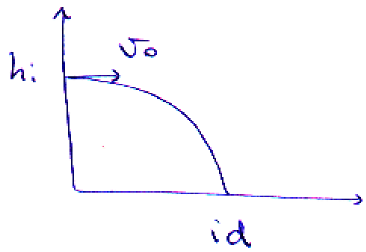
SOLUCIÓN CONTROL 1

Solución P1

i)



$$x(t) = v_0 t$$
$$y(t) = h_i - \frac{1}{2} g t^2$$

choque con el suelo $\quad y = 0 \Rightarrow \quad h_i = \frac{1}{2} g t_i^2$

$$id = v_0 t_i$$

entonces

$$t_i = \frac{id}{v_0}$$

$$\Rightarrow \qquad h_i = \frac{1}{2} g \left(\frac{id}{v_0} \right)^2$$

$$\boxed{h_i = \frac{1}{2} \frac{g d^2}{v_0^2} i^2}$$

ii)

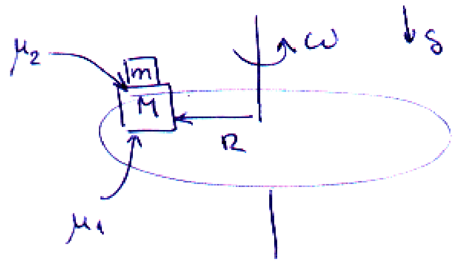
$$\Delta t = t_{i+1} - t_i = \frac{(i+1)d}{v_0} - \frac{id}{v_0}$$

diferencia de tiempo en aterrizar = retardo entre cada lanzamiento

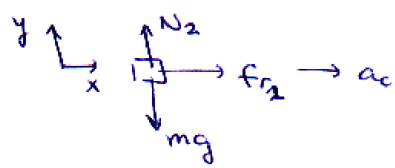
$$\Rightarrow \boxed{\Delta t = \frac{d}{v_0}}$$

SOLUCIÓN CONTROL 1

Solución P2 |



DCL m



x) $fr_2 = m a_c = m\omega^2 R$

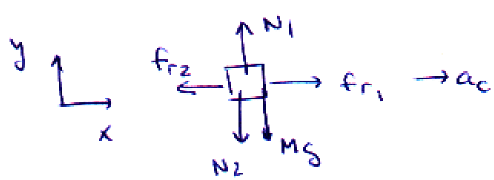
y) $N_2 - mg = 0 \Rightarrow N_2 = mg$

$$fr_2 = m\omega^2 R \leq \mu_2 N_2$$

$$\cancel{m}\omega^2 R \leq \mu_2 \cancel{m} g$$

$$\boxed{R \leq \frac{\mu_2 g}{\omega^2}}$$

DCL M



x) $fr_1 - fr_2 = M a_c$

y) $N_1 - N_2 - Mg = 0$

$\Rightarrow N_1 = (m+M)g$

$$fr_1 = M a_c + fr_2 \leq \mu_1 N_1$$

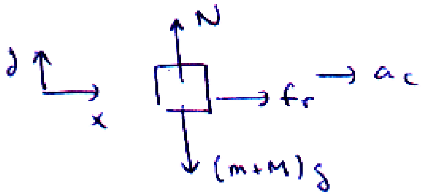
$$fr_1 = \cancel{(m+M)}\omega^2 R \leq \mu_1 \cancel{(m+M)} g$$

$$\boxed{R \leq \frac{\mu_1 g}{\omega^2}}$$

SOLUCIÓN CONTROL 1

Otra manera

DCL (m+M)



x) $f_r = (m+M)a_c$

y) $N - (m+M)g = 0$

$$f_r = (\cancel{m+M})a_c \leq \mu_1 (\cancel{m+M})g$$

$$\omega^2 R \leq \mu_1 g$$

$$\boxed{R \leq \frac{\mu_1 g}{\omega^2}}$$

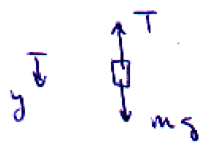
Si $\mu_1 > \mu_2 \Rightarrow R_{max} = \dfrac{\mu_2 g}{\omega^2}$

Si $\mu_2 > \mu_1 \Rightarrow R_{max} = \dfrac{\mu_1 g}{\omega^2}$

SOLUCIÓN CONTROL 1

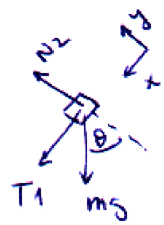
SOLUCION P3

DCL m



$$mg - T = M a_M \qquad (1)$$

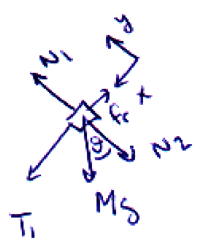
DCL m



$$x)\quad T_1 + mg \operatorname{sen}\theta = m a_2 \qquad (2)$$

$$y)\quad N_2 - mg\cos\theta = 0$$

DCL M



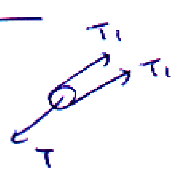
$$x)\quad T_1 + Mg \operatorname{sen}\theta - fr = 0$$

$$y)\quad N_1 - N_2 - Mg\cos\theta = 0$$

$$M = 2m \quad \Rightarrow \quad T_1 + 2mg \operatorname{sen}\theta - fr = 0 \qquad (3)$$

$$N_1 = 3mg\cos\theta$$

DCL Polea



$$2T_1 = T$$

SOLUCIÓN CONTROL 1

Relación aceleraciones : $2a_M = a_2$

De (1) se tiene

$$mg - 2T_1 = ma_M \Rightarrow a_M = g - \frac{2T_1}{m} \quad (4)$$

y de (2)

$$T_1 + mg\,\text{sen}\,\theta = 2ma_M$$

$$T_1 + mg\,\text{sen}\,\theta = 2mg - 4T_1$$

$$5T_1 = 2mg - mg\,\text{sen}\,\theta$$

$$T_1 = \frac{mg}{5}(2 - \text{sen}\,\theta) \quad (5)$$

reemplazando en (3)

$$\frac{mg}{5}(2 - \text{sen}\,\theta) + 2mg\,\text{sen}\,\theta - f_r = 0$$

$$f_r = \frac{mg}{5}(2 + 9\,\text{sen}\,\theta) \leq \mu N_1$$

$$\frac{\cancel{mg}}{5}(2 + 9\,\text{sen}\,\theta) \leq \mu\, 3\cancel{m}g\cos\theta$$

$$\boxed{\mu \geq \frac{1}{15\cos\theta}\left[2 + 9\,\text{sen}\,\theta\right]}$$

SOLUCIÓN CONTROL 1

ii) usando (5) en (4) se obtiene

$$a_M = g - \frac{2}{\cancel{m}} \frac{\cancel{m} g}{5} (2 - \operatorname{sen}\theta)$$

$$a_M = g \left(1 - \frac{4}{5} + \frac{2}{5} \operatorname{sen}\theta \right)$$

$$\boxed{a_M = \frac{g}{5} (1 + 2\operatorname{sen}\theta)}$$