Chapter 1

Fault Diagnosis of Induction Motors Using Motor Current Signature Analysis: A Review

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ABSTRACT

Induction motors are termed as horses of modern industry because they are playing a vital role in industries. They are simple, efficient, robust, rugged, and highly reliable. The feasibility of mishap in induction motors is less, but they are prone to faults, which are left unobserved most of the time. Hence, more attention has been paid to detection and diagnosis of incipient faults to prevent damage spreading and increase the lifetime of the motor. To detect and diagnose the faults, online condition monitoring of the machine has been utilized in a wide manner. At present, focus is made on optimization procedures for fault diagnosis in induction motors to obtain a quick assessment at industry level. This chapter discloses an overview of various types of possible faults in induction motors. In addition, the conventional (invasive) and innovative techniques (noninvasive), especially motor current signature analysis (MCSA), techniques for fault detection and diagnosis in induction machines are covered with a focus on future research.

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INTRODUCTION

From domestic applications to many complex industrial applications, where the transformation from electrical energy to mechanical energy is required it would be possible with the help of electric Induction Motors (IM). This motor is an Asynchronous Motor falls under the type of Alternating Current Motor, which operates, on electromagnetic induction principle to supply power to the rotor. They are the spine of the industries for their low cost and maintenance (Bhowmik, Pradhan & Prakash, 2013; Merizalde, Hernandez-Callejo & Duque-Perez, 2017; Bayar & Terz, 2016). However, this machine undergo for failure due to electrical or mechanical defect. This is because of heavy-duty cycles, unfortunate working environment, improper installation, excitation and manufacturing factors etc (Bhowmik, Pradhan & Prakash, 2013). The factors involving in failure of induction motor are likely to be environmental, operations, equipment, human and electrical power (Merizalde, Hernandez-Callejo & Duque-Perez, 2017). Under these factors, so many faults lie which lead to the mishap of induction motors have covered in section 2. When the induction motor is subjected to failure it may lead to unwanted interruption in industrial plant, safety measurement and product excellence with results in revenue losses (Messaoudi & Sbita, 2010). Hence, the field of fault detection and diagnosis in Induction motor is attaining more importance due to the elevation of demands for reliability and proficiency.

However, the maintenance techniques available such as default type, proactive technique, preventive maintenance, discard technique and online-offline type there is always an anxiety for the decision maker on choosing the type of maintenance that results with more optimal. Henceforth, it is necessary for the decision maker to have a concern on suggestions from the manufacturer, their own experience on the plant and the data regarding the condition of plant offline or online (Sonje & Monje, 2011). As a whole, considerable amount of research has been carried out on condition monitoring and fault diagnosis techniques for induction motor in last many years (Bhowmik, Pradhan & Prakash, 2013; Mehala & Dahia, 2007; Kucuker & Bayrak, 2015). The summary of the techniques are given below:

- Fast Fourier Transform based fault diagnosis.
- Fault detection and diagnosis with use of vibration signal.
- IR recognition, measurement of temperature, RF (Radio Frequency) emission observing.
- A detection technique based on harmonic analysis of machine speed fluctuation measurement.
- An approach based on state and parameter estimation.
- Fault detection based on flux analysis or airgap torque approach.
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