

OPINION

on a dissertation work for the acquisition of the educational and scientific degree "doctor"

Author of the dissertation: mag. Eng. Martin Lachezarov Ralchev
Dissertation topic: Emission and sensor registration of microparticles in inhomogeneous structures under uniaxial deformations
Professional direction: 5.2 Electrical engineering, electronics and automation
Scientific specialty: Elements and devices of automation and computer technology
Member of the scientific jury: Petko Hristov Petkov, Ph.D., professor

1. Relevance of the problem developed in the dissertation work

Modern methods for establishing the deformation status and revealing the mechanisms for the occurrence of the pre-critical states of rock formations and concrete composites have been developed in the dissertation work. Regardless of the significant achievements in this area, due to the frequent natural disasters and their increasing unpredictability, there is a marked interest in this topic on a global scale, which shows that the dissertation work is up-to-date, and the results obtained in it are useful for theory and practice.

2. Degree of knowledge of the state of the problem

The author of the dissertation has serious training in the field of elastic deformations in homogeneous and isotropic materials, which is evident from the competent and thorough overview of the methods for studying the internal stresses and states of rock massifs and concrete. In the dissertation, significant scientific results were obtained, several publications were made and inventions were registered on the subject. In the dissertation, 71 works are cited, of which 49 are in Latin, which shows that the author is well acquainted with the research in the given field.

3. Correspondence of the chosen research methodology and the set goal and tasks of the dissertation with the contributions achieved

Based on the performed in-depth analysis of the known approaches for studying the dynamics of deformations of rock massifs, an integrated approach was used, which consists in applying theoretical methods for studying the stress-strain state of rock massifs, laboratory tests on the uniaxial deformation of rock massifs structures and experimental studies of the processes of deformation and destruction of rock materials. The effectiveness of this approach is confirmed by the obtained results. Therefore, there is a complete correspondence between the set goals and the achieved results in the dissertation work.

4. Main scientific and applied contributions

The candidate has formulated 5 scientific and applied contributions, which I fully support. The experimentally established and previously unknown generation of microparticles in solid inhomogeneous systems at high uniaxial strains, as well as their amount for specific types of materials, should be evaluated as a significant contribution. As a significant scientific-applied contribution, the determination of the functional dependence of the generation of particles on external factors should be noted, as their intensity and sizes have been determined by the type of rocks. A phenomenological and physicochemical interpretation of the new regularity is proposed. As an important applied contribution, the development of an integral method and system for dynamic determination of the stress-strain state of rock massifs can be indicated, which can be used for early notification of pre-emergency and emergency situations in critical infrastructure. As a significant applied contribution, it should be noted the design, construction, implementation and testing of an experimental set-up in four variants depending on the geometric shape of the rock samples, to study the emission of fine mineral fractions under uniaxial pressure. The installation is equipped with modern sensor devices, measuring with high accuracy and sensitivity the characteristics of the released microparticles.

5. Evaluation of publications on the dissertation work

Three publications have been made on the dissertation work at conferences in our country, two of which are independent. The candidate is also a co-author of three patents for inventions and a participant in two research projects. The candidate is the winner of the 2023 Ivan Evstratiev Geshov Award of the National Academy of Sciences, the 2023 Eureka Young Inventor Award, as well as the 2021 Ivan Tsotsorkov Foundation Award. All this gives me reason to evaluate the publications presented in the dissertation as essential.

7. Opinions, recommendations and remarks

The dissertation makes a very good impression with the professional mastery of innovative engineering methods and systems for the prevention of destruction in critical infrastructure, which has enabled the doctoral student to obtain new results. I have no significant comments on the work, I hope that the obtained results will find application in real practice.

CONCLUSION

Based on the significant contributions in the candidate's works and his successful research activity, I allow myself to propose to the Honorable Scientific Jury to award the M.Sc. Eng. Martin Lachezarov Ralchev, the educational and scientific degree "doctor".

18.06.2024

Jury member:

/prof. Ph.D. Petko Petkov/