Use of logical models for proving operational termination in general logics*

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Abstract

A *declarative programming language* is based on some logic $\mathscr{L}$ and its operational semantics is given by a proof calculus which is often presented in a *natural deduction style* by means of inference rules. *Declarative programs* are theories $\mathscr{S}$ of $\mathscr{L}$ and *executing* a program is proving goals φ in the inference system $\mathscr{I}(\mathscr{S})$ associated to $\mathscr{S}$ as a particularization of the inference system of the logic. The usual soundness assumption for $\mathscr{L}$ implies that every *model* $\mathscr{A}$ of $\mathscr{S}$ also satisfies φ. In this setting, the *operational termination* of a declarative program is quite naturally defined as *the absence of infinite proof trees* in the inference system $\mathscr{I}(\mathscr{S})$. Proving operational termination of declarative programs often involves two main ingredients: (i) the generation of logical models $\mathscr{A}$ to *abstract* the program execution (i.e., the provability of specific goals in $\mathscr{I}(\mathscr{S})$), and (ii) the use of *well-founded relations* to guarantee the absence of *infinite branches* in proof trees and hence of infinite proof trees, possibly taking into account the information about provability encoded by $\mathscr{A}$. In this paper we show how to deal with (i) and (ii) in a uniform way. The main point is the synthesis of logical models where *well-foundedness* is a side requirement for some specific predicate symbols.

Keywords: Abstraction, Logical models, Operational Termination.

References

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