Ain Shams University
Faculty of Engineering

PROTOTYPE MODEL FOR POWER TRANSFORMER PROTECTION SYSTEM

By

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B.Sc. (2002)

A Thesis
Submitted in Partial Fulfillment of the Requirements
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APPROVAL SHEET

Prototype Model for Power Transformer Protection System

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Electrical Power Engineering (Electrical Power and Machines Department).

The included work in this thesis has been carried out by the author in the Department of Electrical Power Engineering, Ain Shams University.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

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ABSTRACT

Transformers are one of the most important elements of power systems. Most transformers are equipped with protection systems to avoid damage to the transformers. As any outage of the transformer have several technical and economical consequences for the network, implementing fast relaying algorithms for transformer protection devices to satisfy high reliability of the whole power systems is very important.

In designing high speed protection systems, the fast discrimination of magnetizing inrush current is very crucial to prevent the false tripping of relays. Conventional method of inrush current detection for transformer protection is based on the value of the second harmonic component in the current waveform. However, this method requires a longer time to determine the second or higher harmonic components in transient current waveform, and cannot detect the inrush current within the one short cycle. Moreover, the second harmonic components in the magnetizing inrush currents tend to be relatively small in new designed power transformers due to improvements in the power transformer core material.

This thesis presents a new method to enhance the sensitivity of traditional techniques for power transformer protection. This method is based on the estimation of transformer magnetizing characteristic to distinguish between magnetizing inrush current and internal fault currents.

To validate the proposed method, a three phase power transformer of 250MVA, 400/132/18kV is modeled by alternative transient program (ATP) package. Simulation of inrush current at different switching instants and different internal fault cases are obtained. Results show the effectiveness of the proposed method.

In addition, this thesis includes experimental measurements which have been carried out using a mobile test laboratory. The lab was designed to meet all the requirements of real system under normal and abnormal conditions and latest measuring systems available in the Extra High Voltage Research Center-Egyptian Electricity Holding Company Experimental measurements are carried out on a three phase transformer of 25kVA, 11/0.4kV using the mobile test lab. Experimental measurements cover both transformer inrush current at different inception angles and different internal fault cases with different percentages of fault winding. Experimental results prove the reliability and simplicity of the proposed method.

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