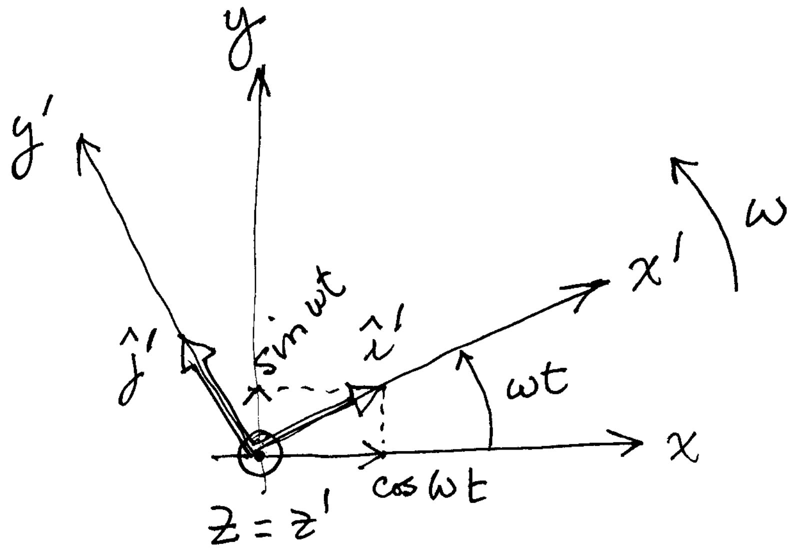


Define $\vec{\omega} = \omega \hat{k}$

$$\hat{i}' = \hat{i}\cos\omega t + \hat{j}\sin\omega t$$

$$\dot{\hat{i}}' = -\hat{i}\,\omega\sin\omega t + \hat{j}\,\omega\cos\omega t$$

Compare with

$$\vec{\omega} \times \hat{i}' = \omega\hat{k}\times\hat{i}' = \omega\hat{j}'$$

$$-\hat{i}\sin\omega t + \hat{j}\cos\omega t$$

$$\therefore \quad \dot{\hat{i}}' = \vec{\omega}\times\hat{i}'$$

$$\dot{\hat{j}}' = \vec{\omega}\times\hat{j}'$$

Consider a generic vector $\vec{u}$. In the rotating frame

$$\vec{u} = u'_x \hat{i}' + u'_y \hat{j}'$$

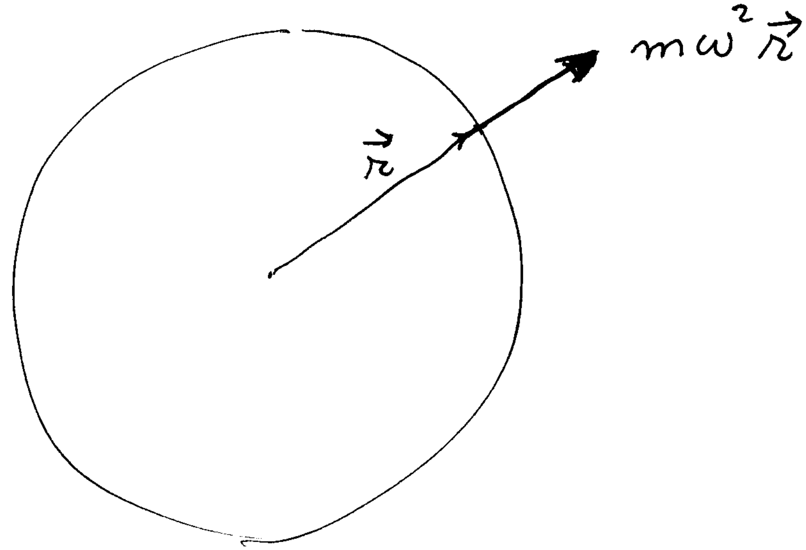
$$\dot{\vec{u}} = \underbrace{\dot{u}'_x \hat{i}' + \dot{u}'_y \hat{j}'}_{= \left(\frac{d\vec{u}}{dt}\right)_{rot}} + \underbrace{u'_x \dot{\hat{i}}' + u'_y \dot{\hat{j}}'}_{\vec{\omega} \times \big(\underbrace{u'_x \hat{i}' + u'_y \hat{j}'}_{\vec{u}} \big)}$$

$$\dot{u}_x \hat{i} + \dot{u}_y \hat{j} = \left(\frac{d\vec{u}}{dt}\right)_{in}$$

$$\boxed{\left(\frac{d\vec{u}}{dt}\right)_{in} = \left(\frac{d\vec{u}}{dt}\right)_{rot} + \vec{\omega} \times \vec{u}}$$

$$m\vec{a}_{rot} = \vec{F} \underbrace{- 2m\vec{\omega}\times\vec{v}_{rot}}_{\text{Coriolis force}} \underbrace{- m\vec{\omega}\times(\vec{\omega}\times\vec{r})}_{\text{Centrifugal force}}$$

If $\vec{v}_{rot} = 0$,



F. ex. set $\vec{u} = \vec{r}$

$$\vec{v}_{in} = \vec{v}_{rot} + \vec{\omega} \times \vec{r}$$

Now set $\vec{u} = \vec{v}_{in}$

$$\left(\frac{d\vec{v}_{in}}{dt}\right)_{in} = \left(\frac{d\vec{v}_{in}}{dt}\right)_{rot} + \vec{\omega} \times \vec{v}_{in}$$

$$\left(\frac{d\vec{v}_{in}}{dt}\right)_{in} = \left(\frac{d\vec{v}_{rot}}{dt}\right)_{rot} + \vec{\omega} \times \left(\frac{d\vec{r}}{dt}\right)_{rot} + \vec{\omega} \times \vec{v}_{rot} + \vec{\omega} \times (\vec{\omega} \times \vec{r})$$

$$\vec{a}_{in} = \vec{a}_{rot} + 2\vec{\omega} \times \vec{v}_{rot} + \underbrace{\vec{\omega} \times (\vec{\omega} \times \vec{r})}_{-\omega^2 \vec{r}}$$

$$\underbrace{m\vec{a}_{in}}_{\vec{F}} = m\vec{a}_{rot} + \ldots$$

$\vec{F}$ (gravity, Coulomb, etc.)

ROTATING PLATFORM