Study on the algorithm detecting PD phenomenon of underground transmission cables

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ABSTRACT

In the case of ultra-high-voltage underground transmission lines, most of them are located in large cities, so it takes a lot of time and money to recover them when they are broken. In order to prevent such the equipment failure, Partial Discharge measurement and inspection are regularly performed by KEPCO as preventive diagnosis activities.

in order to effectively perform preventive diagnosis activites through Partial Discharge measurement, it is necessary to first extract the location(Phase) of abnormal signal and derive the final diagnosis result after long-term monitoring and precision diagnosis.

In this paper, we talk about the algorithm and device that can be easily and effectively detecting the location of abnormal signal occurred.

KEYWORDS

3PARD, PRPD, PD, Underground

INTRODUCTION

A representive analysis method for analysis of partial discharge signal is PRPD (Phase Resolved Partial Discharge) pattern analysis. The Korea Electric Power Corporation regularly conducts PD diagnosis to prevent failure on all lines using this PRPD technique. However, the existing PRPD analysis are require high level technique to analysis PRPD pattern and use the device functions. and it takes a lot of time and difficulty to perform all sites using such devices. In addition, more than 90% of PRPD analysis is judged to be good, so an efficient measurement method is required to extract only the occurrence spot(Phase) where the abnormal signal is occurred. In this paper, the algorithm that can effectively extract abnormal signal generation spots by mapping the Phasor vector sum to a diagram for pulse signals measured simultaneously with three phases is studied, and an equipment equipped with the algorithm was developed for verification through partial discharge defect data and field demonstration.

DEVELOPMENT OF THE ENTRY-LEVEL DEVICE

requirement of the entry-level abnormal signal extraction device

PRPD, a representative analysis of partial discharge, is a method of determining the source of partial discharge defects by superimposing PD pulses on the phase. As shown in Table 1, the existing method(PRPD) has several problems. so we researched analysis methods and devices that can be easily judged by non-experts.

Table 1. Requirements for PRPD analysis device and accompanying issues

Requirements	Accompanying issues
voltage phase sync	phase information is required
High performance Analysis	High cost of equipment due to high performance
PRPD pattern knowledge	Requires high level of expertise for PD pattern analysis

Therefore an entry-level abnormal signal detection device should be able to analyze partial discharge signal without phase information. In order to do that, we need battery-operated equipment.

3-phase pulse Phasor vector sum measurement method

In order to measure the micro-part discharge signal of the high frequency band (HF~VHF) flowing toward the external sheath of the ultra-high voltage underground transmission cable as shown in <Figure 1>, HFCT is fastened to the ground wire or the Sheath Voltage Limiter (SVL). In such a measurement configuration method, even if there is one abnormal signal source, the same pattern is detected in HFCT sensors installed on all phases, making it difficult to determine the phase in which the abnormal signal occurs.

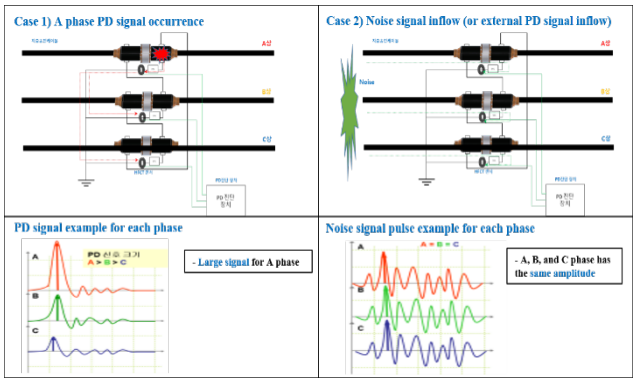

Figure 1. An example of underground transmission cable joint box PD signal measurement

However, the high frequency component of the partial discharge signal generated in the cable junction box is attenuated due to the SVL and cross-bonding structure in propagating to other phases, while relatively low frequency component, such as external noise remains the same amplitude. OMICRON's Phase Amplitude Relation Diagram(3PARD) analysis method is a program that