Homework 5 MATLAB

Signal & System (003)

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HW5: Sampling

- In this assignment, you will implement sampling and interpolation using MATLAB, mostly in frequency domain.
- Complete ‘HW5.m’ to implement. See ‘HW5.m’ for more details.

Prob 1. Fill in the blanks to implement sampling using MATLAB, and find a solution for the aliasing that occurs [60 points]

Prob 2. Restore zero-filled signal with different interpolators and discuss the differences in the resulting sounds [40 points]

HW5: Sampling

☐ Your goal is to complete the code of **'HW5.m'** following steps below

1. (a) Determine the undersampling frequency (Fs_under)

   (b) Describe the results of undersampled sound and suggest the reason why Mr. Kim's idea failed

   (c) Suggest a way to remove the noise in the frequency domain

   (d) Complete the missing lines below and plot the resulting frequency spectrum. Then compare the music with those from part 1 and part 2 and discuss the results

2. (a) Implement zero order hold interpolator and display the frequency spectrum

   (b) Implement linear interpolator and display the frequency spectrum

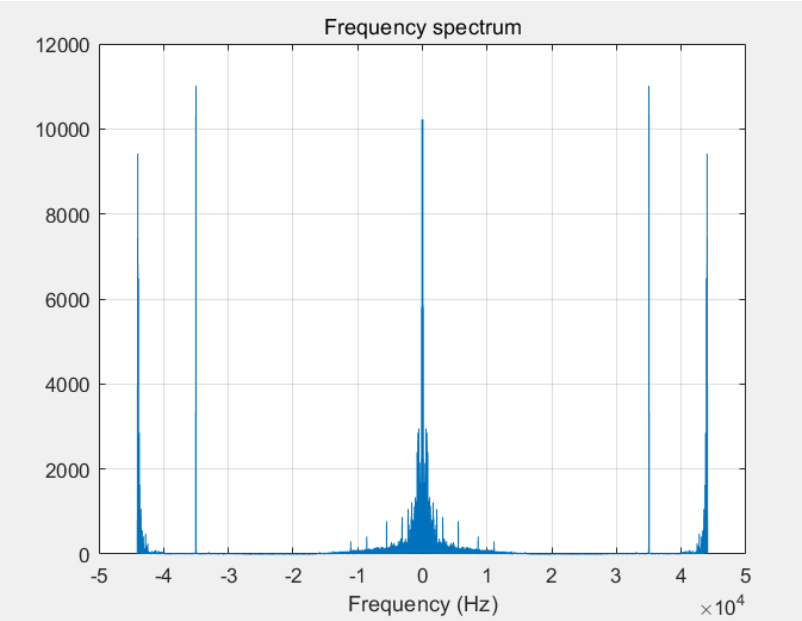
   (c) Implement the sinc interpolator with a sinc function width of seven (i.e. use only 7 non-zero points for interpolation) and display the frequency spectrum)

   (d) Discuss the difference in the resulting sounds

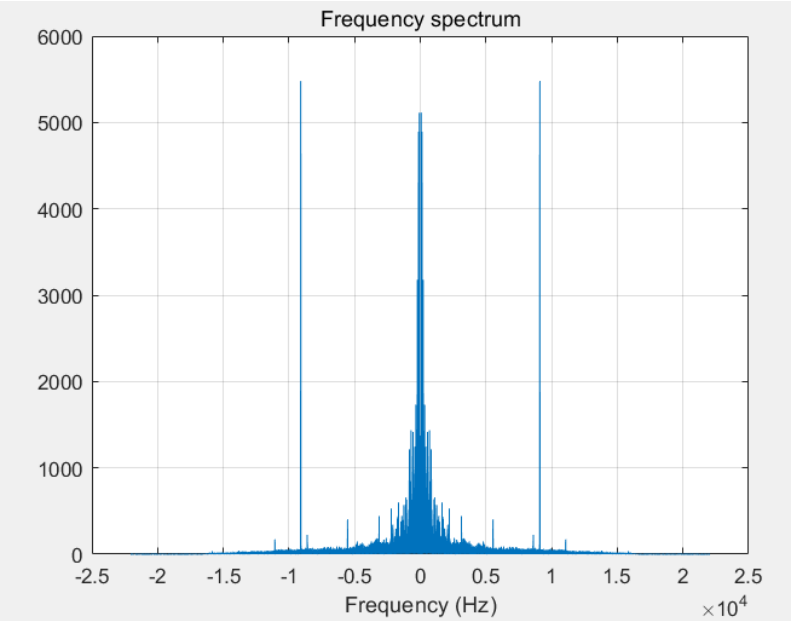
HW5: Sampling

Prob 1. (a), (b)

- Frequency spectrums should be like this images below
- You will listen to one more song in addition to the original song from the undersampled sound



Original sound

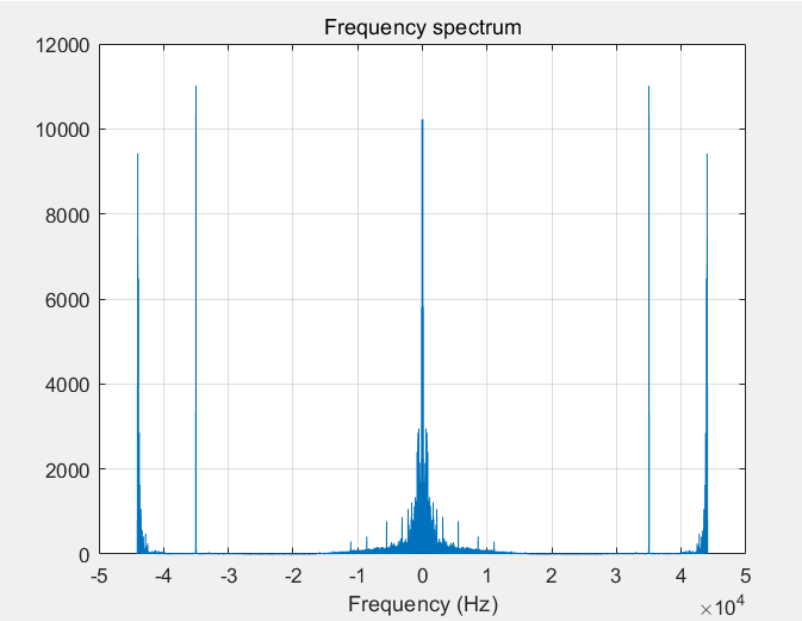


Undersampled sound

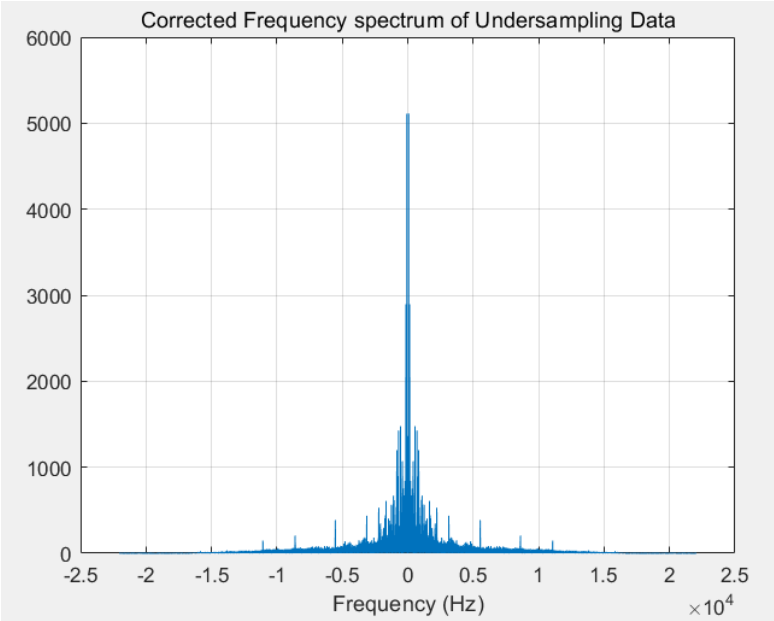
HW5: Sampling

Prob 1. (c), (d)

- Frequency spectrums should be like this images below
- You need to get rid of high frequency sound (> 22.1 kHz)



Original sound

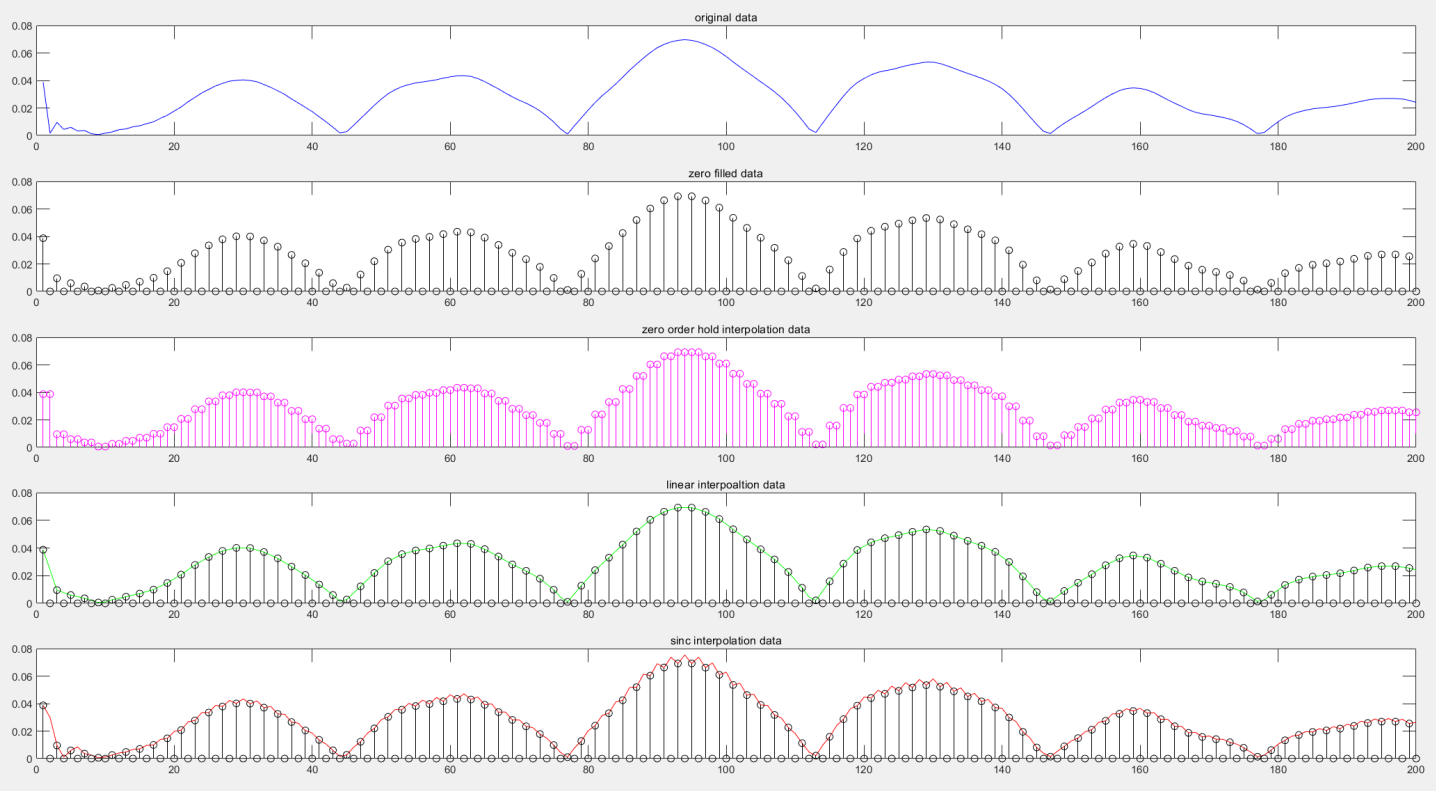


Corrected undersampled sound

HW5: Sampling

Prob 2.

- You need to restore the original sound from the distorted sound (zero filled sound).
- The results should be like this image below



HW5: Sampling

☐ Compress '**HW5.m' and your report** as zip file and upload it in eTL. → Zip file name : **Student ID_NAME_HW5 (**ex: 2023-12345_gildonghong_HW5)

☐ Additionally, Submit '**free-form Word Report pdf'** which explains about your writing Matlab codes (approximately 1~2 pages) in either Korean or English. The Report should include outcome images.

☐ Please read all comments in given m files before posting a question in eTL.

☐ Feel free to email me if you have any questions about the matlab assignment : snu.icl.ta@gmail.com (TA Wongi Jeong, 정원기 조교)