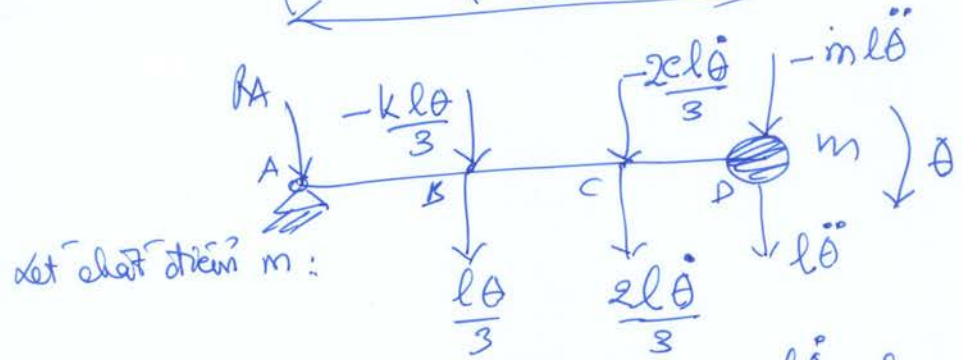
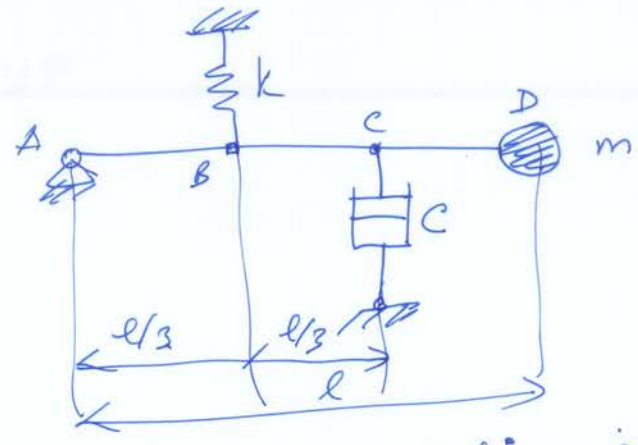


①



Chọn chốt điểm m:

$$\sum M_A(\vec{F}_i) = -\frac{kl\theta}{3} \cdot \frac{l}{3} - \frac{2cl\dot{\theta}}{3} \cdot \frac{2l}{3} - ml\ddot{\theta} \cdot l = 0$$

2đ

$$ml^2\ddot{\theta} + \frac{4}{9}cl^2\dot{\theta} + \frac{1}{9}kl^2\theta = 0$$

$$m\ddot{\theta} + \left(\frac{4}{9}c\right)\dot{\theta} + \left(\frac{1}{9}k\right)\theta = 0$$

1,5đ

Hệ số giảm chấn tới hạn $c_c = 2\sqrt{\left(\frac{1}{9}k\right) \cdot m}$

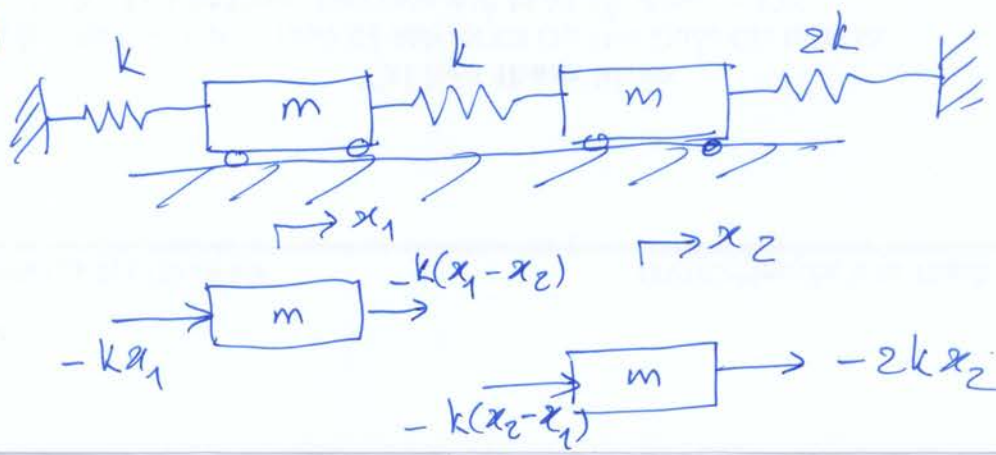
$$c_c = 2\sqrt{\left(\frac{1}{9} \cdot 100\right) \cdot 1} = \frac{20}{3} \frac{\text{kg} \cdot 1}{\text{s}}$$

1,0đ

Tỉ số giảm chấn $\xi = \frac{\left(\frac{4}{9}c\right)}{c_c} = \frac{\frac{4}{9} \cdot 20}{\frac{20}{3}} = \frac{4}{3}$

Vì $\xi = \frac{4}{3} > 1$ nên: Hệ chịu giảm chấn mạnh
 Trên giảm chấn.

②



Phương trình:

$$\begin{cases} -kx_1 - k(x_1 - x_2) = m\ddot{x}_1 \\ -k(x_2 - x_1) - 2kx_2 = m\ddot{x}_2 \end{cases}$$

(1d) $\Rightarrow \begin{bmatrix} m & 0 \\ 0 & m \end{bmatrix} \begin{Bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \end{Bmatrix} + \begin{bmatrix} 2k & -k \\ -k & 3k \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} = 0 \quad (*)$

$$\begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} = \begin{Bmatrix} X_1 \\ X_2 \end{Bmatrix} \sin(\omega t + \phi) \Rightarrow \begin{Bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{Bmatrix} = \begin{Bmatrix} X_1 \\ X_2 \end{Bmatrix} \omega \cos(\omega t + \phi)$$

$$\Rightarrow \begin{Bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \end{Bmatrix} = \begin{Bmatrix} X_1 \\ X_2 \end{Bmatrix} \omega^2 \sin(\omega t + \phi)$$

Thay vào (*):

$$- \begin{bmatrix} m & 0 \\ 0 & m \end{bmatrix} \begin{Bmatrix} X_1 \\ X_2 \end{Bmatrix} \omega^2 \sin(\omega t + \phi) + \begin{bmatrix} 2k & -k \\ -k & 3k \end{bmatrix} \begin{Bmatrix} X_1 \\ X_2 \end{Bmatrix} \sin(\omega t + \phi) = 0$$

$$\begin{bmatrix} m\omega^2 + 2k & -k \\ -k & -m\omega^2 + 3k \end{bmatrix} \begin{Bmatrix} X_1 \\ X_2 \end{Bmatrix} \sin(\omega t + \phi) = 0 \quad (1)$$

$$\det \begin{bmatrix} m\omega^2 + 2k & -k \\ -k & -m\omega^2 + 3k \end{bmatrix} = 0$$

$$(m\omega^2 + 2k)(-m\omega^2 + 3k) - k^2 = 0$$

$$m^2\omega^4 - 3km\omega^2 - 2km\omega^2 + 6k^2 - k^2 = 0$$

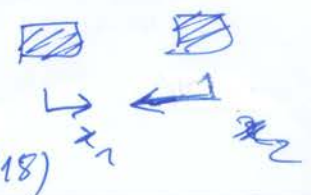
$$m^2\omega^4 - 5km\omega^2 + 5k^2 = 0$$

$$\omega^4 - 5\frac{k}{m}\omega^2 + 5\frac{k^2}{m^2} = 0 \quad (2) \quad (1d)$$

Giải ra: Tần số riêng $\begin{cases} \omega_1 = 1,902 \sqrt{\frac{k}{m}} \\ \omega_2 = 1,176 \sqrt{\frac{k}{m}} \end{cases} \quad (1d)$

Tần số riêng $\omega_1 = 1,902 \sqrt{\frac{k}{m}} \quad \left(\frac{\sqrt{5+\sqrt{5}}}{2} \sqrt{\frac{k}{m}} \right)$

Thay vào (1): $\begin{bmatrix} \frac{-1-\sqrt{5}}{2}k & -k \\ -k & \frac{1-\sqrt{5}}{2}k \end{bmatrix} \begin{Bmatrix} X_1 \\ X_2 \end{Bmatrix} = 0$

\Rightarrow dạng dao động 1: $\begin{cases} X_1 = 1 \\ X_2 = \frac{1+\sqrt{5}}{2} \end{cases}$ 

(1d) (-1.618)

• Tần số riêng $\omega_2 = 1,176 \sqrt{\frac{k}{m}}$ $\left(\sqrt{\frac{5-\sqrt{5}}{2}} \sqrt{\frac{k}{m}} \right)$

Thay vào (1):

$$\begin{bmatrix} \frac{-1+\sqrt{5}}{2}k & -k \\ -k & \frac{1+\sqrt{5}}{2}k \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} = 0$$

\Rightarrow Phương dao động 2: $\begin{cases} x_1 = 1 \\ x_2 = \frac{-1+\sqrt{5}}{2} \end{cases}$

1d

(+0,618)



$\rightarrow x_1$



$\rightarrow x_2$