Rotating frame

$$m\vec{a}_s = \vec{F} + m\vec{r}\times\dot{\vec{\Omega}} + 2m\vec{v}_s\times\vec{\Omega} + \underbrace{m(\vec{\Omega}\times\vec{r})\times\vec{\Omega}}_{\vec{F}_{cf}}$$

$2m\vec{v}_s\times\vec{\Omega} = \vec{F}_{cor}$ Coriolis term

$\vec{F}_{cf}$ centrifugal force

Could add an accelerating frame $-m\vec{a}_{s0}$

$$\boxed{m\vec{a}_s = \vec{F} + m\vec{r}\times\dot{\vec{\Omega}} + \vec{F}_{cor} + \vec{F}_{cf} - m\vec{a}_{s0}}$$

Free fall acceleration

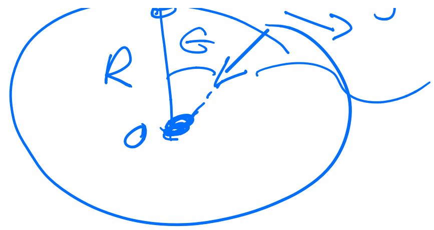
$$m\vec{r}\times\dot{\vec{\Omega}} = 0$$

$$F_{cor}/F_{cf} \ll 1$$

$$m\vec{a}_s = \vec{F} + \vec{F}_{cf}$$

$$\vec{F} = \vec{F}_{grav} = -\frac{GM_E m}{R^2}\hat{r} = \underline{m\vec{g}_0}$$

$\hat{r}$ = unit vector that points out

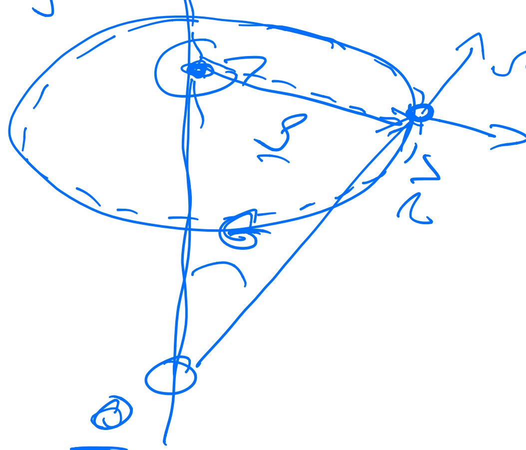


$\vec{F}_{grav}$ from O (center of Earth)

$$m\vec{a}_s = m\vec{g}_0 + m(\vec{\Omega}\times\vec{r})\times\vec{r}$$
$$= m\vec{g}_{eff}$$

$$\underline{\vec{g}_{eff} = \vec{g}_0 + (\vec{\Omega}\times\vec{r})\times\vec{r}}$$

$$\vec{F}_{cf} = m(\vec{\Omega}\times\vec{r})\times\vec{\Omega}$$



$\vec{F}_{cf}$ points radially outward,

Magnitude is given by

$$\Omega^2 r \sin G = \Omega^2 \rho$$

$$\vec{F}_{cf} = \boxed{m\Omega^2\rho}\,\hat{\rho}$$

$$v = \Omega\rho \Rightarrow$$

magnitude of $F_{cf} = mv^2/\rho$

Free fall object without Coriolis

$$\vec{g}_{eff} = \vec{g}_0 + \Omega^2 R \sin\theta \, \hat{\rho}$$

<u>Just Coriolis force</u>

$$F_{cor} = 2m\vec{v}_s \times \vec{\Omega}$$