Available online at: http://www.ijmtst.com/vol6issue04.html

International Journal for Modern Trends in Science and Technology

ISSN: 2455-3778 :: Volume: 06, Issue No: 04, April 2020

AI Technique Based Fault Location in a Transmission Network with DG's

M V V Satya Sairam[1] | S Ashok[1] | E Vijay Babu[1] | Syed Abdul Mujeer[2]

[1]UG Students, Department of Electrical and Electronics Engineering, Godavari Institute of Engineering and Technology (A), Rajahmundry, Andhra Pradesh, India.

[2]Assistant Professor, Department of Electrical and Electronics Engineering, Godavari Institute of Engineering and Technology (A), Rajahmundry, Andhra Pradesh, India.

To Cite this Article

M V V Satya Sairam, S Ashok, E Vijay Babu and Syed Abdul Mujeer, "AI Technique Based Fault Location in a Transmission Network with DG's", *International Journal for Modern Trends in Science and Technology*, Vol. 06, Issue 04, April 2020, pp.:01-05.

Article Info

Received on 26-February-2020, Revised on 19-March-2020, Accepted on 23-March-2020, Published on 27-March-2020.

ABSTRACT

The increase in usage of distributed generation(DG) have much impact on configuration and operation mode of power system. When DG units are connected to a transmission network, the system will be losing coordination among the network protection devices. Fault type and Fault line are identified by using Neural Network for a transmission network with dg's are used. This method can be able to determine the accurate fault type and fault line by using Neural network. Different fault currents data are considered to verify the accuracy of the fault type and faulty line of transmission system with DG's using MATLAB.

KEYWORDS: *Fault location, Transmission network, Distributed generation, AI Techniques*

I. INTRODUCTION

The Electric Power System is divided into many different sections. One of which is the transmission system, where power is transmitted from generating stations and substations via transmission lines into consumers. Both methods could encounter various types of malfunctions is usually referred to as a "Fault". Fault is simply defined as a number of undesirable but unavoidable incidents can temporarily disturb the stable condition of the power system that occurs when the insulation of the system fails at any point. Moreover, if a conducting object comes in contact with a bare power conductor, a short circuit, or fault, is said to have occurred. The causes of faults are many, they include lighting, wind damage, trees falling across transmission lines, vehicles or aircraft colliding with the transmission towersor poles, birds shorting lines or vandalism.

II. BACKGROUND

The development of this project will ease user to perform the calculations of fault. This project is focusing on the development of a toolbox for power system fault analysis using MATLAB. Power system fault analysis is the process of determining the magnitude of voltages and line currents during the occurrence of various types of faults. The magnitude of these currents depends on theinternal impedance of the generatorsplus theimpedance of the intervening circuit.It can be of the order of tens of thousand of amperes. Faults on power systems can be divided into three-phase balanced faults and unbalanced faults. Three types of unbalanced fault occurrence on power system transmission lines are single line-to-ground faults, line-to-line faults, and double line-to-ground faults. The magnitude of the fault current must be accurately calculated in order that mechanical and thermal stresses on equipment may be estimated. Fault studies are used to select and set the proper protective devices and switch gears.

The determination of the bus voltages and line currents is very important in the fault analysis of power system. The process consists of various methods of mathematical calculation which includes loads of formula and matrix approach to determine the magnitude of the voltage and current. The calculation may form a large rows and columns of matrix depending on the number of busses. The calculation is possible when dealing with small number of busses. However it is difficult to perform by hand when dealing with large number of busses. We will discuss the method of analysis in the methodology.

III. FAULTS IN POWER SYSTEM

Symmetrical faults:

These are very severe faults and occur infrequently in the power systems. These are also called as balanced faults and are of two types namely line to line to line to ground (L-L-L-G) and line to line to line (L-L-L).

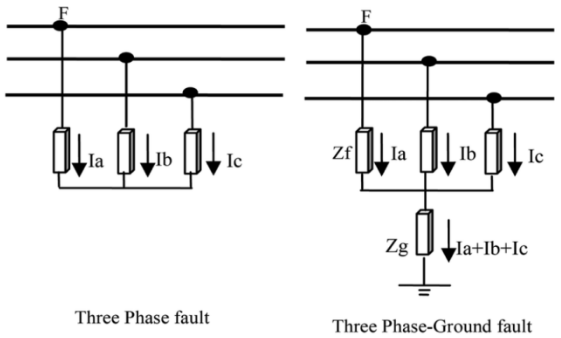

Fig 1.1 Symmetrical Faults

Only 2-5 percent of system faults are symmetrical faults. If these faults occur, system remains balanced but results in severe damage to the electrical power system equipments. Above figure shows two types of three phase symmetrical faults. Analysis of these fault is easy and usually carried by per phase basis. Three phase fault analysis or information is required for selecting set-phase relays, rupturing capacity of the circuit breakers and rating of the protective switchgear.

Unsymmetrical faults:

These are very common and less severe than symmetrical faults. There are mainly three types namely line to ground (L-G), line to line (L-L) and double line to ground (LL-G) faults.

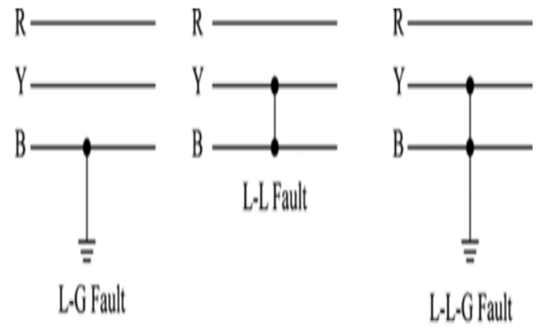

Fig 1.2 Unsymmetrical Faults

Line to ground fault (L-G) is most common fault and 65-70 percent of faults are of this type.

It causes the conductor to make contact with earth or ground. 15 to 20 percent of faults are double line to ground and causes the two conductors to make contact with ground. Line to line faults occur whentwo conductors make contact with each other mainly while swinging of lines due to winds and 5- 10 percent of the faults are of this type.These are also called unbalanced faults since theiroccurrence causesunbalancein the system. Unbalance of the system means that that impedance values are different in each phase causing unbalance current to flow in the phases. These are more difficult to analyze and are carried by per phase basis similar to three phase balanced faults.

IV. WIND ENERGY

Principal of Wind Energy

A windmill converts wind energy into rotational energy by means of its blades. The basic principle of every windmill is to convert kinetic energy of wind into mechanical energy which is used to rotate the turbine of electrical generator to produce electricity. They are sometimes used to pump water or to extract groundwater.

The most commonly seen windmills are Horizontal axis windmills which have their main rotor shaft and electrical generator at the top of a tower arranged in a row, horizontally. Basic parts include blades, rotor, a gear box (which amplifies the energy output of the rotor), and a generator which generates electricity. Sometimes, a tail-vane is also attached to direct the turbine to gather maximum wind energy. When the main rotor shaft is set traverse, not necessarily vertical, to the wind, it is a Vertical axis windmill. The main components of these windmills are located at the base of the turbine. The main advantage of this arrangement is that the generator and gearbox are located close to the ground, facilitating service and repair. These windmills do not necessarily be pointed into the wind, which removes the need for orientation mechanisms.

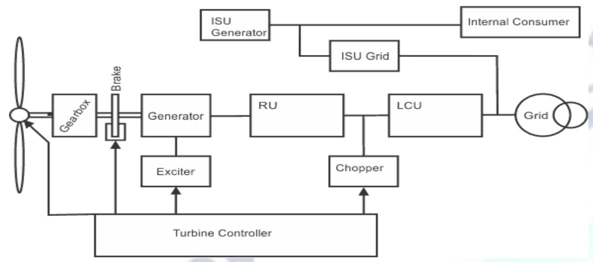

Fig 1.3 Block Diagram Of Wind Energy

When the wind strikes the rotor blades, blades start rotating. The turbine rotor is connected to a high-speed gearbox. Gearbox transforms the rotor rotation from low speed to high speed. The high-speed shaft from the gearbox is coupled with the rotor of thegenerator and hence the electrical generator runs at a higher speed. An exciter is needed to give therequired excitation to the magnetic coil of the generator fieldsystem sothat it can generate the required electricity. The generated voltage at output terminals of the alternator is proportional to both the speed and field flux of the alternator. The speed is governed by wind power which is out of control. Hence to maintain uniformity of the output power from the alternator, excitation must be controlled according to the availability of natural wind power. The exciter current is controlled by a turbine controller which senses the wind speed. Then output voltage of ELECTRICALGENERATOR(alternator) is given to a rectifier where the alternator output gets rectified to DC. Then this rectified DC output is given to line converter unit to convert it into stabilized AC output which is ultimately fed to either electrical transmission network or transmission grid with the help of STEPUPTRANSFORMER. An extra unit is used to give the power to internal auxiliaries of wind turbine.

V. RBF NEURAL NETWORK

The design of supervised neural network may be pursued in a variety of ways. A completely different approach by viewing the design of a neural network as a curve fitting (approximation) problem in a high dimensional space. According to this viewing point, learning is equivalent to finding a surface in a multidimensional space that provides a best fit to the training data, with the criterion for "best fit" being measured in some statistical sense. Correspondingly, generalization is equivalent to the use of this multidimensional surface to interpolate the test data. Such a view point is the motivation behind the method of radial-basis functions in the sense that it draws upon research work on traditional strict interpolation in a multidimensional space. In the context of a neural network, the hidden units provide a set of "functions" that constitute an arbitrary "basis" for the input patterns (vectors) when they are expanded into the hidden space; these functions are called radial-basis functions. Radial-basis functions were first introduced in the solution of the real multivariate interpolation problem. It is now one of the main fields of research in numerical analysis.

The construction of a radial-basis function (RBF) network involves input layers is made up of source nodes (sensory units) that connect the network to its environment. The second layer, the only hidden layer in the network, applies a nonlinear transformation from the input space to the hidden space; in most applications the hidden space is of high dimensionality. The output layer is linear, supplying the response of thenetwork tothe activation pattern (signal) applied to the input layer. A pattern-classification problem cast in a high-dimensional space is more likely to be linearly separable than in a low-dimensional space-hence the reason for frequently making the dimension of the hidden space in an RBF network high. Another important point is the fact that the dimension of the hidden neuron is directly related to the capacity of the network to approximate a smooth input-output mapping; the higher the dimension of the hidden space, the more accurate the approximate will be.

VI. IDENTIFYING FAULT YTPE

To identify the various fault types, namely, single phase to ground fault, phase to phase fault, two phase to ground fault and three phase fault, the 3 phase currents of the main source from the feeding substation are used. Fault type is identified by the fault type code (A,B,C,G).

Two RBFNNs are developed.

- For first RBFNN, input is 3 phase short circuit currents of each bus are considered and the output comprising of faulty code (A,B,C,G).

- For second RBFNN, input is 3 phase short circuit currents of each bus are considered and output is identification of exact faulty line.

IMPLEMENTATION PROCEDURE:

Step1: Obtain the input data and target data from simulation.
Step2: Assemble the fault data in a manner and preprocess the training data for RBFNN.
Step3: Create the network object by using input and target data. Now train the network.
Step4: Store the trained network.
Step5: Create a fault and train the fault current data to obtain required results.
Step 5 is online process or it may be a offline process.

VII. SIMULATION AND RESULTS

Single Line Diagram For IEEE 14 Bus System

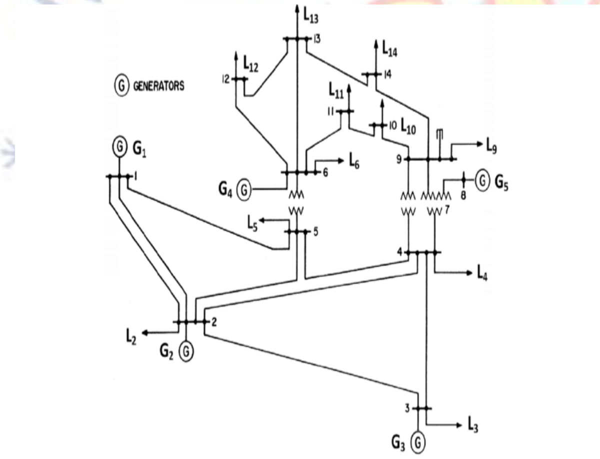

Fig 1.4 Single Line Diagram

From the fault current data obtained from each bus is used to identify the fault type and fault line. From the 169 data sets trained in the RBF neural network can identify the fault type and fault line.

Testing Performances of RBFNNs for 3 phase short circuit currents without renewable energy

Testing Data	RBFNN 1	RBFNN 2
	Fault Type	Faulty Line no.
Bus 3	1-phase to ground	3
	Phase to phase	3
	2-phase to ground	3
	3-phase	3
Bus 6	1-phase to ground	6
	Phase to phase	6
	2-phase to ground	6
	3-phase	6
Bus 7	1-phase to ground	7
	Phase to phase	7
	2-phase to ground	7
	3-phase	7

- ➢ Wind energy is connected to the 8th bus and we identify the fault type and fault line.
- ➢ Wind energy capacity is 9 MW.

Testing Performances Of RBFNNs for 3 phase short circuit currents with renewable energy

Testing Data	RBFNN 1	RBFNN 2
	Fault Type	Faulty Line no.
Bus 3	1-phase to ground	3
	Phase to phase	3
	2-phase to ground	3
	3-phase	3
Bus 6	1-phase to ground	6
	Phase to phase	6
	2-phase to ground	6
	3-phase	6
Bus 7	1-phase to ground	7
	Phase to phase	7
	2-phase to ground	7
	3-phase	7

VIII. CONCLUSION

The presence of Distributed Generation (DG) in transmission network represents the high fault current level. When a short circuit fault occurs, the protection devices may produce false action and non-action. For such networks predicting the exact fault location is more difficult. Neural network is an effective method for fault diagnosis. A method using RBF Neural Network to determine the fault type and location of fault in transmission network is presented. The proposed method was implemented on MATLAB and the required data for training the neural networks is extracted.

In this paper, the fault location problem of transmission network with Distributed Generations (DGs) is studied. With two different Neural Networks are used for the proposed method for fault identification i.e., fault type and fault line in the transmission network with penetrationof DG. The results verified the correctness and effectiveness of the model and algorithm for 3-phase short circuit Currents.

REFERENCES

[1] Chanda D, Kishore NK, Sinha AK (2005) Application of wavelet multiresolution analysis for identification and classification of faults on transmission lines. Electr Power Syst Res 73:323–333.
[2] Dalstein T, Kuliche B (1995) Neural network approach to fault classificationfor high speedprotective relaying. IEEE Trans Power Deliv 10(2):1002–1011

[3] Das B, Reddy JV (2005) Fuzzy-logic-based fault classification scheme for digital distance protection. IEEE Trans Power Deliv 20(2):609–616
[4] Dash PK, Pradhan AK, Panda G (2000) A novel fuzzy neural network based distance relaying scheme. IEEE Trans Power Deliv 15(3):902–907
[5] Eristi H (2013) Fault diagnosis system for series compensated transmission line based on wavelet transform and adaptive neuro-fuzzy inference system. Measurement 46(1):393–401
[6] Ferrero A, Sangiovanni S, Zapitelli E (1995) A fuzzy set approach to fault type identification in digital relaying. IEEE Trans Power Deliv 10(1):169–175
[7] Jain A (2013) Artificial neural network-based fault distance locator for double-circuit transmission lines. Adv ArtifIntell 2013:1–12
[8] Jamil M, Sharma SK, Singh R (2015) Fault detection and classification in electrical power transmission system using artificial neural network. Springerplus 4(334):1–13
[9] Koley E, Verma K, Ghosh S (2015) An improved fault detection classification and location scheme based on wavelet transform and artificial neural network for six phase transmission line using single end data only. Springerplus 4(551):1–22
[10] Liang J, Elangovan S, Devotta JBX (1998) A wavelet multiresolution analysis approach to fault detection and classification in transmission lines. Int J Electr Power Energy Syst 20(5):327–332
[11] Zhao W. HVDC transmission technology. Electric Power Publishing of China: Beijing, 2004