

Documents

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Application of cepstrum pre-whitening for the diagnosis of bearing faults under variable speed conditions
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Abstract

Diagnostics of rolling element bearings involves a combination of different techniques of signal enhancing and analysis. The most common procedure presents a first step of order tracking and synchronous averaging, able to remove the undesired components, synchronous with the shaft harmonics, from the signal, and a final step of envelope analysis to obtain the squared envelope spectrum. This indicator has been studied thoroughly, and statistically based criteria have been obtained, in order to identify damaged bearings. The statistical thresholds are valid only if all the deterministic components in the signal have been removed. Unfortunately, in various industrial applications, characterized by heterogeneous vibration sources, the first step of synchronous averaging is not sufficient to eliminate completely the deterministic components and an additional step of pre-whitening is needed before the envelope analysis. Different techniques have been proposed in the past with this aim: The most widely spread are linear prediction filters and spectral kurtosis. Recently, a new technique for pre-whitening has been proposed, based on cepstral analysis: the so-called cepstrum pre-whitening. Owing to its low computational requirements and its simplicity, it seems a good candidate to perform the intermediate pre-whitening step in an automatic damage recognition algorithm. In this paper, the effectiveness of the new technique will be tested on the data measured on a full-scale industrial bearing test-rig, able to reproduce the harsh conditions of operation. A benchmark comparison with the traditional pre-whitening techniques will be made, as a final step for the verification of the potentiality of the cepstrum pre-whitening. © 2012 Elsevier Ltd.

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