

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Mile Mitrovic

PhD Program: Engineering Systems

Title of Thesis: Data-driven stochastic AC-OPF using Gaussian processes

Supervisor: Assistant Professor Elena Gryazina

Co-supervisor: Assistant Professor Petr Vorobev

Name of the Reviewer:

I confirm the absence of any conflict of interest Haoran Zhao (Alternatively, Reviewer can formulate a possible conflict)	Date: 30-09-2023
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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

Generally, the thesis is well written. The overall structure is well organized and the contribution is novel and clear. The topic of the thesis is timely. How to efficiently solve the AC CC-OPF is essential for its practical application. The proposed data-driven method using Gaussian Processes (GP) is proved to be a potential efficient solution.

Several comments to improve the quality of the thesis:

1. Regarding the **methods**, the model generalization should be discussed more. The primary idea of the thesis is to replace the standard AC-OPF equation and security constraints with a GP regression model. However, concerns arise regarding the generalization capability of this model. It is important to investigate how the model performs when exposed to data that deviates from the assumed distribution. Are there any provisions or assessments in place to ensure robustness under such conditions? By addressing these concerns and evaluating the model's performance under different data scenarios, the thesis can provide a comprehensive understanding of the model's capabilities and limitations, ultimately enhancing its applicability and usefulness in real-world situations.

2. Regarding the **case study**: The proposed CC-OPF methods are assessed using the IEEE 9, IEEE 39, and IEEE 118 bus systems, which serve as standard benchmarks. However, it is worth noting that real-world OPF scenarios often involve systems with hundreds or even thousands of nodes. Therefore, providing insights into the performance of these methods when applied to larger and more realistic benchmark systems would be highly valuable.

3. Regarding the **results**: The manuscript compares the data-driven GP CC-OPF approach with state-of-the-art sample-based CC-OPF methods. However, to provide a more comprehensive analysis, it would be beneficial to compare the results with non-sample-based CC-OPF methodologies as well.

4. Regarding the **solver**: The thesis mentions the utilization of IPOPT, an NLP solver, for solving both the full GP CC-OPF and hybrid GP CC-OPF. However, it is important to acknowledge that IPOPT might not always provide a globally optimal solution. Therefore, it would be advantageous to explain the steps taken to mitigate any potential suboptimality resulting from this choice of solver.

I noticed the candidate has published several high-level papers during the PhD study. The quality is very good!

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