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

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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:

\textbf{Z} a derivative of first order set theory

but semantics fails to give an account of recursive types.

\textbf{VDM} used to be described as "set theory"

but semantics uses "BQM spaces"

\textbf{HOL} (\textbf{H}igher \textbf{O}rder \textbf{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
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Martin-Lof - Intuitionistic Type Theory
Constable et.al. - NUPRL

Coquand & Huet - The Calculus of Constructions

Peter Aczel - Logical Theory of Constructions

Programming Languages
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Cardelli’s semantics for type:type