

Control and testing of bidirectional DC/DC converters for battery charging stations

Prima Electro is a strategic EMS partner in high-tech sectors such as railway, energy and industrial automation. For over forty years, we have been converting ideas into full-custom embedded products, becoming the reference point for all those companies wishing to improve the features and performances of their systems with industrial-grade solutions. Always at the cutting edge of technology in power and control electronics design and production, Prima Electro offers support from the concept and preliminary analysis through the qualification and production stage, supervising the whole manufacturing process. Our business model can be summed up in the acronym DOTS (Dedicated Off The Shelf), because we are able to offer custom “end-to-end” turnkey solutions with a fast time-to-market and competitive costs.

Background:

Prima Electro is taking part in the European INCIT-EV project (Horizon2020), focusing on innovative charging solutions to accelerate the transition towards sustainable mobility and to improve the EV users experience. The first prototypes of these innovative set of charging infrastructures will be installed in different European cities including Torino. In particular, the target of the Torino use case is to realize a “park&ride” hub with slow and ultra-fast charging stations directly supplied by the tram rail-way. The proposed charging station allows the fully exploitation of the already existing and underused tram rail-way infrastructure leading to an easy diffusion of EV charging points in the urban environment. Prima Electro has been involved in the project for the design, development and production of the bidirectional battery charger called eThunder. The eThunder module embeds a DC/DC converter that regulates the charging process between the DC grid and the EV battery. Besides, the bidirectional topology allows to support the rail-way grid stability.

Type of work: Master Thesis

The goals of the thesis are the analysis and comparison of the control techniques for the high-frequency isolated DC-DC converters. The candidate, supported by the R&D department, will evaluate the control strategies in the PLECS simulation platform in order to explore the limits of the converter soft-switching operation and reduce the stresses in the components. Furthermore, the control strategies will be experimentally evaluated by implementing it in the eThunder battery charger.

The thesis activity will be carried out in the Prima Electro R&D department.

Expected tasks:

- Literature survey of the state-of-the-art topologies for the isolated bidirectional DC-DC converters (10% of time)
- Control simulation (40% of time)
- Experimental testing (30% of time)
- Hardware design considerations (10% of time)
- Documentation of all the activities (10% of time)

Requirements:

- Basic knowledge of power electronics converters principles and topologies
- Background on power electronics components
- Background of control theory and digital control
- Good knowledge of MATLAB and PLECS tools
- Basic knowledge of analog circuit design
- Analytical skills

Duration: 6-9 months

Contact:

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The master thesis project will be carried out at Prima Electro S.p.A.

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