Master Thesis

Design and Evaluation of Power Inductors for DC/DC Converters Operating in Discontinuous Conduction Mode

Discontinuous conduction mode (DCM), boundary conduction mode (BCM), and quasi-resonant (QR) operation of DC/DC and AC/DC converters show significantly higher inductor losses when compared with continuous conduction mode (CCM). Considering DCM, the inductor losses are mainly determined by core losses due to large ripples in the magnetic field. Further parameters are the core material, the DC offset, the frequency, the duty cycle and the waveform of the current. Conductor losses, on the other hand, are due to the DC resistance of the used material as well as the skin and the proximity effect.
Selecting the proper inductors for DCM power applications (10-100W) is very challenging since off-the-shelf inductors are optimized for CCM operation. However, DCM, BCM, and QR operation offer several advantages compared to CCM, e.g., less switching losses or less electromagnetic interference.

This master thesis focuses on the design and evaluation of power conductors for DCM applications. Characteristics like core material (ferrite vs. powder), permeability and winding technique are to be considered and compared. Based on the outcome of the thesis, a designer should be able to implement the power conductor with the highest efficiency for a given application that is determined by various parameters, e.g., inductance, frequency, duty cycle, and power,

The following tasks are to be performed:

1. Literature survey on the design of power inductors and the selection of cores
2. Design and implementation of various power inductors
3. Design and implementation of a test bench (PCB) for the power inductors
4. Measurements and their evaluation

What we expect:
Interests in electronic circuits and physics, autonomous working style, well documented work.

What we offer:
Intensive supervision of the thesis, well equipped laboratory, latest simulation software & data analysis tools, and free space for own ideas.

Starting Date: As soon as possible

Contact Person:
Dr. Lucas Spohn
Tel.: 0761 / 203 - 7585
Email: lucas.spohn@imtek.de

Prof. Dr.-Ing. Y. Manoli
Fritz Huettinger Chair of Microelectronics
Department of Microsystems Engineering
University of Freiburg, Germany