A Fault Diagnosis Approach for Rolling Bearing based on Ensemble Empirical Mode Decomposition

ABSTRACT

Bearings are the most often failed but vital components in rotary machinery. Continuous effort spent in research is necessary to find a reliable bearing fault diagnostic method that can provide early warning to the maintenance staff and avoid unexpected breakdown of bearings. Hence, intensive research has been conducted on finding such method for bearing, especially in the research field of vibration-based fault diagnosis. Although many methods have been developed, each method has its merit and limitations. One of the popular methods is the Empirical Mode Decomposition (EMD). It is an adaptive time-frequency analysis method and starting to be employed in bearing fault diagnosis. However, this method creates mode mixing that distorts the modes in the signal, which leads to serious aliasing in the time-frequency distribution. Recently, an enhanced method, called Ensemble EMD (EEMD), has been proposed to minimize the mode mixing problem. In this paper, we used EEMD to decompose the raw signal into a number of signals bands. Then envelope analysis and Fast Fourier transform (FFT) was applied to obtain the corresponding spectrum for main components related to the fault. Comparison was used to reveal the difference between the results obtained from normal and defective bearings. The results proved that early warning can be triggered reliably even for a minor inner-race defect that has occurred in a bearing. Hence, the combined EEMD and FFT method is effective in bearing fault diagnosis without having the problem of mode mixing.

BIOGRAPHY

GUO Wei received her BSc degree in Automation from Taiyuan University of Technology (2002) and MSc degree in Control theory and control engineering from Dalian University of Technology (2005). Currently, she is a PhD candidate in the Department of Manufacturing Engineering and Engineering Management, City University of Hong Kong, where she works with Dr. Peter W. TSE. Her research interests include fault diagnosis and data compression.