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Rolling bearing fault diagnosis based on improved complete ensemble empirical mode of decomposition with adaptive noise combined with minimum entropy-deconvolution

R.ABDELKADER, A.KADDOUR

Abstract: The vibration signals provide useful information about the state of rolling bearing and the diagnosis of the faults requires an accurate analysis of these signals. Several methods have been developed for diagnosing rolling bearing faults by vibration signal analysis. In this paper, we present an improvement of the technique Complete Ensemble Empirical Mode Decomposition with Adaptive Noise (CEEMDAN), this technique is combined with the Minimum Entropy Deconvolution (MED) and the correlation coefficient to diagnose defects. First, the vibration signal was decomposed by the improved CEEMDAN decomposition into several oscillatory modes called Intrinsic Mode Function (IMF). After calculation of the correlation coefficients between the original signal and their IMFs, the modes with higher coefficients are selected as the relevant modes. Secondly, the MED technique is applied to the selected modes in order to improve the sensitivity of the scalar and frequency indicators of faults detection. Finally, kurtosis and envelope analysis are used to detect and locate the defect position. The simulation is carried out using the Case Western University data base and the results obtained show that the proposed method provides very good results for the early detection and diagnosis of defects and can efficiently extract the defective characteristics of the rolling bearing.

Keywords : vibration signal, rolling bearing fault, complementary ensemble empirical mode decomposition, coefficient correlation, minimum entropy deconvolution, Kurtosis, Envelope analysis