SFWR ENG 3DX4 – Assignment 3

1. A unity feedback system has transfer function:

$$G(s) = \frac{K}{s(s^2 + 4s + 13)}$$

   (a) Plot the root locus for this problem.

   (b) Find the value of K that gives a damping ratio of 0.2588.

   (c) Find the location of the roots for the value of K that you found in part (b).

   (d) Plot the step response of your closed-loop system, along with the step response of an ideal second order system with damping ratio 0.2588 and poles that correspond to the two poles with imaginary parts.

   (e) Find the value of K that leads to a marginally stable system.

2. Consider the open-loop system

$$G(s) = \frac{(s + 10)}{(s + 1)(s + 2)(s + 12)}$$

   (a) Suppose that the design specifications are that the $\%OS$ is 20% and the settling time is 1 second. Use the root-locus approach to design a PD controller for this system.

   (b) Using your PD controller from the previous part as a starting point, design a PID controller that meets the specifications in (a) and removes steady-state error.