Editorial

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Biographical notes: Kang Li is a Senior Lecturer in Intelligent Systems and Control at Queen's University Belfast. His research interests include advanced algorithms for training and construction of neural networks, fuzzy systems and support vector machines, as well as advanced genetic algorithms, with applications to non-linear system modelling and control, microarray data analysis, systems biology and environmental modelling and monitoring. He has produced over 120 research papers and co-edited seven conference proceedings in his field. He is a Chartered Engineer, a member of the IEEE and the InstMC and the current Secretary of the IEEE UK and Republic of Ireland Section.

Q. Henry Wu is a Chair Professor in Electrical Engineering and leads the Intelligence Engineering and Automation Research Group at The University of Liverpool. He is a Chartered Engineer, fellow of IET and Senior Member of IEEE. He has served as Committee Member of IET professional groups and as an Editorial Board Member of four academic journals. His research interests include non-linear adaptive control, neural networks, evolutionary computation, reinforcement learning, support vector machines, mathematical morphology, biologically inspired algorithms and multi-agent systems. He has authored or co-authored over 320 papers and has undertaken a number of research and industrial projects.

This is the first of the two special issues on computational intelligence, presenting ten papers which are selected from the *Proceedings of the 2008 International Conference on Modelling, Identification and Control (ICMIC 2008)* held in Shanghai, China from 28 June to 2 July 2008, and are in their extended version. ICMIC 2008 provided an international forum for professionals, academics and researchers to present the latest developments from interdisciplinary theoretical studies, computational algorithm development and applications in modelling, identification and control. The conference particularly welcomed those emerging methodologies and techniques that bridge theoretical studies and applications in all branches of engineering and sciences. The two special issues reflect some of the latest research advances in computational intelligence and its applications in engineering systems, and particularly in the area of non-linear system modelling and control. This special issue mainly focuses on the application of artificial neural networks (ANNs) in engineering applications.

There are six papers included in this special issue which are concerned with the application of neural networks and fuzzy systems in control, and one paper on the stability analysis of neural networks.

Sun et al. propose a modified neural network-based predictive control strategy for non-linear systems. In this new control strategy, control signals are generated by minimising an objective function, which considers both the cumulative differences between a set-point and the output of the neural model and the control signal changes. This leads to a more accurate control performance. The efficacy of their proposed method has been confirmed by simulation results, in comparison with other control strategies.

Wu et al. report a new robust non-linear feedback control strategy combined with a neural network estimator for bank-to-turn (BTT) missiles. The non-linearities in the system dynamics are considered. Standard feedback linearisation is employed, and then a linear matrix inequality (LMI) based guaranteed cost control (GCC) is used to tackle the robust control problem with regards to the uncertainties in the linear models. Further, adaptive neural network estimators are used to eliminate high-order uncertain terms. Simulation results demonstrate that the proposed approach achieves better tracking performance in comparison with a conventional method.

Zhao et al. investigate radial basis function (RBF) neural network-based slide mode control for a type of ballistic missiles. They analyse the non-linear models for the three

channels of a ballistic missile. The coupled terms are taken as additional disturbances for every single channel and an RBF neural network-based sliding mode controller is designed for every channel's thrust vector control system. Their simulation examples show that the designed RBF neural network-based sliding mode controller performs well in comparison with that of a conventional PID controller.

Sun et al. study the decoupling control of bearing permanent magnet-type synchronous motor (BPMSM), and they propose a complete model including the two Park inverse transformations, two Clark inverse transformations, two current following inverters and a load model of BPMSM. With the design of an ANN-based inverse model, the control system is decoupled into two independent second-order linear subsystems and a first-order linear subsystem. This makes it much easier for the design of the close-loop linear regulators. The simulation results confirm the efficacy of the proposed method.

Li et al. study the control of fuzzy discrete event systems (FDES) and its application to air conditioning (AC) systems. They find that the non-linear, asynchronous and uncertain nature must be considered in the control of the AC systems. A FDES is introduced into the AC control where both the cost and effectiveness function are considered.

Finally, Wu et al. investigate the stability analysis of cellular neural networks with time-varying delay. They present new delay-dependent exponential stability conditions of cellular neural networks with time-varying delays by constructing the Lyapunov function and using LMI. Numerical examples demonstrate the effect of the proposed method.

This special issue also includes two papers concerning the application of neural networks in system modelling, and another two papers investigating the application of support vector machines (SVM) in bio-medical systems.

Yan and Yang investigate the modelling of thermally induced error of machine tools, and they propose a new method of combining all of the trained neural networks to represent the error. Algorithms for selecting the component networks are developed. The method is applied to cutting experiments conducted on a CNC turning machine, and the results show that a significant improvement in the model accuracy and robustness has been achieved compared with single neural networks.

Jin and Li use neural networks to model the transmission hydraulic actuators. They identify that the availability of pressure information in a hydraulic actuator would make it possible to improve the fuel economy, reduce emission and enhance driving performance. They recognise that it is still hard to obtain an accurate model which accurately reflects the non-linear characteristics of the hydraulic actuator through routine methods. Therefore, an RBF neural network-based algorithm is developed in this paper to estimate the parameters of the hydraulic actuator in a vehicle power transmission control system. The experimental results show that the proposed model can effectively capture the main characteristics of the hydraulic actuator dynamics.

Wu et al. investigate the problem of monitoring and evaluation of chronic fatigue syndrome (CFS). They recognise that the intelligent garment (IG), embedded with electrical vital signal capturing and analysis model can be use to offer the personal health monitoring anytime and anywhere. Therefore, an IG embedded online CFS evaluation system has been proposed. The principal component analysis (PCA) method is used to reduce the feature space and a fuzzy multiclass SVM is developed to improve the evaluation accuracy. Experimental results confirm the efficacy of the proposed method.

Finally, Xia et al. propose a two-stage gene selection method when the SVM is applied to microarray data. This new method aims to reduce the number of genes involved in the construction of the SVM and their experimental results, from two well-known microarray datasets, show that SVMs with two-stage gene selection maintains a consistently high accuracy with a small number of genes. It is also shown that the proposed method outperforms the two other typical gene selection methods – baseline method and significance analysis of microarrays in terms of accuracy.

These ten papers serve as an introduction to the applications of bio-inspired computing techniques in modelling and control of engineering systems as well as in the analysis of bio-medical data and should act as a catalyst and inspiration for future research. Finally, we would like to express our gratitude to many reviewers involved for editing this special issue.