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Modelling of Ultra High Voltage Transmission Line Faults Detection and Identification by Using Matlab Simulation

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Abstract: ***Electrical power is increases day by day and transmits more electrical power transmission line capacity from one station to another station. The main aim of this paper is to detect and identified the location of the different faults on High transmission lines. During some faults are occurred in the UHV transmission line system, such as single line to ground fault (L-G), double line to ground (LL-G), triple line to ground fault (LLL-G) and Line to line fault (L-L). These types faults are affecting the electrical power system component which are connect in UHV Transmission line. The major faults in UHV transmission lines is single line to ground fault which are harmful to the electrical equipment. The Complete proposed model in 600km/865kv UHV transmission lines are simulated in MATLAB software to detect and identified the faults. Fault element was taken from the sim-power system block library. The whole simulation of different operating and different conditions of fault on UHV transmission line, their faults are L-G fault, LL-G fault, and LLL-G fault circuit of the proposed all work presented in this paper.***

Keywords: UHV Transmission line, MATLAB Software, L-G fault, 2L-G fault, 3L-G fault.

I. INTRODUCTION

In UHV transmission lines there are different 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. The electrical power system is terms bus voltage and bus current of high 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 high transmission line of power system. Different types of faults such as line to ground fault, double line to ground fault and triple line to ground fault. The UHV transmission line fault detects 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 UHV transmission line fault can be easily found 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].

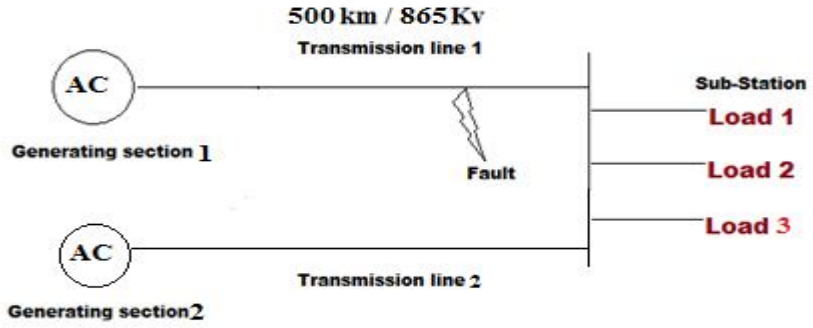

Figure: 1 Block diagram of UHV transmission line fault

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.
In UHV transmission lines major faults are classified like as L-G fault, 2L-G fault, 3L-G fault and three phase faults. These faults can be analysis and Detected has to use discrete wavelet transform. During the fault are occurs, the grid voltage and current undergoes transients waveform. The transient waveform is detected and classified by using discrete wavelet transform and the different fault can be Analysis [5]. Detection 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, LL-G and LLL-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 affects 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]. 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 Block diagram of UHV transmission line fault [8].

II. WAVELET TRANSFORM OF UHV TRANSMISSION LINE

The main 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 identified precisely. Results obtained from the transmission line wavelet transforms are shown on the time domain and the frequency domain. The High transmission line wavelet transform has to be a change in detect and identified scale by the factor is called discrete wavelet transform [9].

III. SIMULATION OF UHV TRANSMISSION LINE

The power system under consideration consists of two 865 KV single lines having 300 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 865 KV Ultra 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 865Kv is located on long transmission line are three phase simulator used to simulate faults at mid position on Ultra high-voltage transmission line. The faulted on UHV transmission line is represented by distributed parameters. As an application of 500 Km UHV transmission line with the parameter of the transmission line simulation diagram shown in figure 2.

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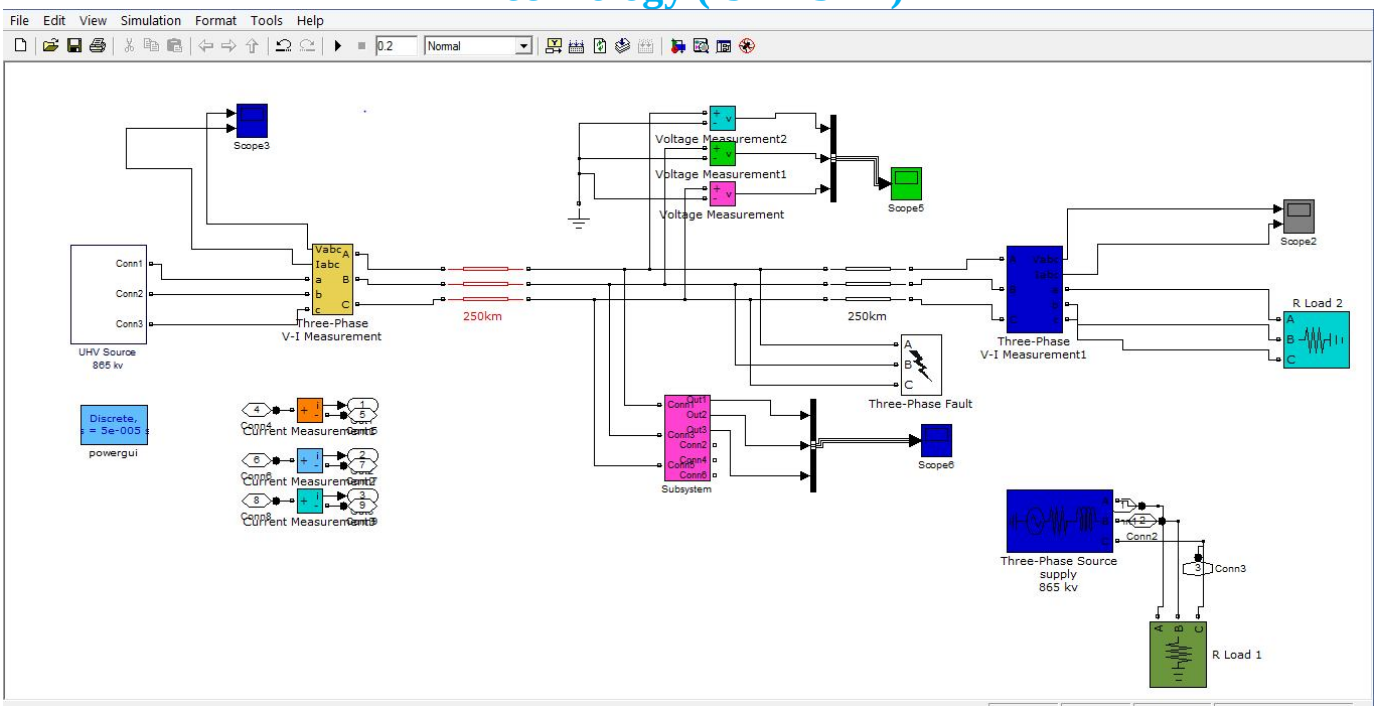

Figure 2 Simulation Diagram of UHV Transmission line fault

In the above figure-2 three phases (V-I) measurement blocks is used to measure V & I sample at source end. The UHV transmission line is one line 500 Km long. Here in this paper modelling and simulation of three phase fault simulator is used to simulate various types of faults. In UHV transmission line faults are classified as L-G fault, 2L-G fault and three phase fault.

IV. MODELLING AND SIMULATION RESULTS

In High transmission line is one of the important components in electric power system. In UHV 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 [3].

A. Single Line To Ground Fault At Output Side

Single line to ground faults occurs in UHV 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 Detected 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 is changed and thus this is an R-G fault system.

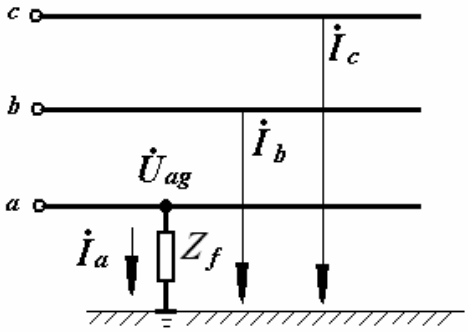

Figure: 3 Single line-to-ground fault

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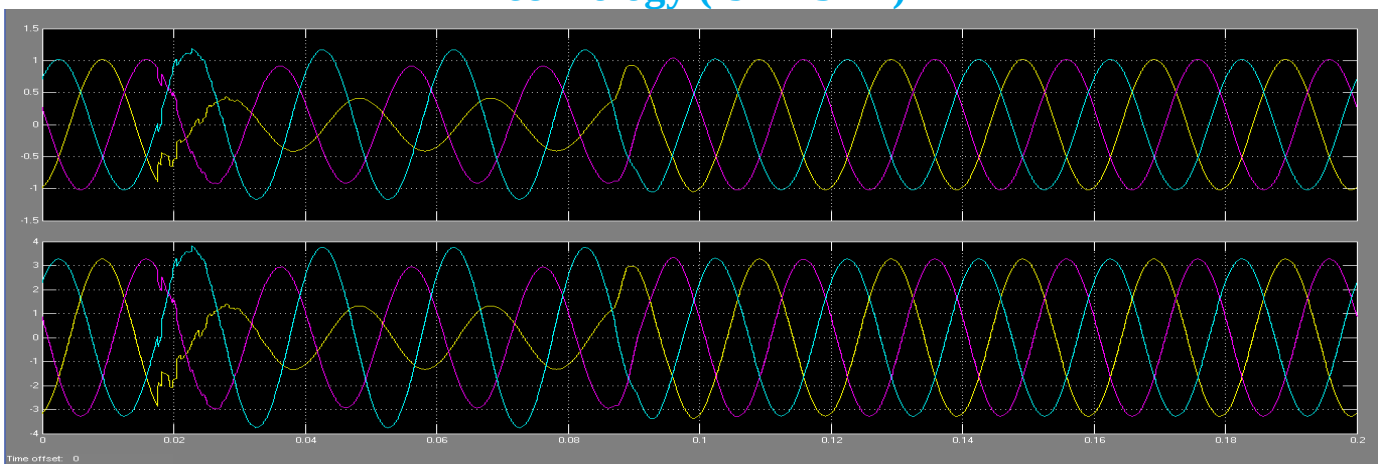

Figure: 4 Output voltage and current waveform Single line to ground in P.U.

B. Double line to ground Fault at output side

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.

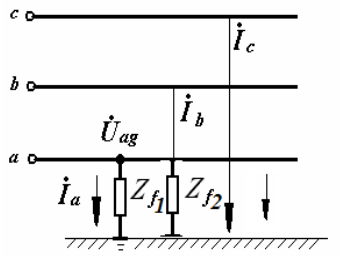

Figure: 5 Double line-to-ground fault

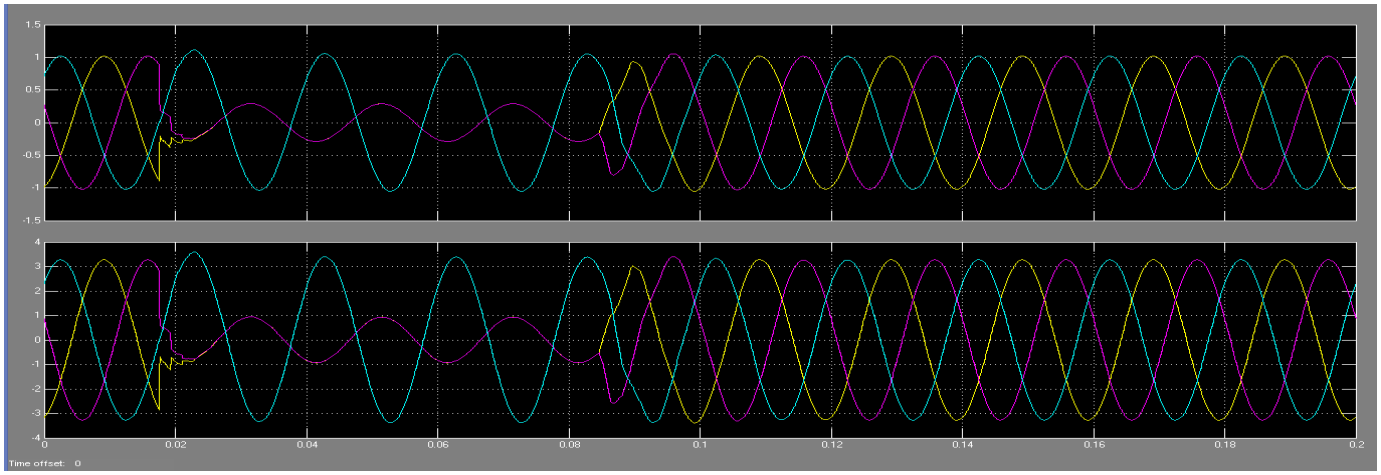

Figure: 6 Output voltage and current waveform Double line to ground in P.U.

C. Triple Line To Ground Fault At Output Side

In three phase faults occurs in UHV transmission system are RYB faults and R-Y-B-G faults. Simulation and modelling results of both fault detect 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

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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.

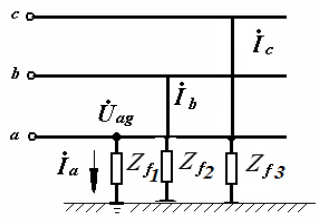

Figure: 7 Triple line-to-ground fault

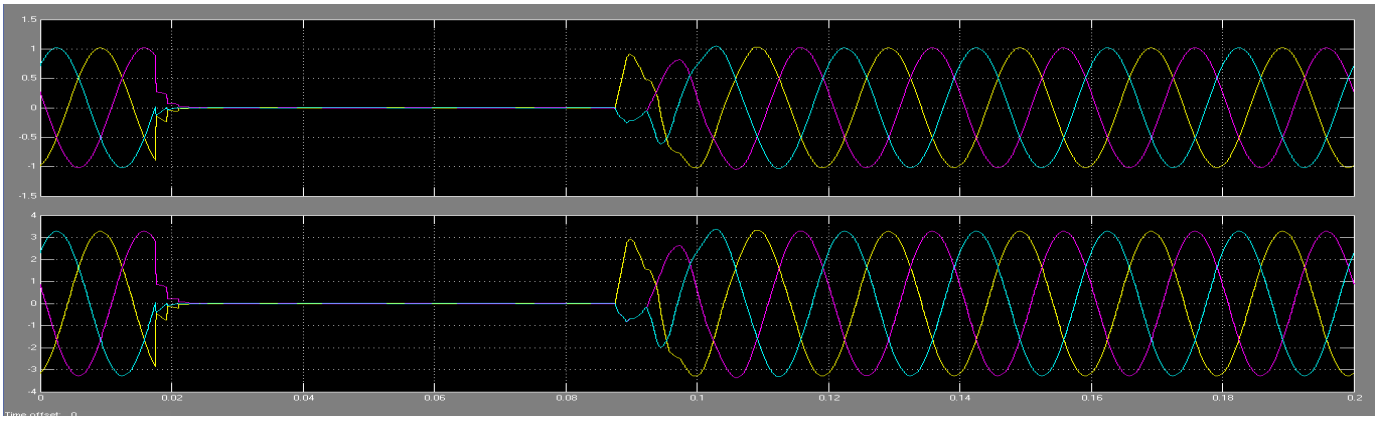

Figure: 8 Output voltage and current waveform Triple line to ground in P.U.

D. Single Line-Ground Fault At Input Side

Here we have simulation and modelling on L-G 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 UHV transmission line.

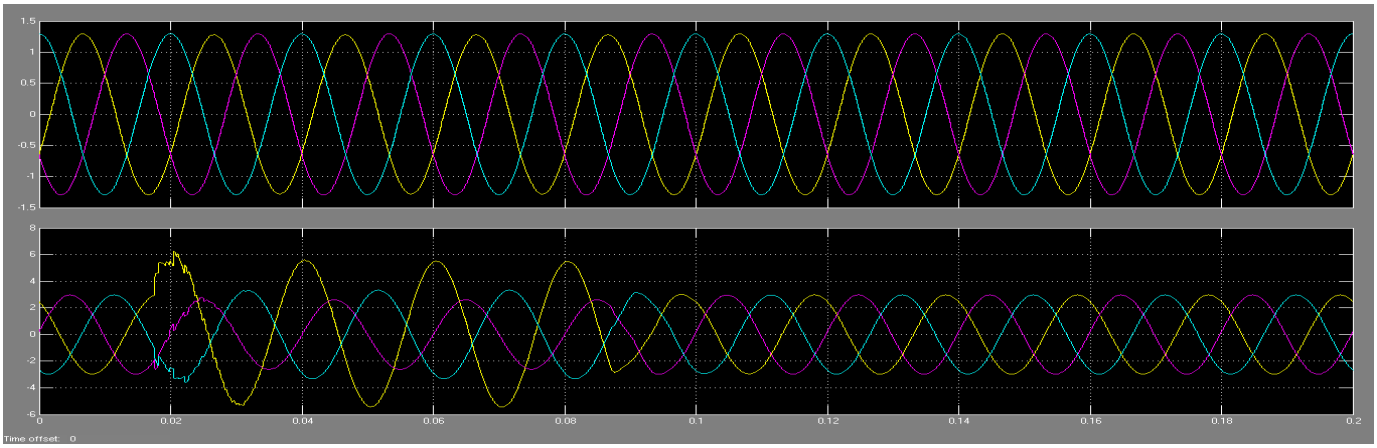

Figure: 9 L-G Fault waveform of current at input side in P.U.

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 UHV transmission line.

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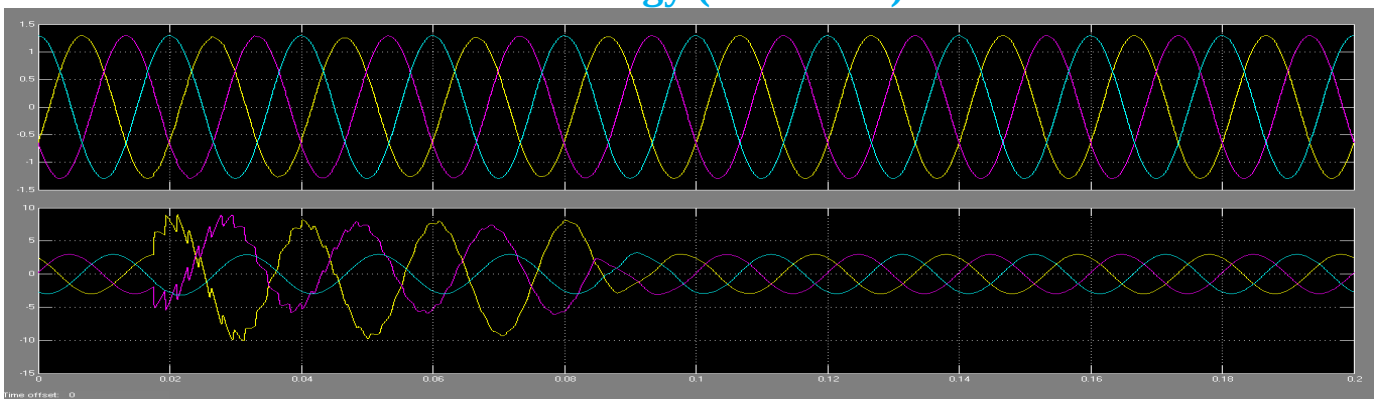

Figure: 10 LL-G Fault waveform of current at input side in P.U.

F. Triple Line-Ground Fault At Input Side

Modelling 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 LLL-G fault occur on UHV transmission line.

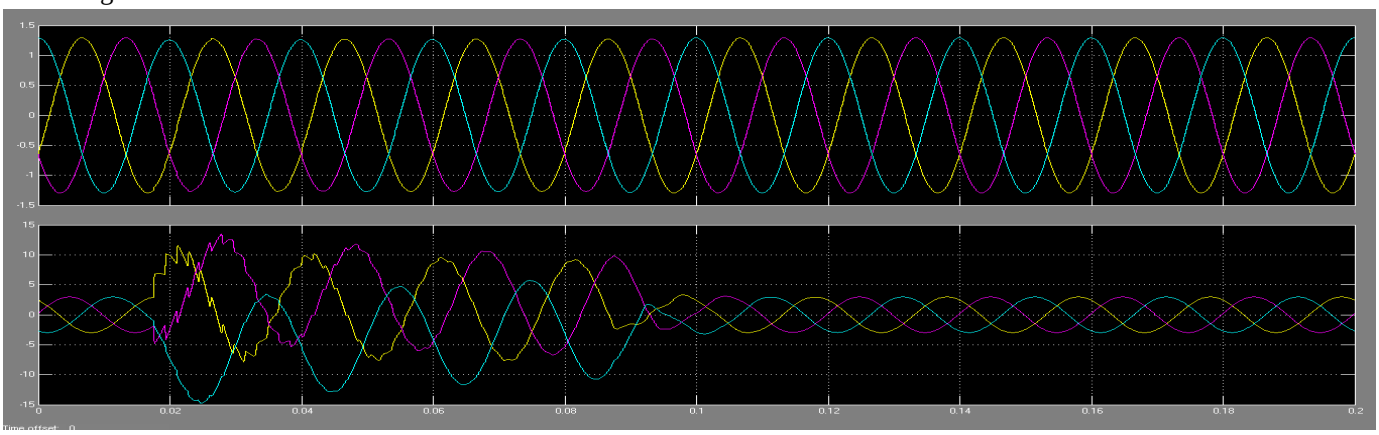

Figure: 11 LLL-G Fault waveform of current at input side in P.U.

G. Without fault Waveform

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

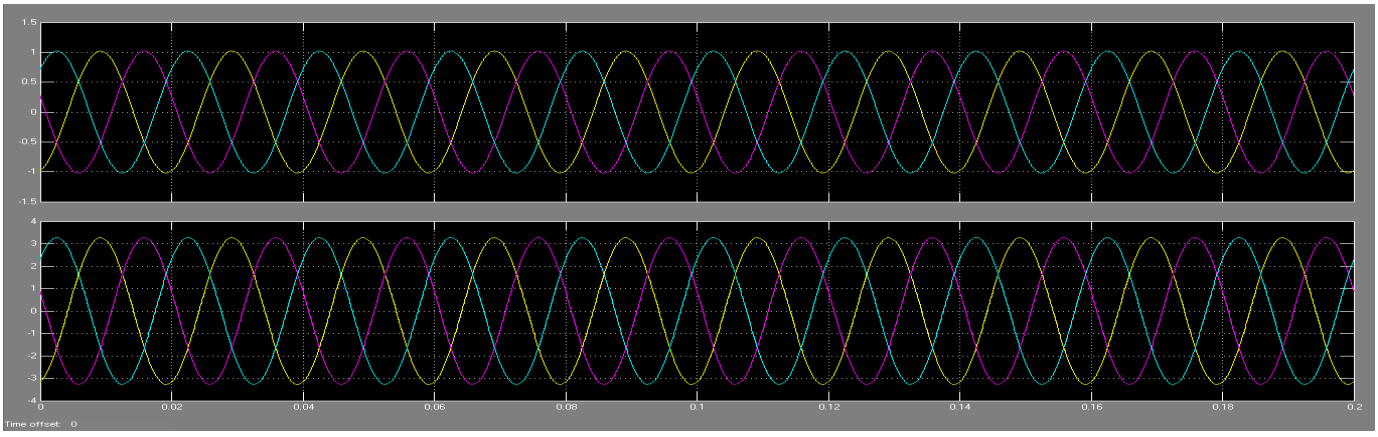

Figure: 12 Voltage and Current waveform of healthy network in P.U.

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H. L-G Fault Waveform At Fault Point

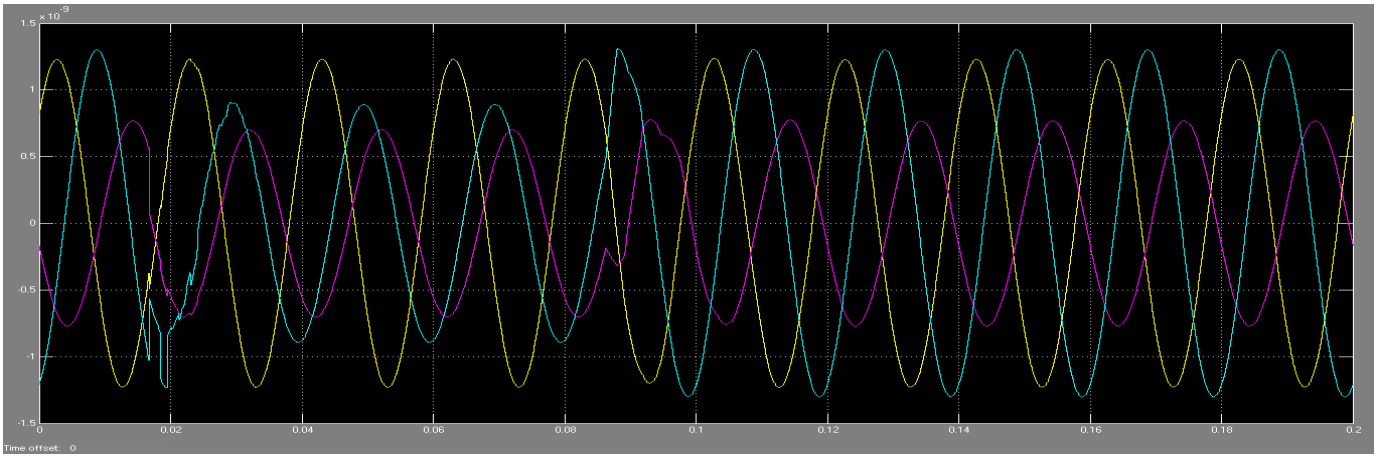

Figure: 13 Fault Current waveform of L-G fault location

I. 2L-G Fault Waveform At Fault Point

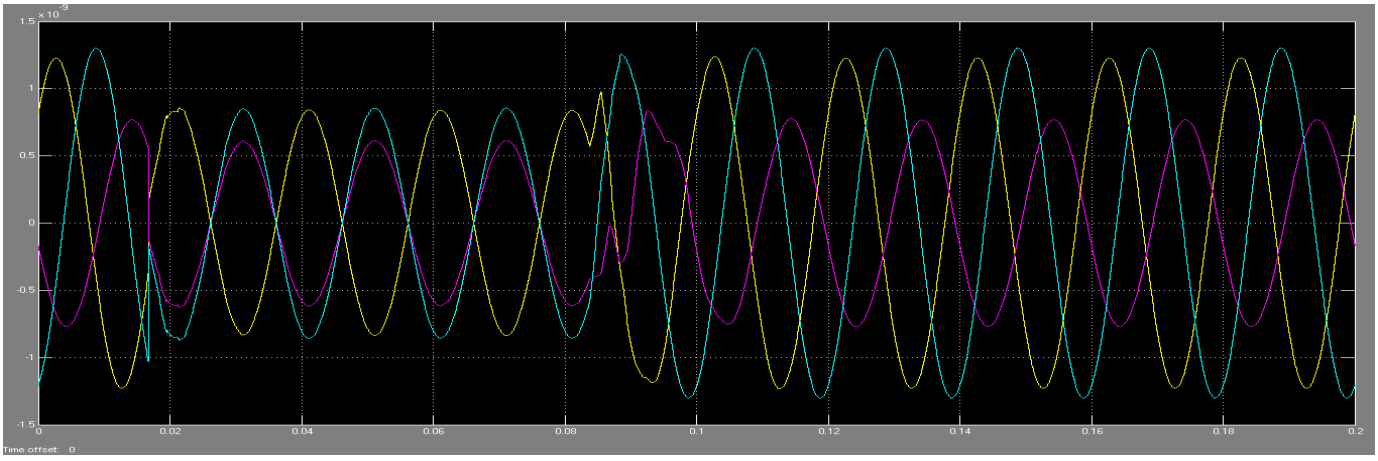

Figure: 14 Fault Current waveform of LL-G fault Location

J. 3L-G Fault Waveform At Fault Point

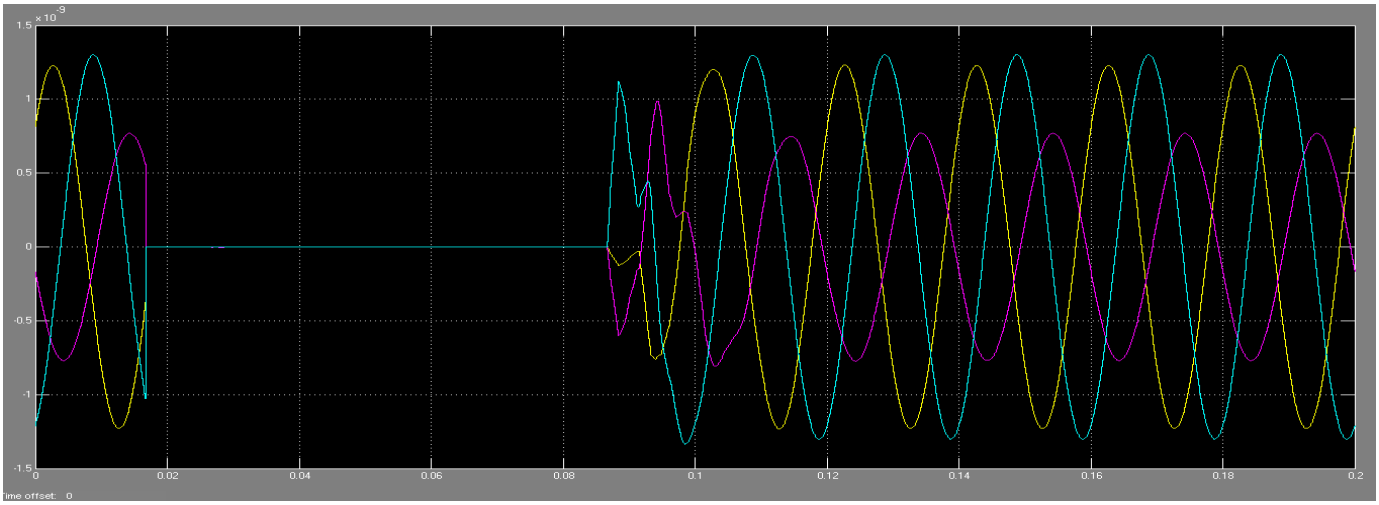

Figure: 15 Fault Current waveform of LLL-G fault Location

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

S.NO.	Types of faults	Distance	Current Value
1	L-G	500 Km	1 p. u.
2	LL-G	500 Km	1 p. u.
3	LLL-G	500 Km	0 p. u.

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	500 Km	6 P.U.
2	LL-G	500 Km	9.5 P.U.
3	LLL-G	500 Km	14 P.U.

V. RESULT AND DISCUSSION

In this paper we discuss about earth fault have been carried out for various locations along the UHV transmission line for different types of the faults. Now we detect and analysis the reactive power, active power, bus current and voltage of the long transmission line system at various types of fault condition. In each case the phase of the 865kv UHV transmission line for voltage and current are changed and also the impedance seen by the Ultra high voltage transmission line is not change and their whole experimental work are in MATLAB Simulation software.

VI. CONCLUSION

Here we studies and Detect faults locations on UHV transmission line parameter is convenient by using MATLAB software along with the Sim-power system toolbox in Simulink for detection and classification of faults distance on 500 km/865 kV supply on High transmission line. Properties of traveling waves on UHV transmission lines were discussed. Now UHV transmission line are line four types of fault such as L-G, LL-G, LLL-G and L-L-L faults have been Distance taken at 500 km into consideration into this simulation and experimental work and here many types of fault namely as single line ground fault, Double line to ground faults, Triple line to ground faults and L-L-L faults are detection and analysis has been show on this paper to their proposed work in MATLAB Simulation software.

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