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On Explicit Substitution with Names

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Abstract This paper recounts the origins of the λx family of calculi of explicit substitution with proper variable names, including the original result of preservation of strong β-normalization based on the use of synthetic reductions for garbage collection. We then discuss the properties of a variant of the calculus which is also confluent for "open" terms (with meta-variables), and verify that a version with garbage collection preserves strong β-normalization (as is the state of the art), and we summarize the relationship with other efforts on using names and garbage collection rules in explicit substitution.

Keywords Explicit substitution · Preservation of strong normalization · Confluence · Open terms

1 Introduction

The λ calculus [11] permits substitution of all free variables with a copy of a term as an atomic operation. However, it was always clear that, if used as a programming language construct, it should be assigned an operational complexity related

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