

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Mikhail Nikolaev

PhD Program: Engineering Systems

Title of Thesis: Concept selection of innovative complex engineering systems considering systems emergent properties

Supervisor: Professor Clement Fortin, Skoltech

Name of the Reviewer: Andrei Osiptsov

I confirm the absence of any conflict of interest

Date: 17-11-2022

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 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

This thesis is devoted to the problem of constructing an ontology model for emergent properties of a complex system.

This is a well-written and well-structured thesis. Chapter 1 is related to literature and analysis review Chapter 2 describes the ontology model. Chapter 3 contains description of the cases as applied to particular problems (coded by CDMM 1 and CDMM 2).

Critical remarks:

- The list of publications includes one paper in a refereed journal (Q1, IF=12), which is a review paper, whereas all substantial novel results are published in conference proceedings only.
- I might be coming from a different background which is too deterministic, I am accustomed to use first principles (conservation of mass, momentum and energy) to describe the motion of fluids and gases in technology applications, so for me the present work appears to be more descriptive than predictive. My key question: is it possible to use the proposed models to create new scientific knowledge, or they can only be used to describe the work done by others?
- How does the decision quality chain (Fig. 23) help to improve the decision making process?
- When we discuss emergent properties of a complex system in Chapter 3, what is the level of complexity of a mathematical problem to be solved? Is it the level of a weighted arithmetic average or something else?

The questions above are formulated in what might be perceived as a sharp manner, but it is done so only for the sake of more productive and simulating discussion.

Provisional Recommendation

YES 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