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Modelling Acoustic Emissions Generated by Tribological Behaviour of Mechanical Seals for Condition Monitoring and Fault Detection

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Abstract

Acoustic emission (AE) signals are useful for the condition monitoring of mechanical seals as tribological regimes affect the AE signatures. In this paper the investigation develops a mathematical model that can predict the energy of an AE signal under different tribological regimes. The developed model has been validated with experimental studies and satisfactory results have been perceived. Therefore, the model has strong potential to be used to obtain tribological behavior of mechanical seals and hence develop a reliable and accurate condition monitoring system under varying operating conditions.

Key words: Tribological regimes, Mechanical seals, Acoustic emission

1 Introduction

Acoustic emission (AE), as an attractive method, has been proven to be sensitive to tribological behaviour of rotating machines such as journal bearings and mechanical seals. This includes identification of lubrication regimes [1,2], monitoring the sliding contact [3,4], investigation of the effect of working parameters [5, 6] and fault detection [7,8]. Since AE sensors measure the actual source mechanism itself, the application of acoustic emission for condition monitoring of other tribosystems such as wind turbines [9,10], gearboxes [11,12] and rolling element bearings [13,14] is also very popular.

As a tribosystem, Fig.1, mechanical seals are exposed to widely varying operating conditions, and hence may experience different tribological regimes i.e. boundary lubrication (BL), mixed lubrication (ML) and hydrodynamic lubrication (HL) regime depending on the operating conditions. The effect of operating conditions (e.g. load, rotational speed and viscosity) on tribological behavior of mechanical seals is characterised by well-known Stribeck curve, where

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