

# **Team Second Report**

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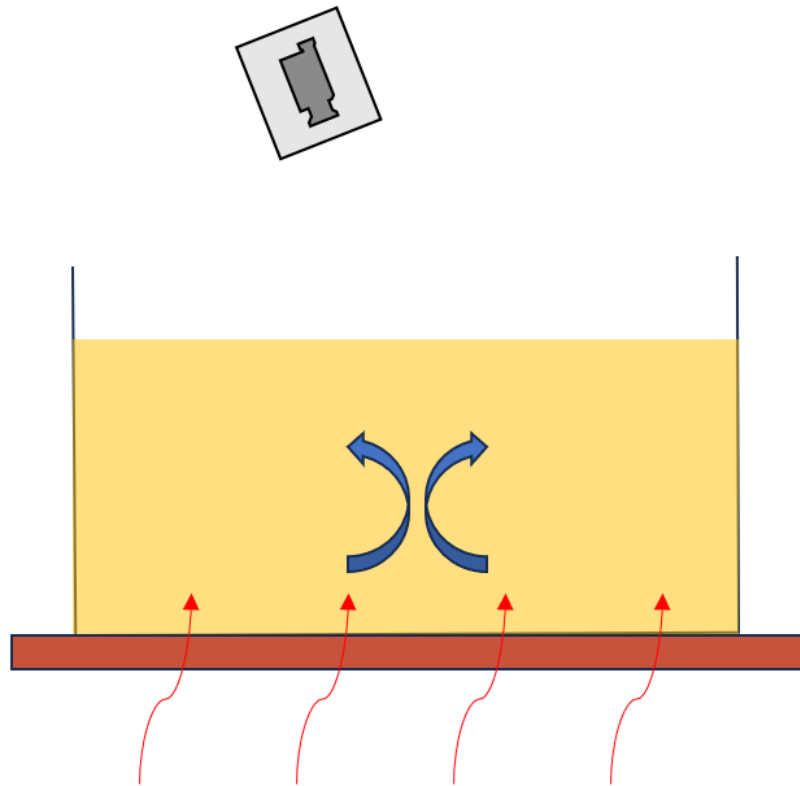
Flow Visualization Fall 2023 Section 001

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## Context and Purpose

For the second team exercise, our group selected Rayleigh-Bénard convection as the subject. We thought that this was a cool visualization and that it would be fairly simple to visualize. The equipment we used was Crisco vegetable oil, “Recollections” mica powder from Michael’s, a baking sheet made of aluminum, and a hot plate from the ITLL on campus. We added approximately one inch depth of oil and mixed a sufficient amount of mica powder to make the oil easier to visualize when convection took place. The mica powder has a low density and reflects light very well giving the oil a sparkle in light which drastically increases the visual properties of the fluid. The hot plate was then turned on and we observed the results as heat transfer in the form of conduction and convection began to occur.



**Figure 1: Sketch of setup used for image capture.**

In this experiment we took the opportunity as a group to learn more about convection. As the heat is applied to the oil, it begins to decrease in density and rise towards the surface. This is driven by the effects of buoyancy in the different temperatures of oil where it is cooler on top and warmer on the bottom. This creates columns of flow as seen in figure 1. Although we did not

see several columns which would have created the cells we were after, we can still see the process of this in our results.

### **Visualization Technique**

The initial technique our group intended to use was not able to be replicated due to difficulties obtaining the visual “cell” effects in the oil. Some things we could change in the future is the size of our pan or container for the fluid, and ensure the surface area ratio is very high (where the plate is much bigger than the container, or the container is much bigger than the plate). The fluid we desired was silicon oil, but due to lack of availability we chose vegetable oil, which gives a yellow hue to the fluid. The depth of the fluid also may be a factor, so we could have used a thinner layer of oil. Overall we were still able to visualize the turbulence of the oil when heated, but the Rayleigh-Bénard convection effects were not clearly visible.

### **Photographic Technique**

The video settings are described here as follows. The camera used was a Sony A7Riii with a Sony FE 16-35mm F2.8 GM lens. The subject of the image was approximately 10 inches away, and a field of view of about 4 inches. The video resolution was 1920x1080 captured at 60 FPS on automatic exposure settings. The raw video file was processed using Davinci Resolve, where brightness, RGB curve, and frame size were edited to enhance the features. The lighting used were LED lights on our iPhones in conjunction with the ambient lighting in the room.

### **Reflection**

I wish our team had done more research into this and planned better, but as stated in the beginning section, we underestimated the complexities of visualizing the convection cells as the videos and reports we researched were very straight forward. This was also my first time taking a video and using DaVinci Resolve outside of watching in class and I really struggled with the video editing. In retrospect, I should have used my laptop and utilized the iMovie application as it is a little more user friendly for beginners.