

Abstract :

An improved process monitoring scheme is presented in this paper, it is based on the integration of multivariate and univariate statistical analysis methods. Instead of conventional fixed control limits, adaptive thresholds are developed for common fault detection indices used with principal component analysis, including the Hotelling T^2 statistic and the sum of squared prediction error known as the Q statistic. The thresholds are updated based on a modified exponentially weighted moving average chart with a limited window length. The primary goal of this strategy is to enhance the performance of principal component analysis-based process monitoring method and overcome its shortcomings, by increasing fault detection rate to improve monitoring sensitivity and eliminating false alarms to ensure higher robustness and reliability. Fault detection in the revised model of Tennessee Eastman process benchmark is also investigated. The developed monitoring scheme is tested and compared with conventional fixed threshold technique, and its performance is evaluated across various types of process faults. The obtained results demonstrate the promising capabilities of the developed scheme.