



## OPINION

by competition for the academic position of professor of  
5.2. Electrical engineering, Electronics and Automation, Sensors and  
measurement technologies in robotics and mechatronics (Magnetic field  
sensors)

announced in the State Gazette, no. 26 of March 21, 2023  
with candidate: August Yordanov Ivanov, PhD, Associate Professor  
Member of the scientific jury: Petko Hristov Petkov, Ph.D., professor

### • **General characteristics of the candidate's research and scientific-applied activity**

The candidate in the competition for "professor" under 5.2. Electrical engineering, Electronics and Automation, section "Sensors and measurement technologies in robotics and mechatronics (Sensors for magnetic field)", Dr. August Yordanov Ivanov, Associate Professor in the section "Sensors and measurement technologies in robotics and mechatronics" at the Institute of Robotics at the BAS, participated in the competition with 29 scientific works, of which 14 were published in journals (10 of them with an impact factor). Twelve of the publications have been brought together in a work that has been proposed as equivalent to a monograph. The candidate also participates with papers in a number of international and national conferences that are published in full text. The content of the works shows that the candidate is a specialist in the area of magnetic field sensors and measuring technologies in robotics and mechatronics. Information is presented on 50 positive citations of the candidate's works, more than 95% of which are in foreign journals and publications. A number of publications are related to the creation of specific sensors and measuring devices. Prof. Ivanov was the leader or participant in 42 research projects, including two projects under the Operational Program "Science and Education for Intelligent Growth" to the Ministry of Education and Science for building competence centers and two projects financed by the European Commission. The applicant is involved in 29 patents in the field of Hall sensors and applications in robotics. His scientific research activity has been marked with a number of prestigious awards, including diploma from the World Exhibition of Innovation, Research and New Technologies in Brussels in 2000 and a gold medal for the invention patent "Hall sensor with parallel axis sensitivity and magneto-diode" from the International Exhibition-Salon of Inventions, Innovations and Trademarks. Prof. Ivanov has significant administrative and managerial experience as the Deputy Chairman of the Innovation Council of IR-BAS (since 2015) and as the Director of IR-BAS (since 2015). All this shows a very good combination of scientific-research, scientific-organizational and applied activity, the level of which fully meets the requirements for a "professor" in the Bulgarian Academy of Sciences.

### • Basic scientific and applied scientific contributions

The candidate's contributions of a scientific and scientific-applied nature can be divided into contributions related to the habilitation work and contributions outside of it. I support the applicant's claims that the papers presented as equivalent to a monographic work contain sufficient contributions in the field of development and implementation of planar-sensitive Hall sensors with applicability in vector magnetometry, on the basis of which a habilitation thesis can be presented for a professor.

The scientific contributions of Assoc. Prof. Ivanov consist in the discovery, research and interpretation of a new, until now unknown effect in magnetosensitive sensor systems, consisting in the occurrence of a strong angular anomaly of the output signal from the direction of the magnetic field, contrary to what was expected, according to the existing theory, sinusoidal behavior. The practical value of this discovery is that on its basis, high-precision electronic compasses for moving objects can be constructed, as well as non-contact angle detectors, decoders, key devices and others. Another essential scientific contribution is that a new approach to measure the magnetic field through the base current in differential diode and transistor structures has been proposed and experimentally investigated for the first time. The information signal in these structures is a linear and odd function of the magnetic field. The utility of this approach is in the construction of intelligent microsystems characterized by achieving low intrinsic noise values, increased sensitivity and resolution, high stability and reliability, and a wide temperature range of operation.

The candidate's scientific and applied contributions consist in the creation of a new class of sensor microsystems with an amperometric output for simultaneous and independent measurement of the direction and value of the magnetic field, as well as of the ambient temperature, using for the first time the diode Hall effect phenomenon. These high-tech converters are characterized by increased noise resistance to parasitic effects, high sensitivity and signal-to-noise ratio, and thermal stability. Original instrument designs two-dimensional CMOS vector microsensors using the functional integration of Hall elements with parallel and orthogonal axis of activation and maximally simplified construction measuring simultaneously and independently the planar components of the magnetic field were designed, implemented and tested. Two-dimensional silicon magnetometers are distinguished from known analog microsystems by their high resolution, greatly reduced parasitic influence between individual sensor channels, low intrinsic noise, extended frequency range and maximum matching and/or equalization of the conversion characteristics of the individual outputs. On their basis, high-precision devices for determining the angle of rotation with universal applicability in non-contact automation and robotics have been constructed. As a scientific and applied contribution, I also consider the development and testing of a methodology for creating solid-state magnetic field sensors based on the Hall effect and the possibilities of their application in energetics.

In conclusion of this section, it can be stated that the candidate has very serious

achievements in the development and realization of modern high-quality sensors and measuring devices for magnetic field.

- **Significance of contributions to science and practice**

The candidate's contributions are essential in the research of new types of magnetic field sensors, which are characterized by increased linearity, noise immunity and thermal stability. The large number of patents in which the candidate participates, shows the practical significance of his research, which in a number of cases has been brought to practical implementation. In this sense, it can be considered that Prof. Ivanov combines research and applied activities extremely successfully.

- **Assessment of the candidate's pedagogical training and activity**

The candidate has supervised one full-time doctoral student and one part-time doctoral student in the scientific specialty Application of the Principles and Methods of Cybernetics in Technical Sciences. In this way, the existing requirements are met and it can be assumed that the candidate's pedagogical training and activities meet the requirements for a "professor" in the relevant specialty.

- **Critical notes and recommendations**

As a recommendation to the candidate, the wish to publish a monograph abroad in the field of Hall sensor research and application could be made. It is also appropriate to extent the teaching activity.

- **Personal impressions of the candidate's work**

I have excellent impressions of the candidate's work, based on which I can characterize him as a highly organized specialist who works precisely and efficiently in his scientific field. As director of the Institute of Robotics, Prof. Ivanov devotes a lot of time and effort to raising the level of the institute and to the development of its specialists. Prof. Ivanov is tolerant of his colleagues and knows how to find balanced solutions in complex situations.

- **CONCLUSION**

Based on the contributions of the candidate's works, his successful scientific research,

applied and scientific-organizational activity, I take the liberty of proposing Dr. August Yordanov Ivanov to occupy the academic position of "Professor" in the professional field of Electrical Engineering, Electronics and Automation, Sensors and measuring technologies in robotics and mechatronics (Sensors for magnetic field).

21.06.2023 r.

Jury member:

/prof. Ph.D. Petko Petkov,  
corr.-member of BAS/