METAHEURISTIC OF ARBITRARY LUMINOUS INTENSITY DISTRIBUTION FOR ROADWAY LIGHTING LUMINAIRES

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Abstract

The introduction of light-emitting diodes (LEDs) for roadway lighting necessitated a completely new approach in the optical design of lighting systems. The small Light Emitting Surface (LES) of the Solid-State Lighting (SSL) sources enables precise and robust optical control. While for illuminance-based lighting scenarios, the desired light pattern is deduced through the inverse-square law, for the perceived luminance-based calculations, the combined effects of multiple light points make the problem statement for the design objective definition challenging. This research paper presents an original theoretical and practical method for generating a luminous intensity distribution for fulfilling the lighting requirements of luminance-based lighting classes. The results showed that designing optical surfaces to achieve this generated luminous intensity distribution is leading to better task efficiency (often over 10 % power saving potential at same wattage compared to Taguchi method) in shorter computation times. Therefore, the method is desirable for roadway lighting optical design and has a prospect in gaining a better understanding of night-time roadway safety. 34 refs.

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SIMULATION AND DIGITAL TWINS TO SUPPORT REVERSE LOGISTICS DECISIONS: A REVIEW

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Abstract

Researchers believe that Industry 4.0 is the new industrial revolution. In this case, we highlight the critical role of decision support tools, such as Simulation and Digital Twins (DT) models, that might help decision-making in strategic decisions in the industry. Additionally, Green Supply Chain is a theme that has been widespread due to all the issues involving pollution and tax breaks that some government offers to industries. Furthermore, enterprises worldwide are becoming more aware of environmental issues. In this subject, an area that has been emerging but is not significantly addressed in the literature is Reverse Logistics (RL). Thus, this work aims to analyse how Simulation and DT are helping RL in the Industry 4.0 context, answering some questions that may support future researchers to begin their studies in the area. 35 refs.

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DYNAMIC SAMPLING ALGORITHM FOR AGRICULTURE-MONITORING GROUND ROBOT

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Abstract

We present the development and evaluation of a dynamic sampling algorithm for an agriculture-monitoring ground robot designed to locate insects in an agricultural field, where complete sampling of all plants is infeasible due to resource constraints. The algorithm utilizes real-time information to prioritise sampling at suspected points, locate hot spots and adapt sampling plans accordingly. A simulation environment was constructed to examine the algorithm's performance, and it was compared to two existing algorithms using Tetranychidae insect data from previous research. Sensitivity analyses reveals that the dynamic algorithm outperformed the others in all tested use cases, reaching 100 % detection approximately 3–5 days sooner when applied to small fields, and identifying 30 %–50 % more insects for larger fields. Its high detection percentages in small fields – 100 for a 1 ha field – decreased moderately with increasing field size to 80 % for a 10 ha field, seemingly irrespective of insect spread rate, which also barely affected insect detection. Doubling the time spent on each sample improved the results by 30–50 % on average in the first ten days, but in the following days the gap narrows. 35 refs.

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BLADE ELEMENT MOMENTUM CALCULATION METHOD WITH VARIOUS CORRECTIONS

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Abstract

Blade element momentum theory is widely used for predicting wind turbine aerodynamic performance. Unfortunately, power and thrust coefficients predicted by momentum theory deviated dramatically from the experimental data when the value of the axial induction factor was more significant than 0.5. To solve this problem and to increase the accuracy of the prediction, correction for the high value of the axial induction factor must be applied. Using BEM theory, this paper uses analytical prediction for power output compared with different existing correction models used to improve the basic calculation of the turbine power output. The results are compared to experimental measurement results for a small wind turbine. Considering all the comparisons, we note minor differences in the results between the Modified ABS and Buhl models on the one hand and between the Spera and Wilson models on the other, that matches our measurements best. 24 refs.
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COMPUTER SIMULATION OF A GAME CONTROL MODEL IN A COMPLEX MARITIME TRAFFIC ENVIRONMENT

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Abstract

A model of the process of a ship's safe control, moving in the vicinity of many other ships, was formulated, which enables the synthesis of algorithms for safe path planning that is appropriate according to the state of the environment. This state can be mapped using three possible algorithms – the game non-cooperative path, game cooperative path and optimal path. Computer simulation of the algorithms on the example of a real navigation situation recorded in the Baltic Sea of the ship's own movement in the vicinity of another nine moving ships made it possible to assess their effectiveness. When comparing the algorithms, the degree of cooperation of the vessels, the state of visibility at sea and the dynamics of the ship itself determined by the manoeuvring advance time were taken into account. The simulation results of the presented algorithms confirm the effectiveness and good representation of the real state of the traffic environment of many ships. The conclusions from the conducted research can be used to optimize other processes of controlling mobile objects. 28 refs.
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MODELLING THE IMPACTS ON ENTREPRENEURIAL ATTITUDES AND INTENTIONS OF FREELANCERS

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Abstract

This paper investigates the effects of the big five, individual entrepreneurial orientation, love of money, and theory of planned behaviour dimensions on the entrepreneurial attitude and intention among freelancers. The moderating effect of gender in freelancers was also examined. The research was conducted in Western Balkan countries: Bosnia and Herzegovina, Croatia, Montenegro, and Serbia. A total of 318 questionnaires were collected. The influences of the theory of planned behaviour and individual entrepreneurial orientation dimensions are significant and positive. The positive impact of dimension openness is emphasised. Motivation to make money has a strong and positive effect on entrepreneurial attitudes and intentions, especially among men. The desire to achieve freedom through money has a positive impact on entrepreneurial attitudes, but also a negative effect on entrepreneurial intentions. Analytical and graphical modelling of the detected impacts was performed. Based on the real values of the independent variables that apply to a certain freelancer, analytical models can be used to simulate the entrepreneurial attitudes and intentions of that individual. 34 refs.
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MULTI-VEHICLE SCHEDULING OF CONTAINERS IN HIGHWAY PORT UNDER NETWORK CONDITION

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Abstract

In order to improve the tractor-to-semitrailer ratio and reduce the operating cost, this study explored the scheduling problem of multi-vehicle tractor and semitrailer scheduling of containers in highway port. A multi-vehicle tractor and semitrailer scheduling model was established to minimize the network operation cost, and a two-stage heuristic algorithm based on the saving mileage method and an improved simulated annealing algorithm was designed to solve the model. Results show that, compared with the fixed transportation mode, the reduction rate of the number of container tractors and semitrailers under network transportation increased from 7.33 % to 49.88 %, the cost saving rate increased from 2.33 % to 14.14 %, and the reasonable value of the tractor-to-semitrailer ratio increased from 1:1.08 to 1:2.00. It is proved that with the increase of the working time of the tractor, the multi-vehicle tractor and semitrailer transportation shows more obvious advantages. In the meanwhile, the reasonable value of the tractor-to-semitrailer ratio and the tractor scheduling scheme under different working hours are obtained, which provides decision support for enterprise operation. 21 refs.

CORRECTION TECHNOLOGY FOR MAIN GIRDER TORSION IN A COMPOSITE GIRDER CABLE-STAYED BRIDGE

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Abstract

To solve the problem of the steel longitudinal beam being unable to match precise installation of the steel main beam due to torsional deformation during the steel installation process of a composite twin-box girder cable-stayed bridge, a torsion correction method through the multipoint jacking adjustment of transverse steel beams is proposed. Based on the constrained torsion calculation theory for closed thin-walled members, a constrained torsion differential equation for steel longitudinal beams and its general solution were established. Then, the torsion angle and the jacking force on each steel beam at zero torsion angles were obtained. In addition, a local refined model by the finite element software Abaqus was established, simulating the jacking process with the transverse steel beams as a lever arm. The accuracy of the theoretical and numerical analysis was verified by the measured results on site. Results show that the torsion angle of the steel longitudinal beam could be adjusted through multipoint jacking of the steel crossbeam, the installation error caused by the torsion is effectively eliminated, and the efficiency and accuracy of the composite twin-box girder cable-stayed bridge are improved. 22 refs.

DESIGN AND ANALYSIS OF A VERTICAL SCREW STIRRING DEVICE FOR FEEDING DAIRY GOATS

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Abstract

Aiming at the problems of low quality of milk production and low feeding efficiency caused by uneven stirring of components in total mixed ration (TMR), a vertical screw stirring device for feeding dairy goat was designed. In this study, based on the material properties of TMR for dairy goats, the pitch (S), bottom inclination angle (Z), and rotational speed of the vertical screw (n) and the sidewall angle (β) and loading rate (L) of the mixing chamber were simulated and analysed by the discrete element method, the optimal parameter combination for the system were determined. Furthermore, a testbed of the stirring device was built in accordance with simulation analysis conclusions, verifying the working performance of the device. Results demonstrated that when $S = 300$ mm, $Z = 70°$, $\beta = 105°$, $n = 60$ r/min, $L = 70$ %, the C_V of mixing uniformity is 12.95 % and mixing power is 1.35 kW. A test showed that the C_V of mixing uniformity was 13.03 %, and that of mixing power was 1.41 kW. These results are basically consistent with the simulation analysis results. The proposed results provide evidence for the design of feeding devices for dairy goats. 21 refs.

SIMULATION MODELLING OF PEDESTRIANS INFLUENCE ON THE ROUNDABOUT CAPACITY

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Abstract

Pedestrians in general have priority to the cars on unsignalized intersections and roundabouts. Roundabout capacity highly depends on pedestrians, which can interrupt traffic flow whenever they step on the crosswalk. If there are pedestrian crossings on each approach, vehicles should stop to allow them to cross the road. In some cases, vehicle stopped on the exiting lane can even block the central circle of the roundabout, causing serious deterioration of the capacity and level of service. Position of the crosswalk on the entering and exiting lane can reduce influence of pedestrian interruption of car flow. Analysis of pedestrian influence on exiting lane capacity has not been researched before and the aim of this paper is to show how pedestrian flow and the crosswalk location influence on the roundabout capacity and level of service. In addition, comparison of the crosswalk location related to the centre of the roundabout was given. 17 refs.

A SYSTEM DYNAMICS-BASED SIMULATION MODEL FOR CROSS-BORDER LOGISTICS RISK TRANSMISSION

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Abstract

Logistical risks are now significantly more acute due to epidemics, economic recession and local political turmoil. Cross-border logistics risks are particularly prevalent given the large number of participants and the long transport distances involved. This paper develops a system dynamics model to analyse the key factors of cross-border logistics risk. In previous studies, people usually consider the risk factors as many independent individuals. But actually, there is a causal relationship as well as conduction effects between risk factors. Therefore, this paper analyses the relationship between risk factors through qualitative analysis and establishes a system dynamics model to indicate the direction of risk transmission. The rate of risk transmission was analysed using quantitative methods. Finally, this paper conducts simulations using survey data of cross-border e-commerce enterprises in Chengdu, indicating that the industry currently has more prominent customs risks, process risks, and cooperation risks. For these more serious risks, this paper proposes corresponding prevention and control measures. 21 refs.

SIMULATION STUDY ON DROP AND EXPLOSION PERFORMANCE OF MARINE STEAM-WATER SEPARATOR

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Abstract

Marine gas-water separator is mainly used to filter impurities in the air for gas turbine, and it also needs to have certain anti-impact ability in engineering application. In order to study its impact resistance, this paper used the method of combination of simulation and experiment. Firstly, the material properties of 5083 aluminium alloy were determined. On the basis of this, the drop test under different acceleration was carried out. Then ABAQUS software was used to carry on the drop simulation analysis and antiknock simulation analysis. The feasibility of the simulation method was verified by comparison of simulation results and experimental results. The following conclusions are obtained: the impact of 5 g-33 g drop will not affect the operation of the gas-water separator; the impact of guide vane's transverse fall on the gas-water separator is less than that of guide vane's longitudinal fall; the direction with guide vane's support has stronger anti-detonating performance than that without guide vane's support. The conclusions drawn in this paper can be used for specific optimization and protection in practical use, and provide a certain reference for the impact performance field of Marine gas-water separator. 21 refs.

OPTIMIZING MANUFACTURING SCHEDULING WITH GENETIC ALGORITHM AND LSTM NEURAL NETWORKS

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Abstract

In response to Industry 4.0 and the rise of intelligent manufacturing, this study develops a system combining Long Short-Term Memory (LSTM) Neural Networks and a Multi-Objective Genetic Algorithm to improve prediction and optimization in manufacturing scheduling. A novel model predicts work-in-process (WIP) inventory using LSTM neural networks, accommodating dynamic changes in production. A manufacturing scheduling model is also created and solved using a multi-objective genetic algorithm, simplifying the resolution process and obtaining practical solutions. These methods provide a valuable approach to optimizing production scheduling in intelligent manufacturing, enhancing efficiency and economic gains. 23 refs.

INTEGRATED OPTIMIZATION OF VEHICLE ROUTING OF AUTOMOTIVE PARTS INBOUND LOGISTICS

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Abstract

This paper makes a systematic analysis of the automotive inbound logistics, and integrates the automotive inbound logistics system and the production system by rationalizing the three main links of the logistics, taking the theory of value chain increment as the guide, and using the idea of station marshalling driving. This paper integrated and optimized three main links of inbound logistics, constructed the optimization mode of automotive inbound logistics driven by station feeding marshalling and its supporting system. In the Work-Station Marshalling-Driven Automotive Inbound Logistics Mode, we construct a mathematical model and design a hybrid genetic algorithm that combines a local search algorithm and a genetic algorithm. And at the end the validity and practicality of this research is demonstrated by real-life examples. 19 refs.

BLOCKCHAIN IN SUPPLY CHAIN COLLABORATION: A QUANTITATIVE STUDY

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Abstract

Amid advancements in information technology, this study explores the integration of blockchain technology in supply chain management, particularly for improving collaborative production mechanisms. Known for decentralization, transparency, and data security, blockchain is seen as a solution for issues like information delays and asymmetry in traditional supply chains. To address a gap in empirical research, a model incorporating blockchain for information collaboration in supply chain production management was developed using the Stackelberg game model. Furthermore, a consensus decision model aimed at enhancing supply chain collaboration was established within the blockchain network. These findings provide valuable insights into the practical benefits of blockchain in supply chain management, offering direction for future practice. 24 refs.