# DIGITAL RELAYING OF HIGH VOLTAGE TRANSMISSION LINES BY ARTIFICIAL NEURAL NETWORKS

BY

**Eng. ABEER GALAL EL-SAIED SAAD**

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the Requirement
for the Degree of

M.Sc.

Electrical Power & Machines Dept.

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Under The Supervision Of

**PROF.DR.OSAMA EL-SAIED GOUDA**
Electrical Power and Machines Dept.
Cairo University

**PROF.DR.M.B.Eteiba**
Electrical Power and Machines Dept.
Cairo University-Fayoum branch

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# Abstract

Detection, classification and location of a fault on a transmission line is essential to the proper performance of a power system. It would be desirable to develop a high speed and accurate approach to determine the type and location of the fault for different power system conditions. The artificial neural network (ANN) is a powerful tool for the detection of the transmission line faults due to its ability to differentiate between various patterns. The proposal system in this paper consists of two generators feed a high voltage transmission line at both ends. Adding a third generators to show the effect of the third generator on the performance of the protective system.

Electromagnetic transient program (EMTP) is used for simulation the proposal power system to obtain the voltage and current signals The fault detector, fault classifier and fault locator are suggested and tested using ANN algorithm. The inputs to ANN are the magnitude of voltage and current signals (Method 1) and the magnitude of impedance or the reactance of the line (Method 2). For each input to the relaying system, the suggested ANN is proposed, learned and tested. In addition, the time of relaying of each suggested relaying system is compared. Moreover, the accuracy of the fault locater of each input is calculated. This study indicated that the ANN reactance relay has advantages such that its time of operation is faster, performance of the fault classifier is better and good performance of the fault locator. A reduction in time of response of the ANN protective relay is already reported. Moreover, the time of response of the ANN protective relay in case of 3G is higher than 2G feed the T.L. **ANN algorithm is used in digital relaying in a T.L. A fault detector, fault classifier and fault locator are suggested and tested. The T.L are fed by 2G and 3G. In each case, the input to the ANN protective relay is the voltage and current signals (Method 1) and the magnitude of the impedance or the reactance (Method 2). When comparing the results in case of 2G and 3G, the time of response of the ANN protective relay in case of 3G is higher than 2G feed the T.L. In addition, the time of response of the fault detector unit in case of Method 2 is lesser than Method 1 for 2G and 3G.** The performance of the suggested fault classification unit of the two methods is very close to each other because the ANN fault classifier classifies the fault for all types with high accuracy. The ANN algorithm in the fault locator unit estimates the fault distance with high accuracy. The percentage of error in case of 2G feed the T.L and the ANN feeding by voltage and current signals is 1.5-1.9%, for ANN feeding by the impedance is 1.4-1.7% and 1.3-1.5% for ANN feeding by the reactance. The ANN reactance relay has advantages such that its time of operation is faster, performance of the fault classifier is better and good performance of the fault locator.