WAT-E2130 EXAM 2 Process control May 28, 2021

Student name:

Student number:

1. Explain the following control configurations (4p):
   1. Feedback control.
   2. Feedforward control.
   3. Cascade control.

Provide some practical examples of application in wastewater treatment plants, highlighting the pros and cons of each configuration.

1. Consider a feedback control system set in manual mode and Figure 1 which provides the process reaction curve (upper plot) resulting from a step-function change in the manipulated variable (lower plot). Based on Figure 1, define and compute the parameters of process model in the form of .

What is the meaning of and ? How can the model be used for tuning a PID controller?

(6p).

Chart

Description automatically generated

Figure 1. Process reaction curve for question 2.

1. For controlling the plant schematically represented in Figure 2 you have the possibility of acquiring ONE suspended solid sensor. Answer to the following (6p.)
   1. Given the available instrumentation, formulate and discuss a possible control configuration for the plant (that is, locate your sensor in the plant and a possible manipulated variable).
   2. Define and justify reasonable values for the set-point of the controlled variable.
   3. Discuss the how your control strategy could affect plant performances.
   4. Suggest a commercial sensor to be acquired, their measuring principl es and highlight possible problems that you might encounter during their life time.

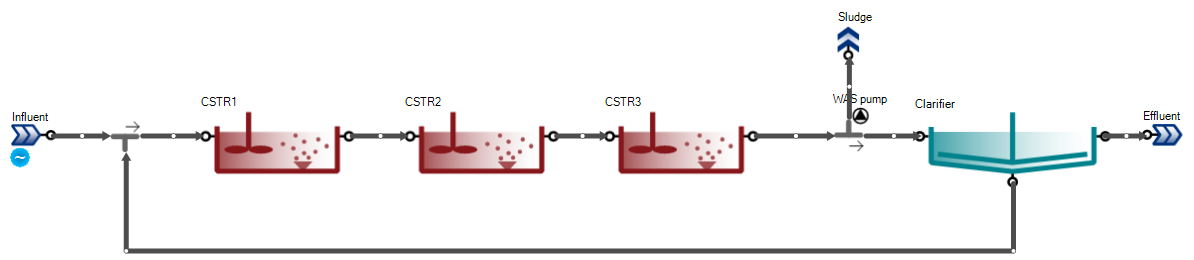


Figure 2. Plant layout for question 3.

1. Figure 2 shows a cascade controller representation in SUMO where the dissolved oxygen setpoint controller targets the effluent ammonia concentration to a setpoint. Do the following (4p):
   1. Represent the system as block diagram identifying the upper- and lower-level control loops, as well as the input/output to/from each block.
   2. What benefit you expect from the cascade control configuration in Figure 2 with respect to a single dissolved oxygen controller in the plant?

