DLA Report 10

Alexey Yermakov
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1 Description of what was done

1.1 Summary

For this report I did many house-keeping tasks. I Emailed Moisy about the problem I had importing Pivmat data. I read Li, Avila, and Xu's modified FS-SS paper and began implementing it. I also brainstormed setting up the water table and broke it down to several different components. Lastly, I began working on my DLA presentation which I will likely use for the SIAM Front Range Student Conference as well.

1.2 Working on my DLA/SIAM Presentation

As mentioned, I began working on my DLA presentation which I will likely use for the SIAM Front Range Student Conference as well.

1.3 Fixing FSSS Code Bug

As mentioned in the last report, my code works almost the same as Pivmat but with a minor problem where the z-scaling isn't the same. This was resolved and now the graphs generated by Pivmat and my code are the same, making my code a reliable fall-back option if Pivmat breaks for some reason.

1.4 Emailing Moisy

I went ahead and emailed Moisy on February 9^{th} the solution for the problem I encountered with OpenPIV and Pivmat. I have not heard back from him yet.

1.5 Li, Avila, and Xu's Paper

I went ahead and read through Li, Avila, and Xu's paper on their extension to Moisy's synthetic Schlieren method. I believe it would be worth pursuing implementing this method after getting the water table set up since a lot of what we have for FS-SS can be reused in this method. One of the primary benefits is that their method is able to calculate the water surface height without a reference height. This would allow us to get more reliable water depth measurements since otherwise we'd be measuring experimentally. This is also a benefit since we're not expecting the average water depth across the water table to be uniformly flat like we would in a glass tray. The problem with slanting, however, still exists using this method and we might need to assume the table

is flat anyways to reduce slanting. The only other additional experimental procedure we would have to incorporate is taking a picture of the water table with no water running across it. This would give us the camera viewing angles for each of the camera's pixels, which isn't required for FS-SS.

1.6 Water Table Set-up

After moving in the water table, a couple of additional set up steps need to be taken:

- The camera needs to be mounted above the table and connected to a computer to take photos
- The LED panel needs to be mounted below the table
- The dot pattern(s) need to be mounted on the underside of the water table's acrylic
- The water pumps need to be set up
- The sluice gate should be attached
- The water table's acrylic needs to be cleaned
- The water table should be levelled (we want it flat)
- We should buy a plastic tub large enough to collect the water from the end of the water table.

1.6.1 Cleaning the Acrylic

The bottom of the acrylic has duct tape residue. The group has mentioned a brand called Goo Gone to remove the residue. They recommend buying Goo Gone Pro-Power ($9.99 at McGuckin) for duct tape residue, though they don't outright state that acrylic is supported, claiming that we should do a spot test first before committing to using it.

Sam said we have access to Goo Gone somewhere, so trying what we have is a good first step.

1.6.2 Dot Pattern Mounting

Moisy's paper (fig. 13) shows that a larger air gap between the bottom of a glass plate containing a water wave and the dot pattern results in blurrier images. Thus, I believe that taping the dot pattern to the bottom of the acrylic to make the air gap effectively zero would be the best course to take. I think clear packaging tape would work well since it wouldn't leave the same residue, if at all, that duct tape does. This would make moving the dot pattern easy, too, since tape isn't a permanent mounting solution.

1.6.3 LED Panel Mounting

The LED panel illuminates the dot pattern from below, reducing picture glare and noise when no other light sources are present. As a result, we want to mount the LED panel as close to the top of the water table as possible; however, like the dot pattern we want to be able to move it around if needed, especially since we need to remove it when replacing/moving the dot pattern.

One option is to just put the LED panel in a cardboard box so that it has a flat base and then put it on top of a chair below the water table. This will allow the LED panel to be moved easily and it can be close to the water table by an appropriately sized chair.

Another option is to build off of Paris Buedel's water table design. Excluding the swiveling studs on the bottom of the water table, the water table's support structure is built entirely from parts by a company called 80/20. Since 80/20 sells modular parts, we can order more support beams and a couple fasteners to have a place under the water table for the LED panel.

- 4 × Roll-In T-Nut ($2.19 each)
- 4 × Gusseted Inside Corner Bracket ($5.22 each)
- 2 × 1.00" X 1.00" X 35.00" T-Slotted Profile ($13.71 each)
- 8 × Flanged Button Head Socket Cap Screw ($0.40 each)
- 4 × Slide in T-Nut ($0.28 each)
- Total price: $61.38 (pre tax, pre shipping)

This option would allow us to move the LED panel to almost any position under the water table as long as we have a screwdriver handy. Once we have the extra beams under the water table, the LED panel can just be placed on top. It's not necessary for the panel to be screwed down since it's not going to be moving on its own. If we want to, there are wheels that we could use to move the support beams as well.

1.7 Setting up the pumps

We ran into several problems while setting up the pump:

- The drain next to the water table clogged almost immediately
- The drain for the sink drains very slowly
- The water table's end is larger than the bucket catching the water

Due to these problems, we had to postpone setting up the pumps until the clogs were removed. The good news is that the pump appears to have been working properly.

2 Description of Next Steps

We still need to set up the water table. I also need to keep refining my presentation for DLA, which I am planning on reusing for the SIAM Front Range Student Conference. If I have any spare time then I will continue trying to implement Li, Avila, and Xu's modified FSSS method.

3 Questions

- How do I register for the SIAM conference?
- If anyone has time I'd appreciate some help with MATLAB's `fsolve` function!