

REVIEW

by Acad. Ivan Petkov Popchev, BAS

of a dissertation submitted for the award of the educational and scientific degree of “Doctor”
in Professional Field 4.6, Informatics and Computer Science,
Doctoral Programme “Informatics”

**entitled “Methods and Architectural Approaches for Semantic Indexing and the
Simulation of Dynamic Processes in a Cloud Environment”**

by Pavel Aleksandrov Kyurkchiev

By Order No. RD-22-1415, issued in Plovdiv on 17 July 2026 by the Rector, Professor Rumen Mladenov, PhD, pursuant to Article 4 of the Act of Development of the Academic Staff in the Republic of Bulgaria (ADASRB), Articles 2(2) and 30(3) of the Regulations for the Implementation of the Act (RIADSRB), and Article 37(1) of the Regulations on the Development of the Academic Staff of Plovdiv University (RDASPU), and in accordance with the decision of the Faculty Council of the Faculty of Mathematics and Informatics recorded in Minutes No. 34 of 15 July 2026, I was appointed an external member of the Scientific Jury for the defence of Pavel A. Kyurkchiev’s dissertation, entitled “Methods and Architectural Approaches for Semantic Indexing and the Simulation of Dynamic Processes in a Cloud Environment”, submitted for the award of the **educational and scientific degree of Doctor** in Professional Field 4.6, Informatics and Computer Science, Doctoral Programme Informatics.

In assessing the dissertation, I have taken account of the requirements laid down in the ASDARB, its implementing regulations and the relevant regulations of Plovdiv University, and therefore will be accurately delivered:

1. Under Article 6(3) of the ADASRB, a dissertation must contain scientific or applied research results that constitute an original contribution to the science. It must also demonstrate that the candidate possesses thorough theoretical science of the relevant discipline and is capable of conducting independent research.

2. Under Article 27(3) of the RIADSRB implementing regulations, a dissertation must be presented in a form and at a length consistent with the specific requirements of the primary academic unit. It must include a title page, contents, introduction, main body, conclusion summarizing the results obtained, a declaration of originality and a bibliography.

Under the **RIADSRB** implementing regulations and the relevant regulations of RDASPU, the **minimum number of points** required under the applicable groups of indicators for the degree of Doctor in Professional Field 4.6, Informatics and Computer Science, is 80 (50 + 30).

Research supervisor: Professor Anton Iliev, PhD

The aim of the dissertation, as stated on page 16, is:

“To investigate and apply methods based on the “System Dynamics” formalism, together with contemporary technologies for semantic and vector search in a cloud environment, and, through the implementation of a prototype, to validate methodologies for visual modelling, numerical simulation and the intelligent retrieval of dynamic processes.”

To achieve this aim, the following objectives were set:

1. To analyse the current state of the field and define an architectural model.
2. To develop a methodology and a search approach.
3. To design and implement an experimental software environment.

4. To carry out experimental validation and analysis.

The dissertation is 140 pages long, cites 146 sources and is structured as follows:

- Introduction (pp. 12–20);
- Analysis of the subject area and existing solutions (Chapter 1, pp. 21–42);
- Mathematical formalism and theoretical foundations (Chapter 2, pp. 43–53);
- Methodology for transformation, simulation and intelligent search (Chapter 3, pp. 54–69);
- Architecture of the Alpha Cloud Data Hub platform (Chapter 4, pp. 70–91);
- Experimental validation and analysis of the results (Chapter 5, pp. 92–113);
- Conclusion (pp. 114–128);
- Declaration (p. 129);
- References (pp. 130–140).

Page 116 lists three publications arising from the dissertation. They may be classified as follows:

- one article in a Q2 journal with an impact factor (publication No. 3);
- one article in a journal (publication No. 2);
- one paper in the proceedings “Information and Communication Technologies” (publication No. 1).

Page 117 states that the dissertation was prepared with the support of Projects IT15-FMIIT-004 and MI17-FMI-007.

The candidate’s scientometric indicators amount to **110 points**, compared with the **minimum requirement of 80 points** for the educational and scientific degree of Doctor.

The requirements of RDASPU and RIADSRB have been complied with

Article 6(3) of the ADASRB requires a dissertation to contain scientific or applied research results that constitute an original contribution to the science. Four applied research and practical contributions are identified on pages 115–116 of the dissertation; however, the text does not explicitly state which of them should be regarded as original contributions to the science.

The principal results of the dissertation may be summarised as follows:

1. An algorithm for the semantic linearisation of cyclic graph structures using the System Dynamics formalism.
2. An architectural model that addresses computational blocking in AI processing by replacing synchronous reading with an asynchronous knowledge-generation pipeline.
3. The Alpha Cloud Data Hub software prototype, which provides practical validation of the effectiveness of the proposed theoretical methods.
4. Empirical evidence demonstrating the advantages of a semantic vector-based approach over conventional lexical algorithms for extracting knowledge from dynamic models.

The dissertation also identifies two technical challenges as directions for **future development** (pp. 117–119):

- infrastructure optimisation;
- algorithmic enhancement.

Questions concerning the dissertation

1. Which of the stated applied research and practical contributions can be shown to constitute original contributions to the science?
2. What criteria are used to determine whether a contribution is original?
3. Within what timeframe, by what team and with what financial resources could the proposed directions for future development be implemented?
4. Can the two proposed directions for future development be ranked in order of priority, including with regard to their proposed timescales?

The abstracts are available in Bulgarian and English, each running to 32 pages, and accurately reflect the content of the dissertation.

Conclusion

The dissertation **satisfies the requirements** of the Academic Staff Development Act in the Republic of Bulgaria, its implementing regulations and the Regulations on the Development of the Academic Staff of Plovdiv University “Paisii Hilendarski”.

I therefore give a **favourable assessment** and recommend that **Pavel Aleksandrov Kyurkchiev** be awarded the **educational and scientific degree of Doctor**.

I recommend that the Scientific Jury vote unanimously to award **Pavel Aleksandrov Kyurkchiev** the **educational and scientific degree of Doctor** in Professional Field 4.6, Informatics and Computer Science, **Doctoral Programme “Informatics”**.

1st of August 2026
Sofia

Reviewer:
/Acad. I. Popchev/