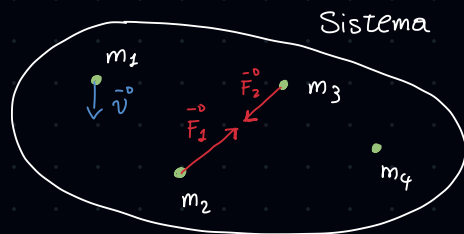


$$1) \vec{F} = m \cdot \vec{a}$$

$$2) \vec{M} = \frac{d\vec{L}}{dt}$$



$$\vec{F}_{TOT} = \sum_i \vec{F}_i \begin{cases} \text{Forze interne} \rightarrow \sum_i \vec{F}_{int} \\ \text{Forze esterne} \rightarrow \sum_i \vec{F}_{ext} \end{cases}$$

masse

$$M_{TOT} = \sum_i m_i, \quad \vec{a}_{TOT} = \sum_i \vec{a}_i$$

$$\Rightarrow \sum_i \vec{F}_{int} + \sum_i \vec{F}_{ext} = \sum_i m_i \vec{a}_i \rightarrow \frac{d\vec{v}}{dt}$$

$$\sum_i m_i \cdot \frac{d\vec{v}}{dt}$$

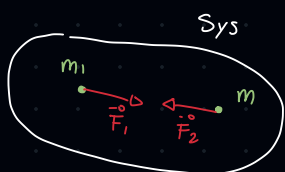
$$\vec{p} = m \cdot \vec{v} \Rightarrow d\vec{p} = m d\vec{v}$$

$$\vec{p}_{TOT} = \sum_i m_i \vec{v}_i$$

$$\Rightarrow \sum_i \vec{F}_{int} + \sum_i \vec{F}_{ext} = \frac{d\vec{p}_{TOT}}{dt} \quad \text{I}^\circ \text{ eq card generalizz.}$$

$$\sum_i \vec{M}_{int} + \sum_i \vec{M}_{ext} = \frac{d\vec{L}}{dt} \quad \text{II}^\circ \text{ eq card generalizz.}$$

Forze interne



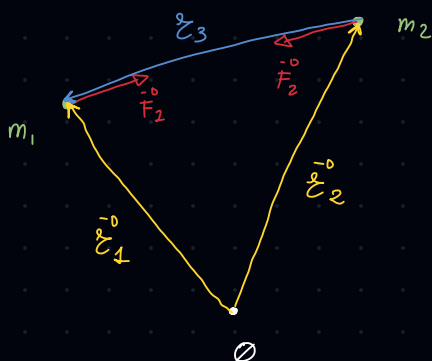
Per il principio di azione - Reazione  $\Rightarrow \vec{F}_1 = -\vec{F}_2 \Rightarrow \sum_i \vec{F}_{int} = 0$

Momenti interni

$$\sum_i \vec{M}_{int} = 0 \quad \text{TESI}$$

$$\vec{r}_1 - \vec{r}_2 = \vec{r}_3$$

$$\vec{r}_1 = \vec{r}_2 + \vec{r}_3, \quad \vec{F}_1 = -\vec{F}_2$$



$$\begin{aligned} \vec{M}_1 + \vec{M}_2 &= \vec{r}_1 \wedge \vec{F}_1 + \vec{r}_2 \wedge \vec{F}_2 = \vec{r}_1 \wedge (-\vec{F}_2) + \vec{r}_2 \wedge \vec{F}_2 \\ &= (\vec{r}_1 - \vec{r}_2) \wedge \vec{F}_2 = \vec{r}_3 \wedge \vec{F}_2 \\ &\quad \vec{r}_3 \parallel \vec{F}_2 \end{aligned}$$

$$\Rightarrow \vec{M}_1 + \vec{M}_2 = 0 \quad \text{QED}$$

Aggiorniamo le equazioni

$$1) \cancel{\sum_i \vec{F}_{int}} + \sum_i \vec{F}_{ext} = \frac{d \vec{P}_{tot}}{dt} \quad \rightarrow \quad \sum_i \vec{F}_{ext} = \frac{d \vec{P}_{tot}}{dt}$$

$$2) \cancel{\sum_i \vec{M}_{int}} + \sum_i \vec{M}_{ext} = \frac{d \vec{L}}{dt} \quad \rightarrow \quad \sum_i \vec{M}_{ext} = \frac{d \vec{L}}{dt}$$

In un sys isolato  $\rightarrow \vec{M}_{ext} = 0$ ,  $\vec{F}_{ext} = 0$

$$\left\{ \begin{array}{l} \frac{d \vec{P}_{tot}}{dt} = 0 \\ \frac{d \vec{L}}{dt} = 0 \end{array} \right\} \quad \vec{P} \text{ e } \vec{L} \text{ sono costanti nel tempo} \Rightarrow \text{SI CONSERVANO!}$$