DIGITAL SIGNAL PROCESSING

TASK 2

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Task 2:

The task was done to calculate the step response of the system using an IIR-filter with difference equation using the MATLAB and convolution operator (conv).

Questions:

We were inside the lab in the university. The professor had just taught us about FIR and IIR Filters. We really wanted to know how they work practically. So me and my friend went to the lab. I chose an IIR filter and he chose the FIR filter.

Given is the difference equation of IIR filter:

[n]=0.35*x[n]+0.34*x[n-1]-0.78*y[n-2]

Calculate step response of the filter with given conditions:

1. Use range from 0 to 100.
2. Calculate step response with the calculation via the convolution operator (conv) if input signal is a sinusoidal function with amplitude 1 volt.
3. Calculate the output signal y[n] with the given input signal.
4. Plot all the signals including step response, output signal, input signal.

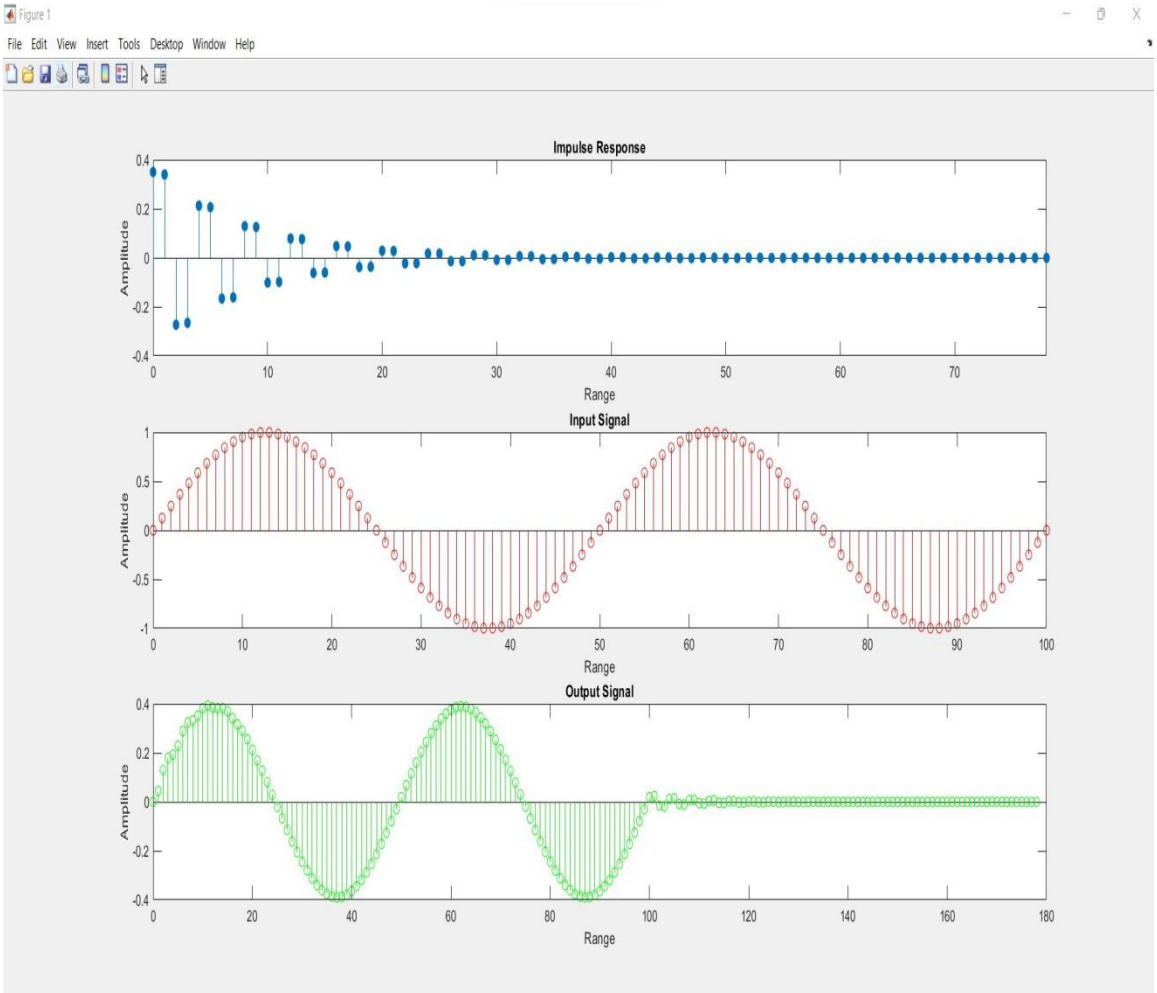
Hints:

After using conv, use the length function to find new length of the output.
Divide the graphs into three windows.
Separate the co-efficient of the filter function into a & b.

1. I chose sinusoidal signal for the input.
2. I chose the number of samples N = 50, the range 0:100.
3. I later then used the conv function to convolute the input sinusoidal signal and the impulse response to see the changes.

Sample Code:

```
%%PORTFOLIO 2
%  y[n]=0.35*x[n]+0.34*x[n-1]-0.78*y[n-2].

clc;clear;
a = [1, 0, 0.78] ;          %y coefficient
b = [0.35, 0.34] ;          %x coefficient

g = impz(b,a);              % impulse response              [1]
n = 0:100;                  % range
N = 50;                     % number of samples, random choice

x = sin(2* pi * n/N );      % our input signal, sinusoidal signal
y = conv(g ,x);             % Change in input signal through filter, OUTPUT signal    [2]
len_y = [0: length(y)-1];   % length of convoluted signal


%GRAPH

subplot(3,1,1), impz(b,a )   ;     %graph 1
xlabel("Range");
ylabel("Amplitude");
title("Impulse Response");


subplot(3,1,2), stem(n, x, 'r') ;     %graph 2
xlabel("Range");
ylabel("Amplitude");
title("Input Signal");

subplot(3,1,3), stem(len_y, y,'g');  %graph 1
xlabel("Range");
ylabel("Amplitude");
title("Output Signal");
```



The graph from the sample solution.

Reference:

[1] Impulse response of digital filter - MATLAB impz - MathWorks Australia
[2] Convolution and polynomial multiplication - MATLAB conv - MathWorks Deutschland