

# **Transformer saturation modeling to optimize the differential protection of the transformer**

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**Abstract** Due to the sensitivity of equipment protected by the differential protection, improving the differential protection accuracy is essential. One of the main factors affecting the accuracy of differential relays, is the current transformers saturation phenomenon. Because of that, this phenomenon, is an as unpredictable phenomenon, predict or estimate the measurement error caused by saturation is impossible and, without detailed modeling and analysis of current transformer saturation behavior, relays should be adjusted to the safer situation. It can causes the lower sensitivity and speed of detection of some internal faults. In this thesis, the new models to model and compensate the impact of current transformer saturation are proposed. First, vision, needs and goals of research, are presented and a brief introduction to the phenomenon of current transformer saturation is introduced. After reviewing some of the previously proposed methods for modeling and compensation of current transformer saturation effect, a new method for modeling and compensation of current transformer saturation phenomena is presented. In this method, the current transformers core characteristic equation, in both saturated and unsaturated be considered. And, after solving nonlinear equations of the of current transformers, current transformer saturation is detected. In addition, with the new compensation method, the primary current waveform is estimated, by core current transformer characteristic and secondary current samples In the end, the accuracy of the proposed methods in modeling and rapid detection and accurate current transformer saturation phenomenon has been investigated and the factors influencing the phenomenon of AC and DC current transformer saturation is investigated. Also, the proposed compensation model accuracy has been studied and shown that, using the proposed method, the current transformers primary current can be predicted with acceptable accuracy in both AC and DC saturations.

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**Keywords : Current Transformer, Saturation, Modeling, Compensation**

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