

Lattice-based SMT for Program Verification with HiFrog for Benchmarks with Trigonometric Functions

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Technical Data

General Files

This readme file is available at

<https://docs.google.com/document/d/1fXPdNhgfgnHOx1eg4zjEyXKuWS-D0EsXcoB0fM5XpDc/edit?usp=sharing>

OpenSMT and HiFrog are compiled with Cmake Version 3.5.1.

Model Checker

HiFrog tool is available at

<https://scm.ti-edu.ch/projects/hifrog/repository?utf8=%E2%9C%93&rev=latticeref-v2-trigo>

and lattices and programs used in our experiments, are available at

https://drive.google.com/drive/folders/1QthdYYhUBNJMfJ6CNcrJZ_M03BWWlp-c?usp=sharing

Compile HiFrog with Cmake

```
cd hifrog/trunk/cprover
mkdir build; cd build;
cmake ../ -DUSE_Z3=ON -DCMAKE_BUILD_TYPE=Release; make hifrog
```

SMT Solvers

We use z3 Version 4.8, and OpenSMT git/master version from the 6th of February 2019:

<https://scm.ti-edu.ch/projects/opensmt2/repository/458/revisions/a6879dd9830c9b262ee9f06818415843af766e23/show>

Compile OpenSMT2 with Cmake

```
cd opensmt
mkdir build
cmake
make
sudo make install
```

Data for Experiments

All data and benchmarks are available in our git repository:

https://scm.ti-edu.ch/projects/hi-bench/repository/revisions/master/show/main-bench/lattice_summaries/trigonometric_ex

In addition, we put a copy of these files in Google Drive:

https://drive.google.com/drive/folders/1QthdYYhUBNJmfJ6CNcrJZ_M03BWWlp-c?usp=sharing

All the lattices and the summaries are found in the following zip file:

<https://drive.google.com/file/d/1c2SXVoh1kQfuZIFZ7R1xE5GqrLIKE9Ex/view?usp=sharing>

All the benchmarks are found:

<https://drive.google.com/file/d/1XKcm590K6sUXzZVnoicyAdEprEFg2Tou/view?usp=sharing>

We aware of some issues with the zip file of all our experimental results. In case you experience any problems, you can either access the folder in Google drive:

https://drive.google.com/drive/folders/18hQMN_jvOxdCGWM5Bj8iqHqPY8brFgeK?usp=sharing

or email us: karine.even_mendoza@kcl.ac.uk and we can send any of the files, unzipped.

How to Run the Code

We describe in detail the commands required per approach we used in our experiments in this github repository: <https://github.com/karineek/latticeref> and here.

HiFrog has a support for 4 logics in SMT: qfuf, qflia, qflra, and prop. Lattice approach is implemented only for qfuf with OpenSMT, and qflia, qflra with Z3. The options are:

```
--solver osmt, --solver z3 with solving mode: --solving-mode inc,  
--solving-mode semi, --solving-mode no, and logics: --logic qfuf, --logic  
qflra or --logic qflia.
```

The name of the input data refers in the following commands to LRA, to change it to LIA replace lra in lia, and to change it to EUF, replace lra in uf.

Run HiFrog

```
./hifrog <c-file> --logic <logic> --save-summaries __summaries --claim  
1 --solver <solver>
```

Run HiFrog with Summaries

```
./hifrog <c-file> --logic <logic> --save-summaries __summaries --claim  
1 --solver <solver> --solving-mode inc --no-slicing --load-summaries  
user_defined_summaries/__summaries_cos_lra_single,user_defined_summarie  
s/__summaries_sin_lra_single,user_defined_summaries/__summaries_const_s  
in_cos --load-sum-model  
lattices/flat_cos_lattice_lra,lattices/flat_sin_lattice_lra
```

Run HiFrog with a Single Lattice

```
./hifrog <c-file> --logic <logic> --save-summaries __summaries --claim  
1 --solver <solver> --solving-mode inc --no-slicing --load-summaries  
user_defined_summaries/__summaries_sin_lra,user_defined_summaries/__sum  
maries_cos_lra,user_defined_summaries/__summaries_const_sin_cos  
--load-sum-model lattices/sin_lattice_lra,lattices/cos_lattice_lra
```

Run HiFrog with Several Lattices

To run the new lattice-based refinement algorithm with many lattices, we run HiFrog like this,

```
./hifrog <c-file> --logic <logic> --save-summaries __summaries --claim  
1 --solver <solver> --solving-mode inc --no-slicing --load-summaries  
user_defined_summaries/__summaries_cos_lra,user_defined_summaries/__sum  
maries_sin_lra,user_defined_summaries/__summaries_const_sin_cos  
--load-sum-model lattices/cos_lattice_lra,lattices/sin_lattice_lra  
--no-error-trace
```