NATURE PHENOMENA AND INNOVATIVE ENGINEERING

Research on the temperature field in refrigerated truck carriage with fresh pork in it
Wang Jiamin, Ding Zhaolei, Huang Chunzhen, Jiang Zhaoliang
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The CFD coupling flow model is established and refrigerated truck experimental platform is built. The internal temperature field in the refrigerated truck is studied by applying mathematical statistics and the fact that the internal temperature field varies with the environment temperature and the speed of the truck with fresh pork in it is analyzed. The conclusion that the variety of the external temperature has a greater influence on the variety of the internal temperature when the refrigerated truck is at a high speed is arrived. The raise of temperature in the top jet area inside the refrigerated truck is obvious and the internal area temperature near side walls of the refrigerated truck is relatively high

Keywords: Refrigerated Truck, Coupling Flow, Temperature Field, Mathematical Statistics, Pork Transportation

A method of measuring the cable tension force with the application of smart phones
Chen Shuang-rui, Yan Quan-sheng
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Smart Phones are portable and extensible, besides they can provide MEMS micro-accelerometer with good support. This article introduces a method of measuring the tension force of the cable-stayed bridge with the application of a Smart Phone. According to the FFT (Fast Fourier Transform) algorithm, the time domain is converted to the frequency domain while we program on the Android platform and the effective peak-picking algorithm is designed to determine the natural frequencies of the cables. An analysis of simulated signals demonstrates that the designed programs can accurately identify the natural frequencies with or without the disturbance and it can also compute the fundamental frequency based on the identified natural frequencies. With the fundamental frequency it goes on to calculate the tension force. A comparison of the result by adopting the method introduced in this article and the one collected from the JMM-268 tension force dynamic measuring instrument indicates that the Smart Phone has some difficulty in measuring the cables shorter than 40m; however, a less than 5% error is detected where the cables are longer than 40m.

Keywords: Smart Phone; natural frequency; cable-stayed bridge; Fourier transform

Numerical simulation of aluminum alloy quenching by direct thermal-mechanical coupling method and evolution of the elastic-plastic area
Luo Jiayuan, Shi Chengxiang
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7075 aluminum alloy plate quenching process is simulated using direct thermal-mechanical coupling method, and the corresponding experimental results verify the numerical simulation with high accuracy. Based on the simulation results to study the Variation in the aluminum alloy plate during the quenching process, such as the conversion law between tensile stresses and compressive stresses and the evolution of elastic-plastic deformation area, and these two changes have been compared and analyzed, the results show that, there is always a transition region in the aluminum alloy plate during the quenching process, the region has very small or zero plastic strain, and the quenching residual stress extremes occurs in the region. The existence of the transition region is leading to the quenching residual stress distribution along the thickness direction has "turning point" and is the main reason for the W-shaped distribution.

Keywords: direct thermal-mechanical Coupling, aluminum quenching, numerical simulation, elastic-plastic evolution

Internal fault diagnosis of aircraft engine fuel metering unit based on artificial immune algorithm
Liwen Wang, Lu Zhang
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This paper present an aircraft engine fuel metering unit internal fault diagnosis fault diagnosis method based on artificial immune algorithm. First, the overall structure and basic working principle of FMU are introduced. Then, the model of the key parts of FMU which include Electro-hydraulic servo valves (EHSV), actuator, sine-cosine revolver model and fuel flow valve model are built. With the parts model, the overall model of the FMU can be built. Then the typical faults like fuel leakage and some other faults are simulated with FMU model. Then, the fault diagnosis method based on artificial immune algorithm is introduced. At last, the FMU faults such as cylinder wall attached to the foreign body fault and resolver output circuit faults are detected with artificial immune algorithm. The diagnosis results show that the fault diagnosis method based on artificial immune algorithm is effective to FMU components failure.

Keywords: Aircraft Engine; Fuel Measuring Unit (FMU); Artificial Immune Algorithm; Fault Diagnosis

Analysis on the influence of shield construction to pile group of hefei high-speed rail south station
Wang Donglin, Jia Yusheng

Since the tunnel shield construction produces the disturbance to the surrounding soil, causes the force impact of the near pile foundation, and leads to the additional stress and strain of the pile foundation. This paper uses the station pile group of Hefei No.1 Subway Line adjacent to the Hefei High-speed Rail South Station as the engineering example, utilizes the large finite element calculation software MIDAS GTS\NX to establish the three-dimensional calculation model, so as to make dynamic simulation of shield tunnel construction and conduct the analysis on the influence of displacement and stress of pile foundation during the shield construction process. Then make comparative analysis on the data of measured ground subsidence deformation on the site, the results show that this simulation analysis objectively reflects the influence law of pile foundation and ground subsidence deformation, which can provide the theoretical basis for the safe and quick construction of the similar engineering.

Intelligent Control Strategy and Proposed Motor Drive Operating Mechanism for High Voltage Disconnecting Switch

Liu Aimin, Zhang Jinhua, Wu Zhiheng

A new type of operating system (motor drive) is introduced to remedy the following typical shortcomings shared by high-voltage Disconnecting Switch ("DS") operating mechanisms in this paper: 1) poor controllability, 2) failure to meet requirements of opening and closing speeds, and 3) closing bounce. The current and speed dual-loop control method was used in the DS operating mechanism control system. Due to the motor operating mechanism control system's nonlinearity, the control error is large when the conventional double-loop PID control system was used. The fuzzy control algorithm combined with the PID controller can adjust the control parameters online and enhance its control capability of nonlinear control system – thereby reducing control error. Experiment results show that combined with fuzzy control algorithm of motor operating mechanism, intelligent control system can make real-time adjust the speed of switch contact to ensure the motion of stability and meet opening and closing speed requirements.

Loss Calculation for High Speed Permanent Magnet Claw Pole Outer Rotor Machine

Liu Guangwei, Zhao Xingang, Xin Zhao, Zhang Fengge

In view of higher frequency electromagnetic field and higher speed rotation comparing with conventional machine, the loss of high speed claw pole permanent magnet outer rotor machine should be considered seriously. In this paper, its structure and operation principle was introduced, and the three dimension magnetic field distribution is analyzed. A new iron loss calculation model is built in consideration of three-dimension quadrature alternative and harmonic magnetic field. In addition, the calculation model of air friction loss and its influencing factors, such as rotor speed, surface roughness and axial ventilation speed, are analyzed. The results of the finite element analysis validate accuracy of that of theory analysis.

Transmission Power Control in Wireless Sensor Networks under the Minimum Connected Average Node Degree Constraint

Qiao Junfeng, Liu Sanyang, Qi Xiaogang

As a branch of topology control, power control is of great importance to prolong the survival time of the network. A transmission power control algorithm is proposed under the minimum connected average node degree constraint in this paper. Using a Poisson point process in two dimensions, we derive an analytical expression that determines the required transmission range to achieve a specified connectivity probability for a given node density, and then the minimum connected average node degree is obtained. Based on the above results, an algorithm named MCAND is designed to achieve the given connected probability by adjusting the transmission power of each node dynamically, with the node degree equal to the minimum connected average node degree. Simulation results show that the performance of our algorithm is superior to that of the related algorithms based on node degree in terms of coverage and connectivity.

Study on the energy storage of super capacitor

Dedi Zhang

Super-capacitor is now widely used in the field of industry and daily life. With a view to improve the availability factor of

SuperCapacitor, we studied the interrelationship among Super-Capacitor energy storage capacity, charging current and leakage current through a large number of experimental data analysis. Based on those experiments we draw the conclusion that super capacitor energy storage capacity tends to be stable after cycle usage; with medium-sized charging current it reaches the maximum storage capacity, while quick charge with high current will reduce its energy storage capacity.

Keyword: energy storage; Super-Capacitor; charging current; leakage current

Development and Application Study of Marine Data Managing and Sharing Platform

Zhang Hongxin, Duan Kanghong, Zhang Xiaobo

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The marine scientific data has the characteristics like grid form, multiple dimensions, and geographic information included. There exists strong semantic and grammar heterogeneity among different types of marine data. So this paper studies and develops the technologies in marine data sharing platform to solve above problems. It proposes a managing and sharing scheme for marine data processing based on distributed computing technology. The scheme adopts parallel and distributed computing technology, Linux cluster technology to process the marine data in Hadoop distributed platform. The technologies of HDFS distributed file system; Map/Reduce parallel computing programming model and Hbase are also used. Then we provide the design of key modules by programming and the distributed system managing of the cloud platform, to offers a data managing and sharing platform with high reliability and stability. Finally, the tests verify the feasibility and effectiveness of the proposed platform.

Keywords: Marine data; NetCDF; Hbase; parallel loading; Hadoop

Realization of micromouse consecutive turning based on STM32

Zhang Haoming, Wang Yinghai

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In order to improve the stability and reduce dashing time of micromouse in complex maze, the traditional turning trajectory and speedtime curves were abandoned. "S" turning method is proposed to achieve fast consecutive turning. For the "S" turning in straight way, controller fully considers passing of the last turning and leading of the next turning, with the help of compensation and navigation sensors to realize precise correction of micromouse position; For the "S" turning in arcs, different speeds are used to track different arcs, gyroscope records its rotation angle and does real-time angle compensation. "S" turning method is verified by micromouse based on STM32. Experiments of seven consecutive turnings show that the method can greatly improve the stability and reduce the turning time of micromouse.

Keywords: micromouse, robot, consecutive turning, servo, gyroscope

Simulation analysis and system testing of multi-core processor 16-channel high-density computer software made in China

Du Jianbin

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Godson 3A processor is China's first quad-core CPU with completely independent intellectual property rights, and the outstanding performance of Godson 3A makes it have broad prospect of application in products including high-performance computers, highperformance pcs, servers, low-energy-consumption data center, high-throughput computing application, high-end embedded applications, and digital signal processing, etc. In order to study the reliability of high-density computer design and the balance between functions and performance, high-density computer with Godson 3A processor as the core design is selected in this paper to make simulation analysis of its design, and emulation software is used for printed emulation simulation, mainly testing its heat dissipation and system performance, and comparing with high-density computers of other types. It has been verified through system testing that high-density computers based on Godson 3A quad-core processor and designed with balance design method are superior in energy consumption, heat dissipation and space.

Keywords: multi-core processor made in China, high-density computer, simulation

Design of rotor air-operated pump mechanism and dynamics analysis

Ding Ming

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The study combines the merits of pump transportation mechanism and swivel mechanism in Concrete Wet Abrasive Blasting Machine, designs new air-operated spring-piston mechanism to complete the transportation of concrete, deduces the calculation formula of loss in pressure of concrete vertical pump transportation mechanism, completes dynamic analysis of the machine, establish the relevant equations.

Keywords: wet abrasive blasting machine, rotor, air-operated, spring-piston mechanism

Foam flooding reservoir simulation algorithm improvement and application

Wang Yining, Wu Han, Huang Xiaojuan, Cao Shuihui, Wang Hui, Ouyang Jingyun
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As one of the important enhanced oil recovery (EOR) technologies, Foam flooding is being used more and more widely in the oil field development. In order to describe and predict foam flooding, experts at home and abroad have established a number of mathematical models of foam flooding (mechanism, empirical and semi-empirical models). Empirical models require less data and apply conveniently, but the accuracy is not enough. The aggregate equilibrium model can describe foams' generation, burst, coalescence from mechanism, but it is very difficult to describe. The research considers the effects of critical water saturation, critical concentration of foaming agent and critical oil saturation on the sealing ability of foam and considers the effect of oil saturation on the resistance factor for obtaining the gas phase relative permeability and the results were amended by laboratory test, so the accuracy rate is higher. Through the reservoir development concepts simulation and field practical application, the calculation is more accurate and higher.

Keywords: foam flooding, numerical simulation of reservoir, EOR method, laboratory experiments

Comparative analysis of the application of aerodynamics impedance algorithm in high and low terrain

Xing Linlin, Gao Peixin
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Aerodynamic impedance is one of the most important factors influencing surface momentum, energy and water exchange. Currently, there are many algorithms about aerodynamic impedance estimation, but most of the researches are based on a certain region or specific underlying surface, while there are few researches about the uneven terrain momentum of different levels of terrain. In this paper, aerodynamic impedance is estimated and analyzed from the perspective of different classic underlying surfaces. Based on the field observation experimental materials of a certain region's uneven terrain of different levels, and the impedance difference under the condition of different levels of terrain is compared and analyzed so as to propose the aerodynamic impedance method suitable for different kinds of underlying surfaces in this region, and improve the estimation precision of aerodynamic impedance

Keywords: aerodynamics, impedance algorithm, underlying surface

A method applied the boundary of sea and land temperature retrieval for atmospheric information correction

Li Jinping, Liu Zhifeng, Wei Zhenhua
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A method applied in the boundary of sea and land for atmospheric correction was analyzed by the radiation information which was adopted from the same picture, and radiance ε of the boundary of sea and land was estimated by prorating the mixed element The estimation of the atmosphere transmissivity $0\ \tau$ could be given out, in which atmosphere parameter D e was measured. And the effects were important actual efficiency and authentic. Simultaneity, several atmosphere patterns were selected by using atmosphere MODTRAN radiation transfer model program, and the different retrieval algorithms were contrasted by presuming the standard atmosphere from America. The fact that derives from study of the boundary of sea and land bears out that the correction method has evident effects and simple operation.

Keywords: sea and land boundary, atmospheric correction, retrieval, channel

Design and implementation of the nuclear logging instrument controlling and monitoring system based on MSComm

Liu Zhifeng, Tang Bin, Wei Zhenhua, Li Jinping
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The author used MSComm to achieve the control of the uranium neutron logging instrument, and the real-time communication between the ground software system and the downhole detecting instrument through serial communication technology. Two problems were resolved intensively. Firstly, the real-time parameter control and feedback monitoring are implemented mainly through controlling the high voltage power supply and ion source to control the neutron flux, and utilizing the instrument feedback information to monitor the neutron source state. Secondly, the real-time data acquisition and display are achieved through the data acquisition module which monitors the instrument indirectly and ensures the instrument to work safely and stably. The reliability and practicability of the software system is verified by experiments.

Keywords: MSComm, nuclear logging instrument, controlling, monitoring

Analysis and study on acoustical quality of a piano soundboard based on ANSYS

Mao Wenhua
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Basing on the theory of finite element method and modal analysis, the models of a bare plate and a piano soundboard are

established in the ANSYS separately，then the two models' natural frequency and mode shape are calculated and compared. What is more，the influences of density and thickness on the piano soundboard's modal frequency are discussed. The result reflects that the piano soundboard's modal frequency is higher than the bare plate's and the piano soundboard vibrates in more complicate way. At the same time, it is found that the piano soundboard's modal frequency turns to be larger when the thickness turns to be larger and turns to be smaller when the density turns to be larger.

Keywords: ANSYS, force analysis, piano soundboard, sound quality, experimental study

Study on badminton system with auxiliary training based on Kinect motion capture
Dong Jiang

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First, the paper studies the algorithm to repair self-occlusion body joint information. Due to the existence of human self-occlusion, the motion capture data is not credible. According to the invariance of the length of human body skeleton and the continuity of human movement, this paper proposes a quick geometric method to repair the skeleton information. The experiments show that the algorithm can real-time repair more than half of the obscured joints information, especially the end of the joint information. Then, study the movement redirection based on constraints of terminal effectors. Different human motions are assigned to another role, it will case feet penetrate the ground, sliding, skin stretching or distortions due to bone size inconsistencies. Base on bone length scale factor of virtual role and Capture body, this thesis proposes a movement redirect method of end constraint effectors. First determine the end constraint of the first frame, and get the three-dimensional coordinate information of the end constraint; secondly, based on the length of the human skeleton invariance redirect the three-dimensional coordinates of the other joints. Third, determine the end constraint of the next frame and get its threedimensional coordinates; finally, calculate other joints three-dimensional coordinates of other frames. The experimental results show that the algorithm can solve the problem of distortion animation, and get standard capture motion data, which will conducive to data analysis.

Keywords: badminton, auxiliary training, Kinect motion capture

Design and implementation of an Android-based numbered musical notation editor
Ma Lin

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Android smartphone is the most widely used terminal equipment for daily contacts by current users, which is portable and whose screen is enough to support many applications, so that your favourite programs can be run at any time and any place as long as there are electricity in the phone; the music player is a necessary program on the phone for users, representing the preference of the majority of users; however, currently there is not a better mobile numbered musical notation editor software allowing a multiple of Chinese music lovers, especially those who wish to make his own creation, to record his work when inspired; based on the above demands, the prototype system design of a numbered musical notation editor that is developed on the basis of the android system and can support virtual keyboard input and screen sliding is primarily introduced in the paper.

Keywords: smartphone, Android system, music editor; virtual keyboard, screen sliding

Fault diagnosis for wind power generation system based on association rule mining
Wenju Ji, Jianwen Wang

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This paper concentrates on the problem of fault diagnosis for wind power generation system, which is a crucial problem for wind power industry. Firstly, framework of the fault diagnosis system for wind power generation is presented. This framework is made up of two main parts, that is, "local device module" and "remote diagnosis center". In the local device module, wind turbines are connected to other servers through lower computers, and then data is transmitted to the remote diagnosis center. Furthermore, the remote diagnosis center can receive the data transmitted by the local devices and then discover faults by the proposed association rule mining algorithm. Secondly, in the proposed association rule mining algorithm, the opportunity and effectiveness of a specific rule is represented as the number of chances to utilize this rule and the average utilization ration of this rule, and then the rules with higher probability are preserved to conduct the Fault Diagnosis. Finally, specific wind power generation equipment is used to test the effectiveness, and experimental results show that the proposed method can discover different kinds of faults in the power generation system with high accuracy.

Keywords: wind power generation system, fault diagnosis, association rule mining, support, confidence