

Accepted Manuscript

A New Fault Diagnosis Algorithm for Helical Gears Rotating at Low Speed using an Optical encoder

Yimin Shao, Daizhong Su, Amin Al-Habaibeh, Wennian Yu

PII: S0263-2241(16)30372-4

DOI: <http://dx.doi.org/10.1016/j.measurement.2016.07.013>

Reference: MEASUR 4200

To appear in: *Measurement*

Received Date: 23 April 2014

Revised Date: 9 May 2016

Accepted Date: 4 July 2016

Please cite this article as: Y. Shao, D. Su, A. Al-Habaibeh, W. Yu, A New Fault Diagnosis Algorithm for Helical Gears Rotating at Low Speed using an Optical encoder, *Measurement* (2016), doi: <http://dx.doi.org/10.1016/j.measurement.2016.07.013>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



A New Fault Diagnosis Algorithm for Helical Gears Rotating at Low Speed using an Optical encoder

Yimin Shao¹, Daizhong Su^{2*}, Amin Al-Habaibeh³ and Wennian Yu¹

¹ State Key Laboratory of Mechanical Transmission, Chongqing University, Chongqing 400030, People's Republic of China

² Advanced Design and Manufacturing Engineering Centre, School of Architecture, Design and the Built Environment, Nottingham Trent University, UK

³ The Innovative and Sustainable Built Environment Technologies research group, School of Architecture, Design and the Built Environment, Nottingham Trent University, UK

* Corresponding author, postal address: Professor Daizhong Su, Product Design, Nottingham Trent University, Burton Street, Nottingham, NG1 4BU, UK; E-mail address: daizhong.su@ntu.ac.uk;

Abstract

Helical gears are widely used in gearboxes due to its low noise and high load carrying capacity, but it is difficult to diagnose their early faults based on the signals produced by condition monitoring systems, particularly when the gears rotate at low speed. In this paper, a new concept of Root Mean Square (RMS) value calculation using angle domain signals within small angular ranges is proposed. With this concept, a new diagnosis algorithm based on the time pulses of an encoder is developed to overcome the difficulty of fault diagnosis for helical gears at low rotational speeds. In this proposed algorithm, both acceleration signals and encoder impulse signal are acquired at the same time. The sampling rate and data length in angular domain are determined based on the rotational speed and size of the gear. The vibration signals in angular domain are obtained by re-sampling the vibration signal of the gear in the time domain according to the encoder pulse signal. The fault features of the helical gear at low rotational speed are then obtained with reference to the RMS values in small angular ranges and the order tracking spectrum following the Angular Domain Synchronous Average processing (ADSA). The new algorithm is not only able to reduce the noise and improves the signal to noise ratio by the ADSA method, but also extracts the features of helical gear fault from the meshing position of the faulty gear teeth, hence overcoming the difficulty of fault diagnosis of helical gears rotating at low speed. The experimental results have shown that the new algorithm is more effective than traditional diagnosis methods. The paper concludes that the proposed helical gear fault diagnosis method based on time pulses of encoder algorithm provides a new means of helical gear fault detection and diagnosis.

Key Words: Machine condition monitoring; helical gear; low rotation speed gear; gear fault diagnosis; encoder; angular domain synchronous averaging; RMS of

Download English Version:

<https://daneshyari.com/en/article/7122849>

Download Persian Version:

<https://daneshyari.com/article/7122849>

[Daneshyari.com](https://daneshyari.com)