

**MATHEMATICAL MODEL OF ASYNCHRONOUS MACHINE FOR  
VIBRATION RESEARCH**

**Kim, Constantine C., Zazybina, Elena B.**

**pp. 6 – 19**

The mathematical model, proposed by the authors, is based on a concept of asynchronous machine in a form of two infinitely long cylindrical shells with current layers, the shells being separated by an air circular gap. The study is based on comprehensive use of information relating to the operation mode, when axes of stator and rotor coincide. New parameters are introduced, resulting from radial displacement of a rotating rotor, but their formulation allows using known methods of calculating parameters of machines.

**Keywords:** mathematical model, vibration studies, induction machine, asynchronous machine, magnetic bearing, rotor, eccentricity, current layer, perturbed field, unperturbed field.

**DISTRIBUTION OF STATISTICS IN HYPOTHESES TESTING**

**Rubichev, Nikolai A., Seydakhmetov, Nurlan B.**

**pp. 20 – 30**

The article considers the influence of the form of laws of distribution of single observations on quantile of statistics used for statistical hypotheses testing and having chi-square distribution or Fisher distribution with the normal distribution of individual observations. Through mathematical modeling on the example of four options it is shown that difference of the distribution law as compared to normal law results in a significant change in the value of quantiles. This is equivalent to an unjustified change in the level of significance in the choice of a decision rule.

**Keywords:** mathematical statistics, distribution law, quantiles, statistical hypothesis, statistical modeling.

## **LOGISTICS OF PASSENGER TRANSPORTATION: FEATURES AND BASIC CONCEPTS**

**Vakulenko, Sergey P., Kopylova, Ekaterina V.**

**pp. 32 – 36**

Logistical approaches to organization of passenger transportation in Russia have taken practical shape quite recently. Basic terms of passenger logistics continue to be formed and still are interpreted differently. To ensure effective work in this area it is necessary to formulate common concepts and describe distinctive features of transportation, organized on the basis of logistic principles. The article deals with concepts such as territorial mobility of population, mobility of passengers, logistics of passenger transportation, logistic chain of passenger movement, passenger transport system, multi-modal transportation in passenger traffic, intermodal transportation in passenger traffic.

**Keywords:** transport, passenger transportation, logistics system, concepts, terminals, analytical methods.

## **GROWTH OF EFFICIENCY OF TRUCK OPERATIONS ON THE BASIS OF TRANSPORT AND LOGISTICS INTERACTION**

**Naumenko, Marina A.**

**pp. 38 – 44**

The author examines approaches to improvement of the efficiency of trucks' operations on the basis of a concept of transition of a road carrier from pure physical movement of cargo to the system of transport and logistics services. The author proposes methods for structuring transport and logistics processes and suggests trends and directions of organization of their interaction.

**Keywords:** transport, car, service, logistics, cycle, need, interaction, ranking, cyclogram, matrix.

## **METHODS TO INCREASE FREIGHT CARS' DISTANCE RUN BETWEEN REPAIRS BY UPGRADING CAR'S BOGIE**

**Petrov, Aleksei G., Sapetov, Mikhail V., Poryadin, Sergei I.**

**pp. 46 – 57**

The authors participated in MIIT University's researches aimed at refining mathematical and computer models of cars were refined, describing a motion along

railway lines with normalized irregularities in plan and profile. The models consider spatial oscillations of each node, details of solid body, structure, material properties, as well as predict abrasive wear of critical parts and components of a bogie. The article justifies a possibility to increase overhaul life of a car by a simple upgrade of a bogie model 18-100 from 160 to 250 thousand km, and by a comprehensive modernization – up to 500 thousand km.

**Keywords:** railway, freight cars, bogie model 18-100, computer model of car motion, upgrading, modernization, distance run between repairs, overhaul life, performance indicators of a car, wear reduction.

## **STUDY OF THE RESPONSE OF BEAM BRIDGES TO THE IMPACT OF A TRAIN**

**Kurbatsky, Evgeny N., Bondar, Ivan S., Kvashnin, Mikhail Ya.**

**pp. 58 – 71**

The article presents the results of measurements of fluctuations of metal and reinforced concrete superstructures of railway bridges in the passage of the rolling stock with different speeds. The obtained data can be used to refine models of structures and to develop algorithms for damage detection.

**Keywords:** railway bridge, girder, amplitude and time dependence, vibration speed, vibration displacement, vibration acceleration, fast Fourier transform, frequency response.

## **INFLUENCE OF FASTENING'S TYPE ON TRACK'S DYNAMIC WORK**

**Kvashnin, Mikhail Ya., Zhangabylova, Aigul M., Zamukhovskiy, Alexander V.**

**pp. 72 – 80**

The authors introduce the results of measurements and analysis of mechanical vibrations of track superstructure with intermediate rail fastening types Pendrol and ZHBR65-SH regarding vibrodynamic impact of rolling stock. Full-scale experimental studies have been performed on the main section of the enlarged Ekibastuz rail track section. The data obtained can be used as a criterion for justifying selection of the most optimal type of rail fastening.

**Keywords:** railway track, intermediate rail fastenings, rolling stock, vibrodynamic effects, vibration displacement, oscillogram, rms value of vibration displacement.

## **PROCESSING MODES OF THREAD SURFACE PROFILE OF METRO CARS' WHEELSETS**

**Ivanov, Igor A., Potakhov, Dmitry A., Urushev, Sergey V.**

**pp. 82 – 93**

The rationalization of recovery modes of thread surface profile of wheel sets due to the use of a criterion «optimal cutting temperature», introduced by professor A. D. Makarov is shown. The work of a tool in this mode provides its maximum dimensional stability (durability) and required speed of metal processing. This process involves similarity method, thermophysical and thermomechanical approaches, as well as a method of linear programming. It was experimentally found that using similarity method, it is possible to calculate processing modes, which not only improve the features of a cutting tool and provide satisfactory chip formation, but also extend service life of wheels of metro cars.

**Keywords:** metro, car, wheel set, wrought wheel, recovery of the thread surface profile, cutting modes, optimal temperature.

## **ACCOUNTING FOR LIMITATIONS OF LONGITUDINAL DYNAMICS IN REGULATION OF ELECTRIC TRAIN STARTUP MODE**

**Feoktistov, Valery P., Nevinsky, Aleksei V., Nazarov, Dmitry V.**

**pp. 94 – 100**

Application of non-contact soft regulation for electric train requires control of traction drive taking into account the restrictions on longitudinal dynamics, i. e. the intensity of increase in traction of train's acceleration when it starts moving. This task is solved in a control system using a master element that implements restrictions on the intensity of acceleration growth. A block diagram is shown that provides the implementation of this criterion on digital elements.

**Keywords:** railway, longitudinal dynamics, startup mode, electric train, traction drive.

## **TIME MULTIPLIER IN TRANSPORTATION**

**Macheret, Dmitry A.**

**pp. 102 – 107**

The article reveals the essence of multiplier effect and time multiplier. An example of calculation of time multiplier is provided with the example of travel by

car along 10 km route in the metropolitan city. A comparative analysis of characteristics of time multiplier and traditional, macroeconomic multiplier is given. It is emphasized that considerable values and high volatility of time multiplier can be seen as an evidence of unfavorable situation in the transportation system, and attempts of «smoothing» serve as criteria of improvement of this situation.

**Keywords:** transport, economy, expenses, multiplier effect, time multiplier, speed efficiency, travel time, transport infrastructure.

## **DISTRIBUTION OF DEMAND RELATED RISKS IN ROAD CONCESSIONS IN RUSSIA**

**Sokolov, Maxim Yu.**

**pp. 108 – 120**

The analysis of global and Russian experience of concession agreements in the transport sector shows the high dependence of successful projects on efficient allocation of demand risk between a grantor and a project company. The article describes major factors affecting demand risk distribution regarding Russian road concessions, contains conclusions and assumptions of the author on current and future trends related to the studied components of concession projects, particularly on the transition from the projects with real tolling to availability fees.

**Keywords:** concession, transportation, transport, roads, risk, demand, risk distribution, concession project.

## **PLANNING OF TRANSPORT ACTIVITY BASED ON CONTINUOUS IMPROVEMENT OF BUSINESS**

**Igolnikov, Boris V.**

**pp. 122 – 129**

The main objectives of planning in transport organizations are complete and timely satisfaction of customer needs in transportation, reduction of delivery terms, enhancing the quality of transport services, as well as improving transport links between economic regions of the country. To do this it is offered to include methods of continuous improvement of business and reduction of losses in planning processes.

**Key words:** economy, railway, business planning, minimization of losses, value of processes.

## **EFFICIENCY CRITERION IN LIFE EXTENSION OF TRACTION ROLLING STOCK**

**Krashenin, Alexander S.**

**pp. 130 – 136**

Operating experience of traction rolling stock shows that due to economic and financial problems it is necessary to study the effectiveness of its use in the period, exceeding the standard. The author conducted a research to determine the effectiveness criterion of TRS regarding repair, modernization or replacement. Criterion, based on the dimension theory, enables us to find maximum operation efficiency of traction means in real economic conditions.

**Keywords:** railway, economics, finance, cost recovery, efficiency criterion, traction rolling stock.

## **PROMISING TRANSPORT CORRIDORS BETWEEN CHINA – RUSSIA – EUROPE**

**Kobytkin, Dmitry N., Domansky, Sergey V., Nak, Grigory I.**

**pp. 138 – 145**

Russia turns its gaze increasingly towards Asia and, in particular, aims to find new opportunities in China, which concordant foreign policy is aimed at coupling of potential of Eurasian Economic Union and ambitious project «Silk Road Economic Belt». It is not just a revival of traditional trade routes, but a real infrastructure revolution. Ways of implementing promising potential include also creation of railway lines and trans-shipment centers on the route Shanghai–Sabetta–Kyzyl–Shanghai using the Northern Sea Route and the multimodal port Sabetta in Yamal.

**Keywords:** transport corridor, New Silk Road, economic belt, infrastructure, Northern latitudinal way, Yamal, multimodal port, Sabetta, development strategy.

## **STRATEGIC ASPECTS OF DEVELOPMENT OF TRANSIT AND TRANSPORTATION CAPACITY OF KAZAKHSTAN**

**Kuanyshev, Bakhytzhhan M., Kiselyova, Olga G., Badambayeva, Saltanat E.**

**pp. 146 – 155**

Located in the center of the Eurasian continent, being an important link of a transcontinental bridge between Asia and Europe, and having a sufficient transit capacity Kazakhstan continues to take efforts to implement it while organizing freight delivery from China to Russia and Europe.

In terms of transit potential of the country, the transit volume is not high enough today. This is due to the fact that available transport and logistics infrastructure cannot to full extent serve and meet the country's logistical needs for the total transit volume.

Hence, there is an urgency of solving the tasks aimed at development of transport and logistics infrastructure, in particular at formation of a rational interaction system between all modes of transport, at development of systems of transport and logistics centers, representing key components of quality enhancement of transport complex of the republic as a whole. The article considers existing approaches as well as strategic projects with regard to solution of above problems.

**Keywords:** transit-transport potential, SWOT-analysis, international transport corridor, transport infrastructure, investment, transport and logistics hub, project.

## **INFORMATION SYSTEMS FOR ROAD TRANSPORTATION**

**Kurganov, Valery M., Dorofeev, Aleksey N.**

**pp. 156 – 171**

The article considers the selection of management systems of transportation activities. A review of IT-solutions for the transport and logistics business, existing in the Russian market, is given and an approach is offered justifying the assessment of functional and non-functional characteristics of the system being implemented. It is based on modern methods, which help to select software, which is suitable for targets.

**Keywords:** road transportation, control, information system, analytical hierarchy method, choice of software.

## **CAR AND PEDESTRIAN: CONFLICT CROSSING POINTS**

**Penshin, Nikolai V., Titova, Alexandra A.**

**pp. 172 – 183**

The intensity of traffic and pedestrian flows in the streets of Russian cities, in particular, Tambov, are studied. Conflict points before and after the introduction of bus lanes are considered. Graphs of transport flow intensity are shown with a division into modes of transport, pedestrian flow intensity graph, and composition of a traffic flow as well as conflict points of the most complex intersections with a high coefficient of conflict.

**Keywords:** car, public transport, pedestrian flows, bus lanes, intersection, traffic intensity, safety, conflict points, route passenger transport.

## **METHOD OF DETERMINING CONTAINER SERVICEABILITY OF PRODUCTS**

**Nikonov, Yuri S.**

**pp. 184 – 190**

The concept of container serviceability of products is concretized and a method of determining the degree of its compliance with conditions of transportation, requirements for transportation process based on multicriteria evaluation is proposed. There are three criteria: technological, transport and logistics, and economic. The technique and its projection are refracted in order to strengthen overall management practices and capacities of containerization in the country, which is now behind the world standards.

**Keywords:** transport, container transportation, containerization, container serviceability, evaluation criteria, conceptual apparatus.

## **PROTECTIVE FUNCTIONS OF LOCOMOTIVE INTELLIGENT SYSTEMS**

**Gorobchenko, Alexander N.**

**pp. 192 – 199**

The article focuses on the questions of increasing efficiency and safety of operation of locomotives by reducing the human factor influence on train control. It is proposed to use intelligent decision support systems on board for partial replacement of a driver at the time of making controlling decisions that can protect against risks and threats, provided that those systems comply with technological and ecological modes. An outlook for most comprehensive of use of those systems in future aiming at larger replacement of a driver impact on decision making in such situations is considered.

**Keywords:** railway, locomotive crew, human factor, safety, intelligent control system, decision support, human ecology.



## **ON LOADING OF A TANK CAR SHELL UNDER HYDRAULIC IMPACT**

**Bespalko, Sergey V., Andriyanov, Sergey S., Bogachev, Vyacheslav, I.**

**pp. 200 – 209**

A mathematical model of shunting collision of a tank car is offered, taking into account the possibility of installing automatic couplers with absorbing devices of various types, fluctuations of transported liquid cargo in tank shell at incomplete filling and the likelihood of hydraulic impact. Calculations resulted in proposed choice of rational parameters and of a shape of tank shell bottom which allow increasing carrying load and volume of the tank shell. Scientifically sound limits for impact speed were determined for certain types of shunting operations with tanks to ensure safe working conditions, minimization of environmental risks.

**Keywords:** railway, environmental safety, tank, shell, bottom, hydraulic impact, variational method, finite element method.

## **MECHANISM OF SPLASH FORMATION IN BALLAST PRISM SECTION**

**Abrashitov, Alexander A.**

**pp. 210 – 217**

The article considers a mechanism of conduct of railway track ballast section in the periods between cleaning or replacement of the ballast, investigates possibilities of preventing the formation of splashes, destroying the strength of basic elements and track geometry. Measures and ways are highlighted to prevent emerging threats and risks in terms of safety operation of railways.

**Keywords:** railway track, crushed stone ballast, smoothing, splash, operational safety, engineering solutions.

## **CONSTRUCTION OF A PROBABILISTIC MODEL OF AXLE BOX RELIABILITY**

**Kruglikov, Evgeny P.**

**pp. 218 – 225**

In operation freight car axle box is subject to considerable dynamic forces that determine its relatively low durability and, as a consequence, a rapid transition to a latent state of emergency. The method for constructing a probabilistic model of axle

box reliability allows to determine a moment of axle box transition in the state of failure and to prevent the emergence of a number of negative consequences for cars being on the line: derailment, train accidents, unproductive idle hours of cars, etc. The article found out that distribution law used by the author when checking the axle box life length to failure does not contradict experimental data and performed calculations.

**Keywords:** railway, axle box, safety, accident rate, reliability, distribution law, life length to failure.

## **ANALYSIS OF RELIABILITY OF AXLE BOX BEARING UNITS OF FREIGHT CARS**

**Martynov, Igor E., Trufanova, Alyona V., Shovkun, Vadim A.**

**pp. 226 – 232**

The authors present an analysis of reliability of axle boxes. Provided data characterize its level in relation to the total freight car fleet. The estimation of parameters of failure flow due to damage to roller axle boxes in cars of total fleet compared with universal covered car fleet is given. The question arises on causes of failures and possibility of having a mathematical model that could help in determining the reliability degree of axle boxes.

**Keywords:** railway, car, axle box, roller axle bearing, reliability, failure, analysis of causes, statistical dependence.

## **PREDICTION OF ORGANIZATIONAL LOYALTY OF RAILWAY PERSONNEL BASED ON GLASSER'S THEORY**

**Mohammadzadeh, Abbas**

**pp. 234 – 244**

This study was conducted with the objective of determining the possible applicability of Glasser's theory of choice (needs satisfaction) on prediction of personnel's organizational loyalty. This study was implemented based on descriptive-correlative method and on the survey that engaged 2899 male personnel of Islamic Republic of Iran Railways, residing in Tehran, using simple cluster random sampling and organizational loyalty questionnaire and needs intensity assessment test. Regression analysis and multivariate analysis of variance were used for data analysis. According to the results, a significant relationship exists between Glasser's theory of needs satisfaction and organizational loyalty of railway personnel ( $p < 0.001$ ). The author shows what needs are most significant for prediction of organizational loyalty and suggests recommendations regarding perspective work with the staff.

**Keywords:** railway, Iran, Glasser choice theory, basic needs, organizational loyalty, staff personnel, executive personnel, analysis of variance, survey.

## **METHODS FOR ASSESSING A COMPETITIVE SPECIALIST**

**Shepilova, Elena G.**

**pp. 248 – 254**

It is proposed to break a vicious circle of negative development of industry enterprises (Knall circle) by qualitative growth of human resources of each organization. For that purpose, it is suggested to improve methods for assessing competence of specialists. The proposed mechanism takes into account integral and particular criteria, and is designed to achieve a multiplier effect of development factors interaction.

**Keywords:** railway, industry enterprises, Knall underdevelopment circles, human capital, competence assessment, competitiveness of a specialist.

## **INFRARED NAVIGATION DURING THE WAR**

**Lievin, Boris A., Kudriavtsev, Igor E., Ovcharov, Igor V.**

**pp. 256 – 265**

The first samples of domestic infrared (hereinafter-IR) navigation devices were created in the late 30-ies of XX century in NII-9 (Leningrad) and VEI (Moscow). Since the beginning of 1941 their production for the Navy and Air Force was organized, as the article describes in detail. After the war, the development of IR devices continued resulting in full coverage of the range of electromagnetic waves.

**Keywords:** infrared technology, navigation, photoelectronics, electron-optical converter.

## **INFINITE TALENT**

**Grigoriev, Nikolai D.**

**pp. 266 – 281**

Underestimated by his contemporaries, but a person, who became a source of many brilliant ideas for followers of his talent and civic courage – that is Mikhail Lomonosov seen from today. And there are reasons for it, mentioned by the author of this biographical article.

**Keywords:** history of science, Lomonosov, natural science, physics, chemistry, navigation, academy, university.

## **QUALITY IS A BETTER INCENTIVE THAN PRICE REDUCTION**

**Kurenkov, Petr V.**

**pp. 288 – 292**

**REVIEW OF THE BOOK:** Sokolov, Yu. I., Lavrov, I. M.

Methods of economic assessment of transport service quality of cargo owners in a multiplicity of transportation process' participants. Moscow, Zolotoe sechenie publ., 2015, 168 p.

**ABSTRACT**

**OF THE BOOK.** The monograph provides a set of methods for economic evaluation and quality control of transport service of cargo owners. The terms and condition of the rail transportation market, the specifics of the competition in the presence of a multiplicity of actors and owners of rolling stock are shown.

**ABSTRACT OF THE REVIEW.** The author of the review insists that the value of transport service for cargo owners in modern conditions can be described at two levels. The first one is general economic (e.g. price and non-price methods of promoting sales). The second level is industrial. The fact is that rail transport is transporting products of almost all economic sectors. Therefore, insufficient transport service quality of cargo owners turns into enormous losses in the economy. Through increasing transport service quality, a significant effect shapes out both in transport sector and beyond. Nontransport effect is obtained by cargo owners (reduction of losses, delivery acceleration, etc.), budgets (growth of tax revenues) and other entities. Thus, improving the quality of transport services, that is both scientific and practical problem, is essential to the national economy.

Consequently and see the studies on the quality of transportation services, a transport company should invest in improving quality, while having reliable tools, able to predict customer's reaction. That reaction has the most direct impact on the performance of payback of funds invested in quality improvement. Another urgent problem is evaluation of external effects arising from quality improvement. The author of the review analyzes different aspects of the topic and concludes that the reviewed monograph can be deemed to have made a valuable contribution to understanding and solving of the problems related to the transport quality improvement and its impact regarding different actors.

**Keywords:** economy, transport, transportation process, cargo owners, quality of service, quality management, assessment methods.