AAE 364 Control Systems Analysis
Problem Set 12

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Reading Assignment: Sections 3-9 in Chapter 7.

Problem 1

Solve B-7-13, B-7-15, B-7-16, B-7-19, B-7-24, and B-7-26 in Chapter 7.

Problem 2

Figure 1 shows a Bode diagram of a transfer function $G(s)$ which is minimum phase. Determine this transfer function.

Problem 3: 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.

Draw the Nyquist plot of the following $G(s)$:

1. $G(s)$ 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 4: Spacecraft

Consider the plant $G(s)$ representing the spacecraft attitude dynamics shown in Figure 3:

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

Draw the Nyquist plot of $G(s)$.

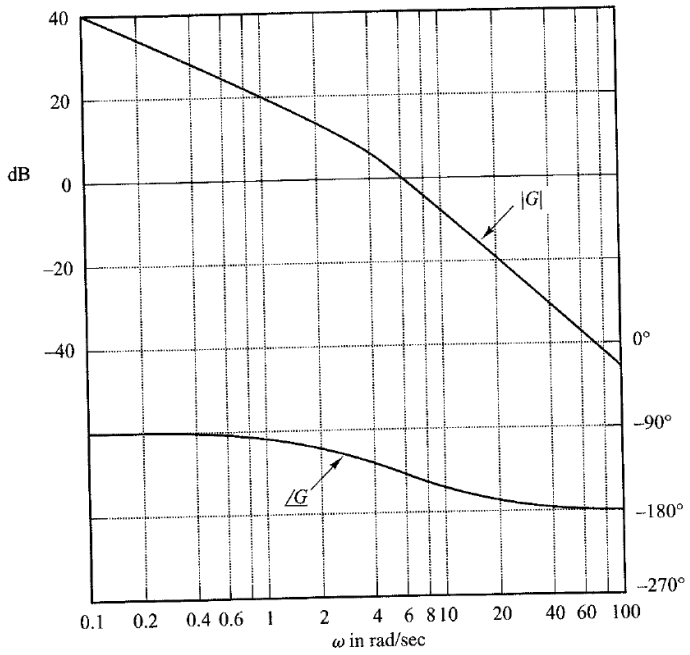

Figure 1: Bode diagram of a transfer function $G(s)$.

Problem 5: Course Evaluation [extra credit: 5 points]

- Complete the online course evaluation and submit a hard copy of the course evaluation front page which shows your name as a proof that you have completed the course evaluation.

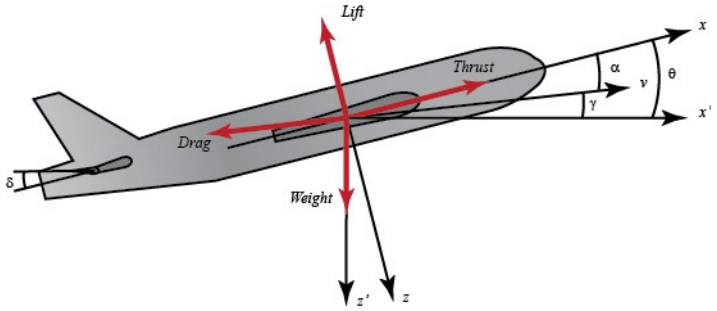

Figure 2: Forces acting on an aircraft in the Longitudinal plane.

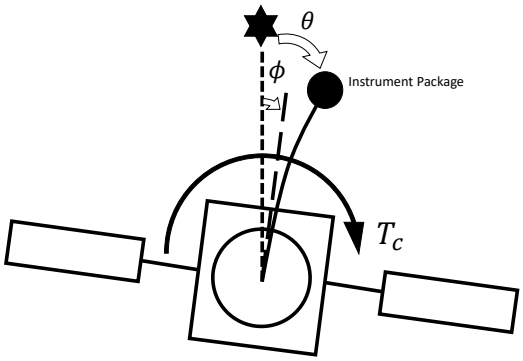

Figure 3: Two-body Model of Satellite

Remarks:

- Do not need to read the sections about state space systems.
- As for Nyquist plots, draw the plots by hand first and then validate them using MATLAB.