

REVIEW
by Prof. Dr. Vladimir Dimitrov Lazarov, Technical University - Sofia
of the materials submitted for participation in the competition

for holding the academic position of "**Associate Professor**" in
field of higher education - **5. Technical sciences**
by professional field - **5.2. Electrical engineering, electronics and automation,**
specialty - "**Electrical Engineering**" (**Electromechanical devices, Electrical machines**).

In the competition for associate professor, announced in the State Gazette, issue 60 / 20.07.2021 and on the website of TU-Gabrovo for the needs of "Technical College - Lovech" of "TU - Gabrovo", as a candidate participates Chief assistant Dr. Eng. Milko Ganchev Dochev

1. Brief biographical data

The only candidate in the competition Ch. Assistant Professor Dr. Milko Ganchev Dochev was born in Lovech. Graduated (1976) MG "Yuri Gagarin, Lovech with an emphasis on numerical methods. In 1984 he completed his higher education with a master's degree in Electrical Machines and Apparatus. He has certificates for postgraduate qualification in "Power Electronic Equipment and Technologies" and "Methods for Technical Diagnostics of Electrical Machines". In 2000 qualifies as a "Quality Expert" from QUALICON AG, Schweiz. He defended his doctoral dissertation in the scientific specialty "Electrical Machines" at the Technical University - Sofia. In 1985 he was a laboratory - researcher of electrical machines at the High Current Plant - Sofia. In the period 1985 – 1999 he works at the Institute of Electrical Engineering (IEP) - Sofia, as a researcher and head of the laboratory "Electromechanics". From 1993 to 2003 he is a lecturer, chief assistant in TC - Lovech. For some time he was half-time in both IEP and TC - Lovech. He was a group leader and head of the specialty "Electrical Engineering". He was the head of the Department of "Electrical Engineering" in TC - Lovech (2003-2013). From December 2016 so far he is chief assistant Dr. in the Dept. of "Mechanical engineering, computer systems and electrical engineering" - "MKSE" of TC – Lovech of TU – Gabrovo.

2. General description of the submitted materials

Dr. Dochev participated in the competition with a habilitation thesis - a monograph on "Highly efficient electric drives for power tools", two published books based on a PhD dissertation, one book, two textbooks (manuals) and 83 publications. There are two publications referenced in SCOPUS, 31 citations in Bulgaria in non-referenced publications and 4 referenced in world-famous databases (SCOPUS). One of the publications is in a journal with SJR, in two others magazines with SJR Chief assistant Dochev has citations. In addition to the publications and the required documents, the candidate has attached references from NACID for his publications and citations. I do not review the publications that are related to his PhD dissertation which are given for information only. In the table below are given in abbreviated form the numerical indicators of the submitted works. *In the column of the groups of indicators are given the required points for associate professor in numerator and their performance by the candidate in denominator. Indicator "E" is not given* in the table, as it is not required for an associate professor. However, this indicator may include the participation of the applicant in a national project, the attracted fund for 7 projects of which he was the head of a total of 18. In the other 11 he was deputy leader or participant.

It can be concluded that Chief Assistant Dochev meets and far exceeds the minimum national requirements, as well as the requirements of TU - Gabrovo.

Group of indicators	Indicator	PhD	Dr.of Sc.	Ch.assis- tant	Assoc Prof.	Total
		1	2	3	4	6
A 50/50	1. Dissertation for the award of educational and scientific degree "Doctor"	Yes		Yes	Yes	1
B No for Assoc. Prof.	2. Dissertation for the award of the scientific degree "Doctor of Sciences"				No	
B 100/100	3. Habilitation work - monograph				1	1
Г 200/951, 48	6. Published book on the basis of a defended dissertation for the award of an educational and scientific degree "Doctor" or for the award of a scientific degree "Doctor of Sciences"				2	2
	7. Scientific publications in editions that are referenced and indexed in world-famous databases of scientific information				2	2
	8. Scientific publications in non-peer-reviewed journals with scientific reviewing or in edited collective volumes				83	83
Д 50/106	12. Citations or reviews in scientific journals, referenced and indexed in world-famous databases of scientific information or in monographs and collective volumes				4	4
	14. Citations or reviews in unreferred scientific journals with scientific reviewing				31	31

3. Reflection of the scientific publications of the candidate in the scientific community

Ch. Assist. Dochev has a total of 35 citations. Articles with the authorship and co-authorship of Chief Assistant Dochev are cited in 32 publications by Bulgarian authors and 3 by foreign authors. Four of his citations are in publications referenced in SCOPUS. Milko Dochev's participation in a number of scientific conferences, citations and implementations (below), are indicative of the impact of his work at

home and abroad. Ch. Assistant Professor Milko Dochev is known and valued among electrical engineer's community.

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

Dr. Dochev presented as the only author - a monograph, two books and two textbooks and co-authored a book. The monograph - habilitation work is entitled "High-efficiency electric drives for power tools". In this work the author discusses the main guidelines in the field of hand-held power tools bearing in mind the research, standardization and determination of their energy efficiency, as well as various design, technological and circuit solutions to improve their usability. Two of the books are based on his dissertation and are entitled "*Methods and tools for technical diagnostics of electric machines*" and "*Methods and tools for technical diagnostics of electric motors and power tools*" and are devoted to the interesting field of diagnostics of electric machines and power tools. Dr. M. Dochev has published also a book on "*Dynamic modes in hand tools*" (co-authored with D. Spirov), as well as manuals for students - "*Guide to the design of electric micromachines*" and "*Guidelines for training practice*" (mechanical and electrical installation and safety at work).

Dr. Dochev has divided the publications with which he participates in the competition into several groups. I accept this division. The first group is related to research in the field of hand-held power tools. In the first subgroup [5,6,18,22,61,66], based on a complex mathematical model that describes the electromechanical system with nonlinear differential equations and with the help of appropriate software, a number of studies concerning dynamic and in particular established modes have been made. Serious attention is paid to experimental research, the connection scheme with the corresponding measurement system. Technological problems are considered, reliability is studied, functional experimental tests are performed and defectoscopy with an electron - beam tube [4,16,17,45,46,50,60,68.]. An interesting subgroup of publications is the one dedicated to the control of power tools, i.e. electric drives [26,27,28,36,41,44,47,82,83]. The second large group is related to the development of training modules and test benches. This group includes 13 publications [1,2,9,10,13,14,15,19,20,21,23,32]. There are developed test benches for electric drives, electromechanical devices, electromagnetic devices, household lighting equipment, household appliances, monitoring and control, hybrid power supply system, etc .. In the third group [8,25,30,33,38,39,40 , 49,54,55] are presented the results of research for modernization of metal cutting machines, modernization of the electrical equipment of an excavator at the open pit mine "Trayanovo", auxiliary starter for internal combustion engine, chair for medical research automated grill cleaning machine in "Apriltsi" hydroelectric power plant, modernization of a machine for extraction of rock blocks, hybrid magnetic connector, etc. The fourth group is related to problems in the textile industry, textile materials and technologies [34,56,59,62,67,69,72,80]. Problems with the operation of sewing machines can be highlighted here. The fifth group [64,65,70,74,78] covers research for the development of methods for economic analysis in the production of power tools and others. The sixth group [3,7,11,12,37,42,53] covers research in various areas due to the author's cooperation with various companies in mechanical engineering - CAD / CAM systems, machine winding, diagnostics of cables for CEZ, generator of Brown's gas, etc.

5. General characteristics of the candidate's activity

5.1. Educational and pedagogical activity (work with students and doctoral students)

Chief Assistant Dochev is a long-term and experienced teacher, as evidenced by his biography. He has organized and conducted seminars and laboratory exercises on electrical machines and devices, operation, repair and diagnostics of electrical products. He has read and lectured on: "Electrical Machines

and Electrical Apparatus”, “Design of Electrical Machine”s, “Electromechanical Devices, Control and diagnostics of electrical machines and apparatus” and “Operation and repair of electrical machines and devices” and “Household electrical engineering” .

5.2. Scientific and scientific-applied activity

The scientific and scientific-teaching activity of the chief assistant Dr. M. Dochev is characterized by v.t. 2, 3, 4, 5.3, 6 of this review. An important aspect is the connection between the scientific and scientific-applied activity with the educational activity of the candidate, as evidenced by the numerous stands, which have been developed and implemented on the basis of the candidate's research.

5.3. Implementation activity

Numerous implementations and approbations of results in the practice of different companies have been declared. Some of the more significant implemented results are summarized below. I divide them into several groups:

A. Applications of scientific results (results of theoretical research):

The developed methods and mathematical models for studying the working and energy characteristics of hand power tools (drills, perforators, hammers) have been tested in the company "Sparky - Eltos" EAD - Lovech, as well as in the learning process in TC - Lovech and UFT - Plovdiv. The developed monitoring system for experimental and analytical determination of the energy characteristics of inverter and classical drive with single-phase collector motor of power tools has been tested and used in the company "Sparky - Eltos" EAD - Lovech, as well as in the training process in TC - Lovech and UFT - Plovdiv . The developed methodology and software for testing electromagnetic calculations of single-phase collector motors for hand power tools has been tested and used in research and scientific activities in Sparky EAD-Lovech and companies in the field of power tools, as well as in the educational process of students. in TC - Lovech from the specialty "Electrical Engineering", in the disciplines "Design of electrical machines", "Control and diagnostics of electrical machines and appliances" and "Operation and repair of electrical machines and appliances" and "Household electrical engineering".

Based on an analytical review, an analysis of damage to hand power tools was performed. The obtained diagnostic tables are used in the educational process of the students in TC - Lovech from the specialty "Electrical Engineering", in the disciplines "Control and diagnostics of electrical machines and appliances", "Operation and repair of electrical machines and appliances" and "Household electrical engineering".

B. Applications in practice:

The application of the developed stands, diagnostic modules and testers is in the laboratories and studios of the following universities and companies:

- In TC - Lovech, lab. "Electrical machines and apparatus", in UFT - Plovdiv - lab. "Electrical Engineering". Companies: Sparky - Eltos EAD - Lovech, Devimax - EAD - Lovech, ELDI ELECTRO - Sofia, Elektroremont - Bozhilov ET - Bankya, Razsolkov ET - Velingrad, I. Karolev ET - Sofia, Zhichka - ET - Sofia, "KOSARA" - EAD - Sofia and others.

Official notes from the companies are attached.

C. A number of prototypes (prototypes) have been developed for small series production and service equipment, as follows:

- Indicator for intercoil short circuits; Device for diagnosing stators and rotors; Stator tester for power tools; Universal winding tester; Rotor winding tester for power tools; Device for identification of the connection scheme of rotor windings of power tools; Device for electropulse diagnostics of windings for stators and rotors of power tools;

D. The candidate has developed and implemented 13 stands and modules for renovation of the training facilities in TC-Lovech in the lab. "Electrical machines and apparatus" and lab. "Operation and repair of electrical machinery and apparatus".

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

In general, I accept the candidate's claims with some clarifications.

I. Scientific (theoretical) contributions.

Generalized mathematical model for analytical-experimental determination of the energy characteristics of impact hand power tools (perforators and breakers), in dynamic and established modes [22, 61]

Mathematical model (s) of the mechanical part of a percussion power tool. A monitoring system for determining the energy characteristics of inverter control of electric drive with a single-phase collector motor of a hand-held power tool has been developed and implemented. A mathematical description of the processes in the operation of a single-phase collector motor and presentation of the mathematical model in the state space are developed energy efficiency. Schematic solutions for the electric drive of hand-held power tools with single-phase collector motors through their electronic control have been developed in order to reduce their losses and increase their energy efficiency. An adaptive magnetizing current observer for electric drive of a power tool with a single-phase collector motor has been developed to determine the angular velocity of the rotor and experimental studies of this adaptive magnetizing current observer for a single-phase electric motor have been performed. Schematic solutions for inverter control of the single-phase collector motor of a hand power tool are presented [28, 31, 36, 82, 83]. A system for regulating the power factor in the control of hand power tools has been designed and studied [31]. Variant solutions have been developed to reduce losses in the inverter to control a single-phase collector motor by using soft switching - achieving soft switching by a quasi-resonant circuit in the DC unit and using a quasi-resonant converter with three additional switches in the DC unit [26, 27] . A microprocessor system has been developed for optimal energy management and monitoring of hand-held power tools [41]. An analysis has been made and basic guidelines for improving energy efficiency and quality in hand tools have been derived [44, 45, 64]. An innovative approach has been proposed to reduce the level of interference due to switching and the oscillations of the brush with the use of so-called impregnated (insulated) graphite brushes [6]

II. Scientific (theoretical) –applied contributions:

Simulation studies of the electromechanical system with the created models. Diagnostic stands, devices, technologies and methods for testing and research of electromechanical devices, hand power tools and electric machines and devices have been developed and implemented in the practice and the learning process [1, 2, 5, 9, 10, 11,12, 13, 23, 29, 57, 59, 66]. A method and a stand for testing and diagnostics of power tools in the conditions of service and repair activity have been developed [5]. Developed and implemented in the development and training of a diagnostic computer model of a single-phase collector motor for power tools [18].

Methodologies for determining economic and reliability indicators for electric motors for hand tools have been developed [46, 70, 74]. A methodology for systematization and visualization of defects and damages in anchor windings for power tools has been developed [68, 73]. Simplified methods for theoretical and experimental determination of torque, resistance and inertial moment in hand power tools and some

types of electric drives have been developed [67, 69, 72, 75, 77]. The factors regarding the choice of the optimal gear ratio of a reducer for a manual drilling machine have been studied [60]. The factors regarding the blow energy of hand power tools as a basic technical and economic parameter have been studied [47]. A controlled electric drive with an asynchronous electric motor for industrial sewing machines has been developed and implemented, and a drive mechatron with microcomputer control for industrial sewing machines has been implemented [56, 65, 71].

A drive unit (mechatron) with a friction electromagnetic clutch has been developed and implemented [54,55]. New circuit solutions for modernization of lathes have been implemented through the introduction of digital-program control with FANUK-3T system [8, 30, 33, 48].

Various solutions have been developed for the control of a dome meter for the examination of the human vestibular apparatus and for the control of a rotating chair for medical examinations IV generation and experimental samples have been tested [76]. An interdisciplinary stand for pneumatic and electric drive training has been developed and implemented in the college [32].

Stands for training and research of electromechanical devices and household electrical appliances have been developed and implemented in the college [4, 15]. A stand for determining the characteristics of an induction motor with inverter (frequency) control has been developed and implemented in the college [24]. A stand for determining the characteristics of coil springs by means of a strain gauge has been developed and implemented in the college [40]. Variants of circuit solutions for automation of a machine for extraction of rock blocks and modernization of such machines have been developed and tested [63,79]. Variant solutions for optimal electric drive of sewing machines and improvement of their energy efficiency have been studied [80]. Studies have been made on the efficiency of using frequency-adjustable drive of sewing machines and the efficiency of using a DC motor to drive sewing machines [62,65].

Developed and implemented in practice devices and machines for mechanization and automation of technological processes [3, 4, 7, 16, 17, 25, 34, 35, 37, 38, 49, 50, 51, 53, 58, 78, 81] . A device (gas-generator cell) for hydrogen production and improvement of energy performance of internal combustion engines has been developed and tested [42]. A technology and a device for winding busbar windings on a rib have been created and implemented [37]. A device for electric starting of internal combustion engines under aggravated (winter) conditions has been developed and tested [39]. A model and device for control and monitoring of a technological process in a bio-bunker have been implemented [19,20,21].

III. Applied contributions:

To this group I refer the implementations in different companies and in the learning process, which are reflected in item 5.3 above.

7. Assessment of the personal contribution of the candidate

Dr. Dochev is the only author of three books and 18 publications. In one book and 30 publications with one co-author he is in first place. In the others with three co-authors he is in different places. No separation protocols are applied. In this case I accept that the contributions are equal. The professional path, researches and implementation work, as well as the publishing activity of Dr. Dochev, give reason to believe that in the papers, projects and implementations with which he is presented in the competition, his personal contribution is initiating, leading and determining. Undoubtedly, he will be the only habilitated specialist in the field of AC and universal collector motors in Bulgaria.

8. Critical remarks and recommendations

There are some repetitions, differences in numbering and excess volume in the submitted documentation for participation in the competition. This makes it difficult to read, but does not diminish the

merits of the candidate's work. I have no significant remarks. I would recommend the candidate to publish in more editions with impact factor.

9. Personal impressions

I know the candidate from his work at the Institute of Electrical Engineering, his collaboration with Prof. Bozhilov and Assoc. Prof. Ivanov from the Dept. of Electrical machines of TU-Sofia and its participation in scientific conferences. My impressions are excellent. Chief Assistant Dochev is an established researcher and lecturer with large erudition in technical sciences and in particular in the field of electrical engineering. I believe that with his election as an associate professor, the academic staff of the Technical University - Gabrovo and the Technical College - Lovech will increase with a highly qualified habilitated lecturer and researcher.

10. Conclusion:

Having in mind the above, I propose Ch. Assistant Professor Dr. Eng. Milko Ganchev Dochev to be elected "Associate Professor"

field of higher education - 5. Technical sciences,

professional field - 5.2. Electrical engineering, electronics and automation,

specialty - "Electrical Engineering" (Electromechanical devices, Electrical machines).

05.11.2021

Reviewer: /signature/

/ Prof. Dr. Vladimir Lazarov /