 356 \times \sqrt{2}}{2 \times 850} = Y_E = -88.84$$

puis en Y

$$300 \times 46 \frac{\sqrt{2}}{2} + 300 \times 310 \frac{\sqrt{2}}{2} - 50 \times 700 - 220 \times 700 - 850 \times Z_E = 0$$

$$\frac{150 \times 356 \sqrt{2} - 270 \times 700}{850} = Z_E = -133$$

en X les forces sont bien entendu nulles

$$\vec{PE} = \begin{pmatrix} 0 \\ -88.84 \\ -133 \end{pmatrix}$$

on peut maintenant écrire

$$\vec{PO} + \vec{PA} + \vec{PB} + \vec{PC} + \vec{PD} + \vec{PE} = \vec{0}$$

$$\begin{pmatrix} X_o \\ Y_o \\ Z_o \end{pmatrix} + \begin{pmatrix} 0 \\ 46 \frac{\sqrt{2}}{2} \\ -46 \frac{\sqrt{2}}{2} \end{pmatrix} + \begin{pmatrix} 0 \\ 310 \frac{\sqrt{2}}{2} \\ -310 \frac{\sqrt{2}}{2} \end{pmatrix} + \begin{pmatrix} 0 \\ 0 \\ 50 \end{pmatrix} + \begin{pmatrix} 0 \\ 0 \\ 220 \end{pmatrix} + \begin{pmatrix} X_E \\ -88.84 \\ -133 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

$$X_o = -X_E = 0$$

$$Y_o = -356 \frac{\sqrt{2}}{2} + 88.84 = -162.85$$

$$Z_o = 356 \frac{\sqrt{2}}{2} - 270 + 133 = 114.7$$

$$\vec{PO} = \begin{pmatrix} 0 \\ -162.85 \\ 114.7 \end{pmatrix}$$