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OPINION

on dissertation work with topic:

“SELECTION OF METHODS FOR ASSESSING THE STABILITY OF A WORK BOARD AND THE POSSIBILITY OF TECHNOLOGICAL IMPACT”

with author **mag.eng. Xiaoling Li-Shtereva**

for award of educational and scientific degree "Doctor", Professional field: 5.8
“Exploration, extraction and processing of minerals”, Scientific specialty: “Mining and
underwater mining of minerals”

by prof. **Cai Qingxiang** – Department of Surface Mining, School of Mines, Xuzhou City,
Jiangsu Province, People’s Republic of China

Mag.eng. Xiaoling Li-Shtereva presents a scholarly work dedicated to a very important problem, whose relevance is not only growing, but is also acquiring new dimensions and aspects in the field of open-cast mining development, and namely the assessment of the stability of the work board and the potential for technological impact .

This is a research study whereby the doctoral student makes her contribution to supplementing the classifications of slope stability assessment methods, which is related both to upgrading the traditional 2D to 3D models as well as to applying of a mechano-mathematical approach.

In the theoretical part of the dissertation there are two main accents that stand out:

- formulated are the theoretical bases for assessing the stability of the slopes of steps and boards in open pit mines, on the basis of which the existing classifications of computational methods are supplemented;
- considered are the perspective approaches for estimation and prediction of slope stability such as: optimization of the sliding surface, probabilistic and sensitivity analysis of the methods and modern models on the behavior of the rock mass and the strength criteria.

The theoretical interpretation of the main problems in the presented material (158 literary sources: 78 in Cyrillic and 80 in Latin) is an expression of the good orientation of mag.eng. Xiaoling Li-Shtereva in the scientific ideas and perceptions of different authors in the other countries and in Bulgaria, and in the context of modern computational methods, best practices and trends in the field of the reviewed problematics. In this context, mag.eng. Xiaoling Li-Shtereva correctly clarifies terminologically the basic concepts used in the dissertation material: stability of board, coefficient of stability, coefficient of safety, computational method, Method of finite element, etc.

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This analysis allows the author to outline and emphasize the need to develop and propose a comprehensive approach for selecting the method for assessing the stability of the board, as well as for justifying the possibilities of technological impact under different geo-engineering conditions. The dissertation construction, unfolded in a logical sequence, presents the conceptual idea of the author and provides its detailed disclosure. The well-structured and reasoned introduction to the choice of the research problem involves correctly formulated innovative ideas: object, subject, purpose, basic tasks and methods for solving them. The stages of the study are well outlined in the dissertation material, as well as the variety of computational methods used according to their purpose: methods based on the engineering-geological conditions of the massif; boundary balance analysis methods, border analysis method, numerical analysis methods and probability methods. The application of numerical and probabilistic methods for assessing the stability of a working board enhances their objectivity and reliability.

A positive aspect is the creation of criteria and indicators consistent with the purpose and objectives of the study, with the contributions aimed at optimizing the results of the stability assessment of the stability of the boards of the open pit mines by analysis of the sensitivity of the applied computational method and the impact of the physico-mechanical parameters of the massif. Achievement of the doctoral student is the quantitative and qualitative analysis of the results of the evaluation of the stability of the working board of mine "Trojanovo-north", Mines "Maritza-East" EAD by the application of the conventional methods (for example, the method of Bishop, Felenius and Yanbu) and the Method of finite element. The analysis is richly visualized through figures and tables, and confirms the successful application of modern specialized geotechnical software products. The advantage of FEM has been proven in the more consistent account of the stressed and deformed state of the array, which in most of the conventional methods is a disadvantage.

From an applied science point of view, the doctoral student M.Sc.Li-Shtereva is considering the decision making on the technological impact on the stability of the working board in the conditions of uncertainty of the natural environment and with taking into account the time factor. The results obtained correspond to the stated goal in the dissertation work, and namely choice of a method for assessing the stability of a working board in an open-cast mine. Moreover, presented are principal measures for technological impact on the sustainability of the working boards in open cast mines, thus proving the practical feasibility of the study, for example, the need to recapture the level of the open horizons for the conditions of the "Trojan-north" mine, Mines "Maritza East" EAD.

The main contributions of the dissertation can be summarized in two main aspects - theoretical and applied-theoretical. In theoretical plan, they are expressed in:

- formulation of the theoretical bases for evaluation of the stability of slopes of steps and boards in open pit mines;
 - updating of the existing classifications of methods for estimation of the stability of slopes on the basis of a mechano-mathematical approach;
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- substantiation of the 3D modeling based on boundary equilibrium methods;
- analysis of the perspective methods for estimating the stability of slopes: by optimization of the position and shape of the sliding surface, analysis of the sensitivity of the method used and analysis of the influence of the physico-mechanical properties of the array on the stability coefficient of the working board.

In theoretical-applied aspect, the contributions are expressed in:

- substantiation and approbation of the Finite Element Method for evaluation of the stability of the working board in an open pit mine (having as example the “Trojanovo-north” mine, Mines “Maritza-East” EAD).
- Development of principle solutions for selection of methods for assessment of the stability of the work board and the possibility for technological influence in prevention of landslide phenomena.

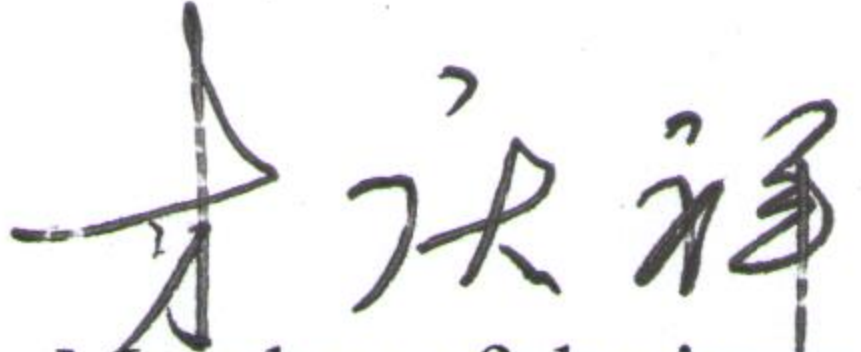
Along with the dissertation, mag.eng. Xiaoling Li-Shtereva has published 3 independent publications that reflect different aspects of the researched problem. The publications are part of the dissertation research and they were reported at the 30th International conference on geology (China, 1996), VIII National school - workshop on rheology, Bulgarian rheological society, Central laboratory for physico-chemical mechanics - BAS (Bulgaria, 1996), V National conference with international participation on open mining of minerals: “State and development of the open mine extraction of minerals in market conditions” (Bulgaria, 1998), Scientific conference of MGU (Bulgaria, 1999, 2016) and International symposium (Serbia, 2017).

The auto-abstract is developed according to the requirements and reflects the main accents, overall content and contributions of the work.

In conclusion: the highlighted above achievements give me reason to believe that this is an up-to-date, innovative and promising scientific study with its achievements of contribution character for the theory and practice in the field of board sustainability in open-cast mines.

Taking into account the qualities of the dissertation work and the achieved contributions, I give a **positive assessment** and suggest to the scientific jury to award the educational and scientific degree “doctor” in the Professional field: 5.8 “Research, extraction and processing of minerals”, Scientific specialty: “Open and underwater extraction of minerals” to mag.eng. Xiaoling Li-Shtereva for the developed by her works.

30.11. 2019 г.


Member of the jury:
(prof. Cai Qingxiang)
Cai Qingxiang