Hochschule
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CVXIF and cocotb Tutorial

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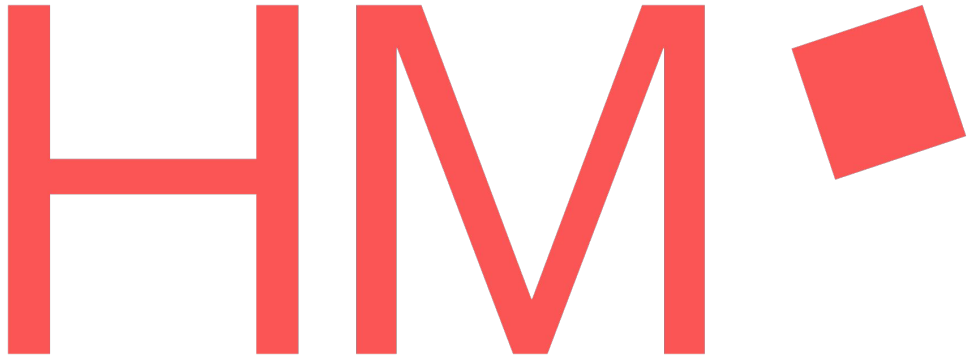
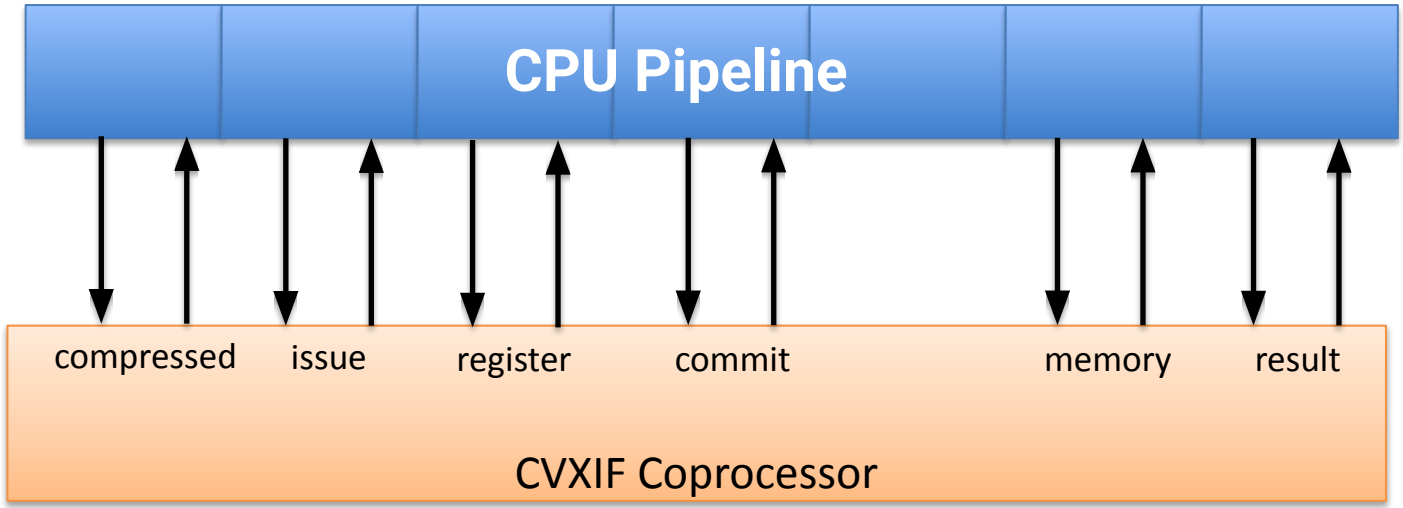


Core-V Extension Interface

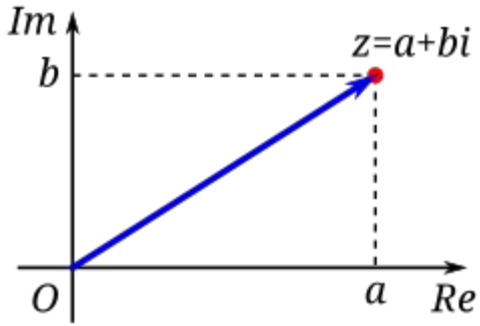
See CVXIF presentation from keynote

Extend core pipelines easily via clear interface



Tutorial Example: Complex Number Operations

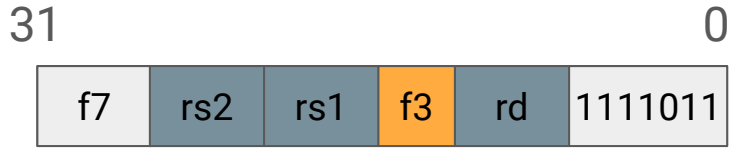
Recap: Complex Number z = a + bi (or: z = a + bj)
(real part a and complex part b)



Two common operations, that are computationally simple:

- Addition: A + B = (x + yi) + (u + vi) = (x + u) + (y + v)i
- Conjugate A* = (x + yi)* = (x - yi)

1st Step: Define Instructions



Use custom-3 opcode space

CVXIF requires operands in same place

func3 field is used to identify operation:

000 addition, 001 conjugate, others undefined

func7 field not used, must be 0000000 for valid instruction

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2nd Step: Define Module

Simplified CVXIF interface:

- compressed omitted
- issue:
  - only accept valid instructions
  - signal read and writeback
- register: wait for both
- commit omitted
- result: return result

```
module cvxif_complex (
   input          clk,
   input          rst,
   input          issue _valid,
   output         issue_ready,
   input [31:0]   issue_req_instr,
   output         issue_resp_accept,
   output         issue_resp_writeback,
   output [1:0]   issue_resp_register_read,
   input          register_valid,
   output         register_ready,
   input [31:0]   register_rs [0:1],
   input [1:0]    register_rs_valid,
   output         result_valid,
   input          result_ready,
   output [31:0] result_data
);
```

3rd Step: Implementation

We will follow through the steps together:

1. Write complex module that implements functionality
2. Write tests for complex module in cocotb
3. Write cvxif_complex module
4. Write tests for cvxif_complex module

Maybe tomorrow: Integrate into processor core (to learn about integration)

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Tutorial

Each step:

- You try out implementation, form groups (5-20 minutes)
- We develop together
  - I will share code with Visual Studio Code LiveShare
  - You can connect to copy or (prefered!) help me develop (use names when connecting) (runs in browser)
- Repeat for next steps

When we run over: Continue tomorrow

Materials (zip): https://t.ly/8gBht

LiveShare: https://t.ly/dXb4P