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WAVELETS AND PRINCIPAL COMPONENT ANALYSIS METHOD FOR VIBRATION MONITORING OF ROTATING MACHINERY

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Abstract: Fault diagnosis is playing today a crucial role in industrial systems. To improve the reliability, safety and efficiency advanced monitoring methods become increasingly important for many systems. Vibration analysis method is essential in improving condition monitoring and fault diagnosis of rotating machinery. Effective utilization of the vibration signals depends upon the effectiveness of the applied signal processing techniques. In this paper, fault diagnosis is performed using a combination between Wavelet Transform (WT) and Principal Component Analysis (PCA). The WT is employed to decompose the vibration signal of measurements data in different frequency bands. The obtained decomposition levels are used as input to the PCA method for fault identification using respectively, the Q-statistic, it is also called Squared Prediction Error (SPE), and the Q-contribution. Clearly, useful information about the fault can be contained in some levels of wavelet decomposition. For this purpose, Q-contribution is used as an evaluation criterion to select the optimal level, which contains the maximum information. Associated to spectral analysis and envelope analysis, it allows clear visualization of fault frequencies. The objective of this method is to obtain the information contained in the measured data. The monitoring results using real sensor measurements from a pilot scale are presented and discussed.

Keywords : vibration, Fault Diagnosis, Wavelet Analysis, principal component analysis, squared prediction error