

Attitude estimation from an ideal accelerometer

Suppose our IMU/Accelerometer in Fig. 1 is only rotating (negligible accelerations). Then, we may

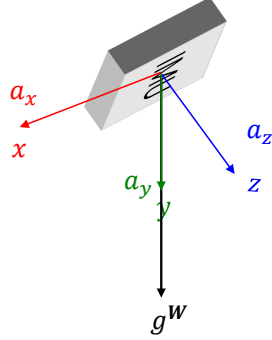


Figure 1: IMU acceleration measurements

estimate its attitude in Euler angles $[\phi \ \theta \ \psi]^T$ using the measured accelerations $[a_x \ a_y \ a_z]^T$ by recognizing that the gravity vector points down.

$$\phi = \tan^{-1} \left(\frac{a_y}{\sqrt{a_x^2 + a_z^2}} \right) \quad (1)$$

$$\theta = \tan^{-1} \left(\frac{a_x}{\sqrt{a_y^2 + a_z^2}} \right) \quad (2)$$

$$\psi = \tan^{-1} \left(\frac{\sqrt{a_x^2 + a_y^2}}{a_z} \right), \quad (3)$$

where (3) is not as robust an estimate as the other two.