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THREE PHASE SYMMETRICAL AND ASYMMETRICAL FAULT DETECTION IN TRANSMISSION LINES

R Lakshmi[1], N Ramesh Raju[2], S Ramesh[3], K Gunaprasad[4], V Supriya[5]
[1]Associate Professor, Department of EEE, Siddharth Institute of Engineering and Technology, Puttur, Andhra Pradesh, India.
[2]Professor & Head, Department of EEE, Siddharth Institute of Engineering and Technology, Puttur, Andhra Pradesh, India.
[3]Professor, Department of EEE, Siddharth Institute of Engineering and Technology, Puttur, Andhra Pradesh, India.
[4]Professor, Department of EEE, Siddharth Institute of Engineering and Technology, Puttur, Andhra Pradesh, India
5Assistant Professor, Department of EEE, Siddharth Institute of Engineering and Technology, Puttur, Andhra Pradesh, India

ABSTRACT:
A key problem in power transmission lines is Transmission line protection because 85-87 percentage of disturbances in power system are occurred in transmission lines. To protect the equipment, fast fault detection is needed. The exact fault location can help service man to remove persistent of the faults, thus reducing the occurrence of fault and minimize the time of power outages. The work is intended to detect fault in transmission line by monitoring continuously. By placing the conducting wire inside the loop of the current transformer, the current will be sensed and is given to the protective circuit to avoid the high current. Exact fault location can be identified by using the data transferred through mobile phone and desktop using the GPS. In this work matlab simulation is done to determine **Line to Ground** fault, **Line to line** fault, Double **Line to Ground** fault and **Triple line** fault for overhead transmission line.

Keywords:
Transmission line, power system, fault, sensor, GPS, Current Transformer and Matlab

1. INTRODUCTION

Electrical Power System is basically an energy supply system which consists of power generation, transmission and distribution sectors. Supplying energy to consumer and transmission lines around the world which is one prominent feature among all. A transmission line is used for transmitting electrical power from generating station to various distribution units which transmit current and voltage from source to several consumer units. Air act as an insulating or dielectric medium between the conductors. Since Power system consists of much powerful equipment operating in HV mode where expected or unexpected fault can occur at any time due to any reason. Mostly the faults occur in transmission sector of power system which could be due to high velocity wind, heavy rainfall or any other technical issue etc. and this can cause interruption to the power system.

2. PROBLEM STATEMENT

Different faults in transmission line, affects the reliability of power system. More than 80% of the power system faults occur in transmission sector which badly affect the reliability of supply and causes damage to the system. Such faults are unpredictable and can occur at any time. The long existence of fault in the system can cause serious damage to the system like an infection does to a body. Therefore in order to protect a system from such situation, the fault should be identified and cleared as soon as possible. In earlier period, the system was established which

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estimate the value of impedance from the data of current and voltage in order to determine the location of fault. But this method was not effective as it takes long time to determine the location of fault which is a sign of unreliability.

3. RELATED WORK

Revolution in the digital technology brings significant advantages to smart grid. But disaster prevention and prediction of power transmission lines is one of the most difficult problems for electricity transmission companies [1-3]. Advanced communication technologies and sensing of using IoT can able to avoid or reduce the damage to the power transmission lines, and effectively improve the stability and reliability of power transmission.

Electrical transmission lines affected due to different types of failures including thundering, rain, lightning phenomena, flash over, and overheating. An IoT when compared with conventional SCADA, uses wireless technology and provides real-time data acquisition [4-7].

It is foreseen that a future smart grid has to handle more dynamic and distributed electricity supply and consumption [8-9]. In that case, a robust automation system becomes essential to monitor the status of the power system, a large amount of sensors are deployed in both the transmission grid and distribution grid.

The sensors generate massive amount of data periodically for automation. This paper studies how the data measured on transmission lines can be delivered efficiently to substations [10-12]. It has been demonstrated that the traditional way of data transmission is not sufficient and direct wireless links should be used to reduce the delay in information delivery. Furthermore, optimal placement of these direct wireless links is studied aiming at minimizing the delay in information delivery.

4. SIMULATION RESULTS

4.1 Case: 1 Single Line to Ground Fault.

During single line to ground fault, the phase-A and ground are selected. Here the voltage from the source is nearly 25KV and the current value during normal working conditions is around 80-90 amps in each of the phases. When fault occurs the voltage value will decreases and the current value will increases to a large extent, nearly up to 550 Amps. From the below waveforms we can observe that the Blue voltage waveform is steady until the fault occurs. After the fault we can observe a decrease in the amplitude of the blue waveform. Similarly in current waveforms, one waveform is increased a lot.

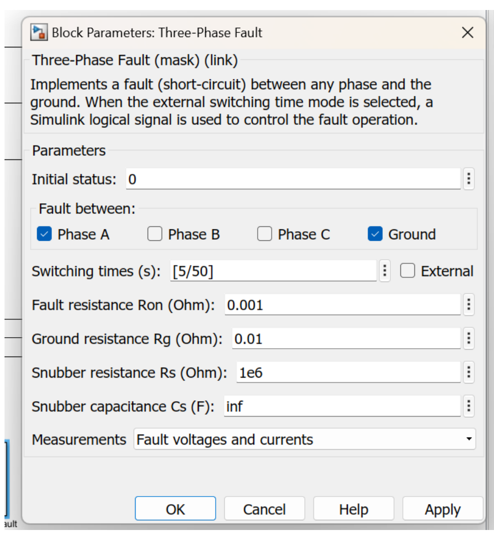

Figure 1 Simulating fault for Line to Ground

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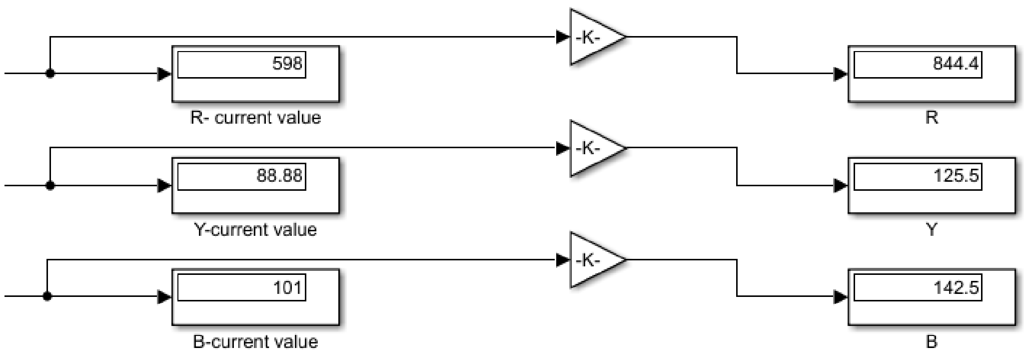

Figure 2 Fault current values during Line to Ground fault.

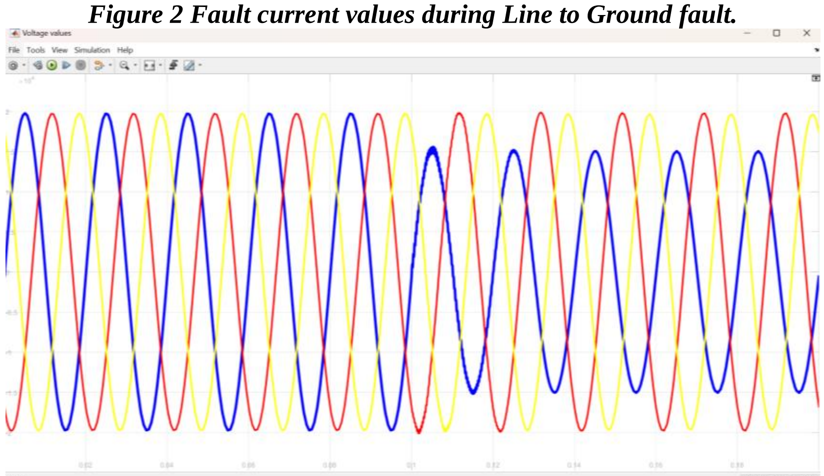

Figure 3 Voltage characteristics for Line to ground fault

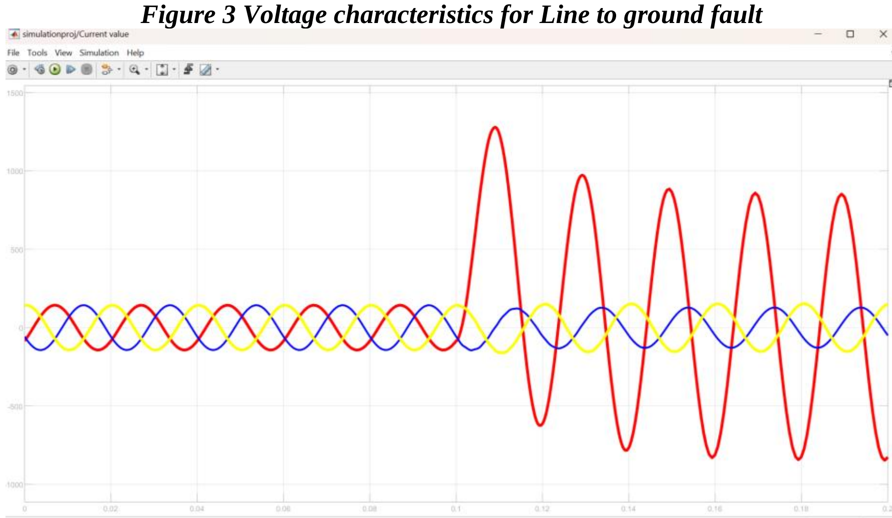

Figure 4 Current characteristics for Line to ground fault

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4.2 Case: 2 Line to Line Fault

During line to line fault, the phase-A and phase-B are selected. Here the voltage from the source is nearly 25KV and the current value during normal working conditions is around 80-90 amps in each of the phases. When fault occurs the voltage value will decreases and the current value will increases to a large extent, nearly up to 950 Amps. From the below waveforms we can observe that Red and Blue voltage waveforms are steady until the fault occurs. After the fault we can observe a decrease in the voltage value of the waveforms. Similarly in current waveforms, both the waveforms are increased a lot.

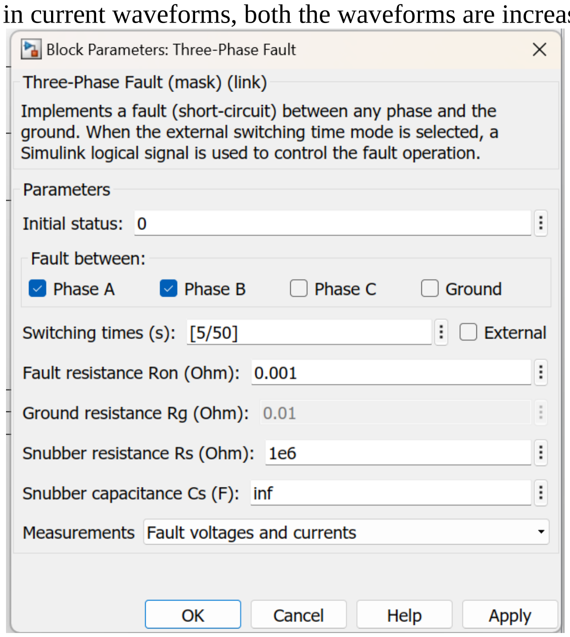

Figure 5 Simulating fault for Line to Line

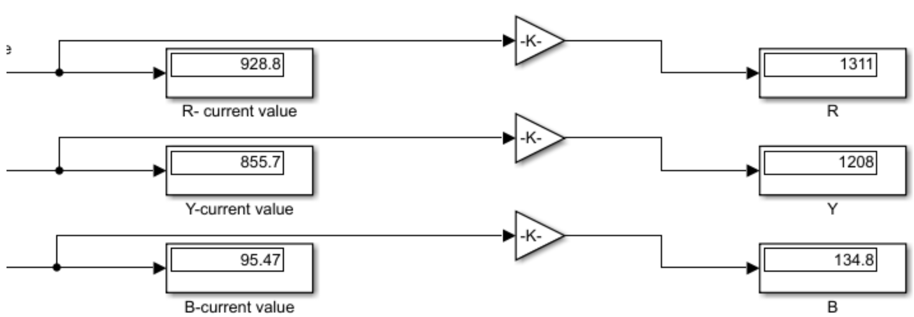

Figure 6 Fault current values during Line to Line fault.

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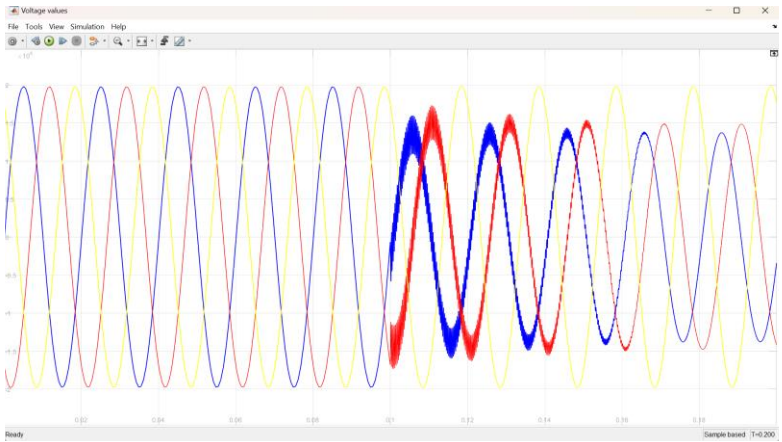

Figure 7 Voltage characteristics for Line to Line fault

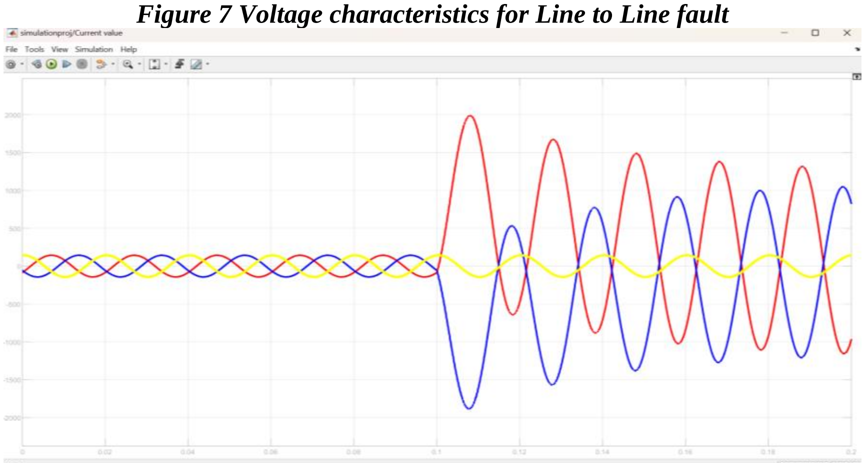

Figure 8 Current characteristics for Line to ground fault

4.3 Case: 3 Double Line to Ground Fault

During double line to ground fault, the phase-A, phase-B and ground are selected. Here the voltage from the source is nearly 25kv and the current value during normal working conditions is around 80-90 Amps in each of the phases. When fault occurs the voltage value will decreases and the current value will increases to a large extent, nearly upto 950 amps. From the below waveforms we can observe that Red and Blue voltage waveforms are steady until the fault occurs. After the fault we can observe a decrease in the voltage value of the waveforms. Similarly in current waveforms, both the waveforms are increased a lot.

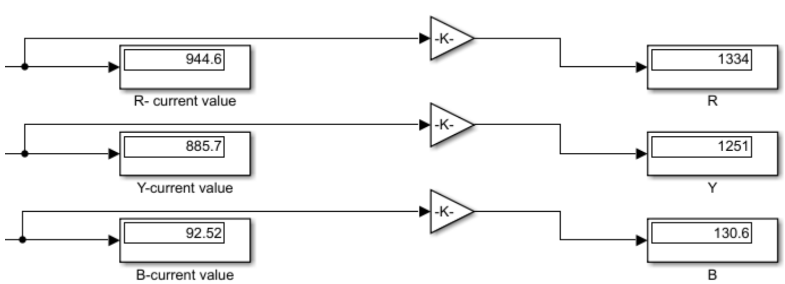

Figure 9 Fault current values during Double Line to Ground fault

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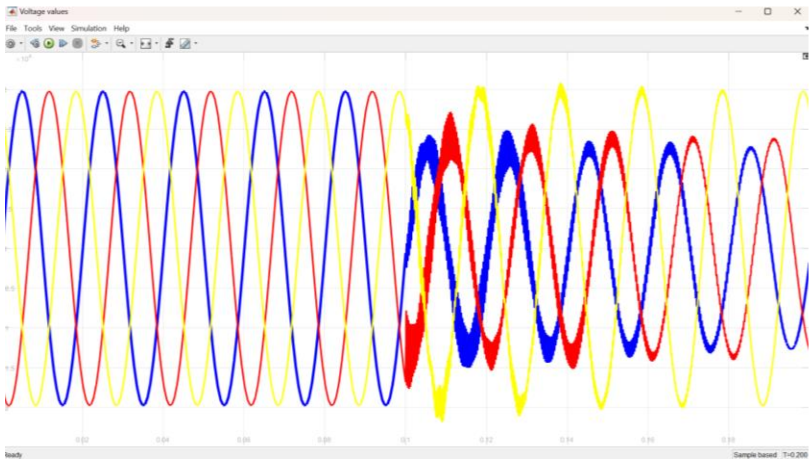

Figure 10 Voltage characteristics during Double Line to Ground fault

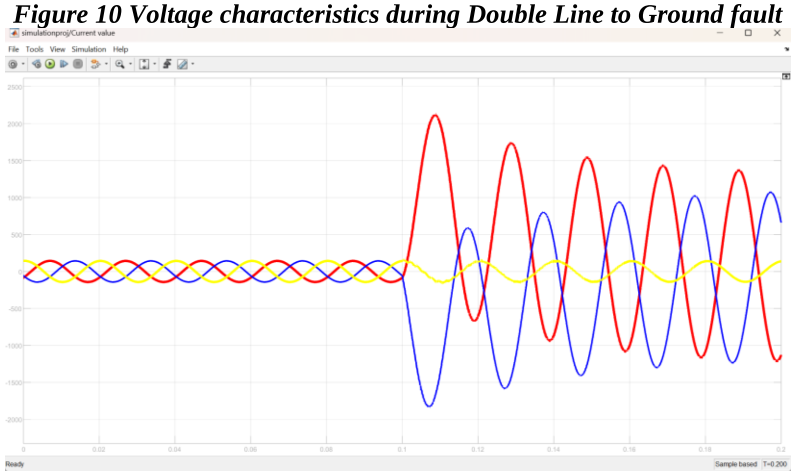

Figure 11 Current characteristics during Double Line to ground fault

4.4 Case: 3 Three Phase Fault

During triple line fault, the phase-A, phase-B, phase-C are selected. Here the voltage from the source is nearly 25kv and the current value during normal working condition is around 80-90 amps in each of the phases. When fault occurs the voltage value will decreases and the current value will increases to a large extent, which is more than 950 amps. From the below waveforms we can observe that Red and Blue voltage waveforms are steady until the fault occurs. After the fault we can observe a decrease in the voltage value of the waveforms. Similarly in current waveforms, both the waveforms are increased a lot.

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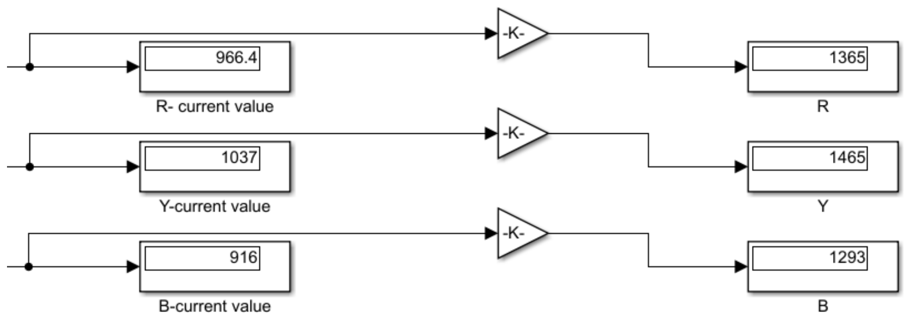

Figure 12 Fault current values during Triple line fault

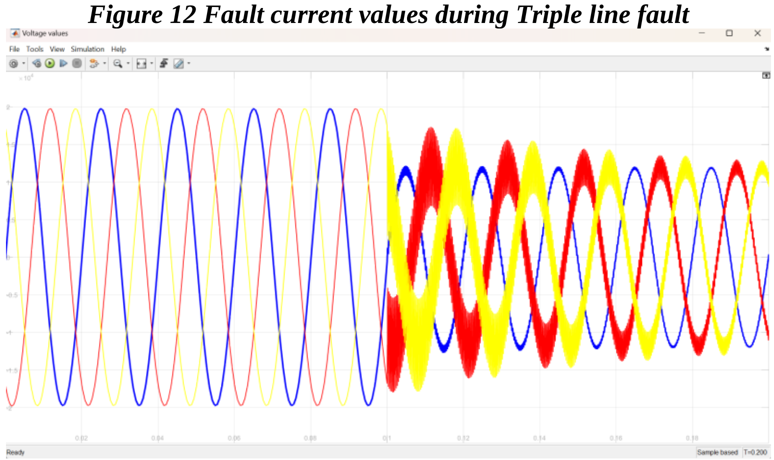

Figure 13 Voltage characteristics during Triple line fault

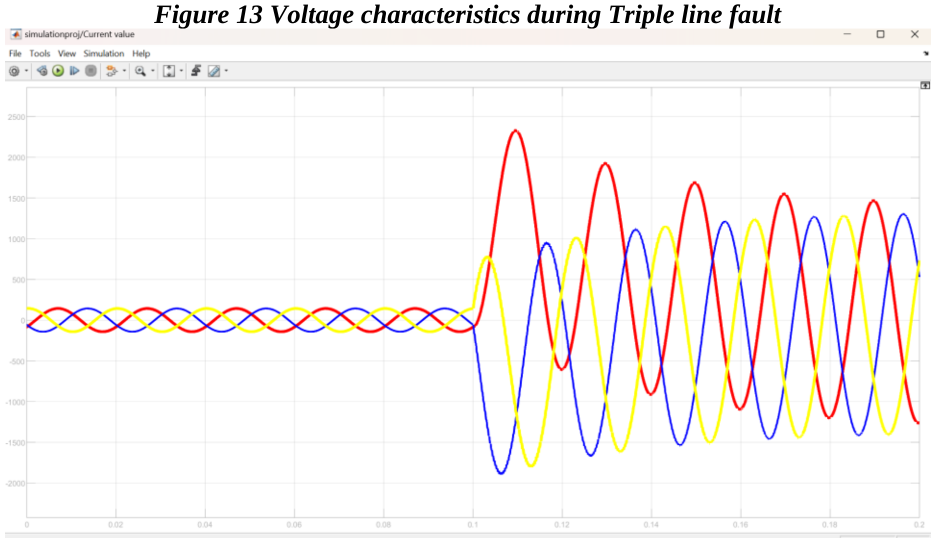

Figure 14 Current characteristics during Triple line fault

5. CONCLUSION

Preliminary researches which have recommended strategies for the protection of transmission lines, mostly rely upon the travelling waves. Even though such systems have the potential and ability to distinguish and find faults on the distribution lines yet these systems are unable to determine the exact location of the fault. Simple analog

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methods were introduced by various researchers in the past and they were mostly based on waves to detect the faults in the system. The methods using analog advancements have various limitations which is the reason for working on new innovations. The approach used in this paper, can be used for the development of fault detection system, uses a variety of hardware equipment's including GPS, Node MCU, ACS712 Current Sensor Module, LCD display. The system can determine the fault location accurately by using the GPS module. Faults which can be identified by the system are: single line fault, single line to ground fault, double line fault and double line to ground fault.

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