**Department of Computer Science and Engineering**

**Course# CSE 426 (Digital Signal Processing Lab)**

**Lab 1: Effects of Sampling in Discrete Time Signals**

**Date: February 12, 2017**

**Objectives:**

1. Simulate and plot two CT signals of 10 Hz and 110 Hz for 0<t<0.2 secs.
2. Sample at Fs= 100 Hz and plot them in discrete form.
3. Observe and note the aliasing effects.
4. Explore and learn.

**Pre- Lab**

Self Study: Signal, CT signals, DT signals, sampling of analog signals, sampling theorem, Nyquist rate

**In Lab Tasks:**

**Task 1: Sampling and aliasing in Sinusoids**

1. Simulate and plot two CT signals of 10 Hz and 110 Hz for 0<t<0.2 secs.
   1. Check for the correctness of the time periods of both sinusoids
2. Sample both sinusoids at Fs= 100 samples/sec and plot them in discrete form.
   1. Observe the plots and explain (write) in your own words the cause and effects of what you just saw

**Task 2: Sampling and aliasing in Audio Signals**

You have to generate a tone in MATLAB and listen to it with ***sound*** command. The frequency of the tone should be 1 kHz at a sampling rate of 8 kHz and the duration should be 3 sec.

**Post Lab Tasks:**

**Task 1:**

Change the value of F which is 1 kHz initially, listen to the tones (make sure your headphones or speakers are on). You can also change the Fs to observe the effects.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl.** | **F (kHz)** | **Fs (kHz)** | **Sounds like what frequency?** | **Reason. Specify whether aliasing is happening or not.** |
| 1 | 1 | 8 |  |  |
| 2 | 2 | 8 |  |  |
| 3 | 3 | 8 |  |  |
| 4 | 4 | 8 |  |  |
| 5 | 5 | 8 |  |  |
| 6 | 6 | 8 |  |  |
| 7 | 7 | 8 |  |  |
| 8 | 8 | 8 |  |  |
| 9 | 9 | 8 |  |  |
| 10 | -1 | 8 |  |  |
| 11 | -2 | 8 |  |  |
| 12 | -3 | 8 |  |  |
| 13 | -4 | 8 |  |  |
| 14 | 9 | 8 |  |  |
| 15 | 25 | 8 |  |  |

**Task 2:**

Consider the continuous time sinusoidal signal: x(t)=sin(2πF0t). The sampled version will be x(n)=sin(2π(F0/Fs)n), where n is a set of integers and Ts is the sampling interval (Ts=1/Fs).

Plot the signal x(n) for Fs= 5 kHz and take i) F0= 0.5 kHz ii) F0= 2 kHz iii) F0= 3 kHz and iv) F0= 4.5 kHz.

Explain the similarities and differences among various plots. Also mention whether aliasing occurs or not.

**Task 3:**

1. Generate an analog signal of F=5 Hz. Plot ot for t= 1 sec. Take Fs= 10 Hz. Count no. of samples using MATLAB and print it.
2. Repeat above exercise for t= 2 sec.
3. Repeat above exercise for Fs= 20 Hz.
4. Repeat above exercise for F= 10 Hz.
5. Repeat above exercise for Fs= 40 Hz.

Observe the differences in above and explain.

**Task 4:**

A cosine signal of 40 Hz is sampled at 30 samples per second. What will be the fd of the corresponding discrete signal?

**Deliverables:**

1. Printed Report addressing the **in lab tasks and post lab tasks**
2. MATLAB code for each task.

**Deadline: February 19, 2017**