(1)

Mécanisme tournant

1) $\dot\theta = -\frac{L}{R}\dot\varphi$; $\vec\Omega_{3/1} = \dot\theta\,\vec{x_2} + \dot\varphi\,\vec{z_2} = -\frac{L}{R}\dot\varphi\,\vec{x_2} + \dot\varphi\,\vec{z_2}$

2) $\vec{Rd}(2/1) = \vec 0$ (centre inertie en A)

$\vec\delta(A, 2/1) = C_2\,\ddot\varphi\,\vec{z_2}$

3) $\vec v(G\in 3/1) = L\dot\varphi\,\vec{y_2}$

$\vec{Rd}(3/1) = m_3 L(\ddot\varphi\,\vec{y_2} - \dot\varphi^2\,\vec{x_2})$

$\vec\sigma(G, 3/1) = \begin{bmatrix} A_3 & & \\ & B_3 & \\ & & B_3 \end{bmatrix}\begin{bmatrix} -\frac{L}{R}\dot\varphi \\ 0 \\ \dot\varphi \end{bmatrix} = -\frac{L}{R}A_3\dot\varphi\,\vec{x_2} + B_3\dot\varphi\,\vec{z_2}$

$\vec\delta(G, 3/1) = -\frac{L}{R}A_3\ddot\varphi\,\vec{x_2} - \frac{L}{R}A_3\dot\varphi^2\,\vec{y_2} + B_3\ddot\varphi\,\vec{z_2}$

4) $\{T_{1\to 2}\} = \begin{Bmatrix} X_A & L_A \\ Y_A & M_A \\ 0 & 0 \end{Bmatrix}_{A, B_2}$ $\{T_{2\to 3}\} = \begin{Bmatrix} X_G & 0 \\ Y_G & M_G \\ Z_G & N_G \end{Bmatrix}_{G, B_2}$

$\{T_{1\to 3}\} = \begin{Bmatrix} 0 & 0 \\ Y_M & 0 \\ Z_M & 0 \end{Bmatrix}_{M, B_2}$

5) <u>On isole (2+3), TRD sur $\vec{z_1}$</u> : $Z_M - (m_2+m_3)g = 0$

$Z_M = (m_2+m_3)g$

6) <u>On isole (3), TMD sur $(G, \vec{x_2})$</u> : $-\frac{L}{R}A_3\ddot\varphi = Y_M . R$

$\Rightarrow Y_M = -\frac{L}{R^2}A_3\ddot\varphi$

7) Adhérence si : $T < fN$

$|Y_M| < f|Z_M| \Rightarrow \frac{|Y_M|}{|Z_M|} < f \Rightarrow \frac{L.A_3\ddot\varphi}{R^2(m_2+m_3)g} < f$

Accélération max $\Longrightarrow$ $\ddot{\varphi} < \dfrac{f R^2 (m_2 + m_3) g}{L . A_3}$

8] $\vec{\delta}(A, 3/1) = \vec{\delta}(G, 3/1) + \vec{AG} \wedge \vec{R_d}(3/1)$

$= \dots + L\vec{x_2} \wedge m_2 L \left(\ddot{\varphi}\vec{y_2} - \dot{\varphi}^2 \vec{x_2} \right)$

$= \dots + m_3 L^2 \ddot{\varphi} \vec{z_2}$

$= -\dfrac{L}{R} A_3 \ddot{\varphi} \vec{x_2} - \dfrac{L}{R} A_3 \dot{\varphi}^2 \vec{y_2} + \left(B_3 + m_3 L^2 \right) \ddot{\varphi} \vec{z_2}$

9] On isole (2+3), TMD sur $(A, \vec{z_1})$

$$(C_2 + B_3 + m_3 L^2)\,\ddot{\varphi} = C_m + L . Y_r$$

avec $Y_r = -\dfrac{L}{R^2} A_3 \ddot{\varphi}$

$$\Longrightarrow \quad C_m = \left(C_2 + B_3 + m_3 L^2 + A_3 \frac{L^2}{R^2} \right) . \ddot{\varphi}$$

$C_m = J_{eq} . \ddot{\varphi}$ $\quad$ J_{eq} : Inertie équivalente.

Rem : Si on rajoute des frottements visqueux sur la pivot entre 1 et 2 $\Longrightarrow$ $C_f = -\lambda . \dot{\varphi}$

$$\Longrightarrow \quad C_m = J_{eq} \ddot{\varphi} + \lambda . \dot{\varphi}$$

$$C_m = J_{eq} \dot{\omega} + \lambda \omega$$

Si on passe dans Laplace : $C_m(p) = (J_{eq}\, p + \lambda)\, \Omega(p)$

$\dfrac{\Omega(p)}{C_m(p)} = \dfrac{1}{J_{eq}\, p + \lambda} = H(p)$ $\quad$ premier ordre