PME2352

15 de outubro de 2011

1 Ex 1

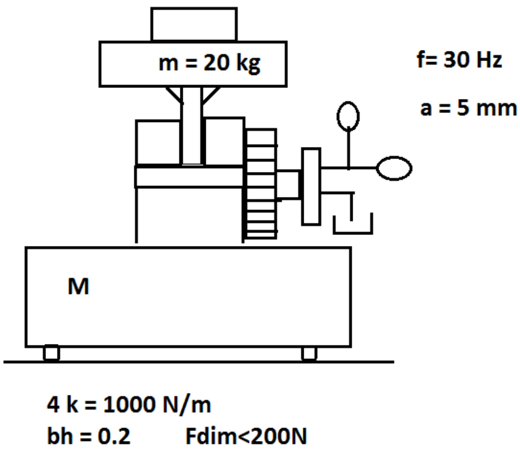

Figura 1: figura Ex 1

$$(M+m)\ddot{x}_{CM} = M\ddot{x} + m([a\sin(\ddot{\omega}_f t) + x]) = -4kx - c_{eq}\dot{x}$$

$$(M+m)\ddot{x} + \frac{4kb_h}{w_f}\dot{x} + 4kx = ma\omega_f^2\sin(w_f t)$$

$$x_p(t) = X_p * \sin(\omega_f t - \psi)$$

$$X_p = \frac{\frac{ma\omega_f^2}{4k}}{\sqrt{(1-r^2)^2 + (4k)^2}}$$

$$\omega = \sqrt{\frac{4k}{M+m}}$$

$$\varsigma = \frac{4kb_h}{w_f 2\sqrt{4k(M+m)}}$$

$$r = \frac{w_f}{\omega}$$

$$2\varsigma r = \frac{4kb_h}{\omega_f \sqrt{4k(M+m)}} * \frac{\omega_f}{\omega\sqrt{M+m}}$$

$$\sqrt{4k} = b_h$$

$$X_p = \frac{\frac{ma\omega_f^2}{4k}}{\sqrt{(1-r^2)^2 + (b_h^2)}}$$

$$F_f = 4kx_p(t) + c_{eq}\dot{x_p}(t) = 4kX_p \sin(\omega_f - \psi) + c_{eq}X_p\omega_f cos(\omega_f - \psi)$$

$$= 4kX_p * (\sin(\omega_f - \psi) + (\frac{c_{eq}\omega_f}{4k})cos(\omega_f - \psi))$$

$$= 4kX_p\sqrt{1 + b_h^2}\sin(\omega_f - \psi + \alpha)$$

$$\frac{\frac{ma\omega_f^2}{4k}}{\sqrt{(1-r^2)^2 + (b_h^2)}} <= 200N$$

$$\frac{20 * 0.005 * (30 * 2\pi)^2 * \sqrt{1 + 0.04}}{\sqrt{(1-r^2)^2 + 0.04}} < 200$$

$$\frac{(20 * 0.005 * (30 * 2 * \pi)2)^2 * (1 + 0.04)}{(200)^2} = (r^2 - 1)^2 + 0.04$$

$$r = 4.4 = \frac{\omega_f}{\omega}$$

$$\omega = \sqrt{\frac{10^6}{M+20}}$$

Portanto, $\omega = 43$ rad/s e M = 520 kg

2 Ex 2

$$c_{eq} = c(\frac{a}{b})^2$$

$$k_{eq} = k(\frac{a}{b})^2$$

$$\frac{c_{eq}}{c_c} = 0.9$$

$$\omega = \sqrt{\frac{k_{eq}}{M}} = 2.2\pi$$

$$k_{eq} = 16\pi^2 M$$

$$c_{eq} = 2\sqrt{M_{eq}K_{eq}} * 0.9$$

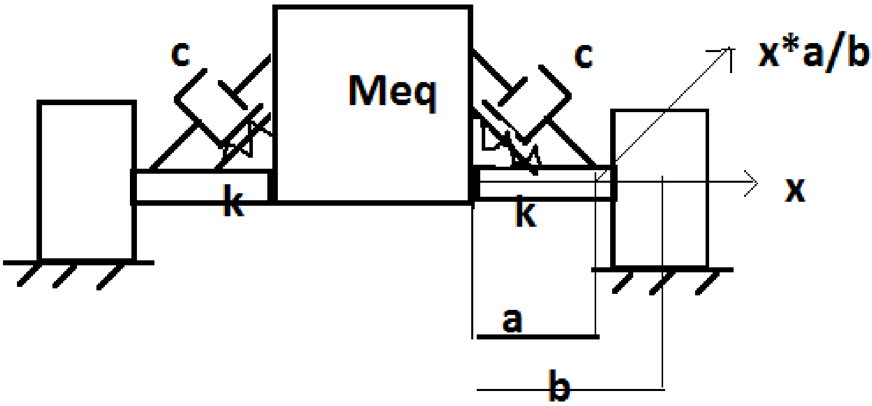

Figura 2: figura 1 Ex 2

$$F = Kx\frac{a}{b}\frac{\sqrt{2}}{2}$$

$$x\frac{a}{b}\frac{\sqrt{2}}{2}$$

$$F_{pMec} = kx(\frac{a}{b})^2 * \frac{1}{2}$$

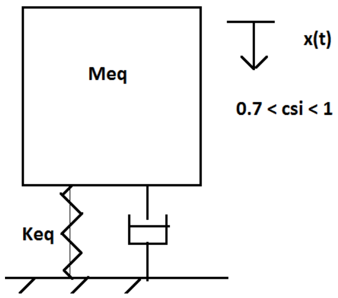

Figura 3: figura 2 Ex 2

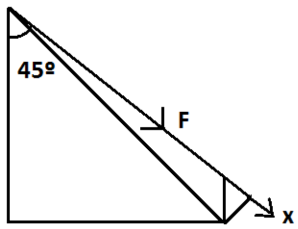

Figura 4: figura 3 Ex 2

3 Ex 3

$$y(t) = y_o \sin(\omega_f t)$$
$$c = \sqrt{Km}$$

TMB:

$$m(y \ddot{+} x) = T - c\dot{x} - Kx$$

TMA:

$$\frac{mR^2}{2}\ddot{\theta} = -T * R$$

Portanto: $\frac{m\ddot{x}}{2} = -T$

$$\theta R = x$$
$$\theta = \frac{x}{R}$$
$$m(\ddot{x} + \ddot{y}) + c\dot{x} + kx = \frac{-m\ddot{x}}{2}$$
$$\frac{3}{2}m\ddot{x} + c\dot{x} + kx = -m\ddot{y} = my_o\omega_f^2 \sin(\omega_f t)$$

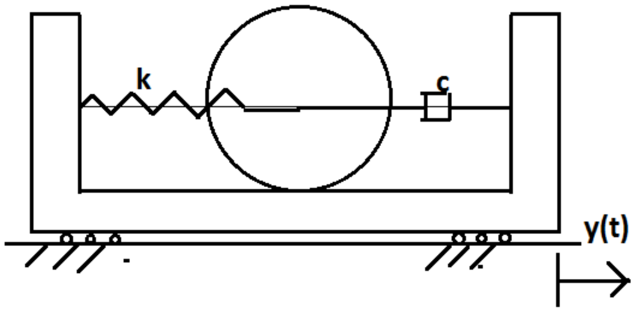

Figura 5: figura 1 Ex 3

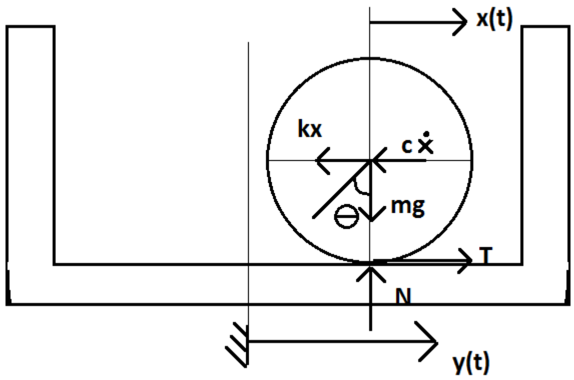

Figura 6: figura 2 Ex 3

$$x_p(t) = \frac{\frac{m y_0 w_f^2}{k}}{\sqrt{(1+r^2)^2 + (2\zeta)^2}} \sin(\omega_f t - \psi)$$

$$\psi = \arctan(\frac{2\zeta r}{1-r^2})$$

Na ressonância, r = 1

$$x_p(t) = \frac{\frac{m y_0 w_f^2}{k}}{2\zeta} \sin(\omega_f t - \frac{\pi}{2})$$

Mas $\omega_f = \sqrt{\frac{2k}{3m}}$

$$x_p(t) = \frac{\frac{2Y_0}{3}}{2\zeta} \sin(\omega_f t - \frac{\pi}{2})$$

$$\zeta = \frac{c}{2\sqrt{k\frac{3}{2}m}} = \frac{\sqrt{km}}{2\sqrt{\frac{3}{2}}\sqrt{km}} = 0.41$$

$$F_d = \int_{CICLO} c\dot{x}\frac{dx}{dt}\mathrm{dt} = \frac{1}{\omega_f}\int_{CICLO} \dot{c}x^2\mathrm{d}(\omega_f t)$$

$$= \pi\omega_f x_{pres}^2$$

$$= \pi\sqrt{km}\sqrt{\frac{2k}{3m}}(\frac{\psi Y_0}{3})^2$$

$$Pot = \frac{E_{dCICLO}}{\Delta T_{CICLO}} = \frac{E_d}{\frac{2\pi}{\omega_f}}$$

`http://www-h.eng.cam.ac.uk/help/tpl/programs/Matlab/1Bdynamics.html`[1]

[1]Uma página interessante que mostra o que é o que nos exercicios