Ain Shams University
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TRANSMISSION LINE PROTECTION USING SYNCHRONIZED SAMPLING

A Thesis Submitted in the Partial Fulfillment of the
Master Degree
Electrical Engineering – Power and Machines

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Statement

This thesis is submitted to Ain Shams University in partial fulfillment of the requirements for M.Sc degree in Electrical Engineering.

The included work in this thesis has been carried out by the author at the Electrical Power and Machines Department, 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

This thesis introduces a complete transmission line protection scheme using synchronized sampling technique implemented with neural networks to precisely detect, classify and locate fault over along transmission line.

For fault detection and classification module, synchronized data of voltage and current signals from both ends of transmission line are processed using a mathematical algorithm to generate the inputs to an Artificial Neural Network (ANN). The target of that ANN signifies the occurrence of a fault. The appearance of current featured modal components points out the type of fault. A data window of 0.25 cycle is used to ensure a fast process.

For the fault location, two approaches were adopted, both based on synchronized sampling time domain data:

Single stage Featured Fault currents fault locator: The first approach uses the featured fault modal components chosen according to fault type as an input to ANN. The ANN is trained on different system conditions (fault inception angle, system loading, fault resistance, fault type) while the ANN target points out the fault location with an acceptable margin.

Single Stage Current Traveling wave based fault locators: The second approach on a different mathematical formulation. The algorithm was used to calculate fault location using current traveling waves based on synchronized data (Single Stage).

Double Stage current Traveling wave based Fault Locators: in the third scheme, the results for fault location are further refined via a trained ANN to minimize the error in the previously determined location from the previous scheme.

The computer software of the studied power system was carried out on PSCAD and the proposed protection schemes were developed using MATLAB. The results of all approaches were tested and validated. Comparisons among different techniques against same criteria were demonstrated.

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