FLIGHT MECHANICS: HOMEWORK -II REPORT

Emircan Kılıçkaya

Istanbul Technical University

110150045

Author Note

This paper is dedicated to UCK322E CRN:21218

Correspondence concerning this article should be addressed to Emircan Kılıçkaya,

Faculty of Aeronautics and Astronautics, Istanbul Technical University, Maslak 34469.

E-mail: kilickaya15@itu.edu.tr

School No:110150045

Date: 11.04.2019

Abstract

This homework contains MATLAB codes and explanations on calculating speed schedules, propulsive forces and fuel consumption for given Aircraft OPF file. All the code here and in the zip file belongs to the author himself. The zip file also includes the functions from Homework I. This is necessary in order to use functions without any error for someone checking the homework.

Keywords: Flight Mechanics, Speed Schedules, Climb, Cruise, Descent, Fuel, Thrust.

Flight Mechanics: Homework-II Report

Speed Schedules

The function "crossover_altitiude_calc" calculates MACH/CAS transition altitude as a function of Mach number and CAS. CAS should be in m/s and the output is in feet. The function can be called as seen below:

```
crossover_altitude_calc(mach,cas)
```

The graph wanted in part a can be obtained from the MATLAB file called "Crossover_mach_cas_3D_graph_call.m"
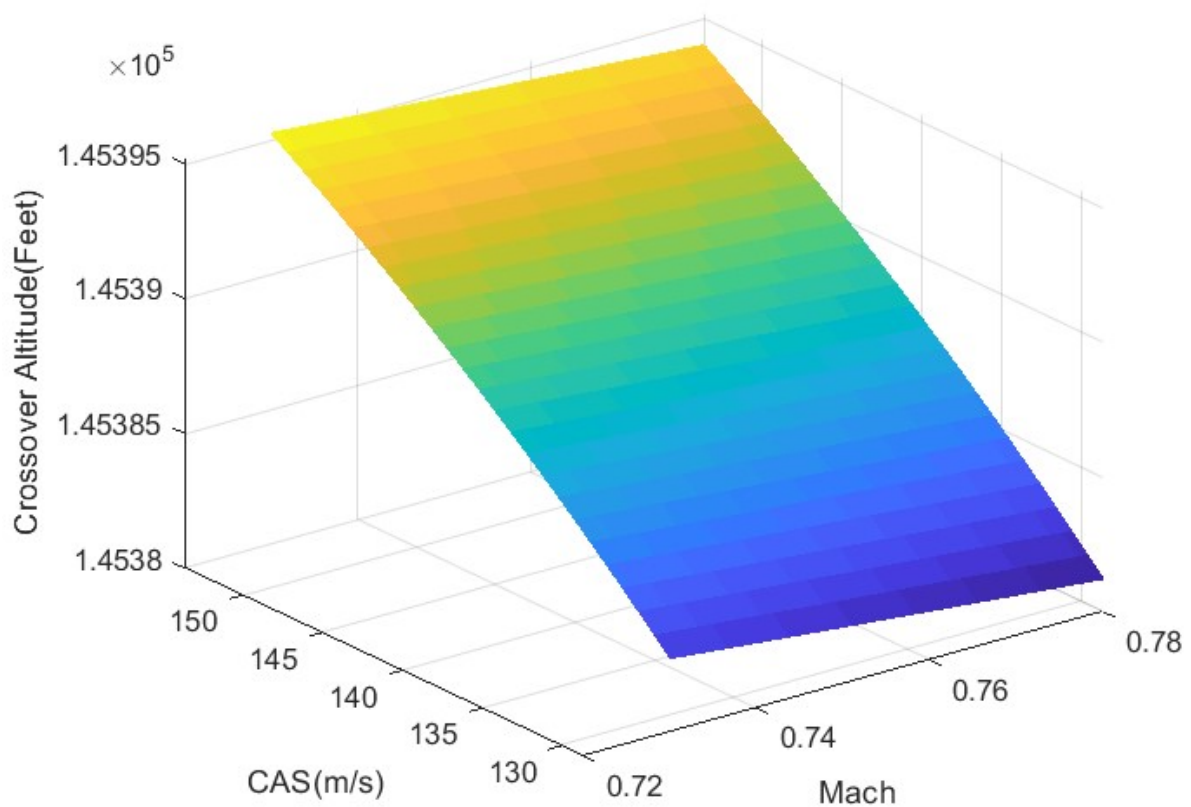
For part b, there are 3 functions written. First is to calculate climb speed schedule, second is to calculate cruise speed schedule and the last one is for descent speed schedule. These functions take only one input which is the altitude in feet. Their output is in knots. They can be called respectively as seen in below:
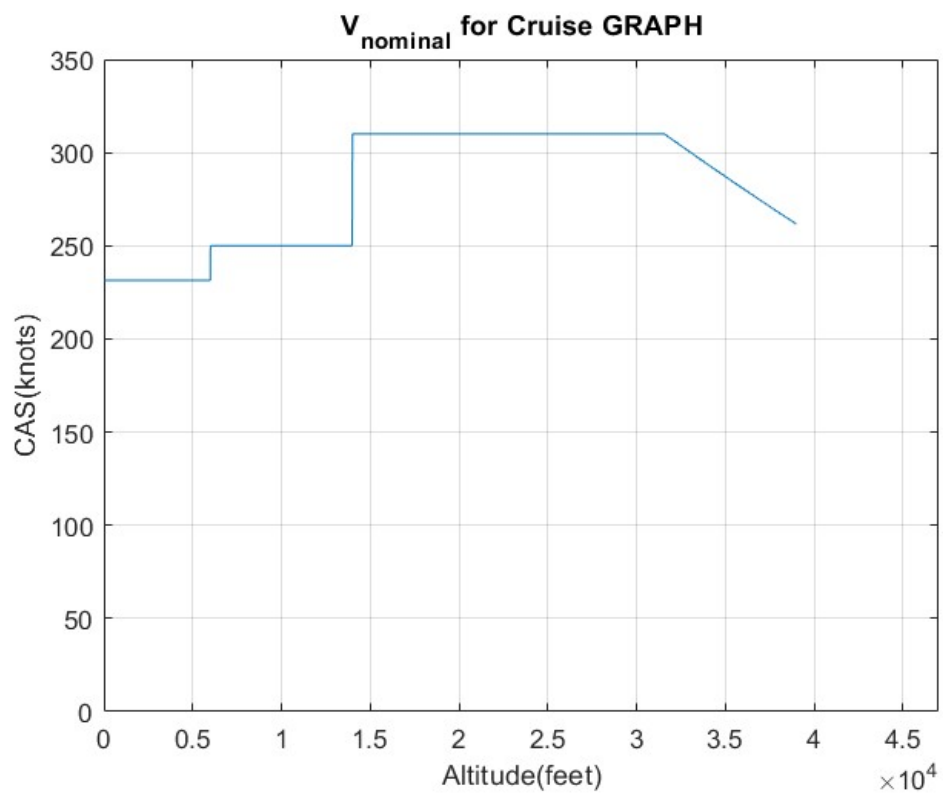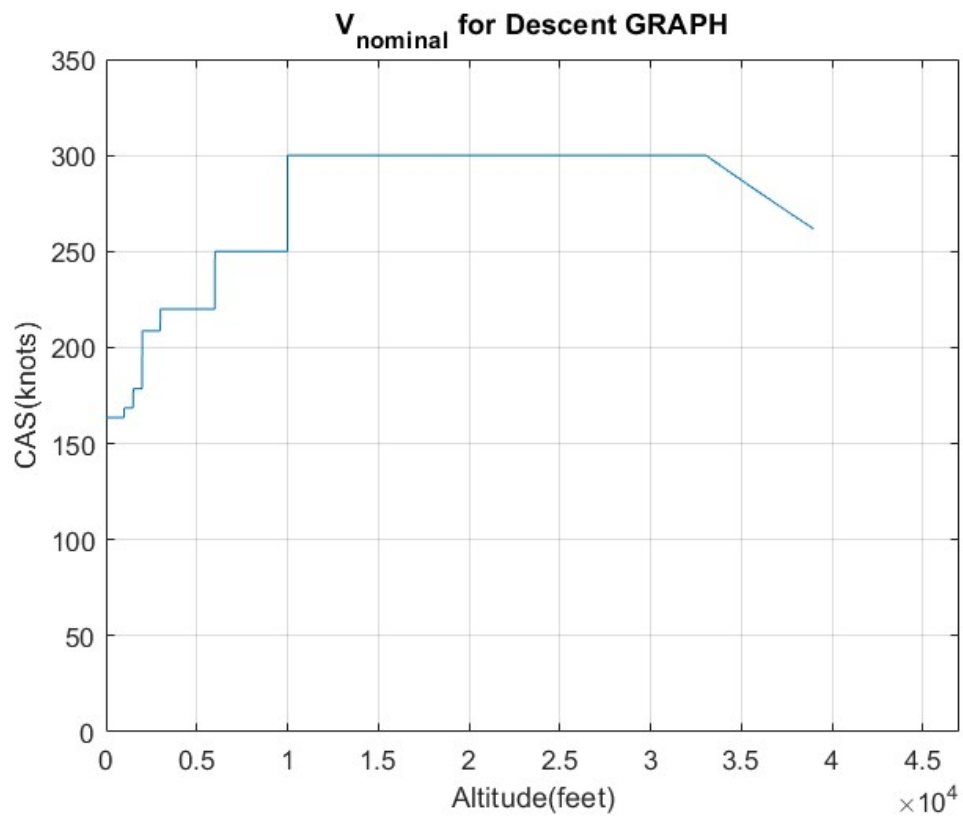
```
climb_speed_schedule(H)
```

```
cruise_speed_schedule(H)
```

```
descent_speed_schedule(H)
```

In another file called "speed_schedules_graphs.m" necessary codes in order to create plots wanted in part be are written. H is between (0,39000) feet.

$V_{nominal}$ for Descent GRAPH

$V_{nominal}$ for Cruise GRAPH
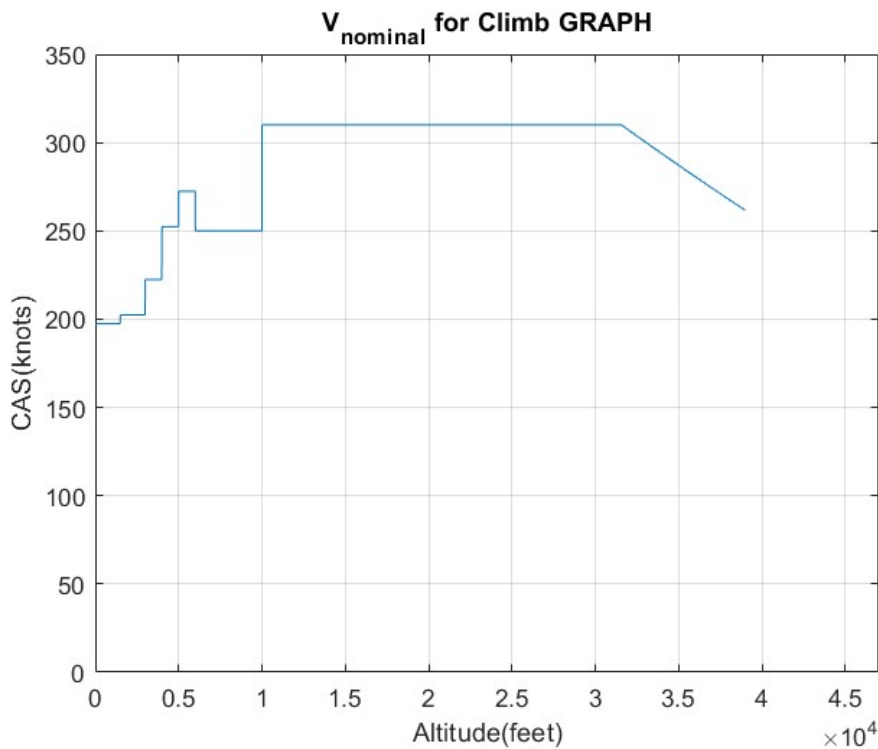
Propulsive Forces

For part a, the MATLAB function written is "maxclimb_takeoff_thrust" and it takes only one input, which is the altitude in feet. The output is maximum climb thrust and its unit is Newton.

 It can be called as follows:

$$maxclimb\_takeoff\_thrust(H)$$

For part b, the MATLAB function written is "descent_thrust". It also takes the altitude in feet as

only input. The output is in again Newton. The calculation is made with only two C_{Tdes} values as

stated in the problem.

It can be called as below:

$$descent\_thrust(H)$$

The graphics for part a and b were obtained in MATLAB file called "thrust_graphs.m".The plots

are given below:
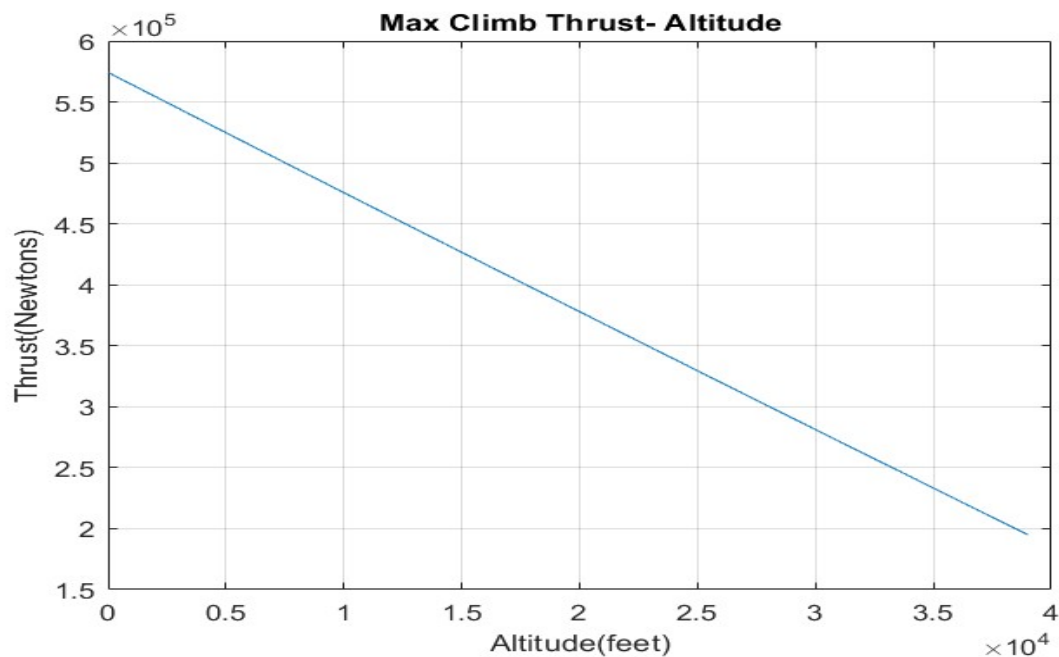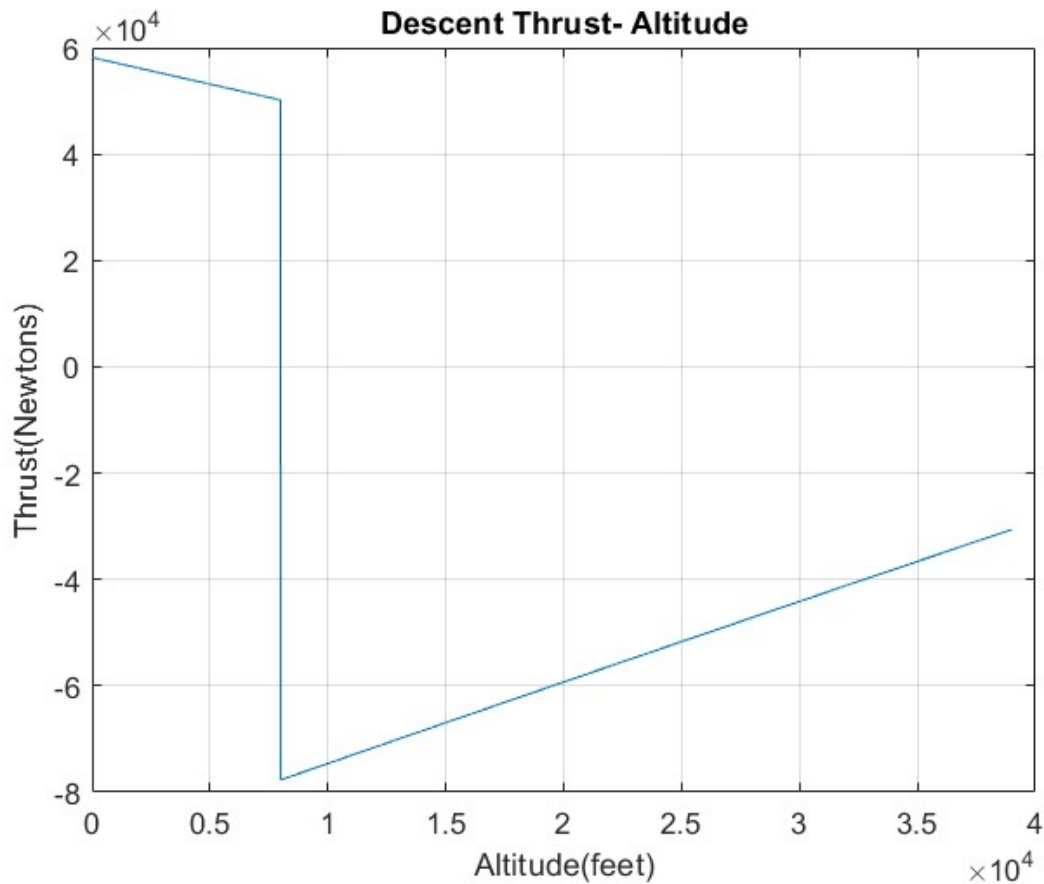
Fuel Consumption

In this part of the homework, there are 3 functions written. They are for calculating the fuel consumption during climb, cruise and descent phases of an aircraft. Their input is the altitude and it is in feet. The outputs are kg/min. They can be called respectively as below:
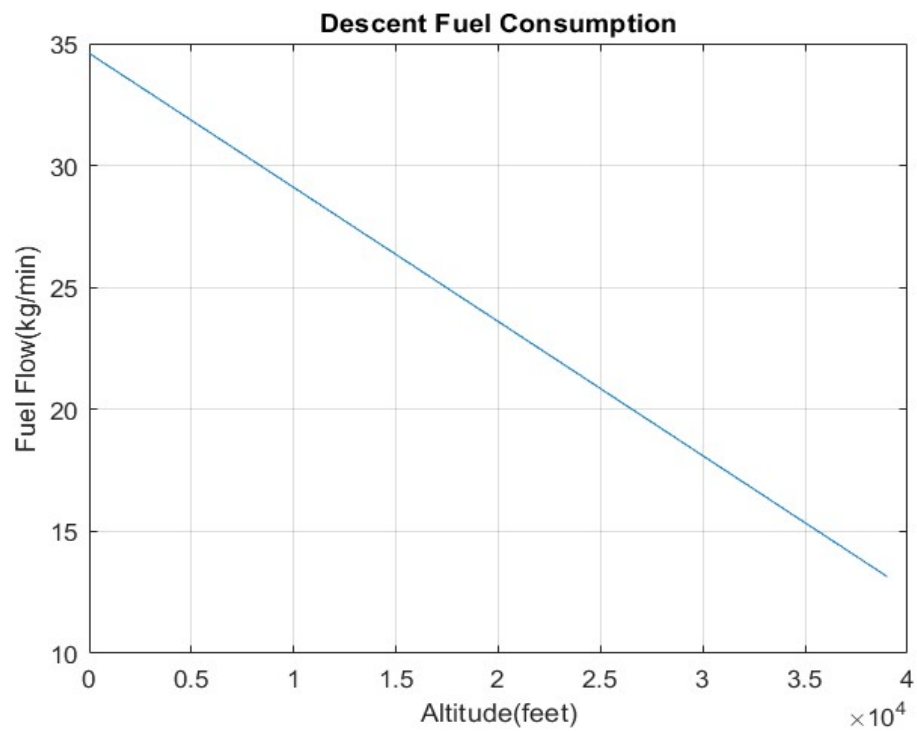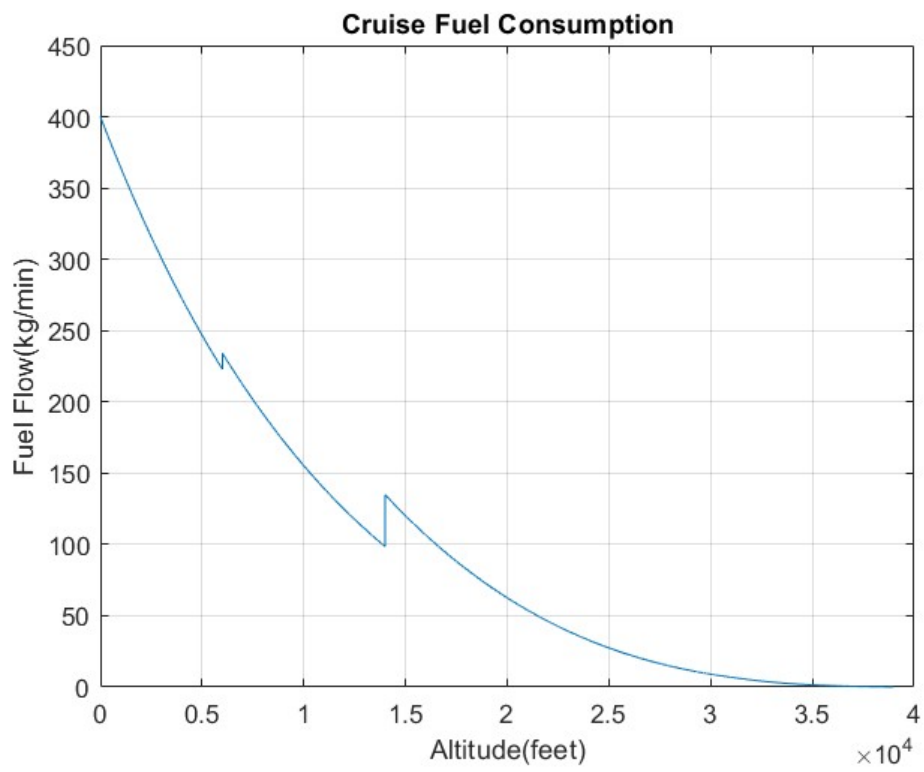
```
climb_fuel_consumption(H)

cruise_fuel_consumption(H)

descent_fuel_consumption(H)
```

For the graphics wanted in this part, the MATLAB file written is called "fuel_consumption_graphs.m" And it outputs 3 different graphics for climb, cruise and descent conditions.The graphs are below and can be inspected:

Cruise Fuel Consumption

Descent Fuel Consumption
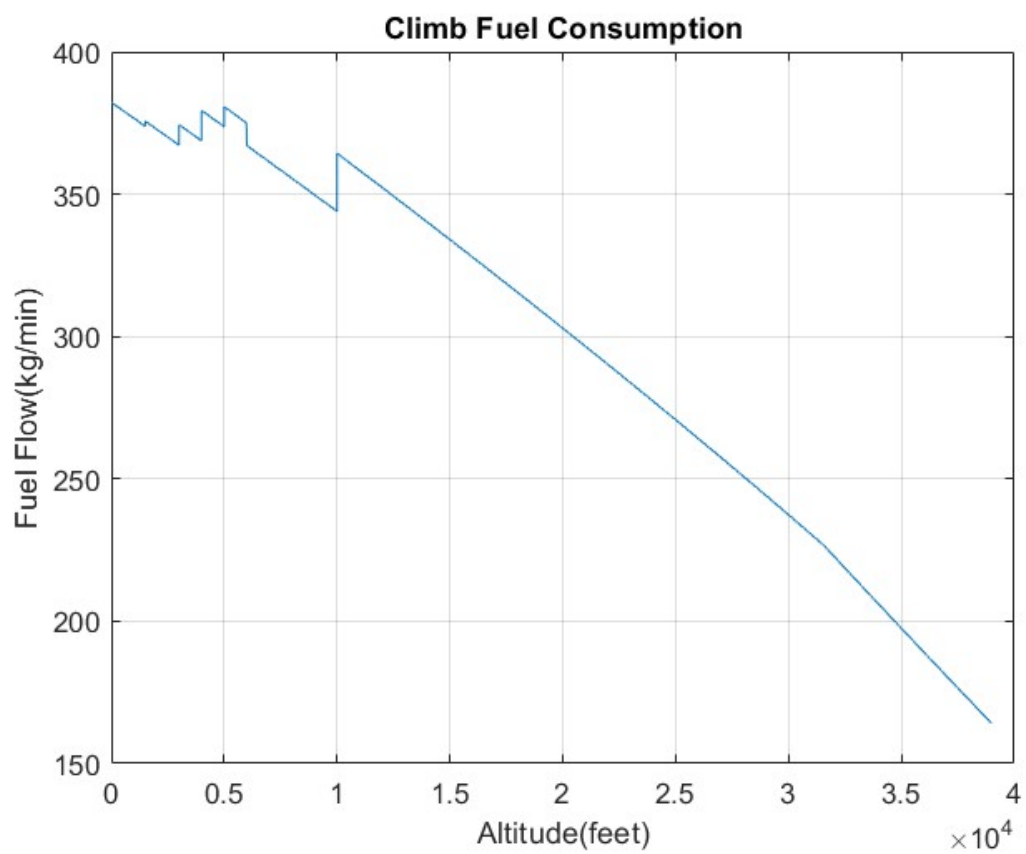
References

EEC Technical/Scientific Report No.13/04/16-01(BADA3.11)

Dr. A. K. Ghosh, NPTEL Flight Mechanics Lecture Notes, 2015