



 **Conference Program**

**2021**

International Conference on  
Applied Mathematics, Modeling and Computer Simulation  
(AMMCS 2021)

—  
**November 13rd, 2021**



**ONLINE via ZOOM**

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# Part I Online Conference Guideline

Download "ZOOM" APP via: <https://www.zoom.cn/download/>

ZOOM Link: <https://us02web.zoom.us/j/6548594952?pwd=MnkvMzdobFBKTTBZM1ZYdSs5K29odz09>

Room ID: 6548594952 Password: ammcS



## Part II Conference Brief Schedule

Saturday, November 13, 2021	
ZOOM Link:	
09:00-09:15	ZOOM Online Conference Testing
09:15-09:20	Welcome Speech
09:20-09:50	Keynote Speech 1: A Nonlinear Framework of Layered Intelligence for Video-based Recognition <i>Prof. Wenfeng Wang, Shanghai Institute of Technology, China.</i>
09:50-10:20	Keynote Speech 2: Low- and Mid-frequency Electromagnetic Field Simulation Methods and Implementation Techniques <i>Prof. Yanpu Zhao, Wuhan University, Wuhan, China</i>
10:20-10:50	Keynote Speech 3: Agent-based Modeling and Simulation for Networked Equipment Support <i>Prof. Xiong Li, Sun Yat-sen University, China.</i>
10:50-11:20	Keynote Speech 4: A New Method for Building a Discrete Counterpart to a Continuous Random Variable Based on Minimization of a Distance Between Distribution Functions <i>Prof. Alessandro Barbiero, Milan University, Italy.</i>
11:20-12:00	Oral Presentations
12:00-14:00	Lunch Break
14:00-16:30	Oral Presentations
16:30-17:00	Poster Presentation
17:00-20:00	Vote for the Presentations on the website: <a href="https://www.ammcs.org/oral_presentations">https://www.ammcs.org/oral_presentations</a> <a href="https://www.ammcs.org/poster_presentations">https://www.ammcs.org/poster_presentations</a>

## Part III Keynote Speeches

### Keynote Speech 1: A Nonlinear Framework of Layered Intelligence for Video-based Recognition



*Prof. Wenfeng Wang*

*School of Electrical and Electronic Engineering,  
Shanghai Institute of Technology, China.*

**Biography:** Prof. Wenfeng Wang is the editor in chief of International Journal of Electrical and Electronics Engineering (IJEEE) and International Journal of Applied Nonlinear Science. He is currently a full professor of School of Electrical and Electronic Engineering, Shanghai Institute of Technology. He is also the director of International Academy of Visual Art and Engineering in London and the JWE Technological Research Center in Shanghai. He has been invited as a tenured professor by IMT Institute in India and the director of Sino-Indian Joint research center of artificial intelligence and robotics. He was selected in 2018 as a key talent in Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences. He is a reviewer of many SCI journals, including some top journals - Water Research, Science China-Information Sciences, Science of the Total Environment, Environmental Pollution, IEEE Transactions on Automation Science and Engineering and etc. He served as a keynote speaker of AMICR2019, IACICE2020, OAES2020, 3DIT-MSP&DL2020, NAMSP2021 and etc. He is also the scientist in chief of several influential companies (e.g., RealMax, SLAI Lab and etc.). Professor Wang has great will to serve for interested journals and he also knows well about how to develop these journals. His belief is to work at the best for each dream.

**Abstract:** Many algorithms for multidimensional signal processing were presented in the past decades although, video-based recognition of occluded faces is still a great challenge. This research presents a new approach to tackle this challenge, which can be summarized as a “five layer intelligence”. These five intelligence layers are respectively environments sensing, active learning, cognitive computing, intelligent decision making and automatic control/execution. The experimental results are very promising and also present a new approach for other real challenges in multidimensional signal processing.

## Keynote Speech 2: Low- and Mid-frequency Electromagnetic Field Simulation Methods and Implementation Techniques



*Prof. Yanpu Zhao*

*School of Electrical Engineering and Automation,  
Wuhan University, Wuhan, China*

**Biography:** Prof. Liu was graduated from Hebei University of technology with a bachelor's degree, and in 2009, he graduated from Nankai University with a master's degree in computational mathematics. In 2010, he went to the Department of electrical engineering of Hong Kong Polytechnic University to study for a doctor's degree. In 2015, he joined the school of electrical and computer engineering of Purdue University for postdoctoral research. In May 2016, he joined the R & D headquarters of American ANSYS company in Canonsburg, Pennsylvania and served as senior algorithm R & D Engineer of ANSYS Maxwell 3D low frequency electromagnetic field products. In July 2019, he returned home full-time to join the school of electrical and automation of Wuhan University.

Research field: in recent ten years, it has been committed to the research and development of engineering electromagnetic field numerical method, multi physical coupling calculation of high voltage equipment, equipment optimization design and engineering finite element software development. The future research group will devote itself to the exploration and research of core research fields related to computational high voltage engineering. Academic part-time: IEEE member, member of the technical committee of ichve 2020 and ei2020 international conferences, member of the integrated energy system digital twin special committee of China simulation society, member of the power system digital twin Technical Subcommittee of IEEE PES China, member of the power system dynamic Technical Committee of IEEE PES China, serving as IEEE Reviewers of many international journals such as IET and ijnm and international conferences on computational and applied electromagnetic fields (COMPUMAG, CEFC, INTERMAG, aces, etc.).

Academic papers: Published 30 papers in IEEE Transactions on industrial electronics, IEEE Transactions on magnetism and other top SCI journals of the discipline; He has published more than 40 international conference papers.

**Abstract:** Two kinds of formulations for low-frequency electromagnetic field computation will be introduced and reviewed first. Finite element programming techniques and implementation difficulties will be demonstrated, basis function and right hand side computation methods are emphasized to ensure the uniqueness and solvability of the discretized algebraic matrix equation. In the next, a new kind of dual formulations based on the magnetic vector potential  $A$  and the magnetic field intensity  $H$  for magnetostatic problems will be presented. This method is featuring the same coefficient matrix for both  $A$  and  $H$  formulation, and it can provide both the upper and lower limit of the system energy and hence it has a great advantage when computing the inductance parameters. In the last part, a new kind of mid-frequency electromagnetic field computational method is proposed by simultaneously considering the inductive and capacitive effects of the system. Numerical schemes are provided and the symmetric version of the discrete scheme is given. Numerical examples are illustrated for validating the proposed scheme, including computing the resonant frequency and a field-circuit coupled capacitor example. The numerical implementation with FreeFem<sup>++</sup> is also demonstrated.

### Keynote Speech 3: Agent-based Modeling and Simulation for Networked Equipment Support



*Prof. Xiong Li*

*School of Systems Science and Engineering,  
Sun Yat-sen University, China*

**Biography:** Prof. Xiong Li focuses on researching in System Analysis and Simulation, Agent-based Modeling, Complex Systems Engineering, and Logistics Data Analytics. He has published a book entitled “Agent-based Warfare Modeling” by National Defense Industry Press in 2013, and more than 100 papers in scientific journals, of which 60 have been indexed by SCI and EI. Besides, his PhD thesis entitled “Study on Warfare System Modeling Based on Meta-agents Interaction Chain” was nominated as one of the 30 Chinese PLA most excellent doctor theses in 2010 and the 100 national most excellent doctor theses in 2011, respectively. He is a reviewer of many SCI journals, such as International Journal of Production Research, Computational and Mathematical Organization Theory, and Journal of Systems Engineering and Electronics.

### Keynote Speech 4: A New Method for Building a Discrete Counterpart to a Continuous Random Variable Based on Minimization of a Distance Between Distribution Functions



*Prof. Alessandro Barbiero*

*Department of Economics, Management and Quantitative Methods,  
University of Milan, Italy*

**Biography:** Prof. Alessandro Barbiero is currently Associate Professor of Statistics at the Department of Economics, Management and Quantitative Methods of the University of Milan, where he has been working since 2008, first as a post-doc fellow and then as a fixed-time researcher. Here he teaches Statistics to both undergraduates and graduate students. He holds a PhD in Statistics from the University of Milano-Bicocca and a master degree in Management Engineering from the University of Udine. His research interests include approximation of continuous random variables, copulas and dependence modeling, stochastic reliability, resampling techniques, missing data imputation. His works were published in Annals of Operations Research, Communications in Statistics - Simulation and Computation, Psychometrika, Multivariate Behavioral Research, Applied Stochastic Models in Business and Industry, etc.

He is member of the Editorial Board of several international journals; Among them, the International Journal of Business Intelligence and Data Mining (Inderscience) and the Journal of Probability and Statistics (Hindawi).

**Abstract:** A novel procedure is introduced and described for constructing a discrete counterpart to a continuous probability distribution, which is based on the minimization of a statistical distance between

cumulative distribution functions. The procedure, which leads to a closed-form expression of the resulting probability mass function for most parametric distributions, is compared to existing discretization techniques, also with reference to the exponential case. An application is also provided, related to the insurance field, which underlines the usefulness of constructing discrete counterparts.

### Part IV Oral Presentations

Saturday, November 13, 2021		
11:20-11:30	CS103	Analysis on Operation Mode of Y-type Rail Transit in Suburbs <i>Ms. Qiqi Gao, Beijing Jiaotong University Beijing, China.</i>
11:30-11:40	CS110	A Quantitative Model of Music Influence Based on Similarity <i>Mr. Yuan Xi, Xiangtan University, China.</i>
11:40-11:50	CS112	Mathematical principle analysis of transition point prediction <i>Prof. Peng Yue, University of Electronic Science and Technology of China, China.</i>
11:50-12:00	CS116	A Hierarchical Multiplex Structure Plus Model With Fuzzy Inference for Vrsdp/Md Practical Transportation Problems <i>Prof. Kewei Chen, Ningbo University, China.</i>
12:00-14:00	LUNCH BREAK	
14:00-14:10	CS119	Structured Condition Numbers for the Total Least Squares Problem with Linear Equality Constraint and Their Statistical Estimation <i>Dr. Mahvish Samar, Shantou University, China.</i>
14:10-14:20	CS124	High Speed Braking Process Analysis of Monorail Rocket Sled Based on Fluid-structure Interaction <i>Dr. Xianwei Liu, Test Institute of North Industries Group Corporation, China.</i>
14:20-14:30	CS128	Outlier-excluding Oriented Estimation Method of Weibull Parameter Used for Lithium-ion Cell Inconsistency <i>Dr. Linshu Wang, China Automotive Battery Research Institute Co., Ltd, China.</i>
14:30-14:40	CS143	Application of Virtual Simulation Technology in Traditional Culture Communication <i>Ms. Lifang Guo, Dalian Polytechnic University, China.</i>
14:40-14:50	CS148	A New Ensemble Reinforcement Learning Recursive Network for Traffic Volume Forecasting in a freeway network <i>Dr. Guangxi Yan, Central South University, China.</i>
14:50-15:00	CS149	Statistical Research on Pulsars with the Gigahertz-Peaked Spectra <i>Prof. Hongbing Cai, Jiangsu Normal University, China.</i>
15:00-15:10	CS155	A simplified and stable lattice Boltzmann shallow water model <i>Dr. Nicolas Maquignon, CEREMA-REM - 134, rue de Beauvais 60280, Margny-lès-Compiègne, France.</i>
15:10-15:20	CS156	Numerical Simulation Method of Roller Hemming on Variable Curvature Aluminium Alloy Sheet with Adhesive <i>Mr. Shunchao Wang, Tongji University, China.</i>



15:10-15:20	CS157	Construction of a Three-Layer Directed Network Model with Multimodal Characteristics <i>Ms. Na Zhang, Qinghai Normal University, China.</i>
15:20-15:30	CS161	Research on Rock Image Recognition Based on Deep Learning <i>Ms. Letao Wang, Wuhan College, China.</i>
15:30-15:40	CS165	Finite Line Method for Solving General High-Order Partial Differential Equations <i>Prof. Xiaowei Gao, Dalian University of Technology, China</i>
15:40-15:50	CS170	Intelligent Lossy Compression Method of Providing a Desired Visual Quality for Images of Different Complexity <i>Dr. Fangfang Li, Nanchang Hangkong University/Ntional Aerospace University-KhAI, Ukraine</i>
15:50-16:00	CS182	Identification and classification method of agricultural diseases and insect pests based on yolov3 <i>Mr. Bingkuan Li, Sichuan Agricultural University, China.</i>
16:00-16:10	CS192	A Generating Algorithm of the Complete Cover of a Compatible Relation on Nonempty Finite Sets <i>Prof. Kaiyou Yuan, Chongqing Institute of Engineering, China.</i>
16:10-16:20	CS198	Evaluation of the Development of National Higher Education System Based on Topsis and Entropy Weight Method <i>Mr. Xiangyu Li, Wuhan Business University, China.</i>
16:20-16:30	CS224	Reservoir Computing Based on VCSEL Subject to Optical Injection and Arbitrary Polarization Optical Feedback <i>Prof. Yushuang Hou, Hebei Normal University of Science and Technology, China.</i>
16:30-16:40	CS225	Optimization Control of Motor Vehicle at Intersection Based on Green Building Materials <i>Ms. Xuejuan Zhan, Hefei University, China.</i>
16:40-16:50	CS237	An Analysis of the Authenticity of Financial Data of Listed Companies Based on Vector Machines <i>Ms. Jing Zhang, Wuhan College, China.</i>
16:50-17:00	Poster Presentations	
17:00-20:00	Vote for the Presentations	

## Part V Abstracts of Oral Presentations

### CS103

#### Analysis on Operation Mode of Y-Type Rail Transit in Suburbs

Qiqi GAO<sup>a</sup>, Baohua MAO<sup>a</sup>, Min WANG<sup>b</sup>, Qi ZHOU<sup>b</sup> and Yi GE<sup>c</sup>

<sup>a</sup>*Key Laboratory of Transport Industry of Big Data Application Technologies for Comprehensive Transport, Beijing Jiaotong University Beijing, China*

<sup>b</sup>*School of Transportation Beijing Jiaotong University Beijing, China*

<sup>c</sup>*China Railway Siyuan Survey and Design Group Co., LTD, China*

**Abstract.** The construction of a Y-type urban rail transit line can effectively solve the problems of low line coverage and low utilization in suburban areas. The purpose of this paper is to study and analyze the effect of different operation modes of the Y-type line of suburban urban rail transit. In this paper, the objective function is to minimize value of passenger travel time costs and enterprise operating costs, and the main and branch train frequencies are used as decision variables to establish a selection model for Y-type operation mode, and design an improved multi-objective optimization algorithm based on NSGA-II. A case study was carried out on the Y-type line to evaluate the effect of each scheme. The results of the study found that there is no obvious difference between the advantages and disadvantages of the three operation modes. The passenger waiting time under the independent operation plan is the highest but the comfort level is greater, and the train travel distance is the lowest. The partial- through operation accommodates the interests of both passenger and business. Therefore, the corresponding operating mode should be selected according to the preferences of passengers and enterprises.

### CS110

#### A Quantitative Model of Music Influence Based on Similarity

Yuan QI<sup>a</sup>, Xiatian JIANG<sup>b</sup>, Xubin SU<sup>c</sup>, Jie JIANG<sup>a</sup>

<sup>a</sup>*School of Material Science and Engineering, Xiangtan University, Xiangtan, China*

<sup>b</sup>*School of Mechanical Engineering, Xiangtan University, Xiangtan, China*

<sup>c</sup>*School of Automation and Electronic Information, Xiangtan University, Xiangtan, China*

**Abstract.** Music, as a kind of cultural heritage, has become an indispensable element in human life. How to intuitively understand the role of music in human collective has become a difficult issue in the field of music research. In this paper, a quantitative model of music influence, which is based on directed graph, Euclidean distance and correlation analysis, is proposed for the development of some genres. In this model, the influences of genre leaders on music development are obtained by evaluating the parameters of the directed graph among artists. Then, the similarity analysis of music within and between schools is conducted to get the musical characteristics of different schools. Then the correlation analysis of music features is carried out by SPSS to get the most "infectious" index of music. Finally, based on the time series, the visual analysis of music evolution is made to quantify the influence of music. In this paper, we've verified the model for many times according to the music development results, which proves that the model has strong guidance for the analysis of music development.

## CS112

### Mathematical Principle Analysis of Transition Point Prediction

Peng Yue<sup>a,b</sup>, Dewei Peng<sup>b</sup>, Jinghui Zhang<sup>a</sup> and Sibe Wei<sup>c</sup>

<sup>a</sup> University of Electronic Science and Technology of China, China

<sup>b</sup> China Aerodynamics Research and Development Center, China

<sup>c</sup> National Aerospace University, Kharkiv aviation institute, Ukraine

**Abstract.** Transition is the basic phenomena of complex flow regime changes in fluid mechanics. So far, the axiomatic expression and rigorous mathematical description of transition and separation are important basic scientific problems, which are also of great significance to the development of Applied Science. This article obtaining the basic conditions and general conditions for transition through the excited state theory of flowfield, which is derivation based on the N-S equations, combined with Euler's description point of view, applied tensor analysis and with the help of the basic principles of superposition states of quantum mechanics. At the same time, it proves the relationship between the occurrence of transition and the pressure distribution curve from a mathematical point of view. The research results of this paper can provide a theoretical basis for the study of turbulence mechanism and the solution of engineering problems.

## CS116

### A Hierarchical Multiplex Structure Plus Model with Fuzzy Inference for Vrsdp/Md Practical Transportation Problems

Xusheng WANG<sup>a</sup>, Ismael Dongmo FODJO<sup>b</sup>, Xiaomin CHU<sup>b</sup>, Kewei CHEN<sup>b</sup>, Fangyan DONG<sup>b</sup>, and Kaoru HIROT<sup>a</sup>

<sup>a</sup>*Fudan University, China.*

<sup>b</sup>*Ningbo University, China.*

<sup>c</sup>*Beijing Institute of Technology, China.*

**Abstract.** By introducing the Vehicle Routing, Scheduling & Dispatching Problem for Multiples Depot (VRSDP/MD) and the description of formalization, it is helpful to offer a solution to solve the complex situation in practical transportation problem. In order to reduce the influence of the problem, A computing model embodying Hierarchical Multiplex Structure to take shape with an object-oriented multiple paradigms (HIMS+ model) is put forward as a proposal. There are 3 layers: the first layer is fluctuation area for the system cost adjusting, the second layer is the system state forming area, and the third layer is the system optimization decision area. Two methods of meta-heuristic and fuzzy inference are proposed as an optimization algorithm for HIMS+ data structure. There are two types of 24 tank lorries in the Tokyo metropolitan area, where the two types of experiments are scheduled for 3-day of actual order data. Experiments results show that the HIMS+ model increase acceleration by 10 percent and decreases fast by 75 percent compared to what experts predict. The HIMS+ model has become a very reliable computing architecture for the multi objective and multi constraint optimization to real world transportation problems.

## CS119

### Structured Condition Numbers for the Total Least Squares Problem with Linear Equality Constraint and Their Statistical Estimation

Mahvish Samar

*Department of Mathematics, Shantou University, Shantou 515063, P. R. China*

**Abstract.** In this paper, we derive the mixed and componentwise condition numbers for a linear function of the solution to the total least squares with linear equality constraint (TLSE) problem. The explicit expressions of the mixed and componentwise condition numbers by dual techniques under both unstructured and structured componentwise perturbations is considered. With the intermediate result, i.e. we can recover the both unstructured and structured condition number for the TLS problem. We choose the small-sample statistical condition estimation method to estimate both unstructured and structured condition numbers with high reliability. Numerical experiments are provided to illustrate the obtained results.

## CS124

### High Speed Braking Process Analysis of Monorail Rocket Sled Based on Fluid-Structure Interaction

Xuewen ZHOU<sup>a</sup>, Shuiyan LV<sup>b</sup> and Xianwei LIU<sup>b</sup>

<sup>a</sup>*Xi'an Jiaotong University, Xi'an 710049 China*

<sup>b</sup>*Rocket Sled Test Method Research Center, Test Institute of North Industries Group Corporation, China*

**Abstract.** Water brake technology has great significance on monorail rocket sled test, which coupling nonlinear process between high-speed flow impact and structure response. In this paper Finite element method(FEM) and Smoothed particle hydrodynamics(SPH) model is used to analyze the braking force performance and the structure response during the monorail rocket sled braking process. The results show that the FEM-SPH method has high accuracy, which braking force error between numerical simulation and experiment is 3.92% when velocity of rocket sled is 750m/s. The safe braking distance of numerical simulation is 100m, while the real distance of experiment is 105m. The error between numerical simulation and experiment is just about 5%.

## CS128

### Outlier-Excluding Oriented Estimation Method of Weibull Parameter Used for Lithium-ion Cell Inconsistency

Linshu WANG, Hang ZHANG, Ting ZHAO, Min GAO, Fengling YUN, Sheng FANG and Yanyan FANG

*China Automotive Battery Research Institute Co., Ltd, No.11 Xingke East Street, Yanqi Economic Development Zone, Huairou District, Beijing, 101407, China*

**Abstract.** Three-parameter Weibull Probability Model used in statistical analysis of Lithium-ion cells inconsistency evaluation reveals more accuracy than Gaussian Probability Model, due to flexibility of fitting asymmetrical distributed data. Conventional estimation methods for Weibull parameters based on dispersion and symmetry of the overall distribution leads to derivation from the actual feature, when outliers are brought in and fails to be identified and excluded. However, there is lack of research on the methods to solve the contradiction between accuracy of the estimation and completeness of the data. In this study, a method is proposed for Weibull parameters estimation to eliminate interference from outliers. The dispersion and symmetry equation are deviated based on Weibull function and expressed by Weibull parameters. Weibull

parameters are estimated based on the distribution of the major variables of the data instead of the whole. The outliers are identified out based on the obtained Weibull parameters and excluded from the data. The method is implemented in capacity distribution of Lithium-ion cells, one of the inconsistency evaluations, and is verified by Chi-square test at confidence of 95%, with less error than the result of Maximum Likelihood method. In conclusion, because the proposed method makes it possible to approach the estimation result to the distribution and be free of influence of the outliers, the solution of the contradiction is given and the implication of function for the estimation method is expanded.

**Acknowledgement.** The study was supported by the Beijing Municipal Natural Science Foundation (Grant No. 2214066) and Youth Fund Project of GRINM.

### CS143

#### **Application of Virtual Simulation Technology in Traditional Culture Communication**

Lifang GUO

*Dalian Polytechnic University, School of Foreign Languages, Dalian, 116034, China*

**Abstract.** Computer virtual simulation technology is integrated into the new media system and organically combined with excellent traditional culture to provide an organic carrier and platform for the improvement of people's cultural literacy. This paper analyzes the means of traditional cultural communication, studies the foundation and strategy of integrating computer virtual simulation technology into the cultural communication system of new media, and formulates the steps and plans of computer virtual simulation technology to promote the improvement of people's cultural literacy.

### CS148

#### **A New Ensemble Reinforcement Learning Recursive Network for Traffic Volume Forecasting in a Freeway Network**

Guangxi YAN<sup>a</sup>, Shuqin DONG<sup>a</sup>, Chengqing YU<sup>a</sup> and Xinwe LIU<sup>b</sup>

<sup>a</sup> *School of Traffic and Transportation Engineering, Central South University*

<sup>b</sup> *School of Mechanical, Electronic and Control Engineering, Beijing Jiaotong University*

**Abstract.** While recent development, the freeways promote economic and traffic demand, but it also increases a lot of traffic congestion and accidents. The effective traffic volume forecasting technology can reduce traffic congestion, and improve traffic network planning and information management. In this research, a new ensemble forecasting model is proposed to forecast traffic volume. The framework of the model consists of the TCN model, the GRU model, and the ensemble SARSA algorithm. TCN and GRU are utilized as predictors to construct the prediction model for deep mining of the traffic volume data and SARSA can integrate the prediction results from these two predictors and achieve satisfactory results. We used two sets of the traffic data collected from a freeway in Changsha to verify the performance. The experiment results proved the effectiveness of the hybrid model that had the best accuracy in both cases, and the MAPEs of TCN-GRU-Sarsa are 7.8281% and 6.9015%.

## CS149

### Statistical Research on Pulsars with the Gigahertz-Peaked Spectra

Hongbing CAI<sup>a,b</sup>, Jingsong XU<sup>a,b</sup>, Beibei WANG<sup>a,b</sup>

<sup>a</sup>*Jiangsu Normal University, Xuzhou 221116, China*

<sup>b</sup>*Xuzhou Huitian Information Technology Co., Ltd, Xuzhou 221010, China.*

**Abstract.** The pulsar's radio spectra in the high frequency shows the power law form in general, but people has also found 23 pulsars with the turn-over spectra peaking near GHz, i.e., the Gigahertz-peaked spectrum (GPS) pulsars. We launch the statistical research on these GPS pulsars, and find the peak frequency of 73.9% GPS pulsars in the sample is between 0.5 GHz and 1.0 GHz. The magnetic star has the higher peak frequency relative to other GPS pulsars, whose average peak frequency is 3.35GHz. The average spectral index of GPS pulsars is -1.33 which is higher than ones of ordinary pulsars. This phenomenon may be caused by the interstellar medium absorption for the pulsar's radiation in the low frequency band. The statistical average of the dispersion measure of GPS pulsars is 348 pc cm<sup>-3</sup>, which is higher than the ones of ordinary pulsars. We also find the strong positive correlation between the period and dispersion measure of GPS pulsars, which imply that the interstellar medium may cause the pulsar's rotation slow down.

## CS155

### A Simplified and Stable lattice Boltzmann Shallow Water Model

Nicolas Maquignon, Hassan Smaoui, Philippe Sergent, Bruno Bader  
*CEREMA-REM - 134, rue de Beauvais 60280, Margny-lès-Compiègne*

**Abstract.** In this article, a simplified and stable (S&S) lattice Boltzmann shallow water (LBMSW) model is introduced. In past articles, several types of LBMSW models based on different collision operators were studied, such as BGK-SRT, raw moments MRT, central moments MRT, or cumulants MRT, and allowed to reach interesting performances in terms of numerical stability, accuracy and execution time. But no simplified and stable model for LBMSW have been published yet, such as those depicted in, for gaseous cases. In this article, such a method is introduced for shallow water problems and numerical performances are studied. For numerical performances evaluation, dam break and circular dam break benchmarks using S&S will be presented and compared to other methods.

## CS156

### Numerical Simulation Method of Roller Hemming on Variable Curvature Aluminium Alloy Sheet with Adhesive

Shunchao WANG, Jianjun LI, Mozhi LI, and Wenfeng ZHU  
*School of Mechanical Engineering, Tongji University, Shanghai, 201804, China.*

**Abstract.** To realize the roller forming process of curved edges of aluminium alloy auto-body closure panels, a numerical simulation method is proposed for the roller forming of aluminium alloy sheet with adhesive in flat variable curvature. Firstly, the motion of the roller is calculated by the discrete variable curvature curve method, and secondly, a numerical method of FEM-SPH coupling is established to simulate the interaction between the adhesive layer and the sheet. Subsequently, a numerical simulation model for the roller forming of aluminium alloy sheet with adhesive in flat variable curvature was constructed and finite element calculations were carried out. The simulation results show that the motion posture of the roller matches that

of the actual roller, and the adhesive layer can adequately fill the inner and outer panel areas during the rolling process, which proves the effectiveness of the method.

## CS157

### Construction of a Three-Layer Directed Network Model with Multimodal Characteristics

N Zhang<sup>a,b</sup>, Y Z Xiao<sup>a,b</sup>, H X Zhao<sup>a,b</sup>, C Y Tang<sup>a,b</sup> and B Y Cui<sup>a,b</sup>

<sup>a</sup> College of Computer, Qinghai Normal University, Xining 810016, China

<sup>b</sup> The State Key Laboratory of Tibetan Intelligent Information Processing and Application, China

**Abstract.** The multi-layer directed network model focuses on portraying the directionality, diversity and difference of the edges in the network. It is also one of the powerful tools for analyzing the complexity of the network system and the heterogeneous interaction characteristics between network layers. This paper constructs three three-layer directed network models combined with traditional complex network theory and analyzes their degree distribution characteristics. By controlling the out-degree and in-degree of the middle-level nodes, a network structure with multi-peak characteristics is configured. Combined with numerical simulation, it is concluded that the number of links between the layers of the directed network makes the network characterize the characteristics of unimodal, bimodal, and trimodal; the combination of the optimal mechanism and the changes in the number of inter-layer links, the network characteristics show the coexistence of power law and unimodal. The research results of this paper have practical value for the analysis of network generation mechanism and correlation law by using multi-layer directed network theory in the era of big data.

## CS161

### Research on Rock Image Recognition Based on Deep Learning

Mingmin GONG<sup>a</sup>, Lei ZHENG<sup>b</sup>, Sheng ZHOU, Quan HAO, Leitao WANG

<sup>a</sup>School of Information Engineering, Wuhan College, Wuhan 430212, China.

<sup>b</sup>Shen Zhen Institute of Technology, Shen Zhen 518116, China

**Abstract.** Three-parameter Weibull Probability Model used in statistical analysis of Lithium-ion cells inconsistency evaluation reveals more accuracy than Gaussian Probability Model, due to flexibility of fitting asymmetrical distributed data. Conventional estimation methods for Weibull parameters based on dispersion and symmetry of the overall distribution leads to derivation from the actual feature, when outliers are brought in and fails to be identified and excluded. However, there is lack of research on the methods to solve the contradiction between accuracy of the estimation and completeness of the data. In this study, a method is proposed for Weibull parameters estimation to eliminate interference from outliers. The dispersion and symmetry equation are deviated based on Weibull function and expressed by Weibull parameters. Weibull parameters are estimated based on the distribution of the major variables of the data instead of the whole. The outliers are identified out based on the obtained Weibull parameters and excluded from the data. The method is implemented in capacity distribution of Lithium-ion cells, one of the inconsistency evaluations, and is verified by Chi-square test at confidence of 95%, with less error than the result of Maximum Likelihood method. In conclusion, because the proposed method makes it possible to approach the estimation result to the distribution and be free of influence of the outliers, the solution of the contradiction is given and the implication of function for the estimation method is expanded.

## CS165

### Finite Line Method for Solving General High-Order Partial Differential Equations

Xiaowei GAO

*School of Aeronautics and Astronautics, Dalian University of Technology, China.*

**Abstract.** In this study, a completely new numerical method, Finite Line Method (FLM), is proposed for solving general High-Order Partial Differential Equations (PDEs). In this method, the computational domain is discretized into a number of collocation nodes as in the free element method, and at each node a set of straight or curved lines crossing the node is formed, which is called the cross-line element and represented by a number of nodes distributed over each line. The shape functions for each cross-line element are constructed using the Lagrange interpolation formulation and their first and high order partial derivatives with respect to the global coordinates are derived through an ingenious technique. The derived spatial partial derivatives are directly substituted into the governing differential equations and related boundary conditions to form the final system of equations.

FLM is a type of collocation method, not needing any integration to establish the solution scheme. Therefore, it is very convenient to be used to solve multi-physics coupled problems. Besides, since the Lagrange interpolation formulation is used to construct the shape functions, high order lines can be easily formulated. It is emphasized that FLM can be used to solve any types of linear and non-linear PDEs. A number of numerical examples will be given to demonstrate the efficiency and stability of the proposed method.

## CS170

### Intelligent Lossy Compression Method of Providing a Desired Visual Quality for Images of Different Complexity

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**Abstract.** Lossy compression plays a vital role in modern digital image processing for producing a high compression ratio. However, distortion is unavoidable, which affects further image processing and must be handled with care. Providing a desired visual quality is an efficient approach for reaching a trade-off between introduced distortions and compression ratio; it aims to control the visual quality of the decompressed images and make them not worse than the required by a user. This paper proposes an intelligent lossy compression method of providing a desired visual quality, which considers the complexity of various images. This characteristic is utilized to choose an appropriate average rate-distortion curve for an image to be compressed. Experiments have been conducted for Discrete Cosine Transform (DCT) based lossy compression coder, Peak Signal-Noise Ratio (PSNR) has been employed to evaluate the visual quality. The results show that our new method has the ability to provide a general improvement of accuracy, and the proposed algorithm for classifying image complexity by entropy calculation is simpler and faster than earlier proposed counterparts. In addition, it is possible to find “strange” images which produce the largest errors in providing a desired quality of compression.



**CS182**

**Identification and Classification Method of Agricultural Diseases and Insect Pests Based on Yolov3**

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**Abstract.** This paper mainly selects four diseases and pests of corn for image recognition and classification, selects wavelet neural network algorithm for image processing, and then uses yolov3 neural network for image loss iteration to achieve better results, Through this research, we can better understand the application and depth of convolutional neural network in the field of image recognition. In this paper, the relevant data sets are used for neural network operation, and the data sets are processed appropriately. After the data set is obtained, the correlation degree is deleted and the wavelet algorithm is used for denoising to obtain the denoised picture and algorithm, which is equivalent to modifying and fitting the picture.

Select the appropriate convolutional neural network on the existing basis, modify the convolutional neural network into several different neural networks, and then apply the convolutional neural network to the data set to obtain the classification effect after passing through the neural network and achieve the classification effect. At this time, the accuracy of the effect after continuous optimization can reach%, and achieve the corresponding effect, It is consistent with the expected effect.

**CS192**

**A Generating Algorithm of the Complete Cover of a Compatible Relation on Nonempty Finite Sets**

Kaiyou YUAN, Heng LI and Feng TAN

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**Abstract.** Searching for the complete cover of a compatible relation on non-empty finite sets plays an important role in data mining and management decision-making. In this paper, the complete cover theory of a compatible relation is discussed, and the relevant theorem of merging compatible classes into complete cover is put forward and proved, and a generating algorithm of the complete cover of a compatible relation is proposed, and apply it to find the optimal solution for resource scheduling and allocating and so on. The application results show that the algorithm has the close efficiency to dynamic programming method, and the practical application is simple, feasible and steady.

**CS198**

**Evaluation of the Development of National Higher Education System based on Topsis and Entropy Weight Method**

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**Abstract.** By using the index data from 14 countries with relatively mature higher education development in the UNESCO database, this paper establishes a comprehensive evaluation system for the health status of the higher education system from 2010 to 2019. By establishing the "vision" model, the optimal level under the five dimensions of the current higher education system is established. By comparing the scores of China and other countries in five dimensions, it is found that there is still a large gap between China's higher education system and the world leading level in corresponding fields in talent training, scientific research and economic development, while the external environment and international exchanges are expected to catch up with or even exceed the world advanced level in the short term.

CS224

## Reservoir Computing Based on VCSEL Subject to Optical Injection and Arbitrary Polarization Optical Feedback

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**Abstract.** We introduce a new reservoir computer based on vertical cavity surface emitting semiconductor laser (VCSEL) with optical injection and arbitrary polarization optical feedback. By changing the feedback optical polarization angle and under parallel or orthogonal optical injection, we demonstrate that the introduction of new parameter (polarization angle) increases one degree of freedom of the system, making the parameters adjustment space much wider than parallel or orthogonal optical feedback ones. Via Nonlinear channel equalization benchmark task, the performance of such RC system is investigated, and the results indicate the system can yield good performance that can be compared with or better than similar reservoirs.

CS225

## Optimization Control of Motor Vehicle at Intersection Based on Green Building Materials

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**Abstract.** Along with the rapid development of urban social economy, under the influence of sustainable development strategy, urban road traffic engineering design should adhere to the concept of environmental protection and develop towards greening and modernization. Firstly, this method uses the green environmental construction materials, such as hot-melt reflective marking paint, color asphalt concrete pavement and polyurethane elastic isolation column, to build green traffic spaces at intersection; Then on this basis, the motor vehicles signal optimization technology is used to balance the space-time resource allocation of the motor vehicle traffic flow, motor vehicle traffic optimal phase combination analysis method is put forward, and the optimal calculation of motor vehicle traffic time is optimized by the signal timing optimization method that considers the overlapping phase. Finally, through the evaluation and analysis of the VISSIM traffic simulation software, the results show that the method based on green building materials has effectively defined about the green traffic spaces of motor vehicles, and under this premise, the efficiency of motor vehicle traffic is further improved by signal optimization technology, providing the foundation for the research on green traffic on urban roads.

Mingmin GONG, Lei ZHENG, Jiayang HOU, Jing ZHANG, Xing LU

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**Abstract.** Driven by the benefits of listing at a high premium, financial fraud in listed companies has become a widespread problem worldwide. In the face of economic interests, even developed countries with relatively complete laws and policies cannot completely eliminate financial fraud. The financial fraud incidents of listed companies have seriously disrupted the normal order of my country's capital market. Therefore, the specific financial data of listed companies are analyzed to obtain the influence of financial indicators on the identification of financial fraud and to determine whether there is financial fraud in listed companies.

### Part VI List of Poster Presentations

1	CS101	Composite Insulator Defect Identification Method Using Improved RCNN Convolution Kernel
2	CS102	Embedded Implementation of YOLO Nano Algorithm for On-site Recognition of Relay Pressure Board Status
3	CS109	Categorical Description of Simple-Folding a Map
4	CS111	The Existence of Multiple Positive Solutions of a Riemann-Liouville Fractional $q$ -Difference Equation Under Four-Point Boundary Value Condition With $p$ -Laplacian Operator
5	CS114	Body Shape Recognition And Prototype Construction Based on Lightgbm Algorithm
6	CS115	Partial Overlapping Order Problems in a Strip
7	CS117	Edge Detection Algorithm Based on Threshold Function De-Noising and Wavelet Neural Network
8	CS118	Clock Synchronization Methods of Electric Meters Based on Wireless Communication
9	CS121	Study on the Influence of Absorbing Interference Cloud on Radar Effectiveness Based on Hfss
10	CS123	Cryptocurrency and the Herd Behavior
11	CS131	Study on Lubrication Flow and Heat Transfer Characteristics of Under-Race Lubrication for High Speed Ball Bearing
12	CS144	Effects of Environmental Wind on Natural Smoke Exhaust in a Tunnel With One Blocked End
13	CS150	Dynamic Multi-Depot Multi-Compartment Refrigerated Vehicle Routing Problem With Multi-Path Based on Real-Time Traffic Information
14	CS151	Predicting China's Aging Portfolio Model Based on Python Big Data
15	CS152	Cyclic Scheduling of Single-Arm Cluster Tools With Multiple Wafer Types: A Case Study
16	CS153	Simulation and Experiment of Dual-Frequency Isolator for Variable Speed Helicopter
17	CS154	Analysis of the Impact Response to Backup Clamp from Broken Transmission Line Tension Clamp
18	CS156	Numerical Simulation Method of Roller Hemming on Variable Curvature Aluminium Alloy Sheet with Adhesive
19	CS157	Construction of a Three-Layer Directed Network Model with Multimodal Characteristics
20	CS160	Gully Identification of Debris Flow Disaster Based on Knowledge Distillation
21	CS163	Robot Path Planning Based on Improved Reinforcement Learning
22	CS164	Research on Low-Cost Iot and its Application in Improving Energy Efficiency of Distribution Networks

23	CS167	Impact of Sample Quality to Deep Learning Classification Model of Multiple Crop Types on Uav Remotely Sensed Images
24	CS168	Research and Development of Automatic Width Measurement And Alignment Equipment for Cold Rolled Aluminum Strip Based on Machine Vision
25	CS180	Vorticity Transports in Wall Turbulent Flow Under Spanwise Wall Jet Forcing and Blowing-Suction Control
26	CS181	Taxes of Pareto Optimality in the Externalities of Consumption Pollution --Based on Sustainability of Renewable Resources
27	CS183	Modeling of Covid-19 Transmission Using Machine Learning
28	CS184	Simulation Research on Mechanical Properties and Crack Growth of Tobacco Leaf
29	CS195	An Integrated Assessment Model for Evaluating Air Pollution Mitigation Policy
30	CS200	Design And Simulation of a Flyback Switching Power Supply
31	CS201	Design and Application of the Intelligent Operation, Control and Maintenance of Distribution Networks Based on Wide-Area Distributed Sinking Computing Technology
32	CS202	Research on Error Bounds of a Kind of Mixed Variational Inequality Problems
33	CS208	Ordering and Shipping Strategies of Materials for Company
34	CS209	A Fluid-Structure Coupling Method to Predict the Interior Ballistic Characteristic of Gas Generator With Complex Structures
35	CS224	Reservoir Computing Based on Vcsel Subject to Optical Injection And Arbitrary Polarization Optical Feedback
36	CS234	Study on Opening and Closing Motion Law of Common Rail Injector Needle Valve

## **Part VII Acknowledgements**

On behalf of the AMMCS 2021 Organizing Committee, we would like to take this opportunity to express our sincere gratitude to our participants. We would also like to express our acknowledgements to the Technical Program Committee members who have given their professional guidance and valuable advice as reviewers. For those who contribute to the success of the conference organization without listing the name below, we would love to say thanks as well.

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