Extraction of winding parameters for 33/11 kV, 30 MVA transformer based on finite element method for frequency response modelling

ABSTRACT

This paper proposes an alternative approach to extract transformer's winding parameters of resistance (R), inductance (L), capacitance (C) and conductance (G) based on Finite Element Method (FEM). The capacitance and conductance were computed based on Fast Multiple Method (FMM) and Method of Moment (MoM) through quasi-electrostatics approach. The AC resistances and inductances were computed based on MoM through quasi-magnetostatics approach. Maxwell's equations were used to compute the DC resistances and inductances. Based on the FEM computed parameters, the frequency response of the winding was obtained through the Bode plot function. The simulated frequency response by FEM model was compared with the simulated frequency response based on the Multi-conductor Transmission Line (MTL) model and the measured frequency response of a 33/11 kV, 30 MVA transformer. The statistical indices such as Root Mean Square Error (RMSE) and Absolute Sum of Logarithmic Error (ASLE) were used to analyze the performance of the proposed FEM model. It is found that the simulated frequency response by FEM model is quite close to measured frequency response at low and mid frequency regions as compared to simulated frequency response by MTL model based on RMSE and ASLE analysis.