

STATEMENT

on the competition for awarding the academic position "Associate Professor"
in area of higher education: "5. Technical Sciences"
professional field "5.2. Electrical engineering, electronics and automation",
specialty "Application of the principles and methods of cybernetics in different fields of science
(biomedicine)"

announced in SG 58/18.07.2025

Candidate: Chief Assistant Professor Dobromir Petkov Dobrev, PhD

Member of the scientific jury: Prof. Irena Ilieva Jekova, PhD
from the Institute of Biophysics and Biomedical Engineering - BAS

Chief Assist. Prof. Dobromir Petkov Dobrev is the only candidate in the competition for the academic position of "Associate Professor", published in the State Gazette No. 58 of July 18, 2025. The presented set of materials has been prepared in accordance with the Law on Academic Staff Development in the Republic of Bulgaria (LASDRB) and the Regulations for its application at the Institute of Biophysics and Biomedical Engineering (IBPhBME) at the Bulgarian Academy of Sciences (BAS). The presented set of materials contains all the necessary documents for participation in the competition.

1. General characteristics of the research and applied research activities of the candidate

Chief Assistant Dobromir Dobrev obtained a PhD degree in 2001. The topic of his PhD thesis is: "Methods and electronic devices for newborns monitoring". He has over 30 years of professional experience as an integrated circuits designer and has held the academic position of Chief Assistant at IBPhBME-BAS for more than 4 years.

To participate in the competition for the academic position of "Associate Professor", the candidate has submitted a total of 36 publications, including 15 papers indexed in the scientific databases Web of Science (WoS) or Scopus (8 papers with impact factor (IF), 2 papers with SJR rank, 5 papers without IF/SJR) and 21 not indexed papers. Some of the not indexed papers are included in proceedings of international and national scientific forums. Chief Assistant Dobromir Dobrev is a single author in 4 of the publications and the first author in 8 of the publications. A list of 196 citations of 30 publications is presented. The candidate's h-index according to Scopus is h-index=6, excluding auto-citations from all co-authors. These are evidences for the value of the achieved results. Evidence of the scientific and applied focus of the research conducted are the four patents (2 international and 2 national) and the application for a national patent, indicated by the candidate in section "Analysis of overall publication and research activity" in the materials submitted for the competition.

The analysis of the research and applied scientific activities of Chief Assistant Dobromir Dobrev (summarized in Table 1) shows that his achievements significantly exceed the minimum national requirements for the academic position of "Associate Professor", as well as the requirements specified in the Regulations for the application of the LASDRB at IBPhBME - BAS.

Table1. Comparison of the candidate's points with the minimum national requirements for the academic position of "Associate Professor".

Group of indicators	Indicator	Minimum number of points for "Associate Professor"	Candidate's points
A	1. Dissertation paper for awarding educational and scientific degree "Doctor"	50	50

C	4. Habilitation work – science publications (not less than 10) in editions referenced and indexed in world renowned databases with scientific information	100*	340
D	7. Science publication in editions referenced and indexed in world renowned databases with scientific information 8. Science publication in not referred journals with scientific reviewing or in edited collective volumes	200*	292
E	12. Citations or reviews in science editions, referenced and indexed in world renowned databases with scientific information or in monographs and collective volumes	50	100

* According to the Regulations for the application of the LASDRB at IBPhBME – BAS, the candidate must have at least 8 articles in journals with IF, which could be distribute between criteria C4 and D7. The materials presented by Chief Assistant Dobromir Dobrev meet this criterion.

2. Main scientific and applied contributions

I accept the contributions formulated by Chief Assistant Dobromir Dobrev, which are in the field of development of hardware and software tools for acquisition and amplification of electrocardiographic (ECG) and bioimpedance signals without a reference electrode; acquisition and processing of signals from photoconverters, capacitive electrodes and sensors with capacitive output impedance; as well as hardware and software tools for filtering network interference in ECG. These are scientific-applied and applied contributions and can be summarized as follows:

- Innovative circuit solutions of differential and non-differential amplifiers without a reference electrode, applicable for two-electrode recording of ECG signals, have been developed. To achieve high differential impedance for the useful signal and low for the common-mode signals, two approaches have been applied: 1) connection of current generators to the amplifiers inputs 2) implementation of 100% positive bootstrap feedback. A method that reduces the common-mode current and the level of common-mode interference by more than 10 times is proposed. It supports an improvement in the rejection ratio by more than 20 dB. The method is based on applying the amplified common-mode voltage for controlling the parasitic capacitance between the shield of the electrode cables and the shell of the amplifier. This summarized contribution is supported by 5 publications from section C and 4 publications from section D. The publications have been cited a total of 115 times.
- A 4-electrode circuit for recording ECG and respiration via bioimpedance method has been developed. The circuit includes a measuring transducer with current-controlled inputs, which provides low in-phase and high differential impedance between the current electrodes and at the same time high differential impedance between the voltage electrodes. The main advantage of the presented concept is the acquisition of an ECG signal without significant PLI noise, since the PLI current flows through the current electrodes, but not through the voltage electrodes. This contribution is supported by 1 paper from section D.
- A photoconverter for registering peripheral pulse from the forehead area has been developed. This contribution is supported by 1 publication from section C and 1 publication from section D, which have been cited a total of 16 times.
- Measuring transducers have been developed for capturing biosignals from sensors with capacitive output impedances. They enable the acquisition of ECG via capacitive electrodes, as well as cardiac and respiratory activity via piezoelectric sensors. A significant contribution is the automatic determination of the operating point through an active negative feedback. Thus, a low cut-off frequency of 0.05 Hz can be achieved, which allows the recording of diagnostic ECG signals. This contribution is supported by 2 papers from section C, which have been cited a total of 15 times.
- A method and device providing better suppression of the offset and low-frequency noise of the measuring transducer via correlated multiple sampling have been implemented and patented. The contribution is supported by 1 paper from section C, which is cited 3 times.

- Software and hardware solutions have been proposed for power line interference (PLI) suppression in ECG using notch and band-pass comb filters with controllable quality factor, adaptive filtration and synchronous filtering. The presented notch comb filters are based on averaging or first order difference, and they remove the odd or all harmonics of PLI, respectively. A notch comb filter with a linear phase characteristic is obtained via correlated averaging of more than one first order difference, spaced at multiple PLI periods. The adaptive filter is implemented through a specially developed linearized model for determination of the PLI frequency. The filters based on synchronous filtering include: (1) mixed analog-digital solution for automatic balancing of electrode impedances and amplifier input impedances; and (2) digital filter with synchronous filtering, based on synchronous processing of the differential and common-mode input signals. The comb filters are described in 6 publications from group D, the adaptive filter is presented in one publication from group D, while the filters based on synchronous filtering are presented in 1 publication from group C and 13 publications from group D. The total number of citations of publications related to this contribution is 41. The synchronous filter is protected by a national patent.

I consider that the candidate's participation in achieving the formulated contributions is significant, taking into account the number of publications, in which he is a single (4) or the first author (29).

3. Significance of the contributions to the science and practice

The contributions noted above, which are based on the candidate's research and applied science activities support the following biomedical practices:

- Two-electrode recording of ECG signals, which increases the patient's comfort and is often used in intensive care units, outpatient systems, defibrillators, etc.
- Four-electrode recording of high-quality ECG and respiratory activity.
- Measurement of peripheral pulse from the forehead area using a photoconverter, which is extremely suitable for application in case of out-of-hospital cardiac incidents.
- Recording of cardiac and respiratory activity from sensors with capacitive output impedances.
- Suppression of noises in ECG signals.

The significance and relevance of the created methods and schematic solutions is indisputable, which is also confirmed by the number of citations found.

4. Critical remarks and recommendations

I do not have any critical remarks.

In order to further promote the results of his scientific work, as well as considering his future academic growth, I recommend that Chief Assistant Dobromir Dobrev focus his attention on publishing the results of his research in journals with an impact factor and open access.

CONCLUSION

Considering the materials presented by Chief Assistant Dobromir Dobrev and assessing the significance of the presented scientific papers and the scientific and applied contributions contained in them, I believe that the candidate meets the minimum national requirements and the requirements for holding the academic position of "Associate Professor" announced in the Regulations for the application of the LASDRB at IBPhBME – BAS. Based on this, I propose Chief Assistant Dobromir Dobrev, PhD, to take the academic position of "Associate Professor" in professional field "5.2. Electrical engineering, electronics and automation", specialty "Application of the principles and methods of cybernetics in different fields of science (biomedicine)", at the Department "Processing and analysis of biomedical signals and data" in IBPhBME – BAS.

Date: 10.11.2025

Member of the scientific jury:

(Prof. Irena Jekova, PhD)