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Detection and Location of Faults in Underground Cable using Matlab Simulink

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Abstract - This project portrays a procedure to recognize, fault and location of an underground cable framework in view of the standards of nonstop wavelet change (CWT). Because of the fault in the power framework a high recurrence current and voltage creates and spread along the power. These produced signals contain a great deal of data and can be utilized for fault recognition and area. The high recurrence segments produced are extricated utilizing the wavelet system and investigation of the separated signs is conveyed. The MATLAB Simulink form 7.6 is utilized to show the underground link system and deficiencies at different areas are reproduced. The subsequent waveforms are subjected through a wavelet change to remove the required signs for investigation. The outcomes demonstrate that the wavelet change is exceptionally powerful to separate the transient parts from the fault signs and identification and area of faults comings should be possible precisely. In this venture three stage 11KV; 100km long link is considered for the investigation reason.

Key words: Underground cables, Simulink, Time domain reflectometry, Faults.

1. INTRODUCTION

At the point when diverse kinds of fault happens in control framework then during the time spent transmission line location investigation, assurance of transport voltage and the rms line current are conceivable. While counseling with the power framework the terms transport voltage and rms current of line are imperative. If there should arise an occurrence of three stage control framework for the most part two deficiencies happens, three stage adjust faults and unbalance faults on transmission line of energy framework, for example, line to ground blame, twofold line to ground blame and twofold line blame. The transmission line blame investigation chooses and build up a superior for insurance reason. For the assurance of transmission line we put the circuit breakers and its rating is relies upon triple line blame. Another demonstrating structure for examination and reproduction of unbalance blame in control framework is technique incorporates the recurrence data in dynamical models and delivers inexact nonlinear models that are very much received for investigation and reenactment. The transformer models incorporates immersion. The parameters have been gotten from reasonable or test estimations. From the investigation it is seen that droops can create transformer immersion when voltage recuperates.

2. SIMULINK MODEL

a. Underground cable network

Simulink model adopted from has been modified. Basically distributed parameter line has been modeled has an underground cable. A 1.1 KV, 25 sq.mm unarmored copper cable parameter have been utilized. The underground network is of 10 km as shown in fig.1. Fourier blocks and scope at sending, receiving and fault points are used to obtain the fundamental components of the voltages and currents at All the faults namely LG, LL, LLG, All the faults namely LG, LL, LLG, LLL, LLLG have been studied and comparison have been made by shifting the fault points.

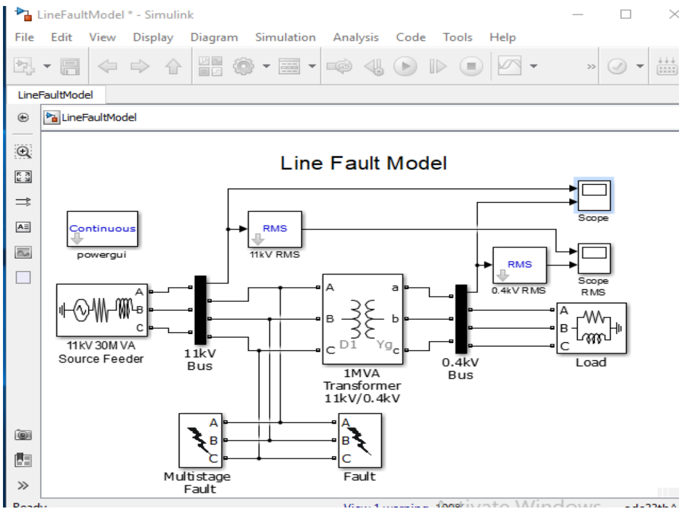

Fig- 1: Simulink model for obtaining voltage waveforms in an underground network

3. Methodology

MATLAB (Matrix labratory) is a multi-worldview numerical processing condition and fourth era programming dialect created by Math Works, MATLAB permits network controls, plotting of capacities and information, usage of calculations, sure of UIs and interfacing with programs written in different dialects. In spite of the fact that MATLAB is expected fundamentally for numerical registering a discretionary tool compartment utilizes the MuPAD representative figuring abilities. An extra bundle, simulink, includes graphical multi-space reproduction and model based outline for dynamic and inserted framework. MATLAB clients originate from different foundations of building, science and financial matters. MATLAB is broadly utilized as a part of scholarly and research organizations and in addition mechanical endeavors. Additionally MATLAB gives an appealing domain with many dependable and exact implicit capacities. MATLAB family cooperate with simulink programming to show electrical, mechanical and control framework. With a specific end goal to think about and dissect the transmission line fault after circuit plan are utilized. Two three stage wellsprings of rating 100MVA, 13.8KV, 50Hz are associated. These two sources are associated with two transformers of rating 1000MVA, 13.8/500KV and 1000MVA, 500/13.8KV. In the middle of the two transformer transport framework are associated. Likewise the resistive load is associated between transport 2 and transport 3, and blame is made close transport 2. The period for production of fault is of 0.1 to 0.4 second. Likewise, three transmission lines are utilized as a part of which one is of 100Km long and another two transmission lines having separation 50Km. When we made 1L-G blame close transport 2 then voltage of stage crosswise over transport 2 ends up zero and positive arrangement voltage of transport 2 turns out to be low at 10KV and negative succession of voltage turn out to be high to 5*104 Volt. Dynamic and responsive power crosswise over transport 2 progresses toward becoming fluctuates between 0.7 to 1.7MW and - 1.3 to 1.3VAR . At the point when 2L-G blame is made close transport 2 then the stage An and stage B voltage crosswise over transport 2 winds up zero and positive and negative grouping segment of voltage over this transport moves toward becoming declines and increments to 5KV individually. Dynamic and responsive energy of transport 2 progress toward becoming fluctuates from 0 to 1MW and from - 1.5 to 1 VAR individually. Also, 2L blame is made then two stage to be specific An and B voltage changes close to zero and positive arrangement segment of voltage crosswise over transport 2 ends up steady at 1.5MV and control crosswise over transport 2 is lies at 17MW.

4. Fault Scenarios

The fault types in a single-conductor cable usually can be classified as the core-sheath-ground fault, core-ground fault and core-sheath fault, which are shown in Figure 2. The combination of values of three fault resistances is tabulated in Table 1 which can be used to decide the actual fault scenario.

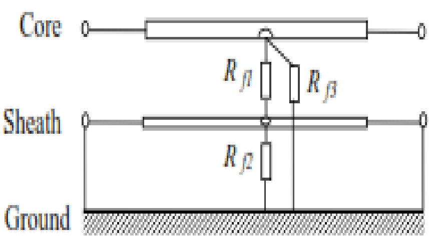

Fig 2: Fault scenarios.

Table 1: Decision of Fault Scenarios in Theory

Fault Scenarios	Fault Resistance		
	R_{f1}	R_{f2}	R_{f3}
Core-Sheath-Ground	X	X	∞
Core-Ground	∞	∞	X
Core-Sheath	X	∞	∞

It should be noted that *X* in Table 1 can be any practical non-negative real value.

5. FAULT PARAMETER

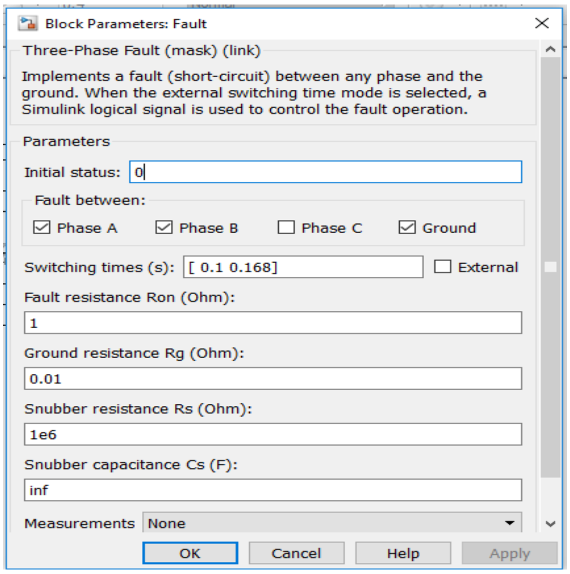

Fig 3: double line to ground fault parameter.

6. FAULT LOCATION

After detecting the type of fault using ANN, the distance of fault point from the source end is calculated using the principle of time domain reflectometry. In this paper, the specimen used is simulated for different type of faults. Series inductance and shunt capacitance are taken as distributed parameter and series resistance is considered as lumped. Also, shunt conductance is neglected which is a considerable approximation for underground lines. Length and various parameters of the cable are inserted as delay time and characteristic impedance in the schematic tab of software. At the time of fault, the fault impedance is considered zero and the load is supposed to be removed as the circuit breaker or isolator trips after fault inception. The open circuit at load end is represented as a very large valued resistance of the order of 1019 ohms. A zero impedance fault is created somewhere on the line (say at mid-point). A low voltage negative pulse having pulse time much less than the period and having a zero rise and decay time is sent along the cable from the source end at t=0. The graph between voltage or current at source end with respect to time is plotted and the time of return of the pulse is noted and it is multiplied with the pulse velocity to get the distance of fault point from the source end. The voltage-time graph at the source end of the cable. The assumption values of the parameters for the cable are given as

Length of cable = 10 km

R= 0.727 ohm/km

L= 334 uH/km

C= 1.05 uF/km

G=0 S/km

Current limiter impedance=1kohm/km Parameters of Voltage-pulse are under:

Amplitude of voltage pulse= -1V

Rise time = 0s

Fall time = 0s

Delay time = 0s

Pulse width = 10us

Velocity of wave is given by equation (1)

$$v = \frac{1}{\sqrt{LC}} \quad (1)$$

From Fig. 8 time t = 187 us, and the distance of the fault is

given as the half of the distance travelled by the wave,

therefore,

d = v*t/2 (2)

= 53398.8 x 187 x 10-6 / 2

= 4.9928 km

7. RESULT

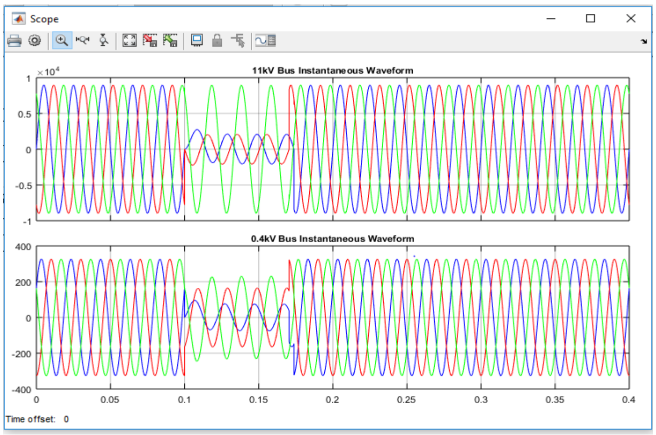

Fig 4: double line to ground fault

8. CONCLUSION

This project enables the researchers to detect and locate the faults in underground cable with the help of software tool i.e., Simulink tool. The method used in this project operates in sequential manner and proves to be useful in detection and location of faults in underground cables.

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