

Вх. № 1101КП / 07.11.2025

REVIEW

in relation to awarding the academic position of Associate Professor
in professional field 5.2. Electrical Engineering, Electronics and Automatics,
scientific subject "Application of the principles and methods of cybernetics in various fields
of science (biomedicine)"

promulgated in State Gazette, issue 58/18.07.2025 for the needs of the "Processing and
Analysis of Biomedical Signals and Data" section at IBPhBME of BAS

Applicant: Dobromir Petkov Dobrev, PhD, Assistant Professor

Member of the Scientific Jury: Corresponding member of BAS Georgy Slavchev Mihov,
DSc, Professor

1. Overall characterization and biography information

Dobromir Petkov Dobrev was born on November 1, 1969 in the town of Gulyantsi, Pleven region. He graduated from the Technical University of Sofia, Faculty of Electronic Engineering and Technologies, specialty "Electronic Engineering and Microelectronics" in 1994 as a Master of Science. In the years 1997-2000 he was a PhD student at the Central Laboratory of Biomedical Engineering of Bulgarian Academy of Sciences. He defended his PhD thesis on the topic "Methods and electronic devices for monitoring newborns". With protocol No. 4 of 19.02.2001, the Higher Attestation Commission (HAC) awarded the educational and scientific degree "Doctor of Philosophy" in the scientific specialty 02.21.07 "Automated information processing and control systems in medicine".

In the years 1994-1997 he worked at EMA Engineering EAD, Sofia as a designer of electronic medical equipment in Central Laboratory for Electro-Medical Equipment (Medical Academy), with main activity and responsibility – development of experimental prototypes of electronic medical equipment. In the years 1997-2009 he worked sequentially for the companies SEMCOTEC ENGINEERING Ltd., SILWAY SEMICONDUCTORS, JET SYSTEMS Ltd., and MELEXIS BULGARIA Ltd. as a designer of integrated circuits and electronic equipment. He has been working in the same position at FACET Ltd since 2009, and since 2021 he is an Assistant Professor in the Institute of Biophysics and Biomedical Engineering (IBPhBMI) of Bulgarian Academy of Sciences.

2. General description of the presented documents

The applicant in the competition for the academic position of "Associate Professor" PhD Dobrev has submitted all the necessary documents, according to the Regulations for the implementation of the Law on the Development of the Academic staff in the Republic of Bulgaria (RILDASRB) at IBPhBME of BAS and the requirements of the National Center for Information and Documentation (NaCID).

The evidentiary material for fulfilling the minimum requirements for occupying the academic position of "Associate Professor" include a total of 36 articles (10 of which are equivalent to a monographic thesis), 10 citations and corresponds to the following number of points:

Indicator A – 50 points (min. 50). It is presented a PhD No. 27142, April 23, 2001, issued by the Higher Attestation Commission;

Indicator B³ – 340 points (min. 100). Ten papers equivalent to a monographic thesis are presented, which are referenced and indexed in world-renowned databases with scientific information (Web of Science, Scopus). Three of the papers are self-authored [B4.2, B4.3, B4.6], the rest are co-authored, with PhD Dobrev as the first author. One paper is in Q1 (Web of Science) – [B4.7], two are in Q2 (Web of Science) – [B4.4, B4.5] and one is in Q3

(Web of Science) – [B4.8]. The papers under indicator **B** have been cited a total of 140 times.

Indicator Γ^3 – 291,67 points (min. 200) 26 papers are presented, of which 5 according to indicator $\Gamma 7$ are referenced and indexed in the world-renowned database with scientific information of Scopus (**100 points**). The remaining 21 papers under indicator $\Gamma 8$ are in non-refereed peer-reviewed journals or in edited collective works (**191,67 points**). One of the papers is self-authored [$\Gamma 8.1$], the rest are co-authored, with PhD Dobrev being the first author in 23 of them, and second in [$\Gamma 8.4$, $\Gamma 8.16$, $\Gamma 8.20$].

Indicator Δ – 100 points (min. 50). Ten citations of the publication [B4.5] for indicator $\Delta 12$ are presented according to the requirements of IBPhBME and NaCID. All citations are made in scientific issues, cited and indexed in world-renowned databases of scientific information;

³⁾ According to the specific requirements for the occupation of the academic position "Associate Professor" in IBPhBME of BAS, the applicant in the competition PhD Dobromir Dobrev has presented 8 papers with an IF impact factor (Web of Science) [B4.1÷B4.8];

3. General characteristics of the applicant's research and applied-science activities

The overall research and applied activity of PhD Dobrev is in the field of analog and digital circuitry, related to the development of circuit, program and combined solutions for electronic devices and systems.

In the field of the competition, the candidate's activity mainly concerns the registration and processing of biomedical signals, and more specifically the following can be mentioned: two-electrode registration and amplification of biosignals and automatic balancing of electrode-amplifier impedances; registration and processing of biosignals from photoreceivers, bioimpedance, signals from capacitive electrodes and sensors; filtration (including synchronous) of power-line interference from ECG signals.

PhD Dobrev's research activity is confirmed by his participation in the co-authorship of three recognized patents (two Bulgarian and one European) and one patent application: Method and device for correlated multiple sampling with high-order noise formation, BG67325 / 02.01.2018; Method and device for recording and synchronous filtering of biosignals, BG67598 / 17.12.2020; Driving Brushless DC motors, international publication number WO 2007/119094A2, 20.01.2006 Method and device for universal filtering of digital signals, patent application BG113961, 10.09.2024

I appreciate the book review of "Analysis and application of analog electronic circuits to biomedical instrumentation" by Robert B. Northrop [B4.6] as a publication contribution in an educational and research aspect.

4. Major applied scientific contributions

The applicant PhD Dobrev has summarized the contributions related to the papers for participating in the competition for "Associate Professor" in five applied scientific areas.

4.1. Contributions to articles equivalent to a habilitation thesis – they can be defined as the enrichment of existing schemes, devices and systems with new qualities and parameters. They are summarized in three applied scientific areas.

In the area "Two-electrode recording and amplification of biosignals":

– Developed circuit solution for a differential two-electrode biopotential amplifier without a

reference electrode with current sources at both inputs, controlled by the common-mode voltage [B4.1]. The solution allows achieving high input differential impedance for the useful signal and low – for the common-mode signals;

- Developed circuit solution of a two-electrode biopotential amplifier without a reference electrode having a standard first-order high-pass characteristic and tolerating high DC input voltages, in absolute value close to the supply voltage of the circuit [B4.3]. The solution allows achieving high input voltage tolerance and high common-mode rejection ratio (CMRR).

- Developed circuit solutions of non-differential biosignal amplifiers without a reference electrode [B4.2, B4.4, B4.5]. The proposed solutions have high differential impedance and are characterized by simplicity, economy and low cost.

In the area "Encoding and processing of biosignals from photoreceivers, bioimpedance, capacitive electrodes and sensors":

- Developed measuring transducers (based on bias integrators) for biosignals from sensors with processing of capacitive output impedances [B4.10, B4.7], achieving a very low high-pass cutoff frequency and are suitable for registering biosignals from capacitive and piezoelectric sensors.

- Improvement of correlated multiple sampling techniques in sensor signal processing [B4.9], greatly improving the amplifier offset and flicker noise suppression of measuring transducers;

In the area "Synchronous filtering of power-line interference":

- Developed a digital synchronous filter [B4.8], based on digital quadrature demodulation and subsequent synthesis of the interference as a complex sinusoid and its subtraction from the signal.

4.2. Contributions in the articles for the competition of Associate Professor (outside the equivalent articles of habilitation thesis). To a large extent, they overlap with contributions in articles equivalent to habilitation work and can be characterized as using existing knowledge for new applications. They are summarized in four applied scientific areas.

In the area "Two-electrode recording and amplification of biosignals":

- Developed circuit solution of non-differential biosignal amplifiers without a reference electrode with a transimpedance amplifier connected to one of the inputs and with a controllable current source – to the other input for common-mode current balance. Suppression of unwanted common mode voltages is significantly more efficient compared to existing solutions [Г8.1]

- Developed circuit solutions for biopotential amplifiers without a reference electrode, in which the increase in input impedance for the useful signal is achieved with positive bootstrap feedback [Г8.2, Г8.3]. The solutions provide low common-mode and high differential impedance.

In the area "Recording and processing of biosignals from photoreceivers, bioimpedance, capacitive electrodes and sensors":

- Developed a method and a circuit solution for simultaneous recording of a high-quality electrocardiogram and body impedance [Г8.5];

- Developed a photoreceiver for registering a peripheral pulse from the forehead [Г8.4] generating an additional signal for cardiac activity, used in portable automated external defibrillators;

- Developed approach for increasing rejection (by a stray capacitance drive) of the com-

mon-mode interference in two-electrode biosignal amplifiers [Г8.6].

In the area "Filtering of power-line interference from ECG signals":

- Developed comb filter [Г8.15], which rejects odd harmonics of the power-line interference and not filtering the low-frequency components;
- Developed combined comb filters [Г8.17, Г8.18], removing odd harmonics of the power-line interference and high-frequency filtering the low-frequency components.
- Developed band-pass comb filters for extracting power-line interference [Г8.16, Г8.20] with a high quality factor;
- Developed combined comb filter with a linear phase response [Г8.19], which rejects all harmonics from the power line interference and restores the low-frequency component by using a moving average low-frequency cascade.
- Developed a model for determining the frequency response of an adaptive filter with incremental evaluation [Г8.21], which can adapt to changes in the power line frequency relative to its nominal value;

In the area "Automatic electrode-amplifier impedance balancing":

- Developed a mixed analog-digital solution for automatic balancing of the impedance bridge formed by the electrode impedances and the input impedances of a biosignal amplifier [Г8.7], using an uncontrolled RC chain in one input and an RC chain controlled by the common-mode signal in the other input of the amplifier;
- Developed an analog option for automatic balancing [Г8.8], using analog multipliers controlled by the common-mode signal;
- Developed an analog option for automatic balancing [Г8.9], using current generators controlled by the common-mode signal;
- developed options for automatic balancing [Г7.1, Г7.2, Г7.3, Г8.12]. using a software PLL synchronized with the power-line frequency;

In the area "Synchronous filtering of power-line interference":

- Developed a digital filter with synchronous filtering [Г8.10, Г8.11], based on digital quadrature demodulation, synthesis of the complex sinusoid of the interference and its subtraction from the signal;
- Developed a software PLL from its analog prototype [Г8.13, Г8.14], generating a reference signal synchronous with the power-line frequency. The main advantage of the software PLL is that synchronization is performed in software and there are no manufacturing costs for components;
- Designed a software automatic gain control [Г7.4, Г7.5], generating common mode signal with constant amplitude, and ensuring constant open-loop gain during synchronous filtering of ECG signals;

5. Significance of contributions for science and practice

The results obtained in the works of the applicant in the competition PhD Dobromir Dobrev are directly applicable in the applied scientific field of Biomedical Engineering in the construction of devices and systems for recording, analyzing and processing biomedical signals and data.

Apart from the citations in the competition for "associate professor", PhD Dobrev has presented a prepared report for 196 citations of 30 publications (WoS, Scopus and other da-

tabases) noted by him. In Scopus, 166 citations of 17 publications with the participation of the applicant are visible, h-index = 6, with self-citations excluded. It can be argued that PhD Dobromir Dobrev is known among scientific community in field of Biomedical Engineering.

6. Critical remarks and recommendations

I have no critical remarks towards the applicant. The competition documentation is precisely and neatly prepared. There is verifiable evidence regarding the achievements of Assistant Professor PhD Dobromir Dobrev. The additional documents requested by me were submitted in a timely manner. The quantitative indicators of the criteria for occupying the academic position of "Associate Professor" at the IBPhBMI of BAS have been exceeded.

I have certain notes regarding the formulation of the candidate's contributions, they are highly fragmented and many of them lack the evaluation part – advantages for specific applications, compared to existing solutions. Articles equivalent to a monographic work should be thematically united under one common scientific research title, with separately declared contributions.

7. Personal impressions and opinion of the reviewer

I know Asst. Prof. PhD Eng. Dobromir Dobrev from his work for the Central Laboratory for Electro-Medical Equipment (Medical Academy), as a capable developer of biopotential amplifiers, as well as from his regular participation in the International Conference "Electronics – ET", where he has delivered meaningful articles. I do not participate in joint publications with the candidate and am not a person related to him within the meaning of § 1, item 5 of the Additional Provisions of the ZRASRB.

CONCLUSION

The submitted materials meet the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its Implementation and the Internal Regulations for the Implementation of the Law in IBPhBMI of BAS. Based on the acquaintance with the submitted scientific works, their significance, the contributions contained in them, I find it reasonable to propose that Assistant Professor PhD Dobromir Petrov Dobrev, to occupy the academic position of "Associate Professor" in the professional field 5.2. Electrical Engineering, Electronics and Automation in the scientific major "Application of the Principles and Methods of Cybernetics in Various Fields of Science (Biomedicine)".

November 7, 2025

REVIEWER:



/Corr. Mem. of BAS Prof. DSc Eng. G. Mihov/