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FAULT CLASSIFICATION BASED ARTIFICIAL INTELLIGENT METHODS OF INDUCTION MOTOR BEARING

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Abstract. *This paper presents an approach of intelligent fault classification of induction motor bearing (IMB) using several artificial intelligent (AI) methods. The significant of this work is to select appropriate method among the common AI methods. The most common AI methods include FeedForward Neural Network (FFNN), Elman Network (EN), Radial Basis Function Network (RBFN) and Adaptive Neuro-Fuzzy Inference System (ANFIS). In this work, the data of IMB fault were obtained from a Case Western Reserve University website in form of vibration signal. For further analysis, these data are converted from time domain into frequency domain through Fast Fourier Transform (FFT) in order to acquire more fault signs during pre-processing stage. Then, during features extraction stage, a set of 16 features from vibration and pre-processing signal is extracted. Subsequently, a distance evaluation technique is used as features selection, in order to select only salient features. Lastly, during fault classification, several AI methods are examined, where results are compared and the optimum AI method is selected.*
Keywords: Induction motor bearing, FeedForward neural network, Elman network, Radial basis function network, Adaptive neuro-fuzzy inference system

1. **Introduction.** Today, many approaches as have been made to utilize the performance of induction motors [1-3]. One of the most concerned aspects related to induction motor is a bearing. Failures that occur due to induction motor bearing (IMB) failure may cause several negative implications such as an increase in machine breakdown, low in productivity and sometimes resulting to safety issues as well. Therefore, this subject is becoming a paramount importance in preventing unexpected bearing failures.

One of the most common techniques in diagnosing IMB is by using vibration analysis. In this technique, accelerometer is used to acquire the vibration signal from the defective bearing. The vibration signal of a defective bearing is normally a combination of modulation signal effect and noise. For modulation signal effect, the spectrum of a defective bearing consisting of harmonics series of frequency components at a bearing defect frequency in which the highest amplitude is around the resonance frequency. In order to extract defective signature from a defective bearing, demodulation techniques should be developed [4]. One of the popular demodulation techniques is a Hilbert transformation.

Even though many techniques are available for detections of IMB failure, they still require an expert to apply them successfully. For instance, by supervisors or engineers through the sense of touch, sight or noise compared to the normal bearing condition. These approaches can be susceptible to human errors and may vary according to experience and