Assignment 4: Air Transportation Systems Analysis

Due: September 28, 2020 Instructor: Trani

Problem 1

Use the data for the commercial transport aircraft similar to the Airbus A380 (http://128.173.204.63/courses/cee5614/cee5614_pub/AirbusA380_class.m) to answer the following questions.

a) Estimate the rate of climb when the aircraft travels at 240 knots indicated airspeed and 5,000 feet. Assume ISA conditions. Assume the takeoff mass is 505,000 kilograms. Estimate the fuel consumption in kg/hr.

b) Repeat the analysis of part (a) for two intermediate altitudes: a) when the aircraft climbs at a true Mach 0.71 at 20,000 feet. and b) when the aircraft climbs at true Mach 0.75 and 30,000 feet.

c) Compare the solutions obtained and comment on the observed rate of climb and fuel burn trends.

Problem 2

Use the new generation, large twin-engine transport aircraft data to answer this question (http://128.173.204.63/courses/cee5614/cee5614_pub/boeing787_class.m). Use the unrestricted climb Matlab code to answer the following:

a) Estimate the time and distance to climb from sea level to FL 330 for the twin-engine aircraft. Assume the takeoff weight is 205 metric tons and use ISA conditions.

b) Repeat the analysis of part (a) under ISA + 5 deg.C, ISA + 10 deg.C, and ISA + 20 deg. C conditions. Plot the distance and time required to reach FL330. Comment on the observed trends.

c) Find the maximum initial cruise altitude possible for the aircraft at its maximum takeoff weight of 220,000 kg.

Problem 3 (Only for CEE 5614)

Use the new generation, large twin-engine transport aircraft to answer this question (http://128.173.204.63/courses/cee5614/cee5614_pub/boeing787_class.m). In this analysis, perform manual calculations as needed. You can use any of the Matlab functions provided in class to support your calculations.

a) Estimate the rate of climb after the aircraft departs Denver International Airport (say at a point 150 meters above the airport ground level). Assume the aircraft has takeoff flaps of 10 degrees which add 0.013 to the zero-lift drag coefficient. The aircraft departs Denver International with a mass of 205,000 kilograms. The indicated airspeed at the point of interest is 185 knots. Do the **calculations manually** at 150 meters above the ground assuming ISA conditions. At the 150 m. AGL point, the aircraft has flaps down but the landing gear is fully retracted (no additional drag generated).

b) Repeat the process now simulating an engine failure at the same point as in part (a) in the climb profile. Compare the rates of climb obtained in parts (a) and (b).

c) Will the aircraft be able to clear a 500 meter obstacle (above ground level) located 6 km. from the point of engine failure? The minimum vertical clearance distance is 300 meters (1,000 feet).