

For large scale and complex processes, data-driven analysis methods are receiving increasing attention for fault detection and diagnosis to improve process operation by detecting when abnormal process operations exist and diagnosing the sources of the abnormalities. Common methods based on multivariate statistical analysis are widely used and particularly principal component analysis (PCA), fault detection indices used along with PCA including the Hotelling  $T^2$  statistic and the sum of squared prediction error (SPE) known as the Q statistic can be used to identify faults. This paper develops a new adaptive thresholding scheme based on a modified exponentially weighted moving average (EWMA) control chart statistic, which is effective in detecting small changes and abrupt shifts in the process operation. The aim is to enhance the performance of PCA methods for process monitoring, while maintaining a low false alarm rate with good sensitivity of anomalies. The performance of the developed scheme is compared to a conventional fixed thresholding technique by evaluating the detection performance across various types of faults that occurred in the Tennessee Eastman Process, The results demonstrate the promising capabilities of our proposed scheme