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AI and ML Techniques for Machine Health Condition Monitoring

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Abstract

Reliable machine condition monitoring systems are critically needed in industries to recognize equipment defects at their earliest stage so as to improve production quality, operation efficiency and safety. An AI and machine-learning (ML)-based monitoring system consists of modules such as data acquisition, signal processing, fault diagnosis and prognosis. Smart sensor-based data acquisition systems are used to collect signals wirelessly. Signal processing is a procedure to extract representative features from measurement for system analysis and fault detection in machinery systems. Diagnosis is a procedure to classify features/patterns into different categories corresponding to different equipment health states. Prognosis is a process to predict the remaining useful life of the damaged equipment to schedule predictive maintenance operations. New AI tools such as adaptive neurofuzzy and evolving fuzzy techniques are used in automatic diagnostic and prognostic operations. Appropriate ML algorithms can be used to improve decision-making convergence and adaptive capability to accommodate different machinery conditions.