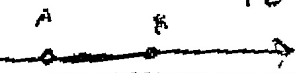
$dW = F_T\, ds = m \frac{dv}{dt} ds = m v\, dv$

L forza peso: $L = \int_A^B m\vec{g} \cdot d\vec{s} = \ldots$

$L = mg(z_A - z_B) = U_{pA} - U_{pB}$

L forza elastica 1D. $L = \int_A^B -kx\, dx = -k \frac{x^2}{2} \Big|_A^B$



L forza attrito. $L = \int_A^B \vec{f} \cdot d\vec{s} = \int_A^B \mu_d N \hat{u}_v \cdot d\vec{s} = -\mu_d N \ldots$

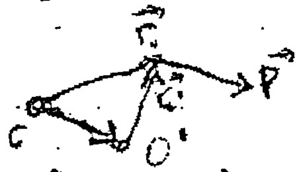
$dW = \vec{F} \cdot d\vec{s} = F_x dx + F_y dy + F_z dz = -dE_p$

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

$F = -\vec{\nabla} E_p \longrightarrow F = mg \Rightarrow \frac{dE_p}{dz} = F = mg$, $E_p = \int mg\, dz$ …

$\qquad \hookrightarrow F = -kx \Rightarrow \frac{dE_p}{dx} = -kx$, $E_p = \int -kx\, dx$ …

$\vec{L}_O = \vec{r}_O \times \vec{p} = \vec{r}_O \times m\vec{v}$ $\qquad \vec{r}_O = \vec{CO'} + \vec{r}_{O'} \Rightarrow \vec{L}_{C} = \ldots$



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

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

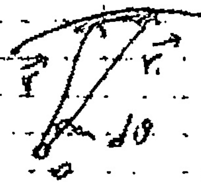
$\vec{M}_O = \vec{r}_O \times \vec{F} \qquad \vec{M}_{O'} = \vec{M}_O + \vec{O'O} \times \vec{F} \qquad \vec{M} = \Sigma\, \vec{r}_i \times \vec{F}_i = \vec{r} \times \Sigma \vec{F}_i$ …

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

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

Se O sta nel piano del moto, $\vec{r} \perp \hat{u}_\theta \Rightarrow L = m r^2 \frac{d\theta}{dt}$

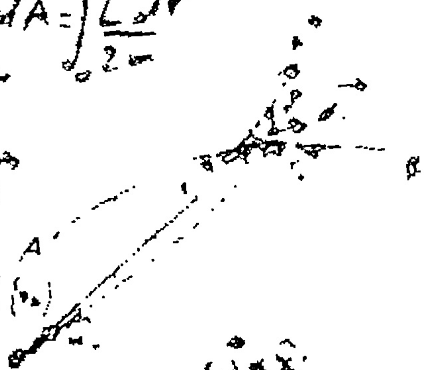
F centrale $\Rightarrow \vec{L} = \text{cost.} \Rightarrow \frac{1}{2} r^2 \frac{d\theta}{dt} = \text{cost.} \qquad \frac{dA}{dt} = \frac{1}{2} r^2 \frac{d\theta}{dt}$



$dA = \frac{1}{2} r\, r\, d\theta \qquad \frac{dA}{dt} = \text{cost.} \qquad \frac{dA}{dt} = \frac{L}{2m} \qquad \int_0^A dA = \int_0^T \frac{L}{2m} dt$

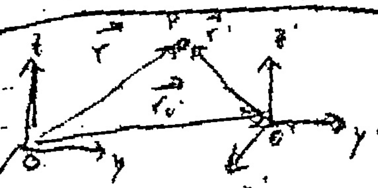
$A = \frac{L}{2m} T \qquad$ periodo: $T = \frac{2mA}{L}$

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



$ds \cos\theta = dr \Rightarrow \hat{u}_r \cdot d\vec{s} = dr \qquad \Rightarrow L = \int_A^B F(r)\, dr = f(r_B) - f(r_A)$

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



$\vec{r} = \vec{r}_{O'} + \vec{r}\,'$ $\qquad \vec{\omega} \times \hat{x}$

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

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