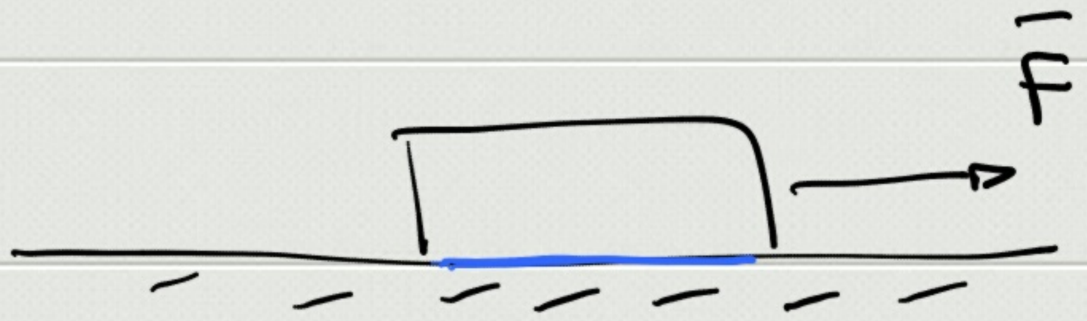
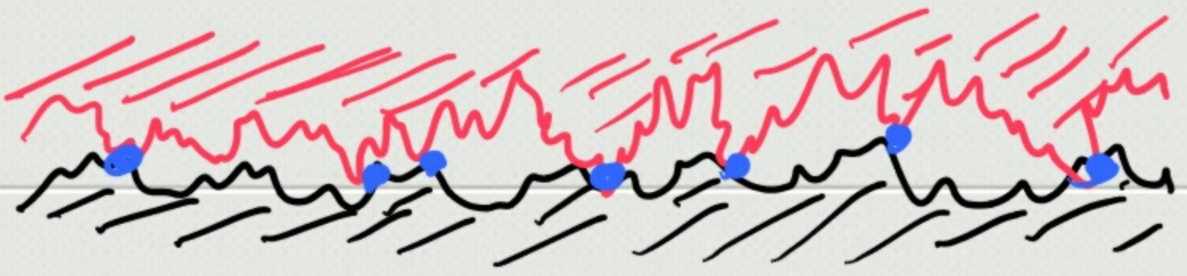
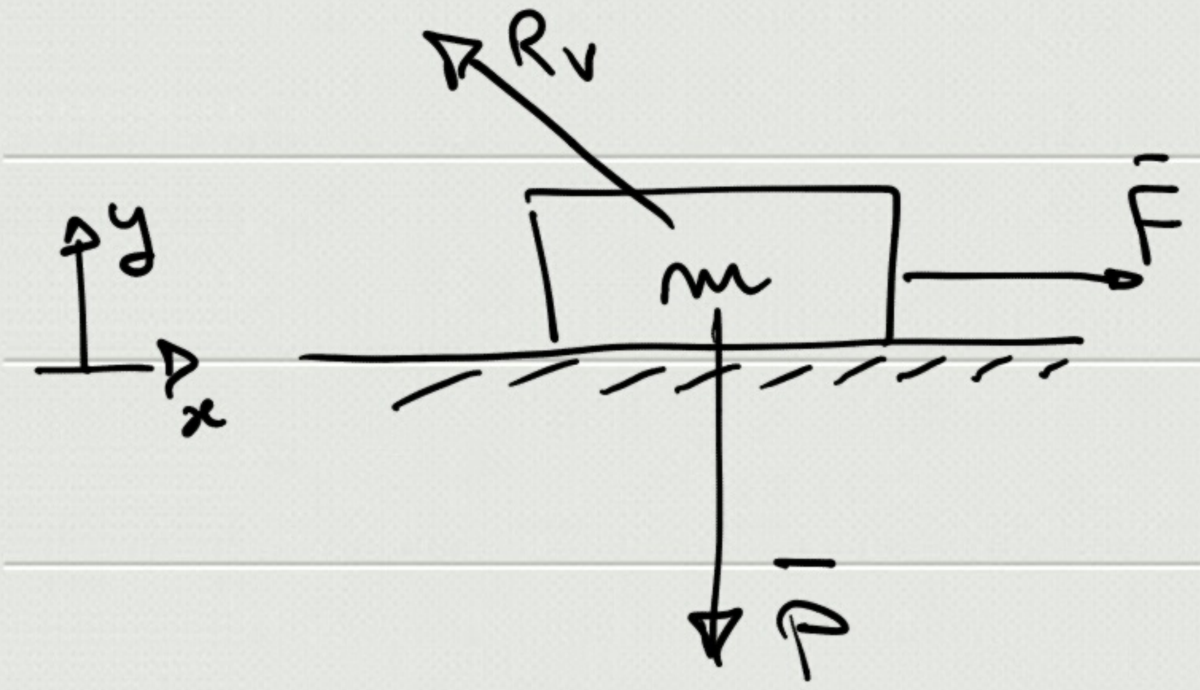


superficie scabre



Staticità



$$\sum_i \bar{F}_i = m\bar{a} = 0$$

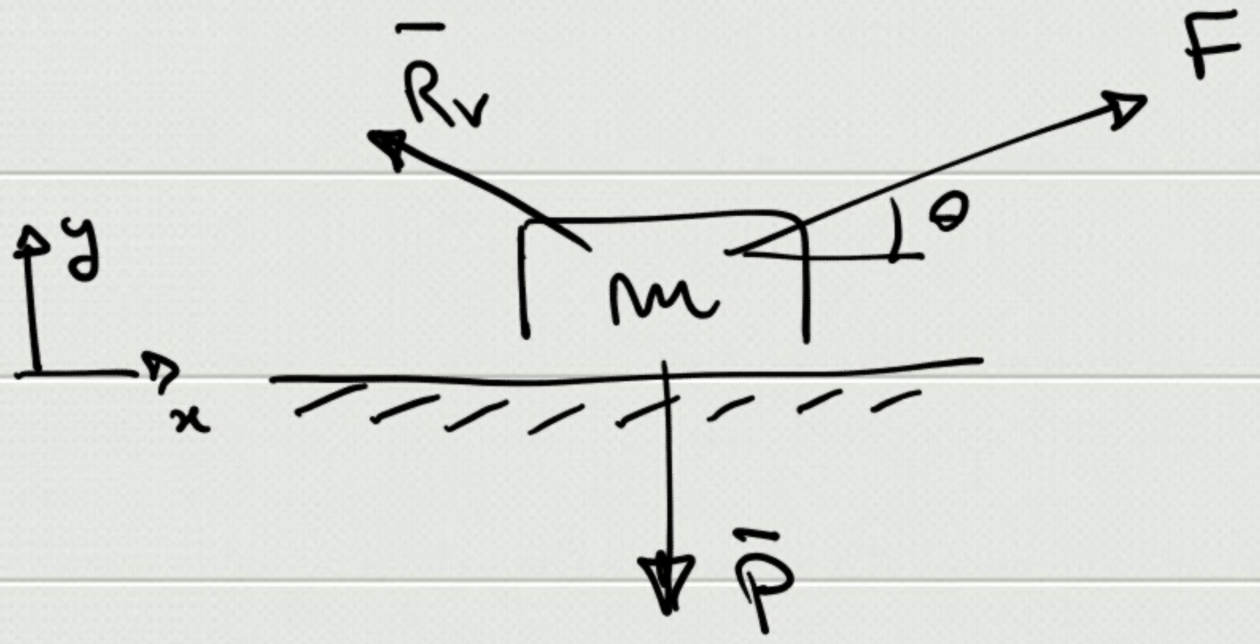
$$\bar{R}_V + \bar{F} + \bar{P} = 0$$

$$\bar{F} = F\,\bar{u}_x \qquad \bar{P} = -mg\,\bar{u}_y$$

$$x: \; R_{Vx} + F = 0 \Rightarrow R_{Vx} = F_{att} = -F$$

$$y: \; R_{Vy} - mg = 0 \Rightarrow R_{Vy} = N = mg$$

Forza di attrito statico: $\boxed{F_{as} = F}$



Statica

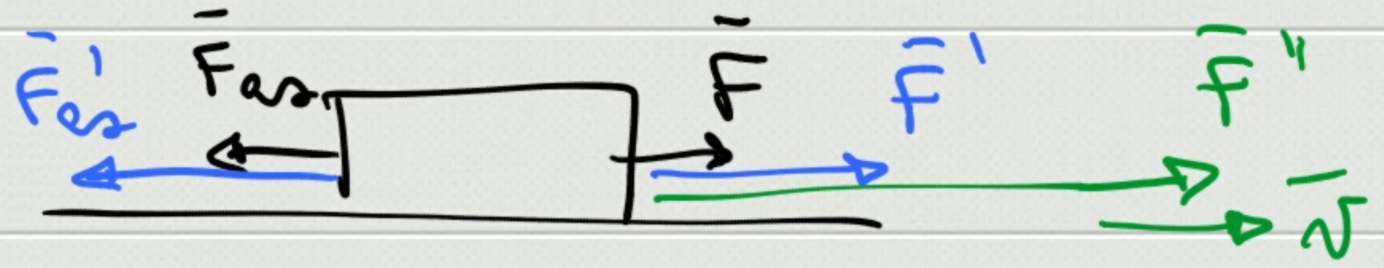
$$\bar{R}_v + \bar{F} + \bar{P} = 0$$

$$x: \; R_{vx} + F\cos\theta = 0 \quad \Rightarrow \quad R_{vx} = \boxed{F_{as} = -F\cos\theta}$$

$$y: \; R_{vy} + F\sin\theta - P = 0 \quad \Rightarrow \quad R_{vy} = \boxed{N = P - F\sin\theta}$$

$(*)$

$$\left[N > 0 \quad F < \frac{mg}{\sin\theta} \right]$$



$$\boxed{F_{as} \leq F_{as,max} = \mu_s N} \qquad \text{(modulo)}$$

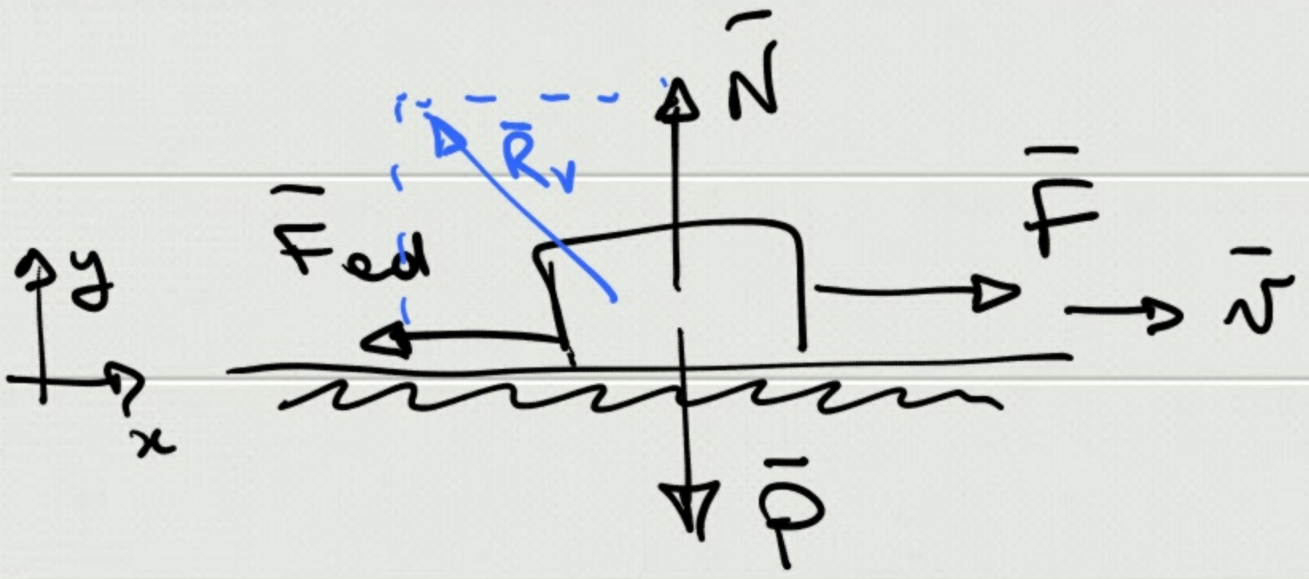
μ_s : coefficiente di attrito statico

$$(*) \Rightarrow F_{as} = F\cos\theta \leq \mu_s N = \mu_s (mg - F\sin\theta)$$

$$F(\cos\theta + \mu_s \sin\theta) \leq \mu_s mg$$

$$\boxed{F \leq \frac{\mu_s mg}{\cos\theta + \mu_s \sin\theta}}$$

Dinamica



$\Rightarrow$ Forza di attrito dinamico : $\bar{F}_{ed}$

$$\boxed{\bar{F}_{ed} = -\mu_d N \bar{U}_v}$$

μ_d : coefficiente di attrito dinamico

$\bar{U}_v$: versore del vettore velocità

$$\overbrace{\bar{F}_{ed} + \bar{N}}^{\bar{R}_v} + \bar{F} + \bar{P} = m\bar{a}$$

$$x: \quad -\mu_d N + F = m a_x$$

$$y: \quad N - mg = m a_y = 0 \qquad \Rightarrow N = mg$$

$$\Rightarrow -\mu_d mg + F = m a$$

$$\Rightarrow \boxed{a = \frac{1}{m}(F - \mu_d mg)}$$