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RESEARCH PAPER ON TRANSMISSION LINE FAULT DETECTION SYSTEM BY USING NEURAL NETWORK

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ABSTRACT

Transmission System is important for transmitting the electrical power. There are different types of faults occur in the transmission system. For example, line to ground (L-G), line to line (L-L), double line to ground (LL-G) etc. Ground faults are considered as one of the main fault in power systems and consider for more than 80% of all faults.

The correct fault detection can help to remove faults and locate the areas where the faults regularly occur. It reduces the occurrence of fault and reduces the time of power outages. Fault detection has been perform by using artificial neural networks. Either signal features pulled using certain measuring algorithms or even unprocessed samples of the input signals are fed into the ANN.

Keywords: Transmission Line, Artificial Neural Network, Fault Identification, System Protection.

I. INTRODUCTION

In the present condition electrical energy is the basic need of our daily life. Due to direct exposure or transmission line to the environment, the maximum fault is occurred in the transmission line. This fault can change the direction of current from the original path. An accurate fault detection can help to remove faults and locate the areas where the faults had occurred, thus reducing the occurrence of fault, it can minimize the time of power loss. In this way, this fault detection system can helpful for power system engineer to detect the faulted lines before any significant damage to the equipment. The biggest task for electrical engineer in power system is to find the exact location of the faults in the transmission line so that we can remove it, reduce power outrage and provide continuous supply to the consumer. Here we are using artificial neural network for the fault detection. The Neural networks are based on neurophysical models of human brain cells and their interconnection. Such networks are characterized by specific pattern recognition and learning capabilities. Neural networks have self-learning capability.

First, the network is presented with a set of accurate input and output values. Then it conforms the connection strength among the internal network nodes until appropriate transformation is learned. Second the network is presented with the help of only the input data, and then this input data produces a set of output values. An Artificial Neural Network (ANN) can be defined as a set of elementary neurons that are normally connected in biologically motivate architectures and organized in several layers. There are Ni numbers of neurons in each i^{th} layer and the inputs to these neurons are connected to the old layer neurons. An Artificial Neural Network study to produce a response based on the inputs given by adapt the node weights. For that purpose, we need a set of data referred to as the training data set, which is used to train the neural network. A weight is inclined to each and every neuron and training an ANN is the process of adapting different weights tailored to the training set. In this way an Artificial Neural Network learns to produce a response based on the inputs given by adjusting the node weights. Hence, we required a set of data assign to as the training data set, which is used to train the neural network.

II. ARTIFICIAL NEURAL NETWORK

Artificial neural networks (ANNs), routinely simply called neural networks (NNs) or neural nets, are computing systems motivate by the biological neural networks that make up animal brains. Such types of networks are characterized by exceptional pattern recognition and their learning capabilities. The major advantage of the neural networks is that the neural network has ability of self-learning. An ANN is craft of collection of

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connected units or nodes called artificial neurons, which roughly model the neurons in a biological brain. Each connection is behaved like the synapses in a biological brain. It can transmit a signal to other neurons. An artificial neuron collects signals then case them and can signal neurons connected to it. The connections are called edges. Neurons and edges typically have a weight that adjusts as training yield. The weight expands or reduce the strength of the signal at a connection. Neurons may have a threshold such that a signal is convey only if the aggregate signal bisect that threshold.

Neural networks are trained by processing data, each of which contains a known "input" and "result,". These input and output forms probability-weighted associations between them, which are stockpile within the data structure of the net as such. The training of a neural network is usually conducted by determining the difference between the processed output of the network and a target output. This difference called as error. The network then adapts its weighted associations according to a studying rule and using this error value. Successive adaption will cause the neural network to generate output that is increasingly similar to the target output. After a sufficient number of these adjustments, the training can be terminated based on certain criteria. This is a form of supervised learning. Such systems "study" to perform tasks without being programmed with task-specific order.

III. EXISTING SYSTEM

Electric power Transmission lines are characterized by its lengthy transmission lines and thus are more exposed to the environment. Consequently, transmission lines have more probability to occur faults, which reduces the continuity of electric power supplied. As the fault increases, the loss of electric power is generated and it creates the loss of economy. Quick detection and classification of a fault can clear and reduces system fault downtime and improve the security and efficiency of the network. Thus, this paper focuses on growing a single artificial neural network that find and classify a fault on Nigeria 33-kV electric power transmission lines. The transmission lines were designed using Sim Power Systems toolbox in Simulink and simulation is done in MATLAB environment. The direct voltages and currents values are extorted and used to train the fault detector-classifier. Simulation results have been supplied to demonstrate the efficiency of the generated intelligent systems for fault finding and classification on 33-kV Nigeria transmission lines. The performance of the finder-classifier is evaluated using the Mean Square Error (MSE) and the confusion matrix. The systems achieved an acceptable MSE of 0.00004279 and an accuracy of 95.7%, showing that the performance of the advance intelligent system is satisfactory. The result of the begin system in this work is well in comparison with other systems in the literature concerning Nigeria transmission lines.

This model was simulated in Simulink. The voltage and current signals were calculate using the three phase V-I measurement block. The transmission line (line 1 and line 2) together is 140 km long and several shunt faults were simulated between 1 km and 140 km at a step of 2 km. Here the resistances we used are 0.25, 0.5, 0.75, 5, 10, 20, 30 and 50 ohms. The model was used to create the whole set of data for training the neural network for the growth of the IFDC. For the purpose of fault detection and classification, ten fault cases plus no fault case were simulated and 6 x 6,160 sample data were earned. The three-phase voltage and current waveforms were created and sampled at a frequency of 1.5 kHz. Consequently, there are 30 samples per cycle and these samples were not made to be fed into the ANN in its raw state. Hence, it has to undergo a pretreated stage called feature extraction and scaling. This, in turn, deplete the overall size of the neural network and proceed the time performance of the network. Meanwhile, the fault was generated at 0.04s which corresponds to the 55th sample.

DISADVANTAGES

- Harmonic compensation performance of not deteriorated
- Unstable system
- Dynamic response is low

IV. PROPOSED SYSTEM

Here we are using the 200 KV transmission line which is used to develop and implement the proposed strategy using ANNs. A one-line diagram of the system using Simulink is shown in below figure 1. that has been used throughout the research. In the proposed system there are two generators of 11 kV. Each generator is located

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on either ends of the transmission line. Here three phase fault simulators used to simulate faults at various positions on the transmission line. The transmission line modelled using distributed parameters to more accurately it describes a very long transmission line.

This power system was simulated by using the toolbox Sim PowerSystems in Simulink by MathWorks. The three phase V-I measurement block is used to calculate the voltage and current samples at the terminal A. The transmission line i.e line 1 and line 2 together is 200 km long. The values of the three-phase voltages and currents are measured and modified accordingly and are ultimately fed into the neural network as inputs.

In both fault and non-fault cases, the SimPowerSystems toolbox is used to generate the whole set of training data for the neural network. In a transmission line fault can be classified broadly into four different categories namely:

1. Line to ground faults
2. line to line faults
3. double-line to ground faults
4. three-phase faults.

Apart from the proposed scheme, the basic concept behind relays remains the same. The digital technology has a significant influence on how the relays get operate and have offered several improvements over traditional electromechanical relays. As shown in Figure 8. Initially, the entire collected data is subdivided into two sets namely the training and the testing data sets. The first step in the process is fault find. Once the fault has occurred on the transmission line, the next step is to classify the fault into the different categories based on the phases that are faulted.

ADVANTAGES

- Low order harmonic distortion reduces
- Stable system
- High efficiency

V. COMPUTATIONAL

The flow chart of the given proposed network model as shown in the below:

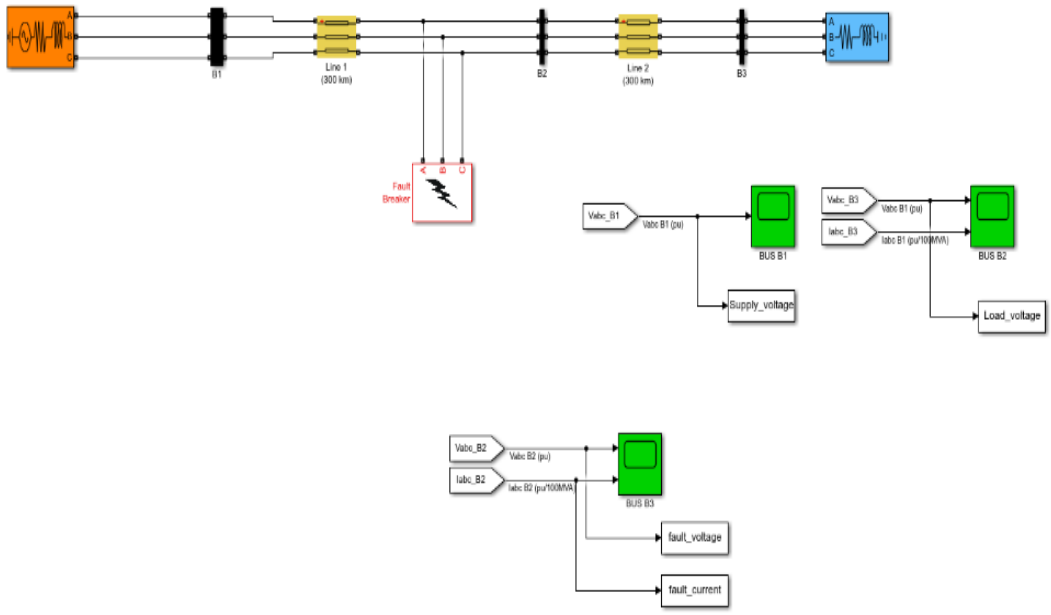

Fig. 1: simulation

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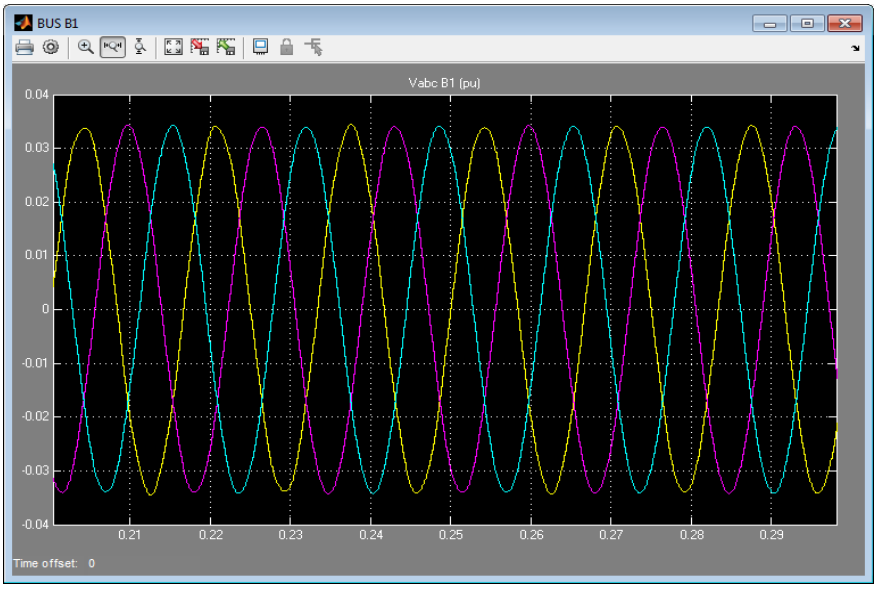

Fig. 2: Three Phase Waveform at normal condition

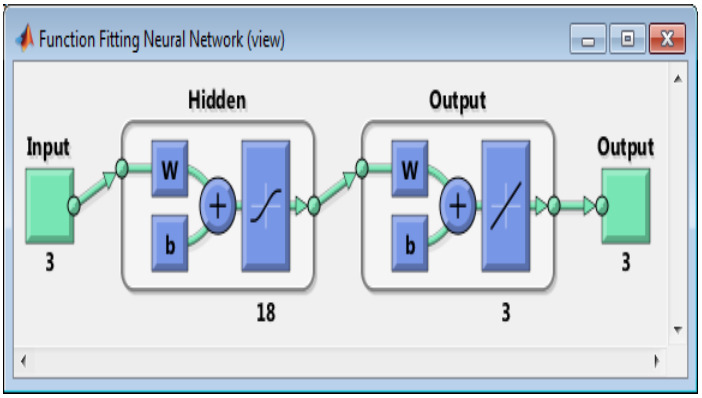

Fig.3: Function Fitting Neural Network (View)

VI. RESULT AND DISSCUSSION

FAULT

- Electrical Fault is defined as the abnormality of a current in the system due to which there is a failure of system. An open-circuit fault occurs if a circuit is interrupted by some failure.
- In three-phase systems, a fault may be involving one or more than one phases and ground, or may occur only between phases. When "ground fault" or "earth fault" happen, current flows into the earth.
- In power systems, protective devices are used to detect faulty conditions and operate circuit breakers and other devices to limit the power loss due to a failure.

UNSYMMETRICAL FAULTS

- **Single line - Ground fault**

Single line-to-ground – The single line-to-ground fault is very often caused by physical contact when a line is come contact with the. In transmission line around 65% - 70% faults are asymmetric single line-to-ground fault.

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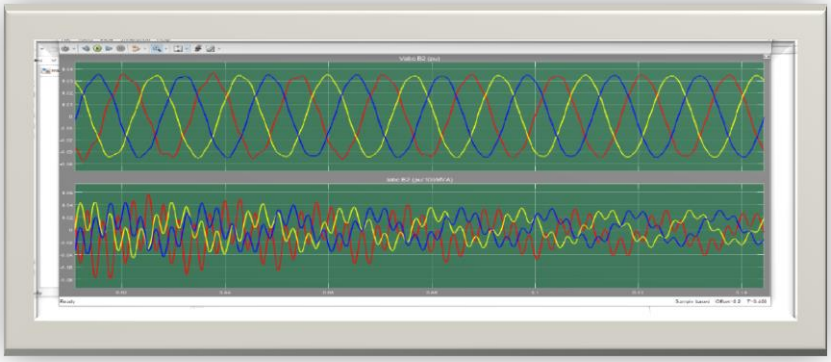

Fig.4: L-G Fault

- **Double line - Ground fault**

Double line-to-ground – The double line-to-ground fault is caused due to incidents like storm damage when two lines are get come contact with the ground. In transmission line around 15% - 20% of faults are asymmetric double line-to-ground faults.

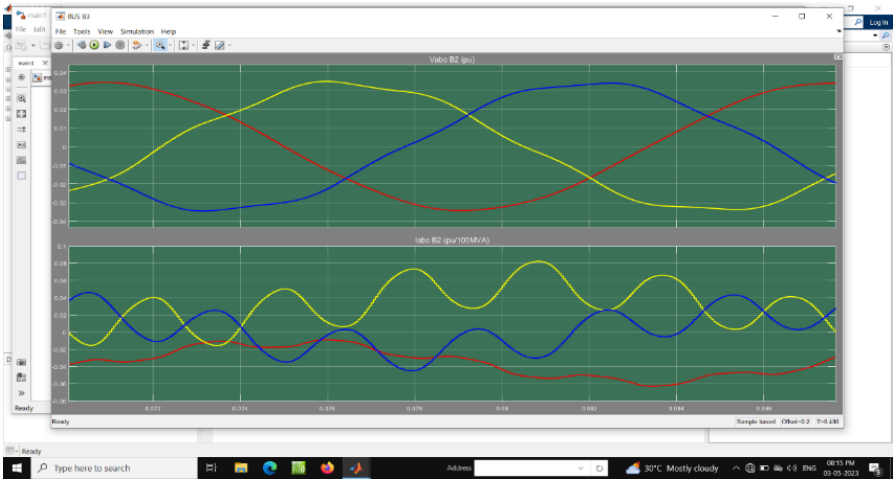

Fig.5: L-L-G Fault

- **Line – Line fault**

Line-to-line – The line-to-line fault is mainly caused by ionization of the air, or when the lines come into physical contact with each other. In transmission line around 5% - 10% faults are asymmetric line-to-line fault.

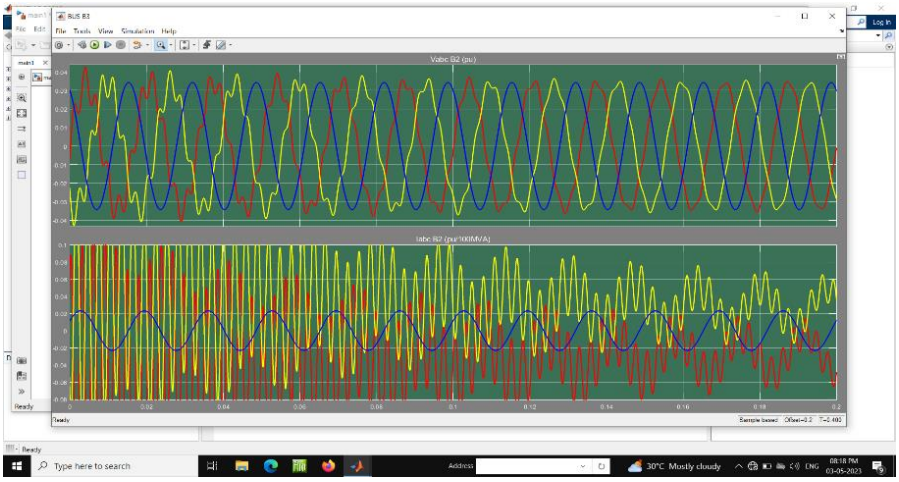

Fig. 6: L-L Fault

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SYMMETRICAL FAULT

Three phase faults

- Symmetric faults are the faults that affects the each of the three phases of a transmission line equally. This type of fault is also called as balanced fault. In transmission line are 5% faults are symmetric faults.
- Since an asymmetric fault not affects the three phases equally, this symmetric fault shows contrast with the asymmetric fault. As compared to the asymmetric fault, symmetric fault rarely occurs in the transmission line. Symmetric includes line to line line fault (L-L-L) and line to line to ground fault (L-L-L-G).
- Around 2 to 5% of the total system faults are roughly symmetric faults. However, this fault can cause very severe damage transmission line and its equipment if occur.

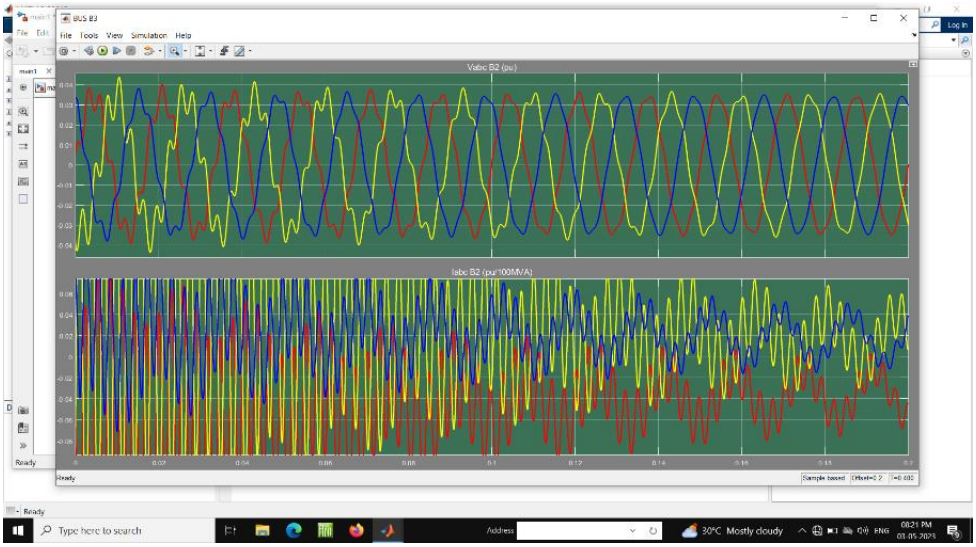

Fig.7: L-L-L Fault

VII. ADVANTAGES

- The artificial neural networks have ability to learn and. In real life, many of the relationships between inputs and outputs are non-linear as well as complex hence; ANN can model non-linear and complex relationship.
- After training from initial inputs and their relationships, ANNs can generalize. It can infer unseen relationship on unseen data, thus making the model generalize and predict and on unseen data.
- The artificial neural network does not impose any restriction on the input variable uunlike many other predication techniques.
- ANNS have aability to work with complete knowledge. After ANN training, the data may produce output with the accurate prediction. Here The loss of performance here depends on the important of the missing information.
- The ANN having fault tolerance, a ccorruption of one or more cell of ANN does not prevent it from generating output. This feature makes the network fault tolerant.

VIII. DISADVANTAGE

- Hardware dependence: artificial neural networks required processor with parallel processing power, as per according to their structure. For this reason, the realization of the equipment is dependent.
- Un accepted behaviour of the network: this is one of the most important problems of artificial neural network. When ANN produces a probing solution, it does not give a clue as to why & how.

IX. APPLICATIONS

- The Project used the MATLAB based models for fault detection in the transmission line. The classification and phasor estimation during various types of fault occur in the line, can also be investigated by using the MATLAB.
- Both distribution and transmission line can use the distance relaying.

- Image compression – neural network can receive and process large amount of information at once. With the internet explosion and more sites using more images on these sites, using neural networks for image compression is worth a look.

X. CONCLUSION

In this paper we studied the use of neural networks as an alternative method for the detection of faults occurs in the transmission line system. These methods are employed to make use of the phase voltages and phase as inputs to the neural networks. Various possible kinds of faults like single line-ground, line-line, double line ground and three phase faults have been taken into consideration into this work and separate ANNs have been proposed for each of these faults. All the neural networks studied in this paper are belong to the back-propagation neural network architecture. Here we are using MATLAB R2010a along with the SimPower Systems toolbox in Simulink to simulate the entire power transmission line model and to obtain the training data set. The Artificial Neural Networks Toolbox has been used extensively to train and analyse the performance of the neural networks, Neural Networks are reliable and attractive scheme for an ideal transmission line to detect the fault scheme especially in view of the increasing complexity of the modern power transmission systems. It is very essential to investigate and study the advantages of a particular neural network structure and learning algorithm before choosing it for an application because there should be a trade-off between the training characteristics and the performance factors of any neural network. Back Propagation neural networks are very efficient when a sufficiently large training data set is available.

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