Study on a novel fault diagnosis method of rolling bearing in motor

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It is important to diagnose the faults of rolling bearings, because they may lead to the failure of motors, and even entire system-wide problems and failures. In order to diagnose the early faults of bearings, a novel method for early diagnosis of rolling bearing faults based on resonance-based sparse signal decomposition and principal component analysis is proposed in the present paper.

Firstly, the vibration signal was processed using resonance-based sparse decomposition, in order to remove the low frequency resonance component and remnants. Simultaneously, the degree of coupling between the separated components is as small as possible. That is to say, the high oscillation frequency components among signals are decomposed into the higher resonant component as much as possible, and the fewer oscillation frequency components are separated into low resonance components. The high resonance component contains many fault feature frequency ingredients, and the low resonance oscillation component contains a small number of smooth continuous ingredients.There are some unexpected spikes (e.g. random noise spikes).

Secondly, the high resonance component was selected as the input of the FastICAalgorithm, in order to calculate and extract the characteristic components, and search the independent components (ICs) that contain major energy ingredients. These independent components include the abundant information of the bearing health system while running. In order to analyze the features of faulty signals, the independent

components (ICs) were transformed into the frequency domain using the Hilbert transform method.

Finally, the frequency of peak amplitude points in the frequency domain were compared to the theoretical calculations of fault feature frequency, in order to identify and diagnose the faulty element.

The proposed method was applied in the experimental data. The experimental results show that the proposed fault diagnosis method quickly discerns the faulty elements of rolling bearings, improves the diagnostic accuracy and provides an overview of the early fault diagnosis of rolling bearings.

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