ChE381A: Process Dynamics and Control

Laboratory Assignment 5

Feedforward-Feedback Control

A two input-single output process is provided to you. There are two scenarios. The process output, y, is controlled using the first input, u_1 (Scenario 1), or using the second input, u_2 (Scenario 2). The process input that is not used for control (u_2 for Scenario 1 and u_1 for Scenario 2) then acts as the disturbance to the process.

Feedforward Compensator Design

(a) Using fitted first order plus dead-time models, design appropriate feedforward compensators for Scenario 1 and Scenario 2 using the theory described in class today.

(b) A gain + lead-lag + dead time feedforward compensator is to be designed. The compensator gain is readily obtained from the steady state gain with respect to the two process inputs. Use *fmincon* to obtain the best lead-lag and dead time parameters of the feedforward compensator for Scenario 1 and for Scenario 2. The objective is to minimize the IAE for the disturbance (no feedback control).

Feedback Controller Design

(c) Estimate K_U and P_U for Scenario 1 and Scenario 2 using the relay feedback test. A PID controller is then implemented with the Zeigler Nichols tuning settings.

Control Performance Evaluation

(d) Obtain the unit step regulator and servo responses for Scenario 1 and Scenario 2 with and without feedforward compensation. Comment on the effectiveness of feedforward compensation in the two scenarios.

Submit a short report on the exercise.