Problem #88

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**Summary:** Is there a calculus of explicit substitution that is confluent on open terms, simulates one-step beta-reduction and preserves beta-strong normalization?

There are confluent calculi of explicit substitutions but these do not preserve termination (strong normalization) [CHL92, Mel95], and there are calculi that are not confluent on open terms but which do preserve termination [LRD94]. César Muñoz presented in [Muñ96] a calculus enjoying both properties (answering Problem #78), however, the calculus is not able to simulate one-step of beta-reduction: if \( a \) beta-reduces to \( b \) in the lambda-calculus then \( a \) does not necessarily reduce to \( b \) in the calculus of Muñoz. Is there a calculus of explicit substitution that is confluent on open terms, simulates one-step beta-reduction and preserves beta-strong normalization?

**Comment sent by Jean Goubault-Larrecq**

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This problem was solved positively in [GL99]. The calculus SKInT, introduced in [GGL00], is confluent on open terms and simulates one-step beta-reduction (although in a slightly contorted way, see [GGL00]; the obvious translation only simulates a bit more that one-step call-by-value beta-reduction). The paper [GL99] characterizes strongly normalizing, weakly normalizing and solvable terms through intersection types, and preservation of strong normalization follows. SKInT is also standardizing, has a terminating subcalculus of substitutions \( \Sigma T \), but is based on an infinite signature and finitely many rule schemes parameterized by integers. Can we lift the latter restriction?

http://www.cs.tau.ac.il/~nachumd/rtaloop/
Bibliography


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