# **Team First Report**

Fall 2019

## MCEN 4151-001: Flow Visualization

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## I. Introduction:

This report explains our first experiment as a team for the Flow Visualization course. So, for this task, we wanted to visualize the movement and collusion of ink clouds underwater. To accomplish this goal, with the help of my team members, we used syringes to shoot two different colors of India ink which is a waterproof ink. The colors of ink that were used are red and blue. Also, the syringes were submerged underwater while conducting the experiment.



## II. Experiment Set Up & Camera Settings

Figure 1. Top view of the experiment set up



Figure 2. Actual set up of the experiment

We performed the experiment that way (white board on the back and light sources from the sides) to get the best result possible using our own cameras. Moreover, we submerged the syringes before releasing the ink to get a better shape of clouds. The angle of capture resulted in some unwanted reflections in the background, but it showed the whole flow of the inks from the surface of the water to the bottom of the aquarium which is what I was aiming for. The photo was taken with a Canon PowerShot SX530 HS. To capture a clear flow, I used 1/50 speed shutter and f/7.1 for aperture. As for the focus and ISO, I used manual macro focus with 800 ISO. Also, the distance from the water tank was about 3 to 6 inches.

### **III.** Flow Physics

The experiment was conducted to visualize the Rayleigh-Taylor instability. This flow phenomenal describes the movement of two fluids with different densities. In our case, the India ink will move through the water, since it has a higher density value. Also, using Reynolds number equation  $Re = \frac{\rho VD}{\mu}$ , we can analyze the flow type.

	Blue Ink	Red Ink
V (m/s)	0.17	0.12
D (m)	0.035	0.023
$\mu$ (Pa. s)	1.123 x10 <sup>-3</sup>	1.114 x10 <sup>-3</sup>
$\rho$ (kg/m <sup>3</sup> )	1008.1	1012.5

Table. 1 Data for ink used in the experiment

Therefore,

 $Re_{blue} = 5341.2$   $Re_{red} = 2508.5$ 

These values indicate that the red ink is transitioning from laminar flow to turbulent. As for the blue ink, it is already a turbulent flow.

## **IV.** Photo Editing

My picture dimensions are  $4608 \times 3456$  pixels. Originally, the background color was white and with a lot of reflections in the left side of the photo. So, I changed the color balance using Photoshop software where I made the picture more purple. I feel the purple color gives the photo a warmer mood.



Figure 3. Photo before editing.

## V. Conclusion

This experiment helped me gain more knowledge about Rayleigh-Taylor instability by performing and visualizing the phenomenal. Also, it allowed me to test and understand more about the camera settings. As for the photo itself, I believe I captured a nice moment of collision which illustrated the flow of ink nicely. However, a way to improve the picture would be either by changing my angle of capture or adding another white board to the left side of the aquarium to reduce the reflections.

#### **VI.** References

https://wiki.anton-paar.com/en/ink/