Sensor Fault Diagnosis for Nonlinear Processes with Parametric Uncertainties

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ABSTRACT

This paper addresses the problem of detecting, discriminating and reconstructing sensor faults for nonlinear systems with known model structure but uncertainty in the parameters of the process. The convenience of the proposed technique lies in the fact that historical operational data and/or a priori fault information is not required to achieve accurate fault reconstruction except for fixed, short intervals. The overall fault diagnosis algorithm is composed of a series of nonlinear estimators, which estimates parameter and a fault isolation and identification filter. Parameter estimation and fault reconstruction can not be performed accurately since faults and parametric uncertainty interact with each other. Therefore, these two tasks are performed at different time scales, where the fault diagnosis takes place at a more frequent rate than the parameter estimation. It is shown that the fault can be reconstructed under some realistic assumptions and the performance of the proposed methodology is evaluated on a simulated chemical process exhibiting nonlinear dynamic behavior.