

Test of a Hybrid Linear Observer Applied to an Alternate Phase Activated Sludge Process

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Abstract

Activated sludge process are widely applied for biological sewage and industrial wastewater treatment. However, process monitoring is delicate due to the lack of instrumentation, and possible observability problems. This paper explores the application of a recently proposed hybrid linear observer [1] to an activated sludge process with alternate phases. This observer is dedicated to switched systems, and requires weaker conditions, i.e. determinability. This observer allows to reconstruct the evolution of the states, after a certain number of process cycles, despite the fact that each phase of the process taken alone does not meet the usual observability conditions. The observer is tested in simulation based on nonlinear and linear models developed in [2, 3]. In the linear model, neither the aerobic nor the anoxic phase taken alone meets the usual observability conditions. Simulations results show that the observer provides good estimates in this case. Although the application of the observer to the nonlinear model seems less satisfactory at first sight (see Fig.2), the observer is still able to provide good estimates for the states of interest : S_{NH_4} and S_{NO_3} .

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References

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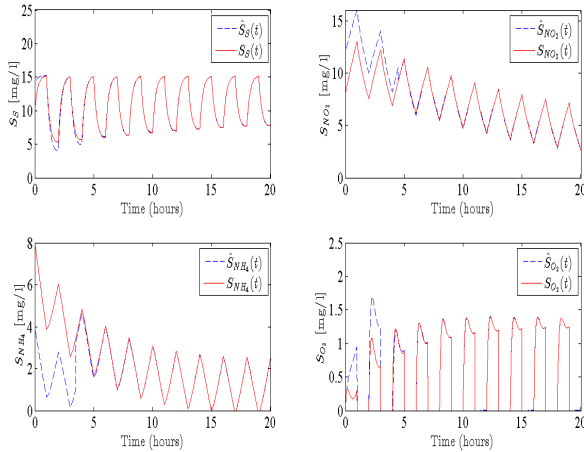


Figure 1: Hybrid observer tests with the same linear model over 20 hours: S_{O_2} is measured during the aerobic phase and S_{NO_3} during the anoxic phase ($N = 3$).

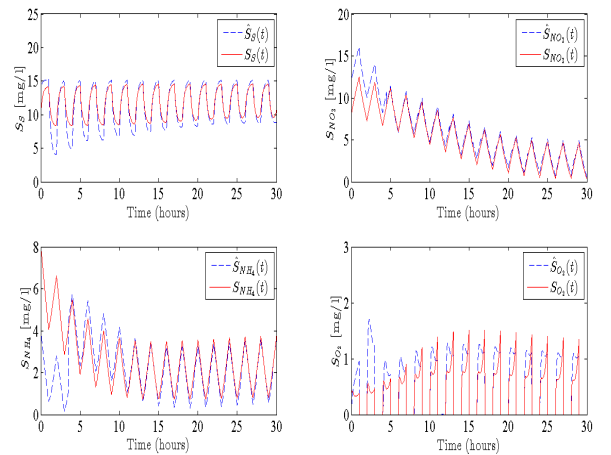


Figure 2: Hybrid observer tests with the nonlinear model over 30 hours: S_{O_2} is measured during the aerobic phase and S_{NO_3} during the anoxic phase ($N = 3$).