Engin 103 April 21, 2011 back to e-syllabus	Topics: CW11 (Cont.) CW12 Project 3 Topic Assignment Logbook questions

Section 1

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Section 2

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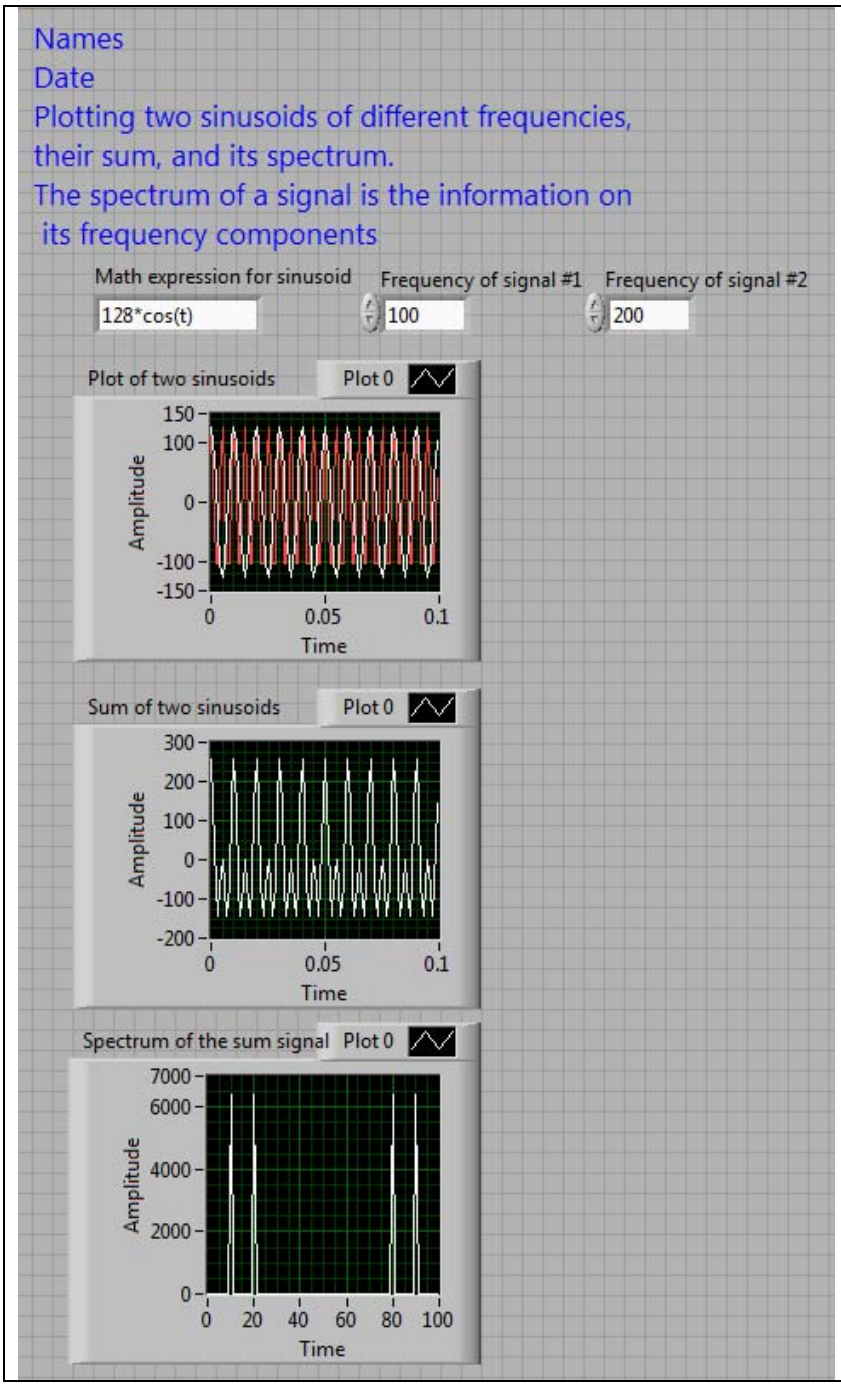
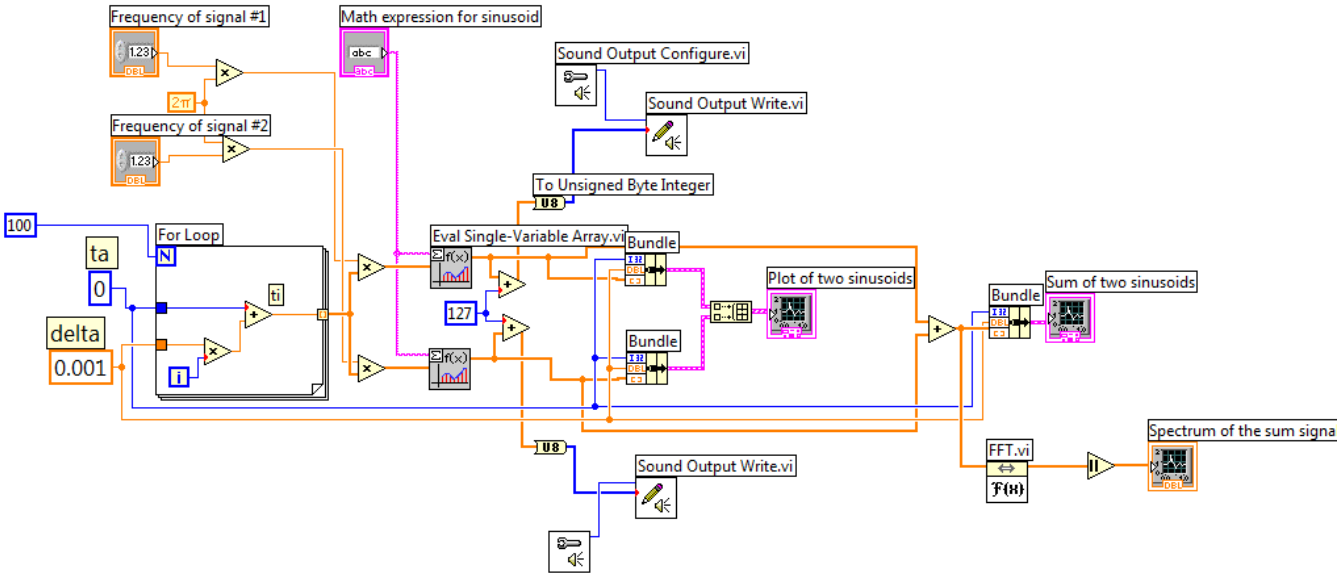
CW 11 (Cont.)


Names
Date
Plotting two sinusoids of different frequencies,
their sum, and its spectrum.
The spectrum of a signal is the information on
its frequency components
Math expression for sinusoid
128*cos(t)
Frequency of signal #1
100
Frequency of signal #2
200
Plot of two sinusoids
Plot 0
150
100
0
-100
-150
Amplitude
0
0.05
0.1
Time
Sum of two sinusoids
Plot 0
300
200
100
0
-100
-200
Amplitude
0
0.05
0.1
Time
Spectrum of the sum signal
Plot 0
7000
6000
4000
2000
0
Amplitude
0
20
40
60
80
100
Time



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Engineering 103 –UMass Boston

CW 12

(In-Class-Work 12)

Digital and Analog representations and conversions

Find in Chapter 4 of DCE (Horenstein) the answers to the following questions (15 min max.)

1.- State the relation between Assembly Code; Programming Language; and Compiler

2.- What is a digital signal? Do an A/D conversion for 2009 with the minimum number of bits, and a D/A conversion for 0101 1010 1101 0010

3.- Do a A/D conversion for 0.5 with 8 bits of information, being 1 the highest number, using no "binary dot" in the binary representation of eight bits; and a second version using a 'binary dot' between two groups of four bits, with the second groups using **negative** decreasing powers of 2 from left two right.

By alphabetical order of the last names, the first two students in each team will submit Word file cw12_XX_a.doc, the next two students will submit Word file cw12_XX_b.doc, to the *files* folder in the server. These files need to be uploaded to the server today to receive credit.

What is a digital signal? Computers work with digital signals; the electronics does 5V (on) and 0V (off). A digital signal is composed of 0's and 1's, like binary numbers.

Analog	Digital
0	0000

1	0001
2	0010
3	0011
8	1000
15	1111
16	0001 0000
255	1111 1111

Analog to Digital conversion (A/D):

We want to write 2003 (an analog number) in digital (or binary) format:

$127 = 1*10^2 + 2*10^1 + 7*10^0$ (using powers of 10; since we use decimal system)

127= 2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0
In binary system, numbers are just 0 or 1, starting from the left, let's insert either 1 or 0 in front of the powers of 2:

$127 = 0*2^7 + 1*2^6 + 1*2^5 + 1*2^4 + 1*2^3 + 1*2^2 + 1*2^1 + 1*2^0$
127 -> 0111 1111

Now convert 2009 into digital format:

Digital to Analog conversion (D/A):

$1001 = 1*2^3 + 0*2^2 + 0*2^1 + 1*2^0 = 9$
1001 -> 9

Now convert 0101 1010 1101 0010 into analog format:

More on CW11:

2)
A/D conversion:

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

What is the highest binary number using 8 bits of information? Answer: 255

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

D/A conversion: 0101 1010 1101 0010 -> ?

3) Represent 0.5 in binary/digital:
a) First alternative:

Decimal system	Binary or Digital system
1	1111 1111 (255)
0.5	1000 0000 (128)

b) Second alternative: using a "binary dot"

$2.5 = 2 * 10^{0} + 5 * 10^{-1}$ (to the right of the dot: negative powers of 10)
We can use this in binary or digital format as well: to the right of the "binary dot" use negative powers of 2:

				2	.	5			
Decimal	$0*10^{3}$	$0*10^{2}$	$0*10^{1}$	$2*10^{0}$	.	$5*10^{-1}$	$0*10^{-2}$	$0*10^{-3}$	$0*10^{-4}$
Binary	$0*2^{3}$	$0*2^{2}$	$1*2^{1}$	$0*2^{0}$	.	$1*2^{-1}$	$0*2^{-2}$	$0*2^{-3}$	$0*2^{-4}$

2.5 -> 0010.1000

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LOGBOOK: example of a logbook page

-Use a quadrille notebook; number all pages; date all entries
-Write your notes for all activities, thoughts, problems and solutions, and learning conclusions related to Engin 103. You should write down progress, outcomes, and conclusions on projects and teamwork; conclusions from class work (including LabVIEW) and homework.
-In addition you should answer in the logbook all questions listed in these notes in blue, as shown below:

45) How many peaks do you see in the spectrum (as produced by the FFT.vi and Abs) for a signal that is composed of two sinusoids of different frequencies? What happens to the spectrum if you leave the frequency of sinusoid #1 fixed while increasing the frequency of sinusoid #2. What would you see in the spectrum of a signal that is composed of 5 sinusoids of different frequencies?

46) In our LabVIEW exercise we used a sinusoid of amplitude 128; then we added 127 to the Y series before converting it to a digital signal using U8 (To Unsigned Byte Integer). Is there any connection between 128; 127; and the 8 in "U8"? Explain. Fill out the table below

# binary digits	Largest decimal number
4	15
8	

12	
16	
32	
64	

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