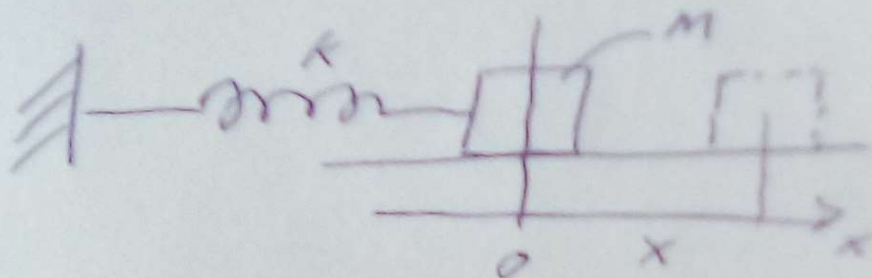


# Физика 1

## предавање (18.5.2020.)

Горан Попарић

Резонанс харманизисий осилолго  
хүй, брэйнс у гэрээс



$$v(t) = \dot{x}(t) = A \cdot \omega_0 \cos(\omega_0 t + \varphi)$$

$$a(t) = \ddot{x}(t) = -A \omega_0^2 \sin(\omega_0 t + \varphi)$$

$$m \ddot{x} = -k x$$

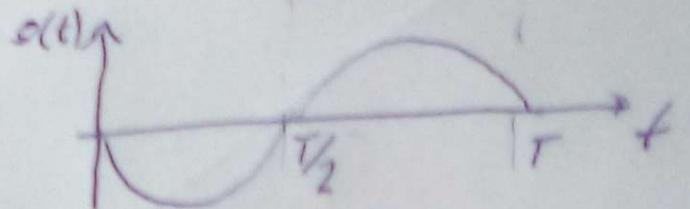
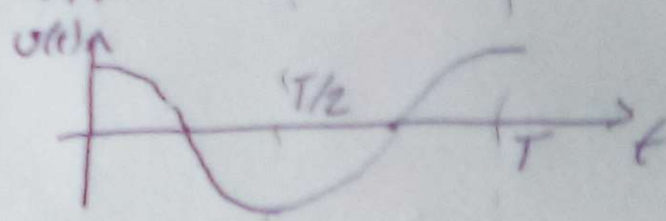
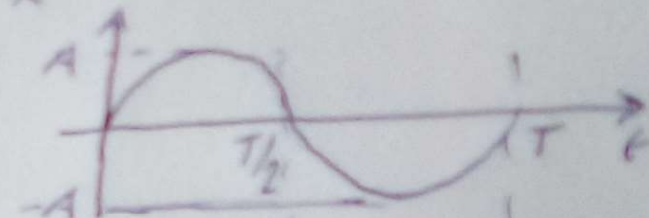
$$\ddot{x} + \left(\frac{k}{m}\right) x = 0$$

$$T = \frac{2\pi}{\omega_0} = 2\pi \sqrt{\frac{m}{k}} \quad x(t)$$

$\omega_0^2$  энгийнээр үсрэх  
↑ хосло

$$x(t) = A \cdot \sin(\omega_0 t + \varphi)$$

сэлбэлэх хуучир  
түрээсэл





# Математический и физический маятник



$$m \ddot{x} = -mg \sin \varphi \approx mg \varphi = mg \frac{x}{l}$$

$$\boxed{\ddot{x} + \left(\frac{g}{l}\right)x = 0}$$

$\omega_0^2$

$$\boxed{T = \frac{2\pi}{\omega_0} = 2\pi \sqrt{\frac{l}{g}}}$$

$$x(t) = A \cdot \sin(\omega_0 t + \varphi)$$

$$\boxed{T = \frac{2\pi}{\omega_0} = 2\pi \sqrt{\frac{J}{mgl}}}$$

$$J = ml^2 \Rightarrow T = 2\pi \sqrt{\frac{ml^2}{mgl}} = 2\pi \sqrt{\frac{l}{g}}$$



$$J \cdot \frac{d^2 \varphi}{dt^2} = -mgl \cdot \sin \varphi$$

$$\Rightarrow \boxed{\frac{d^2 \varphi}{dt^2} + \left(\frac{mgl}{J}\right)\varphi = 0}$$

$\omega_0^2$

# Ενέργεια αρμονικής οscυλλώσεως κρεμόνου



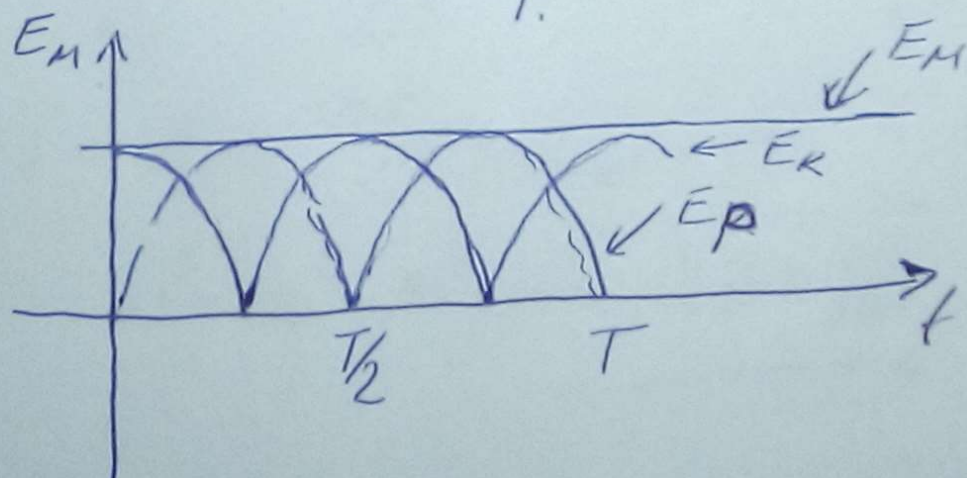
$$E_M = E_K + E_P$$

$$= \frac{1}{2} m \dot{x}^2 + \frac{1}{2} k x^2$$

$$= \frac{1}{2} m A^2 \omega_0^2 \cos^2(\omega_0 t + \varphi) + \frac{1}{2} k A^2 \sin^2(\omega_0 t + \varphi)$$

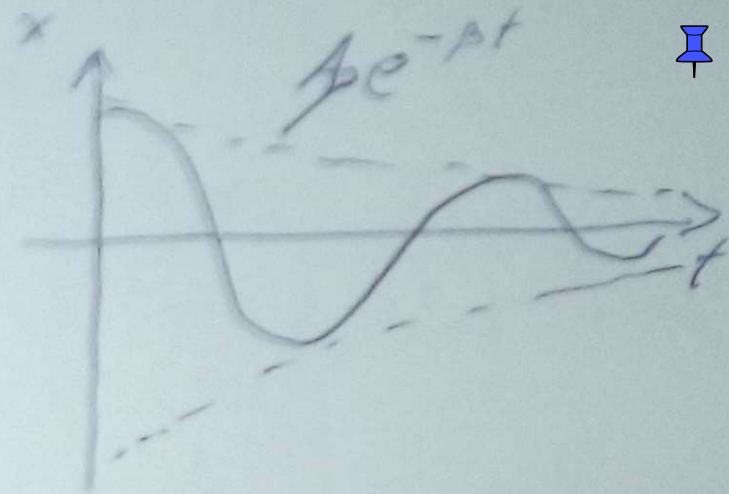
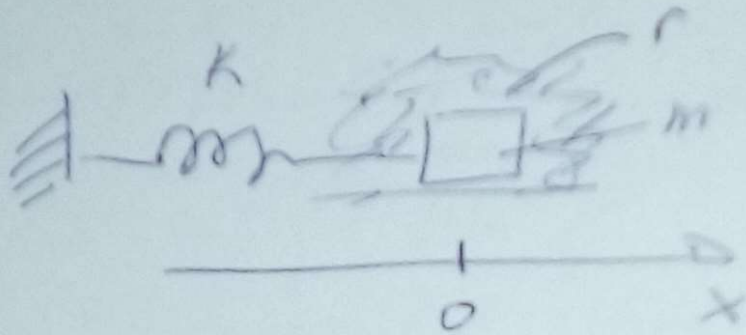
$\omega_0^2 \sim k/m$

$$E_M = \frac{1}{2} A^2 k \underbrace{(\cos^2(\omega_0 t + \varphi) + \sin^2(\omega_0 t + \varphi))}_1 = \frac{1}{2} A^2 k = \text{const.}$$





# Грыгушыне асцыляцыі



$$m\ddot{x} = -kx - r\dot{x}$$

$$\ddot{x} = -\underbrace{\left(\frac{k}{m}\right)}_{\omega_0^2} x - \underbrace{\left(\frac{r}{m}\right)}_{2\beta} \dot{x}$$

$$x(t) = A_0 e^{-\beta t} \cdot \cos(\omega_0 t + \varphi)$$

$$\omega^2 = \omega_0^2 - \beta^2 \Rightarrow \omega = \sqrt{\frac{k}{m} - \frac{r^2}{4m^2}}$$

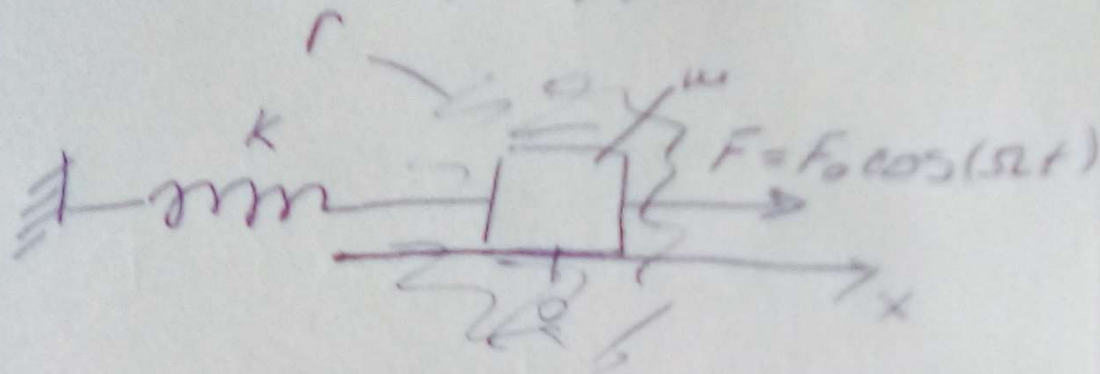
1°  $r^2 < 4km$  кбаву-перасула

2°  $r^2 = 4km$  кнцукта дцёр.

3°  $r^2 > 4km$  дцёрасула

4°  $r \rightarrow 0$  нццццццццц

Прийняте означення. Резонанція.



$$m\ddot{x} = -kx - r\dot{x} + F_0 \cos(\Omega t)$$

$$\ddot{x} = -\underbrace{\frac{k}{m}}_{\omega_0^2} x - \underbrace{\frac{r}{m}}_{2\beta} \dot{x} + \underbrace{\frac{F_0}{m}}_{f_0} \cos$$

$$A = \frac{f_0}{\sqrt{(\omega_0^2 - \Omega^2)^2 + 4\beta^2 \Omega^2}}$$

$A_{\max}$  за  $\Omega \approx \omega_0$   
резонанція!

$$\underline{x(t) = A_0 e^{-\beta t} \cos(\omega t + \varphi) + A \cos(\Omega t + \alpha)}$$