###### University of Dhaka

#### Department of Electrical and Electronic Engineering

EEE-3102: Numerical Technique Laboratory

Section: A

Class Roll: JN-19; SH-11

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Lab-2: Data writing to and reading from excel sheet and adding noise to signal and measurement of signal-to-noise ratio (SNR).

### Purpose

The experiment covers the basic MATLAB commands for Numerical Methods Laboratory. The objective of this laboratory is to add noise in a signal with a given signal-to-noise ratio (SNR). The purpose of adding noise with a clean signal is to analyze the effect of signal in many applications such as, in communication. In this experiment, we also measure the SNR of a noisy signal. The techniques of adding noise and measuring SNR will also be helpful for the next experiments.

**Preparation**

Before writing your report you will need to learn something about SNR and AWGN which you have to include in your report.

**Writing data to excel file**

Sometimes we need to write (store) data in excel file. For this we can use**‘**xlswrite’matlab command.

**Example-1:** Write the following code in a script file

clc; close all; clear all;

x=-2\*pi:pi/32:2\*pi;

y=sin(x);

x\_y=[x;y];

figure;

plot(x,y)

xlabel('value of x')

ylabel('value of sinx')

grid on

xlswrite('x\_vs\_sinx\_row.xls',x\_y)

Questions: What do you obtain after running the above code? Comments on the graph and the written excel file named x\_vs\_sinx\_row

**Example-2**: Now edit the above command as follows:

clc; close all;clear all;

x=-2\*pi:pi/32:2\*pi;

y=sin(x);

x\_y=[x;y];

figure;

plot(x,y)

xlabel('value of x')

ylabel('value of sinx')

grid on

xlswrite('x\_vs\_sinx\_column.xls',x\_y')

Questions: What is the difference between the excel files obtained from Example-1 and that from Example-2.

**Reading data from excel file**

We can also read data from an excel file. For this we can use**‘**xlsread’matlab command.

**Example-3**: Try the following matlab code:

clc;close all;clear all;

x\_y=xlsread('x\_vs\_sinx\_row.xls');

x=x\_y(1,:);

y=x\_y(2,:);

figure;

plot(x,y)

xlabel('value of x')

ylabel('value of y')

grid on

**Questions:**

1. From where the values of ‘x’ are obtained?
2. From where the values of ‘y’ are obtained?
3. Is the plot same to that obtained from example-1?

**Example-4**: Again try the following matlab code:

clc;close all;clear all;

x\_y=xlsread('x\_vs\_sinx\_column.xls');

x=x\_y(:,1);

y=x\_y(:,2);

figure;

plot(x,y)

xlabel('value of x')

ylabel('value of y')

grid on

**Questions**: How the results differ from that obtained from Example-3?

**Adding noise to signal**

We can add additive white Gaussian noise to any signal using matlab function awgn

**Example-4:** Try the following code and observe the plot:

clc;close all;clear all;

x=-2\*pi:pi/32:2\*pi;

y=sin(x);

db=20;

y1=awgn(y,db,'measured');

n=y1-y;

figure;

plot(x,y,'r',x,y1,'-bo',x,n,'-ks')

xlabel('value of x')

ylabel('value of y')

legend('clean sinx','noisy sinx','noise')

grid on

**Questions:** What is the plot obtained after running the code?

**Measurement of added AWGN**

To measure the noise, we can use snr matlab function

**Example-5:** Try the following code

clc;close all;clear all;

x=-2\*pi:pi/32:2\*pi;

y=sin(x);

db=20;

y1=awgn(y,db,'measured');

n=y1-y;

figure;

plot(x,y,'r',x,y1,'-bo',x,n,'-ks')

xlabel('value of x')

ylabel('value of y')

legend('clean sinx','noisy sinx','noise')

grid on

SNR = (snr(y,n))

**Questions:**

1. What is the results obtained after running the code? 21.0949
2. Is it exactly equal to 20? If not, why?
3. Run the above code for different value of db =10, 15, 20, 25, 30.

**Exercise-1:** Let x= [-3pi: pi/20:3pi] and y=sin(x)+sin(2x) +sin(3x) +sin(4x).

1. write the x and y values in an excel file.
2. Add 15 dB noise to y to obtain y1. Store y1 in an excel file.
3. Read excels files for y and y1 and determine noise, n.
4. Plot x versus y, y1 and n in the same graph and use legend command to show them separately.
5. Find the measured SNR added to y by using the excels files for y and y1