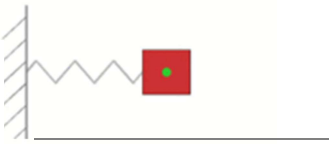
Disciplina 4300357

Oscilações e Ondas

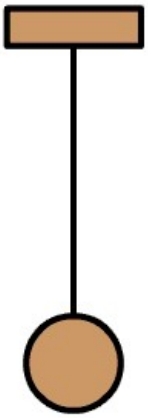
Aula 05

Sistemas oscilantes



$$E_m = \frac{kA^2}{2}$$

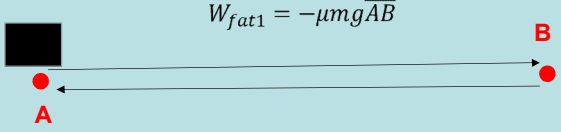
Mas e na prática?



Bloco em superfície rugosa

$$W_{fat} = \overrightarrow{fat}.d\vec{s}$$

$$W_{fat1} = -\mu mg\overline{AB}$$

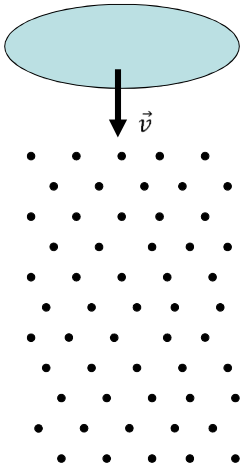


$$W_{fat2} = -\mu mg\overline{BA} = -\mu mg\overline{AB}$$

$$W_T = W_{fat1} + W_{fat2} = -2\mu mg\overline{AB}$$

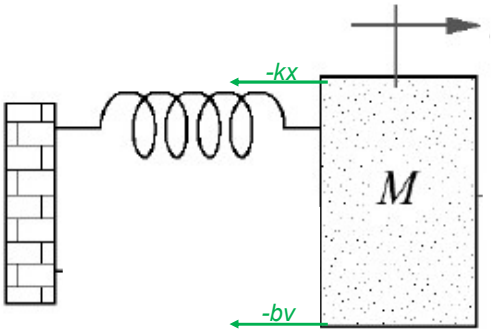
$$W_{fat} < 0$$

Forças resistivas



$F_{res} = - b\ v$

Sistema massa-mola



$$\sum F = m.a$$

$$-kx - bv = m.a$$

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

$$m\ddot{x} + b\dot{x} + kx = 0$$

$$\ddot{x} + \frac{b}{m}\dot{x} + \frac{k}{m}x = 0$$

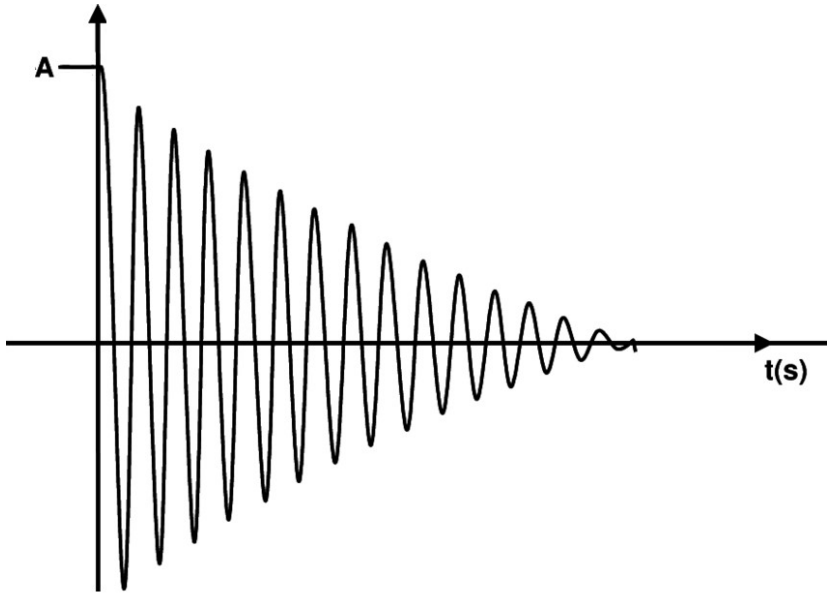
MHS?

Movimento Harmônico Amortecido

$$\frac{d^2x}{dt^2} + \frac{b}{m}\frac{dx}{dt} + \frac{k}{m}x = 0$$

$$\frac{d^2x}{dt^2} + \boxed{\gamma}\frac{dx}{dt} + \omega_0^2 x = 0$$

Oscilador Harmônico Amortecido



MHS

$$\ddot{x} + \boxed{\omega_0 \frac{k}{m}} x = 0$$

$$x(t) = A\cos(\omega_0 t + \emptyset)$$

MH amortecido

$$\ddot{x} + \boxed{\gamma \frac{b}{m}} \dot{x} + \boxed{\omega_0 \frac{k}{m}} x = 0$$

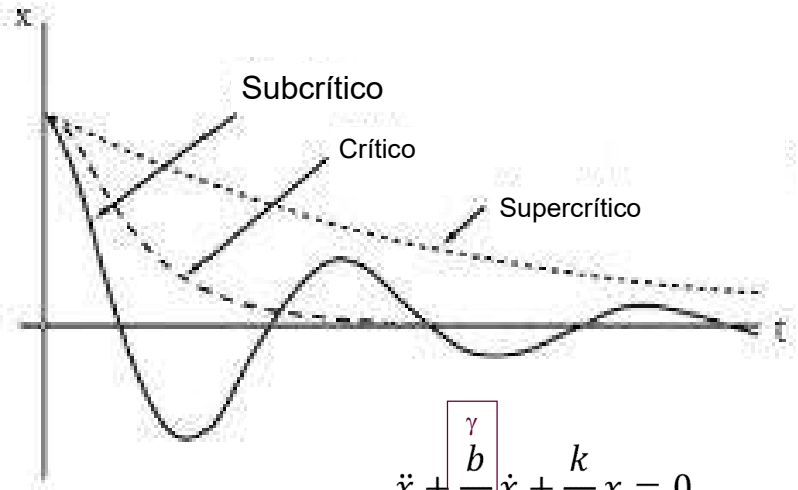
$$x(t) = A^* \cos(\omega_0 t + \emptyset)$$

$$A^* = A.f(x)$$

$$A^* = Ae^{-\gamma t}$$

$$x(t) = \boxed{Ae^{-\gamma t}} \cos(\omega_0 t + \emptyset)$$

Oscilador Harmônico Amortecido



$$\ddot{x} + \boxed{\gamma \frac{b}{m}} \dot{x} + \frac{k}{m} x = 0$$

Tipos de Amortecimento

https://www.youtube.com/watch?v=h_JOS7ldl48

Aula Completa

https://www.youtube.com/watch?v=PB5taDaZh58

De 7min 15s

Ate 10min 25s

Energia nas oscilações amortecidas

$$E_m = K + U_{el}$$

$$\frac{dE_m}{dt} = v(ma + kx)$$

$$\frac{dE_m}{dt} = v(-bv)$$

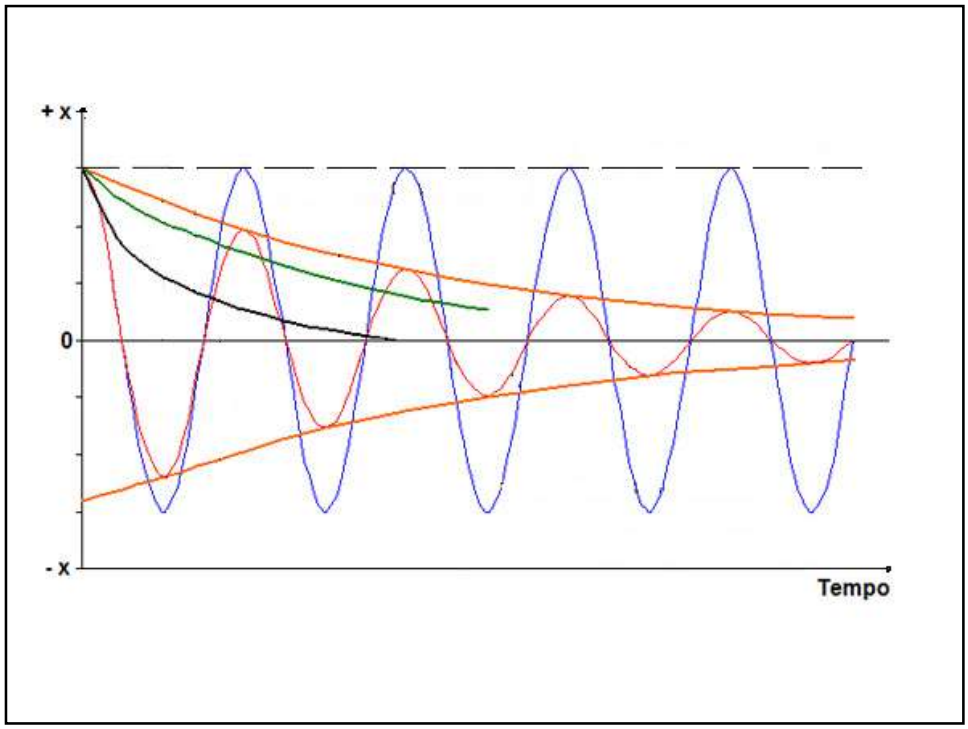
$$\frac{dE_m}{dt} = -bv^2$$

$$\frac{dE_m}{dt} = -bv.v = -F.v = Pot$$

$$\ddot{x} + \frac{b}{m}\dot{x} + \frac{k}{m}x = 0$$

$$ma + bv + kx = 0$$

$$\ddot{m}a + kx = -bv$$


+ x
0
- x
Tempo