CoCo 2019 Participant: nonreach*

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The tool nonreach is an automated, efficient tool to check infeasibility with respect to oriented conditional term rewrite systems (CTRSs). The Haskell source code can be obtained from a public *git* repository hosted on *bitbucket*:

https://bitbucket.org/fmessner/nonreach

Given a CTRS (or a TRS) and one or more infeasibility problems, nonreach uses a combination of the following two approaches:

- *Decomposition* is used to split a problem into conjunctions of easier and disjunctions of more specific subproblems. This creates a tree structure.
- *Fast checks* are then used to prove leaves of the tree infeasible and simplify the structure.

These methods are applied alternately until either infeasibility was proven (by simplifying the tree to False) or a user-defined threshold of iterations has been reached (and nonreach concludes MAYBE).

Our decomposition methods are based on narrowing (with some heuristics) and proving root-nonreachability [2]. The fast checks are based on etcap [3] and the *inductive symbol transition graph* [2].

In the 2019 edition of the Confluence Competition nonreach took part in the *infeasibility* (INF) category and earned the second place. Additionally, nonreach was the second fastest tool. The fastest tool CO3,[1] however, only solved 12 problems, where nonreach solved 30. Furthermore, nonreach only required 0.35% of the time taken by the winner of the competition, infChecker.[2]

For more details concerning the implementation and usage of nonreach, we refer to the tool demonstration paper published in TACAS 2019 [1].

References

[1] Florian Meßner and Christian Sternagel. nonreach - A tool for nonreachability analysis. In *Proc. 25th TACAS*, pages 337–343, 2019. doi:10.1007/978-3-030-17462-0_19.

[2] Christian Sternagel and Akihisa Yamada. Reachability analysis for termination and confluence of rewriting. In *Proc. 25th TACAS*, pages 262–278, 2019. doi:10.1007/978-3-030-17462-0_15.

[3] René Thiemann and Christian Sternagel. Certification of Termination Proofs using CeTA. In *Proc. 22nd International Conference on Theorem Proving in Higher Order Logics*, volume 5674 of *LNCS*, pages 452–468. Springer, 2009. doi:10.1007/978-3-642-03359-9_31.

*This work is supported by the Austrian Science Fund (FWF): project P27502.

[1] https://www.trs.css.i.nagoya-u.ac.jp/co3/

[2] http://zenon.dsic.upv.es/infChecker/