Switching Control with Application to Nonlinear pH-Neutralization

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Extended Abstract

Switching control is a variation of adaptive control, where instead of fitting the model parameters directly to data, one chooses the model which best describes the data from a pre-specified set of models. For each model there is an associated controller that is used for feedback control. A switching controller is more robust than traditional adaptive controllers, as one may specify the allowed models and controllers. Furthermore, robustness is also improved by only allowing model switching when the best model describes current plant behaviour significantly better than the previously chosen model.

In the current research, switching control is applied to a nonlinear pH simulation. The pH neutralization process shows large variation especially in the plant gain depending on both the operating pH level and the amount of buffer in the neutralized liquid. The buffer variations introduce special problems, as one may not be able to measure them, and thus one may not use gain scheduling for compensation of the gain variations. Such unmeasured disturbances do also cause problems in adaptive control, as one has to estimate them or compensate for them.

In the current research, unmeasured disturbances are taken into account by treating the disturbance as a model parameter, a constant added to the input or to the output. In principle, any disturbances can be described by a sequence of such assumed disturbances.

The performance of the switching controller is compared to ordinary PID controllers, as well as a re-tuning adaptive PID controller.