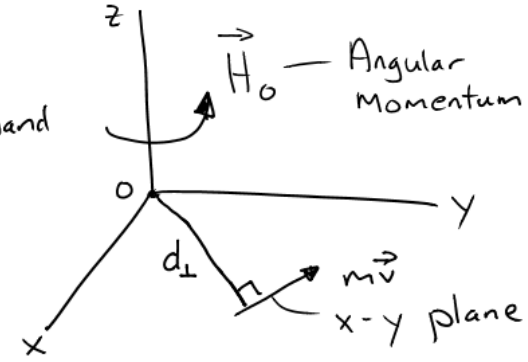
Angular Momentum

- Moment of the momentum vector

$H_o = d_\perp mv$

Direction => Right-Hand Rule



Vector Form

Cross-Product

$\vec{H}_o = \vec{r} \times m\vec{v}$

└ Cross Product

$$\vec{H}_o = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ r_x & r_y & r_z \\ mv_x & mv_y & mv_z \end{vmatrix} =$$

$$\hat{i}\left[r_y mv_z - r_z mv_y\right] - \hat{j}\left[r_x mv_z - r_z mv_x\right] + \hat{k}\left[r_x m_y - r_y mv_x\right]$$

$$\vec{H}_o = \left[r_y mv_z - r_z mv_y\right]\hat{i} - \left[r_x mv_z - r_z mv_x\right]\hat{j} + \left[r_x mv_y - r_y mv_x\right]\hat{k}$$

Angular Impulse

$$= \Sigma \int_{t_1}^{t_2} \vec{M}\, dt$$

$\vec{M}$: Moment vector

$$M = d_\perp F \qquad \vec{M} = (\vec{r} \times \vec{F})$$

$$\vec{M} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ r_x & r_y & r_z \\ F_x & F_y & F_z \end{vmatrix}$$

$$\vec{M} = [r_y F_z - r_z F_y]\hat{i} - [r_x F_z - r_z F_x]\hat{j} + [r_x F_y - r_y F_x]\hat{k}$$

Principle of Angular Impulse and Momentum

$$\vec{H}_1 + \Sigma \int_{t_1}^{t_2} \vec{M}\, dt = \vec{H}_2$$

In 2-D

$$m(v_x)_1 + \Sigma \int_{t_1}^{t_2} F_x\, dt = m(v_x)_2$$

$$m(v_y)_1 + \Sigma \int_{t_1}^{t_2} F_y\, dt = m(v_y)_2$$

$$H_1 + \Sigma \int_{t_1}^{t_2} M\, dt = H_2$$