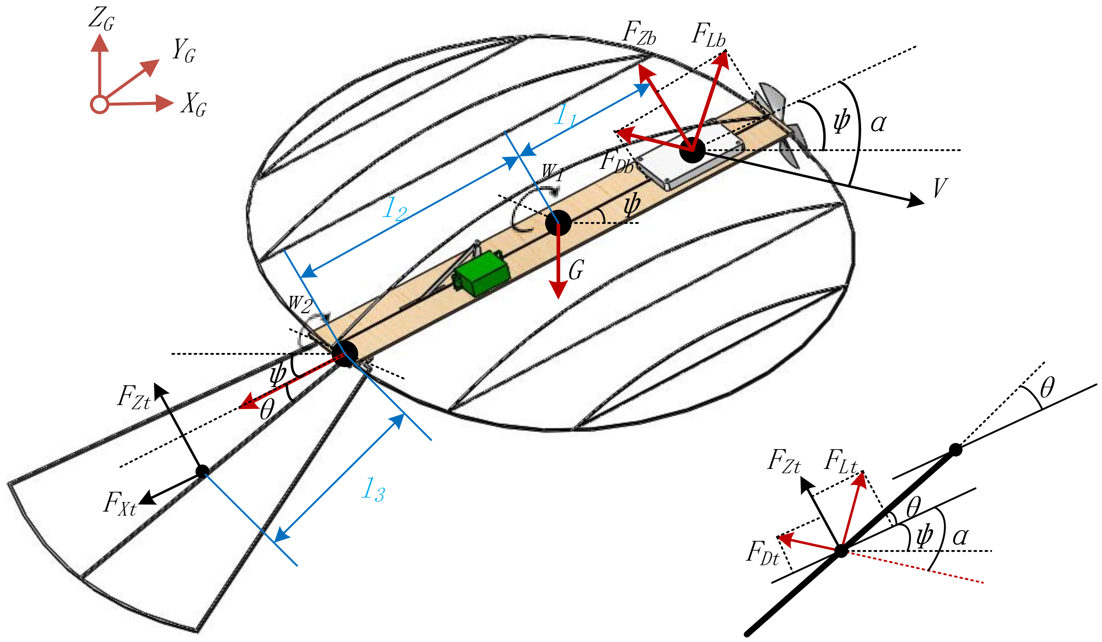


$$F_{Ab}=[F_{Lb} \quad F_{Db}]^T=\frac{\rho S_1 v^2}{2}[C_{L1} \quad C_{D1}]^T$$

$$L_b=[F_{Zb} \quad F_{Xb}]^T=\begin{bmatrix}\cos\alpha & \sin\alpha \\ \sin\alpha & -\cos\alpha\end{bmatrix}F_{Ab}$$

$$F_{At}=[F_{Lt} \quad F_{Dt}]^T=\frac{\rho S_2 v^2}{2}[C_{L2} \quad C_{D2}]^T$$

$$L_t=[F_{Zt} \quad F_{Xt}]^T=\begin{bmatrix}\cos\alpha & \sin\alpha \\ \sin\alpha & -\cos\alpha\end{bmatrix}F_{At}$$

对质心取力矩：

$$J\dot{\omega}=M=F_{Zb}l_1-F_{Zt}(l_3\cos\theta+l_2)-F_{Xt}l_3\sin\theta$$

令 $M=0$

即： $F_{Zb}l_1-F_{Zt}(l_3\cos\theta+l_2)-F_{Xt}l_3\sin\theta=0$

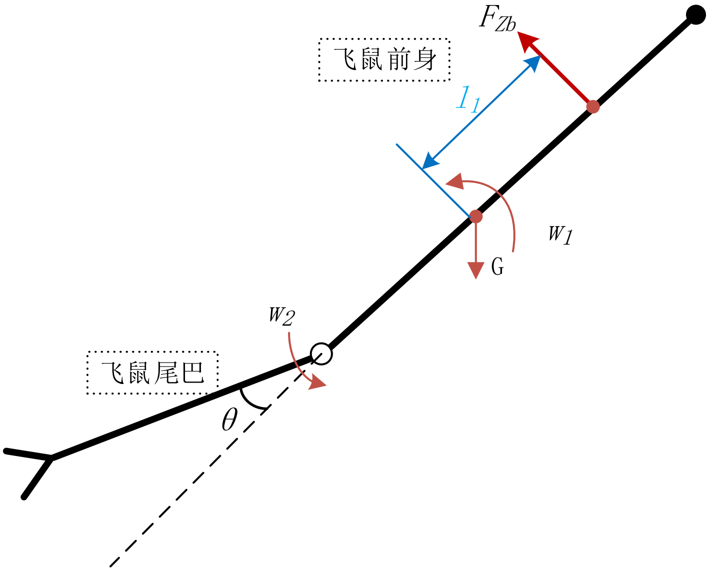
$$F_{Zt}\cos\theta+F_{Xt}\sin\theta=\frac{F_{Zb}l_1-F_{Zt}l_2}{l_3}$$

令： $\gamma=\arctan\dfrac{F_{Zt}}{F_{Xt}}$

$$\theta\text{=arcsin}\left(\frac{F_{Zb}l_1-F_{Zt}l_2}{l_3\|L_t\|^2}\right)-\gamma \quad \text{//俯仰稳定目标值}$$

注：（$\alpha\propto\varphi$ ）

接下来是多刚体调节：以翼型主体为参考



$$J_1\omega_1+J_2\omega_2=0$$

$$F_{Zb}l_1+M_t=J_1\frac{d\omega}{dt}$$

联立可得：
$$\dot{\omega}_2=\frac{F_{Zb}l_1\text{-}J_1\dot{\omega}}{J_2}$$
$$\frac{d\omega_2}{dt}\text{=}(F_{Zb}l_1\text{-}J_1\frac{d\omega}{dt})/J_2$$

速度控制：

$$\begin{cases} mg\sin(\alpha-\varphi)-F_{Dt}-F_{Db}=ma \\ v=v_0+at \end{cases} \text{(速度大小增量)}$$

$$a=g\sin(\alpha-\varphi)-\frac{F_{Dt}+F_{Db}}{m}$$

$$a=g\sin(\alpha-\varphi)-\frac{\rho v(C_{D1}S_1+C_{D2}S_2)}{2m}$$

$$mv\frac{d\alpha}{dt}=-mg\cos(\alpha-\varphi)+F_{Lb}+F_{Lt}\text{(速度方向)}$$

$$\frac{d\alpha}{dt}=-\frac{g\cos(\alpha-\varphi)}{v}+\frac{1}{2m}\rho v(C_{L1}S_1+C_{L2}S_2)$$