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Development of a Fuzzy-Logic Inference Technique for Fault Diagnosis in a
Motorcycle Platform

應用模糊邏輯推論技術於機車故障診斷系統

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Abstract

In the present study, a fault diagnosis system using acoustic emission with adaptive order tracking technique and fuzzy-logic interference for scooter platform is described. Order tracking of acoustic or vibration signal is a well-known technique that can be used for fault diagnosis of rotating machinery. Unfortunately, most of the conventional order-tracking methods are primarily based on Fourier analysis with the revolution of the machinery, the frequency smearing effect is often arises in some critical conditions. In the present study, the order tracking problem is treated as the tracking of frequency-varying bandpass signals and the order amplitudes can be calculated with high resolution. The order amplitude figures are then used for creating the data bank in the proposed intelligent fault diagnosis system. A fuzzy-logic inference is proposed to develop the diagnostic rules of data base in the present fault diagnosis system. The experimental works are carried to evaluate the effect of proposed system for fault diagnosis in a scooter platform under various operation conditions. The experimental results indicated that the proposed system is effective for increasing accuracy in fault diagnosis of scooters.

Key words : Fault diagnosis; Fuzzy logic inference; Adaptive order tracking

中文摘要

本篇論文主要是描述一個利用以聲音訊號搭配適應性階次分析和模糊邏輯推論為基礎的機車故障診斷技術。在傳統上，聲音及振動訊號經常可以藉由階次分析的技術來做轉動機械系統之故障診斷。但是大部分的傳統階次分析都是以快速傅立葉轉換為基礎，在某些情況下會有頻率抹平的現象產生。在本研究中，主要利用多頻帶訊號的追蹤和高解析階次振幅的計算來解決階次分析的問題。此一智慧型故障診斷系統的資料庫由很多階次圖所組成的，而這個資料庫最主要包含了模糊邏輯推論的系統及其推論條件。實驗的工作包括各種轉速的機車故障聲音訊號的量測與紀錄，並藉由所提出的分析技巧來判斷。實驗的結果驗證了這個故障診斷系統能精確且有效的藉聲音判斷出是何種故障所產生。

關鍵字：故障診斷；模糊邏輯推論；適應性階次分析