III Etude énergétique

III. 1 Calcul de l'énergie cinétique de S_4/R_0

$$E_c(S_4/R_0) = E_c(S_{4a}/R_0) + E_c(S_{4b}/R_0)$$

$$* \quad E_c(S_{4a}/R) = \frac{1}{2}\vec{\Omega}(S_4/R_0) \cdot \underline{\underline{I}}(C, S_{4a}) \cdot \vec{\Omega}(S_4/R_0) + \frac{1}{2} m_{4a} \vec{V}^2_{C/R_0}$$

$$\vec{\Omega}(S_4/R_0) = \dot{\theta}\,\vec{x}_4 \quad , \quad \vec{V}_{C/R_0} = \vec{0}$$

$$\Rightarrow E_c(S_{4a}/R_0) = \frac{1}{2} A_a \dot{\theta}^2$$

$$* \quad E_c(S_{4a}/R_0) = \frac{1}{2}\vec{\Omega}(S_{4b}/R_0) \cdot I(O, S_{4b}) \cdot \vec{\Omega}(S_{4b}/R_0)$$

$$= \frac{1}{2}\begin{Bmatrix} \dot{\theta} & 0 & 0 \end{Bmatrix} \cdot \begin{pmatrix} A_b\dot{\theta} \\ -F_b\dot{\theta} \\ 0 \end{pmatrix}_{B_4}$$

$$= \frac{1}{2} A_b \dot{\theta}^2$$

$$\Rightarrow E_c(S_4/R_0) = \frac{1}{2}(A_a + A_b)\dot{\theta}^2$$

II. c Calcul des puissances:

$$P(T_5 \to S_4) = \begin{Bmatrix} F_x & C_m \\ F_y & 0 \\ F_z & 0 \end{Bmatrix}_C \cdot \begin{Bmatrix} \dot{\theta}\,\vec{x} \\ \vec{V}(C/R) = \vec{0} \end{Bmatrix} = C_m \dot{\theta}$$

$$P(\text{Pompe} \to S_4) = \begin{Bmatrix} 0 & C_r \\ 0 & 0 \\ 0 & 0 \end{Bmatrix}_O \cdot \begin{Bmatrix} \dot{\theta}\,\vec{x} \\ \vec{V}(O/R) = \vec{0} \end{Bmatrix} = C_r \dot{\theta}$$

COMATEC
Performance Technologie

$$P(g \to S_4) = P(g \to S_{4c}) + P(g \to S_{4b})$$

$$= \begin{Bmatrix} -m_{4c}\, g\, \vec{y} \\ \vec{0} \end{Bmatrix}_C \cdot \begin{Bmatrix} \dot{\theta}\, \vec{x} \\ \vec{V}(C/R) = \vec{0} \end{Bmatrix} + \begin{Bmatrix} -m_{4b}\, g\, \vec{y} \\ \vec{0} \end{Bmatrix}_G \cdot \begin{Bmatrix} \dot{\theta}\, \vec{x} \\ \vec{V}(G/R) \end{Bmatrix}$$

$$= -m_{4b}\, g\, \vec{y} \cdot \vec{V}(G/R)$$

$$= -m_{4b}\, g\, \vec{y} \cdot y_G\, \dot{\theta}\, \vec{z}_4 \qquad \Big|\ \vec{y} = \cos\theta\, \vec{y}_4 - \sin\theta\, \vec{z}_4$$

$$\underline{P(g \to S_4) = m_{4b}\, g\, y_G \sin\theta\, \dot{\theta}}$$

<u>Action en O</u> $\quad P(S_0 \to S_4) = \begin{Bmatrix} X_0 & 0 \\ Y_0 & 0 \\ Z_0 & 0 \end{Bmatrix}_O \cdot \begin{Bmatrix} \dot{\theta}\, \vec{x} \\ \vec{0} \end{Bmatrix}_O = 0$

Action en B $\quad P(S_0 \to S_4) = \begin{Bmatrix} 0 & 0 \\ Y_B & 0 \\ Z_B & 0 \end{Bmatrix}_B \cdot \begin{Bmatrix} \dot{\theta}\, \vec{x} \\ \vec{V}(B/R) \end{Bmatrix}$

$$\vec{V}(B/R) = \vec{0} \Rightarrow P(S_0 \to S_4) = 0.$$

d'où $\quad P(\bar{S}_4 \to S_4) = (C_m + C_r)\,\dot{\theta} + m_{45}\, g\, y_G \sin\theta\, \dot{\theta}$

III.3 Théorème de l'énergie cinétique :

$$\frac{dE_c(S_4/R)}{dt} = P(\bar{S}_4 \to S_4) + \underbrace{P(\text{forces intérieures})}_{=0}$$

(liaisons parfaites)

$$\Rightarrow (A_C + A_b)\,\dot{\theta}\,\ddot{\theta} = (C_m + C_r)\,\dot{\theta} + m_{45}\, g\, y_G \sin\theta\, \dot{\theta}$$

$$\Rightarrow \boxed{(A_C + A_b)\,\ddot{\theta} = (\cancel{C_m} + C_r)\,\cancel{\dot{\theta}} + m_{4b}\, g \sin\theta \frac{e}{1-\alpha^2}}$$

Cas où $\dot{\theta} = \dot{\theta}_{max}$ $\Rightarrow$ $- \cancel{m_{4b}}\, y_G\, \dot{\theta}^2 = 25\, \cancel{m_{4b}}\, g$

$\Rightarrow \quad y_G = 25 \dfrac{g}{\dot{\theta}^2}$

$\Rightarrow \quad m_{4b}\, g\, y_G \sin\theta = m_{4b} \cdot 25 \cdot \left(\dfrac{g}{\dot{\theta}}\right)^2$