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A Novel Scheme of Transmission Line Faults Analysis and Detection by Using MATLAB Simulation

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Abstract—In this paper is to Analysis and detection the point of the different faults on transmission lines. Faults affect the electrical power system equipments which are connect in transmission line. A fault occurs on transmission line when two or more conductors are contact to each other. Here the implementation is in MATLAB software in transmission line model is designed, simulation and various faults will be occurred by using fault tool box. Mainly the major faults in transmission lines are single line to ground fault. These faults are analysis and detect for discrete wavelet Transform. A proposed model in 100km/33kv transmission line are simulated in MATLAB software to detection the faults. The complete modeling and simulation has been studies and analysis the faults or transients faults by the help of MATLAB Software. In this MATLAB software is used to simulation of different operating and different conditions of fault on transmission line, their faults are L-G fault, LL-G fault, LLL-G fault and three phase short circuit. Here we studies and analysis the whole complete design and detect the faults in simulation of their proposed work in MATLAB software.

Keywords— Transmission line faults, MATLAB Software, L-G fault, LL-G fault, LLL-G fault, discrete wavelet transform

INTRODUCTION

The overhead transmission lines are subjected to many types of faults. It is accurate and quickly faults detection and analysis; direction and distance location under a various types of fault conditions is an important requirement from the fault point of service restoration and flexibility [1]. This methods to find out the fault detection, direction estimation and faults distance location can be classified into the following three categories: power frequency components-based methods, transient signals-based methods and superimposed components-based methods [2].When there is a different types of faults occurs in electrical power system and then in this process of overhead transmission line fault detection and analysis. While their consulting with the electrical power system this terms are bus voltage and RMS current of the transmission line are very important. In this case of three phases electrical power system mainly they are two faults occurs such as three phase balance fault and three phase unbalance fault on transmission line of electrical power system faults are classified are L-G fault, 2L-G fault and 3L-G fault [3]. The high voltage transmission line fault detection and analysis helps to selected and developing for a better to protection purpose and their protection of transmission line. Protected system are circuit breakers and its rating is totally depends on L-L-L fault. The triple line fault current is much higher as compare to other faults current. Simulation is done by using MATLAB simulation in computer and then detection and analysis of over voltage transmission line faults can be easily find out.

The main aim of this paper is to study the general fault types which are balance fault and unbalance faults of overhead transmission line in the electrical power system and perform the detection and analysis is to obtain the result of various parameters, such as (current, voltage, power etc) from their simulation on this types of fault using MATLAB software [4]. In high voltage transmission lines major faults are classified like as L-G fault, LL-G fault, LLL-G fault and three phase faults. These faults can be detect and classified has to 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 [5]. 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. 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 [6]. When a major fault which occurring on

transmission lines not only effects the all equipments and it's 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[7]. 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 transmission line fault analysis [8].

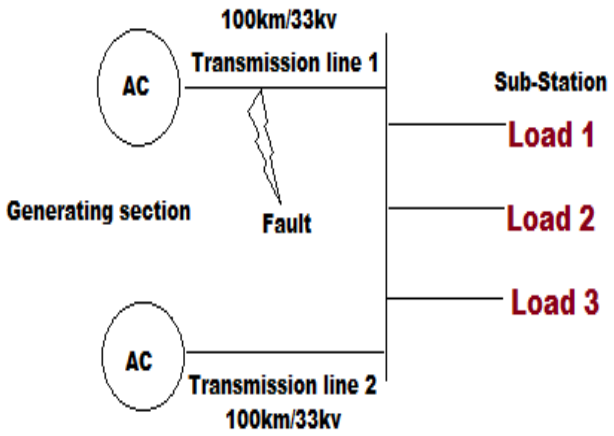


Figure: 1 Show the block diagram of transmission line fault analysis

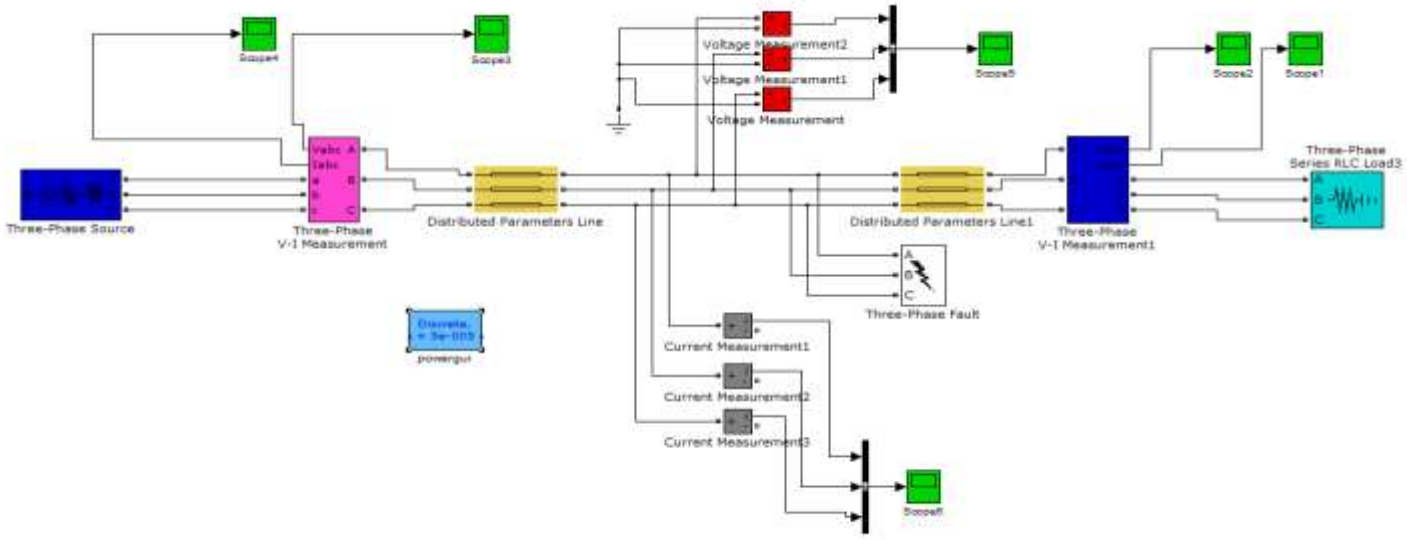
Fault current analysis and detect are most important issue in electrical power system engineering in order that to clear faults quickly and restores electrical power supply as possible as with minimum interruption. When a fault occurs on an electrical high voltage transmission line for its most important 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 line will affect the quality of the electrical power delivery.

Wavelet Transform of Transmission line

The advantage of the transform wave is that the analysis and detected be fine adjusted so that high frequency components and low frequency components can be detect and analysis precisely. Results obtained from the transmission line wavelet transform are shown on the time domain and the frequency domain. The transmission line wavelet transform has to be a change in the analysis and detection scale by the factor is called discrete wavelet transform [9].

Modeling and simulation of Transmission Line System

Here we detect and analysis of fault currents will give information about the nature of the fault. Let us consider a faulted transmission line in electrical power system as shown in figure 2. A 33Kv high voltage transmission line system has been simulated to detection and simulation. Figure 1 shows a block diagram of transmission line fault has been used throughout the work. The system consist of one generators of 33Kv is located on high voltage transmission line are three phase simulator used to simulate faults at mid position on high-voltage transmission line. The faulted on transmission line is represented by distributed parameters. As an application of 100 Km transmission line with the parameter of the transmission line simulation diagram shown in figure 2.



In the above figure-2 three phases Voltage-current (V-I) measurement blocks is used to measure V & I sample at source end. The transmission line is one line 100 Km long. Simulation 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.

Simulation Results of Transmission Line

In high voltage transmission line is one of the important components in electric power system. In 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. It is an accurate faults location on their overhead/high voltage transmission line it is the most important requirement for a permanent fault. Transmission line protection is very important issue in electrical power system because 84-87% of electrical power system faults are occurring in overhead transmission lines [3].

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.

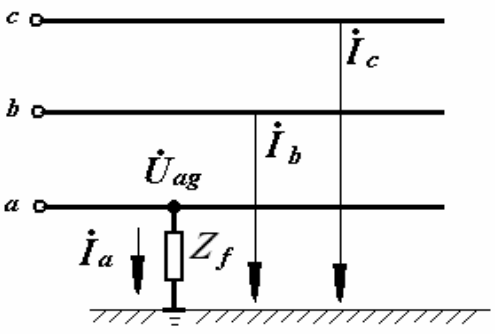


Figure: 3 Single line-to-ground fault

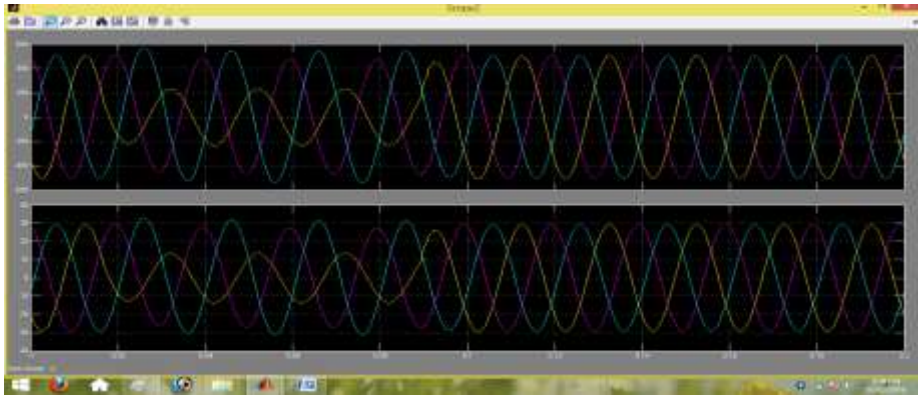


Figure: 4 Output voltage and current waveform Single line to ground

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.

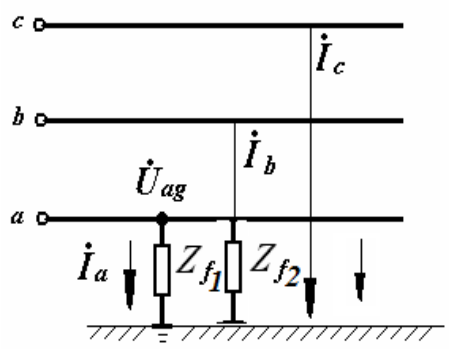


Figure: 5 Double line-to-ground fault

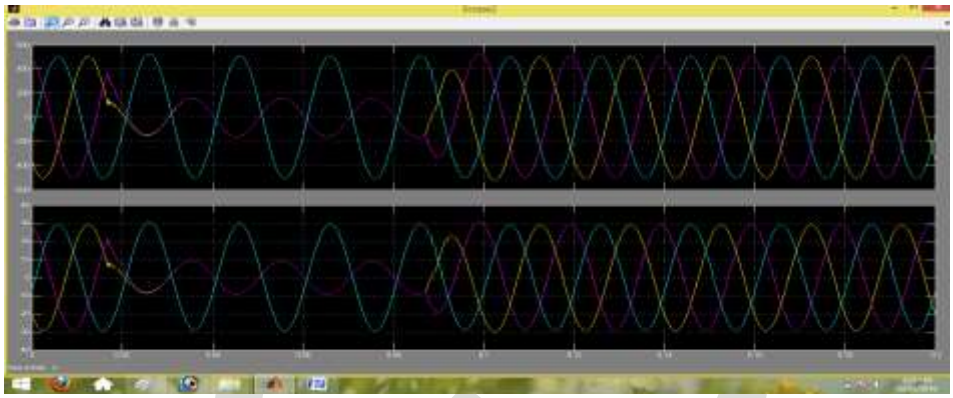


Figure: 6 Output voltage and current waveform Double line to ground

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.

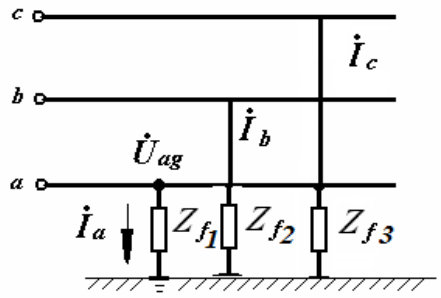


Figure: 7 Triple line-to-ground fault

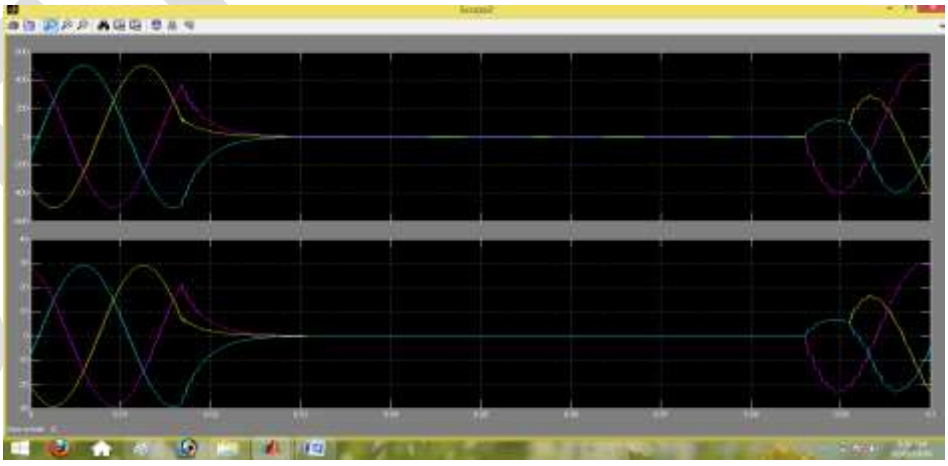


Figure: 5 Output voltage and current waveform Triple line to ground

4.4 Single Line-Ground Fault at Input side

Here we have simulation on L-G fault occurs their one phase is short to the ground and the fault the impedance (Z) is not zero. When the output waveform shows the rise of current on L-G fault occur on overhead transmission line.

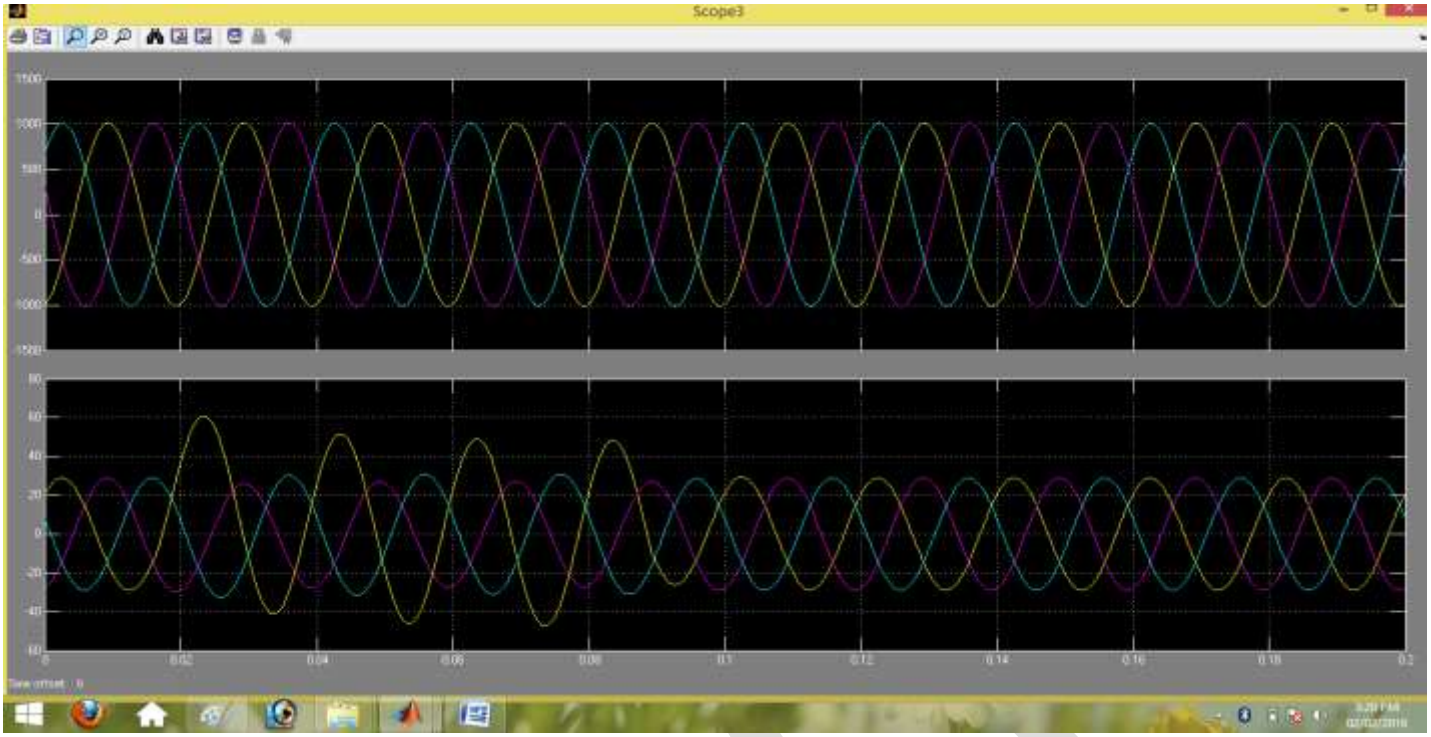


Figure: 6 L-G Fault waveform of current at input side

4.5 Double Line-Ground Fault at Input side

Now modeling and simulation on 2L-G fault occurs their two phases is short to the ground and the fault the impedance, Z is not necessary zero and output waveform shows the rise of current where LL-G fault occur on transmission line.

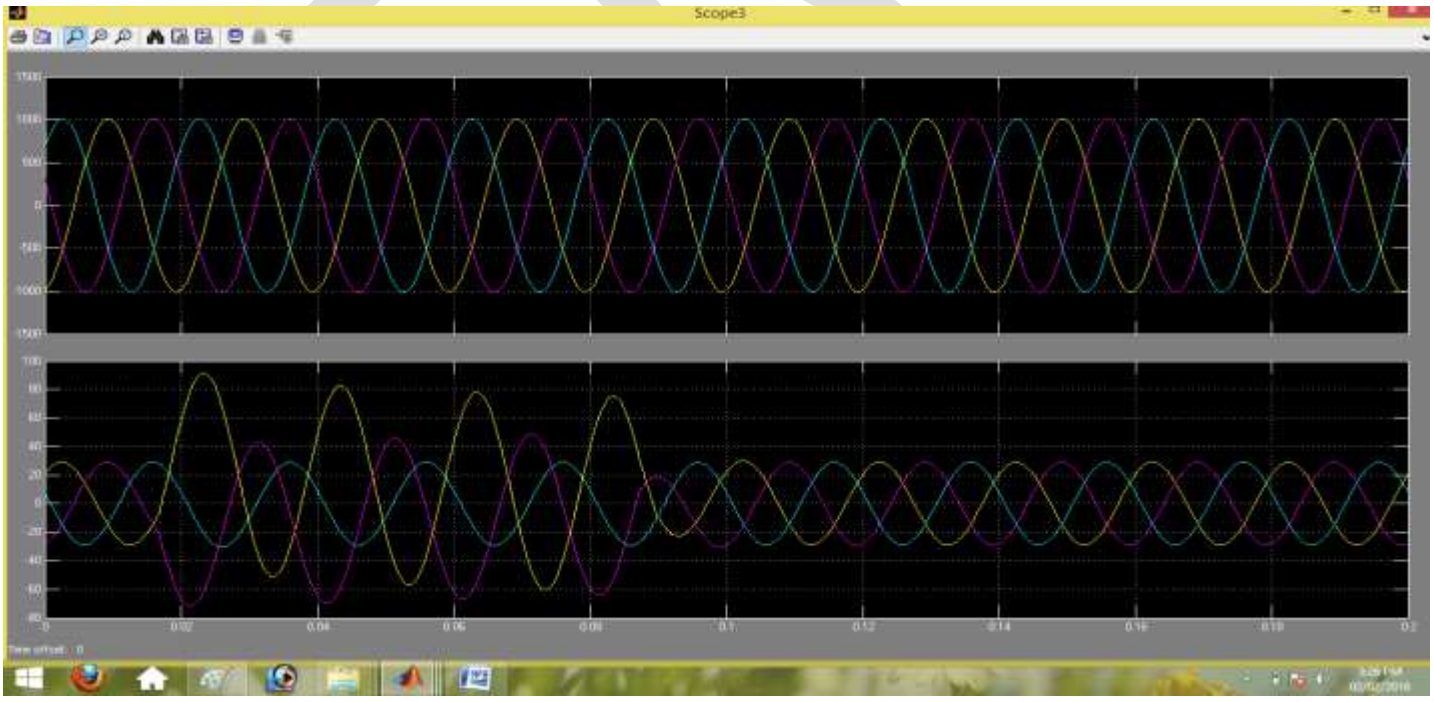


Figure: 7 LL-G Fault waveform of current at input side

4.6 Triple Line-Ground Fault at Input side

A Simulation on 3L-G fault occurs when three phases is shortened to the ground. When the magnitude of the fault current line are higher than the normal input current and the voltage are not change in magnitude. Thus output waveform shows the increasing of current when 3L-G fault occur on transmission line.

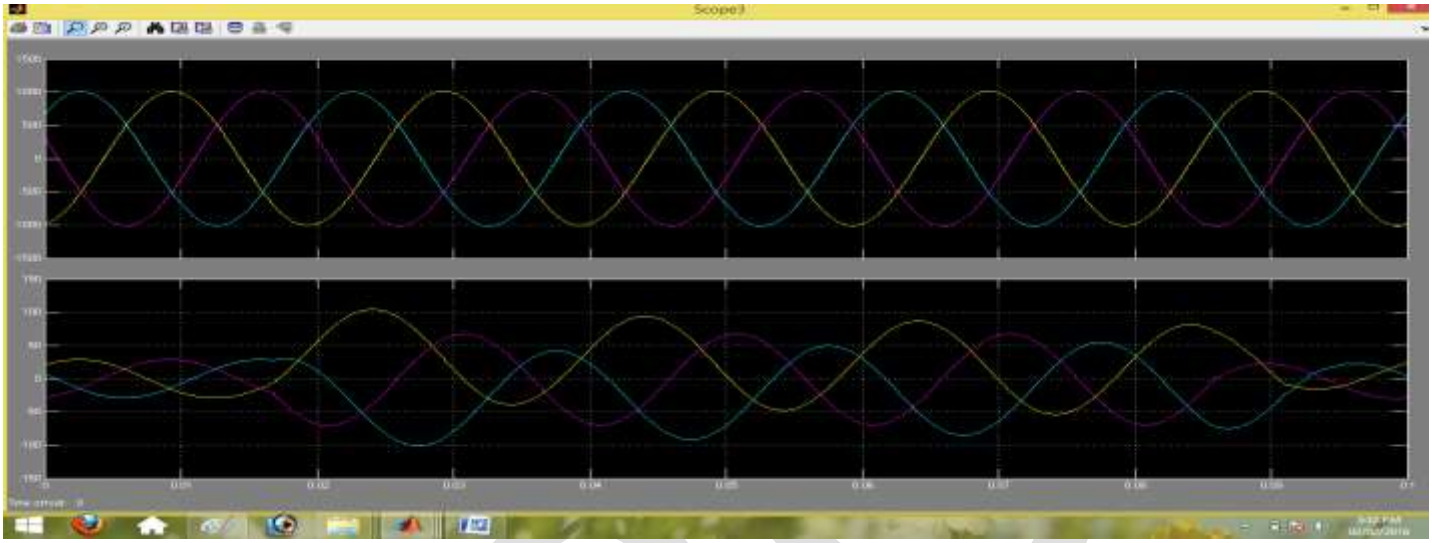


Figure: 8 LLL-G Fault waveform of current at input side

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 any/some change in these parameters, then their phase is considered as faulty condition.

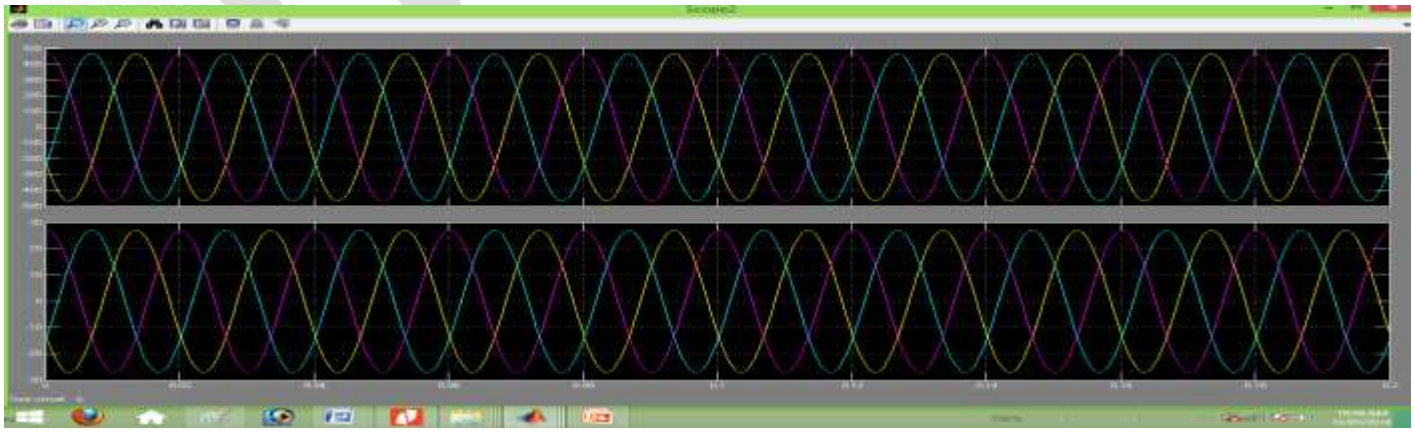


Figure: 9 Voltage and Current waveform of healthy network

4.8 L-G fault waveform

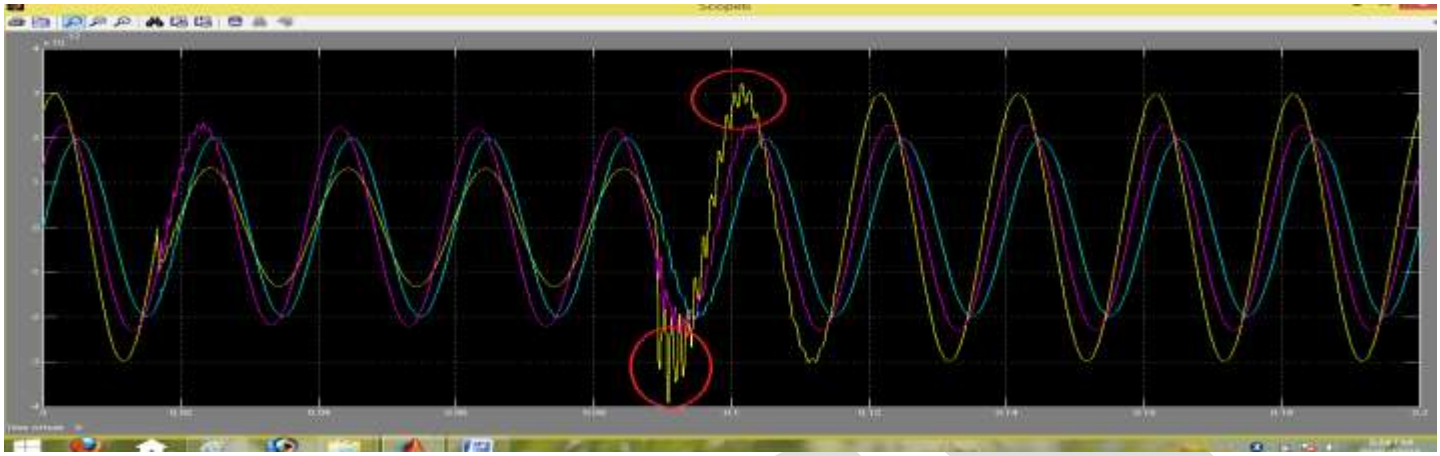


Figure: 10 Fault Current waveform of L-G fault location

4.9 LL-G fault waveform

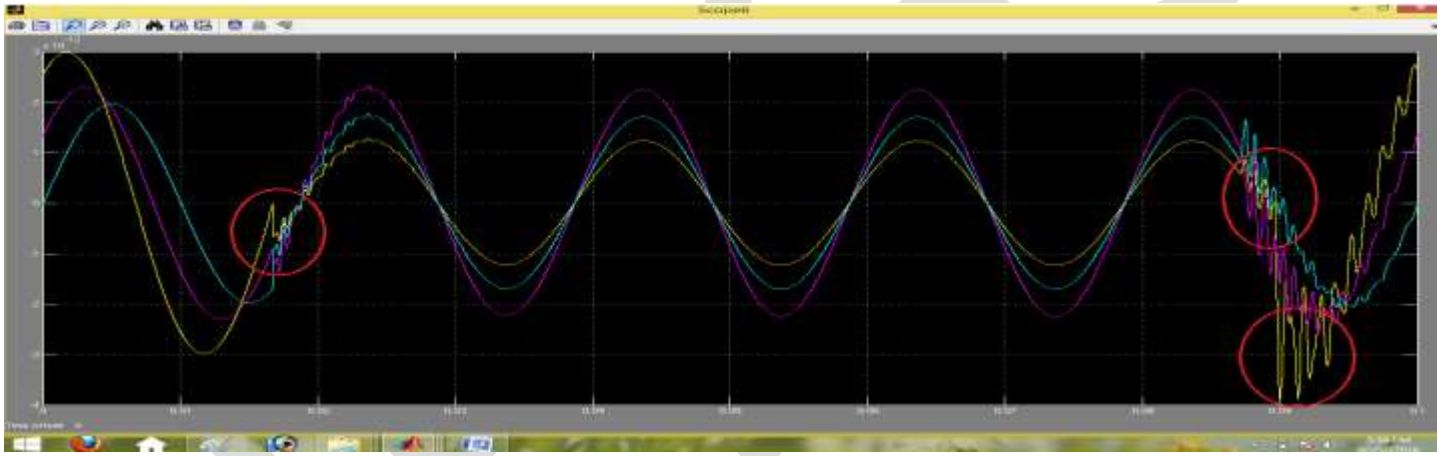


Figure: 11 Fault Current waveform of LL-G fault Location

4.10 LLL-G fault waveform

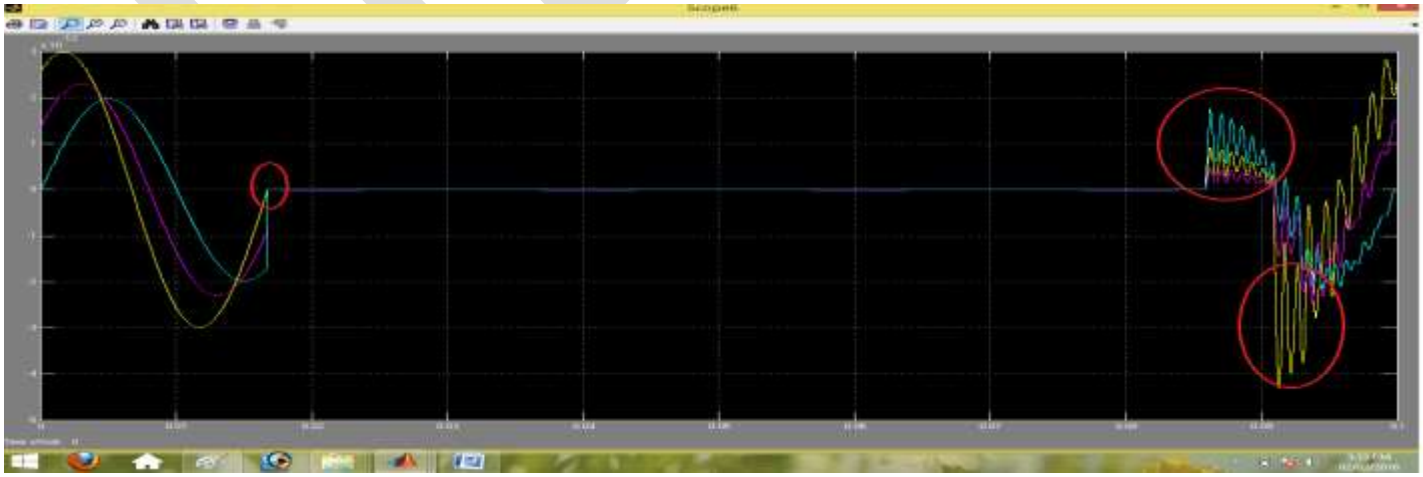


Figure: 12 Fault Current waveform of LLL-G fault Location

Result and Discussion

The earth fault studies have been carried out for various locations along the Overhead transmission line for different types of the faults. In addition to this we detect and analyze the active and reactive power and RMS bus current and voltage of the system at various fault condition. In each case the phase of the 33kv transmission line for voltage and current are changed and also the impedance seen by the transmission line is not change and the complete modeling and experimental work are in MATLAB software.

Conclusion

Modeling and simulation of three phase fault to achieve results of the transmission line parameter is convenient by using MATLAB software along with the sim-power system toolbox in Simulink for detection of faults on 100 km/33 kv supply on transmission line. In this transmission line are line four types of fault namely L-G, 2L-G, 3L-G and three phase faults have been Distance taken at 100 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 analysis and detection has been show on this paper to their proposed work in MATLAB software.

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