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0946.68095

Kuske, Dietrich

Asynchronous cellular automata and asynchronous automata for pomsets. (English)

Sangiorgi, Davide (ed.) et al., CONCUR '98. Concurrency theory. 9th international conference, Nice, France, September 8-11, 1998. Proceedings. Berlin: Springer. Lect. Notes Comput. Sci. 1466, 517-532 (1998). [ISBN 3-540-64896-8; ISSN 0302-9743]

Summary: Asynchronous cellular automata and asynchronous automata have been introduced by *W. Zielonka* [RAIRO, Inf. Théor. Appl. 21, 99-135 (1987; Zbl 0623.68055)] for the study of Mazurkiewicz traces. In [(∗) Asynchronous cellular automata and logic for pomsets without auto-concurrency (extended abstract appeared as "Asynchronous cellular automata for pomsets without auto-concurrency" in CONCUR '96, Lect. Notes Comput. Sci. 1119, 627-638 (1996)] generalized the first to pomsets. We show that the expressiveness of monadic second-order logic and asynchronous cellular automata are different in the class of all pomsets without auto-concurrency. Then we introduce a class where the expressivenesses coincide. This extends the results from (∗). Furthermore, we propose a generalization of trace asynchronous automata for general pomsets. We show that their expressive power coincides with that of monadic second-order logic for a large class of pomsets. The universality and the equivalence of asynchronous automata for pomsets are proved to be decidable which is shown to be false for asynchronous cellular automata.

Keywords : asynchronous cellular automata
Classification :
∗68Q80 Cellular and array automata

Cited in ...

0885.18004

Katis, Piergiolio; Sabadini, N.; Walters, R.F.C.

Span(Graph): A categorical algebra of transition systems. (English)

Johnson, Michael (ed.), Algebraic methodology and software technology. 6th international conference, AMAST '97, Sidney, Australia, December 13–17, 1997. Proceedings. Berlin: Springer. Lect. Notes Comput. Sci. 1349, 307-321 (1997). [ISBN 3-540-63888-1; ISSN 0302-9743]

Structured transition systems, or non-deterministic automata, have been widely used in the specification of computing systems, including concurrent systems [cf. *W. Zielonka*, RAIRO, Inf. Théor. Appl. 21, 99-135 (1987; Zbl 0623.68055)]. We describe here an algebra of transition systems, an algebra in fact already known to category theorists but without any consciousness of its relation to concurrency. The algebra is closely related to, and may be regarded as an extension of, the algebra of Arnold and Nivat [cf. *A. Arnold*, "Finite transition systems", Prentice Hall (1994; Zbl 0796.68141)] (which book contains comparisons with other models of concurrency – Petri nets, process algebras). What it has in addition to Arnold and Nivat's algebra is that there is a geometry

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associated with the new algebra along the lines of Penrose's algebra of tensors [*R. Penrose*, in: Combinat. Math. Appl., Proc. Conf. Math. Inst., Oxford 1969, 221-244 (1971; Zbl 0216.43502)] (a subject much developed of late in relation to the geometry of manifolds, and quantum field theory [*A. Joyal* and *R. Street*, Lect. Notes Math. 1488, 413-492 (1991; Zbl 0745.57001), Adv. Math. 102, No. 1, 20-78 (1993; Zbl 0817.18007); *R. Street*, Appl. Categ. Struct. 3, No. 1, 29-77 (1995; Zbl 0827.18002); *V. G. Turaev*, "Quantum invariants of knots and 3-manifolds", de Gruyter (1994; Zbl 0812.57003); *S. Majid*, "Foundations of quantum group theory", Cambridge Univ. Press (1995; Zbl 0857.17009)]). In this paper we demonstrate how this geometry reflects the geometry of distributed systems.

Keywords : structured transition systems; Penrose algebra of tensors; geometry of distributed systems; non-deterministic automata; specification of computing systems; concurrent systems; algebra of transition systems; concurrency

Classification :

∗18D10 Monoidal categories

68Q45 Formal languages

18B20 Categories of automata, etc.

68Q85 Models and methods for concurrent and distributed computing

68Q10 Modes of computation

Cited in ...

0826.68081

Pighizzini, Giovanni

Asynchronous automata versus asynchronous cellular automata. (English)

Theor. Comput. Sci. 132, No.1-2, 179-207 (1994). [ISSN 0304-3975]

http://www.sciencedirect.com/science/journal/03043975

The investigations of *A. Mazurkiewicz* [Concurrent program schemes and their interpretations, DAIMI-PB-78, Aarhus University (1977)] and *W. Zielonka* [RAIRO Inf. Theor. Appl. 21, 99-135 (1987; Zbl 0623.68055); Lect. Notes Comput. Sci. 38, 278-289 (1989; Zbl 0678.68077)] are continued. It is proved that an asynchronous cellular automaton can be constructed (in polynomial time) accepting the same trace language as a given asynchronous automaton. (The converse construction is obvious.) The question of unicity of minimum asynchronous automata and/or asynchronous cellular automata recognizing a given trace language is studied; both positive and negative results are obtained in this field, depending on which version of the problem is considered. To any (finite or infinite) string γ over $\{0,1\}$ an asynchronous automaton $\mathcal{A}$ is associated, the minimality of $\mathcal{A}$ is shown to be equivalent to the non-periodicity (in another terminology, primitivity) of γ. It follows from the results that the class of concurrent alphabets for which every recognizable trace language admits a minimum finite state asynchronous automaton becomes narrower when "asynchronous automaton" is replaced by "asynchronous cellular automaton".

A.Ádám (Budapest)

Keywords : asynchronous automaton; asynchronous cellular automaton; trace language

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Classification :

*68Q45 Formal languages
68Q80 Cellular and array automata
68Q10 Modes of computation

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