

Abstract

The Theory of Twiners and Linear Parametricity

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Linear parametricity is a principle of polymorphic programming languages dictated in the context of linear logic. We show that linear parametricity induces the fixed points of operators having both positive and negative occurrences of parameters. This kind of fixed points are required by semantics of functional programming languages. The traditional style to achieve this requirement employs Scott's denotational semantics which is an application of a mathematical theory of Scott domains. Our emphasis lies in that the same effect can be derived from linear parametricity, which is a single computer-theoretic principle, rather than from mathematical properties of exotic topology of Scott domains. Consistency of linear parametricity is rather a naive property. In fact, the standard notion of parametricity, which was studied by the author and other researchers in early nineties, conflicts with the existence of fixed points of the kind we are studying in this work. Linear parametricity is weaker than standard parametricity, and does not invoke conflict. We verify this fact by forming a sound model of linear parametricity. To this end, we develop the theory of twiners, which is an extension of the theory of analytic functors introduced by Joyal in the field of enumerative combinatorics.

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