Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Ali Mazhar

PhD Program: Engineering Systems

Title of Thesis: Voltage Feasibility Boundaries

Supervisor: Prof. Janusz Bialek

Date of Thesis Defense: 09 December 2019

Name of the Reviewer: Costas Vournas

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Signature:**  **Date: 19-11-2019**

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 contribution lies mainly in developing and testing the Transversality Enforced Newton Raphson (TERN) method, with which one point on the maximum power transfer (or loadability) manifold is computed directly using some form of the transversality condition as an added equation. The major inequality constraints are included in the model developed as added equations and slack variables. The thesis also reports on a technique to track the loadability limit curve in two-, or three-parameter cases. The analysis is relevant and largely compliant with the state of the art. Following are some concerns and suggestions for improvement:

Terminology:

In general the term "Security assessment" refers to the ability of the system to withstand a set of plausible contingencies (disturbances). The work reported on the thesis can help to improve security assessment, but appropriate use of the word "security" is advised within the text. For instance "security region" needs to take into account contingencies, whereas what is meant in the thesis is feasibility or loadability region.

Comments:

1. In 2.3 Q is positive injection. It would be more reasonable to assume inequality Q<QMax instead of the opposite. This will result in a bounded feasibility space.
2. In 3.1 equation (3.3b) g=0 can correspond to a limit enforcement, e.g. V=Vmin
3. In 3.3 equation (3.30) requires a complementarity condition: t must be positive for lower Q limit, and negative for upper Q limit.
4. It is better to extend the notion of the slack bus to the so-called "distributed slack" where all generators participate in slack power sharing.
5. It is well known that for a simple zero eigenvalue (and singular value), the eigenvectors and singular vectors are equal (ref [29], p. 248). Thus a better explanation of section 6.1.1. is required.

References:

Reference [24] is the same as [11], with the editors' names listed as authors, obviously by mistake.

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*