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Abstract

Currently, temperature-based condition monitoring cannot be used to accurately identify potential faults early in a rotating machines' lifetime since temperature changes are only detectable when the fault escalates. However, currently only point measurements, i.e. thermocouples, are used. In this article, infrared thermal imaging is used which –as opposed to simple thermocouples– provides spatial temperature information. This information proves crucial for the identification of several machine conditions and faults. In this paper the conditions considered are outer-raceway damage in bearings, hard-particle contamination in lubricant and several gradations of shaft imbalance. The fault detection is done using an image processing and machine learning solution which can accurately detect the majority of the faults and conditions in our data set.

Keywords: Condition Monitoring, Fault diagnosis, Early fault detection, Rotating machinery, Infrared imaging, Image processing, Machine learning

1. Introduction

Rotating machinery can suffer from a wide range of sub-optimal conditions, such as misalignment, load imbalance, bearing raceway faults, bearing looseness and inadequate lubrication. These faults can escalate and propagate so that bearings can overheat, wear can be increased, spalling can occur and even other components can be damaged [1]. Hence, to reduce operational costs, it is important to detect these faults as early as possible.

A first approach to detect incipient faults is vibration analysis. Vibration-based condition-monitoring systems can detect a large part of the impending rolling element bearing (REB)

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