

Ultra Hight Voltge Transmission line Faults Identified and Analysis by using MATLAB Simulink

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Abstract — In this paper we studies and discuss electricity or electrical power are increases day by day and transmits more electrical power by rapidly increasing the transmission line capacity from one station to another station. During different types of faults are occurred in the High Voltage long transmission line system, such as single line to ground fault (L-G), double line to ground (2L-G), triple line to ground fault (3LG) and Line to line fault (L-L). These Different types faults are affecting the electrical power system component/equipment's which are connected in High Voltage Transmissioin line. Mainly the Major faults in long transmission lines is (L-G) single line to ground fault which are harmful to the electrical equipment. Fault element was taken from the Sim-power system block library. A proposed model in 350km/840kv HV transmission line are simulated and experimental work in MATLAB software to analysis and identified the faults. The modelling and simulation of different operating and different conditions of fault on High Voltage transmission line, their faults are line to Ground fault, 2L-G fault, 3L-G fault and three line short circuit of the proposed work is presented.

Keywords- High Voltage Transmission line faults, L-G fault, LL-G fault, LLL-G fault, MATLAB Software

I.INTRODUCTION

In High voltage transmission lines there are many types of fault occurs in electrical power system then in the process of transmission line fault analysis and detection, determination of bus voltage and the line current. It consulting with the electrical power system is terms bus current and bus voltage of high voltage long transmission line are very important. In case of three phase electrical power system mostly two types of faults occurs, three phase balance fault and three phase unbalance fault on long transmission line of power system. Different types of faults are line to ground fault, double line to ground fault and triple line to ground fault. The High voltage transmission line fault detect helps to selecting and developing a better for protection purpose [1]. For the protection of long transmission line we place the circuit breakers and its rating is depends on L-L-L fault. Their reason behind is that the triple line fault current is very high as compare to other fault current. Hence by using MATLAB simulation in computer, we identified and analysis of EHV transmission line fault can be easily find out. The main purpose of this paper is to study the general fault types which are balance and unbalance faults of long transmission line in the electrical power system and we have to perform the detect and analysis and obtain the result of various parameters such as current and voltage from simulation on those types of faults using in MATLAB software [2].

It is quickly and accurate faults identified and analysis the direction and distance location under a different types of faults conditions it is an important requirement from the fault point of service restoration and flexibility. This methods to find out such types of fault analysis and detection, direction estimation and faults distance location can be classified into the following three categories name are transient signals-based methods, power frequency components-based methods and superimposed components-based methods [3]. When there is a different types of faults occurs in electrical power system and then in this process of UHV transmission line fault detection and analysis. 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 [4]. The extra 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 analysis of Maximum voltage transmission line faults can be easily Detect and analysis.

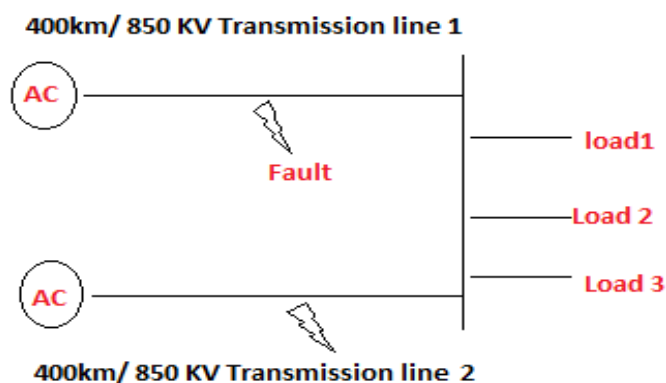


Figure: 1 Show the block diagram of EHV transmission line fault

In EHV 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 identified, analysis and classified has to used discrete wavelet transform. When during the fault are occurs, the grid voltage and grid current undergoes transients waveform. The transient waveform is identified and analysis by using discrete wavelet transform and the different fault can be classified [5]. Identification and analysis the transient's waveform in individual line currents and zero sequence currents are detect this types of 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 fault are occurred two or more conductors come in contact to each other or ground in three phase systems, for it is at such times that the electrical power system components are the greatest stresses from excessive currents. L-G, 2L-G and 3L-G faults gradually rise to serious damage on electrical power system equipment [6]. When there a major fault which occurring on long transmission lines not only effects the all equipment and it 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 analysis the fault quickly and separate the faulty part of the UHV transmission line. We find out 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 and classifying the faults. Figure 1 shows the block diagram of EHV transmission line fault [8].

II. WAVELET TRANSFORM OF HIGH VOLTAGE 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 long transmission line wavelet transform has to be a change in the analysis and identified scale by the factor is called discrete wavelet transform [9].

III. SIMULATION OF HIGH VOLTAGE TRANSMISSION LINE

Electrical power system under consideration consists of two 850 KV single lines having 400 km length. The single lines are feed from generators at 13.8 KV as is represented in the block diagram. The single line models are distributed parameter lines. The lines are assumed to be transposed and their parameters R, L, C /km are specified in positive- and zero-sequence components. We analysis and detected the faults currents will give information about the nature of the fault. A faulted UHV transmission line in electrical power system as shown in figure 2. A 850 KV extra high voltage transmission line system has been modelling and simulated to detection. Figure 1 shows a block diagram of UHV transmission line fault has been used throughout the work. The long transmission line system consist of one generators of 850 Kv is located on long transmission line are three phase simulator used to simulate faults at mid position on extra high-voltage transmission line. The faulted on UHV transmission line is represented by distributed parameters. As an application of 400 Km EHV transmission line with the parameter of the transmission line simulation diagram shown in figure 2.

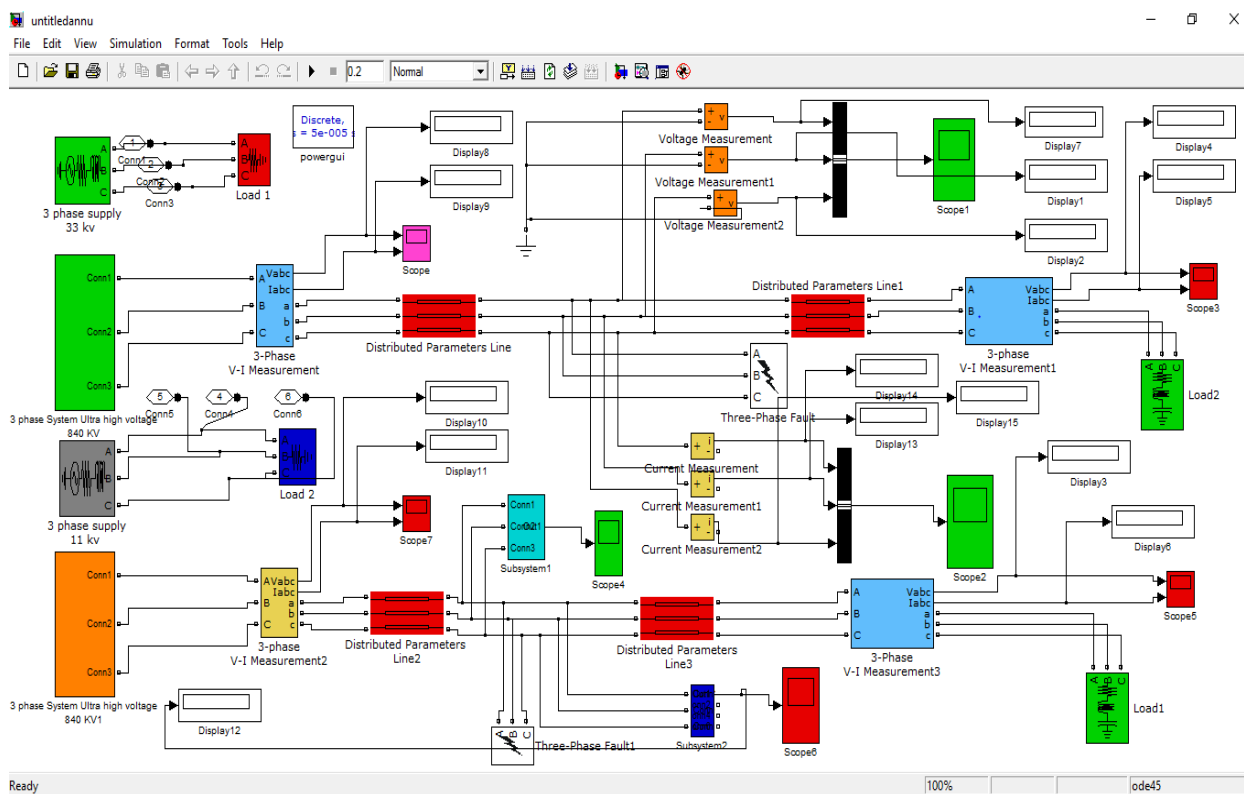


Figure 2 Simulation Diagram of EHV Transmission line fault

In the above figure-2 three phases (V-I) measurement blocks is used to measure V & I sample at source end. The EHV transmission line is one line 300 Km long. Here in this paper Simulation of three phase fault simulator is used to simulate various types of faults. In EHV transmission line faults are classified as L-G fault, LL-G fault and three phase fault.

IV. EXPERIMENTAL AND SIMULATION RESULTS

In Long transmission line is one of the important components in electric power system. In EHV transmission lines connect the stations (generating station) and load centres. When their generating stations are far away from the load centres and they run over few hundreds of kilometres. It is an accurate faults location on their 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 83-86% of electrical power system faults are occurring in overhead transmission lines [3].

A. L-G Fault

When single line to ground faults occur in EHV transmission line 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 or maximum value of current than other phases. Here detailed coefficients are calculated and analysis of energy associated with each phase and ground is tabulated. 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.

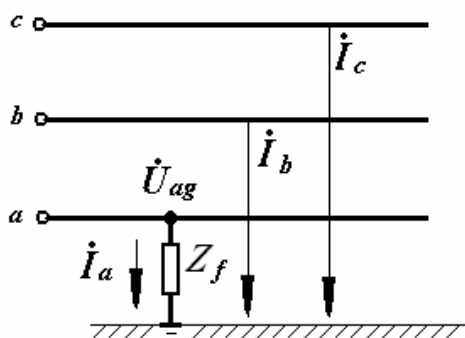


Figure: 3 Single line-to-ground fault

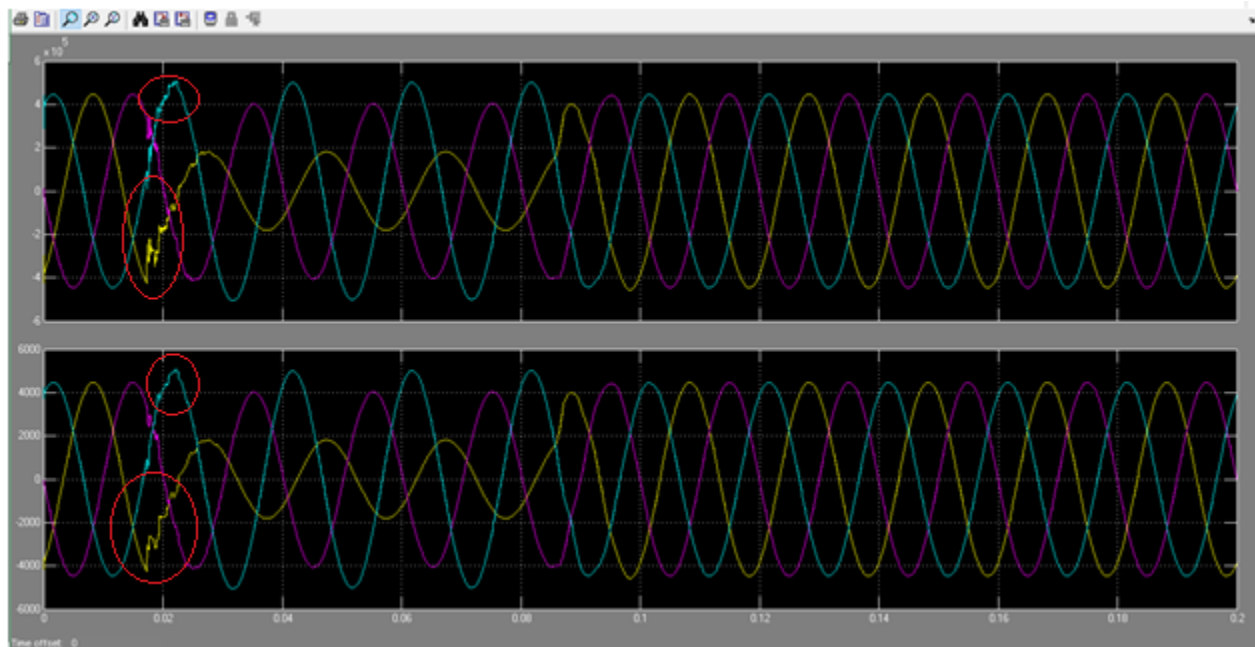


Figure: 4 Output voltage and current waveform Single line to ground in P.U.

B. LL-G Fault

The voltage and current waveforms of RB-G fault system. The R, B and zero signals having more transients fault than other phases. The detailed coefficients are calculated and energy with associated in each phase and ground is below. 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.

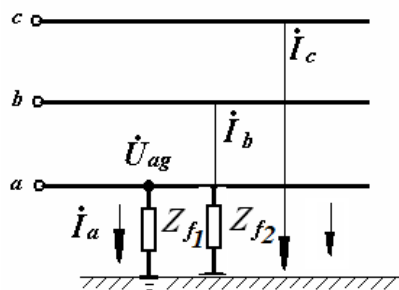


Figure: 5 Double line-to-ground fault

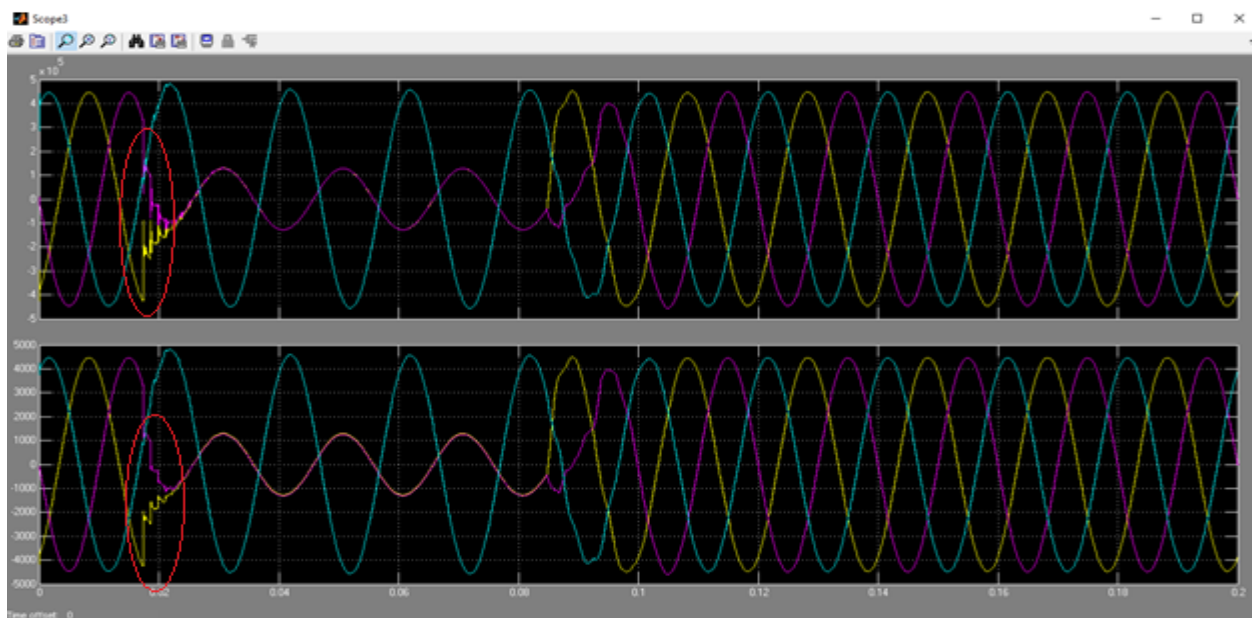


Figure: 6 Output voltage and current waveform Double line to ground in P.U.

C. LLL-G Fault

In three phase faults occurs in EHV transmission system are RYB faults and R-Y-B-G faults. Simulation and modelling 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. If detailed coefficients are calculated and energy associated with each phase and ground is tabulated below. From the table it 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.

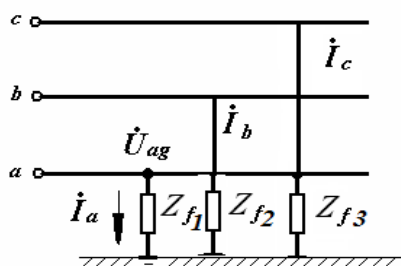


Figure: 7 Triple line-to-ground fault

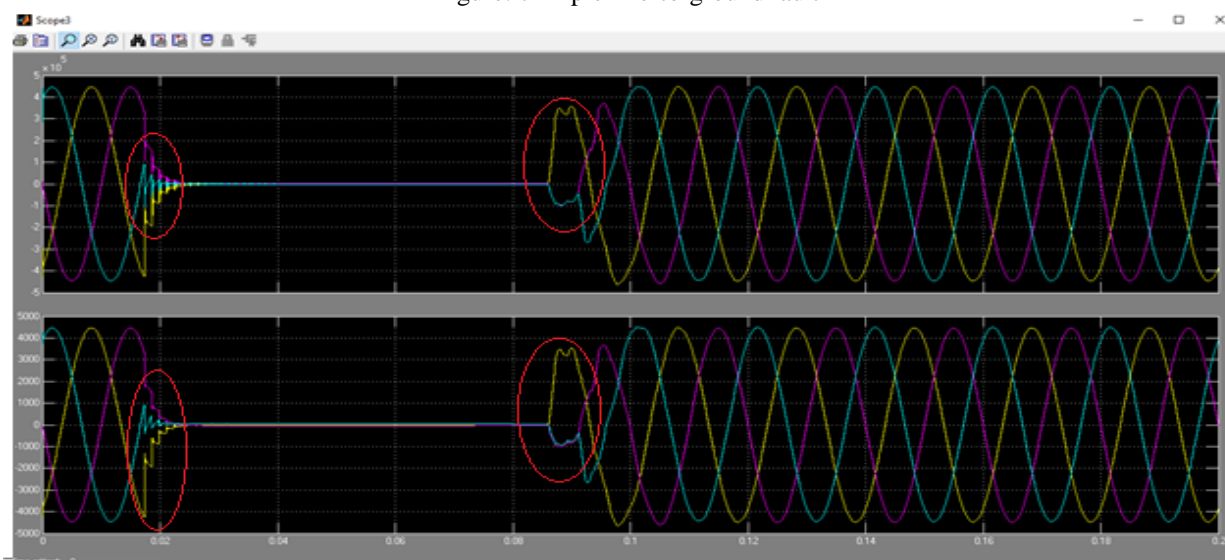


Figure: 8 Output voltage and current waveform Triple line to ground in P.U.

D. Single Line-Ground Fault at Input side

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

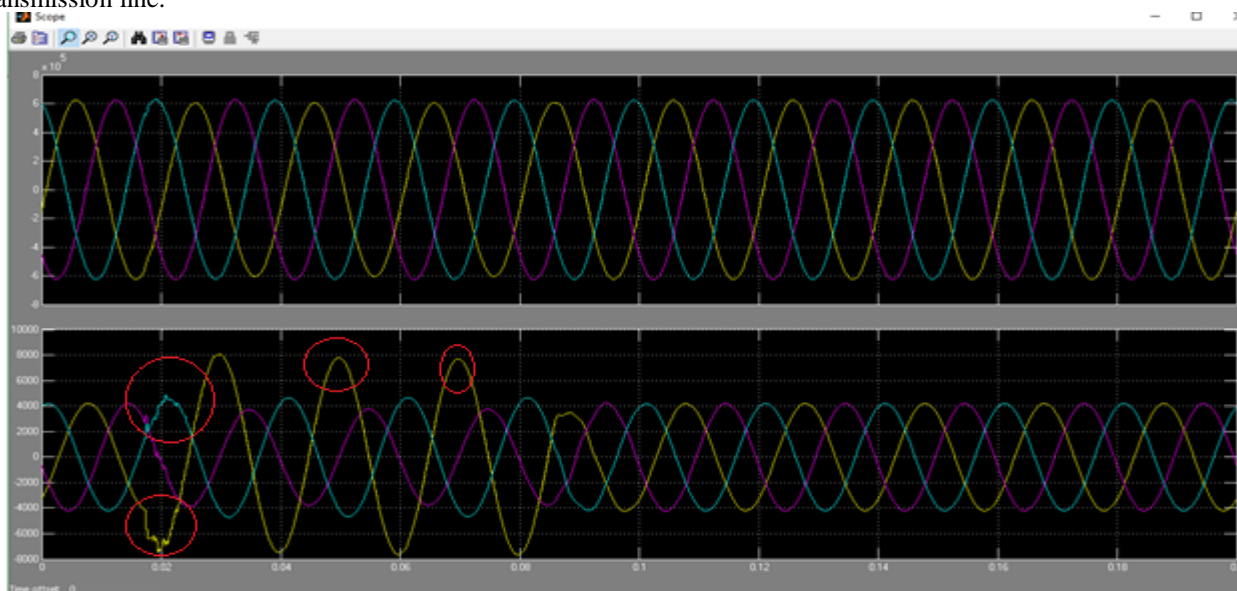


Figure: 9 L-G Fault waveform of current at input side in P.U.

E. Double Line-Ground Fault at Input side

Now simulation and modelling on double line to ground fault occurs their two phases is short to the ground. When the magnitude of the faults current line are higher than the normal input current and the voltage are not change in magnitude and the fault the impedance is not necessary zero and output waveform shows the gradually rise of current where 2L-G fault occur on EHV transmission line.

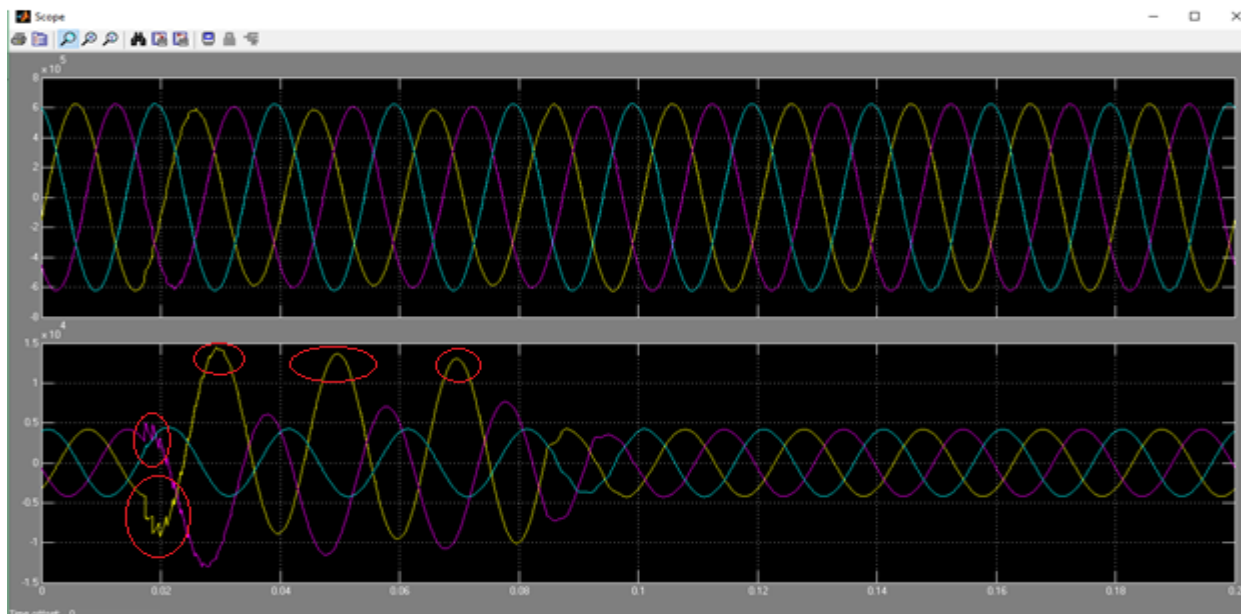


Figure: 10 LL-G Fault waveform of current at input side in P.U.

F. Triple Line-Ground Fault at Input side

Modelling and Simulation on triple line to ground fault occurs when three phases is short to the ground. When their magnitude of the faults 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 EHV transmission line.



Figure: 11 LLL-G Fault waveform of current at input side in P.U.

G. Without fault

In long transmission line we applied balance input and there is no fault in their long transmission thus output will be normal and balance value of current and voltage. These energies are the reference parameters. Now if there is somechange in these parameters, then their phase is considered as faulty condition.

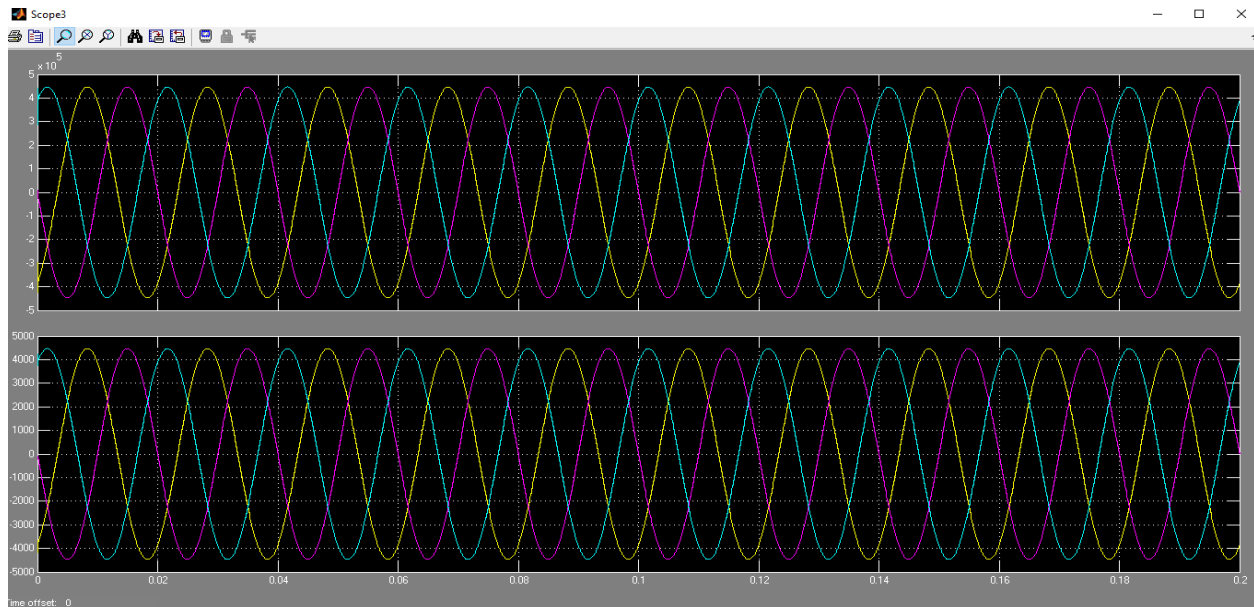


Figure: 12 Voltage and Current waveform of healthy network in P.U.

H. L-G fault waveform

We have simulation on L-G fault occurs their one phase is short to the ground and the fault is detect at the point or the fault location. When their output waveform shows the maximum current on EHV transmission line.

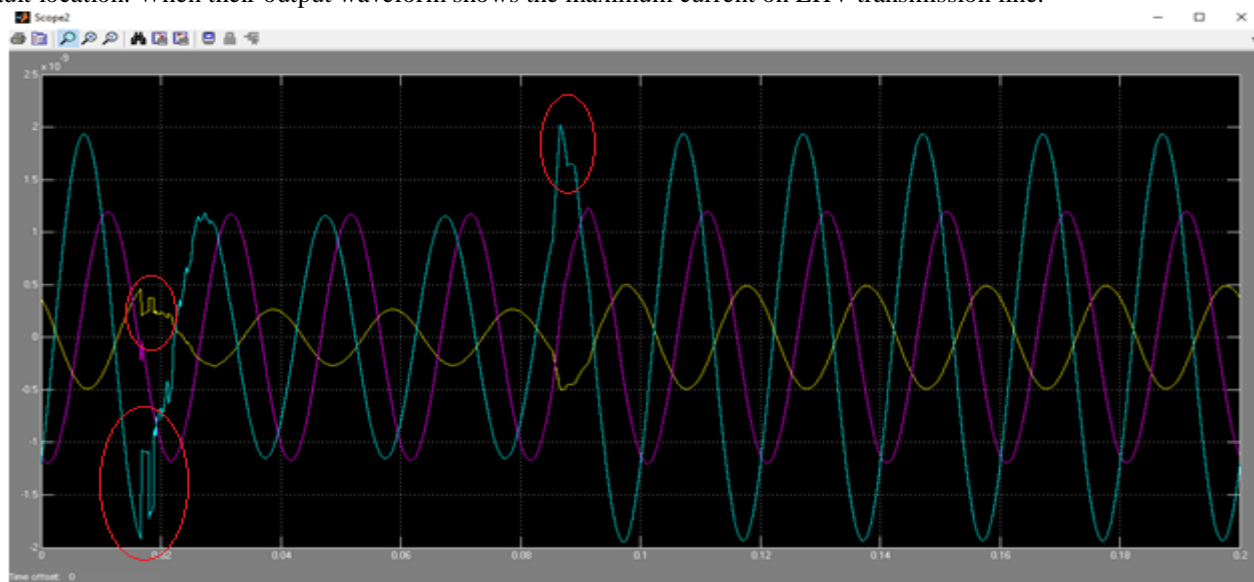


Figure: 13 Fault Current waveform of L-G fault location

I. 2L-G fault waveform

Modelling and simulation on 2L-G fault occurs their two phase is short to the ground and the fault is detect at the fault point. When their output waveform shows the rise of current on EHV transmission line.

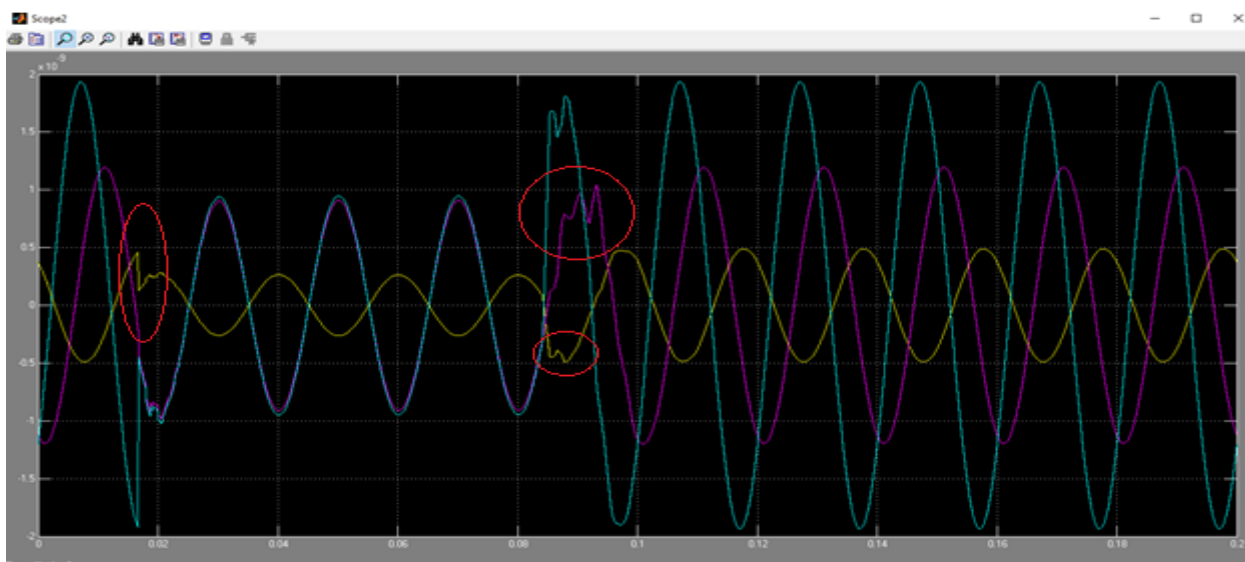


Figure: 14 Fault Current waveform of 2L-G fault Location

J. 3L-G fault waveform

The simulation on 3L-G fault occurs their three line is short to the ground and the fault is detect at the fault location. Then their output waveform shows the maximum current occur on EHV transmission line.

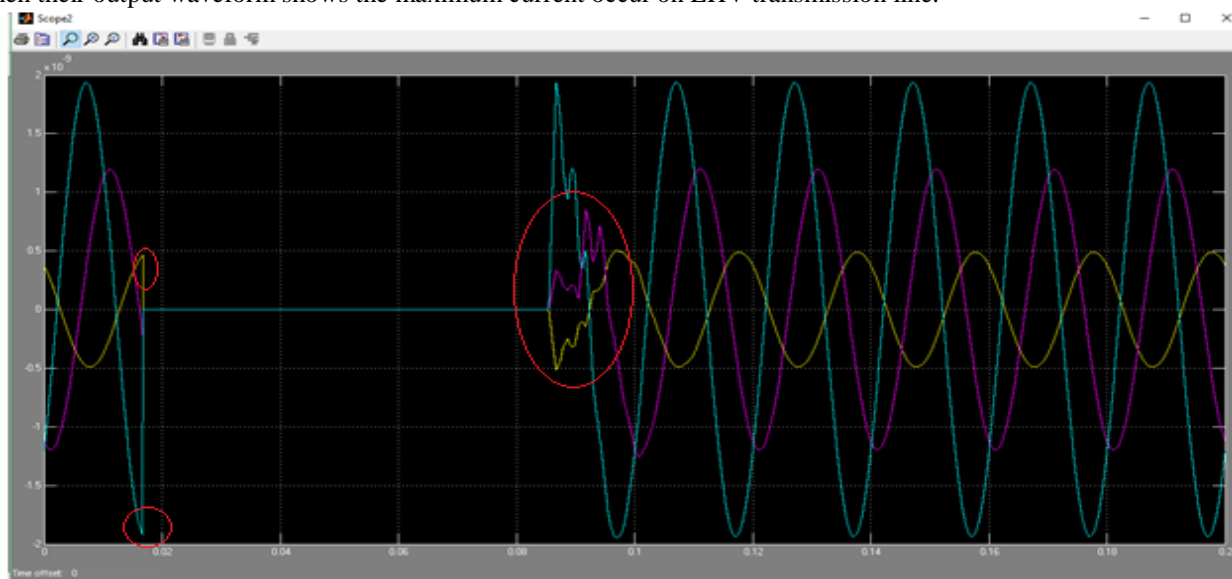


Figure: 15 Fault Current waveform of 3L-G fault Location

V. RESULT AND DISCUSSION

In this paper earth fault have been carried out for various locations along the High Transmission line For different faults. Now we have to studies detect and analysis the reactive power, active power, bus current and bus voltage of the long transmission line system at various types of fault condition. In each case the phase of the 440kv high voltage transmission line for current and voltage are changed and also the impedance seen by the high voltage transmission line is not change and the whole modelling and experimental work are in MATLAB software.

VI.CONCLUSION

Here In this paper we have to studies the different types of faults locations on High Voltage transmission line parameter is convenient by using MATLAB software along with the Sim-power system toolbox in Simulink for analysis, detection and compare of faults distance on 400 km/840 kV supply on high voltage transmission line. The properties of traveling waves on EHV transmission lines were discussed. Now high voltage transmission line are line four types of fault namely as single line ground fault, Double line to ground faults, Triple line to ground faults have been Distance taken at 400 km into consideration into this simulation and here many types of fault namely as L-G, LL-G, LLL-G and Triple line to ground faults.

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