

“GET WET”

Image Context Report

ABSTRACT

This report will provide context for my first image in the fall 2016 flow visualization class.

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Flow Visualization: The Physics and Art of Fluid Flow

1 CONTEXT AND PURPOSE

I am very excited to speak about my first image for the class Flow Visualization. The overall objective of the first assignment was to get your feet wet and just start taking pictures of flows. There were not much guidelines to subject choice, which led to me taking many different styles of photos before deciding upon this one. This photo is taken outside at 2pm on a sunny day. The subject was the spherical water feature outside of the Discovery Learning Center on the CU Boulder Campus. You can see a photo of the style of the fountain below in Figure 1. I attempted to take several close-up macro



Figure 1- Spherical water feature similar to that photographed in Get Wet image.

style images of the water escaping out from underneath the large polished granite ball. I decided upon this image because of the more complex water structure and ideal depth of field. Another reason I liked this photo was its multitude of photographic effects it incorporated. Its depth of field has the subject flow in crisp, sharp focus and the background and surroundings out of focus providing a un distracting warm background and frame. Additionally, the reflection of the polished spherical ball in the top right portion of the image creates an almost motion blur effect. I would argue that this isn't motion blur, but rather the combination of reflection against a polished surface and being slightly outside of the depth of field of the camera at the time. It took several attempts to capture this image. This was because of the unpredictability of this particular flow, and also the challenging focus situation. When I say unpredictable flow, it was challenging to get the water to escape in an interesting fashion in front of my camera set up at the exact distance that my camera was focused. I

couldn't use the automatic focus function on my camera because I was using an extension tube. The extension tube confused the camera and it wasn't able to automatically focus. Overall I am happy with the turnout of this image. I believe that the image captures the randomness and liveliness of the flow, and also shows some interesting fluid physics.

2 FLOW APPARATUS

As previously shown in figure 1, the flow apparatus is a spherical water feature. The system was pre-existing before the image was taken, and only small changes were done to get closer to the image intent. The primary thing that was changed in the flow apparatus was the rotational speed and direction pf the spherical element. The purpose of this was to increase the amplitude and influence the direction of the flow escaping from underneath the spherical element. When describing the flow apparatus, figures 2 and 3 will be referenced. Figure 2 is a sketch of a larger section view of the water feature. In figure 2 you can reference labels 1 and 2, these are pumps that take water from the overflow reservoir and transfer it in to the high pressure area underneath the spherical ball, labeled 3. After

pressure builds to a point where it creates a sufficient upward force to raise the ball, the water escapes through the newly created space between the ball and the base, labeled 4 and 5. After the water escapes from underneath the ball it enters normal atmospheric pressure, this results in a jet like flow at points 6 and 7. At points like 6 or 7 is where the flow was photographed. Figure 3 shows a detailed sketch of the small space that is created between the ball and the base when the water feature is pressurized. In figure 3, the high pressure area under the ball is labeled 1, the base of the feature is labeled 4, the ball itself is labeled 3 and finally where the water releases and the photo was taken was at point 2. The reason this apparatus can work is the incompressible nature of liquid water. Additionally, the flow is made more interesting by the angular momentum gained while traveling through the curved space between the base and the spherical ball. Also some of the escaping water is effected by surface tension against the ball. The fast and chaotic nature of the flow when it exits the nozzle like section from underneath the ball suggests a large Reynolds number above 2000. This indicates that the flow will be fully turbulent in the photograph.

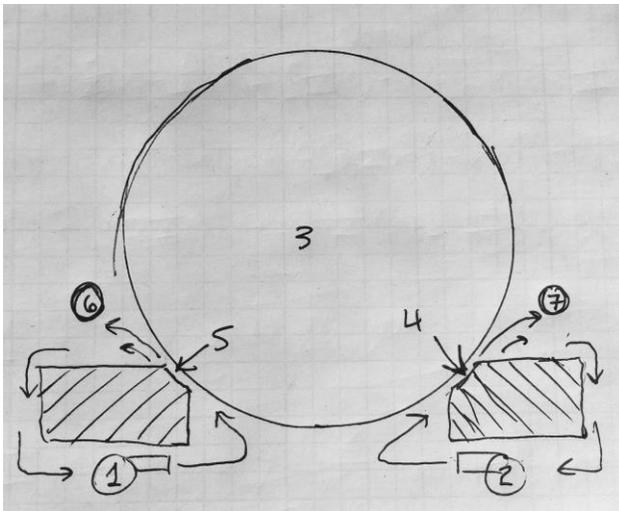


Figure 2- Sketch of flow set up (section view)

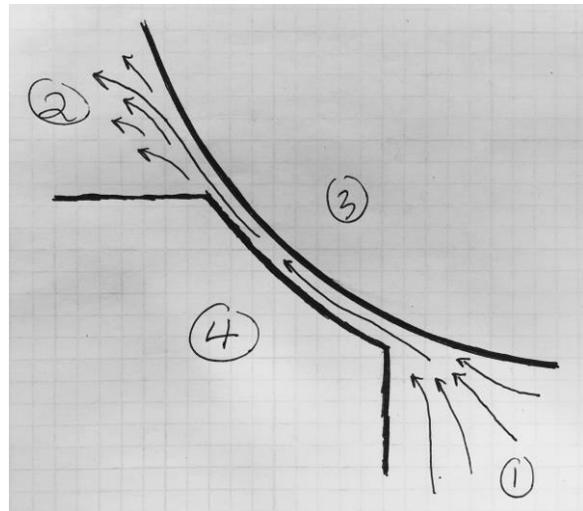


Figure 3- Detailed sketch of flow set-up (section view)

3 DESCRIBE THE VISUALIZATION TECHNIQUE

The visualization technique is quite natural in this photograph. Most lighting effects were done in post processing. You can see that when comparing the figure 4 and 5 below. Figure 4 is the original image before post processing and Figure 5 is the image after post processing. There were three major settings that were adjusted in post processing in this image. The first was the tint, this was changed to give the final image a warmer feel to it. I thought the original photograph seemed a little dark and cold. The second feature of the photo that was adjusted was an increase in contrast. This really brought out a lot of the reflections and shadows. The last thing that was changed was a slight lowering of shadow intensity. I was concerned that some of the detail, mainly between the top of the flow and the spherical ball, was lost with how dark the shadows were in the photograph.



Figure 3- Original image before post processing



Figure 4-Final image after post processing

4 PHOTOGRAPHIC TECHNIQUE

Using the meta data embedded in the original image I was able to determine the settings used to capture this image. There were many photos capturing this flow with various different settings. This meta data was very valuable when reflecting upon what settings were successful in this unique photographic scenario. This photo has dimensions of 3168 x 4752 pixels and was taken with a Canon EOS Rebel T1i. The shutter speed was very quick at 1/800 of a second. This fast shutter speed was the only way I could freeze this chaotic flow in place. My aperture was relatively low at f/5.6. This low aperture was how the varying depth of field in the image was created.

5 WHAT DOES THE IMAGE REVEAL?

When I reflect upon this image there are several things I would change. The first would be my handling of the RAW file format. When I took this image it was before we had the lecture on the RAW file format setting on cameras. I am slightly disappointed with this because I lost some of the sharpness of the photo I believe. Another thing I would do differently is visit the same location in different lighting scenarios to get a more diverse selection of images of the flow. I don't know if I took my final photo with the best lighting.