Higher-order rewriting combines first-order rewriting with notions and concepts from λ-calculus, resulting in rewrite systems with higher-order functions and bound variables. CSI ho is a tool for automatically proving confluence of such higher-order systems, specifically pattern rewrite systems (PRSs) as introduced by Nipkow [3, 6]. The restriction to pattern left-hand sides is essential for obtaining decidability of unification and thus makes it possible to compute critical pairs. To this end CSI ho implements a version of Nipkow’s algorithm for higher-order pattern unification [7]. CSI ho is an extension of CSI, a powerful confluence prover for first-order term rewrite systems. The tool and a web interface are available from 

http://cl-informatik.uibk.ac.at/software/csi/ho

Below we briefly describe the criteria implemented by CSI ho, a more detailed description (also of CSI) can be found in [5].

The first criterion is based on a higher-order version of the critical pair lemma, that is, for terminating PRSs we decide confluence by checking joinability of critical pairs [6]. For showing termination CSI ho implements a basic higher-order recursive path ordering and static dependency pairs with dependency graph decomposition and the subterm criterion. Alternatively, one can also use an external termination tool like WANDA [2] as an oracle. For potentially non-terminating systems CSI ho supports two more classical criteria based on critical pairs, namely weak orthogonality [9] and van Oostrom’s result on development closed critical pairs [8]. As a divide-and-conquer technique CSI ho implements modularity, i.e., decomposing a PRS into parts with disjoint signatures, for left-linear PRSs—note that confluence of PRSs is not modular in general [1]. Finally CSI ho uses the simple technique of adding and removing redundant rules [4], adapted for PRSs, e.g. for finding non-joinable peaks via forward closures.

References


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