An End-to-End Predictive Maintenance System for Autonomous Inspection based on Health Index

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***Abstract*— This paper proposes WFSPM, an end-to-end predictive maintenance system for assessing generator stator wedge fastener strength, centered on a Mahalanobis distance (MD) based health index (HI). The system implements a standards-compliant pipeline—data flow, feature extraction, decision rules, and UI/reporting—and maps the MD-HI to a 0–100 health scale for field interpretability. It exhibits strong static classification performance and robustness under injected synthetic noise. Scenario-based prognostics and health management (PHM) key performance indicators (KPI) and lead-time analyses further demonstrate a practical operate cycle of early warning, action and recovery. Overall, WFSPM provides an explainable and robust solution, with operating policies that can be tuned to field constraints.**

***Keyword*—Predictive Maintenance, Mahalanobis Distance, Health Index, Acoustic Signal Processing**

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