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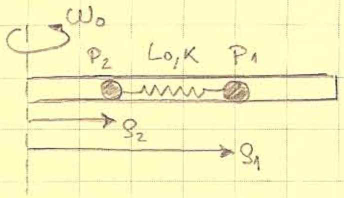
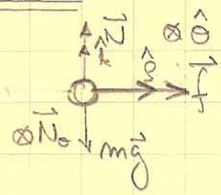


Utilizaremos coordenadas polares con distancias ρ_1 y ρ_2 hasta los centros.

DCL P_1

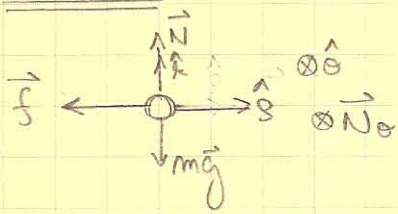


$(\hat{\rho})\quad f = m(\ddot{\rho}_1 - \rho_1\dot{\theta}^2)$

$(\hat{\theta})\quad N_\theta = m(\rho_1\ddot{\theta} + 2\dot{\rho}_1\dot{\theta})$

$(\hat{k})\quad N - mg = 0$

DCL P_2

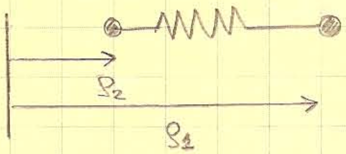


$(\hat{\rho})\quad -f = m(\ddot{\rho}_2 - \rho_2\dot{\theta}^2)$

$(\hat{\theta})\quad N_\theta = m(\rho_2\ddot{\theta} + 2\rho_2\dot{\theta})$

$(\hat{k})\quad N - mg = 0$

Además:



$$f = -k\,\Delta x$$

$$\Rightarrow f = -k(\rho_1 - \rho_2 - L_0)$$

① $-k(\rho_1 - \rho_2 - L_0) = m(\ddot{\rho}_1 - \rho_1\omega_0^2)$

② $k(\rho_1 - \rho_2 - L_0) = m(\ddot{\rho}_2 - \rho_2\omega_0^2)$

Obtendremos la diferencia $\rho_1 - \rho_2$ restando las ecuaciones:

$$-2k(\rho_1 - \rho_2 - L_0) = m(\ddot{\rho}_1 - \ddot{\rho}_2 - (\rho_1 - \rho_2)\omega_0^2)$$

Definimos: $\rho_1 - \rho_2 = \rho$

$\Rightarrow \ddot{\rho}_1 - \ddot{\rho}_2 = \ddot{\rho}$

$$\Rightarrow -2k(\rho - L_0) = m(\ddot{\rho} - \rho\omega_0^2)$$

$$\Rightarrow \boxed{\ddot{\rho} + \left(\frac{2k}{m} - \omega_0^2\right)\rho = \frac{2kL_0}{m}}$$

IMPONEMOS QUE: $\omega_0^2 = \frac{2k}{m}$

$$\Rightarrow \ddot{\rho} = \frac{2kL_0}{m}$$

$$\frac{d\dot{\rho}}{dt} = \frac{2kL_0}{m}$$

$$\int_0^{\dot{\rho}} d\dot{\rho} = \frac{2kL_0}{m}\int_0^t dt$$

$$\dot{\rho} = \frac{2kL_0}{m}t$$

$$\frac{d\rho}{dt} = \frac{2kL_0}{m}t$$

C.I: $\rho_1 = L_0$, $\rho_2 = 0 \Rightarrow \rho = L_0$

$$\int_{L_0}^{\rho} d\rho = \frac{2kL_0}{m}\int_0^t t\,dt$$

$$\boxed{\rho(t) = L_0 + \frac{kL_0}{m}t^2}$$

FINALMENTE SI: $\omega_0^2 < \frac{2k}{m} \Rightarrow 0 < \frac{2k}{m} - \omega_0^2 = \omega^2$

$$\Rightarrow \ddot{\rho} + \omega^2\rho = \frac{2kL_0}{m} \qquad \Rightarrow \text{M.A.S.!!}$$

$$\Rightarrow \rho(t) = K_1\cos(\omega t + \phi) + K_2$$

CON $K_2 = \frac{2kL_0}{\omega^2 m}$ (SOL. PARTICULAR)

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$$\Rightarrow \boxed{\ddot{\rho} + \left(\frac{2k}{m} - \omega_0^2\right)\rho = \frac{2kL_0}{m}}$$

IMPONEMOS QUE: $\omega_0^2 = \frac{2k}{m}$

$$\Rightarrow \ddot{\rho} = \frac{2kL_0}{m}$$

$$\frac{d\dot{\rho}}{dt} = \frac{2kL_0}{m}$$

$$\int_0^{\dot{\rho}} d\dot{\rho} = \frac{2kL_0}{m}\int_0^t dt$$

$$\dot{\rho} = \frac{2kL_0}{m} t$$

$$\frac{d\rho}{dt} = \frac{2kL_0}{m} t$$

C.I: $\rho_1 = L_0$, $\rho_2 = 0 \Rightarrow \rho = L_0$

$$\int_{L_0}^{\rho} d\rho = \frac{2kL_0}{m}\int_0^t t\,dt$$

$$\boxed{\rho(t) = L_0 + \frac{kL_0}{m} t^2}$$

FINALMENTE si : $\omega_0^2 < \frac{2k}{m} \Rightarrow 0 < \frac{2k}{m} - \omega_0^2 = \omega^2$

$$\Rightarrow \ddot{\rho} + \omega^2 \rho = \frac{2kL_0}{m} \Rightarrow \text{M.A.S.!!}$$

$$\Rightarrow \rho(t) = K_1 \cos(\omega t + \phi) + K_2$$

CON $K_2 = \frac{2kL_0}{\omega^2 m}$ (SOL. PARTICULAR)

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