A COMBINATION OF FUZZY AND LINEAR CONTROL TECHNIQUES FOR THE EQUALIZATION OF AN INDUSTRIAL WASTEWATER TREATMENT PLANT

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Most industrial wastewater treatment plants have to treat an influent characterized by a highly varying flow rate and concentration. These variations have a detrimental influence on the purification process. Therefore, in most treatment plants an equalization system is foreseen.

This paper presents a control strategy for an industrial equalization system based on a disturbance-accommodating controller combined with a fuzzy supervisor.

The process considered consists of two large tanks in series, in parallel with a single small tank. The two tanks in series receive a continuous high flow of low concentration from the production facility. In the single tank truck loads of a higher concentration are discharged occasionally. The actuators are the outflow rates of each of the three tanks, and measurements consist of the water levels in each of the tanks and the concentration at the output of the complete equalization system.

From first principles modeling of the whole system, it was established that the system was stabilizable, the volumes being controllable, and the concentrations stable. Considering this, and the structure of the process, the following strategy was conceived. A disturbance-accommodating controller is used to control the volumes of the two tanks in series. A high weighting of the outflow rate of the last tank ensures the equalization of the flow rate. The estimation of the influent flow rate is introduced in a long-term filter, to adapt the functioning point of the flow rates. A PI controller on the outflow rate of the single tank is used to equalize the output concentration.

The true plant, however, is characterized by a great number of constraints, the most important ones being the volume constraints. To deal with these constraints, the controller was extended with a supervisory level. A fuzzy controller was used to adapt the functioning points of the outflow rates when certain volumes approached their limits.

This strategy was evaluated through simulation. Both flow rate and concentration were equalized very well. A modified version of this controller will be implemented on a full scale system.

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