Weak Muller Tree Automata

Aniello Murano
Università degli Studi di Salerno
Hebrew University
murano@dia.unisa.it

Abstract

Over the last decades the theory of finite automata on infinite objects has been an important source of tools for the specification and the verification of computer programs. Trees are more suitable than words to model nondeterminism and thus concurrency. In the literature, there are several examples of acceptance conditions that have been proposed for automata on infinite words and then have been fruitfully extended to infinite trees (Büchi, Rabin, and Muller conditions). The type of acceptance condition can influence both the succinctness of the corresponding class of automata and the complexity of the related decision problems. Here we consider, for automata on infinite trees, two acceptance conditions that are obtained by a relaxation of the Muller acceptance condition: the Generalized co-Büchi and the Muller-Superset conditions. We prove that Muller-Superset tree automata accept the same class of languages as Büchi tree automata, but using more succinct automata. Generalized co-Büchi tree automata, instead, define a class of languages that is not comparable with the one defined by Büchi tree automata. For this class of automata, we prove that the emptiness problem is decidable in polynomial time, and thus we extend the class of automata with tractable decision problems.

Alternating co-Büchi tree automata were introduced by Muller an Schupp in order to characterize the complement of languages nondeterministically accepted by Büchi tree automata. We show that Alternating Generalized and non-generalized co-Büchi tree automata accept the same class of languages and it contains the one defined by the non-alternating Generalized ones. Finally, we compare Alternating co-Büchi tree automata with Muller and Büchi tree automata.