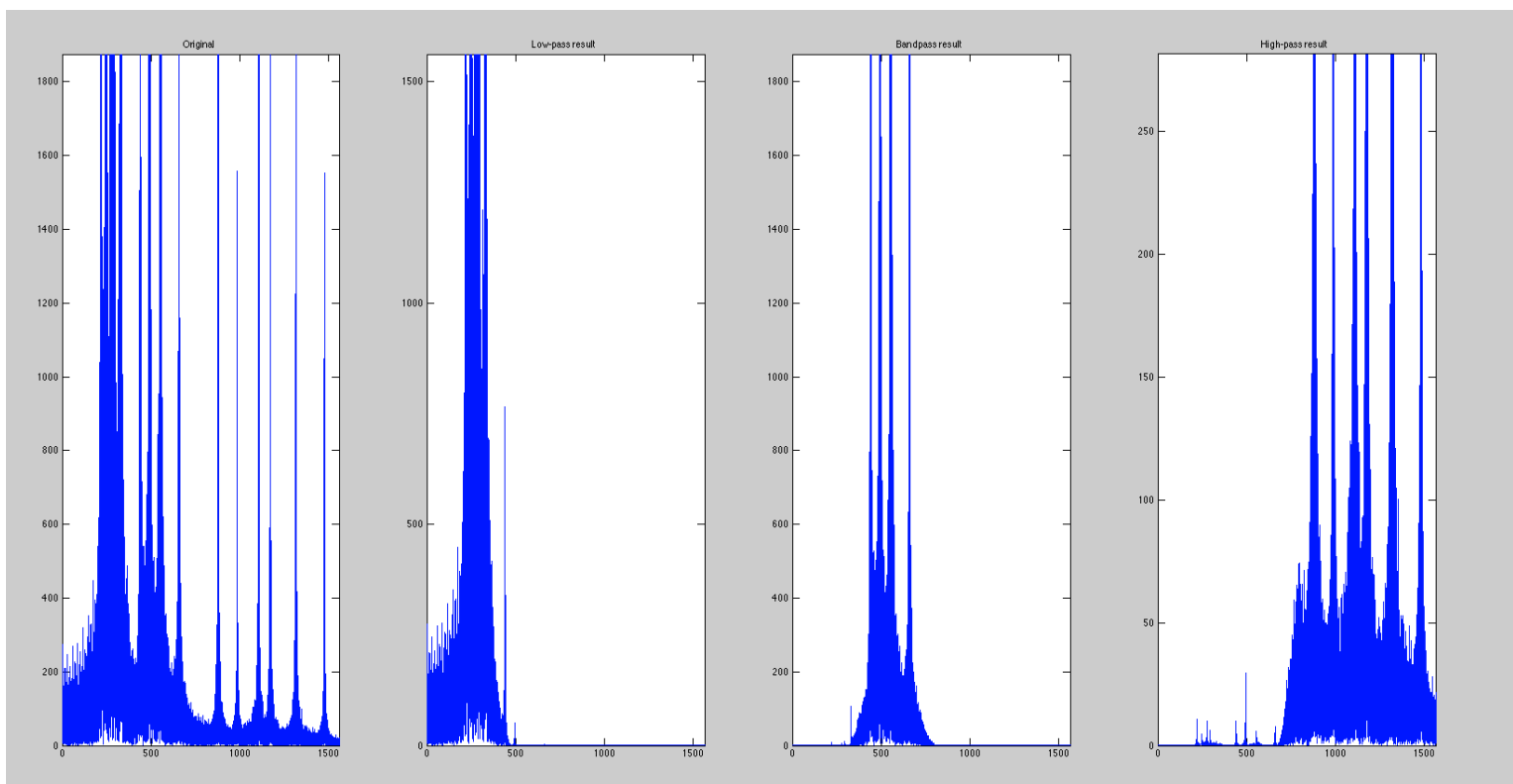


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Introduction to Multimedia Homework 3 Report

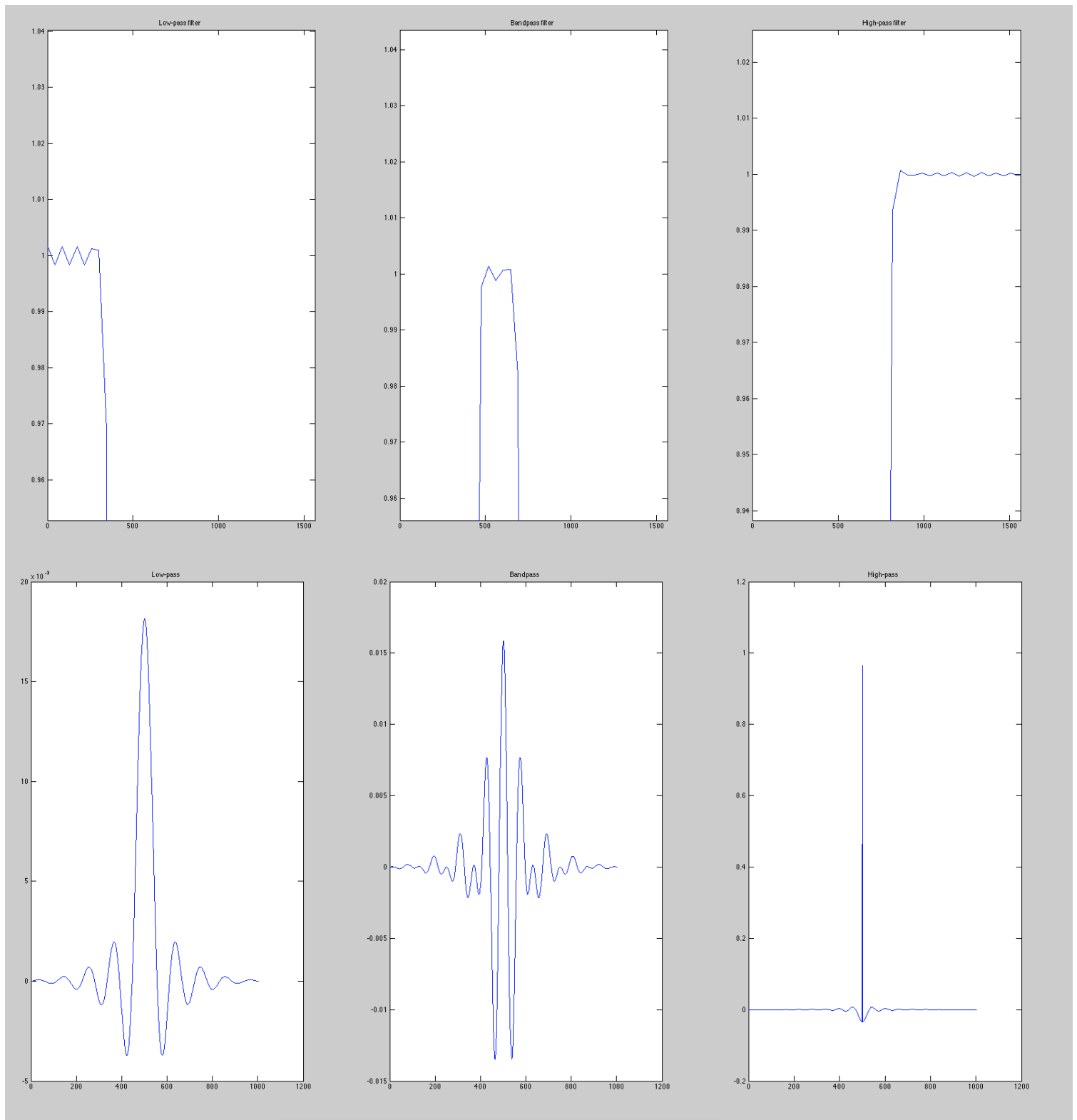
• Part 1

We are given a sound file that is a combination of 3 songs. From the spectrum of the original sound file, we can find that the frequencies can be categorized into 3 regions. For this situation, we can apply a low-pass, bandpass, high-pass filter to filter out the desired part. Here, I choose $f_c = 400$ for low-pass filter, $[f_1, f_2] = [400, 750]$ for bandpass filter and $f_c = 750$ for high-pass filter.



For the filter design, I follow the comment in the code provided by TAs. First, do normalization and apply equations in table 5.2 to get an ideal filter. Then, create a windowing function(Hamming) and multiply it with ideal filter to get the realistic filter. Finally, do 1-D convolution with the input signal and the filter.

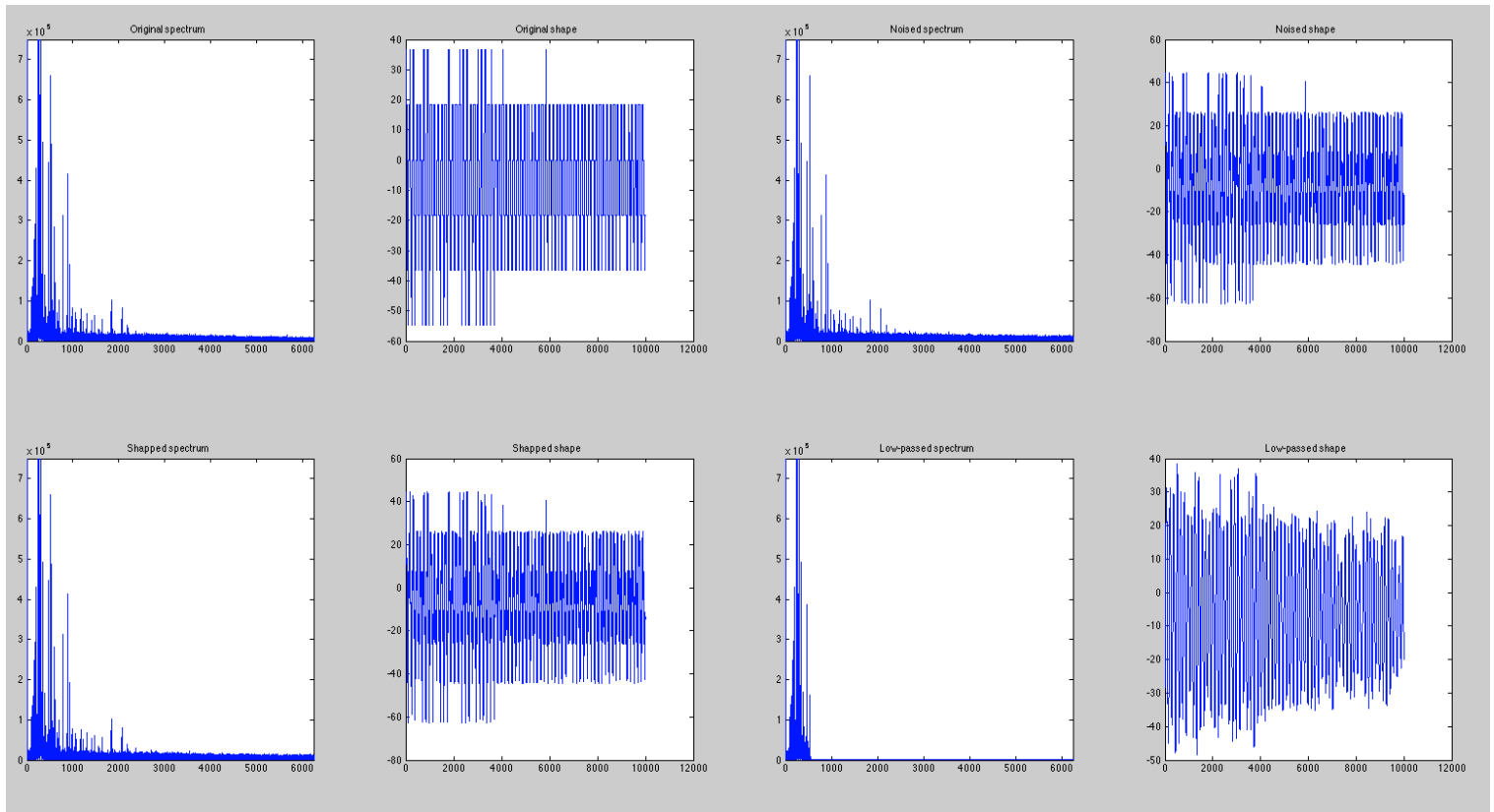
Homework 3



Above are the spectrums and the shapes of the filters. Here, I choose the size of the filters $N = 1001$. At first, I assign $N = 201$. It turned out that the filtered results are not as expected. Some unwanted frequencies can still be heard in the sound. Larger filter size solve the problem; however, it takes much more computation.

• Part 2

We are given an audio file after bit reduction. Some information is lost during this process.



Above are snapshots of the result. We can see that the original shape is very square because the loss of information. So we add some randomness to that shape, the result is less square now. Then, we do noise shaping, we can see high frequency part rise a little bit. Finally, we discard the high frequency part using low-pass filter ($f_c = 500$), the high frequency part is gone. The audio finally sounds better, at last.