SPCR-BASED CONTROL CHART FOR AUTOCORRELATED PROCESS WITH HIGH DIMENSIONAL EXOGENOUS VARIABLES

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ABSTRACT

Monitoring processes in any industry is one means of controlling the production or the service being provided to ensure of those goods and services. Control charts are one of the tools in order to monitor processes. The goal of a control chart is to estimate control limits wherein the process could be identified as stable, then monitoring process shifts by identifying out-of-control points in the charts. In this way, the estimation is critical in the development of the control chart. High dimensional data also comes into the picture as those data could also provide meaningful information on the behavior of the monitored process.

The study proposes a methodology of using sparse principal component regression from high dimensional exogenous variables to estimate control limits of autocorrelated processes. A computational statistics approach was used and a simulation program was developed to generate and study different scenarios that would affect the estimation.

Several indicators were used in the study specifically false alarm rates, average run length during stable periods, and first detection rate upon structural change. It was noted that modelling a certain variable using high dimensional exogenous variables through sparse principal components is seen to create better estimations of that variable (*y*) and its corresponding control chart parameters as shown in the false alarm rates and average run lengths being comparable with the Exponentially Weighted Moving Average (EMWA) control chart. Also, faster identification of structural change could be observed due to the fact that *y* is modelled in terms of the aggregated of the *x's* which would not necessarily follow the behavior of the model.

Keywords: *Sparse principal component regressions, autocorrelated process, control chart, high dimensional data*