

REVIEW

by Prof. Dr. Eng. Ivaylo Stefanov Stoyanov, „Angel Kanchev“ University of Ruse,

of the materials submitted for participation in the competition for the academic position of "Associate Professor" in the field of higher education: 5. Technical Sciences, professional direction: 5.2. Electrical Engineering, Electronics and Automation, specialty "Electric Power Supply and Equipment " (Electrical Machines I).

In the competition for the position of “Associate Professor”, which has been announced in The State Gazette, issue 55 from 27.06.2023 and also on the website of the Technical University of Gabrovo, Chief Assist. Prof. Eng. Dimitrina Yordanova Koeva, PhD participates as a candidate for the needs of the Department of Electric Power Supply and Equipment at the Faculty of Electrical Engineering and Electronics

The review was prepared in accordance with Order №3-01-438/11.10.2023 of the Rector of the Technical University of Gabrovo and the decision of the first meeting of the Scientific Jury on 9.10.2023.

1. Brief biographical data

Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva was born in Sliven. She graduated from the Technical University of Gabrovo, majoring in Electric Power Supply and Electrical Equipment in 1990, with professional qualification - electrical engineer, Master of Science. After successfully passing her exams, she was enrolled in several PhD studies in the scientific specialty Electrical machines at the Faculty of Engineering and Pedagogy in Sliven, branch of Technical University - Sofia. She has defended her dissertation on "Automated system for control, monitoring and diagnostics of wind turbines", for which she was awarded with the educational and scientific degree "PhD" (diploma № TUS-IPF45-NS1-021 / 30.04.2012).

The work activities of Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva started in 1990 in "Dinamo" JSC, Sliven, as a designer of electrical machines, and after 1 year she was promoted to the position of "Technologist" for the division "Generators and Starters".

In 1991 she started her academic career at the Faculty of Engineering and Pedagogy - Sliven, Technical University - Sofia. There she was successful in the academic positions of assistant, senior assistant and chief assistant. After passing a competition in 2015, she was chosen for Chief Assistant Professor at the Department of Electric Power Supply and Equipment at the Technical University of Gabrovo.

During her professional activity Dr. Dimitrina Yordanova Koeva has continuously improved her qualifications and competences. Consistently over the years she has passed a number of qualification courses such as Automated Design of Electrical Machines, Development and Management of EU-funded Projects, Energy Efficiency for Competitive Industry Financing Facility, etc.

Having this in mind, I consider that the candidate Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova fulfills the requirements set in Art. 54 (1) of the Regulations for the Acquisition of Scientific Degrees and Academic Positions at the Technical University of Gabrovo to have acquired the educational and scientific degree "PhD" and to have held the academic position of "Chief Assistant" for not less than two years.

2. General description of the submitted materials

The only candidate for the competition is Dimitrina Yordanova Koeva from the Department of Electric Power Supply and Equipment, Faculty of Electrical Engineering and Electronics, Technical University of Gabrovo. The submitted materials, which are the result of her scientific research and applied activity include **44** scientific publications, of which: **11** publications on indicator B.4 (295 pts.), 1 piece on indicator G.7 (40 pts.), and **32** publications on indicator G.8 (261,73 pts.). The candidate has 25 quotations visible in the Scopus platform (indicator D.12) and 5 others (indicator D.13). The candidate's SCOPUS profile shows that her h-index is 3.

The content of the above-mentioned articles and papers fully corresponds to the scientific field of the competition. The publication activity of Dr. Dimitrina Yordanova Koeva exceeds the requirements for holding academic positions at the Technical University of Gabrovo. Dr. Dimitrina Yordanova Koeva has also the required teaching experience. The research, engineering and pedagogical activities of the candidate are being developed in a balanced and simultaneous manner, complementing each other. She is a member of the Union of Scientists in Bulgaria and a reviewer in several prestigious international scientific events.

All of the above-mentioned facts show the impressive teaching and research activity of the Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva.

3. Impact of the candidate's scientific publications in the scientific society

According to the reference made in the scientific database SCOPUS (SC55359594700) 5 of the scientific publications of Dr. Dimitrina Yordanova Koeva have been quoted 25 times in the publications of 5 foreign and 20 Bulgarian authors. The first three publications have been quoted 22 times in total by other researchers and for that her h-index is 3. The publication activity of the candidate has been referenced in the databases of ORCID – 11 articles; Web of Science – 2 articles; National Reference List (NRL) of the contemporary Bulgarian scientific journals with scientific peer review, etc. All this shows that the candidate's works are well known to the general scientific community.

4. Overview of the content and results in the presented papers

The scientific works of Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva are in the field of electrical machines, electrical drives, electrical energy and power supply, automated design and measurements in power supply systems, study of the operation of electromechanical devices and systems, energy efficiency, etc. For example, in [B.4.1], the performance of a structural scheme that provides continuity and mutual consistency in the operation of solenoid valves and their electrodynamic characteristics with relation to the on and off times has been investigated.

The transient processes during the start-up of a high-power electric drive for a pump unit are dependent on the supply voltage, the total moment of inertia of the electric drive, the torque and the current are studied in [B.4.2, B.4.3]. In [B.4.4.], the influence of the variation of the equivalent circuit parameters and the total moment of inertia on the electric power losses in a compact electric vehicle driven in the resulting dynamic modes is evaluated by simulation. Vector control of an electric pump drive with a medium voltage induction motor is investigated in [B.4.5]. The analysis of electric machines in systems controlled by electric drives is based on a systems approach and systems analysis methods, supporting the design of special motors with adjustable speed with improved regulation, starting, dynamic and vibration-acoustic characteristics, reduced mass and cost characteristics [G.8.2]. Also the development of a permanent magnet brushless motor model [G.8.3] and the analysis of different types of motors used in electric vehicles [G.8.4] have to be taken into consideration. Another part of the candidate's publication activity can be related to the application of renewable energy sources and technologies. For example, in [B.4.6] energy and resource efficiency of a biomass power plant, the application of an automated software algorithm for heat energy forecasting using seasonal autoregressive integrated moving average with exogenous variables (SARIMAX) [B.4.7]. Energy efficient solution for pumping system, energy efficiency improvement measures for electrical machinery and power transformer, evaluation of energy efficiency index of industry under energy transition, etc. [B.4.8, B.4.9, B.4.10, B.4.11]. Another part of the scientific contribution of Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva is related to statistical approaches and the synthesis of models of charging behavior of electric vehicles, taking into account load cycling in the load schedule of electrical equipment in order to optimize charging stations, systems for the diagnosis of wind generators [G.8.6, G.8.8, G.8.9], etc. To maintain the operating conditions of electrical machines, the number of failures have to be reduced and an optimal service and maintenance system has to be built. It is also important to have a condition monitoring system in place, which is coupled with fault identification techniques. In [G.8.7 and G.8.10] are proposed non-contact diagnosis techniques for induction machines based on vibration analysis, etc.

5. General description of the candidate's activities

5.1. Teaching and pedagogical activities (work with students and PhD students)

Dimitrina Yordanova Koeva is the co-author of several teaching programs for the students of the Technical University of Gabrovo:

1. Electrical machines I
2. Electrical equipment
3. Electrical equipment of industrial machines and processes
4. Energy technologies and ecology
5. Optimal design of electrical machines
6. Electromechanical Devices

She has given lectures and has led the laboratory and seminar classes to full-time and part-time students in 6 disciplines for the Bachelor's degree in Electrical Machines I, Energy Technologies and Ecology, Electrical Equipment, Electromechanical Devices, Electrical Equipment of Production Machines and Processes and Optimal Design of Electrical Machines from the Bachelor's course. She has also led 5 courses for the Master's degree in Electrical Engineering, Electrical Machines, Electrical Engineering of Production Machines and Processes, Technical Means of Energy Storage, Electromechanical Devices. According to the attached reference this is an annual teaching load of over 600 teaching hours. Currently, Ch. Asst. Dr. Eng. Dimitrina Yordanova Koeva is the titular of most of the disciplines. Therefore, it can be considered that a sufficient academic load has been ensured for the announced competition for the academic position of "associate professor".

Under the lead of Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva more than 80 graduates in the Bachelor's and Master's degree programmes have successfully defended their diploma theses. She is also the reviewer of more than 60 graduation theses.

According to the attached list, signed by Dr. Dimitrina Yordanova Koeva, she is the co-author of 3 textbooks for students.

From the statements above, it can be concluded that the Dr. Dimitrina Yordanova Koeva is a well-qualified lecturer at the Technical University of Gabrovo, who knows the problems of teaching and uses modern teaching methods.

5.2. Scientific and scientific-applied activities

Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva has participated in this competition with 44 scientific publications. The publications can be classified as follows:

- By order of importance:

- Refereed and indexed in Scopus – **12** publications [B.4-1...B.4-11, G.7-1];
- In unrefereed scientific journals – **32** publications [G.8-1...G.8-32].

- By the language in which they are written:

- In English language - **29** publications [B.4-1...B.4-11; G.7-1; G.8-1, G.8-2, G.8-4, G.8-5, G.8-10, G.8-11, G.8-15 ... G.8-18, G.8-21, G.8-25 ... G.8-32];
- In Bulgarian language - **15** publications [G.8-3, G.8-6, G.8-7 ... G.8-9, G.8-12 ... G.8-14, G.8-19, G.8-20, G.8-22 ... G.8-24].

- By the number of co-authors:

- Individual - **6** publications [B.4-6, B.4-11, G.7-1, G.8-6, G.8-11, G.8-32];
- With one co-author - **6** publications [B.4-7, G.8-1, G.8-2, G.8-4, G.8-5, G.8-7].
- With two or more co-authors – **32** publications.

According to the reference issued by the University Center for Scientific Research and Technology at Technical University of Gabrovo, it can be seen that Ch. Assist. Prof. Dr. Eng.

Dimitrina Yordanova Koeva has participated in the development of 6 scientific research projects, funded by the State Budget for scientific research. One of them - Contract № 2104E/2021 *Electric drives for electric vehicle and industrial applications, electrical components and systems - practical and mathematical modeling studies with regard to energy and economic efficiency*, is the one, which she was in charge of. She has also participated in 2 international educational projects by the Erasmus programme and 1 national educational project - NP MES BG05M2OP001-2.011-0001 "Support for Success", platform "Activities of Interest".

The above-mentioned facts show the significant amount of research activity that the candidate has.

5.3. Implementation activity

Some of the projects, which Dr. Dimitrina Yordanova Koeva has worked on, are applied-implementation by their nature. As a proof of this can be considered:

- The official note issued by Dinamo AD - Sliven stating that she was involved in development, research and design activities of the company: Motor-CAD Project IM 16,5kW. The project is related to the design and implementation of an asynchronous motor for an electric vehicle. Some of the results have been published in a scientific publication: D Y Koeva, G S Stoyanov, S R Ratchev, D S Slavov. Comparative analysis of energy indicators based on engineering model-oriented design of traction motors, Journal of Physics: Conference Series, Volume 2339, International Conference on Electronics, Engineering Physics and Earth Science 2022 (EEPES 2022) 21/06/2022 - 24/06/2022 Varna, Bulgaria. DOI: 10.1088/1742-6596/2339/1/012002, **SJR 0.210, Q4**.
- The reference from EnCoRa EOOD, certifies that it has participated in a team as a consultant in the preparation of energy efficiency audit reports for 7 industrial objects across the country.
- Utility Model Patent No218/1999 - galvanically split current sensor, which she co-authored.

6. Contributions (scientific, scientifically applied, applied).

The analysis of the publications enables them to be categorized by their contribution as follows: scientific, scientifically-applied and applied. The contributions are in the field of theoretical research, development of methodologies and models, evaluation criteria, algorithms, etc. also in the field of electrical machines, drives and energy efficiency.

- Scientific contributions

The operating and energy characteristics of electrical machines are studied in order to analyze the variation of their parameters on their operating and energy characteristics [B.4.2], [B.4.3], [B.4.4], [B.4.8], [B.4.10]. On their basis methodologies, algorithms and mathematical models of

the electromechanical system of drive motors with industrial application have been developed. [G.7.1], [G.8.1], [G.8.2], [G.8.3], [G.8.4], [G.8.14], [G.8.15], [G.8.17], [G.8.19], [G.8.32].

An approach for distribution of combined nonlinear loads is justified for energy efficient and reliable operation of the power transformer. Measurements have been made and load schedules of various types of nonlinear loads in industry and public sector have been taken. [B.4.3], [B.4.6], [G.8.1], [G.8.13], [G.8.14], [G.8.15], [G.8.18], [G.8.20], [G.8.24], [G.8.26]. The applicability of the approach has been demonstrated in electricity sites to identify technological, technical and other problems in the context of energy and resource efficiency management.

To evaluate the operation processes of electric motors powering vehicles a virtual models are synthesized [B.4.4], [B.4.8] in order to optimise charging station infrastructure [G.7.1], [G.8.4]. On this basis, the forecast models for the electricity consumption of electric vehicle charging stations were developed [G.8.21], [G.8.22]. [G.8.23], [G.8.25], [G.8.27], [G.8.28].

A mathematical model, represented by a system of differential equations, is created, which in turn is transformed and solved using appropriate software [B.4.4], [B.4.8]. The specific electric drives with particular parameters are considered. The objective function is to seek a minimum of power losses.

- Scientifically applied contributions

The specific technical indicators and operational parameters of induction motors in two high energy-intensive enterprises - a chemical factory and a food factory are analyzed, [B.4.11], [G.8.5].

An analytical assessment is made of the condition, forecasted trends in terms of energy transformation and the Net Zero scenario of Bulgaria in the context of the current state of the energy-intensive industry sector, [G.8.13], [G.8.18].

A study of existing wind turbine monitoring and diagnostics methodologies and the selection of sensors and their deployment to implement a reliable control and monitoring system was carried out, [B.4.7], [B.4.11].

An overview of the used models, algorithms and diagnostic techniques that can be combined with the control and monitoring system of wind turbines was carried out and, on this basis, a model was selected for building a diagnostic system, with an appropriately selected algorithm and techniques, [G.7.1], [G.8.6].

The most common failures in electric generators are classified and priority subsystems subject to control, monitoring and diagnostics in wind generators are determined, [G.8.8], [G.8.9].

Models for forecasting energy consumption by energy objects are compared and on this basis adequate models are selected in order to establish their adaptability degree, [G.8.11].

- Applied contributions

[B.4.3], [B.4.6], [G.8.1], [G.8.13], [G.8.14], [G.8.15], [G.8.18], [G.8.20], [G.8.24], [G.8.26], [B.4.9], [G.8.1], [G.8.2], [G.8.16], [G.8.19], [G.8.1], [G.8.30], [G.8.31], [G.8.32], [G.7.1], [G.8.4], [G.8.21], [G.8.22], [G.8.23], [G.8.25], [G.8.27], [G.8.28]:

Methodological guides have been developed for students to work with specialized software ANSYS Motor CAD®: Motor-CAD Global Summit, 08-12.02.2021; Learn Motor-CAD and the Multiphysics design of electric motors: Free virtual training, 8-12.11.2021; MathWorks Webinar “Integrated FEM Motor Data into Simscape Electrical”.

The most common faults in electrical generators are studied and the priority subsystems to be controlled, monitored and diagnosed in wind generators are identified.

Measurements have been taken and load graphs of various types of non-linear loads in industry and the public sector have been taken.

A practical approach for distribution of combined nonlinear loads for energy efficient and reliable power transformer operation is proposed.

A methodology to investigate the operational conditions of specific power plants in order to identify technological, technical and other problems in the context of energy and resource efficiency management is proposed. Results are obtained for the change of variables describing in detail the dynamic behaviour of the electric drive.

Numerical values for the variations of electrical power losses in specific designs of induction motors under different control methods are obtained.

Researches of vector control of electric drive with induction motor for specific consumer - pumping units are presented. The possibility of energy saving of variable speed drives is considered.

Practical model simulations with a view to energy and economic efficiency are proposed. Also the operation processes of electric motors driving vehicles are analyzed.

7. Evaluation of the candidate's personal contribution

The personal contribution of Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva can be evaluated by the submitted materials for the competition, which are classified according to the fulfillment of the scientometric criteria as follows:

Group of indicators	Requirements for the academic position "Associate Professor"	Fulfillment
A	50	50
B	100	295
Г	200	301,73
Д	50	250
E	0	40

I consider that the requirements for the quantitative indicators of the criteria for the academic position of Associate Professor have been met.

8. Critical notes and recommendations

I have no critical comments to make of the candidate's submitted documents, research production and teaching activities. Here I will focus only on some recommendations for the future work of the Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva:

- to intensify her participation in projects under European Union programmes;
- to publish their results in scientific journals;
- to publish teaching literature in the courses for which she is in charge off.

The expressed opinion does not diminish the research work carried out by Dr. Dimitrina Yordanova Koeva. I am convinced that her scientific production and teaching activities meet the requirements of national and internal documents.

9. Personal impressions

I know Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva since 9 years, when we met at a scientific conference UNITEH. She has excellent knowledge in the field of electrical machines, energy efficiency, and working with specialized software. This enables her to conduct in-depth research and achieve high scientific results. She is involved in the development of the department's facilities and in the teaching of Bachelor and Master courses. She is a member of nationally recognized scientific and social organizations.

Dimitrina Koeva is responsive and friendly when working with colleagues and students. She observes academic ethics. She is an active participant in the overall activities of the department.

All this gives me the reason to conclude that she is successfully fulfilling her duties as a teacher and researcher.

10. Conclusion:

Bearing in mind the above, I propose Ch. Assist. Prof. Dr. Eng. Dimitrina Yordanova Koeva to be elected as "Associate Professor" in the field of higher education: 5. Technical Sciences, professional direction: 5.2. Electrical Engineering, Electronics and Automation, specialty "Electric Power Supply and Equipment " (Electrical Machines I).

Ruse,

November 9, 2023

Reviewer: /signature/

/Prof. Dr. Eng. Ivaylo Stefanov Stoyanov/