EE/CprE/SE 491 WEEKLY REPORT 04
Oct 22 - Oct 28

Group number: **22**

Project title: **ReRAM Compute Asic Fabrication**

Client &/Advisor: **Cheng Wang & Henry Duwe**

Team Members/Role:

Ali Mannan
Tyler Kloser
Austin Miller
Vinicius Malaman Soares

- **Weekly Summary**

Following our weekly meeting, we needed to come up with some ideas for modules/designs for characterization testing to be implemented on the chip. Some designs have been discussed throughout meetings already, but exploring them further was a significant portion of the work done this week. Additionally, we also continued to get basic cells working, mostly by importing previous teams' solutions (magic files) and working through with the tools. Ongoing is also making sure tools are working as intended and consistently.

- **Past week accomplishments**
    - Vinicius Malaman Soares: Research more possible characterizations. Got the inverter through magic. Tried to set up virtual machine setup. Worked on senior design report.
    - Tyler Kloser: Ran the inverter through magic to help understand how to use the tool and deconstructed it. Downloaded the ReRAM cell, continued deciding trade-offs for ADC
    - Ali Mannan: Completed SSH setup. Figured out how to instantiate the ReRAM cell in Magic by modifying the SPICE netlist created by Austin's schematic to include the ReRAM layout view from previous senior design teams. Fixed DRC issues with the previous senior design team's instantiated ReRAM cells (ReRAM layer must be in between layers of Metal 1 and Metal 2). Attempted to run LVS on previous senior design team's 2 stage op-amp, found issues with their design.
    - Austin Miller: Compiled characterizations based on previous discussions with client/advisor, along with sky130 documentation for some ideas on what might be worth trying to test.

- **Pending issues**
    - Tyler Kloser: N/A
    - Ali Mannan: N/A
    - Austin Miller: N/A
    - Vinicius Malaman Soares: Finish setting up the X11 server for the virtual environment.

- **Individual contributions**

NAME	Individual Contributions	Hours this week	HOURS cumulative
Tyler Kloser	Worked on understanding magic and layout for the inverter and ReRAM cell	6	32
Ali Mannan	Instantiated ReRAM in Magic, fixed previous teams DRC errors. Ran LVS on op-amp design.	6	41
Austin Miller	Explored and compiled characterization module ideas and tests to propose to client, got reram instantiated with Ali's suggestions	8	42
Vinicius Malaman Soares	More characterization ideas, such as the NMOS/PMOS setup, senior design document	6	37

- **Comments and extended discussion**
  - Plus-Delta discussion with advisor and client notes

	Plus	Delta (Progress)	Delta (Understanding)
	What Progress have we made and evidence?	*What further can we do to progress?*	*What further can we do to understand?*
Technical (Feasibility)	Schematics and testbenches, with simulation plots before and after parasitic extraction. Research on the trade-off of different design possibilities.	Reliable toolflow, from schem to harness/pre-check	Document progress, challanges and errors.
Economic (Viability)	Use open-source tools to add no additional cost to our project	Continue using open-source tools	Understanding that keeping small increments of the budget to a minimum will help offset the high cost of fabrication
Human (Desirability)	Use different parameters to characterize design: voltage, temperature, noise, etc.	Reliable tool setup and documentation	Continue to provide good documentation, continuously obtain more detailed requirements

  - A lot of what we discussed during our meeting pertained to the plus-delta components, without us realizing.
  - Towards the end of our meeting, we showed and discussed our previously written answers. Since we talked a lot about similar things, we mostly got feedback on these answers.
  - Overall, our advisor agreed with our answers but also provided some constructive feedback. We should be a little more specific on some of these items, such as hard numbers or tests for evidence of progress, particular issues that might be hindering progress, and understanding more of the client's wants/needs, instead of our personal items for the plus and deltas

- **Plans for the upcoming week**
  - Ali Mannan: Fix the previous senior designs 2-stage op-amp design so it can be imported correctly to Magic and pass LVS, and replace the analog components they used to Skywater 130nm components. Complete and run LVS/precheck on 1T1R ReRAM cell.
  - Tyler Kloser: Work on setting up the VM so I can work remotely, Continue to test the capabilities of Magic
  - Austin Miller: Take inverter and 1T1R through pre-check (assuming tools behave), possibly come up with some more characterization/test modules based on feedback from this upcoming meeting.
  - Vinicius Malaman Soares: Work on getting ReRAM working on magic, and do schematics for characterizations.

- **Summary of weekly advisor meeting**
    - This week, we primarily discussed more about what our advisor and client want from this project, which hasn't been completely clear so far. We discussed the need to develop different modules and designs by characterizing the behavior of the ReRAM cells and other individual components before they can be reliably integrated into the desired overall compute crossbar. Essentially, working closer to a concrete definition and set of requirements for our project. We also discussed creating a master document/slideshow of design ideas, progress, and revisions that is separate from our weekly slides that we have been using for our discussions. With this new document, we can tie decisions back to the previous week or mention why we revised a design or idea, while also keeping a record that we can trace back to the beginning.