

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

$L_{translazionale} = \int_A^B \vec{F} \cdot d\vec{s} = m \int_A^B \vec{v} \cdot d\vec{v} = m \int_A^B v dv = \frac{1}{2} m v^2 \Big|_A^B = \frac{1}{2} m (v_B^2 - v_A^2)$

$L_{pot. elastica} = \int_A^B -kx dx = -\frac{k}{2} x^2 \Big|_A^B = -\frac{k}{2} (x_B^2 - x_A^2)$

$L_{pot. gravitazionale} = \int_A^B \vec{F} \cdot d\vec{s} = \int_A^B -mg dy = -mg(y_B - y_A) = mgy_A - mgy_B$

$L_{forza statica} = \int_A^B \vec{F} \cdot d\vec{s} = \int_A^B F ds = F \Delta s$

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

$\oint dW = 0 \Rightarrow \exists f(x, y, z) \text{ t.c. } F_x = -\frac{\partial f}{\partial x}, F_y = -\frac{\partial f}{\partial y}, F_z = -\frac{\partial f}{\partial z}$

$\vec{F} = -\nabla \epsilon_p$

$\vec{F} = -mg \Rightarrow \frac{d\epsilon_p}{dz} = -mg \Rightarrow \epsilon_p = -mgy$

$\vec{F} = -kx \Rightarrow \frac{d\epsilon_p}{dx} = -kx \Rightarrow \epsilon_p = -\frac{1}{2} kx^2$

$\vec{L}_O = \vec{r} \times \vec{p} = \vec{r} \times m\vec{v}$

$\vec{r}_O = \vec{CO} + \vec{r}_{O'}$

$\vec{L}_O = \vec{CO} \times \vec{p} + \vec{L}_{O'}$

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

$\vec{M}_O = \vec{r}_O \times \vec{F}$

$\vec{M}_{O'} = \vec{r}_{O'} \times \vec{F}$

$\vec{M} = \sum \vec{r}_i \times \vec{F}_i = \vec{r} \times \sum \vec{F}_i = \vec{r} \times \vec{F}$

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

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

$\vec{L} = \vec{r} \times m r \frac{d\theta}{dt} \hat{u}_\theta$

Se $\vec{r} \perp \hat{u}_\theta \Rightarrow L = m r^2 \frac{d\theta}{dt}$

F centrale $\Rightarrow L = \text{cost.} \Rightarrow \frac{1}{2} r^2 \frac{d\theta}{dt} = \text{cost.}$

$dA = \frac{1}{2} r^2 d\theta \Rightarrow \frac{dA}{dt} = \frac{1}{2} r^2 \frac{d\theta}{dt} = \frac{L}{2m}$

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

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

$d\vec{s} = dr \hat{u}_r \Rightarrow \hat{u}_r \cdot d\vec{s} = dr$

$\vec{r} = r d\theta \hat{u}_\theta \Rightarrow |d\vec{r}| = r d\theta = dr$

$\Rightarrow L = \int_A^B F(r) dr = f(r_B) - f(r_A)$

$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$

$\vec{v} = \frac{d\vec{r}}{dt} = \frac{dx}{dt}\hat{i} + \frac{dy}{dt}\hat{j} + \frac{dz}{dt}\hat{k}$

$\vec{v} = \vec{v}_O + \vec{v}' + \vec{\omega} \times (\vec{r}' + \vec{r}_O) = \vec{v}_O + \vec{v}' + \vec{\omega} \times \vec{r}'$