

3rd Year



Computer and Systems Engineering Department

CSE 324 - Computer Integrated Circuits

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Audio compression 2 methods using MATLAB.

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Audio compression 2 methods (DCT & FFT) using MATLAB.

Compression techniques:

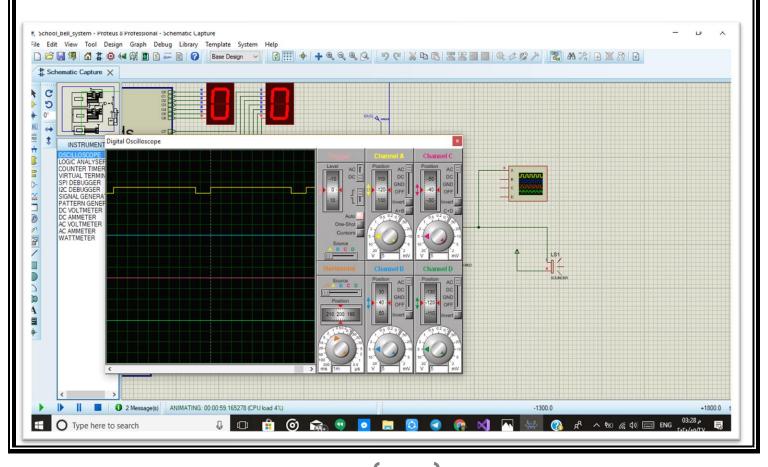
we have three main techniques to compress:

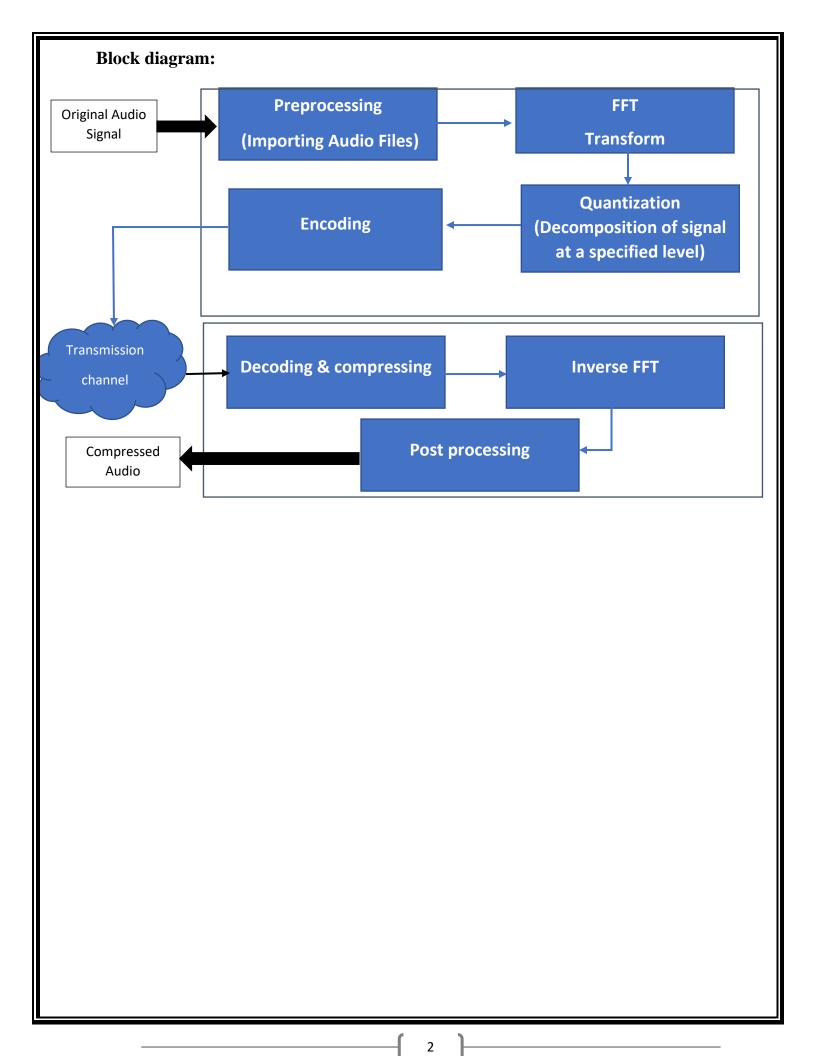
- 1- Fast Fourier Transform (FFT)
- 2- Discrete Cosine Transform (DCT)
- 3- Wavelet Transform (WT)

In this project I used 2 methods (FFT & DCT) to compress an audio signal I have recorded with my voice in 10 seconds as required

1- In (FFT) method I used FFT to convert the signal from time domain to frequency domain It is because an operation that is hard to perform in time-domain may be very simple in frequency domain.

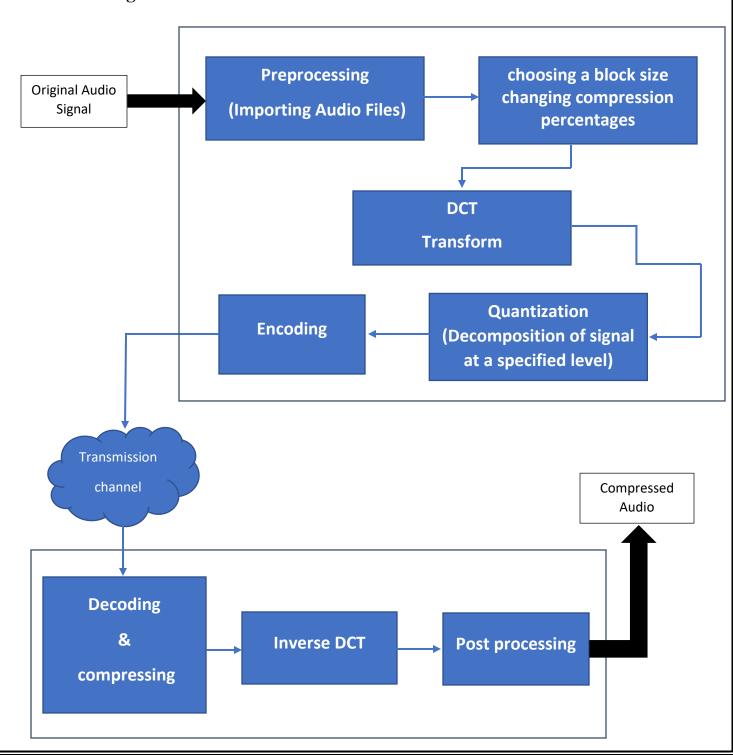
In frequency domain we can easily get rid of some undesired frequencies (noise) and compress the audio signal.

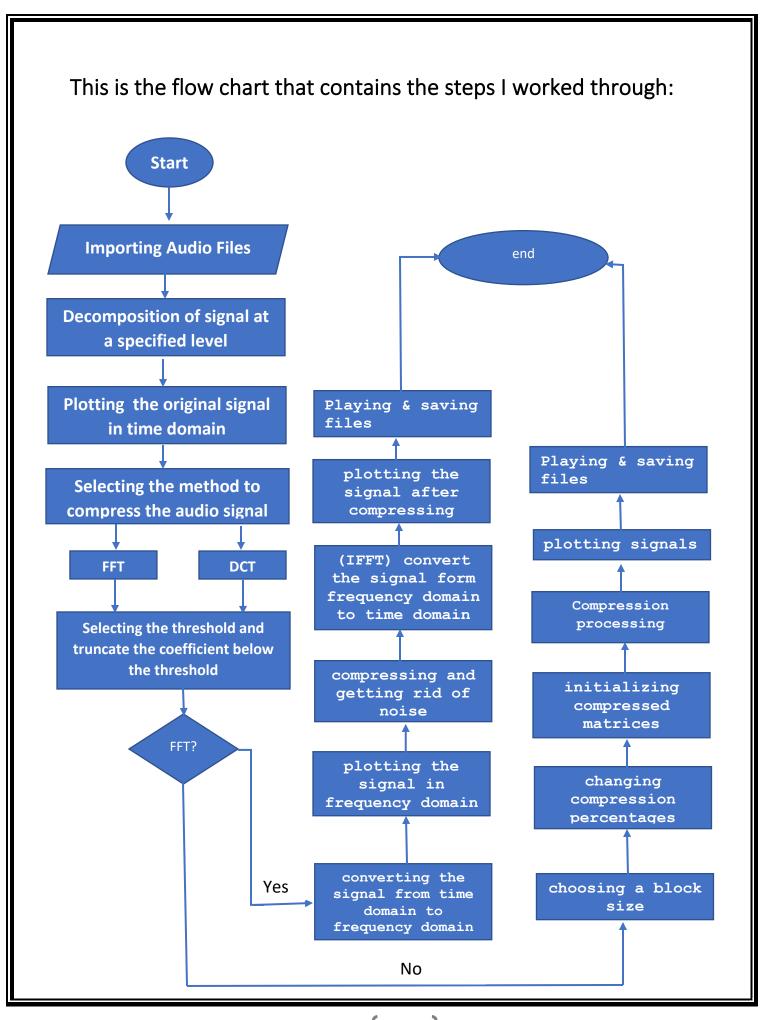


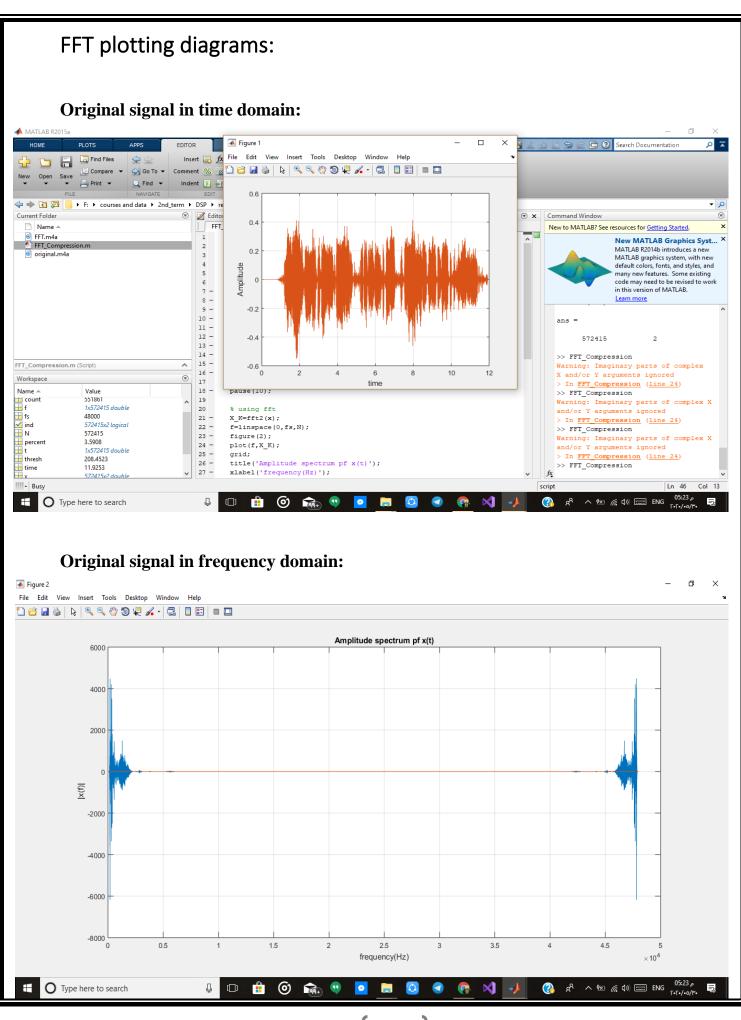


(DCT) method: At present, DCT is widely used transforms in image and video compression algorithms. Its popularity is due mainly to the fact that it achieves a good data compaction; because it concentrates the information content in a relatively few transform coefficients.

Block diagram:





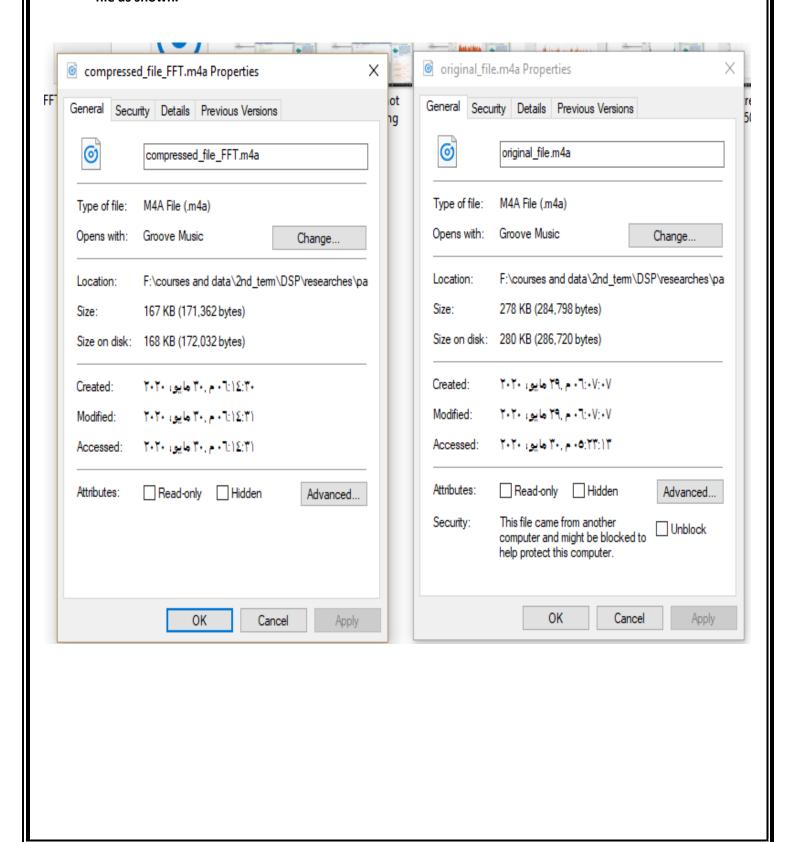


Signal after compression in time domain: ♠ MATLAB R2015a Figure 3 🔁 🔇 Search Documentation PLOTS EDITOR HOME 20 File Edit View Insert Tools Desktop Window Help Find Files Insert 🛃 fx ☐ Compare ▼ 🖟 | 🔍 🥄 🤚 🗑 🐙 🔏 - | 🛃 | 🔲 🔡 | 🎟 🛄 Go To ▼ Comment % Open Save Find Indent 📱 🌡 0.4 **▼** 0 0.3 • Current Folder **Z** Editor Command Window FFT Name ▲ Х New to MATLAB? See resources for Getting Started. 0.2 FFT.m4a New MATLAB Graphics Syst... X FFT_Compression.m 2 0.1 MATLAB R2014b introduces a new original.m4a 3 MATLAB graphics system, with new 0 -0.1 -0.2 default colors, fonts, and styles, and many new features. Some existing code may need to be revised to work 6 in this version of MATLAB. 7 -Learn more 8 -9 -572415 -0.3 10 -11 ->> FFT Compression -0.4 12 -Warning: Imaginary parts of complex 13 -X and/or Y arguments ignored -0.5 14 -> In FFT Compression (line 24) 15 -FFT_Compression.m (Script) ٨ -0.6 >> FFT_Compression 16 -12 Warning: Imaginary parts of complex X $\overline{\mathbb{V}}$ Workspace 17 time and/or Y arguments ignored Name A 18 pause(IU); Value > In FFT Compression (line 24) iii count 551861 19 >> FFT_Compression 1x572415 double ⊞ f 20 % using fft Warning: Imaginary parts of complex X fs 48000 21 -X K=fft2(x); and/or Y arguments ignored 572415x2 logical ✓ ind 22 f=linspace(0,fs,N); > In FFT_Compression (line 24) ₩ N 572415 23 figure(2); >> FFT_Compression 3.5908 percent 24 plot(f, X_K); Warning: Imaginary parts of complex X 1x572415 double 25 grid; and/or Y arguments ignored 208.4523 H thresh 26 title('Amplitude spectrum pf x(t)'); > In FFT Compression (line 24) 👑 time 11,9253 27 xlabel('frequency(Hz)'); fx >> 572415x2 double Шх ||||4 script Ln 46 Col 13 م 05:23 g^Q ∧ № (€ Φ) 📰 ENG Type here to search

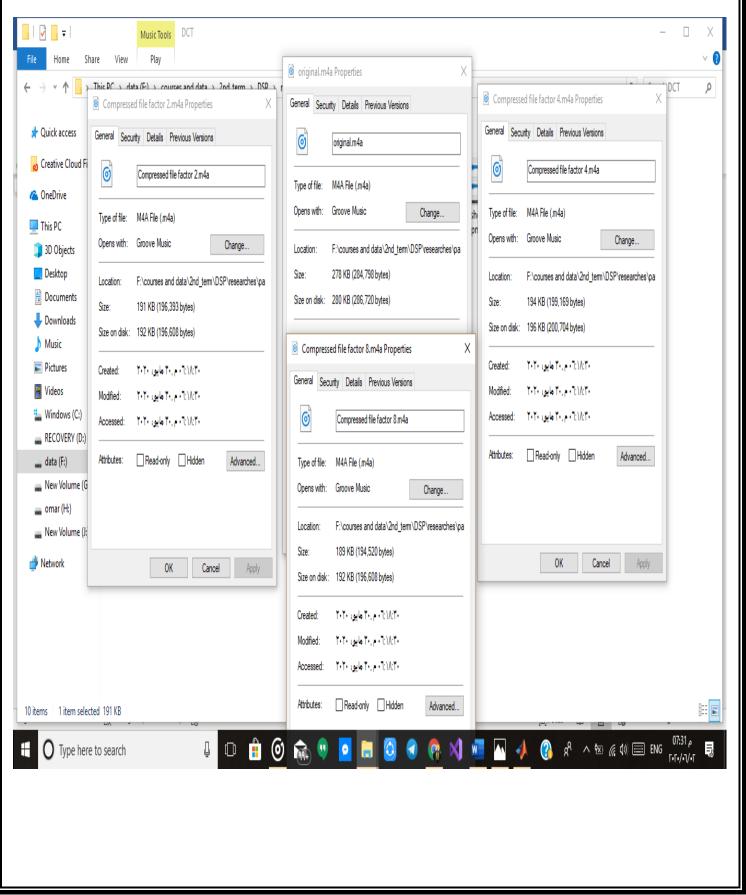
DCT plotting Diagrams: Original signal and compressed gingal with factor2: Figure 1 🖺 🐸 📓 🦫 | 🗞 | 🤏 🤏 🖑 🐿 🐙 🔏 - | 🗟 | 🔲 🔡 | 📟 🛄 -0.2 -0.4 -0.5 Type here to search Compressed signals with factor 4 & 8: Figure 2 File Edit View Insert Tools Desktop Window Help -0.5 0.5 -0.5 O Type here to search

Comparison between FFT & DCT:

In FFT method the code was fairly easy and simple, and I was able to change the frequencies as I want and I was able to reduce some of the noise but not all, and I was able to reduce the size of the original file as shown.



In DCT method the code needed to make matrices and was fairly complicated and I couldn't reduce the noise, but the advantage of the DCT method that I can easily compress the audio signal with any factors (2, 4, 8) and reduce the original audio file's size with different factors as shown.



References and links:
1- Udemy - Digital Signal Processing (DSP) From Ground Up™ with MATLAB 2018-10 course. https://bit.ly/2XqJ2jd
2- https://bit.ly/3eH95sk
3- Some tutorials videos on you tube helped me