

Location of Partial Discharges within a Transformer Winding Using Principal Component Analysis

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Partial discharge (PD) may occur in a transformer winding due to ageing processes or defects introduced during manufacture. A partial discharge is defined as a localised electric discharge that only partially bridges the dielectric insulator between conductors when the electric field exceeds a critical value. The presence of PD does not necessarily indicate imminent failure of the transformer but it is a serious degradation and ageing mechanism which can be considered as a precursor of transformer failure. PD might occur anywhere along the transformer winding and the discharge signal can propagate along the winding to the bushing and neutral to earth connections. As far as maintenance and replacement processes are concerned, it is important to identify the location of PD activity so any repair or replace decision is assured to be cost effective. Therefore, identification of a PD source as well as its location along the transformer winding is of great interest to both manufacturers and system operators. The wavelet transform is a mathematical function that can be used to decompose a PD signal into detail levels and an approximation. Wavelet filtering is often used to improve signal to noise ratio (SNR) of measured signals, but in this case it is used to identify the distribution of signal energies in both the time and frequency domains. This method produces a feature vector for each captured discharge signal. The use of principle component analysis (PCA) can compress this data into three dimensions, to aid visualisation. Data captured by sensors over hundreds of cycles of applied voltage can be analysed using this approach. An experiment (Figure 1) has been developed that can be used to create PD data in order to investigate the feasibility of using PCA analysis to identify PD source location.

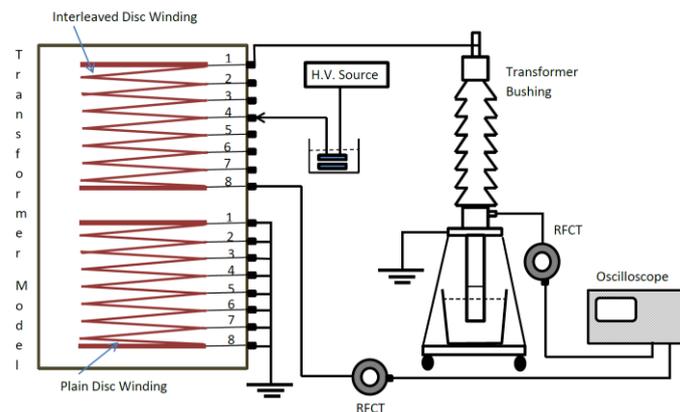


Figure 1: Experimental diagram for measuring partial discharge within transformer winding

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