

**Kasangian, S.; Rosebrugh, R.**

**Non-deterministic and fuzzy automata in toposes.** (English) Zbl 0920.18001  
Boll. Unione Mat. Ital., VII. Ser., A 8, No. 3, 313-321 (1994).

We consider here some topos-theoretic aspects of categorical automata theory. First, we observe that the equivalence of non-deterministic dynamics with categories enriched in a suitable monoidal category (built from the input monoid) [*R. Betti*, Boll. Unione Mat. Ital., V. Ser., B 17, 44-58 (1980; [Zbl 0456.18003](#))] can be extended to automata internal to an elementary topos. Next, after introducing one way to view fuzzy sets as sheaves, and hence as objects in a Grothendieck topos, following *M. Barr* [Can. Math. Bull. 29, 501-508 (1986; [Zbl 0563.03040](#))], we show that the universal minimal realization theory of *J. A. Goguen* [Int. J. Man-Mach. Stud. 6, 513-561 (1974; [Zbl 0321.68055](#)); Math. Syst. Theory 6(1972), 359-374 (1973; [Zbl 0248.18015](#)); Bull. Am. Math. Soc. 78, 777-783 (1972; [Zbl 0277.18003](#))] can be internalized, thus providing a minimal realization for fuzzy automata.

**MSC:**

- [18B20](#) Categories of machines, automata
- [68Q45](#) Formal languages and automata
- [68Q70](#) Algebraic theory of languages and automata
- [18B25](#) Topoi
- [03G30](#) Categorical logic, topoi
- [03E72](#) Theory of fuzzy sets, etc.

**Keywords:**

categorical automata theory; non-deterministic dynamics; monoidal category; elementary topos; Grothendieck topos; universal minimal realization; fuzzy automata