

## 3.5 Studienrichtung Elektromobilität und Autonome Systeme

### 3.5.1 Elektrische Antriebe

Modul EITM 110M.

Siehe gleiches Modul (EITM 110E) in der Studienrichtung „Energietechnik und Erneuerbare Energien“

### 3.5.2 Switched Mode Power Supplies

#### Module title: Switched Mode Power Supplies

Module summary
Module code: EITM 120M
Module coordinator: Prof. Dr. Alfons Klönne
Credits (ECTS): 5 CP workload: in lecture 60 h, independent study time 90 h
Semester: 1 <sup>st</sup> or 2 <sup>nd</sup> semester
Pre-requisites with regard to content: Electronics, Power Electronics, Control Engineering
Pre-requisites according to the examination regulations: none
Competencies: Upon successful completion the student <ul style="list-style-type: none"> <li>• understands the functionality and the components of switching power supplies</li> <li>• has an overview of non-isolated and isolated power supplies</li> <li>• is able to design and calculate switching power supplies in DCM and CCM</li> <li>• can efficiently design power inductors and high-frequency magnetics for switching power supplies</li> <li>• can apply control strategies to stabilize the output voltage</li> </ul>
Assessment: Assessment is done by either a written exam (90 minutes) or an oral examination (20 minutes). The form of examination will be announced at the beginning of the semester
Usability: <i>General:</i> The module provides a theoretical understanding of DC-DC converter principles, their application and design. It takes into consideration not only typical steady state continuous conduction mode (CCM), but also the partial load operating point in discontinuous conduction mode (DCM). <i>Connection with other modules:</i> Switched Mode Power Supplies focusses on calculation and design of power supplies. Starting from basic, not galvanically isolated, DC-DC converters and lossless switching the theory behind power supplies is presented. Thereafter, the main principles are transferred to more complex galvanically isolated dc/dc power supplies regarding also parasitic effects. As a typical DC-DC converter normally uses a wide-range input, it is also point of interest to determine the maximum point of converter stress during a particular design step.

Course: Switched Mode Power Supplies
Module code: EITM 120A
Lecturer: Prof. Dr. Alfons Klönne

Contact hours: by arrangement
Semester of delivery: yearly, winter semester
Type/mode: lecture 4h/week; mandatory in the study field E-Mobility and Autonomous Systems, optional in the other study fields of the program
Language of instruction: English or German; the course language will be announced at the beginning of the semester
Content: <ul style="list-style-type: none"> <li>• Principles of Switching Power Conversion</li> <li>• Role of Power Supply within power system</li> <li>• Fundamentals of Pulsewidth Modulated Switching Power Supplies</li> <li>• Basic Switching Circuits in CCM and DCM (Charge Pumps, Buck Converter, Boost Converter, Inverting Boost Converter, Buck-Boost Converter, Transformer Isolated Converters)</li> <li>• Transformer-Isolated Circuits in CCM and DCM (Feedback Mechanism, Flyback Circuit, Forward Converter, Push-Pull Circuits, Half Bridge Circuits, Full Bridge Circuits)</li> <li>• Quasi Resonant Converters</li> <li>• Magnetic Components</li> <li>• Power Stage Transfer Function</li> <li>• Compensation in Switching Regulator Design</li> <li>• Voltage and Current Control</li> </ul>
Recommended reading: Pressman, A; Billings, K.; Morey, T: <i>Switching Power Supply Design</i> , Verlag McGraw-Hill, 2009 Billings, K.: <i>Switchmode Power Supply Handbook</i> , McGraw-Hill, 1999 Maniktala, S.; <i>Switching Power Supplies: A to Z</i> , Verlag Newnes, 2006 Erickson, R.W.; Maksimovic, D.: <i>Fundamentals of Power Electronics</i> , Verlag Springer, 2001 Mohan N., Undeland, T., Robbins, W.: <i>Power Electronics, Converters, Application and Designs</i> , Wiley Verlag, 2002 Sandler, St.: <i>Switchmode Power Supply Simulation</i> , Verlag MCGraw-Hill, 2006 Brown, M.: <i>Power Supply Cookbook</i> , Verlag Newnes, 2002 Schlienz, U.: <i>Schaltnetzteile und ihre Peripherie: Einsatz, Dimensionierung, EMV</i> , Vieweg Verlag, 2012
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