Digital Signal Processing Lab

Experiment 6

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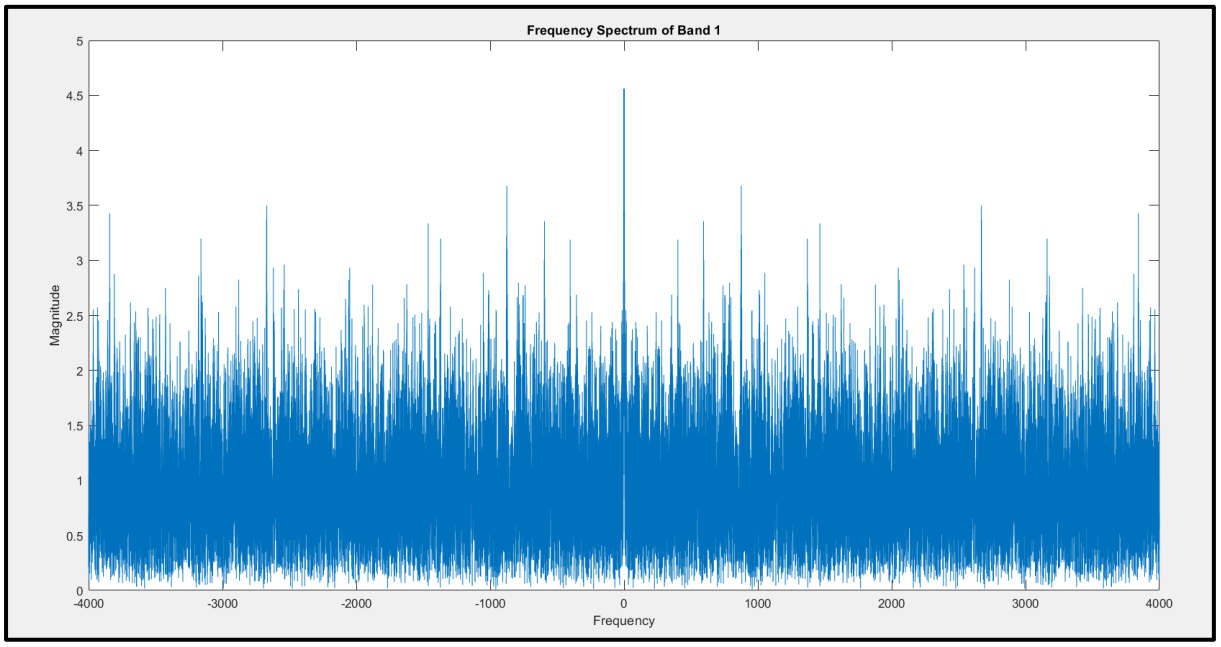
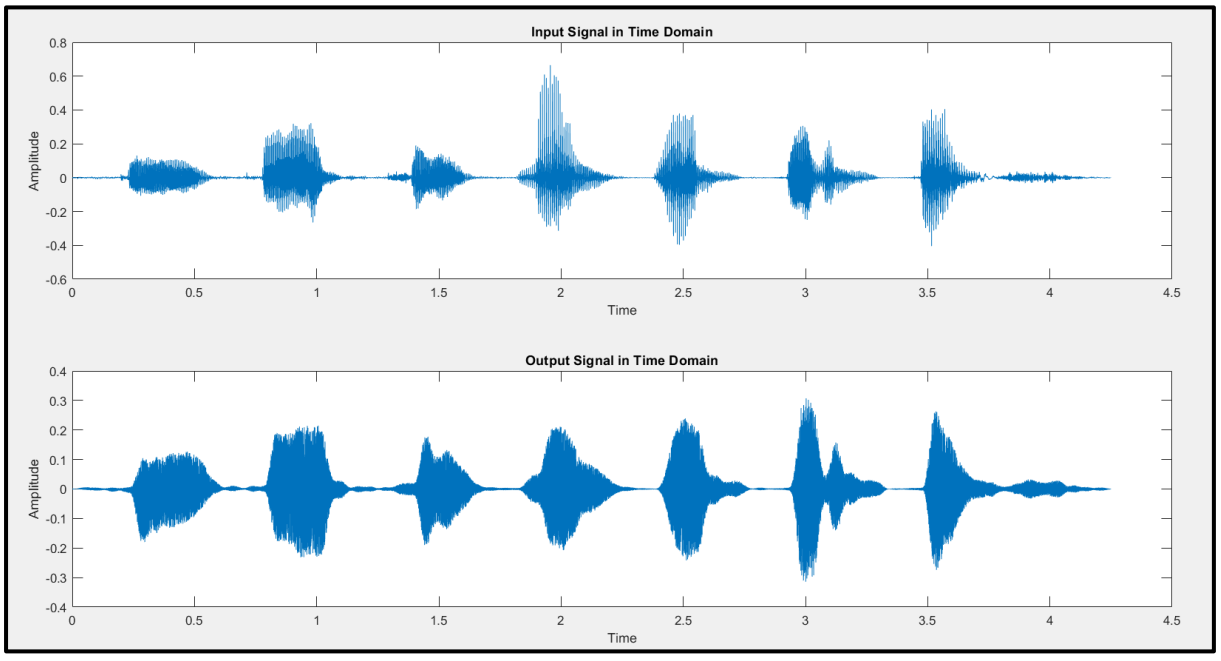
Aim:

Speech Recognition with Primarily Temporal Cues

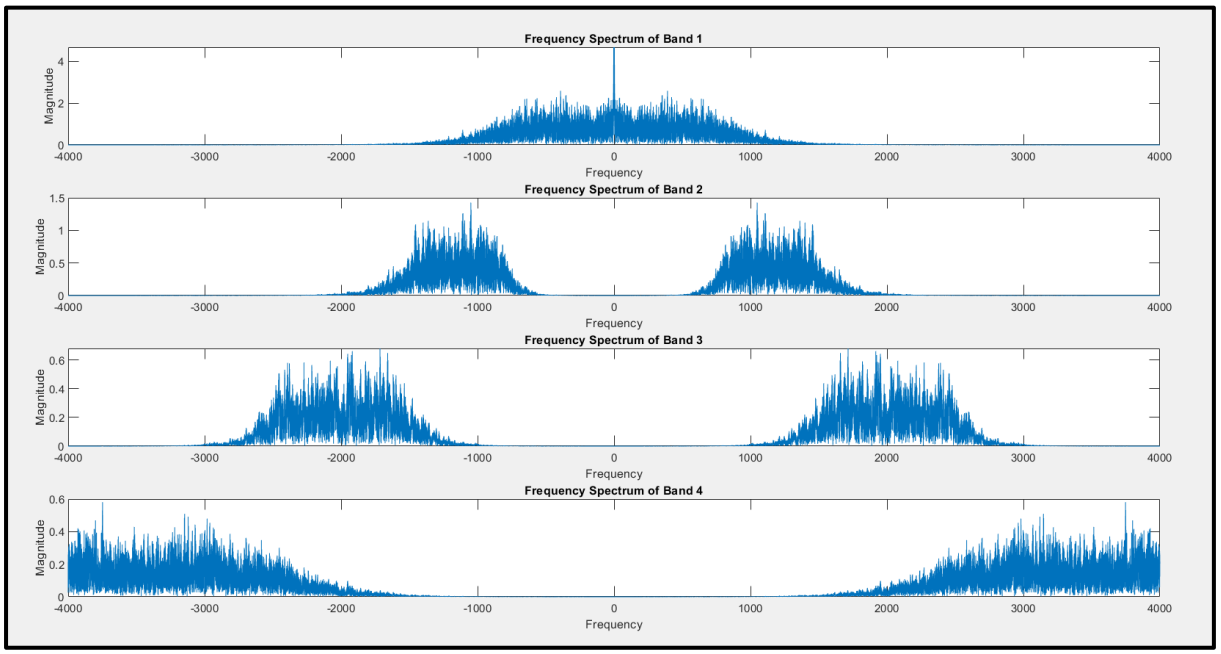
Plots: (Frequency spectrum is for the white noise modulated with the envelope of the speech signal)

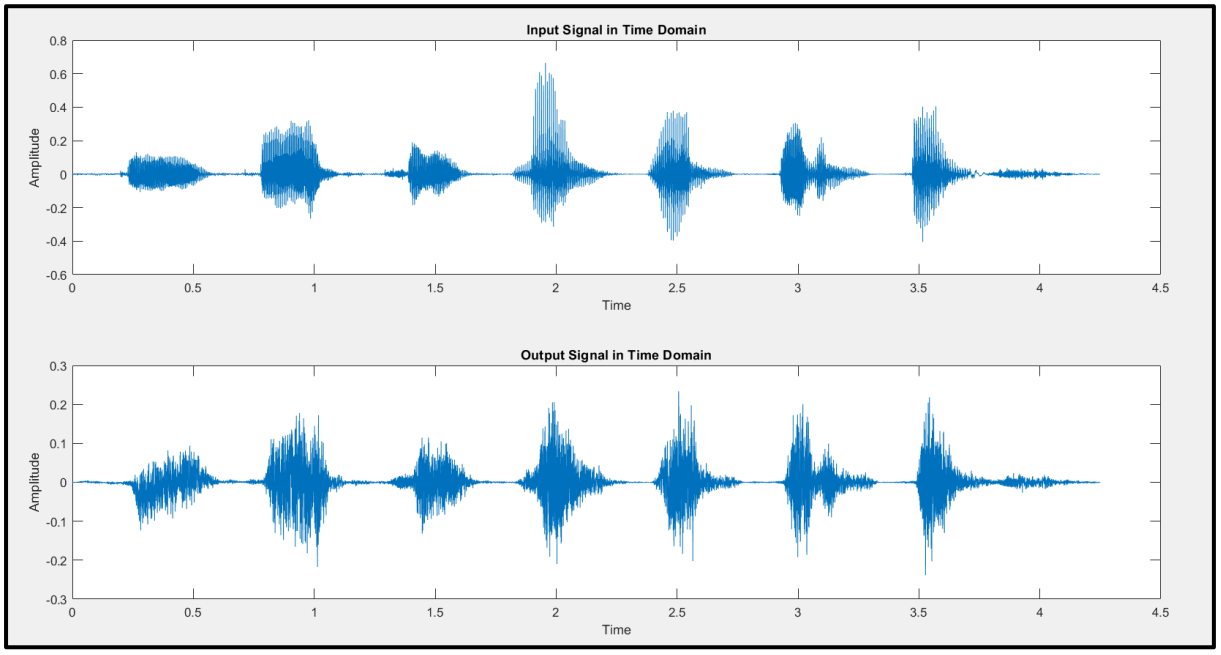
For 1 Band, LPF cut-off = 16 Hz



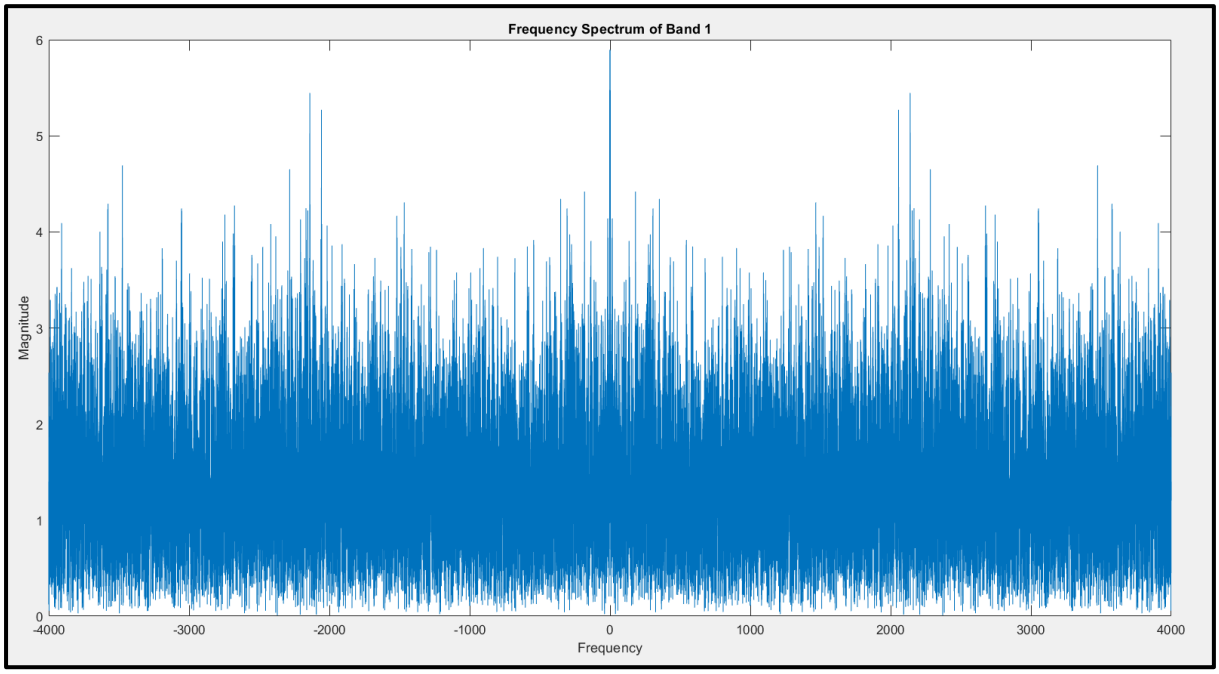


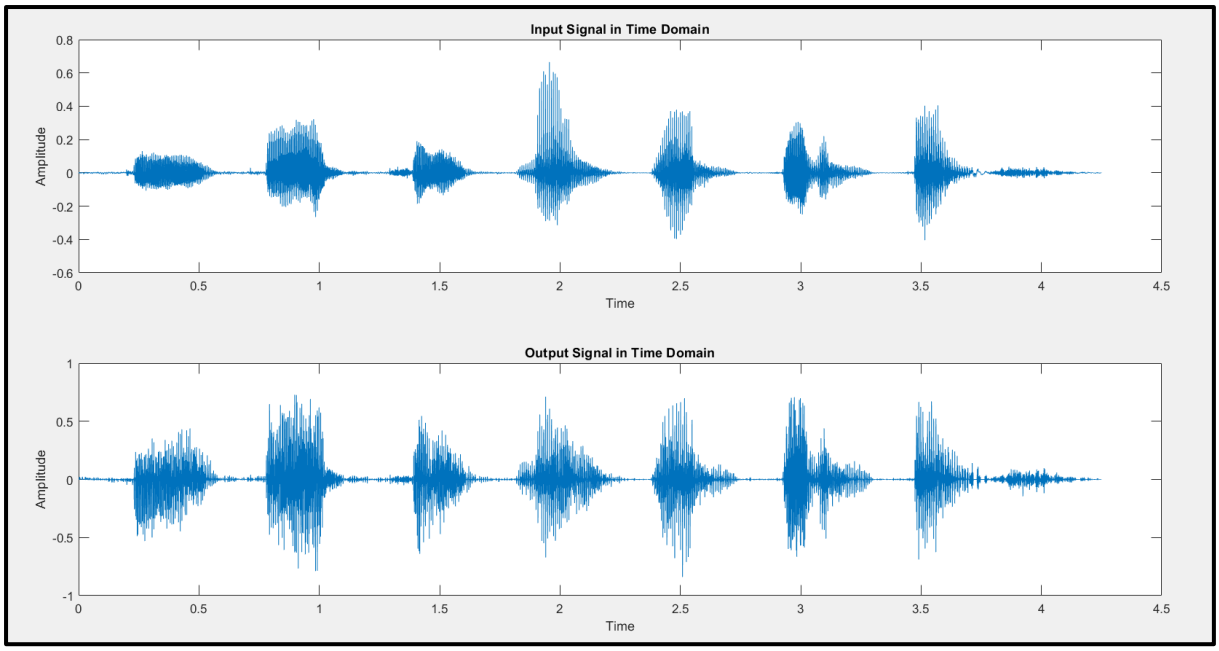
For 4 Bands, LPF cut-off = 16 Hz



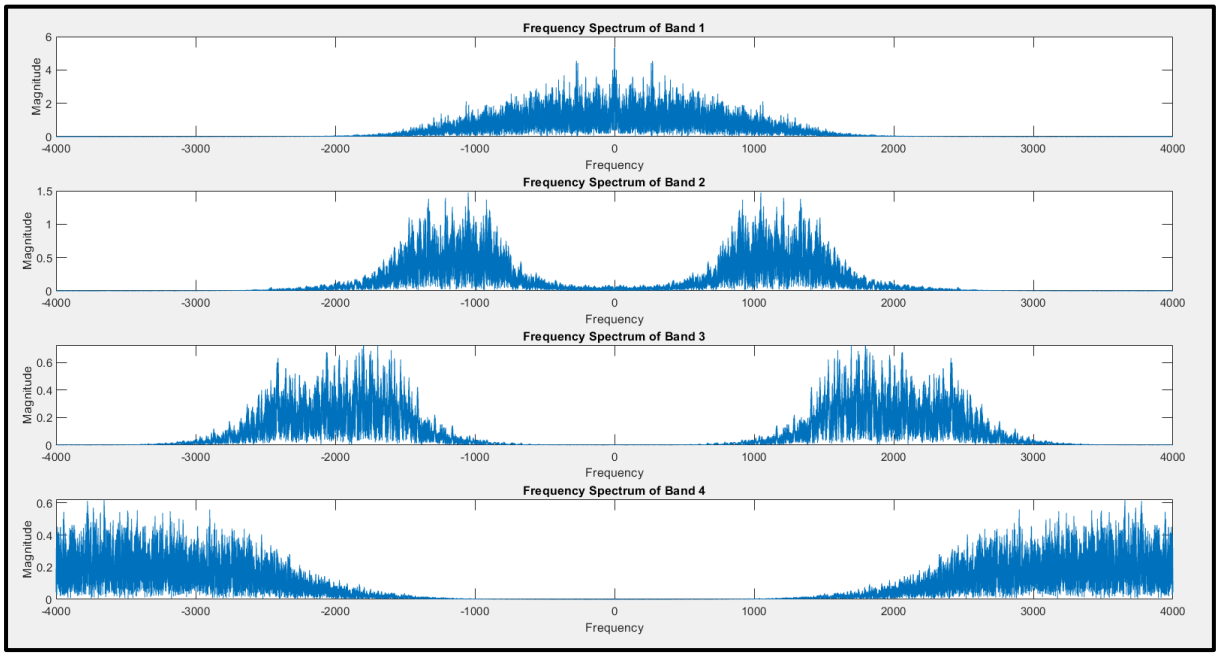


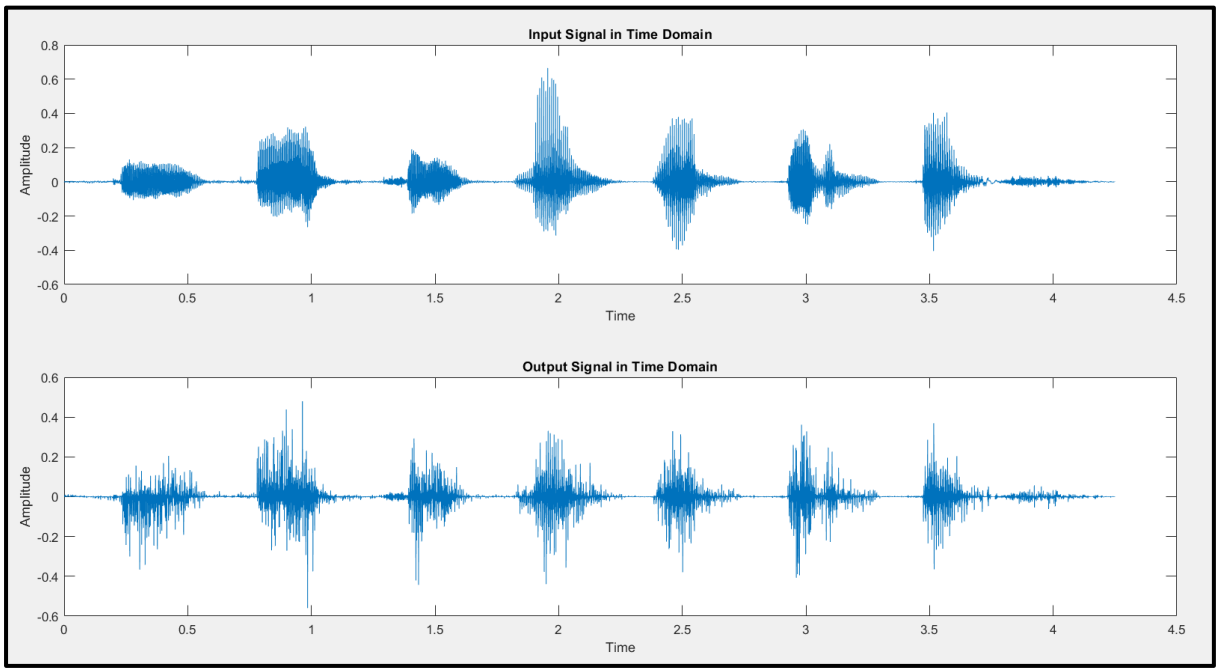
For 1 Band, LPF cut-off = 500 Hz





For 4 Bands, LPF cut-off = 500 Hz





Code:

```
clc
clear all
close all

order = 4;
[y,Fs] = audioread("./Samples/B1_A1.wav");

norm = Fs/2;
for N = [1,4]
Fc = 500;
[B_l, A_l] = butter(order, Fc/norm);
noise = rand(size(y));
output = zeros(size(y));

bands = zeros(4,5);
bands(1,:) = [1, 3999, 0, 0, 0];
bands(2,:) = [1, 1500, 3999, 0, 0];
bands(3,:) = [1, 800, 1500, 3999, 0];
bands(4,:) = [1, 800, 1500, 2500, 3999];

figure();
for ii = 1:N
    [B, A] = butter(order, [bands(N,ii)/norm, bands(N,ii+1)/norm]);
    Y = filter(B,A,y);
    Y_e = Y.*(Y>=0);
    Y_el = filter(B_l, A_l, Y_e);
    n = filter(B,A,noise);

    subplot(N,1,ii);
    NUM = length(Y_el);
    f_range = -norm:2*norm/NUM:norm-1/NUM;
    plot(f_range, abs(fftshift(abs(fft(n.*Y_el)))));
    xlabel("Frequency");ylabel("Magnitude");
    title("Frequency Spectrum of Band " + num2str(ii));
    output = output + n.*Y_el;
end
output = output*10;

figure();
subplot(2,1,1);
t = 0:1/Fs:(length(y)-1)/Fs;
plot(t,y);
xlabel("Time");ylabel("Amplitude");
title("Input Signal in Time Domain");

subplot(2,1,2);
plot(t,output);
xlabel("Time");ylabel("Amplitude");
title('Output Signal in Time Domain');

out_file = "answer_"+num2str(N)+".wav";
audiowrite(out_file,output,Fs);
end
```