

Equation of Motions already included

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These are the equations already included the 6DOF model.

$$C_{b/n} = \begin{bmatrix} \cos(\theta)\cos(\psi) & \cos(\theta)\sin(\psi) & -\sin(\theta) \\ -\cos(\phi)\sin(\psi) + \sin(\phi)\sin(\theta)\cos(\psi) & \cos(\phi)\cos(\psi) + \sin(\phi)\sin(\theta)\sin(\psi) & \sin(\phi)\cos(\theta) \\ \sin(\phi)\sin(\psi) + \cos(\phi)\sin(\theta)\cos(\psi) & -\sin(\phi)\cos(\psi) + \cos(\phi)\sin(\theta)\sin(\psi) & \cos(\phi)\cos(\theta) \end{bmatrix}$$

Also represented as: $C_{b/n} = fn(\Theta)$

$$\Omega = \begin{bmatrix} 0 & -R & Q \\ R & 0 & -P \\ -Q & P & 0 \end{bmatrix}$$

$$\begin{bmatrix} \dot{\phi} \\ \dot{\theta} \\ \dot{\psi} \end{bmatrix} = \begin{bmatrix} 1 & \tan(\theta)\sin(\phi) & \tan(\theta)\cos(\phi) \\ 0 & \cos(\phi) & -\sin(\phi) \\ 0 & \sin(\phi)/\cos(\theta) & \cos(\phi)/\cos(\theta) \end{bmatrix} \times \begin{bmatrix} P \\ Q \\ R \end{bmatrix}$$

Also represented as: $\dot{\Phi} = H(\Phi)\omega_{b/e}^b$

$${}^b\dot{v}_{CM/e}^b = \left(\frac{1}{m}\right)F_{A,T}^b + C_{b/n} \times g + \Omega_{b/e}^b \times v_{CM/e}^b$$

$${}^e\dot{p}_{CM/T}^n = C_{n/b} \times v_{CM/e}^b$$

$${}^b\dot{\omega}_{b/e}^b = inv(J^b) \times [M_{A,T}^b - \Omega_{b/e}^b \times J^b \times \omega_{b/e}^b]$$

These are the equations in the force-moment model.

$$\alpha = \tan^{-1}(w/u)$$

$$Q = 0.5 \times \rho \times \|V\|^2$$

$$C_L = C_{L0} + C_{L\alpha} \times \alpha + \left(\frac{C_{Lq} \times q \times c_{bar}}{2 \times \|V\|}\right) + C_{Lde} \times \delta_e$$

$$C_m = C_{m0} + C_{m\alpha} \times \alpha + \left(\frac{C_{mq} \times q \times c_{bar}}{(2 \times \|V\|)}\right) + C_{mde} \times \delta_e$$

$$C_D = C_{D0} + K_{drag} \times C_L^2$$

$$L = C_L \times s \times Q$$

$$D = C_D \times s \times Q$$

$$Force = \begin{bmatrix} -D \times \cos(\alpha) + L \times \sin(\alpha) + thrust - mg \times \sin(\theta) \\ 0 \\ -D \times \sin(\alpha) - L \times \cos(\alpha) + mg \times \cos(\theta) \end{bmatrix}$$

$$Moment = \begin{bmatrix} 0 \\ C_m \times s \times c_{bar} \times Q \\ 0 \end{bmatrix}$$