Improved Analysis and Modelling of Leakage Inductance for Planar Transformers

Planar transformers have often been mistaken to essentially have lower leakage inductances. The "radial effect" is a nature characteristic for planar windings due to a higher aspect ratio of conductor width to conductor thickness, which gives a reduction in leakage inductance. Traditional formulas for leakage inductance in traditional transformers where the winding width is much smaller than the winding height are not suitable for planar transformers. This paper specifically tailors the traditional 1-D solution of leakage inductance by decomposing the leakage flux into longitudinal and transversal flux. In this manner the "eddy current effect" and the "radial effect" in leakage inductance can be analyzed individually. The proposed new formula including both ac (high frequency eddy current effect) and dc effects (radial effect) offers an accurate prediction of leakage inductance in planar transformers. Finite Element Analysis (FEA) and measurements are carried out to validate the proposed formula.

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