Alexandria University

Faculty of Engineering

Electrical Engineering Department

Signals Report

MATLAB Code Analysis

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Submitted to

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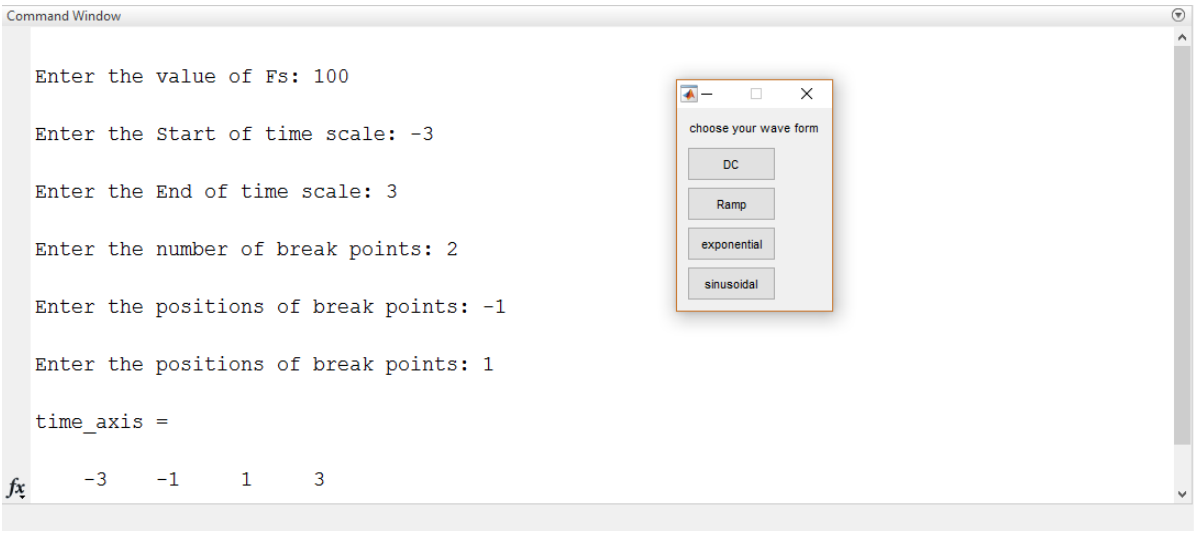
MATLAB code:

Experiment 1 General signal generator results:

1- After running the code, the user input the following parameters:
   - Sampling frequency of signal
   - Start time
   - End time
   - Number of break points
   - Position of break points
2- Then "menu" appeared and the user choose the signal he wants as shown.



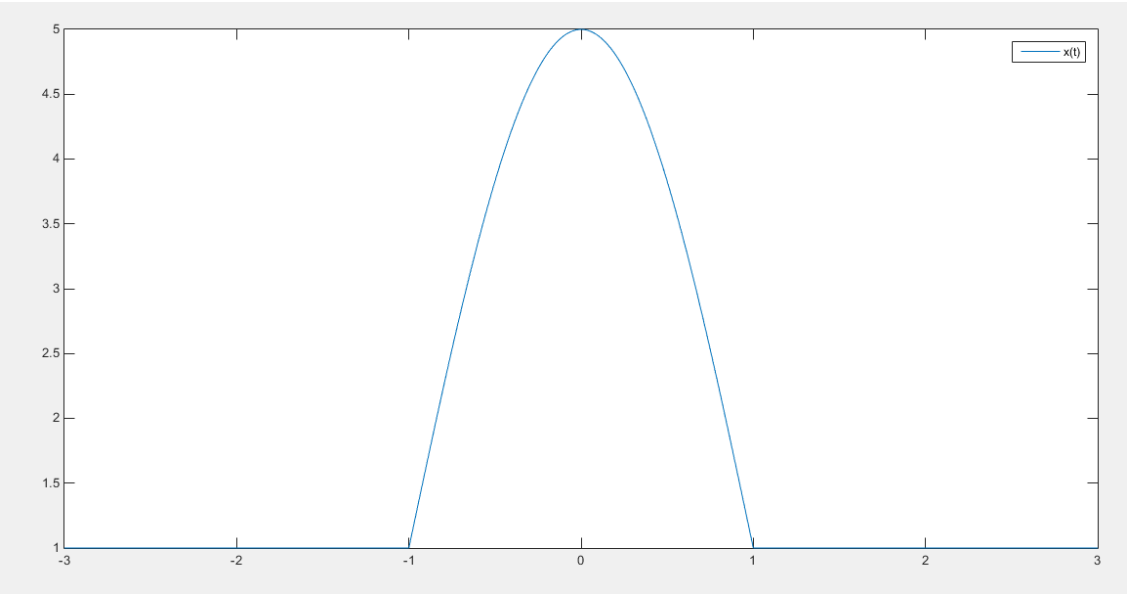
3- To test the code we generate the signal shown in the "PDF"

4- Choose DC signal with amplitude 1 (before the first breakpoint).

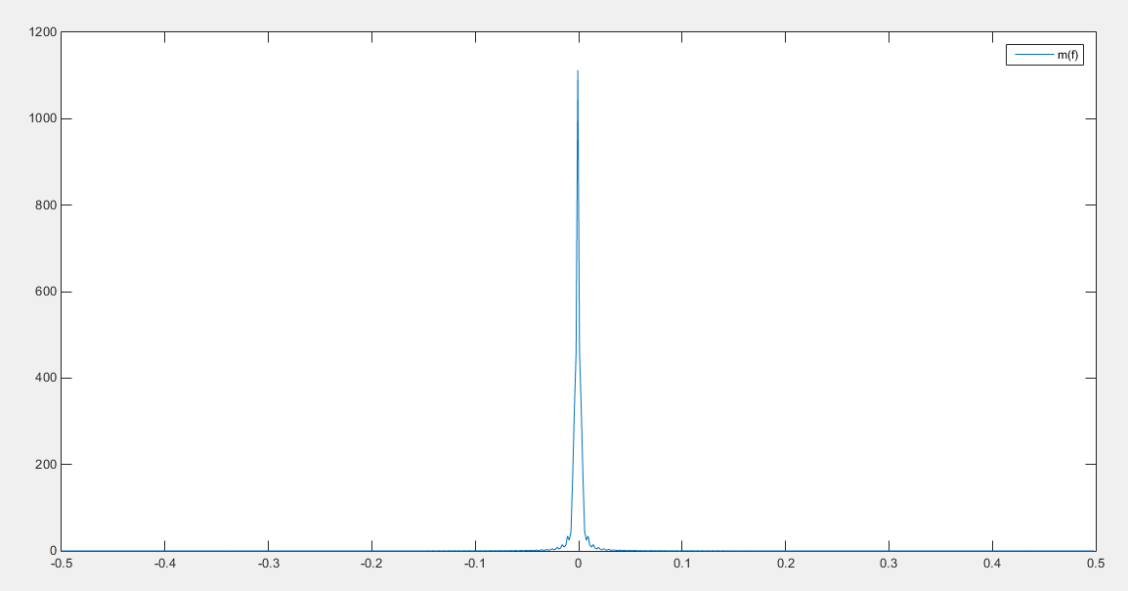
5- Choose sinusoidal signal with amplitude = 4, frequency = 0.25, phase = 90 shift = 1 (before the second breakpoint).

6- Choose DC signal with amplitude 1 (after the second break point till the end).

Output in Time Domain:



In frequency domain:

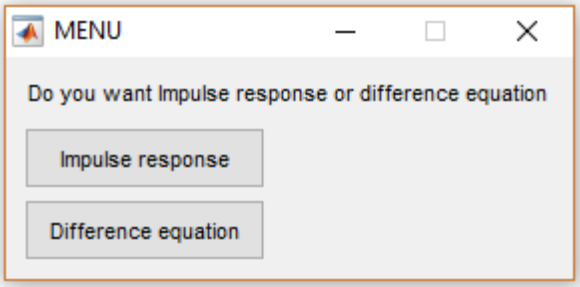


Experiment 2 LTI channel "impulse response" results:

1- For the previous generated signal convolute it with the impulse response.
(The user will choose "impulse response" or "difference equation" from a "menu"… here we choose impulse response for the second experiment)

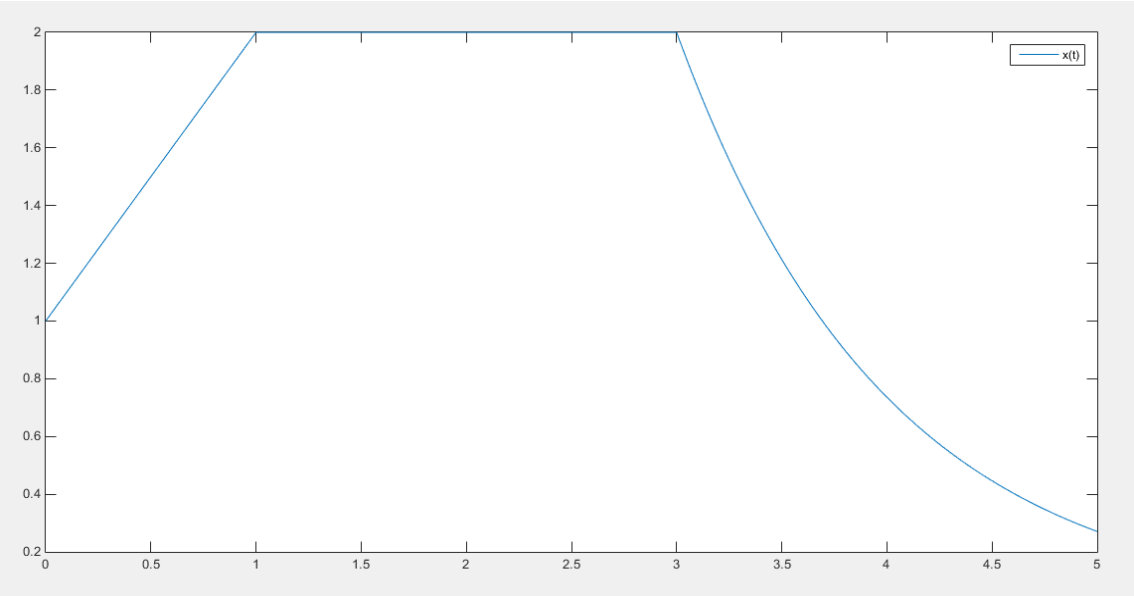
2- The user will enter “the impulse response”
The impulse response in the PDF is:

This impulse is the result of the following inputs:

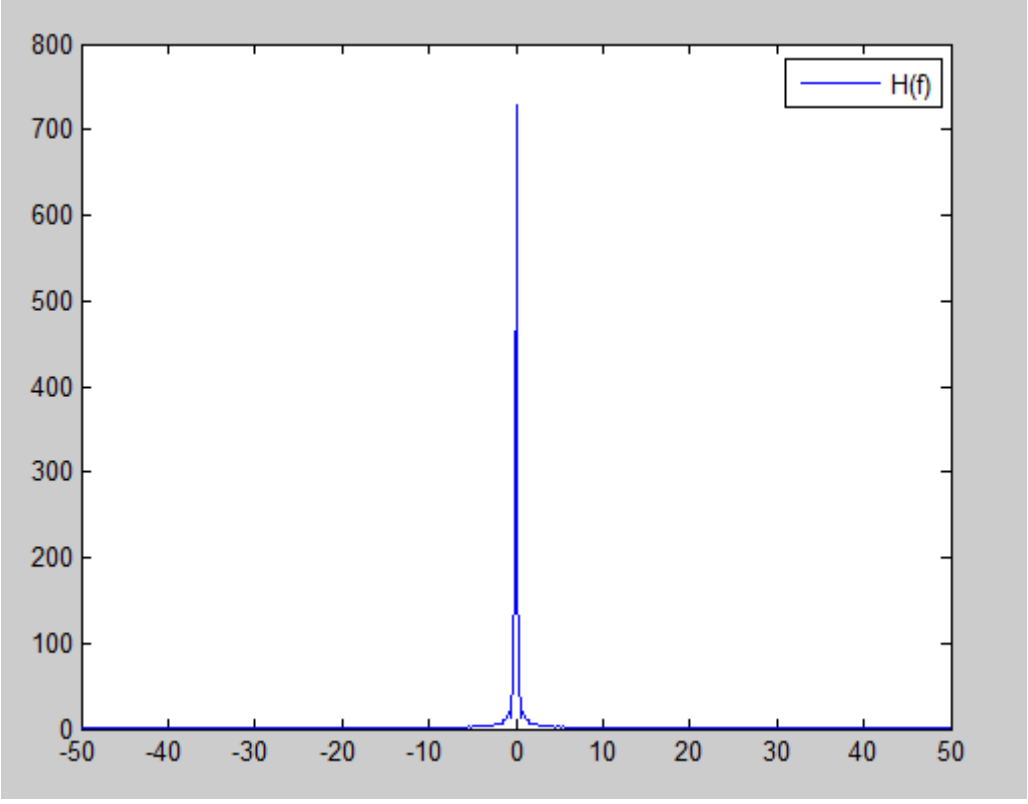



```
Enter the value of Fs: 100

Enter the Start of time scale: 0

Enter the End of time scale: 5

Enter the number of break points: 2

Enter the positions of break points (row vector): 1

Enter the positions of break points (row vector): 3

time_axis =

     0     1     3     5


slope =  1
intercept =  1

amplitude =  2

amplitude =  2*exp(3)
exponent =  -1
Fs=100
>>
```

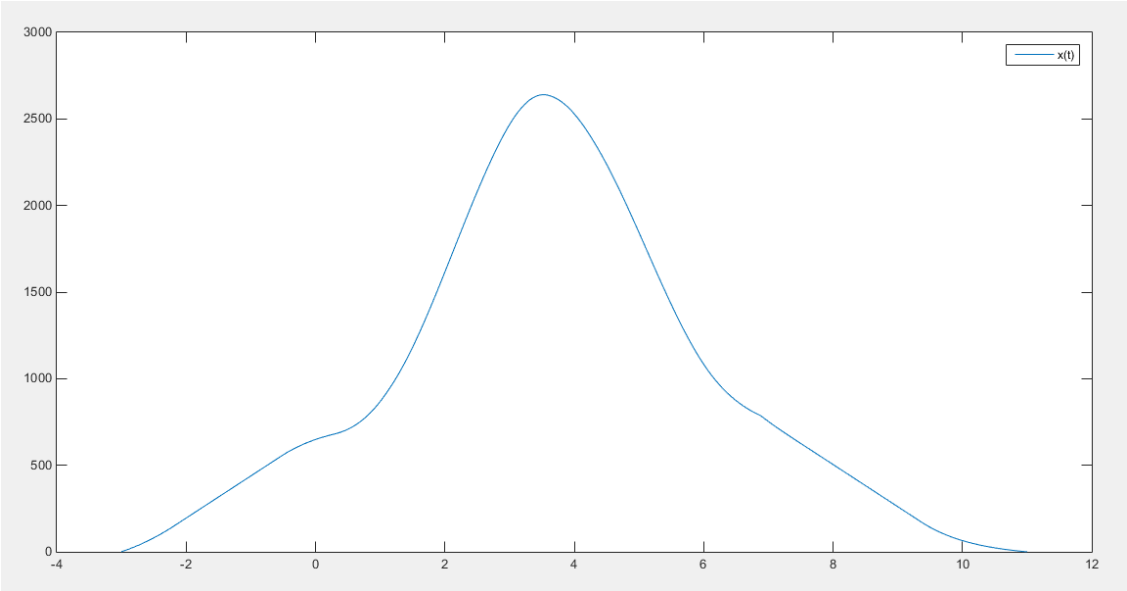
h(t) will be:



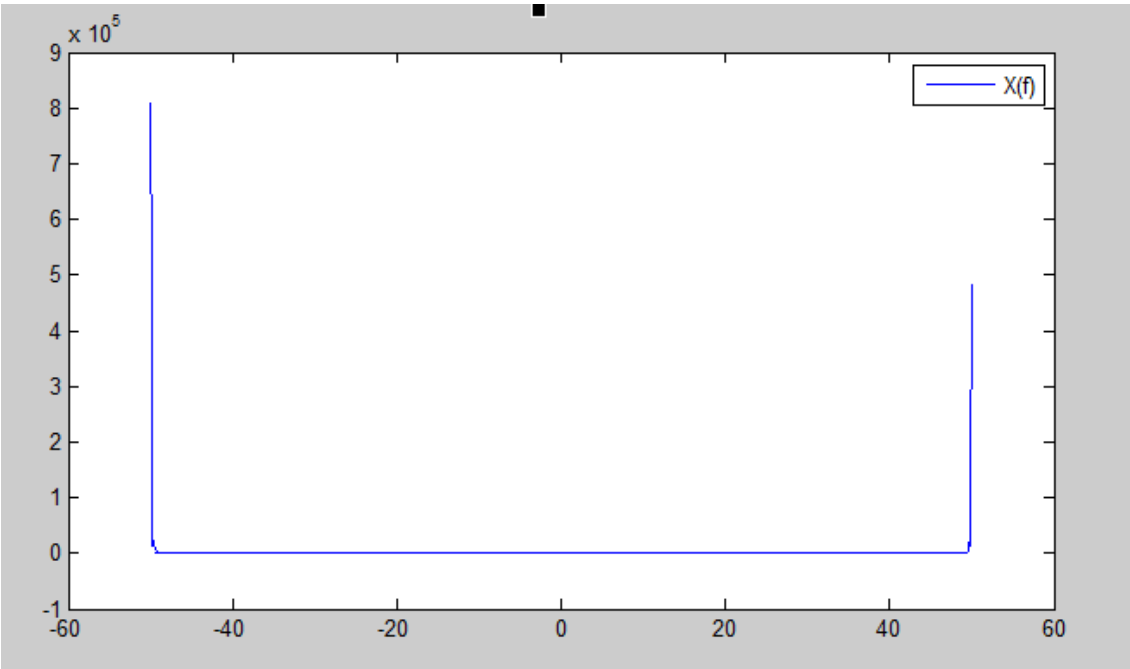
h(f) will be:



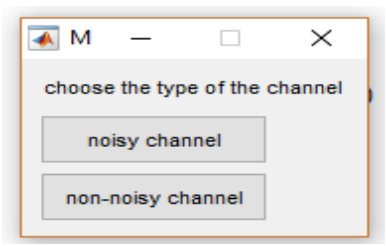
The output in time domain will be:



The output in frequency domain will be:

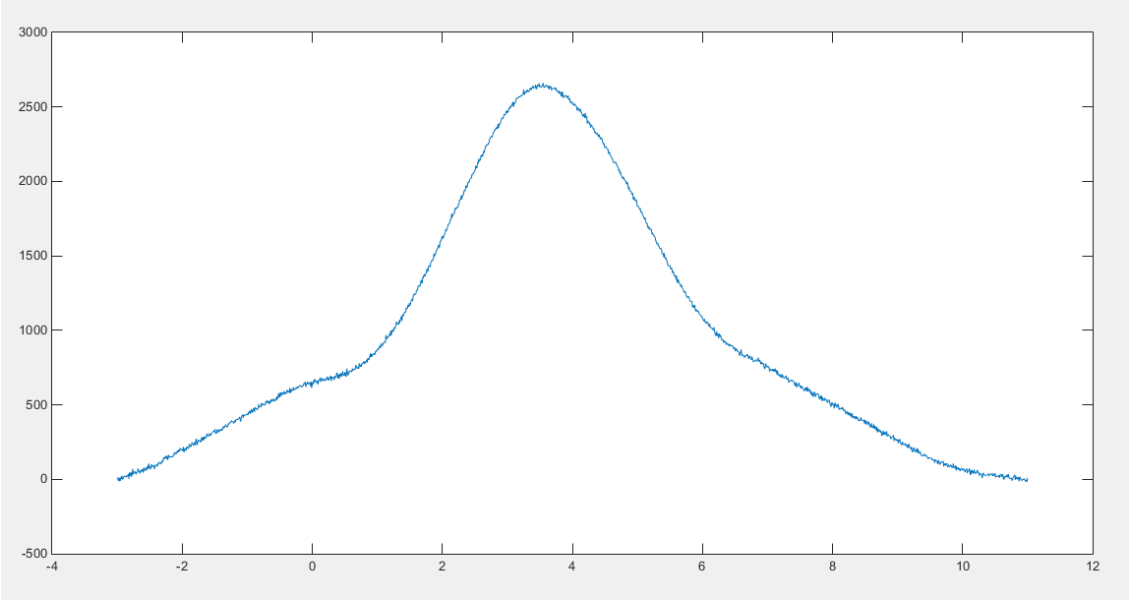


3- The user chooses if he wants to add noise or not from this "menu":

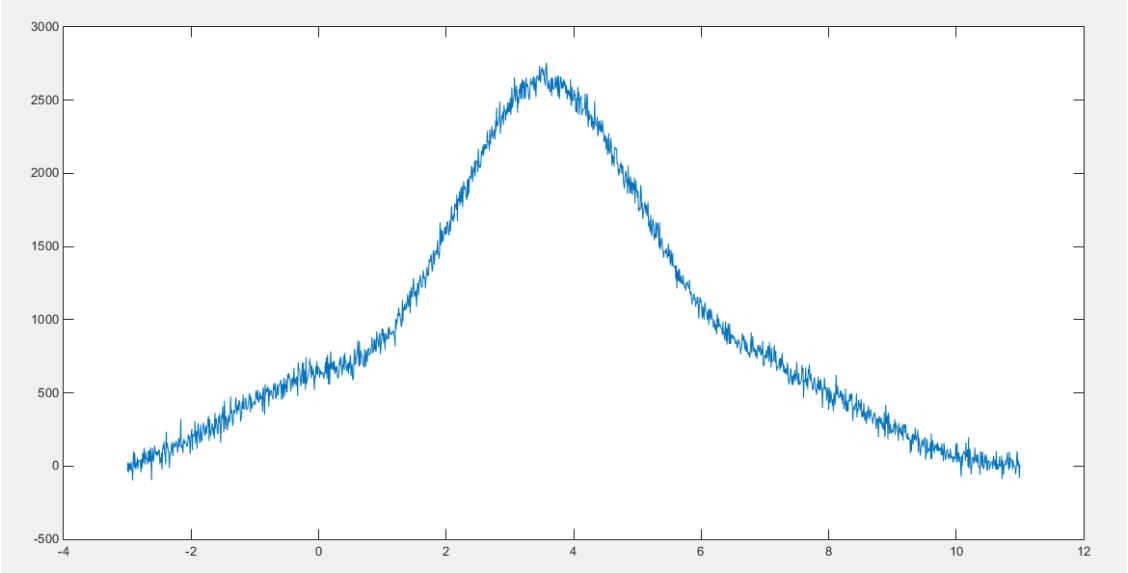


4- For example, we choose “noisy channel” , the user will enter the standard deviation, for example:
Let standard deviation = 10

The output will be as shown:

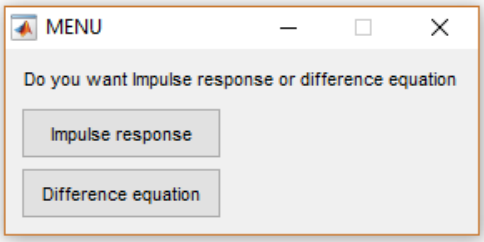


Another value, let the standard deviation = 50, the output will be:



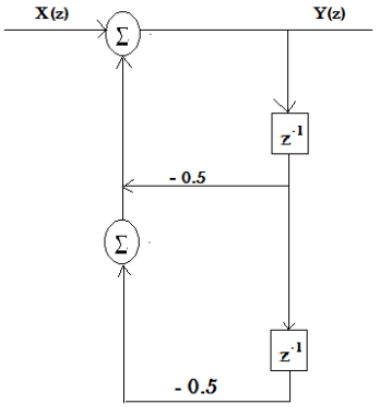
Experiment 3 LTI channel "Difference Equations" results:

1- For the previous generated signal
(The user will choose "impulse response" or "difference equation" from a "menu"… here we choose Difference Equations for the third experiment)



2- To generate the difference equation:

- The user should enter the numerator and denominator of the transfer function of the system in this figure

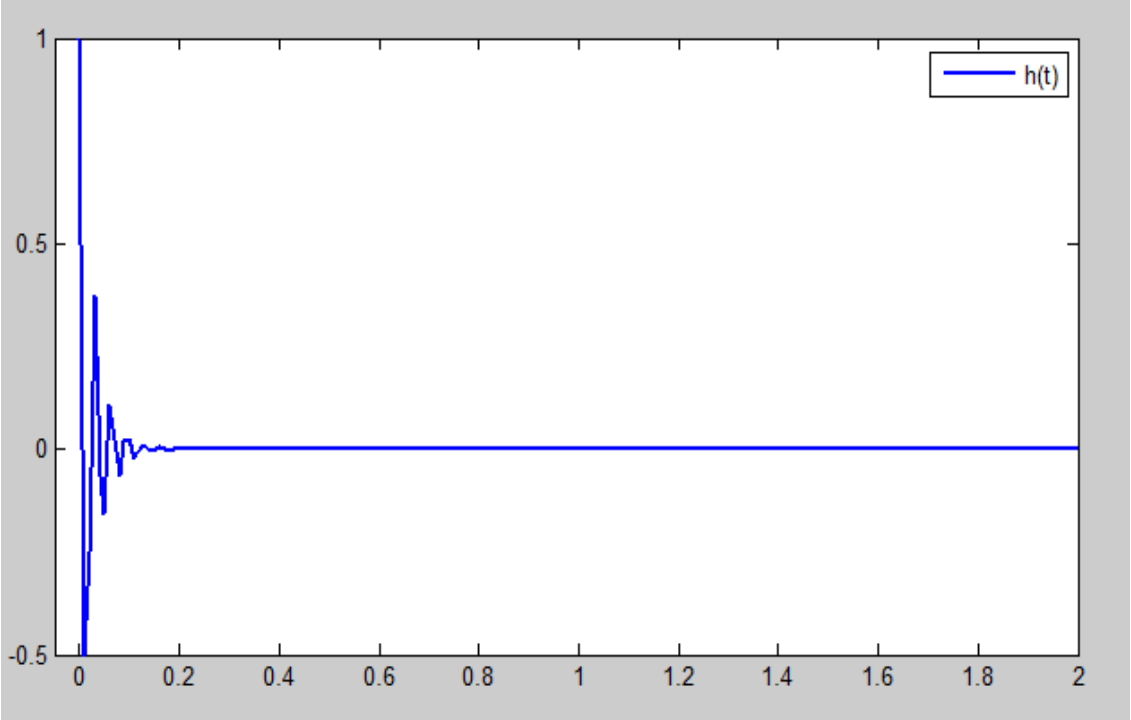


$$H(Z) = \frac{1}{1 + 0.5\,z^{-1} + 0.5\,z^{-2}}$$

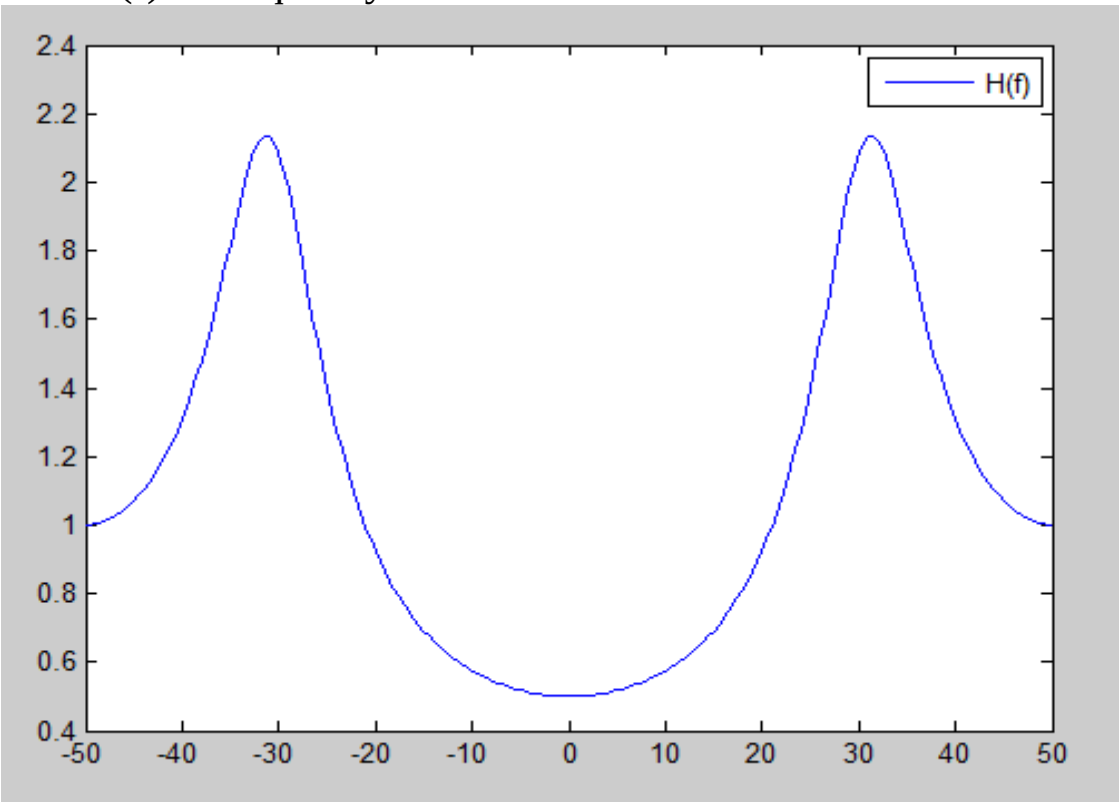
- The user will enter the numerator of the transfer function as a row coefficient vector.
Which is equal to 1 in our example.

- The user will enter the denomenator of the transfer function as a row coefficient vector.
Which is [1 0.5 0.5] in our example.

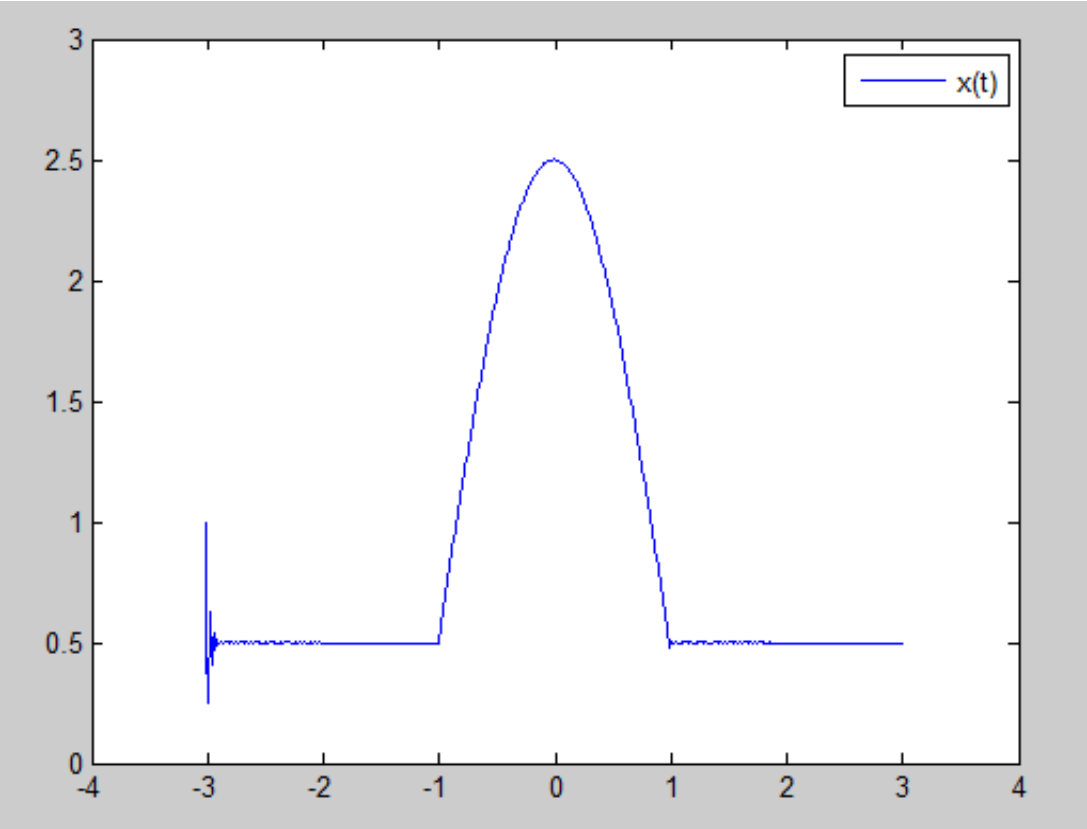
3- h(t) in time domain will be:



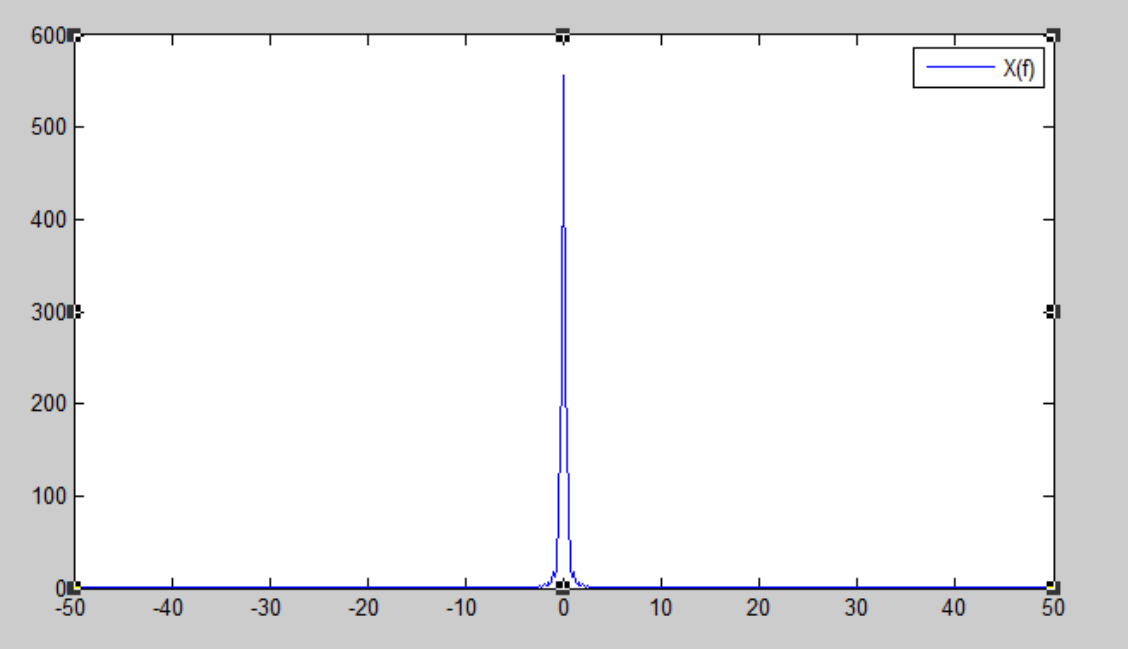
h(f) in frequency domain will be:



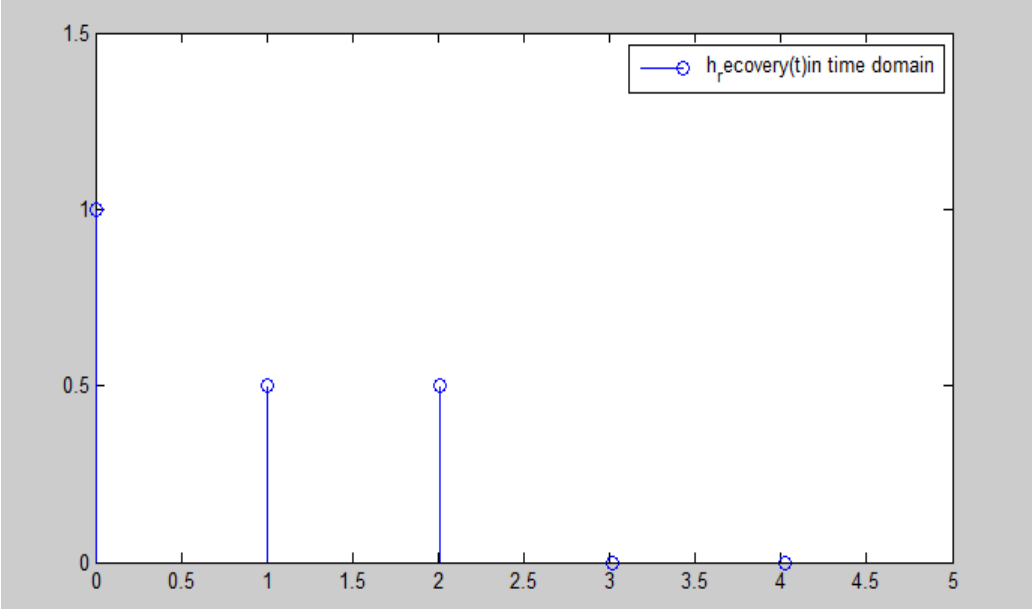
4- the signal output in time domain :



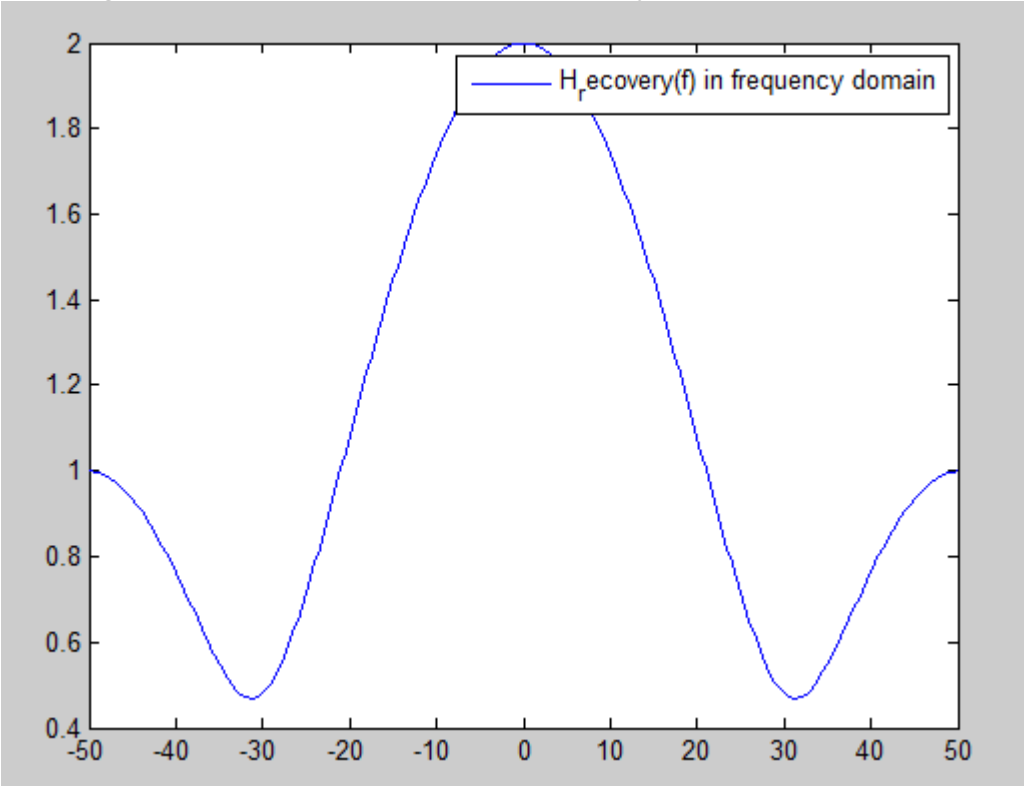
The output signal in frequency domain:



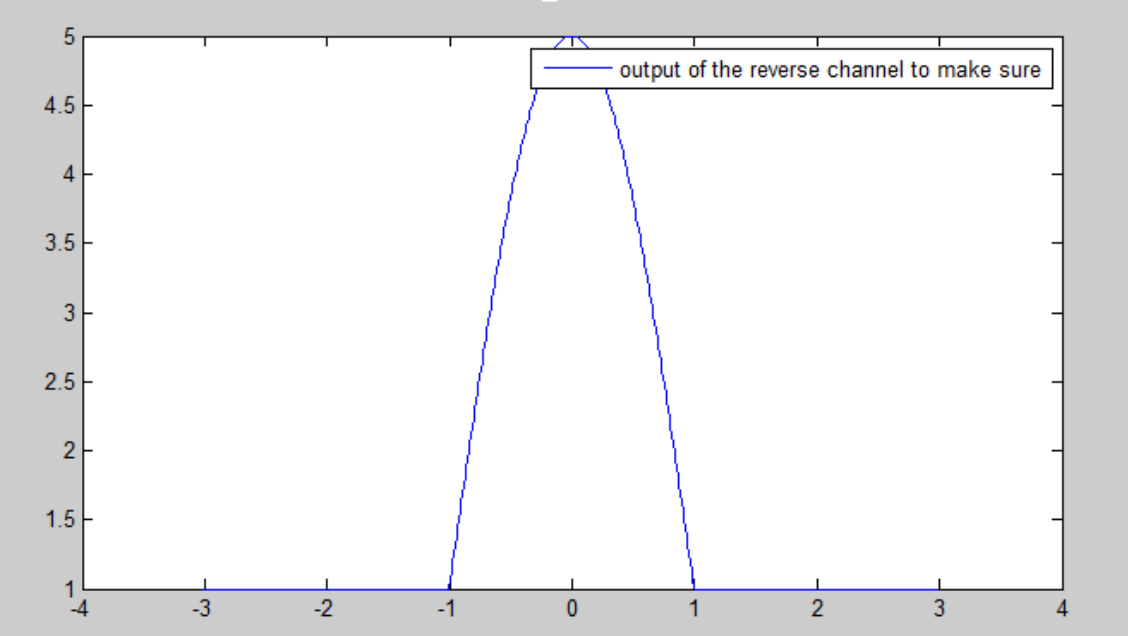
5- the reverse channel :



This figure will be obtained if calculated by hand

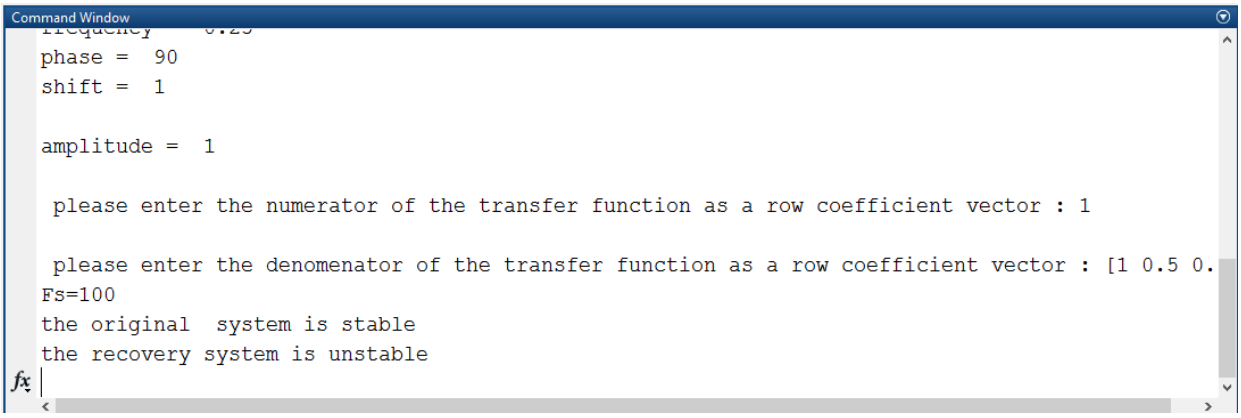


- output of the reverse channel for sure:

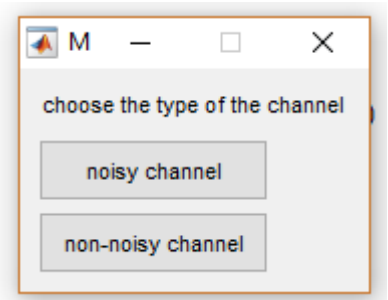


It is the exactly the same as the input, so it's correct

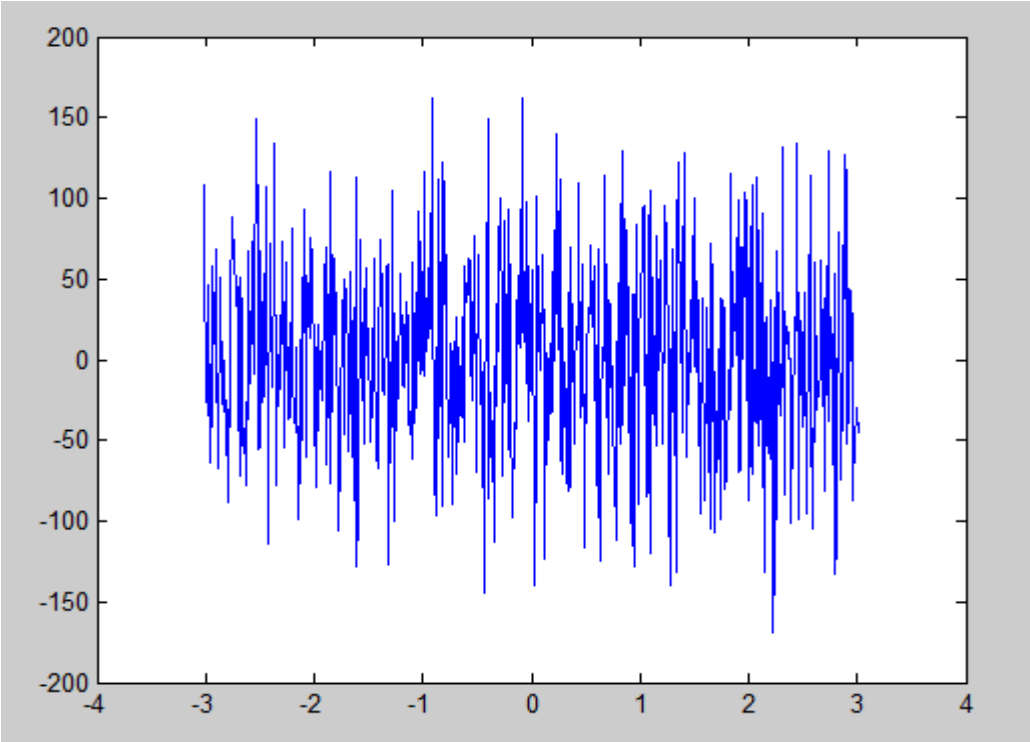
Check for stability: (BOUNS)



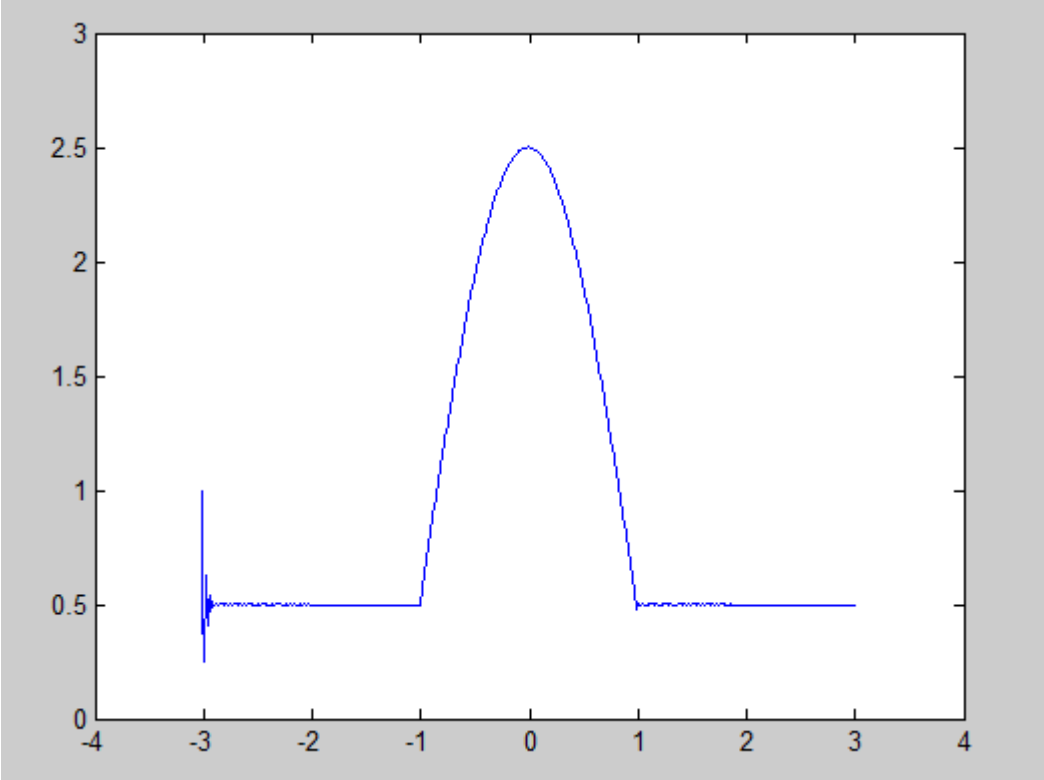
6- The user chooses if he wants to add noise or not from this "menu":



Let the standard deviation = 60
The output will be:



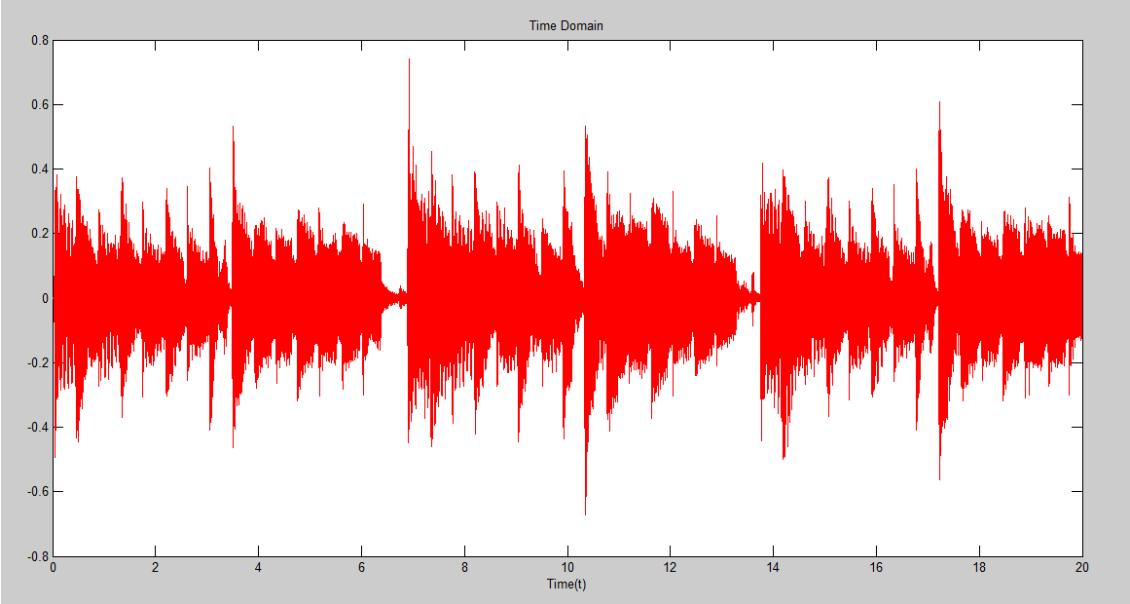
If the user chooses “non-nosiy channel” the output will be:



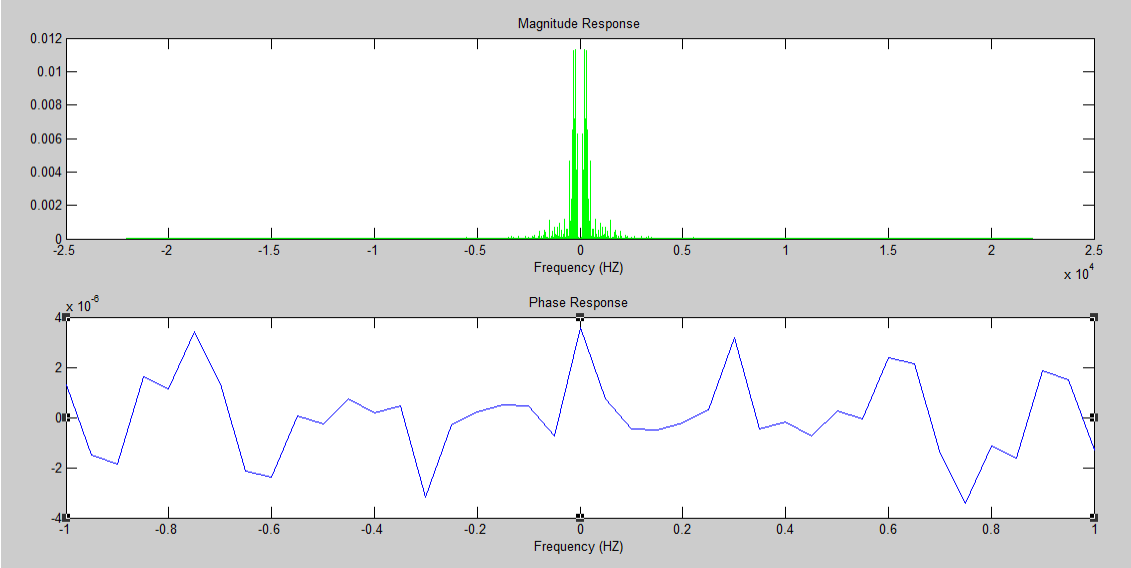
Experiment 4 Sound Processing results:

1- Input a sound file to MATLAB using sampling frequency

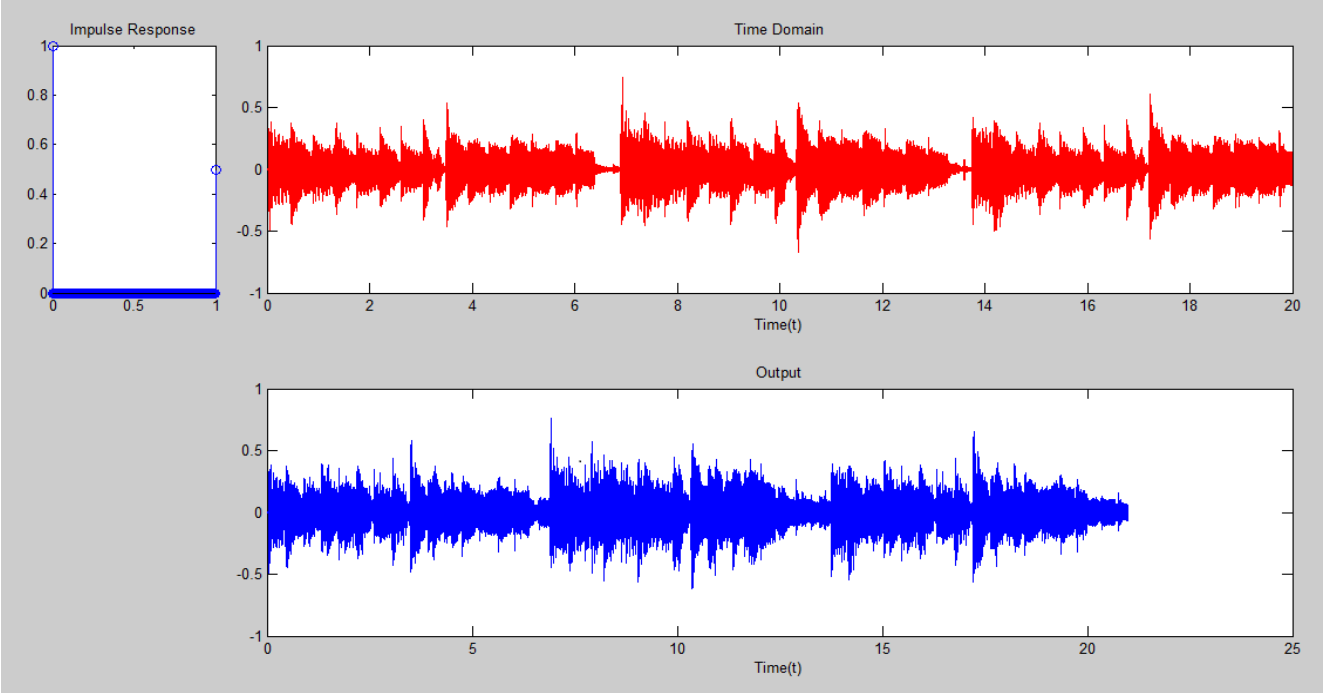
2- Plot the sound in time domain



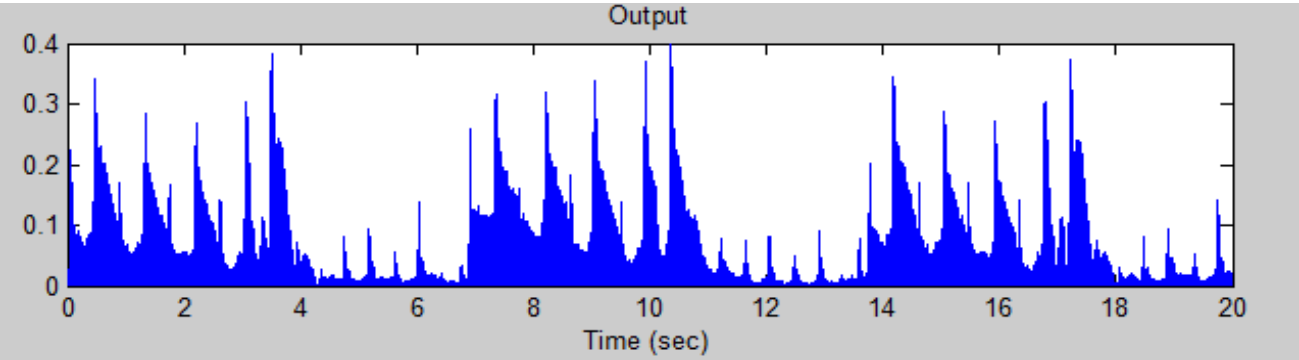
3- Plot the sound in frequency domain.



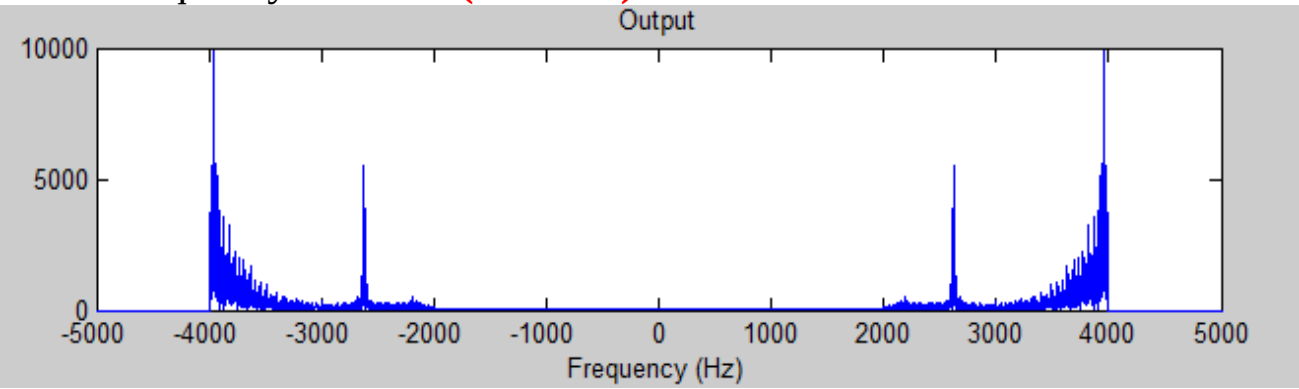
With impulse response:



4- Output will be as shown in time domain: **(BOUNS)**



In frequency Domain: **(BOUNS)**

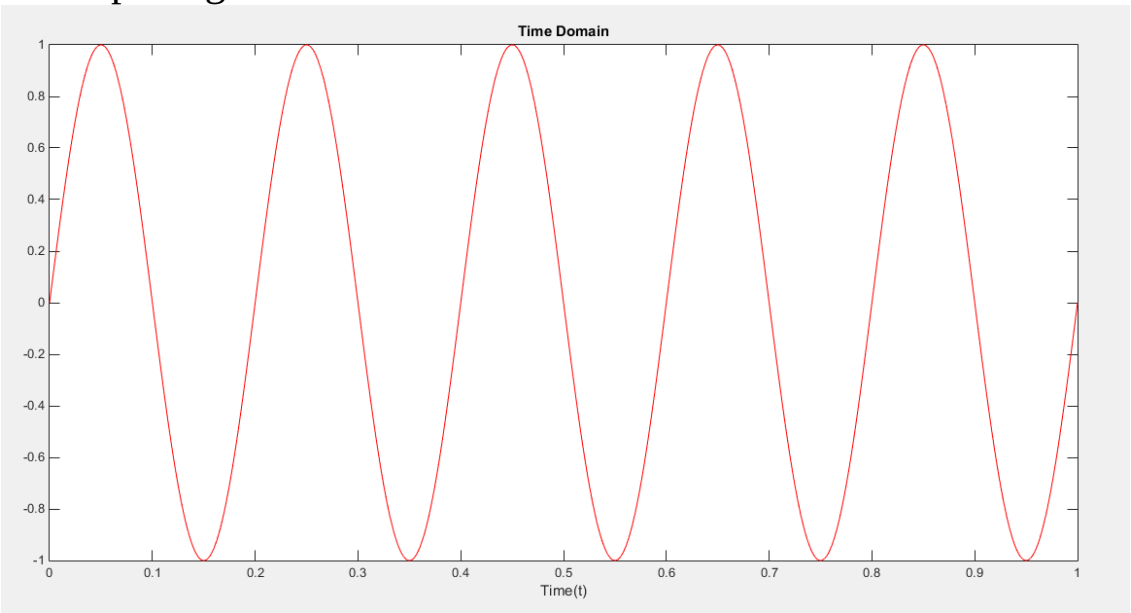


Comment: There is a delay in the output sound file.

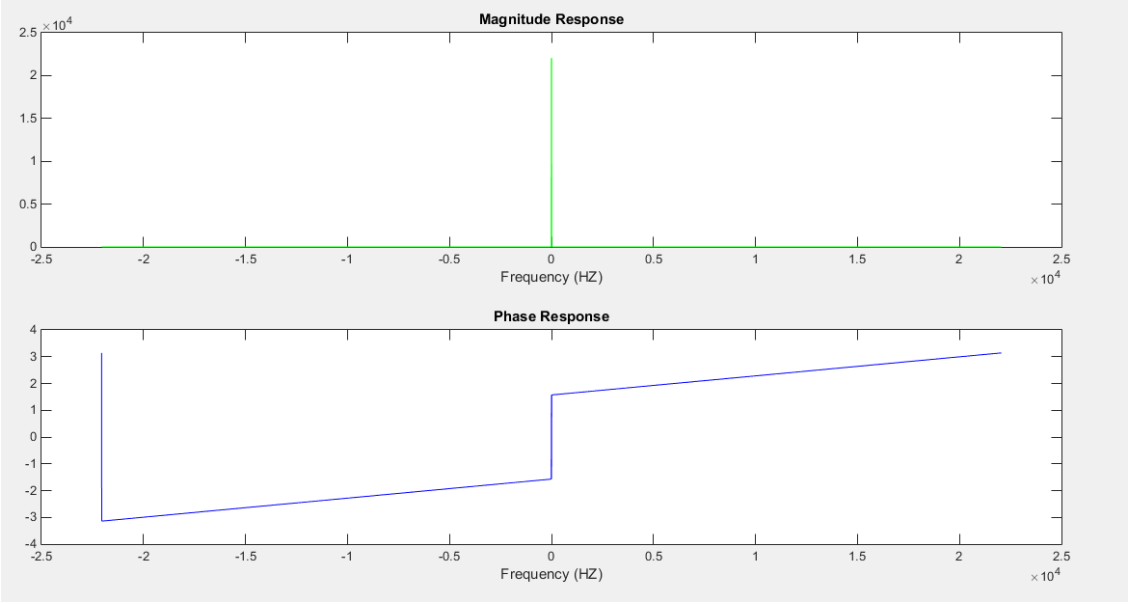
More illustration:

We entered a sine wave instead of taking the signal from the sound.wav file just to illustrate the figures clearly.

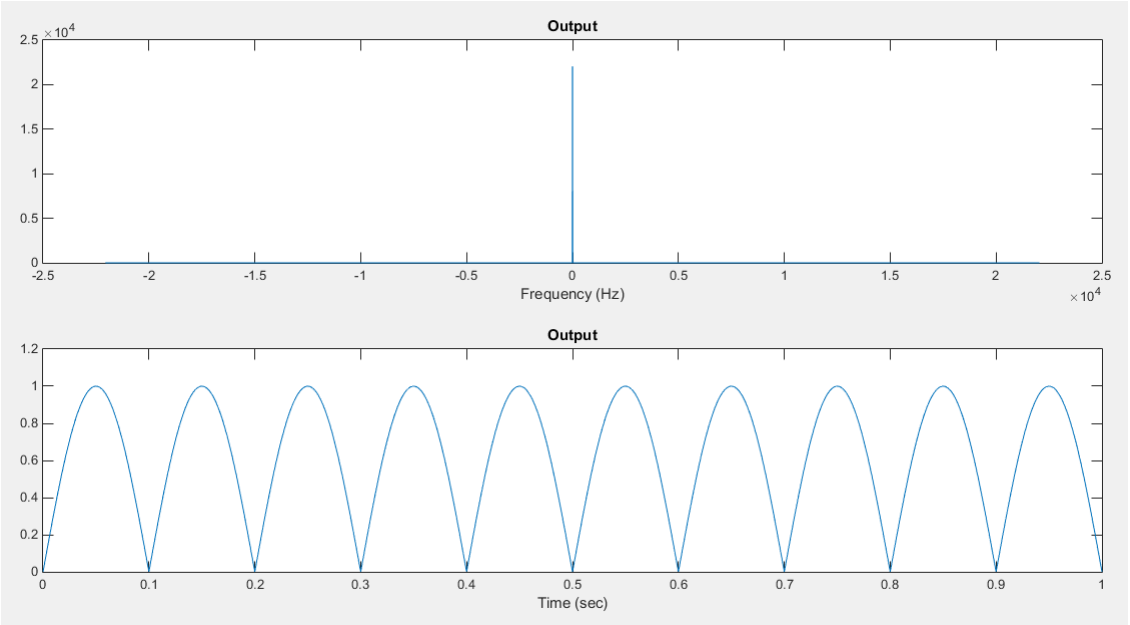
The input signal:



Frequency domain:



The output signal in time and frequency domains:



With impulse response: