Review of the

PhD Thesis

"Discrete transformations and their application in Codding theory and Combinatorics "

by Paskal N. Piperkov

announced in SG № 6/24.06.2022 of the Sci. Council of the Institute of Mathematics and Informatics of the Bulgarian Academy of Sciences.

Applicant of the procedure:

Institute of Mathematics and Informatics (IMI) of the Bulgarian Academy of Sciences.

Member of the Scientific Panel:

Assoc. Prof. Slavcho Shtrakov, DSc., Department of Informatics, SWU "N. Rilski"- Blagoevgrad, appointed by Order 159/27.06.2022 of the Director of the IMI.

1. Brief bibliography of the candidate.

- Mathematician in Institute of Math and Informatics of the Bulgarian Academy of Sciences since 2016
- Chief Assistant, University of Veliko Tarnovo, 2003-2014.
- Master in Mathematics, Sofia University, 1997
- Bachelor in Mathematics, Sofia University, 1996.

2. General description of the presented materials.

Pascal Piperkov has submitted the following mandatory documents: Professional CV, full list of scientific works with their impact factor and number of citations, as well as those with which he participates in the procedure, detailed author's report for scientific contributions, scientific works for participation in the procedure, a list of citations, diplomas for educational degree Master.

3. General characteristics of the research, teaching and scientific applied activities.

Pascal Piperkov participates in the procedure with 4 publications. Here, publications are scientific papers or reports on conferences, 1 of which is in peer-reviewed journal, indexed in world-renowned databases with scientific information Web of Science and SCOPUS, which has an impact factor. More than 3 citations have been noted in referenced scientific publications.

Along with his scientific work, Pascal Piperkov also develops teaching activity at the University of Veliko Tarnovo.

4. Analysis of scientific and scientific applied contributions.

Pascal Piperkov presents a detailed author's report, which describes and substantiates the author's claims for scientific and scientific applied contributions in the PhD Thesis. The considered problems refer to:

1. There is a detailed resume of the Walsh-Hadamard transforms of matrices based on the Walsh function and Hadamard matrix.

2. Pascal Piperkov has created an algorithm to calculate weight distribution of a linear code over prime fields, which is p times more simple than the existing algorithms, based on the Walsh-Hadamard transforms.

3. Similar improvement of the existing algorithms is achieved for the case of composed finite fields using special transforms. The complexity of that algorithm is equal to $O(kmq^{k})$.

4. Using Vilenkin-Chrestenson transform, Pascal Piperkov created an algorithm for computing the covering radius of a linear $[n, k]_q$ code over a finite field. The Vilenkin-Chrestenson transform is used. The transform is applied on the characteristic function of a parity check matrix of the code.

5. Significance of contributions to science and practice.

The contributions of P. Piperkov, are mainly in the field of the Theory of algorithms in Codding and cryptography. It can be concluded unequivocally from the attached list of publications and citations that the achievements of the candidate for PhD are significant and are well known and appreciated by the scientific community.

6. Critical notes and recommendations.

Paskal Piperkov has fulfilled the formal parameters of Regulations on the Implementation of the Development of Academic Staff in the Republic of Bulgaria Act, necessary for the academic degree PhD - number of scientific works, number of citations, etc.

As criticism and recommendations for his future work we can point out the following:

1. There are spelling and stylistic errors (missing letters or words, use of unreasonably long sentences, etc.) in some documents for the procedure (reports, publications, etc.), compiled by the candidate in Bulgarian language. This critical note is typical for almost all researchers. Therefore, its task is only for the future improvement of the candidate.
2. From all publications proposed by P. Piperkov for the procedure, no one is independent. I hope that after the successful outcome of this procedure, the candidate will concentrate his efforts in individual or with his graduates or doctoral students research.
3. Paskal Piperkov did not apply any document to present his results in a foreign language.

7. Conclusion.

After I got acquainted with the overall research and teaching activities of Paskal Piperkov and having in mind the requirements specified in the Act on the Development of Academic Staff in the Republic of Bulgaria, Regulations on the Implementation of the Development of Academic Staff in the Republic of Bulgaria Act and the Regulations for their application in Institute of Mathematics and Informatics of the Bulgarian Academy of Sciences, I give a **positive assessment** of his overall work, and I find it reasonable to **propose Paskal Piperkov to take the academic degree PhD in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.5. Mathematics.**

August, 2022
Blagoevgrad

Member of the Scientific Jury:

Assoc. Prof. Slavcho Shtrakov, DSc.