



Contribution ID: 99

Type: **not specified**

An entropy-based distribution-free approach for profile monitoring

Profile monitoring is a branch of Statistical Process Monitoring (SPM) that uses statistical methods to identify irregularities in process data. The data is characterized by a profile, or response curve, observed over a given time interval. Profile monitoring consists of two main phases: the first involves defining an in-control (IC) profile, and the second focuses on comparing subsequent profiles with the IC profile to detect departures from normal behavior. In this study, permutation entropy (PE) is proposed as a nonparametric approach for profile monitoring. A general IC profile is obtained using B-spline fitting, while multiple IC profile replications are generated through nonparametric residual bootstrapping. The PE values of the IC profiles are then computed to establish upper and lower control limits for monitoring future profiles. The performance of the proposed entropy-based method is evaluated using simulated data, and the results demonstrate that PE is effective in identifying out-of-control process profiles.

Special/ Invited session

Classification

Both methodology and application

Keywords

B-spline fitting, control charts, non-parametric residual bootstrapping, permutation entropy

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Track Classification: Statistical Process Monitoring