

OPINION

on the Thesis for awarding educational and scientific degree PhD

under the Scientific Field 4.

Natural sciences, mathematics and informatics

Professional Area 4.6. Informatics and computer sciences

Author of the PhD Thesis:

Georgi Evtimov Evtimov

Theme of the PhD Thesis:

„Metaheuristic methods for reducing cutting tasks“

Reviewer:

Prof. Olympia Nikolaeva Roeva, PhD,

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- 1. Relevance of the problem developed in the PhD thesis in scientific and scientific-applied terms. Degree and levels of relevance of the problem and the specific tasks developed in the PhD thesis.**

The minimization of the consumption of energy and raw materials is an important issue in many industrial areas. In the context of the above, the problem in the PhD thesis – optimal cutting – is relevant both in scientific and scientific-applied terms.

In the introduction of the thesis the PhD student considers the role of innovative methods to support reducing cutting tasks, i.e. metaheuristic algorithms as Ant Colony Optimization (ACO) method.

The PhD student aims to ensure "Optimal cutting of linear elements with minimal waste ", as well as "Optimal cutting of two-dimensional elements with an irregular shape with minimal waste".

In order to achieve the set objectives, Georgi Evtimov defines the following tasks:

"Task 1. Development of an algorithm for solving the problem of one-dimensional (linear) cutting;

Task 2. Development of an algorithm for solving the problem of cutting two-dimensional elements;

Task 3. To make a program implementation of the developed algorithms and to be implemented the comparison of real construction sites with existing in practice methods of cutting.”

2. Degree of knowledge of the state of the problem and creative interpretation of the literary material

The dissertation is 140 pages long and includes a total of 226 figures and 39 tables. It is structured as follows: list of figures, tables, algorithms, abbreviations and notations used, introduction, 3 chapters, main conclusions, list of publications, approbation of the results, contributions, declaration of originality, thanks and bibliography. A total of 114 references are presented, but references 1-8, 25, 29, 37, 38, 42, 44, 46-48, 50-52, 56-59, 65, 67, 68, 70-87, 89-114 are not cited in the text of the thesis. Some references appear in the list twice – 73 and 89, 90 and 91, 105 and 1106, 108 and 113.

In my opinion “Overview of the main results in the field” is not complete and is presented very briefly in one page. Some basic research on the topic of the PhD thesis and current trends and results in the field are missing. Furthermore, in the bibliography of the dissertation there are references of published results, but they are not summarized and analysed in the thesis.

3. Brief analytical description of the nature and assessment of the reliability of the material on which the contributions of the PhD thesis are built

Chapter 1 consists of Introduction, Actuality of thesis, Overview of the main results in the field (1 page), Aims and objectives of the dissertation and Research approach (1 page).

Chapter 2 of the PhD thesis presents some basic definitions of computational geometry. The definition of point, segment and polygon are given. The important concepts for the construction of algorithms in case a point is inside a polygon, intersection and subtraction of two polygons, etc., are also discussed.

Chapter 3 discusses the results of 1D cutting stock problem. The background of ACO method is discussed. The obtained results from the application of ACO method for the considered cutting stock problem are compared to the results from the commercial product CutLogic and the Greedy + n^3 method. The results show that the ACO-based algorithm proposed in the PhD thesis is superior to the other two approaches.

Chapter 4 discusses the results of 2D cutting stock problem - an NP-complex combinatorial task. The problem is solved by applying a hybrid metaheuristic proposed in the thesis. The proposed approach is applied and compared to the commercial product FP Opti2D. Based on the results

obtained, it is shown that the hybrid metaheuristic algorithm has better performance than the FP Opti2D software. Unfortunately, it is not clear how the hybrid metaheuristic algorithm was constructed and what metaheuristic algorithms were used (Scattered Search and what else?).

4. Scientific and scientific-applied contributions of the PhD thesis

The PhD student formulates 3 scientific and 2 scientific-applied contributions to the PhD thesis, as follows:

The scientific contributions are:

- “An algorithm for optimal cutting in one-dimensional space has been developed;
- An algorithm for optimal cutting in two-dimensional space has been developed;
- A method for two-dimensional cutting based on hybrid optimization has been developed.”

The scientific and applied contributions are:

- “A program implementation of the algorithm for one-dimensional cutting has been made;
- A program implementation of the two-dimensional cutting algorithm has been made.”

I accept the contributions defined by the PhD student and believe that original results have been obtained, which correspond to the goal set in the PhD thesis.

5. Evaluation of the publications on the PhD thesis

The PhD student presents a total of 8 publications: 5 publications in the proceedings of international conferences, published in scientific book series with SJR, which significantly exceeds the necessary requirements.

From the text of the dissertation it is difficult to understand in which of the 8 presented papers the results discussed in the PHD thesis are published.

6. Assessment of the conformity of the autoreferate with the requirements for its preparation, as well as of the adequacy of reflecting the main positions and contributions of the PhD thesis

The autoreferate has a volume of 64 pages and briefly reflects the content of the PhD thesis.

7. Opinions, recommendations and notes

In my opinion the PhD thesis should have one objective: Optimal cutting with minimal waste, of linear elements and of two-dimensional elements with an irregular shape”.

In the PhD thesis there are a number of grammatical and language errors, technical errors and inaccuracies. Unfortunately, omissions of this nature create an unpleasant impression. The PhD student has done a lot of work, has proposed solutions to complex problems, but has failed to present his research at a good level, which has diminished the quality of his dissertation.

The conclusion of the PhD thesis should be a short summary of the work done with an analytical evaluation of the main results achieved and conclusions drawn, which the PhD student has failed to do.

My main recommendation to Georgi Evtimov is to be more demanding and accurate in presenting his results in the future.

I would like the PhD student to briefly present the hybrid metaheuristics used in Chapter 4.

Is there any intention to continue the work on the topic of the dissertation?. Can Georgi Evtimov formulate any directions for future research on the topic?

8. Conclusion with a clear positive or negative assessment of the PhD thesis

My opinion is that the PhD student Georgi Evtimov demonstrates knowledge in the specific field and potential to achieve original ideas. In the PhD thesis scientific and applied results are achieved, which represent an original contribution to science. The results are published in reputable specialized scientific journals and series, and / or presented in international scientific forums.

Based on the above, I confirm that the PhD thesis of Georgi Evtimov Evtimov meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, as well as the Internal Regulations for its application in the Institute of Information and Communication Technologies of the Bulgarian Academy of Sciences, for awarding the educational and scientific degree "Doctor of Philosophy". The scientific results achieved give me reason to express my positive assessment and to recommend to the respected Scientific Jury to award Georgi Evtimov Evtimov the educational and scientific degree "Doctor of Philosophy" in Scientific Field 4. Natural sciences, mathematics and informatics, Professional Area 4.6. Informatics and computer sciences.

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Sofia

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