
Editorial

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Intelligent systems with their dynamic development and wide applications such as fuzzy logic systems, neural networks and evolutionary computation, etc. are complementary to each other and provide solutions to new and challenging problems on the way to manifest features that are usually assumed to be signs of intelligent behaviours. They have the characteristics of self-learning, self-organising, self-adapting and are advantageous for being simple, widely used, robust, suitable for parallel processing and so on.

Intelligent systems have developed from the traditional artificial intelligent systems which deal with the mechanism related systems to computational intelligent systems which are suitable for large-scale parallel computations and have some smart features. The currently intensively investigated intelligent systems include neural networks, evolutionary computation, artificial immune systems, fuzzy systems and so on. They have been widely used in the fields such as parallel processing, associative memory, pattern recognition, automatic access to knowledge and intelligent control.

We believe that this special issue will provide a useful reference for understanding the intelligent systems and their applications. In total, 28 papers have been selected. The contents of these studies are briefly described as follows.

In the paper, 'Dynamic zone modelling for HVAC system control', Jiaming Li, Geoff Poulton, Glenn Platt, Josh Wall and Geoff James present the development and validation of a dynamic zone model used for improved

control of a heating, ventilation and air conditioning (HVAC) system to reduce energy consumption and improve the quality of the indoor environment. This dynamic model is useful for control strategies that require knowledge of the dynamic characteristics of HVAC systems.

In the paper, 'Mobile grid architecture and resource selection mechanism', Wenying Zeng, Yuelong Zhao, Wei Song and Wenfeng Wang discuss and analyse mobile grid architecture and resource managing methods currently, and put forward a logical architecture of mobile grid and its application. They also discuss and design the mechanism of resource selection and assignment based on client requests. The result shows that mobile grid can match the client requests and grid resources by pulling or pushing, and adjust resource assignment by related factors.

In the paper, 'Research on the non-linear characteristics of traffic flow system under different scaling', Fengtao Liu focuses on the problem that how system scaling affects the complexity degree of a system. By calculating the Lyapunov index, relevancy dimension and Lempel-Ziv complexity degree of above traffic flow sequences, it is found that chaos, fractal and high complexity degree existed in the time headway sequences, but the complexity degree is gradually reduced with the gradually increasing scaling.

In the paper, 'Experimental validation of feedback approaches for in-cylinder pressure balancing in SI engines', Po Li, Dichen Liu, Tielong Shen and Junichi Kako adopt the in-cylinder pressure at top dead centre (TDC) for

evaluating the cycle-to-cycle variability and take its four-cycle moving average value as the index for balancing. The control schemes including PI, MVC and MPC are tested under different fuel injection strategies, one is with fixed fuel supply and the other is under A/F balancing. In fact, the MVC and MPC methods are developed from a simple statistical ARMA model. In order to avoid the effect of parameters setting improperly, an adaptive method is employed in MPC controller. Finally, all the controllers are validated in a car-used six-cylinder SI engine.

In the paper, ‘A composite sliding mode autopilot design’, Qunli Xia, Jingju Zhu and Zaikang Qi develop a control method with the primary feedback being proportional to the switching is developed for eliminating the disturbance effect due to model uncertainty. With this control method, they analyse a sliding mode autopilot, then discuss composite sliding mode control strategy to reduce the switching frequency. Numerical simulation results show a good performance of the composite control system.

In the paper, ‘Find the maximum k -disjoint coverage sets in WSN using genetic algorithm’, Jie Jia, Jian Chen, Guiran Chang and Jie Li briefly generalise the searching procedure to maximise the total number of rounds. A novel searching algorithm is proposed on the basis of improved NSGA-II to select the optimal coverage set which includes two competing objectives, the coverage rate and the number of working nodes.

In the paper, ‘Application of the fuzzy neural network with inverse identification structure on neutralisation process’, Ran Zhen, Hua Meng, Fan-hua Meng and Xue-li Wu analyse the characteristics of pH value on neutralisation process in detail. Aiming at the serious non-linear and long lag characteristics in the neutralisation process of acid sewages of the pharmaceutical enterprise, the neural network control with inverse identification structure is presented. The system has good effect in practical applications.

In the paper, ‘Stability of cellular neural networks with time varying delay’, Jian-hua Zhang, Hui-guang Li, Xin-ping Guan and Xue-li Wu present the global asymptotic stability of a class of delayed cellular neural networks and the main contribution of this note is that the result ensures the existence, uniqueness and global asymptotic stability of cellular neural networks with time varying delay.

In the paper, ‘Modelling of phase separation in binary fluid under vibration with LBM’, Qingming Chang, Xia Chen, Changjun Chen and J. Iwan D. Alexander use the LBM to investigate the phase separation under external vibration. The results reveal the effect of vibrational frequency and relative value of vibrational acceleration to gravity acceleration (acceleration ratio G) on phase separation procedure and its deposition. Higher vibrational frequency and acceleration ratio lead to a delay of deposition of separated phases.

In the paper, ‘Formal modelling and analysis of HLA architectural style’, Jie Chen, Di Wu, Flavio Oquendo and Juan Zhang briefly present a formal HLA architectural style using π -ADL. The π -ADL has been chosen based on the consideration of the HLA system characteristics requirements for the formalisation. It includes basically three different kinds, the composite, component and connector. Each kind is composed of the external interfaces and internal behaviour.

In the paper, ‘The optimisation of bevel gear tooth in mesh with various types of profile modifications’, Xia Chen, Qingming Chang, Jiao Wang and Changjun Chen analyse the effect of the transmission error on noise, conclude that only three various forms of modifications can be adopted for bevel gear, that is, straight line, rotated profile and circular forms. The effects of the tooth profile modifications with various types of curves have been presented with the transmission error, the torsional mesh stiffness and the load sharing ratio.

In the paper, ‘UML-based modelling for information system of assembly lines’, Yongfa Qin and Zhigang Xu aim to deal with how to construct intelligent information system of an assembly line in a network-based collaborative manufacturing environment. This system has some basic functions of making electronic cards for assembly process, controlling quality online, recording history data and communicating with remote database management system. The modelling method is applied to a real assembly line of an automotive transmission company in China.

In the paper, ‘Development of virtual-labs based on complex Modelica models using VirtualLabBuilder’, Carla Martin-Villalba, Alfonso Urquia, Sebastian Dormido and Felix Martinez discuss the design and implementation of three virtual-labs as follows:

- 1 a virtual-lab of a double-pipe heat exchanger, which is a useful tool for control education
- 2 a virtual-lab describing the thermodynamic behaviour of the solar house, which is based on a complex Modelica model developed by other authors
- 3 the virtual-lab of a drum-type washing machine, which is an industrial application useful as design aid.

The graphical user interface has been implemented by using the VirtualLabBuilder library.

In the paper, ‘Multi-objective optimisation of steel frame of solid garage based on genetic algorithm’, Youlu Jing, Minxiang Wei, Weidong Wen and Zhiwei Shi study the optimisation algorithm based on genetic algorithm (GA). The result indicates that the above-mentioned multi-objective optimisation of the steel frame is feasible. The weight and the dynamic strain energy of the steel frame are decreased obviously.

In the paper, ‘Research on traffic impact analysis and organisation design optimisation for logistics park’,

Wei Wang, Xuejun Feng and Jianyu Zhang discuss and put up a method system of logistics park traffic impact analysis and organisation design optimisation by using the proposed method before. They take Zhengzhou National Arterial Highway Logistics Park for empirical studies and combine macro planning software TransCAD and micro traffic simulation platform Vissim to demonstrate the feasibility and workability of the method and get good results. It can offer the reference to logistics park planning and design.

In the paper, ‘Observer-based robust model predictive control of singular systems’, Xiao-Hua Liu and Yuan-Hua Yang address a robust predictive control design method based on the state observer for a class of uncertain singular systems with norm-bounded.

In the paper, ‘Boundary predictive control of second-order linear modulus-vary distributed parameter systems based on wavelets transformation’, Douzhang Ding and Xingsheng Gu introduce the boundary control idea into predictive control of distributed parameter system based on wavelets transformation to control of distributed parameter system.

In the paper, ‘A study on bacterial colony chemotaxis algorithm and simulation based on differential strategy’, Zhiqiang Wang, Lixin Zhang and Yongfeng Fan prove the influence of the algorithm parameters on the performance of algorithm through large numbers of experiments on the standard test functions, and then propose the parameter control strategies, which laid the foundation for further study of the algorithm. Large amounts of numerical experiments by Matlab simulation show that the performances of the improved BCC algorithm have been enhanced both in success rate and convergence precision.

In the paper, ‘A MOGA-based approach for optimal analogue test points selection’, Xiaomei Chen, Xiaofeng Meng, Bo Zhong and Hong Ji propose a multi-objective genetic algorithm (MOGA) based approach for optimal analogue test point selection. Experiments on a practical example of analogue circuits and a series of hypothetical circuits indicate that the proposed method outperforms the other existing methods, that is, entropy based method and the GA-based method, in effectiveness and efficiency.

In the paper, ‘Research on structure dynamic neural networks’, Hong-gui Han, Jun-fei Qiao and Xin-yuan Li propose a model of structure dynamic neural network, which simulates the learning skills such as human beings and animals. This model contains two main steps:

- 1 the structure learning phase possesses the ability of online generation and ensures the number of the neural nodes of the neural network
- 2 the parameter learning phase adjusts the interconnection weights of neural network to achieve favourable approximation performance.

This new dynamic neural network is used to track the non-linear functions. Simulation results show that this new algorithm can achieve favourable performance.

In the paper, ‘Overview of human-simulated intelligent control method and its application’, Zhong Luo, Hongyi Liu, Fei Wang and Lixia Xu summarise the development of HSIC and its basic ideology and main features, analyse the static characteristics, dynamic characteristics and stability of HSIC and study the application of HSIC in the trajectory tracking control for robot system.

In the paper, ‘A variable structure adaptive fuzzy logic stabiliser for a two-area load frequency control problem’, Khaled A. El-Metwally presents a variable structure adaptive fuzzy logic control approach to design a decentralised controller for load frequency control of interconnected power areas.

In the paper, ‘The research of man-hour dynamic parameter modelling and visualisation’, Yuan Lu, Shahid Ikramullah Butt and Jia Gu present very important information for production management and man-hour decision, which solves the problem of low efficiency and poor precision and becomes one of the key technologies of CAPP.

In the paper, ‘Modelling on conflict resolution of collaborative design’, Junming Hou, Chong Su, Lida Zhu and Wanshan Wang address an approach of conflict resolution for collaborative design. The method solves the problem of conflict resolution. A UML model for the conflict resolution is set up. The conflict resolution process is divided into conflict observing, conflict decision and the conflict informing. The methodology proposes the knowledge management for conflict resolution, which can assist to solve the problem. In network condition, it is solved well. The system will make conflict resolution automatically. The deadlock problem is solved in the system. Prototype shows that the method is suit to solve the problem of conflict for collaborative design.

In the paper, ‘Study of fuzzy control for controllable suspension based on ADAMS and MATLAB co-simulation’, Zhi-cheng Wu, Quan-min Zhu, Alan Winfield and Si-zhong Chen introduce fuzzy control of controllable vehicle suspension system and co-simulation with ADAMS and MATLAB. The co-simulation of the fuzzy control for controllable suspension with ADAMS and MATLAB is completed. From the results, the fuzzy controller can effectively operate under variable work conditions.

In the paper, ‘Type-II T-S fuzzy modelling for SCR flue gas denitration’, Qian-fang Liao, Ning Li and Xue-cong Hu propose a method of type-II T-S fuzzy modelling for SCR flue gas denitration. It is based on the type-I T-S fuzzy model by fuzzifying the type-I fuzzy sets to get the type-II fuzzy sets as the antecedents and the crisp numbers to get the type-I fuzzy sets as the consequents, respectively. The simulation results of SCR process show a good performance of the proposed method.

In the paper, ‘A new particle swarm optimisation based on MATLAB for portfolio selection problem’, Jianwei Gao and Zhonghua Chu focus on the constrained portfolio selection problem and develop an improved particle swarm optimisation (IPSO) algorithm to solve it.

Overall, we feel that these papers cover quite a spectrum of what is a novel yet highly important research field. Hopefully, this special issue give a clear indication of the present state of play and point to exciting opportunities for future research programmes and investigations in the years ahead.