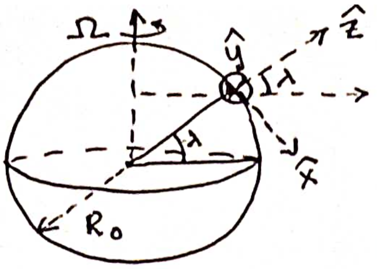
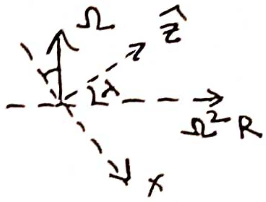


$\Omega^2 R_0 \cos\lambda$ (centrifugal)

$\hat{y}$ axis is vertically inward into the page (Eastward)

$(\hat{x}, \hat{y}, \hat{z})$ forms a right handed cartesian system.

Estimates



$\bar{\Omega} = -\cos\lambda\,\hat{i} + \sin\lambda\,\hat{k}$

$\Omega^2 R$ (centrifugal)

$\Omega = 7.3 \times 10^{-5}$ rad/s

$R_0 \simeq 10^7$ m , $R = R_0 \cos\lambda$

$\Omega^2 R_0 \simeq 54 \times 10^{-10} \times 10^7$ m/s²

$\frac{\Omega^2 R_0}{g} \simeq \frac{0.05}{10} \equiv 0.5\%$

$$\bar{a}_{rel} = \bar{a}_{in} + 2\bar{v}_{rel} \times \bar{\Omega} - \bar{\Omega} \times (\bar{\Omega} \times \bar{R}) \longrightarrow \bar{\Omega} \times (\bar{\Omega} \times \bar{R})$$

$$\parallel$$

$$\Omega^2 R(\sin\lambda\,\hat{i} + \cos\lambda\,\hat{k})$$

$$= -g\hat{z} + \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ v_x & v_y & v_z \\ -\cos\lambda & 0 & \sin\lambda \end{vmatrix} 2\Omega + \Omega^2 R_0 \cos\lambda \begin{pmatrix} \sin\lambda \\ 0 \\ \cos\lambda \end{pmatrix}$$

v_z will turn out to negligible

1. $\ddot{x} = 2\Omega v_y \sin\lambda + \Omega^2 R_0 \cos\lambda \sin\lambda$.
2. $\ddot{y} = (-v_x \sin\lambda - v_z \cos\lambda) 2\Omega$
3. $\ddot{z} = -g + v_y \cos\lambda . 2\Omega + \Omega^2 R_0 \cos^2\lambda$.

Diff terms are diff order in Ω. Can ignore Ω^2 terms right at the beginning.

lowest order soln. $\ddot{z} \simeq -g \Rightarrow \dot{z} = -gt + v_z(0) \Rightarrow z = -\frac{gt^2}{2} + v_z(0)t + z(0)$

$v_z(0)$: Initial vel. along z

$z(0)$: Initial postn along z

$\ddot{x}$ is max $\mathcal{O}(\Omega)$;

if we substitute v_x in $\ddot{y}$ eqn then 1st term is of $\mathcal{O}(\Omega^2)$, ignore.

2. $\ddot{y} \simeq -2\Omega v_z \cos\lambda = -2\Omega\cos\lambda(-gt + v_z(0))$

$= 2\Omega\cos\lambda gt - \underbrace{2\Omega\cos\lambda v_z(0)}_{\text{const.}}$

$\dot{y} = \Omega\cos\lambda\, gt^2 - 2\Omega\cos\lambda\, v_0 t + \dot{y}(0)$ (case b)

$y = \Omega\cos\lambda\, g\frac{t^3}{3} - \cancel{2}\Omega\cos\lambda\, v_0 t^2$

$\simeq \Omega\cos\lambda\, t^2\left(\frac{gt}{3} - v_0\right)$, $t \simeq \sqrt{\frac{2H}{g}} \simeq 10\text{-}20$ se

cases a) $v_z(0) = 0$ when dropped from ht H.

b) projected vertically from ground $v_z(0) = v_0$

But, $y(0) = 0$, $\dot{y}(0) = 0$ In Both cases..

$T1 = v_0/g$
$T2 = 2v_0/g$

Net Displacement
for T1 : East
for T2 : West

So depending v_0, H dir ~~contd~~ displacement can be towards east or west.

But if case (a) $v_z(0) = v_0 = 0$ displacement always East.