M2 and PhD subject

Title : Model Checking Well Structured Transition Systems

Supervisor

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Key words :

Infinite-state systems, verification, decidability, logic, well structured transition systems, data (counter-fifo) automata.

General Context

The theory of *Well Structured Transition Systems*, (WSTS) allows the automatical verification of safety properties of infinite-state systems, such that parts of reachability sets can be finitely represented [4, 7, 6]. Termination, boundedness and coverability are decidable for WSTS.

For complete WSTS [6], the Karp and Miller procedure [8, 6] computes the finite set of maximal elements of the downward closure of the reachability set. This procedure logs a state space exploration of the reachability set with a finite tree allowing to decide liveness problems. But the conditions to insure that this procedure terminate are still not well established. Moreover, we propose to study some temporal logics which are decidable for WSTS (bounded Model Checking on WSTS [3]).

Objectives

1. Survey the recent litterature about WSTS [1, 2, 5],
2. to establish conditions to obtain an algorithm for computing the coverability tree/set.
3. To study temporal logics which are decidable for (classes) WSTS.

Location

This internship will be supervised at the Ecole Normale Supérieure de Cachan.

Qualifications and Connections

Ideally, the candidate holds a Master degree in Computer Science (with courses in formal verification, theoretical computer science and mathematical structures for CS) or equivalently is graduated from a Computer Science Engineering School with a strong background in theoretical computer science.

This research program is directly connected to MPRI C2-9 course, on *Mathematical foundations of the theory of infinite transition systems*. It should suit a theoretically-minded student with some taste for theoretical and algorithmic constructions. The internship is an ideal opportunity for starting a PhD thesis (possible collaborations with Bordeaux and Montréal).

Références

[1] Michael Blondin, Alain Finkel, and Pierre McKenzie. Handling infinitely branching WSTS. In Javier Esparza, Pierre Fraigniaud, and Elias Koutsoupias, editors, *Proceedings of the 41st International Colloquium on Automata, Languages and Programming (ICALP'14) – Part II*, volume 8573 of *Lecture Notes in Computer Science*, pages 13–25, Copenhagen, Denmark, July 2014. Springer.

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[8] Richard M. Karp and Raymond E. Miller. Parallel program schemata. *Journal of Computer and System Sciences*, 3(2) :147–195, 1969.