Rafał Kopacz

Title: Alternative common-leg coupled inductor configuration in a three-level interleaved dc-dc converter.

Abstract:
The study investigates an alternative coupled inductor structure in a three-level interleaved dc-dc converter. The novel common-leg coupled inductor configuration is proposed, and available modulation methods are explored and theoretically analyzed, focusing on the influence on current ripples, efficiency, and common-mode noise. The idea is further validated using a medium voltage SiC-based bidirectional converter designed for battery storage application in a bipolar EV charging station, tested at up to 1 kV and 10 kW. Moreover, the comparison shows that the proposed method shows a smaller volume when stood against the standard approach with several single inductors, comparable performance but with a simpler magnetic design than the tapped inductor solution, and full current controllability, unlike the single-inductor approach. Finally, using the proposed technique, common-mode noise can be entirely limited, allowing the minimization of supplementary filtering. All in all, the proposed inductor configuration can be effectively and competitively used in modern three-level dc-dc converters.

Keywords:
Interleaved dc-dc converter, coupled inductor, EV charging