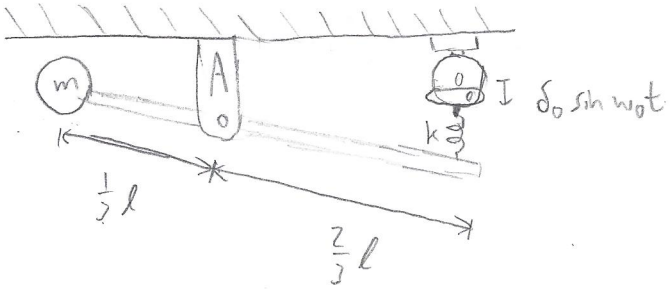
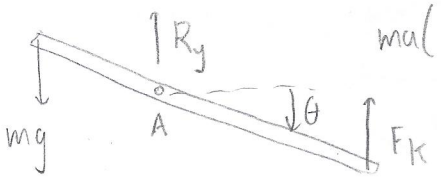


20-R-VIB-DY-19

Solution: FBD $\Sigma M_A: I_A \alpha$ $I_A = 0$;



$$ma\left(\frac{\ell}{3}\right) + \left(\frac{1}{3}\ell\right)mg - \left(\frac{2}{3}\ell\right)k\,y_{eq} + \left(\frac{2}{3}\ell\right)k\left(y_2 - \delta_0 \sin \omega_0 t\right) = 0$$

mg and $-\left(\frac{2}{3}\ell\right)k\,y_{eq}$ cancel

$$ma\left(\frac{\ell}{3}\right) + \left(\frac{2}{3}\ell\right)k\,y = \left(\frac{2}{3}\ell\right)k\left(\delta_0 \sin \omega_0 t\right)$$

small angle

$$a = \frac{\ell}{3}\ddot{\theta} \qquad y = \left(\frac{2}{3}\ell\right)\theta$$

$$m\left(\frac{\ell}{3}\right)^2\ddot{\theta} + \left(\frac{2}{3}\ell\right)^2 k\theta = \left(\frac{2}{3}\ell\right)k\left(\delta_0 \sin \omega_0 t\right)$$

$$\ddot{\theta} + \frac{4k}{m}\theta = \frac{6k\delta_0}{\ell m}\delta_0 \sin \omega_0 t$$

$$\theta_p = C \sin \omega_0 t \qquad \ddot{\theta}_p = -C\omega_0^2 \sin \omega_0 t$$

$$-C\omega_0^2 \sin \omega_0 t + \frac{4k}{m}\left(C \sin \omega_0 t\right) = \left(\frac{2}{3}\ell\right)k\left(\delta_0 \sin \omega_0 t\right)$$

$$C\left(\frac{4k}{m} - \omega_0^2\right) = \frac{6k\delta_0}{\ell m}$$

$$C = \frac{6k\delta_0}{\ell\left(\frac{4k}{m} - \omega_0^2\right)} \qquad \dot{\theta}_p = -C\omega_0 \cos \omega_0 t$$

$$v_{max} = \dot{\theta}_p \times r = C\omega_0 r = \frac{6k\delta_0 \omega_0 r}{\ell\left(\frac{4k}{m} - \omega_0^2\right)}$$