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Statistical Process Monitoring of Electric Battery Systems on High-Speed Trains through Compositional Data Analysis

Electric batteries are often connected in parallel to ensure a wider power supply range to external electrical loads. Their condition is routinely monitored through the current measured when the batteries supply power. When the condition is adequate, the current is balanced throughout the system, with each battery contributing equally to the electrical load.

To ensure that monitoring focuses on the relative contributions of each battery rather than the total electrical load, we propose a statistical process monitoring (SPM) approach based on compositional data. We demonstrate that the proposed approach can maintain a controlled false alarm rate across varying total electrical loads. Its practical applicability is illustrated through a case study in the SPM of parallel-connected nickel-cadmium batteries installed on a modern high-speed train fleet to power auxiliary onboard systems.

Special/ Invited session

Classification

Mainly application

Keywords

Predictive Maintenance, Multivariate Quality Control, Performance Degradation, Current Imbalance Detection

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