Variable gain switching cells with integrated magnetic components

Summary

Short summary of the position.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Dr. Andrii Chub Dr. Dmitri Vinnikov
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between June 01, 2020 00:00 and July 03, 2020 23:59 (Europe/Zurich)

Description

The growing market for residential renewable energy generation and storage systems facilitates the development of new types of photovoltaic modules, fuel cells, batteries, micro wind turbines, etc. Operating voltage and power ratings of these emerging residential energy sources vary in a wide range. As a result, each type requires a different interface converter due to the limitations of conventional power electronics.
This project aims to a new technology enabling wide input voltage regulation range in galvanically isolated dc-dc converters. The main outcome will be in the development of high step-up dc-dc interface converters for dc microgrids, which will feature universal input capable of operation with different low-voltage sources and storages. The developed hybrid switching cells will be based on integral design combining multiphase semiconductor structures and integrated magnetic structures capable of changing their gain. This new technology will decrease the price of residential power systems due to lower capital costs resulting from mass production, lower staff training and supply chain expenses for installers.
Ph.D. student will develop novel topologies of galvanically isolated dc-dc converters and corresponding hardware and digital control methods optimizing the converter operating mode.
Project tasks:

- Development and implementation of PCB-integrated planar magnetic components
- Synthesis of switching cells utilizing low-cost PCB-integrated matrix transformer
- Synthesis and verification of topology modification control methods resulting in efficiency optimization
- Applicability study of GaN semiconductor devices and their benchmarking versus generic Si devices
- Design of control systems based on small and large signal models
- Development and verification of outer control needed for converter operation in a dc microgrid

Preferred qualifications (in order of importance):

- Experience in FE modeling of magnetic components and co-simulation with power electronics
- Practical experience in the design of power electronic converters
- Experience in design of control systems and their implementation in microcontrollers and DSPs
- Experience in the modeling of electronic circuits in PSIM or PLECS software
- Experience with PCB design (preferably using Altium Designer)
- Experience with closed-loop control systems comprising analog and digital sensors
- Good understanding of power semiconductor components and their driving

The applicants should fulfill the following requirements:

The successful candidate should hold a M.Sc. degree in Electrical Engineering. A strong background and interest in Power Electronics are expected. Prior practical experience with galvanically isolated dc-dc converters is preferred. The candidate will work in the international team and collaboration with partner universities and companies. Hence, we expect fluency in spoken and written English.

To get more information or to apply online, visit https://taltech.glowbase.com/positions/2 or scan the the code on the left with your smartphone.