



POSITION

from
Assoc. Prof., Eng. Iliyan Iliev, Phd.
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of the materials submitted for participation in a competition for the occupation of the academic position "Associate professor" in the field of higher education - 5. Technical sciences, by professional direction - 5.2. Electrical engineering, electronics and automation.

In the competition for associate professor, announced in the State newspaper, no. 64/30.07.2024, p.74 and on the website of IR-BAS for the needs of the section "Sensors and measurement technologies in robotics and mechatronics" (Adaptive and inhomogeneous structures in sensors), as a candidate participates Martin Lachezarov Ralchev, Phd.

1. Overview of the content and results in the presented works

The candidate, Martin Ralchev, Phd., has submitted the necessary materials and evidence for participation in the competition for associate professor: an application to the Director of IR-BAS, a curriculum vitae, a copy of the diploma for the educational and scientific degree "Doctor of Philosophy", a list and a copy of the scientific works; author's reference for citations, author's reference for scientific contributions, reference for participation in research projects, reference for fulfilling national requirements and minimum requirements for IR-BAS, specified in the Rules for the acquisition of scientific degrees and holding academic positions in IR- BAS.

He has defended a dissertation on the topic: "Emission and sensor registration of microparticles in inhomogeneous structures during uniaxial deformations" (indicator A - 50 points). To participate in the competition, the candidate submits 23 scientific publications. 10 publications equivalent to habilitation work, which are in editions, referenced and indexed in world-renowned databases with scientific information (index B - 165 items) are presented. Also presented are: 16 publications in editions referenced and indexed in world-renowned scientific information databases as well as 7 scientific publications in non-refereed peer-reviewed journals or in edited collective volumes (group of indicators D.7 - 206.2 items and D.8 - 56.6 points); 28 citations in scientific publications, referenced and indexed in world-famous databases with scientific information, indicator D.12 – 280 items. The applicant has four published applications for a patent or utility model - №113474/25.01.22, №113589/23.0922 ., No. 113625/06.12.22 and No. 113641/10.01.23 (indicator E.25 – 80 items), and four recognized applications for a utility model, patent or author's certificate - No. 67489B1/16.01.23, No. 67551B1/17.07.23, No. 67560B1 /15.08.23 and No. 67643B1/31.07.24, (index E.26 – 160 items). The candidate has participated in 3 research projects with European funding.

As is evident from the presented works, the candidate fully meets the minimum national requirements and the minimum requirements for IR-BAS for the position of "associate

professor" and exceeds them by all indicators. Therefore, the participation of Eng. M. Ralchev, Phd. in the competition is completely legitimate.

2. General characteristics of the applicant's activity

2.1. Scientific and scientific-applied activity

Eng. Martin Ralchev, Phd. has actively participated in the following European projects:

1. National Competence Center "Quantum Communication, Intelligent Systems for Security and Risk Management" (QUAZAR), No. BG05M2OP001-1.002-0006. The total financial impact of the project is BGN 13.5 million.

2. National Competence Center "Personalized Medicine, 3D and Telemedicine, Robotic and Minimally Invasive Surgery" (Da Vinci), No. BG05M2OP001-1.002-0010. The total financial impact of the project is BGN 23.5 million.

3. "Bulgarian National Plan for Quantum Communication Infrastructure - DIGITAL-2021-QCI-01" within the framework of the European initiative EuroQCI, No. 101091399. The total financial impact of the project is BGN 20 million.

Eng. Martin Ralchev, Phd. has actively participated with publications in the following conferences of international importance:

1. Electrical Engineering Faculty Conference (BULEF), Varna, Bulgaria.
2. Seventh Junior Conference on Lighting (Lighting), Sozopol, Bulgaria.
3. Electrical Apparatus & Technologies (SIELA), Bourgas, Bulgaria.
4. International Scientific Symposium Metrology and Metrology Assurance (MMA), Sozopol, Bulgaria.
5. International Conference on Sensing Technology (ICST), Sydney, NSW, Australia.
6. Conference on Electrical Machines, Drives and Power Systems, ELMA.

Martin Ralchev has been awarded many times for his high contribution to scientific activity, namely:

1. Certificate from the XVIII National Youth Scientific and Practical Conference of the Federation of Scientific and Technical Unions in Bulgaria.
2. Award from the Lachezar Tsotsorkov Foundation for the project "Implementation of a System for the Analysis of Nanoparticles".
3. Diploma with an award of the Bulgarian Academy of Sciences "Ivan Evstatiev Geshov" for the youngest scientists under 30 years of age.
4. Diploma for winner of the Eureka Young Inventor Award for 2023.

2.2. Implementation activity

The applicant submits four published patent or utility model applications:

1.№113474/25.01.22г.

2.№113589/23.0922г.

3.№113625/06.12.22г.

4.№ 113641/10.01.23г.

As well as four recognized utility model, patent or copyright applications:

1.№67489B1/16.01.23г.

2.№67551B1/17.07.23г.

3.№67560B1/15.08.23г.

4.№67643B1/31.07.24г.

3. Contributions (scientific, scientific-applied, applied). Significance of contributions to science and practice.

I accept the formulated contributions in the presented works. They have a scientific-applied and applied nature in the field of innovations such as a paired Hall sensor, magnetotransistor sensor transducers, magnetic navigation systems in robotic surgery, etc. also contribute to the improvement of measurement technologies based on additive sensing phenomena.

Scientific-applied contributions in publications equivalent to a habilitation thesis:

An additive method for filtering the harmonic spectrum of current sensors has been developed and improved. It significantly improves measurement accuracy by identifying and correcting harmonic distortions. This generates more reliable and accurate data, which is important for the analysis, management and monitoring of electrical systems.

[B4-1, B4-2 and B4-3].

A new technology for rapid prototyping of rotary flux modulator systems has been proposed and experimented. This enables an accelerated process of design, testing and implementation of new control systems for electric motors and generators, significantly shortening the time to achieve innovative solutions in electrical engineering.

[B4-4].

A system for remote monitoring of transformer switching processes based on additive acoustic sensors has been designed, constructed and tested. This technology allows to monitor the condition of transformers in real time, increasing the reliability of power distribution networks and reducing the risk of malfunctions and accidents.

[B4-5].

An additive silicon sensor (multi-sensor) measuring simultaneously and independently the three components of the magnetic field (X, Y and Z) was created and investigated. This component expands the possibilities of increasing the accuracy in the study of magnetic fields with complex

topology in different configurations and devices, which is especially important for the optimization of many electromagnetic applications.

[B4-6].

Scientific and applied contributions, other than those equivalent to a monographic work:

New methods for monitoring and analysis of electrical discharges using acoustic spectra in inhomogeneous systems have been developed and verified. A typical example is the transient heating of lithium-ion batteries during discharge. The acoustic spectrum of electric arcs and the use of CNN to estimate the power of the electric discharge are analyzed. A study of the acoustic spectrum of direct current was carried out, and the possibility of integration of IoT technologies for monitoring electric discharges was developed. These key results have broad electrical engineering impact.

[D7-1, D7-3, D7-4, D7-5, D7-10].

For the purposes of magnetic field metrology, new inhomogeneous sensor systems and technologies have been developed and researched, which expand the possibilities of measuring magnetic and electrical characteristics in the given conditions. Practically oriented examples are the results for bipolar transistors, obtaining information about inhomogeneous and highly divergent magnetic fields, as well as Hall micro-sensors for determining the plane X and Y components of the magnetic vector. Based on them, original modulator systems containing multi-purpose permanent magnets were constructed. The used Hall elements are suitable for weak-field, high-precision and multidimensional magnetometry, as their sensitivity increases sharply at cryogenic temperatures, especially the boiling temperature of liquid nitrogen $T=77$ K. [G7-2, G8-2, G8-4, G8-5, G8-3].

Implemented in electrical engineering are IoT technologies for remote monitoring and control of various electrical parameters. A characteristic example is the study of electric discharges in real time, which significantly increases the efficiency and reliability of metrology in such complex and inhomogeneous systems

[D7-4, D8-1].

Methods for control and optimization of processes in 3D printing have been developed and tested. The mechanisms of filament feeding and material solidification, which is important for the quality of 3D printing, have been investigated and analyzed. Gas diffusion monitoring chambers have been developed and studied.

[D7-6, D7-7, D7-8, D7-13, D7-12].

This class of sensor systems and devices is based on the experimentally established previously unknown regularity in inhomogeneous systems - rocks and concretes, resulting in the generation of micro- and nano-particles under the influence of high uniaxial deformations. Through additional research, it has been proven that the amounts of emitted particles and their distribution are reproducible for a specific type of rock and concrete. The monitoring of the amount of generated particles is an integral parameter for early notification and prediction of pre-emergency and emergency processes in the infrastructure. Through the new phenomenon, new methods and innovative robotic platforms have been developed for the purposes of anti-seismic engineering. Methodical and engineering solutions are patented as inventions. The proposed

innovations allow early detection of the folding of tectonic plates and the dynamics of faults, the displacement of rock massifs, etc. These studies are aimed at predicting earthquake processes. The action of particle generation in inhomogeneous systems is easily automated for robotic systems with artificial intelligence elements and the protection of critical infrastructure sites. [D7-9, D7-11, D8-2, D8-3, D8-4, D8-6, D8-7].

3. Evaluation of the candidate's personal contribution

My assessment of the candidate's contributions and results in the competition is high. The presented works, citations and participation in projects correspond to the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its implementation, as well as the minimum requirements of IR-BAS for the scientific and teaching activities for acquiring the academic position "Associate Professor".

4. Critical notes and recommendations

I did not find any significant gaps in the candidate's works. I recommend writing a monograph by the candidate.

5. Personal impressions

I know the candidate from his participation in scientific forums in the country. The submitted materials for participation in the competition give me reason to assert that Phd. Martin Ralchev has excellent qualifications and is a well-known specialist in his field.

6. Conclusion:

In view of the above, I propose that Eng. Martin Lachezarov Ralchev, Phd. be elected as an "Associate Professor" in the field of higher education - 5. Technical sciences, by professional direction - 5.2. Electrical engineering, electronics and automation.

24.10.2024

Jury member: Assoc. Prof., Eng. Iliyan Iliev, Phd.