

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Rahim Samanbakhsh

PhD Program: Engineering Systems

Title of Thesis: Design of power converters for renewable energy sources

Supervisor: Assistant Professor Federico Martin Ibanez, Skoltech

Name of the Reviewer: Associate Professor Henni Ouerdane

I confirm the absence of any conflict of interest

(Alternatively, Reviewer can formulate a possible conflict)

Date: 24-10-2022

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 thesis contains 7 chapters, including Introduction and Conclusion. Two entire chapters, 2 and 3, are devoted to literature reviews on two types of devices: multilevel inverters (MLIs), and impedance source converters (ZSIs). Chapter 4 provides an in-depth analysis of multilevel inverters and Z-source inverters modulations techniques. Chapters 5 and 6 are devoted to the proposed topologies for the MLIs and ZSIs respectively and show the key novel results of the doctoral work. Each chapter from 2 to 6 ends with a short concluding section that summarizes the key ideas and main points.

Interestingly, there is a contribution to the field of research statement just before the Introduction chapter, and the publication list is enriched with specific statements of the contributions to the articles and conference presentations, which are validated by the signatures of the coauthors, except for the PhD advisor.

There is a good attempt to write a clear text, but there is a need to “polish” it and pay more attention to vocabulary and grammar for ease of reading.

The table of contents should also show for each chapter the sections and subsections. The mere list of chapters is insufficient for a first overview of the work before reading the thesis.

- **The relevance of the topic of dissertation work to its actual content**

The actual content of the doctoral thesis is in line with the topic and the research question that the PhD student set out to address, notably about the design of new topologies of inverters to manage the growing share of the so-called renewable energy sources in the electric grids.

- **The relevance of the methods used in the dissertation**

The approach adopted in the thesis is quite appropriate: the design of solutions by combination of two different types of inverters to benefit from the advantages that these two types can offer while mitigating the effects of what can be seen as shortcomings. The design, the calculations and simulations were validated by experiments performed at Skoltech.

- **The scientific significance of the results obtained and their compliance with the international level and current state of the art**

The research topic is timely and highly relevant in the field of modern power systems in the context of the so-called energy transition as great efforts are invested to increase the share of renewable sources while mitigating their detrimental effects on the grid stability. The results have been published in Q1 journals and presented at reputable international conferences, which shows that the findings of the doctoral thesis are of interest to the community on the international level.

- **The relevance of the obtained results to applications (if applicable)**

The research work can be considered to be at level 3 on the TRL scale, but clearly this research was performed with a consideration of use. Obviously much work remains to be done before real-life applications, but the basic results give scope for applications.

- **The quality of publications**

The quality of the publications (articles and conferences) is very good as shown by the standards of the journals and conferences.

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

The main issue is in the writing. I would like to see a better written thesis so that the text would be on par with the scientific achievements. The level of English (vocabulary and grammar) should be improved. Vague statements should be avoided. Some references should be added in the Introduction chapters next to statements that are made and sound like opinions. One should also refrain to copy-paste part of the abstract in the Introduction or Conclusion chapters. The table of content should be completed to include sections and subsection of each chapter. Note that a title to section 4.3 is missing. In the publication list, a proper referencing also indicates the year of publication. The Conclusion chapter can be expanded, notably to explain in some more details the future work that is envisaged. I do not see the point of having

Figure 7.1 and 7.2 next to a statement like “In future works, the combination of MLIs and ZSCs topologies should be studied”.

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

