Alexander Dowell

ME 401-0007 HW 1

Homework 1

Write a Matlab script, function, or diagram to define and simulate roll convergence dynamics.

$$\dot{p} = L_p * p + L_{\delta_a} * \delta_a$$

Use the Navion and F-104 Starfighter stability and control derivatives, mass properties, and dimensions. You can also add provisions for including other aircraft dynamic models into your code.
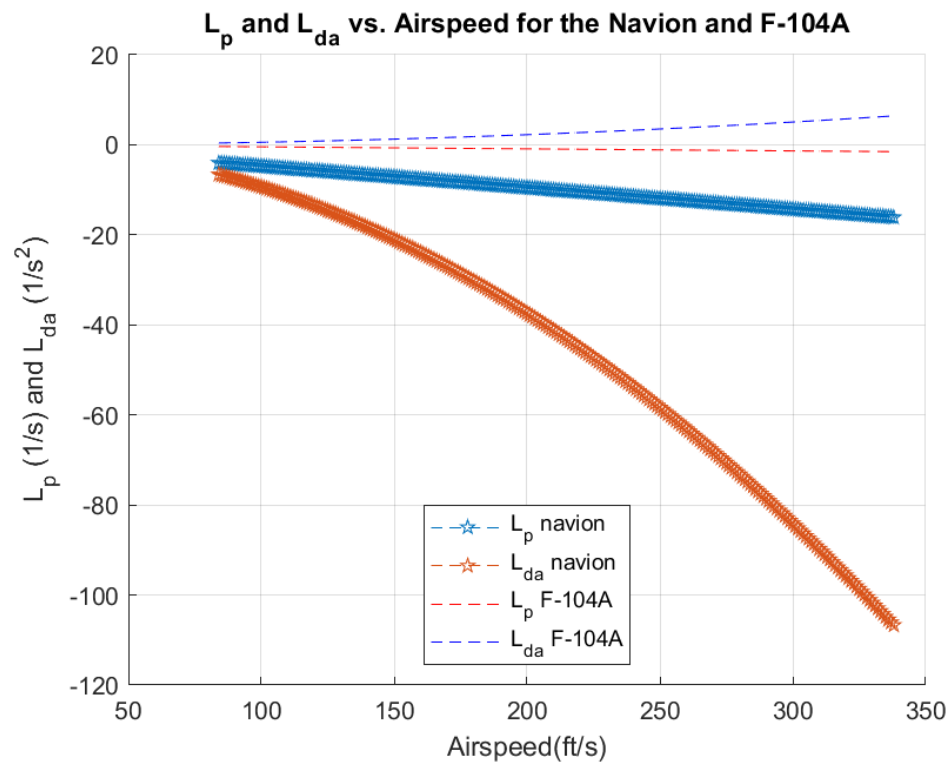
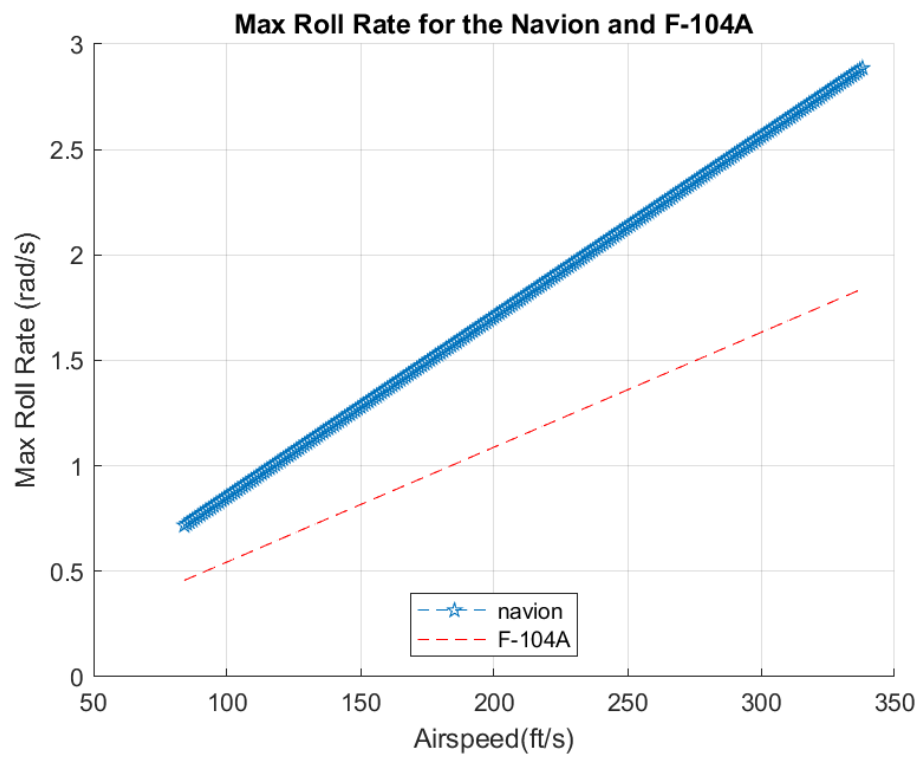Airspeed range: 50 - 200 knots

Generate the results:

1 - How do the derivatives L_p and L_delta_a change over the airspeed range for each aircraft?

2 - How does the maximum roll rate change for each aircraft? Assume delta_a_max is 25 degrees

3 - How does the open-loop step response change over the airspeed range?

4 - What happens during a partial aileron failure? (Fail the left or right aileron and compare maximum roll rate and open-loop step response)

5 - What happens if the wingtip tanks are full? (Compare maximum roll rate and open-loop step response)
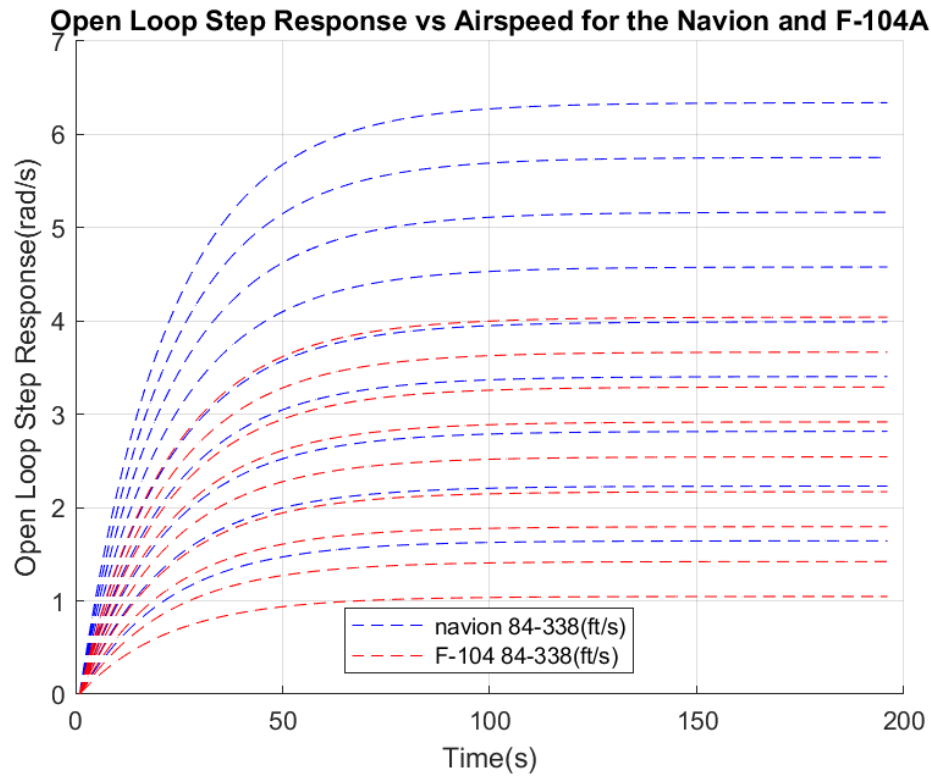

Solution Suggestions:

- See "References" module for stability and control derivative table and aircraft dynamics
- A script/function with a for-loop that covers the airspeed range is a good idea, but there are other ways to solve this problem
- You can split up C_l_delta_a into a left and right side, assume that each side contributes half of the total roll moment
- Assume the wingtip tanks can hold 25% of the total weight. Use the parallel axis theorem to compute the new mass moment of inertia.
- You are welcome to use any other simulation tool for this assignment (Octave, Python, C++, Fortran, etc).
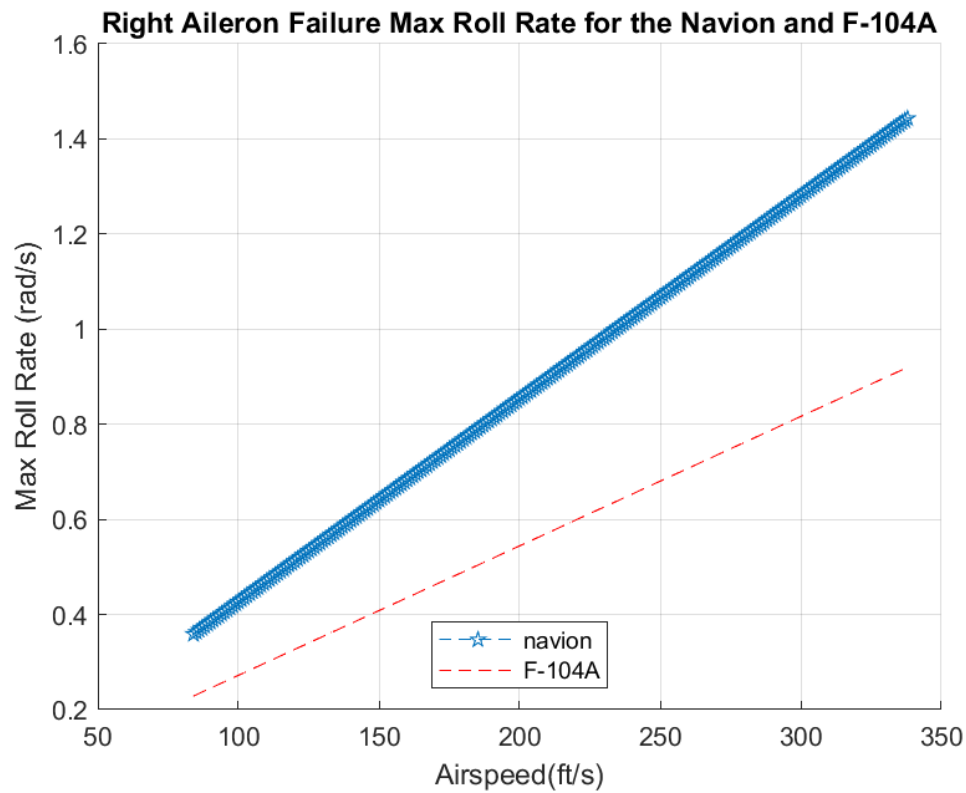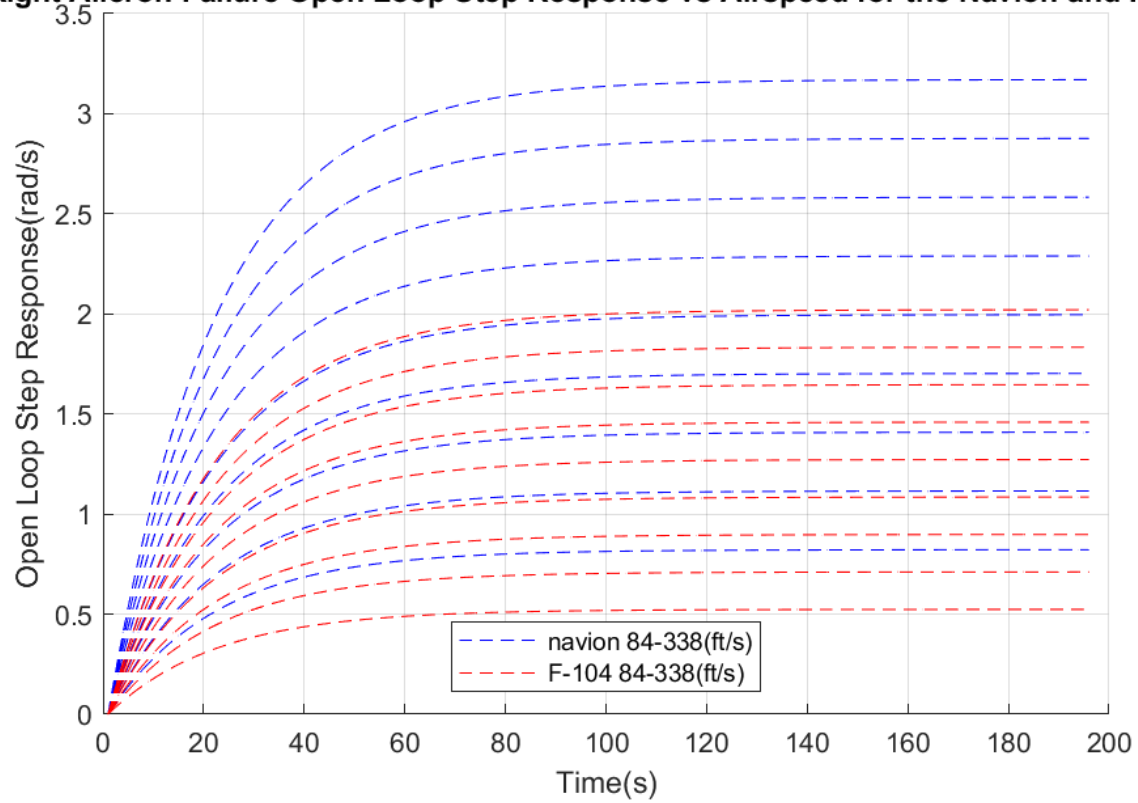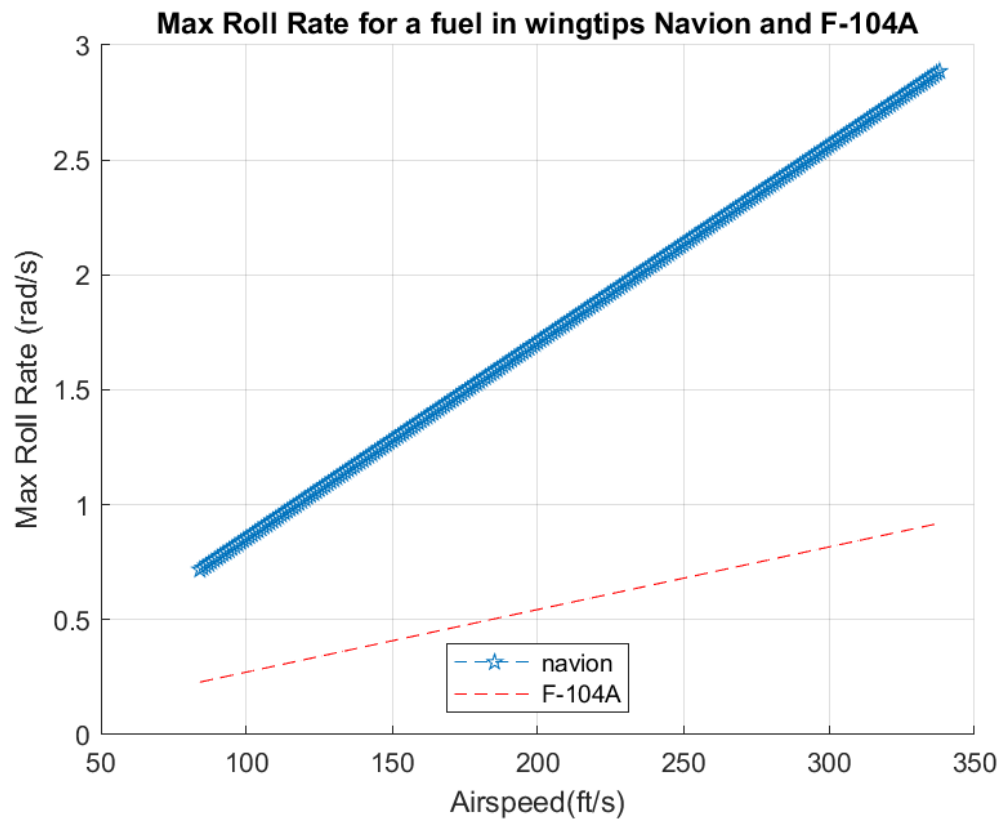

#1

L_p and L_{da} vs. Airspeed for the Navion and F-104A

#2

Max Roll Rate for the Navion and F-104A

#3

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Open Loop Step Response vs Airspeed for the Navion and F-104A

#4

Right Aileron Failure Max Roll Rate for the Navion and F-104A

Right Aileron Failure Open Loop Step Response vs Airspeed for the Navion and F-104A

#5

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Open Loop Step Response vs Airspeed for a fuel in wingtips Navion and F-104A