

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Dmitry Smirnov

PhD Program: Engineering systems

Title of Thesis: Innovative technological pathway for new commercial applications of Stirling cycle-based systems

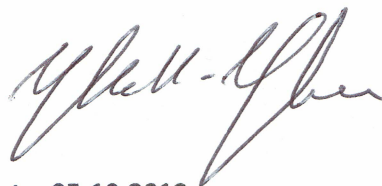
Supervisor: Assistant prof. Henni Ouerdane

Name of the Reviewer: Prof. Ighor K. Uzhinsky

I confirm the absence of any conflict of interest

(Alternatively, Reviewer can formulate a possible conflict)

Signature:



Date: 05-10-2019

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

The Reviewer's Report of the Thesis: Innovative technological pathway for new commercial applications of Stirling cycle-based systems.

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

The dissertation contains very uneven sections of the work. Chapters V and VI are devoted to evaluation of options, problem statement, elaboration of the developed solution, and analysis of testing results of key technical components and processes of Stirling Cycle-based refrigerators. An electro-thermal model of the proposed device is introduced. The experimental results generally confirm viability of the proposed solutions.

But the content of Chapters II and IV, being focused on patents and publications search of the Stirling engines and refrigerators – related topics, seems to be not related directly to the rest of the text and their results practically are not used, at least directly, in the key for the overall research, deliberations and results of Chapters V and VI. Patents and publication analysis demonstrates only the supply side of the reviewed technology: how many researchers are interested and involved in this topic, but the claimed interest in commercialization requires analysis of the demand for this technology, that is, an analysis of the market. Lacking of this analysis results in questionable statements, like: “These observations indicate that (significant increase of number of) the published results during 1980-s were strongly influenced by oil prices...” (Page 70, IV.1.1.). If the market analysis was done than one would find that there was another important factor – the demand for changes in refrigerating technologies because of customer requirements for lower energy-consuming devices and because of changes in the to be employed refrigerant materials.

The Thesis Statement (Page 37, I.6) “The process of selection between alternative decisions at different design stages ... requires a unique set of design methods...” does not seem to be an expression of any concrete and constructive scientific thought.

Concerning the Chapter III of this work – it does not seem to have any relevance to the rest of the dissertation either from the point of view of the research methodology or from the point of view of the technology proposed and implemented.

I would suggest:

1. On the basis of materials, presented in Chapters II and IV, and with incorporation of to be conducted analysis of appropriate markets and SOA solutions for refrigerating systems in the targeted areas of the proposed technology applications, to derive a set of credible quantitative guidelines for technical and economic requirements of the proposed devices and processes that are to be used in evaluation of the solutions, presented in Chapters V and VI.
2. Remove Chapter III from the Thesis or to modify this material to make sure that at least some of its conclusions or the methodology may be useful for the subsequent work either in the analysis of the market or in the development of the mentioned above quantitative guidelines or in the overall methodology (that is to be proposed and constructively presented).
3. There are multiple misspelling and grammar errors across the whole text. It's unacceptable for any of Ph.D. degree theses. The work needs to be spell-checked and edited.

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

The content of Chapters V and VI are relevant to design, realization, and analysis of a real technical system (a representative of the Stirling Cycle-based Systems). The rest of the text is to be revised to get an acceptable level of its relevance.

- The relevance of the methods used in the dissertation

See above.

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

The researched topic currently is one of very popular areas for R&D in energy systems. There is not enough information presented in the work (a comparative quantitative analysis of the proposed

solutions and of its development methodology has not been done) to conclude the level of the results achieved.

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

The proposed design and, particularly, the obtained by the author knowledge in the technology, process modeling, and obtained practical and experimental results can be useful for the development of commercial applications given that its economic and technical characteristics are within commercially viable ranges.

- The quality of publications

The publication in the International Journal of Refrigeration (2019) is relevant to the claimed topic and the Journal is a good professional publication with Impact Factor 3.2, Q1. Relevance of other publications to the topic are questionable.

Overall recommendation:

I'd suggest to postpone defense of this thesis until the recommendation 1-3, stated above will have been addressed and the obtained results appropriately presented at relevant conferences and published. In addition to provided presentation of scientific results obtained, the author should derive, present and prove to relevant audiences the value of the proposed solutions and results for practical applications.

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*