

Chapter 1

Introduction

program correctness by construction (from specifications to programs); type theory (unification of logic and computation and/vs types as classification/specification); new direction of program derivation, while inheriting problems

“datatypes” for inductive families

We start with an introduction to Martin-Löf’s intuitionistic type theory [Martin-Löf, 1975, 1984; Nordström et al., 1990] and dependently typed programming [Altenkirch et al., 2005; McBride, 2004] using the AGDA language [Norell, 2007, 2009; Bove and Dybjer, 2009]. Intuitionistic type theory was developed by Martin-Löf to serve as a foundation of intuitionistic mathematics, like Bishop’s renowned work on constructive analysis [Bishop and Bridges, 1985]. While originated from intuitionistic type theory, dependently typed programming is more concerned with mechanisation and practicalities, and is influenced by the program-correctness-by-construction movement. It has thus departed from the mathematical traditions considerably, and deviations can be found from syntactic presentations to the underlying philosophy.

Bibliography

Thorsten ALTENKIRCH, Conor McBRIDE, and James McKINNA [2005]. Why dependent types matter. Available at <http://www.cs.nott.ac.uk/~txa/publ/ydtm.pdf>. ↗ page 1

Errett BISHOP and Douglas BRIDGES [1985]. *Constructive Analysis*. Springer-Verlag. ↗ page 1

Ana BOVE and Peter DYBJER [2009]. Dependent types at work. In *Language Engineering and Rigorous Software Development*, volume 5520 of *Lecture Notes in Computer Science*, pages 57–99. Springer-Verlag. doi: 10.1007/978-3-642-03153-3_2. ↗ page 1

Per MARTIN-LÖF [1975]. An intuitionistic theory of types: Predicative part. In *Logic Colloquium '73*, volume 80 of *Studies in Logic and the Foundations of Mathematics*, pages 73–118. Elsevier B.V. doi: 10.1016/S0049-237X(08)71945-1. ↗ page 1

Per MARTIN-LÖF [1984]. *Intuitionistic Type Theory*. Bibliopolis, Napoli. ↗ page 1

Conor McBRIDE [2004]. Epigram: Practical programming with dependent types. In *Advanced Functional Programming*, volume 3622 of *Lecture Notes in Computer Science*, pages 130–170. Springer-Verlag. doi: 10.1007/11546382_3. ↗ page 1

Bengt NORDSTRÖM, Kent PETERSON, and Jan M. SMITH [1990]. *Programming in Martin-Löf's Type Theory: An Introduction*. Oxford University Press.

Ulf NORELL [2007]. *Towards a practical programming language based on dependent type theory*. Ph.D. thesis, Chalmers University of Technology. ↗ page 1

Ulf NORELL [2009]. Dependently typed programming in Agda. In *Advanced Functional Programming*, volume 5832 of *Lecture Notes in Computer Science*, pages 230–266. Springer-Verlag. doi: 10.1007/978-3-642-04652-0_5. ↗ page 1

Todo list

program correctness by construction (from specifications to programs); type theory (unification of logic and computation and/vs types as classification/specification); new direction of program derivation, while inheriting problems	1
“datatypes” for inductive families	1