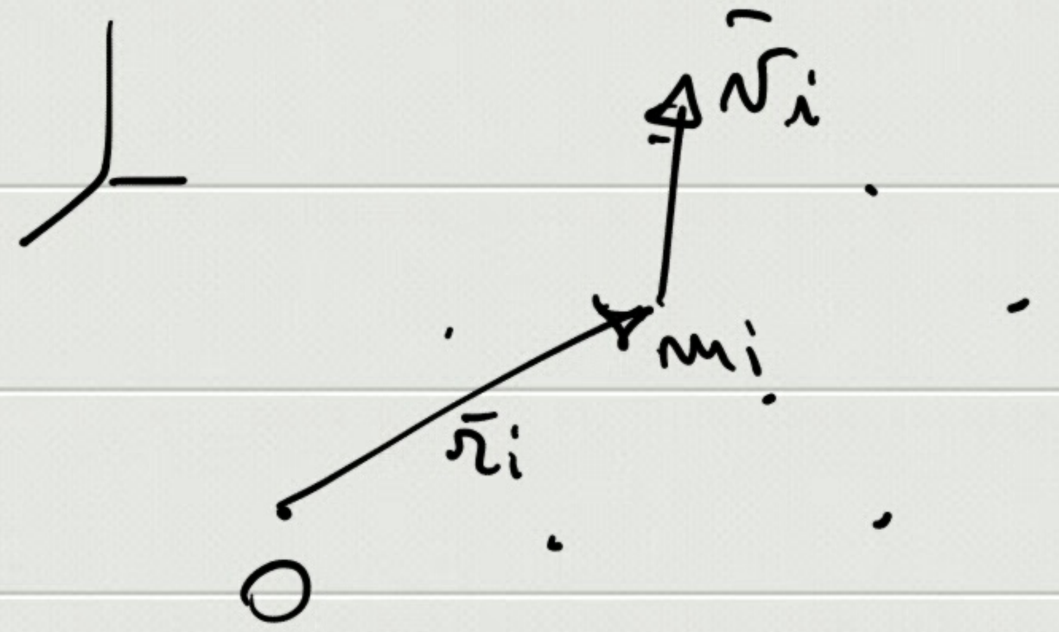


$$\bar{L}_O = \sum_i \bar{r}_i \times m_i \bar{v}_i \qquad (\bar{v}_O \neq 0)$$

$$\frac{d\bar{L}_O}{dt} = \sum_i \frac{d\bar{r}_i}{dt} \times m_i \bar{v}_i + \sum_i \bar{r}_i \times m_i \frac{d\bar{v}_i}{dt} =$$

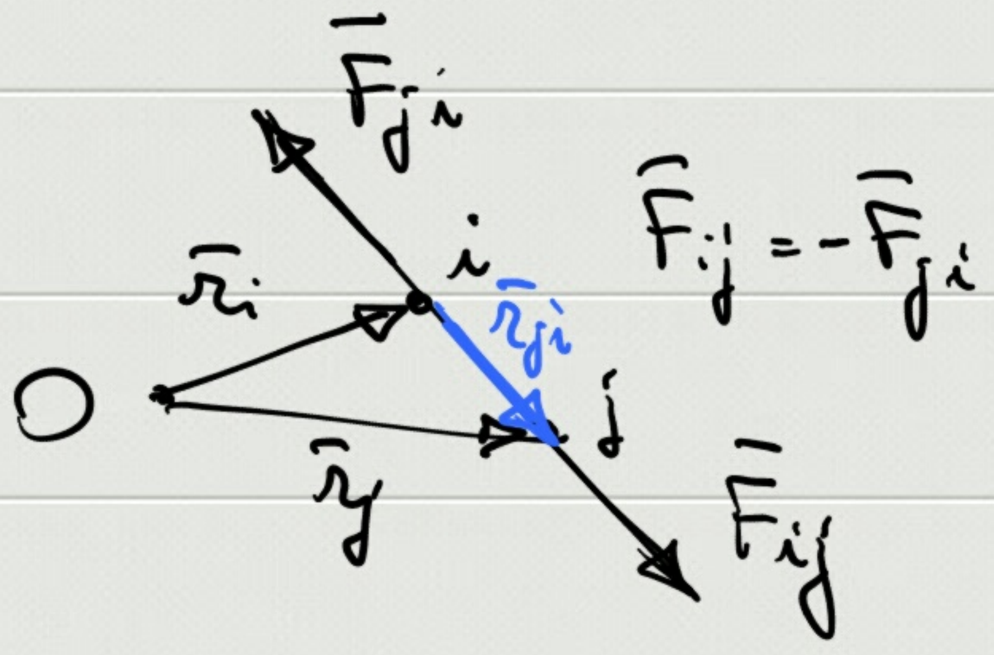
$$= \sum_i (\bar{v}_i - \bar{v}_O) \times m_i \bar{v}_i + \sum_i \bar{r}_i \times m_i \bar{a}_i =$$

$$= -\bar{v}_O \times \sum_i m_i \bar{v}_i + \sum_i \bar{r}_i \times \underbrace{\bar{F}_i}_{(\bar{F}_i^E + \bar{F}_i^I)} =$$

$$= -\bar{v}_O \times m_{TOT} \bar{v}_{CM} + \sum_i (\bar{M}_i^E + \bar{M}_i^I) =$$

$$= -\bar{v}_O \times m_{TOT} \bar{v}_{CM} + \bar{M}_O^E + \bar{M}_O^I$$

$\boxed{\bar{M}_O^I = 0}$



$$\bar{M}_O^I = \bar{r}_i \times \bar{F}_{ji} + \bar{r}_j \times \bar{F}_{ij} =$$

$$= \bar{r}_i \times \bar{F}_{ji} - \bar{r}_j \times \bar{F}_{ji} = (\bar{r}_i - \bar{r}_j) \times \bar{F}_{ji} =$$

$$= \bar{r}_{ji} \times \bar{F}_{ji} = 0$$

$$\boxed{\frac{d\bar{L}_O}{dt} = -\bar{v}_O \times M_{TOT}\bar{v}_{CM} + \bar{M}_O^{\bar{E}}}$$

T. momento angolare per sistema di punti

$$\begin{cases} \bar{v}_O = 0 \\ \bar{v}_{CM} = 0 \Rightarrow -\bar{v}_O \times M_{TOT}\bar{v}_{CM} = 0 \\ O \equiv CM \\ \bar{v}_O \parallel \bar{v}_{CM} \Rightarrow \boxed{\frac{d\bar{L}_O}{dt} = \bar{M}_O^{E}} \end{cases}$$