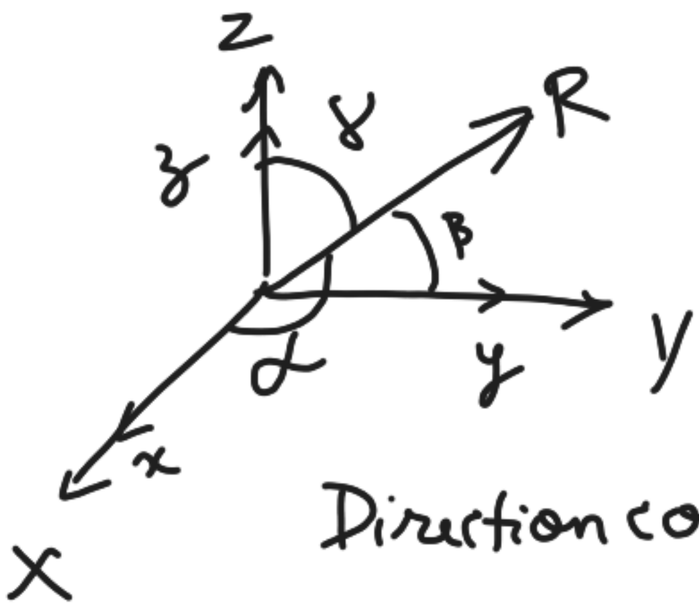


$$\hat{R} = \frac{R}{r} \qquad r = \sqrt{x^2+y^2+z^2}$$

$$R = xi + yj + zk$$

$$\hat{R} = li + mj + nk \qquad |\hat{R}| = l^2+m^2+n^2 = 1$$

Direction cosines $\rightarrow l = \cos\alpha,\ m = \cos\beta,\ n = \cos\gamma$

$$\hat{R} = \frac{x}{r}i + \frac{y}{r}j + \frac{z}{r}k \Rightarrow l = \frac{x}{r},\ m = \frac{y}{r},\ n = \frac{z}{r}$$

$$\Rightarrow \alpha = \cos^{-1}\left(\frac{x}{r}\right),\ \beta = \cos^{-1}\left(\frac{y}{r}\right),\ \gamma = \cos^{-1}\left(\frac{z}{r}\right)$$

Max acceleration, that can be measured, 4g

$$\Rightarrow 4g = 32768 \Rightarrow 1g = 8192$$

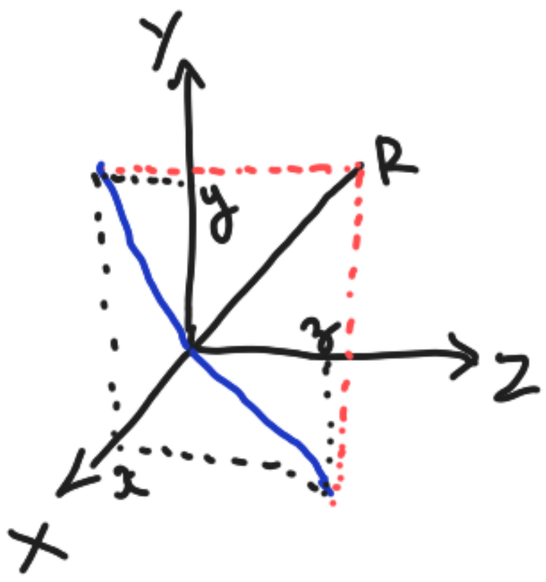
$\pi - 180^\circ$ $\qquad X = \frac{x_{rad} \times 180^\circ}{\pi} = x_{rad} \times 57.2956$

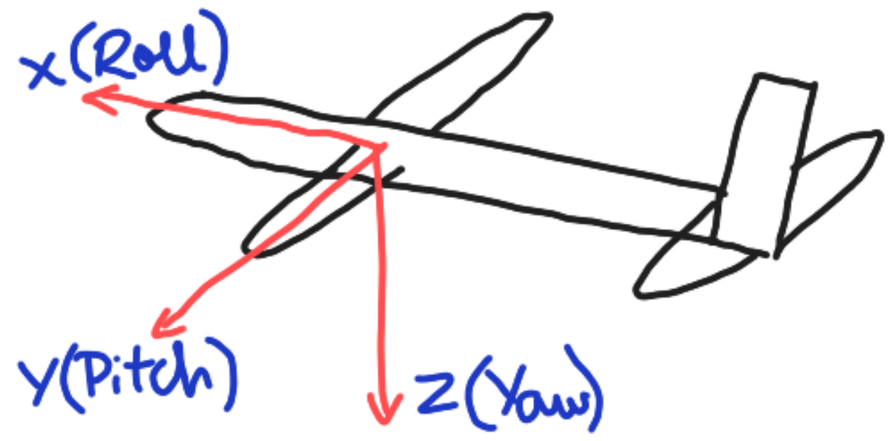
$x_{rad} - ?$

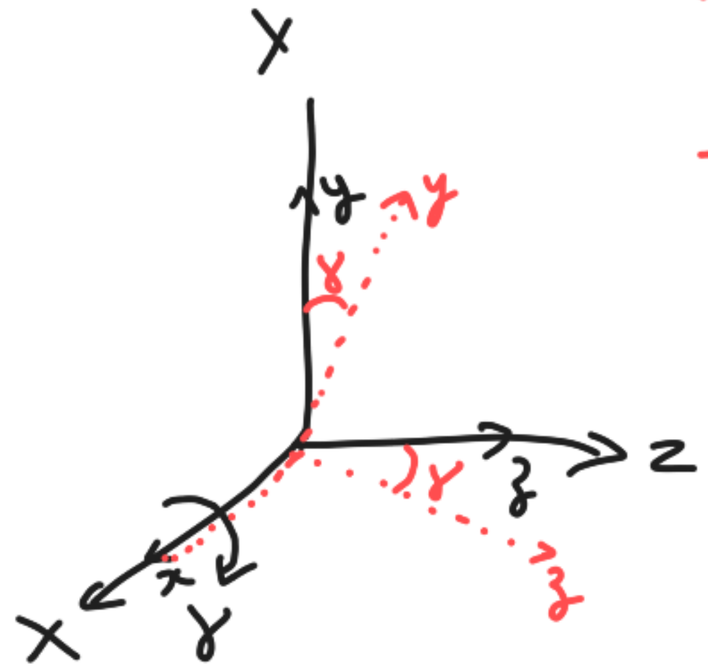
Yaw, Pitch & roll calculations:

↓ ↓ ↓

Z Y X







$$\text{Roll}(\gamma) = \tan^{-1}\left(\frac{x}{\sqrt{y^2+z^2}}\right)$$

$$\text{Pitch}(\beta) = \tan^{-1}\left(\frac{y}{\sqrt{x^2+z^2}}\right)$$

$$\text{Yaw}(\alpha) = \tan^{-1}\left(\frac{z}{\sqrt{x^2+y^2}}\right)$$

Gyroscope measurements: $250\ deg/s = 32768 = \frac{d\theta}{dt}$

$$\theta = \int \frac{d\theta}{dt}\,dt \qquad 1\ deg/s = 131.072$$

$$\Rightarrow \frac{num \times 250}{32768} = num \times 0.00763\ deg/s$$

Integrating it for 4ms time interval:

$$\theta = \int num \times 0.00763\,dt \Rightarrow \theta = \theta + num \times 0.00763 \times 4 \times 10^{-3}$$

$$\Rightarrow \theta = \theta + num \times 0.000031$$