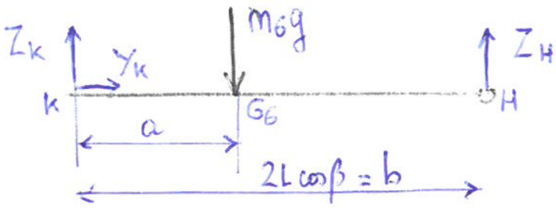
Table élévatrice

en isole ⑥



$b = 2L\cos\beta$

$\sum \vec{F}_{ext \to 6} = \vec{0}$ $\begin{cases} Y_K = 0 \\ Z_K + Z_H - m_6 g = 0 \end{cases}$

$\sum \vec{M}_{K\, ext \to 6} = \vec{0}$

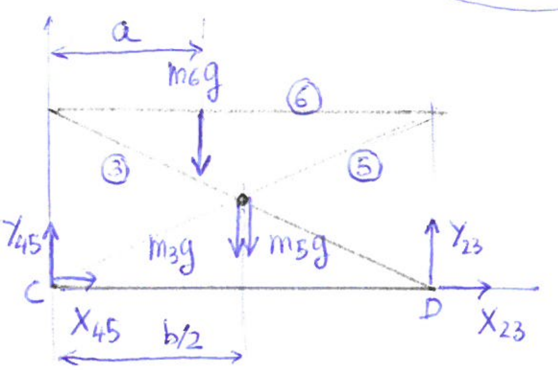
$-a m_6 g + b Z_H = 0$

$Z_H = \frac{a}{b} m_6 g \qquad Z_K = \frac{b-a}{b} \cdot m_6 g$

$(Z_H = Z_{56}$ et $Z_K = Z_{36})$

Efforts en H et K

on isole ③⑤⑥



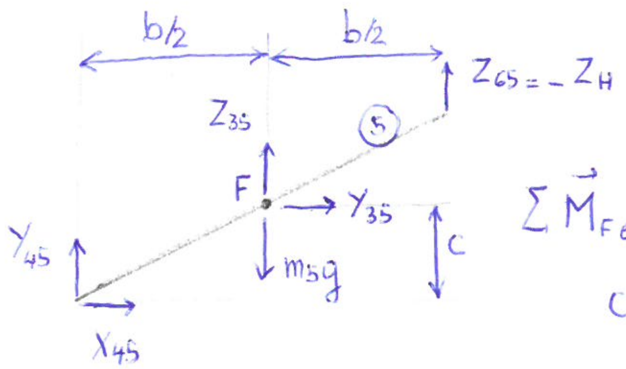
$\sum \vec{F}_{ext \to \Sigma} = \vec{0}$ $\begin{cases} X_{45} + X_{23} = 0 \\ Y_{23} + Y_{45} - (m_3 + m_5 + m_6) g = 0 \end{cases}$

$\sum \vec{M}_{C\, ext \to \Sigma} = \vec{0} \qquad b Y_{23} - (m_3 + m_5) g \frac{b}{2} - m_6 g a = 0$

$Y_{23} = \frac{(m_3 + m_5)}{2} g + m_6 g \frac{a}{b}$

$Y_{45} = \left(\frac{m_3 + m_5}{2}\right) g + m_6 g \left(\frac{b-a}{b}\right)$

on isole ⑤



$\sum \vec{M}_{F\, ext \to 5} = \vec{0}$

$c = 2L \frac{\sin\beta}{2} = L\sin\beta$

$c X_{45} + \frac{b}{2} Z_{65} - \frac{b}{2} Y_{45} = 0$

$X_{45} = \frac{b}{2c}(Y_{45} - Z_{65}) = \frac{1}{\operatorname{tg}\beta}(Y_{45} + Z_{56})$

Efforts en C et D

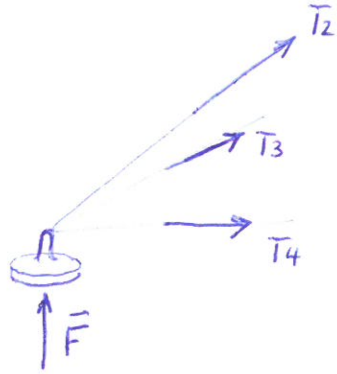
$X_{45} = \frac{1}{\operatorname{tg}\beta} \left\{ \frac{m_3 + m_5}{2} g + 2 m_6 g \frac{b-a}{b} \right\}$

$X_{23} = -X_{45}$

on peut alors déduire facilement les efforts en F.

Pied de stabilisation

on isole A



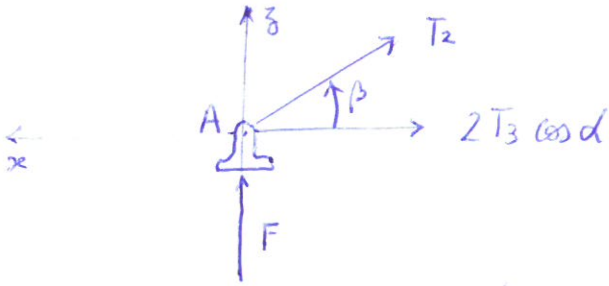
on isole (3) ou (4)
solides soumis à 2 forces
les forces sont suivant (AC) et (AB)

BAMext

- Action du sol
- Action de (2)
- Action de (3)
- Action de (4)

on isole (1)+(2)
Ensemble soumis à 2 forces
les forces sont suivant (AD)

Les problème est symétrique ⇒ plan de symétrie (Oxz) ⇒ $T_3 = T_4$

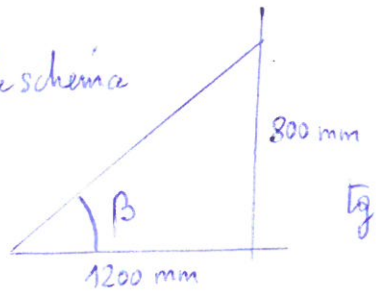


$$\sum \vec{F}_{ext \to A} = \vec{0} \qquad \begin{cases} /x & -2\,T_3 \cos\alpha - T_2 \cos\beta = 0 \\ /z & T_2 \sin\beta + F = 0 \end{cases}$$

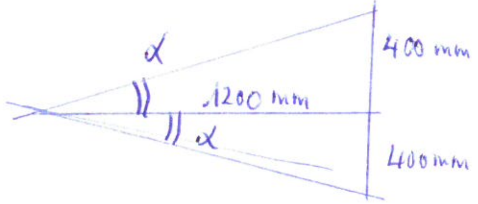
on déduit

$$\begin{cases} T_2 = -\dfrac{F}{\sin\beta} \\ T_3 = T_4 = -\dfrac{T_2 \cos\beta}{2\cos\alpha} = \dfrac{F}{2\cos\alpha \cdot \mathrm{tg}\,\beta} \end{cases}$$

sur le schéma

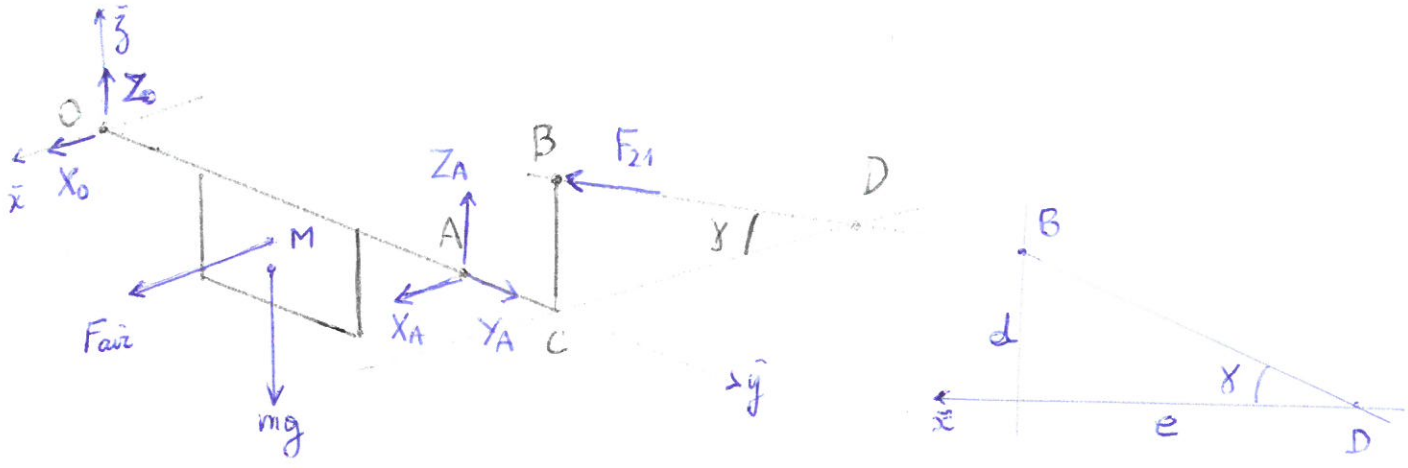


$$\mathrm{tg}\,\beta = \frac{8}{12} = \frac{2}{3}$$



$$\mathrm{tg}\,\alpha = \frac{1}{3}$$

Bouche de climatisation



$tg\,\gamma = \frac{d}{e}$

on isole 1

BAM ext

- on néglige la force de pesanteur (pas d'information sur la masse)
- $\begin{Bmatrix} X_0 & 0 \\ 0 & 0 \\ Z_0 & 0 \end{Bmatrix}_O$ linéaire annulaire en O
- $\begin{Bmatrix} X_A & 0 \\ Y_A & 0 \\ Z_A & 0 \end{Bmatrix}$ rotule en A
- $F_{air}\,\vec{x}$ en M
- $F_{21}\,\vec{x_2}$ en B $= \begin{pmatrix} F_{21}\cos\gamma \\ 0 \\ F_{21}\sin\gamma \end{pmatrix}$

$\sum \vec{M}_{O\,ext\to 1} = \vec{0}$

$\vec{M}_{O(F_A)} = \vec{OA} \wedge \vec{F_A} = \begin{pmatrix} 0 \\ 2a \\ 0 \end{pmatrix} \wedge \begin{pmatrix} X_A \\ Y_A \\ Z_A \end{pmatrix} = \begin{pmatrix} 2a Z_A \\ 0 \\ -2a X_A \end{pmatrix}$

$\vec{M}_{O(F_{air})} = \vec{OM} \wedge \begin{pmatrix} F_{air} \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ a \\ -\ell \end{pmatrix} \wedge \begin{pmatrix} F_{air} \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ -\ell F_{air} \\ -a F_{air} \end{pmatrix}$

$\vec{M}_{O(F_0)} = \vec{0}$

$\vec{M}_{O(F_{21})} = \vec{OB} \wedge \vec{F_{21}} = \begin{pmatrix} 0 \\ 2a+c \\ d \end{pmatrix} \wedge \begin{pmatrix} F_{21}\cos\gamma \\ 0 \\ F_{21}\sin\gamma \end{pmatrix} = \begin{pmatrix} (2a+c)F_{21}\sin\gamma \\ +d\,F_{21}\cos\gamma \\ -(2a+c)\,F_{21}\cos\gamma \end{pmatrix}$

PFS ⇨
$$\begin{cases} 2a Z_A + (2a+c) F_{21}\sin\gamma = 0 \\ -\ell F_{air} + d\,F_{21}\cos\gamma = 0 \\ -2a X_A - a F_{air} - (2a+c) F_{21}\cos\gamma = 0 \end{cases}$$

L'équation autour de Oy donne $F_{21} = \frac{\ell}{d\cos\gamma} F_{air}$

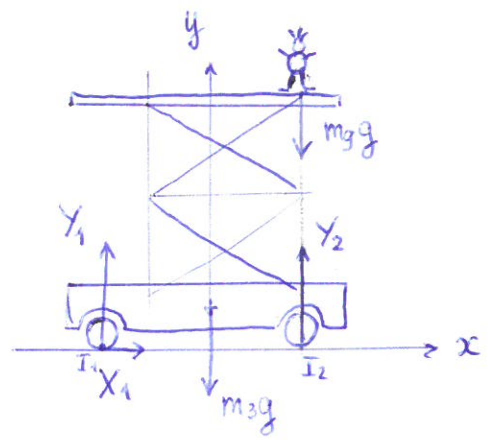
$tg\,\gamma = \frac{2}{3}$ $\qquad \frac{\ell}{d} = 2$ $\qquad F_{air} = 150$ N

Chariot élévateur

on isole l'ensemble

BAM ext

voir figure



$\sum \vec{F}_{ext \to \Sigma} = \vec{0}$

$$\begin{cases} X_1 = 0 \\ Y_1 + Y_2 - (m_3 + m_g) g = 0 \end{cases}$$

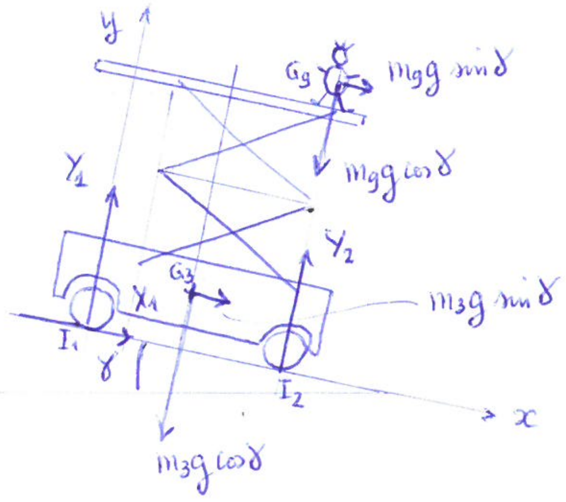
$\sum \vec{M}_{I_1 ext \to \Sigma} = \vec{0}$ $\quad - m_3 g . L + Y_2 . 2L - m_g g\, 2L = 0$

on déduit $\quad Y_1 = \frac{m_3 g}{2} \qquad Y_2 = \left(\frac{m_3}{2} + m_g\right) g$

on isole l'ensemble

BAM ext

Voir figure



$\sum \vec{F}_{ext \to \Sigma} = \vec{0}$

$$\begin{cases} X_1 + m_3 g \sin\gamma + m_g g \sin\gamma = 0 \\ Y_1 + Y_2 - m_3 g \cos\gamma - m_g g \cos\gamma = 0 \end{cases}$$

$\sum \vec{M}_{I_2 ext \to \Sigma} = \vec{0}$ $\quad - h_3 m_3 g \sin\gamma + L m_3 g \cos\gamma - Y_1 . 2L - m_g g \sin\gamma . (H + 4L \sin\alpha + h_g) = 0$

$$Y_1 = \frac{m_3 g \cos\gamma}{2} - \left\{ \frac{h_3 m_3 g \sin\gamma + H_{max} m_g g \sin\gamma}{2L} \right\}$$

La condition de non basculement se traduit par $Y_1 > 0$

d'où $\quad \frac{m_3}{2} \cos\alpha > \left(m_3 \frac{h_3}{2L} + m_g \frac{H_{max}}{2L}\right) \sin\gamma$

$$tg\,\alpha < \frac{m_3 . L}{m_3 h_3 + m_g H_{max}} \qquad AN : \quad tg\,\alpha < \frac{200 . 1{,}5}{200 . 0{,}5 + 100 . 8}$$

$$tg\,\alpha < \frac{1}{3}$$