Exercise (12 points)

Clear all previous variables from the workspace by entering `clear` in the command window.

(1) Run the script init point mass EOM.m to initialize the model, and open the file point mass EOM.slx. **(0 points)**

(2) The aircraft aerodynamics are implemented in point mass EOM/aerodynamics. Extract the equations for the lift and drag coefficients C_L and C_D as well as the expressions for lift and drag L and D. Write them down as functions of α, V, ρ, S_{ref} and the constant terms. **(4 points)**

$$C_L = C_{L\alpha} \cdot \alpha + C_{L0}$$

$$C_D = K \cdot (C_L)^2 + C_{D0}$$

$$L = S_{ref} \cdot \frac{\rho}{2} \cdot V^2 \cdot C_L$$

$$D = S_{ref} \cdot \frac{\rho}{2} \cdot V^2 \cdot C_D$$

(3) The propulsion system is modelled in point mass EOM/propulsion. Extract the equations for the thrust T, as well as for the propulsion components in x and z direction X_P and Z_P. Write them down as functions of δ_T and constants **(3 points)**

$$T = T_0 + \delta_T \cdot T_{\delta T}$$

$$X_P = T \cdot \cos\alpha_T$$

$$Z_P = T \cdot \sin\alpha_T$$

(4) Extract the equation for the change in velocity $\dot{V}$ from the subsystem point mass EOM/V dot and write it down as function of X_P, D, γ and constant terms. **(1 point)**

$$\dot{V} = \frac{X_P - D}{m} - g \cdot \sin\gamma$$

(5) Extract the equation for the change in course $\dot{\chi}$ from the subsystem point mass EOM/chi dot and write it down as function of L, Z_P, μ, V, γ and constant terms. **(1 point)**

$$\dot{\chi} = \frac{(L - Z_P) \cdot \sin\mu}{m \cdot V \cdot \cos\gamma}$$

(6) Extract the equation for the change in climb angle $\dot{\gamma}$ from the subsystem point mass EOM/gamma dot and write it down as function of L, Z_p, μ, V, γ and constant terms. **(1 point)**

$$\dot{\gamma} = \frac{(L - Z_p) \cdot \cos\mu}{m \cdot V} - \frac{g \cdot \cos\gamma}{V}$$

(7) Extract the equation for the change in altitude $\dot{h}$ from the subsystem point mass EOM/h dot and write it down as function of V and γ. **(1 point)**

$$\dot{h} = V \cdot \sin\gamma$$

(8) Describe in your own words, what happens in the subsystem point mass EOM/Integration? **(1 point)**

To do a integration process, from inputs $\dot{h}; \dot{r}; \dot{\chi}; \dot{V}$ to outputs $h; r; \chi; V$, which are go backwards and feedback the subsystem „aerodynamics".