

Група В

Asenov, A., Pencheva, V., Georgiev, I., PLANNING AND MODELING OF THE TIME FOR ACCEPTANCE AND STAY OF VEHICLES AT THE LOADING AND DISCHARGING POINTS, 2021, Transport Problems, 16(4), pp. 23-34

Summary. When delivering goods in the warehouses of enterprises, courier and forwarding companies, and for logistics operators, loading and unloading is usually done manually or mechanically. On the other hand, the load can first be placed on the ground next to the vehicle and then accepted in the pile, or a ramp can be used so that it can be delivered directly to the warehouse or vice versa. When there is a ramp, the loading and discharging activity is performed faster and it is much easier. When there are many vehicles serviced on ramps, it is necessary to have a free ramp available. This is often not the case when the warehouse has more ramps and a large exchange of goods. In this case, a time schedule is usually made for the reception and handling of vehicles, which is communicated to carriers and drivers so that there is no unnecessary downtime of vehicles and overloading of points with ramps. There are cases in which the established organization of work cannot be performed due to various force majeure or other reasons, such as delays at border crossings, bans on passing through certain sections, change in the working hours of warehouses, pandemic and other reasons. The vehicles then arrive at the checkpoints at a time that is different from their schedule and have to wait to be serviced. Waiting at the unloading points makes drivers nervous and they become dissatisfied with the working conditions. In this respect, a solution has been proposed based on the working hours and occupancy of the loading and discharging point and the time of arrival of the vehicles at the point, and how to receive the vehicles so that the waiting time between them is the shortest. For this purpose, a partially integer linear optimization model has been created in Matlab, which provides a valid plan with the shortest waiting times for all vehicles. Simulations have been made for different numbers of ramps and vehicles. The results show that the model is suitable for pre-creating a valid plan for the operation of the vehicle warehouse, if any, with a minimum waiting time.

http://transportproblems.polsl.pl/pl/Archiwum/2021/zeszyt4/2021t16z4_03.pdf

<https://www.scimagojr.com/journalsearch.php?q=21100223305&tip=sid&clean=0>

Georgiev, I., Asenov, A., Pencheva, V., Optimizing the working hours of drivers in public transport of passengers, 2022, AIP Conference, Proceedings, 2459, 030007

ABSTRACT

In public passenger transport on urban and long-distance routes in municipalities, differences often occur in the total working time of drivers on routes. This creates preconditions for dissatisfaction between drivers because they have a different workload, and often calculated wages are not tied to time or if they are, they are tied proportionally to the work done. In order to avoid this, it is necessary that the working time of the drivers to be the same. There are cases where this is not possible for objective reasons relating to the length of routes, running time, business of the streets, etc. It is therefore necessary to find such a solution where the difference in weekly working time between the driver worked the most time and the driver worked the least time on the routes in question to be minimal. In this regard, a mathematical model has been developed, which is partly an integer non-linear task. Such tasks are solved using different methods and a mathematical apparatus,

but in this case a technique of integer optimisation is applied, by which the task is reduced to linear, with additional binary variables introduced. Increasing the number of variables and solution to the task through a classic approach often leads to the use of a greater amount of time to solve, which is sometimes undesirable. In this regard, heuristic algorithms have been used to solve Mixed-integer Linear Programming (MILP). The choice of heuristic algorithms is determined mostly by the size of the task. The calculations in this paper have been made with Matlab version 2017b's with the built-in intlinprog feature, which has different heuristic algorithms to solve MILP. The calculations made are for the weekly work of bus drivers in a municipality and show that the difference in the maximum and minimum working times on the routes in question can be successfully minimized.

<https://aip.scitation.org/doi/abs/10.1063/5.0083543>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Georgiev, I., Grozev, D., Pavlov, V., Veleva, E., Comparison of heuristic algorithms for solving a specific model of transportation problem, 2020, AIP Conference Proceedings 2302,060004

ABSTRACT

A specific transportation problem is presented in the paper. A commonly used variant for the cost value determination is analysed. A Matlab code for solving this specific transportation problem by the heuristic algorithms is developed. The optimization model used is related to solving a problem with nondeterministic polynomial-time (NP) hardness and large dimension. A comparison of different heuristic algorithms for solving this problem is made. Results are commented.

<https://aip.scitation.org/doi/10.1063/5.0033505>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Veleva, E., Georgiev, I.R., Seasonality of the levels of particulate matter PM10 air pollutant in the city of Ruse, Bulgaria, 2020 AIP Conference Proceedings 2302,030006

ABSTRACT

High levels of air pollutants PM10 are a problem of great importance for human health. During the months from April to September of the period 2010 - 2019 the levels in Ruse remain within the norm in 95% of the days. During the other, "cold" months of the year, only 58% of the days have values below the daily norm of 50µg/m³. When planning their activities, it is useful for people to have forecasts for PM10 levels in the coming days. Markov chains allow such predictions to be given in a tabular form, convenient to use, without the need for calculations.

The data for the "cold" months are modelled using three Markov chains with different degrees of discretization of the original values, respectively with 12, 7 and 3 possible states. The latter, with states: {in the norm}, {slightly above the norm} and {a strong excess of the norm}, can be used without official data on the exact PM10 levels. Determining the condition of the PM10 pollutant today in this case can also be done on the basis of a personal assessment of the purity of the air over the city at the moment.

The measured levels in the period 01.01.2020 - 31.03.2020 were used as test data. They show consistency of the measured levels in 2020 with all three Markov chains considered. The obtained tabular values can be used to predict PM10 levels in the following years, in the months from October to March.

<https://aip.scitation.org/doi/10.1063/5.0033628>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Centeno, V., Georgiev, I.R., Mihova, V., Pavlov, V., Price forecasting and risk portfolio optimization, AIP Conference Proceedings, 2019, 2164, 060006

ABSTRACT

Nowadays, the stocks trading is very popular. That is why the problem of forecasting assets' prices is of a special scientific interest. ARIMA (Autoregressive Integrated Moving Average) models for forecasting the stock prices are presented in this paper. For every model the expected return of the shares is calculated and the variance of the rate of returns is analyzed based on a given historical data. Quarterly data on stock prices of the four biggest banks in the United States, that are classified by total assets, are examined for the period 01.01.2014 – 01.04.2019. An optimization problem is formulated, that is based on Harry Markowitz's model. The solution of this problem leads to finding an optimal risk portfolio for one period ahead and gives an estimate value of the expected rate of return. Depending on the coefficient of risk aversion, a comparative analysis of the structure of a complete portfolio of a risky and a risk-free asset is made. A Matlab programming code is developed, giving the results for an optimal risk portfolio with n assets.

<https://aip.scitation.org/doi/10.1063/1.5130808>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Veleva, E., Georgiev, I.R., Zheleva, I., Filipova, M., Markov chains modelling of particulate matter (PM10) air contamination in the city of Ruse, Bulgaria, 2020, AIP Conference Proceedings 2302, 060018

ABSTRACT

High levels of air pollutants PM10 are a problem of great importance for human health. During the months from April to September of the period 2010 - 2019 the levels in Ruse remain within the norm in 95% of the days. During the other, "cold" months of the year, only 58% of the days have values below the daily norm of $50\mu\text{g}/\text{m}^3$. When planning their activities, it is useful for people to have forecasts for PM10 levels in the coming days. Markov chains allow such predictions to be given in a tabular form, convenient to use, without the need for calculations.

The data for the "cold" months are modelled using three Markov chains with different degrees of discretization of the original values, respectively with 12, 7 and 3 possible states. The latter, with states: {in the norm}, {slightly above the norm} and {a strong excess of the norm}, can be used without official data on the exact PM10 levels. Determining the condition of the PM10 pollutant

today in this case can also be done on the basis of a personal assessment of the purity of the air over the city at the moment.

The measured levels in the period 01.01.2020 - 31.03.2020 were used as test data. They show consistency of the measured levels in 2020 with all three Markov chains considered. The obtained tabular values can be used to predict PM10 levels in the following years, in the months from October to March.

<https://aip.scitation.org/doi/10.1063/5.0033630>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Pencheva, V., Asenov, A., Georgiev, I., Multiobjective modelling in choice of route and vehicle for public city transportation for minimum travel time, low cost and energy consumption, 2020, 2020 7th International Conference on Energy Efficiency and Agricultural Engineering, EE and AE 2020 – Proceedings 9279062

Abstract:

There are more than 1.5 million trips in the Republic of Bulgaria using urban passenger transport per day, with 1 688 230 trips recorded in 2017. On these trips, passengers are often faced with the choice for route and vehicle. This is especially true for multimodal travel. A number of factors influences this choice. On the one hand, it is the result of technical, time, financial and environmental constraints, the quality of the transport service and the socio-economic characteristics of the passenger. On the other hand, the different perspectives of individual travelers who try to satisfy their individual preferences must be considered. In recent times, this has been often linked to the public interest in sustainable development, including sustainable transport. In this paper is shown a multi-criteria optimization for the choice of passenger journeys according to three criteria (minimum travel time, low cost and energy consumption) with options for choosing number (n) types of vehicles. As a result, the options for passenger journey (Pareto optimal decisions) are obtained and therefore are given opportunities to the person who takes decisions (passenger) to choose one of these solutions.

<https://ieeexplore.ieee.org/document/9279062>

Zaharieva, S., Georgiev, I., Stoev, I., Modified Approach for Predicting the Temperature in Residential Premises, 2021, 2021 29th Telecommunications Forum, TELFOR 2021 – Proceedings

Abstract:

This article presents a modified approach to predicting the temperature in residential premises in order to minimize the financial costs of a household for electricity. The approach is based on the numerical solution of simple differential equations. The temperature change is considered as a time series. This time series is modeled by a simple differential equation of a special type. Determining the coefficients in the form of the differential equation makes it possible to predict future temperature values. The presented approach makes it possible to operate with a large set of parameters, which

makes it widely applicable in forecasting, both in engineering practice and in other areas. The software product Matlab was used for the needs of the research.

<https://ieeexplore.ieee.org/document/9653330>

Г група

Veleva, E., Zheleva, I., Georgiev, I., Decomposition techniques for modelling the levels of particulate matter PM10 air pollutant in the city of Silistra, Bulgaria, 2020, AIP Conference Proceedings 2302,060019

ABSTRACT

For the studied average monthly values of the levels of the air pollutant PM10 in Silistra in the period 01.2015 – 12.2019, two modern methods for decomposition were used - X-13ARIMA-SEATS and STL. The trend-cycle and seasonal component of the series were estimated in a total of 24 different ways – 8 models with the X-13ARIMA-SEATS approach with two seasonal adjustment options each – X11 and SEATS and 8 with the STL method. A comparative analysis was made between them, both in terms of estimating the components of the decomposition and in terms of the quality of approximation of the predicted values for the first six months of 2020 to the actually observed ones. In 23 out of 24 assessments of the trend- cycle component, a decreasing trend is observed, followed by a slightly increasing trend in the last year and several months of the period 2015–2019. The STL method yielded better forecast results for the first six months of 2020, using the default settings in the corresponding functions of R programming language. The estimated trend-cycle component by STL method is significantly smoother than that by method X-13ARIMA-SEATS.

<https://aip.scitation.org/doi/10.1063/5.0033631>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Manukova, A., Georgiev, I., Marinov, M., Statistically Based Criteria for Complex ECG Signal Assessment at Preventive Cardio Control, 2020, ACM International Conference Proceeding Series, pp. 169-174

ABSTRACT

The article presents the main studies, statistical results and justification of the criteria for complex evaluation in the analysis of electrocardiographic signals of clinically healthy people in preventive control to determine the current cardiac abnormalities. The presented study and statistically valid criteria are part of a software system for the evaluation of the individual medical information from the real life of healthy people and a specific method of analysis of the results.

<https://dl.acm.org/doi/10.1145/3407982.3407985>

[ACM International Conference Proceeding Series \(scimagojr.com\)](https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0)

Kostadinova, V., Georgiev, I., Mihova, V., Pavlov, V., An application of Markov chains in stock price prediction and risk portfolio optimization, 2021, AIP Conference Proceedings, 2321,030018

ABSTRACT

Trading with securities and stock indices gains a lot of popularity these days. Every investor's dream is to know the future prices of financial instruments. This paper attempts to apply a Markov chain model to forecast the trends in the stock prices. Markov chain models are obtained for the prices of 3 different stocks based on probability transition matrix and initial state vector. Quantitative data on the daily closing share prices of the stocks is obtained for the period 01.01.2019-31.12.2019. The analyzed stocks are further mixed up in an optimal risk portfolio. An analysis of risk aversion coefficient and how it influences the choice of complete portfolio is made. Such an approach could be applied in future studies on this matter as well as in the practice of portfolio managers and investors.

<https://aip.scitation.org/doi/10.1063/5.0041119>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Georgiev, I., Veleva, E., Modeling the effect of measures to limit the spread of infectious diseases, 2021, AIP Conference Proceedings, 2321,030008

ABSTRACT

This article aims to model and study the effect of the strength, time and duration of the restrictive measures for the spread of an infectious disease. The inconveniences, economic losses and gaps in education are the price that society pays to prevent the spread of the virus. It is important that restrictive measures cover the shortest possible time interval, at the most appropriate time, in order to have minimal negative consequences for society, and at the same time to be effective against the spread of the virus. We consider as a basis the SIS compartmental model for the spread of a virus and apply numerical experiments assuming that, unlike the classic model, the transmission rate α is a monotonically decreasing function of time. Numerical experiments show that earlier introduction, greater stringency and a shorter period of adaptation to restrictive measures until they enter into force would lead to a smaller proportion of infected people, a shorter period of implementation of measures and small economic losses.

<https://aip.scitation.org/doi/abs/10.1063/5.0040415>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Pencheva, V., Georgiev, I., Asenov, A., Evaluation of passenger waiting time in public transport by using the Monte Carlo method, 2021, AIP Conference Proceedings, 2321,030028

ABSTRACT

The paper proposes the use of a simulation based on the Monte Carlo method to determine the waiting time of a passenger vehicles in urban passenger transport. The method is based on real data

on the operation of urban passenger transport in the conditions of Ruse, Bulgaria. The given test results were obtained with the software product Matlab R2017b. Adjustments to the vehicle schedules may be made on the basis of the results obtained from the test. These corrections lead to the development of more accurate timetables, which has a positive impact on the quality of the transport service.

<https://aip.scitation.org/doi/abs/10.1063/5.0040097>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Zaharieva, S.L., Radoslavov Georgiev, I., Borodzhieva, A.N., Angelov Mutkov, V., Classical Approach for Forecasting Temperature in Residential Premises Part 1, 2021, 20th International Symposium INFOTEH-JAHORINA, INFOTEH 2021 – Proceedings 9400519

Abstract:

This paper presents classical approach for modelling based on time series used as a tool for predicting temperature changes in residential premises. Based on calculations in MATLAB, temperatures are predicted at six points, which are located symmetrically three by three, opposite each other. The forecasting aims to reduce the cost of electricity in a household.

<https://ieeexplore.ieee.org/document/9400519>

Zaharieva, S.L., Radoslavov Georgiev, I., Borodzhieva, A.N., Angelov Mutkov, V., Classical Approach for Forecasting Temperature in Residential Premises Part 2, 2021, 20th International Symposium INFOTEH-JAHORINA, INFOTEH 2021 – Proceedings 9400674

Abstract:

This paper presents the choice of a prediction model using ARIMA time series forecasting approaches. These approaches have been used as a tool to predict temperature changes in residential premises. Based on calculations using the software product IBM SPSS, the temperatures at six points in the residential premises are predicted. The software product MATLAB was used to construct the equations of the functions approximating the temperature in a formed cross section of six symmetrically located points in an interval of one hour, every ten minutes.

https://ieeexplore.ieee.org/document/9400674?fbclid=IwAR08Xq9BdXlgy564VpgXi0VOU0Zu9aXSm6qMFsrNerqxsSe2EM9_5wL-GDg

Georgiev, I., Centeno, V., Mihova, V., Pavlov, V., A modified ordinary differential equation approach in price forecasting, 2022, AIP Conference Proceedings, 2459, 030008

ABSTRACT

For the assets' prices analysis proposed on the financial markets, it is common to use big amounts of data. By making those observations, the movement of the prices can be predicted. Working with big data sets requires more complicated forecasting methods based on numerical methods for solving ordinary, partial, and stochastic differential equations. This paper presents a modified ordinary differential equation approach with different forms of polynomials and periodic functions. The coefficients of the studied forms are calculated using Weighted Least Squares Method. Different variants of parameter settings are considered depending on the time of the horizon chosen by the researcher and the weight function assigned to the observations. Of the set of possible solutions about the model coefficients, those that give the best approximation on the test data are suggested, with the help of a weighted error. This approach is empirically tested to forecast the trends in the stock prices. A validation is made that allows to be chosen the best decision from the whole set of possible decisions, which are calculated by the Nonlinear Least Squares Method. That method is used for finding the coefficients of the model. The presented approach gives the opportunity to choose from a huge set of parameters, which makes it widely applicable. A Matlab programming code is developed for the purposes of the study. The code could be applied in the practice of portfolio managers and investors.

<https://aip.scitation.org/doi/abs/10.1063/5.0083542>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Mihova, V., Centeno, V., Georgiev, I., Pavlov, V., An application of modified ordinary differential equation approach for successful trading on the Bulgarian stock exchange, 2022, AIP Conference Proceedings, 2459,030025

ABSTRACT

In this paper, a modified ordinary differential equation approach, developed by the authors, is used to forecast the stocks' prices of four Bulgarian companies. The models for the stocks' prices prediction are built, using the quantitative data on the daily closing share prices for the period 01.06.2020-29.10.2020. The computational tests consist of a range of data fitting models in order to choose the best solution from the set of possible solutions, based on the weighted error on the studied data. Further, the expected rates of return are calculated and the variances of the rates of return are analyzed, based on the best models for each of the observed stocks. An optimal risk portfolio, is composed from the assets of the four companies. A risk aversion analysis is performed, comparing the structures of different complete portfolios, based on the risk aversion coefficient.

<https://aip.scitation.org/doi/10.1063/5.0083665>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Atanasov A., I. Georgiev, I. Hristakov, P. Hristov ., "Application of mathematical model for apiaries location evaluation" *21st International Scientific Conference "Engineering for rural development"*, (2022): 187-193. doi: 10.22616/ERDev.2022.21.TF055

Abstract. An approach for evaluation of apiaries' location in flat-hilly regions by using a mathematical model is presented. The study was conducted in 2021 based on the assessment of the existing bee forage resources as Black locust (*Robinia pseudoacacia*), Linden (*Tilia cordata*), Sunflower (*Helianthus annuus*), Rapeseed (*Brassica napus*), Lavender (*Lavandula*) and the number of bee colonies kept in three different regions in the North-eastern part of Bulgaria. We use the mathematical model designed to estimate the potential location where hives can be placed, comparable to a coefficient characterizing the extent to which this place is desired to be created. The evaluation coefficient named π , preferably in a given place, the sum of the "values" of all feeding places in relation to the given apiary place are taken in consideration. Possible solutions are illustrated with numerical values giving assessment of potential distribution sites for cases without overpopulation of the area with bee colonies and for areas with overpopulation. The effectiveness of the proposed approach is reported in two directions. On the one hand, the benefit for beekeepers in their selection of suitable places for apiaries guaranteeing optimal nutrition of bee colonies. The correct assessment of the location will provide pollen and nectar for bees, reduction of harmful effects of overpopulation with bee colonies and high yields of bee products. On the other hand, the benefit for farmers growing flowering agricultural crops in the respective area is expressed in guaranteeing better pollination of crops, which is a prerequisite for higher yields

<https://www.tf.llu.lv/conference/proceedings2022/Papers/TF055.pdf>

<https://www.scimagojr.com/journalsearch.php?q=21100198208&tip=sid&clean=0>

Grozev, D., M. Milchev, I. Georgiev, I. Beloev "Analysis of refusals when operating a car service with a non-stationary inflow of requests" *13th International Scientific Conference on Aeronautics, Automotive and Railway Engineering and Technologies, BulTrans 2021*, (2022): 1-10. doi: 10.1063/5.0105950

ABSTRACT

During their work, car repair shops often fail to fulfil all received requests. This leads to economic losses and bad reputation of the services. Every car repair shop has to deal with this problem, to ensure its successful development. During the operation of a car service there are periods during which the inflow increases and this leads to refusals of orders. The present analysis examines the nature of this flow of refusals and provides opportunities to address this issue. Two peaks of rejections have been determined in the months of October-November (about 189.86 rejections) and April-May (about 194.75 rejections). The inflow is defined as non-stable. Some possible options are to create additional jobs and hire workers, to use outsourcing services in other garages or to create additional storage areas for waiting cars. Two peaks of service failures are identified, which are in the months of October-November (about 189.86 failures) and April-May (about 194.75 failures). These two peaks account for 48% and 46.79% of all failures, respectively. The results of the research are presented. The proposed approach can be used to analyze and optimize the activities of other garages.

<https://aip.scitation.org/doi/abs/10.1063/5.0105950>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Georgiev, I., D. Grozev, M. Milchev, I. Beloiev "Optimizing the distribution of labor in car service"
13th International Scientific Conference on Aeronautics, Automotive and Railway Engineering and Technologies, BulTrans 2021, (2022): 1-10. doi: 10.1063/5.0105329

ABSTRACT

To achieve high productivity in a car service shop it is necessary to ensure high labour efficiency of workers. Achieving this requires high motivation for work and a healthy work environment. The object of the current study is an even distribution of labor among workers. The article proposes a mathematical model of the distribution of work performed by workers. Each worker must have a weekly workload of 40.92 hours, which is the arithmetic mean hourly workload per employee, and this often not feasible. The model indicates the limitations related to the specifics of the task. The difference in the weekly workload of the employee who worked the longest and the one who worked the shortest was 0.1 h (6 min). This confirms that this plan is optimal or very close to it. The purpose of optimization is the to achieve the lowest value of the difference between the maximum and minimum time of employees' work. The model is a partially integer linear problem. This type of task takes an exceptional amount of time and computing power. This requires the use of heuristics, genetic, stochastic, etc. algorithms in order to solve the problem faster to solve the task faster. To study the model, a specialized car service for a certain brand of cars, operating in the city of Ruse has been chosen. The results of the study are presented here.

<https://aip.scitation.org/doi/abs/10.1063/5.0105329>

<https://www.scimagojr.com/journalsearch.php?q=26916&tip=sid&clean=0>

Глава от монографии група Г

Pavlov, V., I. Georgiev, Optimization methods with MATLAB, ISBN: 978-954-337-318-5, 2016

This monograph formulates some basic linear optimization problems and discusses methods for their solution. Special attention is paid to the construction of linear optimization models, graphical method, simplex method, transport problem, assignment problem, multicriteria and integer problems. Applications based on graph theory, mass service systems are also considered and optimal inventory management.

Examples of a highly applied nature are included to illustrate the scientific methods used. Original MATLAB codes for solving some of the basic optimization problems are presented or guidelines for working with embedded MATLAB packages are given.

The monograph has a scientifically applied character and is suitable for undergraduates, graduate students, teachers, researchers, and all inquisitive readers who would like to increase their competence in the field of applications of optimization methods in economics.

<http://booksinprint.bg/Publication/Search?SearchCriteria=ISBN%3A978-954-337-318-5%3AAnd&page=1>

Pencheva, V., Asenov, A., Georgiev, I., Śladkowski, A., Research on the State of Urban Passenger Mobility in Bulgaria and Prospects for Using Low Carbon Energy for Transport, Lecture Notes in Networks and Systems, 2020, 124, pp. 441–504

Abstract

The work investigates the state of and the challenges facing the urban mobility in Bulgaria, related to demographic problems, the operation of urban public transport, the environment and traffic safety. Four stages in the evolution of urban mobility in the country in the second half of the 20th century have been reviewed and a study on the 12 plans for sustainable urban mobility (SUMP) developed by 2019 has been presented. The issues of building a sustainable transport system in the cities through engineering and technological solutions for decarbonisation of transport, shared integrated mobility, as well as servitisation of transport in the cities have been discussed. Some technological solutions for the use of electrical, hybrid and hydrogen fuel cell powered vehicles, including prototypes developed by high school and university student teams have been presented. Research on energy consumption for a river vessel, powered by solar panels has been reported. On the basis of two criteria—for the shortest time and the least harmful emissions, a multicriterial optimisation of public transport travels has been developed. Using Matlab, a programme solving the task of the model defined has been implemented. The input data are the adjacent matrices and the number of pseudorandom Sobolev probing points. Pareto-optimal discrete solutions have been defined, providing the opportunity for the decision-maker to choose one.

https://link.springer.com/chapter/10.1007/978-3-030-42323-0_8

Pencheva, V., Asenov, A., Śladkowski, A., Ivanov, B., Georgiev, I., Current Issues of Multimodal and Intermodal Cargo Transportation, Studies in Systems, Decision and Control 400, pp. 51-124

Abstract

Freight transport is constantly growing and the forecast is that this trend will continue in the future. The sustainable development of transport requires the development of activities, which yield higher economic and social results while at the same time reduce the negative impact on the environment. In the long term, the sustainable development of transport activities is complex and tied to enormous challenges, difficulties and barriers, related to the development of the technological environment, the social and economic development, the influence of political factors and regulations. One of the central perspectives for the development of the freight transport in Europe is the development of multimodal and intermodal transport. The present chapter reviews some essential issues about the conditions for interaction between the modes of freight transport and the main challenges this kind of transport faces. An overview has been made of the main characteristics of organization and technology in multimodal and intermodal transport, and the related to them commodal and synchro modal transport that have appeared in recent years, as well as the physical internet concept. The application and barriers for modern use of information and communication technologies in multimodal and intermodal transport has been reviewed. An overview of the development of multimodal and intermodal transport in Bulgaria in accordance with the development of international transport corridors that pass through the country is carried out. A mathematical model has been developed on the basis of multicriteria optimization with three

criteria: direct costs, time and external costs. The transport scheme is presented as an oriented graph line with each point corresponding to a node and each road, connecting nodes i and j , to an oriented weighted rib (i, j) in the graph. Weight c_{ij} is directly connected to the three criteria set. We assume that on each rib transport can be carried out by three modes: waterway, road and rail. If there is no physical connection, the respective weight is assumed to be an infinitely large number. Pareto optimal solutions have been determined under conditions for integer variables and application of a weighting method. To verify the model, a specific task for providing multimodal transport has been solved with the help of Matlab R2017b software and the optimization functions built into the product have been found to be optimal under Pareto solutions, using heuristic approaches for solving a partially integer linear optimization problem.

https://link.springer.com/chapter/10.1007/978-3-030-87120-8_2