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Simulation-Based Investigation of Ferroresonance in Different Transformer Configurations

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Abstract : Ferroresonance poses a substantial threat to the quality and reliability of power distribution systems due to its inherent characteristics of sustained overvoltages and currents. This paper aims to enhance the understanding and reduce the ferroresonance threat by investigating the susceptibility of different transformer configurations using MATLAB/Simulink simulations. To achieve this, four 200 kVA transformers with different vector groups (D-Yn, Yg-Yg, Yn-Yn and Y-D11) and core types (3-limb, 5-limb, single-phase) were systematically exposed to controlled ferroresonance conditions. The impact of varying the length of the 11 kV cable connected to the transformers was also examined. Through comprehensive voltage, current and total harmonic distortion analyses, the performance of each configuration was evaluated and compared. The results of the study indicate that transformers with Y-D11 and Yg-Yg configurations exhibited lower susceptibility to ferroresonance in comparison to those with D-Y11 and Yg-Yg configurations. This implies that the Y-D11 and Yg-Yg transformers are better suited for applications with high risks of ferroresonance. The insights provided by this study are of significant value for the strategic selection and deployment of transformers in power systems, particularly in settings prone to ferroresonance. By identifying and recommending transformer configurations that demonstrate better resilience, this paper contributes to enhancing the overall robustness and reliability of power grid infrastructure.

Keywords : cable-connected, core type, ferroresonance, over voltages, power transformer, vector group
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