

correctness rate reaches 95%, and the cumulative contribution rate at this time is 88.9%. Then as the number of principal components increases, the cumulative contribution rate increases. The correct rate of accuracy fluctuates about 95%. Therefore, taking five main elements is the final solution, which can ensure the accuracy and efficiency. The comparison of the three methods is shown in Table 2.

Tab.2. Comparison of three methods for correct diagnosis.

Method	Energy method	Multi - feature method	Multi - feature PCA
Accuracy	85.33%	91%	95%

It can be seen that the accuracy of the energy method is low, and the accuracy is improved effectively when two features are added. It is thus obvious that the kurtosis and skewness of vibration signal can be used to make up the deficiency of energy feature in fault information completeness. Finally, on the basis of multi-feature method, the PCA is processed to further improve the fault diagnosis accuracy, which proves that PCA can effectively remove the noise and redundancy in the vibration signal.

6. Conclusion

(i) The proposed feature index combined with the energy, kurtosis and skewness of first few IMFs, can recognize the fault type of rolling bearing.

(ii) The feature index of the principal component analysis has higher accuracy rate than that of the feature index without main component analysis, which indicates that the principal component analysis can eliminate the redundancy and noise in the information to a certain extent.

(iii) When the principal component analysis is used to reduce the dimensionality of the data, the higher the contribution rate is, the higher the accuracy is, but it remains within a certain range after reaching a certain limit.

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