

# 1 Equations of Motion

## 1.1 Translation

$$m\ddot{\mathbf{x}} = \mathbf{g} + \mathbf{F} + \mathbf{F}_D$$

$$\mathbf{g} = -mg\mathbf{k}$$

$$\mathbf{F} = \mathbf{R}\mathbf{F}_B$$

$$\mathbf{F}_B = k\mathbf{u}_2 \sum \gamma$$

## 1.2 Rotation

$$I\dot{\omega} + \omega \times (I\omega) = \tau$$

$$I = \begin{bmatrix} I_{xx} & 0 & 0 \\ 0 & I_{yy} & 0 \\ 0 & 0 & I_{zz} \end{bmatrix}$$

$$\tau_B = \begin{bmatrix} Lk(\gamma_1 - \gamma_3) \\ Lk(\gamma_2 - \gamma_4) \\ b(\gamma_1 - \gamma_2 + \gamma_3 - \gamma_4) \end{bmatrix}$$

# 2 Control

## 2.1 Position

$$\mathbf{e} = \mathbf{x}_{ref} - \mathbf{x}$$

$$\mathbf{F} = m\mathbf{a} = m(\mathbf{K}_p\mathbf{e} + \mathbf{K}_d\dot{\mathbf{e}})$$