Editorial

Xing-sheng Gu* and Yugang Niu

School of Information Science and Engineering,
East China University of Science and Technology,
130 Meilong Rd, Shanghai, 200237, China
E-mail: xsgu@ecust.edu.cn
E-mail: acniuyg@ecust.edu.cn
*Corresponding author

Biographical notes: Xing-sheng Gu works with the East China University of Science and Technology, where he is currently a Professor. He is now acting as the Vice Chairman of Shanghai Association of Automation, the Director of Chinese Association for System Simulation, the Vice Director of the Specialized Committee of Chemical Process Automation and Instruments. He is acting as the Editorial Member of *Cognitive Neurodynamics*, *Journal of East China University of Science and Technology*, and *Chemical Process Automation and Instruments*. His recent research interests include planning and scheduling for process industry, modelling complex industry processes, control and optimisation, etc.

Yugang Niu now works with the East China University of Science and Technology, where he is currently a Professor. From 2004 to 2008, as a Research Fellow, he visited the City University of Hong Kong for two years. In 2008, as a Visiting Research Fellow supported by the Royal Society of the UK, he visited the Brunel University in UK. Currently, he is acting as the Associate Editor of Conference Editorial Board, and IEEE Control System Society. His recent research interests include stochastic systems, sliding mode control, networked control systems, Markovian jumping systems, neural network control, etc.

This volume contains many of the papers presented at the conference *ICMIC 2008* held in Shanghai, China in October, 2008. The majority of the papers consider aspects of advanced control technology from the theoretical to applications. Many of the problems arising in the advanced control theory in general and the articles in this volume in particular, fall into the category of modelling, algorithms, modal analysis and identification and applications.

In the *Modelling* section, these are papers on modelling problems arising in the six-phase induction machine, speed servo system, general transmission system, non-linear system, the measuring system of the cell segmentation and tracking, Takagi-Sugeno-Kang (TSK) fuzzy model and a three-dimensional root model for root segment individual.

In the *Algorithms* section, these are papers on dynamic balance distribution algorithm for network traffic problem, combined algorithm of genetic algorithm (GA) with extremal optimisation (EO) for the 2D lattice model of protein folding, an improved particle filter algorithm for visual target tracking, an improved dynamic time warping (DTW) algorithm for online handwritten signature verification, an improved formulation of linear quadratic optimal control law based on GAs and a real-time motion detection algorithm.

In the *Modal analysis and identification* section, these are papers on modal analysis of Francis turbine blade and the online multivariable process frequency identification technology.

The *Applications* section covers more aspects, such as the application of wavelets transforms for distributed parameter systems, metaheuristic control for an activated sludge process, immune control system for thermal processes, neural fuzzy optimising control for switched reluctance motor drive system, synchronisation estimation and signal acquisition for direct-sequence ultra wide band (DS-UWB) system, a robust non-fragile controller design for switched linear system with state delays, a lifting technique to transform a multi-rate input sampling control system into single-rate one, a new concept of the robust compound observer for Lipschitz non-linear system with unknown input disturbance, a satisfying optimal control for switching multiple model systems based on mixed logic dynamics and the theoretical and statistical analysis for the probability density function (PDF) of the target location error in bi-station bearing-crossing locating.

We believe that the series of works in this special issue provide a useful reference for understanding the theory and application of advanced control technology. In total, 25 papers have been selected. The contents of these studies are briefly described as follows.

Modelling

In the paper, 'Modelling and control of six-phase induction machine under special current waveform', Yongle Ai, Yumei Wang and Kamper Marrten proposed a new control

strategy of the torque and field currents applied to the six-phase induction motor drive, which simplifies the control algorithm by removing the complex transformations used in flux orientated control.

In the paper, 'Study on parameters self-tuning of speed servo system based on LS_SVM model', Pengzhan Chen and Xiaoqi Tang proposed a parameters self-tuning method, by using LS_SVM reference model of the practical system so as to satisfy the demand of the parameters self-tuning of the speed servo system.

In the paper, 'On the finite queuing model M/G/m/1/h system', Yuqiang Wu and Lijun Gao presented the models of a general transmission systems with general distribution for the transmission time and gave the performance evaluations by computing the state transition probabilities.

In the paper, 'Robust stability of non-linear system with modified Prandtl-Ishlinskii hysteresis model', Mingcong Deng, Changan Jiang and Akira Inoue considered the robust stability of non-linear system with modified Prandtl-Ishlinskii (PI) hysteresis model. A modified PI hysteresis model with unknown slopes was concerned, with which the BIBO stability of the non-linear system was achieved by a condition based on robust right coprime factorisation.

In the paper, 'Cell motility tracking of intravital microscopy via binary fitting energy driven model for level-set', Qiang Wang and Qi-hua Yang considered the cell segmentation and tracking techniques to improve the performance of measuring cell activity and a contour strategy for digital cell image by local binary fitting energy under variational model framework was presented.

In the paper, 'An iterative fuzzy identification method hybridising modified objective cluster analysis with genetic algorithm', Na Wang and Yu-pu Yang developed an iterative fuzzy identification method hybridising modified objective cluster analysis with GA for TSK fuzzy modelling problem. The performance of the proposed method is shown to be superior to the other methods by a famous electrical simulation example.

In the paper, 'Simulation of interactions between root system growth and soil water movement', Wu-ping Zhang, Kuan-hu Dong and Bao-guo Li developed a three-dimensional root model based on the functional-structural plant model of GREENLAB and spatial growth rules of root segment individual. By means of the above models, this paper provided a method to implement the interacting processes between root growth and soil water distribution.

Algorithms

In the paper, 'Optimisation and simulation on dynamic balance distribution algorithm for network traffic', Suying Yang, Xin Zhang and Jincheng Wang presented a dynamic balance distribution algorithm to distribute the traffic so as to get a more reasonable allocation of the network-source.

In the paper, 'A combined algorithm to the 2D lattice model for protein folding', Hengyun Lu, Genke Yang and Lam Fat Yeung presented a search strategy for protein folding by combining GA with EO. It was demonstrated in the paper that the marriage of GA and EO can be applied successfully to the protein folding problem and the proposed algorithm can find these best solutions so far for the listed benchmarks.

In the paper, 'Visual tracking by particle filtering in a dynamic environment', Guocheng Liu and Yongji Wang presented an improved particle filter algorithm to track a moving target under natural environment. It was shown via simulation examples that the proposed method can track the target with robustness in real-time.

In the paper, 'The algorithm of online handwritten signature verification based on improved DTW', Fang-Jun Luan, Kai Li and Si-Liang Ma presented an online handwritten signature verification algorithm using improved DTW technology. Some experiment results were provided to illustrate the effectiveness of the proposed algorithm.

In the paper, 'An optical flow and inter-frame block-based histogram correlation method for moving object detection', Nan Lu, Jihong Wang and Q.H. Wu presented a real-time motion detection algorithm based on the integration of optical flow and inter-frame block-based histogram correlation method. The optical flow method is used to detect any movement under the background and the inter-frame block-based histogram correlation method is used to eliminate the background information and separate the moving object from it.

In the paper, 'An improved optimal guidance law with impact angle constraints based on genetic algorithms', Zongzhun Zheng, Yongji Wang and Hao Wu proposed an improved formulation of optimal guidance law based on GAs. Linear quadratic optimal control theory is derived to consider terminal velocity maximisation, GAs are employed to search weight coefficient matrix of the linear quadratic performance index optimum process problem.

Modal analysis and identification

In the paper, 'Modal analysis of Francis turbine blade based on fluid-structure interaction theorem', Zhang Lixia, Zhang Wei and Yang Zhaohong gave some modal analysis on Francis turbine blade with fluid-structure interaction (FSI), which showed that the natural frequencies decrease dramatically and the mode shapes in operating flow path are close to those in air.

In the paper, 'Online multivariable process identification in the frequency domain', Ya-Gang Wang, Xiao-Ming Xu and Wen-Jian Cai presented an online method of multivariable process identification in the frequency domain by using signal decomposition and frequency spectrum analysis, which was further illustrated by some simulation examples.

Applications

In the paper, 'Application of wavelets transforms to distributed parameter systems' control', Gui-ge Gao,

Xian-wen Zeng and Xing-sheng Gu presented an approach for a class of DPS boundary control by using Haar orthogonal wavelets approximation. This simulations show that the proposed method has an advantage over other orthogonal function approximate ones in some aspects.

In the paper, 'Metaheuristic control of substrate concentration for an activated sludge process', Fotis N. Koumboulis, Nikolaos D. Kouvakas, Maria P. Tzamtzi and Anna Stathaki proposed a two-stage linear dynamic control scheme for the effluent substrate concentration of an ASP. The simulation experiments were provided to illustrate the proposed control method.

In the paper, 'The design of an immune control system for thermal processes and its stability analysis', Jie Wu, Jiong Shen and Yi-guo Li constructed an immune feedback controller system (IFCS) and proved the stability and boundedness of the immune control system for the self-balanced thermal processes.

In the paper, 'Neural fuzzy control to minimise torque ripple of SRM', Jian Liu, Feng Qiao, Caiyun Li and Bin Li proposed a kind of neural fuzzy controller to tackle the problem of torque ripple reduction in switched reluctance motor drive. The simulation results were provided to illustrate the effectiveness and feasibility of the proposed scheme.

In the paper, 'Synchronisation estimation and signal acquisition for DS-UWB system', Dong Feng, Sabir Ghauri and Quan Zhu proposed a simple and fast method to realise UWB synchronisation estimation and signal acquisition for DS-UWB system. The transmitter-receiver synchronisation and one signal acquisition method for DS-UWB signals were investigated and then the channel impulse response was studied via simulation. The simulation results were presented and discussed.

In the paper, 'Calculation of the probability density function of the target location error in bi-station bearing-crossing locating', Fa-xing Lu and Ling Wu presented the theoretical and statistical analysis on the PDF of the target location error and proven that the error is not normally distributed under most circumstances.

In the paper, 'Robust non-fragile control for the switched discrete-time linear system', Dejun Tang, Dongqing Zhang, Yonghu Yang and Zhenyu Liu developed a robust non-fragile controller applying for switched linear system with state delays. The observer is also designed for measuring unknown state variables. The reduction of the conservatism is resolved by using of the switched Lyapunov function approach. Numerical examples are described to show the effectiveness of the proposed methods.

In the paper, 'On model-based networked control system with multi-rate input sampling', Zhi-wen Wang and Ge Guo introduced a lifting technique to transform a multi-rate input sampling control system into single-rate one. Model based control scheme, state feedback control and stability are used. Some simulations are presented.

In the paper, 'Robust compound observers design for Lipschitz non-linear systems with unknown input disturbance', Jin Zhao, Zhong-Yu Shen and Xing-Sheng Gu presented a new concept of the robust compound observer for Lipschitz non-linear system with unknown input disturbance, which can simultaneously estimate the system states and unknown input disturbances. Numerical simulation results are presented to validate the approach and the robustness to the system non-linearity and uncertainty.

In the paper, 'Satisfying optimal control of switching multiple models based on mixed logic dynamics', Han-hua Xiong and Shao-yuan Li proposed satisfying optimal control for switching multiple model systems based on mixed logic dynamics. The numerical simulation result revealed the validity of the algorithm.