NATURE PHENOMENA AND INNOVATIVE ENGINEERING

Reconstruction of electrical impedance tomography using improved Newton-Raphson algorithm based on wireless distributed system

Li Peng, Fang Xi, Zhang Xiaoyu, Li Zhuoqiu

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In the fields such as non-destructive testing and structural health monitoring, Electrical Impedance Tomography (EIT for short) caused concern for people in recent years. This paper introduced the wireless distributed EIT data acquisition system for the advantages of low costing, reliable, accurate and efficient. For this wireless EIT system we have designed the corresponding software which could receive and process data and reconstruct image in one step. On the other hand, based on the existing algorithms this paper proposed the improved Newton-Raphson algorithm to reconstruct image. The experiment result proved that both the system and algorithm was a successful, accurate and optimized for EIT experiment.

Keywords: electrical impedance tomography, wireless sensor network, distributed acquisition system, improved Newton-Raphson algorithm

Estimation on concrete trench barrier effect: a hybrid experimental method based on neural network mode

Li Daniel, Wang Jun, Li Mingjie, Li Xi, Sun Zhenping, Leng Zheng

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In this paper, the neural network is introduced as the basic model, and the barrier effect of the vertical seismic wave amplitude is estimated by the three dimensional concrete trench. The back propagation training method is adopted in the paper. The main procedure includes inputting the related parameters of trench barrier seismic wave, analyzing by the pre-processed method and factor algorithm, and selecting six parameters such as the trench section, the distance between the epicenter and the trench, the immersed depth in the foundation and the in-filled material property, etc. The disadvantage of the node numbers and the network learning, which is made by the previous trial-anderror method, should be improved by the Cascade Correlation learning procedure, the automatically adjusted learning speed ratio and the inertia factor algorithm. In addition, the neural network should be built up and taken the average vertical amplitude as the output value. The experiment results show that the built neural network model can simulate the barrier effect of the vertical seismic wave amplitude analyzed by the three dimensional concrete trench, and its accuracy of the predicted results is better.

Keywords: neural network, vibration, seismic waves, trench

Experimental research on modified polymer concrete

Guo Jin-min; Wang Yi

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A sort of high performance modified polymer concrete was needed to develop as while as the maturing and function defecting of concrete become one common issue for dam engineering, coffering engineering and foundation engineering of hydraulic structure. In order to researching the composite additive of polymer concrete and the influence of silica fume mixing proportion on polymer concrete, A series of orthogonal tests were processed. Firstly, an optimum mixing proportion of the composite additive was proposed, the antifoaming agent is 1.5% of polymer emulsion, the water reducing agent is 1.2% of cement and the stabilizing agent is 3% of polymer emulsion. Secondly, the result shows that the compressive strength, rupture strength and splitting tensile strength of polymer concrete firstly increases and then decreases with the increase of the mixing amount of silica fume and the mechanical properties will be optimized at mixing amount of 12%. Thirdly, compared with ordinary concrete, the modified polymer concrete raised the compressive strength 11.2%, the rupture strength 8.3%, splitting tensile strength 11.4% and improved the impermeability 4.4 times on the 28th day. Finally, the action mechanisms of the modified polymer concrete are analyzed.

Keywords: Modified polymer concrete, orthogonal test, impermeability, splitting tension strength, composite additive

The hardware design of Type B residual current device

Shen Quntai, Shen Zixing, Li Sheng

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Conduct the analysis of available type B residual current device in the market, compare their functions and technical characteristics, research their operation principle and feature, then purpose the corresponding solution. Finally, develop a prototype and conduct the test. There are three samples. They are ABB RC223 residual current release, which can be combined with the Tmax T4 four-pole circuit-breaker in the fixed or plug-in version, Socomec earth leakage relay RESYS B 475 and Bender residual current monitor RCMA470LY

Keywords: residual current device (RCD), ABB RC223, circuit-breaker

Study on steel box girder with partial precast concrete deck by top-down method

Wang Zi-jing

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Top-down construction method is one popular used method in constructing steel box girder throughout the world. But the existing method is uneconomical due to using closed rectangular section and full in-situ casting concrete in the deck. An open-trapezoidal steel box-girder cross section and partial precast concrete deck is proposed here. To evaluate practicability of this method, finite element computer model has been set up for simulating the behaviour of the continuous steel box girder during construction, and then the elastic stresses of steel and concrete during construction stages were analyzed by considering the full-scale model of bridge.

Keywords: steel box girder, top-down construction method, precast concrete deck, finite element analysis

Measurement circuit of solenoid inductance sensor

Li Suming, Quan Long

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To achieve the accurate measurement of the hydraulic valve opening position, two different measurement circuits were designed respectively for two-coil and three-coil differential solenoid inductance displacement sensors. Compared the pros and cons of their static and dynamic performances. The peripheral measurement circuit based on the AD698 was improved, so as to enhance the sensitivity of displacement detection. The different sensor measurement circuits were tested to compare the static output characteristics of these two types of sensors. The experimental results show that AD698 sensor measurement circuit is featured with small nonlinear error, high repeatability, and low hysteresis error. Sensitivity varies with the range of the measurement. When the sensor measuring ranges of conditions are defined, it is appropriate to increase sensitivity. In Valvistor hydraulic cartridge valve system, AD698 measurement circuit would be used to test the real-time dynamic detection. When the system pressure is maintained constant, the valve opening size influences the response speed of the sensor measuring circuit. The greater the pressure valve, the faster the dynamic response of the valve. The relationship between main valve displacement and flow rate is also detected in these experiments.

Keywords: differential solenoid inductor sensor, detection circuit, AD698, sensitivity

Analysis of assist characteristic of electric hydraulic power steering system

Liu Wenguang, He Ren, You Zhuan

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According to vehicle handling dynamics and multi-body dynamics, the dynamic steering torque geometric model considered the change of the front wheel ground was established. The vehicle mathematical model and the tire model for vehicle steering system were analyzed. Fuzzy PID control method was used to control influence assist steering of electric hydraulic power steering (EHPS). The results show that control method of EHPS achieves the adaptive change of assist steering. This method enhances the stability of driving vehicle and steering portability.

Keywords: geometric model, fuzzy PID, assist steering, EHPS

The influence of the steering wheel angle on vehicle handling stability

Zhao Qiufang, Fu Hongge, He Tao, Lu Sitong

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Based on the ADAMS software, we established a whole vehicle model to study its handling stability. It includes the front suspension system, the rear suspension system, the steering system and four wheels. After the simulation trials, we analyze the vehicle speed, the steering radius and the yaw angular velocity. The influence of steering wheel angle on the vehicle speed is not big, but the influence on the steering radius and the yaw angular velocity is obvious. The results accord with the actual steering motion and can be a reference for researchers on the study of handling stability.

Keywords: ADAMS, the whole vehicle model, the handling stability, the steering wheel angle

Research of coal gas warning model based on fuzzy clustering

Liu Desheng, Xu Zhiru, Chen Wenping, Zhou Jingguo

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Prevention of coal safety is the major problem that has been a concern around the world, coal mine gas disaster forecast predicted in advance is essential. In this paper, coal environmental parameters and device parameters monitoring data are acquired, coal gas fault symptom information are extracted, the gas concentration level of warning model is established using fuzzy clustering method. Simulation results show that the proposed fault classification model is accurate, reliable, practical value, and that can obtain the integration of coal mine gas fault level decision results.

Keywords: coal, gas failure warning, fuzzy clustering, model

New performance-based seismic design thought and stability evaluation of underground engineering

Zhao Jichang, Liu Yuanxue, Zhang Yu, Tan Yizhong

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With the rapid development of the national economy and the urban modernization, the traditional intensity-based (or displacement-based) seismic design method can longer meet the demand of the seismic design of modern buildings in recent years, which is much more obvious especially for the seismic design of underground engineering. In this paper, aimed at the prominent problems for seismic safety of underground engineering at present, the prospective performance level and fortification objective based on specific structural forms, surrounding rock classifications, support types and other factors of underground engineering are determined, to ensure to fully play its functional performance and to minimize the overall loss under seismic effect that may occur in the whole life period; Based on the dynamic and static combined cycling loading method and the design strategy of the structure performance, this paper adopts the combination method of similarity physical model experiment and the numerical analog calculation to conduct dynamic damaging mechanism and performance standard design research of underground off-wall tunnel. The research results show that the dynamic and static combined cycling loading method can better reflect the generation and expansion progress of the inner micro cracks of rocks and concrete materials, thus it is an effective method to research into the damaging rules and stability of the underground off-wall tunnel; the plasticity displacement, strain and pressure stress changes of the monitoring point can better describe the damaging status of the underground projects; the increase of load magnitude can obviously result in the displacement of the monitoring point vault, which may cause the first transcending damage of the tunnel, and the cycling loading will show accumulated damage with the load magnitude positively related to the degree of accumulated damage; the strain of the monitoring point will undergo sudden changes when reaching the ultimate pressure value, while the crack width parallel to the tunnel diameter is the reference to the damaging status of the underground tunnel; the experimental and numerical simulated results coincide with each other, and can well represent the performance standard of the underground tunnel, thus providing the reference for the earthquake and explosion effect, as well as the protection a design of the underground tunnel.

Keywords: underground engineering, seismic design, seismic performance target, numerical simulation, fortification level of seismic performance, underground off-wall tunnel

A wavelet time entropy algorithm for ultrasonic signal detection

Xu An-ran, Ye Qing-wei, Qiang Jia-huan, Shan Sheng-qi, Zhang Dan

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Ultrasonic signal detection is an important method of the non-destructive test. The ultrasonic signal detection can diagnosis the internal defects of materials or mechanical components non-destructively. There are some difficulties of ultrasonic signal detection to check the echo signal within the ultrasonic signal. With the wavelet transform and Shannon entropy theory, an improved wavelet-time entropy algorithm is put forward in this paper. The high-frequency coefficients of wavelet transform are replaced by the low-frequency coefficients, and the optimal width of window is worked out for actual ultrasonic signal. The numerical simulations are carried out to prove the feasibility of this algorithm in abnormal signal detection. The results show that the improved wavelet-time entropy algorithm can detect the echo signal in ultrasonic signal effectively.

Keywords: ultrasonic signal detection, wavelet transforms, wavelet-time entropy, non-destructive test

The research on thermal expansion and thermal compensation method of Rogowski coils

Zhang Hongling, Hong Bin, Gui Yuan, Yang Xiaoqing

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Rogowski coils are mostly used to measure AC current, pulse current and transient current in power industry. Thermal expansion can change the structural parameter of the coils when the ambient temperature varies, so it affects the measurement precision of Rogowski coils. The mathematical model of the thermal expansion effect on measurement precision of Rogowski coils is proposed in this paper. The ratio voltage error caused by thermal expansion effect is identical with the ratio error of coils mutual inductance that is obtained by Matlab simulation. The thermal compensation method that can eliminate the thermal expansion effect on Rogowski coils is introduced, that is, a compensation ring is embedding in Rogowski coils former. The mathematical model ofthermal compensation is proposed, and it is verified by Matlab simulation. The experimental results show that the ratio voltage error tendency with temperature is the same as the error tendency from theoretical analysis and the limitation of measurement precision relates with coils thermal expansion; It may eliminate the thermal expansion effect on Rogowski coils to embed a compensation ring in Rogowski coils former.

Keywords: Rogowski coils, thermal expansion, the ratio error, compensation ring

Shift schedule with dynamic three-parameter brought in angular acceleration of engine

Zhang Yan, Ma Wenxing, Yuan Zhe

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In order to make automatic transmission vehicles more reasonably select shift points, ensure optimal shift schedule, shift schedule with dynamic three-parameter was proposed through the analysis of the dynamic characteristics of engine and

hydrodynamic torque converter under unstable conditions and establishment of dynamic model of vehicle driveline, where parameters were vehicle speed, throttle opening and angular acceleration of engine crankshaft. Shift schedule with dynamic three-parameter was better than shift schedule with dynamic two-parameter in power performance and fuel economy which was verified by simulation test on a certain type of heavy vehicle, then power performance and fuel economy of the optimal dynamic shift schedule and the optimal fuel economy shift schedule with dynamic three-parameter were respectively compared and analyzed. The results show that angular acceleration of engine crankshaft has a great influence on the selection of shifting points, and shift schedules with dynamic three-parameter proposed have important theoretical significance and engineering application value on improving the performance of automatic transmission vehicles, improving the power performance and fuel economy, saving energy and reducing emissions.

Keywords: automatic transmission, dynamic shift schedule with three-parameter, best power performance, best fuel economy

Application of vibration analysis in the condition monitoring of electrical equipment

Fu Chao, Sun Junying

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Condition monitoring of power equipment has become an important research direction of fault diagnosis, then vibration signal analysis technology plays an important role. This paper introduces the research status of vibration signal analysis technique, the emphasis is placed on the main research method in the condition monitoring, fault diagnosis of vibration signal. Through the comparison of several vibration signal de-noising method, focuses on the analysis of the operation state of electric equipment through vibration signal.

Keywords: vibration signal, power equipment, fault diagnosis

Study on the stability of hybrid systems

Zhang Honghui, Geng Wenbo

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Hybrid dynamic system HDS (Hybrid Dynamic Systems) is also called hybrid system, which is composed of event driven subsystem and the time evolution of the interaction subsystem and a class of complex dynamic system. "Mixed" means the combination of continuous and discrete part of the hybrid dynamic system, means that the system dynamic behavior is decided by the interaction of continuous dynamics and discrete dynamics. So far, the hybrid system definition is quite acceptable for: contains discrete event dynamic systems DEDS (Discrete Event Dynamic Systems) and continuous variable dynamic systems CVDS (Continuous Variable Dynamic Systems), system and interaction between them is called the hybrid dynamic system.

Keywords: impulsive switched systems, hybrid system, stability

Finite Element Analysis of Mechanism Behaviour of Multi-tower Self-anchored Suspension Bridge

Zheng Zequn

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A finite element three-dimension space model is built by ANSYS based on the first multi-tower self-anchored suspension bridge in China. After that, the work aims at developing finite element analysis using backward and forward methods, discussing internal force of main bridge components in different construction stages. Then, linear change law of the main cable in different load conditions is analysed, and mechanism behaviour of this new structure in the whole construction is acquainted. Therefore, the work provides key force analysis for multi-tower self-anchored suspension bridge, making a good example for design and construction of similar bridges.

Keywords: Multi-tower Self-anchored Suspension Bridge, Mechanism Behaviour, Backward Analysis, Forward Analysis, Finite Element

Time-related Increase Evaluation in Bearing Capacities of End Bearing Jacked Piles by a New Type of CPT

Hu Yongqiang, Tang Liansheng, Li Zhizhong, Sang Haitao

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The time-related increase in capacity of displacement piles after installation (known as set-up) is caused mainly by the shaft resistance. But the shaft and base resistances are seldom considered separately in the set-up evaluation. The time-related increase in capacity depends on the mobilization degree of the shaft capacity at the end-of-jack (EOJ), though this mobilization is closely related to the bas resistance. In this paper, a series of field tests including the jacking installation tests, load tests of model piles and a new type of CPT with a total resistance sensor installed were conducted at the Pearl River Delta alluvial plain. The tests have found that there are three type of distribution curves between the ultimate total shaft resistance and the measured one: the ultimate resistance is greater than, very close to or less than the measured one, and set-up is obvious in the first one, while in the other two are not. This indicates the mobilization of the shaft resistance at the end of jacking installation affects set-up. According to the experimental study, a new evaluation method has been proposed and proved reliably by practice, in which the mobilization of the shaft resistance is considered.

Keywords: Time-related Increase, Bearing Capacity, Jacked Pile, cone penetration test

Parallel Algorithm for Collision Avoidance Motion Planning of Dual Arm Grasping of Humanoid Robot

Li Hua-Zhong, Liang Yong-Sheng, Tang Qiang-Ping

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Aiming at such problems as grasping space limitation, unknown target configuration, DOF redundancy of dual arm and singular configuration for collision avoidance motion planning of simultaneous grasping of high-dimensional space humanoid robot, firstly, forward kinematics for dual arm of humanoid robot and SVD-based inverse kinematics models have been established. Secondly, this paper has put forward a parallel algorithm for dual arm grasping motion planning framework integrating SVD and RRT techniques and DAGRRT collision avoidance motion planning. Finally, the correctness and effectiveness of the algorithm proposed in this paper has been verified via computer 3D visualization simulation.

Keywords: humanoid robot, dual arm grasping, rapidly-exploring random tree (RRT), singular value decomposition (SVD), DAGRRT planner, parallel algorithms.

Fault Diagnosis Model of Transformers Based on Neighborhood Rough Set and Relevance Vector Machine

Chen Jialin, Zhang Mingyu, Duan Jiahua

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Transformers are important devices in power supply system. Since the testing data in fault diagnosis of transformers have features such as high dimension, uncertainty and incompleteness, existing fault diagnosis methods are incapable of dealing with the high-dimensional and abnormal data, and the diagnosis precision needs further improvement. This paper innovatively proposes a fault diagnosis model for transformers based on neighborhood rough set (NRS) and relevance vector machine (RVM). It integrates advantages of NRS in handling uncertain and incomplete information and RVM's capability in dealing with high-dimensional data. Based on data provided by Yunnan Kunming Power Supply Company in fault diagnosis of transformers, case study has shown that the testing diagnosis rate of four classifiers in this model are 92.55%, 93.87%, 93.44% and 92.28% respectively, higher than the diagnosis precision of RVM, which indicates this model enjoys better diagnostic capability.

Keywords: neighborhood rough set; relevance vector machine; transformers; fault diagnosis

Near-threshold adiabatic SRAM based on CPAL circuits with DTCMOS technique

Qi Beibei, Hu Jianping, Han Chenghao, Geng Yeliang

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An adiabatic SRAM (Static Random access memory) operating in near-threshold region based on CPAL (Complementary pass-transistor adiabatic logic) circuits with DTCMOS (dual-threshold CMOS) technique is realized for low-energy applications. The SRAM using the CPAL circuits can recover the energy of the read driver, write driver circuit, word-line decoder, and sense amplifier in a fully adiabatic manner. The DTCMOS technique can effectively reduce the leakage energy consumption of the SRAM. In addition, near-threshold technique can not only greatly reduce dynamic energy consumption, but also satisfy the requirement of mid-performance systems. Modelling and sizing of adiabatic storage cells are constructed and analysed. The simulations for the function and energy consumption of the SRAM are carried out with a SMIC 130nm CMOS process. The HSPICE simulation results show that the SRAM has ideal logic function and low energy consumption.

Keywords: Static random access memory, complementary pass-transistor adiabatic logic, Dual-threshold CMOS, near-threshold, low-power designs

Research on seismic response of a large liquid storage tank using equivalent load method

Li Jingyuan, Hua Wang, You Xiachuan, Ding Min, Ju Jinsan

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Based on the principle of added mass method, a method of calculating the dynamic response of the large liquid storage tank under seismic loads is proposed in this paper i.e. equivalent load method. The main idea of this method is converting the added mass to dynamic surface pressure. Compared with added mass method, equivalent load method not only simplifies calculation process but also improves computational efficiency. In order to verify the feasibility of the proposed method, a large liquid storage tank(36m in diameter and 19m in height) was simulated in ABAQUS with added mass method and equivalent load method respectively. The user subroutine UEL was introduced to build added mass element and the different distributions of dynamic pressure was derived in equivalent load method. The results of added mass method and equivalent load method show that they are numerically close. It illustrates the difference and relationship between equivalent load method and added mass method in calculating the dynamic response of the large liquid storage tank under seismic loads, at the same time demonstrates the feasibility of equivalent load method.

Keywords: liquid storage tank; added mass; equivalent load; dynamic response

Slipping coefficient study of frictional high strength bolt joint

Li Jingyuan, He Qiang, Zhang Kai, Lin Zichen, Ding Min, Ju Jinsan
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The finite element model was developed by the software ABAQUS based on the existed test to analyze the slipping coefficient of frictional high strength bolt joint. The effects of connecting plate thickness, distance from bolt axis to the component edge, bolt hole diameter, and pretension on slipping coefficient were discussed. The results show that the simulated slipping coefficient is about 0.23 and agrees well with the existed test results. It is smaller than the corresponding code value 0.3. Increasing connecting plate thickness or edge distance could improve the slipping coefficient slightly. Increasing bolt hole diameter or pretention would decrease the slipping coefficient slightly. At the same time, the minimum and the maximum pretension curves for M20 bolt were obtained for practical usage.

Keywords: frictional high strength bolt, slipping coefficient, pretension, bolt hole diameter

Research on memristor and LDR memristor mathematic models

Wang Xiao-Yuan, Wang Guang-Yi
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In this paper, the mathematic models used to describe memristors are summarized, including the cubic nonlinear model, passive and active monotonic increasing piecewise linear models, parabolic curve model and memristive system model of memristor. To further understand these models' characteristics, the definitions on memristor, HP memristor and each mathematic model are introduced first, based on that the basic characters, power characters and circuit characters are studied in detail. And as we known, the LDR (Light Dependent Resistor) memristor which is a novel analogue model of the memristor proposed in 2012 can be used as a two port device like a resistor, it is good in using for future research into memristor applications. So here, by studying the mathematic models of memristor, one of the most suitable mathematic models for the LDR memristor is decided.

Keywords: LDR memristor, mathematic model, memristor.

The designs of iron roughneck working torque real time monitoring scheme and the hardware system

Wu Hao, Peng Yong
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The iron roughneck, a full automatic making-up or breaking-out device instead of the traditional hydraulic tongs, has been applied in production practice and become the essential equipment in automatic pipe handling system on marine drilling platform. When the iron roughneck is at working, real time monitoring and controlling of the working torque is necessary. It can ensure the torque value is under control when drilling tools are made up or broken out so as to protect the drill screw threads and prolong the service life of drills. Based on the measurement and control of the working torque of the iron roughneck, the scheme, which treats testing hydraulic cylinder working pressure as the measurement information, is determined. The hardware circuit including sensors, single chip microcomputer, alarm, feedback control and so on is designed to provide hardware conditions for the test and control of the iron roughneck working torque. Finally, the simulation experience used to test alarm function of the system is carried out.

Keywords: The iron roughneck, Working torque, Real time monitoring, Hardware, Design

Finite element simulation of stray currents on subway shield tunnel

Wang Guo, Pei Xiaoxiang
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Three-dimensional Finite element model and a circuit element model were simulated respectively in homogeneous soil media and stratified soil media by loading different currents of railway. Simulation results show that the potential attenuation is nonlinear from the subway tunnel to the surrounding underground environment and along far away rail loading current of direction; With the loading current increasing, the potential of surrounding media advanced, to increase the resistance of the ragion near the subway railway can reduce the effect scope of the stray current. Compared to the traditional model of circuit elements, the three-dimensional finite element model can calculate the potential value of each position on the running rails and surrounding, resulting in stray current sphere of influence.

Keywords: subway shield tunnel, finite element model, circuit element model, homogeneous soil media, stratified soil media

Analysis of heavy vehicle rollover and stability

Zhao Zhiguo
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Features itself of heavy vehicle led to their poor roll stability and prone to rollover accidents. Vehicle rollover accidents are a significant traffic accidents resulting in loss of life and property, and have become an important issue affecting transport security. Exploration and research of heavy vehicle safety and stability control have become the important topic concerned all over the world. A 3DOF dynamics model is created with heavy truck for example to set the LTR (Lateralload Transfer Ratio) as the rollover evaluation index, study on the relationship between speed, the front corner and centroidal moment with rollover

angle, lateral load transfer ratio, then analyse the influence of vehicle condition parameters on the roll stability with both cases of no load and loaded, and make a simulation in SIMULINK. The simulation results show that load mass and centroid position have the greatest impact on rollover stability, vehicle driving stability can be improved by reducing the height mass and increasing the track and wheelbase, the traditional warning method cannot completely reflect the state of rollover of heavy vehicles. All this work finally provides the basis for optimization of heavy vehicles bodies and improves of rollover stability of heavy vehicles.

Keywords: Heavy vehicles, Rollover stability, Rollover model, Lateral-load transfer ratio, Rollover angle.

Thermal management of ARM SoCs using Linux CPUFreq as cooling device

Zhou Lei, Guo Shengchao

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While the performance of modern ARM System on Chips (SoCs) increases significantly than the previous generation, the power dissipation and on-chip temperature becomes dramatically high. The existing thermal management solutions are mostly built on Advanced Configuration and Power Interface (ACPI) and Dynamic Thermal Management (DTM) model for traditional desktop and server machines. They do not directly apply on mobile ARM SoCs as it is. This paper proposes a solution for thermal management on high performance ARM SoCs based on a model which is built on some ACPI thermal concepts and DTM DVFS mechanism. The thermal model is implemented on Free scale i.MX6Q SoC with Linux Kernel 3.6. It uses a lot of help from Linux thermal infrastructural and CPUFreq subsystem, and builds a cooling device backed by CPUFreq driver. A comparison testing on i.MX6Q shows that the cooling device can effectively controls the on-chip temperature around a designed threshold value. The thermal model is built on generic thermal hardware support and common software infrastructural, and therefore should work universally for other ARM SoCs.

Keywords: ARM, Thermal, i.MX6Q

Characterization of water flooded layers of alluvial fan reservoirs in China Xinjiang oil field

Zhao Liang, Ji Lidan

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Alluvial fan reservoirs have strong heterogeneity, which would result in complicated remaining oil distribution in mid-late water injection development stage of oilfield. To assess the flooding degree of water flooded layers and find out the remaining oil distribution law are important and difficult in oil field developing adjustment. The paper took Kexia formation reservoirs in Xinjiang oil field for example, and on base of establishing the criterion of identification of water flooded layers, the reservoir flooding degree and features were analysed. The remaining oil distribution model of alluvial fan reservoirs were divided into 4 categories: injection-production without corresponding, oil layers on top, interface barrier type and lenticular type. The effect of sedimentary facies to remaining oil distribution was concluded: the middle fan reservoirs are the main target of tapping potential, interbeded of multi-period braided river distributary channel deposition and sheet flood fine particle deposition, which has strong heterogeneity and result in low swept volume of displacement of oil by water. And their distribution models mostly are layers on top type and interface barrier type.

Keywords: alluvial fan reservoirs; remaining oil; Kexia formation; water flooding oil field; high water cut stage

Study on the shear capacity of PBH shear connector basing on PBL shear connector

Fan Liang, Zhou Zhixiang

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According to the structural characteristics of steel box-concrete composite structure, a new type of shear connector with Perfobond hoop is proposed basing on PBL shear connector (Perfobond Hoop, PBH in short). PBH shear connector is composed of stiffening rib and stirrup, the joint work of steel box and concrete is realized without adding any special connection construction. Push out test of the PBL and PBH were performed, results show that the shear capacity and shear stiffness of PBH are higher than that of the PBL; multi-parameters effect on the mechanical behaviour and the shear capacity of PHB were analysed using FEM analysis in terms of the concrete strength, the perforation diameter and so on; on the basis of the test and analysis, three failure modes of PBH were concluded, the construction requirements were proposed to avoid the welding shear failure and compression buckling of the perforated stiffening rib, and the shear capacity formula of PBH was established according to the fracture or large deformation of the steel concrete tenon.

Keywords: Composite Structure; Shear Connector; Experimental Study; Parameter Analysis; Shear Capacity

Specialty-oriented "Computer Network" experiment design

Zhao Guang-yuan

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In this paper, the teaching usage feasibility of open-source electronics platform Arduino is discussed, with regard to the loosely combination status of "Computer Network" course experiments and measurement and control technology specialty. Then the improved solution of "Computer Network" course experiments is proposed and embedded server simulated industrial

applications for experimental teaching is designed based on Arduino. Practice shows that the design cost is low and the development cycle is short due to the use of open source hardware. Moreover, the specialty-oriented characteristics can help students to enhance professional knowledge understanding, increase interest in learning and strengthen innovative practice atmosphere.

Keywords: Arduino, Computer network, Course experiment, Embedded sever, PBL

The study on computer aided building renovation simulation

Li Fang, Chen Qun

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Many global organizations have invested significant resources to create sustainable environments during the last decade. As the economic, environmental and social aspects of built environment sustainability are considered, building renovation has received increasing attention as a viable alternative to redevelopment or reconstruction, reducing the tremendous cost, abating environmental impacts and maintaining better social relationships with neighbors. Building simulation is very useful to accurately determine the thermal performance and energy consumption of buildings, especially for improving buildings at the design stage. However, the results predicted by the simulations are only valid if the model is properly calibrated. Calibration means technical and operational adjustments of the computer model that represents the building. For this purpose, many techniques have been developed, which are based either on long or short term measurements of some building parameters. It is a laborious process, in which the user has to insert several input parameters in the simulation programmer and, at the same time, collect responses from the actual building operation. The algorithm developed in this study is very effective and suitable for solving complicated and large-scale combinational, discrete and determinate problems. The data module of the system is flexible, and data for cost score and assessment items can be modified or customized according to actual requirements in different regions and countries. Although the system development is based on major characteristics of office buildings, the flexible data module employed in the system can also provide users with high feasibility and flexibility to define different assessment items, renovation actions, as well as their corresponding cost and score for other building types to conduct optimization. Future efforts to continuously improve the system and to promote its application to contribute towards more sustainable built environments are expected.

Keywords: Computer aided, Building renovation, Simulation

An intellectual fault detection and alarm system based on multitude of tools

He Tao, Ye Xinquan

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Mainly due to the drive to improve safety, reliability and efficiency of process operations, intellectual fault detection and alarm management has gained significance in the recent years. This paper highlights an in-house industrial implementation of a multitude of tools used for monitoring, analyzing and reporting alarm and safety system performance at LongLake site of Nexen Energy ULC. These tools mainly used by plant engineers and control room operators in improving the alarm system performance. The efficacy is demonstrated through case studies. A brief overview of the implementation architecture is also presented in this paper

Keywords: alarm Management, data visualization, event analysis

Numerical simulation of seismic damage evolution of ancient masonry pagodas in China

Li Shengcai, Zhao Youjun, Liu Yu

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The visualization of seismic damage evolution will be useful to elucidate the mechanism of damage progression of ancient masonry pagodas undergoing shock from earthquakes. The typical seismic damage features of ancient masonry pagodas are summarized in this paper. The methodologies for how to construct a dynamic elastic-plastic analysis model of masonry pagodas are probed. In addition, explicit dynamic analysis was conducted with an example of the Longhu Ancient Pagoda which is located at Deyang, Sichuan Province in China, and experienced the Wenchuan Earthquake in 2008. The evolution time-sequence of deforming, cracking, and local crushing of the Longhu Ancient Pagoda during the Wenchuan Earthquake is analysed. The visualization presents the main features of seismic damage evolution in different seismic vibrating stages and could serve as a useful reference for further research.

Keywords: Nonlinear Analysis; Ancient Masonry Pagoda; Dynamic Elasto-plasticity; Explicit Integral

Suitability of polymer mortars for repairing seismic damaged ancient masonry pagodas

Li Shengcai, Wang Can, Gao Yuewen

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To assess the properties of polymer mortars for seismic damaged ancient masonry to be bonded and strengthened by steel strips, such as fibre-reinforced mortar and acrylic-emulsion cement mortar, it is vital to conserve the cultural relics of ancient masonry pagodas. In this paper, the compressive strength, split strength, carbonation, and weatherability of the polymer

mortars were obtained from mechanical tests and freeze-thaw cycling tests. By comparing corresponding parameters and analyzing internal microscopic structures from electron microscopy scanning photos, the reliability of the repair scheme on physico-mechanical properties of the polymer mortars has been evaluated, and some suggestions have been proposed.

Keywords: Seismic damaged ancient pagoda; Polymer bonding mortar; Physico-mechanical properties; Weatherability; Microstructure

The hysteresis characteristics of a sensor with sensing memory function and linearization

Cao Xin-liang, Cui Wei, Ren Xin-cheng

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With the emergence of a memristor, a new opportunity has been brought for further development of electronic information technology. The new memory devices with a self-contraction of hysteretic behaviour, as a sensor, it is usually required linearization, but the linearization result would make sensor to loss the memory function. In the study, the general character of memory sensor is summarized based on the characteristic analysis of a new analog memory device. And, as memristor to an example, according to the duality between the different types of devices, the linearization method is proposed for keeping memory. By theoretical analysis, the conditioning networks of linearization memristor sensor would be not only established a one-to-one correspondence relationship between the input and output of sensor, but also marked the history state of the memristor.

Keywords: Analog memory devices; Sensor; Hysteresist loop; Linearization

Analysis of conductive particle electric characteristics for anisotropic conductive adhesive film

Li Hui, Zhang Yanyan

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The electric characteristics connected by anisotropic conductive adhesive film were significant affected by the deformation of the conductive particle. In this study, the theory model was set up to calculate the conductive particle resistance after ACF bonding. The effects of the deformation of the conductive particle on its resistance were analysis. The result compared with the experiments was fit well. The rebound of the conductive particle under the high temperature and humidity environment was simulated using FEM, and the deformation was determined. The effects of the rebound of the conductive particle of ACF on its resistance were investigated, and the effects of the number of the conductive particle on the total electrical properties were also studied. The optimal deformation of the conductive particle connected by ACF and the effects of the thermal and humidity ambience on its electric characteristics were obtained.

Keywords: Anisotropic conductive adhesive films, Conductive particle, Electric characteristics, Numerical simulation

Demagnetization fault diagnosis of permanent magnet in synchronous motor

Yang Yongming, Li Yaqiang

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Permanent Magnet (PM) embedded in the rotor simplifies the mathematical model of Permanent Magnet Synchronous Motor (PMSM), making its control method simple and flexible, and improving its power factor. But in the actual operating environment, the biggest risk of PMSM lies in demagnetization of rotor permanent magnet material. High temperature would make PM in the rotor suffer demagnetization, which is irreversible. If it develops without sufficient attention, there will be a major accident. From the detection state of the rotor flux, the stator magnetic flux equation is analysed under the demagnetization and the flux observer system is reconstructed, in order to obtain a quantitative analysis of the d-q axis flux and the demagnetization flux angle. Finally, the respective simulations will be made from three perspectives, such as no demagnetization, amplitude demagnetization and angle demagnetization of PM in the motor. It turns out that the flux observer can be used to real-time monitor the demagnetization of PM in the PMSM and the similar case, and can timely make an accurate fault diagnosis.

Keywords: permanent magnet (PM); demagnetization fault diagnosis; permanent magnet synchronous motor (PMSM); flux observer

Theoretical model of materiel quality characteristics metrics

Zhao Gang, Zhao Guangyan, Sun Yufeng

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Facing the continuous enrichment of intension of quality characteristic, a theoretical model of quality characteristics metrics regarding complicated materiel was established in this paper so as to perform systematic metrics of the quality characteristic of complicated materiel. On the basis of definition of metrics, metrics was described, so as to clarify the intension of metrics; conceptual model of materiel quality characteristic metrics including three hierarchies of comprehensive characteristic, single characteristic and metrics element was established; on the basis of conceptual model of metrics, overall and complete quality characteristic metrics system was established from three dimensions including system dimension, characteristics dimension and process dimension; 4 steps of materiel quality characteristic metrics were further specified, so as to clarify the entire process of

its metrics. Finally, typical quality characteristic metrics parameter system of the materiel was given by taking aircraft as an example. The model structure is clear and simple, and overall understanding and sorting of all contents of materiel quality characteristic were performed so as to provide energetic support for realization of metrics of quality characteristic of complicated materiel.

Keywords: metrics; quality engineering; reliability engineering; metrics parameter

Vibration fault processing experiment and analysis of hydropower unit

Wang Ruilian, Gao Yunda

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To find the truth of unit vibration fault more accurately and timely, mathematical model is led in archetypal test analysis. The measuring point of vibration is selected reasonably. The caution of vibration fault is judged preliminarily according to the change of the vibration in each measuring point as changing speed, exciting voltage, load and phase modulation operation test. The parameters in sample are chosen on the basis of the vibration fault characteristic and then the mathematical model is established based on fuzzy analysis. The membership grade of vibration characteristic parameters is gotten by the ascended half Cauchy distribution function, the fuzzy relational matrix is gotten from the experience of experts evaluation by fuzzifying the relationship between vibration fault characteristic parameter and fault type, then the membership grade matrix of vibration fault type is composed by the membership grade of vibration character parameter and fuzzy relational matrix. Vibration fault causation is confirmed through the data in the membership grade matrix of the vibration fault type and the disposal measure is chosen. For the example of a certain unit whose upper guide bearing vibrating exceeding standard, the cause judged preliminarily is imbalance of mass in the unit. The swing indexes in the rated speed and rated exciting voltage are regard as sample, and then the imbalance of mass and excessive gap in upper guide bearing are judged as the major causation of the hydroelectric generating set based on the membership of the vibration fault type. Because the vibration fault of unit doesn't eliminate when the upper guide bearing overhauling, the station decided to conduct experiment of dynamic balance. After the disposal, the fault problem is radically solved.

Keywords: hydro-turbine generating unit; vibration fault disposal; the scene test; model analysis; fuzzify; membership

Effect analysis of the interface design of humanized mobile phones using the structural equation model

Liu Sichen, Huang Xinyuan

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Mobile phones interfaces have been developed according to the "people first" principle, which is a consistent development principle that highlights the need for a mobile phone interface that is increasingly humanized in terms of human–computer interaction. The principle also asserts that mobile phone interfaces should be designed such that it considers the general feeling of users. Users are considered principal objects in studies that examine the significant effect of a humanized interface design. However, investigations into this area are statistically limited. Accordingly, the current study distributes a questionnaire survey to different user groups and applies the structural equation model to calculate the influence of each core aspect of the humanized design. Given this background, this study verifies and analyzes the results of the questionnaire survey and calculates the effect of each influence factor with the structural equation. The result of the effect analysis obtained using the structural equation is rigorous and reliable; furthermore, it provides a basic reference direction for the humanized design of mobile phone interfaces in the future.

Keywords: Humanized, structural equation model, mobile phone interface, factor

The study of wireless signal propagation characteristics under micro-cellular environment

Zhang Yucheng, Yu Fangtao

Computer Modelling & New Technologies 2014 18(12D) 245-249

A wireless signal automatic tracking model is established aiming at radio wave propagation characteristics of micro-cellular environment, which is based on ray-tracing theory and MATLAB simulation, using the method of radiation source tree. Firstly, reflection and diffraction point set are judged theoretically. Secondly, the wireless signal path tracking algorithm is proposed. In order to validate correctness and rationality of the algorithm, the simulated calculations combined with the urban environment of Ottawa are employed; at the same time, the wave propagation path is given and the optimal combination is chosen. Finally, the simulation and calculation results are analyzed and compared, thus the optimum model are obtained. The results show that the algorithm has higher precision and comparatively accurate forecasting results; what's more, it has the significant reference value for the propagation prediction of the cellular radio and the construction of the base station.

Keywords: Signal tracking; Microcellular; Reflection; Diffraction; Simulation

The research on the dynamic compensation and real-time processing method of the shock wave's pressure sensor

Wang Wei, Zhang Zhijie

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The dynamic compensation technology is an effective approach to improve the dynamic response characteristics of the sensor. Based on the improved Quantum-behaved Particle Swarm Optimization (QPSO), a sensor dynamic compensation method is put forward with the shock wave's pressure testing as background. This method is according to the experimental data of the sensor dynamic calibration experiment for the system identification, thus creating the sensor and the reference model, which can get the weight and coefficient of the Dynamic Compensation Filter quickly and accurately. After the MATLAB simulation, the results show that the response speed of the sensor model, which is compensated by this method, accelerates, the working frequency bandwidth is expanded, and meanwhile the noise is restrained effectively. In addition, based on the FPGA data acquisition system, the distributed arithmetic is introduced, and the parallel structure design of the Sensor is completed so as to realize the real-time correction of the dynamic error of the pressure sensor.

Keywords: Quantum-behaved Particle Swarm Optimization (QPSO), Dynamic Compensation, FPGA

The influences of coupling beam device on the collision response between cable-stayed bridge and its approach bridges

Chen Ping, Li Xiaoqing, Luo ShiDong

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Human beings always suffer huge lost in natural disasters, particularly earthquake, which directly brings catastrophic consequences. Aimed at this, scholars intensify relevant facilities and perfect the structure of affected buildings at all aspects. Regarding earthquake, measures are taken to increase the strength of some earthquake prevention materials and change the construction spot or structure that are inconformity with the seismic safety evaluation. Bridge, as an important composition of communication, calls for improvement for its earthquake prevention. To begin with, the paper discussed the difference between the dynamic characteristics of cable-stayed bridge and its approach bridges. A bridge was applied as research object, and the influences of coupling beam device on the collision response between cable-stayed bridge and its approach bridges were investigated by analyzing the models, ground motion input, seismic influences and bridge structure parameters. Furthermore, several improvement suggestions were put forward. The research provided reference for the construction of cable-stayed bridge with ideal dynamic characteristics and theoretical basis for reducing damages that induced by the collision of cable-stayed bridge and its approach bridges.

Keywords: approach bridge, cable-stayed bridge, coupling beam device, collision

Research on physical parameter damage identification of chimney structure under excitation response of earthquake

Wu Liming, Wang Zijian

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When seismic load affects structure height direction, it presents time domain correlation feature. According to this feature and on the basis of utilizing total compensation composite inversion algorithm, establish physical parameter damage identification method combining with probability average method in which seismic excitation response is unknown. Taking one typical chimney as engineering background, input stability and accuracy of analysis algorithm under the action of unknown EI seismic wave and do discussion on anti jamming capability under low-level noise. Research results show that parameter damage identification of structure without noise jamming keeps high accuracy and stability. Damping has sensitive response on noise jamming in which error amplitude of damping identification obviously enlarges with the increasing of noise level. Meanwhile its accuracy and stability reduce. Response of stiffness on the change of noise level is relatively low and its stability and accuracy are higher. Therefore, research results would provide references for seismic damage and health monitoring method of chimney structure.

Keywords: Seismic Excitation, Chimney Structure, Physical Parameter, Damage Identification

Diagnosis and application of carbon footprint for machining workshop on energy saving and emission reduction

Zhang Cuixia, Liu Conghu, Liu Lei

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This paper takes carbon footprint of the machining workshop as the research object, and carbon footprint connotations of energy, material, and environment were defined, and then standard carbon emission formula of workstation was made with the thought of industrial engineering and the practical production requirement of workshop. We took standard carbon emission as comparison object and constructed uncertain measure model of carbon emission in workshop to describe the control level of workshop carbon footprints quantitatively under uncertainty. A diagnosis method of the station carbon footprints was proposed. The application of this method in a machining workshop demonstrated its effectiveness and feasibility. This diagnosis method on energy saving and emission reduction can provide instruction for optimal control and management of workshop carbon footprint and provide the solution for low carbon production mode. It is an innovative application of industry engineering basic theory in carbon footprint control and management under uncertainty, so it can provide theory and technology support for energy saving and emission reduction, cost saving and production safety.

Keywords: machining workshop, carbon footprint, optimization decision, energy saving and emission reduction

Design and modelling of the self-propelled hedge trimmer

Sen Men, Lei Yan, Hua Qian, Jian Wu

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Highway hedges need seasonal and periodic trimming and the trimming work is labor-intensive and dangerous. In order to improve the trimming efficiency and ensure the operation safety, a self-propelled hedge trimmer was proposed in this paper, which had the functions of walking and trimming along the central isolation belt in highway. The mechanical structure design and control system design was introduced, and modularized structure was adopted in the design of control system. During the automatic control process, the sensors could collect the environment information in real time, and further determine whether each mechanism worked or not. The proposed self-propelled hedge trimmer is especially suitable for the trimming work in highway, and it can satisfy the requirements in the trimming work.

Keywords: Hedge Trimmer; Self-propelled; Automatic control

High-accuracy ultrasonic positioning through optimization of the extended Kalman filter algorithm

Li Jun-Zheng, Yuan Da, Wang Bin

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The application of extended Kalman filter algorithm to ultrasonic positioning systems has difficulty in meeting the requirements of precision positioning because the algorithm produces a new calculation error when the system is linearized. Modal optimization of the extended Kalman filter algorithm is thus investigated. The received ultrasonic signal is first decomposed by empirical mode decomposition, the intrinsic mode functions that best represent the original signal are then selected to restructure the waveform, and the transition time is finally corrected. Meanwhile, the ultrasonic wave velocity can be corrected. Traditional ultrasonic positioning can also be improved by combining with a radio-frequency module. It is experimentally shown that the proposed method limits positioning error to within ±5 cm and within ±1 cm after multiple recursions.

Keywords: ultrasonic location, extended Kalman filter algorithm, modal optimization, intrinsic mode function, transition time

A linearly-polarized passively mode-locked yb-doped fiber laser with nanosecond pulses

Zhu Xiaojun, Zhang Guoan

Computer Modelling & New Technologies 2014 18(12D) 284-288

A linearly-polarized, all-normal dispersion (ANDi), passively mode-locked ytterbium-doped fiber laser is demonstrated with a master oscillator power amplifier (MOPA) structure. Using a cascaded long-period fiber grating as an all-fiber format spectral filter, the mode locked pulse is achieved by nonlinear polarization evolution (NPE) effect. Nanosecond pulses with a low repetition rate of 1.53 MHz and a output power of 363 mW when the seed source after amplifier, and the pulses duration can be tuned from 0.78 ns to 3.57 ns with a polarization extinction ratio of >20 dB. The preliminary experiment shows that the nanosecond pulses output from the ANDi fiber laser could be used as an ideal seed source for all-fiber amplifier system.

Keywords: Fiber Optics; Fiber Laser; All-Normal Dispersion; Amplifier

Unstructured meshes calculation method for reponse amplitude operators of TLP wind turbines

Wang H F, Fan Y H

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Here we propose a new method for calculating the pitch Response Amplitude Operators (RAOs) for a Tension Leg Platform (TLP) wind turbine. The traditional method is limited for finding the stability of a body in water; the traditional method is also limited regarding the development requirement of worldwide floating offshore wind energy. The TLP is modeled and meshed in GID software, and a time domain analysis at a particular wind speed was carried out using FEM analysis on an unstructured mesh (UM-FEM). The calculations of mass and hydrodynamic matrices are discussed in detail. Also, translation of these matrices from the origin, which is typically on the free surface of a body of water, to the center of gravity for the platform is discussed in detail. Finally, a linear analysis of a mooring system is discussed, and pitch RAOs were calculated and validated against prior data. The result from the proposed new method closely fits the NREL results and reaches the same conclusion as other studies. This implies that this computation process is correct and that this new method can be used with low error and in conjunction with other methods for offshore wind energy generation applications.

Keywords: Offshore Wind Turbine; Floating Foundation; Tension Leg Platform; Unstructured Mesh

A new 3D graphical representation for similarity/dissimilarity studies of protein sequences

Chen Yan, Li Kang-Shun, Chang Shan, Yang Lei

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With the development of sequencing technology and the rapid growing number of protein sequences, how to find useful information from these large numbers of protein sequences has become an important research focus. The dominant factor of

protein's characteristic is each amino acid of it. So this paper uses three-dimensional Cartesian coordinate system to represent three important physical chemistry properties of amino acids: hydrophobicity of amino acids, aromatic amino acids, and side-chain conformations. A new 3D graphical representation of protein sequences is proposed, based on the analysis. Using this graphical approach, 1D sequence of the protein can be expressed as a 3D graphics. At the same time, the similarity comparison of protein-sequences, prediction of functional sites, and other sequence analysis operations can be done further. The paper selects 15 protein sequences of ND6 to conduct the experiment, and the result shows that the analysis of the structures is consistent with the actual results of biological evolution. The experiment illustrates the utility of our approach.

Keywords: Protein sequence; 3D representation; Similarity/Dissimilarity Studies

Grinding force of profile-grinding bearing rail platform for ballastless track slabs

Zhang Jianchao, Liu Na, Han Yanjun

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High-precision grinding for CRTS II ballastless tracks labs is needed before these slabs are laid on high-speed rails. Thus, the current study focuses on the grinding force of profile-grinding bearing rail platforms. First, the formulas of cutting force and sliding friction force of a single diamond grit are analyzed. Second, an experimental method using a scanning electronic microscope is proposed to analyze the samples of bearing rail platform after grinding as well as to calculate the number of cutting grits and sliding grits in the grinding arc. Third, the mathematical models of cutting force and sliding friction force are established based on the four grinding profiles of the bearing rail platform. Last, the grinding force formulas of the profile-grinding bearing rail platform are deduced. The current study analyzes the parameters that influence the grinding quality of the bearing rail platform to promote track slab grinder optimization.

Keywords: Grinding force; Profile grinding; Track slab; Bearing rail platform

Research on application of inflatable rubber support in actual mining roadway

Lu Zhong-liang, Li Yin-zheng, Wang Hong-li

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The increasing mining depth lead to severe deformation of surrounding rock and greater ground stress, which brought great difficulties to the support and mining In order to further accelerate the support rate and simplify the support technology, thus solving the supporting problem under high stress, this paper developed an inflatable rubber support which has won the national patent for utility models. It could make the load applied on the steel support have uniform distributed and absorb part of the energy caused by roof weighting, thus effectively reducing the loads; with the weak stiffness, the rubber layer can buffer loads and achieve close contact with the roof of the roadway, so it could bear external loads quickly to prevent the surrounding rock deformation caused by the decoupling of the steel support and roadway in the initial stage. Therefore, the inflatable rubber support is of great significance for the improvement of supporting reliability and the cost reduction.

Keywords: rubber support, local overload, energy dissipation, broken rock zone

Ring-shaped array ultrasound imaging using ellipse algorithm

Yang Liu, Xu Chunguang, Guo Xianghui

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A ring-shaped array tomography modal consists of 36 ultrasonic transducers is established to study the multi-objects imaging in fluid medium by the ellipse algorithm. The algorithm is based on ultrasonic reflection mode which is a good alternative to transmission tomography when the inspected object would bring about severe attenuation to ultrasound. Ultrasonic propagation inside the ring-shaped array is simulated by COMSOL Multiphysics® software. Air bubbles and solid objects are insonified separately by the propagating waves and the corresponding scattering waves are detected through the ring-shaped array transducers. After the superposition of the numerous ellipses and threshold filtering for the reconstructed images, the shapes, sizes and positions of the tested objects are successfully reproduced.

Keywords: Ultrasonic Tomography; Ring-shaped Array; Ellipse Algorithm

Spatial model and safety evaluation for water supply and drainage system and fire fighting system of football field

Zhang Guoqing, Fan Jun

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With the host of World Cup in Brazil, football becomes popular again and more audiences watching games in football field. To guarantee audiences' personal safety, the water supply and drainage system and fire fighting system of football field are significant. In order to provide a reasonable water supply and drainage system and the standard for evaluating the fire fighting system of football field, the necessity of the design of water supply and drainage system was analyzed and the design plan and layout map of the drainage system were obtained. Afterwards, the analytic hierarchy process (AHP) model was constructed for analyzing the safety evaluation standard for the fire fighting system of football field. In consideration of the influencing factors including personal safety, property safety, construction safety and environment safety, the proportions of each factor that

influences the standard for evaluating the fire fighting system were acquired by analyzing. The analysis of the proportions of the factors such as safe evacuation facilities, fire protection, and smoke exhaust and alarm system indicated that there were slight differences among the proportions of these factors; and the safe evacuation facilities factor accounted for a largest proportion. All these illustrated that the safety evaluation of fire fighting system of football field had to be performed based on the standard that whether there were safe evacuation facilities, fire protection, and smoke exhaust and alarm system, and apply the personal safety protection as its main objective.

Keywords: Drainage system, Safety Evaluation for fire fighting system, Analytical hierarchy process

Study on characteristics of external load of transmission system for cutting unit of shearer under multiple load cases

Wang Yong, Sun Dongye, Liu Changzhao

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To improve the accuracy of dynamics analysis, anti-fatigue design and reliability calculation of transmission system for cutting part of shearer, the accurate external load model of transmission system for cutting unit is required to be firstly built. In this study, the system dynamics model of cutting unit including drum, transmission system and motor is built, the impact of drum load and motor on external load of transmission system is comprehensively considered, and external load characteristics of transmission system during tilt and straight cutting of front and rear drums are studied, when the model is built, the impact of changes in the actual attack angle caused by the axial tilt angle on the cutting resistance is considered. The case analysis is conducted with this model, and the impact of changes in the actual attack angle caused by the axial tilt angle on the cutting resistance is mainly considered, the result shows that: during tilt cutting, the external load acting on the transmission system gradually increases and the fluctuation range also increases; while during straight cutting, the external load acting on the transmission system remains stable; the load of transmission system of front cutting unit is worse than that of transmission system of back cutting unit.

Keywords: Shearer; Transmission System; External Load; Multiple Load Cases

Streaming numerical simulation of cylinder pier laminar flow and control measure research on external concave rib

Wang Zijian, Wu Liming, Xiao Shengxie

Computer Modelling & New Technologies 2014 18(12D) 331-335

This paper utilizes FIUENT Software to simulate the appearance, development and change of vortex shedding in cylinder streaming under low Reynolds number, calculates displacement of pressure coefficient and changing rules of lift and resistance coefficients on cylinder surface and introduces working conditions with 10 different rib heights on cylinder surface to do comparative calculation so as to acquire the control measures of concave rib streaming on cylinder surface. Calculation results show that the application of concave rib on cylinder surface could help effectively control vortex shedding of cylinder surface, reduce its resistance and restrain vibration. Calculation results of each parameter are consistent with those in literatures. When height of concave rib is 0.12D, effect of restraining streaming is the best. At this moment resistance coefficient of cylinder surface is 1.0849 which decreases about 39.609% comparing with its resistance coefficient without concave rib. Meanwhile lift coefficient reduces by 79.691%. The results above provide references for control measures of cylinder pier streaming.

Keywords: Low Reynolds Number; Surface Concave Rib; Cylinder Pier; Control Measure; Restrain Streaming;

Study on ratio of similar materials based on coal mass strength

Liu Xiao, Lin Haixiao, Zhang Fan

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In laboratory, studies on the coal mine hydraulic fracturing principle and crack propagation characteristics require a large amount of coal samples, collection and processing are difficult, based on these, put forward a technical idea that using ratio of similar materials to simulate hydraulic fracturing native structure of coal and catalectic coal. On the basis of raw coal physical and mechanical properties tests, through the orthogonal method to allocate different proportion of cement, coal, gypsum, water and processing sample, then test physical and mechanical parameters including compressive strength, tensile strength modulus of elasticity, Poisson's ratio and so on, regression analysis shows that the higher the proportion of gypsum, the smaller the compressive strength of the material, based on this, we obtained the reasonable ratio of similar materials through trial and error, studies on the condition of the ratio of sample damage characteristics of acoustic emission and comparing with the raw coal, the result shows it is consistent with raw coal. Eventually get the similar material simulation of hydraulic fracturing of coal, cement, gypsum, water ratio: native structure of coal is 2:3:1:3; catalectic coal'sis 1:1:1.2:1.3.

Keywords: Coal body structure; Similar material; Orthogonal ratio; Mechanical parameters tests; Acoustic emission

Vibration research of cable-stayed bridge with tower-girder consolidation

Chen Ping, Li Xiaoqing, Luo Shidong

Computer Modelling & New Technologies 2014 18(12D) 341-345

Cable-stayed bridge is a combinative system of bridge towers, beams, piers and cables. Researches on the vibration of the structure generally use finite element method. And the vibration analysis of structure with the specific geometry is easy to get, while the research on the self-vibration considering the change of the bridge geometric parameters is difficult. Based on the Hamilton principle, this paper studied self-vibration frequency of a cable-stayed bridge whose tower and girder were consolidated. The motion equation of a cable-stayed bridge under the symmetric vibration was gained. Considering the changes of the geometric parameters, comparative analysis of the influences on natural vibration frequency were carried out. Results showed that the natural vibration frequency turned approximately linearly when the stiffness and the cable force changed. And the influence with beam changes on the natural vibration frequency was likely a parabola.

Keywords: Hamilton principle, cable-stayed bridge, natural vibration frequency

Greenhouse temperature controller design based on the fuzzy PID

Zong Zheying, Wang Chunguang, Zhang Yong, Zhang Chunhui

Computer Modelling & New Technologies 2014 18(12D) 346-349

Greenhouse temperature system is a system featuring big time lag and huge inertial. Its typical control methods generally fail to achieve good control effect. Therefore, based on the fuzzy PID control method, this paper conducts real-time adjustment of PID parameters through the temperature difference and the temperature deviation variation rate. The numerical simulation result with MATLAB Simulink suggests that to control greenhouse temperature based on the fuzzy PID control method can achieve great control effect. The controller designed is characterized with fast dynamic response good robustness, high stability precision, low overshoot, and strong anti-jamming capability.

Keywords: Temperature System; Conventional PID; Fuzzy PID

Numerical study on Brazilian test of slate with different bedding orientations

Xie Bing, Ma Yunling, Ding Wuxiu

Computer Modelling & New Technologies 2014 18(12D) 350-355

There are a variety of parallel planes of weakness in slate; consequently, slate's tensile strength can be significantly impacted by different bedding orientations in the weak planes. In order to reveal the anisotropy of tensile strength and difference between the fracture patterns caused by the orientation of weak planes, Brazilian tests were carried out using numerical specimens with ten types of bedding angles by implementing a discrete element method. The anisotropy of tensile strength and fracture patterns were obtained through a series of simulations; the results shows that there are three kinds of failure forms in the specimens, which are as follows: a pure tensile failure when the bedding angle was , a shearing failure when the bedding angle was , and a mixed failure mode when the bedding angle was between 40° and 70°.

Keywords: Tensile strength; Fracture pattern; Brazilian test; Discrete elements

The movement rule of rust in primary airflow on fully mechanized heading faces and its numerical simulation

Lu ZHong-liang

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Ventilation mode is applied in most coal mines in China for dedusting on fully-mechanized coal faces. On the heading faces, the cutting head of road header generates primary airflow of dusts when it works. While, the ventilation flow for discharging dusts produces secondary airflow that moves dusts. Owing to secondary airflow is the major power source of dust movement, how dusts move on heading faces without ventilation flow and the movement rule were investigated. Based on fluid mechanics and by using the discrete phase model in FLUENT software, numerical simulation was performed for the movement of discrete-phase dusts of different sizes on the heading faces. The simulation results indicated that the maximum moving distance of dusts was within 0.5 m to the heading faces. The conclusion provided significant theoretical basis for dedusting on heading faces in coal mines.

Keywords: Dusts, Road header, Fully-mechanized heading faces, Primary airflow, Secondary airflow

Effect of heat treatment on property of brazed joint

Jia Qianzhong, Zhang Hongtao, Li Man

Computer Modelling & New Technologies 2014 18(12D) 361-366

Two different filler metal is used to join polycrystalline diamond (PCD) compact into a cemented carbide substrate. The effect of brazing holding technology on shearing strength and microstructure of brazing seam in hi-frequency induction brazing is investigated. Based on analyses of the microstructure of brazing joints by means of scanning electron microscope (SEM) and electron probe micro analyzer (EPMA), it is indicated that the shearing strength of brazing joints increased with the increase of heat preservation temperature; however, the shearing strength increased first and decreased afterward with the prolonging of heat preservation time. And the shearing strength of PCD cutting tools using the way of post-weld heat preservation is higher

than that of those using plaster power cooling or air cooling. Thermal damage happened on the PCD cutting tools, and the damage became serious gradually with the increase of post-weld heat preservation time.

Keywords: Polycrystalline Diamond Compact, Cemented Carbide, Brazing Joint, Heat Treatment, Shearing Strength

Analysis on cushion performance of quartz sand in high-g shock

WangYan, Ma Tiehua, Zhu Jiangjiang

Computer Modelling & New Technologies 2014 18(12D) 367-370

The cushion protection for light mass electronic instruments in projectile is of vital importance to the normal work of an ammunition system. Quasi-static compression tests were conducted on two kinds of quartz sand with different grain diameters and their energy absorption abilities were analyzed. The cushion effect under high g shock was studied by using air gun. The results of experiments show that the quartz sand material takes in energy by grain breakage and the energy absorption ability in unit volume, the energy absorption ability in unit mass and the ideal energy absorption efficiency all improve with the increase of grain diameter. The cushion efficiency of the coarse quartz sand material with grain diameter of 1.0mm to 5.0mm can reach more than 50% under high g shock. This provides a favorable cushion protection for light mass equipment.

Keywords: High g Shock, Quartz Sand, Grain Breakage, Cushion