Switched System Diagnosis Based on Intelligent State Filtering with Unknown Models

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Abstract : The paper addresses the problem of fault diagnosis for systems operating in several modes (normal or faulty) based on states assessment. We use, for this purpose, a methodology consisting of three main processes: 1) sequential data clustering, 2) linear model regression and 3) state filtering. Typically, Kalman Filter (KF) is an algorithm that provides estimation of unknown states using a sequence of I/O measurements. Inevitably, although it is an efficient technique for state estimation, it presents two main weaknesses. First, it merely predicts states without being able to isolate/classify them according to their different operating modes, whether normal or faulty modes. To deal with this dilemma, the KF is endowed with an extra clustering step based fully on sequential version of the k-means algorithm. Second, to provide state estimation, KF requires state space models, which can be unknown. A linear regularized regression is used to identify the required models. To prove its effectiveness, the proposed approach is assessed on a simulated benchmark.

Keywords : clustering, diagnosis, Kalman Filtering, k-means, regularized regression
Conference Title : ICCAES 2019 : International Conference on Control, Automation and Electrical Systems
Conference Location : Barcelona, Spain
Conference Dates : February 11-12, 2019