Deciding Bisimulation-Like Equivalences with Finite-State Processes

We design a general method for proving decidability of bisimulation-like equivalences between infinite-state processes and finite-state ones. We apply this method to the class of PAD processes, which strictly subsumes PA and pushdown (PDA) processes, showing that a large class of bisimulation-like equivalences (including e.g. strong and weak bisimilarity) is decidable between PAD and finite-state processes. On the other hand, we also demonstrate that no `reasonable' bisimulation-like equivalence is decidable between state-extended PA processes and finite-state ones. Furthermore, weak bisimilarity with finite-state processes is shown to be undecidable even for state-extended BPP (which are also known as `parallel pushdown processes').