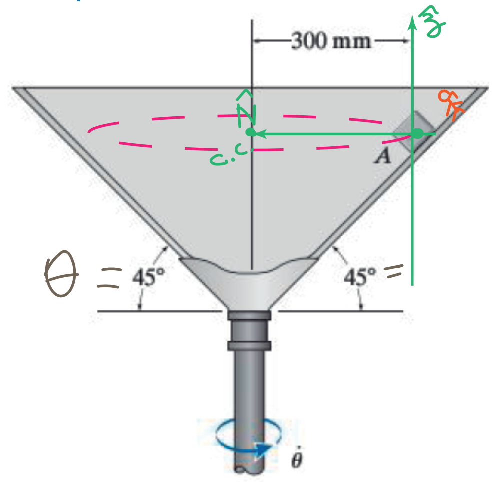
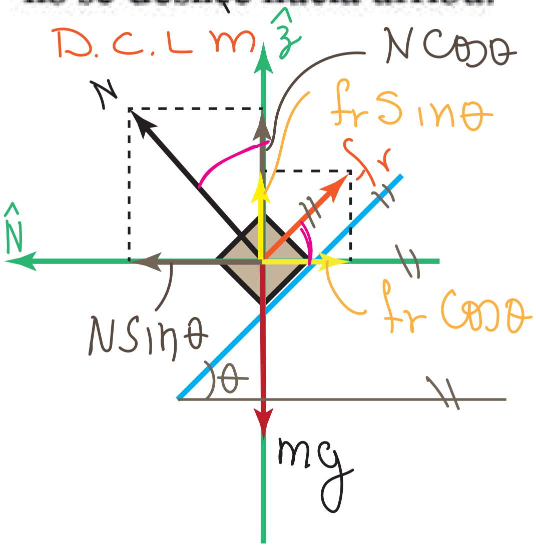
•13-93. Si el coeficiente de fricción estática entre la superficie cónica y el bloque es $\mu_s = 0.2$, determine la velocidad angular constante máxima $\dot{\theta}$ de modo que el bloque no se deslice hacia arriba.



Probs. 13-92/93

D.C.L m



$\theta = 45°$

$\cos 45 = \sin 45 = \frac{\sqrt{2}}{2}$

$\uparrow \sum F_z = 0 \quad f_r = N\mu \quad \theta = 45$

$N\cos\theta + f_r\sin\theta - mg = 0$

$N\left(\frac{\sqrt{2}}{2} + \mu\frac{\sqrt{2}}{2}\right) = mg$

$\frac{\sqrt{2}}{2} N(1+\mu) = mg$

$\frac{\sqrt{2}}{2}\left(\frac{N}{m}\right) = \frac{g}{(1+\mu)}$

$c.c. \sum F_N = m\frac{v^2}{R} = mRw^2$

$N\sin\theta - f_r\cos\theta = mRw^2$

$\left(\frac{\sqrt{2}}{2}\frac{N}{m}\right)(1-\mu) = Rw^2$

$g\left(\frac{1-\mu}{1+\mu}\right) = Rw^2$

$\hookrightarrow w = \sqrt{\frac{g}{R}\left(\frac{1-\mu}{1+\mu}\right)}$

$\Rightarrow w = \sqrt{\frac{9{,}8}{300\times10^{-3}}\left(\frac{1-0{,}2}{1+0{,}2}\right)}$

$$\boxed{w = \dot{\theta} = 4{,}66 \ \text{rad/s}}$$

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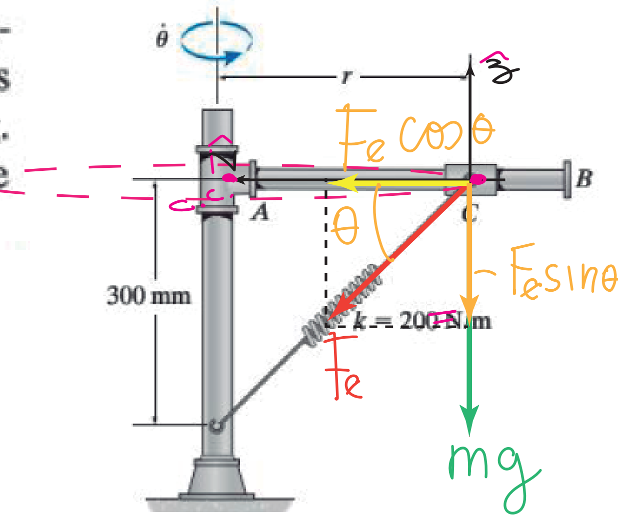
13-95. El mecanismo gira sobre el eje vertical a una velocidad angular constante de $\dot{\theta} = 6\text{rad/s}$. Si la barra AB es lisa, determine la posición constante r del anillo C de 3 kg. La longitud no alargada del resorte es de 400 mm. Ignore la masa de la barra y el tamaño del anillo.



$$\sum F_N = m R \omega^2$$

$$F_e \cos\theta = m r \omega^2$$

$$F_e = k\Delta x$$

$$\Delta x = l - l_0$$

$$F_e = k(l - l_0)$$

$$\Rightarrow k(l-l_0)\left(\frac{\cancel{r}}{l}\right) = m\cancel{r}\omega^2$$

$$\cos\theta = \frac{r}{l}$$

$$l = \sqrt{D^2 + r^2}$$

$$k\left(1 - \frac{l_0}{l}\right) = m\omega^2$$

$$1 - \frac{l_0}{l} = \frac{m\omega^2}{k}$$

$$\frac{l_0}{l} = \underbrace{1 - \frac{m\omega^2}{k}}_{\alpha}$$

$$l = \frac{l_0}{\alpha} \Rightarrow \left(\sqrt{D^2+r^2}\right)^2 = \left(\frac{l_0}{\alpha}\right)^2 \Rightarrow D^2 + r^2 = \frac{l_0^2}{\alpha^2}$$

$$r = \sqrt{\frac{l_0^2}{\left(1 - \frac{m\omega^2}{k}\right)^2} - D^2} = \sqrt{\frac{(400\times10^{-3})^2}{\left(1 - \frac{3\cdot 6^2}{200}\right)^2} - (300\times10^{-3})^2}$$

$$\boxed{r = 0{,}8162\,m = 81{,}62\,cm = 816{,}2\,mm}$$

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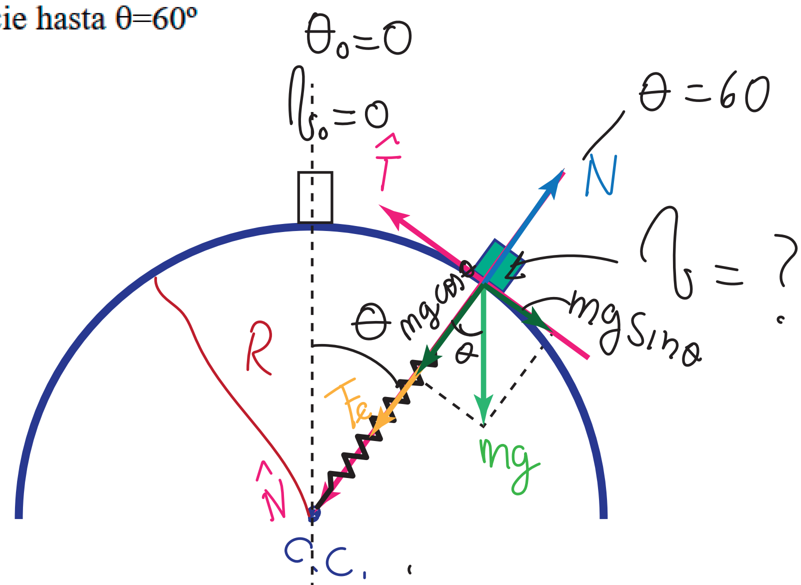
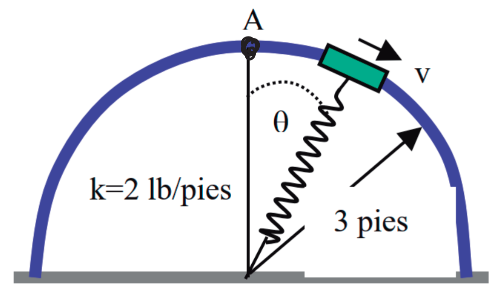
15.- El bloque de 2 lb se suelta desde el reposo en A y se desliza sobre una superficie cilíndrica lisa. Si el resorte tiene una rigidez k=2 lb/pies, determine la longitud no estirada de tal manera que el bloque se despegue de la superficie hasta θ=60° **R. 2.5 pies**





Prob. 15

$$\text{c.c.} \sum F_N = m\frac{v^2}{R} \qquad \text{Si } \theta=60^\circ \Rightarrow N=0$$

$$F_e + mg\cos\theta - \cancel{N}^{0} = m\frac{v^2}{R} \qquad \cos 60 = \frac{1}{2}$$

$$k(R-l_0) + \frac{mg}{2} = m\frac{v^2}{R} \qquad F_e = k\Delta l = k(R-l_0)$$

$$\Delta l = l - l_0 = R - l_0$$

$$\sum F_T = m a_T \qquad a_T = \frac{dv}{dt} \qquad l = R \qquad l_0 = ?$$

$$\cancel{m}g\sin\theta = \cancel{m}\frac{dv}{dt}$$

$$dv = g\sin\theta\, dt\, \frac{d\theta}{d\theta} \Rightarrow dv = g\sin\theta\, d\theta \cdot \frac{1}{\left(\frac{d\theta}{dt}\right)}$$

$$\frac{d\theta}{dt} = w \qquad v = Rw \Rightarrow w = \frac{v}{R}$$

$$\frac{d\theta}{dt} = \frac{v}{R}$$

$$\hookrightarrow dv = g\sin\theta\, d\theta \cdot \frac{R}{v} \Rightarrow \int_{v_0=0}^{v} v\,dv = gR\int_{\theta_0=0}^{\theta=60^\circ} \sin\theta\, d\theta$$

$$\left.\frac{v^2}{2}\right|_0^v = gR\left(-\cos\theta\Big|_0^{60}\right) \Rightarrow \frac{v^2}{2} = -gR\left(\cancel{\cos 60}^{1/2} - \cancel{\cos 0}^{1}\right)$$

$$\frac{1}{2} - 1 = -\frac{1}{2}$$

$$\frac{v^2}{\cancel{2}} = +gR\left(+\frac{1}{\cancel{2}}\right)$$

$$v^2 = gR$$

$$k(R-l_0) + \frac{mg}{2} = \frac{m\cancel{g}\,v^2}{\cancel{g}R} \Rightarrow k(R-l_0) + \frac{W}{2} = \frac{W}{\cancel{gR}}\left(\overbrace{g\cancel{R}}^{v^2}\right)$$

$$k(R-l_0) = W - \frac{W}{2}$$

$$k(R-l_0) = \frac{W}{2} \Rightarrow R - l_0 = \frac{W}{2k}$$

$$l_0 = R - \frac{W}{2k}$$

$$l_0 = 3 - \frac{\cancel{2}}{2\cdot\cancel{2}} = 3 - 0{,}5$$

$$\boxed{l_0 = 2{,}5 \text{ ft}}$$ // sol.