

# Saigawa: A Confluence Tool\*

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

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

This system description is based on Saigawa version 1.5. The typical usage of the tool is: `saigawa <file>`. Here the input file is written in the standard WST format. 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. The tool is based on the next criteria.

**Theorem 1** ([2, Theorem 3]). *Left-linear locally commuting TRSs  $\mathcal{R}$  and  $\mathcal{S}$  commute if  $\text{CPS}_{\mathcal{S}}(\mathcal{R}) \cup \text{CPS}_{\mathcal{R}}(\mathcal{S})$  is relatively terminating over  $\mathcal{R} \cup \mathcal{S}$ .*

**Theorem 2** ([4, Theorem 2]). *Suppose  $\mathcal{R}$  and  $\mathcal{S}$  are strongly non-overlapping on each other,  $\mathcal{S}$  is confluent, and  $\mathcal{R}/\mathcal{S}$  is terminating. The TRS  $\mathcal{R} \cup \mathcal{S}$  is confluent iff  $\text{CP}_{\mathcal{S}}(\mathcal{R}) \subseteq \downarrow_{\mathcal{R} \cup \mathcal{S}}$ .*

**Theorem 3** ([6]). *A TRS  $\mathcal{R}$  is confluent if every critical peak is decreasing with respect to the rule labeling heuristic.*

**Theorem 4** ([3]). *Suppose  $\mathcal{R}/\text{AC}$  is terminating. The TRS  $\mathcal{R} \cup \text{AC}$  is confluent if and only if  $\text{CP}_{\text{AC}}(\mathcal{R}) \subseteq \rightarrow_{\mathcal{R}, \text{AC}}^* \cdot \leftarrow_{\text{AC}}^* \cdot \mathcal{R}, \text{AC}^* \leftarrow$ .*

Our tool uses  $\mathbb{T}\mathbb{T}_2$  and MU-TERM to check (relative) termination.<sup>1</sup> When termination of  $\mathcal{R}$  is proved, for every  $(s, t) \in \text{CP}(\mathcal{R})$  the joinability  $s \downarrow_{\mathcal{R}} t$  is tested by comparing normal forms of  $s$  and  $t$ . In the other cases we test  $s \rightarrow_{\mathcal{R}}^m \cdot \frac{n}{\mathcal{R}} \leftarrow t$  for each  $(s, t) \in \text{CP}(\mathcal{R} \cup \mathcal{R}^{-1})$  and  $1 \leq m, n \leq 5$ . Unjoinability is detected by the TCAP function [7]. A suitable rule labeling is searched by using MiniSmt,<sup>2</sup> see [1, Section 4]. We are planning to support the methods in [5] in the next version.

## References

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<sup>1</sup><http://colo6-c703.uibk.ac.at/ttt2/> and <http://zenon.dsic.upv.es/muterm/>

<sup>2</sup><http://cl-informatik.uibk.ac.at/software/minismt/>