

R E P O R T
from assoc. prof. Petya Georgieva Popova-Krumova

regarding to a competition for holding the academic position "**Professor**" in professional field **4.2. Chemical Sciences "Processes and Apparatus in Chemical and Biochemical Technology"**, for the needs of the laboratory "Innovative Processes and System Engineering" of the Institute of Chemical Engineering at Bulgarian Academy of Sciences, announced in the state newspaper no. 37 (21.04.2026)

Candidate: **Assoc. Prof. Dr. Eng. Elisaveta Georgieva Kirilova**

1. Brief biographical data and description of the candidate's scientific interests

Associate Professor Elisaveta Georgieva Kirilova, PhD, is an established researcher in the field of Chemical Engineering with more than twenty-five years of research experience at the Institute of Chemical Engineering, Bulgarian Academy of Sciences (BAS). After obtaining her Master's degree in Processes and Equipment in Chemical and Biochemical Engineering from the University of Chemical Technology and Metallurgy (UCTM), Sofia, she was awarded the educational and scientific degree Doctor (PhD) in the same scientific field in 2011 with a dissertation entitled: "A Systems-Oriented Approach to the Environmentally Sustainable Management of Multipurpose Chemical and/or Biochemical Production Systems."

Assoc. Prof. Kirilova's professional career has progressed through the academic positions of Research Associate, Assistant Professor, and Associate Professor at the Institute of Chemical Engineering, BAS. Since 2018, she has been Head of the Innovative Processes and Systems Engineering Laboratory, and since 2022 she has also served as Scientific Secretary of the Institute.

Her scientific interests are focused on systems engineering, mathematical modelling, and optimization of chemical, biotechnological, and energy systems. Her research encompasses the development of mathematical models and optimization methods for sustainable supply chains, modelling and heat integration of biotechnological processes, the application of artificial intelligence methods to engineering process modelling, and analytical modelling of nanocomposite structures. Her scientific work is aimed at developing innovative engineering solutions to improve resource and energy efficiency and to promote the sustainable development of modern production systems.

2. General characteristics of the candidate's scientific research and applied scientific activity

The research activity of Associate Professor Elisaveta Georgieva Kirilova, PhD, is characterized by consistency, scientific relevance, and a clear focus on the development of methods for modelling, optimization, and systems analysis of chemical, biotechnological, and energy processes. Her research successfully combines fundamental scientific approaches with practical applicability in addressing challenges related to resource efficiency, the circular economy, and low-carbon technologies.

The candidate has extensive experience in the implementation of national and international research projects funded by the Bulgarian National Science Fund (NSF), the Bulgarian Academy of Sciences, the European Union, and the German Research Foundation (DFG). She has served as the principal investigator of three research projects, including two projects funded under the Fundamental Scientific Research Programme of the National Science Fund at the Ministry of Education and Science. This demonstrates her well-established scientific reputation and successful experience in leading research activities.

Her applied research is focused on the development of mathematical models and optimization approaches for the analysis and design of sustainable production, biotechnological, and energy systems with significant potential for practical implementation.

Associate Professor Kirilova is actively engaged in expert and scientific organizational activities as a reviewer of scientific publications and research projects, a participant in procedures for awarding scientific degrees and academic positions, Head of Laboratory, and Scientific Secretary of the Institute of Chemical Engineering, Bulgarian Academy of Sciences.

She has also participated in the organization of national and international scientific conferences and is a member of international scientific organizations and COST Actions, thereby contributing to the advancement of international scientific cooperation and enhancing the international visibility of the Institute.

Overall, the candidate's research, applied research, and organizational activities clearly demonstrate that she is an established researcher with outstanding scientific competence, extensive project experience, and significant contributions to the development of systems engineering and chemical engineering in Bulgaria.

3. Evaluation of the presented materials

The materials submitted by Associate Professor Elisaveta Georgieva Kirilova, PhD, fully satisfy the minimum national requirements for appointment to the academic position of Professor in accordance with the Act on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its Implementation, and the Regulations of the Bulgarian Academy of Sciences.

For the purposes of this competition, the candidate has submitted **25 scientific publications** published during the period **2018–2024**, none of which duplicate publications used for obtaining the educational and scientific degree Doctor (PhD) or for appointment to the academic position of Associate Professor.

In addition to these publications, the candidate has authored **two chapters in scientific books** published by two of the world's most prestigious academic publishers—**Elsevier** (2021) and **Springer** (2022)—which further demonstrates the international recognition of her scientific achievements.

The submitted publications are directly relevant to the subject area of the competition and have been published in reputable international scientific journals and conference proceedings indexed in Web of Science and Scopus, a substantial proportion of which are ranked in the first and second quartiles (Q1 and Q2).

The candidate's scientific output reflects a consistent development of research in the fields of mathematical modelling, systems analysis and optimization of chemical, biotechnological, and energy processes, sustainable supply chains, applications of artificial intelligence, and modelling of nanocomposite materials.

The quality and international recognition of her scientific achievements are convincingly demonstrated by her bibliometric indicators, namely **594 citations** and an **h-index of 8** according to **Scopus**.

The submitted materials provide convincing evidence of the candidate's high publication activity, international visibility, and sustained development of her scientific career.

4. Basic scientific and scientific-applied contributions

The scientific work of Associate Professor Elisaveta Georgieva Kirilova, PhD, represents a consistently developed research programme characterized by clearly defined research directions and significant fundamental and applied scientific achievements.

The principal contributions may be summarized as follows:

4.1. Mathematical Modelling and Optimization of Chemical and Biotechnological Processes

The candidate has developed mathematical models and methods for systems analysis and multi-objective optimization integrating technological, economic, and environmental criteria in the design and operation of complex production systems.

4.2. Sustainable Supply Chains and Circular Economy

She has developed models for the sustainable design and optimization of supply chains under conditions of uncertainty, aimed at improving resource efficiency and reducing environmental impact.

4.3. Energy Efficiency of Biotechnological Processes

She has proposed engineering approaches for heat integration and optimization of organic waste treatment processes, contributing to reduced energy consumption and more efficient utilization of resources.

4.4. Application of Artificial Intelligence

The candidate has investigated the application of artificial neural networks in the modelling and optimization of chemical and biotechnological processes, corresponding to contemporary trends in the digitalization of engineering systems.

4.5. Modelling of Nanocomposite Materials

She has developed analytical models for multilayer graphene- and polymer-based nanocomposites, expanding the possibilities for the design and analysis of advanced high-performance materials.

The obtained scientific results are distinguished by their interdisciplinary character, scientific originality, and practical applicability. They have made substantial contributions to the advancement of systems engineering, mathematical modelling, and optimization of chemical and biotechnological processes and have gained international recognition, as evidenced by their publication in prestigious scientific journals and their high citation impact.

5. Reflection of scientific publications in the literature

The scientific publications of Associate Professor Elisaveta Georgieva Kirilova, PhD, have received broad international recognition. The presented bibliometric indicators—**594 citations** and an **h-index of 8** according to **Scopus**—demonstrate the high visibility and lasting impact of her research.

Her publications are actively cited by other researchers and have contributed to the advancement of systems engineering, mathematical modelling, and the optimization of chemical and biotechnological processes, providing convincing evidence of their scientific significance and relevance.

6. Critical notes and recommendations

I have no critical remarks regarding either the submitted competition materials or the candidate's scientific achievements.

The submitted publications are characterized by high scientific quality, thematic consistency, and full compliance with the requirements for appointment to the academic position of **Professor**. The reported scientific results have been published in reputable international scientific journals and have deservedly received recognition from the international scientific community.

I have no specific recommendations to the candidate. I am confident that she will continue to develop her research successfully and further expand her international scientific collaborations.

7. Personal impressions of the reviewer about the candidate.

I have known Associate Professor Elisaveta Georgieva Kirilova, PhD, for many years, during which we have worked together on numerous research projects. This has given me the opportunity to observe closely her professional and academic development.

My opinion of Associate Professor Kirilova is exceptionally high. She is an established scientist with excellent academic training, profound expertise, and remarkable consistency in her research activities. She is distinguished by analytical thinking, precision, and an outstanding ability to develop scientifically sound solutions to complex engineering problems.

In addition to her excellent professional qualifications, she enjoys the respect of her colleagues owing to her integrity, collegiality, and responsible attitude toward her work. I highly appreciate her willingness to share her professional experience and her ability to work constructively and effectively within a research team.

CONCLUSION

Having carefully reviewed the submitted competition materials, analysed the candidate's scientific output, and evaluated her overall research, applied research, and scientific organizational activities, I conclude that Associate Professor Elisaveta Georgieva Kirilova, PhD, fully satisfies the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations on the Terms and Conditions for

Acquiring Academic Degrees and Holding Academic Positions at the Bulgarian Academy of Sciences, as well as the additional requirements for appointment to the academic position of Professor established by the Regulations of the Institute of Chemical Engineering, Bulgarian Academy of Sciences.

The submitted scientific works contain significant scientific and applied scientific contributions, have been published in authoritative international journals, and have received broad recognition, as evidenced by their citation record. The candidate is an established scientist with outstanding publication activity, active participation in research projects and scientific organization, and significant contributions to the advancement of systems engineering, mathematical modelling, and the optimization of chemical and biotechnological processes.

Based on the above considerations, I give my unequivocally positive assessment of the candidate and strongly recommend that the distinguished Scientific Jury propose to the Scientific Council of the Institute of Chemical Engineering, Bulgarian Academy of Sciences (ICHE-BAS) the election of Assoc. Prof. Elisaveta Georgieva Kirilova, PhD, to the academic position of Professor in the professional field 4.2 Chemical Sciences, specialty "Processes and Apparatus in Chemical and Biochemical Technology."

Date:

14.08.2015

Sofia

Prepared the report:



/ Assoc. Prof. Dr. Petya Popova-Krumova /