

OPINION

by Corr. Member Lyubka Atanasova Doukowska, DSc
from the Institute of Information and Communication Technologies,
at the Bulgarian Academy of Sciences,
on the Thesis for awarding scientific degree “Doctor of Sciences”,
Author of the DSc Thesis: Prof. Olympia Nikolaeva Roeva, PhD

**DSc Thesis Title: “Metaheuristic algorithms for nonlinear dynamic system
identification”**

This opinion was prepared in implementation of Order No. 560 of 01.06.2026 of the Director of the Institute of Biophysics and Biomedical Engineering at the Bulgarian Academy of Sciences, issued in implementation of Art. 13 of the *Development of Academic Staff Act in the Republic of Bulgaria* and a decision of the Scientific Council of the Institute of Biophysics and Biomedical Engineering, reflected in Protocol No. 7 of 29.05.2026, to open a procedure for defense in the department „Bioinformatics and Mathematical Modeling“, of the DSc thesis of Prof. Olimpia Nikolaeva Roeva, for obtaining the scientific degree “Doctor of Sciences” (DSc) in the scientific field 4. Natural Sciences, Mathematics and Informatics, in the professional area 4.6. Informatics and Computer Science, on the topic “Metaheuristic algorithms for nonlinear dynamic system identification”.

As a member of the scientific jury, I received a DSc thesis, an abstract to it and the accompanying administrative documentation.

In order to form the final evaluation of the dissertation, the requirements of the *Development of Academic Staff Act in the Republic of Bulgaria* are implemented the

specific requirements in the Act's Institutional Regulation shall be taken into consideration, where the respective norms are:

Art. 12. (announced as anti-constitutional by a Decision of the Constitutional Court No. 11 of 2010 – SG 81/10; new – SG 101/10) (1) (Suppl. - SG 30/18, in force from 04.05.2018) The scientific degree of Doctor of Science shall be awarded to a person with an educational and scientific degree of a Doctor who meets the minimum national requirements under Art. 2b, Para. 2 and 3.

(2) For awarding of the scientific degree of a Doctor of Sciences the person referred to in Para. 1 must defend a dissertation paper subject to the terms and conditions and following the procedure of this act.

(3) (New - SG 30/18, in force from 04.05.2018) Admitted to defend their dissertation shall be persons who meet the minimum national requirements under Art. 2b, Para. 2 and 3.

(4) (Previous Art. 3 - SG 30/18, in force from 04.05.2018) The dissertation paper under Para. 2 must contain theoretical conclusions and solutions of major scientific and applies scientific problems, which correspond to the up-to-date achievements and can be regarded as a considerable and original contribution to science.

(5) (Previous Art. 4 - SG 30/18, in force from 04.05.2018) The dissertation paper referred to in Para. 2 shall be prepared independently and may not repeat literally the topic and a considerable part of the content of the paper presented for awarding of the educational and scientific degree of Doctor of Philosophy.

These requirements in the *Development of Academic Staff Act in the Republic of Bulgaria* correspond to Articles 35 and 37 of the Regulations for the Implementation of the *Development of Academic Staff Act in the Republic of Bulgaria*, therefore they will not be cited.

I accept that the requirements of Art. 12 para. 1 of the *Development of Academic Staff Act in the Republic of Bulgaria* have been met, since Prof. Olimpia Nikolaeva Roeva has defended a PhD thesis on the topic “Modeling of functional states during cultivation of *Escherichia coli* with the application of genetic algorithms”, for which she was awarded

the educational and scientific degree PhD, with diploma No. 31836 of 10.12.2007 of the Presidium of the Higher Attestation Commission at the Council of Ministers of the Republic of Bulgaria, in the professional field 5.2. Electrical engineering, electronics and automation, PhD program “Bioautomation”.

According to the presented reference, Prof. Olympia Nikolaeva Roeva fulfills the minimum national requirements under Art. 2b, Para. 2 and 3.

I accept that that the requirement of Art. 12, Para. 5 of the *Development of Academic Staff Act in the Republic of Bulgaria* is met, because publications on this DSc thesis do not coincide with the publications for the educational and scientific PhD degree, also the reviewed DSc thesis does not literally repeat the topic and a significant part of the content of the thesis for the educational and scientific PhD degree.

The research hypothesis of the DSc thesis is “The systematic hybridization of complementary metaheuristics, guided by a formal analysis of their dynamical search behavior, enables the construction of optimization frameworks with improved convergence, robustness, and scalability compared to constituent algorithms, particularly for ill-conditioned problems in fermentation process engineering.”

The aim of the DSc thesis is “the theoretical investigation, development, and experimental validation of metaheuristic algorithms and hybrid methodologies, with systematic application to bioprocess modelling and control, aimed at the design of improved, high-performance, and efficient optimization algorithms”. To achieve this aim, six research tasks have been formulated.

The DSc thesis has a volume of 288 pages. The work is structured in an introduction, six chapters, a conclusion and a bibliography. The list of literature used includes 581 sources. The cited sources are quite diverse and are mostly written by foreign authors. The presence of Bulgarian authors in the literature used makes a good impression.

I accept that such defined DSc thesis's contributions can be defined as enriching the existing scientific field with new knowledge.

The publications on the DSc thesis are twenty and include ten publications in journals with an impact factor, six publications in publications with an impact rank and four publications in publications referenced in Scopus.

A list of 304 citations of the works of Prof. Dr. Olimpia Nikolaeva Roeva is presented. I accept that this number is up to the moment of submission of the documents for the competition and newly appeared citations are not included.

The presented data give me reason to conclude that the results of the DSc thesis are provided with the necessary publicity.

The DSc abstract has a volume of 42 pages. It faithfully reflects the essence and content of the DSc thesis, including the purpose, subject, object and tasks of DSc thesis research and the ways of their realization.

In order to form the final evaluation of the dissertation, the requirements of the *Development of Academic Staff Act in the Republic of Bulgaria* and its Implementation Rules are to be taken into account, according to which I have the following remarks and recommendations:

1. In the DSc thesis is used the terms “resilience” and “robustness” interchangeably and does not present the difference between them.

2. The contributions of the DSc thesis are not convincingly formulated so as to contain theoretical generalizations that correspond to modern achievements and represent a significant and original contribution to science.

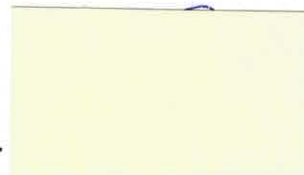
In conclusion, I accept that the requirements of the Law for the *Development of Academic Staff Act in the Republic of Bulgaria* and the specific requirements in the Act's Institutional Regulations for its implementation, the Rules for the conditions and the order for acquiring academic degrees and for the occupation of academic positions in Bulgarian Academy of Sciences and the Rules for the specific conditions for acquisition of academic degrees and occupation of academic positions at the Institute of Biophysics and Biomedical Engineering are fulfilled. After an assessment of the DSc thesis and its publications, an analysis of their significance and the contributions they make, I give my positive assessment and I recommend to the Honorable Jury to award the scientific degree DSc to

Prof. Olympia Nikolaeva Roeva in the Professional Area 4.6. Informatics and Computer Sciences, the Scientific Field 4. Natural Sciences, Mathematics and Informatics.

20.07.2026

Sofia

Signature:



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/Corr. Member Lyubka Doukovska, DSc/