

Cumulative Index

Nanoscience and Nanotechnology

N Mykytenko, D Fink, A Kiv Generalized Model of Pulsating Track Device

Computer Modelling & New Technologies 2014 18(1) 7-12

A model for description and study of pulsating track-based devices is developed. The track electronics opens up perspectives for solving new scientific and technical problems. The successful solution of these problems requires an elucidation of the mechanisms of the functioning of track-based devices. In this paper, the nature of the pulsating behaviour of electric parameters of track devices is clarified using a specially developed model based on classical Molecular Dynamics. It is demonstrated that the model describes adequately the main features of pulsations in track devices that were established experimentally.

Keywords: track electronics, current pulsations, molecular dynamics

T Lobanova-Shunina, Yu Shunin Nanothinking and Nanoeducation: Nanoscientific Literacy for Responsible Consumer Decision Making

Computer Modelling & New Technologies 2014 18(1) 13-24

Consciously or unconsciously, the term ‘nanotechnologies’ is firmly entering the life of every consumer-citizen of the global community designating both relatively simple nanomaterials and goods that have already entered the market, and very complex technologies that are supposed to change radically the future of mankind. Applications based on today’s basic research are expected to form the next industrial revolution. The unique properties of nanotechnology applications suggest potential to solve some of the most pressing social and business challenges, but they come with uncertainties and risks as all new technologies.

Taking advantage of technological progress and preventing adverse side-effects requires analysis, evaluation and guidance to ensure technology is developed in ways that benefits wider consumer society and every individual consumer on the planet. Unfortunately, general public lacks understanding and awareness of the basic properties, and sometimes even the existence of nanotechnologies and their implications linked to the consumption of nanoproducts. Moreover, a generally sceptical attitude among society groups prevails towards new technologies.

The general lack of public knowledge about nanoproducts that are already on the market in a full swing is likely to bring irrational and erroneous, potentially harmful, results. Therefore, modern technology requires educated workforce and responsible consumers and hence imperative for educated population.

Our mission had a focus on introducing changes into the curriculum to eliminate gaps in scientific knowledge of students (as potential consumers, managers and scientists) and to foster an active approach to developing responsible scientific consumption practices and to offer an opportunity for students from a wide range of disciplines to learn about nanoscience and nanotechnology, to explore these questions, and to reflect on the place of new technologies in the spheres of their major and in the global society.

Keywords: Nanotechnologies, responsible scientific consumption, consumer identities, nanoeducation, nanothinking

Mathematical and Computer Modelling

J Zhou, W Q Ma, J Y Miao Supplies Transportation Planning in Power Grid Urgent Repair Based on Hierarchical Genetic Algorithm

Computer Modelling & New Technologies 2014 18(1) 25-30

To optimize supplies transportation solutions of power grid, a hierarchical genetic algorithm is put forward. Double hierarchical objective function is set by weighting, that is, when the precondition of inequality constraint is met, objective solution is to find out the shortest supply time and if the solution is also within the time constraint, the final solution would be the least supply cost, otherwise, it would still be the shortest supply time. The solution for optimal supplies transportation scheme at the least cost would be worked out by iteration of genetic algorithm. Compared with single objective genetic algorithm in simulation, hierarchical genetic algorithm is proved more effective and superior to decrease economic loss of accidents.

Keywords: Hierarchical Genetic Algorithm, Time constraint, Transportation Cost, Transportation Time, Economic Loss

Zengqiang Ma, Yacong Zheng, Sha Zhong, Xingxing Zou Study of Maneuvering Target Tracking Algorithm Based on Kalman Filter and ANFIS

Computer Modelling & New Technologies 2014 18(1) 31-37

Although Kalman filtering algorithm has been widely used in the maneuvering target tracking, conventional Kalman filtering algorithm always fails to track the maneuvering target as the target changes its movement state suddenly. In order to overcome its disadvantages, an improved Kalman filtering algorithm that based on the adaptive neural fuzzy inference system (ANFIS) is proposed in this paper. In the improved algorithm, the covariance matrix of Kalman residual is gainer and the measurement noise covariance can be updated in real-time by ANFIS module. Finally, the comparison and analysis of the experiment results between the original Kalman filtering algorithm and the improved one has been carried out. The experiment results show that the tracking error is obviously reduced and the accuracy is significantly boosted after the original Kalman filtering algorithm was substituted by the improved one.

Keywords: maneuvering Target tracking, Kalman filter, Adaptive Neuro-Fuzzy Inference System (ANFIS)

Ji Mingyu, Li Yanmei, Chen Zhiyuan The Property Verification Methods of Complex Stochastic System Based on Directed Graph

Computer Modelling & New Technologies 2014 18(1) 38-43

With the increasing complexity of computer hardware and software systems, how to ensure system accuracy and reliability becomes an increasingly pressing issue. The quantitative verification of multiple until formula property has important practical significance in the field of biology. In this paper, for particular probability reward model, we give the detailed analysis of properties verification methods of the multiple until formula with transition step and transition reward constraints based on the weighted directed graph. At last, the example analysis is given. The theoretical analysis and example result show that the feasibility and validity of the method.

Keywords: Probabilistic system; Model checking; Multiple until formula; Directed graph

Zhang Yongheng, Zhang Feng Research on the Smart Wireless Sensor Perception System and its Application Based on Internet of Things

Computer Modelling & New Technologies 2014 18(1) 44-51

In order to solve the uncertain perception information appears in the perception process of intelligent wireless sensor, this paper considers the intelligent perception problem of Internet of Things (IoT) based on context perception. The current status of the research on intelligent perception and its existing problem is analyzed, and then a context perception method to solve the intelligent perception problem of Internet of Thing is proposed. The intelligent perception context description model of Internet of Things is constructed. In addition, it was investigated that how the intelligent routing maintained under fault conditions, and intelligent information management system of agriculture's was proposed of agricultural IoT system, combined with agricultural automatic control devices, which had already been successfully used in the agricultural production.

Keywords: Internet of Things, intelligent perception, automatic control, context perception, intelligent wireless sensor

Huang Li Data Cleansing Base on Subgraph Comparison

Computer Modelling & New Technologies 2014 18(1) 52-60

With the quick development of the semantic web technology, RDF data explosion has become a challenging problem. Since RDF data are always from different resources, which may have overlap with each other, they could have duplicates. These duplicates may cause ambiguity and even error in reasoning. However, attentions are seldom paid to this problem. In this paper, we study the problem and give a solution, named K-radius sub graph comparison (KSC). The proposed method is based on RDF-Hierarchical Graph Model. KSC combines similar and comparison of 'context' to detect duplicate in RDF data. Experiments on publication datasets show that the proposed method is efficient in duplicate detection of RDF data. And KSC is simpler and less time-costs than other methods of graph comparison.

Keywords: RDF data cleansing, K-radius sub graph comparison

Li Gongfa, Liu Jia, Jiang Guozhang, Kong Jianyi, Xie Liangxi, Xiao Wentao, Zhang Yikun, Cheng Fuwei Numerical Simulation of Flow, Temperature and Phase Fields in U71Mn Rail-Head Quenching Process

Computer Modelling & New Technologies 2014 18(1) 61-70

With the sustainable and fast development of Chinese economy, the volume of railway freight was increasing, and

which promoted the train load and speed continue improving, in order to meet the needs of high speed and over loading trains' running, heavy and seamless steel rail has increasingly widely used Heat-treatment was emphasized for its important role to qualify the products of heavy rail. And air-cooling quenching was one of the widely used heating process methods. Air-jet is a very vital instrument in quenching by air-cooling. At present, the international community has been widely used air-cooled quenching, most quenching production lines of domestic converted into wind cold quenching line. It is necessary to simulate the inner and outer flow-field of air-jet. In this paper, by means of computational fluid dynamics soft system Fluent to establish the geometric model of heavy rail, analysis the distribution of the internal and external flow field about air-jet centre cross section and the three sections were in parallel with it. Then through setting surface heat transfer coefficient of air-cooling, numerical simulation of temperature field in the cooling process of heavy rail. Finally, the phase changing temperature of steel U71Mn was got based on its CCT curves. With the cooling curves of several key points, the cooling rate at phase transition point was calculated. By comparing with every microstructure's critical cooling rate, the final cooling microstructure was predicted. Relative tests showed that the prediction was reasonable. It is significantly valuable for parameters' selection in heavy rail's technical operation.

Keywords: temperature field, flow field, phase field, air-cooling, heavy rail

Information Technologies

Ranran Man, Dongsheng Zhou, Qiang Zhang An Improved Collision Detection Algorithm Based on OBB

Computer Modelling & New Technologies 2014 18(1) 71-79

In this paper, we present an effective algorithm based on the Oriented Bounding Box (OBB). Particularly, the article focus on how to reduce the amount of the time that the intersection of bounding boxes are detected for increasing the efficiency of collision detection algorithm through the following three steps. Firstly, the detection time of bounding box intersection is decreased by a pre-treatment method. Secondly, we optimize the traversal approach of the bounding box tree and reduce the depth of the two fork tree under take into account the temporal and spatial correlation of motion of virtual environment. Then, we reduce the breadth of tree result from this algorithm compares the distance between the bounding boxes and traverse the node of distance that near the tree. At last, the validity of the algorithm is verified by programming simulations.

Keywords: Collision detection; Oriented bounding box (OBB); Spatio-temporal correlation; Bounding volume hierarchy

Liu Hongxia, Zhang Feng Precision Agriculture Compressed Sensing and Data Fusion Algorithm for Wireless Sensor Networks

Computer Modelling & New Technologies 2014 18(1) 80-84

In order to improve the energy efficiency of WSN nodes and prolong the life of the network, reduce data redundancy. In this paper, proposed the spatial correlation node data compression and fusion algorithm based on the theory of compressed sensing. Firstly, make signal node random projection based on time correlation, then, for random routing instability and network transmission of data fusion technology reconstruction energy effects, proposed the energy consumption of compressed sensing and clustering data fusion technology. The experiment showed that after data fusion, not only effectively removes the redundant information of neighbouring nodes, and the reconstruction error is small, and can accurately realize data decompression, thereby reducing the node communication in wireless sensor network capacity, reduce power consumption of node, provides important support for the field environment in large scale wireless sensor network deployment.

Keywords: compressed sensing, intelligent wireless sensor, agriculture IoT, automatic control, data fusion

Yun-Feng Wang, Wei Cheng Structural Design and Active Control Simulation for Double Beam Actuator Based on ANSYS

Computer Modelling & New Technologies 2014 18(1) 85-92

A double-beam actuator (DBA) is designed in this study for attenuating the harmful vibration. Its finite element model including the folded beam, glue layers and piezoelectric laminar is developed in commercial software ANSYS. DBA's dynamic characters are analysed by employing modal and transient analysis in ANSYS. The calculated results are used to develop an explicit state space model by using the observer/Kalman filter identification (OKID) technique and Eigen-system Realization Algorithm (ERA). The robust H_2 controller is designed based on the identified state space model and it is then incorporated into the ANSYS finite element model to perform the close loop controlling

simulation. The results of simulation show the settling time reduce to 0.06s with active control under impulse exciting and the response amplitude decrease 20 dB under sine exciting, which demonstrate the validity of DBA in application of active control.

Keywords: active control, system identification, active control, ANSYS, piezoelectric

Weihua Yuan, Hong Wang Using Two-Stage Non-Negative Matrix Factorization for Topic Recommendation in Online Social Networks

Computer Modelling & New Technologies 2014 18(1) 93-99

This paper put forward a two-stage non-negative matrix factorization (TSNMF) for topic recommendation in online social network to solve the existing problems of mass data, extreme sparseness and cold start. In stage I, we use co-clustering to divide user-topic interest matrix into smaller sub-matrices called cluster-sub-matrices based on non-negative matrix factorization on interest-density matrix D . Each cluster-sub-matrix is much smaller than the original with similar internal interest pattern. In stage II, we use weighted non-negative matrix factorization algorithm to predict unknown items on each of cluster-sub-matrix directly. Experiments on real datasets show that TSNMF can not only gain high prediction accuracy on extreme sparse datasets, but avoid the problem of too much computation of NMF on the whole user-topic interest matrix, as well as the problem of the recommendation's quick local convergence.

Keywords: Recommender algorithm; NMF (non-negative matrix factorization); Clustering; Data sparseness

Operation research and decision making

D Zagulova, R Muhamedyev, I Ualiyeva, A Mansharipova, E Muhamedyeva Optimization of Medical Information Systems by Using Additional Factors

Computer Modelling & New Technologies 2014 18(1) 100-108

Increasing longevity is one of the most important problems of modern Gerontology. Solution of these problems is connected principally with the use of information and communication technologies. Creation of a comprehensive health information system requires consideration of many factors, such as qualitative screening system based on patients' self-assessment, identification of possible errors that affect decision-making and patients' personal characteristics. The work presents the results of elderly Almaty and Almaty Region population survey conducted with the help of Active Longevity Portal designed for data collection, analysis and assistance to the elderly population of Kazakhstan. The results showed that the number of medical consultations is directly related to health self-assessment and anxiety levels. Detection of cardiovascular diseases (CVD) with the help of effort angina self-assessment demonstrated low sensitivity. Correlation between the Kettle's index of effort angina self-assessment, the impact of Physical Component Score (PCS) of SF-12 test onto the manifestation of cardiovascular disease in hereditary background, anxiety level and coronary heart disease manifestation, impact of Health Survey estimated by Physical Component Score (PCS) and Mental Component Score (MCS) SF-12 test onto the correspondence between Effort Angina Questionnaire and CVD patient state was detected. Studies showed that detection of diseases through Questionnaire Survey self-assessment in certain situations may lead to significant errors. Consideration of these factors will help to build a more powerful information system in which personal data will be combined with clinical data and expert estimates.

Keywords: gerontology, Kazakhstan population, information technology, cardiovascular diseases, medical information system

M Fay, V Grekul, N Korovkina IT Investments Justification Based on the Business Driver Tree

Computer Modelling & New Technologies 2014 18(1) 109-114

Choosing the right IT project for supporting the company business development is nowadays one of the most critical tasks in information technology management. No one has yet managed to create one optimal solution, equally suitable for different types of stakeholders (business owners, managers, investors). This article, based on the ideas of Value Based Management and business/value-driver trees, concentrates on an original approach to managing investments in enterprise architecture IT component. The method suggested has been successfully applied to evaluate the IT project portfolio within a large metals company in Russia.

Keywords: Value Based Management, IT-project, IT investments, business driver, IT projects portfolio, investments justification

Bang-Jun Wang CBM-based Integrated Management Information System Design for Mine Construction Enterprises

Computer Modelling & New Technologies 2014 18(1) 115-120

To solve existing problems in the management for mine construction enterprises, this research introduced the concept of CBM (Comprehensive Budget Management) on the basis of data and information demand analysis using enterprise management decision. Next, under the circumstance of project management, the market mechanism was introduced in mine construction enterprises, materializing the CBM-based integrated management information system design for mine construction enterprises. The system architecture encompassed six modules, namely, production progress management, project material management, mechanical and electrical equipment management, human resource management, integrated cost management and performance management. The system covered the integrated management information system for each process of the mine construction management. With the B/S structure, technological development approaches of this system consisted of UML modelling technique, dynamic configured technology, database design and implementation. The actual application of integrated management system in sample mine enterprises showed optimized enterprise management process and improved data processing proficiency, greatly enhancing the financial performance and competitiveness of mine enterprises.

Keywords: Comprehensive Budget Management (CBM); mine construction enterprises; integrated management information system; design and application

Yinzhou Zhu, Hui Yang, Baolin Yin Method for Defining Multiple Homogeneous Activities in Distributed Workflow Management System

Computer Modelling & New Technologies 2014 18(1) 121-128

In current process-oriented software systems, most of the processes have large number of parallel activities, which are homogeneous. These parallel activities are often used in the split-merge workflow structure and make the workflow model too complex to manage, as in the traditional workflow management systems each activity has to be defined respectively and bind to one resource. In this paper, we explore a novel method to define the distributed workflow model, which replaces the multiple homogeneous parallel activities with a batch-activity node to simplify the workflow model. An architecture is designed based on this method, which involves the model of organization structure, resource allocation and the sub-workflow. This architecture allows one batch-activity node bind to multiple resources, which are distributed, over a wide geographic area. Real-world scenarios, which are built and implemented based on this architecture, are shown to prove the effectiveness and usefulness of the method.

Keywords: workflow management, business process, distributed systems, resource allocation, multiple-instances pattern

Wang Mingpeng, Sun Qiming Empirical Research on Existing Quantity of Small and Medium-sized Enterprises in China, Based on System Dynamics

Computer Modelling & New Technologies 2014 18(1) 129-135

A system model for the existing quantity of small and medium-sized enterprises is built in this document, by establishing relationship equations with study on relationships among more than 30 variables such as total enterprise quantity, establishment rate of new enterprises, level of human resources, level of technical innovations, index of resource dependence, etc. Moderate breakthroughs are made on the mathematical methodology, such as the method of education years to calculate the level of human resources, the method of resource dependency evaluation for the resource dependency index. However, certain corrections are made for adaptation to the study. The innovative concept of establishment rate of new small and medium-sized enterprises is created in modelling and correlated with level of technical innovations, level of human resources and resource dependency index through relationship functions. The purpose thereof is to explore mechanisms where and extents to which influence factors make impact on the existing quantity of small and medium-sized enterprises. Finally, emulational prediction for the system model is made with the emulator Vensim and the error analysis on comparison between emulational and historical data is performed. It is found that the agreement with historical data is good and the error is acceptable.

Keywords: existing quantity of small and medium-sized enterprises, establishment rate of new small and medium-sized enterprises, system dynamics

Wang Fen, Chen Jianping The Buyback Contract Coordination for a Logistics Service Supply Chain

Computer Modelling & New Technologies 2014 18(1) 136-143

This article is about the coordination issue of the logistics service supply chain leading by the functional logistics

provider (FLP). The service supply chain is consisted of the risk-neutral FLP and the loss-averse logistics integrator (LI), and the contract model of the wholesale price and buyback contract model are established. The study found that the wholesale price contract cannot coordinate the supply chain, but the introduction of the buyback contract can stimulate the LI to increase the order quantity of the logistics capacity, reaching the level of the centralized logistics service supply chain and finally it is verified through examples.

Keywords: logistics service supply chain, loss averse, buyback contract, coordination

Bing Wang, Tinggui Chen, Guanglan Zhou, Chonghuan Xu Research on resource-constrained project scheduling method based on heuristic priority rules

Computer Modelling & New Technologies 2014 18(1) 144-151

The traditional project scheduling problem only considers the logical constraints. However, there is a need to consider the resources such as labour, capital and other constraints. Resource constrained project scheduling problem (RCPSP) integrates logic and resource constraints, which are closer to the actual scheduling. And most of these problems belong to NP-hard problem, which have certain difficulty in solving process. And therefore, there is a very important significance to study in the RCPSP, especially in the theory and application. Among the many the RCPSP models, resource constrained project scheduling problem is the most fundamental, but also the most basic model. Most RCPSP research has focused on a single project scheduling problem. The main content of this article describes the single resource constrained project scheduling problem and establishes the according model. Then, it studies how to use heuristic priority rules for solving the single project scheduling problem. In addition, this paper finally simulates a single project scheduling as an example of mold production and solves it by using the heuristic algorithm based on priority rules in order to verify the effectiveness of the algorithm. It combines with the different schedule generation schemes and priority rules as well as compares the different solution results. The final outcome indicates that the combination of different priority rules and schedule generation schemes would influence the single project scheduling results.

Keywords: resource constraints, project scheduling, heuristic priority rules

Xie Yuanmin Optimization Research of Material Inventory Management Based on Genetic Algorithm

Computer Modelling & New Technologies 2014 18(1) 152-156

Inventory management is an indispensable part in supply chain management. On the one hand the important position it has in the enterprise competitiveness. It has a direct impact on the cost of the products, respond speed to the market, delivery date and other indexes; On the other hand, the inventory system is a dynamic system, which involves huge inventory and wide area. The paper first under the influence of the uncertain factors does certain analysis to the raw material inventory issues, establishes minimum model of raw materials inventory cost in the iron and steel enterprises. Among them, the raw materials inventory cost includes fixed cost, procurement cost and storage cost. By making each purchase amount and raw materials inventory as the decision-making variables, it adopts the corrected genetic algorithm and uses MATLAB to get the optimal solution and get the most optimized raw materials procurement and inventory. The optimization model of raw materials inventory control, which presents in this paper mainly applies to iron and steel enterprises of continuous production process, and can also be extended to other types of the enterprises in raw materials inventory control.

Keywords: material inventory, iron and steel industry, optimization, genetic algorithm, MATLAB

Yehong Han, Lin Du An update algorithm of decision rules in expert systems based on rough sets theory

Computer Modelling & New Technologies 2014 18(1) 157-164

The decision table in rough sets theory is a kind of prescription, which specifies what actions should be undertaken when some of conditions are satisfied. Therefore, this tool can be used as knowledge representation system in expert systems. Decision rules, which are obtained by simplification of decision tables, can be used as rationale of decision reasoning. In order to compute new decision rules on the decision table in which a new instance is added, new instances are classified three cases according to the relation between the new instance and the original set of decision rules in the paper, and the category is proved that it is a partition of new instances. According to the category, an update algorithm of decision rules based on rough sets theory in expert systems is presented, and the complexity of the algorithm is obtained.

Keywords: rough sets, expert systems, incremental learning, decision table, algorithm