AERO 7970/7976 Multivariable Control of Uncertain Systems (3)
Summer Semester 2019

Midterm Test take home (100 pts)

Assigned July 3, 2019
Due July 10, 2019

Reading assignment

All the material in Canvas related to Chapter 3

Problem 1

Given the system:

$$G(s) = \begin{bmatrix} \dfrac{10(s+1)}{s^2+0.2s+100} & \dfrac{1}{s+1} \\ \dfrac{s+2}{s^2+0.1s+10} & \dfrac{5(s+1)}{(s+2)(s+3)} \end{bmatrix}$$

- Find a state space realization
- Determine the controllability and observability
- Find the transmission zeros and the eigenvalues of the A matrix using Matlab
- Find the H2 and Hinf norms and plot the Hinf vs frequency
- Plot the singular values vs frequency

Problem 2

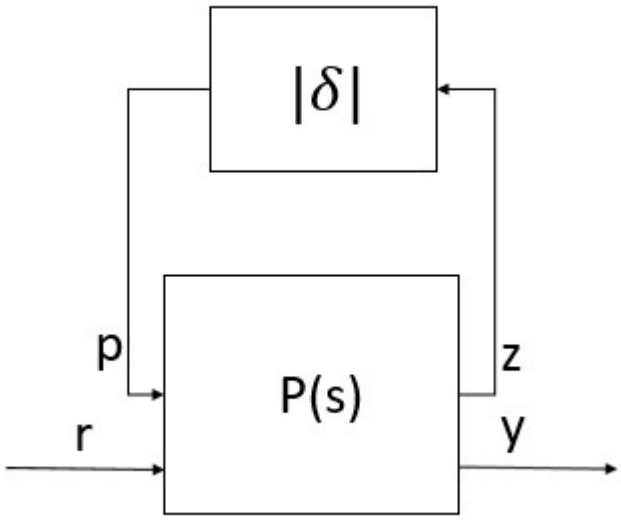
Using the class notes and the appropriate handouts, provide a 1 page max explanation of the relationship between Hamiltonian matrices and algebraic Riccati equations, concentrating on the LQR guaranteed closed loop stability.

Problem 3

Given the following system:

$$\begin{cases} G(s) = \dfrac{y(s)}{r(s)} = \dfrac{s+1}{s+10 \pm 0.1\delta} \\ \left|\delta\right| \leq 1 \end{cases}$$

Using block diagram algebra, show that the system is equivalent to the following:



Where p and z are auxiliary input and output, and P(s) is equal to:

$$P(s) = \left[\begin{array}{c|c} \frac{-0.1}{s+10} & \frac{-0.1(s+1)}{s(s+10)} \\ \hline \frac{1}{s+10} & \frac{s+1}{s(s+10)} \end{array}\right]; \begin{bmatrix} z \\ y \end{bmatrix} = P(s) \begin{bmatrix} p \\ r \end{bmatrix}$$

THE TEST SHOULD REFLECT YOUR INDIVIDUAL WORK

You can either upload the homework in Canvas or email it to me.