

MULTIPHASE CONVERTERS FOR SOLAR ENERGY CONVERSION AND BATTERY CHARGING IN ELECTRIC VEHICLES

Goal of the project

Proposal of two new dc-dc multiphase converter families suitable in solar energy processing and battery charging systems.

Short description of the project

The multiphase Boost family exhibits higher static conversion ratio while maintaining a smooth input current and high efficiency.

The Buck family consists of topologies prone to be used in battery charging because of smooth output current.

Implementation period

21.11.2017 – 31.12.2018

Budget

46.500 RON (10000 EUR)

Main activities

Activity 1.1. Synthesis of a multiphase converter family based on the C-Step Down cell.

Activity 1.2. Converters design.

Activity 1.3. Model validation by simulation.

Activity 1.4. Equipment purchase.

Activity 1.5. Synthesis of a multiphase converter family based on the L-Step Up cell.

Activity 1.6. Converters design.

Activity 1.7. Model validation by simulation.

Activity 1.8. System architecture for solar energy conversion system using L-SU topology.

Activity 1.9. Component purchase.

Activity 1.10. Participation at the SACI 2018 Conference.

Activity 1.11. Practical implementation of converters. Hardware testing and practical measurements.

Activity 2.1. Payment of participation fee for EPE and PEMC conference.

Activity 2.2. System architecture for solar energy conversion system using L-SU topology. Practical measurements.

Activity 2.3. Defending the paper at the PEMC 2018 Conference.

Activity 2.4. Defending the paper at the EPE 2018 Conference.

Activity 2.5. Battery charging system based on C-SD converters topologies. Measurements and system evaluation.

Activity 2.6. Defending the paper at the ISETC 2018 Conference.

Activity 2. Paper sent to an ISI journal (letter accepted and published).

Results

The proposed topologies were validated by experiment and by being published at the following international conferences and journal.

1. I-M. Pop-Calimanu, S. Lica, S. Popescu, D. Lascu, I. Lie, R. Mirsu, „A New Hybrid Inductor-Based Boost DC-DC Converter Suitable for Applications in Photovoltaic Systems”, „Energies”, vol. 12, no.2.
2. I-M. Pop-Calimanu, S. Lica, F. Renken, R. Mirsu, G. Simion, I. Lie – „A Comparison Between Single-Phase and Two-Phase Hybrid Boost-L Converter”, International Symposium on Electronics and Telecommunications 2018, Timisoara, Romania.
3. I-M. Pop-Calimanu, S. Lica, D. Lascu, F. Renken – „A Novel Hybrid Buck-L Converter”, 20th European Conference on Power Electronics and Applications – EPE'18 ECCE Europe, Riga, Latvia.
4. I-M. Pop-Calimanu, S. Lica, D. Lascu, F. Renken, M. Gurbina, R. Mirsu – „A Novel Hybrid Step-Down DC-DC Converter”, 18th International Conference on Power Electronics and Motion Control – IEEE-PEMC 2018, Budapest, Hungary
5. M. Gurbina, I-M. Pop-Calimanu, D. Lascu, S. Lica, A. Ciresan – „Exact Stability Analysis of a Two-Phase Boost Converter”, 41st International Conference on Telecommunications and Signal Processing, Athens, Greece.
6. I-M. Pop-Calimanu, R. Mirsu – participation at the 12th International Symposium on Applied Computational Intelligence and Informatics (SACI 2018), Timisoara, Romania.
7. I-M. Pop-Calimanu – participation at the tutorial „Fast Charging Ready? Infrastructure, Topologies and Key Enabling Components, EPE'18 ECCE Europe, Riga, Latvia.

Applicability and transferability of the results:

Companies producing and implementing equipment for PV based systems can easily adopt the Boost family as also a MPPT algorithm is provided and a system is presented in order to prove its applicability. For low power chargers automotive companies can take benefit of the new multiphase Buck converter.

Research team

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