

Orthogonal projection based statistical feature extraction for continuous process monitoring

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March 7, 2023

Abstract

Multivariate statistical techniques have been widely applied in industrial processes to detect abnormal behaviors, while their performance could be unsatisfactory due to insufficient extraction of complex data characteristics. A method named Orthogonal transformed statistics Mahalanobis distance (OTSMD) is developed to handle this issue. As a feature-based method, OTSMD simultaneously considers various data characteristics through monitoring statistical features of process variables. Orthogonal transformed components (OTCs) are first calculated to capture variable correlation, and a set of statistical features is determined to extract other crucial characteristics, especially for the process nonstationarity. Statistical features of OTCs, which reveals implied process information, are continuously obtained using a sliding window, and a Mahalanobis distance index is utilized for fault detection. Compared with existing methods, OTSMD extracts data characteristics more comprehensively with a lower dimension, making it more effective in monitoring various faults. The results are illustrated through a numerical example, and two chemical industrial processes.

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