AAE 364 Control Systems Analysis
Problem Set 11

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Fall 2019
Issued 11/15; Due 11/22

Reading Assignment: Sections 2-3 of Chapter 7.

Problem 1

Draw the Nyquist plots of the systems in B-7-3, B-7-4, B-7-9, and B-7-13 in Chapter 7 with $K = 1$. (Note that you don't need to solve the problems themselves. Just draw Nyquist plots.)

Problem 2: Aircraft Example

The following figure shows the coordinate axes and forces acting on the aircraft in the longitudinal plane of motion. Assuming that the aircraft is cruising at constant velocity and altitude.

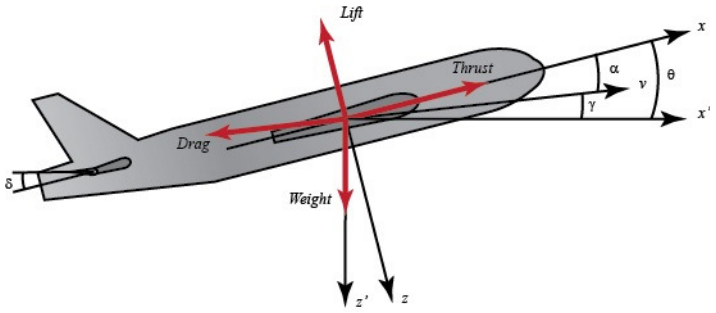

Figure 1: Forces acting on an aircraft in the Longitudinal plane.

Plot the Bode diagram of the following $G(s)$:

1. $G(s)$ representing the aircraft pitch angle response output to the elevator deflection input:

$$G(s) = \frac{\Theta(s)}{\Delta(s)} = \frac{1.1057s + 0.1900}{s^3 + 0.7385s^2 + 0.8008s}$$

2. $G(s)$ representing the aircraft altitude response output to the elevator deflection input:

$$G(s) = \frac{H(s)}{\Delta(s)} = \frac{1.1057s - 0.1900}{s^5 + 17.95s^4 + 123.3s^3 + 366.3s^2 + 112.2s}$$

Problem 3: Spacecraft

Consider the plant $G(s)$ representing the spacecraft attitude dynamics shown in Figure 2:

$$G(s) = \frac{\theta(s)}{T_c(s)} = \frac{0.036(s + 25)}{s^2(s^2 + 0.04s + 1)} \tag{1}$$

Plot the Bode diagram of $G(s)$.

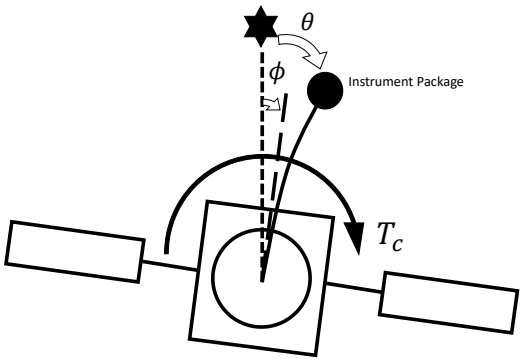

Figure 2: Two-body Model of Satellite

Remarks:

- As for Bode plots and Nyquist plots, draw the plots by hand first and then validate them using MATLAB.