Editorial

This special issue contains the papers corresponding to the plenary and semi-plenary lectures presented at the joint 50th IEEE Conference on Decision and Control and European Control Conference (CDC-ECC 2011), held in Orlando, Florida, USA 12–15 December 2011. This is the second time two of the most important conferences in control, the IEEE Conference on Decision and Control (CDC) and the European Control Conference (ECC), are celebrated as a joint conference. The IEEE CDC is the annual meeting of the IEEE Control Systems Society (CSS) while the ECC is organized every two years under the auspices of the European Union Control Association (EUCA).

We gathered a set of speakers and topics to cover not only emerging fields but also new developments in well-established research fields. The conference marks the 50th anniversary of the IEEE CDC and the 20th anniversary of the ECC series. Each President of EUCA was asked to prepare a report on the corresponding ECC. These reports appear in an appendix.

The paper by Lennart Ljung, Håkan Hjalmarsson and Henrik Ohlsson, corresponding to the first plenary lecture, by Lennart Ljung, deals with how system identification develops and sharpens its tools by amalgamating concepts, features, and methods from other fields. It describes encounters with four areas in systems theory and engineering: networked systems, particle filtering techniques, sparsity and compressed sensing, and machine learning. The impacts on system identification methodology by these encounters are described and illustrated.

The second paper, by Fiona Chandra, Dennice F. Gayme, Lijun Chen, and John C. Doyle, corresponding to the plenary lecture by John C. Doyle, reviews recent progress on developing a unified theory for complex networks from biological systems and physics to engineering and technology.

The paper associated to the plenary lecture of Mathukumalli Vidyasagar discusses four specific problems in cancer biology that are amenable to study using probabilistic methods: reverse engineering gene regulatory networks, constructing context-specific gene regulatory networks, analyzing the significance of expression levels for collections of genes, and discriminating between drivers (mutations that cause cancer) and passengers (mutations that are caused by cancer or have no impact). Some research problems that merit the attention of the control community are also suggested.

The paper by Dimitar Baronov and John Baillieul, corresponding to the plenary by John Baillieul (Bode Lecture Award recipient), presents a motion description language for robotic reconnaissance of unknown fields.

The paper covering the semi-plenary lecture by Vikram Krishnamurthy deals with the dynamics of biosensors and networks of biosensors, where individual biosensors are constructed out of protein molecules. Such biosensors are fully functioning nano-machines. The paper explores methods for decentralized self-activation of networks of biosensors using game-theoretic methods.

The paper corresponding to Massoud Amin’s semi-plenary lecture presents an overview of smart grids and recent advances in distributed sensing, modeling, and control, particularly at both the high-voltage power grid and the consumer level.
The semi-plenary by Antoine Girard and George J. Pappas presents a framework for system approximation that applies to both discrete and continuous systems and defines a hierarchy of approximation metrics between the two systems that quantify the quality of the approximation.

The paper corresponding to the semi-plenary by Jan H. van Schuppen et al. is a survey on the control of distributed systems. Coordinated distributed systems are defined for linear systems, for Gaussian systems, and for discrete-event systems, and an algebraic-geometric characterization is provided. Coordination control of distributed systems requires a specific control synthesis procedure, which is presented. Distributed control with communication between controllers is formulated and discussed.

The paper corresponding to the semi-plenary by Francesca Boem, Riccardo M.G. Ferrari and Thomas Parisini deals with a distributed fault detection and isolation methodology for nonlinear uncertain possibly large-scale continuous-time dynamical systems.

We would like to thank all the plenary and semi-plenary authors for making such an extraordinary contribution to the conference and to this special issue of the EJC.

Guest Editors
EDUARDO F. CAMACHO
EDWIN K.P. CHONG
JAY A. FARRELL
MARIOS M. POLYCARPOU