

REVIEW

in a competition for the academic position of "Associate Professor",
announced in SG issue 86 / 06.10.2020

Field of higher education: 5. Technical sciences

Professional field: 5.2. Electrical engineering, electronics and automation

Scientific specialty: Biomedical equipment and technologies

Candidate: Assistant Professor Dr. Eng. Zhivko Borisov Bliznakov

Reviewer: Prof. Dr. Idilia Alexandrova Batchkova, UCTM-Sofia

1. General provisions and biographical data

The competition for associate professor in the scientific specialty "Biomedical Equipment and Technologies" was announced by a decision of the Faculty of Science at the Faculty of Public Health (Minutes № 156 / 20.11.2020) at the suggestion of the Department of Medical Equipment, Electronic and Information Technologies in Healthcare (report with entry № 102-2607 / 28.10.2020) and by decision of the Academic Council of the Medical University (MU) - Varna. The only candidate in the competition is Assistant Professor Eng. Zhivko Borisov Bliznakov.

He was born on December 2, 1973 in the city of Varna. He graduated in 1996 with a degree in Electronic Engineering and Microelectronics from the Technical University of Varna and obtained a Master's degree in Electrical Engineering. In the period 1996-1998 he studied for a second master's degree in Biomedical Technologies at the University of Patras, Greece, which grew into a doctoral program for the period 1998-2003 as a full-time doctoral student in the Laboratory of Biomedical Technologies, Department of Medical Physics. Medicine at the University of Patras, Greece. The title of the dissertation defended in 2003 is "Methodology for a global approach and development of an integrated medical equipment management system." In the period 2004 - 2016 he was Head of the Biomedical Technologies Management Department at the Institute of Biomedical Technologies, Patras, Greece. During the same period he worked as a researcher in the Laboratory of Biomedical Technologies, at the Department of Medical Physics at the University of Patras, Greece. In the period 2013 - 2019 Dr. Zhivko Bliznakov also works as a research associate and part-time lecturer at the Laboratory of Computer Simulations in Medicine at the Technical University - Varna, and in 2016 he became Head of the Center for National and International Projects at the same university. . Since 2019 he has been working at the Medical University - Varna, as Deputy Director of the Center for Simulation Techniques and Medical Equipment. Since 2020, Dr. Bliznakov has been an assistant at the Department of Medical Equipment, Electronic and

Information Technologies in Healthcare at the Faculty of Public Health, at the Medical University of Varna.

In the period 2016 - 2020 Dr. Bliznakov has conducted 7 specialized courses with issued certificates of competence in Modern 3D images of biological samples (2016, TU-Varna, Catholic University of Leuven, Belgium), in Methods for modeling breast tumor and breast imaging (2018, Napoli, Italy), FPGA (2018, Technical University - Varna), PYTHON programming (2019, Technical University - Varna), specialized training for working in an environment with sources of ionizing radiation (2020, Technical University - Varna).

As. Bliznakov has a good foreign language training, speaks 3 foreign languages: English, Greek and Russian, which has a positive impact on his teaching and research activities.

2. General description of the submitted materials

To participate in the competition for associate professor, the candidate has submitted 28 scientific papers, which relate as follows:

- To cover the minimum scientometric indicators in Group B, 10 scientifically peer-reviewed publications in English were selected, referred to in the international database SCOPUS with a total number of 100.96 points. These scientific publications are equivalent to a monograph on the topic: "Computer models, simulations, algorithms and software applications in X-ray imaging"
 - Papers published in specialized journals and yearbooks - 6 pcs. in specialized international journals, such as: Physica Medica (2), Physics in Medicine and Biology (1), Journal of Composite materials (1), Journal of Structural Integrity (1) and Computer Methods and Programs in Biomedicine (1)
 - Papers from international conferences (papers published in full text) - 4 papers, all in English and all were held abroad.
- A total of 18 scientific peer-reviewed publications in English with a total number of 204.00 points were selected to participate in the competition and cover the minimum scientometric indicators in Group D. of which 13 are referenced in the international SCOPUS database.
 - Scientific publications from Group G7, referred to in the international database SCOPUS - 13 copies, of which 2 papers published in specialized journals and 11 papers - in proceedings from international conferences (papers published in full);
 - Scientific publications from Group G8, including papers published in proceedings from international conferences (papers published in full text) - 5 papers, all in English;

The candidate has submitted in document 21 "Curriculum vitae with a list of all publications" a list of 118 publications, of which 49 journal papers and 69 papers from participations in scientific conferences (14 participations in 10 national scientific forums and conferences and 76 participations in 52 international scientific forums and

conferences). The academic reference presented as document 12 describes the presented publications for obtaining an educational and scientific degree "DOCTOR", as they are not included in the list of publications, with which the candidate participates in the competition for "ASSOCIATE PROFESSOR". There are no data for participation in previous competitions for academic positions in Bulgaria. Subject to review are the scientific publications, represented in documents 14 and 15 from Group B and Group G, 28 in total. All scientific papers submitted for participation in the competition are collective, with one or more co-authors (28 pcs.), as in 8 papers the candidate is the first author, with 7 papers each in second and third place. There are no publications with individual participation. Most publications are with four authors (8 papers), followed by those with three authors (6 papers) and 2 authors (5 papers).

The candidate has also submitted a Certificate for teaching experience (Document 6) and a Certificate for the workload (Document 7). The certificate for teaching experience includes:

- Certificate for teaching experience from the Medical University - Varna as assistant, which until 10.11.2020 amounts to 9 months;
- Contracts (3) for teaching activities as a part-time lecturer from the Technical University - Varna for the periods 29.01.2018 - 15.09.2018; January 28, 2019 - September 14, 2019 and August 26, 2019 - May 23, 2020.
- Certificates (2) for teaching activities from the University of Patras, Greece. The first certifies the lecturing in Clinical Engineering at the Faculty of Medicine for a period of 6 academic years (2004-2011) within the Inter-University Postgraduate Program in Biomedical Technologies and Certificate for lecturing in the discipline "Special Topics - IT applications in medicine" in the III semester of the Inter-University program for postgraduate education in the specialty "Information technologies in medical sciences" for a period of 3 academic years (2009 - 2012).

Reference for study load includes:

- Reference for study load from the Medical University - Varna: The report confirms the load of 140 hours of exercises for the summer semester of the 2019/20 academic year. The course is not mentioned in the reference.
- 3 Contracts for teaching as a part-time lecturer at the Technical University - Varna: lectures on the subject "Clinical Engineering" for Bachelor's degree, specialty Biomedical Electronics 91.2 hours for 2017/18 academic year, 18.4 hours for 2018/19 academic year and 33.5 hours for 2019/20 academic year.
- 2 Certificates for teaching activities from the University of Patras, Greece: The teaching hours of the discipline "Clinical Engineering" taught for 6 years at the Faculty of Medicine at the University of Patras and the Faculty of Mechanical Engineering and Electrical Engineering and Computer Technology at the National Technical University in Athens, Greece is not specified in the in the document. The teaching hours of the course "Special Topics - IT Applications in Medicine" taught

for three academic years at the Faculty of Medicine of the University of Patras for the specialty "Information Technology in Medical Sciences" is also not covered.

The certificates for teaching experience and the Information for study load show that Dr. Bliznakov has accumulated many years of teaching experience in various universities in Bulgaria and abroad in disciplines directly related to the scientific specialty of the competition. During the last ten academic years, Assistant Professor Dr. Bliznakov has had an annual study load covering the requirements for standards at MU-Varna.

Document 21 "Curriculum vitae with a list of all publications" presents a list of research and educational projects in which Dr. Bliznakov has participated. They are a total of 23, of which 2 are current. 18 are international research projects, including 2 under H2020, 2 under 7FP and 1 under 6FP, as well as 5 projects at national level.

3. General characteristics of the research and applied research activity

All submitted scientific papers are in the scientific field of the competition announced in the scientific specialty "Biomedical Engineering and Technology".

3.1. Description of the monographic work

The candidate participates in the competition with 10 publications, equivalent to a monograph entitled "Computer models, simulations, algorithms and software applications in X-ray imaging", which complies with the requirements of „ЗРАСБ“ and “ПУРЗАД” of MU Varna. Their thematic focus concerns the solution of various tasks related to image diagnostics using X-rays. Publications equivalent to a monograph cover the following problem areas:

- Comparative analysis of two approaches to generate noise-reduced tomograms based on simulation using three mathematical phantoms and experiments with two physical ones similar to the mathematical ones. Overview and classification of reliability assessment methods presented in papers [B4-01].
- Study the use of new materials to create physical phantoms of the mammary gland [B4-02].
- Methodology for generating realistic three-dimensional software models of Carbon Fiber Reinforced Polymer (CFRP) structures, intended for use in simulation studies of modern methods for non-destructive testing by X-ray technique. Software models used to quantify the feasibility of various X-ray imaging techniques: cone-beam computed tomography, digital tomo-synthesis and radiography, as techniques for inspection by non-destructive testing of CFRP structures [B4-03, B4-04].
- Approach to creating computer anthropomorphic phantoms as prototypes of physical objects and demonstrating the applicability for reproduction of real physical phantoms for use in clinical practice by their computer models (software model of the mammary gland and its 3D printing) [B4-05, B4-06]. A new approach to developing a physical model of the breast with realistic shape, size and X-ray

absorption properties has been proposed, eliminating the need to segment breast tissue directly, mimicking the radio density of each voxel from computed tomography [B4-10].

- Development of an approach for creating complex computer models of the breast, including models of breast tumors [B4-07]. The approach allows the simulation of multiple scenarios and an unlimited number of cases that can be used to model and study existing or new techniques for breast imaging.
- A new method for evaluating the X-ray properties (absorption coefficients β and refraction δ) of twelve materials used for 3D printing for the purpose of making quality and adequate three-dimensional physical models of the mammary gland [B4-08].
- A method has been developed to create computer models of mammary gland lesions that have irregularly shaped lesions and are segmented by patient data. For this purpose, digital tomo-synthesis of the mammary gland and images of mastectomies were used, as well as computed tomography of the whole breast [B4-09]. The method is implemented in the MATLAB programming environment.

The scientific works presented in this section are equivalent to a monographic work, treating in its logical sequence, interconnections and completeness the problems of X-ray imaging. The proposed innovations, such as software models, algorithms and approaches have been tested and validated in practice with various examples. The presented materials satisfy the requirements of Art.1 (2) and Appendix 1 of the Regulations for development of the academic staff (RDAS) in MU - Varna.

3.2. Description of publications outside the monograph

The publications outside the monographic work, which are 18, concern various researches, thematically related to the scientific specialty of the competition and can be grouped in the following groups of researches and developments:

- Computer models, simulations, algorithms and software applications in X-ray imaging using [X7-01, G7-06, G7-07, G8-01];
- Management of medical equipment in healthcare and development of specialized software systems for this purpose [G7-02, G7-03, G7-04, G7-05, G7-13, G8-02, G8-03];
- Reforming and harmonizing curricula in the field of biomedical engineering in Europe [G7-08, G7-09, G7-10, G7-11, G7-12, G8-04, G8-05];

I believe that publications G7-01, G7-06, G7-07 and G8-01 can safely be referred to publications equivalent to a monograph, as they address the same problems in the field of X-ray imaging.

3.3. Description of the scientific-applied activity of the candidate

Document 21 "Curriculum vitae with a list of all publications" presents a list of research and educational projects in which Dr. Bliznakov has participated. They are a

total of 23, of which 2 are current. 18 are international research projects, including 2 projects under H2020, 2 under 7FP, 1 under 6FP, 4 projects under TEMPUS IV, as well as 5 projects at national level: 1 project under the Research Fund, 1 - under OP "Science and education for smart growth", 1 - to the Bulgarian Innovation Fund and 1 project under OP Innovation and Competitiveness. The thematic area of the projects coincides with the area of the announced competition "Biomedical equipment and technologies".

Dr. Bliznakov's active research activity is confirmed by his many years of work as a researcher (12 years) in the Laboratory of Biomedical Technologies at the Department of Medical Physics at the University of Patras, Greece, as well as a research associate in the laboratory of computer simulations in medicine of the Technical University - Varna. It is worth noting the 3 years of experience of the candidate related to project management as Head of the Center for National and International Projects at the Technical University - Varna, as well as his position as Deputy Director of the Center for Simulation Techniques and Medical Equipment at the Medical University - Varna.

This information gives me reason to appreciate very highly the scientific and applied work of Dr. Bliznakov.

4. Assessment of the pedagogical preparation and activity of the candidate

The presented in the documents certificate for teaching experience (document 6) and reference for the workload (document 7) of Assistant Professor Dr. J. Bliznakov show that he has been participating since 2004 in the teaching and methodological activities of departments from three universities: the Department of Medical Physics at the University of Patras, Greece; at the Technical University - Varna and at the Department of Medical Equipment, Electronic and Information Technologies in Healthcare of the Faculty of Public Health at the Medical University of Varna.

Dr. Bliznakov has issued 3 textbooks, as follows:

- Book - textbook in English "Anthropomorphic Phantoms in Image Quality and Patient Dose Optimization: A EUTEMPE network book" (Anthropomorphic phantoms for image quality and patient dose optimization: a book on the EUTEMPE network), Publisher: IOP Publishing Ltd, 2018, Online ISBN: 978-0-7503-1323-0, Print ISBN: 978-0-7503-1324-7.
- Exercise Guide (in English): K. Bliznakova, I. Buliev, Z. Bliznakov, "MPE05: Anthropomorphic Phantoms" (MPE05: Anthropomorphic Phantoms), Laboratory Exercises - Guide for Learners, Publisher: European Project EUTEMPE-RX, FP7 Fission-2013-5.1.1 (GA: 605298), 2015.
- Lecture notes, Patras University Press, Greece: Z. Bliznakov, K. Bliznakova, N. Pallikarakis (2008), "Aspects of Clinical Engineering - Management of Biomedical Technology", Lecture notes, University of Patras, Greece, 2008.

Taking into account the rich theoretical and practical experience gained during the years from 2004 until now in his work and commitments as a research engineer and research associate, it can be safely said that the candidate is highly qualified and trained in the field led by him. disciplines. In conclusion, I believe that the pedagogical training and activities of Assistant Professor Dr. Z. Bliznakov fully comply with the requirements for holding the academic position of "Associate Professor".

5. Main scientific and applied scientific contributions

5.1. Contributions to publications equivalent to a monograph

From the analysis of the scientific works of the candidate, which are presented as equivalent to a monograph, I make the following assessment and classification of the contributions:

Scientific contributions:

- Methods for reconstruction of tomographic images have been developed [B4-01, G7-07]
- A methodology for generating realistic three-dimensional software models of carbon-fiber-reinforced polymer structures has been developed for use in simulation studies of modern methods for non-destructive testing by X-ray technique [B4-03, B4-04].
- Development of new physical phantoms of the female breast for research in the field of X-ray imaging [B4-06, B4-10]. The new method is based on the use of variable speed extrusion of plastic filaments when creating models with 3D printing

Scientific and applied contributions:

- Development of algorithms for reconstruction of tomographic images [B4-01, G7-07]
- Research of new materials for preparation of physical models for testing of new X-ray techniques [B4-02, B4-08].
- New methods have been developed for modeling small in shape and volume composite parts composed of carbon fiber reinforced polymers (CFRP) [B4-03, B4-04].
- New computer models of the female breast have been developed for research in the field of X-ray imaging [B4-07, B4-09]. They have been developed by combining mathematical models with parts of segmented real three-dimensional images from patients with tumors. This approach leads to the creation of realistic computer models involving breast tumors.

Applied contributions:

- Application of the developed algorithms for reconstruction of tomographic images in digital tomosynthesis, method for limited angular reconstruction of tomographic images [B4-01, G7-07];
- Nine materials and a mixture of iodine with epoxy resin were simulated for the purposes of developing a physical model of the breast [B4-02];
- The X-ray properties of twelve materials used in 3D printing were studied. The twelve materials are six photopolymer resins: Black, Clear, Flex, Gray, Tough, and White and six plastic materials: ABS, Hybrid, Nylon, PET-G, PLA and PVA [B4-08].
- Application of the CFRP model in a simulation study of two X-ray imaging techniques: conical computed tomography and digital tomosynthesis, as inspection techniques through non-destructive testing of CFRP structures [B4-03, B4-04].
- A software tool has been created that allows the creation of models of mammary gland lesions
- Introduction of new, attractive methods for conducting training in the field of computer simulations in medicine [B4-05]

5.2. Contributions to publications beyond the equivalent of a monograph

Contributions to publications outside the equivalent of a monograph can be attributed as follows:

Scientific and applied contributions:

- Development of a comprehensive integrated software system to improve the management of medical equipment [G7-02, G7-03, G8-02];
- Comprehensive analysis and classification of withdrawals of medical devices from their manufacturers [G7-04, G7-13];
- Development of Monte Carlo based software simulators for research in the field of X-ray imaging and radiation therapy [G7-06, G8-01];
- Comprehensive overview of the current state of biomedical engineering curricula in European universities [G7-08, G7-09, G7-12];
- Proposal for harmonization of curricula in the field of biomedical engineering in European universities [G7-10, G7-11, G8-04, G8-05].

Applied contributions:

- Solution to increase the efficiency and utilization of conventional technologies used in radiation therapy [G7-01]
- Implementation of specialized software systems for management of medical equipment in the health sector in Greece [G7-05, G8-03]

- Proposal for harmonization of curricula in the field of biomedical engineering in European universities [G7-10, G7-11, G8-04, G8-05].

6. Significance of contributions to science and practice

6.1. Significance of contributions

From the analysis of the scientific works of Dr. Bliznakov presented in item 5 it is evident that they are significant, developed at a modern level using the achievements in the field of Biomedical techniques and technologies using modern methods of computer science and information technology. The scientific, scientific-applied and applied contributions of the candidate of both groups of publications are indisputable. All publications in Group B have Impact Factor (IF), amounting to 14,574 for publications in Group B and 1,975 for Group D. A significant part of the presented publications are of great benefit for the practice and increase of efficiency and quality in the field of biomedical techniques, technologies and training, in particular in the field of various aspects of X-ray imaging. The significance of the contributions is not in doubt.

6.2. Compliance with the quantitative indicators for holding the academic position of associate professor

Based on the presented in document 12 "Academic reference" for the publications, citations and scientific profiles of Dr. Bliznakov, prepared by the Library of MÚ-Varna, in accordance with the Regulations of „ЗРАСПБ“ and the Regulations for development of the academic staff in MU-Varna, the results can be summarized quantitatively in Table 1. It is obvious that the candidate meets the requirements of “ПУРЗАД” in MU - Varna. I believe that the quantitative indicators presented in Table 1 are completely sufficient to hold the academic position of "Associate Professor".

Табл. 1: Сравнителна таблица на показателите

Group of indicators	Contents	Associate Professor	Dr. Bliznakov
A	Indicator 1	50	50
Б	Indicator 2	-	-
B	Indicator 3 or 4	100	100,96
Г	Sum of indicators from 5 to 11	200 (Ind.7 - >= 60 p.)	204 (167,32 – Ind.7)
Д	Sum of indicators from 12 to 15	50	50
Е	Sum of indicators from 16 to the end	-	-

7. Critical remarks and recommendations

I consider it appropriate to make some remarks and recommendations regarding the materials presented by Dr. Bliznakov:

- I find it insufficient to submit documents for the study load of the candidate, without indicating the lecture courses he conducts and their hours, especially when it concerns MU-Varna, which has announced the competition. This makes it difficult for the external members of the jury to assess the pedagogical preparation and activity of the candidate.
- I believe that the published textbooks should be provided to the jury for review and review, and not just for reference.
- I recommend the candidate to publish independent publications in the future, as well as more participation in specialized conferences and events in Bulgaria.
- I recommend the candidate to prepare textbooks in the disciplines taught by him for MU-Varna, in Bulgarian.

These comments and recommendations in no way reduce the value of the submitted materials and should be considered as recommendations for the future work of the applicant.

8. Personal impressions and opinion of the reviewer

I do not know personally Assistant Professor Zhivko Borisov Bliznakov, PhD. My only impressions, which are positive, are from the materials submitted for participation in the competition.

CONCLUSION

Based on the **positive assessments** of the research and pedagogical activity of the candidate, the relevance and significance of the contributions in the submitted works and the fact that the indicators of his previous activity meet the legal requirements of „ЗРАСРБ“ and “ПУРЗАД” of MU Varna in this competition, I consider it reasonable to propose to the esteemed Faculty Council at the Faculty of Public Health to support the proposal of Assistant Professor Dr. Eng. Zhivko Borisov Bliznakov to take the academic position of "Associate Professor" in the professional field 5.2 "Electrical Engineering, Electronics and Automation" in Biomedical equipment and technology.

Sofia, 17 February, 2021

Reviewer: 

/Prof. I. Batchkova/