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A Single Control Chart with Runs Rules for Detecting Shifts in the Parameters of a Shifted Exponential Process

A single Shewhart chart based on a Max-type statistic has been suggested for monitoring a process using one control charts, based on a single plotting statistic, and detecting changes in its parameters. To improve its power, it is suggested to apply one or more supplementary rules based on run statistics, known as runs rules. Supplementary runs rules have been used since the 1950s to improve the performance of control charts in detecting small to moderate shifts in process parameters. Recently, there has been an increased interest in proposing improved control charts for monitoring a shifted exponential process, i.e. a process where the critical-to-quality characteristic follows a shifted exponential distribution. However, the case of single control charts with runs rules has not been investigated so far. In this work, we introduce and study a Max-type control chart supplemented with runs rules for detecting changes in the parameters of a shifted exponential process. Using a Markov chain method, we calculate the run length distribution of the proposed charts whereas we assess their performance, in terms of the average run length and the expected average run length metrics. In addition, the performance of the proposed charts is compared with other competitive single control charts, such as the SEMLE-Max chart and the RS-SEMLE-Max chart. Finally, a real dataset is used to illustrate the implementation of the proposed charts in practice.

Special/ Invited session

Classification

Both methodology and application

Keywords

Average run length, Runs rules, Markov chain, Statistical process control, Shifted exponential distribution

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