Lab 06: Multi-loop PID Control Simulation

CHEN4011: Advanced modeling and Control

Ranjeet Utikar

2023-09-17

# 1. Objectives

1. To develop a MATLAB Simulink model for multi-loop PID control simulation
2. To apply controller tuning methods.

# 2. Problem Statement

Consider a 2x2 MIMO process given as follows:

$$G\left(s\right)=\left[\begin{matrix}\frac{22.89e^{−0.2s}}{4.572s+1}&\frac{−11.64e^{−0.4s}}{1.807s+1}\\\frac{4.689e^{−0.2s}}{2.174s+1}&\frac{5.80e^{−0.4s}}{1.801s+1}\end{matrix}\right]  \left(1\right)$$

# 3. Tasks

1. Determine suitable controller pairings for the MIMO process given above. Based on the results of the controller pairing analysis, next reduce the decentralized system above to a diagonal form with two effective open-loop transfer functions (EOTF). [2.5 marks]
2. Complete the multi-loop PI controller tuning using the aforementioned 2 different tuning methods stated in the objectives. Then, evaluate the multi-loop PI controller performances for sequential setpoint tracking to 1 unit step change in the setpoints of y\_1 and y\_2. Analysis the simulation results and identify which of the 2 tuning methods gives the best performance for this particular MIMO process. [2.5 marks]
3. Next, evaluate the multi-loop PI controller performance for disturbance rejection: consider 1 unit step changes in the output disturbances to y\_1 and y\_2. Again, based on your analysis of the simulation results identify the best multi-loop PI control system. [2.5 marks]
4. Suppose that there are modelling errors in the process model where the gain errors are 10% and deadtime errors are 20%. Under these modelling errors, run the simulation of the multi-loop PI control systems involved. Analyze the simulation results and summarize 2 key findings from the simulation. [2.5 marks]

# 4. Notes

* Show the Simulink model in the report
* Provide a few figures or plots to show your control system responses
* Use tables to summarize your results
* Maximum report is 5 pages excluding the cover page