Fault Estimation and Monitoring with Multi-Sensor Data Fusion: An Unscented Kalman Filter Approach

Mahmoud, Professor Magdi S. and Khalid, Dr. Haris M. (2011) *Fault Estimation and Monitoring with Multi-Sensor Data Fusion: An Unscented Kalman Filter Approach.* [Preprint]

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1223Kb

Abstract

Abstract— In this paper, an unscented Kalman filter (UKF) is proposed in an integrated design frameworks to utilize multi-sensor data fusion techniques for process fault monitoring. The multi-sensor data fusion (MSDF) technique is presented by frameworks of centralized and decentralized architectures. A set of simulation studies has been conducted to demonstrate the performance of the proposed scheme on quadruple tank system (QTS) and industrial utility boiler (IUB). It is established that the decentralized integrated framework retrieves more effectively the critical information about presence or absence of a fault from the dynamic model with minimum time delay and provides accurate unfolding-in-time of the finer details of the fault as compared to the centralized integrated framework, thus completing the overall picture of fault monitoring of the system under test. Experimental results on QTS and IUB, show that the proposed method is able to correctly identify various faults even when the dynamics of the systems are large.

Item Type:	Preprint
Keywords:	Index Terms— Fault monitoring, fault estimation, unscented Kalman filter, integrated design framework, multi-sensor data fusion, quadruple tank system, industrial utility boiler.
Subjects:	Computer Science > Dynamical Systems
ID Code:	8910
Deposited By:	Khalid, Dr. Haris M.
Deposited On:	04 May 2013 23:07
Last Modified:	04 May 2013 23:07

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