DETECTION AND DIAGNOSIS OF STATOR INTER TURN SHORT CIRCUIT FAULT OF AN INDUCTION MACHINE

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Degree of Master of Science

by

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Declaration

The work submitted in this thesis is the results of my own investigations, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

J.A.D.S Ranjan
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ABSTRACT

Motors are the workhorses of the industry. Safety, reliability, efficiency, and performance are some of the major concerns and needs for motor system applications. The issue of preventive and condition-based maintenance, online monitoring, system fault detection, diagnosis, and prognosis are of increasing importance. The use of motors in today's industry is extensive and the motors can be exposed to different hostile environments, misoperations, manufacturing defect etc. Different internal motor faults (eg. inter-turn short circuits, short circuit of motor leads, ground faults, bearing and rotor faults) along with external motor faults are expected to happen sooner or later.

Early fault detection, diagnosis, and prognosis allow preventive condition based maintenance to be arranged for the motor system during scheduled downtime and prevent an extended period of downtime caused by system failures.

This thesis deals with the stator faults and mainly for inter-turn short circuit fault. The faults related to the rotor and bearing also are considered in many research and developed successful fault diagnosis techniques. Literature survey revealed that Fast Fourier Transform (FFT) based current spectrum analysis can be successfully applied in rotor and bearing faults analysis.

FFT based Inter-turn short circuit analysis, Air-gap flux sensing by external coils and Partial Discharge (PD) analysis have been discussed. This research has been focused to the negative sequence current analysis, since the FFT augmentation due to inter- turn fault is marginal.

A Power Decomposition Technique (PDT) has been used to derive positive and negative sequence components of measured voltage and current. A multi-phase based motor model is developed to simulate the inter turn fault and the results are verified by practical testing. The practical current waveforms are subjected to power decomposition based sequence component analysis in MATLAB calculation platform.

The practical testing has been done for loaded machine and the machine under no load condition to prove no load machine is more suitable for applying this technique. Harmonic analysis also has been done for comparison.

Simulation model is validated using the practical test results. Either novel methods of on line monitoring or off-line inter turn fault diagnosis as routing maintenance test scheme is presented.

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