

# SCIENTIFIC REVIEW

on a competition for the occupation of an academic position **Associate-Professor**

in professional field: **5.2. Electrical Engineering, Electronics and Automation,**

subject "Control of electromechanical systems"

published in **the State Gazette 53 / 20.06.2023**

with the candidate chief assistant Dr. Eng. **Zhivko Stefkov Zhekov**

Member of the Scientific Jury: **Prof. Dr. Eng. Ventsislav Tsekov Valchev**

## 1. General information and biography background

The competition for academic position Associate Professor was announced on the proposal of the departmental council of the "Automation" department, confirmed by the decision of the faculty council of the FITA (Faculty of Information Technologies and Automation) of TU-Varna and later by the Academic Council of TU-Varna. The competition for AP "Associate Professor" is in professional direction 5.2. "Electrical engineering, electronics and automation", subject "Control of electromechanical systems" and was announced in the State Gazette number 53 / 20.06.2023 and on the TU - Varna website.

Dr. Zivko Stefkov Zhekov is the only candidate for participation in the "Associate Professor" employment competition in professional direction 5.2. "Electrical engineering, electronics and automation", the needs of the department "Automation" of TU - Varna, FITA.

The documents of Dr. Zivko Stefkov Zhekov have been examined by the university admission committee and the conclusion is that all necessary documents, evidence and references have been submitted.

Assistant professor Dr. Zhekov graduated the Technical University - Varna in 2002 with a specialization in "Production Automation" and obtained the Master's Degree in Automation Engineering. He acquired basic knowledge in the fields of Control Theory, Electric Drive, Control of Electromechanical Systems. In 2004, he acquired the Master of Science in Engineering - basic knowledge in Adaptive Management, Intelligent Management, Digital Management Systems.

In 2007 Dr. Zhekov acquired the scientific degree "Doctor", the subject of the doctoral studies "Development of systems for sensorless vector control of asynchronous motors" code 02.21.08.

In 2009 he was appointed as an assistant in the College in the structure of the Technical University - Varna. In 2018 he was elected as a chief assistant at the Automation department of TU - Varna.

## **2. General description of the presented materials**

For participation in the competition, Chief Assistant Assistant professor Dr. Zhekov presented:

- Autobiography,
- a copy of the diploma for the acquired educational and scientific degree "Doctor",
- copies of the employment contracts for the employment as an "Assistant" and "Chief Assistant",
- a table certifying the fulfillment of the minimum national requirements for occupying the academic position "Associate Professor",
- a list of the scientific works submitted for participation in the competition for the acquisition of AP Associate -Professor,
- reference to the scientific, scientific-applied and applied contributions,
- report on the study load for the last 3 academic years, report on graduates and work with students,
- reference for his participation in research projects,
- a document on the implementation of research results,
- statement of credibility,
- declaration of originality of the contributions, declaration of absence of plagiarism in the submitted scientific works and full-text scientific publications submitted for participation in the competition.

Dr. Eng. ZIVKO STEFKOV ZHEKOV participates in the competition with a total of 25 scientific works. Among the scientific articles and reports submitted for participation in the competition, 12 are indexed in the **Scopus database**.

The presented 25 publications in Bulgarian and English are in publications included in the National Reference List.

The scientific production is fully related to the current competition for employment of "Associate Professor " and are in the professional direction 5.2. "Electrical engineering, electronics and automation", related to the subject "Control of electromechanical systems".

**Covering the minimum requirements for acquisition of AP 'Associate Professor' by the indicator groups is shown in Table 1.**

**Table 1.** Report on Chief Assistant Dr. Eng. Zhivko Stefkov Zhekov on covering the minimum requirements for acquisition of "Assoc. Proffesor" AP by the Indicator Groups for the area of high education "5. Technical Sciences"

<b>Group of indicators</b>	<b>Content by indicators</b>	<b>Indicator</b>	<b>Minimum requirements for acquisition of AP „Associate Professor“</b>	<b>Points for Dr. Eng. Z. Zhekov</b>	
A	Indicator 1	1. Dissertation work for the award of an educational and scientific degree"PhD"	<b>50</b>	<b>50</b>	
B	Indicator 4	4. Habilitation work - scientific publications (not less than 10) in publications that are referenced and indexed in world-famous databases with scientific information	<b>100</b>	<b>340</b>	
C	Sum of indicators 7 and 8	7. Scientific publication in publications that are refereed and indexed in world-renowned databases of scientific information	<b>200</b>	<b>80</b>	<b>200</b>
		8. Scientific publication in non-refereed peer-reviewed journals or in edited collective volumes		<b>130</b>	
D	Sum of indicators 12 and 14	12. Citations or reviews in scientific publications referenced and indexed in world-renowned databases of scientific information or in monographs and collective volumes	<b>50</b>	<b>70</b>	<b>50</b>
		14. Citations or reviews in non-refereed peer-reviewed journals		<b>0</b>	
E	Indicator 29	29. Hours total for delivered lectures at TU-Varna for the last three years ( 1 point per a delivered lecture)	<b>30</b>	<b>479</b>	

### **3. General characteristics of the applicant's scientific research and scientific implementation activities**

The research and scientific-applied activity of Dr. Eng. Zh. Zhekov are presented by the attached publications and from the projects in which he participated. The candidate participated in a total of 4 projects. He was the project leader of 1 project.

The topics are mainly focused on controls in the electric drives and motion - ie. in the area of the competition.

**Main directions of scientific research in which the candidate works are as follows:**

1. Research of neural regulators applicable to control of robots and drives;
2. Systems for vector and sensorless vector control of asynchronous motors;
3. DC motor control systems.

The presented scientific research activity (publications, projects, practical implementations) of chief assistant Eng. Zh, Zhekov proves that he can independently solve scientific research tasks and he has accumulated good theoretical and practical knowledge.

**My overall assessment of the candidate's Chief Assistant Dr. Eng. Z. Zhekov scientific research and applied scientific activities is very good.**

#### **4. Assessment of the candidate's pedagogical preparation and activity**

Dr. ZIVKO STEFKOV ZHEKOV has already proven himself as a teacher in the department, FITA of the TU - Varna. In the last 3 years, he has led a total of 479 hours of lectures.

The candidate has two teaching laboratory handboks. He also developed/participated in the development of 6 study programs and 4 lecture courses.

Dr. ZIVKO STEFKOV ZHEKOV is a co-author of 2 university textbooks, which are in the field of the competition. He supervised 33 diploma graduates, trained at the Bachelor's College and the Master's College.

**My overall assessment of the candidate's Chief Assistant Dr. Eng. Z. Zhekov pedagogical preparation and activities is excellent.**

#### **5. Basic scientific and scientifically-applied contributions**

I accept the candidate's reference for her main contributions as valid with some small corections.

*I consider the contributions to be in two groups:*

- *Scientific-applied contributions*
- *Applied contributions*

## **5. 1. Scientific and applied contributions**

1. A neural regulator is proposed, characterized by the use of a gradient algorithm to calculate its weighting coefficients of an online trained neural model. The proposal has been verified in vector control systems for asynchronous motors and robot control systems.
2. Offline and online trainable neural approximators are proposed. The operability of the approximators has been practically confirmed when they are used in control systems of two-jointed planar robots.
3. Innovative systems for sensorless vector control of an induction motor are proposed. The systems are two-channel and use two neural regulators. Improved systems for sensorless direct torque control of an induction motor have also been proposed. For the speed estimator, the electromagnetic moment and the stator flux are used. The latter system extends the estimator, which leads to an increase in the quality of the evaluation and the performance of the system.
4. Improved systems for control along a given trajectory of two-jointed robots are proposed. The specificity is a practically unchanged quality of the processes of the angular speed and position of the joints, as well as working out the set trajectories regardless of the load on the robots.
5. The applicability of least squares recursive methods was analyzed and evaluated; weighted least squares and instrumental variable for adaptive parameter control of DC motors.

## **5. 2. Applied contributions**

1. A control system for a twin-propeller laboratory mock-up of an aircraft was developed, aiming at the study of various control laws of the aircraft, using Simulink.
2. A two-loop DC motor control system based on a digital signal controller was created. Through a Simulink model, various motor control laws are developed and investigated.
3. A two-legged manipulator robot was studied and a system for its control using Matlab was created. An opportunity to develop and research different algorithms for controlling the robot is provided.
4. A two-channel system for coordinated control of a two-motor electric drive was modeled and studied. The master and slave channels are set to modular optimum. The need to implement combined management to ensure improved management indicators has been proven.

## **6. Importance of the contributions to science and practice**

The significance of contributions to science can be seen by the relevance and number of publications in the SCOPUS database (12 items, visible on 4.11.2023), as well as the Hirsch index in SCOPUS (h-index=3, on 4.11.2023) .

The candidate has practical realizations in the control of drives and robots, from which the candidate's innovative activity can be assessed.

The quantitative indicators of the criteria for obtaining the AP "Associate Professor" in the Technical Sciences have been met.

## **7. Critical notes and recommendations**

I have no significant comments on the materials submitted for participation in the competition.

I recommend the candidate:

- To concentrate on publishing in scientific journals with an impact factor. This will increase the candidate's citation and visibility, as well as help TU-Varna to better rank in rating systems and accreditations;
- Activate the work on scientific projects;
- To work towards the creation of a scientific group consisting of his doctoral students, graduate students.

## **8. Personal impressions and opinion of the reviewer**

I don't have personal impressions of the candidate. I know that he is actively involved in the activities of the department and the faculty.

Ch. assistant professor Dr. Zh. ZHEKOV is already a known scientist and specialist in the field of electric drives and their management.

## **CONCLUSION**

The materials presented by the candidate in the competition for the appointment of AP "Associate Professor" allow evaluating his teaching, pedagogical and research activities.

After thorough reading the presented scientific and academic production and other documents of the candidate ch. assistant Professor, Dr. Eng. Zivko Stefkov Zhekov, I believe that they comply with the ZRASRB and the Regulations for its application in the part for AP "Associate Professor".

The minimum requirements for obtaining the academic position "Associate Professor" in professional direction 5.2. "EEA", determined by the Regulations for the Application of ZRASRB, have been met. The candidate's contributions for the indicators are sufficient for AP "Associate Professor" in field 5. Technical Sciences.

On the basis of the scientific works presented, the contributions presented and the fulfillment of the minimum national requirements, I find it reasonable to propose the chief assistant. Dr. Eng. Zhivko Stefkov Zhekov to obtain the academic position of "Associate Professor" in professional direction 5.2 Electrical Engineering, Electronics and Automation, Department of Automation, FITA of TU - Varna.

**03.11.2023**  
**TU - Varna**

**Member of the Scien**  
**/ prof. Dr. Eng**

**Заличена информация**  
**по Регламент (ЕС)**  
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