

Guest Editorial

This special issue of the *European Journal of Control* contains the two plenary papers followed by the four semi-plenary papers and the seven leading papers of the minitutorial sessions presented at the *European Control Conference 2007*, held in Kos, Greece, on July 2–5, 2007. The speakers and topics of these papers were selected to cover hot areas of control through the presentation of both well-established results and new results of high practical and societal value.

The paper by *Glover* and colleagues provides an overview of the major developments in the automotive engine management and control area, including a number of prospects promised by new technologies. A description of recent advances in catalyst and sensor technologies is also included. These developments and technologies together with key feedback control implementations have led to substantial improvements in emissions and fuel consumption.

The paper by *Baras* is concerned with the analysis and solution of a number of security, trust and information assurance problems for wireless autonomic networks, such as detection and defense against attacks, trust evaluation, routing and MAC protocols, etc. The focus is on basic principles and properties of these networks which are successfully designed, evaluated and operated as autonomous distributed, controlled dynamic systems.

The paper by *Willems* provides an introduction to the concept of dissipativity in the classical framework of input/state/output systems, including a discussion of some shortcomings in this framework. It is then shown how the dissipation inequality can be extended to a setting where only the supply rate histories are used in the definition of dissipativity. Explicit conditions for dissipativity are derived for the case of supply rates that are quadratic differential forms.

The paper by *Morari* and colleagues presents a survey of recent work on parametric linear programming (pLP) from the point of view of control. The fundamental concepts and problem setup for parametric programming are first provided, and the fact that all pLPs can be formulated as vertex or facet enumeration problems is then demonstrated. The available methods are reviewed in terms of the above vertex/facet enumeration, and their relative complexity is investigated.

The paper by *Schmidt and Denk* provides an optimal control procedure for the synthesis of a walking primitive (WP) database for perception-based guidance control of biped robots. These WPs are concatenated into a practical walking reference trajectory with adaptable step length, changeable direction and stepping ability over or upon obstacles. The technique was applied successfully to a human-sized 3D walker.

The paper by *Tempo and Ishii* presents an introduction to Monte Carlo and Las Vegas randomized algorithms for uncertain systems and robustness problems. Control related applications namely quadratic stability analysis of interval systems and distributed average consensus are then treated using the Las Vegas type algorithms. A representative numerical example is included.

The paper by *Astolfi* and colleagues presents a method for designing asymptotically stabilizing and adaptive control laws for uncertain nonlinear systems through system immersion and manifold invariance. The proposed adaptive control law, in contrast with previous ones, gives stabilizing schemes that face the parameter uncertainty adopting a robustness perspective. Several academic and physical examples are included.

The paper by *Monaco and Normand-Cyrot* demonstrates how a number of recent results developed in the framework of series expansions associated to formal integration procedures are fundamental to the sampling process and instrumental for the design of nonlinear digital control schemes. An iterative procedure for computing the series expansions so as to give approximate practical solutions is described and applied to the problem of input-state matching of a continuous-time model by a sampled data control and vice versa.

The paper by *Juloski* and colleagues is devoted to the identification of hybrid systems, i.e. systems involving interacting subsystems with continuous and discrete dynamics. Besides the literature overview, four particular approaches for the identification of switched affine and piecewise affine (PWA) models, namely an algebraic procedure, a clustering-based procedure, a Bayesian procedure, and a bounded-error procedure are presented and discussed.

The paper by *Arzen* and colleagues proposes a component-based approach to face the software complexity of networked control systems. A general overview is first provided and it is then shown how it can be applied to particular problems that arise in control over wireless sensor networks and in the control of network and communication resources. A number of control-oriented middleware components needed for the control applications are developed and their integration is designed.

The paper by *Patton* and colleagues presents a tutorial overview of fault tolerant control (FTC) as applied to networked control systems (NCS). The fault tolerance properties of two architectures for NCS are studied and compared. It is demonstrated that the decentralized architecture suffers from the difficulty in finding how to compensate for faults occurring over the NCS, whereas, under a suitable coordination scheme, the distributed architecture is equivalent to the classical FTC.

The paper by *Papageorgiou and Papamichail* presents a macroscopic traffic flow model along with a set of validation results, followed by an overview of some generic traffic surveillance methods and control policies for motorway networks. Motorway traffic control measures such as local and coordinated ramp metering, dynamic traffic assignment, route guidance, variable speed limits and other link control measures are discussed.

The paper by *Vachtsevanos* and colleagues is concerned with the intelligent control of unmanned aerial vehicles (UAV) and suggests control architectures and technologies which result in augmented stability and enhanced robustness and autonomy. Particular problems considered include mission planning and vehicle cooperated control for missions in urban and other areas. Most of the technologies presented have been validated via simulation and flight tests.

The above papers provide a useful set of fundamental issues and advanced results in the control field with important existing and potential applications. We wish to express our thanks to all authors for providing their results to this special issue of the *European Journal of Control*.

Guest Editors
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