Efficient power processing through power electronics circuits has been a popular academic field for the past decades, especially after “green” vehicle applications based on fuel cells, batteries and super-capacitors emerged as alternative sources of propulsion for transportation. Dc-to-dc converters found their places in such applications as voltage/power regulators where relatively lower voltages with higher currents are to be handled. Among various converter topologies proposed and used in the literature, Primary Parallel Isolated Boost Converter (PPIBC) is a good candidate for such applications due to its simplicity and ability to handle higher currents.

Design of magnetic structures like transformers and inductors is part of power electronics engineering in which trade-offs exist between size, price and losses. In higher currents this becomes even more challenging since conventional wire wound design approach has some shortcomings. It is possible to use copper foil in windings however this will increase the amount of handcraft during manufacturing; so academic attention was needed for this part of low voltage high current switching converter design.

Planar magnetics and integration of magnetic components are becoming more widely used by switch mode designers since there is a trend towards high power density, high switching frequency and higher efficiency. Planar magnetic components are also suitable for Printed Circuit Board (PCB) compatible design which results in easier manufacturing. Integration of magnetic components together with planar magnetic technology offers unique solutions where some of the contributions of this thesis came from.

During this research the aim was to design a dc-to-dc converter module based on PPIBC topology for a fuel cell operated forklift manufactured by H2Logic A/S. This thesis is written based on the academic outcomes during this design process. Various aspects of PPIBC have been investigated and a number of contributions to the literature have been made.

- An integrated transformer structure has been proposed for PPIBC where modular design with less core volume and core loss due to flux cancellation has been obtained.
- An inductor with integrated current balancing transformer has been applied to PPIBC eliminating the need for a separate current balancing transformer. -Transformers and inductors of a PPIBC have been integrated into a single magnetic structure.
- Different current balancing configurations for PPIBC have been investigated.
- A modeling approach to PPIBC has been proposed for closed loop control.
- A bidirectional version of PPIBC has been built and tested successfully.

**General information**

State: Published
Organisations: Department of Electrical Engineering
Contributors: Sen, G.
Number of pages: 180
Publication date: 2012

**Publication information**

Publisher: Technical University of Denmark (DTU)
ISBN (Print): 978-87-92465-77-1
Original language: English
Electronic versions:
GS_PhDThesis_updated.pdf
Research output: Research › Ph.D. thesis – Annual report year: 2013