

Problems in Logical Foundations for Computer Science

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Abstract for papers

This presentation identifies some problems in Computer Science which might benefit from new approaches to logical foundations.

WANTED

GOOD FOUNDATIONS with **type:type**

WHY?

We NEED:

Specification languages supporting formal reasoning which are closely integrated with programming languages.

SUGGESTS:

enrich type system to enable types to serve as specifications.

BUT..

programming languages need *type:type*

What is a FOUNDATION SYSTEM?

FOUNDATION

=

LOGIC + ONTOLOGY

Paradoxes arise from *ontological* assumptions, therefore these should be settled before we begin to do mathematics.

This allows questions of consistency to be dealt with by logicians, rather than software engineers.

DON'T: add axioms to a logic

DO: add definitions to a foundation system

SPECIFICATION LANGUAGES are FOUNDATION SYSTEMS

e.g., loosely:

Z a derivative of first order set theory

but semantics fails to give an account of recursive typ

VDM used to be described as "set theory"

but semantics uses "BQM spaces"

HOL (**H**igher **O**rders **L**ogic)
based on Church's type theory.

Why PROGRAMMING LANGUAGES need *type:type*

PERSISTENCE

MODULARITY

TYPE INHERITANCE

DEPENDENT TYPES

Other Related Needs

DENOTATIONAL SEMANTICS

PARAMETERISATION of SPECIFICATIONS

"POLYMORPHISM"

SELF-APPLICATION

SOME RELEVANT WORK

Foundations

Martin-Lof - Intuitionistic Type Theory

Constable et.al. - NUPRL

Coquand & Huet - The Calculus of Constructions

Peter Aczel - Logical Theory of Constructions

Programming Languages

Cardelli's semantics for type:type