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Termination, AC-Termination and Dependency Pairs of Term Rewriting Systems

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Abstract

Recently, Arts and Giesl introduced the notion of dependency pairs, which gives effective methods for proving termination of term rewriting systems (TRSs). In this thesis, we extend the notion of dependency pairs to AC-TRSs, and introduce new methods for effectively proving AC-termination. Since it is impossible to directly apply the notion of dependency pairs to AC-TRSs, we introduce the head parts in terms and show an analogy between the root positions in infinite reduction sequences by TRSs and the head positions in those by AC-TRSs. Indeed, this analogy is essential for the extension of dependency pairs to AC-TRSs. Based on this analogy, we define AC-dependency pairs.

To simplify the task of proving termination and AC-termination, several elimination transformations such as the dummy elimination, the distribution elimination, the general dummy elimination and the improved general dummy elimination, have been proposed. In this thesis, we show that the argument filtering method combined with the AC-dependency pair technique is essential in all the elimination transformations above. We present remarkable simple proofs for the soundness of these elimination transformations based on this observation. Moreover, we propose a new elimination transformation, called the argument filtering transformation, which is not only more powerful than all the other elimination transformations but also especially useful to make clear an essential relationship among them.

Key Words: **AC-Term Rewriting System, AC-Termination, AC-Dependency Pair, Argument Filtering Method, Elimination Transformation, Argument Filtering Transformation.**