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TRANSMISSION LINE FAULT ANALYSIS BY USING MATLAB SIMULATION

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ABSTRACT

Now-a-days the demand of electricity or power are increases day by day this results to transmits more power by increasing the transmission line capacity from one place to the other place. But during the transmission some faults are occurred in the system, such as L-L fault (line to line), 1L-G fault (single line to ground) and 2L-G fault (double line to ground). These faults affect the power system equipments which are connected to it. The main aim of this paper is to study or analysis of various faults and also identifies the effect of the fault in transmission line along with bus system which is connected to transmission line. This paper approaches to the MATLAB software in which transmission line model is designed and various faults will be occurred by using fault tool box which has discussed above. After that, various effects on bus system due to different faults are shown such as voltage, current, power along with the positive, negative and zero sequence components of voltage and current output in terms of waveforms.

KEYWORDS: L-L –Line to Line fault, 1L-G –Single Line to Ground fault, 2L-G Double Line to Ground fault.

INTRODUCTION

When different types of fault occurs in power system then in the process of transmission line fault analysis, determination of bus voltage and the rms line current are possible. While consulting with the power system the terms bus voltage and rms current of line are very important. In case of three phase power system mainly two faults occurs, three phase balance fault and unbalance fault on transmission line of power system, such as line to ground fault, double line to ground fault and double line fault. The transmission line fault analysis helps to select and develop a better for protection purpose. For the protection of transmission line we place the circuit breakers and its rating is depends on triple line fault. The 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, the analysis of transmission line fault can be easily carried out. The main purpose of this paper is to study the general fault types which are balance and unbalance faults of transmission line in the power system. Also to perform the analysis and obtain the result of various parameters (voltage, current, power etc) from simulation on those types of fault using MATLAB[6].

A new modeling framework for analysis and simulation of unbalance fault in power system is procedure includes the frequency information in dynamical models and produces approximate non-linear models that are well adopted for analysis and simulation[4]. The transformer models includes saturation. The parameters have been obtained from practical or experimental measurements. From the study it is seen that sags can produce transformer saturation when voltage recovers. This leads to produce an inrush current that is similar to inrush current produced during the transformer energizing. The study point out that the voltage recovery instant can take only discrete value, since the fault-clearing is produced in case of natural current zeroes[1]. The instant of voltage recovery corresponds to the instant of fault clearing. For phase to phase fault and single phase fault, a single point-on-wave of voltage recovery can be defined. On the other hand for two-phase-to-ground and three-phase fault, the recovery takes place in two or three steps[2]. In petrochemical industry, the grounding and ground fault protection are very important factors. For that first it is important to have the proper system grounding for the particular system application, and along with this it is equally important to have the proper protection against the ground-fault[3].

TRANSMISSION LINE FAULT

As discuss above in three-phase transmission line of power system mainly two types of fault occurs, balance fault which is also called symmetrical fault and unbalance fault called as unsymmetrical fault. But this paper only deals with the unsymmetrical

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fault which mainly occurs between two or three conductors of the three-phase system or some time in between conductor and ground.

Depending upon this the unsymmetrical faults can be classified into main three types:-

- Single Line to Ground fault.
- Double Line fault.
- Double Line to Ground fault.

The frequency of occurrence of the single line to ground fault is more in the three phase system followed by the L-L fault, 2L-G fault and three phase fault. During electrical storms these types of fault are occurs which may results to insulator flashover and ultimately affect the power system[4].To study and analyze the unsymmetrical fault in MATLAB there is a need of develop a network of positive, negative and zero sequence. In this paper us analysis positive, negative and zero sequence voltage and current of buses at different fault situation. In addition to this we analyze the active and reactive power and rms bus current and voltage of the system at various fault condition

METHODOLOGY

MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment and fourth-generation programming language developed by MathWorks, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, certain of user interfaces and interfacing with programs written in other languages. Although MATLAB is intended primarily for numerical computing an optional tool box uses the MuPAD symbolic computing capabilities. An additional package, simulink, adds graphical multi-domain simulation and model-based design for dynamic and embedded system. MATLAB users come from various backgrounds of engineering, science and economics. MATLAB is widely used in academic and research institutions as well as industrial enterprises. Also MATLAB gives an attractive environment with hundreds of reliable and accurate built-in functions. MATLAB family work together with simulink software to model electrical, mechanical and control systems[1]. In order to study and analyze the transmission line fault following circuit arrangement are used which is shown in figure (a). In figure (a) two three phase sources of rating 100MVA, 13.8KV, 50Hz are connected. These two sources are connected to two transformers of rating 1000MVA, 13.8/500KV and 1000MVA, 500/13.8KV as shown in figure (a). In between the two transformer bus system are connected. Also the resistive load is connected between bus 2 and bus 3, and fault is created near bus 2. The period for creation of fault is of 0.1 to 0.4 second. Also, three transmission lines are used in which one is of 100Km long and another two transmission lines having distance 50Km.

When we created 1L-G fault near bus 2 then voltage of phase across bus 2 becomes zero as shown in figure (b) and positive sequence voltage of bus 2 becomes low at 10KV and negative sequence of voltage become high to 5*104 Volt as shown in figure (c). Active and reactive power across bus 2 becomes varies between 0.7 to 1.7MW and -1.3 to 1.3VAR as shown in figure (d).

When 2L-G fault is created near bus 2 then the phase A and phase B voltage across bus 2 becomes zero as shown in figure (e) and positive and negative sequence component of voltage across this bus becomes decreases and increases to 5KV respectively. Active and reactive power of bus 2 become varies from 0 to 1MW and from -1.5 to 1 VAR respectively as shown in figure (f).

Similarly, 2L fault is created then two phase namely A and B voltage varies near zero and positive sequence component of voltage across bus 2 becomes constant at 1.5MV as shown in figure (g) and power across bus 2 is lies at 17MW as shown in figure (h).

CIRCUIT MODEL

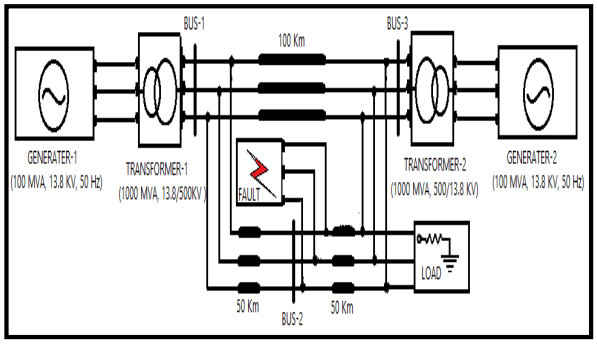

Figure (a) :- Model For Transmission Line Fault Analysis.

FAULT ANYLASIS METHOD

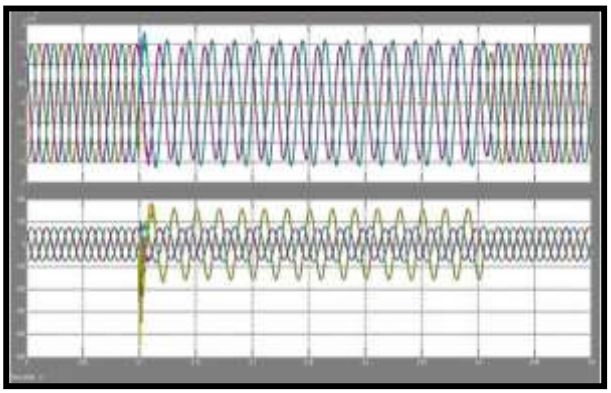

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Figure (b):- When L-G fault created, three phase voltage and current waveforms across bus 2.

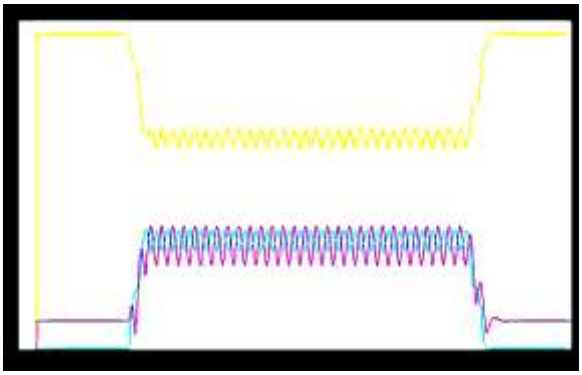

Figure (b):- When L-G fault created, three phase voltage and current waveforms across bus 2.

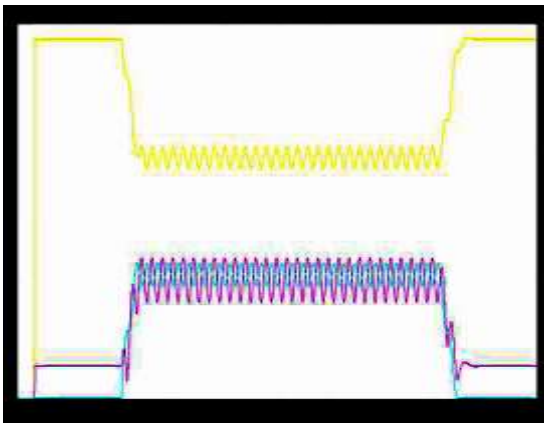

Figure (c):- Three Phase Sequence Component of Voltage Wave Form.

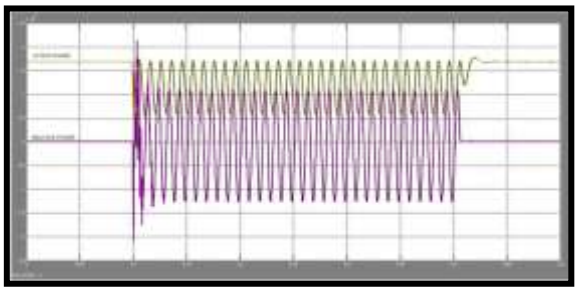

Figure (d):- When L-G Fault Is Created, Instantaneous Active And Reactive Power Waveforms Across Bus 2.

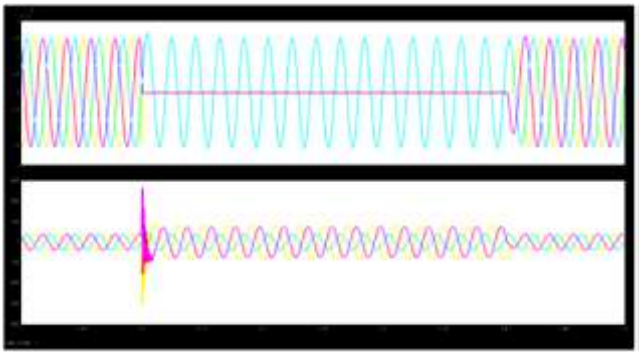

Figure (e):- When 2L-G Fault Is Created, Three Phase Voltage And Current Waveforms Across Bus 2.

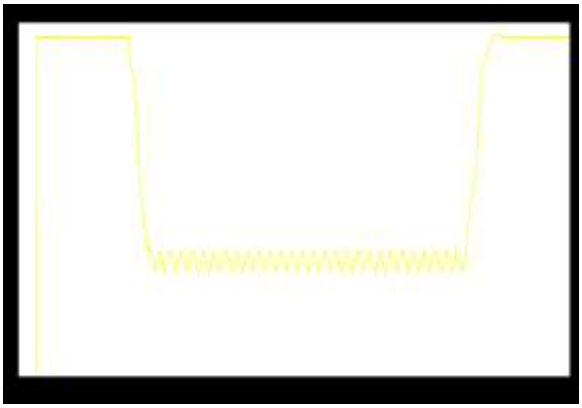

Figure (f):- When 2L-G Fault Is Created, Three Phase Sequence Component Of Voltage Waveform Across Bus 2.

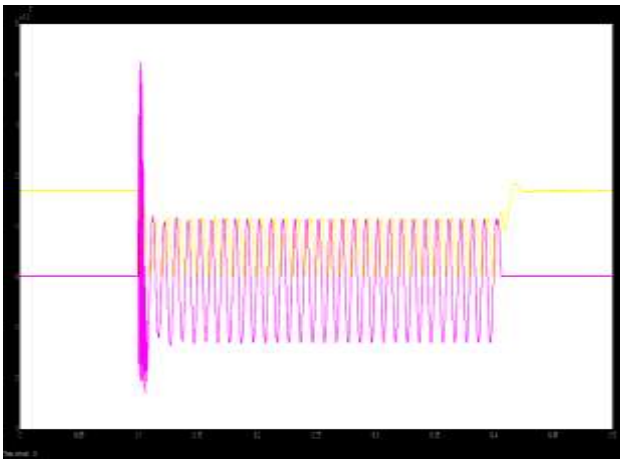

Figure (g):- When 2L-G Fault Is Created, Instantaneous Active And Reactive Power Waveforms Across Bus 2.

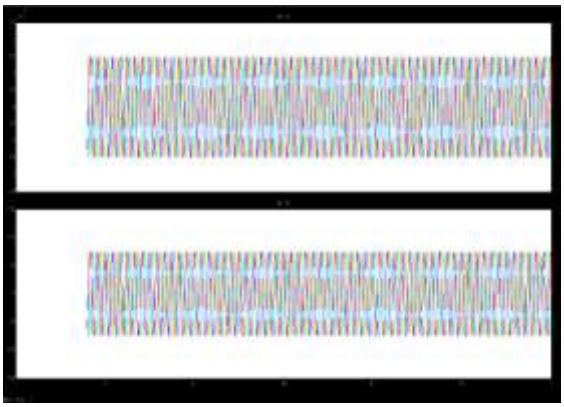

Figure (h):- When L-L Fault Is Created, Three Phase Voltage and Current Waveforms across Bus 2

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Figure (i):- When L-G Fault Is Created, Three Phase Sequence Component Of Voltage Waveform Across Bus 2.

Figure (j):- When L-G Fault Is Created, Instantaneous Active And Reactive Power Waveforms Across Bus 2.

CONCLUSION

The simulation and analysis of three phase fault to achieve results of the transmission line parameter is convenient by using MATLAB software. In this paper simulation of three phase transmission line fault analysis system is proposed. Single Line to Ground fault, Double Line fault etc in transmission line is simulated in this paper. This system opens the way to redesign the bus system of the power system according to its results.

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