IV 3 Report: Alessandro Villain

12/7/2022 Section 1

Living in Andrews Hall has its perks, one of which being the kitchen. Over the years, I have abused this space, and I thought I would continue this tradition with an enormous fish tank. Thanks to Ella, we have a few subjects to photograph. Thanks to my diabetic and HIV positive roomate, Ted, we have a few hypodermic needles to play with.

The hypodermic needle's functionality is quite straightforward: A plunger creates a pressure differential forcing the contents of the syringe out. We mixed some acrylic paint and food coloring with water in order to get the opaque mixture. We suspect that the density is close enough to water for reynolds number calculations.

As the pigment is exiting the hypodermic needle, the flow is immediately transitional. This is because of the small diameter of the hypodermic needle (3 mm) and the velocity it is traveling at (very fast relatively). The Reynolds number can be calculated for the paint by using some of the other images taken. My camera has a burst mode of 5 frames per second, meaning that every shot is 0.2 seconds apart. Using this, we can estimate the Reynolds number to be approximately 1200, which is still laminar. If the flow moves 0.5cm in 0.2 seconds, we can assume it moves 0.0008 centimeters in one shutter interval for this shot.

$$Re = \frac{UD}{\nu} = \frac{\left(\frac{0.005m}{0.2s}\right)(0.025m)}{1.004 \cdot 10^{-6}\frac{m^2}{s}} = 622.5$$

This reynolds number implies a transitional flow, which is good since that is what I claimed before the math. To calculate the true reynolds number, we would add this to the reynolds number for transitional flow.

There were no visualization techniques used in order to better elucidate the flow. We were fortunate to have a fish tank which prevented lensing. Additionally, the white paper which we used as a background allowed us to get a much clearer shot. I really like the mysterious fog from previous attempts lining the bottom of the tank. It adds a really mysterious effect.

The specs for the photo are as follows:

Camera	Canon EOS 250D
Lens	Canon EF 50mm 1.4 Ultrasonic
Aperture	f/6.3
ISO	3200
Shutter Speed	1/800

The photo was taken about two feet away from the subject. The 50 mm lens was used due to it having an appropriate focal length. The lighting conditions were poor, despite the fact we set up three lamps. The shutter speed was pretty low, but the flow was so slow it did not matter much. I used a high f-stop in order to get more of the subject in focus and pulled the image out of the shadows in post.

I like the sharpness of this photo and how voluptuous the pigment is. These are the types of flows I see on youtube and I am especially pleased with what we were able to pull off. There is nothing wrong with this photo, the hands are ominous and hint at a message which is not there. The little dude is a perfect subject, and the strong contrast of the blue and the hazy ground do a lot to add to the mood.

Original photo (4000x6000)

Edited Photo (4000x6000)

References:
Diabetes and HIV information: https://lelit.com/

Equations for the minimal surface area were taken from the University of Chicago:
https://math.uchicago.edu/~may/REU2019/REUPapers/Zheng.SiqiClover.pdf

Information on Plateau-Rayleigh instability was found at:
https://ui.adsabs.harvard.edu/abs/1995PhFl....7.1529P/abstract
https://arxiv.org/abs/chao-dyn/9612025

Supplemented by wikipedia:
https://en.wikipedia.org/wiki/Plateau%E2%80%93Rayleigh_instability#cite_note-Papageorgiou1995-1