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Suitability of Parametric and Nonparametric Statistical Methods for Turboprop Engine Diagnostics

Turboprop engines undergo regular inspections, yet continuous analysis of in-flight sensor data provides an opportunity for earlier detection of wear and degradation—well before scheduled maintenance. The choice of statistical method plays a crucial role in ensuring diagnostic accuracy and interpretability. In this study, we compare the performance of traditional parametric methods—specifically regression models—with a non-parametric, depth-based functional data approach for anomaly detection. We evaluate each method's ability to identify deviations in engine behavior that may signal early-stage faults or potential sensor errors. Using a real-world engine performance dataset, we assess the sensitivity, applicability at different stages of the diagnostic analysis, and practical interpretability of both approaches. The results offer recommendations for applying these methods in safety-critical aircraft engine condition monitoring.

Special/ Invited session

Classification

Both methodology and application

Keywords

Aircraft, Functional depth, Regression model

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Track Classification: Statistical Process Monitoring