The Rewriting Calculus as a Semantics of ELAN

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Rewriting techniques are now recognized as a fundamental concept in many areas of computer science including mechanized theorem proving and operational semantics of programming languages.

From a conceptual as well as operational point of view, the notion of rewrite rule application is crucial. It leads immediately to the concept of rewriting strategy which fully defines the way several rules are applied.

The combined concepts of rewrite rules and strategies are the first class objects of the programming language ELAN [BKK+98][1]. In this language, the actions to be performed are described using first-order conditional rewrite rules and the control is itself specified using strategies that can be non-deterministic. The use of these strategies is permitted directly in the rules via where statements. This provides a very natural way to describe e.g. theorem provers, constraint solvers, knowledge based reasoning techniques. Moreover such specifications can be executed very efficiently via new compilation techniques implemented in the ELAN compiler [MK98,Vit96]. In the first part of our talk we will present these concepts and provide running examples of their use.

Making the rule application an explicit object is the first step in the elaboration of the recently introduced rewriting calculus [CK98]. The ρ-calculus, as we call it, provides abstraction through the rewriting arrow and explicit rule application. It also embeds the notion of sets of results to deal with non-deterministic computations. Furthermore, the calculus is parameterized by the matching algorithm used in order to fire the rules. In its simplest instance, ρ-calculus embeds standard first-order rewriting as well as λ-calculus. In the second part of the talk, we will introduce the ρ-calculus and show how it provides a simple semantics for ELAN programs.

References

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