Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Dmitry Popov

PhD Program: Engineering Systems

Title of Thesis: Topology and parameter optimization for additive manufacturing based on function representation

Supervisors: Professor Iskander Akhatov, Skoltech

Dr. Alexander Pasko, Skoltech

Name of the Reviewer: Ivan Sergeichev, assistant professor

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Date: 06-09-2022**

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

Dmitry Popov's dissertation is well structured and written in high-quality scientific language. The content of the dissertation fully corresponds to the stated topic and research methods. The objects of research, scientific novelty and relevance are clearly formulated.

The author applies advanced theoretically grounded and proven methods and techniques of geometric modeling and optimization, which were improved within the framework of the dissertation. Such methods include Functional Representation, Topology Optimization based on level set methods, and the Finite Element Method with an ersatz material model.

Dmitry Popov has developed and implemented in the program code a new system of geometric modeling based on the Function representation method. The system architecture and mathematical apparatus providing the construction and topological optimization of arbitrary geometric objects based on a library of geometric primitives have been developed. The created system of geometric modeling and optimization is focused on the design and production of products of complex shape using additive technologies. The applicability and effectiveness of the developed system is demonstrated by the example of solving design problems and 3D printing of prototypes based on FDM, DMD and DLP technologies.

The scientific results obtained by Dmitry Popov correspond to advanced international research and development in the field of theoretical and applied problems of geometric modeling and topological optimization.

The results presented in the dissertation are both fundamental and applied, and are necessary for the development of additive manufacturing technologies based on materials and components of various physical nature.

The results of the dissertation have been published in highly-rated peer-reviewed international journals and presented at several leading conferences.

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*