IOT BASED UNDERGROUND CABLE FAULT DETECTION

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Abstract:

Underground cable system is followed in major areas in Metro Cities. Fault may be classified into open, close, asymmetrical and symmetrical. in kilometers and displayed over the internet. While a fault occurs for some reason. This IOT Technology is used to find out the exact location of the fault and to send data in graphical format to our website using anlines with the transformation of the transmission network and the enlargement of the urban construction scale. In order to meet the requirements of power supply reliability and reducing the loss of the transmission line transporting electric energy in the smart grid, the T branches of a transmission line are increasing, which makes the high voltage transmission network change from a single mode to a tree structure, or even a network structure gradually.

I. INTRODUCTION

A large number of implementations has been introduced over the years [1]–[10], all sharing a similar idea: a test signal p(t) is injected into a cable under test through a testing port and the output signal e(t) is monitored for any significant echo, e.g., by comparing or cross-correlating it with p(t).

\[ f_c = \frac{v}{w} = \frac{1}{T}, \]

A soft fault can be schematically described as a local change in the characteristic impedance of a cable, passing from its nominal value Zo to a local value ZF, assumed to be constant over a length w. Transmission-line theory allows to quantify this local impedance mismatch by defining a surge reflection coefficient \( \Gamma \).

\[ \Gamma_0 = \frac{Z_F - Z_0}{Z_F + Z_0} \]

II. MODEL-BASED FAULT IDENTIFICATION

The rationale for expanding \( |\Gamma F(\nu)| \) in the variable \( \nu/fo \) is twofold. First, it provides

expansion coefficients \{wn(\Gamma_0)\} evolve with the fault severity \( \Gamma_0 \), with the first two terms of the series providing the main contributions for \( \Gamma_0 \) < 0.4. showing that the contribution from \( b_1(\nu) \) is about 20% of \( b_0(\nu) \) if faults with \( \Gamma_0 \) ≤ 0.3 are involved, as long as tests are carried out for \( \nu < fo \). As a result, measurements taken at frequencies \( \nu \ll fo \) could be expected not to be reliable for the identification of a fault, since in this can be approximated as \( \Gamma in(\nu) \approx 2j\nu \Gamma ow e^{-j2kdc} \),

\[ fo \approx \frac{f_c}{2\pi} \left( 1 - \Gamma \right)^{2} \]

The relationship between the curvature of \( |\Gamma F(\nu)| \) and the fault parameters can be established by expanding \( |\Gamma F(\nu)| \), a power series, in order to factorize the relative contributions of frequency and fault parameters. Proceeding to a Taylor expansion for \( \nu \to 0 \) yields. The fault parameter estimators require an accurate estimate of the polynomial coefficients p0 and p1. The previous section has shown that in low-frequency testing, i.e., well below fo, the simpler expressions where the fault extension w has no effect on the polynomial coefficients \{wn(\Gamma_0)\}. Second, as proven in Sec. II-B, the ability of fo to identify the frequency range where the fault reflectivity starts to deviate from its low frequency regime, thus confirming its role as an important fault parameter. how the amplitudes of the
reflectivity of an impedance fault is mostly proportional to the frequency, so that any identification attempt is bound to fail unless the contribution of at least the first higher-degree term \( b_1(\nu) \) can be measured, which can be challenging in case of data affected by noise. More generally, including higher-degree terms may result in an overfitting of the data samples, with reproducing noise contributions rather than operating as a regression procedure, which it is therefore important to understand what is the minimum value of test bandwidth \( f_M \) to be considered in order for the proposed fault identification procedure to be applied successfully, \( f_M \), will share the same property of proportionality to \( p(t) \) as \( s(t) \), but will now reach its peak.

III. EXISTING WORKS

Many researchers were worked on fault detection in cables. Chen & Feng [1] proposed a global positioning system with ZigBee for fault detection. They worked design of the subsystem of underground oil pipe online monitoring system, but if making a little pertinence improvement, that can be the real-time monitoring and position system in other areas, so it has broad and enlarged complication areas. The disadvantage of this work was Zigbee technology is not enough for world wide monitoring system.

Naidu et al. [2] proposed a new fault location method for underground cables in distribution systems proposes an accurate fault location method for underground power cable in power distribution systems.

In fault occur in the cable, then manually it was identified and then process will takes place to short out the problems. After detection, the cable wire will be changed and other precautions will be take place to overcome further failures and faults. Fault may be classified into open, close, asymmetrical and symmetrical. This paper uses the standard theory of Ohms law, i.e., when a low DC voltage. It is of practical interest that the input reflection coefficient \( \Gamma_{in}(\nu) \) measured from one end of a cable has \( |\Gamma_{in}(\nu)| \)

(1) The transmission lines have been running for a period of time before a fault, and the time remains at least 8 seconds. The current through the transmission lines is not 0(A) and the voltage is not 0(V).

(2) The current surges when appearing a fault. \( I_f = I_L \ast K(If) \). The incremental is \( I = I_f - I_L \). In the formulas, \( I_L \) is the load current before a fault, \( I_f \) is the fault current, and \( K(If) \) is the inverse time factor. According to the operating experience, the set value of the fault current is 400(A) in 110kV and above high voltage transmission lines.

(3) The surge current remains a period of time after the fault occurring, and the time is \( If \). 40ms < \( T_f \) < 2000ms. That is to say, the short circuit current lasts 40-2000ms, line. When the above current characteristics are satisfied in order, the fault of the line is considered to occur. At this time, the automatically positioning system will give fault warning instructions and information. It can be seen from the above analysis that the current characteristic criterion does not need to set the fault value. The criterion can calculate and set the fault current according to the load current value.

IV. PROPOSED APPROACH

The basic principle behind the system is Ohms law. The system consists of Wi-Fi module, Microcontroller, and Real-Time Clock. Project can be proposed by IoT technology. Power supply is distributed through the step down transformer, rectifier. It can be using the fault switch. Distance can locater to

\[
E(v) = P(v)\Gamma_{in}(v) = P(v)\Gamma F(v)e^{-2jkd}
\]

Fundamental limitations to the use of TDR methods for soft-fault testing were highlighted in [13]. In particular, the amplitude of TDR echoes was shown not to represent an accurate estimator of how severe a fault is, as echoes also strongly depend on other parameters, e.g., the bandwidth of the test signal, \( p(t) \), and the fault length \( w \). In [14] it was shown that echoes generated by soft faults with a very different degree of severity can be practically identical, if tested at frequencies well below \( fc/4 \), with \( fc \) the fault characteristic frequency.
disadvantage of this work was output checked only simulation only in real-time faces problems.

Yang, Z., Wei, W., Xiang, S., Kai-Jun, F., & Bing-Yin, X. [3] proposed the simulations validate the effectiveness of this control strategy. This work provides a new solution to suppress the forced oscillation source, especially for a wind farm combined with an energy storage system. The advantage of this work was low frequency.

Buccella, M. Feliziani, and G. Manzi [4], proposed the localization of the cable section with defects is finally obtained in a very simple way due to the adopted method of measurement in time domain using a ultrawide-band pulser with a very fast rise time. The disadvantages of this work was less accuracy.

C. Furse, Y. C. Chung, C. Lo [5] proposed the compares Time domain reflectometry (TDR), frequency domain reflectometry (FDR), mixed signal reflectometry (MSR), sequence time domain reflectometry (STDR), spread spectrum time domain reflectometry (SSTDR) and capacitance sensors. The disadvantages is maintenance cost is high.

Figure 1(a) proposed the IoT underground cable. Fault echoes were isolated from residual reflections from the 50 Ω far-end load by means of time gating. This approach should be applied systematically in cable testing, in order to allow frequency-domain procedures as the one here proposed, starting from data obtained from TDR techniques. Alternatively, wavelet expansions could be used, as they also allow effective data denoising while capturing a signal over a limited time interval. This kind of approach allows processing data presenting multiple echoes of interest, by processing them cables.

Figure 2: underground cable

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Figure 3: groups of wires in metro cities

Its main application is to detect the fault of underground cable which is very hard to detect.
as it is not possible to see such faults which are quite possible in the case of overhead transmission line. So for such cases this project is very helpful as the distance at which the fault has occurred can be calculated and then further action regarding the fault can be taken to overcome them.

V. EXPERIMENTAL RESULTS

Their average phase velocity over a 6 GHz bandwidth was estimated on an undamaged cable from transmission delays, resulting in $v \approx 2.18 \times 10^8$ m/s, with negligible dispersion up to 6 GHz. The velocity $v$ is a quantity of interest not only for converting time delays into distances, but also for estimating the fault length $w$. It should be noticed that the same velocity is assumed for the undamaged cable as well as for the faulty cables. The background monitoring system should design the main functions, which include selecting transmission lines, showing the fault section topology, querying the alarm information, statistics action events, and so on. Add the network topology for all transmission lines according to taking a substation as a node in the system. Configure the type, address number and the frequency of a detection device at different points in the network topology. Design the information and models of the substations, transmission lines, towers and other equipment according to the hierarchical and classification principle in the network topology. Set up the functions, such as querying fault events, listing alarm information, and so on. In the main interface, design and display the logic diagram of the transmission lines and the installation positions of the detection devices, display the detection devices which have been in action, and integrate the function of related SMS module to send fault information in time.

**Figure 4:** Under ground cable fault detect

The modeling of network topology needs to be established before realizing the function of positioning a fault location automatically. The model should be according to the layout locations of the detection devices and the actual transmission lines. The structural relationships among the substations, export lines, transmission lines and user equipment, should be reflected in the topology model accurately.

**Figure 5:** Two cables can fault the under ground

According to the requirements of the system operating, a certain number of fault detection devices should be installed on the appropriate towers of the transmission lines in the field by
V. CONCLUSION

Though the characteristic current method doesn't set the constant value of locating faults, it can detect the faults automatically in a multibranch transmission line network. The method is of great significance to improve its adaptability to the power grid structures and operation modes. The testing equipment and mobile terminal transmission can help capture the fault location and provide information to organize the emergency repair, which is meaningful for reducing power loss and the impact on the safety of the power grid in the failure mode. And then avoid the occurrence of the blackout accident. The method in the system of positioning transmission line fault location automatically can help provide high-quality and high-efficiency electric power for the national economic development, and highlight the social responsibility of the power grid enterprise on the other hand. Project simple concepts of Ohm's law and voltage divider rule, fault can be rectified on the cables. The advantages of accurate location of fault are fast repair to revive back the power system; it improves the system performance and reduces the operating expense and the time to locate the faults in the field. Minimum conditions that ensure the feasibility of the proposed procedure were derived, explaining the reasons for the difficulties in detecting and interpreting this class of faults. These results are expected to pave the way to quantitative methods for designing early-warning testing methods allowing automatic systems to reliably decide whether echoes may be caused by severe impedance faults, before they develop into hard faults, even when they still generate weak echoes. Such a procedure could then be iterated, if needed. Future work will focus on the case of lossy and dispersive cables.

VI. REFERENCE


[16]