Modern methods of electrodynamic forces calculation in power transformers.

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In this paper the authors reviewed modern methods of electrodynamic forces calculation in power transformers and considered new way to improve accuracy of calculations. The accuracy of an electrodynamic force calculation mainly determinates by accuracy of magnetic field distribution calculation, because such kind of the calculation usually very complicated, especially in a nonlinear system, like a transformer. One of the modern ways to solve such problems is Finite Element Method analysis, which helps to find numerical solutions of system of nonlinear equations. The authors considered method of calculation of the electrodynamic forces, which combined with the FEM analysis of the magnetic field and accounting influence of the external electric network. According to this method, axial and radial electrodynamic forces are determinated in every turn of transformer winding, which can be very useful for mechanical strength analysis. The process of calculating is shown on ex-ample of three phase group of single phase transformers ORTS-417000/750/24/24 in different operating conditions. Based on the results of the calculations, graphs of the distribution of electro-dynamic loads on the turns of the windings, graphs of the magnetic field distribution in the core and near the windings were constructed. The proposed methods for calculating electrodynamic forces can be useful in the manufacturing of the new trans-formers, allowing designers to reduce the cost of field tests by identifying and eliminating the weak points at the stage of project planning.

Key words: transformer, electrodynamic withstand, electrodynamic force, FEM analysis, transient analysis.