Editorial

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Biographical notes: Ahmad Taher Azar received his MSc in System Dynamics in 2006 and PhD in Adaptive Neuro-Fuzzy Systems in 2009 from Faculty of Engineering, Cairo University, Egypt. He is currently an Assistant Professor, Faculty of Computers and Information, Benha University, Egypt. He is the Editor-in-Chief of two journals published by IGI Global, USA entitled *International Journal of System Dynamics Applications* (*IJSDA*) and *International Journal of Rough Sets and Data Analysis* (*IJRSDA*). He is an Associate Editor of *IEEE Trans. Neural Networks and Learning Systems*. His research interests include control systems, soft computing, and computational intelligence.

This issue for 2014 of the *International Journal of Modelling, Identification and Control* (*IJMIC*) covers a lot of topics in ‘Sliding model control and nonlinear system identifications’. It contains six contributions that are distributed as follows.

The first paper by Msaddek et al. presents a novel technique of higher order sliding mode control in order to solve the problem of chattering phenomenon which appears, generally, with standard sliding mode controller. The proposed approach provides an exponential stability on the sliding surface and guarantees the robustness of the closed loop system against uncertainties and external matched disturbances. The resulting controller has been applied to control an induction motor. The proposed controller provides for an exponential stability of the closed loop systems. Simulation results show the high performances and the effectiveness of the proposed approach.

The second paper by Rhif et al. provides new analytic tools for a rigorous control formulation and stability analysis of sliding mode-multimodel controller (SM-MMC). In this way to minimise the chattering effect a multimodel approach is proposed to change the commutation of the sliding mode control (SMC) into fusion using a first order then a high order SMC with single sliding surface and, then, with several sliding surfaces. The stability conditions invoke the existence of two Lyapunov-type functions, the first associated to the passage to the sliding set in finite time, and the second with convergence to the desired state. The approaches presented in this work are simulated on the immersion control of a submarine mobile which presents a problem for the actuators because of the high level of system nonlinearity and because of the external disturbances. Simulation results show that this control strategy can attain excellent performances with no chattering problem and low control level.

The third paper by Tarhouni et al. deals with the identification of nonlinear systems using multi-kernel approach. First, support vector regression (SVR) has been improved in order to identify nonlinear complex system. The idea consists in dividing the regressor vector in several blocks, and, for each one a kernel function is used. This blockwise SVR approach is called support kernel regression (SKR). Furthermore, two methods are proposed: SKR(rbf-lin) and SKR(rbf-rbf). Second, the SKR approach is improved to deal with the problem of NARMA system identification. Therefore, a new method called support kernel regression for NARMA (SKR NARMA) model is suggested. The basic idea is to consider the terms of auto-correlation and cross-correlation of the nonlinearity of input output discrete time processes, and for every term a kernel function is used. An example of MIMO system is presented for qualitative comparison with the classical SVR approach based on a single kernel function. The results reveal the accuracy and the robustness of the obtained model based on the proposed SKR NARMA-based approach.

In the sequel, the paper by Flah et al. deals with an online motor parameters estimation algorithm. The proposed estimator algorithm is implemented on an electrical vehicle prototype, in order to discern the influence of the speed variation on the motor parameters, such as stator resistance and inductance and on the magnet used in the rotor, especially at a high speed mode. The high speed running mode is extremely required in the traction and electrical vehicle application. This last mode induces problems related especially to the motor temperature rising. Hence, the temperature motor variation modifies the values of the motor parameters and specially, the stator resistance and the magnet flux. Therefore, this work is elaborated, to clarify this running mode and its impact on the motor behaviour. Two essential methods are applied in order to validate the obtained results. The software method based on the model reference adaptive system (MRAS) technique and the hardware method using a specific measurement materials. The obtained results are based on a real prototype and under a high speed mode, where the running speed can reach the 32,000 rpm.

The fifth paper by Romdhane et al. involves a new discrete second order sliding mode control via input output model. A stability analysis of the proposed control was then studied. To illustrate the effectiveness of the proposed discrete second order sliding mode control law, a classical discrete sliding mode control and discrete second order sliding mode control were applied to a real discrete second order system via input output model. The experimental results of the proposed discrete sliding mode control law show good performances in terms of the rejection of the external disturbances and the reduction of the chattering phenomenon.

Finally, Vaidyanathan in the last paper of this issue, the problem of sliding controller design for the global chaos synchronisation of identical nonlinear chaotic systems is investigated and new results are derived using Lyapunov stability theory. The general result gives a procedure for constructing a sliding mode controller for achieving global chaos synchronisation for identical chaotic systems under certain assumptions. Next, the problem of sliding controller design for the global chaos synchronisation of identical Li-Wu chaotic systems (Li et al., 2013) is investigated and a new result is derived. The sliding controller design for identical Li-Wu chaotic systems is illustrated with numerical simulations.

As a guest editor, I hope that the papers in this issue will stimulate further research in sliding model control and nonlinear system identifications. I hope that this issue, covering so many different aspects, will be of value for all readers.

I'm pleased with the fact that the journal has been attracting good quality papers covering very interesting and novel aspects of sliding model control. This issue is a clear indication of the positive trend and we thank the authors for their contributions in this issue. I'd like to thank also the reviewers for their diligence in reviewing the papers and the Editors who managed the review of the papers. Special thanks to the Editor-in-Chief of *Int. J. Modelling, Identification and Control* (*IJMIC*), Prof. Quan MinZhu, University of the West of England, UK.

References

Li, C., Wu, L., Li, H. and Tong, Y. (2013) 'A novel chaotic system and its topological horseshoe', *Nonlinear Analysis: Modelling and Control*, Vol. 18, No. 1, pp.66–77.