

Jury Member Report – Doctor of Philosophy thesis.

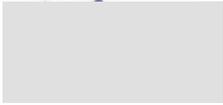
Name of Candidate: Fernando Davalos Hernandez

PhD Program: Engineering Systems

Title of Thesis: Supercapacitor Energy Storage System based on Modular Multilevel Converter with embedded self-balance control

Supervisor: Associate Professor Federico Martin Ibanez

Name of the Reviewer:

I confirm the absence of any conflict of interest Petr Vorobev (Alternatively, Reviewer can formulate a possible conflict)	 Date: 15-08-2023
--	--

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

The thesis is dedicated to topology design, theoretical analysis, numerical simulation, and experimental assembly and validation of a multi-level converter for use with super capacitors (SCs).

The Thesis is well structured and easy to follow. It contains a comprehensive literature review on different types of converters, with the proposed converter topology justified from the point of view of the required performance. The review is sufficient to provide the background for the research presented.

The theoretical analysis is performed using methods, well established in the power electronics field. Different converter switching states are considered separately with the subsequent build of an averaged model which is used for small-signal stability analysis. The theoretical analysis is then validated using numerical simulations with a standard PSIM software package.

Experimental study is done using a lab-scale converter prototype connected to real super capacitors and different modes of operation are tested.

In my opinion, all the parts – theoretical, numerical, and experimental are performed according to the existing well-established academic standards in the field of power electronics, so the work definitely corresponds to the standards of a PhD thesis.

The publications are two journal and two conference papers. I would especially note the publication at the IECON conference – which is the top conference of the society for industrial electronics. This confirms the value of the thesis results.

I have few minor questions/suggestions, that are fully optional.

1. Maybe it makes sense to add references to the figures in literature review, whenever they are borrowed from the papers cited in the text. This would make it easier to navigate the text.
2. How fast is your converter in terms of the bandwidth of your control? Alternatively, is you make a step input, what would be the speed of response?
3. Is there any difference in efficiency when operating with different power factors?
4. Is efficiency very important for SC operation? Maybe there are some other characteristics that are more important specifically for SCs?

Provisional Recommendation

I recommend that the candidate should defend the thesis by means of a formal thesis defense

I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report

The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense