193. Gekoppelte physikalische Pendel

$$m = 5\text{ kg};\quad k = 2\text{ N/m};\quad a = 0.1\text{ m};\quad h = 0.4\text{ m};\quad l = 0.1\text{ m}$$

a) $\omega = \sqrt{\frac{mgl}{I}}$

$$I = \tfrac{1}{12}m(a^2+h^2) + ml^2 = 0.12\ \mathrm{kg\,m^2}$$

$$\omega_a = \sqrt{\frac{mgl}{I}} = \underline{\underline{6.37\ \mathrm{rad/s}}}$$

b) $F = -m\omega^2 x;\quad \Delta x = x_1 - x_2$

$$m\ddot{x}_1 = -m{\omega_a}^2 x_1 - k(x_1 - x_2)$$
$$m\ddot{x}_2 = -m{\omega_a}^2 x_2 - k(x_2 - x_1)$$
$$\Rightarrow\ m(\ddot{x}_1 - \ddot{x}_2) = -m{\omega_a}^2(x_1 - x_2) - 2k(x_1 - x_2) = -(m{\omega_a}^2 + 2k)(x_1 - x_2)$$
$$\Delta\ddot{x} = -\underbrace{({\omega_a}^2 + \tfrac{2k}{m})}_{=\,\omega_b}\Delta x$$

$$\omega_b = \sqrt{\omega_a^2 + \tfrac{2k}{m}} = \underline{\underline{6.43\ \mathrm{rad/s}}}$$

c) $\delta\omega = \omega_b - \omega_a$

$$0 = \cos\left(\tfrac{1}{2}\delta\omega t\right)$$
$$t = \frac{2\arccos(0)}{\delta\omega} = \underline{\underline{50.29\ \mathrm{s}}}$$

color	**HTML**
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