Altitude Kinematics

$$\dot{q} = \frac{1}{2} \Omega \overbrace{q}^{\text{Quaternion}}$$

where $\Omega = \begin{bmatrix} 0 & -\omega_x & -\omega_y & -\omega_z \\ \omega_x & 0 & \omega_z & -\omega_y \\ \omega_y & -\omega_z & 0 & \omega_x \\ \omega_z & \omega_y & -\omega_x & 0 \end{bmatrix}$

$$\bar{\omega}_{b/v}^{\,b} = \begin{bmatrix} p \\ q \\ r \end{bmatrix} = \begin{bmatrix} \omega_x \\ \omega_y \\ \omega_z \end{bmatrix} \begin{array}{l} \rightarrow \text{roll rate} \\ \rightarrow \text{pitch rate} \\ \rightarrow \text{yaw rate} \end{array}$$

Implementation in Simulink

$$\overline{w}_{b/v}^{\,b} = \begin{bmatrix} w_x \\ w_y \\ w_z \end{bmatrix}$$

from state gyros → Form Ω Matrix → Ω (4×4) → Matrix Multiplication → $\frac{1}{2}$ → $\dot{q}$ → $\frac{1}{s}$ Integrator → q → quat2angle and rearrange → $\begin{bmatrix} \phi \\ \theta \\ \psi \end{bmatrix}$ ↓ Euler angles