

## REVIEW

by Acad. Ivan P. Popchev – BAS

of dissertation work for awarding the educational and scientific degree

"Doctor"

in professional direction 4.6. "Informatics and Computer Science"

Doctoral program "Informatics"

Titled "Modelling and optimization of communication strategies in information process management"

to Gergana Petkova Mateeva

By Order № 265 / 31.10.2025 of the Corresponding Member, Dr. Svetozar Margenov - Director of IICT-BAS, in according with Art. 4, para. 2 of the Act on the Development Staff of the Republic of Bulgaria (ADASRB) and with the decision of Academic Council of IICT (rec. of proceeding № 8 / 29.10.2025) for awarding of the educational and scientific degree "Doctor" in professional direction 4.6. "Informatics and Computer Sciences" doctoral program "Informatics" to Gergana Petkova Mateeva for a dissertation work titled "Modelling and Optimization of Communication Strategies in Information Process Management" I have been appointed as a member of the Scientific Panel.

When assessing the dissertation work, the terms of the ADSRB, the RAADSRB (Decree No. 26 of February 13, 2019) and the Rules for specific requirements of IICT - BAS for the application of the law and therefore will be accurately delivered:

1. According to Art. 27 (1) of the RAADSRB "the dissertation work shall contain scientific or applied research results that represent an original contribution to science. The dissertation shall show that the candidate has profound theoretical knowledge in the respective subject, as well as abilities of independent scientific research".

2. According to Art. 27 (2) of the RAADSRB "the dissertation work should be presented in a form and volume corresponding to the specific requirements of the primary unit. The dissertation work should contain: title page; introduction; presentation; conclusion - summary of the results accompanied by a declaration of originality; bibliography".

The scientific supervisor of the dissertation is **Prof. Tatiana Atanasova, PhD.**

On page 59, **the goal of the dissertation** is formulated: "To develop models and methods for optimizing communication strategies in information process management."

**The following five tasks** are defined:

1. To develop heuristic methods for optimizing communication strategies when managing information processes in a digital environment;
2. To propose a modification of genetic algorithms for optimization of communication strategies in information process management;
3. To propose a method for improving the efficiency of genetic algorithms for the purposes of information process management;
4. To develop models that allow for effective implementation and application of the developed heuristic methods on heterogeneous mobile and IoT devices in distributed digital environments with limited resources;
5. To propose an approach for assessing the effect of the application of the developed models and methods for optimizing communication strategies for managing information flows in distributed digital environments.

The dissertation consists of 135 pages, 48 figures, 9 tables, 137 references and it includes:

- Glossary of terms and abbreviations used in the dissertation (5-7);
- Introduction (14);
- Modern trends in the development of communication strategies for managing information processes (**Chapter 1** , 16-59);
- Methods for heuristic optimization of communication strategies in information process management (**Chapter 2** , 60-91);
- Models for communication strategies in managing information processes in a digital environment: Technical and architectural aspects (**Chapter 3** , 91-117);
- Conclusion and summary of the results obtained (117-118);
- Directions for future research (119);
- Publications on the topic of the dissertation (120);
- Noted citations (121-123);
- Declaration of originality of results (125);
- Bibliography (126-135).

**7 publications on the topic of the dissertation** are presented.

**The analysis** of these publications briefly shows the following:

- 6 publications are indexed in Scopus (No. 1, 2, 3, 4, 5 and 6);
- 1 publication is indexed in Web of Science (No. 1);
- 4 publication is indexed in IEEE (NN<sub>o</sub> 3, 4, 5 и 6);
- All publications are in English;
- No independent publications;
- In 6 publications she is the first co-author.

**22 citations of 7 publications** are known.

Publication № 5 has the largest number of citations – a total of 19.



The doctoral student has participated in two projects: National Scientific Program "Intelligent Animal Husbandry" and "Research on Methods and Technologies for Digitalization of Education".

**The requirements** of the RAADASRB and specific regulations of IICT - BAS are fulfilled.

According to Art. 6 (3) of ADASRB, "the dissertation must contain scientific or scientifically applicable results that represent an original contribution to science." This predetermines **the author's self-assessment** of the results.

**The obtained results briefly** can be systematized as follows:

1. Modification of Genetic Algorithms (GA) as Double-Strand Genetic Algorithms (DS GA);
2. Adaptive method using Lagrange polynomial for approximation of time-consuming objective functions, which makes the application of GA feasible on devices with limited resources;
3. CPS/IoT architectural model for practical implementation of heuristic optimization algorithms on heterogeneous mobile devices with limited resources;
4. Model for monitoring and data processing in smart agriculture;
5. SWOT analysis of CPS/IoT and redistributed computing resources;
6. Directions for future research.

#### **Critical notes:**

1. In the "Conclusion – Summary of the obtained results" three main scientific and applied contributions are formulated:
  - Methodological improvement;
  - Architectural innovation;
  - Practical application.

It is not determined (according to Art. 27 (1) of the RAADSRB) whether these results represent an original contribution to science.

#### **Questions on the dissertation work:**

1. Which scientific and applied results can be said to represent an original contribution to science? What are the criteria for original contribution to science?
2. Why are genetic algorithms GA listed, with which other heuristic optimization methods are they compared, and by what criteria was the comparison made? Can examples be provided?

3. Why is the Lagrange polynomial proposed to approximate the fitness function (p. 76)? Is there a comparison with other fitness approximation functions? What advantages does the Lagrange polynomial have?
4. Is it possible to determine what time and resources are needed to implement the "Directions for Future Research"?
5. How is the statement in the "Main Scientific and Applied Contributions" proven that "... the joint design of an algorithm and architecture is a significant contribution to the field of Edge AI and distributed intelligence"?

A generalized "**scientific-metric profile**" of doctoral student Gergana Mateeva can be built on data taken from world scientific databases:

- Scopus: 7 documents, 22 citations, h - index 2;
- Web of Science: 1 publication, 0 citation, h-index 0;
- Scholar.google: 36 citations, h-index 2, i10-index 1;
- Researchgate: 52.1 Research Interest Score, 33 citations, h-index 2;
- IEEE: 4 publication, 19 citation

The generalized "**scientific-metric profile**" deserves to be the subject of careful and critical **self-analysis**, to form future research, and to present sufficient grounds for independent publication activity in publication with IF/SJR (Q1 and Q2).

**The Abstracts** are in Bulgarian and English, respectively including 45 and 48 pages, and present the dissertation work.

## CONCLUSION

The dissertation work fulfils the requirements of the ADASRB, RAADASRB and the specific regulations in IICT - BAS.

I give a **positive conclusion** for the acquisition of the educational and scientific degree "Doctor" to Gergana Petkova Mateeva.

**I propose to the Scientific Panel to unanimously vote for awarding Gergana Petkova Mateeva with the educational and scientific degree "Doctor" in 4.6. "Informatics and Computer Science, doctoral program "Informatics".**

11.11.2025

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