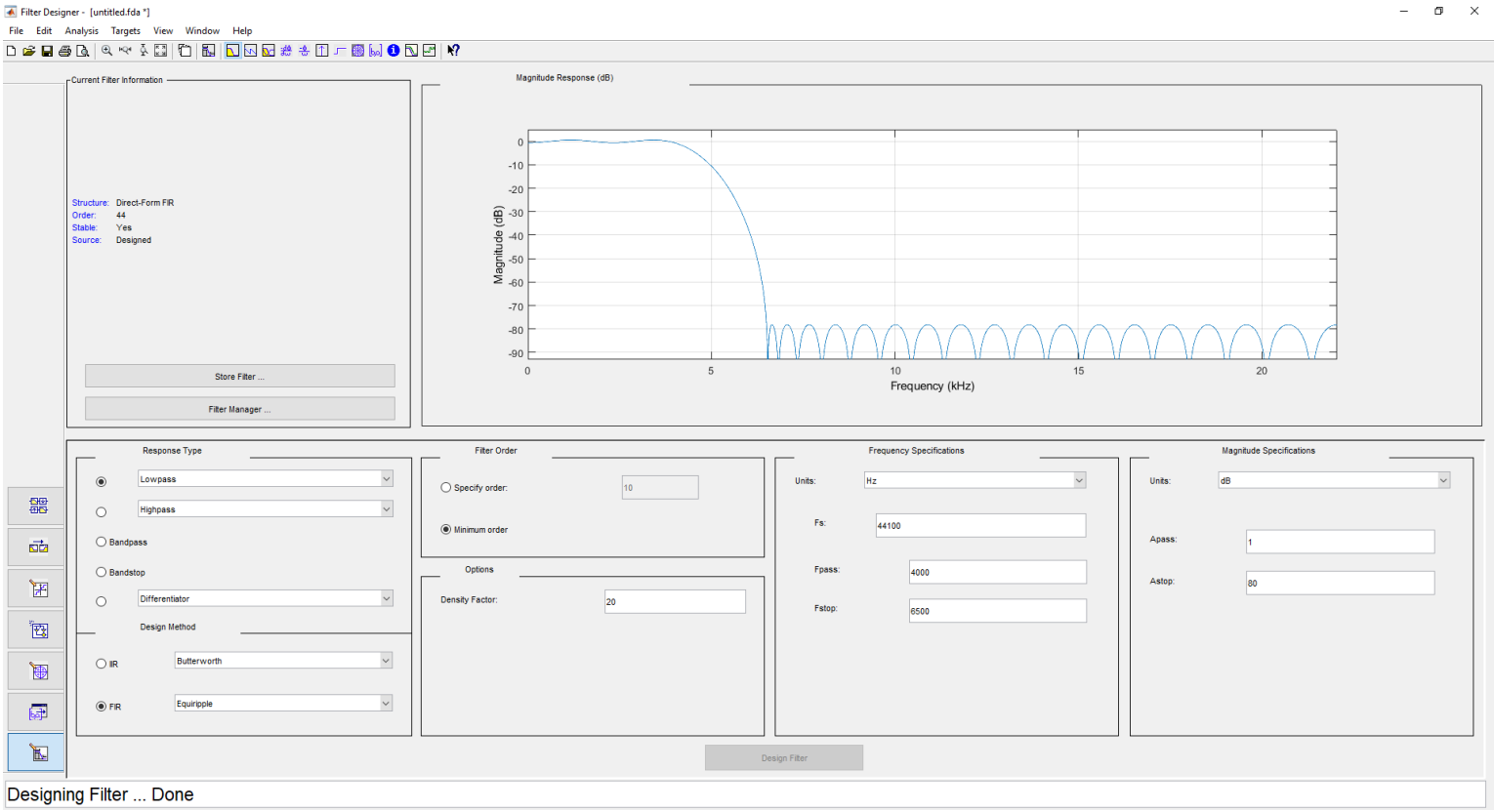
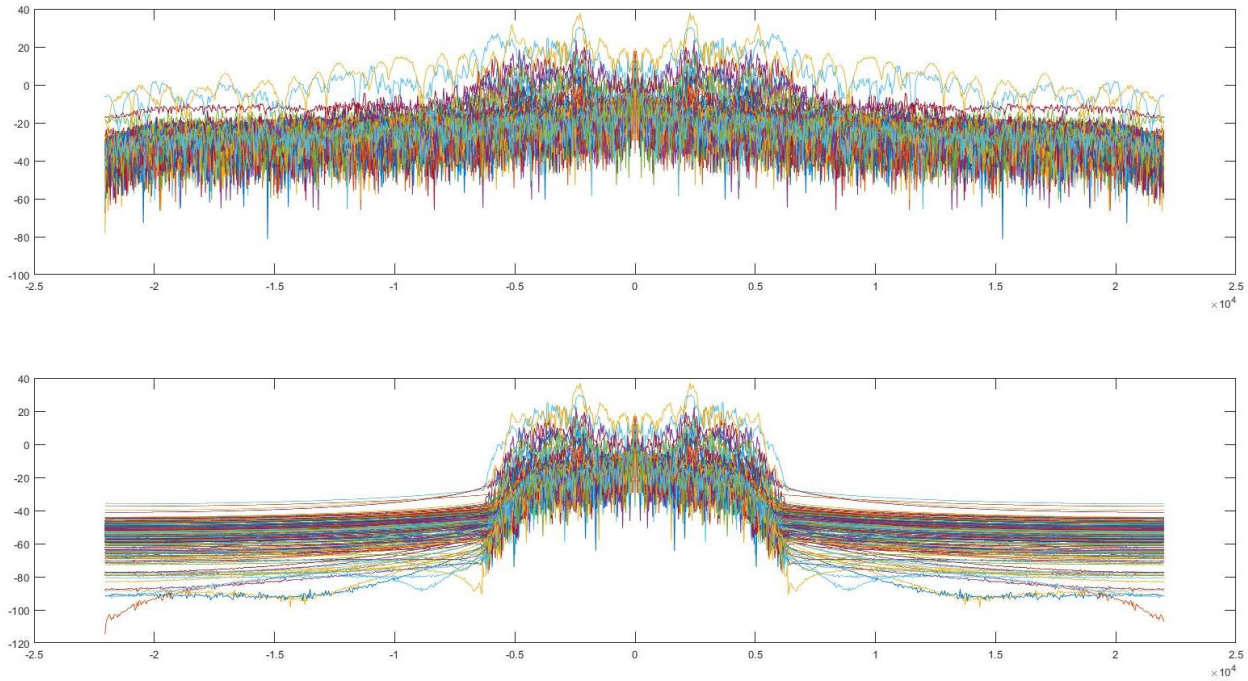
Lab 5 – Aayush Gupta

Task 3: . Your own experiments with FIR filter



FIR, lowpass filter
Fs=44100
Fpass=4000
Fstop=6500



As we can see implemented filter works. The filter is cutting the beginning of the signals and leaving the main part only.

Note: The two clapping sounds are top of each graph (blue and yellow)

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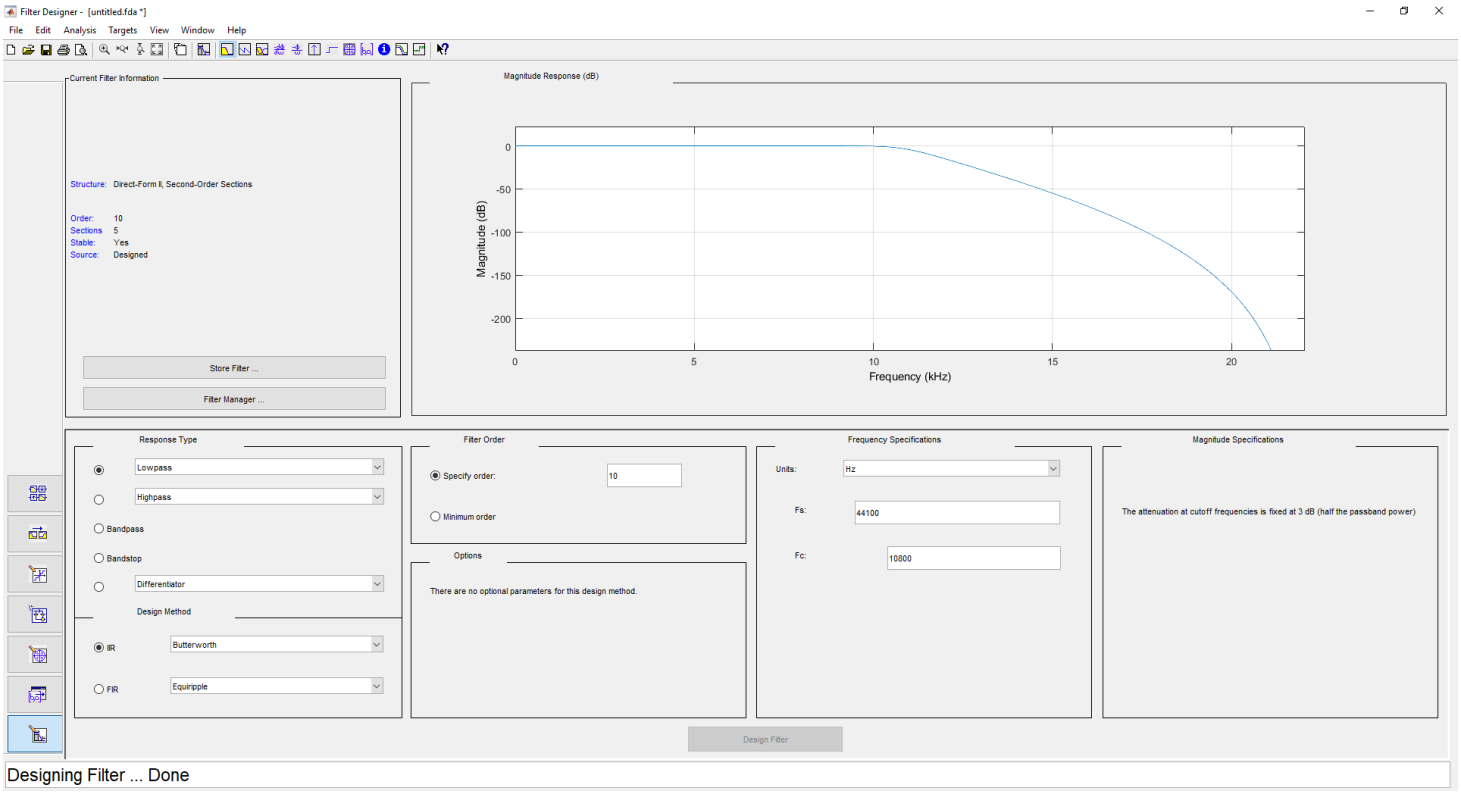
Task 4. IIR filter

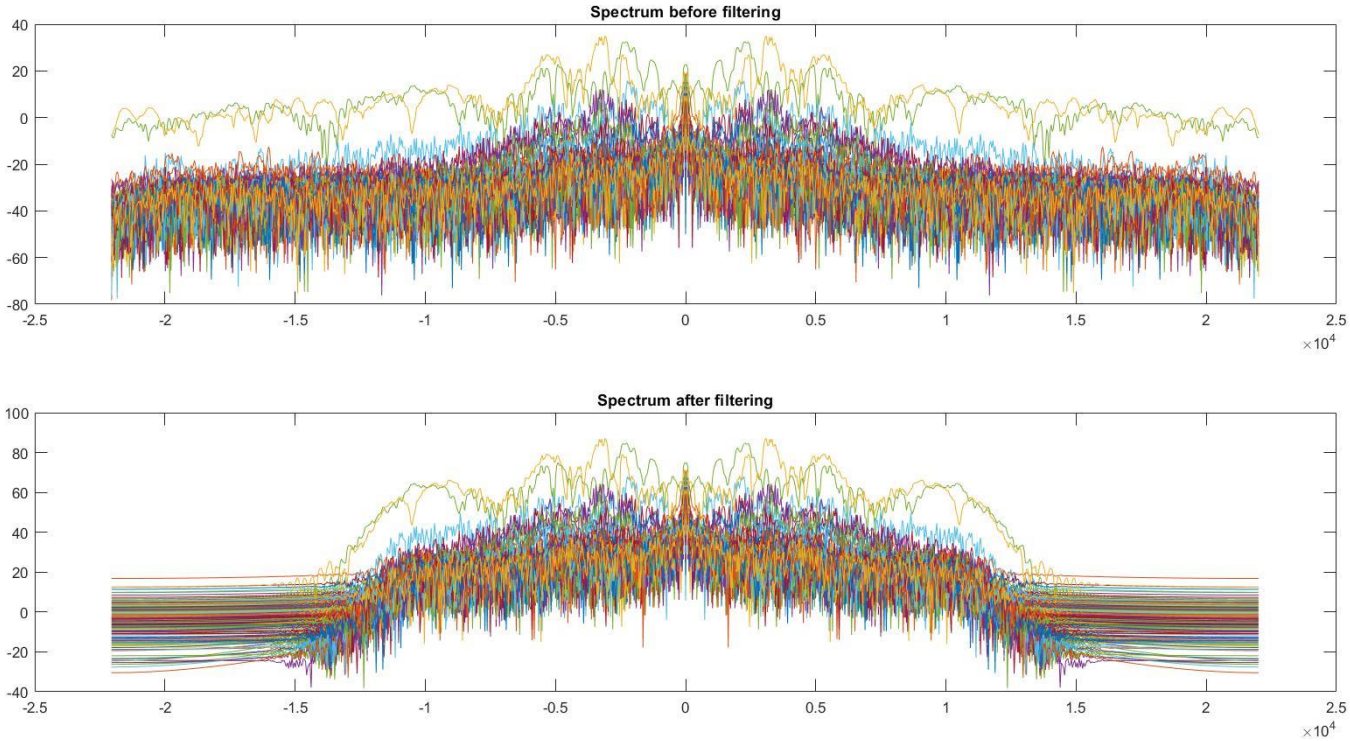


IIR Lowpass filter (Butterworth)

Order=10

Fs=44100 [Hz]

Fc=10800 [Hz]



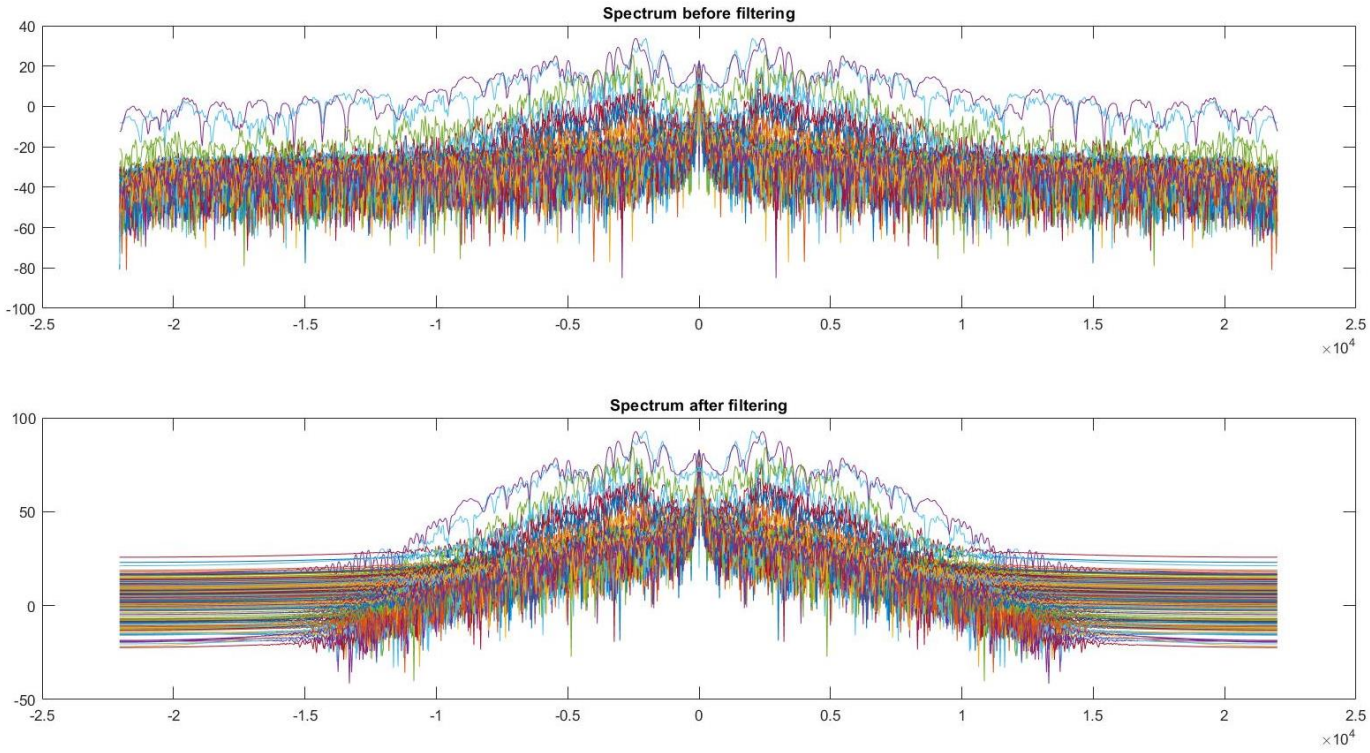
The work of filter can be observed as it has processed two sounds which were claps and snaps of finger and represented by green curve and yellow curve.

Answers to the question

Q1. : **is it possible to correct errors now by remembering a fragment of the previous block.**

Ans. No, remembering the previous fragment of the block will not help much for correcting boundary errors because we now use a different type of IIR filter which is based on impulse response.

Thus by saving previous fragment will not correct the errors as we are dealing with error frequencies which are presented at frequency spectrum.



This graph is to illustrate about what happens with signals which are similar when we use saving of the filter state. (zi and zf parameters of a filter() function in MatLab).

As zi is a matrix or multidimensional array, then the size of the leading dimension must be max(length(a),length(b))-1. That is to say that, the size of each remaining dimension must match the size of the corresponding dimension of our signal X.

Question2: **why in the description (matlab help) of the filter() function states: "If zi is a vector, then its length must be max (length (a), length (b)) - 1."**

Ans:
The reason for this is that the filter has a certain number of "memory" elements, which are used to keep track of the previous input and output values. The number of memory elements required by the filter is determined by the length of the filter coefficients vectors a and b. The zi vector is used to specify the initial values of these memory elements.

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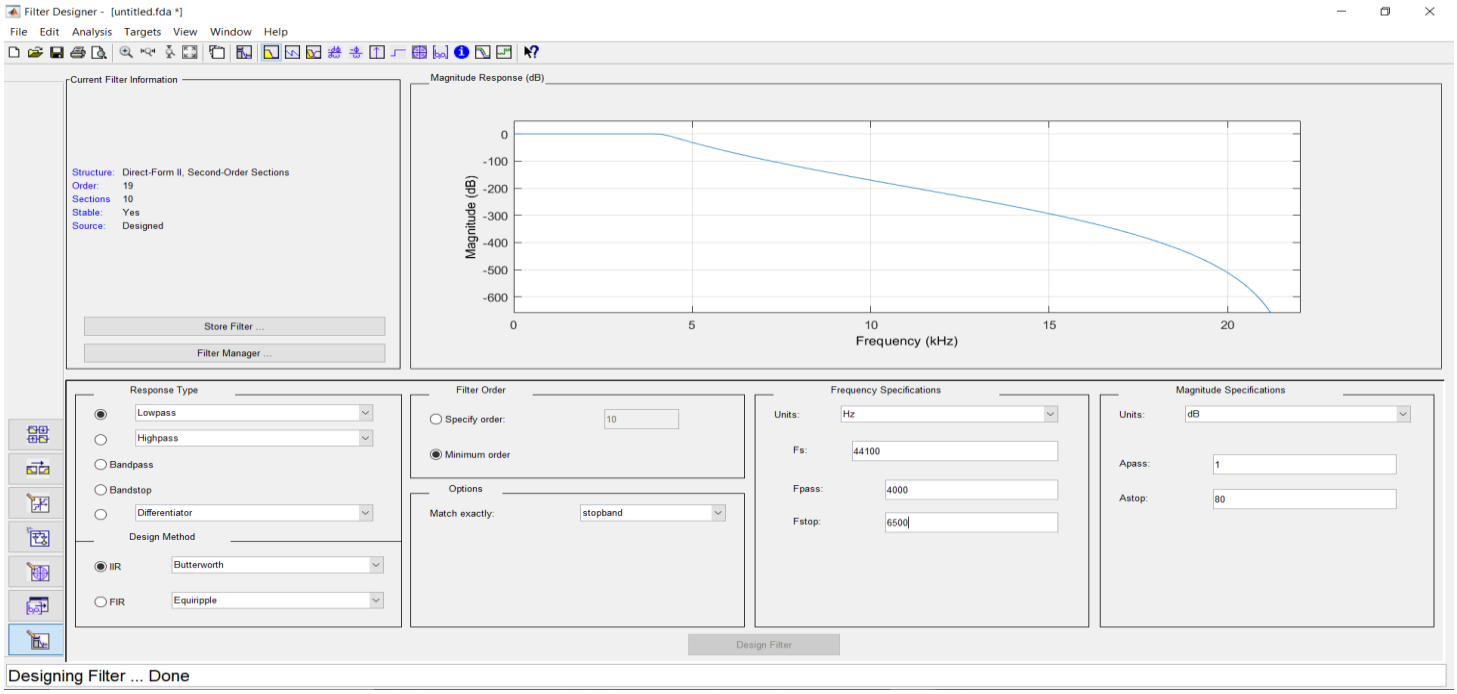
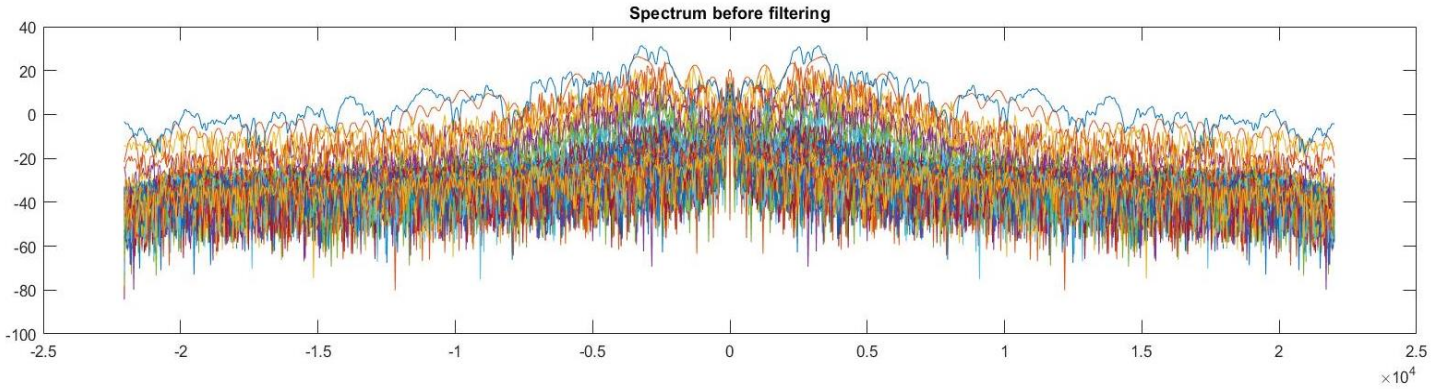
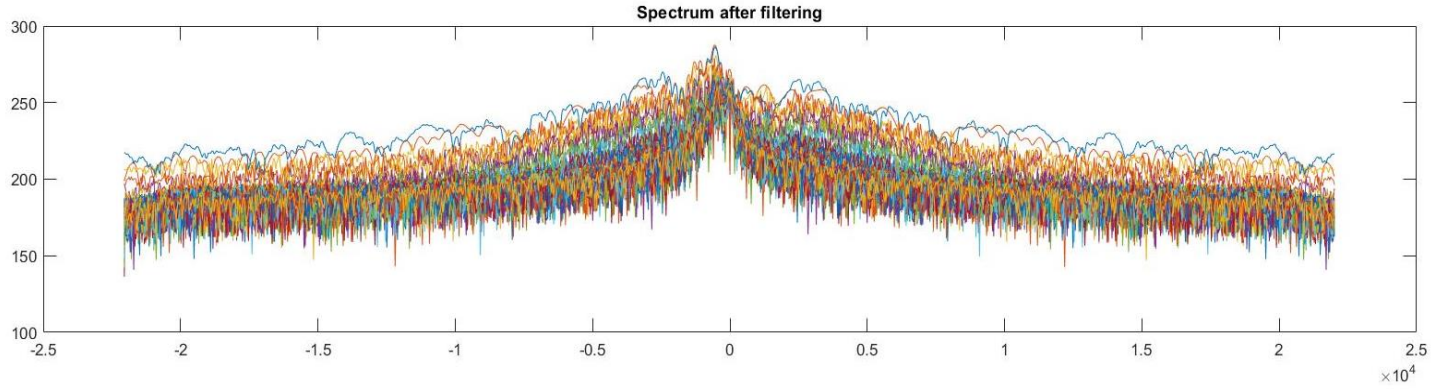
In summary, the zi argument of the filter() function is used to specify the initial conditions of the filter, and its length must be set to max(length(a), length(b))-1 to ensure that there are enough initial values for all the memory elements of the filter.

Task 5:



I have used IIR lowpass filter
Fs=44100
Fpass=4000
Fstop=6500





As we can see the IIR filter with the FFT realization works but the noises are still present. Two clapping are represented by blue and yellow curves are positioned along with the top of the graph.

This filtering process is smoother in comparison to pervious task as signals are not cut abruptly.