

## **OPINION**

on a competition for the occupation of the academic position "Professor" in  
professional direction 5.5. "Transport, shipping and aviation",  
in the discipline "Ecology of transport equipment"  
announced in SG No. 56 / 19.07.2022  
with Candidate Assoc. Dr. Eng. Zdravko Dinchev Ivanov,  
by a member of the scientific jury, Col. Prof. Dr. Eng. Svilen Evtimov Stefanov

### **1. General characteristics of the candidate's research and applied scientific activity.**

The competition for the academic position "professor" in the field of higher education 5. "Technical sciences", professional direction 5.5. "Transport, shipping and aviation" was announced by a decision of the Academic Council of TU and published in the State Gazette No. 56 of 19.07.2022. The competition was announced for the needs of the Department of "Transport Technology and Technologies" in the discipline "Ecology of Transport Technology" and is duly announced on the University's website. Within the deadline, one candidate submitted documents, namely Associate Professor Dr. Eng. Zdravko Dinchev Ivanov.

The candidate, Associate Professor, Dr. Eng. Zdravko Ivanov, submitted the following scientific works for participation in the competition:

- 10 scientific reports indexed in the world scientific database SCOPUS, as replacing a monographic work with an equivalent of 120.67 points;
- 7 scientific reports indexed in the world scientific database SCOPUS with an equivalent of 69.98 points;
- 25 publications in non-refereed publications with scientific review, with an equivalent of 233.35 points;
- A reference to the citations of the candidate's scientific works with a total equivalent of 270 points;
- Evidence of leadership of national, scientific and educational projects totaling 11 projects with the equivalent of 220 points;
- Participation in national scientific and educational projects – 3 projects with 30 points
- Published textbooks and teaching aids with a total of 100 points;
- Guidance of a successfully defended doctoral student;
- Auditor employment repeatedly exceeding the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria.

I have not had the opportunity to work together with Assoc. Prof. Dr. Eng. Ivanov, therefore I can only evaluate his scientific activity based on the materials presented at the competition. It can be seen from them that his scientific interests are directed in several directions, namely:

- Research the characteristics and management of the fuel system of internal combustion engines and its elements of modern cars;
- Research and improvement of the environmental characteristics of internal combustion engines and cars;
- Investigating the possibilities of using biofuels in order to improve the environmental characteristics of LPG and their efficiency;

- Modern technologies for the production and repair of Internal combustion engine (ICE) elements, etc.

The fact that a large percentage of the publications submitted to the competition are indexed in the world databases with scientific information shows that their quality, as scientific works, is extremely high. The scientific fields in which the candidate works are up-to-date and obviously the results achieved by him are of interest to the scientific and engineering community in the country and abroad. This is clearly seen from the citation reference presented. Some of the scientific publications are related to the presentation of developed ICE testing equipment and their various components. This, in turn, shows that the candidate's work has a practical orientation and does not consist only of theoretical developments.

## **2. Evaluation of the pedagogical preparation and activity of the candidate.**

As I mentioned above, I do not know the candidate personally and my assessment of his pedagogical activity is based only on the submitted data and references for the competition. From the report on the fulfillment of the minimum national requirements, it can be seen that Assoc. Prof. Dr. Eng. Ivanov has conducted over 1000 classes of lectures for the last three years (an average of 360 classes per year) in the disciplines of Computer Technologies in Transport Technology, Dynamics and Vibration of ICE, Ecology of transport equipment, etc. He participated in the conduct of semester and state exams (diploma design).

I believe that he has fulfilled the requirements for the Technical University - Varna for classroom occupancy and meets the minimum national requirements, as well as those of the University in terms of this indicator.

The published significant number of textbooks and study aids testify to his activity in conducting the educational process at TU-Varna.

The facts that he has a successfully defended doctoral student, as well as that he holds the administrative position of Head of Department, as well as the participation and management of numerous projects show that Associate Professor Dr. Ivanov actively participates in the scientific, educational and administrative life of the University.

## **3. Basic scientific and scientific-applied contributions.**

The reference for the scientific contributions of Assoc. Prof. Dr. Eng. Zdravko Ivanov, proposed for the competition, includes the following:

### **1. Scientific contributions**

1.1. A methodology has been developed for researching the environmental and noise characteristics of internal combustion engines when operating in unspecified modes.

1.2. A method has been developed for determining and analyzing the natural frequencies of the dynamic models of discrete oscillating systems, based on the solutions of chain fractions through iterations in a convergent sequence.

1.3. A methodology has been created for the pre-processing of arrays of data from processes recorded with analog-to-digital converters, with the aim of eliminating the step-like nature of the curves and enabling the analysis of processes with derivatives of a higher degree..

1.4. A new method for analyzing the factors and defining the boundary conditions determining the degree of exhaust gas recirculation and evaluating their impact on the emissions of the limited components NO<sub>x</sub> and PM is proposed.

1.5. A new method has been created and verified for determining in operating conditions, with a running engine, the phases for the beginning and end of fuel delivery, as well as the degree of nervousness of injection, by analyzing the vibration pulses of vibration acceleration.

## **2. Scientific and applied contributions**

2.1. The mechanical losses and environmental characteristics during the operation of an internal combustion diesel engine with modified fuels and nano additives to the operating materials were investigated.

2.2. An approach has been created and verified to study the phases of fuel supply in a Common Rail battery system.

2.3. A system has been created for modeling the composition of the fuel when using biogas as a fuel for liquefied natural gas.

2.4. A methodology has been created to study the influence of the parameters of the control pulse on the operation of low-resistance injectors for engines with forced ignition.

2.5. A method has been developed to study the fuel supply through the stroke of the armature of gas solenoid valves.

2.6. The noise characteristics of fuel electromagnetic valves from fuel equipment were investigated and a diagnostic parameter was determined for acoustic diagnostics based on harmonic analysis results.

2.7. A research system has been established to study the environmental characteristics of automobile engines.

2.8. A model has been developed to study the influence of support compliance on the oscillatory processes of crankshafts.

2.9. A digital correction filter was developed for the analysis of the anthropogenic perception of the noise emitted by the transport equipment. Determining the specific frequency and amplitude correction is done by surface interpolation of equal loudness curves. The correction filter is presented analytically and in the form of contour graphs.

2.10. An analytical and experimental investigation of the vibration shapes of a multi-cylinder engine cylinder block by impulse force testing has been carried out.

2.11. An algorithm was developed for forming frequency bands with arbitrary relative width and determining their parameters when processing experimental sound pressure data in time windows with arbitrary boundaries.

2.12. A new approach to the energy assessment of the use of hybrid drives of cars is proposed, based on the assessment of fuel consumption during the long-term operation of the vehicles, which guarantees the correct assessment of the planned goals for reducing CO<sub>2</sub> emissions.

## **3. Applied Contributions**

3.1. An analysis of the methods for experimentally determining the torsional susceptibility of crankshafts was performed.

3.2. The noise emission factor of an automotive diesel engine was determined experimentally, by means of which characteristic the level of emitted noise can be predicted at all frequency and load modes of engine operation.

3.3. The noise characteristics of a small internal combustion engine are determined.

3.4. A bench has been synthesized for the experimental study of torsional and strain measurement of longitudinal vibrations of engine crankshafts in order to evaluate the effectiveness of newly developed dampers regarding motor vibration forms.

3.5. The main factors for the emission of noise from internal combustion engines are analyzed and a complex of measures to influence them in order to reduce sound pressure levels is proposed.

In general, I accept the contributions presented, and since I am not a specialist in the field of IIIIE, I cannot commit myself to defining others. The contributions presented are of a high level and meet the requirements for the academic position of "Professor". I have no information to dispute in any way the applicant's authorship of the submitted contributions, and from a review of the publications I conclude that they are his work.

#### **4. Significance of contributions for science and practice.**

As I mentioned above, the fact that a significant percentage of the publications submitted to the competition are indexed in the world's databases with scientific information shows their high quality, and hence the quality of the obtained results and contributions to science. In practice, almost all publications contain data and results that develop science in the field of transport technology and are relevant to practice in research and testing of technology samples.

From the list of citations in the reference for compliance with the minimum national requirements, it is clear that the results obtained by Assoc. Prof. Dr. Eng. Ivanov are accepted by the scientific community at the national and global level.

The data indicated in the submitted reference under Art. 2b of the Law on the Development of the Academic Staff in the Republic of Bulgaria, Art. 60 par. 3 of the Regulations for its implementation and art. 1 para. 2 of the Regulations for the terms and conditions for holding academic positions at the Technical University - Varna show that Assoc. Prof. Dr. Eng. Zdravko Dinchev Ivanov fully meets the requirements for holding the academic position of "professor" at the national and university level.

#### **5. Critical notes and recommendations.**

Submit materials for the competition for the academic position "professor" in professional direction 5.5. Transport, shipping and aviation significantly exceed the requirements at the national and departmental level. I have no remarks or recommendations for the candidate - Zdravko Ivanov, Assoc. Ph.D., Eng.

### **CONCLUSION**

The materials submitted for the competition show that the candidate Zdravko Dinchev Ivanov, Associate Professor, PhD, Eng., meets the national and university requirements for holding the academic position of "Professor". The contributions in his scientific works further develop science and technology and are fully sufficient for the current competition.

Based on the familiarization with the presented scientific works, their importance, the scientific, scientific-applied and applied contributions contained in them, I find it reasonable to propose Assoc. Prof. Dr. Eng. Zdravko Dinchev Ivanov to occupy the academic position of

"professor" in the professional direction 5.5. "Transport, shipping and aviation" in the discipline "Ecology of transport equipment".

Date:

23.11.2022

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Col. Pro

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Svilen Stefanov

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