Multi-Agent Product Systems: Analysis, Synthesis and Control

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Abstract.

This work uses the formal framework of *Multi-Agent (*MA*) product* systems for the analysis of complex systems. The results constitute a natural extension of the main classical supervisory control results for scalar systems to the more general MA product system case. The notion of MA controllability is introduced and is shown to essentially constitute a necessary and sufficient condition for the synthesis of an MA supervisor. An algorithm for finding the *infimal* MA *controllable superlanguage* of a given vector language specification K is presented, and an algorithmic procedure is given for the recursive construction of an MA supervisor when an additional automaton is linked to a system via the MA product. The computational complexity of the construction of MA supervisors is shown to be in general exponential. Several examples are given to motivate the notion of an MA product.

Joint work with Iakov Romanovski.