Pauta taller 5 - secciones 7 y 8

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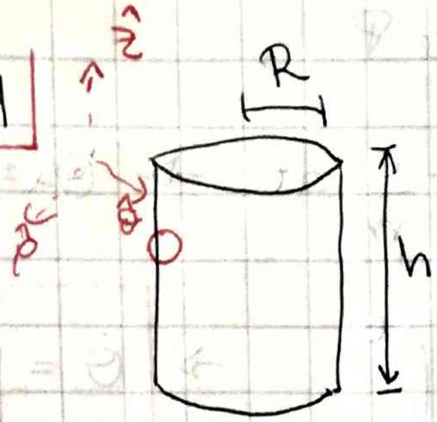
Pregunta 1



v_0 ; $\vec{F}_{r,v} = -c\vec{v}$

a) Primero elegimos nuestro sistema coordenado (cilíndricos)

$\vec{r} = R\hat{\rho} + z\hat{k}$; $\vec{v} = R\dot{\theta}\hat{\theta} + \dot{z}k$; $\vec{a} = -R\dot{\theta}^2\hat{\rho} + R\ddot{\theta}\hat{\theta} + \ddot{z}k$

Tomamos la aceleración y hacemos ΣF en cada eje:

(1) $\Sigma F_{\hat{\rho}} \rightarrow -mR\dot{\theta}^2 = -N$

(2) $\Sigma F_{\hat{\theta}} \rightarrow mR\ddot{\theta} = -cR\dot{\theta}$ → Fuerza de Roce Viscoso

(3) $\Sigma F_{\hat{z}} \rightarrow m\ddot{z} = -mg - c\dot{z}$ → Roce Viscoso

Nos piden V_z → En (3):

$$m \cdot \frac{d\dot{z}}{dt} = -mg - c\dot{z}$$

$$\frac{d\dot{z}}{g + \frac{c\dot{z}}{m}} = -dt \quad / \int_{\dot{z}=0}^{\dot{z}(t)} \text{ ó } \int_{t_0=0}^{t}$$

$$\Rightarrow \boxed{\dot{z}(t) = \frac{mg}{c}\left[e^{-\frac{c}{m}t} - 1\right]}$$

Además $\dot{z} = \frac{dz}{dt}$ → Analogamente: $dz = \frac{mg}{c}\left[e^{-\frac{c}{m}t} - 1\right]dt$

$$\int_{z_0=h}^{z(t)} \text{ ó } \int_0^t \Rightarrow \boxed{z(t) = h - \frac{mgt}{c} - \frac{m^2 g}{c^2}\left[e^{-\frac{c}{m}t} - 1\right]}$$

b) Velocidad Angular de P

Usando (2) $\rightarrow \dfrac{d\dot{\theta}}{\dot{\theta}} = -\dfrac{c}{m} dt$ $\rightarrow$ ~~$\theta(t)$~~

$$\int_{\dot{\theta}=\frac{v_0}{R}}^{\dot{\theta}(t)} \quad ó \quad \int_{t=0}^{t} \rightarrow \boxed{\dot{\theta} = \frac{v_0}{R} e^{-\frac{c}{m}t}}$$

c) Para que de una sólo vuelta, $\theta_f - \theta_i = 2\pi$
si suponemos $h \rightarrow \infty$, entonces $t \rightarrow \infty$ hasta que alcance el fondo.

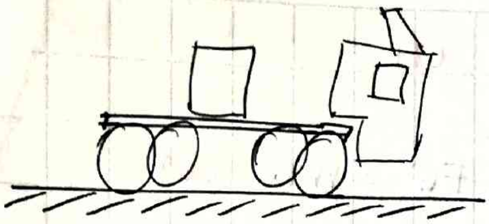
$$\rightarrow \dot{\theta}(t) = \frac{d\theta}{dt} = \frac{v_0}{R} e^{-\frac{c}{m}t}$$

$$\int_{\theta=0}^{\theta=2\pi} d\theta = \int_{t=0}^{t=\infty} \frac{v_0}{R} e^{-\frac{c}{m}t}$$

$$2\pi = -\frac{v_0 m}{Rc} \left[e^{-\frac{c}{m}t} \right]_0^{\infty} = 0 + \frac{mv_0}{Rc}$$

$$\therefore \boxed{c = \frac{mv_0}{2\pi R}}$$

Pregunta 2



$\mu_e = 0{,}3$

$v_0 = 72{,}4\ Km/h$

$\vec{a} = cte$

F_R máx entre caja y camión: $F_R = \mu_e \cdot N$

$F_R = \mu_e \cdot mg$

$\Sigma F_x \Rightarrow m \cdot a_{max} = F_{Rmax}$

$a_{max} = \mu_e g$

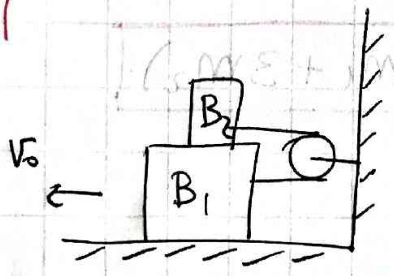
Menor tiempo de Frenado es $t = \dfrac{v_0}{a_{max}} = \dfrac{v_0}{\mu_e g}$

$\Rightarrow$ De cinemática: $x = v_0 t + \frac{1}{2} a t^2$

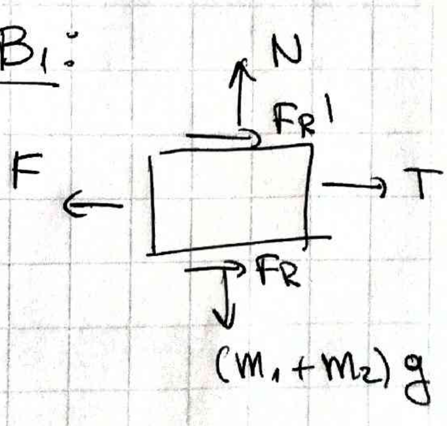
$s = v_0 t + \frac{1}{2} a t^2 = \frac{1}{2} \dfrac{v_0^2}{\mu_e g} \rightarrow$ Resolviendo con los datos

$\boxed{s = 68{,}71 m}$

Pregunta 3



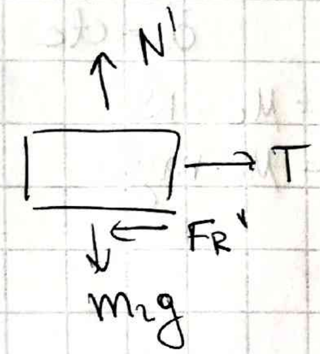
DCL B_1:



$\sum F_y = 0 \Rightarrow N = (m_1 + m_2) g$ (1)

$\sum F_x = ma \Rightarrow -F + T + F_R + F_R' = ma$ (2)

DCL B_2



$\sum F_y = 0 \Rightarrow N' = m_2 g$ (3)

$\sum F_x = ma \Rightarrow T - F_R' = ma$ (4)

Además, $F_R' = \mu \cdot N'$

$F_R' = \mu m_2 g$ (5)

Analogamente, $F_R = \mu (m_1 + m_2) g$ (6)

Si Notamos, del enunciado nos dicen $v_0 = cte \Rightarrow a = 0$

Tomamos (2) y (4):

$$F = T + F_R + F_R'$$
$$T = F_R'$$

$$\Rightarrow F = F_R + 2F_R'$$
$$F = \mu (m_1 + m_2) g + 2 \mu m_2 g$$

$$\boxed{F = \mu g (m_1 + 3 m_2)}$$