Journal of Automata, Languages and Combinatorics **11** (2006) 1, 107–142

BASIC REWRITING VIA LOGIC PROGRAMMING, WITH AN APPLICATION TO THE REACHABILITY PROBLEM [1,2]

SÉBASTIEN LIMET
Université d'Orléans, France
e-mail: sebastien.limet@univ-orleans.fr

and

GERNOT SALZER
Technische Universtät Wien, Austria
e-mail: salzer@logic.at

ABSTRACT

We present a general translation of term rewrite systems to logic programs such that basic rewriting derivations become logic deductions. Certain rewrite systems result in so-called cs-programs, which were originally studied in the context of constraint systems and tree tuple languages. By applying results of cs-programs we obtain new classes of rewrite systems that preserve recognizability (i. e. systems with the property that the terms reachable from a regular set of terms by rewriting form again a regular set). Our findings generalize previous results in the field of term rewriting and can be useful for reachability problems originating for example from the verification of infinite state systems.

Keywords: Tree languages, term rewriting, logic programming, formal verification, reachability

1. Introduction

The verification of infinite state systems is frequently based on the analysis of reachability, i. e., on checking whether particular states are reachable from initial states. Genet and Klay, for instance, prove properties of the Needham-Shrœder public key protocol in this way [5]. Often states are modelled as terms, and state transitions become steps of term rewriting. The reachability problem then amounts to the question: can some terms be obtained from a set of initial terms E by rewriting? For example, to prove safety properties of a system, one has to show that the set of all terms reachable from a set of initial terms has an empty intersection with the set of unsafe states.

[1] Full version of a submission presented at the *International Workshop on Security Analysis of Systems: Formalisms and Tools*, SASYFT 2004, (Orléans, France, June 21 – 22, 2004).

[2] A short version of this paper was presented at RTA'04 [12].