High Frequency AC Inductor Analysis and Design for Dual Active Bridge (DAB) Converters

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The dual active bridge (DAB) converter is an isolated bidirectional dc-dc topology which is the most critical part for the power conversion systems such as solid-state transformers (SST). This paper focuses on analysis and design of high frequency ac inductors which are the power interfacing component in DAB converters or DAB's derivative topologies for transferring energy between the primary and secondary sides. The DAB converter’s operation principles, and the corresponding voltage and current stresses over its ac inductor are analyzed. Hereby, six diverse winding arrangements are studied in order to find a design having the lowest ac resistance and core loss. Core loss is calculated by both GSE and iGSE methods, and then the results are compared under two operating conditions. Based upon the finite element method (FEM) simulation, winding losses are investigated. Finally, the case in which the core loss and the winding loss are almost equal is selected as the optimal one. The experimental results are presented to verify the validity of the analysis and design.

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