

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:

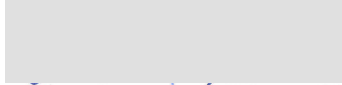
Assistant Professor Ivan Sergeichev, Skoltech

Professor Stepan Lomov, KU Leuven

Co-supervisors:

Assistant Professor Yentl Swolfs, KU Leuven

Name of the Reviewer: Professor Oleg Vasilyev, Skoltech

I confirm the absence of any conflict of interest ,  (Alternatively, Reviewer can formulate a possible conflict)	Date: 28-09-2023
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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

The doctoral thesis of Radmir Karamov aims to develop deep learning algorithms for CT image processing for automated extracting of microstructures, fibre break detection, and creation of accurate FEM models of fibre-reinforced composite materials. The study is comprehensive and cover all the pipeline of developing the FEM model for the composite materials from CT image processing, to use of machine learning to enhance the quality of the resulted FEM model both in terms of correct representation of the anisotropy of the material and mechanical properties. The studies can be classified as a grounding work for creation of fully automated procedure of creating industrial FEM model of heterogeneous materials from CT measurements, what the author is called CT-based finite element modeling.

The use of machine learning for CT image processing in the context of composite material characterization and automated FEM model construction is quite novel and is of high interest to the community. The thesis is comprehensive, all the conclusions in the thesis are supported by the results. The thesis is of high quality and satisfies all the requirements of a doctoral thesis. Furthermore, even though the methodology was developed and verified for composite materials, it is general and can be easily extended to other heterogeneous materials.

The organization of the thesis is a little unorthodox, mainly due to presence of multiple introduction (5.1.1, 5.2.1, 5.3.1, 6.1.1, 6.2.1) and conclusion (5.1.7, 5.2.6, 5.3.5, 5.4, 6.1.6, 6.2.5, 6.3) subsections, which is probably the artifact of the subsections being published as papers. Conclusion sections 5.4 and 6.3 read more like summary. These organizational peculiarities are not critical and do not affect the quality of the thesis. However, they are distractive to the reader to the point that I wanted to mention them in my report.

The papers constituting the thesis are of high quality and published in reputable journals.

In conclusion, I feel that the thesis meets and even exceeds the expectations for the doctoral dissertation and without any hesitation I recommend the thesis for the defense.

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