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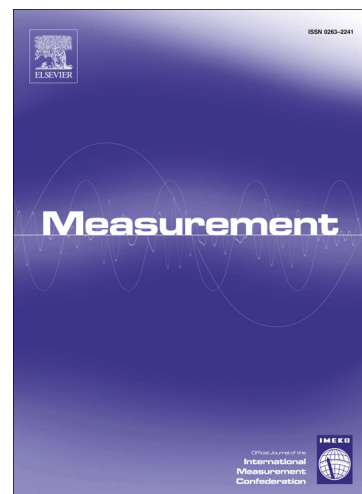
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Multi-Fault Diagnosis of Gearbox Based on Resonance-Based Signal Sparse Decomposition and Comb Filter

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Abstract: Fault diagnosis of gearbox is very important for the security and reliability of the equipment. In actual working conditions, multiple faults usually occur in a gearbox. However, the multi-fault diagnosis in gearboxes is a challengeable problem because the signal measured from the gearbox with multiple faults is complex and non-stationary. Particularly, the weaker fault feature signal is generally submerged by the stronger one and background noise. In order to avoid missed diagnosis and misdiagnosis of multi-faults in a gearbox, a novel method called resonance-based signal sparse decomposition (RSSD) with comb filter (CF), namely the RSSD-CF method, is proposed in this paper. The RSSD-CF method is based on the RSSD method which can nonlinearly decompose the vibrational signal of the gearbox with multiple faults into the high resonance component and the low resonance component. To obtain good separation results, the stepwise optimization strategy is applied to the adaptive selection of the optimal decomposition parameters in the RSSD method. In RSSD-CF method, the collected signal is firstly separated into the high and the low resonance components through using the RSSD method with the optimal decomposition parameters. And then, both of the high and the low resonance components are demodulated with the Hilbert transform and the fault information can be found in Hilbert envelop spectra. Finally, CF is constructed to extract the weaker fault feature signal from resonance components and exclude the interference components. The effectiveness of the RSSD-CF method is evaluated by using two experimental cases in this paper. The results confirm the advantage of the proposed method over the traditional RSSD method and the wavelet decomposition for multi-fault diagnosis in gearboxes.

Keywords: Resonance-based signal sparse decomposition (RSSD); stepwise optimization strategy; comb filter (CF); gearbox; fault diagnosis

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