Research on SCARA Robot Fault Diagnosis Based on Hilbert-Huang Transform and Decision Tree

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Abstract

Aiming at the current situation that industrial equipment failures are difficult to detect and diagnose with low efficiency, this paper takes Selective Compliance Assembly Robot Arm (SCARA) robots as the research object and proposes a method for extracting SCARA robot features based on Hilbert-Huang Transform (HHT). First, the original vibration signal is separated by the empirical mode decomposition (EMD) algorithm, and the intrinsic mode function (IMF) is obtained. Then the envelope of IMF is obtained through Hilbert transform and the spectrum energy of each envelope is calculated. Finally, the representative envelope spectrum energy is selected and combined into the feature vector of the signal, and the decision tree (DT) is used for classification prediction. The conclusion shows that the method proposed in this paper can accurately and effectively identify the state of SCARA robots and can be better applied to fault diagnosis.
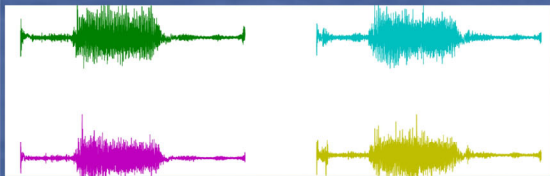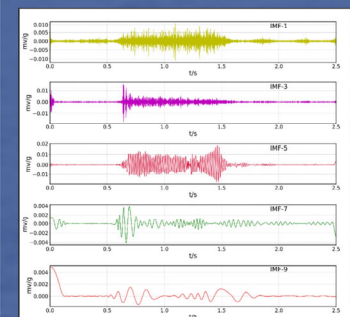
Methods

In order to improve the calculation efficiency and decrease the calculation quantity, the paper selected five components of IMF1, IMF3, IMF5, IMF7 and IMF9 to extract the characteristics. The purpose of selecting IMF at equal intervals is to reduce the amount of calculation and improve efficiency, while preventing some characteristic information from being ignored.
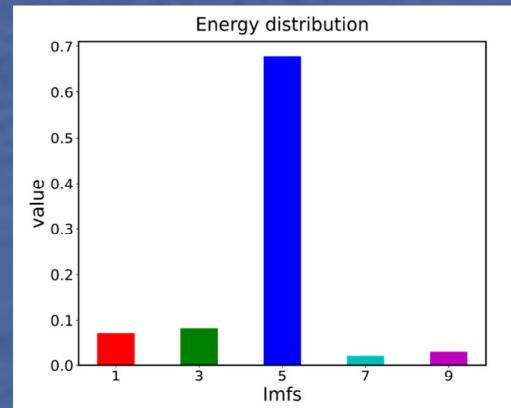
Conclusion

The results show that based on the HHT theory, the original signal is decomposed by EMD to select IMF components with rich feature information, the Hilbert transform is used to calculate the energy of the envelope integral, and the DT model is used for classification .And the prediction method is effective, which further improves the prediction accuracy of SCARA robot fault diagnosis.

EMD decomposition

Hilbert Transform