Editorial

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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 advanced control are selected into this special issue. The contents of these studies are briefly described as follows.

The paper by Golpîa, Bevrani and Golpîra entitled 'Effect of physical constraints on the AGC dynamic behaviour in an interconnected power system' aims to demonstrate the effect of re-heat and non-reheat turbines and some important physical constraints such as generation rate constraint (GRC), time delay and speed governor dead band on the dynamic behaviour of automatic generation control (AGC) in an interconnected power system. Simple structure beside acceptable response of the conventional integral controller makes it attractive for power system AGC issue. Optimum integral gains are computed by genetic algorithm (GA) technique for an interconnected three control areas with non-reheat/reheat generating units to achieve an optimal performance. Simulations results reveal that the scope of optimum solutions was limited by considering physical constraints in addition to the increasing of settling time and over/under-shoots.

'WAM-signal-based decentralised fuzzy control for large power systems with unavailable states' by Dou, Zhao, Bo, Jia and Liu and introduces a novel decentralised fuzzy control design method by using wide-area measurement (WAM) signals. First, a set of equivalent Takagi-Sugeno (T-S) fuzzy models are extended in order to accurately represent the non-linear dynamics of large power systems. Furthermore, taking consideration of systemic states not all available, a fuzzy observer is proposed to estimate these

states. Then, a fuzzy-observer-based decentralised state feedback controller is designed. Based on Lyapunov functional approach and H_∞ control method, some sufficient conditions for the existence of the controller are cast into the feasible problem of LMIs, by which the system can be asymptotically stabilised. Moreover, the minimising approach is proposed to search the suboptimal upper bound value of H_∞ performance function. Finally, the better control performances of the proposed methods are shown by the simulation examples.

In 'Robust H_∞ reliable control of uncertain stochastic switched non-linear systems' by Xiang, Qiao and Wang, investigates the problem of robust H_∞ reliable control for a class of uncertain stochastic switched non-linear systems. The parameter uncertainties are assumed to be time-varying but norm-bounded. Firstly, using the average dwell time approach, a criterion of mean-square exponential stability with H_∞ performance for stochastic non-linear switched system is proposed. Then, a kind of design method of H_∞ reliable control for stochastic switched non-linear system with actuator failures is presented, and the problem of robust H_∞ reliable control for uncertain stochastic switched non-linear systems with actuator failures is investigated. Finally, a numerical example is presented to illustrate the effectiveness of the proposed approach.

The paper by Kami and Nobuyama entitled 'An exterior-point approach to the robust **D**-stability control with output feedback' deals with the robust **D**-stability (regional pole placement) control against time invariant polytopic uncertainties. It is known that such robust control problems can be described as parameter dependent bilinear matrix inequality (robust BMI) problems which are difficult to be solved. In this paper, an iterative approach is proposed to design a static or a reduced-order output feedback controller achieving the robust **D**-stability constraint. The feature of the proposed approach is to construct a controller sequence approaching a feasible region from the outside. Numerical examples are given to show the efficiency of the proposed approach.

'Modelling and multivariable robust controller for a power plant', by Gharib, Kamelian, Mousavi and Dabzadeh. The primary intention of this paper is to apply a robust quantitative feedback theory (QFT) controller for boiler pressure of the Mashhad power plant system. Initially, modelling of the mentioned system and its disturbance are achieved experimentally. Then, a controller is designed for tracking problem and disturbance. The main steps involved in designing are template generation, disturbance, loop shaping and per-filter shaping design. For more comparisons, sliding mode control as a well-known control approach is also applied to the plant. Finally, non-linear simulation has been carried out and the two controllers are compared. Obtained results demonstrate that applying the proposed techniques successfully overcome obstacles for robust control of the power plant pressure.

In 'Multi-objective dynamic state and output feedback controllers for MIMO system using evolutionary algorithm and eigenstructure assignment', Sutha and Thyagarajan consider design of eigenstructure assignment (EA)-based multi-objective dynamic state and output feedback controllers for linear discrete MIMO system. Fast and elitist multi-objective evolutionary algorithm (MOEA) known as non-dominated sorting genetic algorithm-II (NSGA-II) is applied for solving multi-objective problem. The robust stability and transient response are ensured by minimum condition number of eigenvector and minimum norm of controller gain. The proposed controllers use complex valued chromosomes to represent complex parametric vector. The effectiveness of the proposed controllers is validated by implementing the same in an interacting three-tank benchmark system.

In the paper by Yang, Zheng and Huang entitled 'Impulsive synchronisation for a class of non-linear coupled reaction-diffusion systems', a class of non-linear coupled reaction-diffusion systems is studied using the non-linear theory and methods. The existences of global solutions of the systems with and without impulses are obtained. By using Lyapunov function and comparison theorem, a criterion of impulsive synchronisation for the driving and the driven systems is established. As the application, an example about impulsive synchronisation is given, and the numerical simulation shows the method is effective.

'Application of matching pursuits of power quality disturbance classification', by Wang, Jia, Dou and Bo. In this paper, a novel power quality disturbance classification method based on matching pursuits (MP) algorithm which is used to decompose the atom dictionary is presented. Authors design four coherent dictionaries by analysing characteristic of power quality disturbance, which simplifies the calculation of MP algorithm. Based on the coherent dictionaries, the fundamental frequency component (FFC) and disturbance component are extracted respectively. And the parameters of FFC and disturbance component are obtained. By analysing the relationship of energy in disturbance component and residual signal, the noise and the disturbance with little influence the FFC can be filtered. Simulation and real data results confirm the effectiveness of the proposed method.

As guest editors of this special issue, we would like to thank all the authors for their contributions. We wish that the readers can benefit from the above eight papers. We 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, we would also like to thank the reviewers for their excellent job on evaluating these papers.