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% ECE504

% Homework #9

%% Problem #2

clear all; close all; clc;

% Compute the state space realization of each individual TF in G(s):

num\_11 = [1 1];

den\_11 = [1 2];

num\_12 = [0 1];

den\_12 = [1 3];

num\_21 = [1 0];

den\_21 = [1 1];

num\_22 = [1 1];

den\_22 = [1 2];

[A\_11 B\_11 C\_11 D\_11] = tf2ss(num\_11,den\_11)

[A\_12 B\_12 C\_12 D\_12] = tf2ss(num\_12,den\_12)

[A\_21 B\_21 C\_21 D\_21] = tf2ss(num\_21,den\_21)

[A\_22 B\_22 C\_22 D\_22] = tf2ss(num\_22,den\_22)

%% Prolem #3

clear all; close all; clc;

syms s;

% Compute SS description from num & den:

num = [1 1 -2];

den = [1 2 -5 -6];

[A B C D] = tf2ss(num,den)

% Check for matrix controllability:

Qr = [B A\*B (A^2)\*B]

%% Problem #4

clear all; close all; clc;

A = [1 1 -2; 0 1 1; 0 0 1];

syms l;

% Compute the characteristic polynomial:

c\_p = det(l\*eye(3) - A);

pretty(c\_p);

% Using the A,B,C,D matrices, find the transfer function.

% This will be done to put the system into canonical form.

B = [1;0;1];

C = [2 0 0];

D = [0];

[num, den] = ss2tf(A,B,C,D)

syms s;

g\_s = C\*(inv(s\*eye(3) - A))\*B + D;

pretty(g\_s);

P = [4 -4 1; -1 1 0; 1 -2 1]

G = [4 -2 2]

P\_inv = inv(P)

F = G \* P\_inv