

## Jury Member Report – Doctor of Philosophy thesis.

**Name of Candidate:** Saeed Osat

**PhD Program:** Computational and Data Science and Engineering

**Title of Thesis:** Percolation on complex networks and its applications

**Supervisor:** Assistant Professor Vladimir Palyulin

**Name of the Reviewer:** Nikolay Koshev



I confirm the absence of any conflict of interest

(Alternatively, Reviewer can formulate a possible conflict)

**Date:** 25.09.2021

*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 devoted to the mathematical description of the processes occurring in complex networks. Namely, the percolation in monoplex and multiplex networks is considered. Researches in this area lead to the improvement of mathematical modeling in complex systems, and the actuality of such researches follows by both growing number of applications (neuronal networks, social networks, transport systems, etc.) and permanently improving the power of modern computational systems.

The thesis starts with the introduction acquainting the reader with basics (definitions) of network analysis, a review of problems and results in this area, and a short summary of the results obtained by the Candidate. The aforementioned introduction is written in a good academic manner and meets high standards of structure, readability (including the English language), and overall quality. It avoids any ambiguity and leaves no questions, even for a reader, who is new to this area.

Further chapters of the Thesis are compiled with the articles published by the Candidate during his Ph.D. study. This is possible since the Candidate published more than five articles in WoS/Scopus indexed journals, and therefore meets requirements for the representation of a Thesis as a Coherent Academic Treatise (Skoltech Ph.D. Theses Defense Policy). The structure of the Thesis also meets the requirements of the Policy.

The results of research work are dedicated to both theory and applications of the percolation theory: avalanches in neuronal systems, generalization of leaf removal algorithm, an extension of the observability model to multiplex networks, optimal percolation on multiplex networks, etc. The novelty, the relevance of the topic and methods, and overall scientific significance of the aforementioned results are undoubtedly confirmed by the high level of journals publishing them: Physical Review Letters, Nature Communications.

During the Ph.D. study, the Candidate published 7 articles in high-rated journals (Q1 by WoS/Scopus, nature indexed). Undoubtedly, the Candidate proved his ability to perform research meeting the highest standards and, therefore, to achieve high-rated scientific results. I definitely recommend the thesis for the presentation with the aim of receiving the Ph.D. degree.

Since the Thesis is prepared in form of a coherent academic treatise and compiled of articles, the only minor comment on the thesis refers to the first – introductory – Chapter. Figure 1.4 on Page 22 should be changed since it is impossible to understand colors at the legends.

#### **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*