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EDITORIAL

Special issue on 'recent trends on the use of switching and mixing in adaptive control'

Dedicated to Edoardo Mosca for his 70th birthday

This issue of the *International Journal of Adaptive Control and Signal Processing* contains invited papers dedicated to Edoardo Mosca on the occasion of his 70th birthday. We are very pleased that all invited authors have accepted enthusiastically to contribute and made a splendid job in providing a snapshot of the current state of the art in the field and identifying open problems for future research directions.

The last two decades have witnessed a great deal of theoretical and practical interest in adaptive control techniques based on mixing, switching and falsification logic, relying on multiple models or no model at all, in order to overcome the intrinsic limitations of classical adaptive control approaches based on continuous tuning. Thanks to the effort of many researchers, the basic concepts, goals and expectations of this novel class of strategies have been laid down and a fairly satisfactory theoretical framework is therefore now available, along with some related successful applications. Ten years after a first special issue on the same topics (Special Issue: Switching and Logic in Adaptive Control, IJACSP, May 2001- J. Hespanha & D. Liberzon, Eds.), the present special issue contains seven papers which provide new results and perspectives on the use of switching, mixing and logic in broad areas of adaptive control.

The paper by Jin and Safonov revisits unfalsified adaptive control by introducing a novel approach to controller falsification. On the basis of the idea of self-falsification, new controller switching algorithms are designed, which open up the possibility of data-driven robust adaptive control designs with fading memory cost functions.

Closely related to this work is the paper by Baldi, Battistelli, Mari, Mosca, and Tesi, which presents an adaptive switching controller for uncertain multi-input multi-output systems. A control strategy is developed which combines unfalsified control with multi-model architectures. The proposed method is able to preserve the robustness properties of unfalsified control with the additional benefit of reducing the time duration of learning transients.

The paper by Battistelli, Hespanha, and Tesi describes recent progress in the field of hybrid control of nonlinear systems. The authors introduce a new switching logic which considers data over suitable time windows whose length is adjusted online. The proposed approach is applied to the stabilization of uncertain nonlinear time-varying processes subject to persistent disturbances.

The paper by Vu and Liberzon addresses the problem of stabilizing uncertain systems with quantized outputs using the supervisory control framework. For both static and dynamic quantizers, the authors establish conditions on the quantization range and the quantization error bound that guarantee closed-loop stability. The results reported in the paper prove to be useful for adaptive control of systems with limited information.

The paper by Cao and Morse deals with the application of switching control to the three-neighbor station-keeping problem in which range measurements are the only sensed signals upon which station keeping is to be based. By using concepts from adaptive switching control, a tractable and provably correct solution is given with satisfactory performance even in the presence of increasing measurement and misalignment errors.

The last two papers in the issue consider online refinement strategies for adaptive switching control. Combining ideas from switching and tuning, Narendra and Han describe a novel way of using

multiple models for identification and control of unknown linear time-invariant plants. The proposed approach uses the information generated by a finite number of conventional adaptive identifiers to re-parameterize and identify the unknown plant. The stability of the procedure is discussed and illustrated via simulation studies.

Finally, the paper by Baldi, Ioannou, and Kosmatopoulos presents an adaptive control scheme with controller mixing. The proposed approach involves the use of pre-calculated controllers whose outputs are weighted on the basis of the parameter estimates generated by online parameter estimators. A multiple parameter estimation architecture is proposed, analyzed and demonstrated that performs better than a single online estimator.

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