ENGINEERING

Reducing emissions into the environment during the operation of small-capacity boilers

Anastasiya Ivanova[1,2,*] , Tsolmon Khalzan[1], Viktor Ivanov[2]

[1]*School of Power Engineering, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[2]*Institute of Engineering & Technology, North-Eastern Federal University, Yakutsk, Republic of Sakha (Yakutia), Russia*

Correspondence author. Email: anastasiia.ykt@gmail.com, ORCID: *0000-0002-9460-6294*

ABSTRACT

This article considers measures to reduce air pollution from autonomous heating facilities. At the present time autonomous heat supply is actively developing. Affordability, controllability, autonomy, economy allow to determine the choice of consumers. But unlike power plants, the design of small boiler units is quite simple. Such boilers have no tail heating surfaces and flue gas cleaning devices. Common solutions to improve energy efficiency often do not take into account the impact of emissions into the environment. This article proposes to consider ways to reduce the impact of emissions into the environment from a small boiler and a group of boilers. A comprehensive approach to improve the efficiency and ecological of the boiler is considered: analysis of the influence of fuel-air mixture parameters and increase of fuel efficiency, optimization of combustion process and reduction of harmful emissions formation; investigation of flue gas removal and dispersion of pollutants into the atmospheric air. This method will improve the efficiency and environmental friendliness of operation from a single boiler and determine the optimal location of a group arrangement of boilers of small capacity.

Keywords: Combustion products, air-pollution control, low power boilers, gas boiler, long-burning solid fuel boiler, fuel efficiency, operational reliability.

REFERENCES

[1]   G. Bhander, W. Jozewicz, Analysis of emission reduction strategies for power boilers in the US pulp and paper industry, Energy and Emission Control Technologies Dovepress, 5 (2017), pp. 27-37. https://doi.org/10.2147/EECT.S139648

[2]   A.V. Ivanova, V. N. Ivanov, A. P. Turin, K. Y. Zamotin, Simulation of Heat-Exchange, Processes in Coaxial Flues at Abnormally Low Temperatures, Journal of Cold Regions Engineering. – USA: American Society of Civil Engineers, 31(3), (2017), www.ascelibrary.org/doi/10.1061/%28ASCE%29CR.1943-5495.0000131

Research of smart lighting system for energy efficient office using image processing

Mandakh Oyun-Erdene[1,*] iD, Tsanjidkhuu Jamsran[2],
Bat-Erdene Byambasuren[3]

[1]*Department of Electric Technique, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[2]*Department of Engineer Technology, Koosen College of Technology, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[3]*Department of Electric Technique, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

 Correspondence author. Email: mandakh@must.edu.mn, ORCHID: 0000-0003-2432-6331

ABSTRACT
Research of smart technology usage for energy saving issue is one of the important things in this sector. In addition, researches appeared about Smart Lighting Control system for office and house building using IoT (Internet of Things). In this paper, approach of lighting control system for office building by using human detection algorithm with image processing from camera system's data is presented. In the experiment, "Raspberry Pi4 Model B", microcomputer and "Maix Dock" are used for embedded development system. In image processing algorithms, blurred images are used to ensure the privacy of the individual. The results demonstrate that the presented method is effective in controlling a lighting system based on human detection, without compromising individuals' privacy.

Keywords: Camera, machine learning, OpenCV, embedded system, power supply

REFERENCES

[1]   Yao-Jung Wen, Alice M. Agogino, Personalized dynamic design of networked lighting for energy-efficiency in open-plan offices. https://doi.org/10.1016/j.enbuild.2011.03.036
[2]   A. Allouhi, Y. El Fouih, T. Kousksou, A. Jamil, Y. Zeraouli, Energy consumption and efficiency in buildings: Current status and future trends. J. Clean. Prod. (2015), 109, pp. 118–130. https://doi.org/10.1016/j.jclepro.2015.05.139
[3]   G. Lowry, Energy saving claims for lighting controls in commercial buildings. Energy Build. (2016), 133, pp. 489–497. doi.org/10.1016/j.enbuild.2016.10.003
[4]   M. H. T. Imam, S. Afshari, S. Mishra, Smart lighting control systems. In Intelligent Building Control Systems, J. Wen, S. Mishra, Eds; Springer International Publishing: Cham, Switzerland, (2018); pp. 221–251.

Building external envelope hygrothermal property assessments analysis

Narantsatsral Chuluunbaatar[1,*], Bilguun Buyantogtokh[1]

[1]*Department of Environmental Engineering, School of Civil Engineering and Architecture, Mongolian University of Science and Technology ,Ulaanbaatar, Mongolia*

Correspondence author. Email: Tsatsral.must@gmail.com

ABSTRACT

Heat loss through the wall is increased as a result of the moisture accumulation in the structure. In order to save building thermal energy accurate design of the building structure is essential. According to the legislative document BNaC 25-01-20 "Building thermal performance" the moisture transmission through the building external envelope could be estimated either following the 8.2th clause checking overall vapor transmission resistance against the normative value or dynamically to calculate as stated in the national standard MNS 13788 "Hygrothermal performance of building components and building elements — Internal surface temperature to avoid critical surface humidity and interstitial condensation — Calculation methods". The aim of the study is to verify specificity of two methods whose considering parameters are different. The six types of external wall structures commonly used for the residential building in Ulaanbaatar, Mongolia were considered for the analysis. The moisture regime of the external walls has been calculated by both methods stated in the building code and the national standard. Assessment results are differed for two types of structures due to their static and dynamic calculation method and considering variables. Further, the method stated in the MNS shall be analyzed in more detail in combination of testing due to its specific result. Therefore, the building code shall be updated specifying the accurate one method.

Keywords: Building norm and code, MNS, water vapor resistance, condensation.

REFERENCES

[1] BNaC 25-01-20 Building thermal performance, Ulaanbaatar, 2021
[2] BNaC 23-01-09 Climate and geophysical data for construction, Ulaanbaatar, 2009
[3] MNS 13788, Hygrothermal performance of building components and building elements-Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods, Ulaanbaatar, 2013
[4] Ts.Dashdorj et al, Engineering- dictionary 1, Ulaanbaatar, 2014, ISBN 978-99973-51-09-8
[5] BC 23 – 103 – 10 Building thermal performance design: Ulaanbaatar, 2013

Phase Change Material application to tromp-wall strategies for housing in Ulaanbaatar, Mongolia

Temuulen Bat-Ochir[1], Tsovoodavaa Gantumur[1], Uelun-Ujin Purev[1,*] ⓘD,
Bolormaa Damdinsuren[1]

[1]Department of Architecture, School of Civil Engineering and Architecture, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia

*Correspondence author. Email: ujin@kyudai.jp, ORCID: 0000-0003-4821-3833

ABSTRACT

In this study, we aim to evaluate the effectiveness of the Trombe-wall strategy combined with Phase Change Material (PCM) for buildings in the cold climate of Ulaanbaatar, Mongolia. The building sector is the largest energy consumer in the world, which is responsible for a significant amount of energy usage and carbon emissions. Passive building strategies and sustainable architecture implementation can help to address this issue and reduce building energy consumption. Tromp-wall strategy is one of the efficient passive strategies which uses thick masonry walls to absorb heat during the daytime and release it to the building during night-time. The wall usually faces the south with a glass layer to create an air layer to trap heat. Concurrently, Phase Change Material (PCM) is an efficient method to store energy. Our numerical analysis shows that the introduction of PCM Trombe-wall heating reduced energy consumption by 35.6 per cent in Ulaanbaatar, Mongolia.

Keywords: Trombe-wall, Phase change materials (PCMs), Building envelope, Energy saving, Numerical study.

REFERENCES

[1]   https://worldgbc.org/advancing-net-zero/embodied.carbon/
[2]   U. Purev, A. Hagishima, A Field Survey of Traditional Nomadic Dwelling Gers Used as Urban Habitats in Ulaanbaatar, Mongolia, EVERGREEN Joint Journal of Novel Carbon Resource Sciences Green Asia Strategy, vol. 07 (2020), pp. 155-171. https://doi.org/10.5109/4055214
[3]   E. G. Farrugia, Thermal Morphology, Geometry Optimized Trombe Wall ,ThesisAmlan K Roy, Shih-I Chu, J. Phys. B: At. Mol. Opt. Phys. 35, 2072 (2002). https://doi.org/10.1088/0953-4075/35/9/306

Mix design study of cement-treated base

Erkhembayar Otgondavaa[1,*] (iD)

[1]*Department of Engineering Structure, School of Civil Engineering and Architecture, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

Correspondence author. Email: erkhembayar.o@must.edu.mn, ORCID: 0000-0002-1825-0097

ABSTRACT

The planning to strengthen the stone materials and soils that do not meet the requirements of road materials in different areas of Mongolia with different climates and natural conditions where the materials meeting road construction conditions are in lack shall be one of the factors to reduce the cost of high-cost road construction. This study presents the results of a study of cement-stabilized foundation materials using commonly distributed local materials. The 50-km road from Chinggis city to Batnorov of Khentii province has been selected as the research object. The results of laboratory and field studies of soil stabilized with inorganic binders have been formulated to improve the properties of the foundation by mixing the soil with cementitious materials using base materials and industrial waste materials. Based on the results of laboratory tests, when calculating the unconfined compressive strength of the cement-treated base, it was determined that more than 3.5% of cement content provides strength of the cement-treated base. It was determined that the appropriate content of cement to meet the technical requirement of the CTB (Cement-treated Base) can be determined using mathematical modeling.

Keywords: Soil stabilization, cement content, an inorganic binder, local material, unconfined compressive strength.

REFERENCES

[1]   X. Xie and M. Mirmehdi, RAGS: Region-Aided Geometric Snake, IEEE Transactions on Image Processing, 13 (2004), pp. 640-652. https://doi.org/10.1145/800057.808665

[2]   Bold B., Gerelnyam D., Gantumur Kha., Highway Construction Technology, - UB.: 2007, pp. 222-230.

[3]   Dashjamts D., Discussion of Construction Geotechnic, MUST, Scientific research anthology, UB, 2020.

[4]   Rasha. Abd Al-RedhaGhani, Dr. Mohammed A. Al-Jummaily, Dr. Ahlam K. R. Al-Zerjawi, Study of cement treated base aggregate properties for pavement structure, International Journal of Information Research and Review, Jan, 2018.

[5]   U. Purevjav, Road quality depending on it's design, Interview, vip76.mn/content/19895

Study on increased reliability of relay protection and automation for 110 kV transmission line high-load and short-distance in a ring network of national power transmission grid, Mongolia state-owned company

Ichinkhorloo Namsrai[1, 2,*], Lhagvademberel B.[3], Battulga M.[1]

[1]Mongolian University of Science and Technology, School of Power Engineering, Electrical Engineering branch, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia,
[2]National Power Transmission Grid, Ulaanbaatar branch, Mongolia, Ulaanbaatar
[3]Korea University, Green-School, Korea, Seoul

*Correspondence author. Email: ichko_bpisd@yahoo.com

ABSTRACT

As part of the responsibility of providing continuous, reliable and quality energy to the growing electricity consumption of Ulaanbaatar, National Power Transmission Grid is responsible for the expansion, renewal, and maintenance of power transmission lines, substations, and equipment. As the network expands, there is a need to integrate the old system with the new system and increase the reliability. In order to solve these problems, there is a need to use advanced technical solutions. However, in order to meet consumption, new transmission and distribution substations and distribution substations have been planned and put into operation near the city center, new residential areas, and some large consumers, but selectivity is not ensured for the short lines formed by the 110 kV high-load circuit network connecting the substations reached the situation. Therefore, in this research work, the relay protection solution to ensure the selective operation of automatic relay protection of short lines with high load of 110 kV and the impact of its introduction on the dynamic stability of the system are investigated.

Keywords: Trustworthiness, solution, relay protection, main protection.

REFERENCES

[1] NDC Mongolian State-owned Company, 2022-2023 operational planning
[2] A. Choidorj, Mode calculation of NDC Mongolian state-owned company, Erdenet city, 2018.
[3] NPTG Mongolia' state-owned company of Ulaanbaatar branch balance measurement
[4] N. Ichinkhorloo, B. Togtokhjargal, M. Battulga, Study of relay protection of lines and equipment in the transmission network of Ulaanbaatar region, compilation of academic works of Bachelor, Master and Doctoral students, No 22 (4) 292, 2021

Experimental study on the determination mechanical characteristics of concrete with steel fiber

Enkhtur Shoovdor[1], Sergelen Purev[2,*] iD

[1]*Department of Structural Engineering and Construction Engineering, School of Civil Engineering and Architecture, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[2]*Department of Building Materials and Technology, School of Civil Engineering and Architecture, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

Correspondence author. Email: psergee@must.edu.mn, ORCID: 0000-0002-1825-0097

ABSTRACT

Our paper documents the effect of various fibers are used to concrete to improve their some mechanical properties recently. The conventional concrete is weak in tension, steel fibers has been add to concrete to improve its characteristics in tension. The steel fibers concrete specimens with and without fibers were cast and tested to watch the improvement of certain mechanical and physical properties. In this study, experimental works carried out to investigate the effect of adding 0.5%, 1.0%, 1.5%, 2.0% hooked-end (3D type) and flat crimped steel fiber into C30 grade concrete with W/C= 0.42 constantly. Compressive, tensile and flexural strength, modulus of rupture- MOR, water absorption-WA, freeze/thaw cycles (100 cycles) are investigated with different dosage of steel fiber containing at 7, 14, 28 and 365 days. Moreover, the strain and stress property is checked as well. The result showed that steel fiber additives has a slight effect on the compressive strength of concrete. In other words, it increased by 3-7.09% compared to the period without addition. When the amount of additive is increased by 1.5-2%, the difference in its compressive strength is small. But his ferocious nature was greatly reduced. The fibers have little effect on compressive strength. The flexural strength of concrete without fiber reinforcement is approximately 10-12% of its compressive strength. However, when using steel fiber, its bending strength increased to approximately 30.7%. On the other hand, the duration of micro cracks during the flexural strength of normal concrete increases with the duration of macro cracks.

Keywords: Compressive strength, flexural strength, strain, stress.

REFERENCES

[1] A. B. Aleksandr Ischenko, Application of fibre-reinforced concrete in high-rise construction, Energy Efficiency in Building Construction. Volume 164, 2020.Topical Problems of Green Architecture, Civil and Environmental Engineering 2019, (TPACEE 2019) https://doi.org/10.1051/e3sconf/202016402005

Determination of Geometric Characteristics of Fatigue Cracks by Digital Image Processing Methods

Bokhoeva L. A.[1,*], Bazaron S. A.[1], Bochektueva E. B.[1]

[1]*East Siberia State University of Technology and Management, 40V Klyuchevskaya, Ulan-Ude, Russia*

Correspondence author. Email: seseg003@gmail.com

ABSTRACT

A method for image processing is proposed in order to obtain the geometric characteristics of the fatigue failure of an aircraft part. The developed algorithm was implemented in the Python programming language. Computational experiments were carried out, as a result of which the geometric parameters of cracks were determined to calculate the rate of change in their sizes.

Keywords: *Crack development, programming, modeling.*

REFERENCES

[1] A. Dasgupta, M. Pecht, Material Failure Mechanisms and Damage Models, IEEE, Transactions on Reliability, 1991, 40(5), pp. 531-536. http://doi.org/10.1109/24.106769

[2] P. S. Volegov, D. S. Gribov, P. V. Trusov, Damage and fracture: review of experimental studies, Fizicheskaya mezomekhanika, 2015, 3, pp.11-24.

[3] A. E. Burov, Models of destruction of fibrous composite materials, Bulletin of the Siberian State Aerospace University after M. A. Reshetnev, 2008, 3 (20), pp. 133-138.

[4] Ed Habtour, Gary S. Drake, A. Dasgupta, M. Al-Bassyiouni, C. Choi, Improved Reliability Test Using Multiaxial Electrodynamics Vibration. http://www.teamcorporation.com/images/curts_papers/23ImprovedReliabilityTeseUsingMultiaxialElectrodynamicsVibration.pdf

[5] A. G. Samusenko, S. Yu. Esaulov, V. A. Ivchin, Simulation of helicopter vibration reduction by means of higher harmonics control with the use of flight simulator, (2012), European Rotorcraft Forum (ERF).

[6] A. Markov, A. Barabanov, V. Tsirlov, Models for Testing Modifiable Systems. In Book: Probabilistic Modeling in System Engineering, by ed. A. Kostogryzov, IntechOpen, 2018, Chapter 7, pp. 147-168. http://doi.org/10.5772/intechopen.75126

A study on the convective heating method of cold weather concreting

Uranchimeg Davaasuren[1], Duinkherjav Yagaanbuyant[1], Khishgee Radnaabazar[1*], Bolormunkh Gantugs[1]

[1]*Department of Structural Engineering, School of Civil Engineering and Architecture, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

*Correspondence author. Email: khishgee_radnaa@must.edu.mn

ABSTRACT

In Mongolia, construction work in the coldest months of the year decreases dramatically due to a lack of reliable technology methods for cold weather concreting. Last 10 to 15 years, the convective heating method has started to be dominantly used in cold weather concreting in the country but comprehensive study on this method still lacks. The convective heating environment that is close to the actual construction site was created to cure concrete column specimens and their internal temperature distribution, compressive strength, and pore structure developments were studied. The importance of air circulation inside the heated enclosure is common knowledge, but due to its difficulty it is mostly omitted in the current practice leading differential temperature fields in vertical structures like columns and walls, this issue was studied. The results of the temperature study at the contact surface between old and new concrete in cold weather were discussed.

Keywords: Cold weather concreting, convective heating, concrete column structure, temperature field, compressive strength, porosity.

REFERENCES

[1] B. Narantogtokh, T. Nishiwaki, D. Pushpalal, Current Issues and Questionnaire Survey of Cold Weather Concreting in Mongolia, Buildings, 2022, 12, 1262 https://doi.org/10.3390/buildings12081262

[2] B.H. Oh, S.W. Cha, Nonlinear Analysis of Temperature and Moisture Distributions in Early-Age Concrete Structures Based on Degree of Hydration, ACI Materials Journal, V. 100, No. 5, pp 361-370.

[3] S. Yousuf, P. Shafigh, Z. Ibrahim, H. Hashim, M. Panjehpour, Crossover effect in Cement Based Materials: A Review, Appl. Sci. 2019, 9, 2776; https://doi.org/10.3390/app9142776,

[4] BNbD 52-02-05 Cast in Place Concrete and Reinforced Concrete Structures, Ministry of Construction and Urban Development of Mongolia, 2005.

[5] B. A. Krylov, S. A. Ambartsumyan, A. I. Zvezdova, Guidelines of Cast in Place Concrete Heating, Research Institute of Concrete and Reinforced Concrete, NIIZHB, M, 2005, NIIJB, M, 2005.

Study of material supply critical factors affecting the construction industry in Mongolia

Enkhbold Surenjav[1,*], Altanzagas Ochirdorj[1]

[1] *Department of Civil Engineering, School of Civil Engineering, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

Correspondence author. Email: enkhbolds@must.edu.mn

ABSTRACT

Material cost is almost 50-60% of most construction projects. In recent years, the price of building materials and the supply has decreased, directly affecting the construction cost. This study aims to identify the main factors supply of materials affecting the construction industry in Mongolia. A quantitative approach was adopted in carrying out the research. The target population included civil engineering companies in Ulaanbaatar, Mongolia. In the survey, stakeholders of construction projects, such as clients, contractors, designers, consulting service companies, and construction material suppliers of various construction projects, were targeted for the survey. A total of 90 respondents were surveyed. The respondents were a mix of CEOs, consultant engineers, field engineers, project managers, architects, and budgeters. Descriptive statistics (measures of central tendency) and the Relative Importance Index (RII) were used to analyze the data. The most significant factors identified were a shortage of materials, building materials quality, economic instability, pandemic situation, mistakes during construction, and financial difficulties of the owner.

Keywords: Construction sector, Material critical factor, Relative Importance Index (RII), construction project.

REFERENCES

[1] A. D. Bank, Mongolia's Economic Prospects: Resource-Rich and Landlocked Between Two Giants, no. June. 2020. [Online]. Available: https://ledproxy2.uwindsor.ca/login?url=https://www.proquest.com/books/mongolias-economic-prospects/docview/2545616612/se-2?accountid=14789%0Ahttps://uwindsor.primo.exlibrisgroup.com/openurl/01UTON_UW/01UTON_UW:UWINDSOR?&genre=book&issn=&title=Mongolia%27

[2] E. A. Zeb et al., Factors Affecting Material Procurement, Supply and Management in Building Projects of Pakistan: A Contractor's Perspective. doi: 10.17758/UR.U0615309

[3] L. C. Bell, G. Stukhart, Costs and Benefits of Materials Management Systems, 1987. https://doi.org/10.1061/(ASCE)0733-9364(1987)113:2(222)

[4] V. R. Battula, S. K. Namburu, V. Kone, A study on factors involved in implementation of supply chain management in construction industry, Mater. Today Proc., May 2020, https://doi.org/10.1016/j.matpr.2020.04.900

Computation of Lightning Electro-magnetic Transients on Wind Turbine Tower Structure

Chinges Tserensambuu[1,*], Qingmin Li[2]

[1]*School of Power Electrical Engineering, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[2]*School of Electrical & Electronic Engineering, North China Electric Power University, Beijing, China*

Correspondence author. Email: chingee@must.edu.mn

ABSTRACT

This paper attempts to model lightning transient overvoltage distribution along the wind turbine tower structure. The numerical approximation techniques are used in the computation under considering the assumptions for the lightning physical complexity. The equivalent circuit of the tower is created in PSCAD/EMTDC software environment. Circuit parameters are calculated using the double integral formula and finite element method. Then the inductance and capacitance matrices are implemented into MATLAB and PSCAD/EMTDC based on the computer codes. The resulting model shows a good agreement even it has limitations and simplifications and common numerical analysis methods are still sufficiently accurate enough for computation of lightning.

Keywords: *Computation of lightning transient overvoltage, Numerical analysis methods for calculating conductor parameters and computational analysis, Capacitive and inductive coupled equations.*

REFERENCES

[1]   Ikeda Y., Nagaoka N., Baba Y., Lightning surge analysis on wind farm with interconnecting grounding wire using circuit model for vertical conductor, 2015 50th International Universities Power Engineering Conference (UPEC)*, Stoke on Trent, UK, (2015), pp. 1-6. https://doi.org/10.1109/UPEC.2015.7339968
[2]   Sekioka S., Simulation of Lightning Overvoltages in Substation for Lightning Strike to Wind Turbine, 2021 35th International Conference on Lightning Protection (ICLP) and XVI International Symposium on Lightning Protection (SIPDA)*, (2021), pp. 01-06. https://doi.org/10.1109/ICLPandSIPDA54065.2021.9627343

Optimal Design of BLDC Motors Using a Multi-objective Differential Evolution Algorithm

Ulziinorov Dondov[1,*] ⓘ, Nyambayar Baatar[1]

[1]*Mongolian National University of Science and Technology, Ulaanbaatar, Tuv 14191, Mongolia*

Correspondence author. Email: ulziinorov@must.edu.mn, ORCID: 0000-0002-1903-3457

ABSTRACT

BLDC motors have been increasing rapidly in recent years due to their lightweight and high power. However, the size and operating parameters may vary depending on the intended use. Therefore, developing an efficient optimization method for optimal BLDC motor design is essential. This paper presents the optimal design of BLDC motors using a multi-objective differential evolution algorithm. The optimization problem contains five design variables, and electric, magnetic, and thermal phenomena are considered.

Keywords: *Electromagnetic device, optimization, BLDC, multi-objective, differential evolution algorithm.*

REFERENCES

[1] S. Brisset and P. Brochet, Analytical model for the optimal design of a brushless DC wheel motor, COMPEL vol.24 no.3, (2005), pp. 829-848. https://doi.org/10.1108/03321640510612952
[2] M. T. Pham, D. Zhang, C. S. Koh. IEEE Trans. Magn., vol. 48, no. 2, Feb. 2012. https://doi.org/10.1109/TMAG.2011.2173559

Supporting the Flexibility and Reliability of Power Systems: Optimal Scheduling Approach

Zagdkhorol Bayasgalan[1,*] 🔘, Tsetsgee Bayasgalan[2,*], Adarsuren Sukhbaatar[1], Tumengerel Purevjav[1], Altangerel Barkh[3], Bat-Undral Baasan[4]

[1] *Department of Electrotechnics, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[2] *Department of Technology Management, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[3] *Energy regulation commission, Ulaanbaatar, Mongolia*
[4] *Department of Electrical Engineering, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

*Correspondence author. Email: zagdkhorol@must.edu.mn, btsetsgee@must.edu.mn
ORCID: 0000-0002-4413-6968

ABSTRACT

The optimal scheduling of the electricity market requires a holistic approach that incorporates demand-side measures, energy storage systems, renewable energy integration, market mechanisms, and system operations. The power system can achieve greater flexibility, reliability, and efficiency by leveraging these strategies. Therefore, in this paper, we modelled the electricity market, which can reward generators for maintaining a certain capacity level on the system. In addition to the mathematical models of Unit Commitment (UC) for the Mongolian Energy System, the optimal placement of Phasor Measurement Units (PMUs) has also been computed. The computed results from the optimal placement of PMUs can provide a set of locations where the PMUs can be installed to achieve maximum power system observability. This result can improve the system's reliability by providing real-time information about the state of the power system and allowing operators to detect and respond to potential problems efficiently. To further enhance the effectiveness of this approach, we consider incorporating other strategies such as energy storage systems and renewable energy integration.

Keywords: Electricity market, real-time pricing, regulation, unit commitment, phasor measurement units.

REFERENCES

[1] Bayasgalan Tsetsgee, Zagdkhorol Bayasgalan, Fabrizio Granelli, and Francesco Muzi. The Unit Commitment model for the Smart grid. WSEAS Transactions on Systems 2014.
[2] B. Zagdkhorol and B. Tsetsgee, Real-time balancing services in the electricity market, 7th International Forum on Strategic Technology (IFOST), (2012), pp. 1-4. https://doi.org/10.1109/IFOST.2012.6357675

Ultimate moment capacity of 50 m ultra-high performance fiber reinforced concrete composite box girder

Tsas-Orgilmaa Makhbal[1,*] [iD], Sang Mook Han[2]

[1]*School of Civil Engineering and Architecture of Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[2]*Civil Engineering Department of Kumoh National Institute of Technology, Gumi, South Korea*

Correspondence author. Email: tsasorgilmaa@must.edu.mn, ORCID: 0000-0002-1825-0097

ABSTRACT

The objective of this study described in this paper is to grasp the ultimate moment capacity of 50 m prestressed ultra-high-performance fiber reinforced concrete (UHPFRC) composite box girder. The feature of prestressed UHPFRC composite box girder is no longitudinal reinforcement and no stirrups in two webs and lower flanges. In order to predict the flexural behavior of large-scale UHPFRC composite box girders, the current knowledge of UHPFRC properties and modelling tools are to be developed. The UHPFRC composite box girder consists of three segments UHPFRC U-shaped girder, UHPFRC depth deck plate and reinforced high strength concrete (HSC) slab. The steel fiber 1.5% of volume fraction was added to ultra-high performance concrete (UHPC) to induce ductile behavior in the girder. Totally 146 tendons are installed in the upper and lower flanges of the U-shaped girder to cause flexural strength. In order to predict the ultimate moment capacity of the composite box girder, the following periods of study were done including obtaining of constitutive laws for compressive and tensile behavior for UHPFRC and HSC, deriving of equivalent rectangular stress blocks for compressive and tensile constitutive laws of UHPFRC and HSC, predicting of instantaneous prestress loss by an analytical method. Finally, the ultimate moment capacity of the composite box girder is evaluated by a modified analytical model, which has strain-softening behavior in tension. The result of ultimate moment capacity shows high flexural stiffness of composite box-girder.

Keywords: flexural behavior, bridge, girder, stress block, prestress loss

REFERENCES

[1]   Ultra high strength concrete, Heft 561, Berlin, 2008.
[2]   B. Graybeal, Characterization of the behavior of ultra-high performance concrete, Maryland, 2005.
[3]   Korea Concrete Institute, Design Recommendations for Ultra-High Performance Concrete K-UHPC, vol. KCI-M-12-003, Seoul, Korea, 2012.

Investigation of Factors Affecting an Accuracy of the Fault Location Determination Method for Overhead Electric Transmission Lines

Bayarmaa Ulziibat[1,*] ⓘ, Arslan Jamsran[1]

[1] *Department of Electrotechnique, Power engineering school, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[2] *Department of Administration and Human Resources, Power engineering school, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

Correspondence author. ubayarma99@gmail.com, *ORCID: 0009-0009-5406-7183*

ABSTRACT

A new opportunity in the power system is being opened to analyze the fault location determination methods for overhead electric transmission lines, and to develop methodology for the reducing their errors. In particular, there is a need to develop a method (methodology) for mathematical processing, using the parameters obtained during the emergency states. In this article, the factors that would ensure the technical conditions for improvement of the overhead transmission line 's reliability, fast detection of the faults and on -time maintenance considered. The aim is to improve the accuracy of the fault location determination for multi-terminal OETL that commonly is used in the power grids of our country. The main purpose of the investigation is to improve the accuracy of the method for the fault location determination, using emergency state parameters. Emergency state parameters include phase voltage, current and their angles, zero, reverse, and direct sequence parameters during the fault, but it is convenient to use one-way and two-way measurement methods among the number of technical methods. The one-way measurement method was developed in the mid-80s, and the localization of short-circuit fault is one of the main methods for the analysis of fault in the OETL and the comparison of the parameters of the OETL. The main feature of this method is to eliminate the influence of random factors by analysing the change of the functions.

A general criterion for determination of the fault location is to find a general minimum magnitude of a function from a comparison set of parameters.

The two-way measurement method is more suitable for determining the fault location during asymmetric short-circuits with large currents. Three phase symmetrical short circuits, conductor breakage and single-phase to-ground short circuit in electrical networks with insulated neutral point cannot be determined by this method.

Keywords: Overhead electric transmission lines (OETL), investigation of the breakdowns (IB), determining the fault location (DFL).

Survey during the changes of loop numbers on the main knitting data

Dalkhjav Shatar[1,*]

[1]Department of Technical Mechanics, School of Mechanical Engineering and Transportation, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia

*Correspondence author. Email: dalkhjav_cdio@must.edu.mn

ABSTRACT

An experimental work was conducted to identify the interrelations between knitting weight and horizontal and vertical densities, the main data of knitting, during the changes of numerical loop meaning at constant take down force on flat knitting machinery. The objective of the present work is to identify the interrelations between knitting weight and horizontal and vertical densities during the changes of numerical loop meaning at constant attracting force on flat knitting machinery. Upon experimental works and formulation of measurement results, correlation analysis method was used through f(x) correlation command at Microsoft Excel to make mathematics model at every factor.

Keywords: *Horizontal density, vertical density, surface density.*

REFERENCES

[1] K. Srinivasulu, Monika Sikka, J. Hayavadana, Study of loop formation process on 1x1 V-bed rib knitting mashine: The factors affecting loop length and validation of model, 2014.
[2] S. Gosh, P. K. Banerjee, Mechanic of the single jersey weft knitting process, Textile Research Journal, (1990), pp. 203-211.
[3] David J Spencer, Knitting technology, A comprehensive handbook and practical guide
[4] D. Enkhtuya, D. Chimgee, Knitting industry technology, 1994. [in Mongolian]
[5] Ch. Avdai, D. Enkhtuya, Research and analysis methodology, 2013. [in Mongolian]

Predicting the Service Life of Bridge Structures in Harsh Climatic Conditions

Khasnavch Sambuu[1,*]

[1]*School of Civil Engineering and Architecture, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

Correspondence author. Email: s_khasnavch@must.edu.mn, ORCID: 0000-0002-1825-0097

ABSTRACT

The paper is designed to predict the remaining time of bridge interconnections in the city of Ulaanbaatar. The normative service life of individual elements of bridge structures (in particular, reinforced concrete) is nowhere strictly regulated and not standardized. In the works of many scientists different versions of their vision of these terms are given based on the approaches developed by them to evaluate the longevity of the bridge facilities in operation. The remaining period of operation of the structure can be determined based on the proposed calculated service life values. It may turn out that the construction will last more than the established time, which is confirmed by the existence of such bridges in Ulaanbaatar (already described as 10%). In particular, the author determined the numerical values of the coefficients of the significance of the factors of natural and climatic, and technogenic impacts, as a result of the probability of damage (defects) in the design of the elements from a given impact. The effects of anthropogenic nature will accelerate the degradation processes in the structures of the structures. As a result of consideration and generalization of negative impacts of anthropogenic nature directly affecting the state of the exploited reinforced concrete bridge structures in Ulaanbaatar, defined as the "μ" coefficient.

Keywords: structures, durability, damage, condition assessment, lifetime

REFERENCES

[1] S.Khasnavch, Factors affecting the durability of reinforced concrete bridge structures/ dissertation/ Ulaanbaatar, Mongolia 2018, p.173. http://122.201.23.45/cgi-bin/koha/opac-ISBDdetail.pl?biblionumber=88349, http://catalog.must.edu.mn/cgi-bin/koha/opac-detail.pl?biblionumber=71803

[2] N.Adilbish, "Road Asset Management and Maintenance System and "Best Practice of Road" program" Future Development of Road Sector and Best Solution and Idea Proceeding of Symposium 2019, Ulaanbaatar, Mongolia, 2019, p.47–82

[3] Japan international cooperation agency (JICA), Project for capacity development on bridge maintenance and management in Mongolia, Ministry of Road and Transport, Mongolia Road Department, Ulaanbaatar city, Project completion Report 2015, https://openjicareport.jica.go.jp/pdf/12247953.pdf

Wastewater Treatment Solutions and Pollution Reduction Opportunities for Wool Scouring Industries

Ariunaa Ganbat[1,*] [iD], Chuluunkhuyag Sangi[2], Munkhbaatar Pumsantsogvoo[3],

Amgalan Magsar[4]

[1]*SCE, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[2]*Department of Environmental Engineering, School of Civil Engineering and Architecture, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[3]*Department of Chemical Engineering, School of Applied Sciences, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[4]*Department of Physics, School of Applied Sciences, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

*Correspondence author. Email: durtmalus@gmail.com, ORCID: 0000-0002-1926-188X

ABSTRACT

Domestic wastewater treatment facilities in urban areas struggle to properly treat wastewater from the wool scouring industries. One of the physico-chemical procedures used to remediate wool scouring wastewater is coagulation and flocculation. For the purpose of treating the wastewater from the wool scouring industry, MJ-B coagulant were extracted, which is a mixture enriched with mineral raw materials (zeolite, quartz, fly ash, sodium carbonate, and lime). An appropriate dose of MJ-B coagulant was found using a mathematical model based on the results of laboratory and semi-industrial wastewater treatment experiments. The treatment quality resulted in a reduction of 86.17% of SS and 85.7% of COD, and other parameters fully meet the criteria of MNS 6561:2015 standard when the amount of MJ-B was 8 g/L, pH-8, and temperature 30°C. In order to reuse treated water, it is possible to install additional facilities (such as an equalization tank or mixer, clarifier, activated carbon filter, or membrane filter), and a plan is put forth to enable the treatment quality to achieve 95–98%. In this situation, treated water can provide 80% of the total demand for technological water.

Keywords: Chemical coagulant, natural minerals, wastewater treatment, wool scouring.

REFERENCES

[1] Sonor M., Dissertation Research on development of soft technology for washing cashmere, UB, SHUTIS, (2004), p. 15.

[2] Jordi Labanda, Joan Llorens, Wool Scouring Waste Treatment by a Combination of Coagulation-Flocculation Process and Membrane Separation Technology, Chemical Engineering and Processing: Process Intensification, Volume-47, pp. 1061-1068, 2008. https://doi.org/10.1016/j.cep.2007.07.010

Using DEM-CFD simulation in berries separation process

Ulziisaikhan Purevsuren[1,*], Ganbold Dagvadorj[2], Gangerel Khorloo[3]

Department of Technical Mechanics, School of Mechanical Engineering and Transportation, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia

Correspondence author. Email: ulziisaikhan_p@must.edu.mn, ORCID: 0000-0002-9388-7645

ABSTRACT

Granular materials and its separation process is used in many industrial applications. This paper presents a modelling of separation berries in air flow. In modelling by DEM-CFD use ANSYS FLUENT and EDEM. The study explores the berries separations, modelling is based on middle size and properties of seabuckthorn berries from Mongolia. In simulation there are 5 kg particles with densities 650 kg/m^3, 1300 kg/m^3, have respective size 5 mm. The results shows modelling of density separation process of particles in gravity force by on horizontal air flow (v_x=16 m/s, v_y=-0.5m/s).

Keywords: Air flow, Discrete Element Method.

REFERENCES

[1]   Ch. Avdai, D. Nasanjargal, G. Chimed-Ochir, G. Turmunkh, Sea buckthorn processing technology, Ulaanbaatar, Mongolia 2021.

[2]   Ch. Avdai, Scientific basis of the dynamics of work processes and substantiation of the parameters of machines for harvesting sea buckthorn berries in natural and climatic conditions, Ulaanbaatar, Mongolia 1990.

[3]   V. C. Kelessidis, Terminal Velocity of Solid Spheres Falling in Newtonian and non Newtonian Liquids, Tech. Chron. Sci, Vols. No 1-2, pp. 43-54, 2003.

[4]   B. Auyrzana, Model of air and heat flow inside a Mongolian ger, 12 11 2017. [Online]. Available: https://www.trends.mn/n/7349

[5]   Y. He, C. Duan, H. Wang, Y. Zhao, Tao, Separation of metal laden waste using pulsating air dry material, Environ. Sci. Tech, vol. I, pp. 73-82, 2011. https://doi.org/10.1007/BF0332619

[6]   B. Indraratna, Ngoc Trung Ngo, Cholachat Rujikiatkamjorn, J. S. Vinod, Behavior of Fresh and Fouled Railway Ballast Subjected to Direct Shear Testing: Discrete Element Simulation, Intrnational journal of geomechanics, pp. 34-44, 2014. https://doi.org/10.1061/(ASCE)GM.1943-5622.0000264

High-density PUR (polyurethane) foam as insulation material for pipes in district heating systems

Tserendolgor Dugargaramjav[1,*] 🆔, Chantsaldulam Erdenechuluun[2]

[1]*Power Engineering School, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*
[2] *Energy Regulatory Commission, Ulaanbaatar, Mongolia*

Correspondence author. Email: ts_dolgor@must.edu.mn, ORCID: 0009-0001-2441-318X

ABSTRACT

In recent years, Mongolia has experienced a shortage of district heating sources and networks due to intensive construction, including apartment construction. The amount of heat distributed to consumers in 2022 was about 4 percent more than in the previous year. Therefore, one of the tasks of our energy department is to implement a cost-saving policy to reduce heat losses in the distribution network. Also, about 30 percent of Ulaanbaatar's heating networks are outdated and difficult to replace in a short time due to economic and time constraints. This paper is focused on experimental studies of heat losses from pipe networks in district heating (DH) systems. In heat networks, various insulating materials are used. During the long period of use, the insulation of the pipeline wears out, and due to damage and natural effects, it does not meet the technical requirements, and the heat loss significantly increases from the calculated value. The practical implementation of energy efficiency of a district heating requires knowledge of the energy performance of pipe networks through energy audit techniques. With the help of a drone equipped with a thermal camera, pipeline heat loss, and damage were determined in real-time dynamic mode. Also, pipeline insulation materials were compared and feasibility studies of using high-density pre-insulated polyurethane foam insulation boards were conducted. The actual heat loss of the insulation panels introduced in our proposal will be 1.7 times less than the norm and will have 30% energy savings, which is confirmed by both technical and economic calculations.

Keywords: District heating pipe, insulation, thermal conductivity, energy efficiency.

REFERENCES

[1]   Altangerel T. et al., Solutions of hydraulic mode by decreasing heat loss of DH, Power&engineering, ISSN978-99929-73-24-2, Ulaanbaatar, 2023, pp. 29-33.
[2]   Enkhjargal D., Tserendolgor D., Heat leakage detection in DH systems, Academic papers at MUST, 22(18)-306, ISSN1560-8794, Ulaanbaatar, 2022, pp. 63-68.
[3]   Sara Mangs, Camilla Persson, Morgan Fröling, Olle Ramnäs, and Ulf Jarfelt, Environmental comparison of DH pipes - PET and PUR foam insulated district heating pipes, Euroheat & Power, ISSN0949-166X, 2006, Vol. 3, no 1, pp. 26-31.

Study on Calculation of Variable Resistance in Heat Supply Hydraulic Mode

Enkhbayar Bat-Erdene[1] , Tserendolgor Dugargaramjav[1,*]

[1]*School of Power Engineering, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

Correspondence author. Email: ts_dolgor@must.edu.mn, ORCID: 0009-0001-2441-318X

ABSTRACT

The hydraulic mode of the district heating (DH) system depends on an integrated concept that includes a large number of consumers, pipelines, and power sources, and all of those are hydraulically dependent on each other and define the interrelation between the charge of the heat carrier and pressure in various points of the system at present time. We have been implementing the hydraulic system calculation, which is the basis of the heat supply system, by using the software of other countries such as Russia and Denmark. Consequently, the basic calculation method has been left out of engineers' interests, and how it develops at the theoretical level is no longer a matter for us. To enhance our situation from user to creator and contribute to the development, we have been studying the calculation methods of the hydraulic system, and as a result of the first stage, it was developed the hydraulic calculation program the Hydro-C 1.0 model. The system is a nonlinear equation system that is extensive and difficult to solve, so in this article, we will describe the equivalent equation to simplify and develop the methodology and further create algorithms and software. Now this research work is presented with the need to develop the next version of the Hydro-C 2.0 model.

Keywords: *District heating network, constant resistance, variable resistance, pressure drop.*

REFERENCES

[1] Stanislav Chicherin et al., The new method for hydraulic calculations of a district heating network, Energy, volume 260, 125071, 2022. https://doi.org/10.1016/j.energy.2022.125071

[2] Z.I.Shalaginova, Mathematical model for calculation of the heat-hydraulic modes of heating points of heat-supplying systems, Thermal Engineering, 63, 2016, pp. 222-232. https://doi.org/10.1134/S0040601516020075

[3] Luo P., Wang H., Liu Y., Du Q., Zhang Z., Resistance Characteristic Parameters Estimation of Hydraulic Model in Heating Networks Based on Real-Time Operation Data. Buildings 2022, 12, p. 743. https://www.mdpi.com/2075-5309/12/6/743

Study of technological characteristics of some wheat varieties

Tuyatsetseg Jambal[1,*]

[1]*School of Industrial Technology, National University of Mongolia, Ulaanbaatar, Mongolia*

Correspondence author. Email: tuyatsetseg_j@must.edu.mn ,ORCID: 0000-0001-7037-6693

ABSTRACT

In wheat yield and quality, the interaction of factors such as genotype, soil fertility, climatic conditions and agrotechnology that has been applied play major roles. The purpose of the study was to compare the yield and grain of the main wheat cultivars that have been domesticated in the cultivation area of our country in recent years, and their suitability for the production of high-quality flour that meets the requirements of flour technology. A field trial was carried for six years between 2017 and 2022 in the western, eastern and Khangai regions, and the technological characteristics were compared. According to the results, the average indicators of wheat grain filling, density, 100 kennel weight, gluten, protein, and fiber of Darkhan-74, Darkhan-144, and Darkhan-181 wheat types were above the international average and their technological quality meet the requirement of baked goods. Study shows that it is feasible to harvest crops that meet the quality requirements for cultivation in the eastern and Khangai regions. Plus, there were also numerous interactions between cropping and production systems, indicating different performance of cultivars and, in fact, some cultivars being better suited to production systems.

Keywords: *Cultivation area, wheat, wheat flour, 1000 kennel weight, protein content, gluten, technological characteristics.*

REFERENCES

[1]   Ang Zhang, Effect of wheat flour with different quality in the process of making flour products, International Journal of Metrology and Quality Engineering 11:6, 2020. https://doi.org/10.1051/ijmqe/2020005

[2]   B. Tseveendari, Physico-technological characteristics of some varieties of wheat, Master's thesis, Ulaanbaatar, 2022.

[3]   W. Biel, K. Kazimierska, U. Bashutska, Nutritional value of wheat, triticale, barley and oat grains, Acta Sci. Pol. Zootech, 19 (2020), pp. 19-28. https://doi.org/10.21005/asp.2020.19.2.03

[4]   Carmela Lamacchia, Loretta Landriscina, Antonio Carla, Rossella Caporizzi, Severini Derossi, Characterizing the Rheological and Bread-Making Properties of Wheat Flour Treated by Gluten FriendlyTM Technology, Foods 10(4) (2021), p. 751. https://doi.org/10.3390/foods10040751

Mathematical modeling and energy effeciency of drying process of potato in a closed-loop air circulation heat dryer with a moisture removal condenser through natural cool

Myagmarjav Chuluun[1,*], J. Baljinnyam[1], J. Tuyatsetseg[1]

[1]*School of Civil Engineering and Architecture, Mongolian University of Science and Technology, Ulaanbaatar, Mongolia*

Correspondence author. Email: myagmarjavchuluun@gmail.com

ABSTRACT

In this paper, experimental results of potatoes drying through a drying method with closed-loop air circulation are reported. In order to air-cool and remove moisture in the drying process with closed-loop air circulation, we use natural cool air. Moisture escaped and cooled air is heated by an electric heater. Potato is one of the major crops and foods, being ranked fourth worldwide. The drying experiment was carried out on the peeled off potatoes in the form of cubes (5´5´5 mm) without any pre-treatment. Firstly, the potatoes were dried at an air flow rate of 1.0 m/s and at temperatures of 42, 56, and 65 °C, after that the feasible one from the identified mathematical models by researchers was defined. Midilli's mathematical model was a feasible one among the others. The value of SMER was ranging between an interval of 0.24132-0.26624 kg/(kWh).

Keywords: Heat pump, low temperature drying, SMER, drying model, drying kinetics.