Lab 08: Digital control

CHEN4011: Advanced modeling and Control

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1 Objectives

1. To develop MATLAB Simulink model of continuous and digital control systems.
2. To simulate digital PI controller vs. continuous PI controller performance for different sampling periods T: 0.5, 1, 2.

2 Problem Statement

A continuous process is represented by the following transfer function:

$$G_p(s) = \frac{5exp(-2s)}{(7s+1)(s+1)} \tag{1}$$

Also, an output disturbance transfer function is given by,

$$G_d(s) = \frac{1.4exp(-3s)}{(10s+1)} \tag{2}$$

For the digital PI controller implementation, use zero-order hold and sampler where the sampling period can be varied as mentioned in the objectives.

3 Tasks

i. Develop a Simulink model that contains the continuous and digital control systems. Provide the screenshot of the Simulink model in the report. [2 marks]
ii. Tune a PI controller for the continuous control system, e.g., using Control System Designer. [1 mark]
iii. Apply the PI controller tuning in (b) to the continuous and digital systems. For the digital system, switch the continuous mode to the discrete mode. [2 marks]
iv. Compare the performance of the digital PI controller for the 3 different sampling periods mentioned above with the continuous PI controller. Plot the responses and give comments on the results. [5 marks]