

REVIEW

By: Prof. Dr. Eng. Krasimir Todorov Krastanov VTU “Todor Kableshkov”

Regarding: Dissertation thesis for obtaining the educational and scientific degree “Doctor” in professional field 5.8 *Prospecting, Extraction and Processing of Mineral Resources* scientific specialty *Mechanization of Mines*

Grounds for presenting the review: Participation in the Scientific Jury, approved according to Order No. RD13-23/22.05.2026 of the Rector of the University of Mining and Geology “St. Ivan Rilski”

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

Title of the dissertation thesis: **“Investigation of the Mechanical and Technological Parameters of a Rotary Crusher – Eccentric Type”**

1. Information about the PhD student

The PhD student, Eng. Stanimir Georgiev Stanchev, graduated from the University of Mining and Geology “St. Ivan Rilski”, where he consecutively obtained the educational qualification degree *Bachelor* in the specialty *Mechanization of Mining Production* and the educational qualification degree *Master* in the specialty *Mechanization for Processing Mineral Raw Materials*.

Since 2022 he has been a PhD student in the doctoral program *Mechanization of Mines* within professional field 5.8 *Prospecting, Extraction and Processing of Mineral Resources*. Since September 2024 he has been an assistant at the University of Mining and Geology “St. Ivan Rilski”, combining teaching activity with research work in the field of mechanization of mining production and machines for processing mineral raw materials.

The PhD student possesses solid engineering training and considerable practical experience in machines and technological systems. He is proficient in specialized engineering software, including AutoCAD Mechanical, used for technical design and three-dimensional modeling.

He has successfully passed all examinations included in his individual study plan, according to Certificate SSPM No. 385-2026 of 12.05.2026. He has been discharged with the right to defend, according to Order No. UD-16-62/20.05.2026 of the Rector of MGU “St. Ivan Rilski”.

The dissertation thesis was presented and discussed at a meeting of the Departmental Council of the Department “Mechanization of Mines”, Mining-Electromechanical Faculty, held on 11.05.2026.

The set of materials submitted by M.Eng. Stanimir Stanchev on electronic media complies with the Rules and Procedures for Admission and Training of PhD Students and for Obtaining the Educational and Scientific Degree “Doctor” at MGU “St. Ivan Rilski”.

2. General notes and evaluation of the thematic orientation

The dissertation thesis is dedicated to the investigation of a rotary crusher of eccentric type (RCET) — a construction that occupies an intermediate position between classical jaw, roll and rotary crushers, yet remains insufficiently analyzed in contemporary scientific literature.

The author convincingly demonstrates that this type of machine possesses specific kinematic and technological characteristics that distinguish it from other crushing devices and justify the need for an independent study.

The topic is relevant, as crushing processes are among the most energy-intensive in the mining industry, and optimization of operating modes is directly related to reducing costs, increasing productivity and improving product quality. The dissertation aligns with contemporary trends in energy efficiency, sustainability and modernization of technological processes.

3. Structure, scope and logical sequence

The work is structured into eight chapters covering the full cycle of an engineering study: literature analysis, theoretical modeling, simulation studies, experimental work, statistical processing, optimization and formulation of contributions.

The structure is clear, consistent and academically sound. Each chapter fulfills a specific function and logically leads to the next. The combination of theoretical statements and experimental results is particularly well achieved, which is essential for a dissertation of engineering-technological character.

4. Analysis of the literature review

The literature review is extensive and includes historical information, classification schemes and contemporary constructive solutions. The author examines the classical energy hypotheses (Rittinger, Kick, Bond), as well as modern developments of rotary and eccentric crushers.

It is correctly noted that RCET is insufficiently represented in scientific publications, which substantiates the need for the present study. The review is well structured, though it could benefit from a more detailed comparison with industrial machines of the latest generation.

5. Theoretical framework and simulation studies

The theoretical part is professionally developed. The author derives dependencies for productivity, load and energy indicators, taking into account geometric parameters, kinematics and the specific features of eccentric motion.

The CAD model is constructed precisely, and the FEM analysis includes: • stress-strain state, • modal analysis, • assessment of safety margins.

The results show that the construction is stable within the specified operating ranges. This section is a strong part of the dissertation, demonstrating high engineering competence.

6. Experimental setup and results

The experimental program is well organized and includes 40 main tests with different combinations of frequency, gap and number of chambers. Two types of material were used — limestone and diabase — enabling comparison of behavior under different physico-mechanical properties.

Measured indicators include: • productivity, • energy consumption, • vibrations, • grain size distribution.

The results are clearly presented, with graphs and tables, and subjected to critical analysis. Identified regularities are later used in statistical modeling.

7. Statistical analysis and optimization

Statistical processing was performed using ANOVA, regression models, coefficients of determination and significance criteria. The models were validated through comparison with experimental data and show high adequacy.

Multi-objective optimization was conducted using a generalized utility function, considering variants with and without weighting coefficients. A rational operating region was determined, balancing product quality, productivity and energy consumption.

This section is methodologically strong and demonstrates skillful application of modern optimization approaches.

8. Scientific and applied contributions

The contributions are clearly and correctly formulated.

Scientific-applied contributions: • Identification of RCET as an independent class of machine. • Development of a methodology for theoretical, simulation and experimental investigation. • Creation of regression models for technological indicators. • Development of multi-objective optimization of operating modes. • Validation of theoretical models through experimental data.

Applied contributions: • Determination of rational operating modes. • CAD/FEM model applicable for designing similar machines. • Experimental dependencies useful for adjustment and operation.

The contributions are real, well-argued and fully meet the requirements for the educational and scientific degree “Doctor”.

9. Critical notes

In the spirit of academic objectivity, several constructive critical notes should be mentioned:

1. The experimental range is limited — frequency and gap were studied within relatively narrow limits, restricting extrapolation to industrial machines.
2. Lack of comparison with industrial crushers — including data from real production installations would be beneficial.

3. Limited set of materials — inclusion of more rock types would increase the universality of the results.
4. Vibration analysis is used mainly diagnostically — expansion toward dynamic loads and resonance phenomena is possible.
5. No quantitative comparison with classical energy hypotheses — Rittinger, Kick and Bond are reviewed theoretically but not compared with experimental data.
6. Low publication activity.

These notes do not diminish the value of the work but outline potential directions for future research.

10. Conclusion

The dissertation thesis of Assist. M.Eng. Stanimir Stanchev is a completed, original and scientifically substantiated study that:

- solves a real industrial problem;
- fills a clearly defined scientific gap;
- offers a comprehensive methodology for analysis and optimization;
- demonstrates an excellent combination of theory, simulation and experiment;
- contains significant scientific and applied contributions.

The work fully meets the requirements for awarding the educational and scientific degree “Doctor” in professional field 5.8 *Prospecting, Extraction and Processing of Mineral Resources*, scientific specialty *Mechanization of Mines*.

I propose that the Scientific Jury award Assist. M.Eng. Stanimir Georgiev Stanchev the educational and scientific degree “**Doctor**”.

13.08.2026

Prof. Dr. Eng. K. Krastanov