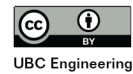
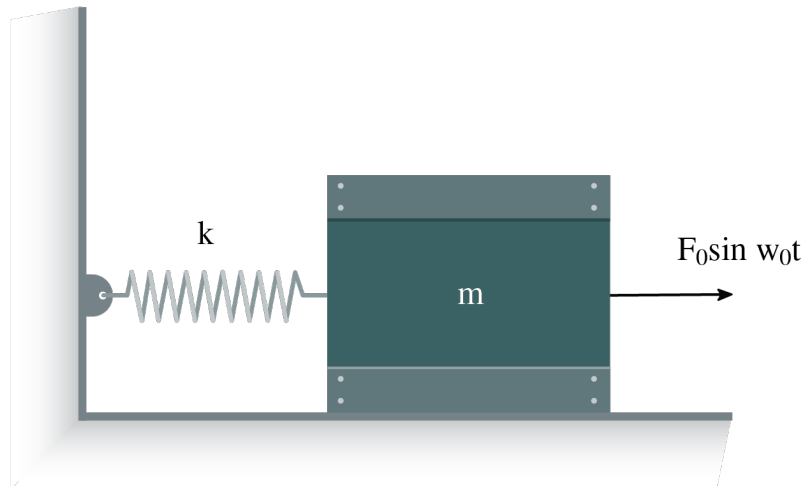
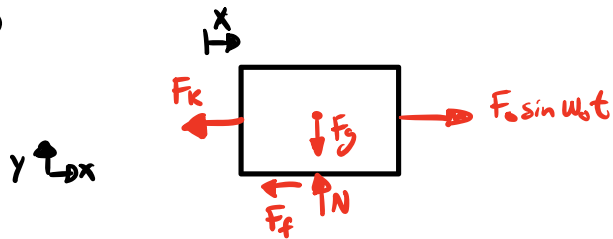


A periodic force $F = 5\sin(3t)$ is applied to a 5kg load, which is connected to a 10 N/m spring. Given that the floor's coefficient of friction is $\mu = 0.5$, what is the maximum amplitude of the steady state function?



FBD



$$\sum F_y = 0 \Rightarrow F_g = N \Rightarrow N = mg$$

$$\sum F_x = ma \Rightarrow F_0 \sin w_0 t - F_k - F_f = m\ddot{x}$$

$$F_0 \sin w_0 t = m\ddot{x} + kx + \mu mg$$

Steady State \rightarrow Particular Solution

$$x_p = C \sin w_0 t$$

$$\ddot{x}_p = -C w_0^2 \sin w_0 t$$

$$F_0 \sin w_0 t = -m C w_0^2 \sin w_0 t + k C \sin w_0 t + \mu mg$$

$$C(K - m\omega_0^2) = F_0 - \frac{Mmg}{\sin\theta_0}$$

$$C = \frac{F_0 - \frac{Mmg}{\sin\theta_0}}{(K - m\omega_0^2)} \stackrel{\sin\theta \approx 0}{=} \frac{F_0}{K - m\omega_0^2} = \frac{5\text{N}}{10\text{N/m} - (5\text{kg})(3\text{rad/s})^2}$$

$$C = -0.143 \text{ m}$$