EE2703: Report

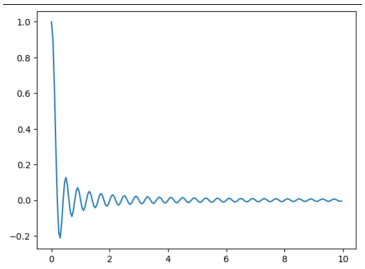
Assignment 7 - Sound localization

EE23B092

0.1 Plots

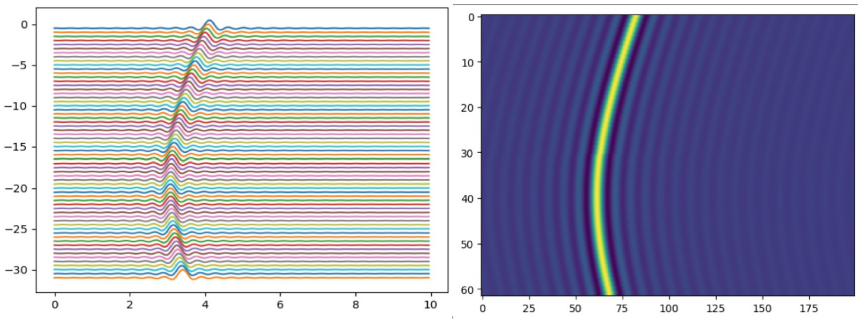
This report will contain the output plots and the answers to the questions asked in the given PDF. A more detailed explanation is given in the notebook submitted along with the code.

0.1.1 Generating the source waveform

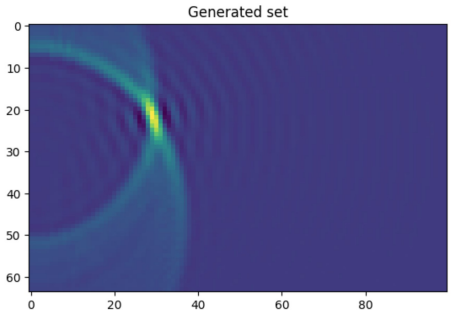


0.1.2 Generating the Mic Output

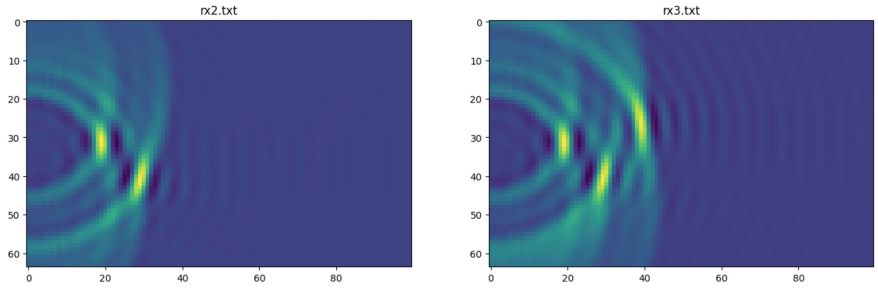
Left is the received reflected waves and the right one is the heatmap of the same.



0.1.3 Reconstructed image for the generated samples



0.1.4 Reconstructed image of the text files



Obstacles for rx2.txt are approximately located at (19, 32) and (30, 42). Obstacles for the rx3.txt are approximately located at (19, 32), (30, 42) and (40, 26).

0.2 Answers to Questions (given in the back)

0.2.1 Question 1

The reason has to do with axes and the code. The x and y axes of the heatmap is a reflection of the indices (i, j) of the 2D reconstructed image grid. To get the actual values, you have to multiply y-axis values by 'pitch' and the x-axis values by dist_per_sample.

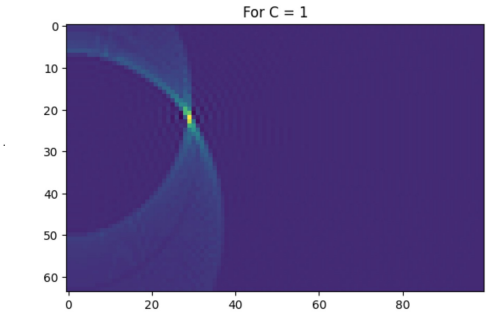
In the code given in the notebook (from plot_grid function), we can observe that the y component of the distance gets calculated from (i-Nmics//2)*pitch which when we plug in the values for i, we get the range from (-3.2, 3.1). So, in the plot, (0, 0) corresponds to (0, -3.2) in actuality and the point, (0, 64) corresponds to (0, 3.1).

By this logic, (30, 22) corresponds to (3.0, -1.0) on the actual distance plane. Therefore, (30, 22) is the correct expected location for this case.

0.2.2 Question 2

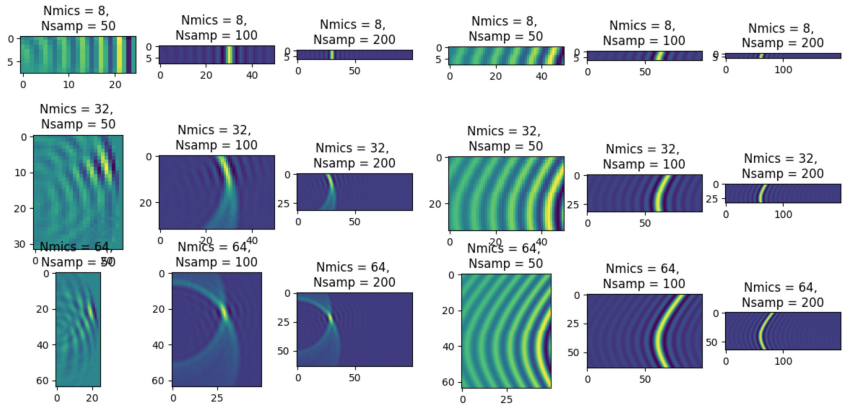
The maximum x-coordinate and y-coordinate must be upper limit of x-axis and upper limit of y-axis in distance plane which is (10, 3.2)

0.2.3 Question 3



Intuitively speaking, if C is decreased, then, your sampling_rate increases. More sampling rate would imply that more information (rather more of the signal gets captured) which therefore leads to a better quality of the image. (For C = 2, the image is given in 0.1.3 for comparison)

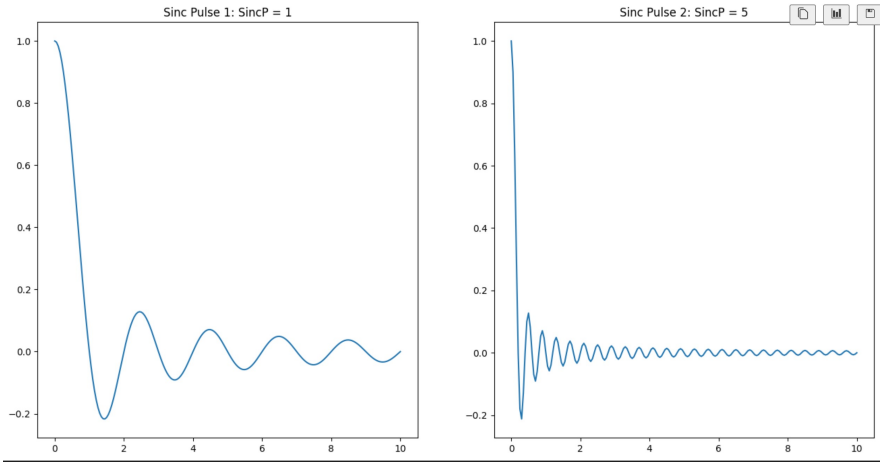
0.2.4 Question 4



(The first set of 9 plots (left) show the reconstructed image and the second set (right) shows the reflected waves). From the above plots it is evident, that more microphones (Nmics) and higher number of samples (Nsamp) results in better accuracy of the obstacle position estimate.

0.3 Answers to Questions (given inside the instructions)

0.3.1 Question 1



To generate pulses like this, we need to modify the "narrowness" of the wave. To do this, we have to change the time scaling factor, sincP. Smaller sincP will result in a more spread out wave, and larger sincP will result in a less spread out wave. (intuitively, sincP acts as frequency, more sincP, more waves in, say, 1 time unit).

0.3.2 Question 2

Since, each sound wave has to travel twice, the more reasonable upper limit for x-axis would Nsamp/2 which in this case would be 100.