



Introduction to Floating-Point Analysis and Reproducibility




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A decorative graphic on the left side of the slide consisting of two overlapping parallelograms. The front one is orange and the back one is light blue, both with dark blue outlines. They are positioned diagonally, with the orange one partially covering the blue one.

FPCore

Standard Format for FP Analysis Tools

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The Numeric Design Phase

$$b - \sqrt{b^2 - 1}$$

Herbie

Find accurate
rearrangement

FPTaylor

Verify accuracy
bound

C/Java/...

Add code to
production

CHALLENGE:

Common format,
semantics, metrics



The FPBench Project

Benchmarks

For tool authors

118 examples

Browsable online

Tools

Compilers

Transformers

Search tools

Standards

Common format

Standard metrics

Reference impl's



Demo

Compose a FPCore program

Apply Herbie

Transform and export to FPTaylor

Export to C code & run it



The FPCore Language

Arguments

```
(FPCore (x)
```

```
:pre (< 1 x 100)
```

Precondition

```
(let ([discriminant (- (* b b) 1)])  
  (- b (sqrt discriminant))))
```

Let, while,
if, ...

Standard functions



The FPCore Language

Easy to parse common format

Support for loops, branches, standard functions

Support for complex mixed-precision operations



Tools - Exporter

Export to languages (C/++) & tools (Sollya)

```
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

Tool authors:

Accept FPCore input/output

Contribute exporters



Using FPBench

Examples: <http://fpbench.org>

Github: [fpbench/fpbench](https://github.com/fpbench/fpbench)

```
racket export.rkt in.fpcore out.c
```

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