THREE PHASE TRANSMISSION LINE FAULT ANALYSIS USING MATLAB SIMULINK

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Abstract: **Power transmission is a major issue in electrical engineering after power generation. Fault in transmission line is common and main problem to deal with in this stream [1]. The faults occurring in power systems can be broadly classified into symmetrical faults and unsymmetrical faults, there is yet another classification of fault types namely, shunt type of faults and series type of fault ,in this paper we are analyzing only shunt type of faults, this shunt type of fault involve short circuit between the conductors and or between conductor and ground . They are characterizedby increases in current and fall in voltage and frequency in faultedphase [2]. The different kinds of shunt faults are single line to ground fault ,double line to ground fault and three line to ground fault.The study of these faults are necessary to ensure that reliability and stability of the power system. Then paper approaches MATLAB software in which user friendly tool box will assist using that transmission line model design and various fault time will be given with the help of signal builder[3].After that various effects on bus system due to different are shown such as voltage ,current and fault current output in terms of waveforms .By analyzing waveforms we can calculate which fault occurring is maximum and what are the safety measurement that we can include in the power system to overcome this fault.**

INTRODUCTION

Afault in a circuit is any failure, which interferes with normal flow of current. It can be undesirable creation of conducting path (or) short circuit fault and blockage to the flow of current (or)open circuit fault[4] .When a fault occur in a power system the short circuit current will be typically high six to ten times more than normal full load current in the system[1]. A faulted part must be quickly isolated from the remaining healthy part before high short circuit current causes any damage to operators like transmission lines and loads. The protective circuit consists of circuit breaker, ideal switch and signal builder.

To understand the stability of system operation fault analysis is important.

The fault occurring in power system can be broadly classified into symmetrical and unsymmetrical fault[5]. In case of symmetrical faults, the fault current same in all three phases and the system remains in balanced even after fault occurrence. Therefore the symmetrical fault condition can be analyzed conveniently. In case of unsymmetrical fault current value are different in each phase. The faults that occur in a power system are

a. Single-line-ground fault
b. Double-line-ground fault
c. Three-line-ground fault

These faults are also called as short circuit fault which are common on transmission lines. These faults occur due to different factors like insulation failure of equipment caused by lightning and switching surges are coming in contact and also when foreign object came in contact with bare power lines[6]. The foreign objects may be falling of trees on line or birds shorting outlines.

In this paper we are using an MATLAB Simulink. MATLAB stands for matrix laboratory. MATLAB is an high performance language for technical computing it has many advantages compare to convectional computer language for solving a technical problem , this software is available since from 1984 and is considered as standard tool[7]. MATLAB can be used for graphical and programmatically analysis, MATLAB as many tool box and we are using Simulink for graphical modeling.

WORKING PROCEDURE :

The working procedure of this model includes simulation analysis of fault. The fault that we are creating is single line to ground fault double line to ground fault and three lines to ground fault[1]. In this model we are using three phase source of 11kv, 50 Hz is connected to the series RLC load with an impedance of load in ohms, and it is connected through transmission lines. Three transmission lines are used of 100km long, while one of the transmission lines is parallel to the two series transmission lines: here two way supply given to the RLC series load through transmission lines since our main aim to create fault in one of the transmission line during that time the supply is not interrupt to the load. To isolate that unhealthy part we are using circuit breaker for switching operation that is, open and close of the circuit breaker , the circuit breaker operation is opposite to that ideal switch that is, if ideal switch is open circuit breaker remains in closed condition,viceversa. For creating a single-line-ground fault,we are connecting one of the lines through resistance via ideal switch. The operation of the ideal switch controlled by signal builder, when signal given to ideal switch with specified fault time,then ideal switch is closed which causes single-line-ground occurs, on

that time we can observe the changes that occur in voltage, current with the help of scope. The operation is similar to double-line -ground fault, three-line- ground fault but while double-line-ground fault two line of transmission line is short circuited and three line of transmission line is short circuited for three-line-ground fault. The obtained results can be calculated theoretically by using formula[7].

a. Single-line-ground fault :

There are three phases that is phase – a , phase – b and phase – c , during single – line – ground fault it is assumed that phase – a shorted to ground directly. The condition at that fault are represented by the following terminal conditions.

$V_a = 0$
$I_b = 0$
$I_c = 0$

The fault current occurred during single – line – ground fault can be calculated by usingbelow formula

$$I_f = 3(Ea / Z_1 + Z_2 + Z_3)$$

b. Double-line-ground fault :

Here we assumed that the fault takes place in phases b and c , this phases shorted ground directly. The condition at that fault are represented by the following terminal conditions.

$V_b = 0$
$V_c = 0$
$I_a = 0$

The fault current occurred during double – line – ground fault can calculated by using below formula

$$I_f = - 3 I_{a1} (Z_2/ Z_1+Z_2)$$

c.Three – line – ground fault :

Here three phases are shorted ground directly.The condition at that fault are represented by following terminal conditions.

$I_a + I_b + I_c = 0$
$V_a = V_b = V_c$

The fault current occurred during Three – line – ground fault can calculated by using below formula

$$I_f = E_a / Z$$

SIMULATION MODEL:

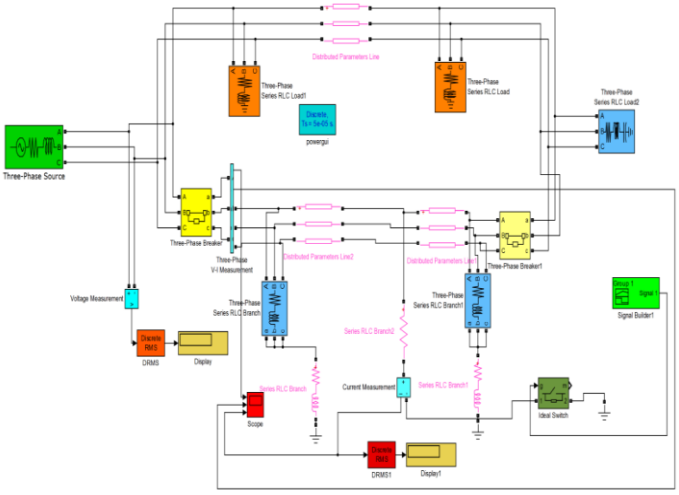

Fig 1 : Shows the three phase fault analysis model

RESULT:

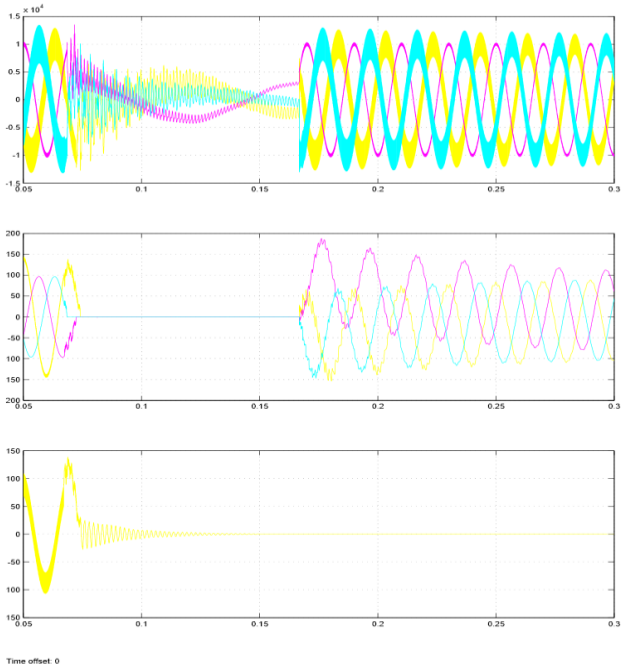

Fig 2 : shows the waveforms of single – line – ground fault

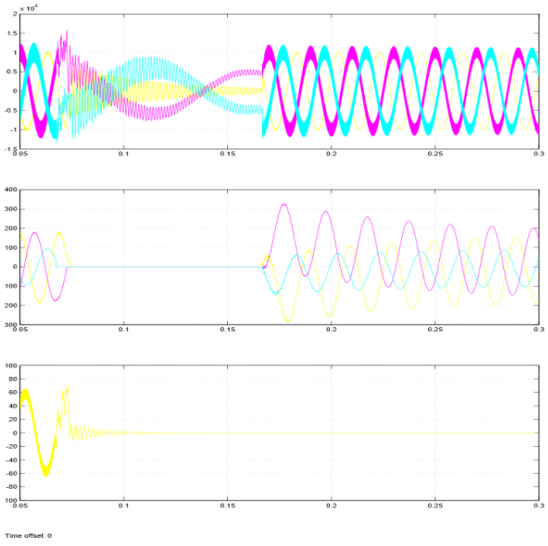

Fig 3 : Shows the waveform of double – line – ground fault

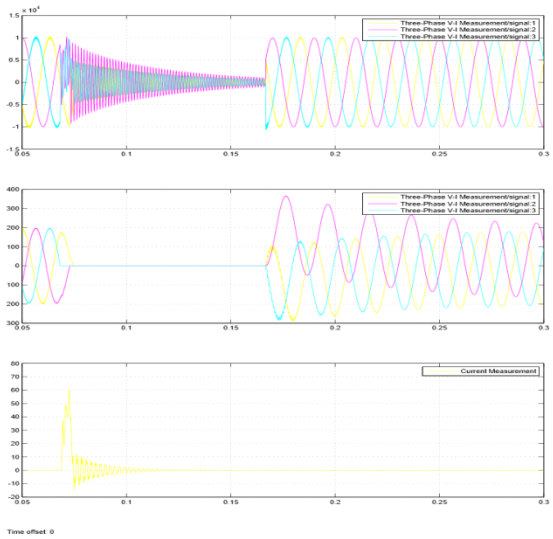

Fig 4: shows the waveforms of three – line – ground fault

CONCLUSION:

The simulation and analysis of three phase fault to achieve results of the transmission line parameter is convenient by using MATLABsoftware[3]. In this paper system is design to show the Variations of voltage and current when single-line-ground fault, double-line-ground fault and three-line-ground fault occurs in transmission line.

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