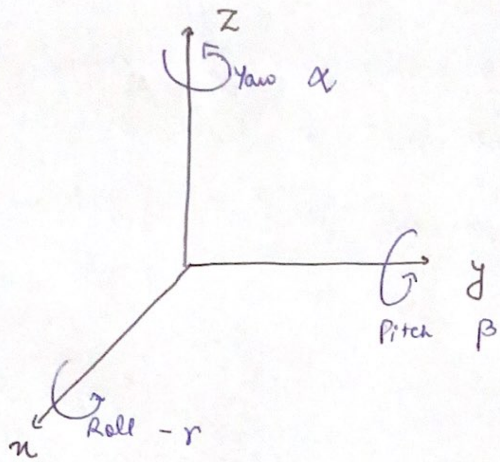
Yaw, Roll, Pitch



$$R_z(\alpha) = \begin{bmatrix} \cos\alpha & -\sin\alpha & 0 \\ \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$R_y(\beta) = \begin{bmatrix} \cos\beta & 0 & \sin\beta \\ 0 & 1 & 0 \\ -\sin\beta & 0 & \cos\beta \end{bmatrix}$$

$$R_x(\gamma) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\gamma & -\sin\gamma \\ 0 & \sin\gamma & \cos\gamma \end{bmatrix}$$

$$R(\alpha,\beta,\gamma) = R(\alpha)\cdot R(\beta)\cdot R(\gamma) =$$

$$\begin{bmatrix} \cos\alpha\cos\beta & \cos\alpha\sin\beta\sin\gamma - \sin\alpha\cos\gamma & \cos\alpha\sin\beta\cos\gamma + \sin\alpha\sin\gamma \\ \sin\alpha\cos\beta & \sin\alpha\sin\beta\sin\gamma + \cos\alpha\cos\gamma & \sin\alpha\sin\beta\cos\gamma - \cos\alpha\sin\gamma \\ -\sin\beta & \cos\beta\sin\gamma & \cos\beta\cos\gamma \end{bmatrix}$$

For an arbitrary matrix such as ;

$$\begin{bmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ r_{31} & r_{32} & r_{33} \end{bmatrix}$$

Solving for each angle yields :

$$\alpha = \tan^{-1}(r_{21}/r_{11}) \qquad \gamma = \tan^{-1}(r_{32}/r_{33})$$

$$\beta = \tan^{-1}\left(-r_{31}\Big/\sqrt{r_{32}^2 + r_{33}^2}\right)$$

Since , it will all lie b/w $[0, 2\pi]$ bc of arctangents :

$$\alpha = 2(r_{21}, r_{11})$$

$$\beta = 2\left(-r_{31}, \sqrt{r_{32}^2 + r_{33}^2}\right)$$

$$\gamma = 2(r_{32}, r_{33})$$