AE 5222 – Optimal Control of Dynamical Systems

Homework Submission Cover Page and Statement of Academic Honesty

I, John O'Neill, submit the solution to Homework Problem 1.

My signature below affirms that all of the writing in this submission is my own work. Any reference material that I used to prepare this submission, including text or video resources, but excluding the lecture notes and videos provided on the Canvas site for this course, is properly cited.

To prepare this submission:

☐ I verbally collaborated with the following individuals (excluding *Piazza* discussions):

Currently enrolled in AE 5222: _____

_____

Not currently enrolled in AE 5222: _____

_____

■ I did not verbally collaborate with any other individual.

This submission reflects my individual effort and my own understanding of the course content.

I have read and I understand WPI's Academic Honesty Policy, and my conduct in preparing this submission has been in accordance with this Policy.

Signature: _____ **Date:** 04/20/2019

Jack O'Neill
AE 5222
Homework 1

Method

Given the equations for lift and drag, in order to determine the speed at the maximum L/D, I must first determine the expression for the maximum L/D. I assumed the maximum value of L/D would occur at the point at which the derivative of L/D with respect to velocity (V) was equal to zero. This would allow me to determine the velocity V^* which would maximize L/D. Since lift equals weight in this case (L = W), I found the following expression for V*:

$$V^* = \sqrt[4]{\frac{8W^2}{25S^2\rho^2 C_{D0}}}$$

Results

The velocity V^* which maximizes L/D for the B-52 Stratofortress is equal to **V* = 695.087 ft/s**. The following figure shows L/D plotted against airspeed, with V* indicated:

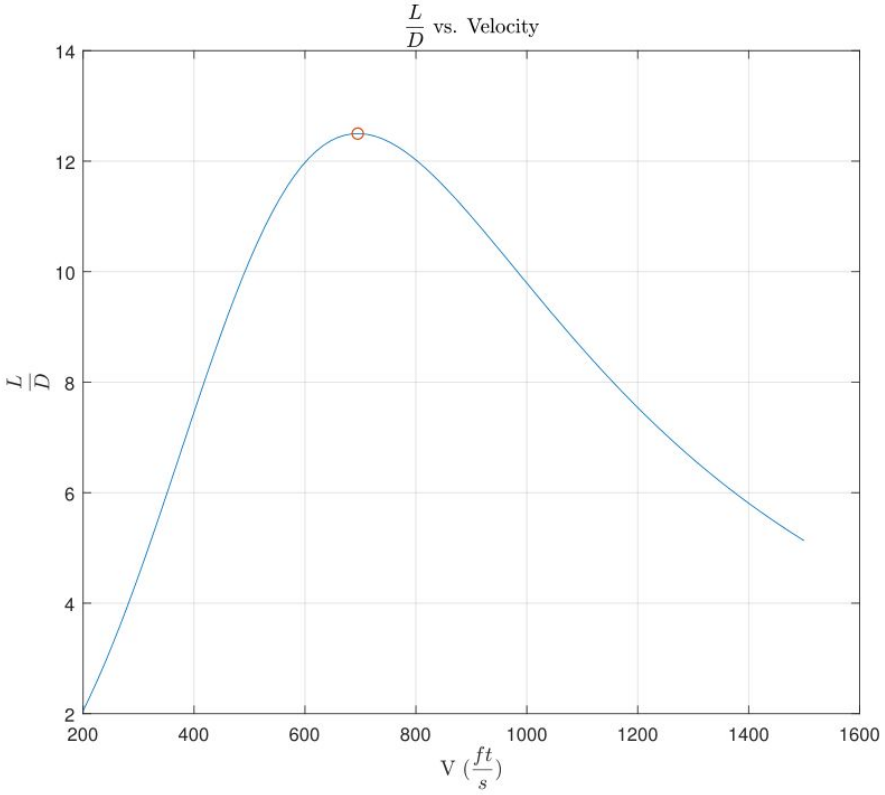

Figure 1: L/D versus airspeed of the B-52 Stratofortress

Discussion

The results above match the expected values because the expression of V* is derived from the derivative of L/D with respect to V, which will maximize L/D. If the L/D curve had multiple local minima/maxima we would have to go further to confirm the value of V which would maximize L/D.