

Π -Ware: An Embedded Hardware Description Language using Dependent Types

Introduction

Research
question

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Hardware Design

Introduction

Research question

- ▶ Hardware acceleration has growing applicability
- ▶ Implementing algorithms in hardware is *harder*
 - Intel FDIIV



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Hardware Description Languages

Introduction

Research question

- ▶ *De facto* industry standards: VHDL and Verilog
- ▶ Were intended for *simulation*, not modelling or synthesis
 - *Unsynthesizable* constructs
 - Widely variable tool support



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Functional Programming

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- ▶ Easier to *reason* about program properties
- ▶ Inherently *parallel* and *stateless* semantics
 - In contrast to imperative programming



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Research question

- ▶ A functional program describes a circuit
- ▶ Several *functional* Hardware Description Languages (HDLs) during the 1980s
- ▶ For example, μ FP [Sheeran, 1984]



Dependently-Typed Programming

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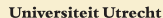
Dependently-Typed Programming (DTP) är en
programmationstechnik...



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Research question

- Develop a hardware Domain-Specific Language (DSL), *embedded* in a dependently-typed language (Agda), that allows for simulation, synthesis and verification



Background

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Conclusion

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Future work

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Thank you!

Questions?



References I

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Sheeran, M. (1984).

MuFP, a language for VLSI design.

In Proceedings of the 1984 ACM Symposium on LISP and Functional Programming, LFP '84, pages 104–112, New York, NY, USA. ACM.



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