

# C+CA: Progress in Engineering and Science

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# Influence of Vacancies on the Electrical Resistivity Size Effect of Nanocrystalline Metal

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## Abstract

In view of the lack of research on electrical resistivity size effect, this paper studies the influence of vacancies on the electrical resistivity size effect of nanocrystalline metal based on the residual resistivity and statistical thermodynamics. The results show that the electrical resistivity and temperature have a linear relationship at the nanoscale in the temperature range of 60~300K. In addition, the defects (vacancies) and electrical resistivity increase with decline in the grain size. Finally, the author verifies the vacancy formation energy and residual resistivity of metal palladium (Pd). The predicted results of the model are in good agreement with the experimental data.

## Keywords

Defects, Electrical Resistivity, Nanocrystalline Metal, Statistical Thermodynamics, Vacancy Formation Energy.

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# Study on the Effects of Jet Velocity and Abrasive Concentration on Pre-Mixed Abrasive Water Jet Cutting

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## Abstract

As a safe cutting technology, abrasive water jet (AWJ) has vast application prospects in the emergency repair of petrochemical equipment. However, it is difficult to study the abrasive particle erosion features through experimental methods, because abrasive water jet cutting (AWJC) is a high velocity and microcosmic process. This paper carries out the cutting experiment by the pre-mixed AWJC system, and analyzes the effects of cutting parameters, including jet velocity and abrasive concentration. In order to explain the internal mechanism of the cutting process, the author establishes the corresponding numerical simulation model based on the SPH and FEM coupled method, and discusses the material failure mechanism. The comparison between experiment and simulation proves that the mesh-free method successfully resolves the large deformation problem during the jet impact process, and the simulation of the erosion process can be realized effectively. The simulation results show that the main reason for material failure lies in the high frequency and high speed impinging of the abrasive particles which causes the plastic deformation failure of the material; the stress and frequency of the abrasive particle erosion can be effectively affected by the variation in jet velocity and abrasive concentration, leading to changes in material damage results. This paper can promote the understanding of AWJC mechanism, and provide guidance for pre-mixed AWJC process control.

## Keywords

Emergency Repair Cutting, Material Damage Mechanism, Mesh-Free Method, Pre-mixed Abrasive Water Jet.

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## Hydrolytic Acidification-Biological Contact Oxidation Method Study on the Stability of Reclaimed Water in University

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### Abstract

Targeted at the stability of reclaimed water in Chinese universities, this paper studies the effluent quality of the hydrolytic acidification-biological contact oxidation system by controlling temperature, hydraulic retention time (HRT) and dissolved oxygen concentration. The results show that the removal rates of BOD, NH<sub>3</sub>-N and turbidity in the wastewater are 85.41%, 82.5% and 94.8%, respectively. When the control system temperature falls between 26–32°C, the hydraulic retention time is 6h and the dissolved oxygen concentration is 2–3mg/L. It is proved that the system boasts good water stability and strong anti-shock load capacity.

### Keywords

Hydrolytic Acidification-Biological Contact Oxidation Method, Intermediate Water Reuse, Stability.

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## Application of Improved Self-cleaning Coatings in the Exterior Wall of Sports Venues

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### Abstract

In recent years, air pollution across the globe is becoming increasingly serious, causing huge economic losses every year. As we all know, tiny particles and oil are floating in the fog. If these contaminants are attached to the surface of the stadium's exterior wall coating, it will not only affect the appearance of the sports building, but also reduce the service life of exterior wall coating and increase maintenance costs. For example, the exterior paint of museums will be damaged by these pollutants with the physical or chemical action. In view of the above problems, it is possible to use the self-cleaning coating on the exterior wall of the stadium to achieve the purpose of increasing the pollution resistance. The coating can be used to remove pollutants or dust particles under the action of gravity, rain, wind and other external forces. In addition, the pollution and dust also can be removed by photocatalytic degradation. It has the advantages of water saving, energy saving and environmental protection. Based on this, our design is to add nano-TiO<sub>2</sub> which are photocatalytically active to water-based fluorocarbon coating, and to improve the hydrophilic effect of coating by covalent modification. Firstly, the modified TiO<sub>2</sub> nano particles are prepared by condensation of silane coupling agent with silanol groups on the surface of nano particles. Then, the modification effect of nano particles in aqueous medium are characterized by infrared spectroscopy. Finally, the effect of different additions of on the photocatalytic self-cleaning property is investigated by the stain resistance test. The results show that self-cleaning paint plays a very good role in the appearance and maintenance of external wall of stadium, and thus other stadiums need long-term anti-fouling facilities to provide ideas.

### Keywords

Exterior Wall, Improved Self-Cleaning Coatings, Simulation Experiment, Sports Venues.

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# The Application of Quadrotor UAV in the Inspection System for Tangerine Orchard

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## Abstract

Recent years has seen an increase in the inspection demand for large tangerine orchards in Southwest China. In order to improve the inspection efficiency of tangerine orchards and lower labor costs, this paper proposes an aerial video inspection system based on quadrotor UAV to identify and capture audio and video records of tangerine orchards. The master computer software is developed under Visual studio 2013 environment, while the hardware is a camera carried by quadrotor UAV. The proposed system is a simultaneous inspection system for tangerine orchards. Specifically, the master computer software monitors, captures and controls the attitude of quadrotor UAV, as well as the height and angle of camera. Test results show that the proposed inspection system is an easy-to-operate, stable and reliable system that increases inspection efficiency of tangerine orchard and lowers labor costs. The system can be applied in large-and medium-scale tangerine orchards in Southwest China.

## Keywords

Attitude Control, Inspection System, Quadrotor UAV, Video Capture.

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# Analysis and Study on Hydraulic Transition Process of Long Distance Water Transmission

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## Abstract

Targeted at the problem of water hammer caused by accident stop pump in long distance water supply pipeline, it is necessary to carry out a simulation following the basic principle of fluid mechanics and characteristic line method. For the sake of the safe operation of irrigation system, this paper conducts an accident water hammer analysis in reference to the principle of fluid mechanics and the characteristic line method and thereby establishes an unsteady water hammer mathematic model for pressure pipeline. Taking the Xin'anquan water supply expansion project as an example, this paper analyzes and calculates the hydraulic transition in two operating conditions, aiming to design a reasonable pump outlet valve for valve regulation and protection. The results show that the two-stage shut-off butterfly valve at the pump outlet can effectively protect the water hammer of the high-lift and long distance pipelines. Through the reasonable control of the fast and slow cutoff time and angle, the proposed valve succeeds in reducing the water pressure, the unit reversal and the drain flow. The water hammer protection measure is suitable for this project and ensures the safe and stable operation of Xin'anquan water supply pumping station. Moreover, the research also provides a valuable reference for the protection of water hammer in the future.

## Keywords

Accident Stop Pump, Butterfly Valve, Long Distance Water Supply System, Water Hammer Protection, Water Pressure.

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## Mechanical System Design of Picking Manipulator

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### Abstract

For the purpose of nondestructive fruit picking, this paper designs a manipulator to the satisfaction of picking requirements through analysis of the growth space of the fruit tree and the workspace of the manipulator in the orchard. Specifically speaking, the author determines the size of the manipulator by the constraint function, carries out the theoretical analysis on the basis of robotics, and performs mechanical analysis of the manipulator and the selection of the motor. After that, the author analyzes the working environment and checks the key components of the manipulator.

### Keywords

Kinematics, Picking Manipulator, Spatial Trajectory, Workspace.

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## Ergonomic-based Design and Simulation of Children's Bicycle

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### Abstract

Due to higher living standards, children's bicycle has become a must-buy item for families with children. As a result, more and more concern has been thrown on the user-friendly design of children's bicycle. Based on ergonomics, this paper explores the design in consideration of the safety and stability of children's bicycle and the impact on the fatigue of the rider. The author establishes a fatigue prediction model with the saddle coordinate position as the variable by regression analysis, thus obtaining the overall frame model of children's bicycle. Then, the author conducts simulation with ANSYS, modifies the frame in accordance with the stress distribution acquired from the simulation, and eventually improves the safety and comfort of children's bicycle.

### Keywords

Children's Bicycle, Ergonomics Design, Regression Analysis, Simulation.

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# The Dynamics Modeling and Simulation of Heavy Vehicle Air Suspension

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## Abstract

As an important part of vehicles, air suspension has a big effect on driving stability. In the optimization design of vehicles, dynamics modeling, analysis and calculation are particularly crucial. This article selects the rear suspension of a specific heavy vehicle as the main research object. With a comprehensive analysis of indicators of vehicles and road friendliness, we give equal consideration to ride comfort and road friendliness in determining objective weights and setting up a general objective function. To simplify the analysis process, a quarter vehicle model and a road simulation model are established in respective ADAMS and MATLAB. With these models, we calculate the values of sprung mass acceleration, dynamic suspension travel and dynamic wheel load of passive suspension and air suspension, respectively. After comparing these two suspensions, it is found that the addition of an air spring to the rear suspension of heavy vehicle helps significantly enhance ride comfort and general objective function and effectively reduce the damages of heavy vehicle to the road in high speed driving.

## Keywords

Air Suspension, Dynamic Suspension Travel, Dynamic Wheel Load, Road Friendliness, Sprung Mass.

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# Finite Element Modal Analysis of Stalk Pulling Cutter of Self-propelled Tobacco Stalk Pulling Machine

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## Abstract

Stalk pulling cutter is an important component of self-propelled tobacco stalk pulling machine. We establish the finite element model of the stalk pulling cutter based on SW and perform simulation study using ANSYS Workbench software. The first 6 order of natural frequencies and the mode shapes are obtained. The results show that the 1st order vibration (57.161HZ) is mainly manifested as deformation of the cutter along X axis. The 2nd order vibration (57.733HZ) is manifested as the deformation of the cutter along X axis. The 3rd order vibration (64.064HZ) is manifested as deformation of both cutter and cutter frame along X axis. The 4th order vibration (134.84HZ) is manifested as the axial rotation of the cutter. The 5th order vibration (136.2HZ) is manifested as the bending of the cutter towards the Z axis. The 6th order vibration (137.16HZ) is manifested as the bending of the cutter towards the Y axis. The experimental data are compared with the simulation data of modal analysis to perceive the true deformation of the cutter at different frequencies. Our modal analysis and simulation experiment provide reference for the optimization of stalk pulling cutter.

## Keywords

Finite Element Modal Analysis, Self-Propelled Tobacco Stalk Pulling Machine, Stalk Pulling Cutter.

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# Empirical Analysis of Cost and Benefits of Green Building Projects Based on DEA Model

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## Abstract

As a manifestation of sustainable development, green buildings are reshaping our life thanks to their superiorities over traditional buildings. During project selection, the developers investing in green buildings are increasingly concerned about the accurate evaluation of the incremental costs and benefits of green building projects because it is difficult to identify the internal benefits of green buildings as clearly as their external benefits. In view of the above situation, this paper firstly analyzes the benefits of green building projects through financial evaluation, and then identifies the incremental cost and benefits of multiple projects by Data Envelopment Analysis (DEA) model, aiming to determine the efficiency of the decision-making units. Based on the results obtained by DEA model, the author analyzes and improves the defects of green building projects, providing certain guidance for developers to select and improve green building projects.

## Keywords

Data Envelopment Analysis (DEA) Model, Green Building, Incremental Benefits, Incremental Costs.

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# Research on Economic Evaluation System of Green Building Based on Analytic Hierarchy Process

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## Abstract

Thanks to the low consumption of natural resources in the construction and utilization processes, green building has received widespread attention from all sectors of the society. The development of green building hinges on the improvement of the economic evaluation of green buildings. In light of this, this paper sets up a complete green building economic evaluation system. Moreover, the author adopts the analytic hierarchy process (AHP), performs layered modelling of the contents of green building economic evaluation, and obtains the economic rating criteria for green building. Moreover, taking a prefabricated green residential building project as an example, the author carries out an economic evaluation of the building and draws the qualitative rating conclusion that it is a four-star green building project owing to the high economy.

## Keywords

Analytic Hierarchy Process, Economic Evaluation, Green Building, Prefabricated Buildings.

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# Calculation and Analysis of Existing Gravity Retaining Wall Adjacent to Slope under the Influence of Excavation

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## Abstract

In order to study stress and deformation of existing gravity retaining wall adjacent to slope under the influence of excavation, we establish a mathematical model to express the relationship between stress and displacement of existing retaining wall under excavation. The experimental analysis of soil's strength parameters was conducted behind existing retaining wall, and we simulated the stress-strain relationship to reveal the law between stress and displacement by GeoStudio2007. The experimental results, numerical simulation and monitoring data showed that errors were small.

## Keywords

Existing Gravity Retaining Wall, Numerical Simulation, Slope, Strain, Stress.

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# Simulation Research of Six Degree of Freedom Parallel Robot

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## Abstract

This paper establishes a three-dimensional model of the six degree of freedom parallel robot with Pro-E. The kinematics simulation is conducted by importing the digital models into ADAMS software. Based on ADAMS, the forward solution is obtained by analyzing the structure of the six degree of freedom robot, and deducing its inverse kinematics solution. The kinematics simulation analysis provides the main parameters for the design, manufacture and experimental application of the parallel robot system, and lays the theoretical basis for the trajectory planning and control system design of parallel robot.

## Keywords

ADAMS, Parallel Robot, Pro-E.

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# Self-learning Longitudinal Dynamics Controllers Based on Model-free Control Approaches

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## Abstract

A self-learning control algorithm for vehicle longitudinal dynamics is proposed based on model-free adaptive predictive control approach. In view of the strong nonlinearity, uncertainty, time-varying and even jumping features of drive dynamics, the nonlinearity and long-time delay characteristics of brake dynamics cannot be modelled and stabilized precisely. Therefore, we designed the model-free adaptive control algorithm for drive dynamics, and the model-free adaptive predictive control algorithms for brake dynamics combining receding horizon concept and model-free adaptive control approach, among which a hysteresis switching logic is established to achieve smooth transition between drive and brake. The cost of the transportability of the designed algorithm is reduced and improved effectively as it does not need physical information of vehicle dynamics and fussy modeling. To verify the validation of the designed self-learning longitudinal dynamics control algorithm, the co-simulation models based on the Simulink and Carsim software are built and compared with the traditional inverse longitudinal dynamics control algorithm with typical control input and under external disturbance.

## Keywords

Adaptive Cruise Control, Longitudinal Dynamics Control, Model-Free Adaptive Predictive Control.

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# Research on the Unified Stabilization Control Problem of Nonholonomic System

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## Abstract

The paper studies stabilization control problem aimed at nonholonomic chained system and a kind of nonholonomic systems that cannot be transformed into chained standard system. The author, considering nonholonomic single chain system, puts forward three overall unified controllers, unified index regulator, index K unified controller and actual unified controller, which are relevant to nonholonomic system. Moreover, the introduction of auxiliary state can address partial feedback stabilization problem of this kind of system; and the utilization of dynamic feedback constructs a controller with special structure to enable feedback stabilization control of this kind of system when it has uncertain parameters. Correcting controller structure can broaden control target to actual stability so that status error can converge to any small neighborhood of the origin, which can eliminate oscillation and peak phenomenon as well as ensure need of engineering precision. It also covers detailed simulation of fixed point stabilization and trajectory tracking targeting typical three-dimensional chained nonholonomic system, the result of which demonstrates the validity of the controller it constructs.

## Keywords

Correcting Controller, Nonholonomic System, Stabilization Control, Unified Controller.

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## Research and Application of Virtual Measuring Instrument Based on BPNN Algorithm in Starch Industry

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### Abstract

Currently, the offline measurement is widely used for measuring moisture content of starch with the characteristics of long measurement cycle and low precision. The purpose of this paper is to demonstrate the use of intelligent algorithms as a replacement of measuring instruments in order to overcome the limitations of the instrument measurement. The methods used include offline algorithm and online computing. Offline algorithm is founded on BPNN algorithm, with temperature and humidity of the material as input and moisture content as output of the network. The mathematic model between input and output was generated by training the network. Online computing uses computer to calculate real-time data and to obtain real-time moisture content. The feasibility of this method was verified simultaneously by test data and system simulation to produce moisture content change curve. Finally, the trained network is applied to the feedback loop of the PID closed loop control, so that it can be used as a virtual instrument that can replace the instrument or sensor.

### Keywords

BPNN, Intelligent Algorithm, Mathematical Mode, Virtual Instrument.

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## Modeling of a Unit of a Suspension Disc Insulator

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### Abstract

The objective of the present paper is to develop a model of a unit of suspension disc insulator. Such insulators are essential components of overhead transmission lines at higher voltages. They are mainly simulated by linear capacitive and resistive elements as per the standard text books. But, it has been observed from experimental data that the voltage across a string insulator is rich in harmonics when subjected to a sinusoidal signal. It indicates the presence of non-linearity in the capacitive elements. Hence, development of a non-linear capacitor becomes a necessity for modeling an insulator string. The scope of this work is limited to the modeling of a non-linear capacitor in PSPICE. The signal analysis has been done in MATLAB software.

### Keywords

Capacitor, FFT, Harmonics, Non-linear, Suspension Disc Insulator.

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# Optimal Allocation of Renewable Distributed Generator for Cost Assessment of Radial Distribution System

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## Abstract

In recent years, electrical utility companies are gaining more attention for the efficient penetration of Renewable Distributed Generator (RDG) to enhance system performance. This paper presents a particle swarm optimization (PSO) algorithm for Renewable Distributed Generation (DG) placement and sizing to maximize energy saving cost. Optimal placement and capacity of Photovoltaic (PV) type RDGs on the radial distribution system have lead to an increase interest in minimization of system losses to save energy. This paper investigates the impact of RDG unit installation on electric losses, and voltage profile of distribution networks. The proposed method is tested on IEEE 33 Bus radial distribution network. The results of the simulation are found to be encouraging as proposed method using PSO which is an effective tool for identifying the best location and rating of a RDG for improving power quality in an electrical power system.

## Keywords

Energy Saving Cost, Losses, PV Array Modeling, Radial Distribution System.

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# Output Feedback Control for Marine Diesel Engine Generator

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## Abstract

In light of the poor measurement of differentials of generator rotor angle and other state variables and the difficulty in achieving full state feedback, this paper puts forward the nonlinear output feedback control algorithm based on multicomputer system of ship power station. Specifically, the author establishes the propeller load model for multicomputer structure preserving system to analyze the nonlinear coupling relation between diesel generator set and its propeller load, linearizes the multicomputer differential algebra system model with the idea of feedback linearization, and obtains output feedback control law of excitation and speed-governing by Backstepping design method. The simulation results demonstrate the effectiveness of the proposed algorithm.

## Keywords

Differential-Algebra Systems, Output Feedback, Propeller Loads, Ship Multi-Generator Power Systems.

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# Prediction of Strip Steel Thickness Based on Improved Fuzzy Neural Network

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## Abstract

Considering the inaccuracy of the finishing exit thickness predicted by the traditional mathematical model, this paper proposes an improved hot rolled strip steel thickness prediction method based on ANFIS optimized fuzzy neural network. The proposed method optimizes the fuzzy neural network modeling by a simplified population algorithm, aiming to improve the accuracy and efficiency of the model. Through the introduction of the dynamic learning factor of asynchronous change and the Laplace coefficient, this method increases the population diversity, accelerates the convergence rate and avoids local optimization. Compared with the traditional mathematical model, the improved neural network model boasts simpler structure, faster convergence and smaller errors, thus validating the feasibility and reliability of the proposed modelling method.

## Keywords

ANFIS, Neural Network, Steel Thickness.

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# Emissions Compensation Benefits of Hydropower to Power Plant in Power Network

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## Abstract

Hydropower generation is a process to convert the river potential energy into electrical energy. It is in line with the basic national policy of energy conservation as it does not consume non-renewable energy or produce polluting gases. Targeted at the problem that the hydropower, as a clean energy, is not effectively valued, this paper comes up with the mechanism and the computing method for compensation benefits of hydropower to thermal power station emission reduction, aiming to reflect the real value of environment protection in the same power grid. In order to illustrate the benefits, the author carries out a case study of the compensation benefits of the hydropower to thermal power station emission reduction in the same power grid. The result shows that the compensation benefits of the hydropower to thermal power station emission reduction are RMB 9.986 million yuan per year in the same power grid. Therefore, the author draws the conclusion that the compensation benefits of the hydropower to thermal power station emission reduction are extremely significant, indicating that the hydropower has made tremendous contributions on energy conservation and emission reduction.

## Keywords

Compensation Benefits, Compensation Regulation, Conservation and Emission Reduction, Hydropower Energy.

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# Design and Implementation of the 3G Technology Based Smart Meter System

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## Abstract

With the rapid development of 3G technology, the power sector is applying new smartgrid technologies to develop smartmeter capable of collecting, transmitting and managing meter data. This paper attempts to design the principles for construction of the smartmeter system, selection of communication channels and establishment of system architecture, and to test the concentrator, smartmeter, and the data acquisition and transmission system. The results are the same as expected, indicating that the smart meter system is well established to ensure data integrity and security, and that the design of the system is feasible.

## Keywords

Concentrator, 3G Technology, Smartmeter.

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# An Improved Fair Scheduling Algorithm for Smart Grid Based on Hadoop Cloud Computing Platform

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## Abstract

Grid scheduling system is the hub of the entire power system. The continuous improvement of the grid interconnection and smart grid construction bring great challenges to the existing grid scheduling system. The main challenge comes from the existing power computing platform, because the capacity of computing and storage cannot meet the development needs of the grid. In order to solve this problem, an improved fair scheduling algorithm based on the Hadoop platform is proposed in this paper. And the annealing-based strategy is used to optimize the tasks to fit the characteristics of smart grid scheduling system. Finally, with the conduct of the research process, we do some algorithm simulation experiments to verify the computational efficiency and stability of the proposed algorithm. After that, we build a Hadoop cluster based on a cloud computing platform and verify the effectiveness of proposed scheduling algorithm.

## Keywords

Cloud Computing Platform, Fair Scheduling Algorithm, Hadoop, Smart Grid.

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## Selection of Passenger Car Using Integrated Fuzzy AHP-TOPSIS Method

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### Abstract

This paper presents an application of integrated Fuzzy Analytical Hierarchy Process and Technique for Order of Preference by Similarity to Ideal Solution (Fuzzy AHP-TOPSIS) method for selection of passenger car in Indian Market. Due to convenience in financing policy and increase in average income of people in rural and urban sector of the country, the passenger car purchasing tendency increases day by day. Due to globalization of Indian economy, many multinational car manufacturers have come up with variety of models characterized by many operational and esthetic features. In multi-criteria environment ranking and selection of car has become a research issue. This paper considers various technical and operational attributes like passenger capacity, fuel tank capacity, boot space, fuel consumption, mileage, and price for selection. Fuzzy-AHP method has been used to obtain the relative weights of the criteria, on the basis of which the alternatives were evaluated using TOPSIS.

### Keywords

Fuzzy AHP, MCDM, Passenger Car Selection, TOPSIS.

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## Design & Implementation of Communication Blocks Using EDA Tools

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### Abstract

The building of low power VLSI system has emerged as significant goal in the fast technology of mobile communication and computation. The developments in battery technology have not taken place as fast as the advancement in electronic devices. So, the developers are attained with more; high speed, high throughput and at the same time, low power consumption as possible. In this paper, the importance of Electronic Design Automation (EDA) tools and HDL has been used in implementing communication blocks and system-level design methodology. Our work designed a Pseudo-random Noise (PN) sequence/code generator with a finite length. PN sequence generators are applicable in spread spectrum systems. The performance of a pass transistor having low-power consumption and low propagation delay are dealt here for the implementation of modern digital design systems. The simulation results of the sample-and-hold is observed at different frequency for designing of unique switched-capacitor building blocks. Our work has contributed an extensive simulation at low frequency for designing of discrete time system where storage of data plays a significant role. This often greatly relaxes the bandwidth requirements of following circuitry which now can work with a DC voltage. Adder's circuitry has also been designed with minimum pass transistors and its transient output has been simulated.

### Keywords

EDA, HDL, Low Power Design, PN Sequence, Sample and Hold.

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# Real Time Digital Simulation Based Fault Diagnosis of Induction Machine Using Sample Shifting Technique

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## Abstract

In this paper, an approach for diagnosis of different Induction machine faults using state-of-the-art Sample Shifting Technique (SST) based sequence component analysis is done. The proposed method relies only on the instantaneous samples of current signals. The working of the method is simulated by modeling three phase induction machinery system and creating different kinds of faults with the help of Real Time Digital Simulator (RTDS) unit. The simulated three phase analog signal output from the RTDS cubicle is interfaced with the Labview based data acquisition system (DAS). Labview DAS samples the input signals simultaneously to provide the instantaneous data set and from these data set the positive and negative sequence components have been calculated by SST. The magnitudes of symmetrical components have been used to detect the type of fault. A KNN based fault detection algorithm is made to identify the fault. From the results of proposed algorithm, it can be shown that the proposed algorithm is reliable for induction machine protection purpose.

## Keywords

Fault Diagnosis, KNN, Real Time Digital Simulator (RTDS), Sample Shifting Technique, Symmetrical Components, Three Phase Induction Machine.

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# Study on Fabry-Perot Microstrip Antenna Based on Near-Zero-Refractive-Index Metamaterial

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## Abstract

This paper proposes a high-gain Fabry-Perot microstrip antenna based on the near-zero-refractive-index metamaterial (NZRIM). Specifically, the NZRIM is placed right above an ordinary rectangular microstrip patch antenna at the distance of 7.3mm, the Fabry-Perot cavity is formed by the metallic ground plane and the NZRIM superstrate, and the finite element method (FEM) is adopted to study the characteristics of the proposed antenna. XFDTD, which is commercial electromagnetic software based on the finite difference time domain (FDTD), is also used to simulate and calculate the gain of the proposed antenna. The results indicate that the realized gain of the proposed antenna is about twice as high as the gain of ordinary antenna, the proposed antenna has a flatness high-gain in the predicted frequency band, and the return loss of the proposed antenna is relatively small in the certain band. In addition, the proposed Fabry-Perot antenna based on NZRIM has low sidelobe and backlobe. In short, the research provides a new design method for high-gain and high-directivity antennas.

## Keywords

Gain, Microstrip Antenna, NZRIM, Fabry-Perot, Directivity.

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# The Construction and Realization of Big Accounting Data Analysis System Based on Cloud Computing Platform

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## Abstract

This paper expatiates on the theoretical basis and technical support of constructing a big data analysis system based on cloud computing platform. After analyzing the status quo of the existing accounting information system, the author uses cloud computing and other technologies to build up an accounting information system centered on big accounting data analysis, designs its overall framework, and establishes related mechanisms to acquire, process, store, interpret, output and secure big accounting data. Taking a conglomerate as an example, the author evaluates the application effect of the system based on cloud computing platform. The results showcase the superiority of the proposed system.

## Keywords

Accounting Information System, Analysis Platform Construction, Big Data Accounting, Cloud Computing.

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# A Pedestrian Detection Method Based on Rapid Cascade Classifier

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## Abstract

Image processing and machine vision research are necessary, pedestrian detection is often applied in the field of video surveillance and smart vehicles. However, the pedestrian images obtained by traditional methods (e.g. frame difference and training classifier) are vulnerable to the background noises, and have some unavoidable flaws, such as low accuracy rate, algorithm complexity and poor real-time pedestrian detection. Against this backdrop, this paper develops an improved frame-difference method to obtain the pedestrian movement information, uses histogram coordinates to divide the movement region, and detects and recognizes the motion area by training a double feature cascade classifier. Experimental results show that the method reduces the probabilities of false and miss detection, shortens the average detection time by 32.77ms, and increases the average detection accuracy by more than 10%. Hence, the proposed method succeeds in improving the recognition accuracy and speed effectively.

## Keywords

Cascade Adaboost, Extraction, Improved Frame Difference, Multi-feature, Particle Filter, Pedestrian Detection and Identification, Pedestrian Tracking.

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# An Improved Proportional Resonant Control Strategy Used in Electromagnetic Transmitter

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## Abstract

With the aim to improve the power factor and power density of electromagnetic transmitter, and make the transmitter smaller in size and lighter in weight, this paper puts forward a novel electromagnetic transmitter circuit based on permanent magnet synchronous generator (PMSG) PWM. To enhance the control precision and reliability of the system, a frequency variable resonance controller is arranged in parallel with conditional proportion controller to form a proportional resonant (PR) controller in the coordinate. Following the proposed strategy, the PR controller resonates at fundamental frequency of input current to obtain a high gain; and the main reference current generated by the PI controller serves as the reference active power current. Based on theoretical analysis, a step by step design procedure is proposed, and an improved Tustin transformation is employed to discrete the PR controller. Finally, simulation and experimental results are presented to validate the feasibility of the transmitter circuit and correctness of the control strategy.

## Keywords

Digital Implementation, Electromagnetic Transmitter, Permanent Magnet Synchronous Generator (PMSG), Proportional Resonant (PR) Control.

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# Research on Personalized Recommendation Algorithm in E-Commerce Based on Hybrid Algorithm

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## Abstract

With the rapid development of e-commerce, personalized recommendation technology has been gradually adopted by major Internet companies. Researchers are increasingly concerned about how to make better use of network data, how to fully mine out massive data information, and how to design more personalized recommendation for different users. In order to improve the accuracy of personalized recommendation, this paper proposes a hybrid recommendation algorithm based on the collaborative filtering algorithm and content-based algorithm. Firstly, this paper briefly introduces the definition, classification and related algorithms of personalized recommendation technology. Secondly, this paper describes the content-based recommendation algorithm and collaborative filtering algorithm. Thirdly, the author expounds the process of integrating two recommendation technologies. In the end, the hybrid recommendation method proposed in this paper is verified by the MAE (mean absolute error). The results show that the hybrid recommendation algorithm has better recommendation accuracy than content-based algorithm and collaborative filtering algorithm in specific environment.

## Keywords

Electronic Commerce, Hybrid Recommendation, Personalized Recommendation.

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# Single-hidden Layer Feedforward Neural Network for Classification of Uncertain Data Based on Node Importance

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## Abstract

Uncertain data exists in various applied fields. However, the mining of uncertain data is far from enough because the traditional mining methods only take the certain data into account. In light of this, this paper proposes the single-hidden layer feedforward neural network for classification of uncertain data based on the node importance. Firstly, the author applies the probability density to dispose of uncertain discrete and continuous attributes, and provides a method for calculating the probability density. Secondly, this paper introduces the single-hidden layer feedforward neural network for classification of uncertain data, and develops its structure method based on the cross-entropy cost function. Finally, the measurement method of the node importance is introduced, and all unimportant nodes of the input and hidden layer are pruned one by one on the basis of the node importance until the termination conditions are satisfied. The experiment results show that the proposed method is effective and feasible for the classification of incomplete data, and can dramatically save time.

## Keywords

Cross-Entropy Cost Function, Feedforward Neural Network, Node Importance, Uncertain Data.

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# Research on Cross-Layer QoS Protocol for Wireless Sensor Networks with Low Duty Cycle

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## Abstract

In order to reduce the packet loss in data transmission of wireless sensor network (WSN), it is necessary to optimize the cross-layer QoS security protocol. Considering the high duty cycle of the current TDMA protocol, this paper proposes an optimized design of cross-layer QoS protocol for WSN based on efficient TDMA dynamic slot allocation. Specifically, the author builds a distributed cooperative scheduling channel model for WSN, adopts the congestion control strategy for the equalization of the data transmission channel in the WSN, assigns an adaptive weight to the timeslot at each time frame node, and realizes the minimum-contention dynamic timeslot allocation of the channel occupancy probability, aiming to complete the design of the cross-layer QoS protocol. The simulation results show that the application of the proposed cross-layer QoS protocol in WSN data transmission lowers the duty cycle of the network channel, effectively reduces the packet loss rate, and improves the utilization rate of the channel.

## Keywords

Channel, Duty Cycle, Protocol, QoS, Wireless Sensor Network.

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# Research on Optimization Method of Power Communication Based on Topological Algorithm

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## Abstract

With the expansion of power communication network, the network is getting more and more complex and capable of withstanding load. In order to ensure the security and stability of the complex network, this paper proposes an optimization method based on complex network topology network. The method optimizes the network by rational addition of effective lines through identification and analysis of the vulnerabilities in the power communication network. It is capable of improving the defense ability of the network, increasing the broadband utilization, reducing the congestion rate and delaying the sudden drop in performance. Finally, the effectiveness of the proposed method is validated with an example.

## Keywords

Complex Network, Optimization, Power Communication, Topology Algorithm.

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# The Application for Image Feature Extraction by SURF Based on OpenStack Cloud Architecture

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## Abstract

SURF is a feature extraction method based on SIFT. It is more robust and efficient than SIFT in image feature extraction. However, SURF is extremely inefficient in feature matching for images with rich texture. Due to the great number of features, much more time is consumed in the process of feature description and feature matching. In order to improve the computing efficiency, this paper deploys the SURF algorithm on the OpenStack-based cloud computing platform, allocates computing nodes dynamically by using the Nova and Swift components, and assigns the computational load to each computing node. In this way, the problem of low computational efficiency of feature extraction by SURF can be solved effectively. Finally, two image pairs are used in the experiments. The experimental results show that the SURF based on OpenStack architecture has the same accuracy as the original SURF algorithm. Furthermore, the computing efficiency is up by about 10%, and the CPU load decreases by nearly 30%.

## Keywords

Image Feature Extraction, OpenStack Cloud Architecture, SIFT.

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# Design and Implementation of Geographic Information Sharing Platform Based on Web Services

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## Abstract

As a basic information source, the geographic information has been extensively applied to such fields as commerce, transportation, and military. However, there are still many problems to be resolved, especially in terms of information sharing. Taking Google maps as the base map and Google Maps API as the development framework, this paper designs and implements a Web Services-based geographic information sharing platform in the .NET platform following the browser / server (B/S) architecture. It is verified that the platform satisfies the needs of diversified and personalized service with abundant intuitive geographic information resources.

## Keywords

Google Maps, Geographic Information, Sharing Platform, Web Services.

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# Application of the Parallel LSSVM Algorithm Based on Hadoop Platform in Real-time Traffic Flow Prediction

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## Abstract

As an important research topic in the field of intelligent transportation, real-time traffic flow prediction is of great significance to urban transportation planning and construction. In order to improve the traffic situation, one of the main tasks lies in promoting the prediction accuracy of the real-time traffic flow. The LSSVM algorithm is known for its good performance in traffic flow prediction. However, the prediction on a single processor requires a long training time and goes against the actual application requirements. For the purpose of meeting the real-time requirements of traffic flow prediction, this paper proposes a parallel LSSVM algorithm based on the Hadoop platform for real-time traffic flow prediction. The experimental results show that the proposed algorithm boasts high accuracy.

## Keywords

Hadoop, Prediction, Traffic Flow.

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# A Selective Ensemble Algorithm Based on Improved Teaching-learning-based Optimization for Classifying Gene Expression Profiles

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## Abstract

Due to the high dimensions and small samples of gene expression profiles, a lot of classification algorithms fail to achieve a good generalization. Therefore, this paper develops a selective ensemble algorithm based on improved teaching-learning-based optimization to classify gene expression profile. Firstly, multiple highly diversified training subsets are generated by bootstrap technology. Secondly, the hybrid approach based on Kruskalwallis and neighborhood mutual information are used to remove irrelevant genes on each training subset and to improve diversity and accuracy of subsets. Finally, an improved teaching-learning-based optimization is designed based on two aspects of the "teacher phase" and "self-learning phase" to construct a selective ensemble system. The results of simulation experiment show that the proposed algorithm has superior classification accuracy, ensemble size, stability and reliability than other ensemble algorithms (e.g., bagging, boosting and random forest, etc.) and some selective ensemble algorithms based on TLBO and MTLBO.

## Keywords

Gene Expression Profile, Kruskalwallis, Neighborhood Mutual Information, Selective Ensemble Classification, Teaching-learning-based Optimization.

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# A Novel Reconfigurable Hardware Architecture of Eclat Algorithm with Extension Calculation Mode

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## Abstract

The frequent itemset data mining algorithm Eclat, which is based on vertical data format, was analysed at the algorithm level and from the characteristic of data stream. Subsequently, a novel edge extension calculation mode was proposed. Based on the analysis of data dependencies, the corresponding parallel computing mode and a mapping strategy for large-scale problems on certain hardware architecture were proposed, in accordance with the novel mode of edge computing. At the same time, an asymmetric 2-d PE (Processing Element) matrix architecture was designed to implement the computing mode in parallel. The analysis result shows that edge computing simplifies hardware implementation of the frequency itemset data mining based on vertical data format and that the parallel degree of the algorithm increased significantly under the constraint of external single port storage. The test result shows that compared to the serial software implementation, the architecture with 21 PE can compute 6 edge items in parallel and reach a speed up to 10.42, showing a better performance than other related works.

## Keywords

Big Data, Data Mining, Eclat Algorithm, Reconfigurable Hardware Architecture.

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# Design and Implementation of Computer-network-based Background Music Monitoring System Software

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## Abstract

In this paper, based on the Internet remote monitoring system, we design a background music monitoring system that integrates GPS and GSM technologies as a whole. This system is a one-to-many distributed remote monitoring system. Through the interconnection with about a hundred audio controllers, it can realize all the monitoring functions, such as audio monitoring, fault self-diagnose and audio control. In this paper, we complete the following work: (1) overall design and composition of the background music monitoring system; (2) analysis on relevant issues in the design of the monitoring centre software for this system; (3) design and compilation of the monitoring centre software, including its interfaces, GSM and GPS functions and database.

## Keywords

Database, NET, Remote Monitoring, Socket.

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# Development and Application of English Teaching System Based on Internet Technology

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## Abstract

According to practical college English teaching construction demand, this paper designs and develops a network English multimedia teaching system on the campus network platform, for which we use the B/S model of J2EE technology and the software engineering method. This paper also completes preliminary teaching practice. The practical results indicate that this system is of great help for improving students' English ability and promoting English teaching in colleges and universities.

## Keywords

English Teaching, Internet Technology, J2EE, Multimedia, Teaching System.

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# Research on the Principles of Multi-element $\alpha$ Resolution Based on Lattice-valued Propositional Logic System LP(X)

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## Abstract

This paper digs into the validity of the principles of multi-element  $\alpha$  resolution based on lattice-valued propositional logic system LP(X) and the basic principle of the dynamic change in the generalized literals involved in the deduction of multi-element  $\alpha$  resolution. This paper also explores some of the principles of the dynamic change in the number of generalized literals involved in the deduction of multi-element  $\alpha$  resolution. The research lays the foundation for the establishment of the multi-element  $\alpha$  resolution approach based on the principles of multi-element  $\alpha$  resolution, and points out a potential way for improving the efficiency of automatic reasoning.

## Keywords

Lattice Implication Algebra, Lattice-Valued Propositional Logic, Principles of Multi-Element A Resolution.

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# Application of Improved FCM Algorithm in Moving Object Detection

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## Abstract

With the rapid development of computer intelligent technology, many scholars are highly interested in the research field of video surveillance of moving target detection and tracking. In addition, moving object detection and tracking is widely used in aspects like military, industrial control, and intelligent transportation. With the rapid progress of economy and society, the traffic regulation becomes more complex. And the real-time detection of vehicles on the road, the illegal vehicle monitoring and effective surveillance of the illegal vehicles, etc. become popular research issues. Because of the complexity of the moving vehicles in traffic video, the author proposes the improved algorithm for moving target detection and tracking which is a modified version of FCM algorithm by combining it with the genetic algorithm. Our algorithm works with Kalman filtering algorithm for target tracking and detection. The experimental results show that the improved algorithm has much more advantage than other clustering algorithms in the feature of optical flow. This algorithm also achieves good experimental effect in improving the accuracy of clustering and calculating the more accurate number of targets and moving vehicles which can be effectively tracked.

## Keywords

Improved FCM, Kalman Filtering, Moving Object Detection.

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# Research on Image Recognition and Processing Based on BP Neural Network

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## Abstract

The promotion and application of image recognition technology are restrained by the defects of traditional image recognition methods in terms of the feature extraction of images. Featuring high uncertainty and aimlessness, the traditional methods are unable to determine how to express and extract features or how many features are needed. In view of these defects, this paper proposes a method of image recognition and processing based on BP neural network, and carries out a simulation analysis to test its actual recognition performance. It is found that the method can improve the accuracy of image recognition through multiple iterations. The ensuing case study reveals that the application of BP neural network in image recognition greatly improves the recognition speed and accuracy and will become a development hotspot in the field of image recognition.

## Keywords

Artificial Intelligence, BP Neural Network, Edge Detection, Image Recognition.

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# Research on an Improved PMJ Cognitive Computation Model

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## Abstract

In order to correct the shortcomings of PMJ cognitive computation model, this paper proposes an improved PMJ cognitive computation model by replacing the stimulus information in the PMJ cognitive computation model with single fuzzy cognitive unit event, and representing the perception, memory and judgment, respectively. Moreover, this paper carries out psychological experiments and cognitive computation experiments based on the improved PMJ cognitive computation model, and compares the results of the two types of experiments. The experimental results show that the improved PMJ cognitive computation model has strong cognitive function and good representation effect, rendering it an ideal cognitive computation model for artificial intelligence and cognitive science research.

## Keywords

Brain Models, Cognitive Computation, Cognitive Systems, Memory Architecture, Perception.

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# Equipment Scheme Assemblability Based on Membership Degree of Extension

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## Abstract

The assemblability of complex equipment design plan is limited by various factors. What is worse, the assemblability analysis is fuzzy and uncertain as it combines quantitative and the qualitative analysis. For better analysis of the assemblability of the plan, this paper proposes an optimization model based on membership degree of extension. This model analyzes the influencing factors of assemblability and constructs an optimization index system. By standardizing different categories of optimization indices and setting up an ideal extension domain, the author manages to establish an extensive correlation function model and extension superiority model based on extension positive domain and extension negative domain. The optimal plan is selected according to the extension superiority of the optimization index of assemblability. In the end, the efficacy and the practicability of the model is proved by a detailed design plan for complex equipment.

## Keywords

Assemblability, Complex Equipment, Extension Theory, Multiple Attribute Decision Making, Optimization Model.

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# Design of Straw Counters-field Compound Machine

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## Abstract

The straw counters-field compound machine is designed to resolve the straw and root stubble problems in modern agricultural producing. However, conventional straw counters-field machine can only bury the straw and root above the ground rather than bury all of them deep into underground, which may hinder secondary tillage operation and the stubble decay. In view of this phenomenon, this paper combines the reverse spiral rotary cultivator, ditcher, disc harrow, covering plough and other components with conveyor chains and press wheel to develop a new compound machine which realizes both conservative shallow tillage and deep burying and achieves straw counters-field and other effects. Through field verification, the author draws the following conclusions: the proposed straw counters-field compound machine can bury 90% of surface straw and stubble to 10 cm below the surface; the power consumed in both deep burying and conservative tillage is similar to that consumed by plowing in 15 cm deep tillage; the proposed machine is capable of turning 4 batches in one time, compatible with agricultural irrigation and waterlogging prevention measures, and in favor of water conservation and straw decay; the late sowing and field management should be performed in consideration of the wavy shape of the plowed field.

## Keywords

Agriculture, Compound Machine, Conservative Tillage, Straw Returning.

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## Research on Optimal Scheduling of Logistics Vehicle Based on Improved Ant Colony Algorithm

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### Abstract

This paper studies vehicle scheduling based on ant colony algorithm, and conducts an empirical analysis of TSP with the aid of basic ant colony algorithm. The ant colony algorithm is introduced and improved from three aspects. Taking vehicle scheduling with time window as an example, the author compares the improved ant colony algorithm and the basic ant colony algorithm, and proves the effectiveness of ant colony algorithm.

### Keywords

Improved Ant Colony Algorithm, Logistics Vehicle, Optimal Scheduling, Traveling Salesman Problem.

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## A Study on Resource Allocation Optimization of the Port Multimodal Transport Operation System Based on the Queuing Theory

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### Abstract

This paper establishes a queuing network model for the multimodal operating system that involves ships at port, trains and external trucks. The configuration and the structure of the original operating port resources are reconstructed and optimized on the premise of meeting the requirements of port operation, and the validity of the simulation model proposed in this paper is verified through comparisons with the example. The findings show that the proposed simulation system, which embeds the DSO algorithm and the distributed optimization structure of the high-level architecture into the queuing model to improve the modeling efficiency, repeatability and interoperability, fairly meets the DSO algorithm's requirements for the multi-node parallel implementation. DSO algorithm and CSO algorithm have the same calculation accuracy in terms of the overall system operation, resource allocation and other aspects. With the increase in the number of nodes, the running time of DSO is significantly cut down, and the acceleration ratio markedly increases. The simulation results show that, compared with the original scheme, resources in the optimization scheme, including ship berths, entry and exit passageway and train loading and unloading lines, are decreased by different amount. The utilization ratio of different resource allocation is 6.32% higher than that of the original scheme. The optimization scheme reduces the total time-at-port for ships, trains and external trucks by 23.1% on average, and cuts the mean waiting time by 46.5% on average.

### Keywords

Container Port, Multimodal Operating System, Optimal Resource Allocation, Simulation Optimization.

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# Construction and Study of Cold Chain Logistics System Model for Fresh Food

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## Abstract

This paper makes a reasonable optimization of the time and temperature of cold chain logistics system for fresh food, identifies the relationship among logistics cost, circulation time and food quality through modeling, optimization and simulation of cold chain logistics system for fresh food, and obtains the optimal target value of three combinations through multi-objective planning. The research is of practical significance for solving the problems of food safety hazard, food waste and high logistics cost in cold chain logistics.

## Keywords

Fresh Food, Food Cold Chain Logistics, Food Safety, Logistics Cost.

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# Simulation of Container Terminal Logistics System Scheduling Based on Multi-agent and PID Control

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## Abstract

This paper attempts to build a model for the container terminal logistics system (CTLS) based on multi-agent computation and computer architecture, incorporate PID control algorithm into the optimized CTLS model, and perform analysis on the production scheduling of the logistics system. Taking the operation of a large container terminal as an example, the author performs comprehensive evaluation and calculation of indicators like port handling capacity, number of ships waiting for operation, number of containers to be unloaded and container throughput. The research results show: when the container terminal is overloaded by 55%, the scheduling strategies under both the optimized and traditional models are able to complete the logistic operations at the port smoothly, the number of ships waiting at the port is below 5, and there are only a few containers awaiting operation; when the container terminal is overloaded by 140%, the container through put and the carrying capacity of ships are only slightly increased, while the number of ships held up at the port and that of containers awaiting operation are dramatically increased, and the service capacity of the container terminal production logistics system reaches its critical point, i.e. overloaded by 100%; under the traditional algorithm, the average delay time per task for a ship is 28.8hrs, while that under the optimized algorithm is only 16.91hrs, but the carrying capacities of ships under the two strategies are almost the same. Under the optimized strategy proposed in this paper, the number of ships waiting can be significantly reduced. With 8 berths, the average number of ships waiting is 2.9, while under the traditional strategy, the number is 3.9. The container throughput under the optimized algorithm based on 8 berths is greater than that under the traditional one.

## Keywords

Container Terminal Logistics System, Decision-Making, Multi-Agent Computation, PID Control, Scheduling.

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# Disruption Management for Vehicle Routing Problem Based on Improved Seed Optimization Algorithm

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## Abstract

Based on customer relationship management and customer value, this paper gives an extensive research on logistics distribution disruption management. According to the idea and method of disruption management, our model measured the deviations from the following three aspects: customers, logistics enterprises and logistics staffs. This paper modifies the immune algorithm into a seed optimization algorithm (ISOA) that designs an adaptive mechanism to extract the feature information and the location of the vaccine. Then, by means of simulation experiment and the comparison with particle swarm optimization algorithm, the simulation result shows that the improved seed optimization algorithm can not only obtain optimal solution, but also improve the efficiency of the original algorithm.

## Keywords

Vehicle Routing, Customer Value, Disruption Management, Improved Seed Optimization Algorithm.

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# Research and Evaluation of Operating Room Scheduling and Optimization under the Parallel Machine Model

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## Abstract

Focusing on the scheduling and optimization problem of Chinese huge public hospital's operation room base on the parallel machine mode scheduling theory, we build a parallel machine model for the operating room scheduling and optimization. It further discusses the impacts of emergency operations on the scheduling strategy of scheduled operations, designs a genetic algorithm to optimize scheduling and then performs empirical analysis on the algorithm by using small cases with a large public hospital H as the example. The research result shows that the operating room scheduling plan obtained under the parallel machine model makes the use of operating rooms more balanced and satisfies the constraints of resources like surgeons and operating rooms. Meanwhile, when an emergency operation arrives, it can prioritize it. Therefore, the parallel machine model can provide optimized operation scheduling strategies.

## Keywords

Operating Room Scheduling and Optimization, Parallel Machine Model, Production Scheduling.

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# Supply-Chain Scheduling with Proportional-Linear Deterioration

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## Abstract

In this paper, we consider the supply-chain scheduling with proportional-linear deterioration, in which the processing time of each job is  $p_j=b_j(A+Dt)$  and the jobs are delivered to customer in batches. Our objective is to minimize the maximum completion time plus the total delivery cost or the total completion time plus the total delivery cost. We first present polynomial time algorithms for two single-machine problems. Then we prove that the two-parallel-machine problem is binary NP-hard.

## Keywords

Dynamic Programming, Proportional-Linear Deterioration, Scheduling.

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# Research on the Model of Smoke Plaque Extraction Based on Edge Detection and Watershed Segmentation

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## Abstract

Fire and explosion in oil depot often causes severe smoke pollution that affects a large area. However, conventional ground monitoring methods fail to meet the requirements of detecting large-area smoke pollution. Despite the lack of research on large-scale fire smoke information extraction from space remote sensing images, space remote sensing is a possible way for detecting oil depot fire smoke pollution thanks to its ability to extract target information in large scale. Taking the oil depot fire in Jingjiang, Jiangsu Province, China as an example, this paper sets up a model for the extraction of smoke plaque based on the panchromatic image data of Landsat 8 satellite. Specifically, the canny operator is introduced to detect the edge information of the model, the same gray level neighborhood merging algorithm is proposed to overcome the over-segmentation of watershed segmentation algorithm, and the extraction results of smoke plaque are obtained by wavelet reconstruction. The results prove the significant practical value of the model as it can effectively extract the information of smoke plaque.

## Keywords

Canny Algorithm, Oil Depot Fire, Region Merging Algorithm, Smoke Plaque, Watershed Segmentation.

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# Assessing Ecological Impacts of Urban Sprawl Based on a Modified Ecological Connectivity Model on Regional Scale

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## Abstract

Habitat fragmentation is one of the primary causes of biodiversity loss in metropolitan area. The key to maintain regional biodiversity and secure critical habitat under the pressure of continuous development lies in the regional ecological connectivity assessment in fragmented metropolitan areas. This paper assesses the ecological connectivity in Zhengzhou-Kaifeng metropolitan area and analyzes the temporal and spatial changes from 1987 to 2014. The research area is studied with a modified ecological connectivity model based on Geographic Information System (GIS) and mathematical language. The research finds that the Ecological Function Areas (EFA) has been declining from 1987 to 2014 under the significant influence from urban sprawl. The ecological connectivity maps are generated to help identify spatial change of ecological connectivity patterns affected by urbanization in this area. The research provides land use planners with a spatial guidance to minimize the influence of construction land expansion on the regional ecological connectivity, which in turn contributes to regional sustainability. According to the research, the ecological connectivity assessment should be integrated into planning and design strategies to overcome the neglect of the ecological processes in traditional land use planning or urban planning.

## Keywords

Cost-distance Model, Ecological Connectivity, GIS, Urban Sprawl, Zhengzhou-Kaifeng Metropolitan Area.

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# Urban Thermal Environment Analysis of Kunming in Winter

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## Abstract

Kunming is a plateau city at low latitudes. The city is known for the slight seasonal temperature variation and significant diurnal temperature difference. This paper tests the thermal environment of Chenggong district in Kunming by mobile observation method and simultaneously modifies the air temperature data to generate air temperature contour maps. Specifically, the author quantitatively analyzes the distribution characteristics of thermal environment in winter, and, on this basis, explores the main factors that affect the thermal environment. According to air temperature contours in Chenggong, the nocturnal heat island intensity is 1.2 °C on January 14<sup>th</sup> and 2.3 °C on January 15<sup>th</sup>. High temperature areas mainly include the university town, commercial district and intensive low-rise building area, while the low temperature areas mostly appear in Dianchi Lake and its surrounding areas. Most of the nocturnal high temperature areas are located close to the university town, the municipal governmental areas and the low-rise construction area nearby. It can be seen that the maximum temperature of the region is about 1.6 °C higher than the lowest temperature during night. In contrast, the low temperature areas are mainly located in the provincial highway, the construction land and the reservoir areas, indicating that the daytime high temperature is mainly affected by solar radiation and building density. The main influencing factor of nocturnal temperature without solar radiation is artificial heat releases. In places with poor heat dissipation capability and intensive night activities, the high temperature at night coincides with that at daytime.

## Keywords

Low Latitude Plateau, Mobile Observation, Urban Thermal Environment.

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# Rural Residents' Acceptance of the Clean Energy Technology in Daxing District of Beijing

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## Abstract

Serious air pollution in Beijing has threatened the health of the inhabitants. The Beijing municipal government plans to enforce Action Plans to reduce the PM<sub>2.5</sub> concentration to 60 $\mu\text{g}/\text{m}^3$  by the end of 2017. Since coal burning is highly correlative with PM<sub>2.5</sub> emission, the goal to reduce household coal burning is supposed to be realized by the 'Project of changing the heating fuel from coal to natural gas/electricity'. When expanding this project from urban to rural area, the management should take social acceptance into consideration. The Technology Acceptance Model is adopted to analyse the determinants that influence social acceptance of the clean energy technology. The results indicate that the prior concerns of rural residents are the cost and government subsidies of the clean energy consumption, followed by issue of the effectiveness of the technology device. Since the 'perceived usefulness' of clean energy technology is well understood by rural residents, the 'perceived ease of use' appears more influential on the residents' intention to use clean energy technology devices.

## Keywords

Clean Energy Technology, PM<sub>2.5</sub> Emission Reduction, Rural Residents' Acceptance, Technology Acceptance Model.

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# Evolution Model and Simulation of Industrial Cluster Innovation Network Based on Complex Network

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## Abstract

This paper analyzes the connotations, network node composition, and network relation characteristics of the industrial cluster innovation network system. In light of the complex network characteristics of industrial cluster innovation network system, an evolution model of industrial cluster innovation network is constructed based on weighted scale-free network. Besides, the numerical simulation method is used to simulate the evolutionary structural characteristics of the industrial cluster innovation network under different stages, and the influence of government intervention on the evolution of industrial cluster network. The simulation results reveal that government intervention is conducive to the rapid, stable development of the cluster innovation network, and the level of government intervention has an impact on the clustering coefficient and the average shortest path of the cluster.

## Keywords

Industrial Cluster, Innovation Network, Numerical Simulation, Weighted Scale-Free Complex Network.

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## Research on Cellular Automata Simulation of the Optimal Design for Toll Plaza Exit Lanes

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### Abstract

In order to solve traffic problems of toll plaza, this paper uses discrete element method to simulate the movement of the vehicle from the multiple toll lanes to the fewer highway lanes after the toll plaza. Since it is very costly and ineffectively to solve traffic problems by increasing the number of toll lanes, this paper attempts to simulate the movement of car from B toll booths to L highway lanes by NaSch cellular automaton. It is discovered that for a given number of highway lanes, the transition rate and the optimal number of toll booths are the key factors. Based on the above assumption, the author develops a macro framework of the plaza design in consideration of cost and security constraints. Besides, on the premise of minimizing system cost and adjusting the throughput of different charging systems, the author acquires the best performance of the toll plaza by simulating the traffic throughput and speed at different types of ETC/MTC toll stations.

### Keywords

Cellular Automaton, Charging Solution, Driving Behavior, Toll Booth.

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## A Study on the Allocation and the Utilization of Community Sports Facilities Based on Big Data Analysis

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### Abstract

Thanks to the progress of urbanization and the development of the mass fitness program, the urban citizens in China are increasingly aware of the importance of keeping fit. The phenomenon is accompanied by the popularization of community sports through the effective allocation and the comprehensive utilization of urban social sports facilities. Based on the big data analysis, this paper digs deep into the situation of community sports facilities in Harbin. The results demonstrate that most of the public sports facilities in Harbin communities belong to the local sports department, and the majority of the residents view the sports facilities as better-than-average. Besides, the community residents choose to participate in sports activities in a variety of venues. Next, the analytic hierarchy process is used to evaluate the allocation and the utilization of the community sports facilities. This paper is wrapped up with good comprehensive evaluation results based on the comprehensive values of the allocation and the utilization of community sports facilities in Harbin.

### Keywords

Allocation and Utilization of Sports Facilities, Analytic Hierarchy Process, Big Data, Comprehensive Evaluation.

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# Research on the Campus Football Development Evaluation under the Background of the Revitalization of Chinese Football

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## Abstract

As an important reserve force of football, campus football lays the basis for football development in China. The development level of campus football has a significant impact on the realization of the national strategy of "revitalizing Chinese football". The evaluation of campus football development not only reveals the problems in the evaluation process, but also helps improve the development of campus football with the aim to achieve the desired evaluation results. In light of the above, this paper puts forward an improved AHP method to evaluate the development of campus football towards the goal of revitalizing Chinese football. The development level is evaluated by the combination of the AHP and clustering. The experimental results show the superiority of the proposed method.

## Keywords

AHP, Campus Football, Evaluate.

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# Research on an Improved Evaluation System of College Students' Work and Its Evaluation Model Based on Grey Relational Analysis

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## Abstract

As a key component of higher education, the college students' work provides the basic condition and guarantee for cultivating high-level talents. It plays an important role in promoting the comprehensive ability training of high-level talents. There are many factors involved in the assessment of students' work in colleges and universities. The assessment is a complex system analysis project in need of comprehensive analysis of various factors. This paper analyzes the current situation of students' work in colleges and universities, and points out its shortcomings. Summing up the limitations of the current work assessment of higher education institutions, the author improves the work evaluation system of colleges and universities, and establishes a new system of college students' work evaluation from the perspectives of society-universities and colleges-students, aiming to improve the credibility of the assessment results. Based on Grey system theory, the author conducts a Grey relational analysis, constructs a measurement model of student work evaluation in colleges and universities, and realizes the quantitative analysis of examination results.

## Keywords

Colleges and Universities, Evaluation System, Grey Relational Analysis, Measurement Model, Student Work.

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# Design and Implementation of Internet Financial Transaction Risk Identification System Based on Big Data Analysis

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## Abstract

Internet financial transactions are highly risky. In order to better manage these risks, a variety of management tools need to be used. In this paper, based on big data analysis, we establish a risk identification method to identify and manage such risks. In the course of the research, we analyse the relationships between users' consumption, social contact and the corresponding credit types. Based on the training set, we establish a corresponding neural network model and a random forest model and, then, perform verification analysis on the test set data to prove that the prediction function of the neural network can meet the requirements. Finally, we discuss the advantages and disadvantages of the Internet finance risk identification method, and put forward suggestions on the establishment of the Internet finance risk system based on our research findings.

## Keywords

Data Mining, Internet Finance, Risks, Risk Identification Method.

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# Comprehensive Evaluation and Analysis on Spoken English Based on Computer Speech Recognition Technology

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## Abstract

Spoken English learning has always been the largest obstacle to the English communicative competence of Chinese students. This paper adopts the in-depth learning method based on computer-aided speech recognition technology to achieve the automatic speech recognition of spoken English and to overcome the defects of spoken speech evaluation in the traditional mode such as fairly high subjectivity and low evaluation efficiency. Meanwhile, the evaluation method of the traditional computer-aided spoken speech quality has been improved, and multi-parameter indicators such as accuracy, speed, rhythm and intonation have been taken into account. Through the establishment of the objective and efficient spoken English speech recognition and evaluation model, we are able to provide true and credible evaluations and timely feedback guidance for learners. The research results effectively guide learners to study spoken English, which uplifts the existing level of spoken English learning in China.

## Keywords

Computer Speech Recognition, In-depth Learning Method, Multi-parameter Index, Speech Recognition and Evaluation Model, Spoken English.

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# Comprehensive Evaluation and Analysis on Spoken English Based on Computer Speech Recognition Technology

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## Abstract

Spoken English learning has always been the largest obstacle to the English communicative competence of Chinese students. This paper adopts the in-depth learning method based on computer-aided speech recognition technology to achieve the automatic speech recognition of spoken English and to overcome the defects of spoken speech evaluation in the traditional mode such as fairly high subjectivity and low evaluation efficiency. Meanwhile, the evaluation method of the traditional computer-aided spoken speech quality has been improved, and multi-parameter indicators such as accuracy, speed, rhythm and intonation have been taken into account. Through the establishment of the objective and efficient spoken English speech recognition and evaluation model, we are able to provide true and credible evaluations and timely feedback guidance for learners. The research results effectively guide learners to study spoken English, which uplifts the existing level of spoken English learning in China.

## Keywords

Computer Speech Recognition, In-depth Learning Method, Multi-parameter Index, Speech Recognition and Evaluation Model, Spoken English.

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# Analysis of the Degree of Correlation between Enterprise Strategic Risk and Economic Benefit Based on PLS Regression Equation

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## Abstract

This paper comprehensively examines the relationship between enterprise strategic risk and economic benefit. Firstly, this paper classifies the strategic risks and identifies the corresponding quantifiable indices. Secondly, the author uses the partial least squares (PLS) theory to construct the econometric model of strategic risk and economic benefit. Finally, with several photovoltaic power generation enterprises as examples, this paper employs the PLS regression equation to test the data of each sample enterprise between 2013 and 2015, and analyzes the influence of risk indices on the corresponding economic benefits of the enterprises.

## Keywords

Economic Benefit, Partial Least Squares Method, Strategic Risk.

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# Simulation Research on Evolutionary Game of Personnel Safety Evacuation

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## Abstract

Based on the cellular automaton method and multi-person snowdrift evolutionary game method, the simulation research is carried on personnel evacuation in emergency, and the evacuation evolutionary model based on cooperative game is constructed. The problem of evacuation under single exit and multiple exit conditions is researched by simulation experiments. The results show that the constructed model can reflect the disorder and congestion phenomenon in real evacuation, as well as can calculate the emergency evacuation time and ratio change of betrayer and cooperator in the process of evacuation. When the beneficial coefficient exceeds 0.4, under the same beneficial coefficient, the smaller the imitation coefficient  $K_p$  is, the faster the group conformity effect is produced, the more prone to cooperation, the shorter the evacuation time is; For the same imitation coefficient, with the increase of beneficial coefficient, the cooperation probability is getting smaller and the evacuation time gradually increases. When the exit is small, in order to evacuate as soon as possible, the system participants all have chosen a cooperative attitude. With the increase of exit width, the cooperation probability of evacuees in four kinds of imitation coefficients decreases, and the influence of exit's width on cooperation probability can be neglected. The optimal evacuation effect can be achieved by setting up the exit keeping probability  $P=0.4$ . The broader the visual field of the evacuees is, the more quickly the current environmental information is collected. It is suggested to develop strategies which is the most conducive to their own and to choose the right evacuation exit to escape.

## Keywords

Cellular Automaton, Choice of Evacuation Exit, Evolutionary Game, Personal Evacuation, Simulation.

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# Research on VaR Risk Measurement of Chinese Fuel Futures Price Based on HMM-GJR

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## Abstract

As an important part of the energy market, the fuel futures market plays a critical role in economic development. This paper describes the volatility of the fuel futures market by a hidden Markov model, revealing that the Chinese oil futures market shows obvious high and low fluctuation states. The HMMs are apparently suitable for the depiction high volatile state. In the meantime, this paper conducts VaR risk measurement of the fuel futures market. The results show that the HMM (2)-GJR model can illustrate the accurate return volatility of the fuel futures market and make the VaR risk measurement more effective.

## Keywords

Fuel Futures Market, HMM-GJR Model, VaR Risk Measurement.

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# PSO-based Neural Network Optimization and Its Application in Predicting Tourism Emergencies

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## Abstract

This paper optimizes the neural network based on particle swarm optimization (PSO) and applied the optimized algorithm into the prediction of tourism emergencies. The research is divided into three steps: first is introducing the principle of PSO and describing the application of the algorithm in the optimization of neural network; second is constructing a forecast model of tourism emergencies and forming training samples based on quantitative historic tourism data; third is the verification of the advantages of the algorithm through experimental comparison. It is proved that the PSO-based algorithm features better prediction accuracy and fewer training times, which provides a theoretical reference for the prediction of tourism emergencies.

## Keywords

Experimental Comparison Verification, Neural Network, Particle Swarm Optimization, Prediction Accuracy, Tourism Emergencies.

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# The Assessment Model of Fuzzy Mathematics on the Basis of Film & TV Art Industry Management

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## Abstract

In this thesis, the author regarded the film & TV art industry of Weifang as the research object. The main factors effecting the management of film & TV art industry were determined after looking over lots of reference. The assessment system of film & TV art industry management was built. AHP was used to calculate the weight of each assessment factor, by which the set was divided into five dimensions as excellent, good, general, poor, very poor. The expert group scored the second-level effecting factors, and then the assessment vector of film & TV art industry management could be obtained. According to the maximum principle to determine the assessment results of film & TV art industry management, a simulation calculation was carried out.

## Keywords

Index, Fuzzy Mathematics, Management, Membership Function, Weight.

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# Evaluation of Management Modes of Small Water Conservancy Projects Based on Gray Theory

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## Abstract

Small water conservancy projects play an important role in farmland irrigation, domestic water supply, aquaculture, and flood and water logging control. However, the projects are managed in diversified modes due to different policies and regulations, investment structures and construction eras. The key to realizing the maximum benefit of small water conservancy projects lies in the selection of appropriate management modes. For this purpose, this paper firstly constructs a gray multi-level evaluation model for the management modes of small water conservancy projects to provide the theoretical basis for rational selection of small water conservancy projects, and then evaluates the three management modes of a small rural drinking water project in Zhejiang Province, i.e. the village collective management mode, contract management mode and association management mode. The results show that the association management mode of the small rural drinking water project in Zhejiang Province has the best effects, followed in descending order by the contract management mode and the village collective management mode.

## Keywords

Management Model, Gray Multi-Level Evaluation Model, Small Water Conservancy Project.

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# Research on Sports Consumption of Community Residents in Henan Province under the Vision of Symbolic Consumption

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## Abstract

With the aid of literature review, questionnaire survey, expert interview, mathematical statistics and logical analysis, this paper summarizes the regularity of and offers suggestions on sports consumption community residents in Henan Province through the analysis of the awareness, behavior, structure, and symbolization of sports consumption of community residents in this province and the causes of symbolic consumption in sports consumption.

## Keywords

Community Residents, Sports Consumption, Symbolic Consumption.

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## Regional Economic Growth and Carbon Emissions in China: A Spatial Econometric Analysis of EKC

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### Abstract

According to the calculation formula of carbon emission, this paper measures carbon dioxide emission of provinces in China from 1998 to 2012. Based on statistical results, it analyzes the regional disparity and spatial correlation of China's carbon emission and establishes spatial panel data model to study whether the influence of long-term economic growth exerted on carbon emission presents significant non-linear feature. Results show that during the study period, carbon emission of each province is diversified. The average carbon emission of coastal province in eastern China is significantly higher than that of inland provinces. According to spatial autocorrelation *Moran's I*, carbon emission of each province has significant spatial correlation and presents a significant cluster trend. Nevertheless, spatial LISA indicates that besides spatial dependence, carbon emission also presents a significant "N" shape curve, meaning that with the continuous growth of the economy, China's carbon emissions showed an uptrend first, and then a downward tendency and finally a second rise. Therefore, the influence of economic growth on carbon emission follows a three-phase tendency, promoting primarily and curbing later.

### Keywords

Carbon Emissions, Economic Growth, EKC, Spatial Econometric.

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## Research on the Optimized Evaluation Model for Forest Carbon Sink Based on the Gray Theory

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### Abstract

Forest carbon sink is of great significance to improve the greenhouse effect and alleviate global warming. Based on the gray theory, with the forest resources in Jiangxi Province as the research object, this paper calculates the carbon sequestration statistics considering five influencing factors – timber yield, pests and mice occurrence area, afforestation area, forest calamity area and investment in forest management. A gray connection model is established based on forest carbon storage to evaluate the impacts of each influencing factor on forest carbon sink. Finally, we propose specific optimization suggestions as reference and basis for improving the ecological benefits of forest carbon sink.

### Keywords

Forest Carbon Sink, Gray Theory, Influencing Factors, Optimized Evaluation Model.

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# Research on the Prediction Model of Epidemic and Intensity of Fusarium Head Blight in Hebei Province

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## Abstract

Fusarium head blight (FHB) is one of the severest wheat diseases. It causes wheat yield loss and affects the quality of wheat. Disease prediction models will help wheat producers in reasonable decision-making on fungicide application. Based on the data of scab occurrence area, control area, yield loss and recovered yield from 1980 to 2012 provided by Hebei Provincial Plant Protection and Quarantine Station, this paper analyses the temporal and spatial evolution and distribution patterns of Fusarium head blight in Haihe Plain. In light of the historical data of FHB in Guantao County, Handan City, the author introduces the quantum genetic algorithm to the neural network training process, and establishes a quantum optimization algorithm based on neural network for the prediction of Fusarium head blight, in which the meteorological factors that influence the disease are taken as the predictive factors, and the diseased panicle rate as the epidemic degree of scab. In comparison, the quantum optimization algorithm achieves better prediction effect than the traditional BP neural network, featuring closer-to-reality results, smaller error, remarkably higher convergence precision, and significantly faster convergence speed. Besides, the proposed algorithm manages to avoid the defect of local minimization. Therefore, the neural network-based quantum optimization algorithm performs better in predicting FHB than the BP algorithm, pointing out a new direction for the prediction of Fusarium head blight.

## Keywords

Fusarium Head Blight, Neural Network, Prediction, Quantum Optimization Algorithm.

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# Study on Integrated Automation of Biological Continuous Counter-current Ultrasonic Extraction

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## Abstract

The complexity of biological continuous counter-current ultrasonic extraction poses requirements for a coordinate control of various production stages. In order to ensure the extraction efficiency of biological active ingredients and achieve the high level of integrated automation, the paper proposes a fuzzy cascade control strategy intended for overcoming strong interference and strong delay in the process of biological extraction. With the use of PCS7, Industrial Ethernet, CFC programming and WinCC configuration technology, the optimization of the control system is realized. The results verify the feasibility of the proposed method. The steadily-operating system is proved effective in overcoming interference and time delay and improving the efficiency of biological extraction.

## Keywords

CFC Program, Configuration, Continuous Counter-Current, Fuzzy Cascade, PCS7.

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## Study on Methods of GC/MS and Solid-Phase Extraction Applied to Doping Control Based on Athlete Urine

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### Abstract

In this paper, a combination of gas chromatography-mass spectrometry (GC-MS) and solid-phase extraction (SPE) method was developed to detect endogenous steroid stimulants and narcotics stimulants in urine samples of athletes. The test results showed that the results were more accurate for pre-treated samples, that the correlation coefficients of the linear equations of the five-endogenous steroid targeted compounds all reached 0.9948 and above, and that the regression was good; the extraction recovery was 92.05%-109.68%, and the relative standard deviation was not more than 3.42%. The detection results of narcotics stimulants showed that the detection limit of 5 kind of compounds were 5mg/L according to S/N=3, and the results were in accordance with the requirements of urine test. The combination of GC-MS and solid-phase extraction can rapidly and accurately detect the content of targeted steroids and narcotics in the urine of athletes and provide a preliminary screening for doping control.

### Keywords

Athlete Urine, Doping Control, GC/MS, Solid-Phase Extraction.

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## Research on Poplar 107 Biomass Allometry Growth Models

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### Abstract

Trees data collection is the basis of forestry management and forestry information, and is also the premise for simulating tree growth using computer technique. At present, new technologies and equipment products for tree shape data appear constantly. But in terms of tree biomass data, people must adopt the traditional destructive cutting and measuring method, which waste time and energy. A new estimate method on Poplar 107 biomass data is put forward in this paper, using shape data which can be obtained more easily to estimate biomass data of new branches according to different allometry growth models, and the accuracy comparison is offered in the second last section. All these allometry models can provide reference for computer simulation and growth analysis on Poplar 107.

### Keywords

Allometry, Growth Model, Poplar 107,

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