IV 4 Report: Alessandro Villain

9/26/2022 Section 1

https://www.youtube.com/watch?v=y42tFkShiYA

Harmonic oscillation is the source of human life. If it were not for the harmonic oscillations by my parents, I would not be here. Additionally, many saddening math classes have proved that partial differential equations can be decomposed into harmonic functions. Even in our imaginary spaces, it's all harmonic. Therefore, since we needed to take a video, this was the choice.

We oscillated the bowl at a frequency of twenty hertz and captured it at a rate of 240 frames per second. The water had a changing viscosity and so we will assume that it has the same viscosity as normal water for the sake of simplicity. There are very few things that can be measured from this experiment. However, one notable thing is the circular harmonics that arise inside the bowl from this experiment. Below are the circular harmonics in question:

Band: 0 Band: 1 Band: 2 Band: 3 Band: 4 Band: 5
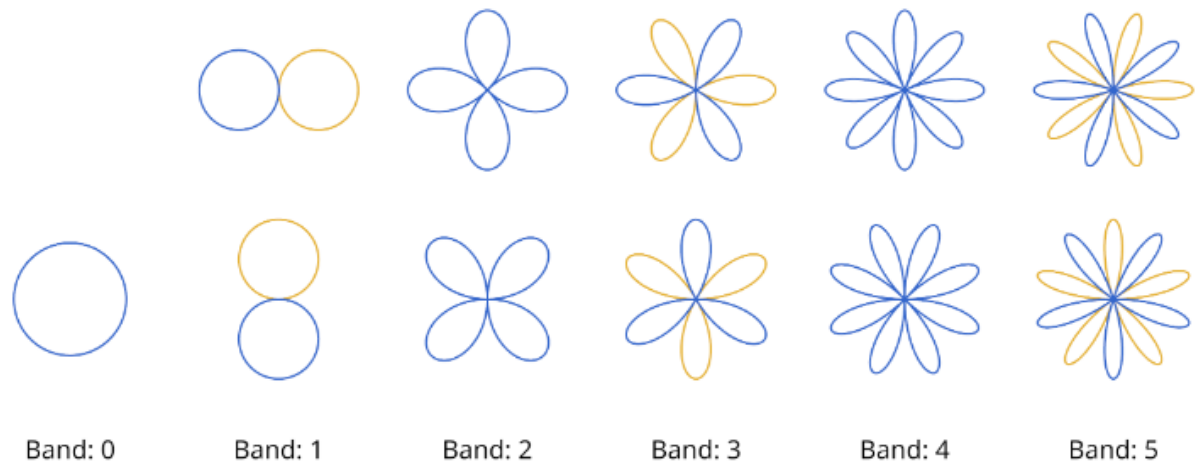
And below is an image from the video. Here, the major lobe oscillates back and forth and sends two adjacent lobes down around the glob of paint.
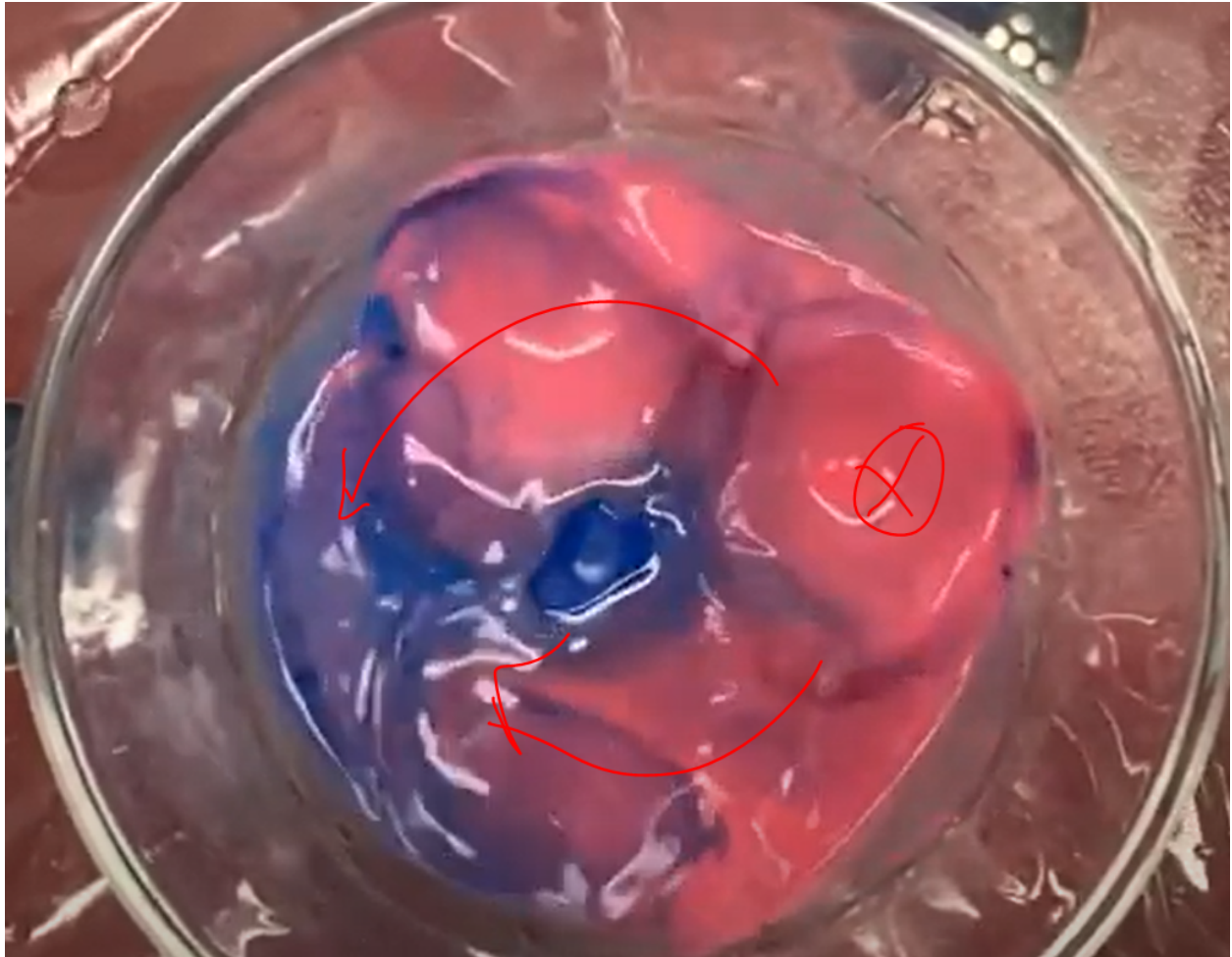
This most closely resembles a linear combination of band 6 and band 2 from the circular harmonics. Below is an approximation of an animation showing the shape of band 6.

Bands: 6
0.31

Bands: 6
.92

Bands: 6
1.69

Bands: 6
1.38

Bands: 6
1.36
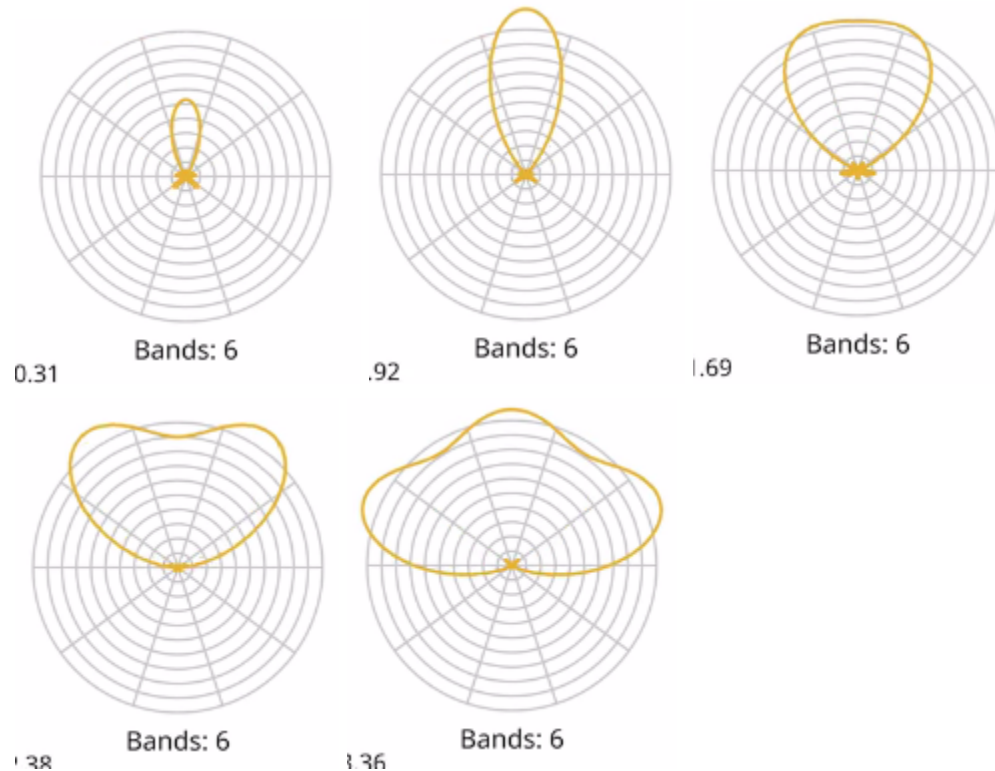
This is the harmonic that we see most prominently in the video. We see that an excitation of 20 hertz is the resonant frequency of this harmonic.

The specs for the photo are as follows:

Camera	IPhone Xs Max

I was quite pleased with this video. I feel that the quality was very good, especially coming from a cell phone camera. However, there's a lot I would want to do to improve the shot. First thing is to edit the video so the rim of the tub is a constant radius. This would mean dynamically changing the zoom in post which sounds like a job for someone with more time and patience. Additionally, I would use better colors in order to make the video more pleasing. However, I am happy of the photo's current state.

References:

Circular harmonics: https://valdes.cc/articles/ch.html

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