Modeling and Simulation of Overhead Transmission Line Faults Detection and Comparison

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Abstract: ***The main aim of this paper is to detect/Analysis the location of the different faults on overhead transmission lines. A fault occurs on overhead transmission line when two or more conductors are contact with each other. Mainly the major faults in overhead transmission lines are classified as L-G fault, L-L fault, double line to ground faults and three phase faults. These faults are classified for discrete wavelet Transform. In this paper presents a proposed model in 250 km/132kv overhead transmission line are simulated in MATLAB software to detection and comparison the faults. Here the complete modeling and simulation has been studies and analysis the faults or transients faults by the help of MATLAB Software. In this software is used to simulation of different operating and different conditions of fault on overhead voltage transmission line, their faults namely as L-G fault, 2L-G fault, 3L-G fault and three phase short circuit. The complete design and comparison the fault current in simulation of the proposed work is presented in it.***

Keywords: ***Overhead Transmission line faults, MATLAB Software, Discrete wavelet Transform***

1. Introduction

In overhead transmission lines major faults are classified as line to ground fault, double to line fault, triple line to ground fault and three phase faults. These faults can be analysis, comparison and classified has to be used discrete wavelet transform. When during the faults occurs, the grid current and grid voltages undergoes transients waveform. The transients waveform are analysis and comparison by using discrete wavelet transform and the different types of fault can be classified [1]. Detection and Comparison the transients in individual phase currents and zero sequence currents are classified and identifying which faults is occurred. After wavelet transform calculating the energy of highest waveform of fault associated to each phase and ground and thus the fault involving phase is identified [2]. When different types of fault are occur two or more conductors come in contact with each other or ground in three phase systems, faults are classified as L-G, LL-G, LLL-G and three phase faults. For it is at such times that the electrical power system components are the greatest stresses from excessive currents. These faults gradually rise to serious damage on electrical power system equipment [3]. When a major fault which occurring on overhead transmission lines not only effects the all equipment and it is also effect the electrical power quality. So, it is necessary to determine the types of fault and location of fault on the transmission line and clear the faults as soon as possible in order not to cause some damages. A flash over, lightning strikes to birds, wind, snow and ice load lead to short circuits[4]. When the deformation of insulator materials are also to occurs a short circuit faults. Thus it is essential to detect and compare the fault quickly and separate the faulty part of the overhead transmission line. We locating the ground faults quickly they are more important for safety, economy and electric power quality. Now this transient wavelet or waveform based fault analysis, detect and compare the faults levels of wavelets of each phase and zero sequence currents and thus detecting, comparison and classifying the faults. Figure 1 shows the block diagram of Overhead transmission line fault analysis [5].

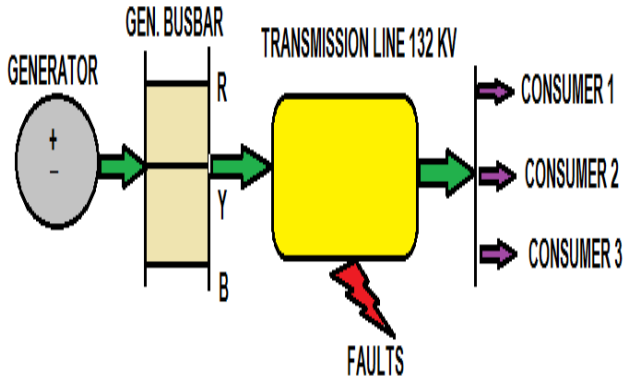

Figure: 1 Show the block diagram of Overhead transmission line fault analysis

Source voltage: 132KV
Frequency = 50 Hz
Source Impedance= $0.01+10^{-3}$
Transmission line impedance:
Positive Sequence = 0.9337e-3, 4.1264e-3
Overhead Transmission line is the mostly faults are single line to ground fault element in the electrical power system to exposed especially and the physical dimension/ length is also be taken into consideration [6]. In this paper has Concentrated, Detection and Comparison on understanding the behavior of their high voltage transmission line each phase voltages and phase currents as a consequence of faults. When new objective of this proposed work is to study and their employed neural network techniques as a flexible tool to identify or detect and compare the faults in an overhead transmission line system. The artificial neural network is a powerful to use in overhead transmission line fault identification, classification and isolation. The parallel line is inherent in neural networks enables them with faster for it computational times rather than traditional techniques. Hence, using this technology in over head transmission line fault diagnosis does validate its usefulness and encourages engineer to using this technique in other electrical power system applications [5-6]. The important objective of this paper is to develop artificial neural network based

autonomous learning system that acquire knowledge and incrementally in real that time, with as little supervision as soon as possible. To deploy effective strategies for practical their application of such system for faults identification and diagnosis. For protection of over head transmission line the fault analysis, comparison and classified and located played is an important role. Due to limited available amount of practical fault data, it is necessary to generate for examples of faults data using for modeling and simulation [5], [7].

The fundamental objective of system protection is to provide isolation of the problem area, keeping the rest of the system to continue in service [8]. The protective relays act after the occurring of an abnormal or intolerable or fault condition, in order to minimize this duration of the trouble and limit the damage and outage time. During the fault, transients arise in both voltage and current waveforms. When the Symmetrical components technique has been used to analyze and detect such waveforms for fault detection and comparison [9].

2. Transmission Line

An overhead transmission line is one of the important components in electric power system. In Overhead transmission lines connect the stations (generating station) and load centers. When the generating stations are far away from the load centers and they run over few hundreds of kilometers. Mainly faults can destabilize the power system they must be isolated immediately. Fault detection are most important issue in electrical power system engineering in order that to clear faults quickly and restores electrical power supply as possible as with minimum interruption. When a fault occurs on an electrical HV transmission line for its most important to detect and analysis to compare and find its located in order to make for its necessary quality repairs and to restore power as possible as and time needed to determine the faults at a point along with their a line will affect the quality of the electrical power delivery. It is an accurate faults to location on their overhead/high voltage transmission line it a most important requirement for a permanent fault. Transmission line protection is very important issue in electrical power system because 83-86% of electrical power system faults are occurring in overhead transmission lines [5].

3. Modeling the Power Transmission Line System

In this case we detect and analysis of fault currents will give information about the nature of the fault. Let us consider a faulted overhead transmission in electrical power system as shown in figure 2. A 132 KV Overhead transmission line system has been simulated to detection and simulation. Figure 1 shows a block diagram of overhead transmission line fault has been used throughout the work. The system consist of one generators of 132 KV is located on transmission line are three phase simulator used to simulate faults at mid position on transmission line. The faulted overhead transmission line is represented by distributed parameters. As an application of 250 Km overhead transmission line with the parameter of the overhead transmission line simulation diagram shown in figure 2.

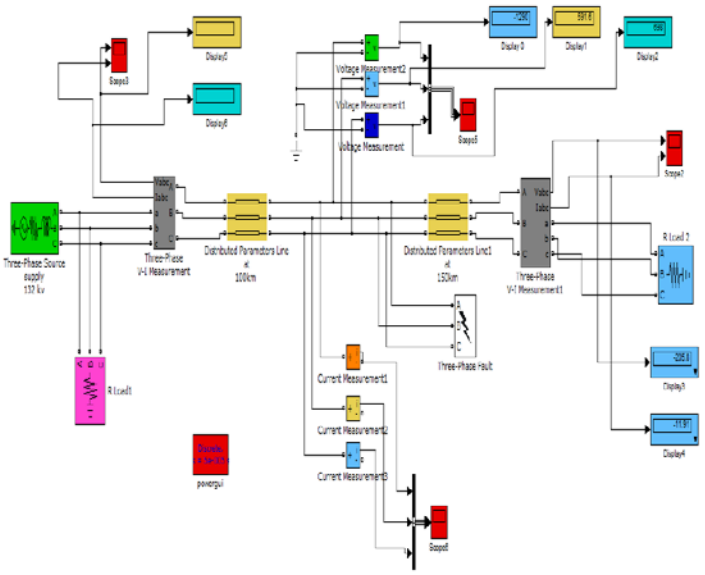

Figure: 2 Simulation diagram of Overhead transmission line fault

In the above figure-2 three phases Voltage-current (V-I) measurement block is used to measure the voltage and current sample at source end. The overhead transmission line is one line 250 Km long. Modeling of three phase fault simulator is used to simulate various types of fault. In transmission line faults are classified as L-G fault, LL-G fault and three phase fault.

Table-1: Comparison of Output L-G, LL-G and LLL-G Voltage/Current Faults Analysis

S.NO.	Types of faults	Distance	Voltage Value	Current Value
1	L-G	250 Km	230 V	14 Amp.
2	LL-G	250 Km	190 V	10 Amp.
3	LLL-G	250 Km	0 V	0 Amp.

Table-2: Comparison of Input L-G, LL-G and LLL-G Faults Current Analysis

S.NO.	Types of faults	Distance	Input Fault Current
1	L-G	250 Km	58 Amp.
2	LL-G	250 Km	82 Amp.
3	LLL-G	250 Km	100 Amp.

4. Simulation results

4.1 L-G Fault

The L-G faults occur in overhead transmission system are R-G, Y-G and B-G faults. For an example R-G fault is considered here. In this figure shows the voltage and current waveforms of RG or L-G fault system. The R phase signals having more transients than other phases. Approximate and detailed coefficients are calculated, and analysis of energy associated with each phase and ground is tabulated. From the table it is clear that the energy associated with detailed coefficients of R phase and ground are changed and thus this is an R-G fault system.

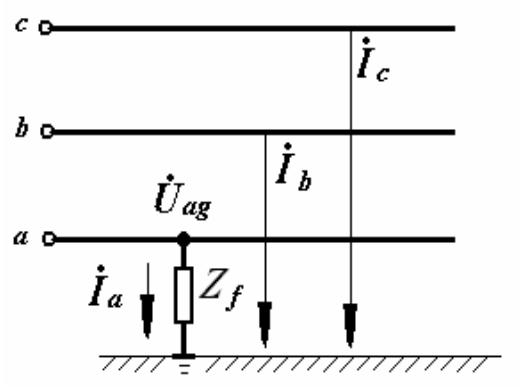

Figure: 3 Single line-to-ground fault

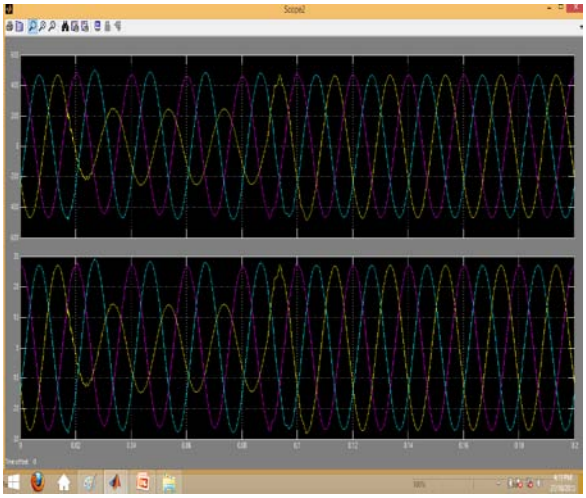

Figure: 4 Output voltage and current waveform Single line to ground

4.2 LL-G Fault

In this figure shows the voltage and current waveforms of RB-G fault system. The R, B and zero signals having more transients fault and than other phases. The detailed coefficients are calculated and energy with associated in each phase and ground is below. From these, table, it is clear that the energy associated with detailed coefficients and analysis of R B phases and ground is changed and thus this is an R-B-G fault system.

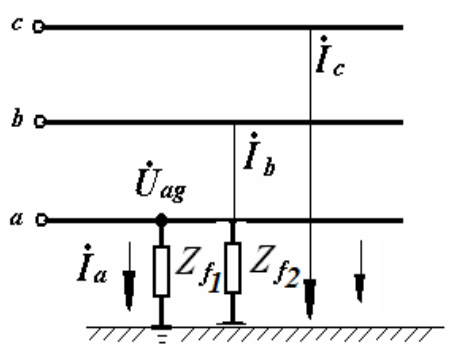

Figure: 5 Double line-to-ground fault

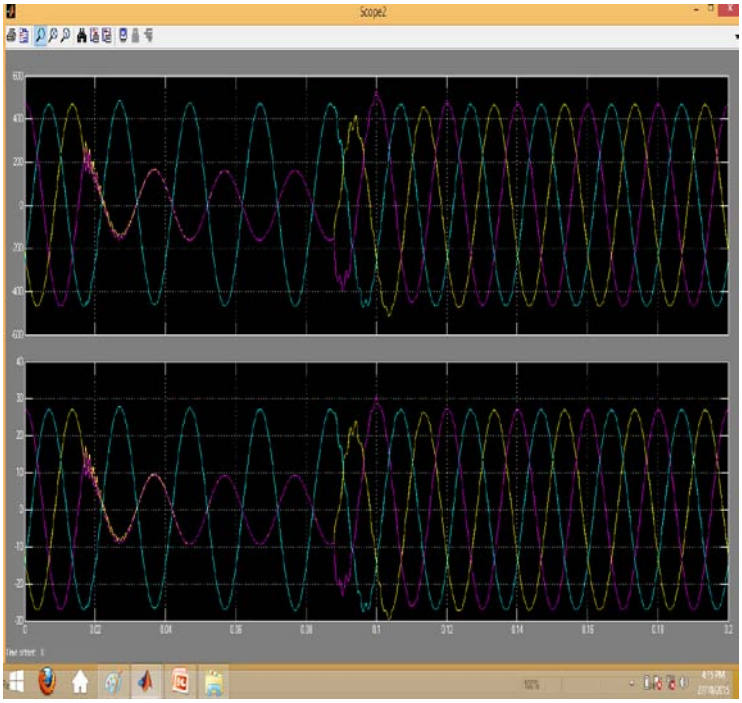

Figure: 6 Output voltage and current waveform Double line to ground

4.3 LLL-G Fault

In three phase faults occurs in overhead transmission system are RYB faults and R-Y-B-G faults. Simulation and modeling results of both fault conditions are discussed. The figure shows the voltage and current waveforms of R-Y-B fault system. In R, Y and B phase signals having more transient waveform and more faults than other phases. Approximate and detailed coefficients are calculated and energy associated with each phase and ground is tabulated below. From the table it is clear that the energy associated with detailed coefficients of R, Y and B phases changed and thus this is an R-Y-B fault system.

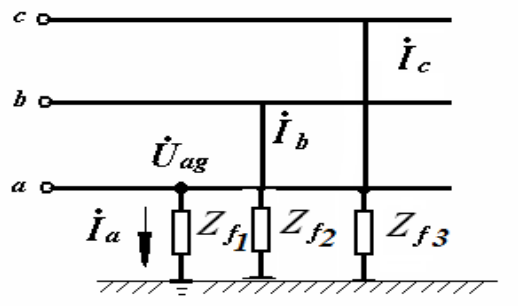

Figure: 7 Triple line-to-ground fault

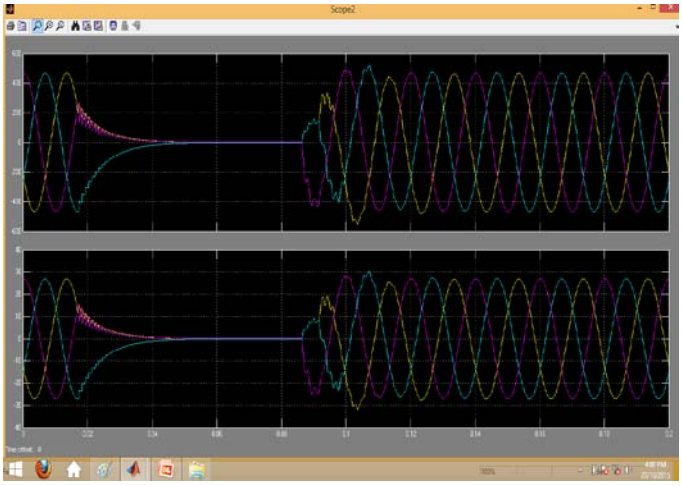

Figure: 8 Output voltage and current waveform Triple line to ground

4.4 L-G Fault at Input side

Here we have simulation on L-G fault occur then one phase is shortened to the ground. When the output waveform shows the rise of current on L-G fault occur on overhead transmission line.

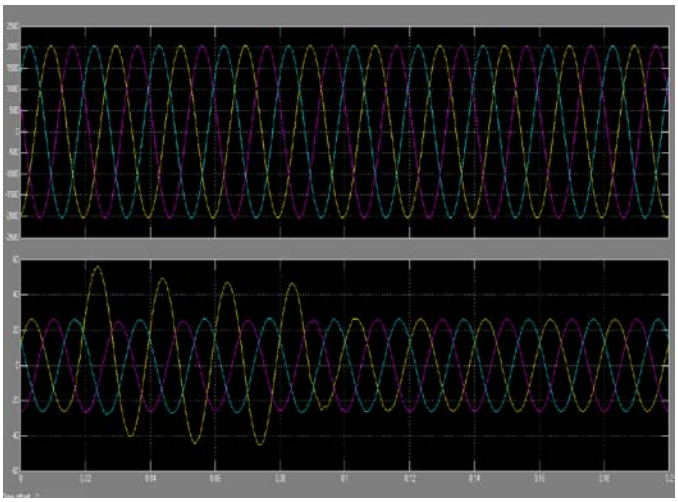

Figure: 9 L-G Fault waveform of current at input side

4.5 LL-G Fault at Input side

Now modeling and simulation on double line to ground fault occur when two of the phase is shortened to the ground. During the fault the impedance, Z is not necessary zero, but it have a non zero impedance and but still have much lesser than the line impedance. The magnitude of current in a faulty line rise higher than their normal starting current and the voltage does not change in magnitude. The output waveform shows the rise of current where LL-G fault occur on transmission line.

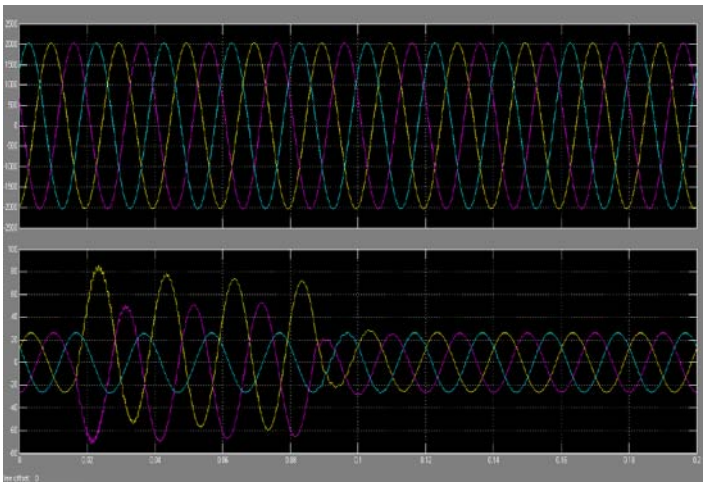

Figure: 10 LL-G Fault waveform of current at input side

4.6 LLL-G Fault at Input side

When Simulation on triple line to ground fault occur when three phases is shortened to the ground. When the magnitude of fault current line are rapidly rise and higher than the normal input current and the voltage does not change in magnitude. Thus output waveform shows the rise of current when LLL-G fault occur on transmission line.

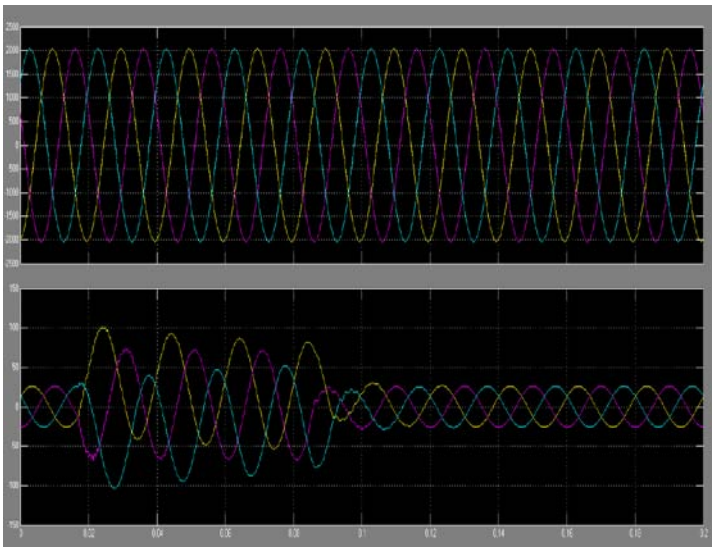

Figure: 11 LLL-G Fault waveform of current at input side

4.7 Without fault

When we applied balance input and there is no fault in their overhead transmission thus output will be normal and balance value of current and voltage. These energies are the

reference parameters. Now if there is some change in these parameters, then their phase is considered as faulty condition.

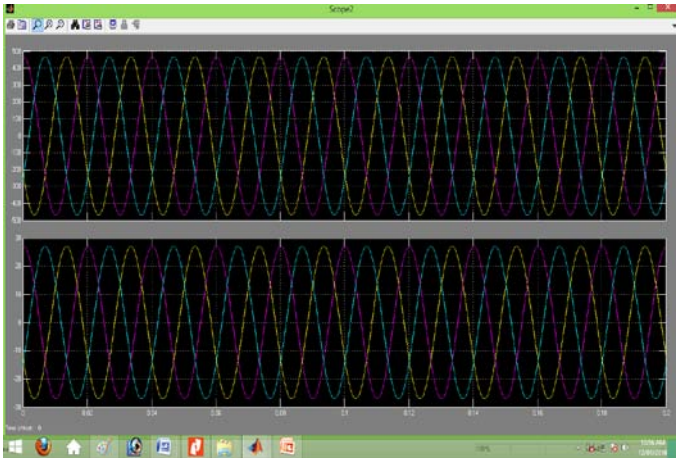

Figure: 12 Voltage and Current waveform of healthy network

5. Result and Discussion

Percentage error between the actual and obtained distances is calculated as [4].

$$\%Error = \frac{(Calculated\ Distance - Actual\ Distance)*100}{Actual\ Distance}$$

We studies about the earth fault have been carried out for various locations along the Overhead transmission line for various types of the faults. In each case the phase of the Overhead transmission line for voltage and current are fluctuate and also the impedance seen by the transmission line is not change and the whole model and experimental work are in MATLAB software.

6. Conclusion

Here In this paper proposed an identified, comparison and classification method for the overhead transmission line faults and simulated model by using MATLAB software along with the Sim-power system toolbox in Simulink for detection and analysis of faults on 250 km/132 KV supply on overhead transmission line. In this overhead transmission are classified line four types of fault namely L-G, 2L-G, 3L-G and three phase faults have been Distance taken at 250 km into consideration into this work and here four fault namely as single line ground fault, Double line to ground faults, Triple line to ground faults and L-L-L faults are comparison and detection has been show on this paper with their proposed work.

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