CoLL-Saigawa 1.6: A Joint Confluence Tool

Kiraku Shintani and Nao Hirokawa

JAIST, Japan

CoLL-Saigawa is a tool for automatically proving or disproving confluence of (ordinary) term rewrite systems (TRSs). The tool, written in OCaml, is freely available at:

http://www.jaist.ac.jp/project/saigawa/

The typical usage is: `collsaigawa <file>`. Here the input file is written in the TRS format [6]. The tool outputs `YES` if confluence of the input TRS is proved, `NO` if non-confluence is shown, and `MAYBE` if the tool does not reach any conclusion.

CoLL-Saigawa v1.6 is a joint confluence tool of CoLL v1.5 [9] and Saigawa v1.9 [2], and there are no major changes from the last release (version 1.5). If an input TRS is left-linear, CoLL proves confluence. Otherwise, Saigawa analyzes confluence. CoLL is a commutation tool specialized for left-linear TRSs. It proves confluence as self-commutation by using Hindley's commutation theorem [1] together with the three commutation criteria: Almost development closeness [10], rule labeling with weight function [11], and Church-Rosser modulo A/C [4]. Saigawa can deal with non-left-linear TRSs. The tool employs the seven confluence criteria: The criteria based on critical pair systems [3, Theorem 3] and on extended critical pairs [5, Theorem 2], rule labeling [11], Church-Rosser modulo AC [4], parallel closedness based on parallel critical pairs [12], simultaneous closedness [7], parallel-upside closedness [8], and outside closedness [8].

References

[1] J. R. Hindley. *The Church-Rosser Property and a Result in Combinatory Logic*. PhD thesis, University of Newcastle-upon-Tyne, 1964.

[2] N. Hirokawa. Saigawa: A confluence tool. In *3rd Confluence Competition*, pages 1–1, 2014.

[3] N. Hirokawa and A. Middeldorp. Commutation via relative termination. In *Proc. 2nd IWC*, pages 29–33, 2013.

[4] J.-P. Jouannaud and H. Kirchner. Completion of a set of rules modulo a set of equations. *SIAM Journal on Computing*, 15(4):1155–1194, 1986.

[5] D. Klein and N. Hirokawa. Confluence of non-left-linear TRSs via relative termination. In *Proc. 18th LPAR*, volume 7180 of *LNCS*, pages 258–273, 2012.

[6] A. Middeldorp, J. Nagele, and K. Shintani. Confluence Competition 2019. *Proc. 25th TACAS*, volume 11429 of *LNCS*, pages 25–40, 2019.

[7] S. Okui. Simultaneous critical pairs and Church–Rosser property. In *Proc. 9th RTA*, volume 1379 of *LNCS*, pages 2–16, 1998.

[8] M. Oyamaguchi and Y. Ohta. On the open problems concerning Church-Rosser of left-linear term rewriting systems. *IEICE Transactions on Information and Systems*, 87(2):290–298, 2004.

[9] K. Shintani and N. Hirokawa. CoLL: A confluence tool for left-linear term rewrite systems. In *Proc. 25th CADE*, volume 9195 of *LNAI*, pages 127–136, 2015.

[10] V. van Oostrom. Developing developments. *Theoretical Computer Science*, 175(1):159–181, 1997.

[11] V. van Oostrom. Confluence by decreasing diagrams converted. In *Proc. 19th RTA*, volume 5117 of *LNCS*, pages 306–320, 2008.

[12] Y. Toyama. On the Church-Rosser property of term rewriting systems. NTT ECL Technical Report, No.17672, NTT, 1981.