

MULTI-STAGE GENETIC ALGORITHM FOR CONTAINER PRE-MARSHALLING PROBLEM

Li Haoyuan, Sun Dongshi

pp. 6 - 15

In order to solve the pre-marshalling problem in container yard, a mathematical programming model and a multi-stage genetic algorithm with binary encoding scheme are required. In the proposed algorithm, the objective function is designed via the definition of confuse coefficient; several heuristic operators provide development of necessary methodical and operational actions. The way how to achieve better solutions is shown at the example of two researches, confirming the efficiency of genetic algorithm with binary encoding as an optimizer to construct a container pre-marshalling model.

Keywords: sea transportation, terminal, container, pre-marshalling, genetic algorithm, binary encoding, mathematical model, heuristics.

OPTIMIZATION OF TECHNOLOGICAL PROCESSES

Popov, Alexander P., Popova, Tatiana A.

pp. 16 - 25

This article considers problems of structural optimization of technological processes, possibility to take into account arising uncertainties, applying decision-making theory. Basing on the analysis of different methods, the authors developed a mathematical model for multicriteria structural optimization of promising technological processes. The implementation algorithm of proposed procedure is shown, which allows to find an ordered set of full routes, based on nondecreasing sequence of their lengths. The flexibility of solution search is provided by possibilities of structuring method and iterative nature of their calculation.

Keywords: decision-making theory, optimization tasks, mathematical model, network graphs, structural optimization, algorithm, system, AMACONT.

WAVES OF RAILWAY INNOVATIVE DEVELOPMENT

Izmaikova, Anastasia V.

pp. 26 - 38

The article considers the need to strengthen innovative development of railway transport. There are examples of a new type of innovations identified by the author – synergies that open up opportunities for radical social and economic changes. Technological revolutions and their impact on industry economy are examined. Basing on comparing a retrospective analysis of innovation with phases of techno-economic paradigm shifts and great surges of Carlota Pe'rez, «great cycles» of Kondratiev, phases of railway evolution graphic model of innovative development of railway transport is generated. «Engine» of upcoming changes can be powered by synergistic innovations – new vehicles and technologies, resulting in hybridization of various modes of transport, followed by consolidated socio-economic effects.

Keywords: railway transport, innovation theory, synergetic innovations, Kondratiev cycles, technological revolution, economic growth, evolution phases.

INNOVATIVE WAYS OF FINISHING OF ROLLING STOCK ASSEMBLY PARTS

Evseev, Dmitry G., Kulikov, Mikhail Yu., Inozemtsev, Vitaly E.

pp. 40 - 49

A method of providing the quality of surface of assembly parts made of non-ferrous metals and their alloys is developed. A scheme of unit is determined, providing the necessary conditions of machining, designed for combination of mechanical and anode impact on the workpiece surface. Complex technology allows to achieve a set of qualitative characteristics and widely vary parameters in the operations of both turning and milling.

Keywords: transport machines, processing of assembly parts, machining, finishing, aluminum, silumin, turning, milling, quality parameters, surface roughness, electrolyte, cutting speed.

FREIGHT TRANSPORTATION: CALCULATION OF POWER INTENSITY OF TRANSPORT OPERATION

Voskresensky, Igor V.

pp. 50 - 57

In addressing the issue of energy saving in transport there is a dilemma: either to increase speed of motion (delivery), and to reduce time when the goods are in the process of product distribution, or to reduce power intensity of transport services. The article analyzes the use of a measuring instrument of transport work – «tran».

Calculations are provided, proving its inadequacy to evaluate energy consumption, especially in the presence of logistics systems and the established order of supply chains service. In the context of logistics neither tonne-kilometres, nor «tran» are critical, as in the background of maximum possible reduction of total cost of product distribution, rather synchronization of operations to ensure continuity and effective technical support (including power intensity) of the transport process becomes determining.

Keywords: car, freight transportation, «tran», power intensity of transport operation, delivery speed, alternative indicators.

MODERNIZATION OF CARGO BOGIES: MOUNTING OF A TRANSVERSE CONNECTION ASSEMBLY

Petrov, Gennady I., Chernyaev, Nikita Yu., Meshcheryakov, Mikhail A.

pp. 58 - 62

The authors offer design of transverse connection assembly in the bogie of type 18-100 of a cargo car. The aim is to eliminate lozenging of side frames, reduce intensity of sinuous movement, vibration load and wear of parts and assemblies, improve smoothness, as well as eliminate pendular oscillations of side frames with respect to their own longitudinal axes (thus facilitating also the operation mode of bearing units and cast bearing elements). Modernization of a bogie by mounting transverse connection assembly, as well as replacing axle bearings with cassette-type bearings and adapters of MIIT design with wear-resistant vibration absorbers, assumes to substantially increase guaranteed overhaul life of freight cars.

Keywords: railway, freight car, bogie, side frame, bolster, modernization, transverse connection of side frames, wear of units and parts, overhaul life.

LAYING OF CONTINUOUSLY WELDED RAIL TRACK IN EXTREME CLIMATIC CONDITIONS

Stoyanovich, Gennady M., Pupatenko, Victor V.

pp. 64 - 78

The article considers issues of track laying in extreme climatic conditions of Trans-Baikal region, features of heavy trains and new locomotives of Ermak type operations at Zabaikalskaya railway [Trans-Baikal branch of JSC Russian Railways]. The interrelation of key indicators for the construction of continuously welded rail track (CWR) is set. They include stress-free temperature, annual temperature amplitude, critical radius and speed of traffic. Technical solutions are suggested that provide electric locomotives with necessary dynamic, speed and other performance characteristics, as can allow well as reduction of the cost of laying and maintenance of CWR.

Keywords: railway, electric locomotive, continuously welded rail track, CWR, critical radius, temperature of strings fixing, Trans-Baikal region, climatic conditions.

STRENGTHENING OF RADIO COMMUNICATION INTERFERENCE IMMUNITY BY CLIPPING BM VOICE SIGNAL

Volkov, Anatoly A., Kuzyukov, Vasily A., Morozov, Maxim S.

pp. 80 - 84

The paper continues research aimed at increasing interference immunity of railway service radio communication. Previously proposed method of clipping referred to single-sideband voice signal with frequency modulation (hereinafter – FM). Now the article refers to double-sideband signal with a balanced modulation (hereinafter – BM). The same gain in fighting interference is proved. Correlation technique allows evaluating harmonic distortion at clipping BM signal. Such an assessment has not existed yet. Analytically, it is shown that application of the method is equally effective for single-sideband and double-sideband voice signals: interference immunity grows by 4,33 times, the level of harmonic distortions is the same (7,4%).

Keywords: railway, radio communication, clipping, single-sideband signal, double-sideband signal, frequency modulation, balanced modulation, coherent detector, interference immunity, harmonic distortion.

REDUNDANT LOCOMOTIVE TRACTION DRIVE

Milovanova, Evgenia A., Milovanov, Aleksey A., Milovanov, Aleksey I.

pp. 86 – 98

The main purpose of the presented work is to study the possibility of using for rail transport (in particular, for development of promising structures and components of locomotive traction electric drive) of new technical solutions for transmission gears.

A design development of gear drive is offered with high processability indices for manufacturing and operation. The possibility of implementation of layout diagram of traction drive with parallel power flows the basis of this gear drive is shown.

Keywords: railway, locomotive, gear drive, traction drive, layout scheme, parallel power flows, redundancy.

LOGISTICS PRINCIPLES AND BUSINESS INTERACTION BETWEEN ROLLING STOCK OPERATORS AND CARGO OWNERS

Eliseev, Sergey Yu., Shatokhin, Andrey A.

pp. 100 - 113

Transportation market links closely economic and transportation processes. Consumer demand dictates the conditions, but it also stimulates carriers to improve organization of production and logistic support of goods movement on railways. In particular, this concerns loading / unloading of cars – with greater dependence on stochastic factors. The presence of such dependence leads to non-productive costs, economic losses. The article shows how to optimize distribution of traffic volumes, helping minimizing costs and maximizing revenue growth in the framework of interaction of operating companies and cargo owners.

Keywords: railway, economics, logistics, freight transportation, transport business, stochastic factors, non-productive costs, profit, costs, operators, cargo owners, interaction, coordination.

TRANSPORT DISCOUNTERS: HOW IT WORKS

Erikhov, Mikhail M., Kardinalova, Olga K.

pp. 114 - 123

Ideas of discounterism, in researchers' opinion, have emerged as a response to market's «glut», excess of supply over demand. And to some extent the elements of

discount technology have been used by carriers of goods and passengers for over half a century. The authors correlate the scientific understanding of market relations with myths (four of them are reviewed) and prejudices about companies-discounters, give their opinion on their practices and pricing policies, economic assumptions of the existence of this phenomenon in the transport business.

Keywords: transport, transportation, economics, business, company discounter, myths, reality, flexible technologies, perspectives.

LOGISTICS REVERSE GOODS FLOWS: CAUSAL RELATIONSHIP

Pavlova, Elena I., Mamedova, Irada A.

pp. 124 - 131

The authors introduce reverse logistics as a tool of management of reverse goods flows. The article reviews main causes of emergence of reverse goods flows and recycling processes, approaches to assessment of economic efficiency of renewing of lost cost value of reversed goods, as well as of its customer-focused quality. The authors put arguments in favor of development of reverse logistics, mathematical models, optimization criteria which will help to achieve target cost and profit objectives of reverse goods flows operations. The accent is made on related transportation issues as well.

Keywords: goods flow, logistics control, reverse production flows, waste recycling, reverse logistics, costs, profits, economic effect.

ROAD USE FEE AS A PART OF TAXATION MECHANISM

Reshetova, Ekaterina M.

pp. 132 - 144

Maintenance and development of road networks requires significant financial investments. The article gives a retrospective analysis of the views of well-known foreign scientists to sources and mechanisms of road facilities funding. Main road taxes are considered, which are levied directly at the place of travel, enabling not only to solve problems of road sector financing, but also to regulate, which is especially important in the current realities, supply and demand for capacity of the road network. The estimation of the use of tax per km is given.

Keywords: road facilities, tax sources, internalization of externalities, corrective taxes, Vickrey's system of tolls, transport behavior of users, tariff rate, fee for passage of vehicles, per km universal tax, tolls.

ON PROCESSES OF TRAIN BREAKING-UP AND THEIR IMITATION

Kuznetsova, Irina A., Kossov, Evgeny E.

pp. 146 - 159

The basic features of train breaking-up at a hump yard, method of determining indicators for a diesel locomotive with account of variable weight are shown. The calculation results regarding the developed algorithm are given in the presentation of the hump yard work in the form of individual modes and analysis of fuel consumption and time of operations against transients. A comparison of shunting hump operations (thrust – breaking-up) at the example of diesel locomotives CHME3 and TEM7 is performed, the criterion of evaluation of the use of a certain type of a locomotive is proposed.

Keywords: railway, station, hump yard, shunting locomotive, individual mode, thrust, breaking-up, variable weight of a train, simulation.

PROSPECTS FOR PASSENGER RAILWAY STATIONS IN METROPOLITAN AREAS

Abdullaev, Ildar S.

pp. 160 - 167

Based on brief historical journey, comparative analysis of passenger stations operation in foreign countries and Russia the article determines a basic problem of railway facilities in metropolitan areas, that is presence and rapid development of urban infrastructure. An approach to solve the problem is proposed and justified: construction of two-level passenger stations. At the example of station Moscow-Passenger the analysis of its work before and after reconstruction is carried out, prospects of further development are determined.

Keywords: railway, train station, reconstruction, metropolitan area, passenger transportation, two-level station, loading of necks, receiving and departure tracks.

TRAFFIC ORGANIZATION: PASSENGER FLOW AND ACCIDENT RATE

Penshin, Nikolai V., Titova, Alexandra A.

pp. 168 - 183

The article studies problems of passenger flows in medium sized towns. At the example of Tambov, the authors analyze passenger traffic by the hour of day, day of

the week, the length of the route. Data are presented in the form of graphs. Also the accident rate is studied, a graph of accident rate is constructed. Economic effects regarding road safety are calculated. The relationship between some technical and administrative decisions and accident rate are studied and conclusions are suggested in order to enhance safety conditions of passengers.

Keywords: bus, trolley bus, public transport, road safety, urban route, passenger traffic, speed of communication.

THE CHOICE OF SOLUTIONS FOR MODERNIZATION OF CONTROL CIRCUITS OF METRO CARS' ENGINES

Veselov, Pavel A.

pp. 184 - 190

The urgency of the problem of energy efficiency of metro resulted in multiple studies on the possibility to use regenerative braking in the metro.

The article analyzes new project developed at the Department of Electrical Transport of National Research University «MPEI» that suggests the use of IGBT transistors in engine control scheme of metro cars. This option should contribute to the achievement of a number of advantages, and commonality of the proposed technical solutions in relation to serial cars 81-717/14 allows to give «new life» to cars which have not exhausted their service life, but which technical capabilities are obsolete as compared to a new generation of trains and modern technical requirements for their operation.

Keywords: metro, regeneration, recuperation, IGBT, engine control circuits, energy efficiency, modernization of trains

PROGNOSTIC ASSESSMENT OF COMMUNICATION CHANNEL TRANSIT CAPACITY

Safonova, Irina E., Goldovskiy, Yakov M., Zhelenkov, Boris V.

pp. 192 – 197

A new method is proposed to perform predictive assessment of communication channel capacity in order to minimize transmission time in telecommunication network, to identify «bottlenecks» and redundancy of throughput resource in the design phase. Appropriate calculations are made, evaluation criteria of network performance and their elements are justified, as well as delay coefficient of network equipment. The results of experimental verification showed that obtained calculated values of the quality of network services for different types of information meet the requirements of ITU-T G.1010 recommendations.

Keywords: communication channel, telecommunication networks, capacity, traffic, transmission delay, redundancy, communication media, network device.

FEATURES OF REGULATION OF SHUNTING OPERATIONS IN THE STATION SIMULATION MODEL

Shmulevich, Mikhail I., Starikov, Aleksey E.

pp. 198 - 212

When building a simulation model of the railway station or the junction one of its mandatory elements is duration of shunting operations. With the help of AnyLogic modeling system to assess this position it is necessary to consider the accounting method for acceleration and deceleration of shunting train in half-run. Moreover, the method used must comply with the rules of calculation adopted in the AnyLogic, requirements of existing procedures for regulation of shunting operations (taking into account emerging constraints). The article describes a way to solve this problem, satisfying these requirements. At the same time adjustment of some of the inaccuracies contained in the current method is proposed.

Keywords: railway, station, shunting operations, regulation, duration of half-run, modeling, system AnyLogic.

REMOVING HYDRAULIC IMPACT RISK IN COOLING SYSTEM OF DIESEL ENGINES

Kiseliov, Valentin I., Slivinsky, Evgeny V., Radin, Sergey Yu.

pp. 214 - 220

Technical solution is proposed to ensure safe operation of diesel thanks to improved hydraulic drive system of a fan. The achieved cooling effect can eliminate such a negative phenomenon peculiar to hydraulic systems, as hydraulic impact, to avoid damage to pipelines under all application modes of hydraulic drive. The article describes operation principles and design characteristics of a damping device of fan hydraulic drive of locomotive's diesel cooling system. Recommendations regarding its application are suggested.

Keywords: locomotive, diesel engine, cooling system, hydraulic impact, fan, hydraulic drive.

NOISE IN LOCOMOTIVE CABINS: EQUIVALENT DEPENDENCIES

Losavio, Natalia G., Vasilieva, Daria N.

pp. 222 - 229

The aim of authors' study was to set dependencies of equivalent levels of sound (noise) in cabins of different types of locomotives on operational life and year of manufacture of rolling stock. By measuring checkable parameters in certain work areas and by conducting calculations, as well as with account for assessment of work places of drivers and their assistants, a conclusion was drawn on the lack of direct dependence between values of noise indicators and operational life, as well as year of manufacture the rolling stock.

Keywords: labor safety, locomotive, noise level, operational life, year of manufacture, dependencies of parameters, certification of worksites.

IMPROVING TECHNICAL REQUIREMENTS FOR PASSIVE PROTECTION SYSTEMS OF ELECTRIC TRAINS

Bespalko, Sergey V., Gordeev, Mikhail A.

pp. 230 - 237

The analysis of interstate standard «Accident crash systems of railway rolling stock for passenger transportation», earlier applied standards, as well as international experience of similar regulations was conducted, proposals to improve technical requirements for systems of passive protection of passenger trains were developed, including their standardized versions. This is done by taking into account scenarios of rolling stock emergency collisions simulated by the authors.

Keywords: railway, passenger train, car, passive safety, norms, standards, collision scenarios, crash system, emergency situation, statistics, modeling.

REJECTION CRITERIA OF CAST PARTS

Malovichko, Vladimir V.

pp. 238 - 249

The author examines the causes and patterns of situation with the growing number of fractures of bogie's side frame. The author proposes measures to improve reliability of cast parts in order to prevent possible defects and improve traffic safety. The article concerns factor analysis of reasons influencing fractures of bogie's side frames, development of rejection criteria by means of non-destructive testing of cast

parts to detect internal defects in them, as well as use of radiation monitoring method in the course of diagnosing.

Keywords: railway, traffic safety, freight cars, cast parts of bogies, fractures, rejection criteria, non-destructive testing.

DYNAMICS OF PASSENGER ELECTRIC LOCOMOTIVE TRACTION DRIVE

Rybnikov, Evgeny C., Vakhromeeva, Tatiana O.

pp. 250 - 256

Problems with mounting of electric locomotive traction motors threaten railway safety. The authors analyze the nature of destruction of fastening bolts and brackets, and formulate a number of working hypotheses explaining causes of destruction. The theoretical significance of the article is to examine the conformity of a design scheme used to determine forces acting on elements of the supporting structure, with actual reactions occurring in the bearings. Particular attention is paid to possible emergence of periodic disturbances in traction drive from clutch taking into account gyroscopic moments, occurring when it is rotating. On the basis of dynamic calculations conclusions are suggested about the causes of destruction of mounts and about what scheme of traction motor fastening to the bogie frame is rational, especially for high-speed modes.

Keywords: railway, safety, mounting of traction motors, system «bogie frame – traction motors», dynamic analysis, clutch gyroscopic moments, clutch imbalance, statically indeterminate mounting scheme.

RAILWAYS AS AN INSTRUMENT OF WORLD WAR II GEOPOLITICS

Fursov, Kirill A.

pp. 258 - 269

The article deals with geopolitical theories of K. Haushofer and H. Mackinder and place of railways in them, with a number of railway projects of the Second World War in Europe and Asia, the role of rail routes in the plans of belligerents, logistic support of front-line operations, as well as in the Allied victory over the powers of the «axis». The author draws a conclusion on railway transport mission in terms of geopolitics, state strategy and military logistics.

Keywords: railways, geopolitics, World War II, geopolitical beam, communication routes, strategy, logistics.

KERCH BRIDGE: TIME AND SEA

Krainov, Grigory N.

pp. 274 - 286

From the Cimmerians to the present day – in the range of times and epochs the author appreciates the emergence of the idea of building a bridge across the Kerch Strait and its implementation in the real world of geopolitics and historical events over the years. Central place in the analysis is occupied by the period of the Great Patriotic War. The experience gained at that time, the comparison of appeared design alternatives (including already at a later time) allow to judge optimistically about the beginning of work on a new project of the bridge.

Keywords: transport, bridge building, the Great Patriotic War, Kerch bridge, retrospective, fight of alternatives.

STEEL SHOULDERS CAN REINFORCE THE COMMON ENVIRONMENT

Rudneva, Svetlana E.

pp. 288 - 292

REVIEW OF THE BOOK: Khmelev, V. V. Influence of Railway Transport on Service Space: Monograph. Moscow, INFRA-M publ., 2015, 108 p.

ABSTRACT OF THE BOOK. The work englobes voluminous subject. The author describes organization methods to achieve comprehensive state of Russian society. Modern conflicts are revealed as a result of incompetence of management systems focused on technocratic approach, while humanitarian approaches are mostly ignored. A suggested model supposes introduction of civilitarian order that includes social justice, reasonable sufficiency, equal weightiness. The author argues that civilism together with railway development can renew the role of a human for the well-being of the country.

ABSTRACT OF THE REVIEW. The book, published in the series «Scientific Thought», is devoted to the problems of viability of social spaces, the role of transport (primarily railways) in development, arrangement of habitat, industrial activity of people, development of new promising areas with high natural and industrial potential. From this perspective, the author focuses on the concepts of the value of life on the planet, emergence of a service space as an alternative to modern conflict situations, using the model of civilitarian order, criteria of equal weight, reasonable sufficiency and social justice. The book presents a plan for revival of small railway stations to maintain and expand small settlements, semiabandoned in times of crisis (transition).

Keywords: transport, railway, habitat, service space, lifesaving resource, service industry, people, social groups, society, territory.