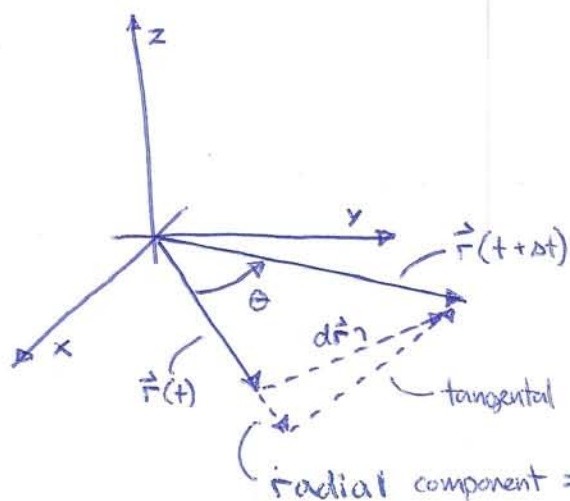


Equations of Motion (general).



$$\frac{d\theta}{dt} \Rightarrow \vec{\omega} = \dot{\theta}$$

angular velocity

$$\frac{d\vec{\omega}}{dt} \Rightarrow \vec{\alpha} = \dot{\vec{\omega}}$$

angular acceleration

$$\frac{d\vec{r}}{dt} = \lim_{\Delta t \rightarrow 0} \frac{\vec{r}(t+\Delta t) - \vec{r}(t)}{\Delta t} = \vec{\dot{r}} + \vec{\omega} \times \vec{r} = \vec{v}$$

$$\frac{d\vec{v}}{dt} = \vec{\dot{v}} + \vec{\omega} \times \vec{v}$$

$$= \frac{d}{dt}(\vec{\dot{r}} + \vec{\omega} \times \vec{r}) + \vec{\omega} \times (\vec{\dot{r}} + \vec{\omega} \times \vec{r})$$

$$= [\vec{\ddot{r}} + \vec{\alpha} \times \vec{r} + \vec{\omega} \times \vec{v}] + [\vec{\omega} \times \vec{v} + \vec{\omega} \times \vec{\omega} \times \vec{r}]$$

$$= [\vec{\ddot{r}} + \vec{\omega} \times \vec{\omega} \times \vec{r}] \hat{r} + [\vec{\alpha} \times \vec{r} + 2\vec{\omega} \times \vec{v}] \hat{\theta}$$

radial

centripetal

tangential

Coriolis