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Fourier Transform and Machine Learning Techniques for Fault Detection and Diagnosis of Induction Motors

Authors : Duc V. Nguyen

Abstract : Induction motors are widely used in different industry areas and can experience various kinds of faults in stators and rotors. In general, fault detection and diagnosis techniques for induction motors can be supervised by measuring quantities such as noise, vibration, and temperature. The installation of mechanical sensors in order to assess the health conditions of a machine is typically only done for expensive or load-critical machines, where the high cost of a continuous monitoring system can be Justified. Nevertheless, induced current monitoring can be implemented inexpensively on machines with arbitrary sizes by using current transformers. In this regard, effective and low-cost fault detection techniques can be implemented, hence reducing the maintenance and downtime costs of motors. This work proposes a method for fault detection and diagnosis of induction motors, which combines classical fast Fourier transform and modern/advanced machine learning techniques. The proposed method is validated on real-world data and achieves a precision of 99.7% for fault detection and 100% for fault classification with minimal expert knowledge requirement. In addition, this approach allows users to be able to optimize/balance risks and maintenance costs to achieve the highest benet based on their requirements. These are the key requirements of a robust prognostics and health management system.

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