

STANDPOINT

on a dissertation

for the acquisition of the educational and scientific degree "doctor"

Author of the dissertation: M.Eng. Stanimir Georgiev Stanchev

Dissertation topic: „Research of mechanical and technological parameters of an eccentric type rotary crusher "

Scientific supervisor: Assoc. Prof. Dr. Petko Nikolov Nedyalkov

Member of the scientific jury: Assoc. Prof. Dr. Eng. Ivan Ganchev Ganchev, associate professor, Head of the Department of "Hoisting and Transport and Construction Machines and Systems" at the Faculty of "Technology and Construction Technologies in Transport" of the Transport Iniversity "Todor Kableshev" - Sofia

Professional field: 5.8 " Exploration, extraction and processing of minerals "

Doctoral program " Mine mechanization" at the Department of "Mechanization of Mines", MEMF of the University of Mining and Geology "St. Ivan Rilski"

This opinion was prepared in my capacity as a member of the Scientific Jury for the procedure for the defense of a dissertation work in accordance with Order No. RD-13-23 of 22.05.2026 of the Rector of the St. Ivan Rilski University of Mining and Geology (St. Ivan Rilski University) and on the basis of a decision of the First Meeting of the Scientific Jury, held on 28.05.2026.

The doctoral student M.Eng. Stanimir Georgiev Stanchev has been enrolled as a full-time doctoral student in the professional field 5.8 " *Exploration, extraction and processing of minerals* " at the Department of Mine Mechanization, Faculty of Mining and Electromechanical Engineering of the University of Mining and Geology "St. Ivan Rilski" by Order No. R-250/22.03.2023 of the Rector of the University of Mining and Geology "St. Ivan Rilski"(MGU). The doctoral student has fulfilled all commitments from his individual plan and has passed all exams from the doctoral minimum. By the Order No. UD-16-62/20.05.2026 of the Rector of the MGU "St. Ivan Rilski", the doktoral student has been effective discharged with the right to defend his dissertation.

The submitted documentation shows that the doctoral student meets the formal requirements for acquiring the educational scientific degree "Doctor", set out in the Low on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its Implementation.

1. General nature of the dissertation work

The dissertation submitted for review is sufficiently comprehensive in volume and content, divided into five chapters, conclusion, contributions, literary sources (120 pieces) and appendices. The appendices consist of 49 tables, 51 photographs, 4 schemes, 2 flowcharts, 63 diagrams. The main text of the dissertation includes 53 schemes, 33 tables, 5 flowcharts, 12 graphs and diagrams, and 3 photographs, which are chronologically numbered and appropriately embedded in the main text.

2. Relevance of the problem developed in the dissertation in scientific and scientific-applied terms.

The topic of the dissertation is relevant. The main goal of the dissertation is to study the interrelationships between the mechanical, kinematic, dynamic and technological parameters of the rotor crusher - eccentric type (RCET) and its energy efficiency and productivity, including the quality indicators of the crushed material..

To achieve the set goal, the doctoral student has adopted the application of a combined approach method, including theoretical modeling, 3D CAD modeling, FEM/CAE simulations, experimental research and statistical processing of the results..

By achieving the goal set by the doctoral student, results will be obtained that will allow establishing quantitative relationships between the main design and operating parameters of the machine and the efficiency indicators of the crushing process. This represents a solution to a problem that is relevant to the modern development of technology, which definitely has scientific-applied significance.

3. Degree of knowledge of the state of the problem and creative interpretation of the literary material

The doctoral candidate demonstrates a thorough knowledge of the state of the problem according to the literature review of 120 sources. Of these, 32 are in English, 56 in Russian and 32 in Bulgarian, including many standards, and documents for current economic and technical reference and information. All used literary sources are correctly cited in the dissertation work.

The dissertation skillfully combines technical, design, engineering, energy and economic specifics. A complex approach for theoretical, experimental and statistical research of the working process of an eccentric type rotor crusher has been applied and adapted. The approach combines structural and kinematic analysis, 3D CAD modeling, FEM load assessment, experimental measurements, granulometric analysis and statistical processing of the results. The study is structured around constant control factors: real rotation speed, width of unloading opening and number of working chambers. The type of material is considered as an experimental condition for comparison, and the derived structural-dynamic quantities are not treated as independent controlling factors. It is impressive that the doctoral student formulated multi-objective optimization as a tool for determining a rational compromise area of work, and not as a proof of an absolute universal optimum. Through this approach, a much more defensible connection between the experimental data, the regression dependencies and the practical recommendations for the work of the rotor crusher - eccentric type has been achieved.

By analyzing and interpreting the results of the conducted and cited scientific research, the doctoral student is able to refine the statistical processing so that the regression models are considered according to their proven statistical significance.

4. Scientific, scientific-applied and applied contributions of the dissertation work

The claims for scientific-applied and applied contributions in the dissertation are 9, 4 scientific-applied and 5 applied, respectively, namely:

➤ **Scientific-applied contributions:**

1. The place of the eccentric type rotor crusher in the classification of crushing machines(ETRC) is justified, as it is shown that the ETRC combines constructive and kinematic features characteristic of different groups of crushing machines, but is not clearly distinguished in the existing classification schemes.;

2. A complex theoretical-experimental scheme for the study of ETRC has been adapted and implemented, including structural modeling, kinematic analysis, 3D CAD/FEM evaluation, experimental measurement of operating modes, grainmetric analysis, energy evaluation and statistical processing of the results;

3. The influence of the main control factors - real rotation speed **n**, width of unloading opening **b** and number of working chambers **z** – on the main technological indicators of the process: mass productivity **Qm**, quantitative grainmetric indicators **Dcp/D80** and relative energy consumption **W** has been experimentally established;

4. The grainmetric composition of the finished product is reduced to quantitatively measurable indicators, which allows for comparison of results under different operating modes, different numbers of chambers and different materials - limestone and diabase;

5. The assessment of the mechanical load in ETRC has been precised by distinguishing between the inertial dynamic load, determined by vibration accelerations, the peripheral/tangential force, determined by torque, and the real contact crushing force, which is not identified with the first two quantities;

6. A rational operating area of the laboratory ETRC has been established, in which a compromise between crushing quality, productivity and relative energy consumption is achieved. This area is considered as an engineering-founded regime, not as an absolute universal optimum;

7. An integrated approach for assessing the efficiency of the process in the ETRC is proposed, combining grainmetric, energy and dynamic indicators, taking into account the statistical significance and applicability of the obtained dependencies.

➤ **Applied contributions:**

1. A spatial 3D CAD model of the laboratory ETRC was created, through which basic geometric parameters, volumes of the crushing chambers and starting assumptions for subsequent kinematic and simulation studies were determined;

2. A FEM assessment of the stress-strain state of the rotor and eccentric mechanism under specified operating loads, determined by torque and corresponding peripheral force, was performed. The results obtained were used to assess the structural stability of the working body;

3. An experimental setup for the study of ETRC was developed and implemented, including control of the rotation frequency, the discharge opening, the number of working chambers, the mass and humidity of the samples, the processing time, the energy indicators, the vibration state and the grain size composition of the finished product;

4. An experimental database was obtained for the operation of the ETRC in crushing limestone and diabase, which can be used for comparing modes, for tuning the laboratory machine, and for future improvement of the design;

5. Practical guidelines for selecting ETRC operating modes have been formulated by simultaneously considering the frequency **n**, the unloading hole **b**, the number of working chambers **z**, the productivity **Q_m**, the grainmetric index **D_{cp}/D80** and the relative energy consumption **W**;

6. The results of the study can be used in the design, adjustment and experimental study of eccentric type rotor crushers and similar crushing systems, provided that the scale of the machine, the type of material and the limits of the laboratory tests performed are taken into account.

I accept the formulated scientific-applied and applied contributions in the form proposed in the dissertation work. I believe that they fully reflect what the doctoral student has achieved and find real application in science and practice.

5. Abstract.

The submitted abstract is 42 pages long and includes all elements and attributes required for such a format.

6. Scientometric indicators.

A total of 2 publications related to the dissertation work are presented. Both were prepared independently and were published in a non-refereed journal with scientific review "Mining and Geology", which demonstrates the skill developed during the development of the dissertation for independent research work and the formulation of scientific publications in a form that is useful and applicable to the scientific community. The publications are of a good scientific level and correctly reflect the issues considered in the dissertation work.

According to scientometric indicators, this equals 40 points, which meets the requirements of the Low on the Development of Academic Staff in the Republic of Bulgaria..

The total sum of the scientometric indicators from group A and group B is 90 points with a minimum requirement of 80 points.

7. Critical notes and recommendations

Considering the relevance of the problems considered in the dissertation and the results achieved in their solution, I give a positive assessment of the work performed by the doctoral student. The textual, graphic and tabular layout of the materials presented in the dissertation is of high quality and provides the necessary correctness and clarity. The presence of some stylistic and technical errors does not lead to a decrease in the value of the presented dissertation.

I have the following remarks and recommendations regarding the dissertation considered in this opinion.

Notes:

- In the comparative analysis between jaw, roller and eccentric type crushers in point 4.1, no graphs or diagrams are presented to illustrate the comparisons made in points 1.4.1 to 1.4.4, inclusive;
- When writing a type of machine in a title, it is written with an abbreviation placed in brackets without writing the full name of the machine. This way of writing is applicable in the text with the exposition, but in the titles of chapters or paragraphs it is not typical of good practice;
- The numbering of the diagrams used, labeled as "figures" and tables, follows the numbering of the corresponding points, and is not organized in chronological order, which creates opportunities for confusion;
- In Fig. 3.3 on page 37 the parameter M_{max} is written incorrectly.
- Very large spaces are marked between individual paragraphs and some lines (e.g. p. 40 after the third paragraph)
- On page 39, formula (3.14) is not placed before the last paragraph, but after it.
- The description of the literature used includes a mix of Bulgarian and Russian sources.

Recommendations:

- To update the algorithm for analyzing the results and taking adequate actions when changing regulatory documents.
- Figures representing technical diagrams and drawings should be presented in a unified format for all of them.

The goals set in the dissertation have been achieved, and the contributions are of a scientific-applied and applied nature. Due to the topicality of the topic, I recommend that M.Eng. Stanimir Stanchev continue his scientific research work in the chosen field, and for the results achieved from future research, take the necessary actions for their publication in refereed and indexed Bulgarian and international scientific journals and scientific conferences.

8. Conclusion

The dissertation correctly reflects the author's research, which has an undeniable scientific-applied and applied nature.

I believe that the presented dissertation, the author's publications and the formulated contributions have the necessary and required qualities and fully comply with the requirements of the "Law on the Development of the Academic Staff in the Republic of Bulgaria" (LDASRB), the Regulations for the Implementation of the LDASRB and the Regulations for the Conditions and Procedure for Acquiring Scientific Degrees at the University of Mining and Geology "St. Ivan Rilski", Sofia.

I give a positive assessment of the dissertation and propose to the esteemed Scientific Jury to award M.Eng. Stanimir Georgiev Stanchev the educational and scientific degree "Doctor" in the field of higher education 5. Technical Sciences, professional field 5.8. "Exploration, extraction and processing of minerals", doctoral program "Mechanization of mines".

12.08.2026

Prepared by:

/Assoc. Prof. Dr. Eng. Ivan Ganchev/