

OPINION

in a competition for the academic position Professor
in the professional field 5.2. "Electrical Engineering, Electronics and Automation", published in the State Gazette, No. 26, 21.03.2023 for the needs of the section "Sensors and measuring technologies in robotics and mechatronics (Magnetic field sensors)", Institute of Robotics at the BAS

Candidate: Assoc. Prof. August Yordanov Ivanov, PhD, section "Sensors and measurement technologies in robotics and mechatronics", Institute of Robotics at BAS

Member of the scientific jury: Prof. Nikolay Dimitrov Madzharov, PhD, dep. "Electronics", TU Gabrovo.

1. Summary of the scientific activity and achievements of the candidate

The research and applied scientific activity of the candidate in the competition - Assoc. Prof. August Yordanov Ivanov, PhD is related to the design, modeling and research of a new generation of multi-functional sensor elements. New principles have been developed and high-precision silicon 2-D and 3-D magnetometers have been created, for robotics and mechatronics purposes, and a family of functional multisensors, simultaneously and independently registering with the same conversion zone the components of the magnetic field vector. A special place is devoted to their practical implementation in innovative robotic platforms, sensor devices and new generation technologies.

With the presented materials - scientific publications - 10 pieces, equivalent to a monographic work, scientific publications, patents and author's certificates, reference for citations and participation and management of scientific projects, the candidate fully covers the minimum national requirements for occupying the academic position "Professor", for the field of "Technical Sciences" in higher education, laid down in Art. 2b of 3PACPE.

According to the groups of indicators Assoc. Prof. August Yordanov Ivanov, PhD presented evidence for collected points as follows:

Group of indicators A (at least 50 points) - dissertation work. Total 50 points;

Group of indicators B (at least 100 points) - B4 scientific publications equivalent to a monographic work - 10 pcs. publications with different number of authors. Total 154 points.

Group of indicators Г (at least 200 points) - Г7 publications in publications that are referenced and indexed in world-famous databases - 16 nos. publications with different number of authors - 209.95 points; Г8 scientific publications in non-refereed journals with scientific review or in edited collective works - 2 pcs. publications with different number of authors - 11.67 points. Total 221.62 points.

Group of indicators Д (at least 100 points) - Д12 - citations - 21 publications were cited a total of 37 times in scientific publications, referenced and indexed in world-famous databases - 370 points; Д13-citations in monographs and collective volumes with scientific review - citation of one publication - 3 points; Д14 - citations or reviews in non-refereed journals with scientific review - 15 citations - 30 points. Total 373 points.

Group of indicators E (at least 150 points) - E18 - participation in 10 national scientific or educational projects - 100 points; E20 - leadership of a national scientific or educational project - 20 points; E22 - attracted funds for projects (1 project) led by the applicant in the amount of 1 100 000 BGN - 220 points; E25 - published application for patent or utility model - 7 pcs. - 140 points; E26 - recognized application for a utility model, patent or author's certificate - 22 pcs. - 880 points. Total 1360 points.

The points scored by the candidate are 2158.65, which is significantly (3.6 times) above the total minimum number of 600 points (according to the regulations on the terms and conditions for acquiring scientific degrees and for holding academic positions at the BAS).

2. Main contributions in the scientific and scientific-applied activity of the candidate

The main contributions of the candidate's works relate to the development of a new generation of multi-purpose sensor elements, models of intelligent sensor structures, correlation methods and algorithms in measurement systems of various physical quantities and data collection and processing systems in semiconductor vector magnetometry. They can be classified as scientific and scientific-applied.

Scientific contributions

- Based on the amperometric principle, an innovative method has been developed for the measurement with the same area in silicon structures of more than one non-electrical parameter (magnetic field and temperature) and a new class of sensor microsystems with amperometric output has been created for simultaneous and independent measurement of direction and value of the magnetic field and the ambient temperature, using for the first time the Diode Hall Effect phenomenon.
[Publications from the list articles 1, 2, 3, 4].
- A new sensor mechanism was created in Hall microsystems, allowing by injection of non-basic carriers, with only 0.1% of the supply current, to increase the magnetic sensitivity by more than 50%.
[Publications from the list articles 8, 9].
- New aspects of the Hall effect are demonstrated, consisting in that the additional current carriers from the Lorentz force on the corresponding boundary surface are mobile and determine the surface current. Hall potentials and voltage are generated both by the different surface charge densities and from the additional voltage drop on the opposite interfaces from the flow of the magnetically controlled surface currents.
- [Publications from the list articles 29, 30, 31, 32, 33, 34], [Publications from the monograph 1, 14].

Scientific-applied contributions

- A hitherto unknown regularity in sensorics was experimentally established, consisting in the occurrence of a linear potential from the magnetic field on one side of the Hall elements and a non-linear one on the opposite surface.
[Publications from the monograph 2, 3, 4, 11, 12, 13].
- New three-component (3-D) vector magnetometers have been designed, implemented and tested using the functional integration of Hall microsensors with parallel and orthogonal axis of sensitivity, measuring simultaneously and independently the three spatial components of the magnetic field.
[Publications from the list articles 5, 6, 7].
- The emergence of a magnetically controlled surface current in semiconductor structures has been experimentally established when a supply current is passed through them and a magnetic field is applied perpendicular to it.
[Publications from the list articles 10, 11, 12, 13, 14], [Publications from the monograph 5, 7, 8].

- A family of multidimensional silicon vector magnetometers has been developed, containing a minimum number of contacts, registering simultaneously and independently the 2D and 3D components of the magnetic field.
[Publications from the list articles 15, 16, 17, 18, 19, 20], [Publications from the monograph 10, 15, 16].
- A theoretical model was created, interpreting the experimental results of the discovered regularities - magnetically controlled surface current in conductive materials and anomalies in the behavior of the potentials of semiconductor structures in a magnetic field.
[Publications from the list articles 21, 22, 23, 24, 25, 26, 27, 28], [Publications from the monograph 6, 9]

4. Significance of contributions to science and practice

Assessment for Assoc. Prof. August Yordanov Ivanov, PhD in scientific circles are the citations available in the databases of WEB of SCIENCE, SCOPUS, etc. For the period 1998-2023, 129 citations were established. A large part of them are from foreign authors, and as a result the candidate has a Hirsch index of 6 (without self-citations of 5). He was the head of one and participated in another ten national scientific or educational projects directly related to innovative methods in modern microelectronics, the results of which were reported at international indexed conferences and journals. The large number of awards and memberships in commissions of the Ministry of Education and Culture and governing bodies of the BAS are also worth noting. This gives me reason to conclude that Assoc. Prof. August Yordanov Ivanov, PhD is an established researcher, presented his results in well-known scientific journals and conferences in the field of the competition and carried out a technological transfer of his scientific achievements in practice.

5. Critical remarks and recommendations

I have no significant critical comments on the materials presented by the candidate for the competition. I recommend the candidate to continue working in the field of a new generation of intelligent multi-purpose sensor elements and the issues related to their future use and management. Also, in his future actions to deepen the work with the doctoral students and the success rate in the defense of their dissertations, in order to transfer his great experience in the training of young researchers to the Institute of Robotics at the BAS.

CONCLUSION

My general assessment is that the candidate's performance in the competition for the academic position of "PROFESSOR" meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria. Based on the acquaintance with the presented scientific works, their importance, the scientific and applied scientific contributions contained in them, I find it reasonable to propose Assoc. Prof. August Yordanov Ivanov, PhD to take the academic position of "PROFESSOR" in the professional direction 5.2. Electrical engineering, electronics and automation for the needs of the "Sensors and measurement technologies in robotics and mechatronics (magnetic field sensors)" section, Institute of Robotics at the BAS.

July 05.07.2023r.

Member of the Scientific Jury:

(Prof. Nikolay Dimitrov Madzharov, PhD)