Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Milad Jafarypouria

PhD Program: Mathematics and Mechanics

Title of Thesis: Numerical simulations of stress-strain state in fibrous unidirectional polymer composites based on 3D geometry with variable microstructure at different stages of curing and post-curing

Supervisor: Dr. Sergey Abaimov, Skoltech
Co-supervisor: Professor Stepan Lomov, KU Leuven

Name of the Reviewer: Professor Baris Sabuncuoglu, Hacettepe University

I confirm the absence of any conflict of interest	**Date: 10-10-2024**

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

This thesis is a unique one in which the curing effect and fiber breakage were investigated with many parameters. Each subchapter in the thesis are very good among themselves. What I liked most is that the concepts in the subsections were explained together with the literature. Such an explanation method is a very professional way of narrating the story in the chapters making clear the challenges for the readers. Each chapter ends with a conclusion which is e very good way of wrapping up the ideas.

However, the overall integrity of the thesis seems to be problem in this thesis. It was difficult to bring everything to make it a complete thesis. Due to this issue, coming up with an appropriate thesis title is very difficult for this thesis. The current title involves the investigation of curing effect but a very general statement is written for the numerical simulations. The study involves the analysis of the effect of broken fiber in the matrix but a very general "Numerical Simulations…" statement was written as the thesis title. An improvement in the thesis title revealing the studies related to broken fiber case in the matrix would be nice.

Finite element method was used in the simulations as it is known to be the best methodology related with the broken fiber studies. Conducted tests are also relevant to get the inputs for the material properties to be used in the simulations. However, some tests such as shear or TCR seem to be redundant and their relevance with the thesis was not understood. Instead of those, additional tests relevant to the study could have been conducted such as interface strength tests. The related parameters were taken from the literature instead.

The results obtained from the study have scientific significance. There are lots of novelties as mentioned in the thesis such as modeling of misaligned fibers, incorporation of debonding, variable fiber diameter etc. The results are well presented with explanatory figures involving many comparisons. There are lack of scientific explanations for the obtained results. If the candidate adds these explanations, his contribution to the literature would be much higher.

The papers from the thesis were very well written and published in very prestigious journals in composites. The presented work is open to further development in this area. Thus, more publications may be written with the improvement of the developed models. This is also valid for the curing study part. Curing parameters are numerous so the author can publish more materials after his PHD.

In summary, although there are problems with the integrity of the thesis and scientific explanations of the results, the individual studies in the thesis are very well described with a very nice methodology. Thus I thing the candidate should defend this thesis in front of the jury.

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*