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ORIGINAL PAPER

Best Time Domain Features for Early Detection of Faults in Rotary Machines Using RAT and ANN

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Abstract

Background Bearing failure, the most frequent failure mode in rotating machinery is the typical mechanical fault. Such a failure might result in substantial financial losses at the workplace. One of the approaches made possible by other signal processing techniques is the early identification of various faults in rotating machinery; including bearing failures, misalignment, and others.

Purpose This fault is associated with many features used to diagnose different faults; thus, the Diagnostic Features (DF) is estimated at limited cyclic frequencies that refer to machine faults.

Method Two methods are used to extract the DF. The first one depends on time-domain features. The second is based on an advanced representation of the frequency domain, which depends on spectral coherence (SCoh) data over the spectral frequency domain using a center frequency and frequency range determined by a 1/3 binary tree structure. The calculated DFs are represented by a 2D map against the center frequency and frequency resolution. The maps from different fault features are collected to form the diagnostic patterns. The best characteristics connected to these various flaws can be found using statistical techniques like reverse arrangement tests (RAT). Artificial neural networks (ANN) may be trained and auto-diagnosed using the results from the best characteristics.

Results Using RAT is considered very important to summarize features. This method is given good results in training and diagnosis.

Conclusions Additionally, ANN and RAT provide a detection result of 100% based on the description of the machine's operating situation, whether it functioned commonly or incorrectly.

Keywords RAT · ANN · Time-domain feature · Rotating machine

Introduction

Features were employed in early failure detection techniques in the recent time domain. Depending on how well these elements can identify problems, some temporal domain (TD) characteristics are derived TAKÁCS [1]. By estimating the degradation trend in features over time with a cumulative approach, Kosasih et al. [2] were able to determine how the slewing bearing was degrading. An autoregressive model was employed by James and Walter [3]. The retrieved characteristics are established to acquire a deterioration trend; the vibration signals could be changed when faults occur in rotating machinery Liu et al. [4]. The TD signals' amplitude and distribution may differ from the standard conditions. It is feasible to assess whether rotating machine damage is occurring using the TD statistical characteristics, according to Sreejith et al. [5]. The time and frequency domain can be used in feature extraction techniques by Chen et al. [6]. Bansal et al. [7] has presented a study comparing the performance of these three feature extraction methods (SIFT, SURF, and ORB), particularly when combined to recognize an object. The authors presented a comparative study of various feature descriptor algorithms and classification models for 2D object recognition. Bansal et al. [8] has extended their work to Combining in-depth features extracted using

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