

A Literature Review: Traditional and Advanced Protection Schemes of Power Transformer

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ABSTRACT: *In a power grid network, power transformers play a crucial role in ensuring stable electricity supply. Customers. This paper introduces the idea of various forms of transformer security so that it will be more useful for investigating the transformer's security mechanism. An attempt is made in this paper to bring together innovations in the defense about the transformer. Efforts to cover all the methods and philosophies used to that end have been created. The article contains the largest number of the transformer's new techniques and conventional techniques. Many essential components are mounted in the transformer, which is in an uncommon condition, these have to be safe and very expensive. In the power grid, the transformer does a fine job of adjusting the voltage In order to maintain reliability in the system, it is necessary to maintain proper protection for the transformer and the current stage. Typically, a well-designed the transformer security device offers a great existence without uninterrupted interruptions.*

KEYWORDS: *Power Transformer, Fault statistics, Fuzzy set method, Artificial Neural Network Approach Overcurrent protection, Differential protection, Inter-turn fault, Earth-fault protection, Traditional method of protection..*

INTRODUCTION

The function of protective relaying is to initiate the prompt removal of the faulty element from service in order to minimize the damage to the system. Rockefeller first presented the role of digital computers in 1969. Later on, with the development of the microprocessor in early seventies, its role in digital protective relays has become a very attractive option. Among the various elements of the power system, the power transformer is one of the important elements. Due to its importance, its protection needs to be fast and reliable. Hence, significant work has been done in this area. The transformer is part of the power system, so it is necessary for the transformer to have an adequate protection system. Usually, back up

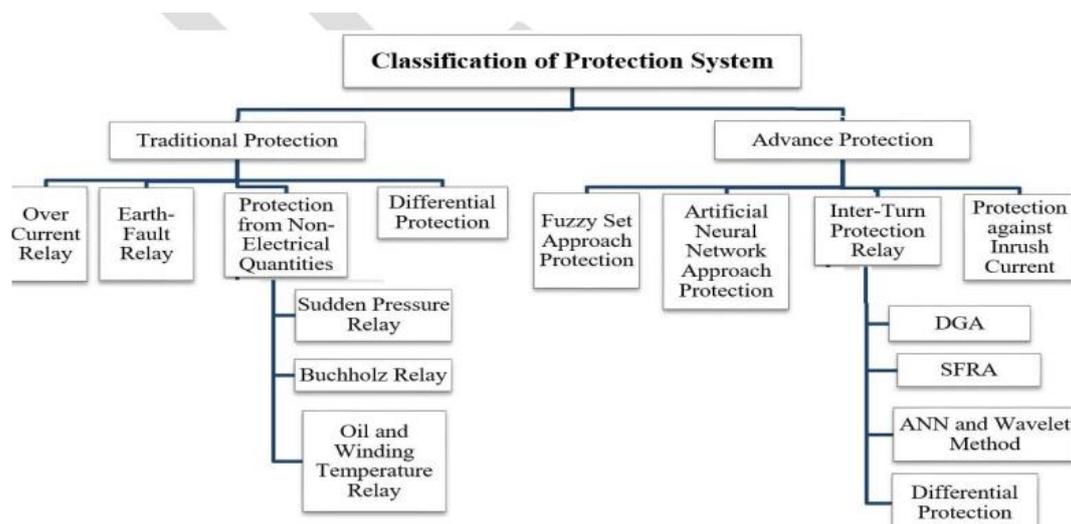
Protection for the safe transformer should be needed because if the relay or circuit breaker fails to work then the possibility exists. It is possible to destroy the entire transformer, so it is not economical. The operation of transformers can be categorized as follows: regular operation, magnetizing inrush, over-excitation, and fault state. The relay could not have been used for the first three operating conditions, operate, but the relay must operate with any fault. The transformer's cost and weight are high and we cannot bear the transformer clearing up for the maintenance department

FAULT STATISTICS

Mostly, due to winding and tap changer near about 70% faults occurred in the transformer and other fault occurring possibilities are quite low as possible so winding and tap changer is the main reason to cause the fault in the transformer. So transformer protection under abnormal condition is great challenging part to engineer. Loose connections are involved as the initiating event as well as insulation failures. The different category includes CT failure, external faults, overloads, and damage in shipment. These failures can be identified by sophisticated online monitoring devices (e.g. gas-in-oil analyzer) before a serious incident occurs. Due to these failure rate observation, proper transformer protection gear is important to maintain continuity of the power supply. So this paper represents various types of the transformer protection system.

ADVANCED PROTECTION SYSTEM

Fuzzy Set Approach for Transformer Protection:



The principle of Fuzzy Set theory was first developed in 1965 by Zadeh scientist for dealing with uncertain and ambiguous properties of the incidents[1]. And the fuzzy set definition was first used in 1979 for power system security. Accordingly, the theory of fuzzy sets can be counted as the generalization of the principle of the regular set. In fuzzy set theory, it is possible to alter the element's association continuously. Ever since Fuzzy Logic is a very useful mathematical medium to solve decision-making problems, using heuristic expertise, expert knowledge, and experience[2]. Thus, voicing quantitatively unknown values and the relationship between them is a very strong tool. A vital part of the electrical power system is the transformer. To magnify conventional fault detection sensitivity fuzzy logic methods are used by the percentage differential current relaying algorithm. Fuzzy inference is a technique that makes a choice in parallel. Because of this property, during the process there is no data destruction and thus final fault detection would be much more this is more accurate than conventional relaying methods. Rather than numerical variables, Fuzzy logic utilizes linguistic variables. The mechanism When a numerical variable (crisp or real number) is transformed into a linguistic variable (fuzzy number), it is called a linguistic variable (fuzzy number)[3].

The following advantages shows the fuzzy logic based approach:

- The fuzzy based relaying algorithm is not allowed to operate unnecessarily operation of the relay in the event of magnetizing inrush with low second harmonic component and internal faults with the high second harmonic component. So these results enhance accuracy and robustness against the change of condition in the power system[3].
- Due to this fuzzy algorithm relay obtain high sensitivity to detect fault detection and operate with average tripping time of about 3/4 cycles. Therefore, the method is reliable and speedy[4].

Artificial Neural Network Approach Protection:

An artificial neural network (ANN) is the second most influential mathematical method of recent times, attracting researchers to Answer the transformer safety challenge[5]. The ANN's characteristic attribute is that it considers the information acquired Gained during training and reacting in the most suitable way to new events provided the experiences gained during the training phase[4]. The model of the ANN is prepared according to network architecture, transfer function, and learning rule. The architecture is concluded by corresponding weights and connection scheme. The objective of the training process is to adjust all ANN weights to obtain minimal deviation between the target and calculated ANN outputs in relation to the mean value of all input samples[6].

The following events have to be considered in applying an ANN approach:

- No fault situation
- Energization
- External fault
- Turn to turn internal fault
- Turn to earth internal fault

Protection against Inrush current:

The transformer is a critical ingredient of the electrical power system. Usually, by utilizing differential protection transformers are being protected. But whenever a transformer is energized, sometime malfunctioning may take place in the differential protection due to inrush current. Some techniques are used to depreciate the fault[7].

These approaches are like the per-phase method, the method of cross blocking, the method of average percent blocking, and the method of harmonic sharing. The fuzzy logic paradigm was then implemented in order to divide the magnetizing inrush current from the internal fault. Differential security was eventually introduced, which was based on the wavelet Transform Packet. Then the inrush blocking method based on mathematical morphology was used[8].

CONCLUSION

This paper provides the simple, advanced level data and provides an overview of the various types and schemes of the security for transformers. This paper refers to the numerous sophisticated and conventional protective relays used for the transformer. There are several problems with the transformer, so proper protective gear arrangement is needed to protect the transformer. The safety systems that have been developed so far can protect the transformer effectively and mitigate the risk of enormous destruction. The advantage of this approach is that it is an automated method of defense that involves no manual labor. This definition may be, in fact, tampered with no difficulty.

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