Editorial

Mingcong Deng*

Department of Systems Engineering,
Okayama University,
3-1-1 Tsushima-Naka,
Okayama, 700-8530, Japan
E-mail: deng@suri.sys.okayama-u.ac.jp
*Corresponding author

Hong Wang

Control Systems Centre,
School of Electrical Engineering and Electronics,
The University of Manchester,
P.O. Box 88, Manchester, M60 1QD, UK
E-mail: hong.wang@manchester.ac.uk

Akira Inoue

Department of Systems Engineering,
Okayama University,
3-1-1 Tsushima-Naka,
Okayama, 700-8530, Japan
E-mail: inoue@suri.sys.okayama-u.ac.jp

Welcome to the special issue composed of selected papers from the *UKACC International Conference on Control 2008*. UKACC stands for the UK Automatic Control Council and the conference was held at the University of Manchester between the 2nd and the 4th of September, 2008, where there were 170 papers presented attracting over 200 participants all over the world. From this conference, six technical contributions of high quality on control theory and application are selected into this special issue. The main contents of the papers are briefly described as follows:

'Design and implementation of non-linear minimum variance filters' by Naz and Grimble. In this paper the authors present the design and evaluation of the NMV algorithm for the non-linear MIMO filtering problem. A case study is used to demonstrate performance that is based upon a problem in the medical signal processing area. The design and the real time implementation of the NMV estimator are also considered, for a laboratory based ball and beam experiment. The performance is compared with that of an extended Kalman filter and real time implementation of both estimators is discussed.

'Constrained variance control of peak-pressure position by spark-ionisation feedback for multi-cylinder control' by Rivara, Dickinson and Shenton. In this paper, a neural-network (NN) is identified in conjunction with the ionisation current from the spark plug of a spark ignition (SI) gasoline internal combustion (IC) engine as a peak-pressure position (PPP) virtual sensor. An ARMAX model is identified around the NN. Constrained variance (CV) control is used to ensure the PPP tracks to a set point known to give minimum advance for best torque (MBT). The technique is extended to multi-cylinder control which experimentally demonstrates a reduction in cylinder-to-cylinder differences of indicated mean effective pressure (IMEP).

'Output regulation of linear systems with non-linear exosystems' by Ding. This paper deals with output regulation with non-linear exosystems. The dynamic system itself is assumed to be linear. Non-linear observer design techniques are exploited for the internal model design. A new strategy for internal model design is proposed, based on a dynamic extension of the existing non-linear observer design for the non-linear exosystem. Additional filters are used to estimate the invariant manifold in the state space subject to the non-linear exosystem. The proposed design for the internal model and control ensures that the state variable asymptotically converge to the invariant manifold, which implies that the regulated output state asymptotically converge to zero.

'Minimum entropy control of non-linear TITO systems with random delays' by Zhang, Wang and Wang. This paper presents a control system design strategy for non-linear two inputs and two outputs (TITO) systems with random delays. In order to cast the TITO feedback control systems into a general framework, the stochastic characteristics induced by uncertain time delays are represented by the entropy of tracking errors. The performance index of the control systems is constructed and emphasised. Back propagation

(BP) neural networks are employed as PID controllers to deal with both non-linearity and randomness. The convergence condition in the mean-square sense is analysed. The methodology is illustrated by simulations.

'The online optimisation of stator vane settings in multi-stage axial compressors' by Roh and Daley. In this paper, self-tuning extremum control and a particle swarm optimisation method are proposed and implemented to obtain the best value for a normalised objective function. A steady state model of a 15 stage multi-stage axial compressor is utilised here to investigate the performance, particularly for obtaining acceptable optimisation convergence time for practical purposes. For the effective search for an optimum setting, the variation in VGV's with respect to a different combination of objective functions is considered. The results demonstrate the relative effectiveness of the two algorithms and the suitability for their use in this proposed application.

'Combined attitude control application of an underactuated helicopter experimental system' by Deng, Inoue, Yu and Shimizu. Combined attitude control of an underactuated helicopter experimental system is considered in this paper. The controlled helicopter experimental system has two inputs and three outputs, namely, this system is underactuated. The combined attitude controller includes a non-linear MIMO controller based on adaptive sliding mode control and non-adaptive non-linear controllers. Control system stability is guaranteed by Lyapunov function based proof. Experimental results show the effectiveness of the proposed method.

As guest editors, we would like to thank all the authors for their contributions to this special issue. We believe that the six papers presented in this special issue are representative of some of the recent advances on control systems techniques of mechatronic. Finally, we would also like to thank the reviewers for their help in evaluating there papers.