Bonnet, Rémi; **Finkel, Alain**; **Leroux, Jérôme**; **Zeitoun, Marc**
Model checking vector addition systems with one zero-test. (English) Zbl 1242.68196
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Summary: We design a variation of the Karp-Miller algorithm to compute, in a forward manner, a finite representation of the cover (i.e., the downward closure of the reachability set) of a vector addition system with one zero-test. This algorithm yields decision procedures for several problems for these systems, open until now, such as place-boundedness or LTL model-checking. The proof techniques to handle the zero-test are based on two new notions of cover: the refined and the filtered cover. The refined cover is a hybrid between the reachability set and the classical cover. It inherits properties of the reachability set: equality of two refined covers is undecidable, even for usual Vector Addition Systems (with no zero-test), but the refined cover of a vector addition system is a recursive set. The second notion of cover, called the filtered cover, is the central tool of our algorithms. It inherits properties of the classical cover, and in particular, one can effectively compute a finite representation of this set, even for vector addition systems with one zero-test.

MSC:

68R99 Discrete mathematics in relation to computer science
68Q05 Models of computation (Turing machines, etc.) (MSC2010)
03D99 Computability and recursion theory

Keywords:

vector addition system; zero-test; reachability; cover; boundedness; place boundedness; Karp-Miller algorithm; LTL model-checking

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