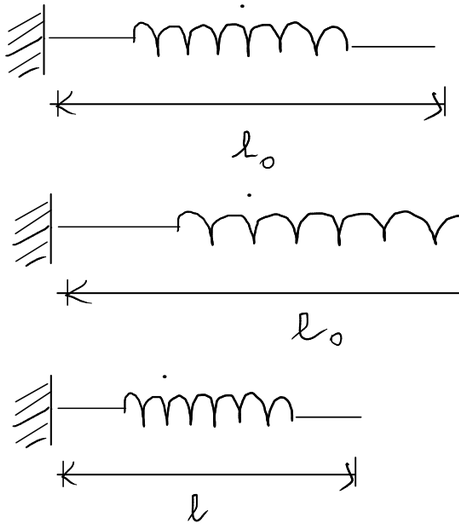
2. **Forza elastica** → piccola deformazione di un corpo macro

Es.: molla

$\Delta l = l - l_0$



$\Delta l > 0$ estensione

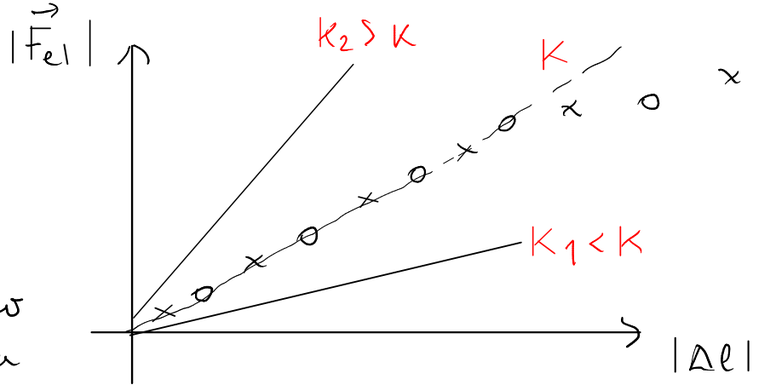
$\Delta l < 0$ compressione

$|\vec{F}_{el}| \sim |\Delta l|$

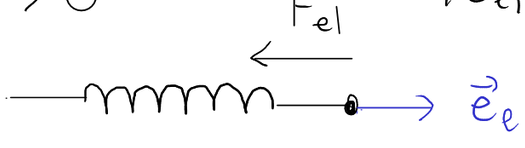
$|\vec{F}_{el}| = K\,|\Delta l|$

K ↑ coefficiente elastico, costante elastica

SI: $\frac{N}{m}$



$\Delta l > 0$

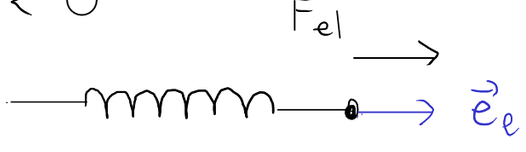


$|\vec{e}_l| = 1$

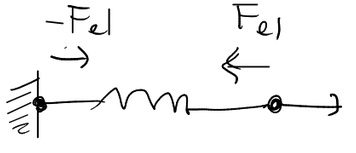
legge di Hooke

$$\vec{F}_{el} = -K\,\Delta l\,\vec{e}_l$$

$\Delta l < 0$



$$\vec{F}_{el} = -K\,\Delta l\,\vec{e}_l$$

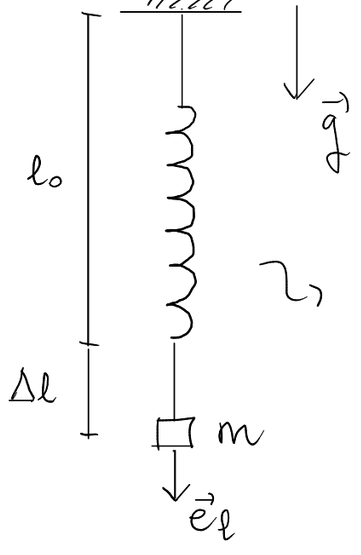


III Newton ⚠

Modello: **molla ideale**

- legge di Hooke
- massa nulla

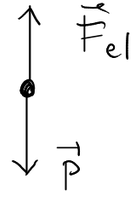
Es. corpo appeso all'estremità di una molla nel campo gravitazionale terrestre



$|\vec{e}_l| = 1$

$\vec{P} = m\vec{g} = mg\vec{e}_l$

$\vec{F}_{el} = -k\Delta l\,\vec{e}_l$



Condizione equilibrio statico: $\vec{v} = \vec{0}$

-//- equilibrio meccanico: $\sum \vec{F} = \vec{0}$

↳ molla ideale

$\sum \vec{F} = \vec{P} + \vec{F}_{el} = \vec{0}$ eq. meccanico

$mg\vec{e}_l - k\Delta l\,\vec{e}_l = \vec{0}$

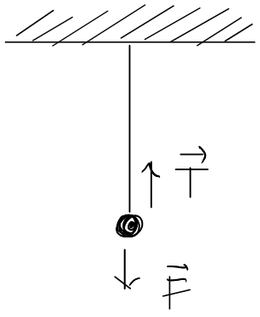
$mg - k\Delta l = 0 \Rightarrow mg = k\Delta l \Rightarrow \Delta l = \frac{mg}{k}$

$\Delta l \nearrow \quad m \nearrow$

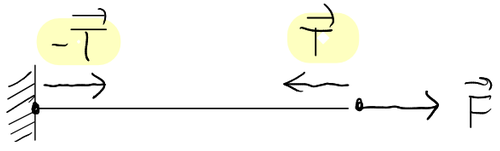
$\Delta l \searrow \quad k \nearrow$

□

3. **Tensione** → forma estrema di elasticità ($K \to \infty$, $\Delta l \to 0$) ~ estensione



corpo equilibrio statico $\Rightarrow$ $\Sigma \vec{F} = \vec{0}$ $\Rightarrow$ $\vec{T} = -\vec{F}$

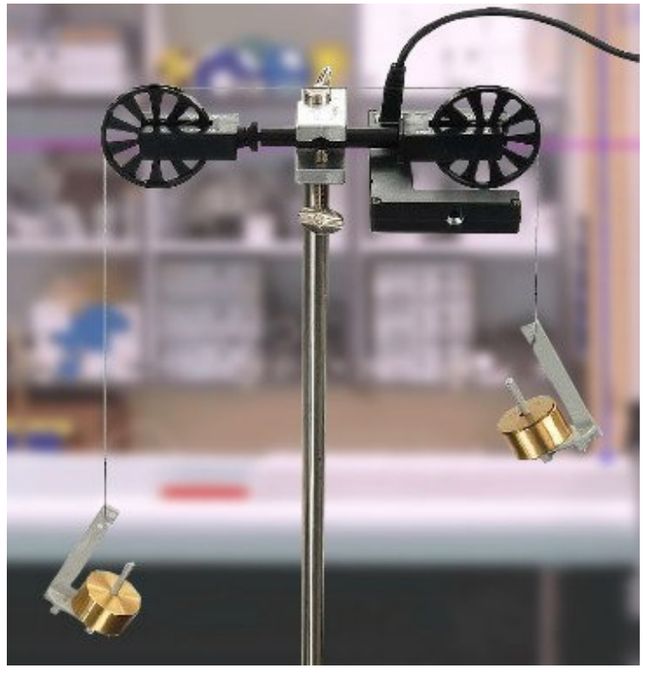


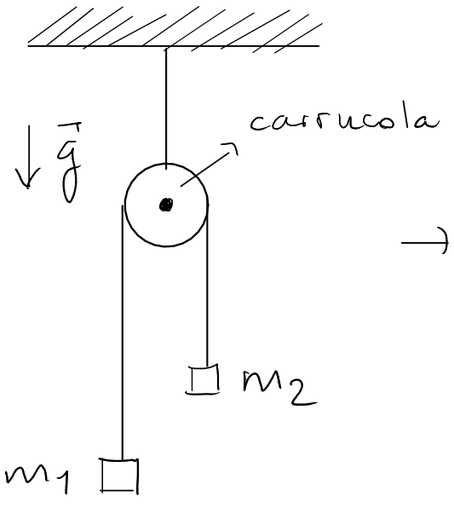
III Newton ⚠

Modello: **filo ideale**

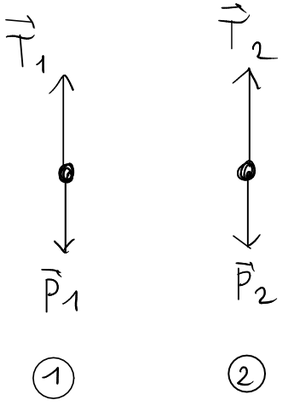
- massa nulla
- inestensibile
- $|\vec{T}|$ è la stessa in tutto il filo

Es.: macchina di Atwood





filo ideale



$|\vec{T}_1| = |\vec{T}_2|$ $\quad \vec{a}_1 = -\vec{a}_2$

$\vec{T}_2 = \vec{T}_1$

II Newton: $\sum \vec{F} = m\vec{a}$

$$\begin{cases} m_1\vec{g} + \vec{T}_1 = m_1\vec{a}_1 \\ m_2\vec{g} + \vec{T}_1 = m_2\vec{a}_2 \end{cases}$$

$$m_1\vec{g} + (m_2\vec{a}_2 - m_2\vec{g}) = m_1\vec{a}_1$$

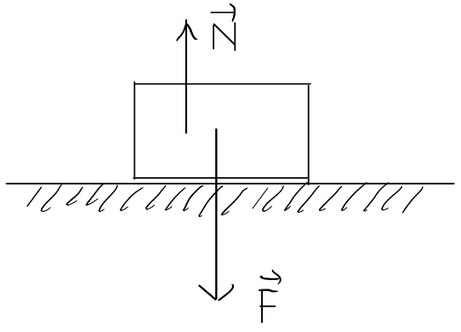
$$(m_1 - m_2)\vec{g} = m_1\vec{a}_1 - m_2\vec{a}_2 = (m_2 + m_1)\vec{a}_2$$

$$\vec{a}_2 = \frac{m_1 - m_2}{m_2 + m_1}\vec{g}$$

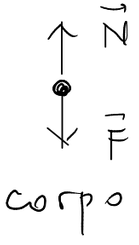
$$\vec{g} = \frac{m_2 + m_1}{m_1 - m_2}\vec{a}_2$$

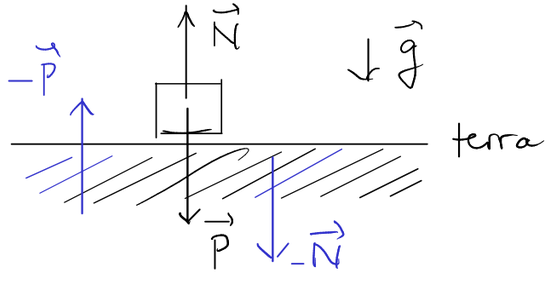
- $m_2 \gg m_1$: $\vec{a}_2 \approx \vec{g}$
- $m_2 \approx m_1$: $\vec{a}_2 \to \vec{0}$

4. **Reazione normale** forza a corto raggio tra solidi ~ elasticità estrema (compressione)

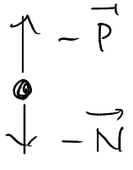


equilibrio statico $\Rightarrow \quad \vec{N} + \vec{F} = \vec{0} \quad \Rightarrow \quad \vec{N} = -\vec{F}$

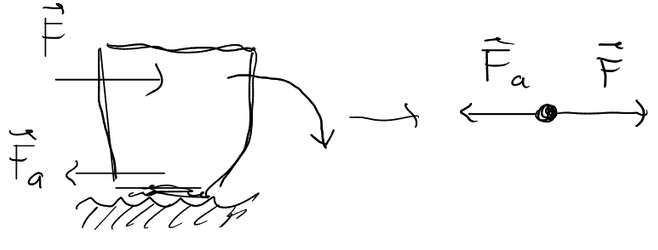




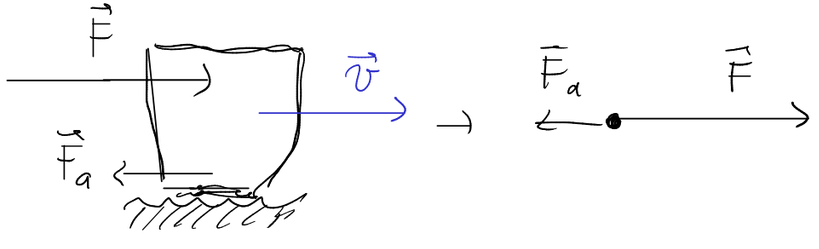
III Newton



5. **Attrito radente** forza a corto raggio tra solidi

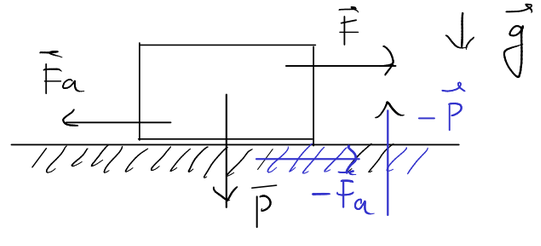


caso statico

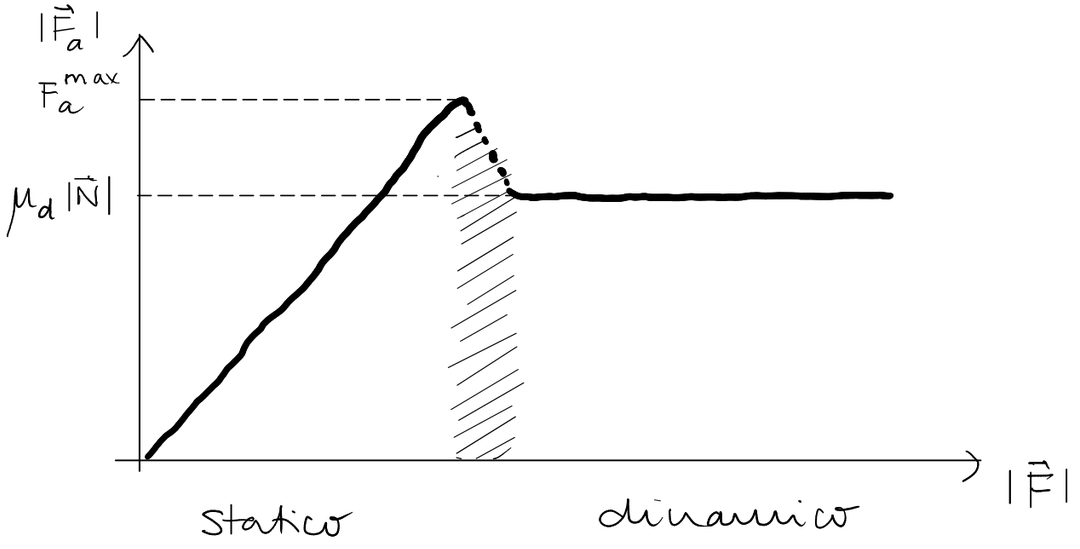


caso dinamico

III Newton



Coefficienti di attrito



F_a^{max} = valor massimo della forza d'attrito in regime statico

$$F_a^{max} = \mu_s |\vec{N}| \qquad |\vec{F}_a| \leq \mu_s |\vec{N}| \quad \text{statico}$$

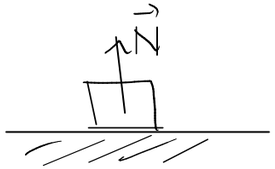
μ_s: coeff. attrito statico

SI: adimensionale

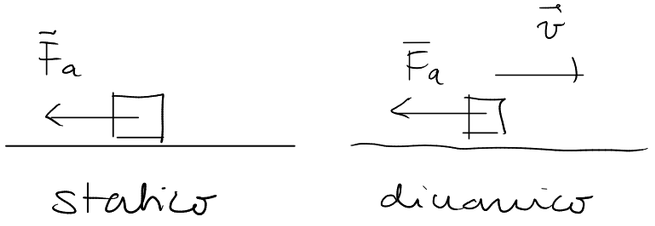
$$0 < \mu_s \lesssim 1$$

$$|\vec{F}_a| = \mu_d |\vec{N}| \quad \text{dinamico}$$

μ_d: coeff. attrito dinamico



$$\mu_d < \mu_s$$



- direzione // superficie
- verso opposto al moto o al moto imminente