

發展以振動訊號及模糊邏輯推論為基礎之齒輪組故障診斷系統
Fault Diagnosis of Gear-Set Using Vibration Signal with Fuzzy Logic Inference

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中文摘要

本篇論文主要是描述發展一個以振動訊號與模糊邏輯推論為基礎的齒輪組故障診斷系統。本系統主要基於振動訊號並搭配離散小波轉換及模糊邏輯推論所建構而成，在故障診斷系統中將包含一個數位訊號處理程序及一個模糊邏輯推論。在傳統中，維修工程師對於轉動機械故障診斷，往往是依據振動和聲音等訊號的大小來做為故障診斷的基礎。其中，在對於各種故障的檢測判定仍然需要仰賴著維修經驗準則，然而；對於轉動機械系統運轉情況而言，可能運轉於複雜且吵雜的環境之中，而傳統的故障診斷方法在針對吵雜的環境下，將可能難以察覺出故障狀況。在本研究中，將利用齒輪組實驗平台來模擬故障振動訊號，來作為故障診斷之基礎，並使用離散小波轉換技當作數位訊號處理程序，針對故障特徵向量擷取方法將提出基於離散小波之能量頻譜技術，以建立特徵向量資料庫，並藉由模糊推論來完成各種故障情況的識別分類。

關鍵字：齒輪組; 離散小波轉換; 模糊推論; 故障診斷系統

Abstract

The paper focuses on development of gear-set fault diagnosis system using vibration signals with discrete wavelet transform and fuzzy logic interference. The diagnosis system is composed of a digital signal processing and a fuzzy state inference. In the conventional, an engineer for fault diagnosis of rotating machinery is based on vibration signal or sound emission signal, and the various faults inspection is depended on services experiences. However, the rotating machinery system may be operated in complex and noisy environment. The conventional diagnosis technique is difficult effective detection of fault features in noisy environment. In the present study, the digital signal processing is using discrete wavelet transform technique based on vibration signals in gear-set experimental platform. The extraction method of feature vector based on discrete wavelet transform with energy spectrum is proposed. On the basis of feature vector, the fuzzy state inference to carry out the variously fault identification. The diagnosis system was applied to experimental gear-set platform, and the result indicated that the proposed system is effective to apply variously gearbox system.

Key words : Gear train; Discrete wavelet transform (DWT); Fuzzy inference; Failure diagnosis system; Fuzzy logic interference; Vibration signal