

**Faculty of Engineering and Technology**

**Electrical and Computer Engineering Department**

***COMMUNICATION SYSTEMS, ENEE339***

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Project #1

In this project you need to write a python or Matlab script (or Simulink) that does the following:

1- Read an audio signal from an audio file (.wav format),

2- Plot the audio signal in the time domain,

3- Determine the Energy of the audio signal,

4- Determine and plot the frequency spectrum of the audio signal,

5- Determine the X% Energy Bandwidth of the audio signal,

6- Apply the audio signal to a Low Pass Filter (LPF). The bandwidth of the LPF is the X% Energy Bandwidth of 5.

7- Determine and plot the filtered audio signal in the time domain,

8- Write the filtered audio signal to an audio file (.wav format),

After executing the above script, try to play the filtered audio signal using any player in windows/Linux. Is there a difference between the original audio signal and the filtered one?

You may work in a group of at most three students. Write a three pages report to present and discuss your results. Submission due date is on the 13th of April, 2019. Discussion date will be announced later.

The table below includes some X% Energy Bandwidth values for different audio files (attached to this memo). You may use these values to validate your code.

**Table 1: X% Energy Bandwidth for different audio files**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **X%** | **Summer.wav (KHz)** | **Counting.wav**  **(KHz)** | **Athan1.wav**  **(KHz)** | **SunnyDay.wav (KHz)** |
| 95% | 2.345 | 1.556 | 1.5 | 6.5 |
| 90% | 2.008 | 1.089 | 1.461 | 3.81 |
| 85% | 1.777 | 0.721 | 1.445 | 0.266 |
| 80% | 1.593 | 0.613 | 1.206 | 0.088 |
| 75% | 1.584 | 0.523 | 1.149 | 0.059 |
| 70% | 1.579 | 0.485 | 1.037 | 0.029 |
| 60% | 1.555 | 0.411 | 0.892 | 0.016 |
| 50% | 1.519 | 0.34 | 0.867 | 0.014 |
| 40% | 1.408 | 0.214 | 0.778 | 0.012 |