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MODEL OF LEADERSHIP AND ENTREPRENEURIAL INTENTIONS AMONG EMPLOYED PERSONS

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Abstract
The paper presents the results of the study of the influence of leadership dimensions, (transformational, transactional, LMX and ethical leadership) on individual entrepreneurial orientation dimensions, the achievement dimension and the theory of planned behaviour dimensions. The respondents were employed persons in organizations in Serbia (540 respondents). Under favourable conditions (good strategic management and intellectual stimulation), entrepreneurial intentions tend to decline, while under unfavourable conditions (expectation of high performance with punishment as motivation), entrepreneurial intentions tend to increase. The leader's unethical behaviour can lead to great dissatisfaction among employees, who then begin to form entrepreneurial intentions, even if they do not have such a positive opinion of entrepreneurial ventures. A general model, of the impact of the observed leadership dimensions on two particularly significant entrepreneurial dimensions: Personal Attitude and Entrepreneurial Intentions, is formatted, as well as a model of those influences in the case of the moderating effect of the respondents' perceived performance at work. 24 refs.
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Key Words: *Leadership, LMX, Ethical Leadership, Entrepreneurial Intentions, Model*

Pages 397-407

OPTIMAL PATH PLANNING FOR AN AUTONOMOUS MOBILE ROBOT USING DRAGONFLY ALGORITHM

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Abstract
Navigation, path generation and obstacle avoidance are considered as the key challenges in the area of autonomous mobile robots. In this article, a new meta-heuristic optimization technique called Dragonfly Algorithm (DA) is employed for the navigation of autonomous mobile robot in an unknown cluttered environment filled with several static obstacles. This new meta-heuristic Dragonfly algorithm is inspired from the static and dynamic swarming behaviours of dragonflies in nature. Two objective functions, target seeking and obstacle avoidance are formulated based on the distance between the robot, target and the obstacles and is optimized using the proposed DA for obtaining optimal path. After every iteration, based on the objective function values the robot proceeds towards the globally best agent in the swarm in a sequence of permutation which finally leads to the target. A variety of static environment is modelled and the algorithm is tested both through simulation and experimentally. The proposed algorithm shows that the robot reaches the target without colliding any obstacles while generating a smooth optimal trajectory. 23 refs.
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Key Words: *Mobile Robot Navigation, Dragonfly Algorithm, Autonomous Robot, Optimization*

Pages 408-419

USING CONTINUOUS SIMULATION FOR IDENTIFYING BOTTLENECKS IN SPECIFIC OPERATION

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Abstract
Article deals with creation of continuous simulation model of actual check-in process of selected airline based on identified decision points in passenger handling process. Case study covers actual passenger acceptance situations based on their fulfilment to ticket conditions, ticket fare, transported baggage and considering overbooking situations as planned part of airline revenue management strategy. The problem is related to the identification of bottlenecks in order to efficiently plan and use check-in counters and effectively utilize aircraft seating capacity. Case study shows importance of proper setting of check-in process, together with associated fees in case of not fulfilling ticket conditions, which helps airlines to move breakpoint to favourable percentage of load factor. Simulation models points to possibilities of restriction procedures that affects risk management and movement of breakpoint according to utilization of the aircraft and influence final revenue from the flight. The results of the computer simulation show that ticket prices range from 100.81 € to 398.14 €, the luggage weights ranges from 0.06 kg to 31.57 kg, the total revenue from ticket sales and baggage payments is 44125.8 €. 32 refs.
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Key Words: *Continuous Simulation, Bottlenecks, EXTENDSIM, Service, System*

Pages 420-431

A FRAMEWORK BASED ON MATLAB/SIMULINK FOR THE SIMULATION OF DES USING PETRI NET MODELS

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Abstract
This paper proposes the construction of a framework for the simulation of Petri net models based on Matlab/Simulink. The building blocks of the proposed framework use some basic elements provided by the SimEvents® toolbox. The objective is to provide a flexible and powerful environment that captures the execution conditions of real systems, besides a natural integration to Matlab environment, for the simulation of Petri nets. This framework simplifies the construction of the models by dragging and dropping blocks, and connecting them together. Moreover, a programmatic approach is possible for the construction of complex models, just as any Simulink model. The rich set of tools, algorithms and visualization mechanisms in the Matlab environment are available for the integration with the Petri net models constructed by using the blocks introduced in this work. This integration allows for a wide range of possibilities for the simulation of Discrete Event Systems modelled as Petri nets. Results obtained within this framework are contrasted with those reported in the original sources. The concluding remarks section provides a link for downloading and testing the library. 34 refs.
(Received in February 2019, accepted in July 2019. This paper was with the authors 2 weeks for 1 revision.)

Key Words: *Petri Net Models, Discrete-Event Systems, Matlab, Simulink, SimEvents, Discrete-Event Simulation, Hybrid Simulation*

Pages 432-440

DETERIORATION OF ROAD BARRIER PROTECTION ABILITY DUE TO VARIABLE ROAD FRICTION

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Abstract
The paper presents an analysis of road barrier performance due to variable friction between tires and the ground under different weather conditions. Analyses are based on the TB42 and TB51 test, wherein a vehicle impacts a KTC 033 and KTC 015 steel barrier. A full-scale experiment using a Renault Midlum truck and a SETRA S215L bus was conducted according to the EN 1317 regulation in order to validate a numerical model. A series of numerical tests were conducted in order to investigate the influence of the friction coefficient (μ_{wr} = 0–1.1) on the normative test results. We proved that in TB 42 test on a very slippery road, the working width W_N is equal to 1.6 m, while for a test conducted in good weather conditions (i.e. a dry and clean road) it is only 0.9 m. Thus, it can be stated that the EN 1317 norm may not provide sufficient information about road barrier safety. The behaviour of a barrier cannot be easily anticipated during impact in poor weather conditions, when surface-wheel contact is insufficient. 26 refs.
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Key Words: *Friction, Road Barrier, Crash Test, Numerical Modelling, Finite Element Method*

Pages 441-452

URBAN CROWDSOURCED LAST MILE DELIVERY: MODE OF TRANSPORT EFFECTS ON FLEET PERFORMANCE

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Abstract
Minimizing last mile delivery costs is of paramount importance for all shipping companies that strive to stay competitive on the market. A potential solution to the problem is the use of crowdsourcing – a model where individuals voluntarily take on a task proposed by another entity (e.g. a company). In this paper, we present the results of a comparison of performance for three types of crowdsourced delivery fleets likely to be used in an urban setting. The fleets differ in the mode of transport the couriers use: bicycles, cars or both. The performance is quantified by the total number of deliveries made and the on-time delivery rates. Experimental results were obtained through a simulation that closely resembles real-world traffic conditions in a city with developed cycling infrastructure and takes into account the variations in the speed of couriers. The research shows that bicycle-based crowdsourced fleets outperform other kinds of fleets under simulated conditions. This makes them a faster, more environmentally-friendly and potentially cheaper alternative to traditional fleets that rely on cars. 30 refs.
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Key Words: *Logistics, Urban Delivery, Last Mile Delivery, Crowdsourcing, Simulation Modelling, Performance Analysis*

Pages 453-463

METHODS FOR INCREASED EFFICIENCY OF FEM-BASED TOPOLOGY OPTIMIZATION

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Abstract
Lightweight construction is playing an increasingly important role for a wide variety of reasons, such as improving energy efficiency. In addition to lightweight material construction, lightweight structure construction is gaining more and more influence, which is made possible due to topology optimization. The aim of topology optimization is to develop an optimal design proposal based on a construction space model and given boundary conditions (e.g. mechanical or thermal). The calculation of the structural response is often done using the time consuming finite element method (FEM). Since topology optimization is an iterative process, usually many finite element analyses (FEA) have to be performed, which results in high computing time. Therefore, this article presents different methods to minimize computing time by exploiting various special features that occur with FEA in the context of optimizations. 29 refs.
(Received in April 2019, accepted in July 2019. This paper was with the authors 2 weeks for 1 revision.)

Key Words: *Structural Optimization, Topology Optimization, Computational Effort, Finite Element Method*

Pages 464-475

SOLID-LIQUID FLOW OF AXIAL FLOW PUMP IN LOOP REACTOR AND OPERATING CONTROL WITH SINGLE INVERT

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Abstract
Solid concentration changes may affect the solid-liquid flow of the axial flow pump in the polypropylene loop reactor, accompanied with unstable operations (e.g., axial power fluctuation). The influencing factors and formation mechanisms of axial power fluctuation were analysed. After that, to discuss the influences of energy allowance of the mixture media in the loop reactor, the internal flow status of the pump under different solid volume fractions were compared. Then a head-correction strategy of operating control with single invert was proposed, to smooth the axial power fluctuation of the axial flow pump. Results demonstrate that viscosity of the mixture media is positively related, whereas the head of the axial flow pump is negatively correlated with solid concentration. Besides, head-correction curves can effectively regulate the off-design operation of pump under different solid volume fractions, with the energy allowance and the axial power fluctuation reduced in the loop reactor and the pump. Researches provide important references for the analysis of internal flow status and the solution of axial power fluctuation of the axial flow pump in the polypropylene loop reactor. 23 refs.
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Key Words: *Axial Flow Pump, Solid-Liquid Flow, Axial Power Fluctuation, Operating Control with Single Invert*

Pages 476-487

OPTIMAL PATH SELECTION FOR EMERGENCY RELIEF SUPPLIES AFTER MINE DISASTERS

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Abstract
Due to the inappropriate path caused by traffic control, climatic conditions, and inconsistent regional economic development, etc., the transportation efficiency of emergency relief supplies is low in mining areas in China. To improve the transportation efficiency, a road impedance function model was proposed based on the uniqueness of emergency relief supplies' transportation after mine disasters. The model, which aimed to solve the optimal transport time conforming to practical traffic conditions, was designed in accordance with China's road design norms and actual traffic flows while considering random delays at road junctions. The weight of path was calculated from the road impedance function model and traffic allocation simulation data. The feasibility and universality of the model were proved by performing simulations under normal traffic, rainfall and traffic control conditions. Results indicate that the optimal path selection by the Dijkstra algorithm achieves a high accuracy. Time cost under rainfall and traffic control conditions increases by 3.3 % and 1 %, respectively, compared with the normal condition. This study provides new ideas to select transport path for emergency relief supplies. 22 refs.
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Key Words: *Path Selection, Emergency Relief, Material Transport, Path-Weight*

Pages 488-499

USING MATURITY MODEL AND DISCRETE-EVENT SIMULATION FOR INDUSTRY 4.0 IMPLEMENTATION

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Abstract
Production environments worldwide transform themselves in order to take the best advantage of the Industry 4.0 guidelines. Automation, data exchange, cyber-physical systems, the IoT, cloud and cognitive computing represent a step in the unknown to these companies, associated with high risks and also the need to restructure their culture. If the execution route is not clearly defined and understandable to all levels of employees, the renovation is too long. The maturity models can be used for the assessment of current Industry 4.0 maturity level, but the practical use of scores and assessed level often requires the involvement of consulting firms. Companies can avoid the involvement of consulting companies with the use of complementary tools. In this paper, we propose a new methodology that combines the Industry 4.0 maturity model and discrete-event simulation tools in the case of steel production company with the possibility of generalization. The combination of these tools in the first step helps the company to assess its current level of maturity for Industry 4.0, and in the second step helps to consider about strengths and weaknesses of possible scenarios for transition to a higher level of maturity. 27 refs.
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Key Words: *Industry 4.0, Maturity Model, Steel Production, Discrete Event Simulation, Performance Analysis*

Pages 500-509

A MULTI-OBJECTIVE HYBRID DIFFERENTIAL OPTIMIZATION ALGORITHM FOR FLOW-SHOP SCHEDULING PROBLEM

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Abstract
This paper puts forward a multi-objective hybrid difference optimization algorithm to solve multi-objective flow-shop scheduling problem (FSP). The hybrid algorithm inherits the merits of differential evolution vector operation, and makes dynamic adjustments to the search direction based on historical data. However, the basic differential evolution algorithm is prone to the local optimum trap, due to the low population diversity in the later stage of evolution. To solve the problem, a hybrid sampling strategy was introduced obtain the distribution information of solution sets and to design the mutation operator of differential evolution, thus improving the convergence of the hybrid algorithm. Finally, our algorithm was applied to solve FSPs through simulation. The simulation results show that our algorithm greatly outperformed the basic multi-objective evolutionary algorithm in convergence and distribution performance. 22 refs.
(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Flow-Shop Scheduling Problem (FSP), Multi-Objective Optimization, Hybrid Differential Evolution, Genetic Algorithms (GA)*

Pages 510-520

A MULTI-OBJECTIVE OPTIMIZATION MODEL BASED ON NON-DOMINATED SORTING GENETIC ALGORITHM

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Abstract
This paper attempts to solve the job-shop scheduling problem (JSP), in which machines are shared among multiple tasks. For this purpose, a multi-objective optimization model was established to minimize the total completion time and total cost. To solve the model, a scheduling strategy was proposed based on the NGSA with crowding mechanism. Compared with the GA, the improved NGSA can effectively avoid the local optimum trap and maintain population diversity in the later stage. In addition, the heuristic crossover operator was introduced to enhance the local search ability of the improved NGSA. The effectiveness of the proposed scheduling strategy was proved valid through simulation. 20 refs.
(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Job-Shop Scheduling Problem (JSP), Genetic Algorithm (GA), Non-Dominated Sorting Genetic Algorithm (NSGA), Multi-Objective Scheduling*

Pages 521-530

AN IMPROVED WHALE OPTIMIZATION ALGORITHM FOR JOB-SHOP SCHEDULING BASED ON QUANTUM COMPUTING

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Abstract
The traditional swarm intelligence algorithms are inefficient and difficult to converge to the optimal solution of the job-shop scheduling problem (JSP). In this paper, an improved whale optimization algorithm (IWOA) is proposed based on quantum computing to solve the discrete JSP. The algorithm was subjected to the analysis on computing complexity, the demonstration of global convergence, and simulation verification on a benchmark example of the JSP. Through the simulation, our algorithm achieved better minimum value, mean value and optimization success rate than traditional swarm intelligence algorithms. The results prove the convergence accuracy and global search ability of the IWOA. 30 refs.
(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Job-Shop Scheduling Problem (JSP), Swarm Intelligence, Quantum Computing, Whale Optimization Algorithm (WOA), Global Convergence*

Pages 531-542

DESIGN AND DYNAMIC ANALYSIS OF A NEW RAIL GRINDING DEVICE USING CLOSED ABRASIVE BELT

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Abstract
With the rapid development of modern abrasive belt grinding, a novel rail grinding method based on closed-structured belt grinding technology has been proposed in this paper. Correspondingly, a new rail grinding device with the closed abrasive belt was designed according to engineering requirements and constraints. It is equipped with four built-in grinding units aiming to achieve required material removal through lateral, vertical, and rotational movements. Afterward, a corresponding dynamic simulation model for the designed device was established in SIMPACK software to verify its working performance in terms of the four dynamic indices, including lateral vibration acceleration, vertical vibration acceleration, axle transverse force as well as derailment coefficient. The results of those indices both for the linear and curved tracks are within the limits, which have proved the design rationality of the new rail grinding device. 23 refs.
(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Rail Grinding, Abrasive Belt, Device Design, Dynamic Analysis*

Pages 543-554

OPTIMIZATION OF MICRO-TEXTURE DISTRIBUTION THROUGH FINITE-ELEMENT SIMULATION

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Abstract
The existing studies on micro-texturing of cutting tools only tackle the micro-textures of uniform distribution. The theoretical and experimental bases are severely lacking for the effects of different micro-texture distributions on the anti-wear and anti-friction properties in titanium alloy cutting. To solve the problem, this paper attempts to explore the wear resistance and friction performance of micro-round-pit (MRP) textures in different distributions. Specifically, the DEFORM-3D finite-element method (FEM) software was adopted to simulate and analyse the effects of these distributions on the ball-end milling of titanium alloy. The simulation shows that the milling force was minimized by the distribution ABC (150-175-200). This result was then confirmed by a milling experiment. In conclusion, the tool wear and cutting friction can be effectively reduced by the optimal micro-texture distribution. 24 refs.
(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Micro-Texture, Finite-Element Method (FEM), Micro-Round-Pit (MRP), Wear Resistance, Friction Performance*