$$\dot{w}_m = \overbrace{\boxed{-\frac{1}{J_{eff}}\left(\frac{k^2}{R}+b\right)}}^{\theta_1\ (>0)} w_m + \overbrace{\boxed{\frac{k V_m}{J_{eff} R}}}^{\theta_2}\alpha$$

$$\dot{w}_z = \underbrace{\boxed{\frac{C_w'}{J}}}_{\theta_3}\frac{L}{2}\delta\cos\delta\cdot V_x + \underbrace{\boxed{\frac{C_w'}{J}}}_{\theta_3}\frac{L}{2}(1-\cos\delta)\cdot V_y - \frac{L^2}{2}\left(\frac{1}{2}\underbrace{\boxed{\frac{C_w'}{J}}}_{\theta_3\ (>0)}(1+\cos\delta)+\underbrace{\boxed{\frac{C_w}{J}}}_{\theta_4\ (>0)}\right)w_z$$
$$+ \frac{R_w L}{2 r_g}\underbrace{\boxed{\frac{C_w}{J}}}_{\theta_4}\sin\delta\cdot w_m$$

$$\dot{V}_x = -\left(2\overbrace{\boxed{\frac{C_w}{m}}}^{\theta_5}+\overbrace{\boxed{\frac{C_w'}{m}}}^{\theta_6}\delta\sin\delta\right)V_x + \overbrace{\boxed{\frac{C_w'}{m}}}^{\theta_6}\sin\delta\cdot V_y + \frac{L}{2}\overbrace{\boxed{\frac{C_w'}{m}}}^{\theta_6}\sin\delta\cdot w_z + w_z V_y$$
$$+ \underbrace{\boxed{\frac{C_w}{m}}}_{\theta_5}\frac{R_w}{r_g}(1+\cos\delta)\, w_m$$

$$\dot{V}_y = \overbrace{\boxed{\frac{C_w'}{m}}}^{\theta_6}\delta\cos\delta\, V_x - \overbrace{\boxed{\frac{C_w'}{m}}}^{\theta_6\ (>0)}(1+\cos\delta)\, V_y + \frac{L}{2}\left[\overbrace{\boxed{\frac{C_w'}{m}}}^{\theta_6}(1-\cos\delta)-2\overbrace{\boxed{\frac{C_w}{m}}}^{\theta_5\ (>0)}\right]w_z - w_z V_x$$
$$+ \underbrace{\boxed{\frac{C_w}{m}}}_{\theta_5}\frac{R_w}{r_g}\sin\delta\, w_m$$

$$\left.\begin{matrix} \frac{C_w'}{J} = \theta_3 & \frac{C_w}{J} = \theta_4 \\ \frac{C_w}{m} = \theta_5 & \frac{C_w'}{m} = \theta_6 \end{matrix}\right\} \Rightarrow \frac{m}{J} = \frac{\theta_4}{\theta_5} = \frac{\theta_3}{\theta_6}$$

Constrain: $\theta_1, \theta_3, \theta_4, \theta_5, \theta_6 > 0$ (stability)

$$\theta_6 = \frac{\theta_3\theta_5}{\theta_4}$$

(lack 1 freedom)

$m = 2.7$

Results:

$C_w = 1880.5$

$C_w' = 1000$

$\theta_1 = 4.5355$ $\quad\theta_4 = 85.018$

$\theta_2 = 12985$ $\quad\theta_5 = 696.47$ $\quad J = 22.1185$

$\theta_3 = 141.17$ $\quad\theta_6 = 370.3704$

$J_{eff} = 5.6247e-6$ (from θ_1) ✓

$5.3088e-6$ (from θ_2)