

Impact of Current Transformer (CT) saturation on the differential protection scheme of a Power Transformer



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Abstract

Power system not only has the capability to meet the present demand but it also has the flexibility to fulfill the future demand. That's why we have to design a power system that can protect the power system from various types of faults and ensures continuity of supply. The main objective of power system protection (PSP) is to protect the electrical system from faults and minimize the risk of damage to the electrical equipment's. In this way the entire electrical system is safeguarded against damage and minimizes the equipment repair or replacement cost. Power system protection also provides safety to the personnel dealing with the electrical systems. The quality of a protection system is that it should be reliable in case of dependency and security, a good protection system is the one that should trip whenever there is a fault and remain inoperative during healthy conditions. Power transformer is the most costly equipment in the power network that is often protected mainly by differential relay. The cost of a new power transformer, or repair of a damaged one and the time required in purchasing, repair or installation should be minimized as far as possible. The expected results from this work would be helpful in improving the performance of a differential relay receiving currents from CTs that saturate. This will be a great achievement in the field of power system protection, and will help in protecting a power transformer in a better and more efficient way. The result gather from research feather utilize for research publication. It would also beneficial for the authorities who use the protection system In Pakistan. It help to enhance the protection of power systems. Differential protection is an important protection for the electrical components such as transformers, generators and busbars, it operates when the magnitude or phase difference between two or more similar electrical quantities exceeds from a pre-set value.

When one of the CTs (or both CTs) associated with the differential protection scheme of a power transformer saturates, incorrect secondary currents are produced which do not reflect the true primary line currents. This causes false operating current to appear in the differential relay's operating coil and causes relay unintended maloperation.

In this thesis, I developed a model power transformer along with its differential protection scheme in MATLAB/Simulink environment, Simulate saturation effects of the current transformer by using IEEE Power Systems Relaying Committee's CT saturation data to analyze the impact of current transformer's saturation on the differential protection scheme the power transformer and Suggest/develop methods to minimize the malfunctioning of the differential relays due to CT saturation.

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List of Abbreviations

PSP	Power system protection
PSO	Power system operation and control
CT	Current transformer
PT	Potential transformer
IEEE	Institute of Electrical and Electronics Engineers
EHV	Extra high voltage
OLTC	On-load tap-changer
AC	Alternating Current
DC	Direct Current
HVDC	High voltage direct current
HVAC	High voltage alternative current
PST	Phase shift transformer
EMTP	Electro-Magnetic Transients Program