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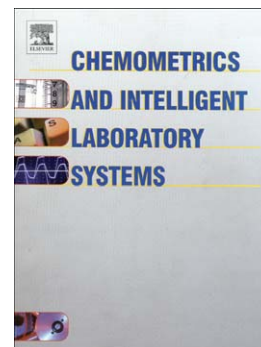
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# Preliminary-Summation-Based Principal Component Analysis for Non-Gaussian Processes

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**Abstract:** To cope with the combined Gaussian and non-Gaussian features in the industrial processes, a novel preliminary-summation-based principal component analysis (PS-PCA) method is proposed in this study. Different from other approaches which improve principal component analysis (PCA) by changing its algorithm structure, PS-PCA just preprocesses the training and monitoring data without modification on PCA. According to the central limit theorem, PS-PCA adds up samples of each variable to make the distribution of the sum approach Gaussian distribution. These sums are then used for state monitoring. It has been proved that preliminary summation can increase the fault detection rate for Gaussian processes. Furthermore, some simulation tests substantiate that PS-PCA can improve the detection capability for non-Gaussian processes and even for nonlinear processes without increasing the computation load.

Key words: multivariate statistical process control (MSPC); principal component analysis (PCA); independent component analysis (ICA); Preliminary-Summation-based PCA (PS-PCA); the central limit theorem

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