ISSN 2518-170X (Online) ISSN 2224-5278 (Print)



«ҚАЗАҚСТАН РЕСПУБЛИКАСЫ ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫ» РҚБ «ХАЛЫҚ» ЖҚ

ХАБАРЛАРЫ

ИЗВЕСТИЯ

РОО «НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК РЕСПУБЛИКИ КАЗАХСТАН» ЧФ «Халық»

NEWS

OF THE ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN «Halyk» Private Foundation

SERIES OF GEOLOGY AND TECHNICAL SCIENCES

6 (468) NOVEMBER – DECEMBER 2024

THE JOURNAL WAS FOUNDED IN 1940

PUBLISHED 6 TIMES A YEAR

ALMATY, NAS RK



NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Webof Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

Бас редактор

ЖҰРЫНОВ Мұрат Жұрынұлы, химия ғылымдарының докторы, профессор, ҚР ҰҒА академигі, «Қазақстан Республикасы Ұлттық ғылым академиясы» РҚБ-нің президенті, АҚ «Д.В. Сокольский атындағы отын, катализ және электрохимия институтының» бас директоры (Алматы, Қазақстан) **H** = 4

Ғылыми хатшы

АБСАДЫКОВБахыт Нарикбайұлы, техникағылымдарының докторы, профессор, ҚР ҰҒА жауаптыхатшысы, А.Б.Бектұроватындағы химияғылымдары институты (Алматы, Қазақстан) H=5

Редакциялық алқа:

ӘБСАМЕТОВ Мәліс Құдысұлы (бас редактордың орынбасары), геология-минералогия ғылымдарының докторы, профессор, ҚР ҰҒА академигі, «У.М. Ахмедсафина атындағы гидрогеология және геоэкология институтының» директоры (Алматы, Қазақстан) **H** = 2

ЖОЛТАЕВ Герой Жолтайұлы (бас редактордың орынбасары), геология-минералогия ғылымдарының докторы, профессор, Қ.И. Сатпаев тындағы геология ғылымдары институтының директоры (Алматы, Қазақстан) **H=2**

СНОУ Дэниел, Ph.D, қауымдастырылған профессор, Небраска университетінің Су ғылымдары зертханасының директоры (Небраска штаты, АҚШ) **H** = **32**

ЗЕЛЬТМАН Реймар, Ph.D, табиғи тарих мұражайының Жер туралы ғылымдар бөлімінде петрология және пайдалы қазбалар кен орындары саласындағы зерттеулердің жетекшісі (Лондон, Англия) **H** = **37**

ПАНФИЛОВ Михаил Борисович, техника ғылымдарының докторы, Нанси университетінің профессоры (Нанси, Франция) **H=15**

ШЕН Пин, Ph.D, Қытай геологиялық қоғамының тау геологиясы комитеті директорының орынбасары, Американдық экономикалық геологтар қауымдастығының мүшесі (Пекин, Қытай) **H** = 25

ФИШЕР Аксель, Ph.D, Дрезден техникалық университетінің қауымдастырылған профессоры (Дрезден, Берлин) H = 6

КОНТОРОВИЧ Алексей Эмильевич, геология-минералогия ғылымдарының докторы, профессор, РFA академигі, А.А. Трофимука атындағы мұнай-газ геологиясы және геофизика институты (Новосибирск, Ресей) **H** = 19

АГАБЕКОВ Владимир Енокович, химия ғылымдарының докторы, Беларусь ҰҒА академигі, Жаңа материалдар химиясы институтының құрметті директоры (Минск, Беларусь) **H** = 13

КАТАЛИН Стефан, Ph.D, Дрезден техникалық университетінің қауымдастырылған профессоры (Дрезден, Берлин) **H** = **20**

СЕЙТМҰРАТОВА Элеонора Юсуповна, геология-минералогия ғылымдарының докторы, профессор, ҚР ҰҒА корреспондент-мүшесі, Қ.И. Сатпаев атындағы Геология ғылымдары институты зертханасының меңгерушісі (Алматы, Қазақстан) H=11

САҒЫНТАЕВ Жанай, Ph.D, қауымдастырылған профессор, Назарбаев университеті (Нұр-Сұлтан, Қазақстан) H = 11

ФРАТТИНИ Паоло, Ph.D, Бикокк Милан университеті қауымдастырылған профессоры (Милан, Италия) H = 28

«ҚР ҰҒА» РҚБ Хабарлары. Геология және техникалық ғылымдар сериясы». ISSN 2518-170X (Online),

ISSN 2224-5278 (Print)

Меншіктеуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» РҚБ (Алматы қ.). Қазақстан Республикасының Ақпарат және қоғамдық даму министрлігінің Ақпарат комитетінде 29.07.2020 ж. берілген № КZ39VРY00025420 мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Тақырыптық бағыты: геология, мұнай және газды өңдеудің химиялық технологиялары, мұнай химиясы, металдарды алу және олардың қосындыларының технологиясы.

Мерзімділігі: жылына 6 рет.

Тиражы: 300 дана.

Редакцияның мекен-жайы: 050010, Алматы қ., Шевченко көш., 28, 219 бөл., тел.: 272-13-19 http://www.geolog-technical.kz/index.php/en/

© «Қазақстан Республикасының Ұлттық ғылым академиясы» РҚБ, 2024

Главный редактор

ЖУРИНОВ Мурат Журинович, доктор химических наук, профессор, академик НАН РК, президент РОО «Национальной академии наук Республики Казахстан», генеральный директор АО «Институт топлива, катализа и электрохимии им. Д.В. Сокольского» (Алматы, Казахстан) **H** = 4

Ученный секретарь

АБСАДЫКОВ Бахыт Нарикбаевич, доктор технических наук, профессор, ответственный секретарь НАН РК, Институт химических наук им. А.Б. Бектурова (Алматы, Казахстан) H = 5 Редакционная коллегия:

АБСАМЕТОВ Малис Кудысович, (заместитель главного редактора), доктор геологоминералогических наук, профессор, академик НАН РК, директор Института гидрогеологии и геоэкологии им. У.М. Ахмедсафина (Алматы, Казахстан) **H** = **2**

ЖОЛТАЕВ Герой Жолтаевич, (заместитель главного редактора), доктор геологоминералогических наук, профессор, директор Института геологических наук им. К.И. Сатпаева (Алматы, Казахстан) **H=2**

СНОУ Дэниел, Ph.D, ассоциированный профессор, директор Лаборатории водных наук университета Небраски (штат Небраска, США) H = 32

ЗЕЛЬТМАН Реймар, Ph.D, руководитель исследований в области петрологии и месторождений полезных ископаемых в Отделе наук о Земле Музея естественной истории (Лондон, Англия) **H** = **37**

ПАНФИЛОВ Михаил Борисович, доктор технических наук, профессор Университета Нанси (Нанси, Франция) **H=15**

ШЕН Пин, Ph.D, заместитель директора Комитета по горной геологии Китайского геологического общества, член Американской ассоциации экономических геологов (Пекин, Китай) H = 25

ФИШЕР Аксель, ассоциированный профессор, Ph.D, технический университет Дрезден (Дрезден, Берлин) H = 6

КОНТОРОВИЧ Алексей Эмильевич, доктор геолого-минералогических наук, профессор, академик РАН, Институт нефтегазовой геологии и геофизики им. А.А. Трофимука СО РАН (Новосибирск, Россия) **H** = 19

АГАБЕКОВ Владимир Енокович, доктор химических наук, академик НАН Беларуси, почетный директор Института химии новых материалов (Минск, Беларусь) **H** = 13

КАТАЛИН Стефан, Ph.D, ассоциированный профессор, Технический университет (Дрезден, Берлин) H = 20

СЕЙТМУРАТОВА Элеонора Юсуповна, доктор геолого-минералогических наук, профессор, член-корреспондент НАН РК, заведующая лаборатории Института геологических наук им. К.И. Сатпаева (Алматы, Казахстан) H=11

САГИНТАЕВ Жанай, Ph.D, ассоциированный профессор, Назарбаев университет (Нурсултан, Казахстан) H = 11

ФРАТТИНИ Паоло, Ph.D, ассоциированный профессор, Миланский университет Бикокк (Милан, Италия) **H** = 28

«Известия РОО «НАН РК». Серия геологии и технических наук». ISSN 2518-170X (Online),

ISSN 2224-5278 (Print)

Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан» (г. Алматы).

Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и общественного развития Республики Казахстан № КZ39VPY00025420, выданное 29.07.2020 г.

Тематическая направленность: геология, химические технологии переработки нефти и газа, нефтехимия, технологии извлечения металлов и их соеденений.

Периодичность: 6 раз в год.

Тираж: 300 экземпляров.

Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28, оф. 219, тел.: 272-13-19 http://www.geolog-technical.kz/index.php/en/

© РОО «Национальная академия наук Республики Казахстан», 2024

Editorial chief

ZHURINOV Murat Zhurinovich, doctor of chemistry, professor, academician of NAS RK, president of the National Academy of Sciences of the Republic of Kazakhstan, general director of JSC "Institute of fuel, catalysis and electrochemistry named after D.V. Sokolsky» (Almaty, Kazakhstan) H = 4

Scientific secretary

ABSADYKOV Bakhyt Narikbaevich, doctor of technical sciences, professor, executive secretary of NAS RK, Bekturov Institute of chemical sciences (Almaty, Kazakhstan) **H** = **5**

Editorial board:

ABSAMETOV Malis Kudysovich, (deputy editor-in-chief), doctor of geological and mineralogical sciences, professor, academician of NAS RK, director of the Akhmedsafin Institute of hydrogeology and hydrophysics (Almaty, Kazakhstan) **H=2**

ZHOLTAEV Geroy Zholtaevich, (deputy editor-in-chief), doctor of geological and mineralogical sciences, professor, director of the institute of geological sciences named after K.I. Satpayev (Almaty, Kazakhstan) H=2

SNOW Daniel, Ph.D, associate professor, director of the labotatory of water sciences, Nebraska University (Nebraska, USA) H = 32

ZELTMAN Reymar, Ph.D, head of research department in petrology and mineral deposits in the Earth sciences section of the museum of natural history (London, England) H = 37

PANFILOV Mikhail Borisovich, doctor of technical sciences, professor at the Nancy University (Nancy, France) H=15

SHEN Ping, Ph.D, deputy director of the Committee for Mining geology of the China geological Society, Fellow of the American association of economic geologists (Beijing, China) H = 25

FISCHER Axel, Ph.D, associate professor, Dresden University of technology (Dresden, Germany) H = 6

KONTOROVICH Aleksey Emilievich, doctor of geological and mineralogical sciences, professor, academician of RAS, Trofimuk Institute of petroleum geology and geophysics SB RAS (Novosibirsk, Russia) H = 19

AGABEKOV Vladimir Enokovich, doctor of chemistry, academician of NAS of Belarus, honorary director of the Institute of chemistry of new materials (Minsk, Belarus) H = 13

KATALIN Stephan, Ph.D, associate professor, Technical university (Dresden, Berlin) **H** = 20

SEITMURATOVA Eleonora Yusupovna, doctor of geological and mineralogical sciences, professor, corresponding member of NAS RK, head of the laboratory of the Institute of geological sciences named after K.I. Satpayev (Almaty, Kazakhstan) H=11

SAGINTAYEVZhanay, Ph.D, associate professor, Nazarbayev University (Nursultan, Kazakhstan)H=11 FRATTINI Paolo, Ph.D, associate professor, university of Milano-Bicocca (Milan, Italy) H = 28

News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technology sciences.

ISSN 2518-170X (Online),

ISSN 2224-5278 (Print)

Owner: RPA «National Academy of Sciences of the Republic of Kazakhstan» (Almaty).

The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Social Development of the Republic of Kazakhstan No. **KZ39VPY00025420**, issued 29.07.2020.

Thematic scope: geology, chemical technologies for oil and gas processing, petrochemistry, technologies for extracting metals and their connections.

Periodicity: 6 times a year.

Circulation: 300 copies.

Editorial address: 28, Shevchenko str., of. 219, Almaty, 050010, tel. 272-13-19 http://www.geolog-technical.kz/index.php/en/

© National Academy of Sciences of the Republic of Kazakhstan, 2024

NEWS of the National Academy of Sciences of the Republic of Kazakhstan SERIES OF GEOLOGY AND TECHNICAL SCIENCES ISSN 2224–5278 Volume 6. Number 468 (2024), 182–197 https://doi.org/10.32014/2024.2518-170X.469

UDC 622.271:621.86

© J. Toshov¹, K. Yelemessov², U. Baynazov¹, T. Annakulov¹, *D. Baskanbayeva², 2024.

¹Tashkent State Technical University, Tashkent city, Uzbekistan; ²Satbayev University, Almaty, Kazakhstan. E-mail: d.baskanbayeva@satbayev.university

CHALLENGES OF MODERNIZING AND OPTIMIZING THE PROCESS OF IM-PLEMENTING CYCLICAL-FLOW TECHNOLOGY IN A COAL MINE

Toshov Javokhir Burievich – Tashkent State Technical University named after I. Karimov, Doctor of Technical Sciences, Dean of the Faculty of Energy Engineering, Tashkent, Uzbekistan, e-mail: j.toshov@tdtu.uz, https://orcid.org/0000-0003-4278-1557;

Yelemessov Kassym Koptleuevich – Satbayev University, Candidate of Technical Sciences, Professor, Director of the Institute of Energy and Mechanical Engineering, Almaty, Kazakhstan, e-mail: k.yelemessov@satbayev.university, https://orcid.org/0000-0001-6168-2787;

Bainazov Umid Raimovych – Tashkent State Technical University named after I. Karimov, doctoral student, Tashkent, Uzbekistan, e-mail: ub629418@gmail.com, https://orcid.org/0000-0002-9941-0821;

Annakulov Tulkin Jovbekovich – Tashkent State Technica University after I. Karimov, PhD, Head of the Department of Mining Electromechanics, Tashkent, Uzbekistan, e-mail: a.tulkin1275@yandex. ru, https://orcid.org/0000-0003-3106-144X;

Baskanbaeva Dinara Dzhumabaevna – Satbayev University, PhD, deputy director of the Institute of Energy and Mechanical Engineering, Almaty, Kazakhstan, e-mail: d.baskanbayeva@satbayev. university, https://orcid.org/0000-0003-1688-0666.

Abstract. In connection with recent economic events in the world, the problems of providing countries with energy resources have become particularly relevant. A special role in solving these problems belongs to the mining enterprises of Uzbekistan, which today are characterized by the further development of the openpit mining method, one of which is the Angren coal mine.

The main task, its relevance, is to present one of the ways to model the optimal options for the operation of cyclic flow t echnology in d ifficult con ditions of stripping operations.

The methods used. In this work, finite e lement m ethods and mathematical modeling based on the computer program "Ansys" were used to model the structures of the Central Processing Plant in order to determine the optimal parameters of the unloading and loading bunkers of the central processing plant of the Angren site.

The main hypotheses and conclusions. The work carried out, the main factors

affecting the integrity of the belt were identified: the tensile strength of the main belt when unloading rock by the unloading and loading hopper of the Central Processing Plant at various belt speed parameters.

Originality. The purpose of this study is computer simulation of the CPU operation process based on the program "Ansys".

Practical significance. The calculation methods used in this study using the finite element method based on the Ansys program can be used to determine the causes of belt conveyor gusts during its operation in various production conditions, when choosing the optimal technical parameters of structures: the height of the production hopper, the speed of the conveyor belt, its angle of inclination and the material of the belt itself

Keywords: conveyor belt, main belt, quarry, modeling, Ansys, mining engineering.

© Ж. Тошов¹, К. Елемесов², У. Байназов¹, Т. Аннакулов¹, *Д. Басканбаева², 2024.

¹Ташкент мемлекеттік техникалық университеті, Ташкент, Өзбекстан; ²Сәтбаев Университеті, Алматы, Қазақстан E-mail: d.baskanbayeva@satbayev.university

КӨМІР КЕНІН ИГЕРУ КЕНІШІНДЕГІ ЦИКЛДЫҚ АҒЫНДЫ ТЕХНОЛОГИЯНЫ ЕНГІЗУ ПРОЦЕСІН ЖАҢҒЫРТУ ЖӘНЕ ОҢТАЙЛАНДЫРУ МІНДЕТТЕРІ

Тошов Жавохир Буриевич – И. Каримов атындағы Ташкент мемлекеттік техникалық университеті, техника ғылымының докторы, Энергетика факультетінің деканы, Ташкент, Өзбекістан, e-mail: j.toshov@tdtu.uz, https://orcid.org/0000-0003-4278-1557;

Елемесов Қасым Көптілеуұлы – Сәтбаев Универститеті, техника ғылымының кандидаты, профессор, Энергетика және машина жасау институтының директоры, Алматы, Қазақстан, e-mail: k.yelemessov@satbayev.university, https://orcid.org/0000-0001-6168-2787;

Байназов Умид Раймович – И. Каримов атындағы Ташкент мемлекеттік техникалық университеті, докторант, Ташкент, Өзбекістан, e-mail: ub629418@gmail.com, https://orcid. org/0000-0002-9941-0821;

Аннакулов Тулкин Жоубекович – И. Каримов атындағы Ташкент мемлекеттік техникалық университеті, PhD, Тау-кен электромеханикасы кафедрасының меңгерушісі, Ташкент, Өзбекістан, e-mail: a.tulkin1275@yandex.ru, https://orcid.org/0000-0003-3106-144X;

Басқанбаева Динара Жұмабайқызы – Сәтбаев Универститеті, PhD, Энергетика және машина жасау институтының директорының орынбасары, Алматы, Қазақстан, e-mail: d.baskanbayeva@ satbayev.university, https://orcid.org/0000-0003-1688-0666.

Аннотация. Әлемдегі соңғы экономикалық жағдайларға байланысты барлық елдерді энергетикалық ресурстармен қамтамасыз ету мәселелері ерекше өзекті бола бастады. Бұл дағдарысты шешуде ерекше рөл Өзбекстанның тау-кен өндіру кәсіпорындарына тиесілі, олар бүгінгі таңда карьерді ашық әдіспен өндірудің одан әрі дамуымен сипатталады және олардың бірі Ангрен көмір кеніші болып табылады. Материалдар меннегізгі әдістері – көмір карьерлерінде аршу жұмыстарының күрделі жағдайында циклдік-ағынды технологияны пайдаланудың оңтайлы, әрі тиімді нұсқаларын модельдеу жолдарының бір түрі ұсынылды.

Негізгі қолданылатын әдістер, бұл жұмыста «Ангренский» кесіндісінің СРТ түсіру-тиеу бункерлерінің оңтайлы параметрлерін анықтау мақсатында, СРТ конструкцияларын модельдеу кезінде «Ansys» компьютерлік бағдарламасы негізге алынады. Соңғы элементтер мен математикалық модельдеу әдістері қолданылды және осы мақалада жазба түрінде келтірілді.

Негізгі гипотезалар мен қорытындылар. Жүргізілген жұмыс нәтижесінде таспаның тұтастығына әсер ететін негізгі факторлар анықталды: кенжар конвейерінің, магистральдық таспаның, конвейер желісінің көлбеу бұрышының, бункердің биіктігінің және пайдаланылатын таспаның материалының сапасының әртүрлі параметрлері жағдайында бункерге жынысты түсіру кезінде магистральдық таспаның деформациясының кернеу күші есепке алына отырып, қорытынды нәтижелері сараланды.

Өзіндік ерекшелігі. Бұл зерттеу «Ansys» бағдарламасы негізінде жүргізілгенін ескерсек, СРТ пайдалану процесін қолдана отырып, компьютерлік модельдеу этаптарын айқындағымыз келді.

Практикалық маңызы. Осы зерттеуде қолданылған «Ansys» бағдарламасы негізінде соңғы элемент әдісін қолдана отырып есептеу әдістері құрылымдардың оңтайлы техникалық параметрлерін есепке ала отырып: пайдалану бункерінің биіктігін, конвейер таспасының жылдамдығын, оның көлбеу бұрышын және де таспаның материалын таңдаған кезде, оны әртүрлі өндірістік жағдайларда пайдалану процесін ескере отырып, таспалы конвейердің импульстарының себептерін анықтауға қол жеткіздік.

Түйін сөздер: конвейер, негізгі таспа, карьер, модельдеу, Ansys, тау-кен инженериясы.

© Ж. Тошов¹, К. Елемесов², У. Байназов¹, Т. Аннакулов¹, Д. Басканбаева*², 2024.

¹Ташкентский государственный технический университет, Ташкент, Узбекистан; ² Satbayev University, Алматы, Казахстан. E-mail: d.baskanbayeva@satbayev.university

ПРОБЛЕМЫ МОДЕРНИЗАЦИИ И ОПТИМИЗАЦИИ ПРОЦЕССА ИСПОЛЬЗОВАНИЯ ЦИКЛИЧНО-ПОТОЧНОЙ ТЕХНОЛОГИИ НА УГОЛЬНОМ РАЗРЕЗЕ

Тошов Жавохир Буриевич – Ташкентский государственный технический университет имени И. Каримова, доктор технических наук, декан Энергетического факультета, Ташкент, Узбекистан, e-mail: j.toshov@tdtu.uz, https://orcid.org/0000-0003-4278-1557;

Елемесов Касым Коптлеуевич – Satbayev University, кандидат технических наук, профессор, директор института Энергетики и машиностроения, Алматы, Казахстан, e-mail: k.yelemessov@ satbayev.university, https://orcid.org/0000-0001-6168-2787;

Байназов Умид Раймович – докторант, Ташкентский государственный технический университет имени И. Каримова, Ташкент, Узбекистан, e-mail: ub629418@gmail.com, https:// orcid.org/0000-0002-9941-0821;

Аннакулов Тулкин Жоубекович – PhD, Ташкентский государственный технический университет имени И. Каримова, Заведующий кафедрой горной электромеханики, Ташкент, Узбекистан, e-mail: a.tulkin1275@yandex.ru, https://orcid.org/0000-0003-3106-144X;

Басканбаева Динара Джумабаевна – PhD, Satbayev University, заместитель директора института Энергетики и машиностроения, Алматы, Казахстан, e-mail: d.baskanbayeva@ satbayev.university, https://orcid.org/0000-0003-1688-0666.

Аннотация. В связи с последними экономическими событиями в мире особую актуальность приобретают проблемы по обеспечению стран энергетическими ресурсами. Особая роль в решении этих проблем принадлежит горнодобывающим предприятиям Узбекистана, характеризующихся на сегодняшний день дальнейшим развитием открытого способа разработки полезных ископаемых, одним из которых является Ангренский угольный разрез.

Базовая проблема, ее актуальность – представить один из путей моделирования оптимальных вариантов эксплуатации циклично-поточной технологии в сложных условиях вскрышных работ.

Применяемые методы. В данной работе при моделировании конструкций ЦПТ с целью определения оптимальных параметров разгрузочно-погрузочных бункеров ЦПТ разреза «Ангренский» использованы методы конечных элементов и математического моделирования на основе компьютерной программы «Ansys».

Ключевые гипотезы и выводы. В результате проведенной работы определены основные факторы, влияющие на цельность ленты: сила напряжения деформации магистральной ленты при разгрузке породы разгрузочнопогрузочным бункером ЦПТ в условиях различных параметров скорости забойного конвейера, магистральной ленты, угла наклона конвейерной линии, высоты бункера и качества материала эксплуатируемой ленты.

Оригинальность данного исследования заключается в компьютерном моделировании процесса эксплуатации ЦПТ на основе программы «Ansys».

Практическое значение. Применённые в данном исследовании методы расчётов при помощи метода конечного элемента на основе программы «Ansys» могут быть использованы при определении причин порывов ленточного конвейера в процессе её эксплуатации в различных производственных условиях, при выборе оптимальных технических параметров конструкций: высоты эксплуатационного бункера, скорости конвейерной ленты, угла её наклона и материала самой ленты.

Ключевые слова: конвейер магистральной ленты, карьер, моделирование, Ansys, горная инженерия.

Introduction. The challenges of modernizing and optimizing open-pit coal mining techniques in Uzbekistan are largely influenced by its geological

characteristics (Akbarov, et al., 2021). Therefore, the accuracy of choosing the right technology, direction, and parameters for mining has a significant impact on the technical and economic performance of open-pit operations. The technology of stripping operations, which are complicated by the climatic and geological features of the quarry, necessitates the creation of ledges in order to prevent landslides (Gulomova, et al., 2023). This, in turn, leads to the need to handle large volumes of overburden during open-pit coal mining. Therefore, the process of transporting overburden becomes particularly important.

The Angren brown coal deposit is located in the Tashkent region of Uzbekistan. It occupies part of the intermountain valley of the Akhangaran River, between the village of Ablyk in the southwest and the Akhangaran dam in the northeast (Toshov, et al., 2024). The valley is surrounded by mountains on all sides. To the north, it is bounded by the Chatkal range, and to the south, by the Kuraminsky range. The height of these mountain ranges reaches up to 3,000 meters. The highest point near the valley is Mount Babaytaidar, also known as Bobo-tog, with an elevation of 3,654 meters. Within the Angren deposit, there are two main areas: the right-bank portion of the valley and the foothill areas. The right-bank area has an absolute height range of 930 to 1,100 meters, while the foothills are located in the northern and northeastern portions of the area and have a higher elevation. The main water source for the region is the Akhangaran river, which is 235 kilometers long (Toshov, et al., 2024). The geological structure of the deposit includes rocks from the Carboniferous, Permian, Jurassic, Mesozoic, Paleogene, Neogene, and Ouaternary periods. The coal-bearing unit has a maximum thickness of 160 meters and contains a complex coal deposit with a thickness of 65 to 75 meters. Above this is a variegated kaolin formation with a thickness of 25 to 30 meters, consisting mainly of clays with siltstone, sand, and gravel impurities. Cretaceous deposits, which are 5 to 25 meters thick, are represented by red sandstone (Wang et al., 2022).

The belt conveyor is widely used in the coal industry and other industries, playing a crucial role in the transportation of raw coal (Huang, et al., 2023). It regulates the pace of production, maintains its rhythm, and contributes to increased labor productivity. This type of conveyor effectively addresses issues related to complex mechanization, automation of transportation, and technological processes (Kovrov, et al., 2024). However, the short lifespan (3-5 years) and high cost of conveyor belts, which account for 50-60% of the total cost of a conveyor system, make them a crucial component due to their load-bearing and traction role (Kassenov, et al., 2022). During operation, the strength and durability of the belts decrease due to various types of damage, such as transverse cracks in the rubber layers, abrasion, breakage and tearing of layers, longitudinal cuts and gouges, damage to the sides and end joints, and delamination of the traction frame (Srimitrungroj, et al., 2023). In many ways, the failure of the conveyor belt can be attributed to its design and operation. During use, the belt experiences not only longitudinal stress from the tensioning device, but also dynamic forces during start-up and shutdown (Mikušová et al., 2019). Additionally, there are issues with the hands on the drums and defects

caused by devices, as well as support from stationary rollers due to inevitable sagging between them (Fedorko et al., 2021). These cyclic deformations lead to fatigue wear, which manifests itself in the form of cracks on the traction frame and plates (Marasova, et al., 2023). For example, in reference the authors demonstrate that their fault diagnosis model outperforms a single-method approach in terms of overall accuracy in diagnosis and recognition (Toshov, et al., 2024). The accuracy of fault classification reaches up to 97.22%, showing the potential for significant improvements in the reliability of the belt transportation system in coal mines. The paper discusses the classification of conveyor belt damage using machine learning techniques (Wang, et al., 2024). The authors developed four classification models and evaluated their accuracy and predictive capabilities (Zohra, et al., 2022). These models could be used in practice to identify and predict conveyor belt failures, which are often caused by damage to the belt. In a novel approach to detecting surface damage on conveyor belts is proposed (Gelman, et al., 2023). This method, referred to as AC-AGAIN, aims to address the challenges associated with long training and deployment times as well as the limitations of previous techniques due to their dependence on limited training data. In a new technology for the automated real-time diagnosis of conveyor belt systems was investigated and validated through extensive experimentation (Semrád, et al., 2024). In focused on developing a diagnostic system that uses magnetic markers embedded directly into the conveyor belt (Gładysiewicz, et al., 2024). This system allows for control of the conveyor speed based on the known distance between the magnetic markers. It can detect potential issues not only with the power supply or control system of the conveyor, but also with wear and tear on the belt itself.

Although there have been some studies on conveyor belts, there has been very little research conducted to determine the optimal settings for unloading and loading bins in the cyclic flow system at the Angrensk plant. By studying the mechanism of cyclic flow technology, we have identified several areas of concern regarding the operation of conveyor belts. One major issue that has been identified is the frequent breakage of the main conveyor belt due to pieces of overburden falling from a significant height. This issue is exacerbated by the high speed at which conveyor belts operate and has become a persistent problem that directly affects productivity. Disruptions to conveyor operations caused by repairs have a negative impact on the entire transportation system as they disrupt the flow of materials and lead to delays.

Materials and Methods

To accurately determine the stress-strain state of a multilayer rubber cable in a winding machine, it is essential to consider the longitudinal compression of the cable, which is unconstrained. Although the stiffness characteristics of each individual layer may vary depending on the number of layers, for simplicity, we will assume that they remain constant. Ignoring this factor could significantly underestimate the calculated power load and potentially lead to failure of the cable or other components in the winding system.

The process of calculating the forces in a multilayer cable involves several stages.

First, we need to determine the displacement of each layer within the bundle. Next, we must calculate the coefficients for transverse stiffness, expansion, and tension. Additionally, a mathematical model should take into account two significant factors: the longitudinal compression of the cable and the elastic properties of the rubber rings. The stiffness characteristics of these materials are determined by the total number of rings used in the winding process and their arrangement. This information can be calculated using programming languages such as Maple 12 and ANSYS Workbench 2022, which produce accurate and efficient results.

This information provides a high degree of accuracy in studying the stress-strain behavior of multi-layer ropes and identifies patterns that can inform engineering design decisions. It can also be used to create guidelines for load testing, ensuring the safety and reliability of these structures, as well as their durability and longterm performance.

In order to improve the efficiency of the cyclic flow technology used in coal mines for the extraction of solid overburden rocks, we conducted a thorough analysis of the main components of the system using computer-aided design. This analysis revealed that one of the main causes of conveyor stoppages was related to the unloading and loading mechanisms in the cyclic flow system. Based on this information, we carefully examined the operation of these mechanisms and created a detailed model of the unloading and loading points using ANSYS software (Figure 1).



1-tape; 2-rock; 3-dumping drum; 4-5- hopper walls; 6-shock absorber; 7-8 - iron aprons; 9-lower rollers; 10-side rollers; 11-roller holder; 12-roller support stop; 13-upper and lower layers of tape; 14-the ropes of the tape.

Fig. 1. General view of the belt direction model for calculation and the structural condition of the hopper model divided into parts

To determine the optimal height of the hopper and the stress-strain state of the belt, calculations were performed to simulate the unloading and loading of bunkers in the technological process of cyclic flow at the Angren coal mine. Overburden is removed from the bottom of the mine and transported to the main conveyor using various production parameters. The height of the bunker was varied between 3.5, 5.4, and 7.8 meters. The volume of rock falling on the belt, denoted as V, was 0.95 m³. The belt moves at a speed of 5 m/s during the working process and enters the

Contra	Bablic burget
(erse)	saids when.
Sinactural	
Windespei Dardinder	
Encod Nort.	many's Global and Fernand's Rate
Yorung's Medulus	dan M. Pa
Patagenta Parisi-	8,30008
Full Ideatable	6,8687a-17 Pa
Beer Mudulus	Littla-10 Pa
Interpretation Conflations of Thermal Represent	1.0610 175
Compression (Mainute Strength	6.84
Companyable Weld Recordshi	Alternation and a second secon
Ream line Parameters	daget they
14 Curve	Willing oggett Lines
knaits Utsnate Inergite -	Ada-18 Pa
Broke Vald Brangth	5,5m-18, Pa
Contractor ()	
	120110-010
and open the send the shade of the	HE DOL: NO WAY

Fig. 2. Properties of building iron (steel) bunker material

The model of the impact of rock on the belt at a speed of 5.5 m/s when it moves with its own weight and an initial speed of 5 m/s is shown in Figure 3.



Fig. 3. General view of the tape with roller

NEWS of the National Academy of Sciences of the Republic of Kazakhstan

The main advantages of rubber conveyor belts are:

- High longitudinal flexibility, which allows for a smaller drive drum diameter compared to other types of belts. This makes them ideal for applications where space is limited, as they can be installed in tighter spaces.

- Good transverse flexibility, resulting in deeper grooves on narrower belts. These grooves help prevent materials from slipping off the belt, increasing transportation efficiency and reducing damage.

Rubber belts are also lighter than steel rope belts, making handling and installation easier. They are covered with a thicker layer to increase strength and durability, preventing wear and tear and ensuring a longer lifespan.

At the Angren coal mine, a STAHLCORD 1600 rubber belt is used to transport overburden rock over a distance of more than 5 kilometers. It is installed on the main conveyor line, which includes both vertical and horizontal curved sections. Figure 4 shows the typical design of a rubber-cord conveyor belt.



Fig. 4. Rubber conveyor belt of standard design

Results and Discussion

The design of rubber belt conveyors in the mining industry is crucial for ensuring the efficient and safe operation of these systems. These belts play a vital role as load-bearing and traction components, carrying materials from one point to another. When designing these systems, it is essential to choose durable and reliable materials that can withstand the high dynamic loads placed on the drive drums, especially in cyclic-flow applications where the belt frequently starts and stops. High-quality materials should also have excellent abrasion resistance to ensure longevity and durability. Lightweight belts help minimize stress on the system, leading to optimal performance and reduced downtime. By selecting the right belt material for the job, miners and operators can maximize productivity and minimize maintenance costs, while ensuring safe and efficient operations. It is also important to choose a durable belt with a long lifespan, as this will help reduce operating costs, ensure optimal performance, and minimize downtime. A reliable belt that requires minimal maintenance will maximize uptime, ensuring uninterrupted production and minimizing the frequency of repairs. Selecting a high-quality belt allows miners and operators to have confidence in their conveyor systems, knowing that they will function smoothly and reliably over the long term. This leads to increased productivity, profitability, and reduced downtime, ultimately saving time and money.

In order to determine the optimal parameters and characteristics of the conveyor belt, we will use the finite element method to analyze the deformation and stress state of the belt under external forces. We will divide the entire area of the belt into smaller elements, as shown in Figure 3. For each individual element, we will calculate the total energy, considering the edges of the small parallelepipeds. Then, we will take the derivative of this total energy with respect to each variable, and set it equal to zero, in order to create a system of equations that corresponds to the number of nodes in the belt. This system of equations will help us in determining the optimal values for parameters such as the strength and flexibility of the belt.

Let us consider a finite element in the form of a parallelepiped (a,b,c). To determine the coordinates of this element, we need to know the displacement components (u, v, w), which can be found in Table 1.

Dot	Point coordinates (ζ, η, θ)	Move Component
1	(0,0,0)	$(u_1, v_1, w_1),$
2	(a,0,0)	$(u_2, v_2, w_2),$
3	(a,b,0)	(u ₃ , v ₃ , w ₃),
4	(0,b,0)	(u4, v4, w4),
5	(0,0,c)	(u5, v5, w5),
6	(a,0,c)	$(u_6, v_6, w_6),$
7	(a,b,c)	(u7, v7, w7),
8	(0,b,c)	$(u_8, v_8, w_8),$

Table 1. This is a table. Tables should be placed in the main text near to the first time they are cited.

We can describe this element by considering a small section of the parallelepiped, as shown in Figure 5.



Fig.5. Elementary piecewise element of a parallelepiped

In this case, the total displacement of the field must also satisfy the edge points of the field u, v, w. Consider the displacement for its first component and obtain (1) a system of equations:

$$u = a_1\zeta + b_1\eta + c_1\theta + d_1\zeta\eta + f_1\zeta\theta + e_1\eta\theta + g_1 + h_1\zeta\eta\theta$$

$$v = a_2\zeta + b_2\eta + c_22\theta + d_2\zeta\eta + f_2\zeta\theta + e_2\eta\theta + g_2 + h_2\zeta\eta\theta$$

$$w = a_3\zeta + b_3\eta + c_3\theta + d_3\zeta\eta + f_3\zeta\theta + e_3\eta\theta + g_3 + h_3\zeta\eta\theta$$
(1)

here $a_i; b_i; c_i; d_i; f_i e_i; g_i; h_i$ constant, not yet known. If we introduce the following definitions $\zeta = \frac{x}{a}; \eta = \frac{y}{b}; \theta = \frac{z}{c}$, and move on to dimensionless values, we will find the displacement of the total area for a threedimensional region in the following form:

$$\begin{cases} u_{1} = g_{1} \\ u_{2} = aa_{1} + g_{1} \\ u_{3} = aa_{1} + bb_{1} + abd_{1} + g_{1} \\ u_{4} = bb_{1} + g_{1} \\ u_{5} = cc_{1} + g_{1} \\ u_{6} = aa_{1} + cc_{1} + acf_{1} + g_{1} \\ u_{7} = aa_{1} + bb_{1} + abd_{1} + cc_{1} + acf_{1} + bce_{1} + g_{1} + abch_{1} \\ u_{8} = bb_{1} + cc_{1} + bce_{1} + g_{1} \end{cases}$$
(2)

From this

$$\begin{cases} g_{1} = u_{1} \\ a_{1} = \frac{u_{2} - u_{1}}{a} \\ b_{1} = \frac{u_{4} - u_{1}}{b} \\ c_{1} = \frac{u_{5} - u_{1}}{c} \\ u_{5} = cc_{1} + g_{1} \\ u_{6} = aa_{1} + cc_{1} + acf_{1} + g_{1} \\ u_{7} = aa_{1} + bb_{1} + abd_{1} + cc_{1} + acf_{1} + bce_{1} + g_{1} + abch_{1} \\ u_{8} = bb_{1} + cc_{1} + bce_{1} + g_{1} \end{cases}$$
(3)

Let's get all the constants depending on the movements

$$g_{1} = u_{1};$$

$$a_{1} = \frac{u_{2} - u_{1}}{a};$$

$$b_{1} = \frac{u_{4} - u_{1}}{b};$$

$$c_{1} = \frac{u_{5} - u_{1}}{c};$$

$$d_{1} = \frac{u_{3} - u_{4} + u_{1} - u_{2}}{ab};$$

$$f_{1} = \frac{u_{6} - u_{5} + u_{1} - u_{2}}{ac};$$

$$e_{1} = \frac{u_{8} - u_{5} + u_{1} - u_{4}}{ac};$$

$$h_{1} = \frac{u_{7} - u_{8} - u_{6} + u_{5} + u_{4} - u_{3} + u_{2} - u_{1}}{abc}$$

From here we can get a complete representation of the u,v,w function: $u^{=}$

$$\frac{u_{2} - u_{1}}{a}\zeta + \frac{u_{4} - u_{1}}{b}\eta + \frac{u_{5} - u_{1}}{c}\theta + \frac{u_{3} - u_{4} + u_{1} - u_{2}}{ab}\zeta\eta + \frac{u_{6} - u_{5} + u_{1} - u_{2}}{ac}\zeta\theta + \frac{u_{8} - u_{5} + u_{1} - u_{4}}{ac}\eta\theta + u_{1} + \frac{u_{7} - u_{8} - u_{6} + u_{5} + u_{4} - u_{3} + u_{2} - u_{1}}{abc}\zeta\eta\theta$$

$$\frac{v_2 - v_1}{a}\zeta + \frac{v_4 - v_1}{b}\eta + \frac{v_5 - v_1}{c}\theta + \frac{v_3 - v_4 + v_1 - v_2}{ab}\zeta\eta + \frac{v_6 - v_5 + v_1 - v_2}{ac}\zeta\theta + \frac{v_8 - v_5 + v_1 - v_4}{ac}\eta\theta + v_1 + \frac{v_7 - v_8 - v_6 + v_5 + v_4 - v_3 + v_2 - v_1}{abc}\zeta\eta\theta$$

 $\frac{w_{2}^{W^{-}}}{a}\zeta + \frac{w_{4} - w_{1}}{b}\eta + \frac{w_{5} - w_{1}}{c}\theta + \frac{w_{3} - w_{4} + w_{1} - w_{2}}{ab}\zeta\eta + \frac{w_{6} - w_{5} + w_{1} - w_{2}}{ac}\zeta\theta + \frac{w_{8} - w_{5} + w_{1} - w_{4}}{ac}\eta\theta + w_{1} + \frac{w_{7} - w_{8} - w_{6} + w_{5} + w_{4} - w_{3} + w_{2} - w_{1}}{abc}\zeta\eta\theta$

As is known, the kinetic energy of a deformable solid is equal to:

$$E_k = \frac{1}{2} \iiint \sigma_{ij} \varepsilon_{ij} dV \tag{4}$$

If we find the components σ_{ii} Hooke's law:

$$\sigma_{ij} = [A][\varepsilon_{ij}] \tag{5}$$

$$[A] = \begin{pmatrix} \lambda + 2\mu & \lambda & \lambda & 0 & 0 & 0 \\ \lambda & \lambda + 2\mu & \lambda & 0 & 0 & 0 \\ \lambda & \lambda & \lambda + 2\mu & 0 & 0 & 0 \\ 0 & 0 & 0 & \mu & 0 & 0 \\ 0 & 0 & 0 & 0 & \mu & 0 \\ 0 & 0 & 0 & 0 & 0 & \mu \end{pmatrix}$$
(6)

here λ, μ - Lamé parameter, σ_{ii} -stress component, ϵ_{ii} - strain component.

Based on the fact that the total kinetic energy is equal to the following for our case:

$$E_{k} = \frac{1}{2} \iiint \sigma_{ij} \varepsilon_{ij} dV = \iiint [A] * [B]^{T} * [u_{ij}]^{I} * [B] * [u_{ij}] dV = \int_{0}^{1} \int_{0}^{1} \int_{0}^{1} \int_{0}^{1} [A] * [B]^{T} * [u_{ij}]^{T} * [B] * [u_{ij}] d\zeta * d\eta * d\theta$$
(7)

In this case, the hardness matrix will be for one element:

$$k = \int_0^1 \int_0^1 \int_0^1 [B] * [A] * [B]^T * [u_{ij}] d\zeta * d\eta * d\theta$$
(8)

here k-matrix coefficient of stiffness material.

Formula 7 represents the stiffness matrix of the unreinforced part of the tape. We use the hyperelastic Ogden model, assuming that the overall belt is hyperelastic, to represent the stiffness matrix of the entire belt (also suitable for large deformations).

Ansys uses existing large deformation models. To simplify the mathematical model, first of all, let's imagine the bottom band as solid, plastic (Figure 6).



Fig.6. Conveyor belt model

To determine the maximum number of nodes in the parallelepiped, a stressstrain analysis of the tape was conducted using the Ansys software package and the finite element method. The results of this analysis are presented in Figures 7.



Fig.7. Strain distribution along a conveyor belt

As shown in Figure 7, when the top belt speed is 5 m/s and the hopper height is 5.4 m, the lower belt speed is also 5.5 m/s. The total belt deformation is 15 centimeters and the z-axis deformation is 2 centimeters. The force acting on the belt is 7464.7 Pascal. The graphical and mathematical calculations for analyzing the operation of the 5.4-meter-tall bunker are presented in the figure, showing the results of stress forces on the main conveyor belt. As illustrated in the diagram, rocks are thrown from the conveyor at a speed of 5 m/s when they reach a specified height and hit the hopper. The hopper then absorbs the speed of the falling rocks

and their impact force, as they freely hit the receiving main conveyor belt at 5.5 m/s. In Figure 8, different colors are used to indicate different levels of stress. Red represents the highest level, while blue represents the lowest. The point at which the highest level occurs is called the "danger zone".



Fig.8. Strain distribution along a conveyor belt loaded with coal

The law of change in the tension of an elastic band over time is shown in Figure 9. The graph shows the voltage levels over time. The highest voltage is represented by green, the average by blue, and the lowest by red. This allows us to see that the peak voltage occurs around 2.125 seconds.



Fig. 9. Graph of stress in the bunker over time at a fall height of 5.4 m.

Thus, the "Ansys Workbench" software was used to create 3D models of the cyclical-flow unloading and loading system located between the conveyor belts of the structure. This software helped us to determine the exact geometric parameters of the system under study. Analysis of the 3D models allowed us to identify the causes of failure of the main conveyor belt in the cyclical-flow process, including the height of the unloading and loading bins, the forces applied by falling hard rocks, and the dynamic stress [19] on the rubber belt.

Conclusions

The results of the calculations, carried out using the finite element method and ANSYS software, have helped us to identify the causes of the frequent failures of the

main conveyor belt during operation. These failures are caused by both structural and technical problems with the belt, as well as the impact forces from the falling rocks at the points of loading and unloading. Bunker-cyclic flow technology was also taken into account in the calculations. Based on this information, the optimal height of the bunker was determined to be 5.4 meters.

Thus, the use of mathematical modeling techniques, such as finite element analysis using the Ansys software, has allowed us to determine the optimal height of the loading and unloading chute. This has extended the lifespan of the conveyor belt by reducing the frequency of breakdowns and, consequently, reducing the need for repairs to the structure.

During the experiment, we also studied and determined other optimal parameters for technical units in the design of cyclic-flow technology. These include: the choice of optimal speed for the production line and main conveyor, as well as the correct setting of the optimal angle for the inclination of the conveyor in the cyclic-flow system.

References

Akbarov, T.G., Israilov, M.A., Makhmudov, D.R. (2021). Analysis and Prevention of Spontaneous Combustion of Angren Coal. Min. informational Anal. Bull. No 1. pp. 170–177.

Fedorko, G. (2021). Application Possibilities of Virtual Reality in Failure Analysis of Conveyor Belts. Eng. Fail. Anal. 128, 105615.

Gulomova, G., Turabekova, U., Nizamova, D., Mudarisova, R. (2023). Problems of Ensuring Security in Open – Pipe Coal Mines in the Republic of Uzbekistan. E3S Web Conf. No 461, 01067.

Gelman, L., Abdullahi, A.O., Moshrefzadeh, A., Ball, A., Conaghan, G., Kluis, W. (2023) Innovative Conveyor Belt Monitoring via Current Signals. Electronics, 12, 1804.

Gładysiewicz, L., Król, R. (2021). Experimental Verification of Load Models for Upper Idlers in Belt Conveyor. Measurement, 168, 108251.

Huang, H., Li, Z., Beng Gooi, H., Qiu, H., Zhang, X., Lv, C., Liang, R., Gong, D. (2023). Distributionally Robust Energy-Transportation Coordination in Coal Mine Integrated Energy Systems. Appl. Energy, 333, 120577.

Kassenov A.Zh., Abishev K.K., Absadykov B.N., Yessaulkov V.S., Bolatova A.B. (2022), News of the National Academy of Sciences of the Republic of Kazakhstan. Series of geology and technical sciences. — Volume 1. — Number 451. — Pp. 63–68. — https://doi.org/10.32014/2022.2518-170X.141

Kovrov, O., Babiy, K., Rakishev, B., Kuttybayev A., (2024). Innovative drill bit to improve the efficiency of drilling operations at uranium deposits in Kazakhstan. NEWS of the National Academy of Sciences of the Republic of Kazakhstan SERIES OF GEOLOGY AND TECHNICAL SCIENCES. Vol. 4. No 466. pp. 224–236.

Marasova, D., Andrejiova, M., Grincova, A. (2023). Experimental Study of the Influence of the Interaction of a Conveyor Belt Support System on Belt Damage Using Video Analysis. Appl. Sci. 13, 7935.

Mikušová, N., Stopka, O., Stopková, M., Opettová, E. (2019). Use of Simulation by Modelling of Conveyor Belt Contact Forces. Open Eng. No 9. pp. 709–715.

Semrád, K., Draganová, K. (2023). Implementation of Magnetic Markers for the Diagnostics of Conveyor Belt Transportation Systems. Sustainability, 15, 8705.

Srimitrungroj, T., Rattanamanee, T. (2023). An optimization Approach in Trough Angle Selection of Conveyor Five Roll. Int. J. Oper. Res. No 48. pp. 221–232.

Toshov, J.B., Sherov, K.T., Sikhimbayev, M.R., Absadykov, B.N., Esirkepov, A. (2024). Analysis

of interaction of rock breaking tool with rock in the drilling process. News of the National Academy of Sciences of the Republic of Kazakhstan SERIES OF GEOLOGY AND TECHNICAL SCIENCES. Vol. 1. No 463. pp. 271–281.

Toshov, Zh.B., Rahutin, M.G., Toshov, B.R., Baratov, B.N., (2024). The method of constructing the scans of the toroidal belts of the faces during drilling wells. EURASIAN MINING. No. 1. pp. 62–66.

Toshov, J., Atakulov, L., Arzikulov, G., Baynazov, U. (2024). Modeling of optimal operating conditions of cyclic-flow technologies with a belt conveyor at coal mine under the "ANSYS" program. AIP Conf. Proc., 3152, 020006.

Wang, X.Q., Long, S.S., Meng, X.R. (2022). Simulation and Optimization of Mining-Separating-Backfilling Integrated Coal Mine Production Logistics System. Energy Explor. Exploit. No 40. pp. 908–925.

Wang, G., Yang, Z., Sun, H., Zhou, Q., Yang, Z. (2024). AC-SNGAN: Multi-Class Data Augmentation for Damage Detection of Conveyor Belt Surface Using Improved ACGAN, 224, 113814.

Zohra, F.T., Salim, O., Masoumi, H., Karmakar, N.C., Dey, S. (2022). Health Monitoring of Conveyor Belt Using UHF RFID and Multi-Class Neural Networks. Electronics, 11, 3737.

CONTENT

B.O. Adyrbaev, A.Z. Darkhan, B.O. Yessimov, T.A. Adyrbaeva, E.S. Dubinina SYNTHESIS OF CERAMIC GRANITE BASED ON DOMESTIC FELDSPAR
RAW MATERIALS
F.Kh. Aubakirova, K.S. Dossaliyev, K. Ibragimov, K.I. Nazarov, A.M. Budikova
RESEARCH OF STRENGTH CHARACTERISTICS OF COARSE CLASTIC
MATERIAL OF A HIGH EARTHEN DAM
D.S. Akhmetova, K.M. Saginov, Yeginbayeva A.Ye, K.M. Arykbaeva, B.N. Kanghabay
ANALVSIS OF LANDSCADE STRUCTURES OF THE TURKESTAN
REGION32
D.K. Bekbergenov, G.K. Jangulova, R.K. Zhanakova, B. Bektur
INVESTIGATION OF THE BLOCK CAVING GEOTECHNOLOGY AT DEEP
HORIZONS
I.S. Brovko, D.Zh. Artykbaev, K.S. Baibolov, M. Karatayev
THE PRACTICE OF CONSTUCTING EARTHWORKS IN THE SOUTH
OF KAZAKHSTAN
D.I. Vdovkina, M.V. Ponomareva, Y.V. Ponomareva, O.Y. Koshliakov,
K.Y. BORISOVA
ZUNING OF KARAGANDA CITY TERRITORY ACCORDING TO THE
STABILITY DEGREE OF THE GEOLOGICAL ENVIRONMENT
Zh.B. Dossymbekova, L.Z. Issayeva, K.S. Togizov, D.B. Muratkhanov,
O.N. Maksutov
THE SPECIFICS OF RARE EARTH INCLUSION IN ORE MINERALS
OF RARE METAL DEPOSITS OF KAZAKHSTAN
T.A. Panfilova, V.V. Kukartsev, K.V. Degtyareva, E.V. Khudyakova, M N. Stepantsevich
INTELLIGENT METHODS FOR CLASSIFYING ROCKS BASED ON THEIR
CHEMICAL COMPOSITION

D.S. Saduakassov, M.T. Tabylganov, A.R. Togasheva, A.T. Zholbasarova,
R.U. Bayamirova
THE INFLUENCE OF WELLBORE AND BIT DIAMETER RATIO ON
MINIMUM RADIUS PARAMETERS AND CHANGES IN WELLBORE
DEVIATION ANGLE
T.K. Salikhov, Zh.M. Karagoishin, A.M. Gibadilova, Zh.K. Bakhov,
S.E. Zhumabayeva
GEOECOLOGICAL RESEARCH ON THE TERRITORY OF THE STATE
NATURAL RESERVE "BOKEYORDA" OF THE WEST KAZAKHSTAN
REGION141
V.N. Talamanov, E.V. Khekert, R.G. Dubrovin, G.L. Kozenkova,
V.A. Kozenkov
VIBRO-ROLLING OF PARTIALLY REGULAR MICRORELIEFS
FOR MINING EOUIPMENT SURFACES
K.K. Tolubayeva, E.V. Blinaeva
DEVELOPMENT OF AN ECOLOGICALLY CLEAN TECHNOLOGICAL
UNIT FOR HEAT AND ELECTRIC POWER GENERATION167
.J. Toshov, K. Velemessov, II. Bavnazov, T. Annakulov, D. Baskanbaveva
CHALLENGES OF MODERNIZING AND OPTIMIZING THE PROCESS
OF IM-PLEMENTING CYCLICAL FLOW TECHNOLOGY IN A COAL
MINE 182
102
V.V. Tynchenko, O.I. Kukartseva, V.S. Tynchenko, K.I. Kravtsov,
L.V. Krasovskaya
INTELLIGENT SYSTEMS FOR ANALYZING CLIMATIC CONDITIONS
IN MINING REGIONS
A. Sharapatov, N. Assirbek, A. Saduov, M. Abdyrov, B. Zhumabavev
CONSOLIDATED GEOLOGICAL AND GEOPHYSICAL
CHARACTERISTICS OF URANIUM DEPOSIT ROCKS AND PROSPECTS
FOR THEIR UTILIZATION (SHU-SARYSU PROVINCE
KAZAKHSTAN) 210

Publication Ethics and Publication Malpractice in the journals of the National Academy of Sciences of the Republic of Kazakhstan

For information on Ethics in publishing and Ethical guidelines for journal publication see http://www.elsevier.com/publishingethics and http://www.elsevier.com/journal-authors/ethics.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the described work has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see http://www.elsevier.com/postingpolicy), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the Cross Check originality detection service http://www.elsevier.com/editors/plagdetect.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of Sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of Sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайтах:

www:nauka-nanrk.kz http://www.geolog-technical.kz/index.php/en/ ISSN 2518-170X (Online), ISSN 2224-5278 (Print)

Директор отдела издания научных журналов НАН РК А. Ботанқызы Редакторы: Д.С. Аленов, Ж.Ш.Әден Верстка на компьютере Г.Д.Жадыранова

Подписано в печать 15.12.2024. Формат 70х90¹/₁₆. Бумага офсетная. Печать – ризограф. 14,5 п.л. Тираж 300. Заказ 6.

РОО «Национальная академия наук РК» 050010, Алматы, ул. Шевченко, 28, т. 272-13-19