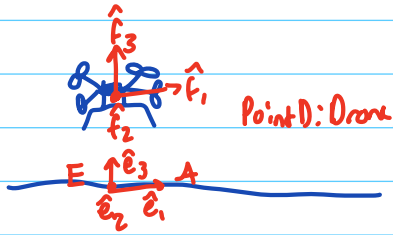
Drone Dynamics

Initial Calculations: Vertical Thrust (10/15/25)

Assumptions:

1. Inertial Frame exists at Earth
2. Drone is a point mass and loses no mass
3. Only forces acting are gravity and thrust



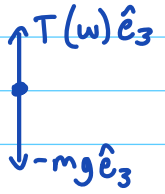
Point D: Drone, frame B

Point E: Earth, inertial frame A

$\hat{e}_3 = \hat{f}_3$

$$\vec{r}_{D/E} = p_1\hat{e}_1 + p_2\hat{e}_2 + p_3\hat{e}_3 \; ; \; {}^{A}\vec{v}_{D/E} = p_4\hat{e}_1 + p_5\hat{e}_2 + p_6\hat{e}_3$$

FBD:



$T(w)$ is a function of input w.

$$\Sigma F = (T(w) - mg)\hat{e}_3$$

$$\Sigma M = 0$$

EOM Calculations:

$$\dot{r} = \vec{v} = p_4\hat{e}_1 + p_5\hat{e}_2 + p_6\hat{e}_3$$

$$\dot{v} = \vec{a}_{D/E} = \frac{F}{m} \Rightarrow m\dot{v} = (T(w) - mg)\hat{e}_3 \; ; \; {}^{A}\vec{a}_{D/E} = \dot{v} = \frac{T(w)}{m} - g$$