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A new auxiliary information based cumulative sum median control chart for location monitoring

Key words: Average run length; Auxiliary information; CUSUM control charts; Location parameter; Median control charts

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Highlights

- Several CUSUM median control charts based on auxiliary variable(s) are proposed and their performances are compared with those of their corresponding mean charts.
- The performances of the proposed control charts are compared under symmetric (normal and Student's t) and non-symmetric (log-normal) probability models.
- The performances of the proposed control charts are also compared with the absence (uncontaminated scenario) and presence of outliers (contaminated scenario).
- An application of the proposed control charts with real data of cement manufacturing industry is provided.

Method

1. We used Monte Carlo simulations to verify the results of our proposed control charts with their counterparts. By simulations, we calculated the run length distributions of the proposed and existing control charts and compare the performance of charts.
2. We used several performance measures as average run length (ARL) to detect out-of-control behavior at a specific shift along with extra quadratic loss (EQL), relative average run length (RARL) and performance comparison index (PCI) to detect out-of-control behavior at overall shift points.
3. We used real industrial data to check the performance of our proposed control.

Findings

- The performance of mean control charts is better in symmetric processes under uncontaminated scenarios.
- The proposed charts based on two auxiliary variables is more efficient than control charts based on one auxiliary variable or usual median control chart.
- With the presence of outliers, our proposed median control charts are more robust than mean control charts under both probability models.