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Editorial

Systematic development of tools employing logic-based switching for the control of systems with large-scale modelling uncertainty began around 15 years ago and has been a very active research area ever since. Earlier work was focussed on weakening the assumptions of more traditional, continuously tuned adaptive control algorithms, but it was soon realized that the use of discrete logic and switching could yield several other benefits. In particular, it could lead to the design of control systems that are simpler to analyse, are more robust with respect to noise and unmodelled dynamics, and have faster transient response. Closely related to this work are recent advances in hybrid systems, switched and discontinuous systems, multiple models, model validation, neural control, learning, and other areas that are often encapsulated under the general title of 'intelligent control.'

With a large but somewhat dispersed body of literature on the use of switching and logic in adaptive control, we felt that it was time to organize this special issue. The objective behind such an endeavour was to compile under one cover a collection of papers that bring to light common paradigms, as well as distinct approaches, that emerge from the work of a representative set of researchers in the field. The special issue contains papers of both theoretical and practical nature. It is hoped that this special issue will identify important research directions and provide a snapshot of the 'state-of-the-art' in the field, thereby becoming a valuable reference source for the readers of the journal.

The first four papers in the issue are of a theoretical nature and give a perspective on the use of switching in four broad areas in adaptive control: robust adaptive control, universal controllers, multiple-model estimation, and stochastic control. The paper by Pait and Kassab Jr. describes a class of switching control algorithms for stabilization of uncertain linear systems. The proposed method has the feature of preserving the robustness properties of linear control design in an adaptive context. The paper by Miller considers the problem of making the output of a given uncertain plant approximately track the output of a reference model. A switching adaptive controller is developed which achieves this objective for every minimum-phase single-input single-output linear system. The paper by Mosca *et al.* studies the problem of inferring the behaviour of a feedback loop consisting of an uncertain plant and a given controller from data produced by the plant driven by a possibly different controller. The results reported in the paper are useful for switching supervisory control of systems with uncertainty. The paper by Narendra and Driollet deals with stochastic multiple-model adaptive control of systems with random disturbances. The control algorithm employs structurally different estimation models and selects, on-line, the one that yields the best performance for given disturbance characteristics.

The last three papers deal with applications of switching control. These papers focus on areas as diverse as robotics, transmission systems, and induction motors. The paper by Tsao and Safonov presents an adaptive switching controller for a non-linear robot manipulator. A control law is developed within the framework of unfalsified control, where candidate controllers are discarded if their ability to meet performance specifications is falsified by new experimental evidence. The paper by Karimi *et al*. investigates the problem of selecting design parameters in the multimodel adaptive control context. The authors study the effects of various design parameters on the performance in tracking and regulation of a flexible transmission system. In the paper by Chang *et al*., adaptation in the form of discrete switching is incorporated into the field-oriented control algorithm for induction motors with unknown rotor resistance. The resulting supervisory control system is shown to be globally stable.

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