AE612 : Atmospheric Flight Mechanics

Assignment - 3

The aircraft parameters that can be used for the simulation are as follows.

Table 1: *Geometry, Mass and Inertia Characteristics*

Mean Aerodynamic Chord, $\bar{c}$	1.211 m
Wing Span, b	10.47 m
Aspect Ration, AR	8.8
Wing Area, S	12.47 m^2
Mass, m	750 kg

The aerodynamic model for the aircraft is given in the equations as follows.

Longitudinal Aerodynamic Model

$$C_L = C_{L_0} + C_{L_\alpha}\alpha + C_{L_{\delta_e}}\delta_e$$

$$C_D = C_{D_0} + KC_L^2$$

The initial condition for the simulation are:

- Free stream velocity, V_∞ = 50 m/s
- Altitude, H = 0 m

Aerodynamic Derivatives

(a) *Longitudinal*

C_{D_0} = 0.036	C_{L_0} = 0.365	C_{m_0} = 0.05
C_{D_α}= 0.041	C_{L_α} = 4.2	C_{m_α} = -0.59
e = 0.8	C_{L_q} = 27.3	C_{m_q} = -9.3
$C_{D_{\delta_e}}$ = 0.026	$C_{L_{\dot{\alpha}}}$ = 8.3	$C_{m_{\dot{\alpha}}}$ = -4.3
$C_{L_{max}}$ = 1.5	$C_{L_{\delta_e}}$ = 0.26	$C_{m_{\delta_e}}$ = -1.008

Aerodynamic Derivatives

Maximum shaft power at SL $P_{S_{SL}}$	100 BHP
Propeller Efficiency	0.8
Power model	$P_S = PP_{S_{SL}} * \sqrt[3]{\sigma}$

With the given parameters, find out the excess power plots for altitude from 0 - 5000m. Using the maximum rate of climb, find out the absolute ceiling and service ceiling for this aircraft. Plot the relevant graphs with proper comments on them. Using the graphical approach, find the climb plot the climb schedule and find out the minimum time to climb for this aircraft to climb to the service ceiling from sea level. Proper justifications are required for your comments. Try to use the plots in a proper way to support your comments. Try not to cluster everything in one plot. The codes have to submitted along with the report in a zip file, with file name as "SCnumber.zip"

Copying in any aspect will result in NO MARKS for all assignments.