Hybrid adaptive Petri nets: a conceptual framework for partial fluidization of Petri nets

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Abstract

Petri nets (PNs) constitute a well known family of formalisms for the modeling and analysis of Discrete Event Dynamic Systems (DEDS). As most formalisms for discrete event systems, PNs suffer from the state explosion problem, which renders enumerative analysis techniques unfeasible for large systems. A technique to overcome the problem is to relax integrality contraints of the discrete PN model, leading to continuous PN. This relaxation highly reduces the complexity of analysis techniques but may not preserve important properties of the original PN system such as deadlock-freeness, liveness, reversibility, etc. This work focuses on Hybrid Adaptive Petri nets (HAPNs), a Petri net based formalism in which the firing of transitions is partially relaxed. The transitions of a HAPN can behave in two different modes: continuous mode for high transition workload, and discrete in other case. This way, a HAPN is able to adapt its behaviour to the net workload, it offers the possibility to represent more faithfully the discrete model and use efficient analysis techniques by behaving as continuous when the load is high. Reachability space and the deadlock-freeness property of hybrid adaptive nets is studied in this work.