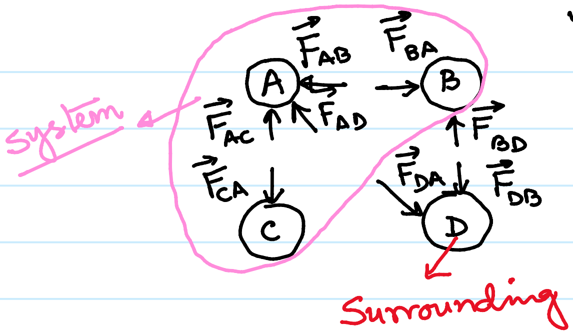
System of particles and C.M.

Thursday, October 7, 2021 9:23 PM



$\vec{F}_{BA} = -\vec{F}_{AB}$

$\vec{F}_{CA} = -\vec{F}_{AC}$

$\vec{F}_{DB} = -\vec{F}_{BD}$

$\vec{F}_{AD} = -\vec{F}_{DA}$

Internal forces: $\vec{F}_{AC}, \vec{F}_{CA}, \vec{F}_{AB}, \vec{F}_{BA}$

$\vec{F}_{AD}$ ✗ $\quad \vec{F}_{BD}$ ✗

$$\left.\begin{array}{l}\vec{F}_{BA} + \vec{F}_{AB} = 0 \\ \vec{F}_{CA} + \vec{F}_{AC} = 0\end{array}\right\} \quad \vec{F}_{BA} + \vec{F}_{AB} + \vec{F}_{CA} + \vec{F}_{AC} = 0$$

$$\boxed{\sum \vec{F}^{int} = 0}$$

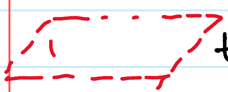
External Forces: $\vec{F}_{AD}, \vec{F}_{BD}$ are ext. forces.

$$\sum \vec{F}^{ext} = \vec{F}_{AD} + \vec{F}_{BD}$$

* Sum of all external forces acting on a system may or may not be equal to zero.

Note: The internal forces may cause motion in individual parts of the system but they can not generate a net motion in the system as a whole.

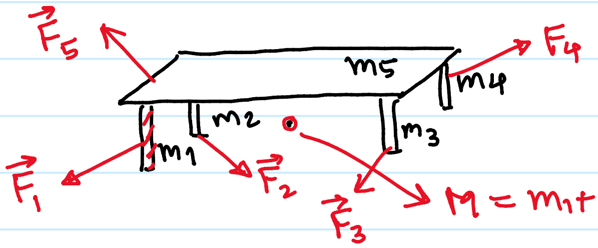
Centre of mass: The point at which whole of the mass of a body or a system is supposed to be concentrated is called its C.M.



$\vec{F} = m\vec{a}$

$a = \frac{F}{m}$

$S = ut + \frac{1}{2}at^2$



$M = m_1 + m_2 + m_3 + m_4 + m_5$

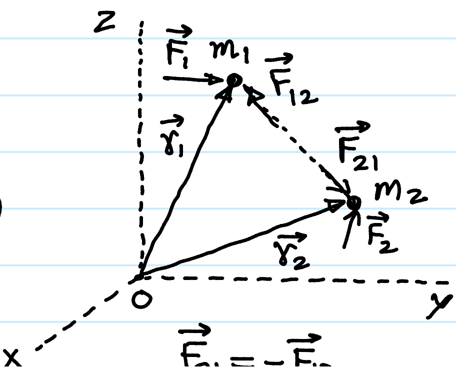
CM of a Two particle system:

$$\left.\begin{array}{l} m_1, m_2 \\ \vec{r}_1, \vec{r}_2 \end{array}\right\}$$

Position vector of CM

$$\vec{r}_{cm} = \frac{m_1\vec{r}_1 + m_2\vec{r}_2}{m_1 + m_2} \quad \text{— (1)}$$

moment



Derivation of $\vec{r}_{cm}$:

$\vec{F}_{12} = -\vec{F}_{21}$