

機械力学【解答例】

1

(1) $m\ddot{x} + 2c\dot{x} + \frac{5}{2}kx = 0$

(2) $\sqrt{\frac{5k}{2m}}$

(3) $\sqrt{\frac{5mk}{2}}$

(4) $\sqrt{\frac{5mk - 8c^2}{2m^2}}$

2

(1) $4m\ddot{x} + kx + ml\ddot{\theta} = F_0 \cos \omega t, \quad ml^2\ddot{\theta} + mgl\theta + ml\ddot{x} = 0$

(2) 慣性マトリックス: $\begin{bmatrix} 4m & ml \\ ml & ml^2 \end{bmatrix}$, 剛性マトリックス: $\begin{bmatrix} k & 0 \\ 0 & mgl \end{bmatrix}$

(3) $\frac{C_2}{C_1} = \frac{\omega^2}{g - l\omega^2}$

3

(1) 運動エネルギー: $\frac{3}{2}m\dot{x}_1^2 + \frac{1}{2}m\dot{x}_2^2 + \frac{5}{2}ml^2\dot{\theta}^2,$

ポテンシャルエネルギー: $\frac{1}{2}k \left\{ (x_1 - 2l\theta)^2 + (x_1 + l\theta)^2 + (x_2 - x_1)^2 \right\}$

(2) $3m\ddot{x}_1 + 3kx_1 - kx_2 - kl\theta = 0, \quad m\ddot{x}_2 - kx_1 + kx_2 = 0, \quad 5ml^2\ddot{\theta} - klx_1 + 5kl^2\theta = 0$

(3) $\sqrt{1 - \sqrt{\frac{2}{5}}} \cdot \sqrt{\frac{k}{m}}, \quad \sqrt{\frac{k}{m}}, \quad \sqrt{1 + \sqrt{\frac{2}{5}}} \cdot \sqrt{\frac{k}{m}}$

(4) $\sqrt{\frac{2}{5}}$