

## Operation Research: Modelling and Simulation

### An improved adaptive weighted clustering algorithm based on time interval grade in Mobile Ad Hoc networks

Zhang Huyin, Wang Jing, Xu Fang, Xu Ning, Wang Zhiyong, Zhou Xuejun, Lin Haitao, Yu Peng, Zhou Yuanyuan  
*Computer Modelling & New Technologies 2015 19(1B) 7-14*

Mobile Ad Hoc Networks (MANETs) are self-configuring dynamic networks of mobile devices connected by wireless links without any fixed infrastructure or centralized administration. In order to achieve stable clusters, the cluster-heads (CHs) maintaining the cluster should be stable with minimum re-affiliation times and number of changes on CHs, with maximal throughput of the clustering formation and maintenance. An improved adaptive weighted clustering algorithm based on time interval grade (IATIGWCA) in MANETs is proposed. Each node can be assigned an adaptive role and set its status value through their Hello messages in the formation procedure of clusters, and an appropriate CH of a cluster is elected by the calculation the total weight which comprising four factors: degree difference, average Euclidean distance, average relative speed and consumed battery power. In the maintenance procedure of clusters, the duration of clustering maintenance is set to 2 grades which are Little Time Slot and Big Time Slot in order to improve the efficiency of clustering and decrease the times of computation of the total weight of every node. The simulation results show that the selection of numbers of CHs and numbers of clusters in the stage of the formation of clusters is an optimal solution which brings higher throughput, less re-affiliation times, less number of changes on CHs and longer residence time of cluster in IATIGWCA than LID and WCA.

*Keywords: clustering, cluster-head (CH), time interval grade, clustering maintenance*

### Calculation modelling of static constructions

Karatun N, Khatjatouski S, Statsenko A  
*Computer Modelling & New Technologies 2015 19(1B) 15-17*

The mathematic model of force loads calculations of static constructions in the framework of Theoretical Mechanics course is presented. The software to visualize and analyse force loads of static constructions is created.

*Keywords: theoretical mechanics, informative systems of engineering analysis, visualization and analysis of static constructions, visualization of the force loading*

### Application of the fiber image detection algorithm based on the Grey system theory and Directed graph

Wang Xiaodong, Yang Jianhui  
*Computer Modelling & New Technologies 2015 19(1B) 18-22*

After doing research on fiber image with low quality and the Grey prediction model, the Grey correlation degree, directed graph and existing edge detection algorithm, this article proposed a new edge detection algorithm to obtain complete and continuous edge and to improve the defects in traditional operators profiled fiber contour extraction, such as the discontinuous edge, the false edge. This article obtains the fiber outline firstly, and then the edge detection algorithm is applied to the adhesive fibers. Thus, filling algorithm and contour tracking algorithm are used to get the fibers' outer contour. After that applying the directed graph algorithm to edge detection and the complete edge is gained after the burr is eliminated. Proven by the experimental results, the proposed edge detection algorithm can overcome the defects of the conventional edge detection algorithm, such fracture as edge, false edge, etc.

*Keywords: grey correlation degree, directed graph, edge detection algorithm, directed graph*

### Research in search engine user behaviour based on cloud computing

Liu Wei, Tang Cunchen, Kang Fan  
*Computer Modelling & New Technologies 2015 19(1B) 23-28*

User behavior analysis is important for both Web information retrieval technologies and commercial search engine algorithms. With the expansion of information data, the current search engine is facing some serious problems, such as limited storage space and computing power. The paper discussed the shortcomings and technical bottlenecks of the current traditional search engine. Then, in the understanding of search engine features and technical requirement, it improved the system by means of the cloud computing architecture. With the combination of the static analysis of user behaviour and real-time monitoring, real-time acquisition of Web log and user to access the context information of the page, the paper tested the whole system performance in the laboratory environment, demonstrated the superiority of the system by analysis of experimental data.

*Keywords: user behavior analysis, search engine, cloud computing, system performance*

### Worm detection and prevention based on network segmentation algorithm

Zhu Shan hong  
*Computer Modelling & New Technologies 2015 19(1B) 29-32*

Due to large space demanding and time-consuming, as the Internet is large and complex, the detection and prevention of the worm has many engineering constraints factors, the classic graph theory algorithms cannot suitable for solving some problems

in the large-scale network. Sub-graphs of vertices have a higher density of edges within them while a lower density of edges between sub-graphs. To solve large-scale network analysis, the method of using DFS network segmentation algorithm based on network topology was proposed by analyzing the study of graph depth-first search (Depth First Search, referred to as DFS) segmentation algorithm, and thus obtain a description of the network connectivity of undirected connected graph  $G(V, E)$ . This provides a strong theoretical support for fast access network backbone node. The result of experiments shows that the proposed method is effective.

*Keywords: worm detection, sub-graphs, DFS, network segmentation algorithm*

### **Selection method of wireless communication modes in internet of vehicles**

Liu Feng, Wang Jing

*Computer Modelling & New Technologies 2015 19(1B) 33-40*

Internet of Vehicles has great effect on improving the efficiency of the transportation system and driving safety. Communication process of Internet of Vehicles can be done adopting various wireless communication modes which include 3G, WLAN and WAVE. As each wireless communication mode has different traffic scene applicability and different communication effects, this paper proposed a selection method for wireless communication mode based on support vector machine. This method obtained learning samples which indicate the communication mode with best communication performance through simulation of various traffic scenes in OPENT Modeler. Through the study of support vector machine algorithm, this designed method can output the predicted result mode of wireless communication adaptively under unknown traffic scenes. The outstanding results show that the selection method based on support vector machine can accurately choose the optimal communication mode in Internet of vehicles.

*Keywords: internet of vehicles, wireless communication mode, support vector machine, communication performance, OPENT modeller*

### **Study on the task scheduling problem of complicated products' design**

Cao XiaoBo, Xu ChengDong, Fan GuoChao

*Computer Modelling & New Technologies 2015 19(1B) 41-48*

The process of complicated products design has the characters of high complexity, long period and various requirement of resource. So a reasonable resource scheduling scheme has great significance to the design of complicated product, so as to shortening product development cycles and reducing the cost of product. Firstly, design task collaboration and scheduling features in three complicate product design process modes are discussed in terms of research results of collaboration design and Integration Design Environment (IDE). Secondly, Virtual Design Unit (VDU) is adopted to be taken as the basic task execute unit, VDU design is a complex product design, Furthermore, Design Task Scheduling Approach based Design Ability (DTSADA) is detailed stated by combining ACO and GA. Finally, a design task scheduling case is demonstrated to validate the proposed approach.

*Keywords: complicated product, virtual design unit (VDU), IDE, task scheduling*

### **Diagnostics programs efficiency analysis in operation systems of radioelectronic equipment**

Solomentsev O, Zuiev O, Zaliskyi M, Yashanov I

*Computer Modelling & New Technologies 2015 19(1B) 49-56*

Two variants of diagnostics programs of radioelectronic equipment in exploitation systems are considered. Analytical formulas for calculation of efficiency indexes in the absence and presence of first and second kind errors are given.

*Keywords: radioelectronic equipment, diagnostic programs, data processing; maintenance*

### **Time series neural network systems in stock index forecasting**

Wang Chaoyou

*Computer Modelling & New Technologies 2015 19(1B) 57-61*

This paper adopts artificial neural network (ANN) and two varieties of time series neural network to forecast the stock index of Chinese market. Daily close prices between 1999 and 2011 are tested. The ANN works as a benchmark. Its inputs include delayed price and technical indicators. Time series neural network with external input (NARX) outperforms the Time series neural network (NAR), and it works best when the delay is 8. Moreover, NARX has the best ability of the three. This is mainly resulted from the fact that it contains external data and the technical indicators while NAR does not. As a whole, the ANN and NARX models achieved satisfying results. They can be employed by practitioners to assist trading and by regulators for monitoring. The NARX will be improved when more external data imported.

*Keywords: forecasting, ANN, NAR, NARX*

### **Study on the electrodeposited Au-Co alloy coating**

Zhu ShanHong

*Computer Modelling & New Technologies 2015 19(1B) 62-65*

Au-Co alloy deposit was prepared by selecting the best component in the bath with citrate the deposit exhibited golden appearance and high percentage of coverage. Good hardness and improving anti-corrosion capability could be achieved by

adding 3~4.5%Co element and little rare-earth element to the system, and micro-hardness could increase to 180~190Hv. Optimized bath has stable performance, good throwing power and good covering power. The Scanning Electron Microscope (SEM) illustrated that the deposit was smooth, compact and crystal was nice. It is suited for electrical production; decorative coating, advance electrodeposits and hard-gold deposite.

*Keywords: Au electrodeposited, Au-Co alloy, citrate*

### **The micro-structure study on mechanical properties of Dredge fills**

Ma Yun, Si Hua

*Computer Modelling & New Technologies 2015 19(1B) 66-71*

Mechanical tests and electron microscopy scanning tests were done and micro-structural parameters were quantitatively analyzed in order to study the essence of structural characteristics of Dredge Fills. After comparing the mechanical test results with the statistical results of microstructure parameters, it can be find that the transition stage of the stress-strain curve of dredge fill compression test is also the mutation stage of the curve of micro-structural parameters, and the same time, the micro-structural parameters of shear test soil samples under different axial strain were not linear variation with the axial strain increases and mutated in 10% to 15% axial strain. The analysis result shows that the structural mechanical properties of the dredge fill are subject to its microstructure, and mutation of mechanical test curve is a macroscopic manifestation of microscopic structure damage. The experimental results indicate that dredge fill has the basic mechanical properties of structural soil.

*Keywords: Dredge Fills, structural constitution, microstructure, mechanical properties*

### **Method of calculating forest land surface area based on automatic boundary extraction**

Zheng Jiahzu, Gao Yehemin

*Computer Modelling & New Technologies 2015 19(1B) 72-76*

Calculation of the forest land parcel surface area is vital to the confirmation, segmentation and assignment of forest ownership. Therefore, the method calculating irregular forest land parcel surface area, which is based on the principle of space triangle area calculation, establishes automatic extraction of irregular forest parcel boundary and structures Triangulated Irregular Network (TIN) model by interpolating feature points based on Thin Plate Spline (TPS) function. This paper expounds the feasibility of this method and complete calculation process. By experimental comparison, this method can reduce about four-fifths of field data collection effort in the case of no accuracy loss in calculating results. Simultaneously, this method extracts boundary automatically without manual drawing boundary lined, improves degree of automation in computing within the industry greatly.

*Keywords: forest land parcel, surface area, boundary extraction, thin plate spline (TPS)*

### **Application of computer virtual reality technology in ship equipment assembly**

Wang Ying

*Computer Modelling & New Technologies 2014 19(1B) 77-79*

It is known to us all that in factors of determining shipbuilding cycle, ship assembly occupies an important position in shipbuilding. In traditional shipbuilding model, front-line workers conduct assembly according to the two-dimensional drawing of marine designer. They will make mistakes inattentively, which results in the waste of manpower and material resources. At the same time, the abstraction of drawing will tend to generate deviation in the communication system between designer and ship-owner because of no concrete model object. This paper adopted a kind of technology that could use three-dimensional entity form to express ship model and assembling process-ship virtual assembly technology. The combination of virtual reality technology and ship assembly technology revealed the insufficient and defect in design, which avoided the waste of manpower and material resources during practical assembly. Through the selection and comparison of virtual assembly, we could optimize assembly technology, thus to convenient for the learning and execution of front-liner workers, enhance shipbuilding efficiency and shorten shipbuilding cycle.

*Keywords: Virtual technology; Ship assembly; Digitalized shipbuilding; Three-dimensional model*

### **Ecological architecture system based on landscape ecology**

Ji Fengquan, Jia Yuanyuan

*Computer Modelling & New Technologies 2014 19(1B) 80-84*

This paper briefly summarized the concept of landscape ecology and ecological architecture and the current research status of ecological architecture both at home and abroad. It also analyzed ecological architecture system based on landscape ecology, and studied the construction of ecological architecture from the aspects of the construction of ecological architecture system and space structure. In addition, this paper reviewed with the green building demonstration in University of Logistics for instance.

*Keywords: landscape ecology, ecological architecture*

### **Modelling and simulation of relationship between internal cell temperature and apparent resistivity for lithium-ion battery**

X B Hong, N Z Li, W W Yin, J H Feng, G X Liu

*Computer Modelling & New Technologies 2015 19(1B) 85-91*

Safety problems caused by thermal runaway have been restricting the popularization and application of power lithium-ion battery (LIB). As Electrical Resistance Tomography (ERT) method can potentially detect the variations of internal cell apparent resistivity influenced by temperature, the simulation of the relationship between the internal cell temperature and apparent resistivity is presented to monitor the thermal circumstance inside LIB cell. Using the linear interpolation functions, the LIB model is built and meshed. The appropriate boundary conditions are imposed to simulate the cell virtual heating process and ERT process. During the simulations, the distributions of the apparent resistivity at different temperatures are given. It is found that the correlation of apparent resistivity and temperature is well fitted by quintic function. Meanwhile, the evaluation of quintic fit under cell discharge reveals a deviation of 6.2K between the cell core temperature and the surface temperatures. The presented method cannot only be applied in thermal balance management, life prediction and load control, but also afford a possible way for monitoring the health of separator structure of LIB.

*Keywords: lithium-ion battery model, thermal simulation, internal cell temperature, apparent resistivity*