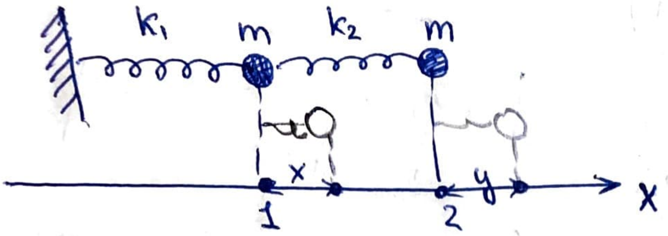
Семинар №2.

$k_1 = 3k$

$k_2 = 2k$

19.01.21

(0)



$$\begin{cases} m\ddot{x} = -k_1 x - k_2(x-y) \\ m\ddot{y} = k_2(x-y) \end{cases}$$

III з-н Ньютона

$\vec{F}_g = -\vec{F}_{пр}$

$\ddot{X} = -AX, \quad X(t) = \begin{pmatrix} x(t) \\ y(t) \end{pmatrix}$

$$A = \frac{1}{m}\begin{pmatrix} k_1+k_2 & -k_2 \\ -k_2 & k_2 \end{pmatrix} = \frac{k}{m}\begin{pmatrix} 5 & -2 \\ -2 & 2 \end{pmatrix}$$

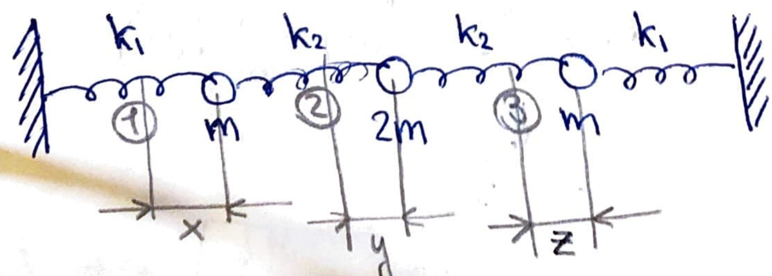
$\lambda_1 = \omega_1^2 = \frac{k}{m}, \quad \lambda_2 = \omega_2^2 = \frac{6k}{m}$

$\Psi_1 = \begin{pmatrix} 1 \\ 2 \end{pmatrix} \qquad \Psi_2 = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$

Норм. моды $\Psi_i \cos\omega_i t, \ \Psi_i \sin\omega_i t$ $\quad i = 1,2$

А как понять, что описывают моды?

(1)



$$\begin{cases} k_1 = 3k \\ k_2 = 2k \end{cases}$$

$$\begin{cases} m\ddot{x} = -k_1 x - k_2(x-y) \\ 2m\ddot{y} = +k_2(x-y) - k_2(y-z) \\ m\ddot{z} = +k_2(y-z) - k_1 z \end{cases}$$

почему нет z?

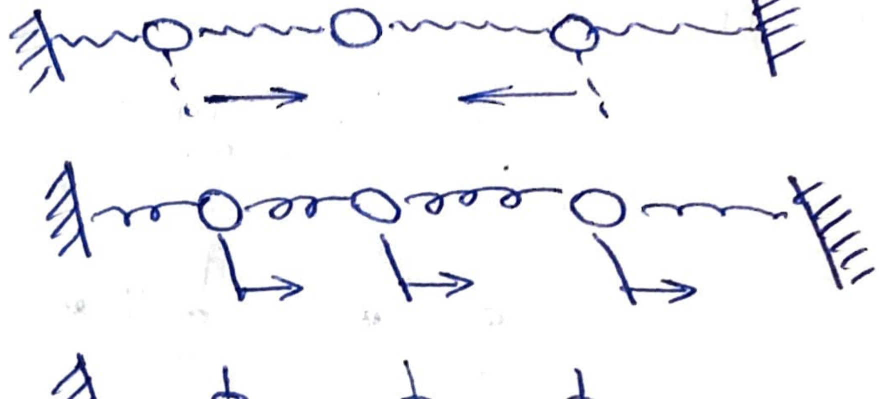
$$\ddot{X} = -AX$$

$$A = \frac{1}{m}\begin{pmatrix} k_1+k_2 & -k_2 & 0 \\ -\frac{k_2}{2} & k_2 & -\frac{k_2}{2} \\ 0 & -k_2 & k_1+k_2 \end{pmatrix} = \frac{k}{m}\begin{pmatrix} 5 & -2 & 0 \\ -1 & 2 & -1 \\ 0 & 2 & 5 \end{pmatrix}$$

$$\lambda_1 = \omega_1^2 = \frac{5k}{m} \longrightarrow \psi_1 = \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}$$

$$\lambda_2 = \omega_2^2 = \frac{k}{m} \longrightarrow \psi_2 = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}$$

$$\lambda_3 = \omega_3^2 = \frac{6k}{m} \longrightarrow \psi_3 = \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix}$$



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