
Pyha

Release 0.0.0

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Mar 28, 2017

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INTRODUCTION

Essentially this is a Python to VHDL converter, with a specific focus on implementing DSP systems.

Main features:

- Simulate in Python. Integration to run RTL and GATE simulations.
- Structured, all-sequential and object oriented designs
- Fixed point type support (maps to [VHDL fixed point library](#))
- Decent quality VHDL output (get what you write, keeps hierarchy)
- Integration to Intel Quartus (run GATE level simulations)
- Tools to simplify verification

Long term goal is to implement more DSP blocks, especially by using GNURadio blocks as models. In future it may be possible to turn GNURadio flow-graphs into FPGA designs, assuming we have matching FPGA blocks available.

Objective/goal

Provide simpler way of turning DSP blocks to FPGA

Structure

Thesis structure.

Description of pyha

Conversion to VHDL

Simulation and verification

Testing

BACKGROUND

Give a short overview of whats up.

Python

Other HDL in Python

MyHDL

Migen

CocoTb

DESIGN EXAMPLES

This chapter provides some example designs implemented in Pyha.

First example develops a moving-average filter.

First three examples will iteratively implement DC-removal system. First design implements a simple fixed-point accumulator. Second one builds upon this and implements moving average filter. Lastly multiple moving average filters are chained to form a DC removal circuit.

Second example is an FIR filter, with reloadable switchable taps ?

Third design example shows how to chain together already existing Pyha blocks to implement greater systems. In this case it is FSK receiver. This example does not go into details.

Moving Average

Use accumulator and shift register to develop Moving Average algorithm

Linear phase DC Removal

Todo

What is DC and why to remove it?

FIR filter

Maybe skip this one?

FSK receiver

Glue blocks together...needs explanation...

[Pyhacores](#) is a repository collecting cores implemented in Pyha, for example it includes CORDIC, FSK modulator and FSK demodulator cores.

BIBLIOGRAPHY

- [1] William Strunk, Jr. and E. B. White. *The Elements of Style*. Macmillan, third edition, 1979.