LPV model development and control of asolution copolymerization reactor

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Abstract:

In this paper, linear parameter-varying (LPV) control is considered for a solution copolymerization reactor, which takes into account the time-varying nature of the parameters of the process. The nonlinear model of the process is first converted to an exact LPV model representation in the state-space form that has a large number of scheduling variables and hence is not appropriate for control design purposes due to the complexity of the LPV control synthesis problem. To reduce such complexity, two approaches are proposed in this paper. First, an approximate LPV representation with only one scheduling variable is obtained by means of a parameter set mapping (PSM). The second approach is based on reformulating the nonlinear model so that it provides an LPV model with a fewer number of scheduling parameters but preserves the same input-output behavior. Moreover, in the implementation of the LPV controllers synthesized with the derived models, the unmeasurable scheduling variables are estimated by an extended Kalman filter. Simulation results using the nonlinear model of the copolymerization reactor are provided in order to illustrate the performance of the proposed controllers in reducing the convergence time and the control effort.

Keywords:

Copolymerization reactor; Linear parameter-varying systems; Parameter set mapping; LPV control; Extended Kalman filter.

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