On the Optimal Operation of the Open Plate Reactor

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Abstract

In this work, we are mainly interested in the optimal operation of a new chemical reactor namely the *Open Plate Reactor* (OPR). The OPR allows complex reactions to be performed with an accurate thermal control by combining high heat transfer capacity with improved micro-mixing conditions. The OPR is being developped by Alfa Laval AB and is proposed as a benchmark problem in the context of the European Project HYCON [1].

The process is modelled by a set of first order PDE that are discretized using a backward difference method that yields a 30 *th* order nonlinear system[1]. The system is to be operated under states and control constraints. The process contains uncertain parameters, the ranges of which are given and thus can be used to robustify the control approach. The proposed approach is to use a predictive control strategy taking explicitly into account the uncertain parameters. This is done by formulating the corresponding open loop optimal control problem as a min-max optimization problem. Using nonlinear programming techniques, the optimization problem is then solved and implemented in a receding horizon fashion. A particular attention should be paid to the feasibility of the approach in real time. For this, simple open loop control parametrization e.g., constant profiles, will be used.

Tasks

The student is required to execute the following tasks.

- Understand the physics of the process and conduct the first numerical experiments.(1 month),
- Developp an optimal control algorithm using a minimax approach and code it (4 months),
- Close the loop using the receding horizon technique (1 month)

The computational aspects of the problem can be carried out using Matlab and Simulink.

Working language

English

Contact information

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References

[1] http://www.ist-hycon.org/

[1] The analytical model is already available. On this side, no contribution is expected from the student.