ATP Simulation for Relay Application and Testing for Transformer Protection

Transformers are very important elements of any power system. Unfortunately, they are subjected to faults and abnormal conditions which can affect the operation of not only the transformer itself but also other equipment connected to the transformer. Thus, it is very essential to provide sufficient protection for transformers and at that provide selectivity and sensitivity of the protection.

Nowadays microprocessor relays are widely used to protect power equipment. Current differential and voltage protection microprocessor relays are used in protection of transformer applications and provide fast and sensitive multi-level protection of transformers as well as monitoring of transformer conditions and circuit breakers.

The scope of this work included simulation of such internal faults as turn-to-turn and turn-to-ground faults for two step-down power transformers with capacity ratings of 11.2 MVA and 290 MVA. These simulations were applied to a microprocessor relay to check its sensitivity for internal faults in these transformers. The elements responsible for detecting turn-to-turn and turn-to-ground faults are the negative-sequence percentage differential element and restricted earth-fault element respectively.

During severe internal faults current transformers can saturate and slow down the speed of relay operation which affects the degree of equipment damage. Saturation of current transformers was also studied in this work.

All the simulations of internal fault conditions as well as saturation of current transformers were performed in the Alternative Transients Program (ATP) utilizing the internal faults model for three-phase two-winding transformers.

The tested microprocessor relay was the SEL-487E current differential and voltage protection relay.