Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Elena Egorova

PhD Program: Computational and Data Science and Engineering

Title of Thesis: Signature Codes for Multiple Access Channels, Digital Fingerprinting Codes and Symmetric Group Testing

Supervisor: Prof. Grigory Kabatyansky

Name of the Reviewer:

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Signature:**  **Date: 29-03-2020**

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

Referee's Report on the doctoral thesis by Elena Egorova

``SIGNATURE CODES FOR MULTIPLE ACCESS CHANNELS, DIGITAL FINGERPRINTING CODES AND SYMMETRIC GROUP TESTING''

Moscow, 29 March, 2020

This PhD thesis is devoted to important and challenging problems related to error-free coding for multiple access channels and their potential applications to codes for digital right management and group testing. The presented results are new and original and supported by publications

The thesis consists of four chapters, plus an introduction, a conclusion and a full list of references. In the Introduction, Ms. Elena Egorova explained her motivations of the problems that she considered in the thesis, including practical needs, and provides a quite clear overview of the state of the art approaches for related problems. In my opinion, it would be worthy to add discuss in more details many possible practical applications, especially in the view of emerging 5G telecommunication systems.

In Chapter 1 Elena gives detailed an overview of known, state of the arts models of multiple access channels (MACs), which she called ``MACs Zoo'', and she established important relationship between MACs, multimedia fingerprinting codes (which in fact, belongs to data protection science) and also group testing (what is a part of advanced mathematical statistics). This demonstrated her wide and deep knowledge of many aspects of modern communication and broad spectrum of her scientific interests.

Chapters 2 and 3 contain the main research results of the thesis. Namely, upper, i.e. nonexistence, and lower bounds on the rate of signature codes for three channels: A/B-channels and weighted binary adder channel, as well as some explicit constructions of the corresponding families of codes.

In the fourth chapter of her thesis Elena investigates potential applications of her results to several areas and she constructs, for instance, the first family of digital multimedia fingerprinting codes with non-vanishing rate and only polylog in the number of user/codewords complexity of finding a coalition of malicious users.

In my opinion the thesis is quite well written, with a very clear structure that allows relatively easily following the author's ideas and developments. All results are supported by quite impressive scientific papers, published in three journals and in four international conferences proceedings publications.

Minor critical comments: The readability of the thesis could be further improved in the Author could add in the Introduction or the Appendix a Table with frequently used symbols/notations and abbreviations. Moreover, in preliminary version I found in serval palaces missing commas and dots, especially in sentences, which include mathematical formulas. Please see e.g., pages 15, 16, 25,-27, 35-38, 44-47, 61-64.

In my opinion, the thesis satisfies all necessary conditions; therefore, I recommend that the candidate should defend the thesis by means of a formal thesis defense.

Andrzej Cichocki

Professor of SKLOTECH

Provisional Recommendation

x☐ *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*