UNIVERSITY OF ŽILINA

15th international scientific conference of young scientists on sustainable, modern and safe transport

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under the auspices of

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BOOK OF ABSTRACTS

Mikulov, Hotel Galant
29 May – 31 May 2023

Czech Republic

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PREFACE

TRANSCOM 2023: 15th International Scientific Conference on Sustainable, Modern and Safe Transport aimed at establishing and expanding international contacts and cooperation. The main purpose of the conference is to offer young scientists an encouraging and stimulating environment in which they can present the results of their research to the scientific community. TRANSCOM has been organized regularly every other/second? year since 1995. Between 160 and 400 young researchers and scientists participate regularly in this event. The conference is organized for PhD students and young scientists up to the age of 35 and their tutors. Young workers are expected to present the results they have achieved.

Topics of TRANSCOM 2023 are focused on transportation in these areas:

- Operation and Economics in Transport
- Mechanical Engineering in Transport
- Electrical Engineering in Transport
- Civil Engineering in Transport
- Management Science and Informatics in Transport
- Safety and Security Engineering in Transport
- Travel and Tourism Studies in Transport Development

The conference is organized by the University of Žilina. At this time, more than 7,400 of its students are being educated at seven faculties in 169 accredited fields of study in all forms and degrees/levels of university studies. In its over 70 years of successful existence, it has become the alma mater for almost 90,000 graduates, highly skilled professionals specializing mostly/predominantly in transport and technical fields as well as in management, marketing, or humanities. The quality and readiness of our graduates for the needs of practice are proven by long-term high interest in hiring them by employers that cooperate with the University in the recruitment process. For more details, see www.uniza.sk.

The 15th international scientific conference of PhD students and young scientists on sustainable, modern, and safe transport TRANSCOM 2023 was held under the auspices of Prof. Ing. Ján Čelko, CSc., Rector of the University of Žilina.

This TRANSCOM 2023 was held from 29 to 31 May 2023 in Mikulov, Czech Republic and 206 papers were presented by scientific researchers and PhD students at this conference.

The full papers will be published in Elsevier – in the Procedia entitled Transportation Research Procedia.

Guest editors

- ***Professor Milan Dado***
  Faculty of Electrical Engineering and Information Technology - University of Žilina, Slovak Republic
- ***Professor Mario Guagliano***
  Department of Mechanics – Politecnico di Milano, Italy

All papers were reviewed by two reviewers.

The official language of the conference: English

Conference partners

CONTENTS

The detailed contents of the individual topics may be found on the following pages.

TOPIC 1: OPERATION AND ECONOMICS IN TRANSPORT 24

TOPIC 6: SAFETY AND SECURITY ENGINEERING IN TRANSPORT 191

TOPIC 1: Operation and Economics in Transport

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Authors are responsible for language and content of their abstracts.

A case study of the creation of a common depot for several postal operators to ensure the last mile in Slovakia

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Abstract

In recent years, green delivery is mainly understood as the replacement of the fleet of vehicles with conventional propulsion (diesel, petrol) with alternative propulsion, whether in the form of CNG or the use of electric vehicles. Some authors already see green delivery in the use of packaging materials, which should be environmentally friendly and biodegradable. In our case, we have decided to consider as part of green delivery in last mile for postal operators the creation of a single distribution center (depot) providing the last mile for all participating postal enterprises. The first mile would be provided by the postal enterprises themselves, while the sorting of the postal items and their actual delivery would already be carried out from the depot. To assess the strategy of an enterprise that would decide to provide the service in the Slovak Republic, we decided to perform a SWOT analysis. The solution is understood only as a case study. The case study on the creation of distribution centers does not discuss the exact number of distribution centers needed to ensure delivery availability, nor does it specify the quality that would need to be met for delivery. The case study focuses only on aspects of the external and internal environment that could influence a developer in creating such a depot.

Keywords: Postal services; distribution center; SWOT analysis

Bike-Sharing System in the Czech Republic and Foreign

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Abstract

This paper discusses the bike-sharing system in the Czech Republic and selected neighboring states. The current problem of deteriorating air quality is driving cities to implement an efficient, more environmentally friendly approach. One of them is introducing a system of shared resources - shared bikes, scooters, cars, and others. Our goal is to address the issue of shared bikes, which are already widely used worldwide. However, it is necessary to point out that it is essential to have the bikes appropriately distributed in the stations, and their collection during the night at frequented stations must be ensured. The paper aimed is to analyze bike-sharing systems in the Czech Republic and foreign countries in Middle Europe, primarily in the Slovak Republic. The bike-sharing system in the Czech Republic and Slovak republic was analyzed mainly. The Poland bike-sharing system was added. The analysis of the bike-sharing providers was based on the available data. Based on the results, we can conclude that two (three) primary providers are in the selected states. These providers have different ways of bike storage. The vast difference is the number of bikes in the chosen town with the same population.

Keywords: Bike sharing; sustainability; transport; infrastructure.

Factors affecting mileage of battery electric multiple units

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Abstract

There are a large number of non-electrified sections of railway lines in the world, and in many countries non-electrified sections predominate. Many of them are primarily used for regional or shorter distance transport. In some cases, diesel-powered transport on these lines is less eco-friendly than competing bus services, so authorities often consider maintaining rail services on these sections. Reversing this phenomenon is possible through the use of battery electric multiple units (BEMU), which would replace conventional high-emission diesel vehicles on the selected stretch with a more eco-friendly solution. However, battery trains and the batteries themselves are still under development and their mileage (mileage) is still very limited. Therefore, before introducing BEMU operation, it is important to determine whether the vehicle will be able to reliably and safely provide service on a given line. This can be ascertained from the mileage which is, however, influenced by various factors that still need to be appropriately sorted and grouped. The aim of this paper is therefore to appropriately delineate, sort and group the various factors affecting the mileage of BEMUs based on their common characteristics and also to characterize their operating options according to the available electrification.

Keywords: Battery electric multiple unit, mileage, affecting factors, railway transport

Application of container terminal virtual reality in student education

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Abstract

The continuous emergence of digital technologies and the strong trend of digitization in numerous segments of human activity imposes the need to devote additional attention to better adaptation of the educational process. The special focus is on improving competencies of the new generation of employees through the modernization of educational methods. This article contributes to the wider debate of bigger involvement of virtual reality (VR) as modern pedagogical tool in student engineering education. VR as computer-generated environment allows its users better understanding of real or imaginary scenarios, processes and interaction like one in real conditions. Numerous research on the application of VR for educational purposes is devoted mainly to the detection of the final effects on the mental or physical performance of the examinee. However, insufficient attention is paid to the basic precondition for the successful application of VR technology in teaching, namely the way of its use and the credibility of the replicated content. Therefore, the article explains in more detail the process of creating realistic VR models for managing container terminal equipment designed using equipment technical data provided by Adriatic Gate Container Terminal in Rijeka, the strategically most important and largest seaport in the Republic of Croatia. In the end, potential directions of future research with the developed VR model among different interest groups and interviewees are listed.

Keywords: Virtual reality application; student education; high education; port container terminal

New innovative method to increase digitalization level of supplier selection process at transport companies

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Abstract

In this article we share results of our research, which deals with the design of a new methodology for defining of a new supplier selection process in a selected company. Main aim of the new methodology was to ensure higher level of digitalization in the focused area in a selected company. The new methodology was developed based on the analysis of actual domestic and foreign professional literature focused on the area of purchasing, purchasing processes and their digitization as part of the conducted secondary research. Specific basis was an internal documentation of selected company regarding the current state of processes in the subject area. The acquired information and knowledge were verified by selected representatives of the selected company through primary qualitative research. The subsequent synthesis of outputs from primary and secondary research formed a basis for the design of the methodological procedure and for the new design of individual sub-processes of the supplier selection process. The newly developed and implemented methodology increased the level of digitization of the supplier selection process in the selected company by +157%.

Keywords: Digitalization; supplier selection process

The Influence of the Energy Market on the Operation and Pattern of Losses in the Distribution Network

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Abstract

The paper discusses the development of district heating systems and the impact of the energy market on the distribution network losses during the process of delivery to customers. The subject of interest is the occurrence of heat losses in pipelines during its operation, determining the amount and causes based on economic motivation and market behavior of heat producers. The technical parameters of the pipelines as well as the operating parameters of the distribution medium are used to calculate the heat losses. On the basis of the data, the average overheating of the pipeline by the flowing medium and the potential savings of the primary energy source are calculated. Subsequently, the economic impact of such a distribution network operation on the source of cogeneration production of heat and electricity is assessed. To determine the economic impact, the principles of the heating company operations, the impact of stock exchange price development for electricity and natural gas as the cause of the generation of waste heat in the form of heat losses are used.

Keywords: Distribution network; district heating system; energy market; regulation

Implementation of the Kano model in a company providing public transport services

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Abstract

The aim of the work was to define the attributes that the client expects and requires from the public transport service transporting children from home to school and back. These attributes were assigned to a specific group, in accordance with the Kano model used in the work: to must-have attributes, one-dimensional attributes, delighters and mistakes. The aim of the work was achieved by applying the individual stages of the Kano model. The analysis was performed in a small enterprise, existing on the market for 7 years and providing public transport services. This company decided to provide a new school transport service. In order to better understand the requirements and expectations of service recipients, the company used the Kano model. A survey was conducted, as a result of which a representative group was distinguished and answers were obtained on the attributes that respondents require and expect when providing school transport services, divided into positive and negative variants. Using the subsequent stages of the Kano model, these attributes were divided into 4 groups, thanks to which information was obtained that could be helpful in the process of creating a school transport service that would be best suited to the needs of service recipients.

Keywords: Public transport; collective transport; service; Kano model

How to ensure safe mobility during the pandemic?

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Abstract

At the beginning of 2020, the COVID-19 pandemic affected almost the entire world. It had a significant societal impact. Life in the entire society has been changed significantly in almost all areas of life. People's behavior has been also changed, as it was necessary to significantly reduce their mobility. It had a major impact on rail transport in the EU, because the reduction of the mobility has had an impact on passenger transport performance. The contribution focuses on the analysis of the impact of the pandemic COVID-19 in the field of rail passenger transport. Firstly, there are described the changes and milestones that have been implemented in practice since the beginning of the pandemic. Subsequently there are proposed operational-organizational and reconstruction measures against the spread of the COVID-19 pandemic in rail passenger transport. Within the proposal part, there are presented the specific levels of measures in rail passenger transport, as well as the brief procedure for passengers´ equipment in rail passenger transport in the case of the highest level of COVID-19 restrictions.

Keywords: Covid-19 pandemic; railway passenger transport; measures; mobility

Comparison of courier companies in Slovakia in the context of sustainable development

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Abstract

The sustainable development of the company can be explained as the process of managing the organization about concerning various aspects - economic, social, and environmental. Although the original idea was used almost exclusively in connection with the environment and natural resources, today the word sustainability is used in a wide range of fields and activities. Businesses should not focus only on profit, but on all pillars of sustainable development to ensure the ethical, rational, and efficient execution of all business processes and activities. The paper aims to point out the integration of the concept of sustainable development into the strategy of courier companies. Increasing rates of urbanization and the continuous development of e-commerce are increasing the pressure on last-mile delivery in urban areas. With the increase in demand for home delivery, to parcel lockers or delivery points, the question arises of how to implement these processes efficiently and more sustainably. The paper focuses at comparing selected courier companies - Packeta, DPD, SPS, DHL and Slovenská pošta, operating in the Slovak Republic and identifying the elements and activities they implement in connection with the integration of sustainable development.

Keywords: Sustainability; sustainable development; last mile; parcel delivery

Integration of sustainable development by selected low-cost airlines

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Abstract

The sustainability of business development can be explained as the process of managing an organization about concerning to various aspects - economic, social, and environmental. Sustainable development represents systematic and rational progress, raising living standards and economic growth in harmony with the environment and limited resources. The paper aims to identify the approach of selected low-cost airlines - Ryanair, easyJet and Wizz Air, to the integration of sustainable development into their strategy. As in all areas, environmental problems and solutions that would minimize these problems are coming to the fore in the operation of airlines. Popular topics in air transport are the use of Sustainable Aviation Fuel, decarbonization, the use of renewable resources, increasing operational efficiency and building a green image. The contribution is aimed at comparing selected factors related to sustainability or sustainable development and identifying the activities that airlines carry out in this area. It also includes a comparison of selected indicators, which are among the key ones from the point of view of operating an airline.

Keywords: Low-cost airlines; sustainable development, airline comparison; sustainable strategy

Research of the relevance of changing the liability limit of freight forwarders in selected countries

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Abstract

The most important component of the forwarding contract is the definition of the freight forwarder's liability limit. Given the absence of international legislation regulating forwarding activities, the limitation of liability of freight forwarders of different companies is not unified. An important step towards setting the limit of compensation to the client is the creation of standard forwarding conditions by national associations of freight forwarders, which offer a total amount of liability for their members. To determine the relevance of the current limits of liability, the authors conducted a survey of representatives of forwarding companies that are members of two associations – Association of Logistics and Freight Forwarding of the Slovak Republic and The Association of Forwarding and Logistics of the Czech Republic. The topic of the survey was to identify the demand from customers to establish a liability limit in the forwarding contract that exceeds the limit set by the association of freight forwarders. A survey was also conducted on the need to change the liability limit from the point of view of freight forwarders. The study showed that there is a demand from customers for an increased freight forwarder's liability limit, although it is not extremely high. In turn, most of the freight forwarders interviewed claim enough liability. The results suggest the possibility of considering ways to change the current limits of liability.

Keywords: Freight forwarder liability; transport law; freight forwarder law

Electrified and non-electrified railway infrastructure - economic efficiency of rail vehicle change

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Abstract

The economic efficiency of the provision of services in railway transport is higher if the transport is carried out on electrified lines. However, carriers often carry out transport on routes where they use both electrified and non-electrified railway lines. This paper deals with the economic efficiency of railway vehicle change if change the electrification (electrified to non-electrified or vice versa) from undertakings providing railway freight transport services. We suggested the methodology to decision-make process of RV change if the change electrification of railway line in the same transport relation from economic efficiency point of view. We researched how the changing of input data and conditions influence the break-event point. In this paper we modelled the length of electrified rail line and price of electric energy. We have reached to a significant result, despite the high prices of electric energy, in many cases it is more economic efficiency to realize rail vehicle change when changing traction than to use a diesel RV for the whole of transport relation.

Keywords: Costs, electrified railway line, railway freight transport, railway undertaking, railway vehicle change

Outdoor advertising and visual pollution on selected roads in the city of Žilina

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Abstract

This paper examines outdoor advertising and visual pollution on selected roads in the city of Žilina. Outdoor advertising is often connected with visual pollution. Visual pollution can be unsightly, distracting, and can create a sense of visual confusion and chaos. This is even more true for drives in traffic. Therefore, the research we carried out examines how much is outdoor advertising present on the selected key roads of city of Žilina. The results of the conducted research provide information on how many advertisements are located in selected sections and what their thematic focus is. Furthermore, research can serve the makers of policies related not only to transport, but also to the environment. In addition, the study also serves operators of marketing agencies dealing with outdoor advertising issues.

Keywords: Outdoor advertising, visual pollution, visual smog

Specific cases of zone-oriented timetable

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Abstract

This paper deals with the topic of railway zone-oriented timetable which is an operational concept suitable for suburban and alternatively long-distance transport. Initially, the paper describes the main principles, advantages, and disadvantages of the zone-oriented timetable, especially in terms of travel times, train sets capacity, and railway capacity. Then there are described some specific cases/forms of the zone-oriented timetable and compared to the basic form of the zone-oriented timetable in the mentioned terms. Also, some examples of the concepts, where they are or can be applied, are stated.

Keywords: Railway transport, transport technology, timetabling, suburban transport, long-distance transport, service level, zone-oriented timetable, train paths, railway capacity, travel time, train sets capacity

Equity fare system: Ranking of transport development criteria in integrated passenger transport

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Abstract

The purpose of the use of equity fare systems lies in preventing transport marginalization by means of favouring participants in an unfavourable position with the aim of ensuring equality. In integrated passenger transport, equity is characterized by the specificities of the region where such a system is either planned or already carried out. The criteria that describe said specificities are the development of fare zones from the transport, economic, and demographic aspects. This paper assesses the transport development criteria in integrated passenger transport. The Analytic Hierarchy Process methodology was used to determine the relevance. It is based on the rankings made by 117 European experts on transport, economy and demography. The assessment of the criteria will ensure the development of a new equity fare model for calculating fares in integrated passenger transport.

Keywords: Transport development, integrated passenger transport, equity fare system, analytic hierarchy process

Simulation of pedestrian and cyclist underpass to reduce risky behaviour and traffic violations - a case study level crossing Trnava in Croatia

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Abstract

Level crossing accidents are among the most common accidents in rail transport. Accidents between trains and pedestrians often end in serious injury or death. Several key factors contributing to the occurrence of train-pedestrian accidents are human error (violation of laws), poor visibility, inadequate infrastructure, etc. One of the aims of this study is to analyse the problem of frequent illegal pedestrian and cyclist crossings at the Trnava level crossing in Croatia. Data was collected through observations and camera recordings of illegal pedestrian and cyclist crossings (traffic violations). Frequent train traffic on the double-track international and suburban railway line M102 (Zagreb Glavni kolodvor - Dugo Selo) leads to long closing times of the level crossing. The problem is exacerbated by the high volume of pedestrian and cyclist traffic, which makes the Trnava level crossing a high-risk location for accidents. Data collected on site (at the Trnava level crossing) is used to create a simulation of a pedestrian and cyclist underpass using PTV Vissim software and to investigate the effectiveness of the underpass as a solution to reduce risky behaviour by level crossing users at the Trnava level crossing. The result of implementing of the underpass for pedestrians and cyclists is a complete separation of non-motorised traffic and rail traffic, which significantly reduces traffic violations and insures safe movement of level crossing users.

Keywords: Pedestrian/cyclist traffic violations, level crossing, underpass, traffic modelling, PTV Vissim

Analysis of the time and number of stops during the operation of selected public bus line in Rzeszow

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Abstract

Public transport fulfils many functions in the city. Its efficient functioning improves the comfort of residents' life and eliminates communication exclusions. One of the basic criteria to evaluate different means of transport is the travel time on a given route. This time is largely dependent on stops. In the case of city buses, some of these stops result from the need to stop at bus stops. The second major part of these stops is forced by external traffic conditions. The article is devoted to examination of the number of stops and stopping times of a city bus on a selected route. The results obtained from the research indicate the possibility of reducing travel time and thus fuel consumption. These activities are part of the development of sustainable transport and contribute to the increase in the competitiveness of public transport in the city.

Keywords: public transport; travel time; traffic volume; operating parameters; bus stops

Analysis of Traffic Noise Pollution Using Siemens Tecnomatix Plant Simulation

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Abstract

This paper considers a simulation-based tool for the prediction of roadside noise pollution. A special feature of the tool is that its core is a standard manufacturing simulation software – Tecnomatix Plant Simulation by Siemens. The tool uses standard elementary object classes of Plant Simulation such as path, vehicle, method etc., and provides a powerful and highly parameterisable environment for analysing the noise pollution by traffic flows. It possesses a high flexibility of model programming and is open for extensions and adjustments to new calculation methods. The infrastructure modeling facilities are essentially independent of the noise computation algorithms and thus can be used with various tool-internal or external numerical calculation components. As a result of earlier computational studies, a set of functional interdependencies of flow parameters and model settings have been obtained, and methods for calculating noise indicators have been adapted for their implementation in embedded languages of simulation tools. As a result of the programming-experimental study, a "Traffic Noise Tool" (TNT) software module has been developed. TNT allows to analyse the impact of traffic flow characteristics (traffic intensity, traffic flow by vehicle categories, and traffic mode in each track etc.) and of road infrastructure (number and carrying capacity of the cracks, additional distance between opposite directions, availability of noise protection devices, etc.) on the noise pollution of the roadside environment. During the simulation&calculation process, the noise characteristics of the individual vehicles are recorded and displayed by diagrams, and so is the equivalent overall noise level at a given monitoring point. The results of this study can be used in the practice.

Keywords: traffic noise pollution; Tecnomatix Plant Simulation; flow parameters

Research of drivers' attitudes to the front brake light

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Abstract

The front brake light (FBL) is not an entirely new idea. It appeared already in 1920. However, the front brake light did not enter traffic for almost a century. The breakthrough came only in 2017. At that time, a practical experiment began at the Tegel airport in Berlin, Germany. This experiment required the installation of green LED lights on airport vehicles. Most airport employees expressed positive opinions about this new device. Therefore, the next stage of the project takes place in Slovakia. Such an experiment requires a much larger number of vehicles with FBL in as small an area as possible due to their concentration. This article describes the principle of operation of FBL, its execution and justification of the colour of the light. It also theoretically describes examples of traffic situations in which FBL is helpful. The research in this article uses a traffic-sociological questionnaire, which is described and summarily evaluated. Many respondents were professional drivers. Up to 80% of them would like to have FBL in traffic. Other results, described in the text, are also interesting. We also confirmed the hypothesis that drivers assume the positive impact of FBL on road safety.

Keywords: safety; front brake light; traffic; road; accidents

Accuracy verification of magnetic sensors in different weather conditions

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Abstract

An intelligent transport system cannot exist without high-quality information about transport. One of the possibilities for data collection is a sensory transport network. The city of Žilina has a wireless network of magnetic sensors built a few years ago. I continuously collect traffic information. It monitors all lanes in the direction to and from the city center. The sensors thus create an area bounded by virtual gates which count entering and exiting vehicles. The sensory network sends obtained data by each sensor to a publicly accessible database. This article also describes mentioned database that provides the traffic flow characteristics – intensity, speed, and classification of vehicles. The question of the magnetic sensors used is their accuracy. Their function is counting, speed measuring, and vehicle classification. Sensors detect all these characteristics based on the magnetic field changes by passing vehicles. In this paper, the authors verify the accuracy of the sensors in two traffic surveys in warm weather and winter conditions. In both surveys, certain deviations were evident, but they did not fundamentally affect the accuracy of vehicle counting.

Keywords: magnetic sensors; intelligent transport system; traffic flow; weather conditions

Development of a model environment for autonomous driving

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Abstract

Developing automated driving functions can be elaborate and cost-intensive. Simulation helps to decrease both, the effort and the costs. With physical model environments of a smaller scale, automotive research can be improved even further.
This work presents a method with five steps for building a scaled model environment to answer research questions regarding autonomous driving functions in the automotive domain. For this purpose, the five steps of the method are first introduced and explained. Each step comes with indications that can be further extended. Then, the method is performed by creating a model environment.
The model environment build in this work is a recreation of an urban intersection in Ingolstadt, Germany, in the scale of 1:10. In addition to two model vehicles, the model environment consists of pedestrians and traffic control elements such as signs, signals, various lanes and road markings. The advantages of the model environment are low costs and high reproducibility. On the other hand it comes with limitations. For example, the materials used for construction (polylactic acid) are different from the materials in reality. The aim of this work was achieved by providing a method for building a model environment for automotive domain. The limitations of the built model environment and actual testing of automated driving functions will be performed in the future.

Keywords: automated driving; autonomous driving; low-cost, model environment; model vehicle; model world; scaled environment; testing

The impact of the pandemic on the business models of air cargo carriers

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Abstract

The global pandemic has affected all sectors of the economy, including cargo air transport, and it is obvious that it has brought with it many changes. For cargo air carriers, the onset of the pandemic was a big challenge. The pandemic affected both the employee sector and the customer sector of the analyzed cargo air carriers, which required a change in the usual processes. Cargo airlines had to flexibly and creatively look for ways to cope with the new market demands that arose as a result of the pandemic. The paper deals with the analysis of the impact of the pandemic on changes in the business models of selected cargo airlines. Based on the evaluation of the analysis, a proposal for a hybrid business model for air cargo carrier is created in the conditions of aviation market affected by the pandemic.

Keywords: cargo airline; air carrier; business model; pandemic

Comparison of mobile applications of selected postal operators in Slovakia

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Abstract

In recent times, the popularity of mobile applications and e-commerce has soared. The emergence of smartphones in the global market has led to a remarkable transformation in the use of the internet and smart technology. With the development of mobile applications and the development of the Internet, e-commerce also began to develop. In addition, the latter also helps the development and growth of postal operators, thanks to which companies are able to deliver their products to the customer quickly, safely and with high-quality service. Customers expect to be informed in real time about the status of their shipment, to be able to submit a shipment request within a few clicks, and to be able to quickly and easily find the nearest pick-up and drop-off points. The aim of this paper is to carry out primary research aimed at obtaining respondents' experience with postal operators in Slovakia and their mobile applications in order to create a comparison of mobile applications of selected postal operators in Slovakia.

Keywords: Transport; Logistics; Mobile application; Postal operator

Analysis of the selected tram lines operation during the tram lines modernization project in the city of Košice - the case study

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Abstract

The sustainability of public passenger transport is a key aspect for ensuring efficient urban mobility. For this reason, transport systems need to be maintained at a level where they can deliver the required transport performance, quality and reasonable operating costs. Regular maintenance and modernization is a necessary condition for meeting these criteria. However, this process must be carried out in such a way that it does not significantly affect the quality of the transport services provided. The paper presents research aimed at analyzing the impact of the tram transport system reconstruction in Košice on the transport means capacity utilization and on the vehicles delay time monitoring. The research revealed the differences that existed before and during the reconstruction of the tram lines.

Keywords: tram lines; passenger transport; capacity utilization; delays

The impact of the COVID-19 pandemic on passenger rail transport: a case study of the Slovak Republic

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Abstract

Human mobility has been rapidly reduced by COVID-19. That had a great impact on international and domestic public transport in all its modalities. This paper aims to analyse the impact of COVID-19 on public passenger rail transport in Slovakia. Implications of COVID-19 on public rail transport are researched via transport and economic activity indicators of the largest railway passenger transport operator in Slovakia - the Slovak railway company (ZSSK). Results show that the pandemic and related measures caused a significant decrease in the transport performance of ZSSK, with a decline of around 40% in 2020 and 2021 compared to pre-pandemic levels. However, the traffic performance remained mainly unchanged, so the pandemic also had a negative impact on the economic indicators of ZSSK. But the compensation of losses through state subsidies and public service payments significantly reduced revenue loss from transport activities.

Keywords: passenger rail transport; COVID-19; ridership; Slovakia

Improving the safety of provided ATS at LZTT by implementing MLAT

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Abstract

Nowadays the air traffic services are provided with surveillance and procedural services are not used any more. In order to provide radar services at airports we need to have 100% coverage. The combination of present technologies gives us the opportunity to provide such services even at mountainous terrains. The paper deals with air traffic services and their improvements at Poprad-Tatry international airport. In the first part it shows characteristics of primary radar and problems associated with its operation as the radar is out-dated. In the second part the authors describe secondary radar and problems with too high minimum vectoring altitudes and an inappropriate location of SSR ground station. In the last part a new technology – MLAT is presented and other benefits such as improved coverage, lower electrical consumption, redundancy etc. The paper shows risks associated with implementations of such a technology and a safety risk tolerability matrix is created.

Keywords: ATS, surveillance, MLAT, PSR, SSR

Monitoring of territory pollution by particulate matter in relation to road traffic

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Abstract

Nowadays, air pollution is an important and at the same time often overlooked problem that causes short-term health as well as long-term respiratory problems. Road transport is a significant source of air pollution. The effort of the EU and the Slovak Republic is to reduce greenhouse gas emissions and look for alternative sustainable sources. In order to improve air quality, it is very important to determine the main sources and problem areas of air pollution. Monitoring by air pollution measuring stations is used as a tool to comply with the values. The aim of the contribution is to analyze the current distribution of air quality monitoring stations in relation to road transport. The paper targets to point out the excessive air pollution with particulate matter $PM_{2.5}$ and PM_{10} due to road freight transport. The analytical part of the research is processed for 11 selected locations in the territory of the Slovak Republic. The results show an increase in the concentration of particulate matter in places with a high volume of freight traffic. From the research, it is also possible to determine places in Slovakia that are affected by a frequent decrease in quality within the national monitoring system.

Keywords: air quality; particulate matter; monitoring stations; transportation; security

Safety of internal mechanical transport in the upper-tier establishments in Poland

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Abstract

The aim of this article is to present the safety rules in internal mechanical transport in plants operating under the Seveso Directive. Although the regulations of the Seveso Directive regulate many aspects of safety in the operation of these plants, not all important issues are sufficiently addressed in the directive. One such issue is the regulation of internal transport safety. The following article will discuss the current regulations, which are found in various legal acts and present some current standards for safety in internal transportation. The topic of internal regulations in plants will also be discussed. The case study will present solutions of this type in one of the largest plants in the Lubuskie Voivodeship - SWISS KRONO Ltd., which is classified in the category of the upper-tier establishment. The presented scope of analyzes is the basis for cooperation in the preparation of training materials for drivers and employees in the field of internal transport safety. The presented scope of documentation is the basis for the preparation of training and analyzes of the working day to increase the sense of safety at work.

Keywords: internal transport, upper-tier establishments, Seveso establishments

The position of road and rail transport in terms of carbon neutrality

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Abstract

The article focuses on the topic of green transport in terms of carbon footprint and its importance for environmental protection and sustainable development. Nowadays, society is becoming more and more aware and at the same time urging for positive impacts of transport, such as individual motorism in particular, and trying to find alternatives. The article raises very important questions about the current challenges facing the transport sector in relation to road and rail transport. The article discusses the various options for green transport from a carbon neutral perspective. The article concludes by discussing the need to promote and develop green transport as part of sustainable development and environmental protection.

Keywords: carbon dioxide; carbon footprint; road and railway transport

Transport Market and Status of Rail Freight Transport in the Context of Liberalization of Services

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Abstract

The deregulation of the rail transport market in the EU aims to improve the quality of the provided services and increase the efficiency of operation. This effect should manifest itself by increasing the competitiveness of rail transport, but also help to maintain an ecologically favourable transport system. However, transport policy is different in individual countries and there are differences in how they approach the support of rail freight transport. The paper evaluates the position of freight transport on the liberalized market, the positives and negatives. The research deals with bottlenecks in rail transport and offers a way to support rail transport. It is based on the authors' own research. It uses the Delphi method and multicriteria analysis. The benefit is the proposal of three sets of packages with different impacts on strengthening the position of railway transport in the transport market. The first is focused on technological changes with minimal expenditure of financial costs at the national level. The second package concerns new technological procedures, interoperability, security, and charges for the use of infrastructure and information systems. The third represents the greatest effectiveness for increasing the performance of bottlenecks in rail freight transport.

Keywords: transport market; liberalization; rail freight transport

The impact of the war in Ukraine on inland water transport in the Danube region

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Abstract

The war conflict in Ukraine that started on 24th February 2022 has had a big impact on a lot of aspects of our lives not only in Europe but in the world. It has also had an impact on the area of inland navigation, mainly in the Danube region. As a result of the war conflict, transport routes have been changed between Ukraine and other countries. Some of them are still blocked, and some of them are used more than they used to be. Europe was not prepared for such a situation. Therefore, it has been necessary to solve a lot of logistics issues. Ukraine has been one of the biggest exporters of agricultural products and raw materials on the EU market. Logistic support for the export of these products is crucial for the maintenance of the economy of each country, especially for a country that is at war. Ukrainian maritime ports have been blocked; railway transport has always had limited capacity; part of the railway infrastructure has been completely damaged. The Danube was and still is significant and sometimes the only possibility for the transport of goods between Ukraine and other European countries.

Keywords: war, raw materials, cargo transport, the Danube, Danube region

Trends in the development of inland waterways of the Slovak Republic

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Abstract

Due to the long-term unfavorable development of the parameters of the water transport sector, insufficient parameters of the infrastructure, it is unlikely that demand for water transport services will be spontaneously created by the corporate sector. In addition, if the infrastructure of the Slovak waterways is currently insufficient. The COVID 19 pandemic has paradoxically brought an opportunity for water transport, which represents a competitive alternative for other modes of transport, especially rail and road transport. However, it is necessary to ensure adequate infrastructure from the state, which is essential for the functioning of water transport. Currently, commercial shipping is carried out exclusively on the Danube River. Váh Waterway is currently not used for commercial shipping. Freight navigation on the Bodrog River has slowed down, currently only passenger ship cruises are carried out here. The major problem that prevents the development of water transport in Slovakia is the current state of the infrastructure of waterways. It is necessary to take measures to start commercial navigation on the Váh Waterway as well as to revitalize the Bodrog River, so that it uses the potential that this river has in the region.

Keywords: Inland waterways, Danube, Váh Waterway, Bodrog, Navigation

The Impact of Age Diversity on Employee Turnover and Loyalty in the Postal Sector

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Abstract

The aging of the population has a major impact on the labor market, so age management is becoming a part of strategic human resources management. An important part is the analysis of the employees' age diversity and the investigation of its impact on the company's performance. The diagnosis of age diversity and the identification of the impact of age management on organizations is an important prerequisite for achieving sustainability. The aim of this paper is the analysis of employee age diversity in the postal sector in the Slovak Republic and the identification of its impact on human resources sustainability in the postal sector. Methods of analysis and synthesis were used in the secondary research, the personnel audit method was used in the primary research aimed at diagnosing the structure of human resources in postal company. The knowledge gained in this survey show that the trend of an aging population is reflected in the increasing workplace age diversity in the postal sector, with the largest representation of employees in the age category of 44-58 years, the highest fluctuation is in professions: delivery person, postman, sorter of items, from the point of view of loyalty, a significant part of employees have been working in postal company for less than 5 years.

Keywords: Human resource management; Age management; Employment structure; Age diversity; Turnover; Loyalty; Sector of transport, logistics and postal services

Pilot Fatigue Experience and Fatigue Reporting: Short-Haul Airline Operation

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Abstract

Introduction. - The specifics of a short-haul operation relate to high crew workload, higher levels of sleepiness and/or drowsiness caused by sleep loss/deprivation, and many times, insufficient recovery time. Along with the changeover to EASA FTL's and the introduction of the Fatigue Risk Management approach, this paper focuses on fatigue perception and fatigue reporting provided by airline pilots flying for a UK-based short-haul airline. Objective. - To assess the fatigue perception and experience of airline pilots involved in short-haul operations, after the adoption of EASA FTL's, and after establishing the Fatigue Risk Management. Method. - Professional airline pilots flying on short-haul routes for a UK based airline participated in a survey between December 2016 and January 2017 and provided their views on fatigue incidence and experience and shared their knowledge about fatigue reporting. Results. - Although there is a high level of awareness about the importance of fatigue reporting, pilot fatigue on short-haul, mainly as a consequence of long duty hours and extended duties, can lead to work-life imbalance, higher fatigue levels as well as health-related issues. Conclusions. - This paper gave hindsight and added some evidence about the knowledge of fatigue reporting amongst short-haul pilots, and their experience and incidence of fatigue, a few months into the new EASA FTL scheme.

Keywords: Pilot, Fatigue, Short-Haul, Airline, Sleepiness, Fatigue Risk Management, EASA FTLs, Flight Time Limitations

Break-even distance of rail and road container transport. Case study of Central Europe providers

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Abstract

In transport practice, rail transport is considered an alternative to monomodal road transport over a certain distance, which is called the break-even distance. Freight costs are often a decisive factor in the choice of freight transport mode and are therefore used as a relevant criterion for estimating the break-even distance. In the paper, the authors compare the usability of individual types of transport in intermodal freight transport, with carriers operating in the region of Central Europe, using the break-even distance. The cost principle, by means of which the break-even distances are determined, is analyzed from the point of view of the customer of transport services, i.e. the manufacturing or forwarding company.

Keywords: break-even distance; road transport; rail transport; container

Potential use of RFID and QR code in the supply chain based on Blockchain and Smart contract

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Abstract

Nowadays, the discovery of new technologies is more intense than ever before. Terms such as Blockchain technology or Smart Contracts are becoming more and more familiar. Thanks to the decentralized system and the distribution of immutable records of transactions among all network participants, Blockchain finds application in almost any field, whether industry or society. Supply chain is one such area. In this paper, a theoretical model of supply chain based on Blockchain is presented. The participants of the presented model are the manufacturer with suppliers, the carrier, the retailer, and the final consumer. The model describes the process from the production of components to the sale of the final product to the final consumer. By implementing RFID and IoT, the participants can track the goods in real time. The end consumer enters the chain by scanning the QR code of the product. Contractual relationships are stored in the Blockchain in the form of Smart Contracts, which automatically execute the action based on the agreed terms. In addition, the paper describes selected Blockchain platforms that are used in the real world. Finally, we also present tools for simulating and testing Blockchain in a local network.

Keywords: Blockchain technology, Smart contracts, Supply chain, RFID,QR code

Microdepots in City Logistics

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Abstract

City logistics is all transport, including flows of goods within the city, which ensures the operation of shops, services and business activities. The problem of logistics is extensive and above all parking spaces in traffic jams, insufficient number of spaces, but constantly tightening emission requirements and a number of other factors. Every city is different and so are the supply options in given city locations. However, what is common in most cases is the lack of suitable logistics spaces in the city center and in the immediate vicinity. Traffic is also complicated by many parked cars, which sometimes make it impossible to even temporarily stop the vehicle, let alone handle the goods.
Currently, there are several options for solving this group of problems. Ever-tightening emission requirements are pushing internal combustion cars out of city centers. As a result, carriers are being pushed into electromobility or other alternatives for supplying the so-called last mile. This term characterizes, for example, the microdepots network. These depots are most often located in abandoned parking lots and are operated by the given transport company. Prague participates financially in the operation of these depots.

Keywords: City logistics; Supply chain; Microdepot; Circular logistics; Last mile

Port 4.0: a conceptual model for smart port digitalization

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Abstract

Port and terminal operators are experiencing growing complexity and rapidly accelerating demands. As a result, the entire port ecosystem — from the seaports to inland intermodal terminals — is under pressure to modernize. Port 4.0 is a port that leverages advanced technologies to digitally transform key business processes, improve security, and increase operational efficiency and port sustainability. This study presents a conceptual framework for Port 4.0. The conceptual framework describes key principles, enabling technologies, and key service areas for port digitalization. The framework is illustrated using digitalization examples in different ports worldwide.

Keywords: Port 4.0; smart port; digitalization; port automation; Industry 4.0.

Supply chain transportation management

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Abstract

The smooth unfolding of supply chains is of particular importance for the quality of life of all citizens. They provide the necessary inputs for the production, as well as their delivery to customers or end users. Any disruption in the unfolding of supply chains results in a disruption of the balance between supply and demand on the market, with all the negative consequences, from shortages of certain products, inflation, to the emergence of the black market, crime and in extreme cases conflicts and wars. The transportation process connects all phases of the supply chain, from the delivery of raw materials to production facilities, through storage to distribution to the end users of the product. Likewise, transportation enables the development of a circular economy and the waste management after the consumption of the product, for the purpose of recycling and reuse in production, i.e. permanent, harmless disposal of that part of the waste that can no longer be recycled. In the paper, applying the methods of scientific cognition, it is proved that the supply chain can't take place without transportation and that management of the transportation process is a condition for the quality unfolding of the supply chain.

Keywords: Supply chain, transportation process, transportation management, supply chain quality management.

The concept of shaping virtual activities in urban mobility planning

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Abstract

The article presents the concept of studying the factors shaping the possibility of introducing remote performance of tasks and duties related to a specific activity, i.e. introducing virtual activities, i.e. virtualization of activity. The concept is derived from the principles of urban mobility planning and management. Therefore, these issues are briefly presented in the first part of the article. The aim of this concept is to reduce the volume of physical flows of people in urban transport networks by reducing the volume of transport demand, i.e. reducing the volume of transport needs, caused by reducing the number of trips generated by socio-economic activities performed in the form of virtual activities. The concept is presented in the form of a block diagram with extensive commentary. The assumptions for the presented concept were formulated on the basis of a review of preliminary studies of objective and subjective personal factors that relate to the possibility of virtualization of work-related activities.

Keywords: virtual activities; urban mobility plannig; virtualization of activities; reduction of traffic flows; reduction of transport needs; reduction of transport demand; COVID-19 pandemic;

Research on selected positive externalities from road freight transport in Slovakia and EU

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Abstract

Research article specializes on the identification of positive externalities in the road freight transport and their correlation with economic growth. Processed data on economic indicators of the Slovak Republic, its individual regions, and economic indicators of the European Union are analyzed. Researched positive externalities of road freight transport were selected according to the analysis. At the current situation, most of the attention is shifted towards the negative impact of the transport and the positive externalities are in the back despite the fact that road freight transport and road infrastructure have undeniable positive impact on the economic growth of the country and development of society.

Keywords: positive externalities; road freight transport; economic indicators; correlation analysis; covid-19

Innovative package delivery possibilities in Slovakia

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Abstract

The use of newly created technologies in all areas of business is becoming an increasingly important factor for the competitiveness of the company. With the rapid growing number of orders via e-shops and demanding customer requirements, even delivery services are forced to keep up with the times and not be afraid to implement innovative technologies and systems in their processes. New delivery options, such as delivery using drones or autonomous vehicles, are starting to come to the fore in the field of parcel delivery by postal operators around the world. This brings with it not only possible benefits, but also obstacles that companies must solve. However, for the successful implementation of such technologies, it is necessary to understand the behavior and requirements of potential customers, who have different opinions on the issue and may have respect and fear towards adopting innovations. The paper defines the basic characteristics of drone and autonomous vehicle delivery options. The aim of the paper is to create primary research focused on finding out the awareness and opinion of customers of postal operators in Slovakia regarding innovative package delivery options and their readiness to accept new components.

Keywords: Drone delivery; Autonomous vehicle; Smart logistics; Postal operator

Characteristics of urban transport users and their level of satisfaction with transport services. A longitudinal study of passengers in Lublin city in 2018 and 2020

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Abstract

Urban transport users play a critical role in the success of public transportation systems as they are the primary consumers of these services. Understanding the characteristics and preferences of these users is essential to enhance the quality of public transport services and meeting the needs of diverse populations. The level of satisfaction with transport services among urban users can be influenced by various factors, including accessibility, reliability, comfort, cost, and safety. The study aims to explore changes in satisfaction with public transportation in Lublin over two years and determine how urban transport users' characteristics affect general satisfaction with transport services. To verify the hypotheses, a questionnaire was constructed to assess the level of satisfaction with 19 public transportation services. The method also has an overall index ($\alpha = .95$). A total of 642 people participated in the study. The results revealed positive and negative changes in satisfaction with particular public transportation services among those surveyed in 2018 versus 2020. The results revealed positive and negative changes in satisfaction with particular public transportation services among those surveyed in 2018 versus 2020. In addition, user characteristics such as ownership of a private car, waiting time or free-fare significantly affect satisfaction with public transportation.

Keywords: sustainability, satisfaction, urban transport, services, user behavior

Behavior of pedestrians when using a pedestrian crossing with traffic lights

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Abstract

Reducing the number of road accidents and the number of fatalities involving pedestrians remains a topical topic in Poland and European Union countries. It should be noted that the last 10 years have seen an increase in the use of electrical devices by pedestrians or cyclists, which may affect the behavior of pedestrians crossing the road. Undoubtedly, such behavior may lead to an increase in road accidents involving pedestrians, in particular when crossing pedestrian crossings. In order to investigate this problem, surveys were carried out on a group of 820 people and observational studies on 4 selected pedestrian crossings. Observational studies were conducted at fixed times on different days of the week. Particular attention was paid to whether pedestrians use a mobile phone when crossing a pedestrian crossing. The main purpose of the article is to draw attention to the problem of distraction of pedestrians by telephones. Undoubtedly, it should be emphasized that this type of behavior is very dangerous and can cause a road accident, because the pedestrian focuses his attention on the mobile phone and not on the surroundings. Surveys have shown that 15% of respondents always use their mobile phone when crossing a pedestrian crossing. However, experimental studies have shown that approximately 21% of pedestrians crossing pedestrian crossings use a mobile phone.

Keywords: safety; mobile phones; road accidents; pedestrians

Risk Evaluation of Single-engine Turboprop Commercial Operations in IMC

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Abstract

The main topic is aimed at risk assessment and possible risk mitigation of single-engine turboprop (SET) aeroplanes as part of commercial air transport (CAT) and operated in instrument meteorological conditions (IMC) or at night. The paper in the introductory part describes the theoretical issues of the SET-IMC flights and reveals the reasons why the approval of this type of operation was needed. The used analysis verifies later compared results of risk segments along the two compared flight paths, depending on various determinants affecting aircraft performance. The outputs alternatively present new possibilities for enhancing safety in case of engine flameout and following emergency landing procedures. The aim of the paper is also to provide an overview of legislation and regulations related to the CAT operations with SET aeroplanes, which also reflects risk evaluation, especially in IMC.

Keywords: Turboprop; Risk evaluation; Safety

Increasing public transport system operation efficiency in the city of Košice - the case study

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Abstract

The paper deals with the urban public transport in the city of Košice and the proposed solution to traffic congestion, which causes delays for public transport vehicles. The biggest problem is the fact that the volume of cars used for individual transport is increasing in the city, and so the resulting congestions cause time losses for public transport vehicles. In the research, traffic data was collected to determine the one bus line experiencing the greatest travel time delays and the locations where the biggest time losses occurred were identified. In order to reduce these travel time delays, solutions and their application were proposed, which could reduce time losses and ensure high-quality urban public transport.

Keywords: Urban public transport; congestions; vehicle preference;

Possibilities of Integrating Urban Logistics Centers (ULC) into the Freight Service of Cities

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Abstract

The article deals with the possibilities of integrating urban logistics centres into the freight service of cities. The authors aim is to define the issue of City freight logistics and the overall processes within this system of serving cities to meet the needs of the population. Attention is successively paid to the approach to the location of urban logistics centres, the costs of their construction and the benefits of their actual use. Subsequently, statistical data on the possibilities of distributing food and fruit and mixed municipal waste through urban logistics centres are presented and, using mixed municipal waste as an example, the specific optimisation of its collection through the creation of round trips, which are an integral part of the servicing of urban logistics centres, is applied.

Keywords: City logistics, urban logistics centre, freight services, routes optimisation

Transportation problems and their solutions: literature review

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Abstract

The transportation problem is a classic problem in operations research that involves finding the optimal way to move goods from one place to another. With the increase of globalization and the development of complex distribution networks, the transportation problem has become increasingly important in the field of operations research. This article provides a literature review of transportation problems and their solutions. The authors explore the various types of transportation problems and the available solutions that can be used to address them. The article looks at the different objectives and constraints that can be used to formulate transportation problems and presents the main algorithms used to solve them. The authors discuss the applications of transportation problems in different areas including logistics, supply chain management, urban planning, and others. They also examine the potential benefits and drawbacks of using transportation problems in these areas and conclude by suggesting further research in the field.

Keywords: transportation problems; algorithms; assignment problem; transshiping problem; distribution problems

New Design of Avionics Technologies for the VSO-10 Glider

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Abstract

The aim of the paper is to analyze the technical-economic assessment of aircraft instruments that are used on board non-motorized aircraft and then to assess the instrument equipment designs. The paper contains a comparison of the content of flight instruments in the cockpits of aircraft used for training, recreation or sports purposes. The benefit of the paper is to evaluate the optimal design of changes to the technical solution in connection with the economic indicators. The proposed instrument equipment designs will differ in terms of the content of the instrument panel of the VSO-10 sports key, where the new instrument equipment will differ mainly in terms of price and purpose of use. The proposals involve the replacement of devices with analog display for more modern and cost-effective ones with the preservation of existing functions. Quantitative comparison methods are based on technical aspects such as weight, accuracy and economic aspects such as the price of the equipment with assembly. All three created designs are compared in terms of weight and finances.

Keywords:

TOPIC 2: Mechanical Engineering in Transport

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Authors are responsible for language and content of their abstracts.

Numerical analysis of the wheel camber of the front axle of a passenger car during cornering

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Abstract

The work attends to the numerical analysis of the wheel forces and the resultant wheel camber of the reference vehicle Alfa Romeo 156 for four distinct suspension variants of front steered wheels, namely, non-parallel arms of different lengths (these are actually used on these vehicles with a nominal wheel camber of -1.1°), parallel arms of different lengths, long parallel arms and short parallel arms. In addition to these models, reference vehicle models with nominal wheel camber of 0° and +1° were built by the authors. The mentioned six models were employed to evaluate the influence of kinematic parameters on the dynamic response of the vehicle. The outputs of the simulations will provide a valuable basis for comparison with real measured data. Experimental data acquisition will be the subject of further research by the authors. If an acceptable correlation of the values is demonstrated, it will be practicable to verify the predictive power of the presented simulations. Accordingly, it will enable to carry out future simulations of vehicle braking with the necessary deceleration values. Attainment of these values would be problematic in the case of a real vehicle experiment.

Keywords: wheel camber; numerical analysis; suspension; axle models; vertical force; multibody dynamics simulation.

The computer modelling of the vertical loading on a long-base flat wagon loaded with hopper containers

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Abstract

The article presents the results of the computer modelling of the vertical loading on the long-base flat wagon loaded with hopper containers. The research was made for a long-base 13-7024 flat wagon. The accelerations and their distribution fields were determined with the finite element method in SolidWorks Simulation. The maximum acceleration was concentrated in the middle part of the bearing structure of the flat wagon and amounted to 1.47 m/s2. At this vertical acceleration value the motion of the wagon can be estimated as excellent. The model designed was verified with an F-test. The results of the calculation demonstrated that the hypothesis on adequacy of the model was not rejected. The results of the research will be of value for those concerned about developing advanced and competitive container structures and improving the cost-effectiveness of the rail transport.

Keywords: transport mechanics; hopper container; dynamic loading; dynamic characteristics; container transportation.

The research into the vertical dynamics of the flat wagon loaded with hopper container with consideration of their elastic interaction

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Abstract

The article presents the results of the research into the vertical dynamics of the long-base flat wagon loaded with hopper containers. The research was made for a 13-7024 flat wagon loaded with four 1CC containers. The containers were studied as added masses interacting with the flat wagon frame through the elastic linkage. The research included the elastic characteristics of the track. The differential equations of motion were solved with the Runge-Kutta method in MathCad. The initial conditions were taken equal to zero. The results of the calculations demonstrated that the dynamic characteristics under study were within the allowable values, and the motion of the flat wagon was excellent. The results of the research will be of value for those concerned about designing advanced container structures and enhancing the operational efficiency of container transportation.

Keywords: transport mechanics; hopper container; dynamic loading; dynamic characteristics; container transportation.

Passive safety in railway vehicles: a review

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Abstract

The main aim of this contribution is to present the railway vehicles passive safety issues together with related rules, standards and norms being significant to the producers of railway vehicles. Such aim corresponds to criteria, which have to be met regarding the passengers' safety, and which are related even to the interior design of passenger railway vehicle. Moreover, the current technical solutions of passenger wagons are presented together with selected aspects of their safety testing. The paper includes fundamentals in design of individual parts of railway wagons, and an overall solution of an interior design to minimize the negative impact on the passengers' and train crew's safety, i.e. to prevent injuries in case of a potential collision. The objective of this contribution is to provide the review of current technical solutions of railway vehicles, including the normative requirements, regarding to the passive safety of railway vehicles.

Keywords: railway vehicles; passive safety; requirements; interior; exterior.

A calculation and analysis of a cylindrical part of a steam boiler of a steam locomotive miniature model

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Abstract

The aim of this study is to calculate and analyze a cylindrical part of a steam boiler of a steam locomotive model. The cylindrical part of a steam boiler is the fundamental part of the steam boiler because it is designed to heat water and create steam using a large number (up to several hundred pieces) of boiler tubes passing through it, inside of which hot flue gases flow. Stress and reliability previous of the cylindrical part of the boiler were carried out using the methods of a theoretical analysis and the finite element method analysis.

Keywords: steam locomotive; steam boiler; FEM analysis.

Possibilities of Implementing Pre-Trained Feed-forward Neural Networks in Mobile Robotics

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Abstract

This paper is describing how artificial intelligence algorithms can be implemented in controlling development boards like Arduino, ST32, or Raspberry for mobile crawler robots. Especially in the classification of decisions based on the input variables. The artificial intelligence algorithms specifically used in this paper and this example are called feed-forward artificial neural networks. In this paper, there is described how a relatively small neural network that is pre-trained in MATLAB platform can be implemented to the Arduino control board for controlling crawler mobile robot. In this article, there is described the mechanical construction and electrical connections of the mobile robot for a better understanding of this application. The designed crawler mobile robot in this article was primarily used for educational purposes.

Keywords: artificial intelligence; mobile robotics; neural networks; classification.

Resistance of the CrN coating to wear and corrosion

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Abstract

Resistances to wear and corrosion of the CrN coating deposited to high-quality, medium carbon, C55 steel, were studied in this research. Experimental work included the determination of the chemical composition and evaluation of the microstructure of both the base material and the CrN coating. The methods used in the research were the EDX analysis, mechanical properties measurement, wear resistance, scratch tests and corrosion tests. From the results obtained in experiments, the authors concluded that the CrN coating has very good sliding, abrasion-resistance and anti-corrosion properties.

Keywords: CrN coating; C55 steel; wear and corrosion resistance; useful properties.

The effect of emergency engine mode on the fuel consumption of a passenger car

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Abstract

Vehicles with a combustion engine are characterized by different fuel consumption. The aim of the research is to determine the fuel consumption during the operation of the internal combustion engine. Consumption is monitored in the state when the vehicle is without a fault and in the state when the vehicle's engine is operating in emergency mode. The aim of the research is to carry out driving tests on a personal vehicle. The course of fuel consumption is monitored at various sections. In the first section of the route, consumption is monitored when driving in an urban environment, the second section represents driving outside the village and the third section on the highway. With the help of a diagnostic device, it is possible to monitor current consumption data via the engine control unit. The emergency state of the engine is caused by the disconnection of the electronic component that enters into the preparation of the fuel mixture. The cause of such disconnection is the engine being put into emergency mode, which in real operation may mean a drop in engine power and torque. The measurement results actually show an increase in fuel consumption when the engine is working in emergency mode. However, consumption is lower when driving on a highway section. This is due to the vehicle not being able to reach the required speed. The research carried out thus points to the impact of operating a vehicle with an emergency engine condition in relation to fuel consumption.

Keywords: engine emergency; vehicle; engine; emissions; traffic safety; electronic component.

A process of modelling a rail vehicle multibody system with a deformable body

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Abstract

The current softwares allow to perform advanced virtual models of rail vehicles, which provide to simulate reality by means of computer. When a simulation analyses of rail vehicles have to be as realistic as possible, a simulation model of a rail vehicle has to reflect real properties of a component or an entire vehicle. Further, dynamical properties of rail vehicles are the most often analyzed using a multibody model. Usually, it includes rigid bodies. However, a flexible bodies correspond better to their real behavior during an operation. Therefore, implementation of deformable bodies into a multibody model become more popular among scientists. On the other hand, this modelling approach meets some complications, which hamper to more widely applications in modelling practice. This article is aimed at the description of a basic steps in modelling of a multibody model of a rail vehicle with a deformable body. It relates with two particular softwares, namely with the finite element software Ansys and the multibody software Simpack, however, these principles can be also applied in an appropriate manner for other similar simulation programs.

Keywords: steam locomotive; steam boiler; FEM analysis.

Evaluation of the vehicle behaviour when not responding to the take-over request of Tesla Autopilot and Volkswagen Travel Assist

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Abstract

In this work, driving tests were carried out with a Tesla Model 3 and VW ID.4. During the tests, the vehicles were controlled by an SAE Level 2 system (Tesla Autopilot and VW Travel Assist). The study aimed to investigate the behaviour of the vehicles when the driver does not react to the take-over request of the vehicle while it is in a non-critical driving situation. The aim was to clarify whether this can lead to accidents from a purely technical point of view and whether there is still room for improvement. As a result, it could be determined that a non-reaction of the driver to the take-over request leads to system-initiated braking decelerations, which can lead to a rear-end collision by the following traffic. Furthermore, secondary accidents are possible if the driver fails to act as a fallback. This could be reduced by improving the applicable UNECE standard R79 by specifying deceleration values for this case. In addition, the risk of an accident could be reduced by decelerating earlier and warning the environment. For this purpose, a driver monitoring system would also be recommended to allow situational decisions by the system. The implementation of the measures proposed could result in a significant increase in road safety while using these systems.

Keywords: Accident Analysis; SAE Level 2 System; VW Travel Assist; Tesla Autopilot; take-over request; TOR.

The use of automated guided vehicles in the internal logistics of the production company

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Abstract

The company's internal logistics is one of the most important areas that we should improve and optimize. There are currently many technologies available on the market that will help make this area more efficient. The problem arises with the incorrect implementation of these technologies, which can result in not using the full potential of the given technology. The paper deals with the introduction of automated guided vehicles (AGVs) to support internal logistics in a specific organization. The proposal includes a description of a specific company, the selection and description of suitable AGVs, the use of these trucks, time calculations and the subsequent calculation of the number of necessary trucks for internal material needs in the production company. Finally, this paper summarized the benefits and return on investment for the selected company.

Keywords: internal logistics; transport; production company; automated guided vehicles (AGV); production line.

Assessment of the effect of surface roughness on electrochemical characteristics of AZ80 magnesium alloy treated by PEO

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Abstract

The main purpose of this article, is to provide the evaluation of the influence of selected pre-treatment method, mainly grinding by various emery papers, which were used before the plasma electrolytic oxidation (PEO) process to assess the electrochemical characteristics of AZ80 magnesium alloy in 0.1 M NaCl solution. Moreover, the exposure time of the PEO pretreatment was set on 14 min. Subsequently, the surface roughness of PEO coatings was analyzed by confocal microscope. In the next step, electrochemical characteristics of ground surfaces with prepared PEO coatings were determined by the potentiodynamic polarization (PDP) at the laboratory temperature.

Keywords: potentiodynamic polarization; magnesium alloy; plasma electrolytic oxidation; corrosion.

Prospects for using blockchain technology in transportation and supply chain management

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Abstract

The purpose of this paper is to analyse the blockchain technology tools used in the supply chain industry. To achieve this aim, a detailed analysis of the individual technologies is made, and practical examples of their use are given, proving the usefulness of their integration. The spread and maturity of information technology are facts of life today. In the last few decades, it has been a major determinant of economic, industrial, and social development, which has led to huge changes in technological progress. The formation and development of the digital environment are one of the top priorities for most developed countries, including the USA, Germany, and others. Modern technological progress is characterized by the development of different information technologies that help improve the rational use of resources and increase the efficiency of modern enterprises. Currently, there are a lot of applied and professional tasks, the most effective solution to which involves using various kinds of information technology.

Keywords: blockchain; logistics; smart contracts; decentralized environment; supply chains; Ethereum blockchain.

Use of product geometry specifications in the design of 3rd generation combined bearing hubs

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Abstract

This article is an excerpt from the development of the technological process and implementation into production of a third-generation automotive hub assembled with a tapered roller bearing. The article addresses the use of ISO GPS standards and their application in determining geometric tolerances of a bearing hub. Their role in ensuring that the functional requirements specified by the designer and expected by the user are met is indicated. Using selected specifications as an example, the application of ISO GPS standards and their interpretation is shown. The paper uses four ISO GPS standards to define the dimensional and geometric characteristics of a combined bearing hub. These specifications will then be verified when the hub is put into production. For this purpose, a trial batch of third-generation combined bearing hubs will be produced. The conclusions point to the need for a standard dedicated to combined bearing hubs. along the lines of or in addition to ISO 492, which relates to rolling bearings. This need arises from the increasing popularity of the use of combined bearing hubs in automotive vehicles. The complexity of hub designs and their impact on fuel consumption and, above all, safety, makes bearing hubs a highly responsible component. The lack of a standard dedicated to combined bearing hubs forces designers to have, know and apply up to a dozen standards when designing combined bearing hubs.

Keywords: rolling bearings; geometrical product specification; ISO GPS; tolerance; bearing hubs.

Use of geometrical product specifications in the structural design of second generation bearing hub unit

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Abstract

The article discusses selected issues of the application of ISO GPS standards and their use in defining the specifications of designed products. Their importance in meeting the functional requirements specified by the designer and expected by the user is highlighted. This was presented on the example of a comparative analysis of the design of a second-generation composite bearing hub, which is a modification of a double-race angular contact ball bearing. A comparison of the ways in which the requirements of the more important dimensions are specified was made according to ISO 492:2002 and ISO 492:2014. Verification of the requirements description according to the GPS will be carried out during the manufacturing process of the bearing hub unit.

Keywords: geometrical product specification; GPS; dimensioning; tolerance; bearing hubs.

Effect of increasing Fe content on the fatigue resistance of secondary aluminium alloy AlSi7Mg0.6

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Abstract

Since the discovery of aluminium, scientists have always seen aluminium alloys as excellent construction materials. They are among the most widely used metals in many industries. Over the last decades, secondary aluminium alloys have received much attention. Recycling aluminium scrap is beneficial for the environment. Furthermore, it requires less energy, so the production costs are lower compared to primary aluminium. The most common obstacle while using secondary aluminium alloys is their increased iron content because it negatively affects their properties. The study aims to widen current knowledge of iron's impact on the fatigue resistance of secondary aluminium alloys.

Keywords: aluminium alloys; AlSi7Mg0.6; A357; fatigue resistance; effect of iron.

Prediction of temperature behavior in hydraulic circuits

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Abstract

The increasing complexity of products and systems in modern engineering production requires higher demands on the operation and maintenance of systems. For this reason, the role of maintenance can hardly be underestimated, as the maintenance of machinery and equipment is an integral part of any manufacturing process. Maintenance is closely related to the precision of the parts produced and the quality of the manufacturing process. A current trend in Industry 4.0 is predictive maintenance, which enables real-time detection of faulty equipment conditions based on condition monitoring. Utilizing artificial intelligence for predictive analytics can considerably contribute to the prediction of potential failures. Consequently, maintenance costs related to production downtime and equipment repair will be decreased. In this paper, a non-linear autoregressive neural network for real-time prediction of working fluid temperature parameters in a hydraulic circuit is presented. A testing device is also developed to collect experimental data, optimize, and test the proposed prediction model.

Keywords: neural network; NAR; predictive maintenance.

The influence of Mn addition on corrosion resistance of secondary AlSi7Mg0.3 alloys with higher Fe content

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Abstract

This paper focuses on the study of secondary AlSi7Mg0.3 alloy with higher Fe content with the addition of manganese as well as applied heat treatment. The quantitative analysis was performed to investigate the influence of higher Fe content on the shape and amount of Fe-rich intermetallic phases. AUDI test as a form of corrosion testing was carried out with the aim of analysing the corrosion resistance of tested alloys. The influence of higher Fe content, the addition of manganese, and applied heat treatment were investigated. Secondary AlSi7Mg0.3 alloy has a wide range of applications in the automotive industry and therefore, it is crucial for these alloys to be resistant to corrosion and to have all the needed properties.

Keywords: corrosion resistance; AlSi7Mg0.3; AUDI test.

Comparison of risk assessment approaches and analyzes used in technical transport systems

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Abstract

On the basis of current normative and legal bases, such as standards, directives, and laws that control interoperability and safety of systems, the paper's goal is to compare methods for risk assessment of transportation and engineering equipment and protection systems. The initial system definition defined at a high level of abstraction and a few methods used in the development of safety requirements' initial phase are taken into consideration. Eliminating the risk or lowering either of the two criteria that determine the relevant risk, such as the severity of the damage caused by the risk in question and the likelihood that the harm will occur, either independently or concurrently, can accomplish the objective of risk reduction.

Keywords: transport; safety; risk.

The effect of borides on the mechanical properties of tool steels and sintered carbides

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Abstract

The presented article is devoted to the effect of borided surface layers on tool steel 19 541 and sintered carbides of type M1 and M2. The article describes the method of boriding sintered carbides and Cr-Mo-V steel. The aim of this work is to analyze knowledge about the boridation of steels. It focuses on the technological prerequisites for the use of boridation in the production process of forming tools in order to increase resistance to frictional, abrasive and adhesive wear. Boriding technology took place at 900 °C for 240 minutes. A thick boride layer, hard 1092 HV10, 60 μm thick, was formed on the steel sample. A 5 μm thick layer with a hardness of 1290 (M1) and 1378 (M2) was formed on the sintered carbides. An increase in microhardness of more than 700 HVM was measured for carbide M1 and almost 1500 HVM for M2. The increase in hardness is due to the formation of dispersed cobalt borides Co_2B for M1 and CoB for M2.

Keywords: boriding; sintered carbides; tool steel; technology; powder metallurgy.

Microstructure evolution and corrosion mechanism of AZ91 magnesium alloy in chloride environments for commercial purposes prepared by Ohno continuous casting

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Abstract

Billets of commercially used AZ91 magnesium alloy with the diameter of 100 mm were prepared by Ohno continuous casting (OCC) process. Microstructure of AZ91 magnesium alloy was observed by performing optical microscope images. In addition to microstructure analysis, effect of OCC process comparing to the conventional continuous casting on corrosion performance of AZ91 in solutions consisting of 0.01, 0.1, 1M NaCl was evaluated by using potentiodynamic polarization. Results revealed that chloride ion concentration did not affect thermodynamic stability of both As-cast and OCC AZ91 however kinetics of corrosion process was influence in non-linear character. SEM images of corroded surfaces confirmed this influence. Microstructure plays an important role on the corrosion kinetics at higher salt concentrations what is proven in this study.

Keywords: corrosion; potentiodynamic polarization; magnesium alloy; Mg17Al12; microstructure.

Mechanical Design of a Device for Automatic Implementation of Security Features on Passports

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Abstract

In general, biometrics is concerned with the identification and verification of a person's identity. The biometric passport is one of the forms of identification for establishing an individual's identity in their home nation and abroad. Various national and international regulatory and security requirements govern the size, content, and structure of biometric passports. The mechanical design of a biometric passport marking device is the subject of this research article. The purpose of this research is to generate a practical design that meets all legal and safety standards. The best option is chosen from a variety of design concepts.

Keywords: biometrics; passport; mechanical design; marking; perforation; single-purpose machine; automation.

Investigation of the influence of bitumen emulsion and reclaimed asphalt pavement content on the mechanical properties of bitumen stabilised materials with high fine particle content

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Abstract

Cold recycling technology is gaining popularity as an economically and environmentally effective way of pavement rehabilitation. The main benefits of the use of cold recycling mixtures (CRMs) in road base courses are associated with the reduction of raw materials consumption by replacing them with recycled materials such as Reclaimed Asphalt Pavement (RAP), as well as the decrease in energy consumption during production and paving compared to Hot Mix Asphalt (HMA). Bitumen Stabilised Materials (BSMs), described as non-continuously bound CRMs, exhibit granular and viscoelastic materials properties due to the presence of local bituminous bonds and a reduced amount of cement. Their mechanical properties are still being investigated. In this paper, Bitumen Stabilised Materials with bitumen emulsion (BSM-E) were investigated. Mixtures characterised by high fine particle content and designed with different Reclaimed Asphalt Pavement (RAP) and bitumen emulsion contents were subjected to Indirect Tensile Strength (ITS) tests at 25°C. TSR water resistance parameter for the mixtures was calculated. Test results were analysed using two-way ANOVA statistical tests. The laboratory test results showed that BSM-E mixtures exhibited different trends of an increase in ITSdry, ITSwet and TSR values as a function of bitumen emulsion content, depending on the RAP amount used. The statistical significance of the effects of bitumen emulsion content, RAP content, and the interaction between these two factors on the tested ITS values was proven.

Keywords: cold recycling technology; Bitumen Stabilised Materials; bitumen emulsion; Reclaimed Asphalt Pavement; RAP; indirect tensile strength.

Increasing the strength of full suspension bicycle frame by component modification within maintaining a bike geometry

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Abstract

The article focuses on the possibility of increasing the strength of the downhill bike frame by modifying the front triangle component, the article also focuses on the creation of a strength analysis. In the first part, the article deals with the analysis of suspension kinematics and available suspension systems. The article also describes and compares materials used for the production of frame parts. In the next part, the action of external forces and their transmission to the examined part is described, as well as the possibility of damage to the frame is shown. The last part of the article compares the proposed structural solution and the original solution of the problematic area in the 3D CAD program Creo Parametric. The FEM analysis is made in Ansys workbench software.

Keywords: bicycle frame; strength; kinematics; suspension; FEM analysis.

FEM analysis of the hatch for special use

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Abstract

The thesis focuses on the design of a maintenance hole cover for a service shaft that will be located near the taxiway. Service shafts are a common part of airport taxiways, as they are necessary for the operation of the security and announcement systems that are present at every airport. Each piece of infrastructure that is used at an airport is subject to strict standards that must be met in order for the facility to be used at the airport. The main objective of this thesis is to analyse and simulate the stress tests that are specified by the standard followed by a thorough analysis.

Keywords: hatch; FEM analysis; cover; dimensioning; mechanical design.

Construction design of gripper for casting manipulation

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Abstract

The aim of our work focused on the construction design of the reaction arm for the tightening tools and subsequent FEM analysis. Furthermore, to design the construction of the reaction arm attached to the assembly table. A tightening device from ATLAS COPCO will be screwed at the end of the reaction arm and then modeled in the Creo parametric 4.0 program. In the next step, we will use a numerical simulation of stress, strain, and bending to ensure that the structure is dimensioned for sufficient rigidity and functionality of the arm.

Keywords: automation; reaction arm; INDUSTRY 4.0; finite element method.

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A Structural Design of the Injection Mould

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Abstract

This paper proposes the design of an injection mould for a lightning frame. A challenging area in the field of the injection moulding process is undoubtedly the correct design of the injection mould. The injection moulding method has received much attention in recent years due to the mass production of plastic components with complex shapes and exacting dimensional specifications. Advantageous features of injection moulding are high repeatability and precision paired with speed, a cheap cost per item, and a wide variety of plastics. The software program used to design the injection mould and simulate its functionality was Autodesk Inventor. The result of this paper is to extend our knowledge of injection mould construction.

Keywords: injection mould; injection moulding; polymer; constructional design.

Design of specialized gripper for automated casting manipulation

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Abstract

This paper describes the optimal mechanical design of gripper for manipulation of specific castings used in the automotive industry. The current trend in mass production is implementing robotic stations into the manufacturing process. This study presents different designs of grippers for the manipulation of specific castings. Robotic grippers have many applications in various fields of technical focus, manufacturing, biomedicine, or the food industry. In the beginning, we propose three variants of potential solutions for gripper design. Each design deals with a different physical principle of gripping the object. Subsequently, these designed variants are evaluated according to specific criteria. The gripper with the most suitable characteristics for the implementation is elaborated. This study aims to propose the optimal way of casting manipulation.

Keywords: manipulation; gripper; end-effector.

The use of additive technologies for the restoration and strengthening of parts of transport means

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Abstract

The article is devoted to the comprehensive development and implementation of multifunctional coatings obtained through the use of additive technologies, based on scientific research in the field of restoration and strengthening of worn parts to increase the resource of transport means and their elements, aimed at reducing the material and technical resource and reducing the supply of spare parts. When choosing a method of gas thermal spraying, the main conditions for the formation of high-quality coatings are established, and it is proved that the method of electric arc spraying best meets these conditions. The conducted assessment showed that to restore and strengthen the surfaces of parts of ship's technical equipment, it is expedient to replace expensive powder-coated wires made of highly alloyed alloys with cheaper and more affordable steel wires of a solid cross-section made of iron-carbon alloys. The obtained research results of coatings applied by the electric arc method showed the prospects and feasibility of their processing by pulsed ion nitriding. As a result of the conducted research, for the first time, a method of increasing wear resistance was proposed and developed, which provides an increased level of physical and mechanical properties of restored surfaces and a comprehensive solution to the problems of ensuring the characteristics of strength and operational properties of restored surfaces and developing a technological process of restoring parts of ship's technical equipment.

Keywords: additive technologies; durability; restoration; multifunctional coatings; electric arc spraying; nitriding.

Modeling and analysis of composite plates and their implementation in transportation

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Abstract

The article describes the process of creating and comparing composite structures using 3D models created in the graphical program ANSYS Workbench in the ACP (Ansys Composite Pre-Postprocessing) module. The research is a contribution in the field of transportation, where it is appropriate to use a lightweight yet sufficiently strong material, which is mainly influenced by the distribution of reinforcing fibers.

Keywords: ACP; composite; onyx; carbon fiber.

Determination of loads for load-bearing components in crane slewing mechanism considering their embedding stiffness

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Abstract

This article discusses selected structural solutions of pivot mechanisms, which are classified as internal transport means. The construction of a coronary bearing is discussed, which is an excellent solution for the rotary embedding of the carrier system of the crane. The paper presents a numerical method of determining internal load distribution in calculation rows of double row ball bearing. In the calculated characteristics, the pre-clamp of the screws holding susceptible rings, the susceptibility of the bodies, the variable angle of operation of the rolling elements of the bearing are considered. The basic problems of modeling component parts of coronary bearings are discussed. Different vulnerabilities of an open ring girder with local stiffeners resulting from its foundation on flaccid support structures have been considered in the considerations. The results obtained were presented in the form of charts.

Keywords: transport; cranes; slewing bearing; FEM.

Software Support for Evaluating the Hardness Tests of Construction Materials Used in Vehicles

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Abstract

The goal is to create a program for the automatic evaluation of hardness using a series of images taken by a charge-coupled camera (CCD). It will be explained the importance of materials testing for applications in vehicle design. We will present a specially developed program in Matlab to graphically display the surface hardness field of the object under study. The focus of the research is the evaluation of the hardness according to Vickers. In the first step, we developed an algorithm to select the image with the most appropriate sharpness from a series of images of different sharpness. In the second step, we created an algorithm that evaluated the imprint area in the selected image, from which the resulting hardness was calculated. Then we integrated the algorithms into a single resulting program. We compare the measurements of the program with measurements on an automatic ST-2000 Zwick Roell instrument and a manual V 10/HT instrument.

Keywords: indentation; hardness tests; image processing; CCD camera.

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Parking information system with artificial neural network

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Abstract

Intelligent parking systems are necessary for deploying smart cities. For safe and comfortable parking in the parking places, it is necessary to install an information parking system that can show the current number of free and possibly also occupied parking places. Private parking places can be limited to their owners and the access can be protected by an arm barrier or retractable post. For vehicle presence sensing or vehicle transition sensing we can use various types of sensors. Every sensing technology has its own limitations or advantages, and it does not exist one universal solution for all possible situations. This article presents and describes the parking information system (PIS) based on real-time vehicle video detection with a safety IP camera and an artificial neural network. The proposed PIS consists of trained Yolo v5 neural networks trained to detect cars, vans, and trucks. To prevent false counts many control mechanisms were implemented.

Keywords: artificial neural network; parking information system; yolo v5.

Characterization of the heat-affected zones in the laser welded joints of quenched and thermo-mechanically processed high-strength steels

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Abstract

The objective of this research is to compare the heat-affected zone (HAZ) characteristics of quenched and thermo-mechanically processed high-strength steels. Laser-welded butt-welded joints of S690QL, S1100QL, and S700MC steels were used for the analysis. The aim was to describe the effect of microstructure, chemical composition, and manufacturing process on the HAZ´s properties. The considered parameters included the grain size, the width of individual HAZ subzones, and the distribution of hardness throughout the HAZ. The results showed that the content of C, Mo, and microalloying elements Nb and Ti has the greatest influence on the HAZ´s properties. This was observed mainly through the average grain size in the CGHAZ and the hardenability of the CGHAZ and FGHAZ. Based on measured data, the mean grain size of quenched steels is up to 15% larger and the width of CGHAZ is 20% wider than that of thermo-mechanically processed steels. At the same time, it is possible to observe a martensitic structure in the CGHAZ and FGHAZ of QL steels that is absent in S700MC steel.

Keywords: AHSS; S690QL; S700MC; S1100QL; softening; HAZ.

Additive brakes

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Abstract

The aim of this article is to approach the problem of additive brakes, their description, comparison and requirements placed on this type of brakes. I wrote the thesis because of my interest in road vehicles - their individual systems, specifically the additive brakes of trucks and buses. The result is a detailed description and analysis of individual types of additive brakes.

Keywords: additive brakes; brake; vehicle; engine; retarder.

Simulation of a Hybrid Robot for Bridge Inspection

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Abstract

In this paper, simulation tests for a hybrid inspection robot are addressed. The proposed system can be used for indoor and outdoor surveys, and thanks to its compactness and ability in overpassing obstacles, it has been applied for planning the inspection of the deck of railways or highways bridges. Recently, robots have been used for substituting personnel in dangerous or unsafe operations. Referring to structures and infrastructure inspection, either autonomous or tele-operated systems can be used for monitoring purposes for making secure the access to manholes of decks, and box girder bridges. Indeed, a hybrid robot can be used for the inspection in such environments, which are dangerous, difficult, or almost impossible to access. Particularly, the robot must be able to carry suitable sensors for inspection, as well as having the ability in overpassing or circumnavigating obstacles, being compact and maneuverable. In this paper, we report a survey of built bridges in Slovakia with main problems that have to be considered and first simulation results for the hybrid rover developed and equipped with suitable sensors to accomplish the task of the inspection in the context of a selected case of study. The inspection of bridges is becoming nowadays an issue for the security of critical infrastructures, not only at European level, but worldwide.

Keywords: mobile robots; simulation; robotic inspection; structural health monitoring; security engineering; experimental tests.

Planar Cable-Driven Manipulators for Inspection of Large Surfaces

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Abstract

Cable-Driven Parallel Manipulators (CDPM) are a type of parallel robots in which the rigid links connecting the base with the terminal link, also called end-effector, are replaced by cables. This kind of system has been introduced during the last two decades, since then many issues have been addressed, but there are still open problems. Thanks to the nature of the cables, lightweight if compared to the overall structure, and the very large workplace, their possible applications are increasing. Recently, Robotics and Automation have been applied to the inspection of structures and infrastructure; therefore, they are starting to be used to substitute personnel in dangerous or unsafe operations. Related to the inspection, autonomous or tele-operated systems can be used for securing the access to the buildings or infrastructure. In this paper, we propose the application of CDPMs for the inspection of large surfaces, constituted by buildings facades, top roofs, and parts of infrastructures. The development of suitable model of the system, also called Digital Twin, allows the managing of the operation in safe conditions. As new application, we propose the use of a planar CDPM for being applied to the inspection and monitoring. The 3D model acts as a Digital Twin of the real prototype that has been developed and used for experimental testing. Since the purpose is to drive the end-effector to point of interest carrying suitable sensors, tests for trajectory planning and experimental tests are proposed. The inspection of structures and infrastructures has become a very important issue for the security of critical infrastructures, not only at European level but worldwide.

Keywords: cable-driven parallel manipulators; simulation; robotic inspection; structural health monitoring; security engineering; experimental tests.

Multibody simulations in analyses of the vehicles' dynamics

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Abstract

Nowadays, simulation computations are an integral part of design of vehicles, both passengers' cars and lories of all categories. These simulation analyses are based on a creation of a multibody model in some commercial software. Such a multibody model can be of varying complexity depending on users' demands. The multibody model consists of rigid or eventually deformable bodies interconnected by massless elements. This article presents fundamentals of modelling a multibody model of a vehicle. It elucidates the key steps of a modelling process and basic modelling elements applied in a fundamental multibody model of a road vehicle. There is presented a comparison of the results of analytical and numerical calculation of some selected fundamental calculation belonging to evaluation of driving properties of road vehicles.

Keywords: mulltibody simulations; dynamics; cars; virtual models.

Comparison of driving stability of three-wheeled vehicles with an electric powertrain while driving in a curve

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Abstract

Crowded cities and towns with cars and their pollution give opportunities for operation of different kinds of vehicle then ordinary vehicles. Some cities are known by operation of smaller and lighter vehicles, which are often in the three-wheeled configuration and which occupy less space. Moreover, such vehicles use with advantage an electric powertrain with minimal adverse effects to the environment. The objective of this article is focused on investigation of driving properties of a three-wheeled vehicle. Namely, there are compared four versions of the E-3kolka vehicle differing to each other by the frame design and the steering mechanism design. The investigation is aimed at the evaluation of the driving stability while driving in a curve. The main outputs are forces in the wheel/road contact and the maximal driving speeds in curves. The research is performed by means of simulation computations in a commercial multibody system Simpack.

Keywords: railway vehicles; passive safety; requirements; interior; exterior.

Electromotor housing microstructure dependence on HPDC process parameters

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Abstract

The microstructure of high-pressure die casting (HPDC) product directly influences its mechanical properties. The aim of this article is to evaluate the effect of the fast-shot speed on the microstructure for two geometric variants of the casting. Material used in the experiment will be a commonly known AlSi9Cu3(Fe) alloy. For experimental purposes, numerical simulations, microstructural analysis, SDAS index, and length of eutectic Si plates measurement will be implemented. The simulations have shown the possibility of air being entrained in the cold chamber. Oxides, and consequently microporosity, were predicted, which led to the selection of critical points of the casts chosen for further observation and evaluation. With the use of optical and scanning microscope, fast-shot speed value of 3.6 m.s-1 was selected as the most advantageous.

Keywords: high-pressure die casting; numerical simulation; porosity; fast-shot speed.

Generation of bicycle frame image designs using DCGAN network

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Abstract

The crucial step in the creation of every new product is the design process which is highly subjective and time-consuming. Artificially generated design suggestions can help to accelerate this process. We propose a method which can automatically generate 2D images with different design ideas for the specific design nodes. Images are generated by the DCGAN network. The DCGAN model is trained using real data in combination with synthetically generated images. Synthetic data is created using the generative design module of PTC Creo Parametric. In the paper, we train the DCGAN model to generate bicycle frame images. After some improvements to the model, it can become a helpful tool in the product design process.

Keywords: design process; synthetic data; gan; dcgan.

Surface roughness of hardened steel 90MnCrV8 after turning with actively driven tool rotation

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Abstract

With the increase in the use of difficult to machine and hard materials, it is necessary to find new productive ways of machining these materials. Among these technologies, we can also include forced tool rotation turning (ADRT), the easy deployment of which is made possible by the development of CNC machine tools. This non-standard kinematic structure of machining brings many advantages, mainly in increased tool life and lower temperatures in the cutting zone. This technology can be used for the production of parts in the automotive and aerospace industries. In the experiment of the paper, the dependence of surface roughness on cutting speed in turning with forced tool rotation was investigated. A monolithic tool was designed and used for the experiments, which was predicted to have higher strength and reduced recess formation compared to a tool with an interchangeable cutting insert. The measured roughness of the machined materials reached relatively low values, which could be further improved with improvements in the overall process technology system.

Keywords:

Roughness surface analysis of samples produced by the additive manufacturing process

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Abstract

The above research consists of a comprehensive analysis of the roughness of samples produced by metal-based additive processes in the engineering and automotive industries. The experimental part consists of a comparison of three manufacturing technologies that work based on the additive process. The SLM technology consists of layering the material in the form of a powder that is selectively melted by a laser. The ADAM technology consists of layering of a metal-metal weave filament followed by sintering in a vacuum. The last fabrication technology, Binder Jetting (BJ), uses a material in powder form, which consists of layering successive layers followed by post-processing. The research is concerned with the analysis and comparison of quality parameters in manufactured samples by each technology, with an emphasis on roughness. Experimental results confirm the significant advantages of Binder Jetting technology. This technology is advantageous due to several parameters, such as production volume, speed of parts production, and overall quality of the produced parts.

Keywords: additive manufacturing, ADAM, Binder Jetting, SLM, industry.

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Mikulov, Czech Republic

Influence of trochoidal milling parameters on tool load

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Abstract

In recent years, there has been an increasing interest in high-production technologies, including trochoidal milling. As it provides high productivity even when cutting difficult-to-machine materials, this method has high potential. The research is aimed the issue of the variation of trochoidal milling parameters on tool load. The trochoid pitch and the engagement angle are the process-defining parameters in trochoid milling and their appropriate adjustment can optimize the production process. The effect of trochoidal milling on surface quality has been demonstrated in previous research.

Keywords: trochoidal milling; cutting forces; high productivity machining.

Friction coefficient of the deposited DLC layer as a function of the test ball material

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Abstract

DLC coatings have numerous properties that can be utilized in industry. Low coefficient of friction, hardness, abrasion resistance, and corrosion resistance are their principal advantages. Coatings are evaluated with a variety of test methods. The results of experiments, which are the subject of this paper, were conducted using the ball-on-flat method. The tribological pair was comprised of a plate with a DLC coating and a test balls composed of three different materials. The outputs of experiments are the friction coefficient curves as well as the optical evaluation of the wear of the DLC coating. In all three types of tested tribological pairs, the coating was worn, however there was no complete removal of the DLC coating from the plate. The level of coefficient of friction shows nearly constant values after run-in phase.

Keywords: coefficient of friction; tribology experiment; DLC coating

Modelling and simulation of a compact sample of composite materials

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Abstract

Additive manufacturing of composite materials has a high degree of structural strength, which aids in the production of geometrically more complex shapes of components. This paper aims to investigate the crack propagation in the case of eccentric tension, to compare the Von - Mises stresses for the different materials, and to evaluate the stress intensity factor, which will provide a basis for further experimental measurements. In solving the simulations, three different materials were compared with each other, with emphasis on the comparison of carbon fiber reinforced Onyx and aluminum alloy materials. Crack propagation was monitored by simulations in Ansys using the Smart command.

Keywords: additive manufacturing, composite materials, ansys.

Effect of accelerometer mass on the natural frequencies of the measured structure

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Abstract

The study aimed to determine the weight at which an accelerometer should be used to record natural frequencies to prevent measurement error. This is also because many pieces of transportation machinery passed testing with flying colors. There were two major chapters in the thesis. The first chapter discussed the creation of the numerical model and the results of the modal analysis performed using the finite element method. In addition, the data were presented graphically. The experimental modal analysis of the sample, to which various weights were gradually added, was the focus of the second chapter. The results and the impact of weight on the specimen were represented graphically. The evaluation included a summary of the outcomes. The thesis advised additional studies to explain the impact of sensor mass on natural frequencies in greater detail.

Keywords: natural frequencies; resonant frequencies; accelerometer; Doppler vibrometer; FEM.

Evaluation of bitumen's fatigue resistance - a comparative study

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Abstract

Since asphalt mixtures are based on bituminous binders, a complex organic viscoelastic and time-temperature dependent material, they naturally tend to change their performance. Due to increasing traffic and axle loads, fatigue resistance is one of the most important properties of asphalt materials. The standard procedure of asphalt mixture evaluation is determining their fatigue resistance, but it is also possible to determine the fatigue resistance of bitumen on binders level. This article presents the research results of asphalt binders fatigue resistance, two paving grade bitumens and one polymer modified bitumen, in unaged and aged states. Asphalt binders were tested using three methods according to the Superpave criterion, the time-sweep fatigue test and the linear amplitude sweep test (LAS). Analysis and evaluation of the test results were carried out due to fatigue and time consumption of the testing procedure. In terms of determining the fatigue phenomenon, both in bitumen and asphalt mixture levels, the most critical aspect is the time severity of the tests and the necessity to perform such advanced testing on many test specimens. The results show that the $G^* \cdot \sin\delta$ parameter should not be used to validate the fatigue life of bitumen. The result from fatigue time-sweep and LAS tests appear to give similar outcomes and correlate better, especially the LAS in higher strain levels. Furthermore, regarding test time consumption, LAS requires less time to perform and gives a more flexible approach to determining bitumen fatigue life.

Keywords: bitumen; asphalt binder; fatigue resistance; stiffness; viscoelasticity.

Influence of surface roughness on fatigue performace of additively manufactured metal matrix composite Al2024–RAM2 alloy

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Abstract

Numerous studies on Laser Powder Bed Fusion (L-PBF) have demonstrated the necessity to refine microstructure of additive manufactured (AM) parts to eliminate hot cracking and anisotropy to improve L-PBF processability. It has been shown that ceramic nanoparticles based on Ti can be extremely effective inoculant resulting in fine grains structure for high strength aluminum alloys without hot cracking. The company ELEMENTUM 3D has patented production process of reactive additive manufacturing (RAM) with a low content of ceramic nanoparticles as Al2024-RAM2. This contribution presents results of an experimental determination of high cycle fatigue life of L-PBF Al2024-RAM2 alloy with as-built (i.e., rough) and polished surface. Experiments were done on miniature specimens printed on a SLM 280 HL system with a layer thickness of 60 μm. The specimens were tested in cyclic plane bending at a load ratio of R = 0 at a frequency of 25 Hz. Moreover, the microstructure was investigated by means of scanning and transmission electron microscopy.

Keywords: additive manufacturing; L-PBF; Al2024-RAM2; Microstructure, metal matrix composite; fatigue.

Influence of electrolyte composition on corrosion properties of PEO coating prepared on EV31 magnesium alloy

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Abstract

This paper deals with the influence of electrolyte composition on the corrosion properties of plasma electrolytic oxidation coating prepared on EV31 magnesium alloy. An electrolyte for PEO was prepared with 12 g of Na3PO4 and different amounts of KOH (1, 2, and 4 g). PEO coating was prepared using a DC regime with a constant current density of 50 mA.cm-2. Voltage and time dependence was recorded with BenchVue software. The time to achieve initial dielectric breakdown and the initial dielectric breakdown voltage decreased with increasing content of KOH. Corrosion resistance was evaluated using potentiodynamic polarization after one hour of exposition in 0.1 M NaCl. There was no significant difference in thermodynamical stability among samples fabricated in electrolytes with different KOH contents. The lowest corrosion current density value (1.82 mA.cm-2) was achieved by adding 2 g/l of KOH to the electrolyte..

Keywords: corrosion; plasma electrolytic oxidation; magnesium alloys; surface treatment.

Electrochemical behaviour and surface treatment of magnesium alloy ZK60

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Abstract

Magnesium alloys, specifically ZK60, have emerged as a promising material for use in modern and safe transportation due to their lightweight and high strength properties. To enhance the corrosion resistance of ZK60, the PEO (Plasma Electrolytic Oxidation) process was applied to form a ceramic-like oxide layer on the surface of the alloy. Additionally, a PVA polymer coating was applied on top of the PEO layer. The effect of the PEO layer and the combined PVA polymer coating on the corrosion resistance of ZK60 was evaluated using electrochemical impedance spectroscopy (EIS). The results showed that the PEO layer combined with the PVA polymer coating significantly improved the corrosion resistance of the ZK60 alloy. This makes ZK60 alloy a suitable material for use for many applications not even in the transportation industry.

Keywords: magnesium, magnesium alloys, biomedicine, biodegradation, corrosion, plasma electrolytic oxidation (PEO), polymer coatings.

Application of smart wireless device monitoring emissions of ventilation quality in underground car garage spaces

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Abstract

One of the significant goals of the World Health Organization is to decrease the production of dangerous pollutants and compounds that harm life on Earth, specifically by 55 percent by the year 2030. One of these contributions is undoubtedly the transport industry along with a truck, cars, or other on-road driven vehicles. A SMART monitoring system could be a solution able to measure the pollution levels in busy crossroads and garage spaces that can depict over-reaching values of pollutants such as carbon dioxide, sulfuric oxides, or dust accumulation above health-recommended levels. The study aims to evaluate the air quality levels in garage spaces in the district of Žilina. The results have shown a proof-of-concept of a wireless monitoring emission system run solely on batteries providing active feedback within confined underground spaces. The entire garage ventilation fulfilled norm STN 73 6058 with respect to CO and CO2 values, however, PM values exceeded recommended concentrations. Further scientific experimentation and prototyping will validate the concept in practice, making sure the cities of Europe have accurate, just-in-time data to meet the 2030 emission targets.

Keywords: wireless ; emissions ; monitoring ; SMART city.

Separation of solid pollutants transported from small heat sources with chimney filters

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Abstract

The review deals with the issue of environmental pollution with solid pollutants emitted into the air by small heat sources. It lists the methods and ways of separating solid pollutants released into the air by elements located directly into the heat source or outside the heat source. The attention is focused on the method of capturing solid pollutants through chimney filters. The highest efficiency (more than 90%) in capturing fine particles with a diameter of up to 2.5 μm is achieved precisely by using filters. However, the efficiency of filtration depends on various factors, such as the material composition of filters, the granularity of the material. It is also essential to regenerate the filter, i.e., to remove the applied layer or to slow down the formation of this filter layer to maintain the filter efficiency. Part of the further research is the monitoring of existing technical solutions for the construction of the chimney filter by the state of the art in available sources of patent information.

Keywords: solid pollutants; reducing emissions; separators; filters.

Mathematical modeling energy losses and dynamic loads during operation of the crane lifting mechanism

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Abstract

A mathematical model of an overhead crane has been developed to calculate energy losses and dynamic loads during the operation of the lifting mechanism. The mathematical model of the crane, which is presented in the form of a three-mass design scheme, takes into account all the main parameters of the electromechanical system "electric drive - metal structure – load". The reduced to the ropes force of the asynchronous electric motor of the load lifting mechanism is taken into account using non-linear speed-torque characteristics. Differential and integral equations in the mathematical model of the crane make it possible to calculate energy losses in an asynchronous motor during a transient process due to constant losses, variable losses in the stator and rotor. Using the developed multifunctional computer program (in the Delphi environment), it is possible to calculate with high accuracy the values and build dependencies of all components of energy losses, as well as displacements, velocities, and accelerations of reduced masses, loads in the crane steel structure and ropes when lifting loads in transient processes. Using the presented mathematical model, studies of energy losses in the electric drive of the lifting mechanism and dynamic loads in the steel structures and ropes of an overhead crane with a lifting capacity of 20 (t) and spans from 19.5 to 31.5 (m) were carried out. The article presents the results of studies of transient processes when lifting a load "with pickup". Three stages of lifting the load are considered: the choice of gaps in the mechanism of lifting the load and the sagging of the ropes with a stationary load; change in effort in the ropes from zero to a value equal to the gravity of the load; the movement of all three masses after the separation of the load from the base.

Keywords: load-lifting crane; lifting mechanism; mathematical model; energy losses; dynamic loads.

Mechanical resistance of safety elements in transportation

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Abstract

Polycarbonate is a thermoplastic polymer used in many sectors including security and transportation. Polycarbonate plastic parts can be used in automotive applications because of their low strain, durability, performance, and slow deterioration. This engineering polymer is easily moldable, processable, and thermoformable. This article tests the polycarbonate shield, grit from the polycarbonate shield, and injection molded polycarbonate specimens on a drop-weight impact test. This study is focused on the comparison of the mechanical properties (especially on the impact resistance) between injection molded polycarbonate, and polycarbonate safety shield. Statistical evaluation of the results shows that the injection molded polycarbonate does not reach the mechanical properties of the protect shield.

Keywords: Transportation, Mechanical resistance, Safety, Polycarbonate, Injection molding technology

TOPIC 3: Electrical Engineering in Transport

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Authors are responsible for language and content of their abstracts.

A sensorless stable V/f control of SPMSM based on constant power factor control with a novel MTPA tracking

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Abstract

The paper presents a sensorless stable V/f control strategy of surface permanent magnet synchronous motor (SPMSM), where the maximum torque per ampere (MTPA) condition is satisfied by controlling the *d*-axis current to zero. However, to directly control the *d*-axis current, it is necessary to know the exact rotor position, which is not possible in sensorless V/f control. Based on this fact, a constant power factor (CPF) control loop in voltage vector reference frame *dvqv* with a novel MTPA tracking according to a look-up table (LUT) was developed. The LUT was created based on a set of experimental measurements to store the motor power factor where MTPA is reached. The proposed stable V/f control strategy shows an accurate MTPA tracking of SPMSM in the entire operational range verified by experiments.

Keywords: sensorless control, V/f control, power factor control, surface permanent magnet synchronous motor, maximum torque per ampere.

Loss analysis of perspective multiphase converter topology suitable for the automotive traction inverter

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Abstract

The paper deals with the power losses of semiconductor devices of alternative multiphase topology for traction inverters in the automotive industry. Multiphase traction inverters are getting increasingly more attention due to features that make them superior to conventional three-phase topology used nowadays in the automotive industry. Based on key features of multiphase traction inverter topologies, which are enhanced per-phase power management, fault-tolerance capabilities, and decreased size of DC-Link capacitors, are getting the attention of automotive constructors and their suppliers. Power loss calculation is one of the most important aspects of evaluating the estimated efficiency of the proposed topology of the traction inverter. Power Losses are calculated by using the software PLECS.

Keywords: automotive traction inverter, six-phase NPC inverter, power losses, PLECS.

Comparison of power transistors for WPT power inverter 44kW

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Abstract

This article deals with the selection of components suitable for the construction of a power voltage converter for wireless power transmission systems with a power of 44 kW, in accordance with the requirements that need to be met. At the beginning, the article highlights the properties of SiC-based power transistors. The comparison is based on the evaluation of the properties of the transistors in terms of robustness and dependability, conduction and switching losses, the driver's complexity, dimensions and price. The article deals with the simulation evaluation of power switching elements based on SiC. The comparison is made through thermal models of transistors in a Plecs environment. Features, advantages, disadvantages of power modules and discrete components are discussed.

Keywords: wpt, power inverter, SiC, power loss analysis, thermal model.

Hardware in the loop modeling of T-type voltage source inverter for vehicle to grid applications

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Abstract

The grid-tied three-phase T-type voltage source inverter (T-type VSI) modeling process for residential battery charging stations is described in this paper. The primary goal is to create a HIL simulation model and control algorithm for the PLECS circuit simulator. This paper focused on the importance of the HIL simulation system in testing the control algorithm and power electronics. The hardware architecture of the system, the software tool, and the required modifications are described. Additionally, the proposed converter's simulation results are evaluated.

Keywords: power converter, HIL simulation, Rapid prototyping, PLECS

Experimental Verification of the 3x5 Matrix Converter Using Indirect Control

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Abstract

This paper deals with the experimental implementation and the verification of the indirect control for the direct matrix converter in the 3x5 configuration. As matrix converters gains popularity, their application in the drives and hybrid vehicles can bring advantages. In first, the theoretical preview is presented with development and improvements in the field of the matrix converters. Then, concept and construction of the 3x5 matrix converter sample is shown, together with experimental implementation of the control algorithm to the DSP and FPGA. Finally, the model of the matrix converter used for the motor drive is verified and measured at the output power of 930W. The measured results are then compared to the simulation model to compare the overall behavior of the experimental converter and simulation model created in the MATLAB Simulink environment.

Keywords: Matrix Converter;Indirect Control, FPGA, Matlab Simulink.

The Analysis, Modeling, and Control of the Forward DC/DC Converter for the Electric Vehicle

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Abstract

This article deals with the analysis, modeling, and control of the DC/DC converters. Although it is considered with the analysis of the power semiconductor converters in general however it can be applied also to sophisticated electronic devices perfectly suitable for on-board applications of a huge variety of transport vehicles. Specifically, as an example, the Forward type topology is used which offers the advantage of the galvanic isolation of output. The task is to obtain a state space description of the system, the transfer function of the control, and design controller parameters using MATLAB. The state space model and the transfer function is implemented for the ideal and nonideal type of topology, where it is considered with at least some parasitic parameters of circuit elements to get closer to real results of the physical sample and to compare obtained transfer functions based on their frequency characteristics.

Keywords: state space analysis, forward converter, feedback system, compensator.

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Artificial neural network-based estimation for rotor-flux model reference adaptive system

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Abstract

At the start, this paper focuses on the function of a rotor-flux model reference adaptive system (RF-MRAS) and in the following part on the realization and application of artificial neural networks (ANN) in a sensorless induction motor drive. Afterwards, a data collection and usage process for the training of ANN is described. In the final part, experimental results of ANN's ability to estimate rotor flux are presented. According to simulations, ANN estimations are accurate and its application as a part of a control scheme looks promising.

Keywords: ANN, artificial neural network, NN, neural network, RF-MRAS, MRAS, rotor flux estimation, sensorless control, induction motor.

Existing Fast Reroute Mechanisms in SDN

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Abstract

Nowadays, the implementation of networks using software-defined resource environments is becoming more and more widespread. As with classic IP networks, it is necessary to consider possible complications that occur during connectivity failures (packet loss, unavailable services, congestion). A critical aspect when a connection fails is the time required to restore it. In Software-Defined Networks (SDN), where topologies are large, there are several ways to look for ways to improve network recovery speed. Fast Reroute solutions have been developed to solve negative impacts after link or node failure in SDN.
This paper introduces current Fast Reroute mechanisms in Software-defined networking (SDN). The most used mechanisms include Openflow Fast Failover groups, OpenState failover technique, Loop-free Alternate (LFA) and Remote LFA (RLFA).

Keywords: Fast Reroute, FRR, Fast-failover, SDN, OpenFlow, OpenState, LFA, RLFA.

Brief overview of the general aspects of electromobility

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Abstract

Presented article deals with the description of the general aspects of electromobility, which provide more clearer interpretation of the key characteristics and global impact. Continual development within power electronics and energy storage systems, provide emerging advantages for the improvements of the non-conventional drivetrains of passenger as well as utility vehicles. Several aspects are affecting investments and its return when conventional and non-conventional (hybrid, electric) vehicle is compared. This paper therefore provides description of the general aspects of electromobility, while an example of a comparison of the economic balance of vehicle with a combustion engine and a pure electric vehicle is also demonstrated.

Keywords: electric vehicle, electromobility, cost, carbon, investment.

Analysis of a Residential Charging Station Operation with Stochastic Occupancy Model

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Abstract

This paper analyses the cooperation of a residential grid-connected charging station with a photovoltaic (PV) power plant and its impact on the power flow between the charging station and the main grid. The paper also presents a new charging station occupancy model based on random generation from the distribution functions constructed by analysing real data. The presented results are obtained by using the Monte Carlo method. The results demonstrate that the cooperation of defined charging station with controlled charging and the PV power plant allows a reduction of the power drawn from the main grid. However, the results also show that when controlled charging is present, the power drawn by the charging station is reduced in the case of minimal PV power plant output, which has an impact on the final SoC of the electric vehicles connected to the charging station. This shows the importance of testing proposed residential charging station models using real data.

Keywords: residential charging station, electric vehicle, charging control, photovoltaic power plant.

Influence of over-voltage on LiFePO4 cell and its elements of battery equivalent scheme

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Abstract

The over-voltage effect on a LiFePO4-based cell is discussed in this article. A full overview of the infrastructure required to accomplish a controlled over-voltage of an electric cell is provided. This article examines the waveform of cell over-voltage, changes in electrical parameters, cell temperature, and cell size change in detail. The influence of over-voltage on the parameters of the internal equivalent replacement electrical scheme is the major focus of the article. The detailed parameter change of elements R and C of the equivalent replacement electrical scheme is depicted graphically in relation to the quantity of energy contained in the tested cell (current SOC).

Keywords: LiFePO4 battery, replacement equivalent scheme identification, equivalent battery scheme, battery replacement scheme, over-charged battery, over-charged battery.

The Influence of the Electric Vehicle Charging Station on the Power Supply Network with Regard to Power Quality

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Abstract

The European Union (EU) aims to reduce greenhouse gas emissions by 2030 and therefore a proposal has been accepted to improve publicly accessible charging and refueling infrastructure for alternative fuels. This will result in an increasing number of electric vehicles charging stations, which can negatively impact the power grid. Therefore, this paper investigates the impact of electric vehicle charging by a particular charging station on the grid from a power quality perspective. The charging station's harmonic components, reactive power, and power factor during different operating conditions are analyzed. The harmonic analysis for one period of supply voltage and current consumed by the charging station during maximum load, graphs of active power, reactive power, first harmonic power factor, and total power factor for different operating conditions are shown in this paper.

Keywords: electric vehicle, charging station, power quality, harmonics, reactive power, power factor.

Impact of Road Tunnel Consumption on the Power Quality, Power Factor and Reactive Power Flow

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Abstract

In recent years there has been an increase in reactive power flow from lower voltage levels to higher voltage levels due to changes in the power grid. Road tunnels also contribute to the reactive power flow by their nature of loading. Tunnel consumption is mostly made up of lighting sources. Currently, the most commonly used lighting is LED-based, which includes current sources with non-linear volt-ampere characteristics and high capacitance. As a result, they draw distorted current from the grid and also generate reactive power to the grid. This paper analyzes the overall power quality based on STN EN 50 160, the total harmonic distortion of current, power factor, and reactive power of the road tunnel. The paper especially shows the effect of harmonic distortion of current on the difference between the fundamental harmonic power factor and the total power factor, and also the difference between the reactive power of the fundamental harmonic and the total reactive power.

Keywords: road tunnel, power quality, reactive power flow, total harmonic distortion, power factor.

Investigating the impacts of high voltage powerlines on ground current fields

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Abstract

Stray currents are a typical problem of areas crossed by electric railways. This well-known phenomenon can cause significant damage to all underground metallic installations, especially in case of DC stray currents. In areas close to the railway, the presence of stray currents is expected, and protective measures are applied to all sensitive installations like pipelines. However, field measurements have shown that the presence of high voltage power lines can significantly affect the ground current field due to the well-grounded ground wire representing an excellent alternative path for ground currents. This way, stray currents can appear in areas where the presence of ground current field from DC traction is normally not expected. Preliminary simulations have confirmed that high voltage power lines are a significant element affecting the spreading of ground current and the presence of high voltage power lines must be considered when investigating the ground current field of an area. However, these simulations were performed only for a limited area with a very simplified geometry of railway truck and a single power line. This paper presents results of a more complex simulation involving a large area crossed by a DC railway traction system and a complex high voltage network. The simulation is based on real topology representing an area around the town of Zilina, an industrial area with a complex high voltage network and an important railway hub.

Keywords: stray currents, ground current field, high voltage powerlines, DC traction.

Comparative study of SVPWM techniques modified for three-phase current reconstruction using single current sensor in PMSM drive

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Abstract

This paper aims at the application of three-phase synchronous motors with permanent magnets excited by a three-phase voltage inverter. Specifically, it examines the methods of phase current reconstruction with single-shunt current measurement. When measuring current with a single-shunt, complications arise in the form of impossibility of reconstruction of the phase currents near a sector boundary and in a region of small duty cycle. The paper compares two methods designed to overcome these complications and verifies them on a simulation model of a vector controlled three-phase VSI-excited PMSM drive.

Keywords: single-shunt, three-phase current measurement, three-phase current reconstruction, modulation technique, double-switching.

Design of a beehive monitoring system with GPS location tracking

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Abstract

This thesis deals with monitoring stations focused on beekeeping, using IoT (Internet of Things) technology, and also a brief design solution for the possibility of transporting beehives between different territories. The paper also briefly summarises the monitoring systems that are used by beekeepers worldwide. This paper aimed to create a complete design of a monitoring device for monitoring the environment of bee hives using IoT technology, including a table with a roof where the bee hives will be placed. The paper also includes the possibility of using motion tracking via a GPS module - the principle of motion tracking can be the same as is commonly used for other applications, e.g. by placing it in a car it is possible to track the exact location of the vehicle on a map. The monitoring system proposed in this paper allows to reduce the frequency of beekeepers' interventions and also to shorten reaction time in case of unexpected or unwanted situations.

Keywords: monitoring system, tracking system, bee hives, Internet of Things.

Adaptive Kalman filtration for low noise systems

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Abstract

Kalman filter identification problem is considered in the situation of low noise in observations. This model of observations is widely used in trafic management Antoniou et al. (2010). The proposed procedure consists of several steps. First a preliminary consistent estimator is constructed on the vanishing learning interval. Then this estimator is used to define One-step MLE-process and finally this estimator-process is used for approximation of the unobserved state. It is shown that the estimate thus obtained is consistent, asymptotically Gaussian, and asymptotically efficient. As a result, it is possible to implement a high-speed algorithm for filtering an information process with unknown parameters, which provides good accuracy characteristics.

Keywords: Partially observed systems, hidden Markov processes, parameter estimation, adaptive filter, Kalman filtration, low noise observations.

State space analysis and control transfer function of a flyback converter

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Abstract

Flyback converters are used in automotive power supply applications for their advantage of galvanic isolation and the low number of components on a small PCB area. This paper is dedicated to state space analysis of flyback converter with parasitic elements. The Euler method also uses state-space matrices of the proposed flyback converter with nonideal flyback converter with a Bode plot of both open-loop and closed-loop systems. The advantage of this approach is to determine the stability of the open-loop system from a mathematical model and to estimate suitable PI tuning values for the closed-loop system. Transfer function and Bode plots have been obtained from state space matrices in MATLAB.

Keywords: transfer function, flyback converter, bode plot.

Effect of Window Tinting on Passenger Detection and Enforcement in Road Transport

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Abstract

Due to the high volume of traffic, many transportation agencies have recognised the advantages of exclusive bus, taxi or carpool lanes and encouraged their funding. But enforcement of the rules of these lanes is very difficult. To mitigate danger for officers performing visual observation, automated monitoring systems have been proposed. Recently, Near-infrared (NIR) camera systems have been investigated for occupancy estimation task. We undertook a study to determine if the automatic NIR detection and counting systems of vehicle passengers are feasible when cars are equipped with a modern solar windshield or heavy tinting. Such automated passenger counting systems would greatly improve the effectiveness of carpool lanes and accuracy to help with the future design of infrastructure. In the present paper, we report our findings regarding the spectral transmittance of different car glasses, car window tintings and solar windshields. We are currently building a novel system based on the fusion of five different image types captured with cameras equipped with NIR, polarising, UV and neutral density filters and we demonstrate the feasibility of the NIR approach with theoretical and experimental arguments.

Keywords: occupancy estimation, passenger detection, glass transmittance, window tint transmittance, solar windshield.

Deep Reinforcement Learning for Traffic Signal Control

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Abstract

The increasing demand for mobility in cities and beyond presents challenges for traffic engineering. As a solution to these challenges, we can use the power of artificial intelligence and reinforcement learning. These scientific branches can enable us to use the current infrastructure more efficiently, thus reducing the environmental impact and increasing the comfort of drivers. In this paper, using the Ingolstadt and Cologne benchmarks from RESCO, we compare our agent, which is based on Perceiver with IDQN (Independent Deep Q-Network), to the conventional method of Max-pressure and random times for green signals.

Keywords: deep reinforcement learning, traffic control, traffic lights control, artificial intelligence.

Low-Speed Sensorless Control for Six-Phase PMSM Based on Magnetic Anisotropy

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Abstract

The paper presents a sensorless control technique for the low-speed region. The method is based on tracking of the six-phase permanent magnet synchronous machine (PMSM) saliencies with high-frequency (HF) signal injection. The six-phase system is an effective fault-tolerant propulsion for transport vehicles where the sensorless control can be utilized as the speed/position sensor backup. The machine has negligible geometrical saliencies, so the magnetic salience is excited utilizing the flux-producing component of the field-oriented control. The possibilities of HF injection and the demodulation processes for the whole six-phase system and one of the three-phase systems are examined. The sensorless control technique is verified experimentally on the six-phase PMSM with 30° displacement between two three-phase windings and the power of 1 kW.

Keywords: High frequency injection, Low-speed, Multiphase machine, Sensorless, Six-phase machine.

Measurement of the road surface with a laser scanner

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Abstract

This paper deals with the design of a laser measuring system for measuring road surface irregularities. The work discusses possible methods of measuring the road profile. The goal of the work was to measure the road surface with a mobile device and display it using virtual environment. By using the techniques described in the paper, it is possible to increase the quality of the roads, which ultimately could increase the fluency and safety of road transport.

Keywords: Laser scanner, Laser measuring, Road surface..

Torque ripple investigation of a hybrid-excited PMSM for traction automotive applications using FEA

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Abstract

This paper concerns the electromagnetic design of a hybrid-excited permanent magnet synchronous motor for use in traction automotive and transport applications. Initial topology and dimensions are chosen based on state-of-the-art electric motors used in existing electric vehicles today and taking into account the manufacturing possibilities at the university. The topology is then analyzed using 2D finite element method with respect to torque ripple minimization. Results of the optimization for varying topology parameters and DC current supply are presented, with corresponding magnetic field distributions, produced torques, etc. The optimization excludes mechanical and thermal analyses, which will be subject of future investigation.

Keywords: hybrid excitation, permanent magnets, FEA, electromagnetic design, automotive, EV.

Implementation C++/QT framework for CAN communication

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Abstract

The goal of this paper is to explain and offer a solution to a problem that is often overlooked in the field of robotics and mechatronics used in transportation concepts. It is about the implementation of an existing motor drive based on control by a Controlled Area Network (CAN). This concept is proven, mainly in transport applications; however, it is not commonly applied in research articles. The term CAN is often slanted in the automotive embedded system, but the replacement of the embedded system by a computer as the master system is bringing many questions about its realization. Many research papers, due to that reason, prefer to use non-advanced actuators in the form of stepper motors for kits. A solution for the implementation of advanced servos communicated by CAN is offered in this paper. In addition to proposing the first solution for interface creation in robotic and mechatronic applications, the article offers a solution for developing a Graphical User Interface (GUI) using the C++/Qt framework, which allows for the development of an interface between a computer and a CAN converter. This solution is particularly important in the transportation sector, as it enables the development of specialized interfaces for communication with control units. For these tasks, LabView or MATLAB environments are widely used. However, the contribution of this article is to offer C++ with the Qt extension as a good replacement for a graphical programming environment. As is obvious, software engineering, electroengineering, and mechanical engineering are the three fundamental pillars that make up the methodology known as mechatronics. The answers, which are dealt with in the paper, discuss the connection between the programming and electrotechnology parts of mechatronics. A detailed description of the source code written in the C++ language and extended with the Qt framework is provided. This deals with Application Programming Interface (API) and motor control GUI example of the interface between a non-embedded master system and servo by USB2CAN converter. The freely downloadable source code provides a solution for the following challenges of implementation in the field of the research article

Keywords: C++, Qt framework, CAN; USB, converter, automotive.

TOPIC 4: Civil Engineering in Transport

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Analysis of surface texture using photogrammetry

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Abstract

The skid resistance of the road surface is extremely important, especially from the point of view of the safety of moving vehicles. It is very important to strive for accurate, fast, and objective evaluation within a pavement management system. The current methods of obtaining the friction coefficient of the road, are to some extent influenced by testing conditions, which are difficult to eliminate or control at a constant level. Therefore, there is an effort to obtain the friction value based on non-contact measurement of the road surface structure. The main goal of the article is to verify the possibility of using photogrammetry to analyze the morphology of the road surface and its suitability for calculating surface texture parameters. Validation of the accuracy and applicability of the results was performed using the device Static Road Scanner, which has been shown to be reliable in previous research, by comparing standard texture parameters measured on reference surfaces with known characteristics. The reference surfaces consisted of sandpapers with a wide range of grain sizes. Samples of aggregates with different microtexture and macrotexture were also used to compare the methods. By comparing the texture parameters obtained by both methods, the assumption of the possibility of using photogrammetry to record the 3D surface of the road was confirmed, with the promise of further friction prediction based on non-contact surface measurements.

Keywords: texture; roughness; skid friction; photogrammetry

Resistance of beam-column subjected to compression and bending

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Abstract

The optimisation of the design method for verification of slender steel beam – columns is still current issue not only from the scientific point of view, but also for design practice field. The actual behaviour of slender steel members subjected to a combination of axial compressive force and bending moments which arises due to the eccentricity of compressive force, is included in the calculations relatively complex but not sufficiently accurate. The aim of this paper is comparison of suitability of established design approaches, according to the European standards, on the basis of parametric numerical analyses results. Comparing results to the values obtained from the experiments of the beam-column resistances, it is possible to accurate recommendations for the use of different types of design procedures under currently applicable European standards in EN 1993-1-1, EN 1999-1-1 and their National Annexes..

Keywords: beam-column; steel member; stability verification.

Effect of water content in the composition of an extensive green roof on the temperature regime

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Abstract

Green roofs are becoming an increasingly fast-growing technology in the construction industry to eliminate the manifestations of massive urban development. Bringing natural vegetation back to cities has beneficial effects not only on natural biodiversity and the inhabitants themselves. It also has a beneficial effect on the surrounding climate and affects the building itself. Due to its evapotranspiration capacity, vegetation mitigates temperature fluctuations and eliminates the urban heat island phenomenon. To function properly, vegetated structures must have an optimum water supply, especially during summer. Several studies have shown that the absence of water, especially for extensive roofs, significantly impacts the proper functioning of such structures. The presence of water in the substrate promotes the formation of evaporation, cools the surrounding air and reduces temperature fluctuations at the waterproofing level. This article highlights the impact of irrigation of extensive vegetated roofs during summer days.

Keywords: green roof; irrigation; temperatures

Solar and thermo-technical properties of glazing with external blinds: Experimental analysis in a pavilion laboratory

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Abstract

The current trend in architecture is associated with the use of increasingly large glazed areas in the building envelope, leading to significant problems with high solar and heat gains that negatively affect the overall energy consumption of buildings. Several sources of current research indicate that shading systems significantly impact the indoor microclimate and overall energy consumption of a building. From this point of view, this paper deals with the analysis of the thermal and solar properties of glazing in a test laboratory with several positions of the external blind system arrangement. The pavilion-type test laboratory contains three window constructions of different material bases (wood, plastic, and aluminium) with triple glazing, in front of which exterior blinds for manual control were installed. The indoor environment of the laboratory is conditioned by an air-conditioning unit to the calculation standard values of a living room. During the measurements, the position of the blinds was periodically adjusted to quantify the effect of the different slat positions on the thermal-technical and solar properties of the glazing and their effect on the indoor environment of the living room. The results show that the different positions of the blind slats significantly affect the thermal and lighting performance indoors. The paper will present the values of surface temperatures, heat flux density, glazing U-value and total solar transmittance that are affected by the shading system.

Keywords: green roof; irrigation; temperatures

Bonded insulated rail joint monitoring using gap opening variation with fibre optic sensors: analytical validation and limits

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Abstract

The monitoring of bonded insulated joints makes it possible to overcome the limits dictated by cyclical scheduled maintenance, helping the infrastructure manager to anticipate the formation of possible failures. A field monitoring system that measures the joint gap opening variation was investigated, using optical fibres with Bragg gratings placed at the head of the two adjacent jointed rails. Through the application of the Zimmermann analytical model, a first quantitative validation of the data recorded by the monitoring systems measuring the joint gap opening variation was proposed. Based on the different types of failure of a bonded insulated joint, the debonded of insulating element of the joint was identified as a typical condition. Starting from this through a finite element analysis, some characteristic limitations of these monitoring systems were identified by assuming four different bonding scenarios.

Keywords:: Bonded insulated rail joint; Automatic monitoring system; Zimmermann model; Finite element analysis; Fibre optic sensor; Rail transport.

Investigating changes in the stiffness of asphalt mixtures caused by laboratory ageing and varying asphalt binder content

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Abstract

Green roofs are becoming an increasingly fast-growing technology in the construction industry to eliminate the manifestations of massive urban development. Bringing natural vegetation back to cities has beneficial effects not only on natural biodiversity and the inhabitants themselves. It also has a beneficial effect on the surrounding climate and affects the building itself. Due to its evapotranspiration capacity, vegetation mitigates temperature fluctuations and eliminates the urban heat island phenomenon. To function properly, vegetated structures must have an optimum water supply, especially during summer. Several studies have shown that the absence of water, especially for extensive roofs, significantly impacts the proper functioning of such structures. The presence of water in the substrate promotes the formation of evaporation, cools the surrounding air and reduces temperature fluctuations at the waterproofing level. This article highlights the impact of irrigation of extensive vegetated roofs during summer days.

Keywords: Asphalt mixture; Short-term aging; Long-term aging; Stiffness; Asphalt binder content

Analysis in the field of volume-delay function research

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Abstract

One of the key parts of the travel demand model is the correct determination of the performance of the road system. Performance is partially determined by the correct choice of volume-delay functions (VDFs) and their input parameters. Worldwide, transport modellers have a wide range of VDFs to choose from, but research is needed to select the one that provides the most accurate estimates for specific conditions. The problem is that road conditions and traffic conditions are specific to each country, so assuming that we can use VDFs and their parameters based on traffic data from another country can lead to errors. For this reason, there is a need for research on VDFs in the context of a particular country's traffic conditions.
The main objective of this paper is to provide knowledge and practices that can be used as a basis for future research. This paper discusses the most commonly used VDFs for links, their parameterisation and the types of data required for calibration, and approaches to their collection. This paper also aims to introduce crowdsourced real-time data as a possible new source of traffic data, with a focus on traffic data from the Google Maps Directions API. The results of this paper will be used in future research to select and parameterise the best-fitting VDFs for specific types of road facilities and traffic conditions within the national transport model of the Slovak Republic.

Keywords: volume-delay function; transportation planning; crowdsourced data; traffic modelling; Google Maps API Directions

Prediction of the geometry change of switch frog

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Abstract

The switch frog is one of the most costly infrastructure rail components and yet exhibits short service life. Due to higher wheel-rail contact pressures as the wheel travels in both directions of the frogs, the switch frog deteriorates which results in its shorter service life in comparison to other components. In the aspect of deterioration and geometry, the optimal geometry of the switch frog should be determined to achieve longer service life. This study aims to examine the geometry changes of switch frogs with respect to the influence of the vertical wear area, which is caused by the wheel-rail contact pressure. To analyze and predict the geometry changes, a mathematical model is created in relation to the vertical wear area of the cross-sections along the longitudinal axis. The analysis is based on the measurement data of 13 rigid switch frogs. The results show varying degrees of deviations between the measurement data and the model depending on the considered cross-section. However, these deviations can be narrowed by further calibrating the model with the measured data as a benchmark of accuracy. In future studies, the model needs to be improved to correspond with any initial geometry and be able to extend for the trailing move direction..

Keywords: switch frog; geometry; serve life; contact pressure; wear;

Strengthening of beam against shear failure by means of vertical prestressed shear reinforcement

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Abstract

Strengthening of concrete beams, limited by shear resistance, is one possibility how to extend life span of a structure. Application of a vertical prestressed shear reinforcement is an efficient way how to increase the shear resistance of concrete beam. Unfortunately, current codes lack the information how to design optimal amount of the vertical prestressed shear reinforcement and how to assess retrofitted structure. In this paper, applicability of various codes of practise is assessed as option for design of vertical prestresses shear reinforcement. The presented models are compared with test data available in literature. The results of this paper show that presented models provide un-conservative approach for assessment of reinforced concrete structure strengthened by vertical prestressed shear reinforcement with the space for improvement.

Keywords: Shear resistance, prestressed shear reinforcement, design provisions

Evaluation of the traffic flow characteristics in relation to the platoon occurrences

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Abstract

Traffic congestion has become part of daily life. Morning and afternoon queues have a major impact on increasing the average travel time. Furthermore, increasing the negative impact on the environment reduces the overall satisfaction of the public. Exceeding the maximum capacity of the road significantly reduces the speed and traffic flow. In the worst case, it can stop the traffic itself. The relationship between volume, speed, and density, is commonly expressed by Greenshield's fundamental diagrams. With their help, it is possible to determine the optimal intensity for a specific section of the road. The article deals with the evaluation and analysis of a congestion queue, called a platoon, on a specific section of road I/18 Strečno – Dubná Skala. As part of the study, a traffic analysis using radar was carried out. The interrelationships between the speed of the traffic flow and the formation of the platoon were analyzed from the data based on the measurement results. The results show significant changes in the speed of the traffic flow. Despite the almost constant intensity, a different state of formation of the platoon was recorded. The results are presented by graphical analysis of the values of frequency of occurrence of the platoon in all measured 15-minute intervals with graphical analysis of speed. In the next part, the research will deal with the composition of the traffic flow, direction, and gradient of the route.

Keywords: Traffic flow, volume, speed, density;

Assessing the stability conditions of a slope movement in Northern Italy interacting with the provincial road network

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Abstract

Landslides can have devastating consequences on communities and the environment, including loss of life, destruction of homes and infrastructure, and loss of valuable natural resources. In particular, slope movements involving transport infrastructures such as roads and railways can have a significant impact both in terms of network efficiency and safety for vehicles to use. Therefore, it is extremely important to be aware of the potential risks and take the necessary precautions to mitigate the effect of these phenomena. The case study described in this paper deals with a landslide interacting with a provincial road, which represents the main connection between the city of Berceto (Italy) and the Cisa Motorway. Due to the importance of this road, and after the occurrence of several instability events over the years, a series of investigations were carried out in order to gather information regarding the geological features of the site and to provide a preliminary assessment of the stability of the area. The geological and geomorphological evidences collected during the survey point to a condition of general slope instability, characterized by different states of activity. This is confirmed by the results obtained from the execution of a series of stability analyses based on the Limit Equilibrium Method (LEM), which also underlined the influence of the water level variation on the general stability of the area.

Keywords: Landslide; Slope Stability; Road Network; Displacement

Advanced thermal and rheological characterization of a sustainable anti-icing hydrogel for winter road maintenance operations

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Abstract

As a part of the advancements in the winter road maintenance, a sustainable anti-icing hydrogel has been recently developed for the treatment of the open-graded asphalt pavements. It is obtained by mixing water, a chemical agent and a phyto-based additive (seaweed fiber powder) having thickening and gelling properties. The product has the ability to form a gel-like structure when hot-sprayed on a cold pavement surface. The influence of the interaction between the solutes, i.e. sodium chloride (marine salt) and seaweed fiber, on the gel behavior was evaluated through a laboratory scale study, based on thermal (differential scanning calorimetry) and rheological (rotational and oscillatory tests) analyses. The research findings offer a substantial support for the definition of most suitable recipe and the configuration of the spray application system. The results revealed that the formulation of the anti-icing hydrogel is predominantly governed by the salt concentration, which establishes the freezing point depression capacity. Once the salt dosage is defined on the basis of the climatic condition and the accepted level of service, the gellant content, which controls the gelation mechanism, can be optimized to obtain a sprayable gel with a sufficient stiffness and strength.

Keywords: Winter maintenace; Snow and ice control; Open-graded asphalt pavement; Bio-based deicres; Sodium chloride brine

Experimental assessment of recycled asphalt-bonded materials

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Abstract

In general, nature needs to be protected. For that reason, waste and landfills should be prevented. In order to minimize these negative effects on the environment, it is necessary to use recycled materials. Hence, the paper's objective is focused on material recycling which presents a suitable form of material reusing. During recycling, materials that have already been used are incorporated into new constructions. Constructional waste is generated during the production of certain materials and the erection stage. Besides, it is undesirable and difficult to dispose of. Moreover, it creates a financial cost that burdens and affects individual construction processes and, finally, creates a negative impact on the environment. Therefore, recycling plays an important role in waste disposal. Material reuse is the process by which material is employed for construction without any modification. The benefit of recycled material usage lies in efficient material processing, economic savings, simplification of technological procedures, and reduction of the carbon footprint. During recycling, some properties of the asphalt material are modified. One of the most affected is the fraction because of the aggregate crush. It is an experimental assessment of recycled asphalt mixtures materials and their comparison with materials that do not contain recycling. The article compares the different properties of mixtures with and without R-material. It defines the influence of the presence of R-material on the properties of asphalt mixtures.

Keywords: Asphalt-bonded materials; R-materials; Recycling; Graininess; Volumetric weight

Composite Beams with Web Openings Employing Alternative Layout of Shear Connectors

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Abstract

It is generally accepted that bearing systems consisting of composite elements, combining steel and concrete, are highly efficient. Nevertheless, the current economic situation generates continuous demand for more effective solutions. Hence, by the finite element model, this paper investigates an impact of alternative layout of shear connectors adopting a combination of continuous and discontinuous distribution. On the basis of numerical investigation, the study seeks an optimal layout of shear studs for simply supported composite beams under uniform static loading utilizing the same number of connectors for each span. The paper is divided into three parts. At first, investigated specimens are designed against European Standards and limitations according to the literature. This is followed by a parametric study using finite element models examining shear flow magnitudes at the steel-concrete interface and plastic strain evolution at the level of the bottom flange. Afterwards, the study reveals relations regarding the modified parameters and overall structural performance of composite girders. Despite that, the paper is unable to encompass the entire matter of issue but serves as a preliminary attempt to define a novel structural connection arrangement presenting more unit utilization of composite beams' resistance.

Keywords: Shear Connector Layout; Shear Flow; Coposite Beam; Web Opening; Finite Element Method

TRANSCOM 2023, 29 – 31 May 2023
Mikulov, Czech Republic

Recycled materials as part of climate adaptive paved surfaces

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Abstract

Climate adaptability of the pavement is an inseparable part of the holistic concept of sustainable development, construction, and operation of transport infrastructure in Slovakia. The constructions are implemented at a reasonable price and quality concerning transport and environmental safety. Currently, the emphasis is on the circular economy and the resulting minimization of the carbon footprint. One way to achieve this is using climatic, energetically active STERED material. Preliminary measurements of the absorption and retention of the STERED boards were objectified as part of the research on the design of new "green" pavements.

Keywords: Climate-adaptation; STERED material; Absorption; Retention

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Reducing CO_2 emissions in transportation systems: technologies for electric vehicles powering

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Abstract

This paper illustrates innovative transport systems for the power supply of electric vehicles as a replacement for the plug-in system. Different technologies for energy transfer are being developed worldwide: three of them are more mature, but other may come. Nowadays, the mainly three systems under development are the following: overhead cable power supply system, ground contact power supply system and the contactless wireless charging methodology using the Dynamic Wireless Power Transfer system.
In particular, the last-mentioned methodology will be described in detail, the materials research experience involved the 'Laboratory of Applied Research for Innovation and Technology Transfer' at the University of Parma.
Among the main differences are that recharging technology by aerial contact and the scientific application of ground contact for vehicle recharging has been developed and applied particularly to heavy vehicles such as trucks and buses. On the other hand, the wireless recharging system is tested and applied not only for heavy transport vehicles but also for small transport vehicles such as cars.

Keywords: Electric vehicles; Electric recharging system; DWPT system

Fluid and Structural Analysis of the Safety and Reliability of the Communication Bridge

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Abstract

This paper presents the fragility analysis of the NPP Communication bridge support frame resistance due to extreme wind loads. The aim of the contribution is the reliability analysis of the structural bracing system of the bridge. The wind load was determined on base of the fluid analysis using ANSYS-FLUENT program. On the example of the steel bridge between two NPP buildings with the various forms of the bracing systems is considered the efficiency of the structural system. The beam and the link elements from ANSYS library were used. The methodology for proving capacity reserve of the structural resistance by non-linear analysis considering the uncertainty of the input parameters is described here. The advantages of the utilization the LHS method to analyze the safety and reliability of the structures is presented.

Keywords: Fluid and Structural analysis; Safety; Reliability; Probabilisty; Nuclear power structures; Extreme loads

Comparative Study of The Asphalt Mix Stiffness Modulus Using Selected Test Methods – 2-Point Bending Test, 4-Point Bending Test and Indirect Tensile Test

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Abstract

The stiffness modulus of the asphalt mixture is a fundamental parameter in the understanding of the mixture strain behavior. It is also an essential design parameter of asphalt pavements. According to the European standards EN 12697-26, various test methods can be performed in order to determine this criterion. These tests are varying according to the loading type and the specimen dimensions and shape. The present paper deals with the study of three test methods: the 2-point bending test on trapezoidal specimens (2PB–TR), the 4-point bending test on prismatic specimens (4PB–PR), and the indirect tension test on cylindrical specimens (IT CY) used on three asphalt mixtures representing different structural pavement layers. The results show that the dual comparison of these tests, i.e., IT-CY and 4PB-PR, and 4PB-PR and 2PB-TR have indicated good correlation between each other. However, the comparison between the three tests did not substantiate to any general correlation.

Keywords: Asphalt mixture; Stiffness modulus; 2-point bending test; 4-point bending test; Indirect tension test

Development of a quality control framework for the highway bridge using KPIs

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Abstract

The development of essential transportation infrastructures such as roads and bridges is critical to the growth of the socioeconomic system. To sustain their service performance throughout the operational stage, it is challenging for the engineers to change their strategy from developing new facilities to maintaining the ageing infrastructure already in place. As a result, this article aims to suggest a quality control framework for managing highway bridges utilizing key performance indicators (KPIs). Case studies are being undertaken for several bridges, most located in European countries. The performance indicators (PIs) and goals (PGs) are formed during this. Then, following the assessment of the vulnerable zone, the derivation KPIs from those PIs are introduced and developed while considering various maintenance situations and time functions. The presentation includes a curated case study focusing on a steel truss bridge. This case study demonstrates the good potential for developing a long-term strategy for managing highway bridges on a lifecycle level.

Keywords: Roadway Bridge; Quality Control; Key Performance Indicators; Spider Diagram; Decision-Making

TOPIC 5: Management Science and Informatics in Transport

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The Concept of Methodology for Strategic Decision Making of Managers

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Abstract

Globalization of markets, intense competition and implementation of innovations require quick and appropriate strategic decisions made by managers. The traditional strategic planning process is outdated and ineffective. The principles of the Art of War by Sun Tzu combined with modern methods of multi-criteria decision making provide managers with guidance for appropriate and timely strategic decisions. The contribution of the article is in the development of a methodology concept for strategic managerial decision making.
Strategic and tactical excellence is the key factor of a company's success. The article deals with the possibilities of implementing the ideas of the Art of War into strategic decision making of managers. When implemented appropriately, managers ensure prosperity of their businesses and employees as well as customer satisfaction. The presented methodology can be a guide mainly for managers of railway passenger operators who are facing a big challenge represented by the liberalization of transport services in the public interest in railway passenger transport.

Keywords: Art of War; strategic decision making; methodology; strategy; manager;

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The potential issues of simulation methods application in the analysis of transport poverty

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Abstract

The statistical methods, neural network-based methods, and simulation methods are applied in accessibility measures, planning of transportation, and periodically in analyses related to transport poverty. This paper focused on the last type of the method – the paper's aim is to identify the potential of simulation methods applied to the problem of transport poverty, whereas the one can be recalled under other terms, e.g., "transport disadvantage", "transport-related social exclusion", "accessibility poverty", "transport affordability", "transport mobility", "transport accessibility", "transport inequality", etc. All the synonyms were investigated within the panoramic review method to indicate the future agendas and direction of the authors within their own research on transport poverty and accompanying phenomena.

Keywords: transport poverty; simulation methods; transport disadvantage; transport-related social exclusion; accessibility poverty; transport affordability; transport mobility; transport accessibility; transport inequality.

Localization of IoT nodes in LoRa using RSS measurements

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Abstract

Localization is used more and more often, not just used to navigate people but also for tracking objects for different purposes. The global positioning system is a well-known system but it is not appropriate for use in some situations such as indoor or built-up areas. A solution in these places is positioning using the internet of things. In recent years, it has gained popularity due to increased internet of things nodes. This paper provides an overview of different approaches to localization and provides a survey of data used for localization as well as different localization methods. At the end, we describe the experiment performed using LoRa technology with four anchor nodes. To estimate the position of the node received signal strength was measured and position was estimated by both trilateration and Min-Max algorithms. The experiment was performed in an open space.

Keywords: Internet of Things; IoT; localization; LoRa

Automated Detection Of Potholes Using YOLOv5 Neural Network

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Abstract

Proposed article deals with automated pothole detection algorithm from images containing pothole objects. The potholes negatively affect the road surface quality and can lead to traffic accidents. The detection is performed by YOLOv5 neural network model trained on custom image dataset acquired by authors. The implementation of trained computer model will lead to automated pothole identification and potentially to the road maintenance improvement.

Keywords: pothole; object detection; convolutionl neural network, deep learning

Smart mobility management supported by modern information and communication technologies

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Abstract

Modern information and communication technologies such as artificial intelligence, big data, or the Internet of Things bring modern solutions not only for businesses and households but also for the state and municipalities. Today, many countries are trying to build a network of so-called smart cities. Their core areas are smart economy, environment, governance, housing, mobility, and people. This article looks at the field of smart mobility at a global level. On the one hand, the article aims to compare and summarize the latest rankings of smart cities. On the other hand, the authors of the article try to identify those applications of modern information and communication technologies that ensure innovative city development and thus their smart mobility. These applications are clearly described in the article to use in addressing the smart city issue in future research activities.

Keywords: Management; ICT; Smart City; Smart Mobility; Transport

Automatic pothole detection

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Abstract

Road irregularities, such as potholes and road cracks, are a common hazard of daily commute and transportation. Automobile owners everywhere have long worried about the high price of fixing damage caused by potholes. Many accidents caused by potholes can be avoided if road repair agencies can respond quickly. Thus, an automated pothole detection system may help improve this issue. In this work, automatic pothole detection is performed using Faster R-CNN, Sparse R-CNN, YOLOv3, YOLOv5, and YOLOv7 computer vision algorithms. For this purpose, the dataset of road damage images collected in the Slovak region was used. The use of country-specific data is of great importance since the accuracy of pothole detection is dependent on the country of origin of the data. In this work, YOLOv7 achieved the highest detection accuracy of 0.884 (mAP@0.5) followed by YOLOv5 with the accuracy of 0.854 (mAP@0.5) on the pothole dataset.

Keywords: pothole detection; road damage; YOLOv5; computer vision;

Deep Learning-Based Automatic Helmet Recognition for Two-Wheeled Road Safety

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Abstract

Helmets are one of the most critical road safety precautions for two-wheeled participants (motorcycles, bicycles, and e-scooter) and not wearing protective helmets might cause severe or catastrophic injuries. The primary method for detecting helmets is currently a sequence of Convolutional Neural Network algorithms. To accomplish road safety, detection precision, forecast speed, and deployment simplicity are crucial factors. Traditional object detection techniques frequently fall short of achieving balanced effects in all domains. This research proposes a helmet detection application based on the most recent YOLOv7 algorithm with an attention-based improvement mechanism. The model's performance has been evaluated on a set of helmet test images with an average precision (mAP@0.5) reaching 91.4 %. As results indicate, high detection precision and low computational demands are achieved, making the model suitable for real-world deployment. Therefore, the proposed model can contribute to the solution of the problem involving helmet detection on two-wheeled vehicles.

Keywords: object detection, helmet, YOLOv7, road safety, deep learning, two-wheel vehicles

Information system for monitoring of a ship power plant and prediction of technical condition

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Abstract

The article is devoted to the development of an information system for monitoring and controlling a ship power plant with the possibility of predicting the parameters of the technical condition. A diagram of data flows of the main processes in the information system for monitoring and controlling a ship power plant with its inherent components has been developed and presented. The implementation of the scheme of information exchange between the elements of the ship's power plant for monitoring and controlling the ship's power plant is proposed. As an example, the implementation of the information model for monitoring diesel-electric installations developed by the authors, which is part of the ship power plant, is considered in detail. The article shows a variant of predicting the parameters of the technical condition in dynamics with the possibility of detecting violations of the permissible limits of the values of controlled parameters in the future at the corresponding time interval. The shown development will be useful for further research on the processes of monitoring and controlling the parameters of the technical condition of a ship power plant, both for the corresponding forecast time and up to the obtained parameter values with the smallest forecast time value at which the set of allowable limits will be exceeded.

Keywords: Information System; Ship Power Plant; Monitoring; Technical Condition

A Multi-Level Approach to the Target Development of the Electric Vehicle Charging Stations Network

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Abstract

The paper proposes an approach to managing a charging stations network for electric vehicles based on a combination of their properties as car service systems and infrastructure objects of the transport network. Within the framework of the study, a functional model of the charging stations network management system was built according to the IDEF0 structural modeling standard. The developed model made it possible to determine the main parameters and indicators of the specified management system. The current state of the system determines its configuration within morphological constraints. The optimal configuration is the basis for determining the rational structure of the charging stations network at a given level of detail. The mathematical formulation of the problem of multi-criteria optimization of the network structure was performed. The specified mathematical model represents the charging stations network as a mass service system and takes into account the requirements for its functioning at three target levels: client, business, society. The structure of the demand for charging station services and the client radius are strong arguments for the appropriate objective functions. Other arguments of the objective functions are presented through the configuration of the management system. An algorithm for optimizing the structure of the charging stations network has been developed based on the proposed social efficiency indicator. The considered approach is recommended for use in the process of designing and developing charging station systems, as well as forecasting their performance.

Keywords: electric vehicle; charging stations network; mass service system; social efficiency

Chemical Reaction Optimization for Electric Bus Scheduling

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Abstract

In recent years the usage of electric buses in cities for the purpose of public transportation is increasing. Therefore, the solutions for the problems of the application of electric buses should be proposed. In this paper, we deal with one of the problems which rises during the establishment of the public transport system based on electric buses, specifically the electric bus scheduling problem. In this problem, we assign available buses to the service trips and charging in order to minimize the needed electric buses. We propose the solution to this problem by a metaheuristic algorithm Chemical Reaction Optimization (CRO) with the suggestion of the specific methods that can be used in the implementation of the algorithm for this specific problem. A number of tests were performed with the proposed algorithm on datasets from the public transport system in the city of Žilina. We list the obtained results and compare them to the solutions of the previously presented mathematical model.

Keywords: CRO; Metaheuristics; Electric bus; Bus scheduling, Optimization

Communication architecture for real-time decision support systems in railway nodes

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Abstract

Rail transport nodes are complex systems providing transport for goods and people. The dispatcher providing operational control is essential for the proper functioning of these nodes. His role mainly consists of decision-making connected with the allocation of limited resources such as tracks or personnel. These decisions are complicated because of many unexpected influences, e.g., train delays. Recognizing the importance of decision support for the dispatcher's decision-making process, we had designed a real-time decision support system with a simulation model at its core. Such a system requires a high-quality information source for its operation, that needs to be efficiently acquired, processed, and used. In this paper, therefore, we address the possibilities of obtaining up-to-date information about the railway system. Moreover, we designed a communication architecture that allows the distribution of information to the designed decision support system with a simulation model in the core.

Keywords: Decision support, railway, communication, data transport

Pavement management system: implementing project evaluation for local road administrations

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Abstract

Pavement Management System (PMS) is widely used by highway and airport administrations for the rational managing of pavement networks and for identifying cost-effective maintenance strategies. Local Road Administrations (LRA) need the implementation of PMS due to the limited financial, technology and specialised human resources. To lead the LRA to a more conscious and effective use of PMS, tailored procedures and tools have to be defined considering their own potentiality and requirements. For this purpose, the Geographic Information System (GIS) can be implemented, which facilitates the collection, management and analysis of road inventory and monitoring data. GIS allows to easily display on a thematic map a wide set of geographically referenced information and to relate them with spatial and data management tools. Furthermore, customised GIS-based tools can be created to enhance pavement management and to assist the decision-making phase.
This paper shows how the implementation of the project evaluation phase in a tailored PMS for several local road administrations in the center of Italy, in order to support maintenance planning and to identify the effective maintenance strategies in a long-term perspective. The process is based upon a systematically and progressive application of interconnected activities, which are supported by reference documentations and specific GIS tools. Specific GIS-based tools were developed for the set-up of road database, prioritisation, selection of properly repairs and maintenance planning. To achieve a more rational and objective maintenance planning assessments, alternative maintenance scenarios were defined using predictive models to estimate the evolution of pavement conditions over time. Long-term effectiveness of alternative maintenance strategies was established using a customised strategic index (SI).

Keywords: Geographic Information System (GIS); Pavement Management System (PMS); Local Road Administrations; Maintenance planning;

Predictability of the electric vehicle plug-in duration to a charging station as a marketing prioritisation score to increase participation of drivers in smart charging

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Abstract

Smart charging increases renewable energy utilization and decreases the burden on the electrical grid. However, its acceptance and popularity among electric vehicle (EV) drivers reaches still low numbers. Therefore, we explore what prioritization of drivers would be the best for a targeted marketing campaign to primarily aim at the drivers most beneficial for the smart charging system. As a score, we use several simple measures of plug-in duration prediction error, as we assume that EV drivers' suitability for smart charging varies based on their predictability of charging behaviour. To find the best among these metrics we use computer simulations, where we vary the participation levels of the drivers in smart charging. The median relative error provides the most significant results in terms of the energy charged during the off-peak price period.

Keywords: smart charging, electric vehicles, EV driver engagement, data science, marketing strategies;

TOPIC 6: Safety and Security Engineering in Transport

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Authors are responsible for language and content of their abstracts.

Research of maritime accidents based on HFACS framework

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Abstract

The paper deals with the identification and evaluation of factors affecting the origin of maritime accidents. Based on the analysis of investigation reports, human is the dominant causal factor. Authors provide comprehensive research of human failure in maritime transport; investigate and classify the errors, using the HFACS method. HFACS deals with the classification of human error based on human failure at various levels (organization, management, operation). At the end of the paper, measures to increase safety in critical areas are provided.

Keywords: maritime transport, accident, HFACS, human error, failure.

System of transport security of evacuation in the conditions of the Slovak Republic

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Abstract

The authors' primary motivation for choosing the chosen topic was that there are many ambiguities and problematic areas in this area that have yet to be addressed in the past. Streamlining the decision-making processes in the evacuation system during a crisis event requires a clear definition of the roles and competencies of the authorities. The main goal of the contribution is to analyze and assess the organization and provision of evacuation at the level of crisis management in the conditions of the Slovak Republic.

Keywords: evacuation, crisis management, means of transport, decision-making processes.

Measures of the Slovak Republic to improve military mobility for the needs of military Schengen

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Abstract

Military mobility in Europe (so-called Military Schengen) is a critical issue in collaboration with countries interested in defense. NATO and the EU decided to cooperate closely in this area and jointly proposed measures to improve military mobility. The transportation of military personnel and equipment across borders is a sensitive policy area, and, consequently, today, a range of physical, legal and regulatory barriers impede military mobility in Europe. Slovakia represents a critical transit point for military transfers, and its participation in this area is essential. The article described the strategic importance of military mobility and the context of military mobility in Slovakia. The main goal was to point out the current situation of military mobility in Europe, analyze requirements and provide an evaluation of their fulfilment in Slovakia, which led to the creation of recommendations in four points in the conclusion.

Keywords: Military Schengen; military mobility; transport infrastructure.

Application of the internet of things for the air quality monitoring in public transport vehicles and providing recommendations to ensure its sustainability also in unsafe epidemiological situation

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Abstract

The aim of current paper is to analyze air quality monitoring possibilities in public transport vehicles. Using IoT, to offer the prototype for air quality monitoring in public transport vehicles and provide recommendations to ensure its sustainability also in unsafe epidemiological situation. he practical value of the work is the developed Internet of Things prototype, which is equipped with CO_2, temperature and humidity sensors. The measurement results are sent using the MQTT protocol, as well as the measurement results are reflected in the form of graphs.
In the experimental part of the research, measurements were made in the following types of public transport - buses, trams and trolleybuses. Also, when taking measurements in public transport, the author observes differences in CO_2 rise and differences in temperature fluctuations, depending on the type of public transport.
It can be said that similar prototypes can be a useful solution to be able to make measurements in public transport. The developed prototype provides an opportunity to connect several Internet of Things devices, expanding its functionality, as the advantages of the MQTT protocol can be used.
The framework for ensuring of adapting the public transport system to the COVID-19 challenge and other epidemiological threats, for ensuring public transport system`s sustainability is described in the form of recommendations provided for the sustainable development of the public transport system, considering unsafe epidemiological conditions. Recommendations offered for all main stakeholders.

Keywords: public transport; sustainability; IoT; prototype; covid-19; pandemic; air quality; vehicle; monitoring; recommendations.

Impact on SMEs during the COVID-19 Pandemic and Importance of Risk Management in the Transport Enterprises

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Abstract

Security is one of the phenomena of modern times, playing an increasingly important role in all aspects of contemporary society. It is a stable and favourable security environment that is one of the main factors enabling development and sustainability. However, a dynamic and highly volatile environment brings new challenges that can significantly impact the level of security and thus on aspects of society itself. One of the major security challenges has been the COVID-19 pandemic, which has brought about a major destabilization of the environment and unexpected problems on a global scale. In such a situation, maintaining the required level of security required the implementation of very specific measures, which, however, also had negative consequences. These measures have had a major impact, particularly on small and medium-sized enterprises, which form a significant part of the Slovak Republic's business environment and the national economy itself. These enterprises are engaged in a wide range of business sectors, including transport. This article, therefore, discusses the importance of security during the pandemic period, how security measures have affected small and medium-sized enterprises in the transport sector, and ways in which these measures could be optimized in the future in order to maintain the maximum level of security and minimize adverse impacts.

Keywords: business environment, COVID-19, enterprise, impact, risk management, security, SMEs, transport, quality of life.

Identification of Significant Transport Objects in Rail Transport

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Abstract

The article deals with the issue of risk analysis of an important object in the transport infrastructure. The right has an important position in matters of critical infrastructure, which represents the management of the company and the instrument of the decisive tasks of the state. Explicitly determined plane, as in the past and in the present, they solve the issues of identification, categorization and protection. The load-bearing part of the article is the objects of railway transport in the area of the Púchov – Kraľovany line section. The selected section is characterized by a large economy and societal significance. The assessment of transport objects is carried out on the basis of the method, which identifies point elements on the selected track section and subsequently determines the significance of the object using sectoral and cross-sectional criteria. .

Keywords: critical infrastructure, railway transport, transport facilities, risk analysis, quality of life.

Risk Analysis and Soft Targets

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Abstract

Not only soft targets but also security significant objects of the municipality have been a frequently discussed topic in recent years in the field of security. With the increasing number of attacks abroad, there is a need to focus more on this issue and their security in the Czech Republic as well. For this reason, it is necessary to prepare analyses and to look for deficiencies in the security of objects, and to seek solutions. This article focuses on the risk analysis of the Hvezda cinema in Uherské Hradiště and aims to describe the risks associated with it.

Keywords: analysis; object; risk; shooter..

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Basic OSH requirements and measures in road transport

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Abstract

Occupational health and safety is required in every single industry. Safety in transport should be of high importance to every single transport operator, as several parties can be at risk when an accident occurs. The causes and factors of road accidents can be multiple. The statistics themselves point to the need to improve safety in this area. Safety features used in road traffic are essential to ensure greater safety and traffic flow. Transport od dangerous goods (ADR) should be also dangerous not only for the public but also for the drivers who must fulfil more difficult requirements than other drivers. Nevertheless, safety in transport is really crucial issue and there is really need to understand safety measures and background. This article provides information about risks in transport in general, describes ADR starting points and presents safety measures that must be taken in this area to prevent accidents occurring.

Keywords: occupational safety and health; safety in transport; risk; safety features.

Impact of transport on the environmental safety of Slovakia and Europe

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Abstract

The environment and its changes are a normal part of our planet. However, global environmental change is also influenced by human activity, which accelerates these changes. The impact of transport on the environment has a significant impact on it, both in terms of air and quality of life. It is scientifically proven that several factors of transport reduce the quality of life of people. The European Union and all its Member States are striving for climate neutrality by 2050. In order to meet the targets set for building a better environment, the Fit for 55 package has been created, which contains a number of plans to meet the targets set. Sustainable development in transport is an approach for improving the environmental impact of transport.

Keywords: occupational safety and health; safety in transport; risk; safety features.

Risk assessment of key elements in road transport infrastructure

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Abstract

Critical infrastructure is a part of the infrastructure, the destruction or non-functioning of which due to the action of a risk factor will cause a threat or disruption to the functioning of the state, region, municipality, or a threat to the life and health of the population. The basis is the identification of key elements and objects of the infrastructure in the specific conditions of the given country, based on established criteria. One of the other tasks is the fine-tuning of the assessment, measurement and reduction of possible risks and the creation of a model for calculating possible losses in the event of the activation of risks and the subsequent disruption of one or more elements of the infrastructure. In this article, we will focus on the risk assessment process of key infrastructure elements in the road transport subsector. This approach is also processed as a model scenario for the education of security professionals using virtual reality as virtual reality scenarios help to simulate emergency events with high degree of damage.

Keywords: risk assessment; transport infrastructure; criteria and parameters of risk evaluation .

Cybersecurity Automation in Countering Cyberattacks

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Abstract

Recent years are characterized by permanent increase of number of cyberattacks, which human-driven response can´t tackle. At the same time, we experience a global shortage of qualified IT personnel with highest skill shortage in the area of cybersecurity. Automation can efficiently assist in countering cyberattacks in many ways, like in automated threat detection, automated response and automated security management. It can also cut costs and lessen the burden on IT professionals. At this article, we look at factors that slow down automation, we look for evidence that cybersecurity automation is a suitable tool to tackle today's challenges in cybersecurity area and we give recommendations on the process of implementation of automation in cybersecurity area.

Keywords: cybersecurity; automation; artificial intelligence; machine learning.

Testing the resistance of bicycle locks as part of the property crime prevention

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Abstract

Cycling is environmentally friendly, noiseless and emission-free. Cycling is good for your health, it provides you with healthy movement during the day. Cycling is fun, but it is also a lifestyle. The current trend where we are trying not to pollute the environment is just using bicycles for daily transportation is suitable. The use of bicycles gradually increased during the Covid-19 pandemic, but with the increase in bicycle use, the number of bicycle thefts gradually increased. The price of bicycles ranges from €50 to several thousand €. Therefore, it is necessary to protect parked bicycles in public spaces but also at home in the garage by locking the bicycle with a bicycle lock, for example. Just as there is a wide variety of bicycles, there is also a wide variety of bicycle locks. This article deals with testing the durability of different bicycle locks. The result of the tests was that only the lock of class 4 innumerable resisted up to the specified time limit, but only with the hacksaw.

Keywords: bicycle transportation, bike lock, covid-19, bicycle protection.

Protection of soft targets in correlation with the CPTED concept

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Abstract

Terrorist attacks and violent criminal activity are mainly concentrated in the vicinity of assets that are accessible to the public, characterized by a relatively low level of security and a high concentration of people, the so-called soft targets. Such premises are closely related to a high risk of criminal or other anti-social activity. The term soft targets do not have an officially defined definition, which leads to different interpretations. In security field, this term refers to an object/space with a high concentration of people, which is easily accessible, while the level of security against a potential attack is low or non-existent. Examples of soft targets can be: health facilities, transport infrastructure, schools, markets and others. The events of the last few days show how important it is to discuss the vulnerability of soft targets, as well as to be aware of the procedures that can be applied to increase their protection. The aim of the article is the contribution of new knowledge through which we can reduce crime and ensure a higher quality of life for citizens. An effective modern prevention strategy, the concept of CPTED (crime prevention through environmental design), is devoted to the identification of the conditions of the physical and social environment that give the possibility of committing a criminal activity and their subsequent modification, the intention of which is to limit it. The insufficient level of awareness of the general public about the existence of soft targets, the need for their protection and the possibility of increasing the level of their security through the concept of CPTED, negatively affects the development of the curve of recorded incidents.

Keywords: soft targets, CPTED concept, transport, security.

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Survey of E-Mail Phishing Preparedness Within a Selected Group

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Abstract

Cyber-attacks have been in the cyber space for a long time, but in recent years they have come to the forefront. This is mainly due to organizations and individuals who are increasingly moving their activities to the online space and beginning to realize threats that can damage or misuse their data and information. One of the most common and simplest cyber-attacks is a phishing attack, which can be aimed at individuals, organization, and elements of critical infrastructure such as transportation, healthcare, energy, industry, and others. Phishing attacks have various types with various characteristics and can be sophisticated or less sophisticated. Therefore, this article discusses the definition of fundamental theoretical knowledge about phishing attacks, types of email phishing attacks, their distinctive characteristics, and a testing the preparedness of a selected group for an email phishing attack.

Keywords: phishing, phishing attack, cyber, cyber attack, cyber security.

Reliability Comparison of Programmable Components Usable for Indoor Localization System

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Abstract

Nowadays, location-based systems are used in various spheres of people's lives. Tracking the movement and location of people can be used in the outdoor environment, but it is also used in enclosed spaces. Location systems can also be used in transport for the purpose of tracking the location of vehicles. Location information is useful for navigating vehicles or people to a destination. However, the implementation of systems for determining the location and movement of people and entities is also important within confined spaces. Indoor location systems are gaining importance in terms of people navigation in different types of facilities where there is a high concentration of people during operational hours. Indoor location systems also serve to enhance security in buildings by tracking the movement of the people who are present. Among other things, persons can receive useful information related to the location in which they are. It is also possible to control, coordinate and manage personnel or resources on the basis of location and movement information in order to increase the efficiency of processes. We are living in a time when the COVID-19 pandemic has significantly affected our daily lives. In the framework of the project APVV-20-0457, research is being carried out to design a system for monitoring and tracking the movement and contact of people in healthcare facilities in order to prevent and limit the spread of coronavirus and other respiratory diseases. The aim of this paper is to investigate the reliability of the programmable components forming the proposed confined space localization system. Based on the testing, the receiving devices were compared with each other, pointing out the advantages and disadvantages of their application in a given space.

Keywords: indoor positioning system; receiving devices; beacon; received signal strenght indicator.

Passenger car fire in a confined space

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Abstract

Confined space fires are a long-standing research issue in the field of fire engineering, which we are increasingly able to manage thanks to scientific advances and developments in computing technology. Computing includes modelling tools that are based on scientific and empirical knowledge and whose results are comparable to experiments. This paper aims to assess the effect of the heat load caused by a car fire on the temperature in a confined space using the PyroSim modelling tool and to compare the results with experimentally determined values.

Keywords: PyroSim; fire simulation; confined space fire; fire experiment.

The impact of crisis phenomena on economic security in the automotive industry and the quality of life of employees

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Abstract

The quality of life of people inter alia depends on their economic well-being. The direct source of their well-being is their wage paid by employers. Any economic crisis that impacts the biggest industrial employers in a region directly translates into the deteriorated quality of life of people. This article describes several transmission channels of the two major global crises which have been following covid pandemic and military conflict in Ukraine. Transmission of crisis phenomena into the well-being of people is provided by explaining the importance of the automotive industry for the Slovak Republic and the values of employment and hours worked indices are provided as supporting evidence. The mechanism of increased scarcity is described in the case of increased raw material prices on the global market which resulted in the decreased production in the automotive industry.

Keywords: crisis; quality of life; economic security; automotive; covid.

Monitoring of the cargo securing on semi-trailer when driving on the highway

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Abstract

The European Agency for Safety and Health at Work estimates that up to 25% of heavy vehicles accidents are caused by insufficient or incorrect cargo securing. For this reason, care must be taken to ensure that cargo is properly secured. But to do this, it is necessary to understand the forces acting on the cargo and how they affect it. One of the forces that acts most significantly on the cargo is due acceleration, which occurs continuously during the transport. But the problem arises when the force due to acceleration is greater than the force that secures the cargo. For this reason, an analysis of the accelerations that occur during driving on the highway has been carried out. The main focus of this thesis is on the analysis of the short-term accelerations that occur during highway driving. From the analysis, we found that most of the short-term accelerations occurred while crossing the bridge. This was caused by expansion joints which are a structural component of bridges. A video analysis of the route in question was also carried out and it was found that all accelerations caused by crossing the bumps have a very similar pattern and therefore impact on the cargo. As well, a detailed analysis of a specific bridge crossing with expansion joints is included in the paper, which will allow a better understanding of how the vehicles behave. .

Keywords: a acceleration; cargo securing, vehicle dynamics, semi-trailer.

Analysis of occupational accidents in the land transport and transport sector

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Abstract

In the contribution, we focus on the number of registered, serious and fatal occupational accidents in the land transport and transport sector in a specific time period. At the same time, we also examine in detail the causes of individual occupational accidents in the selected sector and time period. We use statistical methods to process the obtained data. For comparison, we attach serious and fatal occupational accidents that occurred in the monitored time period from the Czech Republic. At the same time, we also propose preventive measures to reduce the number of occupational accidents in the land transport and transportation sector.

Keywords: occupational safety and health; land transport and transport; occupational accidents.

Optimization the Accessibility of the Forces and Transportation Resources of Emergency Medical Service

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Abstract

Fast and safe transportation of ambulance crew to the scene is an essential prerequisite for providing effective pre-hospital emergency care. Apart from external influences, the speed of transportation is mainly influenced by the location of individual ambulance service bases. The paper deals with the availability optimization of the forces and resources of the Emergency Medical Service (EMS). It describes the current approach to the solution of the coverage of the region territory by the bases of the EMS in the Czech Republic. Theoretical and realistic availability models are based on the analysis of the EMS bases current status and data from authentic activities of EMS bases. An important input is the real transport times of the EMS dispatch groups to the incident scene. Its comparison led to the identification of areas with reduced availability for a given time. The optimization assumed the new location of the ambulance service bases on the territory in order to maximize the forces and resources availability in each region and minimize the transportation time.

Keywords: accessibility; arriving time; area coverage; emergency medical services; transport.

Heat Stress During Firefighters Training for Intervention in Tunnels and Other Enclosed Spaces

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Abstract

Fires in tunnels represent a special case of an enclosed space fires. Tunnel fires reach a wide range of heat release rate values with maximums of up to hundreds of megawatts. Tunnel fires are usually fast growing, supported by the geometry of the tunnel, reaching fast high temperatures and in general conditions difficult for firefighting. Training to operate in such extreme conditions is crucial to ensure both the safety of firefighters and effective firefighting. The flashover container is a facility that is used for firefighting training in an enclosed space and to increase the psychological resilience of firefighters. This article presents partial results of a long-term study conducted between 2011 and 2018 in the flashover container facility Zbiroh in the Czech Republic. The main goal of the project was to describe and quantify conditions that are reached in the flashover container during training sessions in terms of the heat exposure and compare them with conditions that occur during the tunnel fire. Results of the study were used to propose new training scenario for firefighting training in enclosed space at extreme conditions corresponding to tunnel fires. The paper compares the use of propane and wood as a fuel in a flashover container. Based on data from the training of 142 firefighters, it presents the relationships between skin temperature, heart rate, and subjective feelings of firefighters.

Keywords: tunnel; fire in the tunnel; fire in an enclosed space; heat stress; firefighter training; safety; enclosed space; training facility.

The use of mixed reality scenarios for training crisis managers and emergency responders in an ADR tanker accident

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Abstract

The article focuses on the potential use of HoloLens 2 devices in educational and training processes in schools, as well as in the professional practice of training crisis managers and firefighters. The article is based on the Erasmus+ FightARs international project, which aims to develop specific educational and training scenarios for the needs of the participating partners involved, allowing to convey to students the possibility of situational understanding and situational awareness. This is made possible by four secondary scenarios focusing on road traffic emergencies, in which the student learns the methodological procedures for specific cases, and one primary scenario in which a road traffic accident involving an ADR tanker and an electric car with an injured driver is on the scene, where the student should apply the knowledge acquired from the four secondary scenarios

Keywords: augmented reality, mixed reality, adr transport, scenarios, crisis management, firefighters, emergency responders.

Risk identification of beverages transport process using decomposition method

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Abstract

In the current situation in the world and in the markets, it is important to know the risks that can threaten businesses. Risk management is a tool that defines and applies measures, which can minimize or completely eliminate these risks. It is also important to know the enterprise's own processes and activities, where risks can occur. Processes in an enterprise form the entire system, which should be able to respond to internal and external influences or factors. By assessing process risks, enterprise can respond to these factors in a targeted and effective manner and thereby increase the resilience and performance of its entire system. The aim of the article is to use the decomposition method to map the beverage transportation process of an enterprise that produces soft drinks and distributes them to warehouses. Subsequently, identify the risks that may arise during the transportation process. By identification, the enterprise thus gets an overview of which risks causes, i.e. problems and weak spots are found in the process and subsequent risk analysis, risk evaluation, risk treatment and determination of measures can help the enterprise manage the beverage transport process without unnecessary failures and associated costs. With regularly assessing process risks, the enterprise can continuously improve the transport process.

Keywords: risk; process, risk assessment; transport .

Draft of the experiment methodology to determine car fire blankets effectiveness in conditions of the Slovak Republic

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Abstract

Nowadays, cars are an integral part of many people's lives. Advances in the automobile industry have brought new types of automobile propulsions to the market. However, crisis situations with extinguishing fires of electric and hybrid car fires have raised many questions. In a collaboration between the Fire and Rescue Service of the Slovak Republic and the Faculty of Safety Engineering of the University of Žilina, a project will be implemented. The aim of the project will be to investigate the effectiveness of extinguishing car fires with different propulsions in road traffic using car fire blankets. This article introduces the purpose of the research and the initial design of the experiments.

Keywords: car fire blanket; car fires; vehicle fires; experiment methodology.

Toxicity of smoke from upholstery materials in underventilated fires

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Abstract

Toxicity of smoke is an important parameter when evaluating the hazards associated with upholstery materials to be used in buildings and transportation vehicles. Fires in enclosed spaces with limited ventilation such as rooms, carriages and fuselages cause smoke accumulation and increased exposure of occupants to its toxic components. The paper focuses on experimental measurements of smoke toxicity in under-ventilated fires and presents data for various ventilation conditions. The results indicate the influence of ventilation on fire heat output, the composition and amount of produced smoke. The data can be used in fire modelling, fire investigation and evaluation of fire toxicity hazards in a particular field of application.

Keywords: toxicity, fire, effluents, smoke, under-ventilated, polyurethane, upholstery.

Comparison of breath alcohol measuring devices

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Abstract

A breath alcohol analyzer is one of the elements of road safety. There is currently a lot of analyzers available for drivers, but not all of them are accurate and can therefore cause variations. Although a driver can test their own analyzer and find a zero alcohol reading, a certified analyzer may show a different reading. For this reason, a study was carried out to verify the accuracy of four selected types of analyzers, including both cheap non-certified and the most expensive certified ones available in the country. The analyzers used in this experiment showed substantial measurement variations. The deviations were largest for the non-certified analyzers, which accuracy cannot be considered reliable compared to the certified ones. This suggests that non-certified analyzers are not suitable for accurate measurements of breath alcohol and are only used to detect its presence.

Keywords: alcohol; alcohol analyser; driver; breath alcohol volume.

Design scenarios of vehicle fires in the road tunnel

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Abstract

The main aim of a paper is a creating design fire scenarios and a consecutive modelling using the CFD model in a rectangular geometry of the Považský Chlmec motorway tunnel. The main method is a computer simulation. We chose three fire scenarios in which we modified the main parameter– heat release rate. The results of scenarios were analysed and we evaluated influences of input parameters on a gas temperature development and a surface of concrete lining temperature development.

Keywords: CFD; FDS; fire in tunnel; modelling of fires.

Long life structural health monitoring of selected bridges

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Abstract

The paper is focused on the structural health monitoring, current methodology of inspection in Slovakia for road and railway bridges. Consequently, the paper presents the advanced methods for monitoring and inspection of bridges using various types of robots and unnamed aerial vehicles. It describes two selected case studies, where all integrated system of structural health monitoring will be applied. Later, it defines the inspection and current condition of road arc bridge with stiffened beams and steel truss bridge.

Keywords: bridge structure, digital twin, transport, security.

Step for digital twins of bridges based on original project drawings

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Abstract

The current period brings challenges in all areas of society's life resilience and the development of transport infrastructure is nowadays crucial in the construction of new agglomerations, new industrial parks and the urbanization of the countryside. This paper presents the interim results of the IRIS (Inspection and security by Robots interacting with Infrastructure digital twinS) project. The article demonstrates the first steps of digitizing technical documentation in order to create digital twins. This procedure is applied to two existing bridges. The bridges were selected on the basis of a risk analysis: one railway viaduct over the Ružín reservoir and one road bridge (first class road).

Keywords: bridge structure, digital twin, technical documentation, transportation, security.

Statistical analysis of road accidents of motorcyclists in Poland from 2011 to 2021

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Abstract

The increase in the number of motorcycles on Polish and European roads has caused a huge change in the state of safety over the last 10 years. The article presents the safety problems of motorcyclists in Poland in the years 2011-2021. The number of road accidents was analysed in detail, considering the main causes of road accidents and the time in which they occurred. The article contains information on the dynamics of the number of registered motorcycle vehicles in the years 2011 - 2021. In addition, the number of fatalities in accidents, including drivers and passengers, is presented.

Keywords: motorcycles; road accidents; security analysis.

Residual risk in Automatic Train Protection systems: evaluation and management

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Abstract

The paper on typical rail operation hazards, such as Signal Passed at Danger (SPAD) and Failed Braking Application by Driver (FBAD). The protection against these hazards is normally by Automatic Train Protection (ATP) systems and emergency braking activation, operated by the onboard systems over a certain Minimum Release Speed (MRS). The determination of such speed is a key design parameter related with the achievable performances in terms of safety and capacity. The present research deal with a systematic analysis of the operational conditions potentially affecting the determination of such speed values by modelling the dynamics of the problem taking into account the features of the infrastructures (tracks layout, gradients, etc.), the vehicles (mass, braking performances, etc.) and the geography of signalling and ATP systems themselves. In fact, the position of main signals protecting the dangerous points (switches, level crossings, etc.) emerges as key player, affecting both the design and the operation of the systems.

Keywords: Railway, Signalling, Operation, Safety, ATP systems.

The Role of Auditors in Critical Infrastructure Protection: Case in Czech Republic

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Abstract

Recent changes in security and technology environment such as Russia's invasion against Ukraine, the rapid development of technology, internet of things, remote working due to the covid-19 pandemic, has led to an increase in cyber-attacks. The emergence of quantum cryptography could give rise to breaches in quantum security in years to come with national security being affected. Delays or disruptions in the supply chain have led to an increase in the risk of supply chain theft. Personal identity theft is on the increase and as such, the role of auditors in critical infrastructures protection cannot be over- emphasized as this has become a high priority at national and EU level. This review paper examines the role of auditors in protecting critical infrastructures in Czech Republic. It adopted a study carried out by P. Lois et al. (2021), evaluated factors relating to audit and security of information systems. The results of the study concluded that advisory roles of auditors and policy- standards affect the security of information systems.

Keywords: Cybersecurity, Auditor, Cyberthreat, European Union Agency for Cybesecurity (ENISA), European Program for Critical.

Significance Criteria for Types of Transport in the Zlín Region

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Abstract

Critical infrastructure is extremely important for the proper operation of the functioning of the state as a whole. In the Czech Republic, critical infrastructure covers nine sectors. The article is specifically about the transport sector of critical infrastructure. Specifically, it is an analysis followed by an evaluation of the criteria of the essential elements of the modes of transport for the Zlín region.

Keywords: Critical Infrastructure; Transport; Traffic; Criteria.

Strengthening Resilience of Electricity Critical Infrastructure in the Context of Railway Transport

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Abstract

The energy sector is crucial in the critical infrastructure system, since other critical infrastructure sectors are dependent on energy supplies. Electricity infrastructure is one of the key sectors of critical infrastructure and, moreover, this sector has been recognized as uniquely critical. This makes it necessary to ensure a high level of protection of energy sector elements, especially by strengthening their resilience. A power outage would have a negative effect on dependent subsystems of critical infrastructure (e.g. transport). The electricity sector is constantly exposed to negative threats; therefore, it is important that the electricity elements achieve a high level of resilience, which in the critical infrastructure system is defined as the ability to reduce the extent and/or duration of disruptive events, absorb negative phenomena, and adapt or quickly recover from potentially dangerous events. The key output of this paper is the proposal of a procedure for strengthening the resilience of electricity critical infrastructure. By applying tools to strengthen resilience, the element becomes more resilient to internal and external negative phenomena, thereby reducing its vulnerability. This results in the strengthening of the resilience of dependent elements of the railway critical infrastructure.

Keywords: railway transport; electricity critical infrastructure; resilience; strengthening the electricity resilience.

Artificial Intelligence Systems for Supporting Video Surveillance Operators at International Airport

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Abstract

International airports come under critical infrastructure. Therefore, its security system consists of many crucial elements aimed at guaranteeing the safety of passengers and airport workers. There is a need to develop the safety aspects to the highest level. This paper aims to analyze the possibilities of supporting video surveillance operators at the airport with modern artificial intelligence (AI) solutions. To obtain the best research results, different functionalities were tested simultaneously. The first is based on built-in camera software to detect loitering, and the second is based on the already-used CCTV system. In addition, practical tests have been carried out at the International Katowice – Pyrzowice airport under actual conditions. The test results show that AI systems can help video surveillance operators perform their duties, but they must be refined.

Keywords: Artificial Intelligence Systems, Supporting Video Surveillance, Airport.

The Basis for Strengthening Organisational Resilience of Critical Transport Infrastructure Entities

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Abstract

As a result of the increase in threats and the growing severity of their impact, there is a need to place increasing emphasis on the protection of critical infrastructure. Transport critical infrastructure is one of the indispensable sectors for the proper functioning of the internal market and the realisation of long-term strategic objectives, especially in the area of competitiveness. Thus, in an effort to minimize the emergence or impact of threats to this type of critical infrastructure, the issue of resilience is coming to the fore. The concept of strengthening resilience represents one of the possible approaches that can be used not only to protect elements of critical transport infrastructure, but also to protect the entities that own or operate these elements. For this reason, the aim of the article is to present the starting points for strengthening organizational resilience that can be applied in the transport critical infrastructure sector.

Keywords: Critical Infrastructure; Strengthening Resilience; Approaches; Tools.

Trends in choosing the right child seat - survey research

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Abstract

It is not enough to transport a child in a vehicle seat to make it safe. Even the best child seat does not protect the child if it is incorrectly fitted or installed in the vehicle. Unfortunately, choosing the right child seat for your child is not so easy. A number of factors should be taken into account, such as the type of seat attachment, its mass, the fit of the seat to the vehicle seat as well as the child's dimensions. In addition, before buying a child seat, you should check whether the child feels comfortable in it, whether it fits freely in the seat, whether the belts holding the child do not interfere. The main purpose of the article was to check the purchasing preferences of the surveyed group of people in terms of the selection of a child seat. For this purpose, a survey was conducted on a group of 950 people with children. The conducted research showed that the main parameter influencing the decision to choose a child seat is the price. Research has shown that only about 30% of respondents look at the safety certificate of a child seat. At the same time, research has shown that most often people decide to buy a child seat fixed with the ISOFIX base and most often decide to install the seat on the back seat of a passenger vehicle behind the driver's seat.

Keywords: child seat; safety; children; comfort.

Time-to-collision for the Pedestrian Protection System simulation

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Abstract

The development of autonomous vehicles has increased significantly, with a high focus on driving safety. Pedestrian avoidance systems are a top priority for ensuring higher pedestrian safety. The Pedestrian Protection System (PPS) is mainly observed in current research to analyze the impact of the time-to-collision for collision avoidance with a pedestrian for different vehicle speed variations. The PPS is a critical system that prevents vehicle and pedestrian collisions based on multiple sensors such as camera and RADAR (radio detection and ranging). Time-to-collision value represents a reliable parameter for the PPS for classifying the traffic conflict between a vehicle and a pedestrian as an inevitable or avoidable event. Simcenter Prescan was used to simulate the traffic infrastructure, the vehicle dynamics of the models, and the sensors. This study aims to evaluate the potential impact of different values of the time-to-collision parameter on the avoidance of collision with the pedestrian. The results showed that Pedestrian Protection System could completely avoid a pedestrian collision.

Keywords: autonomous vehicle; collision avoidance; Simcenter Prescan; critical scenario; time-to-collision.

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Sustainability of Resilient Transport System

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Abstract

This article representsan additional contributionto our research on transport resilience. Our project's purpose is to createa methodological procedure for transport resilience measurement.In our previous work, we identified four coreareas of measurement. These areas are adaptability, absorption (robustness), human factors and recovery,and the fourth one –sustainability. As an objectiveof this paper, we are going to describe the relationship between this last area and transport resilience. Such knowledge is neededso that we can betterunderstandwhat parts of sustainability can affect the level of resilience and how to approach the identification of resilience indicators within sustainability. Hence, we dividedsustainability into four dimensions. In each of them, weexplained what aim of transport sustainability might be achieved and what risk can be mitigated by various elements ofthe givensustainabilitydimension. We have included thedefinition of transport resilience and an explanation for all its partial aims in the introduction and second part ofthis paper.

Keywords: transport; resilience; sustainability.

Simulation of communication and transportation of the wounded in a medical facility

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Abstract

The current modern world, relationships between individuals and the rapidly changing security environment bring with it the possibility of various crisis phenomena. The latest international crisis phenomena are the global pandemic and the war conflict in Ukraine. The mentioned crisis situations also have an impact on the normal operations of organizations, which, however, must also relate to individual other crisis situations that can reach a level of preparedness for their occurrence.When an emergency occurs, it is important to ensure atimely and adequate response to its occurrence. Therefore,it is necessary to create internal guidelines which all employees of organisation must be familiar with. Employees need to be awareof their duties, responsibilities and procedures are for dealing with an emergency as part of prevention and education of employees to ensure required level of preparedness for dealing with an incident. The article is focused on trauma plan, which needs to be activated in a medical facility after emergence of a crisis phenomenon with a mass threat to people. In event such an emergency, two key factors must be met - communication and transport.

Keywords: Crisis Management; Trauma Plan; Communication Simulation; Simulation of the Transport of the Wounded.

Digital Twin in Smart City

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Abstract

The introduction of intelligent systems, technologies and solutions in areas other than transport is necessary for the modernization and development of cities and the creation of so-called Smart Cities. One of the possibilities for the modernization of cities is a form of digital transformation of a large amount of data from life in the city through a digital twin. The digital twin modeland the use of modeling and simulations in the Smart City is one of the current trends in innovative solutions in Smart Cities around the world. In the post, I define the usability of the digital twin in the Smart City, taking into account the issue of safety andprotection of city residents in the future. Currently, this trend is clearly in favor of the introduction of intelligent solutions into the everyday life of cities and their residents.

Keywords: Digital Twin, Smart City, Simulation, Security.

Using Big Data Analysis in increasing transportation infrastructure resilience

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Abstract

Transportation infrastructure plays a vital role in supporting economic activity and ensuring the resilience of communities. This study examines the interconnection of socio-economic effects and the transportation infrastructure resilience in a country in the context of possible disruptions. The results of the study suggest that exploring the relevant socio-economic indicators and monitoring them might help increasing transportation infrastructure resilience by reducing the impact of disruptions on economic activity and improving access to essential goods and services. Additionally, the study finds that the socio-economic effects of transportation infrastructure are complex and multifaceted, and that a comprehensive approach is needed to fully understand and address the challenges posed by disruptions to transportation systems. Overall, the study emphasizes the importance of transportation infrastructure for community resilience and highlights the need for continued investment in this critical infrastructure.

Keywords: transportation infrastructure, resilience, big data, economic indicators, GDP per capita.

Evaluating an E-Government Stage Model by Using SOAR-AHP Process

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Abstract

E-government is a key component of today's efforts to give citizens improved services. As a result, participation of the general public in government policy is essential to assuring the success of e-government. Thus, when developing any e-government model, the security of personal information must be taken into account. According to earlier research, the developing countries are suffering from implementing e-government to provide e-services for their citizens. They also indicate that the biggest obstacles to implementing e-government in such countries are security and privacy. This study attempts to assess e-government stage model via using SOAR (Strengths, Opportunities, Aspirations, and Results) and Analytic Hierarchy Process (AHP). This is a new and reliable technique for evaluating e-government prior implementing. The AHP is combined with the SOAR analysis in this study's approach to analyze the phases and assess the model's viability. The study's findings demonstrate that the model is workable and appropriate for adoption.

Keywords: e-government, Stage Model, AHP, SOAR.

TOPIC 7: Travel and Tourism Studies in Transport Development

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Reputation Management as a part of Online Branding Infrastructure of luxury hotels on the Adriatic Coast - pre and post Covid-19 perspective

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Abstract

The search for optimal approaches to building the online infrastructure of luxury brands is an area that takes on an extremely dynamic dimension in times of accelerated digitization. The aim of the study is to investigate changes in online reputation levels for selected luxury hotels on the Adriatic coast, comparing their status levels before and after the Covid-19 pandemic. The research sample is narrowed down to the 15 best hotels on the Adriatic coast, selected according to the ranking of the prestigious British periodical. For comparison, we use a reference study from 2019, which we follow up with an empirical analysis carried out using the same methodological procedure. Specifically, we use extended sentiment analysis in its complex TOR form. The results of the analysis and subsequent comparison indicate that there was no significant change in the level of online reputation of selected luxury brands during the pandemic. All monitored partial parameters show a high degree of optimization. Based on the findings, strategic recommendations for the field of tourism are drawn up, at the same time key reputators are identified, which must be regularly monitored in the online reputation management process. The study thus serves as a knowledge base for practice, as well as a possible methodological base for further investigation of the impact of the pandemic on the infrastructure of brand development in the online environment.

Keywords: online infrastructure; branding; reputation; the Internet; tourism

Hackathon on the topic of urban mobility as one of the tools of regional development through knowledge-sharing

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Abstract

This paper is dedicated to the importance of the university, its education, and research as well as cooperation with the practice of the region in which the university operates. The purpose of the paper is to point out the benefits of organizing events where university students as well as secondary and elementary school students have the opportunity to participate in solving specific problems of their region and city. The organization of such an event is beneficial for the city, as it will get the opportunity to find innovative solutions for its problems, and it will get citizens' opinions and perspectives on life in the city and feedback on the implemented activities. On the other hand, participants get the opportunity to work with real data, solve real problems under the guidance of experienced domestic and foreign experts and validate their ideas and verify their real contribution to their city and region. It is also a tool to encourage especially young residents to look for solutions for a better quality of life in the city and in the region and to keep such smart people in the region.

Keywords: University; Knowledge sharing; Entrepreneurial education; Startup

GIS analysis of the Andalusian rail trails accessibility from motorhome areas

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Abstract

The symbiosis between motorhome tourism and cycle tourism on the rail trails is not reflected in the development strategies to promote these old railway infrastructures. The project *"New models of intermodal mobility and tourist use of Andalusian rail trails: application of an explanatory, predictive and spatial methodology"*, uses GIS tools and web-scrapping as an essential resource to obtain results. This paper shows results from the use of these two techniques to highlight a relationship that is ignored by the planners of the promotion strategies that have been implemented in the last twenty years about the rail trails in Andalusia. The results, based on the analysis of the primary information prepared by the authors, demonstrate that the symbiosis has occurred spontaneously without any prior planning. This paper presents also a necessary conceptualization to identify the elements that participate in this symbiosis and to develop the GIS model for further analysis. The project is financed by the Department of Economy Knowledge, Business and Universities of the Government of Andalusia

Keywords: GIS analysis; Rail trails; Andalusia

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