CHAPTER 8

FAULT IDENTIFICATION AND CLASSIFICATION OF BEARINGS CONDITION USING ARTIFICIAL NEURAL NETWORKS

8.1 INTRODUCTION

This chapter presents a new approach to the classification of rolling element bearing faults by implementing Artificial Neural Network (ANN). Diagnostics of rolling element bearing faults actually represents the problem of pattern classification and recognition, where the key step is feature extraction from the vibration signal. Characterization of each recorded vibration signal is performed by a combination of signal's time-varying statistical parameters and characteristic rolling element bearing fault frequency components obtained through the frequency spectrum analysis method. Existing literatures and methodologies are available only for bearing vibration monitoring using time and frequency spectrum data. Several works have been carried out in the field of condition monitoring using Artificial Neural Networks. Also they have implemented time and frequency domain in neural nets. However the usage of time domain signal features in bearing vibration analysis is less. The present work considers the features extracted from the time domain signals and the classification is done based on those features. This is done to classify a normal and defective bearing with the help of time domain features.
signals can be used as inputs to the neural network for online condition monitoring.

Among the various combinations tested, when Crest factor, RMS value and Variant are used, the success rate of 100% in PNN and 92% in RBFN are obtained. This is due to the fact that these three features have values which do not correlate with each other. Also, there are considerable variations in their values in each data set. This results in better training of the network and ultimately yielding better test results. If all the seven features are considered, the success rate will be 75% and 62.5% in PNN and RBFN. The reason is that some of the features have correlation with each other. Hence, it may not be advisable to use all the features for online condition monitoring of the system.

It has been shown that the use of amplitudes of vibration harmonics of a rotor system in horizontal, vertical and axial directions helps in indicating the presences of faults like unbalance and misalignment. To quantify these faults, the approach of using artificial neural network of multiplier feed forward back propagation algorithm, is promising and has been seen by training of the network by simulated data obtained experimentally and by testing the same. The ANN has been used for diagnosis and quantifying of faults. The success rates based upon each fault have been reported. In particular, the overall success rates of 99.79% in unbalance, 99.93% in misalignment and combined faults of unbalance and misalignment of 100% have been achieved by test 4 and 5.