

Kinematics for H.S.D

$$\bullet \vec{a}_B = \vec{a}_A + \vec{\alpha} \times \vec{r}_{B/A} - \omega^2 \vec{r}_{B/A}$$

$$\left. \begin{aligned} a_B \hat{i} &= a_A \cos \theta \hat{i} - a_A \sin \theta \hat{j} + (\alpha \hat{k}) \times (L \hat{i}) \\ &= (a_A \cos \theta) \hat{i} + (L\alpha - a_A \sin \theta) \hat{j} \end{aligned} \right\} \begin{aligned} \hat{j}: 0 &= L\alpha - a_A \sin \theta \Rightarrow a_A = \frac{L}{\sin \theta} \alpha \end{aligned}$$

$$\begin{aligned} \bullet \vec{a}_G &= \vec{a}_A + \vec{\alpha} \times \vec{r}_{G/A} - \omega^2 \vec{r}_{G/A} \\ &= a_A \cos \theta \hat{i} - a_A \sin \theta \hat{j} + (\alpha \hat{k}) \times \left(\frac{L}{2} \hat{i}\right) \\ &= (a_A \cos \theta) \hat{i} + \left(-a_A \sin \theta + \frac{\alpha L}{2}\right) \hat{j} \\ &= (L\alpha \cot \theta) \hat{i} + \left(-\alpha L + \frac{\alpha L}{2}\right) \hat{j} \end{aligned}$$

$$\therefore \begin{cases} a_{Gx} = L\alpha \cot \theta \\ a_{Gy} = -\frac{\alpha L}{2} \end{cases}$$

Substitute back into Newton eqn.