Bounded Reachability in Recursive Systems with Resources

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Abstract

We consider formal verification of recursive programs with resource consumption. We introduce prefix replacement systems with nonnegative integer counters which can be incremented and reset to zero as a formal model for such programs. In these systems, we investigate bounds on the resource consumption for reachability questions. As a tool, we introduce relational structures with resources and a quantitative first-order logic over these structures. We define resource automatic structures as a subclass of these structures and provide an effective method to compute the semantics of the logic. Subsequently, we use this framework to solve the bounded reachability problem for resource prefix replacement systems. Moreover, we provide a different approach to this problem based on the logic cost-WMSO.