Detection of Localized Faults in Bearings using 2D Envelope Signal Analysis

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ABSTRACT

Bearing faults are the leading cause of failure in induction motors and result in the longest downtime per failure in wind turbines. The accurate and timely detection of these faults is essential in avoiding unexpected shutdowns and the consequent economic losses. State of the art bearing fault detection is mostly based on envelope analysis. It generally involves band pass filtering the raw signal, demodulating the filtered signal to construct the envelope and then the Fourier analysis of the envelope signal to determine the presence of peaks at characteristic defect frequencies and their sidebands. Recent work on envelope analysis is mostly concerned with improving the visibility of these defect frequencies in the envelope power spectrum by selecting an optimal band for filtering. This is done using techniques like sub-band analysis and spectral kurtosis, thereby making the process tedious and computationally complex. This paper presents a 2D imaging based approach to envelope signal analysis, which is simple yet highly effective. The envelope signal, when projected onto a two dimensional grayscale intensity space, shows a unique texture for each fault. This study shows that these unique textures can be used for automated detection of localized defects in bearings.