Developing an Intelligent Fault Diagnosis of MF285 Tractor Gearbox Using Genetic Algorithm and Vibration Signals

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ABSTRACT
This article investigates a fault detection system of MF285 Tractor gearbox empirically. After designing and constructing the laboratory set up, the vibration signals obtained using a Piezoelectric accelerometer which has been installed on the Bearing housings related to rotary gear number 1 in two directions perpendicular to the shaft and in line with the shaft. The vector data were conducted in three different speeds of shaft 1500, 1000 and 2000 rpm and 130 repetitions were performed for each data vector state to increase the precision of neural network by using more data. Data captured were transformed to frequency domain for analyzing and input to the neural network by Fourier transform. To do neural network analysis, significant features were selected using a genetic algorithm and compatible neural network was designed with data captured. According to the results of the best output mode for each position of the sensor network in 1000, 1500 and 2000 rpm, totally for the six output models, all function parameters for MATLAB Software quality content calculated to evaluate network performance. These experiments showed that the overall mean correlation coefficient of the network to adapt to the mechanism of defect detection and classification system is equal to 99.9%.

Keywords: Fault Detection; Gearbox; Vibration Analysis; Genetic Algorithm

1. Introduction
Rotating machines are the mainstay of several industrial applications worldwide. They can be found in automobile, water industry, wind turbines, agricultural machinery, etc. Failures associated with gears represent the cause of extended outages and are typically caused by gradual deterioration and wear [1]. An important objective of condition-based maintenance (CBM) is to determine the optimal time for replacement or overhaul of a machine. The ability to accurately predict the remaining useful life of a machine system is crucial for its operation and can also be used to improve productivity [2]. Vibration analysis is a powerful tool in machine fault diagnosis. It is a way to check the status of a machine using a special tool. Troubleshooting machines can be more identified in the future. Fault diagnosis of mechanical or electronic components or systems is a subject of expert system applications. Today, neuro-fuzzy devices are emerged by combining network based on adaptive neural networks and fuzzy models. These adaptive networks, based on fuzzy inference system, are called ANFIS. In such systems the desired output will be achieved by means of human knowledge, in the form of if-then rules for the desired input [2]. Neuro Fuzzy system can be applied as a true model based on conventional mathematical tools and component identification. Many researchers [3-12] have employed various methods to detect weak periodic signals using the sensitivity of system parame-