Selected abstracts of Ph.D. theses submitted at Russian transport universities

The text in Russian is published in the first part of the issue.

Текст на русском языке публикуется в первой части данного выпуска.

DOI: https://doi.org/10.30932/1992-3252-2024-22-4-16

Borisov, P. V. Techniques for assessing the residual life of lithium-ion batteries of traction rolling stock. Abstract of Ph.D. (Eng) thesis [*Metodika otsenki ostatochnogo resursa litiiionnykh akkumulyatornykh batarei tyagovogo podvizhnogo sostava. Avtoref. dis…kand.tekh. nauk*]. St. Petersburg, PGUPS publ., 2024, 15 p.

The use of independent energy sources on traction rolling stock, such as lithium-ion battery storage units, makes it possible to use both hybrid traction technology, which helps reduce the load during peak operating modes of the diesel generator and hydrogen proton-membrane power plants, and completely autonomous traction using batteries.

The use of alternative energy sources used for traction rolling stock on the railway network of the Russian Federation is increasingly developing. The task of introducing these types of energy sources on shunting, suburban and other locomotives has not been fully resolved, since there is a problem of the limited life of the battery storage unit. Traction rolling stock equipped with a battery storage unit as the main one energy source requires limited operating modes.

Increasing the efficiency of the «diesel generator – energy storage» system allows to increase the service life, as well as reduce the costs of premature replacement or unscheduled repair of the diesel generator. This fact is the key to successful implementation of plans for operation of shunting locomotives of the TEM9N and TEM5X series, as well as of transition of shunting traction to autonomous one due to the use of EMKA2 locomotives.

The reasons influencing the reduction of the service life of lithium-ion batteries of traction rolling stock (LIAB TRS), manifested in a decrease in the total capacity, were studied.

The equivalent circuit related to LIAB TRS was studied and its parameters were determined with subsequent verification on a model with the values obtained during an experiment.

The characteristics of the internal resistance of LIAB TRS suitable for operation were studied, the relationship between the increase in the value of the total resistance Z and its service life was obtained. The criteria for rejecting LIAB in operation were determined based on the parameters of the equivalent circuit of LIAB.

Proposals have been developed for organising the monitoring of LIAB TRS residual service life using functional diagnostics tools under current operating conditions, which will allow monitoring the current state and predicting the reduction of service life of LIAB without performing maintenance and current repair of the traction storage unit.

Based on the developed proposals for monitoring LIAB TRS service life, algorithms for software diagnostics of LIAB storage unit for TRS have been built.

Software has been developed for the control system of the energy converter operating with LIAB TRS, for which an author's certificate of state registration of the computer program No. 2023681901 has been received.

A traction calculation has been made for an experimental locomotive for shunting work, equipped with LIAB. The capacity of LIAB has been determined for the specified operating mode of TRS within a marshalling yard. The service life of the resulting traction storage unit has been determined, confirmed by experimental studies.

As recommendations and prospects for further development in this direction, it may be proposed to test the proposed methodology on different types of electric energy storage devices, as well as to develop a hardware on-board automated diagnostic complex, implemented in a traction storage device, which collects, stores and analyses information.

2.9.3 – Rolling stock of railways, train traction and electrification.

The work was performed and defended at Emperor Alexander I St. Petersburg State Transport University.

**Kovalev, V. A. Improving the efficiency of interaction of external and traction power supply systems of 25 kV alternating current. Abstract of Ph.D. (Eng) thesis [*Povyshenie effektivnosti vzaimodeistviya system vneshnego*

***i tyagovogo elektrosnabzheniya peremenogo toka 25 kV. Avtoref. dis… kand. tekh. nauk*]. Khabarovsk, FESTU publ., 2024, 24 p.**

As part of the implementation of the Transport Strategy of the Russian Federation, the goal has been set to increase the transit capacity of the Eastern part of railway network. The most important task is the elimination of «bottlenecks» on the transport network of railways, which limit the increase in the speed and weight standards of trains. As one of the mechanisms for eliminating «bottlenecks», the Strategy provides for reconstruction and modernisation of traction power supply systems.

The thesis examines the issues of increasing the efficiency of interaction between external (hereinafter – EPS) and traction (hereinafter – TPS) AC 25 kV power supply systems to fulfil the tasks formulated by the programs for the strategic development of railways.

An analysis of the interaction indicators of external and traction power supply systems of 25 kV alternating current was performed using the example of the Far Eastern Railway's TPS. The connection of traction substations to the 25 kV alternating current TPS using the «feeding» circuit creates a «bottleneck» for increasing the weight of trains and reducing the intervals of passing trains.

The mathematical model for calculating the distribution of traction load currents of electric rolling stock in the windings of traction transformers and phases of the power transmission lines of the external power supply system is specified by the temporary input resistances of the nodes of connection of traction substations to the power transmission lines developed in the thesis study.

An algorithm and automated workstation for determining the temporary input and mutual resistances of the nodes of connection of traction substations to the power transmission lines of EPS have been developed.

A database of power transmission lines, power transformers and automatic transformers of EPS substations feeding the Far Eastern Railway TPS has been developed.

An algorithm has been developed for determining the number of time intervals, selecting power supply circuits for predicted traction loads in the considered period considering the minimisation of dispersion and rational consumption of the resource of switching devices and voltage regulation devices of traction substations. The algorithm was implemented with a computer program.

The obtained results prove that computer modelling of the normalisation of traction load power supply circuits and connection of traction substations to power transmission lines and traction network increases the efficiency of interaction between traction and external power supply systems.

2.9.3. Rolling stock of railways, train traction and electrification.

The work was performed and defended at the Far Eastern State Transport University.

Polyakova, L. A. Monitoring of soil erosion near railway bridge supports through natural vibration frequencies. Abstract of Ph.D. (Eng) thesis [*Monitoring razmyvov grunta i opor zheleznodorozhnykh mostov po chastotam sobstvennykh kolebanii. Avtoref.dis…kand.tekh. nauk*]. Novosibirsk, STU publ., 2024, 24 p.

The safety of bridge structures during operation must be ensured by conducting periodic inspections, control checks and monitoring of the condition of structures. When controlling structures, the operational dependability of transport structures is assessed, and recommendations are given for eliminating the identified defects. Defects affecting the safety of the structure can emerge in places that are difficult to access for inspection (for example, in the underwater part of the supports and in the underbridge channel). One of such defects is soil washout near the channel supports of the bridge.

When designing a bridge crossing, the maximum depth of soil erosion near the support is calculated and the required deepening of the support foundation base into the ground is determined. But these measures are often insufficient for the safe operation of the bridge. This is primarily due to the fact that the calculated characteristics of the water flow during the period of operation of the structure can change significantly compared to the values adopted at the time of design. These changes are associated with climate change, as well as with the initially calculated possible probability of exceeding the characteristics of the water flow. There are also practical cases when the rock foundation at the support, initially considered non subject to erosion, is washed away. This is due to the peculiarity of a particular rocky soil, which, when its natural structure is disturbed (the construction of the foundation of the supports), is destroyed up to the soil subject to erosion. Based on this, periodic monitoring of soil erosion at the supports is

necessary to ensure the reliability of the bridge structure.

The relevance of the study is due to the lack of a scientifically based method for the prompt diagnosis and monitoring of soil erosion at channel supports. And the fact that the free length of the support changes with the development of erosion allowed us to put forward a hypothesis about the dependence of the frequency of natural oscillations of a natural-technogenic system consisting of a support, foundation soil and superstructures resting on the supports, on the amount of soil erosion at the support.

In-kind measurements of natural oscillation frequencies of natural-technogenic systems consisting of supports, foundation soil and superstructures resting on the supports were carried out with different structural designs of the elements and the actual soil level at the supports. As a result, experimental qualitative and quantitative dependencies of natural oscillation frequencies of natural-technogenic systems of different structural designs on the soil erosion depth at the supports were established.

The calculation assumptions were substantiated when determining the natural oscillation frequency of a support considering its joint operation with the span structures resting on it and the foundation soil. Thus, the mathematical model for determining the natural oscillation frequencies of natural-technogenic systems with different foundation depths was refined, describing the interaction of the support and the superstructures resting on it, by considering the specific operation of the supporting parts during free oscillations. Calculated dependencies of natural oscillation frequencies of natural-technogenic systems on the soil erosion depth at the supports were obtained. The compliance of the accepted design assumptions with the actual operation of the structure is confirmed by comparing the obtained frequencies with the results of in-kind measurements for 35 operated supports.

An algorithm has been developed for monitoring the depth of soil erosion at the supports of railway bridges based on the frequencies of natural oscillations, which allows for timely detection of support erosions and monitoring their depth.

The prospects for further research include studies of the dynamic operation of various natural and man-made systems, considering the design features of the bridge structure and the mass of water involved in the oscillatory process.

2.1.8 –Design and construction of roads, metro, airfields, bridges and transport tunnels (engineering sciences).

The work was performed and defended at the Siberian Transport University.

Umanets, V. V. Risk management in the logistics system of railway cargo transportation. Abstract of Ph.D. (Eng) thesis [*Upravlenie riskami v logisticheskoi sisteme gruzovtkh zheleznodorozhnykh perevozok. Avtoref. dis… kand. tekh. nauk*]. St. Petersburg, PGUPS publ, 2024, 17 p.

The objective of the study is to develop methodological provisions for managing the risks of railway cargo transportation arising in logistics transport systems under the conditions of a deficit in the transit capacity of the railway infrastructure and associated with violations of cargo delivery times, failures of technical means (TMF) and actions of third-party organisations.

The need to synchronise the risk management system with the methods of analysis and forecasting of railway cargo transportation, especially in key areas, is substantiated. The formalisation of transport and logistics risks arising under the influence of many factors, including constraints on investment development of infrastructure, tariff restrictions and growth of operating costs related to its maintenance and repair, has been completed.

It has been proven that the existing system for analysing cargo transportation does not fully consider the problems of the state and development of the railway infrastructure, which does not allow for a prompt and flexible response to changes in the structure of cargo flows and the dynamics of transportation. As a solution to the problem, an algorithm for forecasting the volume of cargo transportation is proposed, which makes it possible to clarify changes in the volumes and structure of cargo in accordance with the transit capacity of the infrastructure.

A concept for analysing railway cargo transportation has been developed, considering the risks of infrastructure constraints. The concept of risks of transit capacity constraints regarding railway infrastructure has been expanded.

The semantic modelling method was used to systematise, structure and rank the risks of violation of cargo delivery deadlines and risk owners, and perform quantitative assessment of risks by the sources of their generation. It is shown that the

proposed calculation allows to increase the reliability of assessment of the risks of limiting the transit capacity of the railway infrastructure, considering the frequency of their occurrence and the significance of the impact on the delivery times of goods.

A methodology for managing the risks regarding the transit capacity of the railway infrastructure based on semantic modelling was developed and tested. A software product was developed in the JAVA programming language, the use of which can be useful in the risk management system of logistics transport systems of other modes of transport.

2.9.9. – Logistics transport systems.

The work was performed and defended at Emperor Alexander I St. Petersburg State Transport University. ●

NEW BOOKS ON TRANSPORT AND TRANSPORTATION

The list of original titles in Russian is published in the first part of the issue

Список на русском языке публикуется в первой части данного выпуска

DOI: https://doi.org/10.30932/1992-3252-2024-22-4-17

Ashikhmin, S. A., Ashikhmina, E. A. Car Structure. Textbook [*Ustroistvo avtomobilei: Uchebnik*]. 2nd ed., ster. Moscow, Academia publ., 2024, 318 p. ISBN 978-5-0054-1682-7.

Friedman, A. M. Finances of organisations. Practical course: Study guide [*Finansy organizatsii. Praktikum: Ucheb. posobie*]. Moscow, RIOR: INFRA-M publ., 2024, 249 p. ISBN 978-5-369-01950-4.

Grechanik, A. V., Zamukhovsky, A. V., Semenov, E. V. Design and calculation of the ordinary simple switch. Training and methodological guide [*Proektirovanie i raschet relsovoi kolei: Uchebno-metod. posobie*]. Moscow, Pero publ., 2024, 58 p. ISBN 978-5-00244-214-0.

Gruntovich, Nik. V., Gruntovich, Nad. V. Technical diagnostics of electrical equipment: Textbook [*Tekhnicheskaya diagnostika elektrooborudovaniya: Uchebnik*]. Moscow, INFRA-M publ., 2024, 253 p. ISBN 978-5-16-017836-3.

Gulevich, A. N., Matkovsky, V. V., Soshkin, P. A. Explosive and fire safety of the ship. Study guide [*Vzryvopozharobezopasnost korablya: Ucheb.posobie*]. Moscow, INFRA-M publ., 2024, 223 p. ISBN 978-5-16-018739-6.

Gumerov, A. F., Skhirtladze, A. G., Grechishnikov, V. A. [*et al*.] Quality management in mechanical engineering. Study guide [*Upravlenie kachestvom v mashinostroenii: Ucheb. posobie*]. Stary Oskol, TNT publ., 2024, 167 p. ISBN 978-5-94178-172-0.

Isaev, R. A. Operational risk management: reliability of business processes and IT systems. Practical manual [*Upravlenie operatsionnymi riskami: nadezhnost biznes-protsessov i IT-sistem: Prakt. posobie*]. Moscow, INFRA-M publ., 2024, 152 p. ISBN 978-5-16-019573-5.

Katin, V. D., Kosygin, V. Yu., Zhuravlev, A. A. Study of noise of burners and other devices at oil refining and heat power engineering facilities and enterprises and development of methods for its reduction. Monograph [*Issledovanie shuma gorelok i drugikh ustroistv na obektakh i predpriyatiyakh neftepererabotki i teploenergetiki i razrabotka metodov ego snizheniya: Monografiya*]. Khabarovsk, Publishing house of Pacific State University, 2024, 161 p. ISBN 978-5-7389-3824-5.

Klimova, G. N. Electric power systems and networks. Energy saving. Study guide [*Elektroenergeticheskie sistemy i seti. Energosberezhenie: Ucheb. posobie*]. 2nd ed. Moscow, Yurait publ., 2024, 179 p. ISBN 978-5-534-18321-4.

Krotenko, T. Yu., Sundukova, G. M. Engineering and economic education: transformation and development of the modern space for training managers. Monograph [*Inzhenerno-ekonomicheskoe obrazovanie: transformatsiya i razvitie sovremennogo prostranstva podgotovki upravlentsev: Monografiya*]. Kursk, Universitetskaya kniga publ., 2024, 306 p. ISBN 978-5-907857-81-0.

Kuznetsov, V. V., Polskiy, E. V., Pechenka, S. N. Operation of ship boiler houses and steam generating units. Study guide [*Ekspluatatsiya sudovykh kotelnykh i paroproizvodyashchikh ustanovok: Uchebnoe posobie*]. Moscow, INFRA-M publ., 2024, 134 p. ISBN 978-5-16-017930-8.

Romanov, E. N. Ship refrigeration units and their operation. Reference materials. Training and methodological guide [*Sudovie kholodilnie ustanovki i ikh ekspluatatsiya: spravochnie materialy: Uchebno-metod.posobie*]. Moscow, INFRA-M publ., 2024, 226 p. ISBN 978-5-16-018446-3.

Sekirnikov, V. E. Labour protection at motor transport enterprises. Textbook [*Okhrana truda na predpriyatiyakh avtotransporta: Uchebnik*]. 5th ed., ster. Moscow, Academia publ., 2024, 203 p. ISBN 978-5-0054-1712-1.

Smirnov, A. Yu. Electromechanics. Fundamentals of the theory and computational analysis of electrical machines. Study guide [*Osnovy teorii i vychislitelniy analiz elektricheskikh mashin: Ucheb. posobie*]. 2nd ed., rev. and enl. Moscow, INFRA-M publ., 2024, 348 p. ISBN 978-5-16-016661-2 (print).

Sokolov, Yu. I., Lavrov I. M., Ishkhanyan, M. V. Fundamentals of the economy of the transport complex. Study guide [*Osnovy ekonomiki transportnogo kompleksa: Ucheb. posobie*]. Moscow, RUT (MIIT) publ., 2024, 165 p. ISBN 978-5-7876-0291-3.

Stoyanova, M. V. Study of technologies and markets. Study guide [*Issledovaniya tekhnologii i rynkov: Ucheb. posobie*]. Moscow, Publishing house of Bauman Moscow State Technical University, 2024,125 p. ISBN 978-5-7038-6189-9.

Syaglova, Yu. V., Maslevich, T. P., Safronova, N. B. Business Management in the Digital Economy. Textbook [*Upravlenie biznesom v usloviyakh tsifrovoi ekonomiki: Uchebnik*]. Moscow, Dashkov i K ° publ., 2024, 319 p. ISBN 978-5-394-05804-2.

Zintsov, A. N. Operation of Cars and Tractors: Control, Diagnostic and Adjustment Work. Practical course: Study guide [*Ekspluatatsiya avtomobilei i traktorov: kontrolno-diagnosticheskie i regulirovochnie raboty. Praktikum: Ucheb. posobie*]. Moscow, INFRA-M publ., 2024, 276 p. ISBN 978-5-16-017980-3.

Compiled by N. OLEYNIK ●