Isolated Full Bridge Boost DC-DC Converter Designed for Bidirectional Operation of Fuel Cells/Electrolyzer Cells in Grid-Tie Applications - DTU Orbit (09/11/2017)

Isolated Full Bridge Boost DC-DC Converter Designed for Bidirectional Operation of Fuel Cells/Electrolyzer Cells in Grid-Tie Applications

Energy production from renewable energy sources is continuously varying, for this reason energy storage is becoming more and more important as the percentage of green energy increases. Newly developed fuel cells can operate in reverse mode as electrolyzer cells; therefore, they are becoming an
attractive technology for energy storage grid-tie applications. In this application dc-dc converter optimization is very challenging due to the large voltage range that the converter is expected to operate. Moreover, the fuel-electrolyzer cell side of the converter is characterized by low voltage and high current. Dc-dc converter efficiency plays a fundamental role in the overall system efficiency since processed energy is always flowing through the converter; for this reason, loss analysis and optimization are a key component of the converter design. The paper presents an isolated full bridge boost dc-dc converter (IFBBC) designed for this new application focusing on losses analysis. The system topology is briefly discussed and the major concerns related to the system, cells stacks and converter operating points are analyzed. The dc-dc converter losses are modeled and presented in detail; the analysis is validated on adc-dc converter prototype rated at 6 kW 30-80 V 0-80 A on the low voltage side and 700-800 V on the high voltage side (for a grid-tie application). The prototype is based on fully planar magnetic, Si MOSFETs, Si IGBTs and SiC diodes; efficiencies up to ~96.5% and ~97.8% were demonstrated depending on the
converter operating point.

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