fixed_extensions user manual

Title	fixed_extensions (VHDL fixed-point arithmetic extensions package)
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Rev. history	
v0.1.2	2020-11-07 Add makefile and scripts for GHDL simulation.
v0.1.1	2014-09-26 Updated README and file organization for Github. Renamed COPYING.BSD to LICENSE.
v0.1.0	2014-02-21 Changed documentation format to RestructuredText.
v0.0.5	2011-07-25 First public release.

1. Introduction

`fixed_extensions_pkg` is a fixed-point arithmetic package written in VHDL according to the VHDL-2008 update of the standard. It uses VHDL-2008 back- compatible libraries (by David Bishop) that are included in this distribution for the sake of completeness.

Currently, the `fixed_extensions_pkg` package implements the following:

-ceil: round towards plus infinity.

-fix: round towards zero.

-floor: round towards minus infinity.

-round: round to nearest; ties to greatest absolute value.

-nearest: round to nearest; ties to plus infinity.

-convergent: round to nearest; ties to closest even.

-bitinsert: bit-field insertion to word

-bitextract: bit-field extraction from word

`fixed_extensions` is distributed along with a tool (gentestround) to generate customized VHDL test designs.

The `fixed_extensions` project can be downloaded either from the following OpenCores website: http://opencores.org/project,fixed_extensions or from its corresponding Github repository: http://github.com/nkkav/fixed_extensions

2. File listing

The `fixed_extensions` distribution includes the following files:

/fixed_extensions	Top-level directory
AUTHORS	List of authors.
LICENSE	The modified BSD license.
README	This file.
README.html	HTML version of README.
README.pdf	PDF version of README.
VERSION	Current version of the project sources.
rst2docs.sh	Bash script for generating the HTML and PDF versions.
/bench/vhdl	Benchmarks VHDL directory
testrounding_tb.vhd	Standard testbench file.
/gen/vhdl	Generated RTL VHDL code directory.
testroundings.vhd	Auto-generated test file for sfixed arithmetic.
testroundingu.vhd	Auto-generated test file for ufixed arithmetic.
/rtl/vhdl	RTL source code directory for the package
fixed_extensions_pkg-_sim.vhd	The VHDL package for simulation-oriented use.
/sim/rtl_sim	RTL simulation files directory
/sim/rtl_sim/bin	RTL simulation scripts directory
run.sh	A bash script for testing the package.
testrounding.mk	Makefile for GHDL simulation.
testroundings.do	Modelsim macro script for testing sfixed arithmetic.
testroundings.sh	Bash script for running an sfixed simulation.
testroundingu.do	Modelsim macro script for testing ufixed arithmetic.
testroundingu.sh	Bash script for running an ufixed simulation.
/sim/rtl_sim/run	Simulation run scripts directory
clean.sh	Clean up the artifacts from the GHDL simulation.
ghdl.sh	Simulation driver script for GHDL.
testroundings.do	Modelsim macro script for testing sfixed arithmetic.
testroundings.sh	Bash script for running an sfixed simulation.
testroundingu.do	Modelsim macro script for testing ufixed arithmetic.
testroundingu.sh	Bash script for running an ufixed simulation.

/sim/rtl_sim/src	Various source files for running RTL simulations
fixed_float_typ es_custom.vhd	VHDL package with definitions for fixed-point arithmetic.
fixed_pkg_c.vhd	VHDL package implementing fixed-point arithmetic (VHDL'93 version of the VHDL-2008 package as found http://www.eda.org/fphdl/).
math_real.vhd	VHDL package with some real arithmetic functions (also part of the IEEE 1076 standard for VHDL).
/sw	Software utilities
Makefile	Makefile for compiling the test design generator.
gentestround.c	Test design generator written in ANSI C.

3. `fixed_extensions` usage

The fixed_extensions package can be used as follows. Assuming that the user has changed directory to `./fixed_extensions`, the following can be used:

```
$ cd sim/rtl_sim/bin
$ ./run.sh
```

Alternatively, the user can only generate and run some tests for solely the signed fixed-point and unsigned fixed-point data types. This is correspondingly performed as:

```
$ ./testroundings.sh
```

and

```
$./testroundingu.sh
```

For GHDL do the followng:

```
$ ./ghdl.sh roundings
```

or

```
$ ./ghdl.sh roundingu
```

4. Prerequisites

- Standard UNIX-based tools (tested on cygwin/x86)
  - make
  - bash
- [optional] Mentor Modelsim (`mti`) from http://www.model.com
  Provides a simulation environment to run the tests.