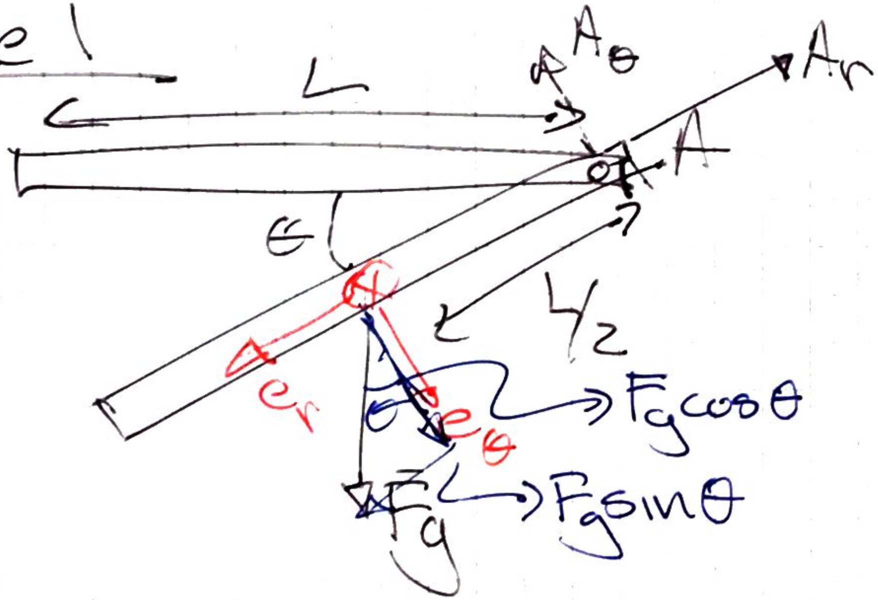
Sample 1



	r	θ
A	$-A_r$	$-A_\theta$
F_g	$F_g\sin\theta$	$F_g\cos\theta$
ma	ma_r	ma_θ

Linear

describes c.m.l.

$$F_g\sin\theta - A_r = m a_r = m\left[\cancelto{0}{\frac{d^2r}{dt^2}} - r\omega^2\right] = -mr\omega^2$$

$$F_g\cos\theta - A_\theta = m a_\theta = m\left[r\alpha + \cancelto{0}{2\frac{dr}{dt}\omega}\right] = mr\alpha$$

Moments

$$\Sigma M_A = (mg\cos\theta)\frac{L}{2} = I_A\alpha$$

$$I_A \text{(from text)} = \frac{1}{3}mL^2 \Rightarrow \cancel{m}g\cos\theta\frac{\cancel{L}}{2} = \left(\frac{1}{3}\cancel{m}L^{\cancel{2}}\right)\alpha$$

1 SQUARE =

$$\Rightarrow \frac{3}{2}\frac{g}{L}\cos\theta = \alpha$$

$$\Rightarrow F_g\cos\theta - A_\theta = m\left(\frac{L}{2}\right)\left[\frac{3}{2}\frac{g}{L}\cos\theta\right]$$

$$\Rightarrow mg\cos\theta - mg\left(\frac{3}{4}\cos\theta\right) = A_\theta$$

$$mg\frac{\cos\theta}{4} = A_\theta \quad \text{for any } \theta\,!$$

Finding ω!

$$\frac{3}{2}\frac{g}{L}\cos\theta = \alpha = \alpha(\theta) = \frac{d\omega}{d\theta}\frac{d\theta}{dt} = \frac{d\omega}{d\theta}\omega$$

$$\Rightarrow \frac{3}{2}\frac{g}{L}\int_0^\theta \cos\theta\, d\theta = \int_0^\omega \omega\, d\omega$$

$$\frac{3}{2}\frac{g}{L}(+\sin\theta)\Big|_0^\theta = \frac{\omega^2}{2}\Big|_0^\omega = \frac{\omega^2}{2} \longrightarrow \omega_0 = 0\,!!$$

$$\Rightarrow +\frac{3g}{L}\sin\theta = \omega^2 \longleftarrow \text{for any } \theta$$

$$F_g \sin\theta - A_r = -mr\omega^2 = -m\left(\frac{\cancel{L}}{2}\right)\frac{3g}{\cancel{L}}\sin\theta$$

$$mg\sin\theta + mg\frac{3\sin\theta}{2} = A_r$$

$mg\,2\sin\theta = A_r$ ← not sure how confident I am

@ $\theta = 0$

$A_r = mg2\sin\theta = 0$!

$A_\theta = \frac{mg}{4}\cos\theta = \frac{mg}{r}$!

matches sample in book