Lab 2 ex4

Saturday, 28 January 2017 17:22

Exercise 4

Code is as given in the lab notes.
Additionally to this,

$$\sum_{i=1}^{N} x^2(t)$$

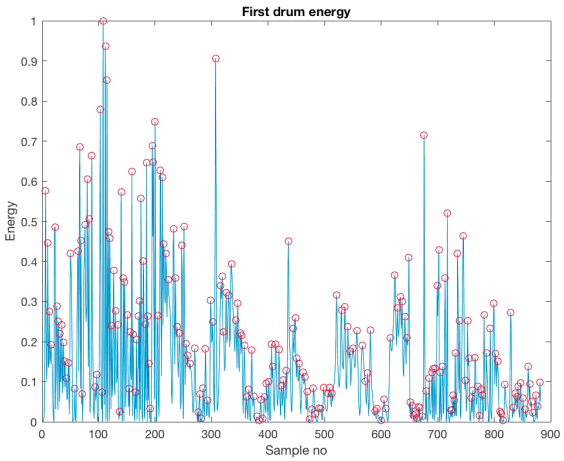
was interpreted as the signal value (in V) being squared at each sample point.

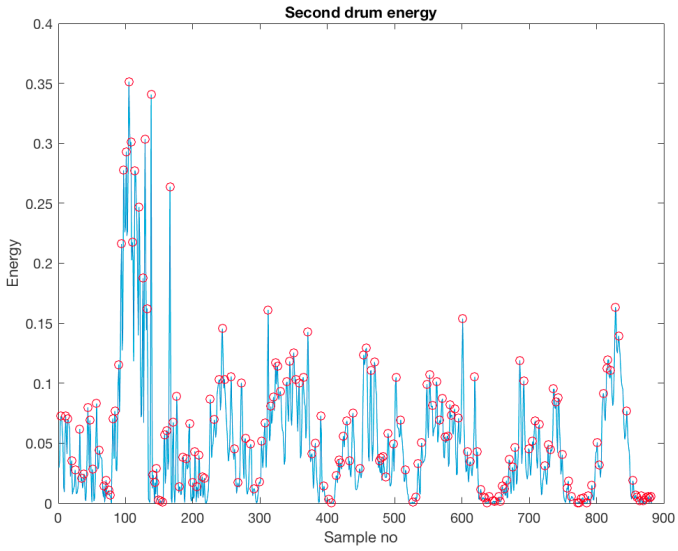
In MATLAB code this is seen as:

```
seg1_energy = sum(segment1.^2)
```

Which sums each element after it has been squared. This may be incorrect and a misinterpretation of the formula but that is yet to be confirmed.

As a result of this preliminary analysis, the energy graph of each drum is seen as follows:

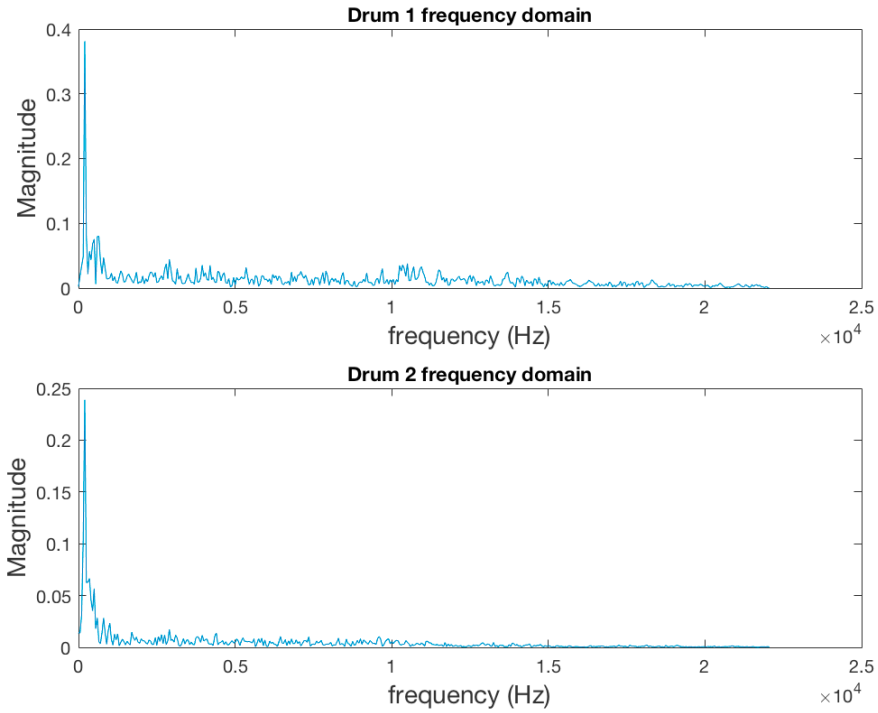




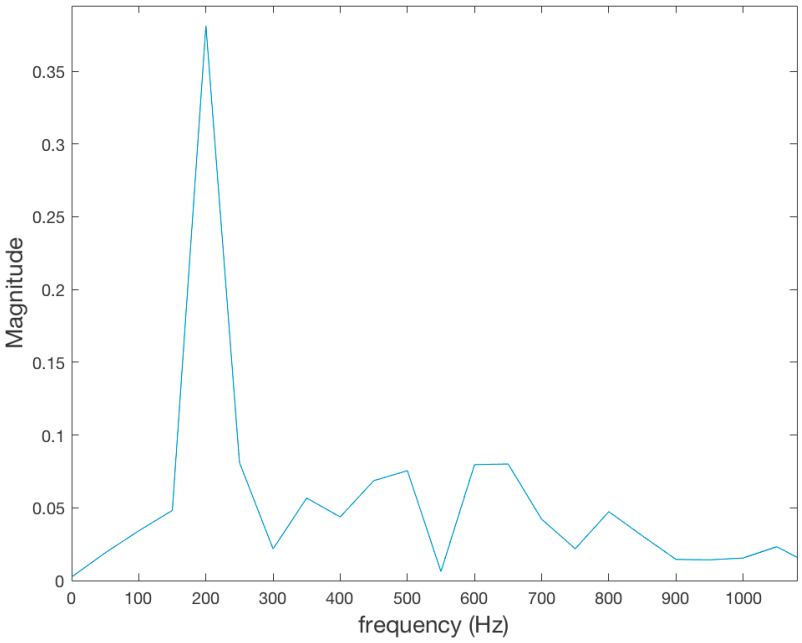
Using earlier code (from Tutorial sheet 1), the peaks were circled for each energy graph.

Final step was to plot the frequency domain of each drum beat. This was done using the **plot_spectrum** function used repetitively over previous tasks.

When this was done however to the first drum, frequencies ranged from 0 to approximately $2.2E4\ Hz$ which seems excessively high.



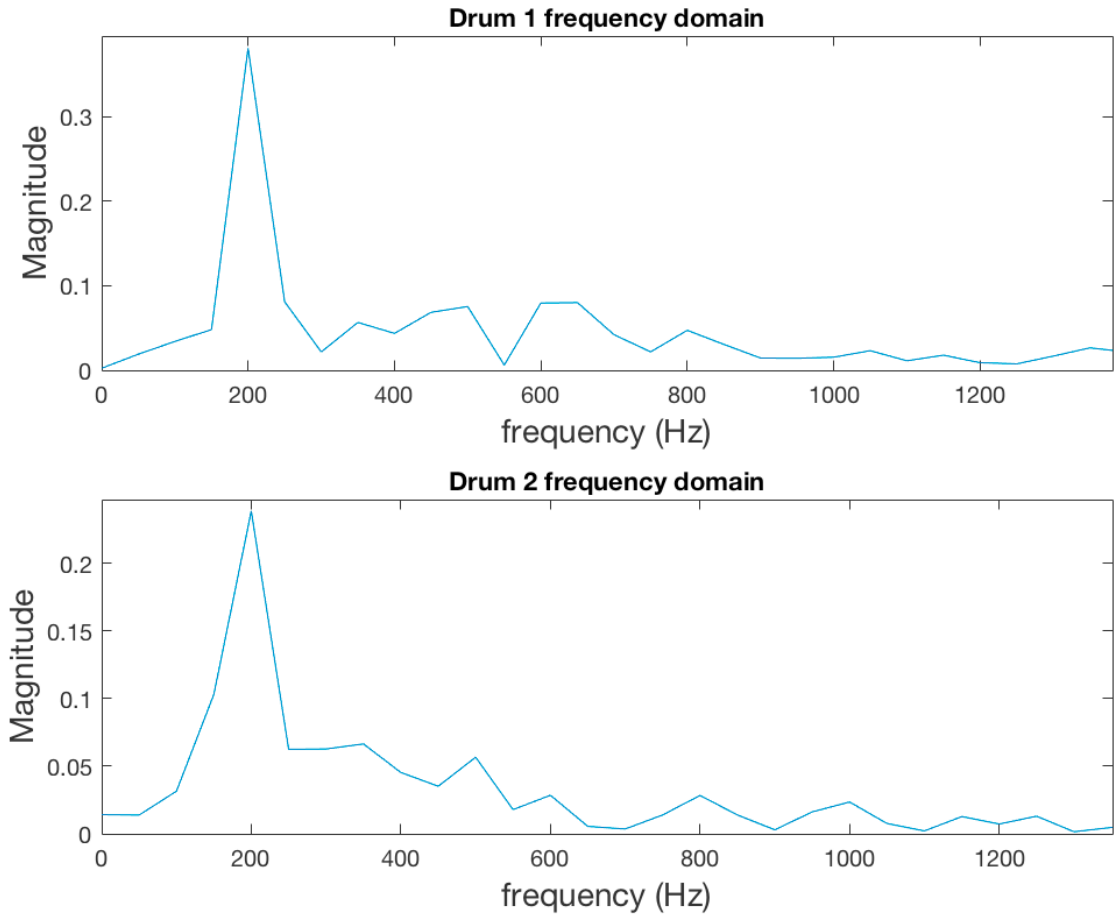
However, analysing the domain shows that the high magnitude spike at a low frequency occurs at $200\ Hz$.



Analysing drum 2 frequency domain resulted in this very high frequency result.

This is believed to be due to the high sampling frequency of the computer/music file.

However when comparing the frequencies of both drums together it seemed that both drums had the same primary frequency (at 200 Hz).

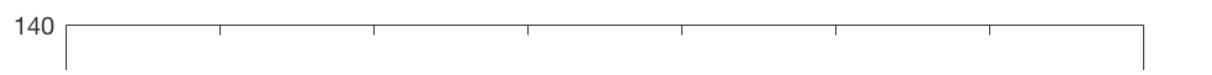


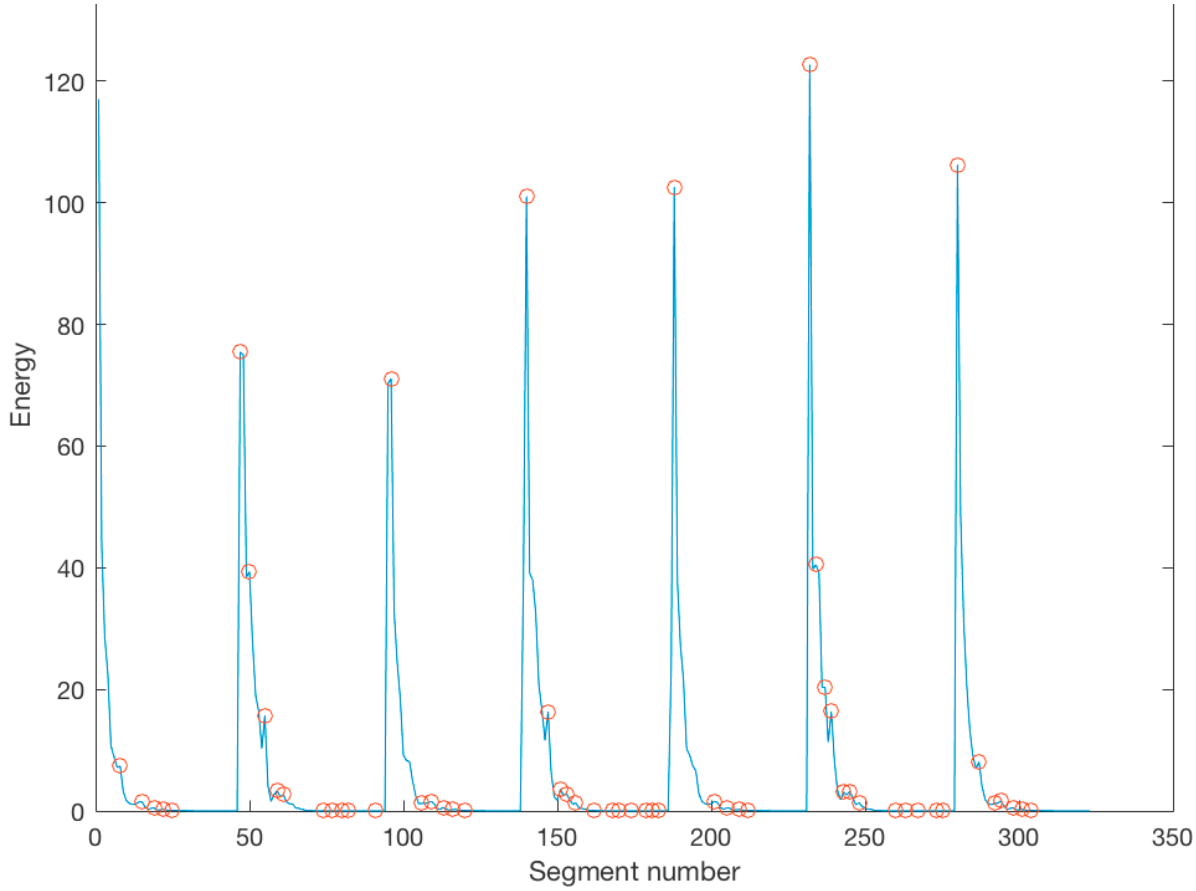
Exercise 4 - Solution

Implementing the solution to the exercise indicated that the process of segmenting and find the energy was done incorrectly the first time.

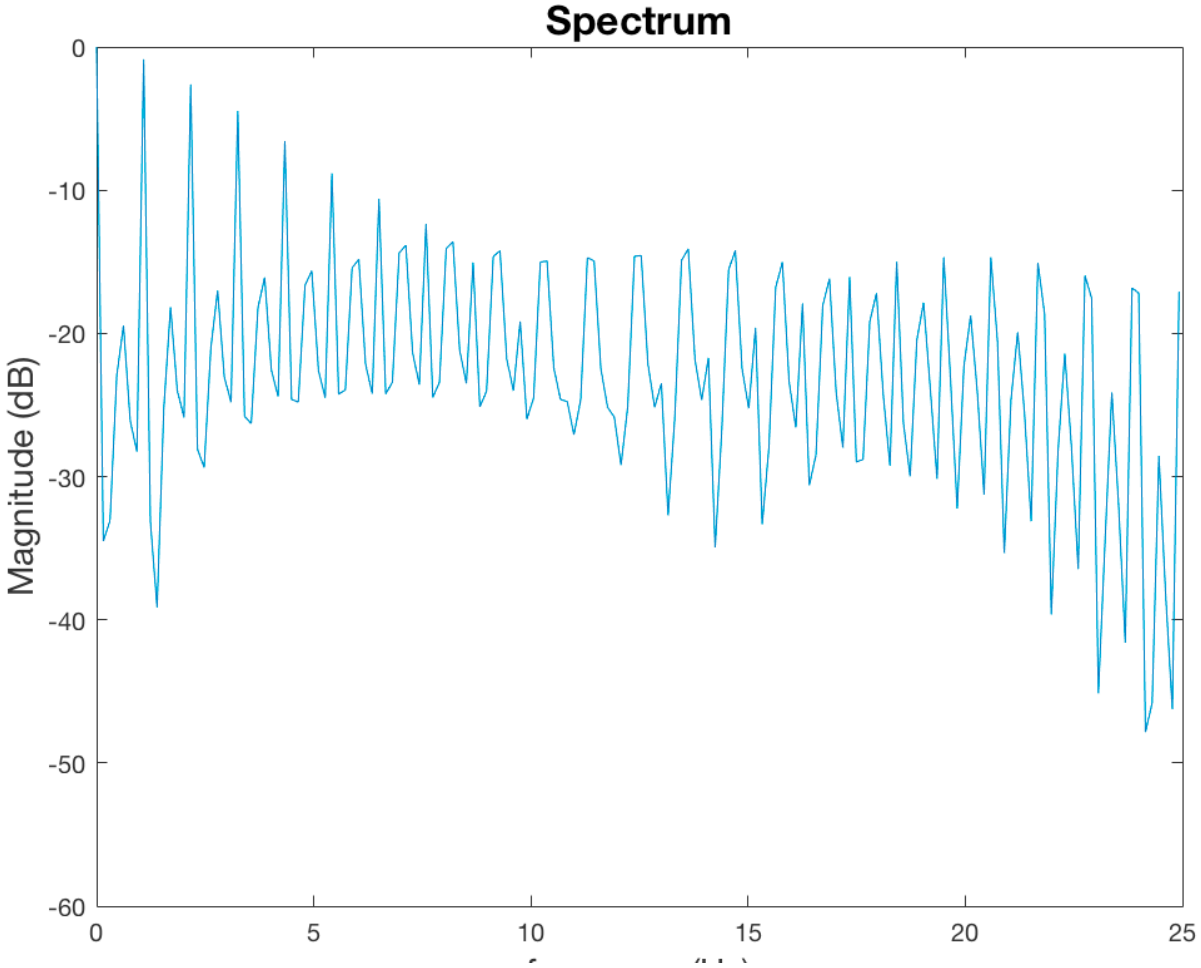
```
% Divide signal into segments and find energy
T = 0.02;
N = fs*T;
E = [];

for i = 1:N:length(sig)-N+1
    seg = sig(i:i+N-1);
    E = [E seg'*seg];
end
```

This shows the correct process for finding the segments and consequent energy. The energy graph should have appeared as follows:





The frequency domain spectrum should have appeared as follows:



Despite this the code for using subplots in MATLAB could be used to update previous versions of the exercise 2 and 3. This allows for viewing of updating graphs simultaneously.