World Academy of Science, Engineering and Technology
International Journal of Energy and Environmental Engineering
Vol:17, No:09, 2023

Modeling and Minimizing the Effects of Ferroresonance for Medium Voltage Transformers

Authors : Mohammad Hossein Mohammadi Sanjani, Ashknaz Oraee, Arian Amirnia, Atena Taheri, Mohammadreza Arabi, Mahmud Fotuhi-Firuzabad

Abstract : Ferroresonance effects cause overvoltage in medium voltage transformers and isolators used in electrical networks. Ferroresonance effects are nonlinear and occur between the network capacitor and the nonlinear inductance of the voltage transformer during saturation. This phenomenon is unwanted for transformers since it causes overheating, introduction of high dynamic forces in primary coils, and rise of voltage in primary coils for the voltage transformer. Furthermore, it results in electrical and thermal failure of the transformer. Expansion of distribution lines, design of the transformer in smaller sizes, and the increase of harmonics in distribution networks result in an increase of ferroresonance. There is limited literature available to improve the effects of ferroresonance; therefore, optimizing its effects for voltage transformers is of great importance. In this study, comprehensive modeling of a medium voltage block-type voltage transformer is performed. In addition, a recent model is proposed to improve the performance of voltage transformers during the occurrence of ferroresonance using damping oscillations. Also, transformer design optimization is presented in this study to show further improvements in the performance of the voltage transformer. The recently proposed model is experimentally tested and verified on a medium voltage transformer in the laboratory, and simulation results show a large reduction of the effects of ferroresonance.

Keywords : optimization, voltage transformer, ferroresonance, modeling, damper
Conference Title : ICREA 2023 : International Conference on Renewable Energy and Applications
Conference Location : Vancouver, Canada
Conference Dates : September 25-26, 2023