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Multivariate Quality Control Chart for Autocorrelated Processes

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Abstract

Traditional multivariate statistical process control (SPC) techniques are based on the assumption that the successive observation vectors are independent. In recent years, due to automation of measurement and data collection systems, a process can be sampled at higher rates, which ultimately leads to autocorrelation. Consequently, when the autocorrelation is present in the data, it can have a serious impact on the performance of classical control charts. This paper considers the problem of monitoring the mean vector and covariance matrix of a multivariate process. A first-order autocorrelated process is modeled using a vector autoregression (VAR) model. A multivariate quality control chart which is based on the VAR model is proposed. The chart is designed to detect shifts in the mean vector and covariance matrix of the process. The chart also helps in identifying the source of variation in the process. The proposed method is applied to a real data set to illustrate its effectiveness.

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