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Location of Downed or Broken Power Line Fault Not Touching the Ground

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ABSTRACT

Faults occurred in power system are common, all these faults are detected by protective devices but faults like Downed or Broken power line Fault not touching the ground, these faults not having enough faults current to operate fault detection devices in Over Head power distribution. Till now there is no protecting devices are identified this type of fault and location of this fault. As of now identifying by only by visual sighting. The proposed solution for finding Fault location Downed or Broken power line Fault not touching the ground.

1. INTRODUCTION

In Power Transmission and distribution system line faults are common issues. Finding Fault and fault location is a critical issue for both Transmission and distribution system. An efficient fault protection and fault location scheme required to protects the equipment as well as public from hazardous over voltages. Downed conductors or broken power lines not touch the ground are of major concern to electric utilities because they may result in public hazard. Finding fault location of down power lines not touching ground is big problem because finding this type of fault is big concern in power system.

Downed conductors may not contact a conductive object and, therefore, have good probability of remaining energized. It's not easy to find fault [1-5] and at present this fault comes under open-circuit fault. This paper mainly concentrated on location detection of Downed or Broken power line Fault not touching the ground. Transmission line Faults and fault location finding is very important for power system. So many methods using for finding open-circuit fault location. Currently travelling wave and impedance-based methods used for finding Open –circuit fault location. In Impedance bases method, phasor voltage and phasor current measured from either sides or single side of transmission line [6-14].

As compare to impedance method, travelling wave method would give accurate results [15-29]. The drawback of this method is depending upon system parameters and configuration of network [30-31]. Travelling waves measured by using Current transformers [32-33, 41-42].

Power Line Guardian's (PLG's) is a latest technology used for increasing or decrease power flow in a transmission line and as well as observe power line between pole to pole every time [34-36]. It's used to find transmission line condition like voltage, current frequency, etc. Harmonics are another problem for power system, but effect of harmonics on power system is low. In some cases, effect of harmonics is more, and Harmonics will reduce power system reliability. The harmonics in power system generated by non-linear loads, if harmonics can control by conducting awareness of harmonics program for industries, so it helps to power system reliability and stability [37-40].

2. HYBRID AD METHOD

The travelling wave method for finding open-circuit location, Power line guardian (PLG) for power flow control, Harmonics in Power system (2^{nd} harmonic). Using Travelling wave method, Power line guardian and 2^{nd} harmonic, we are going to propose new method to find Location of Downed or Broken power line Fault not touching the ground. The proposed method is very simple, and less cost and it will give exact location. In this method PLG (Power line guardian) would play big role and using 2nd harmonic travelling wave, we are going to find Location of Downed or Broken power line Fault not touching the ground**.** PLG having Current transformer and it will measure High frequency ranges (Travelling wave frequency). To find distance of fault please follow below Operation of Hybrid AD Method.

Operation of Hybrid AD method: Please follow below Steps how to detect Location of downed power line conductors' fault between two sub stations. Precondition: 1. First calculate Distance between two sub-stations (distance D)

2. PLG connected between equal distance (at Pont P) (Figure1) from two sub-stations A and B. Please follow below cases how Hybrid AD method help to detect location of fault.

Case 1: Fault occurred between Station A and PLG

Step 1: When Downed or Broken power line Fault not touching the ground occurred (at Point F) (Figure 2) at that point 2^{nd} harmonic first travelling wave generated and travelled towards Station A and Station B (Figure 2).

Step 2: measure 2nd harmonic first forward travelling wave timing between fault point "F" to PLG Point "P".

Step 3: measure 2nd harmonic first forward travelling wave from fault point "F" to Station B.

Step 4: measure first reflected travelling wave from station B to fault point (at point F).

Step 5: measure first reflected travelling wave from station B to at Point P.

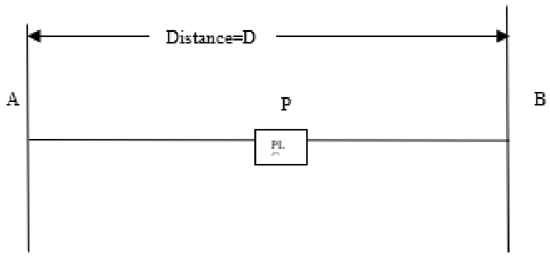

Figure 1. PLG between two substations

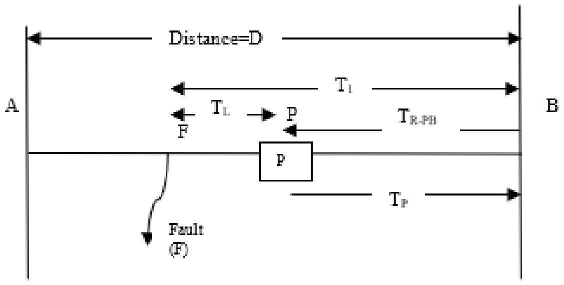

Figure 2. Type AD Method for fault near to station B

D=Total distance between station A and Station B[m]; DX= Fault location distance from Station B[m]

F=Fault point location, P=Power Line Guardian arranged on transmission line; T_L =First forward travelling wave time between Fault point (F) and PLG point (P) [s]

T_{PB}=First forward travelling wave time between PLG point (P) and Station B[s]; T_{R-PB} =First reflected travelling wave time between PLG point (P) and Station B[s]

T=First forward travelling wave time between Fault point (F) and Station B[s]; PLG= Power Line Guardian, V = wave velocity [m/s], T_x =Total travelling time [s], $T_x = (\frac{T_{PB}+T_{R-PB}}{2} + T_L)/10$,

Fault location distance from Station B D_X=$T_x.V$

Case 2: Fault occurred between Station B and PLG.

Step 1: When Downed or Broken power line Fault not touching the ground occurred (at Point F) (Figure 3) at that point 2nd harmonic first travelling wave generated and travelled towards Station A and Station B (Figure 3).

Step 2: measure 2nd harmonic first forward travelling wave timing between fault point “F” to PLG Point “P”

Step 3: measure 2nd harmonic first forward travelling wave from fault point “F” to Station A

Step 4: measure first reflected travelling wave from station A to fault point (at point F)

Step 5: measure first reflected travelling wave from station A to at Point P

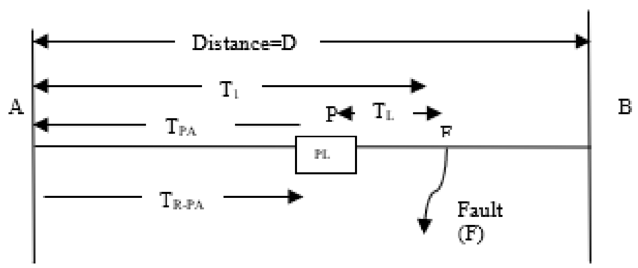

Figure 3. Type AD Method for fault near to station A

D=Total distance between station A and Station B[m]; D_X= Fault location distance from Station B[m]

F=Fault point location; P= Power Line Guardian arranged on transmission line; T_L =First forward travelling wave time between Fault point (F) and PLG point (P) [s]

T_{PA}=First forward travelling wave time between PLG point (P) and Station A [s]; T_{R-PA} = First reflected Travelling wave time between PLG point (P) and Station A[s].

T_1=First forward travelling wave time between Fault point (F) and Station A[s]; PLG= Power Line Guardian, V = wave velocity [m/s],T_x=Total travelling time [s],$T_x = (\frac{T_{PA}+T_{R-PA}}{2} + T_L)/10$,

Fault location distance from Station A D_X=$T_x.V$

3. SIMULATION RESULTS

We used PSCAD V4.2 for this simulation results. if we apply in Theoretical calculation to simulation for Case 1, Distance between station A and B is 100 Kilo meters. If Downed or Broken power line Fault not touching the ground occurred at 25 Km from Station A

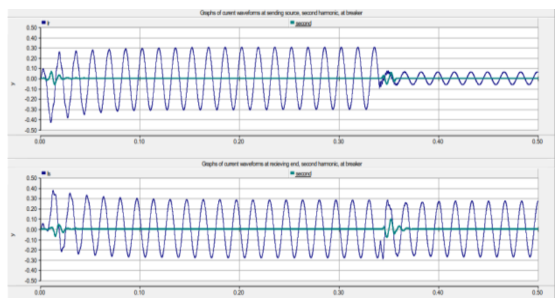

Figure 4. 2nd harmonic wave Generated at fault point

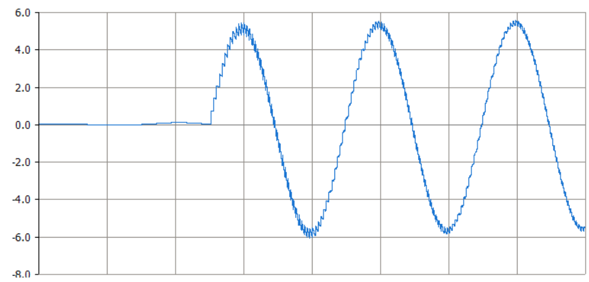

Figure 5. First forward Travelling wave travelling towards station B

Figure 4 and Figure 5. Explains how 2nd harmonic generated at fault point and fault travelling wave travelling towards station B.

From Simulation Results, $T_{PB} = 0.188ms, T_{R-PB} = 0.376ms$,$T_L = 0.6837ms$

$T_x = (\frac{T_{PB}+T_{R-PB}}{2} + T_L)/10$,

Fault location distance from Station B D_X= $T_x.V$ =28. 97KM.Final value near to fault location.

4. CONCLUSION

In Smart grid, Fault location finding methods using travelling wave concept but all methods measuring travelling wave at end of source or destination. As compare to all that methods, my proposed Hybrid AD Method measure travelling wave at middle of Transmission line length. At present very, few methods for finding exact location of Downed power lines Fault without touching ground. As compare to all of that's methods and process, the proposed solution will give better Solution, economic and within less time. I hope it will give almost 100% accurate solution for finding exact location Detect Downed power lines Fault without touching ground. This Paper provides solution used for between two substations. Further Research work will be finding exact location of Downed power lines Fault without touching ground between substations to rural area.

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