

## Jury Member Report – Doctor of Philosophy thesis.

**Name of Candidate:** Radmir Karamov

**PhD Program:** Mathematics and Mechanics

**Title of Thesis:** Machine learning enhancement of micro-CT based micromechanics of composite materials

**Supervisors:**

Assistant Professor Ivan Sergeichev, Skoltech

Professor Stepan Lomov, KU Leuven

**Co-supervisors:**

Assistant Professor Yentl Swolfs, KU Leuven

**Name of the Reviewer:** Associate Professor Alexander Safonov

I confirm the absence of any conflict of interest

(Alternatively, Reviewer can formulate a possible conflict)

  
  
Date: 22-09-2023

*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 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 application of machine learning methods for micromechanics of composite materials. The dissertation contains all the necessary sections. The topic of the dissertation corresponds to its actual content. The author has conducted significant numerical studies on machine learning-based image processing of micro-CT images of composite materials. The results obtained will significantly affect the development of methods for predicting the properties of composite materials based on micro-CT and RVE. In particular, the developed methods will allow creating RVEs with a high fiber content for short fiber composites. The quality of publications is high. However, the Jury Member has the following recommendations on the text:

1. It is necessary to improve the style of the text. There is no dot in the titles of chapters and tables. Use the same style of tables and formulas. Check the numbering of formulas.
2. It is recommended to add an overview of methods and algorithms for Machine learning-based image processing in Chapter 1.
3. Chapter 4 recommends justifying the choice of materials used.
4. Check formula (17).
5. Explain the stress designation in formula (21).
6. In Chapter 6, describe exactly for which materials the results were obtained. For example, for which material the results are given in Table 14.
7. Improve the quality of Figure 44.
8. In Table 16, explain which module is meant for E22. Give values for E33.
9. It is recommended in Chapter 6.1 to make a comparison with analytical models for calculating mechanical properties.
10. Add a legend to Figure 45.
11. It is recommended to describe how the results obtained can be applied in the engineering practice of designing new composite materials.

#### 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

Sadovnikov  
Alexander