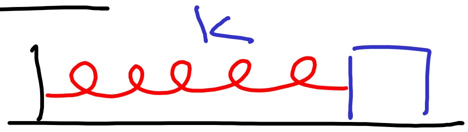
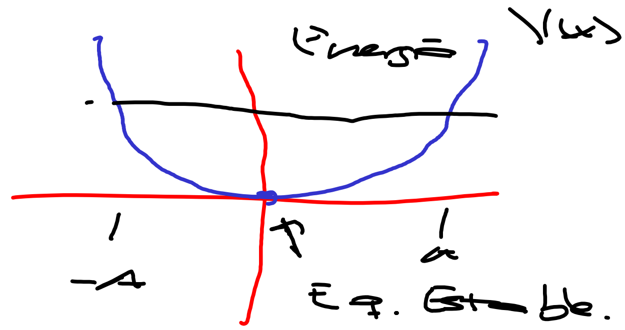
Ley de Hooke



$F = -kx$ → Fuerza Conservativa

$$\boxed{V = \frac{1}{2} k x^2}$$



Oscilador armónico Simple

$$\ddot{x} = -\omega^2 x \quad , \quad \omega^2 = \frac{k}{m}$$

$$\left.\begin{aligned} x(t) &= A\cos(\omega t) + B\,\mathrm{sen}(\omega t) \\ \dot{x}(t) &= -\omega A\cos(\omega t) + \omega B\,\mathrm{sen}(\omega t) \end{aligned}\right\}$$

$$\left.\begin{aligned} T &= \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{k}{m}} \\ E &= V(x) + T = \frac{1}{2} k A^2 \end{aligned}\right\} \text{Isocronía}$$

Diagrama de fase.

$\boxed{x - \dot{x}}$

Péndulo simple: $\ddot{\theta} = -\frac{g}{l}\operatorname{sen}\theta$

$\theta \ll 1$

$\ddot{\theta} = -\frac{g}{l}\theta$

$x(t) = A\cos(\omega t)$

$\dot{x}(t) = -\omega A \operatorname{sen}(\omega t)$

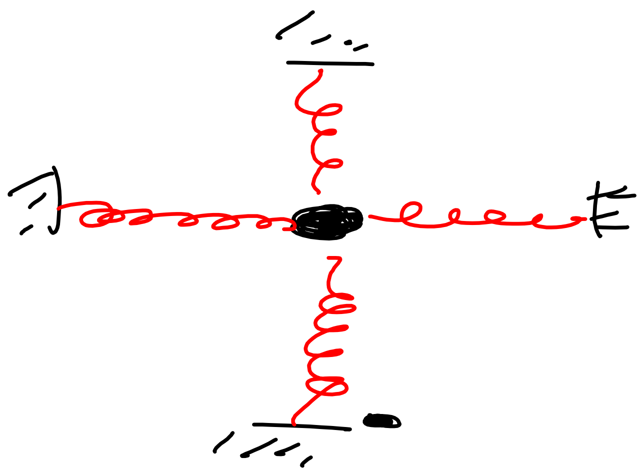
$\ddot{\theta} = -\frac{g}{l}\operatorname{sen}\theta$

$$\begin{cases} \dot{\theta} = \omega \\ \dot{\omega} = -\frac{g}{l}\operatorname{sen}\theta \end{cases}$$

Péndulo simple.

$E = \frac{1}{2}KA^2$

Oscilador 2-D



→ Isótropo : $K_x = K_y = K_z = \cdots = K$

$$\vec{F} = -k\vec{r}$$

$$\left.\begin{aligned} \ddot{x} &= -\omega^2 x \\ \ddot{y} &= -\omega^2 y \end{aligned}\right\} \quad \begin{aligned} x(t) &= A_x \cos(\omega t - \alpha) \\ y(t) &= A_y \cos(\omega t - \beta) \end{aligned}$$

Elipse

$$\frac{x^2}{A_x^2} + \frac{y^2}{A_y^2} = 1 \quad , \quad \delta = \alpha - \beta = \pi/2$$

→ Anisotropo $k_x \neq k_y \neq \cdots$

$$\left.\begin{aligned} \ddot{x} &= -\omega_x^2 x \\ \ddot{y} &= -\omega_y^2 y \end{aligned}\right\}$$

↳ $\frac{\omega_x}{\omega_y} \in \mathbb{Q}$ → periódico

↳ Curvas de Lissajous.

↳ $\frac{\omega_x}{\omega_y} \in \mathbb{I}$ → cuasi-periódico.