Detection of Machinery Faults Using Advanced Signal Processing Techniques

Sami Salem AL Sulti

Abstract

This project presents advanced signal processing techniques for machinery fault detection using vibration and acoustic emission (AE) signals. The acquired signals of a rotating machine with normal and defective conditions are analyzed using different signal processing techniques. The features obtained from the original and the processed signals are used for detection of machine condition. The features include statistical, spectral, cepstral and time-spectral parameters of the acquired and the preprocessed signals. The procedure is illustrated through the experimental vibro-acoustic signals of a rotating machine for two common faults, namely bearing faults and mechanical rub. The defects in rolling element, inner race and outer race have been considered in this study. For mechanical rub, two different materials on a steel shaft in a laboratory scale rotor model have been studied. Several signal processing techniques with both vibration and AE signals have been considered. The results present a comparative study of the signals and the signal processing techniques for detection of different types of faults in rolling element bearings. Discrete wavelet transform (DWT) has been also used as a smoothing filter prior to estimating the statistical features in case of mechanical rub. The results show the effectiveness of the proposed approach in early detection of the mechanical rub with distinction of the rubbing material. The project report summarizes the conclusions of this study and points out the future scope of work.