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SYNCHRONIZING AUTOMATA OVER NESTED WORDS

Dmitry Chistikov[(A,B)] Pavel Martyugin[(C)] Mahsa Shirmohammadi[(D,E)]

[(A)] *Centre for Discrete Mathematics and its Applications (DIMAP) & Department of Computer Science, University of Warwick*
Coventry, CV4 7AL, United Kingdom
d.chistikov@warwick.ac.uk

[(C)] *Institute of Natural Sciences and Mathematics, Ural Federal University*
Pr. Lenina 51, 620000 Ekaterinburg, Russia
martuginp@gmail.com

[(D)] *CNRS & IRIF, Université de Paris*
8 Place Aurélie Nemours, 75205 Paris Cedex 13, France
mahsa.shirmohammadi@irif.fr

ABSTRACT

We extend the concept of a synchronizing word from deterministic finite-state automata (DFA) to nested word automata (NWA): A well-matched nested word is called synchronizing if it resets the control state of any configuration, i. e., takes the NWA from all control states to a single control state.

We show that although the shortest synchronizing word for an NWA, if it exists, can be (at most) exponential in the size of the NWA, the existence of such a word can still be decided in polynomial time. As our main contribution, we show that deciding the existence of a short synchronizing word (of at most given length) becomes PSPACE-complete (as opposed to NP-complete for DFA). The upper bound makes a connection to pebble games and Strahler numbers, and the lower bound goes via small-cost synchronizing words for DFA, an intermediate problem that we also show PSPACE-complete. We also characterize the complexity of a number of related problems, using the observation that the intersection nonemptiness problem for NWA is EXP-complete.

Keywords: synchronizing words, nested words, visibly pushdown automata, Strahler number, decision problems, formal language theory

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[(B)] Most of this work was done while DC was affiliated with the Max Planck Institute for Software Systems (MPI-SWS), Kaiserslautern and Saarbrücken, Germany.

[(E)] Most of this work was done while MS was affiliated with the Department of Computer Science, University of Oxford, United Kingdom.