ReRAM Crossbar Digital Behavioral Model

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Information Current as of 11/15/2024

Setup

1. Clone the repository

```
git clone https://github.com/AidenPetersen/ReRAM_Crossbar.git
```

2. Enter the project and set it up with the following commands:

```
# initialize environmental variables
source setup.sh
# install project dependencies
make setup
```

Project Structure

Drivers

All of the relevant code is in the verilog folder, which contains a dv and rtl folders. The dv folder contains the drivers which is the C code that is ran in the managing RISC-V MCU. The drivers used for our primary test are in the file:

```
verilog/dv/crossbar_la_test/crossbar_la_test.c
```

Which provides functions that act as API calls to perform various operations on the ReRAM crossbar, along with various tests within the main method to ensure the digital model is working properly

Digital Model

All of the files in

```
verilog/rtl/
```

are a part of the digital behavioral model. The primary files that are used are:

- crossbar_wrapper.v
    - Wrapper around the whole ReRAM crossbar
- crossbar_top.v
    - Contains internal components in the system that are not the ReRAM crossbar and links them to the crossbar
- crossbar_mac.v
    - Emulates the functionality of the actual ReRAM crossbar.

crossbar_mac.v

This emulates the functionality of the ReRAM. It has been important in helping us design the analog components so that the whole system works correctly.

It’s able to perform many single, then sum them in the columns, and choose an output bit based on a constant threshold current, which is how our analog design works.

Running Verification

If the project has been setup successfully, now the simulation should be runnable. Here are the set of instructions necessary to run the simulation:

```
# make the simulation environment
make simenv
# run the simulation
make verify-crossbar_la_test
```

Now a vcd waveform should be generated. This can be opened with GTKWave, which is an open source waveform viewer. To view the waveform run:

```
gtkwave verilog/dv/crossbar_la_test/RTL-crossbar_la_test.vcd
```