OPTIMIZATION OF CONTROLLER PARAMETERS FOR IMPROVED WASTEWATER TREATMENT PLANT OPERATION BY GENETIC ALGORITHMS

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Abstract

Wastewater treatment is highly complex, nonlinear and very slows process. Lack of proper instrumentation and stern environmental legislations along with demand for cost effective plants have made automation of wastewater treatment process an important priority. But the intricate nature of the process poses a barrier to the successful implementation of the control system. The challenge lies in the design of a strategy to reduce operational costs and improve effluent quality simultaneously. In this work, Benchmark simulation model no. 1 (BSM1) is used as working scenario and PI controllers are used as control law. Tuning of PI controllers is a tedious job because of plants' highly complex dynamics spread over different time ranges. To address this issue, in this work, Genetic Algorithms which is a subclass of Evolutionary search algorithms is used determine optimal PI controller parameters which result in improved effluent quality and reduction of operational costs. Different objective functions are formulated to find the optimal PI parameters. Pareto optimal curve is plotted for different conditions and the best combination is evaluated. The results indicated that the controllers designed using this approach provided good performances.

References:

1. Santin,I., et al., Santin, I., Pedret, C., & Vilanova, R, Applying variable dissolved oxygen set point in a two level hierarchical control structure to a wastewater treatment process, Journal of Process Control, 28(2015), 40-55.
2. J. Alex, et al., Benchmark Simulation Model No. 1, Report by the IWA Taskgroup on Benchmarking of Control Strategies for WWTPs (2008).
3. K. Duzinkiewicz and M. Brdys, Genetic Hybrid Predictive Controller for Optimized Dissolved-Oxygen Tracking at Lower Control Level, IEEE Transactions on Control Systems Technology, 17(2009), 1183-1192