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EE497 Exp.1

Report

Task 1.a

The frequency of the signal is already 200Hz and there is no applied noise on it. Therefore, the first peak appears at the 200Hz regardless of the sampling rate. For the second peak, the sampling rate is 8k. When +-200Hz is added to this sampling point, peaks appear 7800 and 8200 Hertz. However, 8200Hertz is not in the interval therefore we observe the peak at 7800.

1.b

In this case 8k hertz is tried to be modelled with 799 elements. When the division is made to map 8k to 799 points there is a floating error occurs because of non-exact dividing. 799*200 cannot be divided to 8000. In addition, it seems unstable because 799 is not a factor of 8000 therefore there is a shift at each second. The graph is unstable.

1.c

Signal is identified more clearly in the frequency domain rather than time domain. 5 is the value where we can still identify the signal.

For the SNR calculation;

$$SNR = 10Log_{10}\frac{\sigma_x^2}{\sigma_n^2} \quad \text{(dB)}$$

where RMS of the sinusoidal with amplitude 1; $\sigma_x=1/2^{0.5}$ and $\sigma_n=5$

Therefore, SNR= -16.98 dB

As expected from a plain & non-modulated sinusoidal, it is distorted very easily with noise.

1.d

Phase plot gives the angle information of sinusoidal for each index. We have just considered magnitudes however angles are also important to manipulate signals by LTI systems. Phase information gives the ratio between the real and the imaginary part of that particular frequency index.

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Task 2

Repeat

In the chirp case there is a flat part because of generated signals that consist several frequencies. In others words, the signal has several frequencies which results a flat part in frequency domain. For the part where magnitude decreases in a parabolic shape, it occurs this way because the harmonics occurs several times for each frequency. The error due to digitalizing stack for each harmonic. Therefore, a parabolic shape appears.

2.a

It can be observed until the sampling frequency is two times of f2 value because f2 determines the upper frequency component of the signal. For instance for f1=0,f2=500 sampling freq. can be decrease up to 1000. Below this rate the flat parts overlap and distortion occurs.

2.b

Because the chirp signals are like Frequecny Modulated signals(FM) and FM signals have sufficient SNR values. In real life, modulated signals get distorted a lot due to objects in the transmission environment. Therefore, FM signals are preferred in radar systems rather than basic sinusoidal which corrupts easily. As we have also observed in the experiment. Sinusoidal SNR is low and showed worse performance.