Eric Stahl
456-379
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Team Project 1

This image was done while experimenting with a device that allows easy construction of a soap film tunnel. A soap film allows easy visualization of 2-D flows[1] while it can also display colors that are very pleasing to the eye. My initial plan was to make a short video edit of a pleasing flow, but due to difficulty with software and time constraints I submitted an image instead.

The soap film tunnel was creating using an apparatus provided by the University of Colorado at Boulder. The device allowed solution to run down two nylon wires which could easily be spread to make a soap film tunnel. The device that was used was very similar to the schematic displayed in Figure 1. The field of view is focused on soap film and does not show any part of the apparatus.

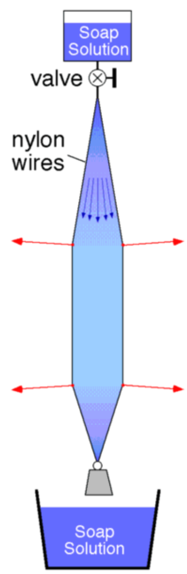

Figure 1: Soap Film Apparatus

The solution was allowed to flow rather slowly (0.25m/s) to the bottom of the apparatus. The Reynolds number for this setup was found to be 1200 which was found by the calculations below.

$$Re = \frac{VL}{\nu} \qquad Re = \frac{\left[0.25\frac{m}{s}\right]*[2mm]}{1*10^{-6}\frac{m^2}{s}}$$

As you can see, the flow was largely laminar. The assumptions for the Reynolds number calculation are that the kinematic viscosity of the solution is the same as water and the characteristic distance was approximated as 2mm for the nozzle diameter. The velocity varied because the solution was being turned on and off, sometimes creating sections of turbulent flow. In the image the flow is moving upwards because of a vortex that was not seen in the image. The color that the soap reflects is dependent on the thickness of the film and the lighting[2]. The yellow areas indicate the thinnest portions

1.http://www.springerlink.com/content/pa4gb5jrt2d5jbqg/fulltext.pdf
2. http://www.webexhibits.org/causesofcolor/15E.html

of the film and are caused by the evaporation of the film. In comparison, the blue areas indicate the thickest portions of the film. The image was thickest on the bottom and has mushroom-like flows that have been pushed through the thick film from the vortex motion.

The solution that was used was comprised of 200 parts water, 10 parts dish soap, and 1 part glycerin. Glycerin is commonly used for soap films to increase the bubble life[3]. A humidifier was also used to minimize evaporation and lengthen bubble longevity. The area was approximately at room temperature during the entire experiment. 500 watt lights were used at an angle of 45 degrees relative to the side of the apparatus.

The image shows an area of 3”x4” and was filmed from approximately 3’ from the film. The video camera was focused manually. I made minor adjustments to the color curves using Adobe Photoshop. The way I captured this image was in the crude manner of the print screen function from HD quality Sony Xacti VPC video footage. I strongly do not recommend this method if you wish to achieve high levels of focus and quality. Because the footage was in HD I was able to capture an image on the scale of 1269x715 pixels. While I am pleased with the concept of the image, I believe it could have been captured with greater focus and clarity. If I had the chance to work again with this concept I would have preferred to make a short film that would show a greater range of soap film flow dynamics.

3. http://pubs.acs.org/cen/whatstuff/stuff/8117sci3.html