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Reasoning about the past with two-way automata. (English) [Zbl 0909.03019](#)

Larsen, Kim G. (ed.) et al., Automata, languages and programming. 25th international colloquium, ICALP '98. Aalborg, Denmark, July 13–17, 1998. Proceedings. Berlin: Springer. Lect. Notes Comput. Sci. 1443, 628-641 (1998).

An exponential time upper bound for the satisfiability problem of the μ -calculus with both forward and backward modalities is proved. To get this result an automata-theoretic approach is employed. It is shown that even though the full μ -calculus does not have the finite-model property, it does have the tree-model property. This property asserts that if a formula is satisfiable then it is satisfiable by a bounded-degree infinite tree structure. It is shown how a formula φ can be translated to an automaton A_φ on infinite trees that accepts precisely the tree models of φ . To check whether φ is satisfiable it suffices then to solve the emptiness problem for A_φ . To deal with backward modalities two-way alternating automata (they are based on an analogous notion of two-way automata) on finite trees are introduced. Alternating tree automata (both one-way and two-way) can be viewed as infinite games. A fact that the winning player has a memoryless strategy (under certain conditions) is used to show that two-way alternating tree automata can be translated to equivalent one-way nondeterministic tree automata with an exponential blowup. The emptiness problem can then be solved by using known algorithms for emptiness of nondeterministic tree automata.

For the entire collection see [\[Zbl 0893.00039\]](#).

Reviewer: [D.Gruska \(Bratislava\)](#)

MSC:

- [03B45](#) Modal logic (including the logic of norms)
- [03D05](#) Automata and formal grammars in connection with logical questions
- [03B70](#) Logic in computer science

Cited in **3** Reviews
Cited in **56** Documents

Keywords:

μ -calculus; satisfiability; alternating automata; one-way nondeterministic tree automata; tree-model property; infinite games; emptiness