Editorial

Lihua Jiang*

State Key Laboratory of
Synthetical Automation for Process Industries,
Northeastern University,
No. 11, Lane 3, WenHua Road, HePing District,
Shenyang, Liaoning Province, 110819, China
E-mail: jianglh@mail.neu.edu.cn
*Corresponding author

Shuhui Bi

Institute of Automation,
Shandong Academy of Sciences,
19 Keyuan Road, Jinan, Shandong, 250014, China
E-mail: bishuhui@gmail.com

Biographical notes: Lihua Jiang received her PhD from Okayama University, Japan in 2009. She is currently a Lecturer with State Key Laboratory of Synthetical Automation for Process Industries at Northeastern University, China. She is also a Vice-Secretary-General of Technical Committee on Process Control, Chinese Association of Automation. Her research interests include robotics, pattern recognition and system identification, instrumentation and measuring.

Shuhui Bi is an Associate Professor of Shandong Academy of Sciences, China. She received her PhD from Okayama University, Japan in 2010. She was a Visiting Researcher at the Department of Electrical and Electronic Engineering, Tokyo University of Agriculture and Technology, Japan. Her research interests include operator-based non-linear system robust control and fault detection, MIMO non-linear systems and time-delay systems.

This is the special issue composed of selected papers from the *2010 International Conference on Modelling, Identification and Control (ICMIC'10)*. It was held at the Okayama University, Japan, July 17–19, 2010. From this conference, eight technical contributions of high quality on system modelling and optimal control are selected into this special issue. The contents of these studies are briefly described as follows.

The paper by Wang, Fan and Lu entitled 'Modelling and simulation of an aerial vehicle steering to hit on top of the target at terminal trajectory' introduces combined attitude control of the terminal trajectory for an aerial vehicle. The combined attitude controller includes the fuzzy adaptive aerodynamic force mode control and the direct lateral thrust mode control. The dynamic and kinematics mathematical models of the aerial vehicle are built based on the designed reaction-jet control scheme. Simulation results show that the combined control system can satisfy the requirements of the aerial vehicle overload better than the traditional mode does.

'A modified adaptive control scheme in the presence of input saturation' by Takagi, Sato and Oya presents a model reference adaptive control scheme (conventional control scheme) for continuous time single-input single-output linear systems with an input saturation. In the closed loop system using the conventional control scheme, the tracking error between the controlled object output and the reference model output can converge to zero. The tracking performance can be improved by setting only one design parameter. In order to save the time spent to meet the condition for initial states, the main attention is focused on reduction of the design parameters to be adjusted. The conventional control scheme is modified and a new adaptive control scheme is proposed. As a result of analysing stability of the closed loop system using the new control scheme, a new condition for initial states is derived. The new control scheme can be applied in a larger region of initial states compared with the conventional control scheme.

The paper entitled 'Implementation of performance-adaptive PI control on a weigh feeder' by Sato, Kitano, Yamamoto, Araki and Konishi, in the design of a weigh feeder control system, proportional and integral (PI) control is widely employed because parameter tuning is easy and the control parameter can be intuitively understood. In this research work, the control parameters of the PI control system are designed on the basis of generalised minimum variance control (GMVC), and the weighting parameter for the control deviation is adaptively updated according to the control performance. Both the simulation and the experimental results demonstrate the effectiveness of the GMVC-based PI control.

In the paper by Wu, McLean, Harris and McAuley entitled 'Selection of optimal parameter set using

estimability analysis and MSE-based model-selection criterion', difficulties associated with poor numerical conditioning are avoided by only estimating unknown parameters that are most estimable. The remaining parameters are left at their initial values or can be removed from the model via simplification. In this paper, a mean squared error (MSE)-based model-selection criterion is used to determine the optimal number of parameters to estimate from the ranked parameter list, so that the most reliable model predictions can be obtained. The method is illustrated by using a dynamic chemical reactor model.

In the paper by Zeng, Zhang, Mao, Li and Fan entitled 'Modelling of SST/BES and its application to power quality improvement', a solid state transformer incorporated with battery energy storage (SST/BES) is proposed. The proposed system, which consists of a SST, a battery bank and a bidirectional dc-dc converter, can be used to improve the reliability of residential power supply. With the help of BES, which is connected to the low voltage dc link in SST via the DC/DC converter, the SST/BES can supply the power demanded by the residential load in the event of the voltage sags and momentary interruptions of the input voltage. Necessary models are developed and control strategies are presented in a detailed manner. Time domain simulations are carried out by using MATLAB/Simulink to demonstrate the effectiveness of the proposed scheme.

In 'Design method of ideal vehicle models in adaptive steering driver-combined-vehicle systems' by Wang, Oya, Tamaru and Takagi, a new method to design ideal vehicle models of adaptive steering driver-combined-vehicle systems for various drivers is proposed. Namely, considering driver reaction time delay, three groups of drivers is classified. For the three groups of drivers, three ideal vehicle models are designed. By carrying out numerical simulations, it is shown that good handling performance can be achieved when the actual vehicles track the designed ideal vehicle models.

The paper by Henmi, Deng and Inoue entitled 'Non-linear controller for stabilisation control of a cart-type inverted pendulum system' discusses a stabilisation control problem of a cart-type inverted pendulum system (CIPS). A new non-linear controller which guarantees stabilising for widespread states of the systems using a partial linearisation method is proposed. The proposed controller is designed in two steps: in Step 1, a reference function for the angular position of the pendulum by analysing a necessary movement of the cart to keep any angle of the pendulum is designed. This reference function is decided in order to achieve converging the cart and the pendulum to desired values, simultaneously. And in Step 2, a partial linearisation controller which can track pendulum to the reference angular position designed in Step 1 is designed. By numerically analysing a ZeroDynamics of system, the stabilities of the pendulum and the cart are proved. Simulation results using MATLAB/Simulink are given to show the effectiveness of the proposed controller.

In the paper 'High gain adaptive control for a class of uncertain non-holonomic systems' by Michino and Mizumoto, a controller design method of high gain adaptive feedback for non-holonomic systems with unknown system parameters and a class of unbounded uncertainties and/or disturbances is proposed. The considered unbounded uncertainties and/or disturbances are decomposed by a known function and unknown constants. The designed adaptive controller is rather simple structure, since it has only one adaptive adjusting term which is a feedback gain designed based on high gain technique. Further, the controller achieves not only the stability of the controlled system but also convergence to a small region around origin by increasing the design parameters. The application of the controller to a non-holonomic wheeled mobile robot is considered as an illustrative example.

Acknowledgements

The guest editors would like to thank all the authors for their contributions. The guest editors wish that the readers can benefit from the above eight papers. The guest editors would like to thank the *International Journal of Advanced Mechatronic Systems* for giving us the opportunity to serve as the guest editors for the special issue. Finally, the guest editors would also like to thank the reviewers for their excellent job on evaluating these papers.