Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Yuri Sarkisov

PhD Program: Engineering Systems

Title of Thesis: Design, modeling, and control of cable-suspended aerial manipulator

Supervisor: Associate Professor Dzmitry Tsetserukou, Skoltech

Co-advisors: Dr. Konstantin Kondak, DLR; Dr. Christian Ott, DLR

Name of the Reviewer: Alessandro Golkar

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Date: 16-01-2022**

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

I write this report in quality of Jury Member of Yuri Sarkisov, PhD candidate at Skoltech. This review is addressing the version of the thesis retrievable on Canvas downloaded in January 2022. This thesis document version consists of 8 chapters (+ appendices and bibliography) and 230 pages.

Brief evaluation of the thesis quality and overall structure of the dissertation

The thesis illustrates the design, modeling, and control of cable-suspended aerial manipulator, work that has been conducted by the candidate in collaboration with the DLR in Germany. The goal of the thesis is to answer the question: *How to enhance manipulation performance and operational safety for the aerial manipulation in industrial applications, e.g., valve turn, peg-inhole assembly?* The candidate further postulates the hypothesis that "*adequately controlled cable-suspended stabilizing platform equipped with a robotic arm can provide high performance and safety in aerial robotic manipulation.*" The research goal is further broken down into three research objectives:

<<

- *To develop a robust control approach that can compensate for dynamic disturbances during transportation and manipulation of the cable-suspended platform without access to the system entire state and characterize its performance.*
- *To develop a control approach to facilitate a manipulation performance of cable-suspended platform endowed with kinematically redundant robotic manipulator by compensation for static disturbances and evaluate its performance.*
- *To assess manipulation performance and operational safety of the cable-suspended stabilizing platform through extensive experimental studies in a similar* [way, sic.] *to the industrial environment.*

>>

The goal of the thesis and its further decomposition into research objectives is properly structured and relevant. The novelty of the thesis is discussed briefly in Section 1.2 Literature Review. The work presented in the manuscript is of very high quality and of experimental nature. The suggestion made here is formulated to help the author to further enhance value of its contributions to the eyes of the academic community and provide additional opportunities for publishing the results of the work in international journals in the future. The candidate has successfully addressed all comments raised in previous review sessions of the thesis.

The relevance of the topic of dissertation work to its actual content

The topic of the thesis is highly relevant to industry and academia alike. The experimental character of the thesis is highly appreciated and of high quality. The main contribution of the author is well stated in section 1.3 of the thesis.

The relevance of the methods used in the dissertation.

The methodology and experiments proposed in the thesis are well formulated and appropriate.

The relevance of the obtained results to applications (if applicable)

The results of the thesis are highly relevant to industrial applications and will certainly provide opportunities for valuable innovation-related outcomes.

Quality of publications

The author reports 2 publications as main author at international conferences, on topics relevant to the subject of the thesis. He reports 4 publications as co-author, including one publication in an international journal as second author. He reports 1 publication submitted as first author to an IEEE journal, and further 2 publications, including one journal, classified as "side topic". The candidate meets and exceeds the publication requirements for the doctoral degree at Skoltech.

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*