Leakage Reactance of Transformer by Measurement of Flux Under Different Condition

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Abstract— A Leakage Reactance of Transformer by Measurement of Flux under Different Condition is presented. It can be applied to Artificial Neural Network Logic Control. The developed technique is based on computing the flux produced by each in the windings. Thus, the fluxes are obtained by applying the concept of under different condition. The obtained analytical calculation of the transformer flux, Losses and resistance with temperature in the power transformers. Leakage reactance was computed for twelve power transformers with different coil configurations and the result is reducing the temperature level of transformer. The result is obtained by simulation and hardware used the artificial neural network logic control.

Key words: Power Transformer, Artificial Neural Network, Flux, Efficiency, Leakage Reactance

I. Introduction

Power transformers are important and expensive components in the electric power system. Transformer is part of the power transformer manufacturing guarantee, thus, precise quantification of the leakage flux of power transformer windings is vital in the calculation of transformer impedance. In the design stage the impedance estimation is verified by the ANN. In the design stage the flux estimation is verified by the artificial neural network logic control.

The difference between the measured impedance value and that requested by a customer must fulfill the ANSI/IEEE C57.12.00 standard that mandates the tolerance of ± 7.5% for two winding transformers that have been impedance > 2.5%. For the impedance values ≤ 2.5% the tolerance is ± 10%. For three zig–zag windings and autotransformers of the tolerance is ± 10%. IEC 60076-1 mandates the tolerance of ± 7.5% for two winding transformers with a impedance values > 10% and ±10% tolerance for the impedance values < 10%. Deviation or inaccuracy of the impedance estimations can cause huge economic losses to transformer manufacturers. Thus an accurate technique to calculate an impedance value of great interest to the designers is short circuit (SC) test in [1].

The computation of leakage reactance to be obtained transformer impedance has been approached with the different procedures in [2] - [4]. Current techniques applied in a design stage are presented in [6]. In this work a new technique was developed to compute leakage flux with the better accuracy, and therefore to compute power transformer losses and resistance. The proposed method takes into account material space, cooling ducts, and voids on the transformer windings. The Power Transformer is used to artificial Neural Network method.

With the value of the resistance, it is possible to determine all the magnetic flux linkages present in winding conductors. This paper presents a technique that will be improving current methods of calculating leakage reactance in a power transformer. A more accurate value of leakage reactance will lead to a better approximation of the transformer. The technique is easily programmed and the proposed in this work has been tested by a transformer manufacturer.

II. Compute Leakage Flux the Power Transformer is Measured Under Different Conditions

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Electromagnetic induction produces an electromotive force within a conductor which is exposed to time varying magnetic fields. Transformers are used to increase or decrease the alternating voltages in electric power applications. A varying current in the transformer's primary winding creates a varying magnetic flux in the transformer core and a varying field impinging on the transformer's secondary winding. This varying magnetic field at the secondary winding induces a varying electromotive force (EMF) or voltage in the secondary winding due to electromagnetic induction.

Making use of Faraday's Law (discovered in 1831) in conjunction with high magnetic permeability core properties, transformers can be designed to efficiently change AC voltages from one voltage level to another within power networks. Since the invention of the first constant potential transformer in 1885, transformers have become essential for the transmission, distribution, and utilization of alternating current electrical energy. A wide range of transformer designs is encountered in electronic and electric power applications. Transformers range in size from RF transformers less than a cubic centimeter in volume to units interconnecting the power grid weighing hundreds of tons.

The core temperature is measured with a thermometer, with readings taken with the transformer "cold" and "hot." With these two readings, the temperature rise is calculated. For example, if we have a reading of 25 [degrees] C "cold" and 75 [degrees] C "hot," then the temperature rise is 50 [degrees] C. The average winding temperature rise is determined by measuring the resistance of a winding when it's "cold" and again when the winding temperature has stabilized under full load. From the difference in the resistance readings, the average temperature is calculated for each winding.

With this test we search determinate the pure ohmic resistance from each phases windings both in high and low voltage and it exist a tap changer in each position. What in a first approach can be easy to measure, it's not so, because it is necessary to make flow relatively high currents to register the usual low resistance values μΩ/mΩ/Ω with the required precision. This current must also flow through the equivalent inductances of the transformer. To overcome the above short comings, the following enhanced high efficiency strategies have been proposed using power transformer.

III. METHODOLOGY

an artificial neural network (ANN) is a network inspired by biological neural networks (the central nervous systems of animals, in particular the brain) which are used to estimate or approximate functions that can depend on a large number of inputs that are generally unknown.

A. Supervised Learning

The ANN learns to approximate the function from the inputs to the outputs.

B. Reinforcement Learning

The reinforcement signal tells how well the true output.

The artificial neural network of many rules is available. The Forward early rule is used in the project. The forward early rule is used in approximate value in power transformer.

IV. PROPOSED METHOD

In the proposed method enhanced under different condition is employed. The accuracies in the current and traditional methods used to calculate the leakage values of power transformers can cause power loss in the transformer manufacturing industry. This work presents a technique to calculate the leakage reactance in power transformers with higher accuracy.

The method takes into account the effects of core material, using the image method as well as details for the windings and conductors, hollow space on tap sections, and cooling duct spaces. The proposed method has been validated with the standard superconducting.

It is important to mention that this accuracy can be maintained as long as the deviation between the design dimension and the manufacturing dimension does not exceed ± 4 mm .The formulas presented here can be adapted to current transformer design software to calculate the leakage reactance of any windings configuration, demonstrating the practical importance of this research. It implements a kind of ANN logic control.

Efficiency is equal to the ratio of output to input. Assess physical condition of the transformer (Geometry of Specimen).Attempting to detect winding movement or deformation.

Flux due to the current in the primary winding that does not link the secondary and the flux due to the current in the secondary winding that does not link the primary winding.

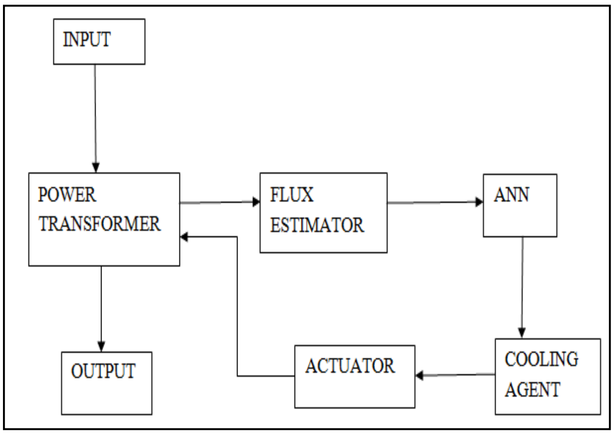

Fig. 1: Proposed Block Diagram

The input supply is given to the power transformer. The output of transformer is delivered to the flux estimate. Find the flux value and output is given to the artificial neural network. This output is given to the Cooling agent. The Cooling agent is Cooling to the value (value mean air, gas, oil anything else) and given through actuator. The actuator is control the over load value. The actuator is delivered to output of power transformer and finally given the output. The under different condition of temperature value is found. The result is Less Temperature Level, High Efficiency, Power loss is less.

The control signal is relatively low energy and may be electric voltage or current, pneumatic or hydraulic pressure, or even human power.

The key advantages of this topology compared to the conventional topologies include reduced temperature level of the transformer and increase the efficiency.

V. RESULT

Power transformer testing is calculating the temperature level. Because the transformer produce a high temperature. So reducing the temperature, find out the resistance value, losses value. Those values are reduced automatically temperature will be reduced. The flux value is 0.1 whether. The leakage reactance value is 0.004Ω. The efficiency value is 93%. The temperature value is 60°. The power loss value is 0.67kw.

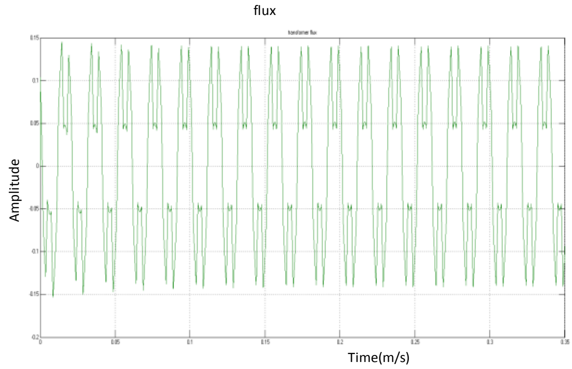

Fig. 2: Flux waveform

The starting value of efficiency 78% and after sometime the operation value is increased.

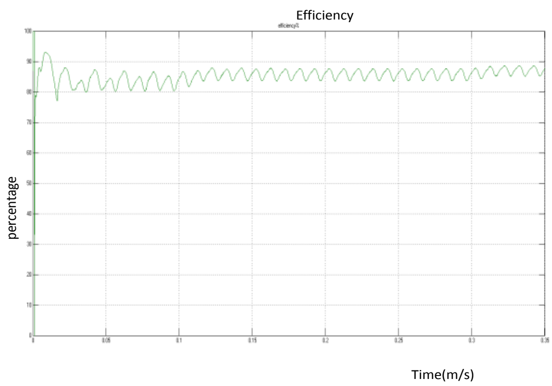

Fig. 3: Efficiency waveform

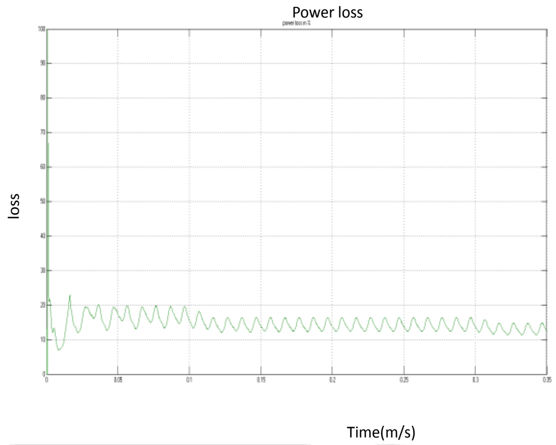

Fig. 4: Power loss waveform

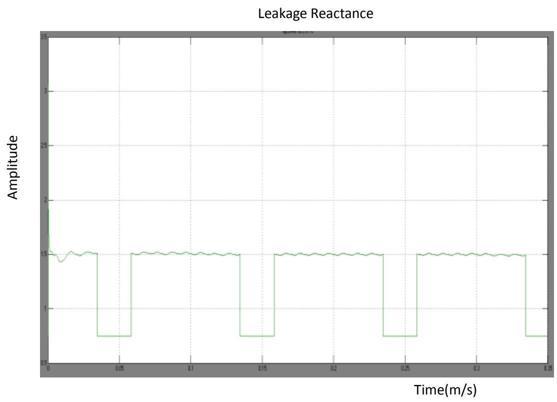

Fig. 5: Leakage reactance waveform

		X-axis		Y-axis
Flux	0.05	0.01	0.15	0.14 whether
Efficiency	0.05	0.01	5	93%
Power loss	0.05	0.01	10	0.67kw
Leakage Reactance	0.05	0.01	1	0.004 Ω

Table 1:

VI. CONCLUSIONS

The power transformer testing to reducing the temperature level in applied to Artificial Neural Network Logic Control. The developed technique is based on computing the flux produced by each in the windings. Thus, the fluxes are obtained by applying the concept of under different condition. The obtained analytical calculating of the transformer flux, Losses and resistance with temperature in the power transformers. Leakage reactance was computed for twelve power transformers with different coil configurations. The result is obtained by simulation verified used in the artificial neural network logic control. The Future Work is different algorithm is used in this project.

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