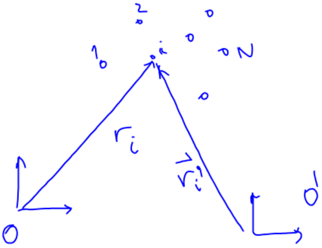
* CENTRO DE MASA → SOLIDOS RIGIDOS.

$$\vec{R}_{cm} = \frac{1}{M} \sum_{i=1}^{N} m_i \cdot \vec{r}_i \quad ; \quad M = \sum_{i=1}^{N} m_i$$



EL VALOR DE $\vec{R}_{cm}$ DEPENDE DEL SISTEMA DE REFERENCIA PERO EL CENTRO DE MASA SOLO DEPENDE DE LAS PARTICULAS.

$$\vec{R}_{cm} = \frac{1}{M}\sum m_i \vec{r}_i$$

$$x_{cm} = \frac{1}{M}\sum m_i x_i$$

$$y_{cm} = \frac{1}{M}\sum m_i y_i$$

$$z_{cm} = \frac{1}{M}\sum m_i z_i$$

CONSIDEREMOS SOLO EL x

$$X_{cm} = \frac{1}{m} \sum m_i x_i \quad / \quad \Delta = ()_{t+1} - ()_t$$

$$\Delta X_{cm} = \Delta \left(\frac{1}{m} \sum m_i x_i \right)$$

$$\Delta X_{cm} = \frac{1}{m} \sum m_i \Delta x_i \quad / \quad \frac{1}{\Delta t}, \lim_{\Delta t \to 0}$$

$$V_{x\,cm} = \frac{1}{m} \sum m_i v_{x_i}$$

$$\boxed{\vec{V}_{cm} = \frac{1}{M} \sum m_i \vec{v}_i}$$

$$\boxed{\vec{a}_{cm} = \frac{1}{M} \cdot \sum m_i \vec{a}_i}$$

$$\vec{a}_{cm} = \sum \frac{m_i \vec{a}_i}{m}$$

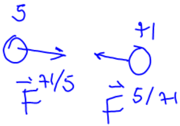
LAS LEYES DE NEWTON SE APLICAN A PARTICULAS

2° LEY.

$$m_i \vec{a}_i = \sum_{J=1}^{H} F_J^{\,i}$$

$$m_i \vec{a}_i = \sum F^{ext} + \sum F_{int}^{J/i}$$

3° LEY



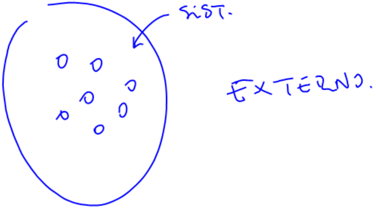
$$\vec{F}^{\,i/J} = -F^{J/i}$$

DERIVATA A LA 3° LEGGI

$$m_i \vec{a}_i = \sum F_{ext} + \sum F_{int}^{j/i}$$

$$M \cdot \vec{a}_{cm} = \sum m_i \vec{a}_i$$

$$\boxed{M \vec{a}_{cm} = \sum \vec{F}_{ext}}$$



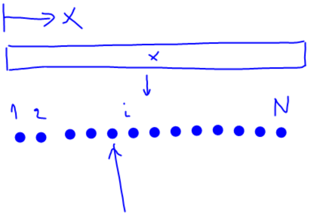
$$\boxed{M \vec{a}_{cm} = \sum \vec{F}_{ext}}$$

$$\vec{p}_i = m_i \vec{v}_i$$

$$\vec{P}_{cm} = \sum \vec{p}_i = M \cdot \vec{V}_{cm}$$

$$\sum \vec{F}_{ext} = \frac{d\vec{P}}{dt} = M \cdot \frac{d\vec{V}_{cm}}{dt} = M \vec{a}_{cm}$$

EL CONCEPTO DE C.M. SE PUEDE GENERALIZAR PARA UN SOLIDO RIGIDO (TRASLADAR + ROTAR)



BARRA UNIFORME (M)

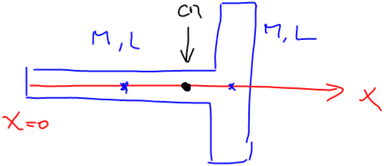
SECUENCIA DE PARTICULAS

Δm_i

$$m_i = \frac{M}{N}$$

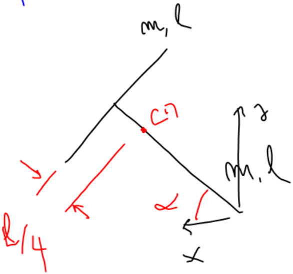
$$X_{cm} = \frac{1}{M} \sum_{i=1}^{N} m_i \cdot X_i = \frac{L}{2}$$

(Rat TEORICO)

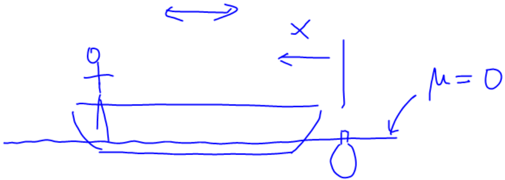


$$X_{cm} = \frac{1}{(2\cancel{M})}\cdot\left(\cancel{M}\cdot\frac{L}{2} + \cancel{M}\cdot L\right)$$

$$X_{cm} = \frac{3}{4}\cdot L$$



Ejemplo



$$\sum F_x^{ext} = F_{R/aire} + F_{R/AGUA} \simeq 0$$

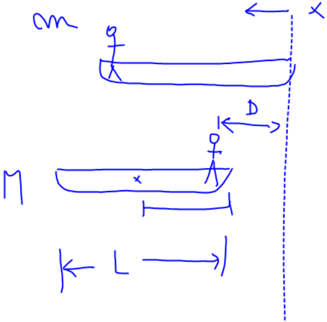
$$\rightarrow \vec{a}_{cm} = 0 \quad \forall t$$

$$\rightarrow V_{cm} = 0 \quad \forall t \left(V_{cm}(t=0) = 0 \right)$$

$$\rightarrow X_{cm} = cte = X_0 \quad \forall t$$

$$X_{cm} = cte = X_0$$

CUANTO VALE D ?



$$X_0 = \frac{1}{(m+M)} \cdot \left(+Lm + \frac{L}{2}M\right)$$

$$X_0 = \frac{+L}{m+M}\left(m + \frac{M}{2}\right)$$

$$X_f = \frac{1}{m+M} \cdot \left(D \cdot m + M\left(\frac{L}{2} + D\right)\right)$$

$$X_f = X_0 \rightarrow \boxed{D = \frac{mL}{m+M}}$$