THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Aerospace Engineering and Engineering Mechanics

ASE 367K FLIGHT DYNAMICS
Fall 2024

HOMEWORK 7
Due: Friday 2024-11-01 at 11:59pm via Canvas

Problem 1

Given the linear system model provided on Slide 22 of Lecture 16 and the dimensional stability derivatives provided in Problem 1 of Homework 4 for the B747 at M = 0.25 and Sea Level (you may assume that any derivative that is not provide is zero):

a. Determine the damped frequency, natural frequency, damping ratio, the time to damp to half the initial amplitude, and the number of cycles to damp to half the initial amplitude for the Roll, Spiral, and Dutch Roll modes.
b. Develop a simulation (using the either MATLAB or Python) for this model and use it to determine and plot the values of the state variables $\Delta\beta$, Δp, Δr, $\Delta\phi$, and $\Delta\psi$ (as functions of time) in response to step and impulse aileron and rudder deflections of maximum amplitude.

Problem 2

Given the following approximate model for the Dutch Roll mode on Slide 35 of Lecture 16, and the dimensional stability derivatives used in Problem 1:

a. Determine the damped frequency, natural frequency, damping ratio, the time to damp to half the initial amplitude, and the number of cycles to damp to half the initial amplitude for this approximate model.
b. Develop a simulation (using the either MATLAB or Python) for this approximate model and use it to determine and plot the values of $\Delta\beta$ and Δr (as functions of time) in response to the same step and impulse rudder inputs used in Problem 1.

Problem 3

Comparing the results of Problems 1 and 2:

a. Explain any differences (using plots to support your findings) between the full model and the approximation in terms of the computed damped frequency, natural frequency, damping ratio, the time to damp to half the initial amplitude, and the number of cycles to damp to half the initial amplitude.