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Homomorphic reduction of coordination analysis. (English. English summary)

Discrete event systems, manufacturing systems, and communication networks (*Minneapolis, MN*, 1993), 105–147, *IMA Vol. Math. Appl.*, 73, *Springer, New York*, 1995.

Let $P_1, \cdots, P_k, P$ and T be ω-automata with $P = \bigotimes_i P_i$ $(1 \le i \le k)$, where $\bigotimes$ denotes the parallel composition operator for automata. The automata P_i are supposed to model together a system with its fairness constraints specified by T. The "verification" that P meets the specification T (or: that P performs the task T) means checking whether $L(P) \subseteq L(T)$. The complexity of this test grows exponentially with the number of subsystems k.

This "state explosion" is a severe obstacle to computer-aided verification; to reduce it, the author presents a general reduction methodology that subsumes many heuristics applied successfully in special cases. This reduction consists of two steps: (i) task decomposition, i.e., T is decomposed into local properties T_i such that $\bigcap_i L(T_i) \subseteq L(T)$, and so the sought-after conclusion $L(P) \subseteq L(T)$ will follow from $\forall i\ L(P) \subseteq L(T_i)$; (ii) task localization, i.e., each test $L(P) \subseteq L(T_i)$ is replaced by a computationally simpler test $L(P_i') \subseteq L(T_i')$. The automaton P_i' is a reduction of P relative to T_i. This reduction abstracts from those parts of P irrelevant to the local property T_i, and T_i' is an abstraction of T_i consistent with the abstraction of P relative to T_i.

{For the entire collection see MR1348875 (96b:68007)}

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