

COMBAT SIMULATION FRAMEWORK INCLUDING CONTINUOUS DETECTION SYSTEM

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Abstract

This paper presents a framework for an anti-air engagement simulation that includes continuous detection systems. According to resolutions, military simulations can be categorized into four different levels; *campaign (war-game)*, *mission*, *engagement*, and *engineering (natural-phenomenon)*. While the campaign and mission level systems are represented by discrete-event systems and the engineering level systems are represented by continuous-state systems, the engagement level systems may include both characteristics of the discrete and continuous systems. An engagement level system includes multiple combat entities represented by discrete-event systems; however, various performance parameters of combat entities (i.e. detection probability) belong to continuous-state systems. Although the detection probability can be computed by equations considering the synthetic environment, it cannot be directly used in a discrete-event system. To cope with the problem, we propose a glimpse probability suitable for the discrete-event systems and a construction procedure. The proposed framework is designed to be compatible with high-level architecture technology, and applied to anti-air engagement simulations. 29 refs.

(Received in June 2013, accepted in March 2014. This paper was with the authors 1 month for 1 revision.)

Key Words: *Continuous-State System, Discrete-Event System, Engagement Simulation, Glimpse Probability, High-Level Architecture, Synthetic Environment*

ERGONOMIC ANALYSIS OF OPHTHALMIC NURSE WORKPLACE USING 3D SIMULATION

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Abstract

The number of work-related musculoskeletal disorders has been increasing in most industries and occupations. Since these injuries impose high costs on employers and society it is important to prevent it through ergonomic assessment and job redesign. The paper presents a research of the workplace ophthalmic nurse regarding strain and stress. In the workplace the Intravenous Fluorescein angiography or fluorescent angiography is made which is a technique for examining the circulation of the retina and choroids using a fluorescent dye and specialized camera. The working procedure is complex and since nurses must assist in several forced positions for longer time ergonomic analyses were made aimed to determine strain and stress at workplace. For assessment of body postures OWAS analysis was performed manually and using computer simulation. The results obtained using computer simulations are comparable to manually performed research for most body positions except for bent and twisted back. Body postures of upper limb, lower limb and neck were exposed as harmful for nurse during working procedure and according to OWAS changes are needed in near future. 18 refs.

(Received in July 2013, accepted in April 2014. This paper was with the authors 3 months for 2 revisions.)

Key Words: *Ergonomic Analysis, Computer Simulation, OWAS Method, Workplace Design, Ophthalmic Nurse*

DEVELOPMENT OF ECONOMICAL VEHICLE MODEL FOR PEDESTRIAN-FRIENDLY FRONT-END PROFILE STUDY

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Abstract

An economical and deformable, hybrid model is developed for studying the effect of vehicle geometry on pedestrian fall kinematics and associated head injury. A simplified structure consisting of Finite Element surfaces and a Multi-body windshield is built using a series of iterative and non- iterative steps. The primary focus is not so much the stiffness characteristics of the structure, but rather the fall pattern and kinematic data of the pedestrian due solely to the vehicle front-end shape. Comprehensive validation is carried out whereby the fidelity of the model is reviewed for pedestrian crash kinematics and injury criteria as well as piecewise vehicle parts impact tests. The model is shown to hold up acceptably well against benchmarked values especially for the former, whereby very close head injury criteria values are obtained at identical impact locations. The model's notable features are its economical computational processing time and ease of modification. 36 refs.

(Received in October 2013, accepted in March 2014. This paper was with the authors 2 months for 3 revisions.)

Key Words: *Pedestrian Protection, Deformable Hybrid Vehicle Model, Validation, Optimization Friendly Model*

MOTIVATIONAL LEAN GAME TO SUPPORT DECISION BETWEEN PUSH AND PULL PRODUCTION STRATEGY

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Abstract

In this paper, we present and propose the interactive push-pull lean game with a specific approach for training/testing of production processes. With our approach of combining the psychologically effective physical lean game and the simulation lean game for deeper analyses of the production process, we can successfully overcome the communication and motivation problems of production and management workers when new production strategies are being introduced into the company to raise the competitiveness. The game only takes two hours and it has been proven to be effective with leadership teams and shop floor workers alike in more than 50 real-case production environments. The game is played in two parts where each part is in sharp contrast to the other with respect to results. Once the participants of the game see the effects of both production strategies, they become extremely engaged and motivated, and it becomes much easier to manage organizational improvements. In the third chapter of the paper, we present the Virtual factory computer models of the game dynamic, showing the same results as obtained with groups. The two simulation models serve to test and verify the interactive game. The paper ends with the discussion and conclusions. 50 refs.

(Received in December 2013, accepted in May 2014. This paper was with the authors 2 months for 1 revision.)

Key Words: *Lean Game, Push, Pull, Production Optimization, Virtual Factory, Production Simulation*

PROJECT EVALUATION USING COST-TIME INVESTMENT SIMULATION

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Abstract

Project success includes time, budget, quality, customer satisfaction etc. We are always confronted with time and money in the first place. Activity schedules must consider the available resources to be completed in the right sequence and in time. Companies must maintain competitive cost-time profiles. Execution periods of non-critical project activities have a considerable influence to the amount of locked-up capital. In the paper we have simulated some cases with varied execution periods of non-critical project activities within the slack, and measured cost-time investment. For the visualisation of project cost accumulation we have applied cost-time profile; we have used Cost Time Profiler software. The results show that the differences are significant, bringing a potential for project optimization. 22 refs.

(Received in December 2013, accepted in May 2014. This paper was with the authors 3 months for 1 revision.)

Key Words: *Project, Activity, Slack Time, Cost-Time Profile, Investment*

ASSOCIATION RULES ALGORITHM AND ITS APPLICATION IN THE MAINTENANCE OF THE TUNNEL

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Abstract

In this paper, effective data mining methods are adopted for the tunnel management information system to deal with safety issue data and work out the relationship among these safety issues in order to estimate risk, establish intelligent decision support, provide basis of governance for railway maintenance departments and remedy the defects of the existed management information systems. In view of the bottleneck of Apriori algorithm, two new algorithms are proposed in this paper. The first is AprioriN algorithm based on arrays, which converts the operation on database to the operation on memory via coding. The second is a high performance association rule mining algorithm based on FP-tree, which accelerates the speed of traverse itemsets by adding an extra data structure. During the second scan of the database, a matrix is generated to save frequent 2-itemsets when the basic FP-tree is created. This paper attempts the improved algorithms to improve the efficiency. 14 refs.

(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Data Mining, Association Rule, Frequent Itemsets, FP-Tree, Tunnel Safety Issue*

MULTI-OBJECTIVE RESCHEDULING MODEL FOR PRODUCT COLLABORATIVE DESIGN CONSIDERING DISTURBANCE

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Abstract

Disturbance is inevitable in product collaborative design (PCDSP), which has always posed a great challenge for enterprises making quick response. Thus, in the paper, a multi-objective rescheduling model and its solution algorithm are presented. Disturbance cases are analysed and dynamic scheduling procedure based on event-driven and lifecycle-driven is developed firstly. Then a multi-objective rescheduling model aiming to minimum the makespan and tardiness penalty is developed. As a solution, multi-objective dynamic adaptive scheduling algorithm (MODASA), based on bi-layer coding strategy, self-adaptive double point crossover and self-adaptive mutation, is proposed following closely. Finally, analytic results from a case of a wind turbine are used to illustrate the model and method proposed in this paper. Simulation results shows that the model and algorithm have full advantages in computing speed and precision. With the analysis, it can provide insight into ways of improving the strategic and operational decision making for enterprises. 25 refs.

(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Product Collaborative Design, Rescheduling Problem, Disturbance, Multi-Objective Optimization, Algorithm*

EMERGENCY RESPONSE CAPABILITY ASSESSMENT OF EMERGENCY SUPPLY CHAIN COORDINATION MECHANISM BASED ON HESITANT FUZZY INFORMATION

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Abstract

In recent years, as global economy is intertwined, the competition among enterprises is epitomized by the supply chain. Owing to its vulnerability, once there are emergencies, huge losses would take its toll. Therefore, it is significant to assess the emergency response capability of the emergency supply chain coordination mechanism. However, during the assessment, subjectivity of experts may make things complicated and cause a lack of information and fuzziness. Thus, this paper proposes a TOPSIS METHOD based on hesitant fuzzy information to address the abovementioned issue. Numerical analysis proves that the method is efficient and accurate. 19 refs.

(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Emergency Supply Chain Coordination Mechanism, Emergency Response Capability Assessment, Hesitant Fuzzy Information, Assessment System*

SIMULATION ON THE COMPLEMENTARY PRODUCT STRATEGY BASED ON THE COURNOT-BERTRAND MIXED GAME MODEL

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Abstract

In this article, we report the results of a study that explores an output-pricing game model in a complex system which comprises two main manufacturers and two complementary product enterprises. First, optimization method is used to study the influence of parameters on the optimal decisions of the model. Second, a dynamic game model and a controlled model are established in order to analyse the system's dynamic characteristics in disequilibrium state by dynamic simulation. The simulation results show that the increase of product substitutability will be unfavourable to all members of the complex system, enterprises should control the product's complementarity thus can they obtain maximum profit respectively. In addition, enterprises in the system can reach Nash Equilibrium, but complementary enterprises are lack of cooperation enthusiasm with the increase of substitutability of main product. The complex characteristics of the model with the change of parameters is exhibited by dynamic simulation, and the stability of variables will change when the parameters taking different values. The results can provide references for managers in variable adjustment, choice of complementary product strategy and product design, etc. 28 refs.

(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Complementary Product, Cournot-Bertrand Mixed Model, Dynamic Simulation, Chaos*

AN IMPROVED GENETIC ALGORITHM FOR JOB-SHOP SCHEDULING PROBLEM WITH PROCESS SEQUENCE FLEXIBILITY

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Abstract

A new scheduling problem considering the sequence flexibility in classical job shop scheduling problem (SFJSP) is very practical in most realistic situations. SFJSP consists of two sub-problems which are determining the sequence of flexible operations of each job and sequencing all the operations on the machines. This paper proposes an improved genetic algorithm (IGA) to solve SFJSP to minimise the makespan, in which the chromosome encoding schema, crossover operator and mutation operator are redesigned. The chromosome encoding schema can express the processing sequence of flexible operations of all the jobs and the processing sequence of the operations on the machines simultaneously. The crossover and mutation operators can ensure the generation of feasible offspring for SFJSP. The simulation results on three practical instances of a bearing manufacturing corporation show that the proposed algorithm is quite efficient in solving SFJSP. 31 refs.

(Received, processed and accepted by the Chinese Representative Office.)

Key Words: *Process Sequence Flexibility, Job Shop Scheduling, Genetic Algorithm*
