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PLANNING AND MINE DESIGN IN OPEN-PIT MINING PROCESSES AT MINING ENTERPRISES

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ABSTRACT

This article presents the problem of short-term planning of open-pit mining processes and work shifts in mines and the design process of technological mine parameters in open mines is shown. The problem is mine and waste as well several problematic situations in truck parks and drop-off points are highlighted. Truck distribution is dynamic to permit each truck must be assigned multiple routes. The problem is deciding which one facades should be mined and specify the number of trucks, their routes and directions, and the amount of material transported by them to each drop-off point is satisfactory we can see the calculation ratio and their indicators as needed. The goals are to minimize the deviations starting with production targets, chemical grade and particle size range of each parameter control in each plant and reduce the number of trucks we can give examples of processes. To solve the problem, we developed a mixed integer linear objective programming model and tested it using real data from an iron ore mine. The results showed the proposed approach supports decision makers in sizing and allocation and in meeting the required targets of truck fleets and production and control parameters by ore processing plants in a day-to-day scenario such as low availability the flexibility of shovels and trucks, ore quality, and the need to increase production have been widely discussed.

Introduction

In mining enterprises, for example, after the last commodity supercycle of iron ore, mining enterprises began to have their own main enterprises (in the case of the Tebin Bulak mine) meet target ore quality objectives and reduce variability in specific controls selecting parameters (such as iron, silica, manganese, and particle size range) and planning mine operations without compromising production volume is critical. Due to the abundance of iron ore, market demand begins to increase and more and more companies are offering products

that meet customer specifications. A product with greater added value can be obtained by producing material within them specifications. Quality is important in production. It is necessary to consider the processes of design and planning of mining enterprises from all sides, and excavation works should be carried out according to the coordinates of the geological location of the mine, and it is necessary to consider the convenience of movement of mining vehicles in the open mine. This article deals with the short-term planning of the last two types of open pit mines cases of short-term problems are shown as examples. The goal is to more strictly adhere to the distribution and planning of the processes of mining enterprises and transport, dispatch, the decisions made on the problems in the Kondayuk circuit are presented. There are several encounters in this problem indicators to have a quality schedule, such as: achieving production goals and chemical level and particle size range of each control parameter at each plant should be considered), reduction the number of trucks in operation, Calculation of the turnover time of trucks, that is, taking into account the time adopted for the movement of the truck between the loading and unloading points and consists in calculating the efficiency indicators of the trucks) compliance with the requirements in order for this indicator to be consistent with strategic planning, the proportion of planning and planning should be equal. Operator use only mining table search experience that is efficient, fast and able to satisfy everyone these indicators have proven to be insufficient. This paper presents an objective programming formulation capable of producing good solutions for open pit mining processes in mining enterprises. this problem should be solved taking into account the work shift. The main contributions of this work are:

* Description of the problem under study with heavy loading and unloading, and heavy loading, overloading and transportation of trucks with more than the specified amount will cause malfunctions based on the technological parameters of the truck, and in open mines, causes a delay in performance for a long period of time, points, location fleet of trucks, dynamic distribution of trucks, mixing of ores, determination of the number of trucks and their routes, and compliance with cleaning. ratio;
* A new mixed-integer linear objective programming formula was developed to solve the planning of open-pit mining processes in mining enterprises.
* Based on the results of a case study involving two iron ore mines, the main stages of planning are outlined;
* Analysis of different production scenarios for ore control parameters, production after opencast mining processes in mining enterprises, and it is necessary to select the number of trucks in relation to the volume of cargo.

Problems in planning and design in open pit mining enterprises

The studied problem is related to the problem of operational planning of open pit mining enterprises is considered one of the problems encountered during the work shift. Planning consists of selecting the mine fronts used for mining the material and is to determine the number of arrivals for each truck at its destination. The goal is to create a short-term plan that meets the chemical processes, particle size ranges, and required production goals, and produced by processing enterprises and cases where it is necessary to reduce the number of working trucks. Planning is an essential component of any successful implementation to achieve the desired results. Clearly predicting outcomes is the basis of any planning activity.

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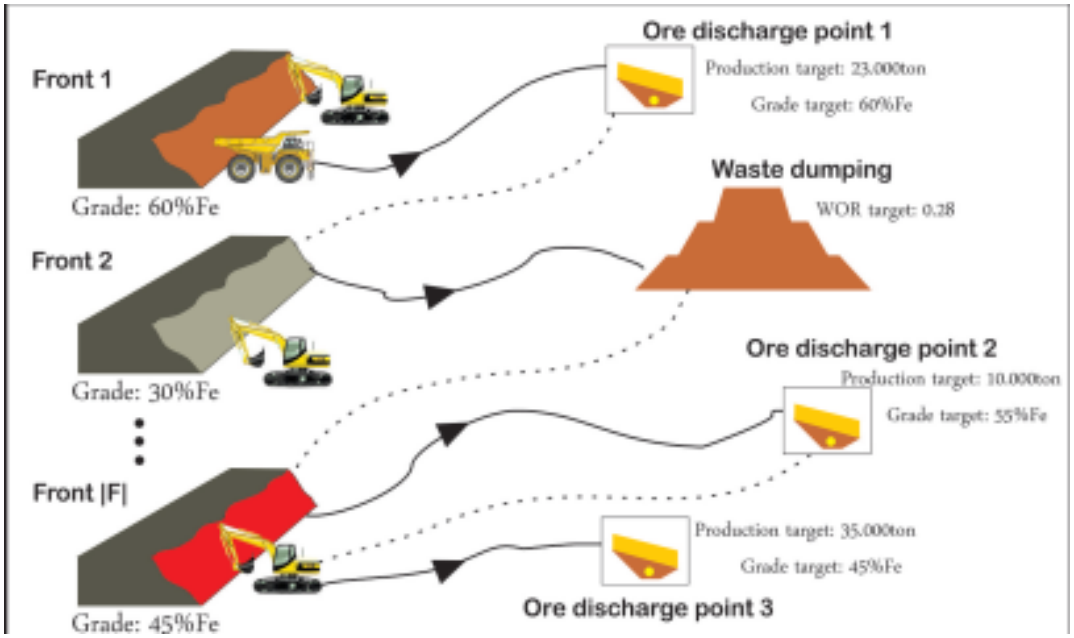
This article is intended presents an approach that is discrete event simulation combined with an optimization tool and used for effective short-term mine production planning and design processes based on accurate forecasting. This is an article describes how to develop a detailed mining discrete event simulation model, that the scenario is easy to analyze and flexible enough to be reused throughout the life of the application, together with modeling techniques for freight transport, and interaction with the freight road network external intelligent decision support systems for operational decision making. Invited the simulation optimization framework works in a bottom-up approach by simulating operations developing short-term plans. The applied external decision support system works in the mine will consist of optimization and identification of truck performance indicators that provide shovel allocation decisions based on a strategic schedule. Picture 1 illustrates the transportation processes of the truck in the scenario. As seen in Picture 1, it consists of a set will cause the movement of mine fronts, loading equipment and trucks to be delayed for a certain period of time. Each truck is loaded with a shovel it is calculated based on the quantity of materials taken from the mining front to its unloading point. The distribution of the truck is dynamic, that is, in the same picture, the truck goes from Front 1 to Ore outlet (1). Then, it goes to Front (2) Finally, it completes its final journey at the 3rd release point.



Picture 1. Illustration of open pit mining problems arising in planning and designing.

In open-pit mining enterprises, the mining plan consists of a geometry that takes into account several operational parameters and it takes some time to prepare it. This plan presents the mining aspects that organize the production and it is assumed that the work processes in the shift schedule will be correctly distributed. The purpose of the mining plan is to manage operational groups and (use of the mine, topography, quality control) is to manage the control that occurs at the mining fronts. Currently weekly and daily the table is drawn up by the mine technician, which gives information about which aspects are available during that period and examines the existing ore grade and the historical performance of the existing equipment. To whom evaluation of the implementation of the mining plan, the topography team performs mine topography and at the end of the last day of the planned month, the

results of the measurements are reviewed. With the results of these measurements, performance and comparison indicators are obtained. The first indicator reports, the ratio between the planned mined mass and the total mined mass. This is a second the indicator compares predicted and actual mass and qualities. Technical manager quality control performs a visual assessment of the facades and calculates the amount of material each shovel must be fully calculated mining processes through trial and error based on field experience. However, taking into account the complexity of the problem, the purpose of production, the goals of the control parameters and the minimum clearance ratio is not always met.

Conclusions

This paper considered the problem of short-term scheduling of work shifts for open pit mines. The goal is to minimize deviations from production goals, limits, and targets, and will consist of carrying out design work on the selection of control parameters and the required number of trucks. We proposed new mixed integer linear objective programming procedures to solve it. This the approach was applied to a mine complex with two mines supplying material to three mines, and one waste disposal site would be identified. In the design and planning processes of mines, the technological parameters of the mine and coordinates of geological, geodetic and cartographic conditions should be provided. Four scenarios simulating some operating conditions of mines and the iron ore market was analyzed. These scenarios differ in the given weights each objective of the weighted objective function. The results showed that the proposed approach can support decision makers in sizing and in allocating truck fleets and determining the amount of ore to be extracted from each mine front. Thus, decision makers can achieve the goals required by production and control parameters ore processing plants in a daily mining scenario, due to the need to increase production, low availability of equipment and flexibility of ore quality. Also, only for the analyzed scenarios it takes about 5 minutes to schedule a work shift. We also intend to evaluate the solutions generated by the optimizer we would have touched on the theories of controlling the simulator system. Thus, the simulator can consider stochastic aspects of the process, such as travel time and truck queue time will consist of running test runs to validate the results provided by the optimizer. Otelbayev Azizbek, a student of the Nukus Mining Institute under the Navoi State University of Mining and Technologies, has conducted extensive research on processes in mining enterprises. Azizbek's interests are currently researching the process of beneficiation of iron ore in mines using magnetic separators. Azizbek is also studying metal melting furnaces and conducting research. Azizbek has a great interest in his specialty. Currently researching computer software and mining process software. as technology develops, human labor becomes easier.

References:

1. Bekturganova, Z., & Jumamuratov, R. (2017). МЕТОДЫ ОБУЧЕНИЯ САМОСТОЯТЕЛЬНОЙ РАБОТЕ УЧАЩИХСЯ НА УРОКЕ ХИМИИ.
2. Бектурганова, З., & Jumamuratov, R. (2016). Методические особенности и характер формирования понятий по химии.
3. Kaipbergenov, A., & Jumamuratov, R. (2019). The methodology of teaching chemistry based on the use of computer programs.

4. Каипберганов, А., Косназаров, С., Нургалиева, М., Jumamuratov, R., & Жумамуратов, Р. (2018). АНАЛИЗ ПРОЦЕССА ПОЛУЧЕНИЯ ТРОНЫ МЕТОДОМ КАРБОНИЗАЦИИ СОДОВОГО РАСТВОРА УГЛЕКИСЛОТОЙ.
5. Aynazarova, S., & Jumamuratov, R. (2020). ЗНАЧЕНИЕ БИОЛОГИИ В ЖИЗНИ ЧЕЛОВЕКА.
6. Bekturganova, Z., Bektileyova, G., & Jumamuratov, R. (2017). ИСПОЛЬЗОВАНИЕ НОВЫХ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ В ОБУЧЕНИИ ХИМИИ.
7. Aynazarova, S., Embergenova, U., & Jumamuratov, R. (2021). KIMYONI O'QITISH VOSITALARI TIZIMI VA UNING DIDAKTIK IMKONIYATLARINI O'RGANISH.
8. Abdirazakov, I., & Jumamuratov, R. (2022). MAKTABDA KIMYO FANINI O'QITISHDA KOMPYUTER MODELLARINI QO'LLASH.
9. Kaipbergenov, A., Aynazarova, S., & Jumamuratov, R. (2022). XIMIYA SABAQLIĞIN OQITIWDA INFORMACIYALIQ TEXNOLOGIYALARINAN PAYDALANIW.
10. Bekturganova, Z., Tangirbergenova, R., & Jumamuratov, R. (2017). ТЕХНОЛОГИИ ОБУЧЕНИЯ НА УРОКАХ ХИМИИ.
11. Бектурганова, З., Жумамуратов, Р., & Султанов, Д. (2017). РЕКОМЕНДАЦИИ ПО РАЗРАБОТКЕ И ПРОВЕДЕНИЮ С МЕТОДОМ ПРОБЛЕМНОГО ОБУЧЕНИЯ НА УРОКАХ ХИМИИ.
12. O'TELBAYEVA Muhayyo Alisherovna. (2023). METHODOLOGY AND THEORY OF CHEMISTRY TEACHING IN SCHOOLS, METHODS AND PROCESSES OF THEIR STUDY. Journal of Experimental Studies, 2(2), 10–16. https://doi.org/10.5281/zenodo.7623700
13. O'TELBAYEVA Muhayyo Alisherovna. (2023). ANALYSIS OF PEDAGOGICAL AND PSYCHOLOGICAL METHODS AND APPROACHES. Pedagogical and Psychological Studies, 2(2), 12–16. https://doi.org/10.5281/zenodo.7624764
14. Yeshmuratova A. MINE BLASTING PROCESSES OPTIMIZATION STAGES OF DIGITAL TECHNOLOGY OF DETONATORS //Scienceweb academic papers collection. – 2023.
15. Utepbaeva G. et al. FOAM FLOTATION PROCESS, STAGES AND TECHNOLOGICAL PARAMETERS //Science and innovation. – 2023. – Т. 2. – №. A2. – С. 136-140.
16. Утемисов А. О., Юлдашова Х. Б. К. СИСТЕМЫ АВТОМАТИЧЕСКОГО УПРАВЛЕНИЯ //Universum: технические науки. – 2022. – №. 5-2 (98). – С. 45-47.
17. Tulepbergenovich K. B., Orazimbetovich U. A. Classification and analysis of computer programs for the physical preparation of athletes and expasure of prospects for their studies //European science review. – 2015. – №. 7-8. – С. 11-13.
18. Kaipbergenov A. T., Utemisov A. O., Yuldashova H. B. K. STEADY OF AUTOMATIC CONTROL SISTEMS //Academic research in educational sciences. – 2022. – Т. 3. – №. 6. – С. 918-921.
19. Orazimbetovich U. A. THE USE OF INFORMATION TECHNOLOGY IN THE FIELD OF PHYSICAL CULTURE AND SPORTS //European Journal of Research and Reflection in Educational Sciences Vol. – 2019. – Т. 7. – №. 2.
20. Djaksimuratov, K., O'razmatov, J., Yuldashev, S., Toshpulatov, D., & O'telbayev, A. (2021). Geological-Geochemical and Mineralogical Properties of Basalt Rocks of Karakalpakstan.

21. Djaksimuratov, K., O'razmatov, J., Mnajatdinov, D., & O'telbayev, A. (2021). PROPERTIES OF COAL, PROCESSES IN COAL MINING COMPANIES, METHODS OF COAL MINING IN THE WORLD.
22. Djaksimuratov, K., Toshev, O., O'razmatov, J., & O'telbayev, A. (2021). MEASURING AND CRUSHING THE STRENGTH OF ROCKS USE OF VARIOUS TYPES OF SURFACTANTS FOR GRINDING.
23. Djaksimuratov, K., Ravshanov, Z., O'razmatov, J., & O'telbayev, A. (2021). Comprehensive monitoring of surface deformation in underground mining, prevention of mining damage. Modern technologies and their role in mining.
24. Djaksimuratov, K., O'razmatov, J., Maulenov, N., & O'telbayev, A. (2021). FACTORS INFLUENCING THE CONDITIONS OF OPEN PIT MINING, ORE MASS AND DEFORMATION, PROCESSES THAT LEAD TO IMBALANCE DURING EXCAVATION.
25. Djaksimuratov, K., Jumabayeva, G., Maulenov, N., & Rametullayeva, M. (2022). Improving the Efficiency of Excavators Increasing the Efficiency of Temporary Ditch Excavator.
26. Djaksimuratov, K., Jumabayeva, G., Maulenov, N., & Rametullayeva, M. (2022). MONITORING THE CONDITION OF THE DEPOSIT IN MINING ENTERPRISES. MODERN METHODS OF DETERMINING THE LOCATION OF MINERALS.
27. Djaksimuratov, K., Joldasbayeva, A., Bayramova, M., Tolibayev, E., & Maulenov, N. (2022). TECHNOLOGICAL CLASSIFICATION OF UNDERGROUND EXCAVATION WORKS IN GEOTECHNICAL MONITORING SYSTEMS.
28. Djaksimuratov, K., Maulenov, N., Ametov, R., Rametullayeva, M., & Bayramova, M. (2022). MODERN TECHNICAL METHODS OF MONITORING LANDSLIDES IN OPEN MINES.
29. Joldasbayeva, A., Ametov, R., Embergenov, A., Maulenov, N., & Kulmuratova, A. (2022). Technology to prevent Methane or coal dust explosions in the mine.
30. Djaksimuratov, K., Maulenov, N., Rametullayeva, M., Kulmuratova, A., & Embergenov, A. (2022). Technology for Determining the Force of Impact on Buildings in the Vicinity during Blasting Operations in Mines.
31. Djaksimuratov, K., Jumabayeva, G., Maulenov, N., & Rametullayeva, M. (2022). CORROSION OF METALS AND FACTORS AFFECTING IT. METHODS OF PREVENTING CORROSION OF METALS.
32. Kulmuratova, A., Utepbaeva, G., Azizov, A., Yo'ldashova, H., & O'telbayev, A. (2022). AUTOMATION AND ROBOTIZATION OF UNDERGROUND MINES.
33. Ravshanov, Z., O'razmatov, J., Zaytova, M., Kulmuratova, A., & O'telbayev, A. (2022). Conveyor belt structure and mode of operation in mines.
34. Djaksimuratov, K., Maulenov, N., Joldasbayeva, A., O'razmatov, J., & O'telbayev, A. (2022). Model Of Stages of Determination of Strength of Dynamic Fracture of Rocks and Digital Technological Verification.
35. Djaksimuratov, K., Ravshanov, Z., Ergasheva, Z., O'razmatov, J., & O'telbayev, A. (2022). Underground mine mining systems and technological parameters of mine development.
36. Djaksimuratov, K., Maulenov, N., Joldasbayeva, A., O'razmatov, J., & O'telbayev, A. (2022). Methods of Determining the Effect of Temperature and Pressure on the Composition of Rocks.

37. Ravshanov, Z., Joldasbayeva, A., Bayramova, M., & O'telbayev, A. (2023). MINING TECHNOLOGICAL EQUIPMENT THAT DETERMINES THE SLOPE ANGLES OF THE MINE BY MEANS OF LASER BEAMS.
38. Yeshmuratova, A., Kulmuratova, A., Maulenov, N., & Otemisov, U. (2023). MINE BLASTING PROCESSES OPTIMIZATION STAGES OF DIGITAL TECHNOLOGY OF DETONATORS.
39. Ravshanov, Z., Joldasbayeva, A., Maulenov, N., & O'telbayev, A. (2023). Determination of mineral location coordinates in geotechnology and mining enterprises.
40. Djaksimuratov, K., Batirova, U., Otemisov, U., & Aytmuratov, S. (2023). STEPS FOR DETERMINING THE SLOPE ANGLE OF AN OPEN MINE.
41. Djaksimuratov, K., Batirova, U., Abdullaev, A., & Joldasbayeva, A. (2023). GATHERING COORDINATES OF THE GEOLOGICAL AND GEOTECHNICAL LOCATION OF THE MINE.
42. Ravshanov, Z., Joldasbayeva, A., Bayramova, M., & Madreymov, A. (2023). IN GEOLOGICAL AND GEOTECHNICAL PROCESSES IN THE MINE USE OF TECHNOLOGICAL SCANNING EQUIPMENT IN THE UNDERGROUND MINING METHOD.
43. Djaksimuratov, K., Jumabayeva, G., Maulenov, N., & Rametullayeva, M. (2022). Casting And Evaluation of Properties for an Aluminum Alloy Material and Optimizing the Quality Control Parameters.
44. Djaksimuratov, K., Jumabayeva, G., Batirova, U., & O'telbayev, A. (2023). GROUNDWATER CONTROL IN MINES
45. Abdiramanova, Z., Jumabayeva, G., Batirova, U., & O'telbayev, A. (2023). ACTIVITY OF TEBINBULAK IRON ORE MINING ENTERPRISES IN THE REPUBLIC OF KARAKALPAKSTAN.
46. Qurbonov.A.A, Djaksimuratov Karamatdin Mustapaevich, & O'telbayev Azizbek Alisher o'g'li. (2021). FACTORS INFLUENCING THE CONDITIONS OF OPEN PIT MINING, ORE MASS AND DEFORMATION. PROCESSES THAT LEAD TO IMBALANCE DURING EXCAVATION. Eurasian Journal of Academic Research, 1(6), 45–49. https://doi.org/10.5281/zenodo.5500210
47. O'telbayev Azizbek Alisher o'g'li. (2022). STRENGTH PROPERTIES OF ROCKS AND FACTORS INFLUENCING THEM AND THE PROCESS OF CHANGING THE PROPERTIES OF ROCKS. https://doi.org/10.5281/zenodo.6034442
48. Joldasbayeva, A., Maulenov, N., Mnajatdinov, D., & O'telbayev, A. (2023). PROCESSES OF DRAWING UP A VENTILATION SYSTEM SCHEME IN MINES.
49. Maulenov, N., Joldasbayeva, A., O'razmatov, J., & Mnajatdinov, D. (2023). TECHNOLOGICAL MODES OF MONITORING THE LOCATION OF MINES IN THE MINE AND THE SLOPE BORDER OF THE BLAST AREA.
50. Maulenov, N., Joldasbayeva, A., Amanbaev, N., & Mnajatdinov, D. (2023). PROCESSES OF BENEFICIATION AND EXTRACTION OF ORES IN IRON MINES (IN THE EXAMPLE OF TEBIN BULAK IRON MINE).
51. Maulenov, N., Joldasbayeva, A., Amanbaev, N., & Mnajatdinov, D. (2023). DETERMINATION OF VIBRATIONS CAUSED BY BLASTING PROCESSES IN OPEN PIT MINING AT MINING ENTERPRISES.
52. Maulenov, N., Joldasbayeva, A., O'razmatov, J., & Mnajatdinov, D. (2023). MOBILE TECHNOLOGICAL METHODS OF SAFETY MANAGEMENT IN SURFACE MINING.

53. Jumabayeva Guljahon Jaqsilikovna. (2023). CONTROL OF UNDERGROUND WATER IN THE MINE, DETECTION AND PREVENTION OF RISKS. ACADEMIC RESEARCH IN MODERN SCIENCE, 2(5), 159–166. https://doi.org/10.5281/zenodo.7648010
54. Утемисов А. О., Юлдашова Х. Б. К. СИСТЕМЫ АВТОМАТИЧЕСКОГО УПРАВЛЕНИЯ //Universum: технические науки. – 2022. – №. 5-2 (98). – С. 45-47.
55. Ametov Bayram Tursynbaevich, Uzakbaeva Akmaral Sulayman Kizi, & Allamuratov Guljamal Bisengali Kizi. (2022). Wind Mill and Solar Energy. Texas Journal of Engineering and Technology, 15, 178–179. Retrieved from https://zienjournals.com/index.php/tjet/article/view/3068
56. Tolibayev Y. et al. WITH CHARGE MELTING METHODS AND LOW METAL CONTENT IN THE FURNACE EFFECT OF ELECTRODES //Международная конференция академических наук. – 2023. – Т. 2. – №. 2. – С. 151-160.
57. Tolibayev Y. et al. ENVIRONMENTALLY FRIENDLY METHODS OF MINING METAL ORES //Академические исследования в современной науке. – 2023. – Т. 2. – №. 7. – С. 45-56.
58. Tolibayev Y. et al. METHODS OF ENSURING THE INCREASE IN THE QUALITY OF EXTRACTION OF NON-FERROUS, RARE, RARE EARTH METALS //Science and innovation in the education system. – 2023. – Т. 2. – №. 3. – С. 22-31.
59. Tolibayev Y. et al. DISADVANTAGES OF TECHNOLOGICAL AUTOMATION IN METAL MELTING //Development and innovations in science. – 2023. – Т. 2. – №. 2. – С. 136-146.
60. Tolibayev Y. et al. IN METALLURGICAL PROCESS MODELING SYSTEM HIGH TEMPERATURE COPPER REFINING PROCESSES //Models and methods in modern science. – 2023. – Т. 2. – №. 3. – С. 12-22.
61. Abdiramanova Zamira Uzaqbayevna. (2023). STUDIES ON THE CHEMICAL COMPOSITION AND PROPERTIES OF PORTLAND CEMENT. EURASIAN JOURNAL OF ACADEMIC RESEARCH, 3(3), 13–21. https://doi.org/10.5281/zenodo.7712581
62. O‘telbayeva , M. ., & O‘telbayev , A. . (2023). EXPERIMENTAL WORKS BASED ON ADVANCED, PEDAGOGICAL-PSYCHOLOGICAL AND MODERN METHODS OF TEACHING CHEMISTRY AT SCHOOL. Евразийский журнал академических исследований, 3(3), 79–88. извлечено от https://in-academy.uz/index.php/ejar/article/view/10938
63. Ravshanov, Z., Ergasheva, Z., Maxsitaliyeva, L., Pardaev, S., & O’telbayev, A. (2022). 3D Technological System of Management of Geological Exploration Processes of Mining Enterprises.
64. Mirzabek qizi, A. M., & Orinbay qizi, K. S. (2023). Application of Modern Microprocessors in Technological Measuring Devices and Principles of their Use. Miasto Przyszłości, 32, 320–326. Retrieved from https://miastoprzyszlosci.com.pl/index.php/mp/article/view/1158
65. Kulmuratova Aliya Janabay qizi. (2023). Automation Technique Design Classification of Technological Objects. International Journal of Scientific Trends, 2(2), 128–136. Retrieved from https://scientifictrends.org/index.php/ijst/article/view/66
66. Elmurodovich T. O. et al. Measuring and crushing the strength of rocks use of various types of surfactants for grinding //ACADEMICIA: An International Multidisciplinary Research Journal. – 2021. – Т. 11. – №. 10. – С. 557-561.

67. Djaksimuratov K. Comprehensive monitoring of surface deformation in underground mining, prevention of mining damage. Modern technologies and their role in mining //Scienceweb academic papers collection. – 2021.
68. Mustapaevich D. K. et al. FACTORS INFLUENCING THE CONDITIONS OF OPEN PIT MINING, ORE MASS AND DEFORMATION, PROCESSES THAT LEAD TO IMBALANCE DURING EXCAVATION //Galaxy International Interdisciplinary Research Journal. – 2021. – Т. 9. – №. 10. – С. 648-650.
69. Muxtar o'g'li A. R. et al. Technology to prevent Methane or coal dust explosions in the mine //The Peerian Journal. – 2022. – Т. 10. – С. 22-32.
70. Axmet o'g'li M. A. et al. IN GEOLOGICAL AND GEOTECHNICAL PROCESSES IN THE MINE USE OF TECHNOLOGICAL SCANNING EQUIPMENT IN THE UNDERGROUND MINING METHOD //Intent Research Scientific Journal. – 2023. – Т. 2. – №. 1. – С. 20-27.
71. Maulenov N. et al. PROCESSES OF DRAWING UP A VENTILATION SYSTEM SCHEME IN MINES //Академические исследования в современной науке. – 2023. – Т. 2. – №. 4. – С. 161-166.
72. Maulenov N. et al. TECHNOLOGICAL MODES OF MONITORING THE LOCATION OF MINES IN THE MINE AND THE SLOPE BORDER OF THE BLAST AREA //Development and innovations in science. – 2023. – Т. 2. – №. 2. – С. 27-32.
73. Jumabayeva Guljahon Jaqsilikovna. (2023). CONTROL OF UNDERGROUND WATER IN THE MINE, DETECTION AND PREVENTION OF RISKS. ACADEMIC RESEARCH IN MODERN SCIENCE, 2(5), 159–166. https://doi.org/10.5281/zenodo.7648010
74. Janabay Qizi, K. A. . (2023). Application of Automation Tasks and Management of Technological Processes. Pioneer : Journal of Advanced Research and Scientific Progress, 2(3), 13–19. Retrieved from https://innosci.org/jarsp/article/view/940
75. Janabay qizi, K. A., Jumabay o'g'li, U. A., & Nuratdinovna, E. A. (2023). Application and Technological Description of Microprocessors in Technological Measuring Devices. Miasto Przyszłości, 33, 89–96. Retrieved from https://miastoprzyszlosci.com.pl/index.php/mp/article/view/1192