Giulio Vaccari 966357 11/01/2021 (+)

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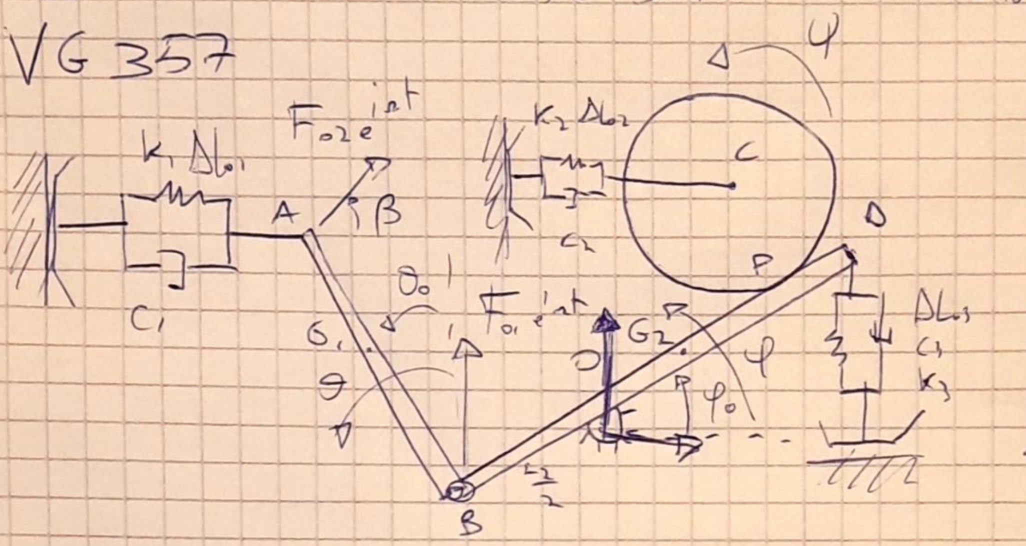
VG 357



$$\underline{x} = \begin{Bmatrix} \theta \\ \varphi \\ \psi \end{Bmatrix}$$

$$\underline{x}_0 = \begin{Bmatrix} \theta_0 \\ \varphi_0 \\ 0 \end{Bmatrix}$$

$$T = \frac{1}{2} m_2 V_{G2}^2 + \frac{1}{2} J_2 \dot{\varphi}^2 + \frac{1}{2} m_1 \dot{x}_{G1}^2 + \frac{1}{2} m_1 \dot{y}_{G1}^2 + \frac{1}{2} J_1 \dot{\theta}^2 +$$

$$+ \frac{1}{2} \dot{x}_c^2 m_3 + \frac{1}{2} m_3 \dot{y}_c^2 + \frac{1}{2} J_3 \dot{\varphi}_{ASS}^2$$

$$D = \frac{1}{2} \sum_{i=1}^{3} c_i \Delta \dot{L}_i^2 \qquad V_{el} = \frac{1}{2} \sum_{i=1}^{3} k_i \Delta L_i^2$$

$$V_g = m_1 h_{G1} + m_2 h_{G2} + m_3 h_c$$

$$\delta W = F_{02} e^{i\Omega t} \cos(\beta)\, \delta x_A + F_{02} e^{i\Omega t} \sin(\beta)\, \delta y_A + F_{01} e^{i\Omega t} \delta y_B$$

$$V_{G2} = \frac{L_2}{2} \dot{\varphi} \qquad x_{G1} = -\frac{L_2}{2} \cos(\varphi) - L_1 \sin(\theta)$$

$$y_B = -\frac{L_2}{2} \sin(\varphi) \qquad y_{G1} = -\frac{L_2}{2} \sin(\varphi) + L_1 \cos(\theta)$$

$$x_A = -\frac{L_2}{2} \cos(\varphi) - 2L_1 \sin(\theta) \qquad \varphi_{ASS} = \psi + \varphi$$

$$y_A = -\frac{L_2}{2} \sin(\varphi) + 2L_1 \cos(\theta) \qquad y_D = \frac{3}{2} L_2 \sin(\varphi)$$

$$x_c = (a - \psi R) \cos(\varphi) - R \sin(\varphi)$$

$$y_c = (a - \psi R) \sin(\varphi) + R \cos(\varphi)$$

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$$\Delta L_1 = -\left(x_A - x_{A0}\right) \qquad \Delta L_2 = x_c - x_{c0} \qquad \Delta L_3 = y_D - y_{D0}$$

$$[\Lambda_m] = \begin{array}{c|c}
\begin{matrix} \theta & \varphi & \psi \end{matrix} & \\
\begin{bmatrix}
-L_1\cos(\theta_0) & \frac{L_2}{2}\sin(\varphi_0) & 0 \\
-L_1\sin(\theta_0) & -\frac{L_2}{2}\cos(\varphi_0) & 0 \\
1 & 0 & 0 \\
0 & L_2/2 & 0 \\
0 & 1 & 0 \\
0 & -a\sin(\varphi_0)-R\cos(\varphi_0) & -R\cos(\varphi_0) \\
0 & +a\cos(\varphi_0)-R\sin(\varphi_0) & -R\sin(\varphi_0) \\
0 & 1 & 1
\end{bmatrix} & \begin{matrix} x_{G1} \\ y_{G1} \\ \dot{\theta} \\ V_{G2} \\ \dot{\varphi} \\ x_c \\ y_c \\ \varphi_{ASS} \end{matrix}
\end{array}$$

$$[m] = \mathrm{diag}\left(\left[m_1 \; m_1 \; J_1 \; m_2 \; J_2 \; m_3 \; m_3 \; J_3\right]\right)$$

$$[\Lambda_c] = [\Lambda_k] = \begin{array}{c|c}
\begin{matrix} \theta & \varphi & \psi \end{matrix} & \\
\begin{bmatrix}
+2L_1\cos(\theta_0) & +\frac{L_2}{2}\sin(\varphi_0) & 0 \\
0 & -a\sin(\varphi_0)-R\cos(\varphi_0) & -R\cos(\varphi_0) \\
0 & \frac{3}{2}L_2\cos(\varphi_0) & 0
\end{bmatrix} & \begin{matrix} \Delta L_1 \\ \Delta L_2 \\ \Delta L_3 \end{matrix}
\end{array}$$

$$[\Lambda_Q] = \begin{array}{c|c|c}
\begin{matrix} \theta & \varphi & \psi \end{matrix} & & \\
\begin{bmatrix}
0 & -\frac{L_2}{2}\cos(\varphi_0) & 0 \\
-2L_1\cos(\theta_0) & \frac{L_2}{2}\sin(\varphi_0) & 0 \\
-2L_1\sin(\theta_0) & -\frac{L_2}{2}\cos(\varphi_0) & 0
\end{bmatrix} & \begin{matrix} F_{01} \\ F_{02}\cos(\beta) \\ F_{02}\sin(\beta) \end{matrix} & \begin{matrix} y_B \\ x_A \\ y_A \end{matrix}
\end{array}$$

$$[K_{el_I}] = K_1 \Delta L_{01} \begin{array}{c} \\ \left[\begin{array}{ccc} -2L_1\sin(\theta_0) & 0 & 0 \\ 0 & -\frac{L_2}{2}\cos(\varphi_0) & 0 \\ 0 & 0 & 0 \end{array}\right] \end{array} \begin{array}{c} \theta \\ \varphi \\ \psi \end{array}$$

$$\begin{array}{ccc} \theta & \varphi & \psi \end{array}$$

$$[K_{el_{II}}] = K_2 \Delta L_{02} \left[\begin{array}{ccc} 0 & \overset{0}{\cancel{-a\cos(\varphi_0)+R\sin(\varphi_0)}} & 0 \\ 0 & -a\cos(\varphi_0)+R\sin(\varphi_0) & R\overset{\sin}{\cancel{\cos}}(\varphi_0) \\ 0 & R\underset{\sin}{\cancel{\cos}}(\varphi_0) & 0 \end{array}\right] \begin{array}{c} \theta \\ \varphi \\ \psi \end{array}$$

$$\begin{array}{ccc} \theta & \varphi & \psi \end{array}$$

$$[K_{el_{III}}] = K_3 \Delta L_{03} \left[\begin{array}{ccc} 0 & 0 & 0 \\ 0 & -\frac{3}{2}L_2\sin(\varphi_0) & 0 \\ 0 & 0 & 0 \end{array}\right] \begin{array}{c} \theta \\ \varphi \\ \psi \end{array}$$

$h_{G_1} = Y_{G_1}$

$$\begin{array}{ccc} \theta & \varphi & \psi \end{array}$$

$$[K_{G_I}] = m_1 g \left[\begin{array}{ccc} -L_1\cos(\theta_0) & 0 & 0 \\ 0 & \frac{L_2}{2}\overset{\sin}{\cancel{\cos}}(\varphi_0) & 0 \\ 0 & 0 & 0 \end{array}\right] \begin{array}{c} \theta \\ \varphi \\ \psi \end{array}$$

$h_{G_2} = Y_{G_2} = \frac{L_2}{2}\sin(\varphi)$

$$\begin{array}{ccc} \theta & \varphi & \psi \end{array}$$

$$[K_{G_2}] = m_2 g \left[\begin{array}{ccc} 0 & 0 & 0 \\ 0 & -\frac{L_2}{2}\sin(\varphi_0) & 0 \\ 0 & 0 & 0 \end{array}\right] \begin{array}{c} \theta \\ \varphi \\ \psi \end{array}$$

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$h_c = Y_c$

$$[K_{G3}] = m_3\, g \begin{array}{cccc} \theta & \varphi & \psi & \\ \left[\begin{array}{c} 0 \\ 0 \\ 0 \end{array}\right. & \begin{array}{c} 0 \\ -a\sin(\varphi_0) - R\cos(\varphi_0) \\ -R\cos(\varphi_0) \end{array} & \left.\begin{array}{c} 0 \\ -R\cos(\varphi_0) \\ 0 \end{array}\right] & \begin{array}{c} \theta \\ \varphi \\ \psi \end{array} \end{array}$$

I didn't write any evidence on the procedure, I just ~~ddd~~ differentiated by what I wrote on the matrices' sides.

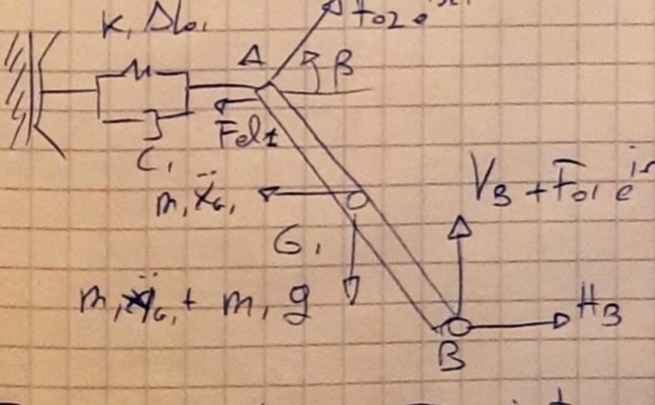
3) Absolute rotation: $\psi_{ASS} = \psi + \varphi$

Vertical disk displacement: Y_c

4) Horizontal AB displ: X_{G1}

Elastic force ~~k~~3 : $F_{el3} = (k_3 + i\,\Omega\, c_3)\,\Delta L_3$

5)



$$\sum F_{x_{AB}} = 0 \qquad H_B + F_{02}\, e^{i\Omega t} \cos(\beta) = F_{el1} + m_1 \ddot{X}_{G1} + F_{el01}$$

$$H_B = F_{el1} + m_1 \ddot{X}_{G1} - F_{02}\, e^{i\Omega t} \underset{\cos(\beta)}{\wedge} + F_{el01}$$

$$\sum F_{Y_{AB}} = 0 \qquad V_B + F_{01}\, e^{i\Omega t} + F_{02}\, e^{i\Omega t} \overset{\sin(\beta)}{\frown} = m_1 g + m_1 \ddot{\cancel{x}}_{G1}$$

$$V_B = m_1 g + m_1 \ddot{Y}_{G1} - F_{01}\, e^{i\Omega t} - F_{02}\, e^{i\Omega t} \sin(\beta)$$