Model Prediction-Based Approach to Fault Tolerant Control with Applications

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Abstract

Abstract— Fault-tolerant control (FTC) is an integral component in industrial processes as it enables the system to continue robust operation under some conditions. In this paper, an FTC scheme is proposed for interconnected systems within an integrated design framework to yield a timely monitoring and detection of fault and reconfiguring the controller according to those faults. The unscented Kalman filter (UKF)-based fault detection and diagnosis system is initially run on the main plant and parameter estimation is being done for the local faults. This critical information is shared through information fusion to the main system where the whole system is being decentralized using the overlapping decomposition technique. Using this parameter estimates of decentralized subsystems, a model predictive control (MPC) adjusts its parameters according to the fault scenarios thereby striving to maintain the stability of the system. Experimental results on interconnected continuous time stirred tank reactors (CSTR) with recycle and quadruple tank system indicate that the proposed method is capable to correctly identify various faults, and then controlling the system under some conditions.

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