Introduction to Floating-Point Analysis and Reproducibility

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FPCore
Standard Format for FP Analysis Tools

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The Numeric Design Phase

\[ b - \sqrt{b^2 - 1} \]

- **Herbie**: Find accurate formula
- **FPTaylor**: Verify accuracy bounds
- **C/Fortran/...**: Tuning, testing, production
CHALLENGE:
Common format for numerical tools
The FPBench Project

**Benchmarks**
- For tool authors
- 118 examples
- Browsable online

**Formats**
- Common format
- Standard metrics
- Reference impl’s

**Tools**
- Compilers
- Transformers
- Search tools
Demo

Compose a FPCore program

Apply Herbie

Transform and export to FPTaylor

Export to C code & compile it
The FPCore Format

Easy to parse common format

Support for loops, branches, standard functions

Support for complex mixed-precision operations
The FPCore Format

\[(\text{FPCore} \ (b)) \quad \text{pre} \ (\langle \ 1e5 \ b \ 1e6 \rangle) \quad (\text{let} \ ([\text{discriminant} \ (- \ (* \ b \ b) \ 1)]) \quad (- \ b \ (\sqrt{\text{discriminant}})))\]
Tools - Exporter

Export to languages (C) & tools (FPTaylor)

racket export.rkt in.fpcore out.c

Customizable through metadata, flags

:precision binary32
Tools - Transformer

Common code **transformations** for analysis

racket **transform.rkt** --unroll 3 in.fpcore -

Automate inter-tool **communication**

tool1 | racket **transform.rkt** --cse | tool2
You Can Help!

HPC authors:
Submit examples
File bugs + test exporters
Looking for tensor kernels

Tool authors:
Accept FPCore input/output
Contribute transformations
Web-accessible tools
Using FPBench

Examples: http://fpbench.org

Github: fpbench/fpbench

racket export.rkt in.fpcore out.c

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