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Using Fuzzy ARTmap Neural Network for Determination of Partial Discharge Location in Power Transformers

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***Abstract*--Techniques for locating a partial discharge source are of major importance in both the maintenance and repair of a transformer. This paper presents a novel approach to identify partial discharge locations in transformer winding using neural network. In this paper for simulation and detection of partial discharge, detail model of transformer is used. With modeling of partial discharge impulse source in EMTP software, this phenomenon is implemented in different points of transformer winding. Then produced current in both ends of winding is measured and use for training and test of neural network. In actual, obtained current signals is with noise. Thus in this paper the performance of the Fuzzy ARTmap neural network for correct determination of partial discharge location in power transformer with considering different noises on simulated current signals for simulation of actual conditions is surveyed. The most important characteristics of neural networks are capabilities to learning and predict the various patterns and other is capability to provide a fast responsible for input patterns. The neural network used here for simulation patterns trainings and testing of the partial discharge in power transformer winding is Fuzzy ARTmap.**

***Index Terms*—Detailed model, Fuzzy ARTmap neural network, Partial discharge, Transformer.**

I. Introduction

PARTIAL Discharges (PD) are well known as a source for insulation degradation and a major source of insulation failure in power transformers [1]. Power transformers play a major part in electricity transmission and [2]. The capital cost of a transformer is extremely high and the economic penalties incurred by transformer failure, and the resulting outage costs, are considerable. If insulation deterioration caused by Partial Discharge (PD) activity can be detected at an early stage, then incipient insulation faults can be identified and preventive maintenance measures taken [3]. Therefore, many researches in PD location detection are done. PD detection is classified into acoustic and electrical methods. Electrical method is based on the taking created impulses in cavity of transformer insulation. Assessment of PD in electrical method is possible by using current transducers which is connected to measurement terminals. In this method many different ways is used or now studying i.e., tip-up, dielectric loss analysing, inductive probes, pulse detecting and analysing and transformer methods and etc.

The vantage point of the acoustic method is the simple locating algorithm but the sensitivity is very low. On the other side complicated structure of power transformers is caused difficult finding PD with due attention to propagation velocity of acoustic waves resulting from PD. Therefore, in recent years concentration of researches is on electrical method. In all researches, the PD current impulses is injected into the different point of the winding and produced signals in the neutral and ending point of the winding is recorded. With analysing of these signals, location of PD is detected. Locating of the PD is performed by transfer function [4], zeroes and poles of signals frequency spectrum [3], wavelet and neural network [5]. In this paper a novel approach to finding location of PD using Fuzzy ARTmap neural network is proposed.

II. Partial Discharge and Modelling

PD are localized ionization within electrical insulation that are caused by a high electrical field. They occur in part of the insulation system and are limited in extent, so they do not immediately cause full insulation breakdown.

PD acts similar to an impulse current source [6]. Thus, the depicted circuit in Fig. 1 is used for modeling of PD in the EMTP software. The value of shown elements in Fig. 1 is specified in [7].

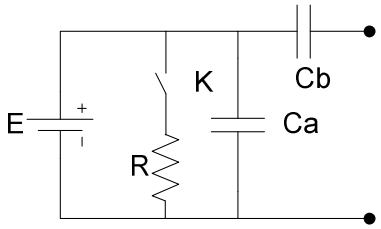

Fig. 1. Circuit for PD pulse modelling

Fig. 2 depicts the produced waveform by the circuit which is shown in Fig. 1. The PD impulse is used for this paper simulation is similar to specifications and results of

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