

Jury Member Report – Doctor of Philosophy thesis.


Name of Candidate: Grigory Yashin

PhD Program: Engineering Systems

Title of Thesis: Development of group of flying robots with multifunctional robotic limbs aimed at operations in cluttered environments

Supervisor: Associate Professor Dzmitry Tsetserukou

Name of the Reviewer:

<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: 13-11-2020</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

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

The Ph.D. Thesis by Grigoriy Yashin is devoted to the holistic study of new approaches to UAVs, from mechanical design, to kinematic analysis, the student has actively contributed on each step of the robot creation process.

The first robot studied, AeroVR, is a quadrotor equipped with 4 dof manipulator under the aerial vehicle. This work includes the platform design as well as contribution to the human-robot interface for remote manipulation. These parts include the first 2 content sections of the thesis. The next section describes the second robot, DroneGear, which is meant for safe landing and locomotion by using 4 articulated legs.

Thought the thesis work there exist a common methodology required in the thesis which is the kinematics analysis, required for each of the robots systems and its correct functioning.

The innovative contribution of the work is significant, the areas of study is an intersection between mechanical design, robotics, and human-robot interfaces which makes this work valuable. As a result, these works were published at international conferences and journals.

Update from the second submitted version: The student has increased the amount of material to the thesis mostly in the introduction and in the chapter dedicated to virtual reality tele-operated system. These new contributions are mainly related to the evaluation part, qualitative and quantitative.

Some issues are present in the locomotion study, and its limitations due to the the actuators used (servos). This issue should be properly mentioned in the thesis, since one can get the wrong idea that this configuration of actuators could be further improved, and for an improvement, in fact it would be necessary a complete redesign of the system.

The thesis id disperse in the sense that the elements researched are too disperse: multiple open and different topics compose this thesis, as written in the first review. Still, the document makes an effort for unifying all them.

Overall, the publication record stays the same, with a new journal submission. The list of publications fulfills the program requirements, although some of the publications venues are not ranked.

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

The relevance of the topic, enhancement of UAVs with novel approaches could be achieved in many different ways. Currently, multiple laboratories are working in this direction, but following different methodologies. Grigoriy's contributions are relevant in the global context of UAV design and interfaces, and at the same time there is undoubtedly originality on the approach followed. Thereby, I consider that the topic of the dissertation and its work coincide.

Update: New content does not change the relevance of the topic.

- The relevance of the methods used in the dissertation.

In this thesis, as stated in the brief evaluation, there is a wide diversity of methods used and they cover almost the whole spectrum in robotics design. I find them relevant, some of them could be further improved, for instance the kinematic analysis could be carried out in full 3d, but this level of involvement would require a full thesis dedicated to the analysis of mechanics.

I find particularly valuable the fact that the student had to master many diverse methods to succeed on his thesis, probably supported by colleges dividing the workload.

Update: On this part we have seen some improvement. On its previous version, the thesis emphasized on the design and testing of ideas. However, the evaluation part was not presented at the same depth, which is something indispensable for quality research. On its current format, more evaluations, including polls from users on the VR problem, more metrics reported, etc. make this chapter more solid.

- The scientific significance of the results obtained and their compliance with the international level and current state of the art.

The contributions of the present thesis have been submitted to international conferences and journals, in compliance with the program directions. In the literature review, there are some reference to European projects in related areas, such as ARCAS or EUROARMS, trying to accomplish similar goals. The problem is still open.

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

In addition to the publications obtained, there are additional results in the form of patents, some of them related to the thesis works, other tangentially related.

- The quality of publications.

The work has been published in good conferences and journals, some of them in robotics or other fields. Probably the highest impact publication accomplished is RAL, now in year 2019 ranked as a Q1 in robotics (not sure which rank was in 2018).

Update: The new submitted publication to the *Journal of Intelligent & Robotic Systems* (Q2 in CS-AI) is yet not accepted, and should not be considered. Its results on the other hand have strengthen the thesis

as discussed above.

The complete list of publications include:

- RAL (Q1 in robotics)
- IEEE Journal on Miniaturization for Air and Space Systems (not in SJR but fulfills the IF requirement)
- International Conference on Advanced Robotics (ICAR) (not in core)
- IEEE Haptics Symposium (not in core)

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