ELEC301 – Systems Control and Communication

Matlab Homework #3

Due: 17/12/18

(Submit your MATLAB source code, which is properly commented, along with a report that includes the output images/plots, and your analysis/comments about the results in a zip via Blackboard.)

In this homework, you will design an analog and a digital controller for a feedback control system given an analog plant with the transfer function

$$P(s) = \frac{1}{s^2 + 3s + 1}$$

The aim of the controller is to decrease rise time of the step response. The definition of rise time is the time it takes for the response to go from 10% of its steady-state value to 90% of that value. You can use Matlab functions or step response plot to find rise time.

- Is the open-loop system stable? Justify your answer analytically. Compute and plot the step response of the plant P(s).
- Design an analog PI controller by using a method of your choice. Explain why you chose this method and the steps of the method. Show that your choice of K_p and K_i coefficients result in a stable closed-loop system.
- Find the steady state error, rise-time, settling time, overshoot and peak response for
    - the open-loop (without controller)
    - the closed-loop plant with P control only
    - the closed-loop plant with PI control

  Comment on your results.

- Convert the analog controller into a discrete-time controller using a mapping of your choice. Explain why you chose this mapping. Is the closed-loop system with discrete-time controller stable? Plot the root locus of the closed-loop system with the discrete-time controller and comment on your results.

(Hint: You can use rlocus, tf, step, c2d and feedback functions.)