

TALLER #2. OPTICA Y ACOUSTICA

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1)

$$m = 0.2 \text{ kg}$$

$$k = 80 \text{ N/m}$$

$$b = 4 \frac{\text{N} \cdot \text{s}}{\text{m}}$$

$$F_0 = 2 \text{ N}$$

$$F(t) = F_0 \sin(\omega t)$$

$$\omega = 30 \text{ s}^{-1}$$

$$A = \frac{F_0}{\sqrt{(k - m\omega^2)^2 + b^2\omega^2}}$$

$$A = \frac{2 \text{ N}}{\sqrt{(80 \text{ N/m} - (0.2 \text{ kg})(30 \text{ s}^{-1})^2)^2 + (4 \frac{\text{N} \cdot \text{s}}{\text{m}})^2 (30 \text{ s}^{-1})^2}}$$

$$A = 0.012 \text{ m}$$

2) $m = 0.2 \text{ kg}$

$$k = 80 \text{ N/m}$$

$$b = 4 \frac{\text{N} \cdot \text{s}}{\text{m}}$$

$$F = F_0 \cos(\omega t)$$

$$F_0 = 2 \text{ N}$$

$$\omega = 30 \text{ s}^{-1}$$

$$A = \frac{2 \text{ N}}{\sqrt{(80 \text{ N/m} - (0.2 \text{ kg})(30 \text{ s}^{-1})^2)^2 + (4 \frac{\text{N} \cdot \text{s}}{\text{m}})^2 (30 \text{ s}^{-1})^2}}$$

$$\delta = \frac{4 \frac{\text{N} \cdot \text{s}}{\text{m}}}{0.2 \text{ kg}} = 20 \text{ s}^{-1}$$

$$\omega_0 = \sqrt{\frac{80 \text{ N/m}}{0.2 \text{ kg}}} = 20 \text{ s}^{-1}$$

$$\delta = \tan^{-1} \left(\frac{\delta \omega}{(\omega_0^2 - \omega^2)} \right)$$

$$\delta = \tan^{-1} \left(\frac{20 \cdot 30}{(20^2 - 30^2)} \right) \approx -0.87$$

$$T = \frac{2\pi}{\omega_0} = \frac{2\pi}{20} = 0.31 \text{ s}$$

$$\frac{\Delta E}{E_0} = \left(\frac{E}{E_0} - 1 \right) \times 100 \%$$

$$= (e^{-\delta t} - 1) \times 100 \%$$

$$= (e^{-(20)(0.31)} - 1) \times 100 \%$$

$$= -99.7 \%$$

$$3) \begin{aligned} m &= 2 \text{ Kg} \\ K &= 400 \text{ N/m} \\ b &= \frac{2 \text{ Kg}}{\text{s}} \end{aligned}$$

$$\begin{aligned} F_{\text{max}} &= 10 \text{ N} \\ \omega &= 10 \text{ rad/s} \end{aligned}$$

$$\begin{aligned} \gamma &= \frac{2 \text{ Kg}}{\text{s}} \\ \gamma &= 1 \text{ s}^{-1} \end{aligned}$$

$$\omega_0 = \sqrt{\frac{400 \text{ N/m}}{2 \text{ Kg}}} = 14.14 \text{ rad/s}$$

$$A = \frac{F_{\text{max}}}{m \sqrt{(\omega_0^2 - \omega^2)^2 + (\gamma \omega)^2}}$$

$$A = \frac{10 \text{ N}}{2 \text{ Kg} \sqrt{(200 - 100)^2 + (1 \cdot 10)^2}}$$

$$A = 0.049 \approx 0.05 \text{ m}$$

b) debido a que la frecuencia de resonancia es igual a la frecuencia natural del oscilador $\omega = 14.14 \text{ rad/s}$

$$\omega \approx \omega_0 \quad \omega_{\text{res}} \approx 14.14 \text{ rad/s}$$

$$c) A = \frac{10 \text{ N}}{2 \sqrt{(14.14^2 - 14.14^2)^2 + (14.14)^2}} = 0.35 \text{ m}$$

$$d) \frac{\Delta \omega}{\omega_0} = \frac{1}{Q}$$

$$Q = \frac{\omega_0}{\gamma} = \frac{14.14}{1} = 14.14$$

$$\Delta \omega = \frac{\omega_0}{Q}$$

$$\Delta \omega = \frac{14.14 \text{ rad/s}}{14.14 \text{ rad/s}}$$

$$\Delta \omega = 1$$