Chapter 1

INTER-TURN WINDING FAULT ANALYSIS AND INVESTIGATION OF EFFECT ON STATIC AND MAGNETIC CHARACTERISTIC OF THREE-PHASE INDUCTION MOTOR USING FEM

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INTRODUCTION

One of the most important electric energy consumers in industry is the three phase squirrel-cage induction motor[1]. Low cost and robustness that characterize induction motors make them an almost exclusive alternative for supplying mechanical power[2]. Although these motors are very robustness, they can be confronted with different faults because of heavy duty cycles, poor working environment, installation, inappropriate excitation and production factors etc[3]. Different faults can occur in the motor such as broken rotor bars, eccentricity, inter-turn winding failure and end ring failure[4-7]. In addition, the other factors such as frequent restarts, stresses caused by electrical, mechanical, temperature, environmental effects, voltage fluctuation, overloading can cause motor windings to fail. According to the statistics, the ratio of inter-turn winding faults can reach up to 30% - 40%. If this fault cannot be avoided, it will usually cause a phase-to-phase short circuit or ground fault. In fact, it causes damage to other equipment in the production line of the motor and resulted in long-term production loss and expensive maintenance costs[8]. Therefore, early detection of faults in the induction motors is of great importance. Sang et al. proposed a method called motor current signature analysis to diagnose stator failures of induction motors. Motor failure is detected with the proposed method based on the spectrum analysis of the stator current[3]. In the Naderi's study, inter-turn winding failure including saturation effect for a squirrel cage induction motor was investigated. In order to monitor the performance of the motor, it has used the Magnetic Equivalent Circuit model and the nonlinear B-H curve[9]. Gaied examined the performance of an induction motor with stator and speed faults by improving the wavelet-based fault prognosis

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tor winding structure and the number of windings, these parameters have varied greatly as the inter-turn winding failure ratio increases.

Keywords: Induction motor, inter-turn fault, performance analysis, magnetic analysis, finite element method.

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