Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Sajjad Asefi

PhD Program: Engineering Systems

Title of Thesis: Advancements in power system state estimation: innovative algorithms and solutions for enhanced reliability and efficiency

Supervisor: Assistant Professor Elena Gryazina

Name of the Reviewer: Dr. Henni Ouerdane, Associate Professor

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Date: 24-11-2023**

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 doctoral thesis manuscript is composed of 7 chapters, including the Introduction and the Conclusion. The main text is complemented by an appendix providing some technical details. Overall, the thesis reads well and is well-structured. Each chapter is quite informative. The Introduction is much too short though. I will comment on that at the end of the report.

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

The focus of the doctoral work has been to develop and implement new state estimation methods adapted to the management of modern, decentralized power grids, to ensure their stability and reliability. The problem treated is quite topical as modern power grids are not only characterized by a significant share of renewable energy sources but also by loads that have become "smart" and flexible; while useful,

these features have a detrimental impact on the stability of power grids, and any anomaly should be detected and addressed in a timely manner.

- The relevance of the methods used in the dissertation

The state estimation algorithms presented in chapter 4 cover three types: centralized, distributed, and forecasting-aided. Their implementation permits detection, classification and identification of anomalies using machine learning approach techniques.

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

The scientific significance of the results obtained by the candidate is shown by the publications of his articles in peer-reviewed journals and his presentations at peer-reviewed international conferences of high standing, hence also demonstrating that they comply with international standards and the state of the art.

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

The obtained results (development of an anomaly detection and classification algorithm; topology-robust classification solution; useful evaluation of the distributed state estimation methods; optimal power system partitioning; enhanced data transfer security; and consideration of asynchronous and delayed data transfer) clearly target their application to real-life problems as the research has been developed to improve the reliability and stability of modern power systems.

- The quality of publications

The results of the doctoral work have been published in good peer-review international journals and presented at reputable international conferences, which indicates their good quality.

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

I have no criticism to make about the scientific work; however, the Introduction chapter needs more work. First, there is not enough background information that allows the reader to quickly understand how the research work fits into the broader context of modern power grids. While the objectives have been stated, a proper research question has not been formulated. The main hypotheses that underpin the approach adopted and the methodology, are not clearly stated. The thesis should show how the hypotheses have been tested and the outcomes. Further, although there is a literature review chapter, it would make sense that works are cited and possibly briefly discussed to help with the formulation of the research questions and the hypotheses.

Reference 3 of the publication list, page 4 should be updated.

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*