Olin College of Engineering
ENGR2410 – Signals and Systems

Assignment 9

Problem 1 Use Matlab to analyze the behavior of the systems listed. Feel free to use the code shown below.

```
s=tf('s');h=(s^2+1)/(s^2+3*s+1)
subplot 311;bode(h)
subplot 312;pzmap(h)
subplot 313;step(h)
```

For each system, note the relationship between all three plots: order of the system, number of poles and zeros, real or complex poles, oscillations and so forth. Hand in a couple of sentences for each system describing its behavior and any notable characteristics concisely.

A. $\dfrac{s}{s+1}$

B. $\dfrac{s}{s^2+100s+1}$

C. $\dfrac{s}{s^2+s+1}$

D. $\dfrac{s}{s^2+0.1s+1}$

E. $\dfrac{s^2-0.01s+1}{s^2+0.01s+1}$

F. $\dfrac{s^2+0.1s+1}{s^2+0.11s+1}$

Problem 2 You are asked to stabilize the system

$$H(s) = \frac{1}{s^2 - 0.01s + 1}$$

Do the algebra by hand in this problem. Matlab will introduce numerical errors that will give you the wrong answer!

A. Plot the step response and pole-zero map of this system using Matlab.

B. Use the pole-zero map to show the effect of using proportional control on this system. Show the step response of at least two feedback gains to illustrate. Can you stabilize the system?

C. Repeat part B using integral control.

D. Repeat part B using differential (or derivative) control.