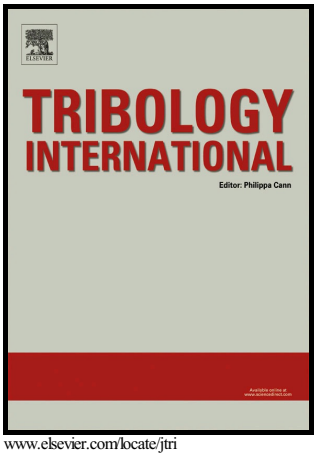

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Classification of acoustic emission signals generated from journal bearing at different lubrication conditions based on wavelet analysis in combination with artificial neural network and genetic algorithm

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ABSTRACT

This paper presents the results of Acoustic Emission (AE) investigation for monitoring lubrication conditions of a journal bearing under various operating conditions. Hydrodynamic Lubrication (HL), Mixed Lubrication (ML), and Boundary Lubrication (BL), are the basic types of the fluid film lubrication. The aim of this investigation is to identify effective frequencies and most useful features of the AE signals for classification of the lubrication types. Continuous Wavelet Transform (CWT) and time domain signal analysis methods are used for feature extraction of the recorded AE signals. Then, Genetic Algorithms (GAs) in combination with Artificial Neural Networks (ANNs) are applied to select and classify the extracted features. The experimental results showed that the proposed system using AE signal is effective.

Keywords: Acoustic Emission (AE), Lubrication types in the journal bearings, Continuous wavelet transform, Artificial Neural Networks (ANNs).

1. Introduction

Unexpected machine failures can cause considerable damages due to machine downtime and material losses. Condition monitoring is a solution to this problem by installing various sensors and gathering their information in order to gain insight into the online status of the machines under different operating conditions and enabling identification of machine faults in the early stages of their formations [1]. Journal bearings have important industrial role among the mechanical components, which should be maintained at highly reliable conditions to avoid unexpected, premature machine breakdowns. Defects could be arising in the bearings during their usage due to adverse operating conditions, faulty installation, or material fatigue. Adverse operating conditions can lead to improper lubrication which is one of the most important factors of the bearing failures. Thus, real time monitoring of the lubrication situations can lead to effective condition monitoring system. Vibration, acoustic emission, temperature, and force variations are the various signals, which typically have been used for rotating machinery condition monitoring [2]. Comparing to the other non-destructive testing

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