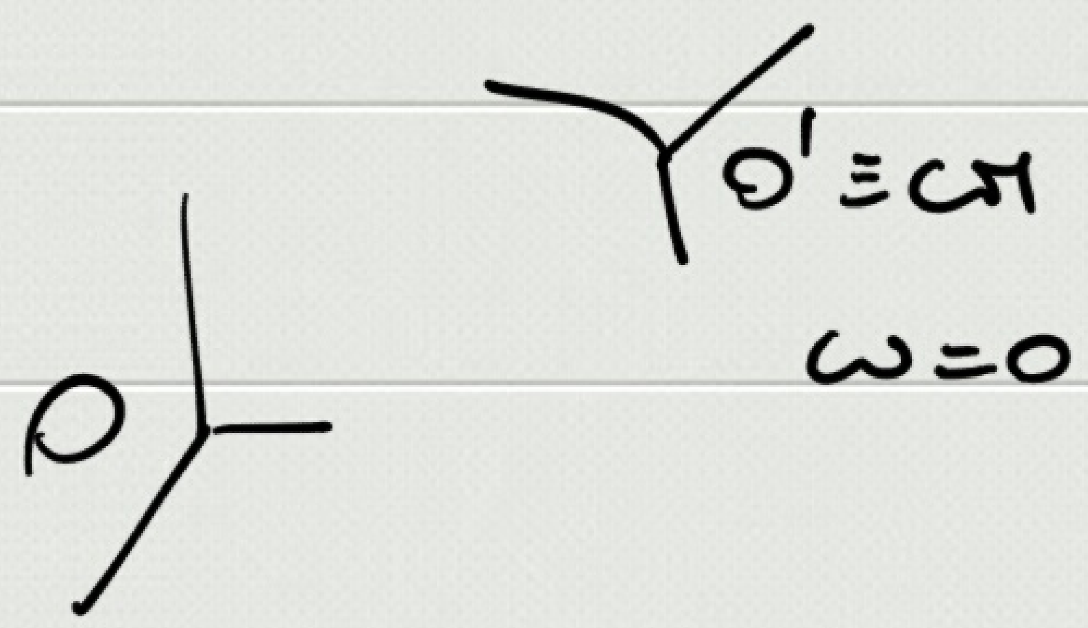
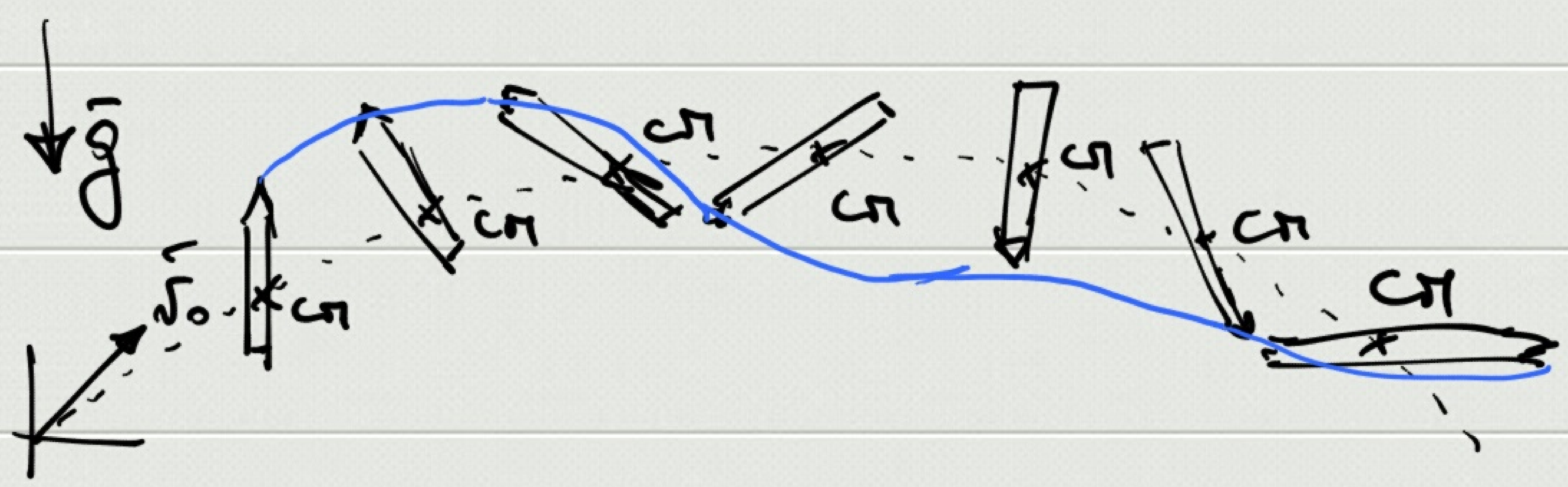
$$\bar r_{CM} = \frac{\sum_i m_i \bar r_i}{\sum_i m_i} \qquad \boxed{\bar R^E = m_{TOT}\, \bar a_{CM}} \qquad \bar P = m_{TOT}\, \bar v_{CM}$$

$$\bar L_O = \bar L'_{CM} + \bar L_{O,CM}$$

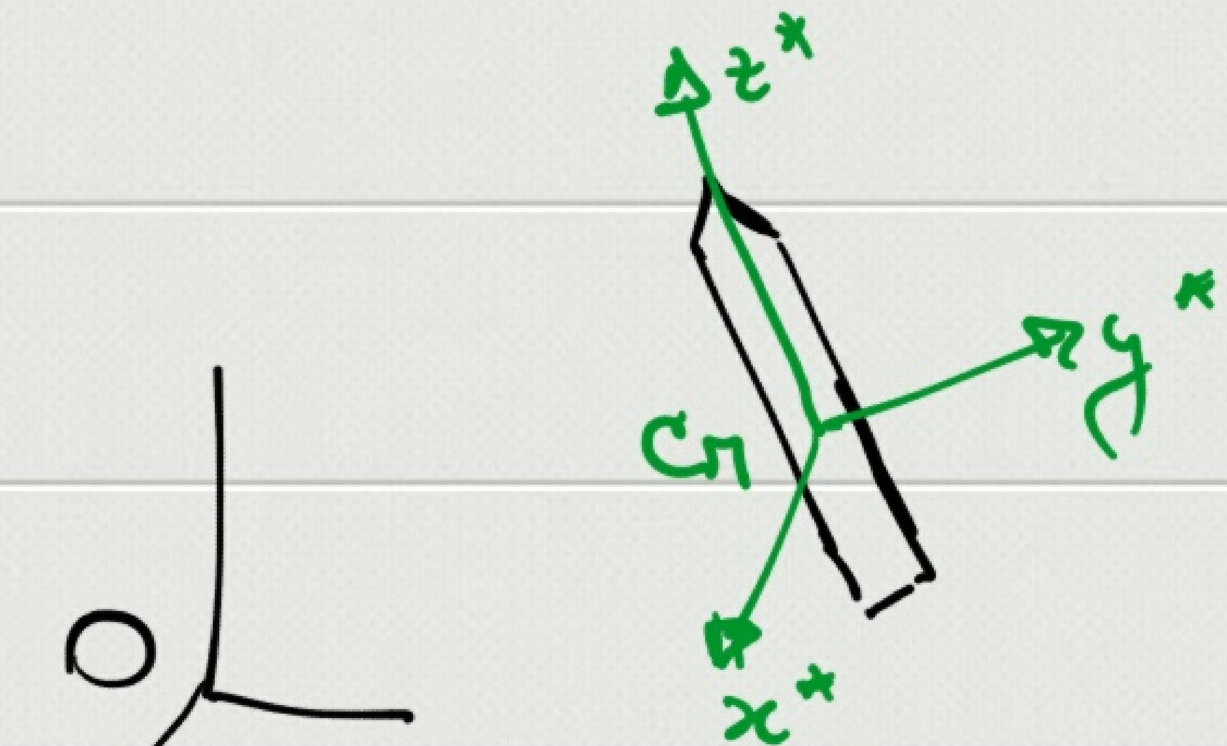


...

Corpo rigido: sistema di punti $\boxed{r_{ij} = cost}$



$$\bar R^E = m\, \bar a_{CM}$$
$$= m\, \bar g$$

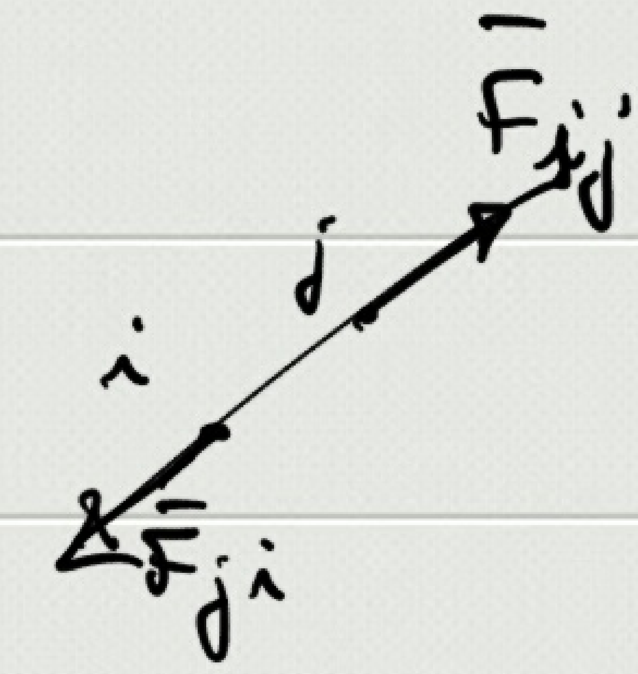


$$\bar v_P = \bar v'_P + \bar v_{O'} + \bar\omega \times \bar r'_P$$

$$\bar v_P = \bar v_{CM} + \bar\omega \times \bar r'_P$$

3 par. + 3 par.

$\Rightarrow$ 6 gradi di libertà (funzione del tempo)



r_{ij} = cost

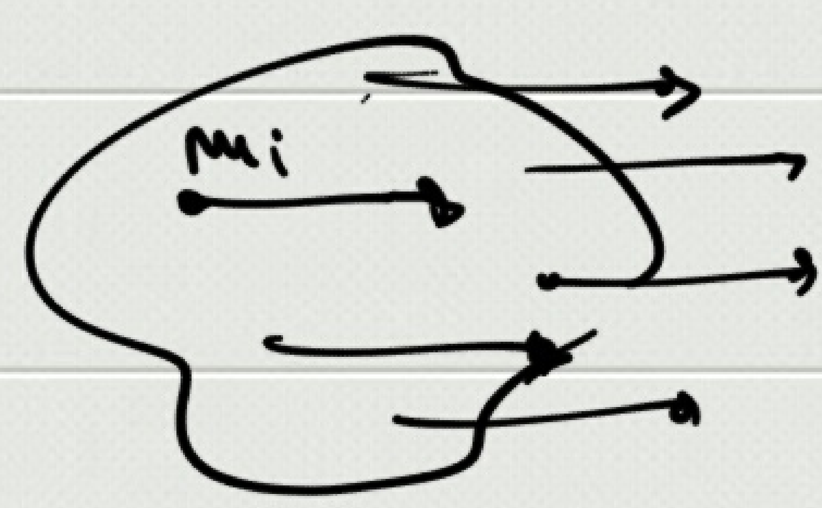
W^I :

$$dW^{ij} = \bar F_{ij}\, d\bar r_{ij} = F_{ij}\, \underset{0}{\underset{\shortparallel}{dr_{ij}}} \cos\theta_{ij} = 0$$

$$\Rightarrow \boxed{W^I = 0}$$

$$\boxed{\bar R^E = m\, \bar a_{cm}} \qquad \boxed{\bar M_0 = \frac{d\bar L_0}{dt}} \qquad \boxed{W^E_{tot} = \Delta E_K}$$

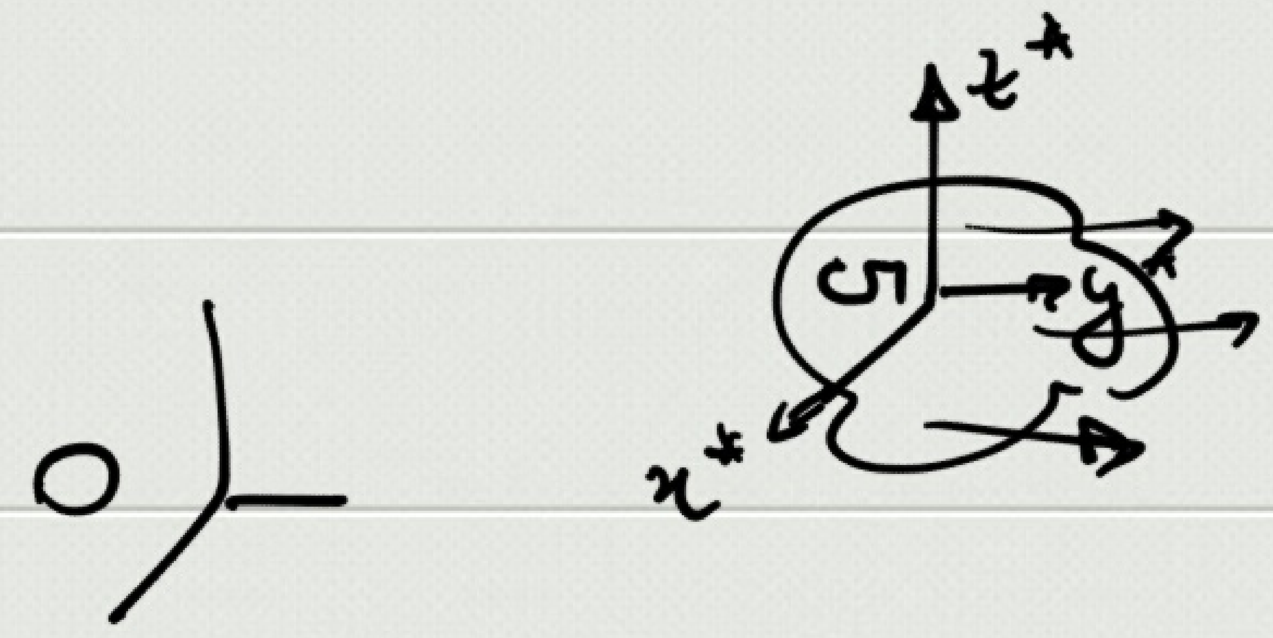
Traslazione :



$$\bar F_i = m_i \bar a_i \Rightarrow \underset{\overset{!}{=}\ \bar R^E}{\sum_i \bar F_i} = \sum_i m_i \bar a_i = \sum_i m_i \bar a = m \bar a$$

$$\Rightarrow \boxed{\bar R^E = m\, \bar a_{cm}} \qquad \boxed{\bar a = \bar a_i = \bar a_{cm}}$$

$\bar p = m \bar v_{cm}$



$\omega = 0$

SdR solidale al corpo

è SdR del CM

$$E_K = E'_K + E_{K,CM} = \frac{1}{2} m v_{CM}^2$$

$\downarrow$

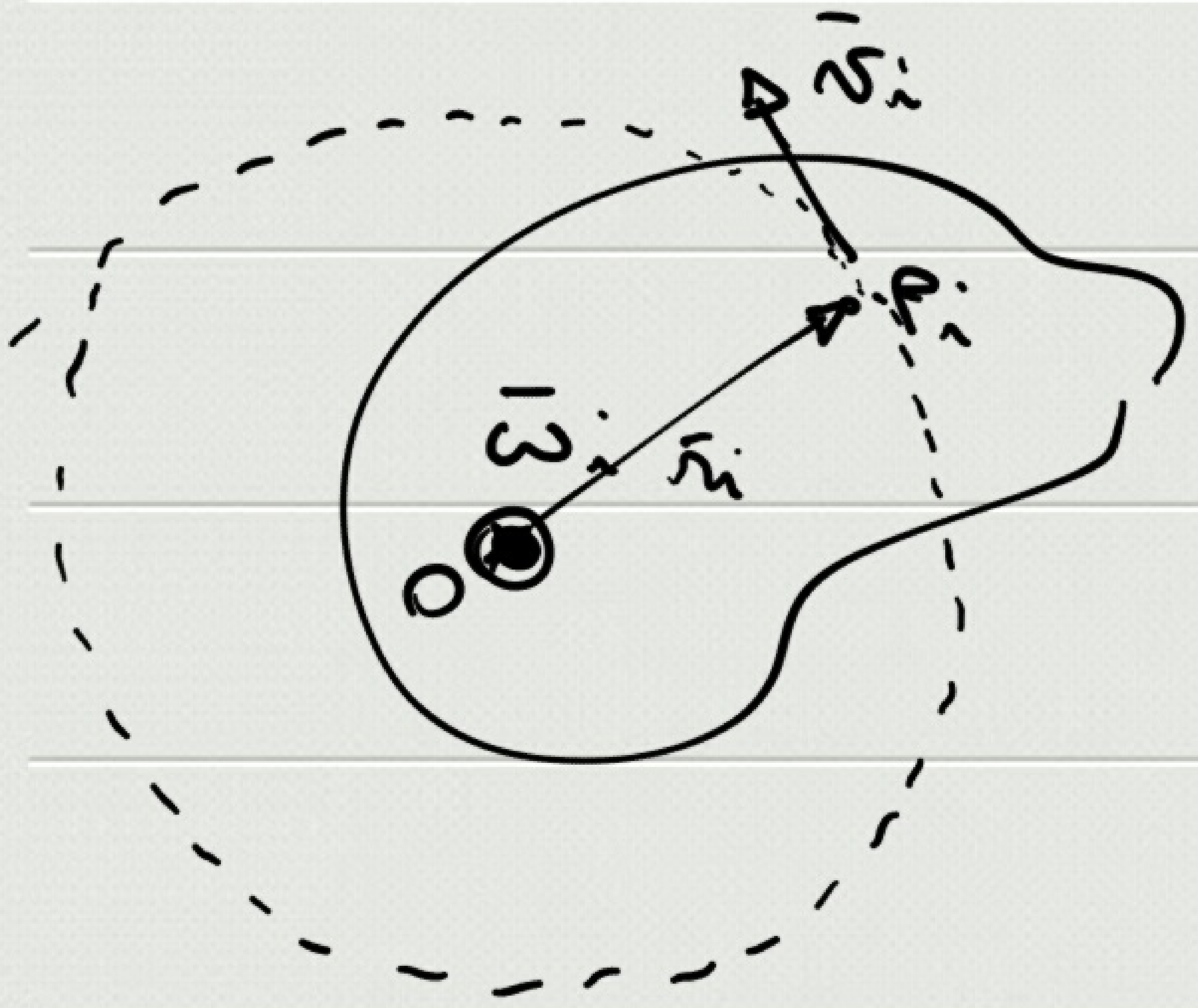
$v'_i = 0$

$$\bar{L}_O = \bar{L}'_{CM} + \bar{L}_{O,CM} = \bar{r}_{CM} \times m \bar{v}_{CM}$$

$\downarrow$

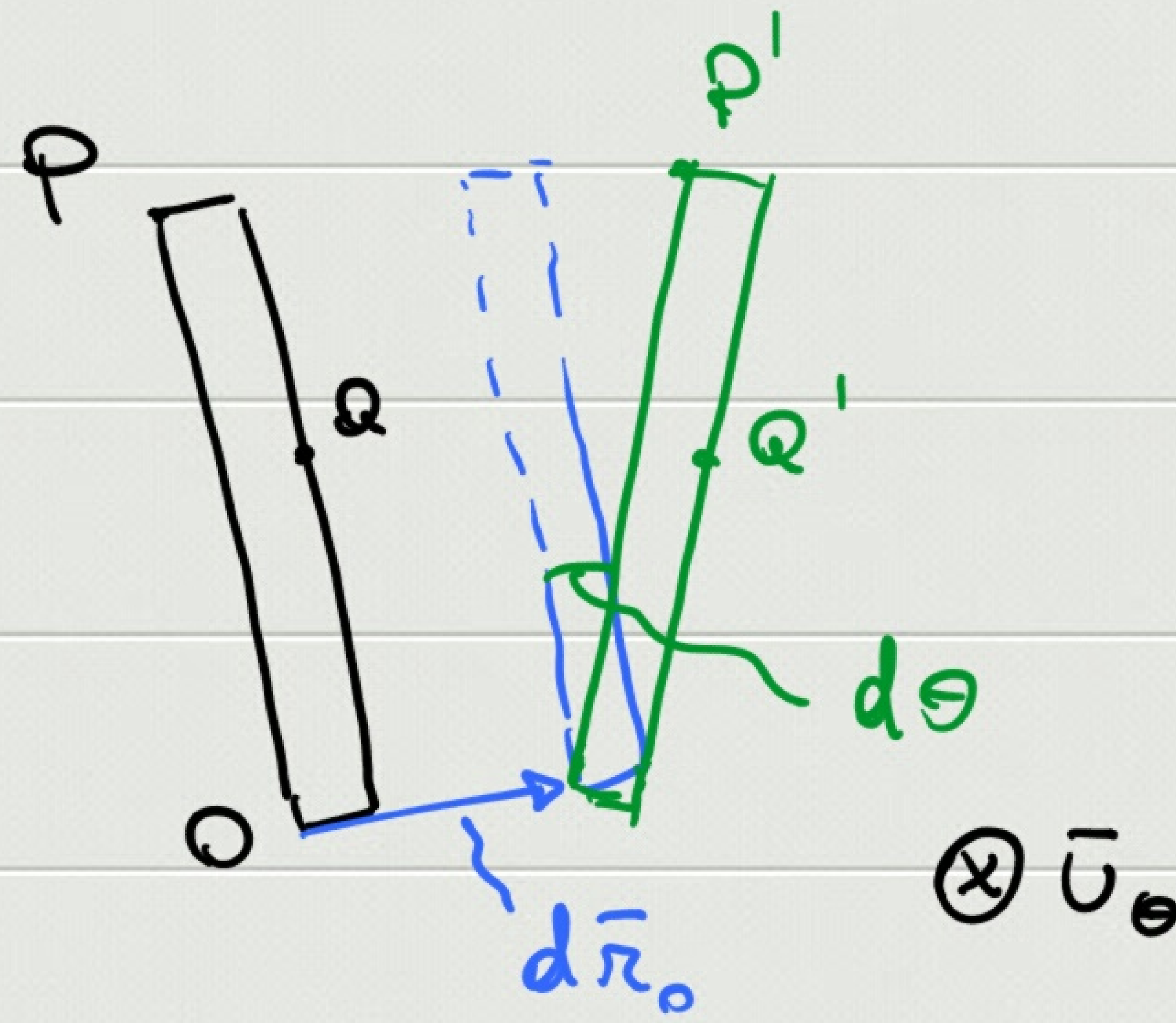
$\bar{v}'_i = 0$

Rotazione



$$\bar{v}_i = \bar{\omega} \times \bar{r}_i$$

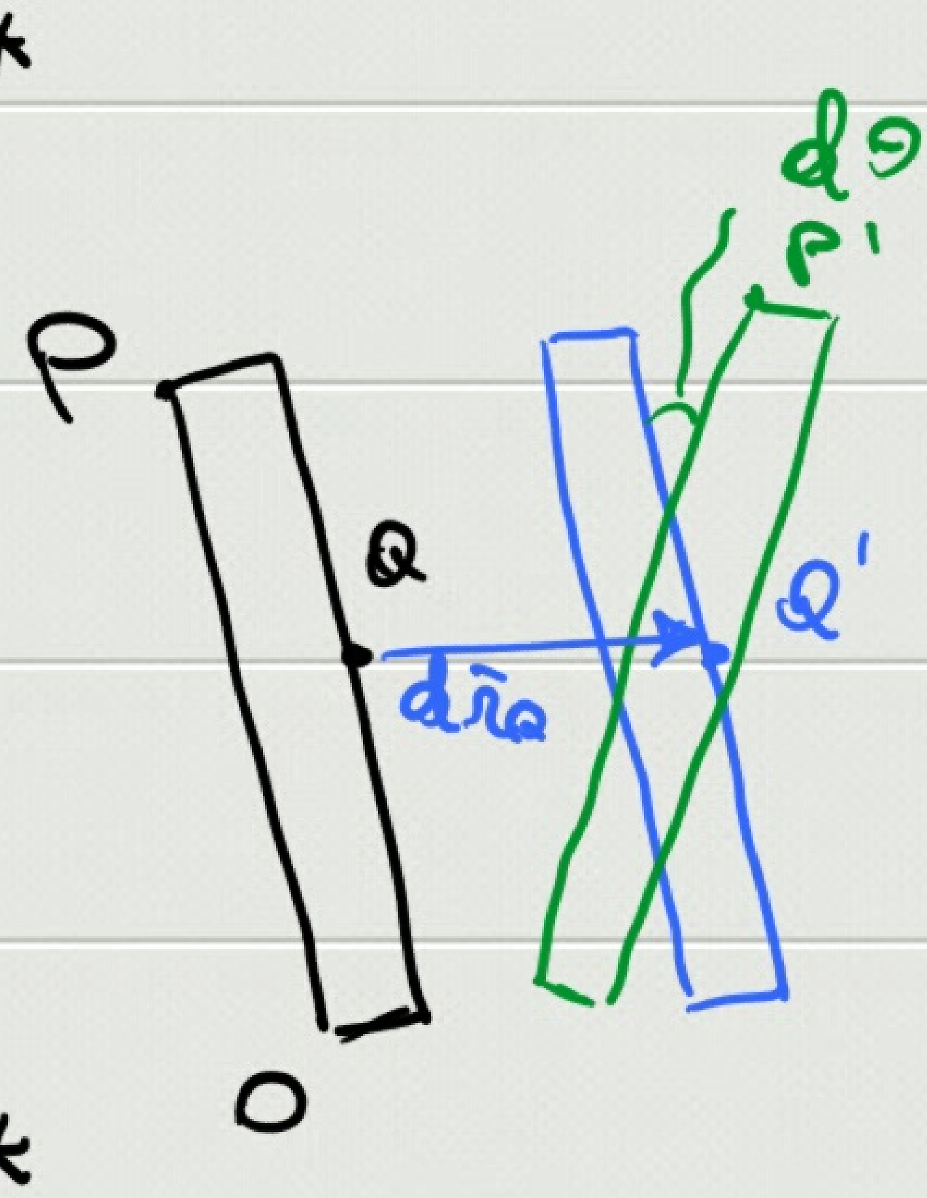
Rototraslazione



$\overrightarrow{PP'}$

$$\underbrace{d\bar{r}_P}_{\overrightarrow{PP'}} = d\bar{r}_O + d\theta\,(\bar{u}_\theta \times \overline{OP}) \quad *$$

$$d\bar{r}_Q = d\bar{r}_O + d\theta\,(\bar{u}_\theta \times \overline{OQ})$$

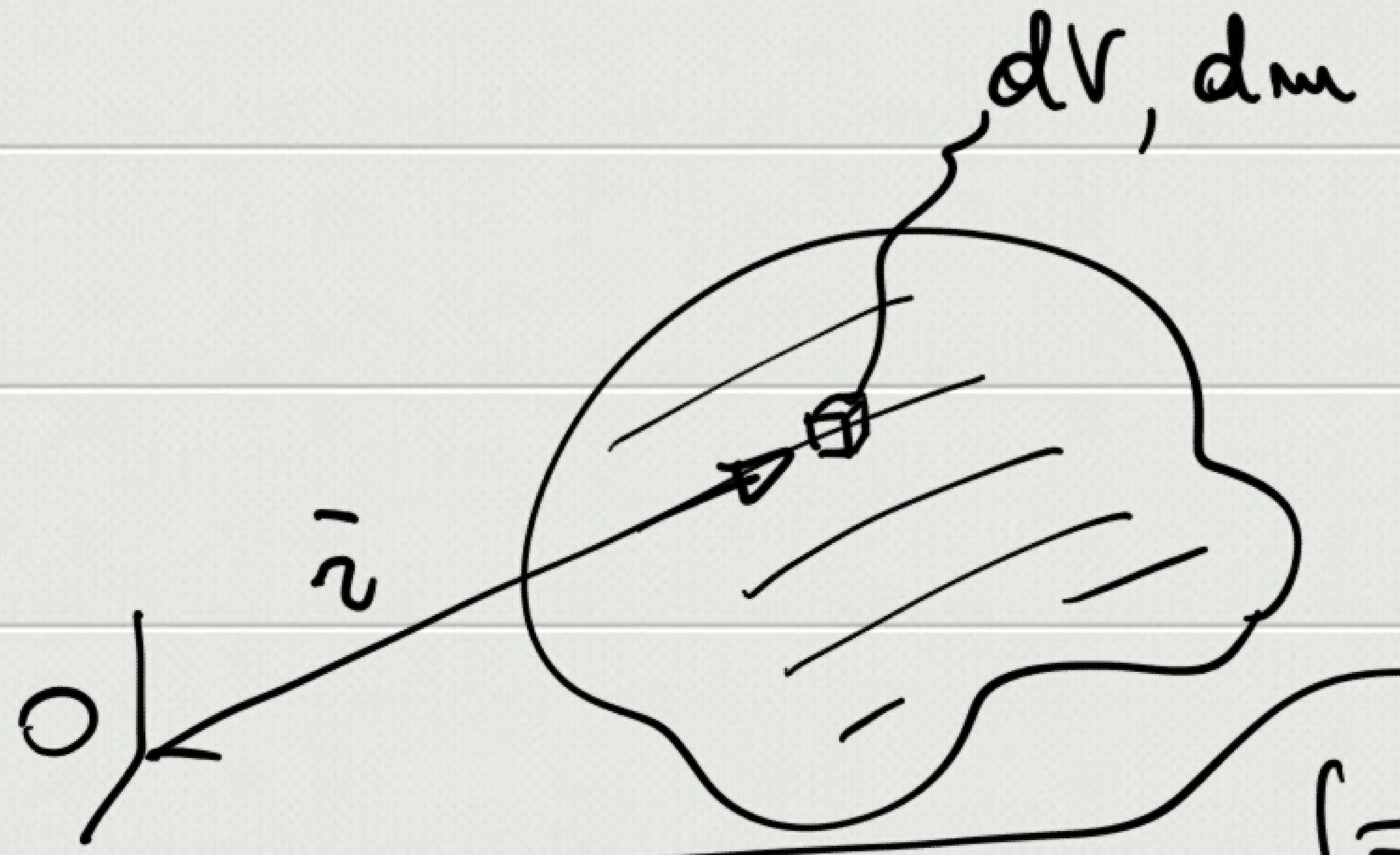


$$d\bar{r}_P - d\bar{r}_Q = d\theta\,(\bar{u}_\theta \times \overline{QP})$$

$$\Rightarrow \quad d\bar{r}_P = d\bar{r}_Q + d\theta\,(\bar{u}_\theta \times \overline{QP}) \quad *$$

$$\frac{d\bar{r}_P}{dt} = \frac{d\bar{r}_O}{dt} + \frac{d\theta}{dt}\,(\bar{u}_\theta \times \overline{OP}) \Rightarrow \underbrace{\bar{v}_P = \bar{v}_O + \bar{\omega} \times \overline{OP}}$$

Corpi continui



Centro di massa : $\boxed{\bar{r}_{cm} = \frac{\sum_i m_i \bar{r}_i}{\sum_i m_i} \rightarrow \frac{\int_{corpo} \bar{r}\, dm}{\int_{corpo} dm}}$

Densità : $\boxed{\rho = \frac{dm}{dV}}$ $\Rightarrow$ $dm = \rho\, dV$

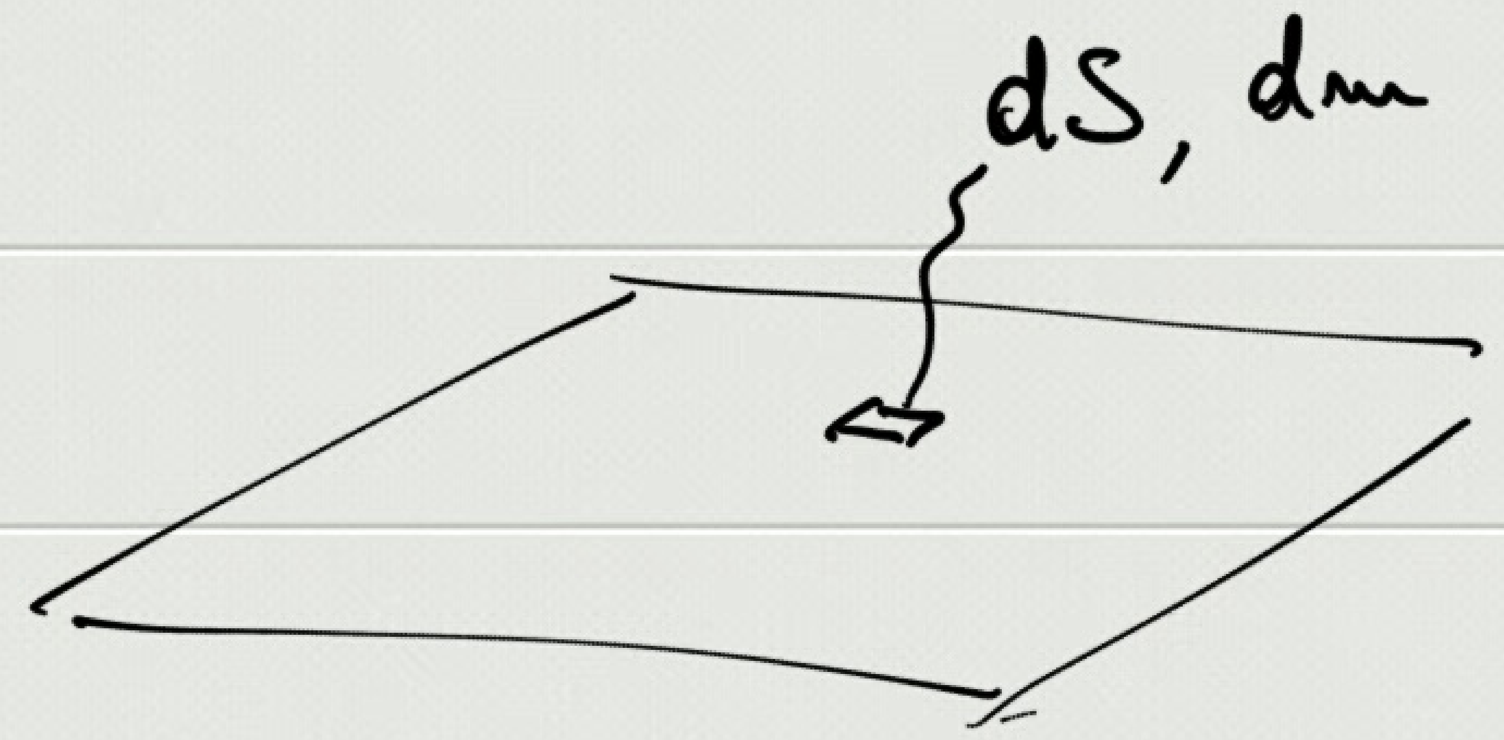
corpo omogeneo : $\rho = cost = \frac{m}{V}$

$$\Rightarrow \bar{r}_{cm} = \frac{\int_{volume} \bar{r} \rho\, dV}{\int_{corpo} dm} = \frac{1}{m} \int_{volume} \bar{r}\, \rho(\bar{r})\, dV \overset{\rho = cost}{=}$$

$$= \frac{\rho}{m} \int_{vol} \bar{r}\, dV = \frac{1}{V} \int_{vol} \bar{r}\, dV$$

$dV = dx\, dy\, dz$ $\Rightarrow \bar{r}_{cm} = \frac{1}{V} \int_{\Delta x} \int_{\Delta y} \int_{\Delta z} \bar{r}\, dx\, dy\, dz$

$[\rho] = \left[\frac{m}{V}\right] = kg/m^3$



$$\rho_S = \frac{dm}{dS}$$

$$\Rightarrow \; dm = \rho_S \, dS \quad \Rightarrow \quad m = \int dm = \int_{Sup.} \rho_S \, dS$$

$$[\rho_S] = kg/m^2$$

$$\rho_\ell = \frac{dm}{d\ell} \quad \Rightarrow \quad dm = \rho_\ell \, d\ell$$

$$\Rightarrow \; m = \int_{length} \rho_\ell \, d\ell$$

$$[\rho_\ell] = kg/m$$