OPINION

by Dr. Eng. Daniela Antonova Shehova, Assoc. Prof. in

University of Plovdiv „Paisii Hilendarski”

of dissertation for the award of educational and scientific degree **„Doctor”**

by: field of higher education *5. Technical sciences;*

Professional field: *5.3. Communication and computer engineering*;

Doctoral program: *"Automation of areas of the intangible sphere (medicine, education, science, administrative activities, etc.)"*

Author: *Phys. Eng. Svetoslav Genchev Hadjigenchev*

Topic: *"Geoelectrical Resistivity Telemetry System in Seismogenic Zones"*

Scientific supervisor: *Assoc. Prof. Dr. Eng. Slavi Yasenov Lyubomirov*

Paisii Hilendarski University of Plovdiv

1. General presentation of the procedure and the PhD student

By order No. PD-21-123/ 19.01.2024 of the Rector of Plovdiv University "Paisii Hilendarski" (PU), I have been appointed as a member of the scientific jury for providing a procedure for the defense of a dissertation on "Geoelectric Resistivity Telemetry System in Seismogenic Zones" for the acquisition of the educational and scientific degree "Doctor" in the field of higher education *5. Technical sciences*, professional field *5.3. Communication and computer engineering*, doctoral program *"Automation of areas of the intangible sphere (medicine, education, science, administrative activity, etc.)"*. The author of the dissertation work is *Phys. Eng. Svetoslav Genchev Hadjigenchev*– a full-time doctoral student at the Department of Electrical Engineering, Communication and Information Technology, with scientific supervisor *Assoc. Prof., Dr. Slavi Yasenov Lyubomirov, from Paisii Hilendarski University of Plovdiv*

Presented by the PhD student, Phys. Eng. Svetoslav Genchev Hadzhigenchev set of materials on paper is in accordance with Art. 36 (1) of the Regulations for the Development of the Academic Staff of PU and includes the following documents: a request to the Rector of the PU to disclose the procedure for the defense of a dissertation work; CV in European format; protocol of preliminary discussion of the departmental council; dissertation work; abstract in Bulgarian and English; list and copies of scientific publications on the subject of the dissertation; declaration of originality and authenticity of the attached documents. All submitted documents meet the requirements. The doctoral student has attached five publications on the topic of the dissertation work.

Phys. Eng. Svetoslav Genchev Hadzhigenchev graduated from Sofia University "Kliment Ohridski", Faculty of Physics, majoring in Physics of the Earth, Atmosphere, and Space (1977-1982) and VMEI - Gabrovo, Faculty of Electrical Engineering, Majoring in "Electronic Engineering and Microelectronics" (1984- 1989). He worked as a seismologist at the "Rozhen" seismic station

(National Institute of Geophysics, Geodesy and Geography - BAS) and as a chief expert - physicist at the Regional Health Inspectorate, Smolyan.

2. Relevance of the topic

The topic of the presented dissertation is related to the search for innovative solutions for the development of a system of hardware and software tools for the telemetry of the variations of geoelectrical resistivity in seismogenic zones. Scientific research related to the construction of a model for the process of preparation and realization of the earthquake, which could explain the observed phenomena and represent a basis for its prediction, is a current problem that is of interest to the scientific community. The improvement of instrumental networks connected with modern communication networks are necessary conditions for the successful development of measurements for seismic protection and forecasting. In this context, the topic of the dissertation is current and globally significant.

3. Knowing the problem

The PhD student in Phys. Eng. Svetoslav Genchev Hadjigenchev is very well acquainted with the issues related to the development of a system of hardware and software tools for telemetry of geoelectrical resistance variations in seismogenic zones. In order to substantiate the approaches to solving the problem posed in the dissertation, publications and scientific achievements by current authors, on which the claim of novelty and originality in the dissertation is based, are critically analyzed. The used material from 105 literary sources is creatively interpreted and it can be concluded that the doctoral student has thoroughly delved into the modern world situation and trends in the development of problems in order to propose his own solutions in the dissertation work.

4. Research methodology

To achieve the goal of the dissertation "To develop a system for telemetry of geoelectrical resistance and other harbingers of earthquakes in seismogenic zones", four tasks are set, the solution of which leads to the achievement of the goal. I believe that the doctoral student correctly chose a research methodology that fully corresponds to the set goal and resulting tasks and contributes to the completeness of the solutions proposed in the dissertation.

5. Characterization and evaluation of the dissertation work and contributions

The dissertation has a total volume of 166 pages, of which the author's text on the topic is presented on 145 pages. In the first chapter, an overview and analysis of the harbingers of earthquakes and the location of the variations of the apparent geoelectrical resistance in them is made, as a result of which, at the end of the chapter, the goal is correctly set and the resulting four problems to be solved are formulated. In the next three chapters, the following are successively and methodically presented: The design of an apparatus for measuring geoelectrical resistance variations (a simulation study of a voltage amplifier in the receiving line at different amplitudes of disturbing sig-

nals and at different values of the input filtering capacitor in the middle of Multisim. The simulation and actually obtained oscillograms of the signals before and after their amplification are applied and analyzed.); The hardware implementation of the apparatus for measuring the variations of the geoelectrical resistance and measuring meteorological parameters; Variants of implementation of the transmission, storage, and visualization of the data received from the equipment for measuring the geoelectrical resistance. Appropriate modules have been selected and programmed to transfer the data from the field part of the equipment to a channel on a cloud platform with the possibility of storing, processing and visualizing the received data. A MATLAB program was written to process the data from the station and visualize it in real-time.

The contributions presented in the dissertation correspond to its purpose of fulfilling the set tasks. 4 scientific-applied and 4 applied contributions were formulated:

- **scientific and applied,** expressed in: research and systematization are the existing methods, techniques, and means in the field of recording the changes of the geoelectrical resistance in connection with the preparation of earthquakes; analyzing the possible sources of noise, the ways of their reduction and the results of the observations of variations of the apparent resistance in the process of preparation of earthquakes; analysis and registration by the author of an anomaly when measuring the apparent resistance in the area of the town of Strazhitsa, after the destructive earthquake of 07.12.1986. (M=5.7).
- **applied,** expressed in: equipment for measuring variations in geoelectrical resistance and meteorological parameters was designed and implemented in hardware; modules for calibration and verification of the equipment for measuring the variations of the geoelectrical resistance have been implemented; data obtained from the registration of geoelectrical resistance and meteorological parameters for eight months are presented, together with recorded earthquakes with a magnitude greater than 2.5 on the Richter scale and epicentral distances up to 100 km.; in software, it is possible to register, transmit, process, store and visualize the received sensor data in a cloud platform. A MATLAB program was created to process the data from the station and visualize it in real-time.

6. Evaluation of the publications and personal contribution of the doctoral student

The publications on the dissertation cover the main highlights of the subject. The PhD student has four independent publications and is a co-author with his supervisor on one scientific publication, being the first author. Three of the publications are in Scientific works of SUB-Plovdiv, one in SUB-Smolyan, and one in a National scientific conference with international participation "Education, Science, Society", Smolyan.

The personal contribution of the PhD student Phys. Eng. Svetoslav Genchev Hadjigenchev is convincing.

7. Abstract

The abstract of the dissertation shows full compliance with the requirements for its preparation and the reflection of the main points and contributions of the dissertation.

8. Recommendations for future use of dissertation contributions and results

The developed dissertation deals with a current problem and offers current solutions. I would recommend that the doctoral student orientate his publication activity in publications that are referenced and indexed in world-renowned databases of scientific information.

This recommendation does not diminish the significance of the proposed solutions and the achieved results and does not affect my positive impression of the scientific production and the main contributions of the PhD Engineer Svetoslav Genchev Hadjigenchev.

CONCLUSION

The dissertation work of Phys. Eng. Svetoslav Genchev Hadzhigenchev is dedicated to a current problem and represents a completed scientific research development, containing scientific and applied results, which represent an original contribution to science and meet all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (LADAPB), the Regulations for the implementation of the LADAPB and the relevant Regulations of Paisii Hilendarski University.

The dissertation shows that the PhD student, Phys. Eng. Svetoslav Genchev Hadjigenchev, possesses in-depth theoretical knowledge and professional skills in the scientific specialty of "Automation of areas of the intangible sphere (medicine, education, science, administrative activities, etc.)", demonstrating qualities and skills to independently conduct scientific research.

Because of the above, I confidently give my **Positive** evaluation for the conducted research, presented in dissertation work, abstract, achieved results and contributions, and I propose to the honorable scientific jury to award the degree of "Doctor" of Education and Science to Phys. Eng. Svetoslav Genchev Hadzhigenchev in the scientific field: 5 Technical sciences, Professional field 5.3. Communication and computer engineering, Doctoral program "Automation of areas of the intangible sphere (medicine, education, science, administrative activities, etc.)".

February 16 2024 **Prepared by:**.....

(Assoc. Prof. Dr. Eng. Daniela Shehova)