

KINETIC ENERGY

(G2)

GENERAL PLANE MOTIONvelocity of mass centre is V_G angular velocity is ω Particle m_i has 2 components of vel

$$\vec{V}_i = \vec{V}_G + \vec{r}_i \times \vec{\omega}$$

vector addition

$$V_i = \sqrt{V_G^2 + (r_i \omega)^2 + 2V_G r_i \omega \cos \theta}$$

COSINE RULE

$$\circ \circ T_i = \frac{1}{2} m_i V_i^2$$

$$= \frac{1}{2} m_i [V_G^2 + r_i^2 \omega^2 + 2V_G r_i \omega \cos \theta]$$

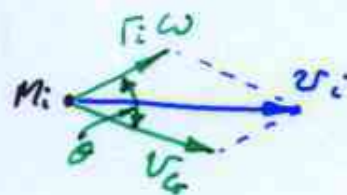
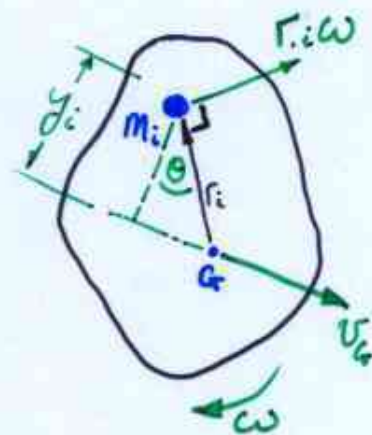
Sum/integrate; 3rd term \rightarrow zero by Defn of C. of G.

$$\Rightarrow T = \frac{1}{2} m V_G^2 + \frac{1}{2} \omega^2 \int m_i r_i^2 \quad \int r_i^2 dm$$

$$\Rightarrow T = \frac{1}{2} m V_G^2 + \frac{1}{2} I_G \omega^2$$

if you know a point that has instantaneous ~~instant~~ ^{zero} velocity, then you can also say

$$T = \frac{1}{2} I_c \omega^2$$

 I_c moment of inertia about that point θ is angle between $r_i \omega$ & V_G