Issues in Fault Diagnosis and Isolation

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ABSTRACT

In the chemical and other related industries, there has been an impetus to produce higher quality products, to reduce rejection rates, limit down time, and to satisfy increasingly stringent safety and environment regulations. To meet higher standards, chemical processes depend on a large number of variables operating under closed loop conditions. Standard process controllers (PID controllers, model predictive controllers, etc.) are designed for steady state operating condition by compensating for small deviations in process variables. However, there occur some deviations that are unpermitted from usual or acceptable conditions. Hence, according to IFAC Technical committee: SAFEPROCESS (Fault Detection, Supervision and Safety for Technical Processes) has defined a fault as "An unpermitted deviation of at least one characteristic property or parameter of the system from the acceptable/usual/standard condition."

This paper discusses generic approaches taken in fault detection and diagnosis in engineering systems, viz. robust model based techniques (residual generation, eigen-structure assignment, parameter estimation, and parity relation), stochastic methods (univariate analysis, partial least square technique, Fisher discriminant analysis, principal component analysis), knowledge based methods for decision making using neuro-fuzzy hybrid models, and various other approaches taken by research scientists, process engineers, and people in academia.