

An approach based on wavelet packet decomposition and Hilbert–Huang transform (WPD–HHT) for spindle bearings condition monitoring

Abstract

In order to prevent possible damages to the spindle systems, reliable monitoring techniques are required to provide valuable information on the condition of the spindle condition. A technique is proposed for monitoring spindle bearings conditions via the use of acoustic emission (AE) signals, which implements Hilbert–Huang transform (HHT) analysis to extract the crucial characteristic from the measured data to correlate spindle running condition. The HHT becomes a promising technique in extracting the properties of nonlinear and non-stationary signal. However, the original HHT has several deficiencies, which eventually lead to misinterpretation to the final results. The improved version of HHT is proposed and used to overcome the weakness of the original HHT. The simulation and experimental results are used to verify the effectiveness of the WPD–HHT and therefore Hilbert marginal spectral, compared to traditional Fourier transform. Experimental results are presented to examine and explore the effectiveness of AE for monitoring spindle bearings conditions. It is concluded that good correlation existed between the results obtained by AE data and the increase in the preload, and change in the dimensions and geometry of the spindle bearings and their housings as the temperature increases. In support of this finding, vibration and acceleration data are also used to assess the amount changes in the antistrophic stiffness and radial error motion.