Analytical Comparison of Dual-Input Isolated dc-dc Converter with an ac or dc Inductor for Renewable Energy Systems - DTU Orbit (06/01/2019)

This paper presents two configurations of dualinput (DI) or three-port (TPC) isolated dc-dc converters for hybrid renewable energy systems such as photovoltaics and batteries. These two converters are derived by integrating an interleaved boost converter and a single-active bridge converter with an ac inductor as a power interfacing element or phase-shift softswitching converter with an output dc inductor. Both converters are controlled by a pulse-width modulation and phase-shift hybrid modulation scheme. The two converter topologies are, even though quite similar from the topological and control perspective, distinct in operation principles, voltage/power transfer functions, loss distributions, soft-switching constraints, and power efficiency under the same operating conditions. Moreover, the inductor design differs greatly between these two cases. In this paper, a comprehensive comparison is given for the first time and thereby the corresponding design tradeoffs are discussed. Finally, a laboratory 1 kW prototype is constructed and tested to verify the theoretical analysis.