# REVIEW

by **Acad. Ivan Petkov Popchev** – BAS

of PhD thesis for awarding the educational and scientific degree

**"Doctor of Philosophy" (PhD)**

under the Scientific Field: **5. Technical Sciences**,

the Professional Area: **5.2. Electrical engineering, electronics and automation**

the Scientific Specialty: **Automated Information Processing and Control Systems**

PhD Thesis Title: **Decision Making in the Management of Technological Objects**

Author of the PhD Thesis: **eng. Radoy Strezimirov Dukovski**

In accordance with Order No.340/22.12.2025 of the Director of the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences, Corresponding Member Svetozar Margenov, in according with Art. 4, para. 2 of the Act on the Development of the Academic Staff in the Republic of Bulgaria and by a decision of the Academic Council of the the Institute of Information and Communication Technologies (protocol No.10/19.12.2025) in connection with the procedure for acquiring the educational and scientific degree PhD in professional area 5.2. Electrical Engineering, Electronics and Automation, scientific specialty "Automated Information Processing and Control Systems" by Radoy Strezimirov Dukovski with a PhD thesis on the topic "Decision Making in the Management of Technological Objects" I have been appointed as a member of the Scientific Panel.

When evaluating the PhD thesis, the conditions of the Act on the Development of the Academic Staff in the Republic of Bulgaria (Decree No. 26 of February 13, 2019) and the Regulations on the Specific Conditions at the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences for the Implementation of the Law are decisive and therefore the following will be accurately delivered:

1. Pursuant to Art. 6 (3) of the Development of Academic Staff Act in the Republic of Bulgaria, PhD thesis should contain scientific or scientific-applied results, which represent an original contribution in science. The PhD thesis must indicate that the candidate has in-depth theoretical knowledge of the relevant specialty and ability for independent research.

2. According to Art. 27 (2) of the specific requirements in the Act's Institutional Regulation, PhD thesis should be presented in a form and volume corresponding to the specific

requirements of the primary unit. The PhD thesis should contain: a cover page; content; introduction; exhibition; conclusion - a summary of the results obtained with a declaration of originality; bibliography.

The scientific supervisor is **Acad. Vasil Stoyanov Sgurev**.

On page 4, the goal of the PhD thesis is formulated: "To develop, using modern design and automatic control systems, models of real technological objects to support the decision-making process in their management".

The following **eight tasks** are defined:

1. To conduct an in-depth theoretical analysis of decision-making systems and the challenges that arise in their application, presented using the tools of modern theory.
2. To analyze the operation of a thermal energy technological control object - a steam generator, by developing models of decision-making systems for control at the steam-water mixture level and at the level in the drum.
3. To propose a decision-making system for automatic regulation of the level of the steam-water mixture in the drum during real-time operation of an industrial steam generator.
4. To design a membrane bioreactor for the production of yeast Hansenula polymorpha, by determining the required aeration rate to achieve a minimum strain rate of the material in the membrane boundary layer of 0.8 [$s^{-1}$]. Also, to determine the required stirring rate to achieve the desired maximum strain rate in the cell growth chamber of 15 [$s^{-1}$].
5. To analyze the operation of a chemical technological control object - a cricket filter, by performing simulation modeling of the decision-making systems for its control.
6. To propose a decision-making system for real-time operation of an industrial cricket filter.
7. To analyze the operation of a chemical technological control object - a dual hired heater, by performing simulation modeling of the decision-making systems for its control.
8. To propose a decision-making system for real-time operation of an industrial dual hired heater.

The PhD thesis consists of 193 pages, 141 figures, 10 tables, 146 literary sources and includes::

- Introduction (3);
- Theoretical basis of the decision-making process (**Chapter 1**, 6-49);
- Decision-making systems (**Chapter 2**, 50-79);

- Decision making in the management of a heating technological object (**Chapter 3**, 80-130);
- Decision making in the management of chemical technological facilities (**Chapter 4**, 131-180);
- Conclusion – summary of the results obtained (181);
- List of publications on the PhD thesis (181);
- Declaration of originality (183);
- Bibliography (184-193).

The list of publications in the PhD thesis (p. 181) includes **five publications in English.**

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

- 1 publication is an edition of with IF/SJR (№ 1);
- 3 publications are in a journal of the Bulgarian Academy of Sciences (№№ 2, 3 и 4);
- 1 publication marked as accepted for publication has already been published in conference proceedings 9th IEEE BdKCSE'2025 (№ 5);
- 4 publications are independent (№№ 2, 3, 4 и 5);
- 1 publication is co-authored (№ 1).

No citation data is provided.

The PhD student has participated in the National Research Programme „Smart crop production" approved by Decision of the Ministry Council No 866/26.11.2020 (No D01-65/19.03.2021) and in the project IS-PGR-SADOVO "Intelligent system for managing Bulgarian plant gene pool, conserved in the Genbank of IPGR-Sadovo" (KP-06-H86/9).

**Fulfilled requirements of 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 the Rules for the specific conditions for acquisition of academic degrees and occupation of academic positions at the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences are accomplished.**

According to Art. 6 (3) of the *Development of Academic Staff Act in the Republic of Bulgaria*, "the PhD thesis must contain scientific or scientifically applicable results that represent an original contribution to science." This predetermines the author's self-assessment of the results.

In the "Conclusion-Summary of the Obtained Results" (pp. 181-182) 7 main scientific and scientifically applied contributions are given, for which there is no assessment, according to art. 27(1) of the RAADASRB law, that they represent an original contribution to science. **The results obtained** in the PhD thesis can be briefly systematized as follows:

1. Simulation models in MATLAB Simulink and Honeywell Experion Process Knowledge System (HEPKS) for a mathematical model of a real steam generator.
2. System for automatic regulation of the level of the steam-water mixture in the drum using HEPKS during real-time operation of a steam generator in a refinery.
3. Membrane bioreactor for yeast Hansenula polymopha with a productivity of 6[g/h] at a cultivation temperature of 30[°C] and a growth medium of methanol. The required aeration and stirring rates were determined by computer simulation in the ANSYS environment of the hydrodynamic behavior.
4. The control system with HEPKS tools in real-time operation of a cricket filter for the KPO B.V. refinery.
5. The control system with HEPKS tools in real-time operation of dual-fired process heaters for the KPO B.V. refinery.

**Critical notes:**

1. In the "Introduction" (p. 3) it is written "original results have been achieved in this dissertation...", but the main scientific and applied scientific contributions (pp. 181-182) are not defined as "scientific and applied scientific results that constitute an original contribution to science", according to Art. 27 (1) of the RAADASRB.
2. On page 182, in points 4, 5 and 7, applications in refineries in El Paso, USA and in Karachaganak, Kazakhstan are marked without corresponding appropriate evidence (for example: projects, protocols, etc.).
3. The bibliography of 146 titles with the participation of Bulgarian authors (excluding R. Dukovski) is only in: Nos. 106, 107, 108, 123, 137 (dissertation), 139, 141 (not cited in the dissertation), 145 and 146.
4. The PhD thesis does not cite 11 titles from the bibliography (No. 6, 9, 15, 52, 54, 103, 104, 133, 134, 135, 141).

**Questions on the PhD thesis:**

1. Which major scientific and applied scientific contributions (pp. 181-182) can be proven to represent an original contribution to science?
2. What are the criteria for original contributions to science?
3. How was the Honeywell Process Knowledge System selected? Has there been a comparison with other systems?
4. Why are only two publications cited for the ANSYS product (p. 148): 142 (1969) and 143 (1989), which do not discuss ANSYS CFX version 16.0?
5. Where is the statement on page 130 proven that "when operating a steam generator at the El Paso refinery in the USA, its productivity is increased"?
6. How do you overcome "Experion station slowdowns or crashes, especially when multiple SCMs are present on a single display"? (p. 179)
7. Is there any numerical data on increasing "system performance" at the Karachaganak Petroleum Operating B.V. refinery? (p.180)
8. Do the results obtained create conditions for further research and applications?

**The Abstracts** are in Bulgarian and English, 47 and 45 pages respectively, and present the PhD thesis.

**CONCLUSION**

The PhD thesis meets the requirements of 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 the Rules for the specific conditions for acquisition of academic degrees and occupation of academic positions at the Institute of Information and Communication Technologies.

I give a positive conclusion for the acquisition of the educational and scientific degree PhD to Radoy Strezimirov Dukovski.

I give my positive assessment and I recommend to the Honorable Jury to award the educational and scientific degree "Doctor of Philosophy" (PhD) to Radoy Strezimirov Dukovski in the Professional Area 5.2. Electrical engineering, electronics and automation and in the Scientific Specialty "Automated Information Processing and Control Systems".

12.01.2026 г.

На основание ЗЗЛД