Load Noise Calculation of a Three-Phase Power Transformer

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Abstract

Vibrations and noise of high power transformers have attracted considerable experimental and theoretical interests over last few years [1, 2]. For such transformers operating under high voltage (~ 100 kV) and power (~ 100 MVA), noise generated is significantly attributed to load noise caused by winding vibrations [1]. In this study, we present a two-step finite element calculation which enables direct comparison with measurements from standard full-load tests. A 2D axis-symmetric electromechanical study is first carried out to calculate vibrational displacements in winding due to Lorentz forces in a single pair of primary and secondary windings. Calculation also considers back emf induced in the windings due to their vibrations. A 3D acoustic-structure simulation involving full geometry of the transformer and its surrounding then follows to calculate the pressure and sound pressure level distribution (Figure). Calculated displacements from the 2D simulation are mapped onto the three pairs of windings of the transformers as phase-added sound sources. Extracted sound pressure level values at different points around transformer enclosure provide direct comparison with standard full-load test measurements.

1. E. Dogan, and B. Kekezoglu, International Journal of Energy and Power Engineering, Vol 10, No:1, 2016.
2. C. H. Hsu,Y. M. Huang, M. F. Hsieh, C. M. Fu, S. Adireddy, and D. Chrisey, AIP Advances 7, 056681, 2017.

Figures used in the abstract

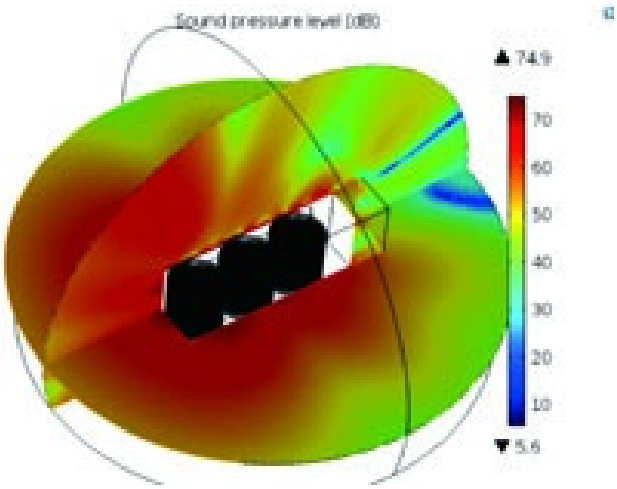

Figure 1: Calculated Sound pressure level distributions outside the transformer enclosure