CoCo 2023 Participant: nonreach 1.2

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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 [4], and *fast checks*, based on etcap [5] and the *inductive symbol transition graph* [4].

These methods are applied alternately until nonreach either obtains infeasibility (by simplifying the tree to False), finds a satisfying substitution, or reaches a user-defined threshold of iterations (and concludes MAYBE).

For more details regarding the implementation and usage of nonreach, I refer to the tool demonstration paper published in TACAS 2019 [1] and my master thesis [2].

I previously participated with nonreach in the INF categories of CoCo 2019 and CoCo 2020 where it earned the second and third place respectively. Additionally, in 2020 the participant ConCon [3] used nonreach as an external tool and earned the second place in the INF category, as well as the first place in both the CTRS and CPF-CTRS categories.

Compared to the version participating in CoCo 2020, the new version nonreach 1.2 is mainly a refactoring release. However, the new competition rules of CoCo 2023 allow me to showcase the certified results of nonreach by running it together with CeTA [6].

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.

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[3] Christian Sternagel. CoCo 2020 Participant: ConCon 1.10 In *Proc. 9th IWC*, page 65, 2020. http://iwc2020.cic.unb.br/iwc2020_proceedings.pdf.

[4] 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.

[5] 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.

[6] Christina Kohl, René Thiemann, and Aart Middeldorp CoCo 2022 Participant: CeTA 2.42 In *Proc. 11th IWC*, page 62, 2022. http://cl-informatik.uibk.ac.at/iwc/2022/proceedings.pdf.