EMPIRICAL MODE DECOMPOSITION AND ROUGH SET ATTRIBUTE REDUCTION FOR ULTRASONIC FLAW SIGNAL CLASSIFICATION

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Abstract- Feature extraction and selection are the most important techniques for ultrasonic flaw signal classification. In this study, empirical mode decomposition (EMD) is first used to obtain the intrinsic mode functions (IMFs) of original ultrasonic signals. Such IMFs and traditional time as well as frequency domain based statistical parameters are extracted as the initial features of flaw signal. After that, spectral clustering method is used for feature value discretization so that rough set attribute reduction (RSAR) can be applied to implement feature selection. Finally, the selected features are taken as input of artificial neural networks (ANNs) to train the decision classifier for flaw identification. Experimental results show that compared to conventional wavelet transform based schemes and principal components analysis, EMD combined with RSAR can improve the performance of feature extraction and selection. Using such hybrid scheme can effectively classify different ultrasonic flaw signals with high accuracy and low training elapsed time.

Index terms: Empirical mode decomposition, rough set attribute reduction, feature extraction and selection, ultrasonic flaw signal classification