Wang, Limin; Song, Jiang; Zhang, Ridong; Gao, Furong
Constrained model predictive fault-tolerant control for multi-time-delayed batch processes with disturbances: a Lyapunov-Razumikhin function method. (English) [Zbl 07459433]
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Summary: This paper mainly studies the design of iterative learning constrained model predictive fault-tolerant control for batch processes accompanied by multi-delays, interference and actuator failures. Firstly, an equivalent 2D-Roesser model with multi-delays is established. The definition of invariant set is proposed. The sufficient conditions with invariant set characteristics are established. After that the predictive fault-tolerant controller is designed with terminal constraints against external disturbances. In this paper, Lyapunov-Razumikhin function (LRF) is used to form Lyapunov-Krasovskii function (LKF) to construct the sufficient condition for the predictive control system that satisfies the terminal constraint condition. Moreover, the system state still remains invariant set characteristics. This method has certain advantages in controller design and calculation. In addition, it has the characteristics of simple design and small computation, and is especially suitable for small delay systems. Finally, a simulation experiment in the nonlinear batch reactor is carried out. Compared with the traditional one-dimensional (1D) method, the presented strategy has better performance through simulation experiment.

MSC:
93B45 Model predictive control
93B47 Iterative learning control
93B35 Sensitivity (robustness)
93C43 Delay control/observation systems

Keywords:
iterative learning constrained model predictive control; batch processes with multi-delays

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