

OPINION

on the dissertation work for the acquisition of the scientific degree „**Doctor of Sciences**”
professional field **4.6. Informatics and computer sciences**

Author of the thesis: **Prof. Stefka Stoyanova Fidanova**

Thesis title: **Ant colony method for decision of combinatorial optimization problems**

Member of the scientific jury: Prof. Petia Doycheva Koprinkova-Hristova

I have been appointed as a member of the Scientific Jury in the procedure for the acquisition of the scientific degree "Doctor of Sciences" by Prof. Stefka Stoyanova Fidanova by order No. 92/31.03.2023 of the Director of IICT-BAS. As a member of the jury, I received the following documents:

1. Dissertation work
2. Abstract in Bulgarian and English
3. Information for fulfillment of the minimum requirements of IICT-BAS
4. Information for fulfillment of the minimum national requirements
5. Lists of the candidate's publications and citations
6. Autobiography according to the European model
7. Declaration of originality of the results
8. Copies of the applicant's publications
9. Copy of the diploma for the acquired educational and scientific degree "doctor"

The submitted documents comply with the requirements of ZRAS, PPZRAS and the specific requirements in the regulations of BAS and IICT.

The dissertation consists of 187 pages, 16 figures and 76 tables. It includes an introduction, six chapters, a conclusion, a statement of contributions, lists of publications and citations, a statement of originality of results, acknowledgments and a bibliography. A total of 128 literary sources are cited, all in English, including the candidate's publications.

The abstract accurately reflects all the main parts of the dissertation work in a summary. It is 49 pages in Bulgarian and 46 pages in English.

From the presented information for fulfillment of the minimum requirements of IICT-BAS (which exceed the national requirements), it is clear that the candidate fulfills all of them, significantly exceeding the minimum threshold for indicators G (publication activity) and D (citations).

The candidate has submitted 19 publications on the topic of the dissertation, of which 1 monograph in a reputable international publisher, referenced in Scopus, 1 article with an impact

factor in Q1, 11 articles with SJR rank, 5 publications referenced in Scopus and 1 in an international academic publisher. The monograph and one of the publications with SJR rank are independent, and in most of the other publications the candidate is the first author and in only 4 the second author. With this, the candidate achieves 360 points, which significantly exceeds the minimum IICT requirements of 100 points in section G of the scientometric indicators. The requirement of a minimum of 15 publications in journals with an impact factor or SJR rank, of which the monograph equals 5 publications, has been fulfilled.

The candidate presented 52 citations only of the publications included in the dissertation work, with the minimum required for IICT-BAN 50 citations in refereed and indexed scientific publications, which bring her 312 points with the minimum required 100 points for this indicator. In addition, a list of all citations to date is presented, which is a total of 1254 (1049 in specialized international editions of which 227 in editions with IF, 3 monographs in English, 18 book chapters and 1 monograph in Bulgarian), with the impressive h-factor 18.

The reference in Scopus shows a total of 154 publications of the candidate available, with 638 citations without self-citations and an h-factor of 12, and in Web of Science – 99 publications with a total of 389 citations without self-citations and an h-factor of 11.

The dissertation developed metaheuristic algorithms based on the ant method for solving combinatorial optimization problems from real life and industry. The presented solutions to specific problems are up-to-date and original with the modification of the basic algorithm (the method of the ants) according to the specifics of each task.

The contributions in the dissertation are classified by the author as scientific and scientific-applied. Briefly they are:

1. Scientific contributions:

- 1) Modified algorithms are developed for solving specific optimization problems based on the ant method with local search procedures, modified search environment and intuitionistic fuzzy pheromone.
- 2) Algorithms were analyzed and compared using intercriteria analysis.

2. Scientific-applied contributions:

- 1) A software implementation of the developed algorithms was made for each of the solved optimization tasks.
- 2) The algorithms have been applied to solve specific tasks: the knapsack problem, inspecting GPS networks, building a wireless sensor network, hiring a workforce, and modeling passenger flow.

A particularly good impression is made by the fact that the theoretical developments in the dissertation find real and diverse practical applications and have the potential for implementation in industry.

The algorithms and their applications described in the thesis are undoubtedly original. Prof. Fidanova is the first author of most of the publications related to her dissertation work, which is proof that the main contribution in them is hers.

I have no objections to the dissertation work. It clearly and comprehensively describes the algorithms developed, the reasons for their modification, and their specific applications, comparing them to other possible solutions for each problem.

I believe that the development has great potential for development in the direction of adaptation of the developed family of algorithms and their application to many more real problems, as well as their implementation.

I have known Prof. Fidanova for years as an outstanding scientist and colleague with whom we work in close scientific fields. She regularly organizes scientific conferences and invited sessions, in which I have also participated with reports. My personal impression is that she is precise in her research and always finds the right place to apply her theoretical developments.

The candidate's dissertation and scientific production meet all the requirements of the Law on the Development of the Academic Staff for awarding the scientific degree "Doctor of Sciences", which is why I give her a convinced **positive evaluation**.

All this gives me reason to recommend to the members of the esteemed Scientific Jury to award **Prof. Stefka Stoyanova Fidanova** the scientific degree "**Doctor of Sciences**" in professional field **4.6 Informatics and computer sciences**.

Date: 16.05.2023

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