

Categorical Models of Explicit Substitutions

Valéria de Paiva*
Topos Institute
Berkeley, CA

Abstract

The advantages of functional programming are well-known: programs are easier to write, understand and verify than their imperative counterparts. However, functional languages tend to be more memory intensive and these problems have hindered their wider use in industry. The xSLAM project addresses these issues by using explicit substitutions to construct and implement more efficient abstract machines. In this work we provide models for the linear calculi of explicit substitutions we are interested in.

Indexed categories provide models of cartesian calculi of explicit substitutions. However, these structures are inherently non-linear and hence cannot be used to model linear calculi of explicit substitutions. This paper replaces indexed categories with pre-sheaves, thus providing a categorical semantics covering both the linear and cartesian cases. We justify our models by proving soundness and completeness results.

Our models of calculi of explicit substitutions appear to be the only ones so far.

*e-mail: valeria.depaiva@gmail.com