REVIEW

by

Dr. Vladimir Vassilev Monov, Professor
Institute of Information and Communication Technologies,
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on the dissertation for the acquisition of the educational and scientific degree "Doctor"

Author of the dissertation:	**M.Sc. Radoy Strezimirov Dukovski**
Topic of the dissertation:	**"Decision-making in the control of technological objects"**
Field of higher education:	**5. "Technical sciences"**
Professional direction:	**5.2. "Electrical engineering, electronics and automation"**
Doctoral program:	**"Automated systems for information processing and control"**
Scientific supervisor:	**Acad. Vasil Stoyanov Sgurev**

By Order No. 340 of 22.12.2025 of the Director of the Institute of Information and Communication Technologies (IICT), I am approved as a member of the Scientific Jury for conducting the defense of the dissertation. By decision of the Scientific Jury at a meeting held on 23.12.2025, I am appointed as a reviewer of the dissertation.

1. General description of the submitted materials

The author of the dissertation is a full-time doctoral student in the "Intelligent Systems" Department of IICT-BAS. The set of materials submitted by the doctoral student includes the following documents:

- CV in European format;
- dissertation for the acquisition of the educational and scientific degree "doctor";
- abstract of the dissertation in Bulgarian and English;
- list of scientific publications on the topic of the dissertation;
- copies of scientific publications;
- declaration of originality of the results obtained;
- reference of fulfillment of the minimum requirements of IICT for the educational and scientific degree "doctor";
- similarity report from the StrikePlagiarizm.com system.

The doctoral student has also attached a copy of the Diploma and plaque for the winner of the award of FNTS "Young Engineer of the Year" for 2023.

The attached documents comply with the regulatory requirements set forth by the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, as well as the Regulations on the specific conditions for acquiring scientific degrees and for holding academic positions in IICT.

2. Brief biographical data of the doctoral student

The attached CV shows that in the period 2016-2021 the doctoral student acquired a bachelor's degree in the specialty "chemical engineer" and a master's degree in the specialty "production automation engineer" at the University of Chemical Technology and Metallurgy in Sofia. From 2020 to 2024 he worked as a systems engineer at the company Statistics & Control Inc., and from 2024 to the present he is a systems engineer at Honeywell International Inc. In the period 2023-2025, M.Sc. Radoy Dukovski is a full-time doctoral student at the Institute of Information and Communication Technologies in the professional field 5.2. "Electrical engineering, electronics and automation". The acquired professional qualification and active work of the candidate in the field of automation, systems engineering and technological process management fully correspond to the specialty under this procedure.

3. Relevance of the topic and appropriateness of the set goal and tasks

The main goal of the dissertation is to develop models of real technological objects to support the decision-making process in their management using modern achievements in the field of automation and automatic control systems for technological processes. To achieve this goal, research tasks related to the analysis of problems in making management decisions, as well as the development of decision-making systems for real-time operation of industrial chemical technological objects, have been appropriately formulated. The relevance of the dissertation research is undeniable, in view of the rapid development of technologies, increased requirements and the establishment of new standards in terms of functional, economic and operational qualities of control systems for complex industrial objects. In this regard, the set goal and tasks of the dissertation are well motivated and generally aimed at the development and implementation of effective models and control methods for real technological objects in the energy and chemical industries.

4. Knowledge of the problem

The analytical review and research in Chapters 1 and 2 of the dissertation are devoted to basic questions and problems in decision-making theory and the development of decision support systems. The theoretical foundations and the formal mathematical description of well-known methods and algorithms with wide application in practice are presented. As an important challenge in the decision-making process, the presence of uncertainty as a result of incomplete

information or the inability to predict future events is indicated. The process of rational decision-making, based on models from probability theory and utility functions, is studied. The analytical review made in the problem area of the dissertation shows a thorough knowledge of the subject, the formal mathematical apparatus and the main factors for the development of effective systems for supporting the decision-making process.

5. Research Methodology

The methodology of the conducted research includes analysis and systematization of known methods and approaches from the theory of decision-making, their formal mathematical description and the possibilities for their practical implementation in the management of industrial processes. To achieve the main goal of the dissertation, an approach of design, development, simulation research and demonstration of the applicability of the proposed decision-making systems in the real-time management of specific chemical and technological processes was chosen. The implemented methodological approach fully corresponds to the set general goal and the formulated tasks of the dissertation.

6. Characteristics and evaluation of the dissertation work

The dissertation is 193 pages long and consists of an Introduction, 4 chapters, Conclusion, List of publications on the dissertation work and Bibliography. According to the requirements, a Declaration of originality of the results obtained is attached to the dissertation. The list of bibliographical sources includes 146 titles, including sources from Bulgarian and foreign authors, as well as Internet sites. The list of publications on the dissertation topic contains 5 titles.

Chapter 1 examines models and methods for decision-making using intelligent agents, probabilistic models, Bayesian networks and time models. The structural and parametric characteristics of the models and the computational complexity of the relevant algorithms are analyzed.

Chapter 2 presents elements of utility theory and methods for making rational decisions that maximize the values of given utility functions.

Chapter 3 develops a mathematical model of a steam generator as a basic facility in electricity generation systems. The production process is analyzed, methods for control and decision-making are proposed, experimental results of the operation of the system for automatic regulation of the level of the steam-water mixture are presented.

In chapter 4, mathematical models are presented and strategies for controlling several technological objects are developed: a membrane bioreactor, an industrial cricket filter for the separation of fine solid particles and a double-layer heater used in the petrochemical industry and electricity generation. In the modeling, control synthesis and simulation analysis of the objects, software tools of the MATLAB, ANSYS CFX and Honeywell Experion Process Knowledge System are used.

The results obtained in the individual chapters of the dissertation are convincingly presented and illustrated. The mathematical models of the studied objects are described and analyzed in detail and demonstrate excellent knowledge of the mathematical apparatus used. For each of the chapters, justified and useful conclusions are made from the conducted research and the obtained results.

In general, the dissertation work is characterized by a thorough knowledge of the methods and systems for supporting decision-making, of modern tools for modeling, analysis and management of complex technological objects, as well as of the possibilities for their practical application.

In the final part of the dissertation, the obtained results are summarized and the contributions of the dissertation research are listed.

7. Contributions and significance of the development for science and practice

I accept and positively evaluate the contributions indicated in the dissertation and the abstract. In a more generalized form, they can be formulated as follows.

- Simulation models of a thermal energy technological object, steam generator, have been developed using the software tools of the MATLAB, Simulink and Experion Process Knowledge System.

- A system for automatic regulation of the level of the steam-water mixture in the steam generator drum has been proposed using the Honeywell Experion Process Knowledge System tools.

- A model of a membrane bioreactor for yeast production has been designed, numerical experiments have been conducted with the model and the operating parameters and productivity of the bioreactor have been determined;

- A real-time control system for a cricket filter for the separation of fine solid particles has been developed using the Honeywell Experion Process Knowledge System tools, increasing the efficiency of the filtration process;

- Simulation modeling of a chemical-technological object, a double-layer heater, is carried out and a system for process control and decision-making in the real-time operation of technological heaters with double heating layers is proposed.

The listed contributions are of a scientific and scientifically applied nature and relate to the development of new and improvement of existing models, methods and approaches in the field of automatic control and decision-making in the operation of complex technological objects. In general, they also have the potential for development and implementation in engineering practice related to the design and implementation of modern control systems in the field of industrial automation.

8. Assessment of publications on the dissertation work

Five publications on the dissertation topic are presented, which are in English and were published in the period 2020-2025. Four of the publications are self-authored and one is co-authored. One of the publications is in edition with impact rank in the Scopus database and one is indexed in the IEEE Xplore digital library. The presented publications reflect essential parts and main results of the dissertation, which have become known to the scientific community in the subject under consideration. They also demonstrate the developed qualities of the doctoral student for working both in a team and for conducting scientific research independently.

9. Personal involvement of the doctoral student

I know the doctoral student personally and have direct impressions of his research work and publication activity. My acquaintance with the dissertation, the abstract and the publications made gives me reason to believe that the dissertation work and its contributions are the personal work of the doctoral student, obtained under the direct supervision of his scientific supervisor.

10. Abstract

The abstract is 47 pages long and meets the requirements for its formatting. Its content corresponds to the content of the dissertation and accurately presents the main results of the dissertation work. An abstract of the dissertation in English is also presented in the same volume.

11. Assessment of the fulfillment of the minimum national requirements

According to the Regulations for implementation of the Law on the Development of Academic Staff in the Republic of Bulgaria, to obtain the educational and scientific degree "doctor" in the professional field 5.2 "Electrical Engineering, Electronics and Automation", a minimum of 50 points is required for indicator A and 30 points for group of indicators Г. The same number of points is also required in the Regulations on the specific conditions for acquiring scientific degrees and occupying academic positions at IICT-BAS. From the submitted Reference on the fulfillment of the requirements for obtaining the educational and scientific degree "doctor", it is evident that the requirements for both indicators are met.

12. Critical remarks and recommendations

I have no critical remarks on the substance of the dissertation and the presented results. Some remarks and omissions of an editorial and technical nature can be indicated.

- The dissertation work contains sufficient scientific and scientifically applied contributions, both in volume and content. The formulation of the first of the contributions listed in the dissertation, however, could be more precise, emphasizing mainly the result obtained from the theoretical analysis conducted.
- The list of used literature could include the works of more Bulgarian scientists with known achievements in the field of automation, control theory and decision making systems.

These remarks are not on the substance of the work and do not reduce the value of the contributions in the dissertation work.

My recommendation to the doctoral student is to continue and expand the research activity with the development of new models and methods for managing technological processes in production and industry.

CONCLUSION

I positively assess the work done and the results obtained in the dissertation. The dissertation contains original scientific and scientifically applied results that meet all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the Regulations for the specific conditions for acquiring scientific degrees and for occupying academic positions at IICT-BAS.

The dissertation shows that the doctoral student possesses in-depth theoretical knowledge and professional skills in the specialty "Automated Information Processing and Management Systems", demonstrating qualities and skills for independent conduct of scientific research.

In view of the above, I confidently propose to the esteemed Scientific Jury to award the educational and scientific degree "doctor" to M.Sc. Radoy Strezimirov Dukovski in the field of higher education: 5. "Technical Sciences", professional direction 5.2. "Electrical Engineering, Electronics and Automation".

На основание
331Д

Sofia,
16.01.2026