A Symbolic Partial Order Reduction Algorithm for Rule Based Transition Systems

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Abstract

Partial order reductions are a class of methods that attempt to reduce the state space that must be explored to verify systems by explicit state enumeration. Partial order reduction algorithms have been successfully incorporated into tools such as Spin and VFSM-valid. However, current partial order algorithms assume that the concurrency model is based on processes. Rule based formalisms, such as Unity and Murphi, are another important and widely used class of modeling techniques. Many important types of systems, such as distributed shared memory (DSM) protocols, are best modeled as a set of global transitions. Rule-based systems require a new approach to implementing partial order reduction, since traditional heuristics are not applicable. Also, the traditional methods of computing the dependence relation give approximations that cause many potential reductions to be missed. We propose a novel algorithm based on using a SAT solver to compute the dependence relation, and a new heuristic for computing ample sets for rule based formalisms.