

# Concept of Isolated Universal Bidirectional Converters for Electric Vehicle Applications

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## Summary

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*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:	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

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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).



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