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Author Chun-Kai Hung
Author's Email Address No Public.
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Abstract
In this paper, a wavelet-based orthogonal function is proposed and derived from Morlet wavelet. The wavelet-based orthogonal function is a complex wavelet function with the four parameters that are the low-cutoff frequency, the high-cutoff frequency, the dilation and the frequency difference. The passband of wavelet-based envelope function can be arbitrarily designated by simply setting the parameters of low-cutoff frequency and high-cutoff frequency. In addition, the imaginary part of wavelet-based function is orthogonal to its own real part. The Hilbert transform is usually applied to demodulate the vibration signal for extracting the signal envelope. So that, the real part of wavelet-based orthogonal function can be defined as the wavelet-based filter function. The wavelet-based filter function is used to design low-pass, high-pass and band-pass filters. From numerical implementation, it is found that the wavelet-based orthogonal function has the satisfactory properties of fast waveform convergence, constant passband gain and less phase distortion. Thus, it could be adopted in the real-time signal processing. For practical interest, the wavelet-based orthogonal function with 3-dB cutoff frequency is presented and implemented in a TMS320C32 DSP interface card. To enhance the discrimination of defect pattern, a framework quantification spectral processing algorithm is proposed. It is effective to obtain the characteristic frequency. The method is advantageous for the vibration signal to erase noise and to increase diagnosis accuracy.
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