$$dW = F_T \, ds = m \frac{dv}{dt} ds = m v \, dv$$

$L_{\text{peso}}: \quad L = \int_A^B m\vec{g} \cdot d\vec{s} = \dots$

$$L = mg(z_A - z_B) = E_{PA} - E_{PB} = \dots$$

L forza elastica $\quad L = \int_A^B -kx \, dx = -k\frac{x^2}{2}\Big|_A^B$

L forza attrito $\quad L = \int_a^b \vec{f} \cdot d\vec{s} = \int \mu_d N \hat{u}_v \cdot d\vec{s} = -\mu_d N \dots$

$$dW = \vec{F} \cdot d\vec{s} = F_x \, dx + F_y \, dy + F_z \, dz = -dE_P$$

$\oint dW = 0 \implies \exists \, f(x,y,z) \quad F_x = -\frac{\partial f}{\partial x} \quad F_y = -\frac{\partial f}{\partial y} \dots$

$F = -\vec{\nabla} E_P \quad \longrightarrow \quad F = mg \implies \frac{dE_P}{dz} \dots$

$\quad \longrightarrow F = -kx \implies \frac{dE_P}{dx} = -kx \quad E_P = \dots$

$\vec{L}_o = \vec{r}_c \times \vec{P} = \vec{r} \times m\vec{v} \qquad \vec{r}_c = \vec{CC'} + \vec{r}_{c'} \implies \vec{L}_c = \vec{CC'} \times \vec{P} + \dots$

$$\vec{L}_{c*} = \vec{CC'} \times \vec{P} + \vec{L}_{c'}$$

$$\vec{L} = \vec{r} \times m(\vec{v}_r + \vec{v}_e) = \vec{r} \times m\vec{v}_e$$

$\vec{M}_o = \vec{r}_c \times \vec{F} \qquad \vec{M}_{o'} = \vec{M}_o + \vec{CO} \times \vec{F} \qquad \vec{M} = \sum \vec{r}_a \times \vec{F}_a = \vec{r} \times \sum \vec{F}_a$

$$\frac{d\vec{L}}{dt} = \frac{d\vec{r}}{dt} \times \vec{P} + \vec{r} \times \frac{d\vec{P}}{dt} = \vec{v} \times m\vec{v} + \vec{r} \times \vec{F} = \vec{M}$$

$$\vec{v} = \frac{d\vec{r}}{dt} = \frac{dr}{dt}\hat{u}_r + r\frac{d\hat{u}_r}{dt} = v\hat{u}_r + r\frac{d\theta}{dt}\hat{u}_\theta \qquad \vec{L} = \vec{r} \times mr\frac{d\theta}{dt}\hat{u}_\theta$

se O $\quad$ sta nel piano del moto, $\quad \vec{r} \perp \hat{u}_\theta \implies L = mr^2 \frac{d\theta}{dt}$

F centrale $\implies \vec{L} = \text{cost.} \implies \frac{1}{2}r^2\frac{d\theta}{dt} = \text{cost.} \qquad \frac{dA}{dt} = \frac{1}{2}r^2\frac{d\theta}{dt}$

$dA = \frac{1}{2}r \cdot r \, d\theta \quad \frac{dA}{dt} = \text{cost.} \quad \frac{dA}{dt} = \frac{L}{2m} \quad \int_{A_o} dA = \int_0^T \frac{L}{2m} dt$

$A = \frac{L}{2m}T \quad$ periodo: $T = \frac{2mA}{L}$

lavoro forze centrali: $\quad L = \int_A^B \vec{F} \cdot d\vec{s} = \int_A^B F(r)\hat{u}_r \cdot d\vec{s}$

$ds\cos\theta = dr \implies \hat{u}_r \cdot d\vec{s} = dr \implies L = \int_A^B F(r) dr = \dots$

$\quad |d\vec{r}| = r\,d\theta = dr$

$\vec{r} = \vec{r}_c + \vec{r}'$

$\vec{v} = \frac{d\vec{r}}{dt} = \frac{d\vec{r}_c}{dt} + \frac{dx'}{dt}\hat{x} + \frac{dy'}{dt}\hat{y} + \frac{dz'}{dt}\hat{z} + x\frac{d\hat{x}}{dt} + y\frac{d\hat{y}}{dt} + z\frac{d\hat{z}}{dt}$

$= \vec{v}_c + \vec{v}' + \vec{\omega} \times (x'\hat{x} + y'\hat{y} + z'\hat{z}) = \vec{v}_c + \vec{v}' + \vec{\omega} \times \vec{r}'$

$\vec{\omega} \times \hat{x}$