

Jury Member Report – Doctor of Philosophy thesis.



Name of Candidate: Evgeny Tsykunov

PhD Program: Engineering Systems

Title of Thesis: Human-swarm interaction for the guidance and deployment of drones using impedance control and tactile feedback

Supervisor: Associate Professor Dzmitry Tsetserukou

Name of the Reviewer: Alessandro Aliakbargolkar

<p>I confirm the absence of any conflict of interest </p> <p>(Alternatively, Reviewer can formulate a possible conflict)</p>	<p>Signature: </p> <p>Date: 15-12-2020</p>
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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

I write this report in quality of doctoral committee member of Evgeny Tsykunov, PhD candidate at Skoltech under the supervisor of Professor Dzmity Tsykunov. This review is addressing the version of the thesis available on Canvas, retrieved on 10 December 2020. This thesis document version consists of 8 chapters and 156 pages.

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

The thesis proposes a novel interaction system for human-swarm communication. The system is based on a novel combination of impedance control and vibrotactile feedback for guidance and deployment of a swarm made of small-scale quadrotors. In particular, the thesis focuses on human swarm interaction issues between the human operator and the swarm. The candidate has expanded his work by including a simplified model of impedance control. This change has substantially improved the clarity of his document and relevance of his contribution.

The thesis is structured in eight Chapters. The structure of the thesis is appropriate, and complete. The structure of chapters is appropriate as well, and accounted for recommendations for changes issued in previous reports.

English language in the document has been improved substantially from its previous issues. Minor issues remain, but do not constitute a prejudice against the current issue of the thesis.

The candidate has done substantial revision work on his thesis document over the last year, and addressed all issues that were raised at pre-defense stage.

Final detailed remarks

The candidate has significantly demonstrated the scientific relevance of his thesis. He has published two journal papers (one as first author, one as co-author) in the IEEE Transactions on Haptics and IEEE Robotics and Automation Letters. He published 8 Scopus-indexed conference proceedings. The publication volume is more than adequate and exceeds the requirements of the doctoral program at Skoltech.

Relevance of the topic of dissertation work to its actual work

The topic of the dissertation is coherent with the research work performed by the candidate.

Relevance of methods used in the dissertation

The mathematical approach developed in the thesis seems to be formally correct. Its positioning with respect to the state of the art has been clarified.

Scientific significance of the results obtained and their compliance with the international level and current state of the art

As discussed previously, the scientific significance of the work of the candidate has been well demonstrated by the publications on Scopus indexed venues.

Relevance of obtained results to applications

I cannot comment on the specific relevance of the work to the field of robotics, as I am not a roboticist myself.

Quality of publications

The candidate meets and exceeds the publication requirements of the Skoltech PhD program.

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