CoCo 2020 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 *decomposition*, based on narrowing (with some heuristics) and proving root-nonreachability [2], and *fast checks*, based on etcap [3] and the *inductive symbol transition graph* [2].

These methods are applied by turns until I either obtain infeasibility (by simplifying the tree to False), a satisfying substitution or reach a user-defined threshold of iterations (and nonreach concludes MAYBE).

I outline the main new features of nonreach 1.2 compared to the version participating in last year's CoCo.

- *Certification* of (some) proofs (which is not visible in the competition for the lack of a CPF-INF category).
- *Positive reachability results* found through narrowing now yield NO together with a satisfying assignment.

While refactoring was necessary in order to generate certificates, and as a nice side-effect leads to more detailed and more readable proofs, I lose a few infeasibility results compared to last year. Furthermore, after finding a bug in internal meetability problem handling, which in rare cases could lead to unsound results, I disabled almost all of those methods, thus losing a few more infeasibility results.

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.

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