Concept of Isolated Universal Bidirectional Converters for Electric Vehicle Applications

Summary

The main goal of this work is to develop the isolated bidirectional power electronic converter for EV application which realizes universal onboard charger.

Research field:	Electrical power engineering and mechatronics
Supervisors:	Dr. Dmitri Vinnikov Oleksandr Husev
Availability:	This position is available.
Offered by:	School of Engineering Department of Electrical Power Engineering and Mechatronics
Application deadline:	Applications are accepted between September 01, 2021 00:00 and September 30, 2021 23:59 (Europe/Zurich)

Description

A dc grid becomes an obvious trend in the residential power system. Recent works show that even a high-voltage dc-current distribution system is more effective than a high-voltage ac system. Due to the latest research efforts in power electronics, the high-voltage dc-current system may replace an ac system in the coming decades. The dc low-voltage distributed system may become a reality even sooner.

At the same time, it is evident that transient from ac to dc grid cannot be done immediately. In the nearest decade, we will observe a merge of dc and ac systems. As a result, the power electronics facilities that have the ability to merge dc and ac grids are required. The main goal: of this work is to develop the isolated bidirectional power electronic converter for EV application which realizes universal onboard charger.

There are several tasks to complete during the PhD study:

1. Propose the optimal power electronics topology which can link high-voltage batteries (300 V-700 V) with dc (350 V-700 V) or ac grid (single and three-phase).
2. Investigate the way of power density and cost optimization of the proposed solutions.
3. Implement conventional control algorithms for grid-connection realization along with wide input voltage regulation, maintaining SoC control technique.
4. Research and development of novel control algorithms for grid-type detecting and smooth connection/disconnection.
5. Development of scaled industrial prototype of new 5 kVA onboard charger .

Applicants should fulfil the following requirements:

- Practical experience in the design of electronic systems.
- Experience with programming of microcontrollers for power electronics application.
- Experience with electronic circuits modeling in (Matlab, PSIM or PSCAD).
- Experience with mixed signals PCB design (preferably using Altium Designer).

To get more information or to apply online, visit https://taltech.glowbase.com/positions/420 or scan the the code on the left with your smartphone.