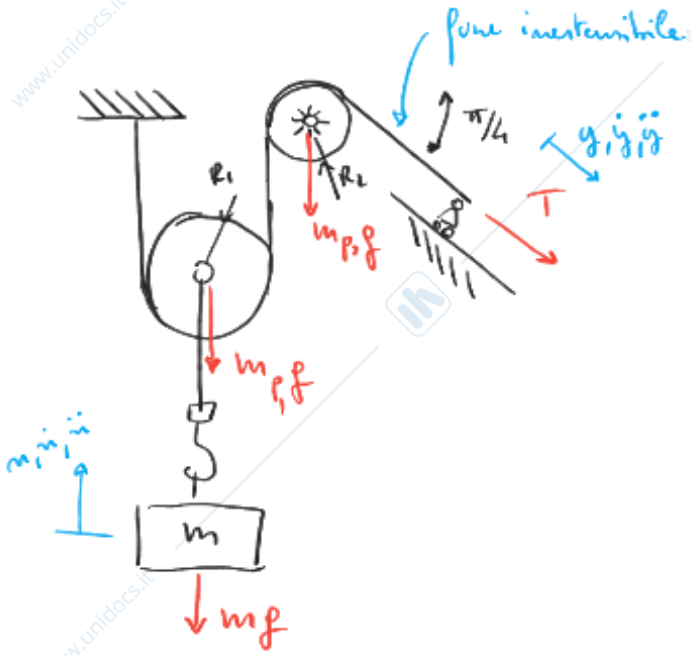
Statica e dinamica del corpo rigido



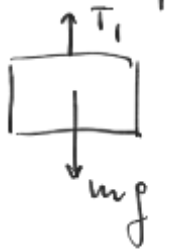
Statica

calcolo T t.c. il sistema sia in equilibrio statico

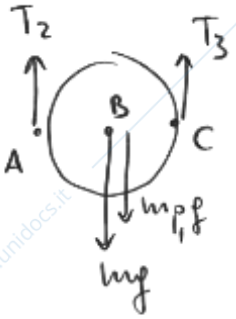
Dinamica

data T come si muove il sistema: x, ẋ, ẍ?

Equilibrio di forze



$$\sum F_y = 0 \qquad T_1 = mg$$

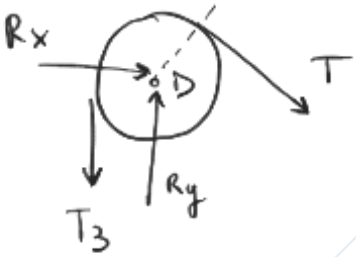


$$\sum F_y = 0 \qquad T_2 + T_3 = (m + m_1)g$$

$$\sum M_A = 0 \qquad T_3 2R_1 - (m + m_1)gR_1 = 0$$

$$T_3 = \frac{m + m_1}{2} g$$

$$T_2 = \frac{m + m_1}{2} g$$



$$\sum F_x = 0 \qquad R_x + T\cos\tfrac{\pi}{4} = 0$$

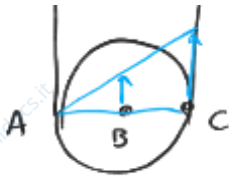
$$\sum F_y = 0 \qquad R_y - T_3 - T\sin\tfrac{\pi}{4} = 0$$

$$\sum M_D = 0 \qquad T_3 R_2 - T R_2 = 0$$

$$T = \frac{m + m_1}{2} g$$

Analisi cinematica

Il punto A ha velocità nulla essendo



la fune inestensibile

A è CIR della puleggia

$\vec{v}_B = \dot{x}\vec{\imath} = \vec{\omega}_p \wedge (B-A) = \omega \vec{k} \wedge R_1 \vec{\imath} = \omega R_1 \vec{\jmath}$

$\omega_1 = \frac{\dot{x}}{R}$

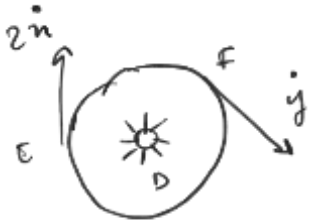
$\vec{v}_C = \vec{\omega}_p \wedge (C-A) = \omega \vec{k} \wedge 2R_1 \vec{\imath} = \omega 2R_1 \vec{\jmath}$

$\vec{v}_C = 2\dot{x}\vec{\jmath}$

$\vec{v}_E = \vec{v}_C$ (fune inestensibile)

$|\vec{v}_F| = |\vec{v}_E| = \omega_{P_2} R_2$

$\longrightarrow \quad \dot{y} = 2\dot{x}$



Statica con PLV

$$\delta \mathcal{L} = m\vec{g} \cdot \delta \vec{y}_B + m_{P_1}\vec{g} \cdot \delta \vec{y}_B + m_{P_2}\vec{g} \cdot \delta \vec{y}_D + \vec{T} \cdot \delta \vec{y}_T$$

($m_{P_2}\vec{g} \cdot \delta \vec{y}_D = 0$)

$y_B = x \quad \delta y_B = \frac{\partial y_B}{\partial x} \delta x$

↑ 1 Jacobiano di y_B rispetto a x

$$\delta y_T = \frac{\partial y_T}{\partial x} \delta x = \frac{\partial \dot{y}_T}{\partial \dot{x}} \delta x$$

↑ = 2 essendo $\dot{y} = 2\dot{x}$

$$\delta \mathcal{L} = -(m + m_{P_1}) g \, \delta x + 2T \delta x = 0$$

$$T = \frac{m + m_{P_1}}{2} g$$