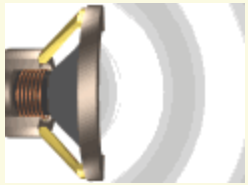
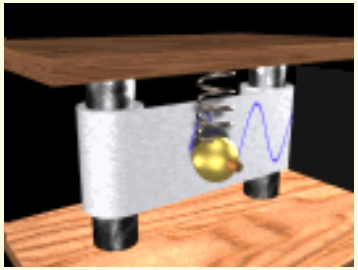


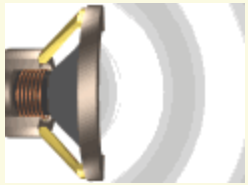
Aula 12: Elasticidade

1. Força elástica
2. Energia potencial elástica
3. Constante de torção
4. Cinemática do MHS
5. Dinâmica do MHS

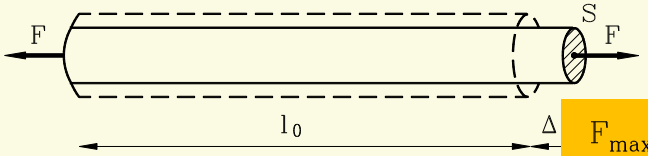


Módulo de Young: animação

Lei de Hooke: animação

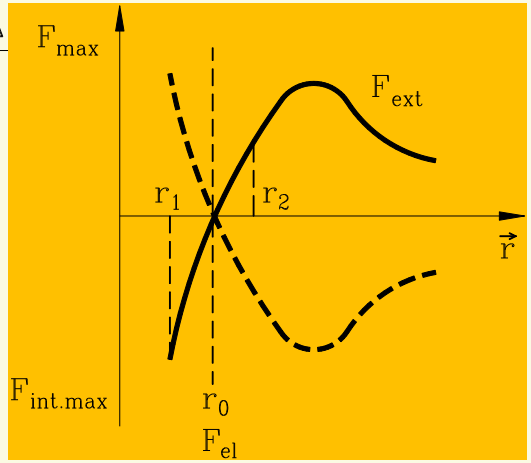


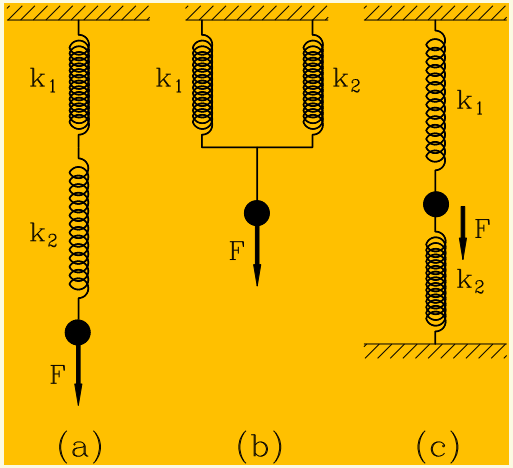
1. Força elástica

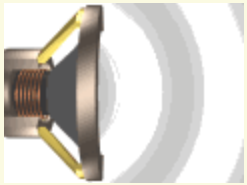


$$F_{el} = -kx$$

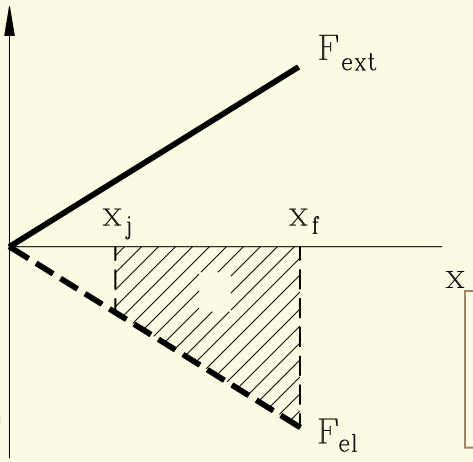
$$E = \frac{\sigma}{\varepsilon}$$

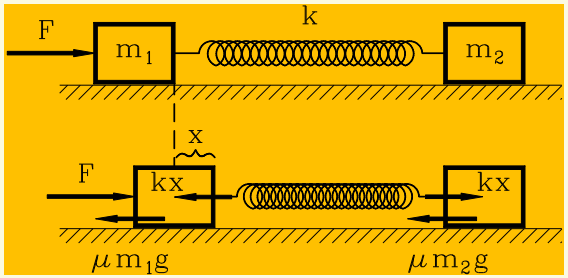


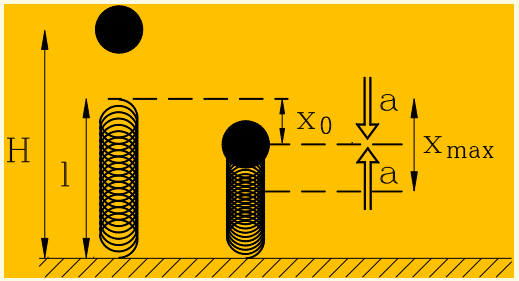




2. Energia potencial elástica



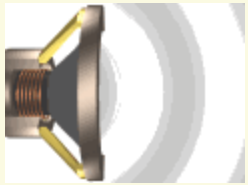




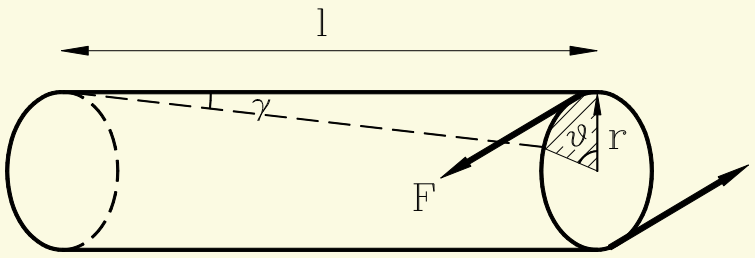
$$U(x) = \frac{1}{2}kx^2$$

$$u = \frac{U}{V} = \frac{1}{2}\sigma\varepsilon$$

MHS linear/angular: animação

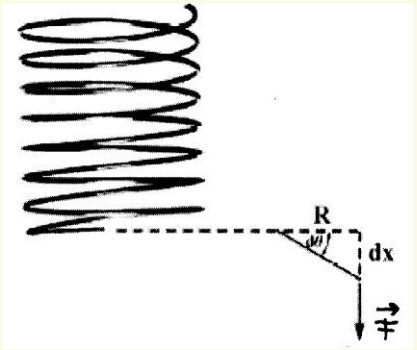


3. Constante de torção



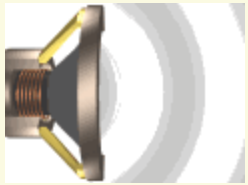
$$k = \frac{c}{R^2}$$

$$\mu = F(2r) = GH\frac{2r^2}{l}\theta = c\theta$$



Movimento circular/harmónico: animação

Funções harmónicas: animação



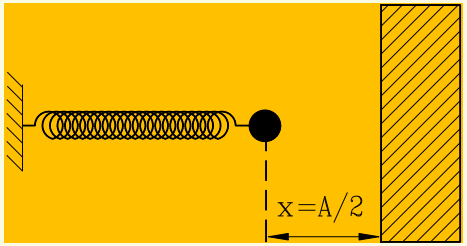
4. Cinemática do MHS

$$\frac{\Delta}{\Delta t}\left(\frac{mv^2}{2}+\frac{kx^2}{2}\right)=\frac{m}{2}\frac{\Delta\left(v^2\right)}{\Delta t}+\frac{k}{2}\frac{\Delta\left(x^2\right)}{\Delta t}=0$$

MHS linear: $a=-\omega^2 x$

MHS angular: $\alpha=-\omega^2\theta$

$$\omega^2=\frac{k}{m}$$

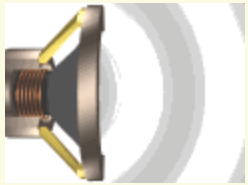


$$x=A\,\mathrm{sen}\left(\omega t+\varphi\right)$$

$$v=\frac{dx}{dt}=\omega A\cos\left(\omega t+\varphi\right)$$

$$a=\frac{d^2x}{dt^2}=-\omega^2 A\,\mathrm{sen}\left(\omega t+\varphi\right)$$

Simulação: período do MHS



5. Dinâmica do MHS

Período de oscilação $T = 2\pi\sqrt{\frac{m}{k}}$