American International University- Bangladesh

Course Name: Communication Laboratory

Experiment No: 02

Experiment title: Study of signal frequency, spectrum, bandwidth, bit rate, quantization using MATLAB

Course instructor: SADMAN SHAHRIAR ALAM

Section: D

Semester: Summer 23-24

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ID:23-51364-1

Title: Study of signal frequency, spectrum, bandwidth, bit rate, quantization using MATLAB

Abstract:

This experiment is designed to-

1.To understand the use of MATLAB for solving communication engineering problems.
2.To develop understanding of MATLAB environment, commands and syntax.

Introduction:

Understanding signal qualities such as frequency, spectrum, bandwidth, bit rate is critical in the design and analysis of data transmission systems. This experiment explores these principles using MATLAB, a powerful computational tool frequently used in engineering. Students may display and analyze signals in both time and frequency domains using MATLAB's powerful set of functions and user-friendly environment, allowing them to get a better understanding of theoretical ideas through actual application.

Performance Task for Lab Report: (my ID = 23-51364-1)

**Generate a composite signal using two simple signals as,

$x1(t) = A1 \cos(2\pi(C*100)\, t)$ $x2(t) = A2 \cos(2\pi(F*100)t)$

$x3(t) = x1(t) + x2(t)$

(a) Select the value of the amplitudes as follows: let $A1$ = G+D and $A2$ = A+F.

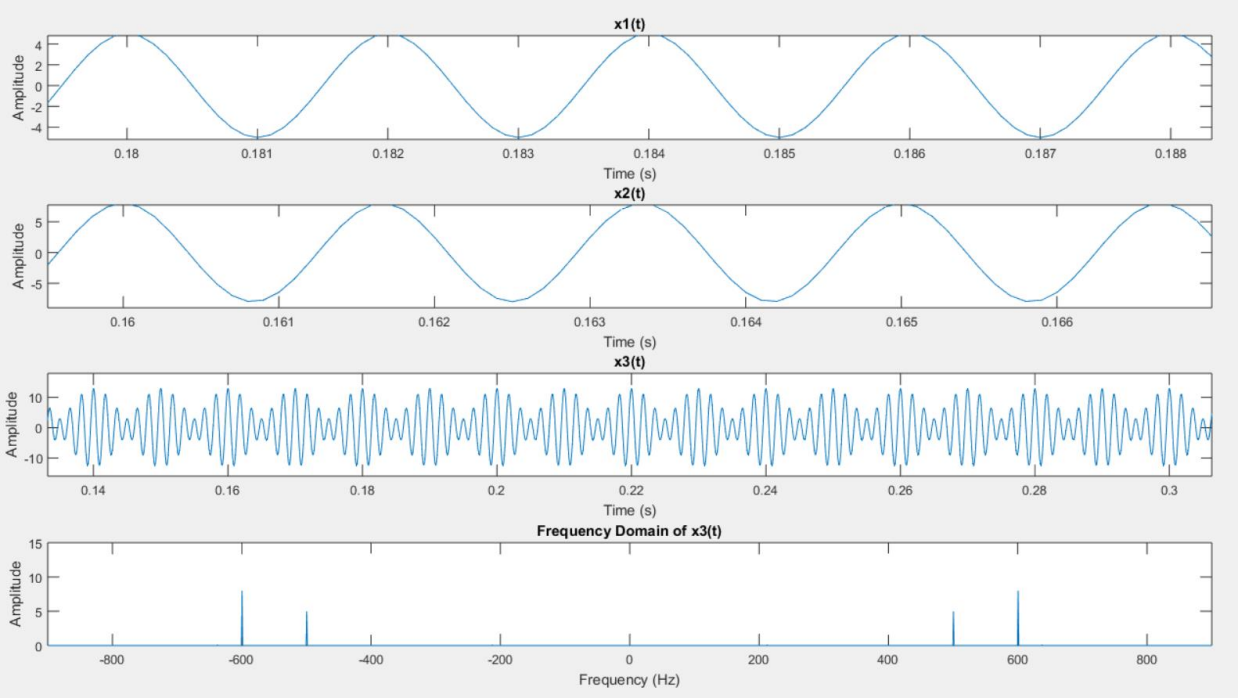
(b) Make a plot of x3 over a range of t that will exhibit approximately 2 cycles. Make sure the plot starts at a negative time so that it will include t = 0, and make sure that you have at least 20 samples per period of the wave.

(c) Plot x3 in frequency domain and calculate its bandwidth.

Code:

```
A = 2;
B = 3;
C = 5;
D = 1;
E = 3;
F = 6;
G = 4;
H = 1;

A1 = G + D;
A2 = A + F;

fs = 10000;
t = 0:1/fs:1-1/fs;

x1 = A1 * cos(2*pi*C*100*t);
x2 = A2 * cos(2*pi*F*100*t);
x3 = x1 + x2;

subplot(4,1,1);
plot(t, x1);
xlabel('Time (s)');
ylabel('Amplitude');
title('x1(t)');

subplot(4,1,2);
plot(t, x2);
xlabel('Time (s)');
ylabel('Amplitude');
title('x2(t)');

subplot(4,1,3);
plot(t, x3);
xlabel('Time (s)');
ylabel('Amplitude');
title('x3(t)');

fx1 = fft(x3);
fx1 = fftshift(fx1)/(fs/2);
f = fs/2*linspace(-1,1,fs);
subplot(4,1,4);
plot(f, abs(fx1));
axis([-900 900 0 15])
xlabel('Frequency (Hz)');
ylabel('Amplitude');
title('Frequency Domain of x3(t)');

fs = 10000;
t = 0:1/fs:1-1/fs;
bandwidth = obw(x3,fs)
```

Output:




```
>> task

bandwidth =

   100.9752
```

References:

1. MATLAB user guide.
2. Prof. Dr.-Ing. Andreas Czylwik, “MATLAB for Communications”