CM2208

Scientific Computing

MATLAB Graphic Equalizer

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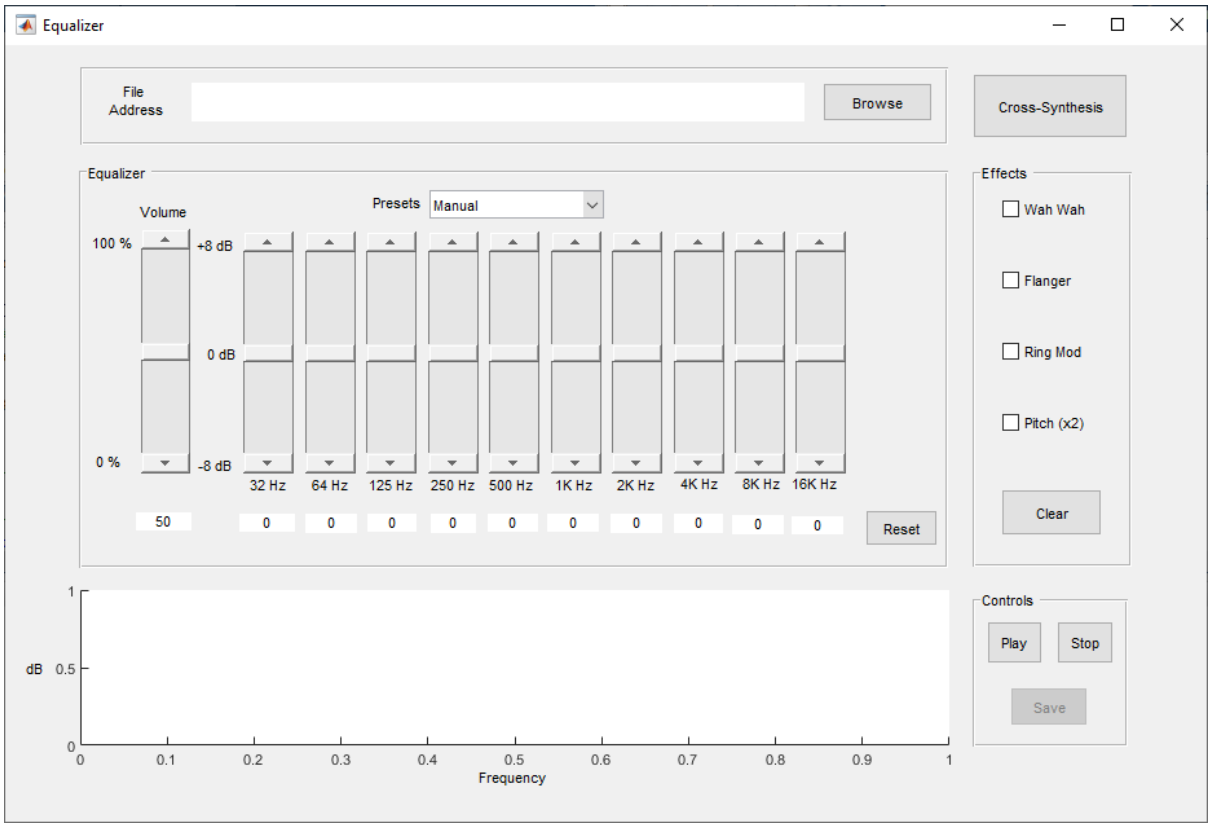
Hours Spent: 35

Overview

I have created a Graphic Equalizer using GUIDE in MATLAB including various UI elements such as buttons, sliders, static texts, combo boxes, drop-down list and axes. It implements the functionality of common equalizers as the user has the ability to change the gain in different frequency points, adjust the volume, select among several presets or use the cross synthesizer. Additionally, there are a handful of effects that can be added to the selected sound file that can loaded by the user using the Browse button.

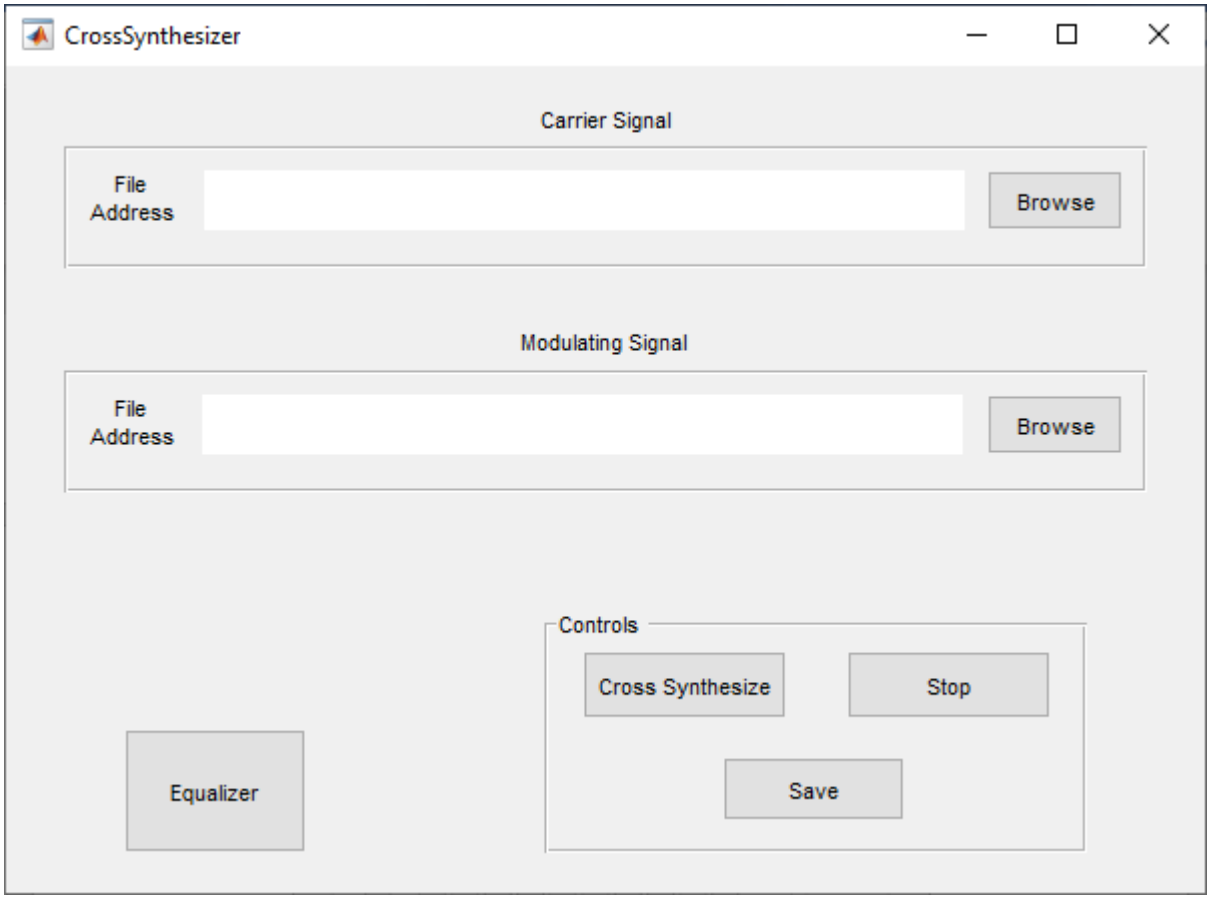
You may use the equalizer to Play the sound adjusted to the bands/effects, Stop the sound from playing or even save the sound to a new file using the implemented adjustments.

In every iteration of loading up or playing the sound file the axes will be updated to a x-y logarithmic representation of the sound that will be played.



Furthermore, I have added the feature of Cross Synthesizing sounds by applying spectral envelope on both of the sounds and processing them together to create a cross-synthesized sound.

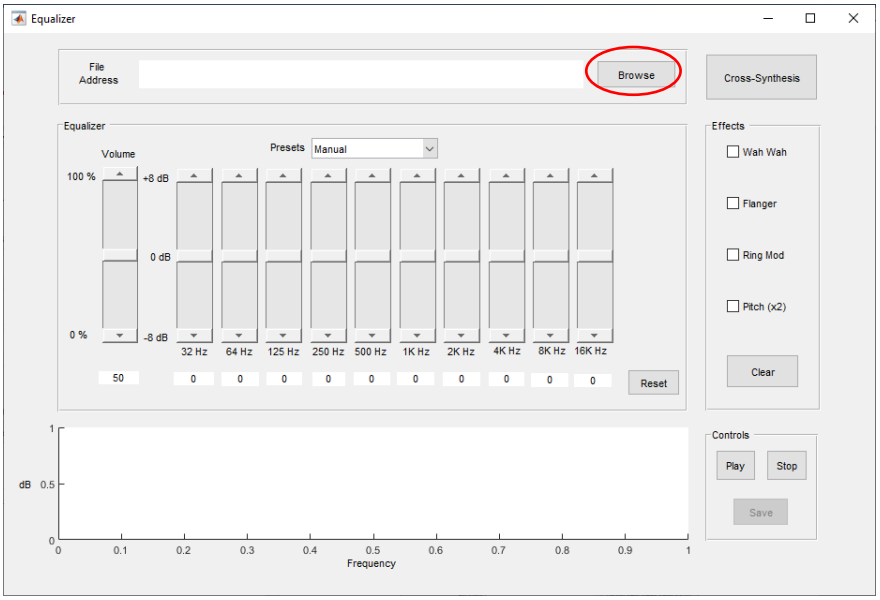
The window itself provides the user with the controls of Cross-Synthesizing/Playing the sound or Stopping the sound. They also have the option to save the synthesized sound or even go back to the Equalizer screen.

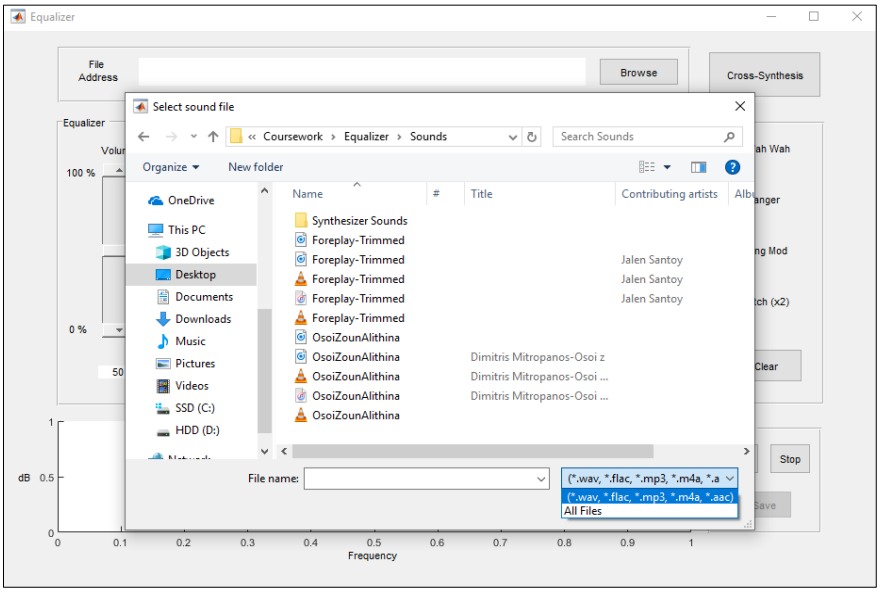


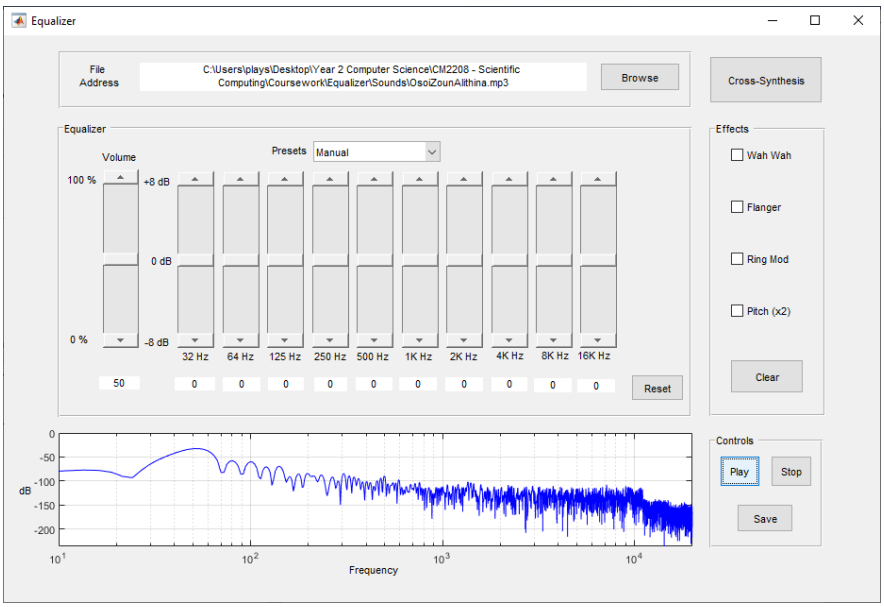
Basic Requirements

Loading audio files

The user is able to select the Browse button where a new window will pop up for them to select a sound file with common extensions such as wav, flac, MP3, MPEG-4, and AAC. All of these extensions are grouped as 1 choice to help the user see all of the extensions in the same folder instead of seeing only the currently chosen. If they click and open a sound file, the sound is processed and shown on a x-y logarithmic graph with frequencies from 0 to 20000 Hz and the gain in dB. On the other hand, if they click cancel a message that the action has been canceled is displayed on the console and no sound file is processed.

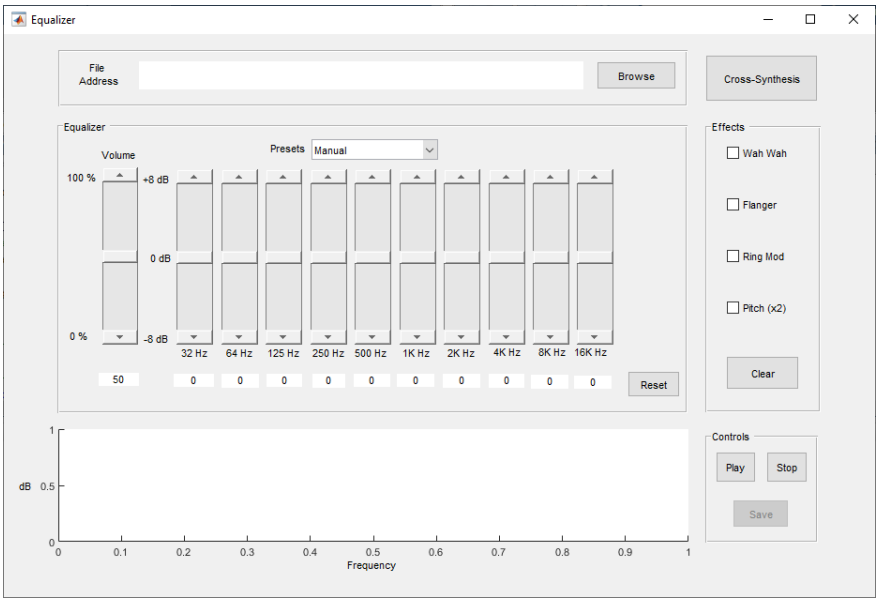

Equalizer
File Address
Browse
Cross-Synthesis
Equalizer
Volume
Presets
Manual
100 %
0 %
+8 dB
0 dB
-8 dB
32 Hz
64 Hz
125 Hz
250 Hz
500 Hz
1K Hz
2K Hz
4K Hz
8K Hz
16K Hz
50
Reset
Effects
Wah Wah
Flanger
Ring Mod
Pitch (x2)
Clear
Controls
Play
Stop
Save
dB
Frequency

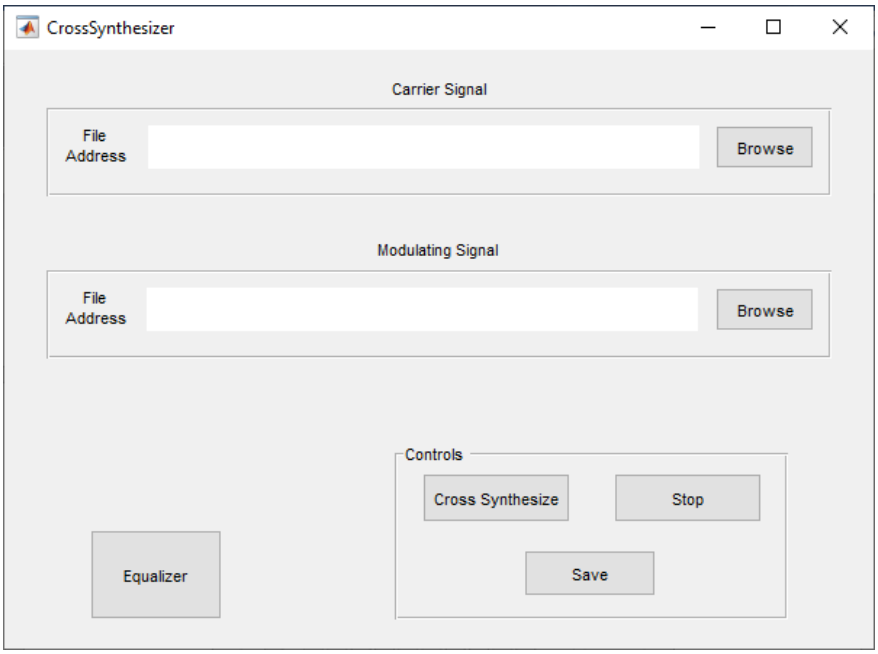

Equalizer
File Address
Browse
Cross-Synthesis
Select sound file
Coursework › Equalizer › Sounds
Search Sounds
Organize
New folder
OneDrive
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
SSD (C:)
HDD (D:)
Name
#
Title
Contributing artists
Synthesizer Sounds
Foreplay-Trimmed
Jalen Santoy
OsoiZounAlithina
Dimitris Mitropanos-Osoi z
Dimitris Mitropanos-Osoi ...
File name:
(*.wav, *.flac, *.mp3, *.m4a, *.aac)
All Files
Stop
Frequency


Equalizer
File Address
C:\Users\plays\Desktop\Year 2 Computer Science\CM2208 - Scientific Computing\Coursework\Equalizer\Sounds\OsoiZounAlithina.mp3
Browse
Cross-Synthesis
Equalizer
Volume
Presets
Manual
100 %
0 %
+8 dB
0 dB
-8 dB
32 Hz
64 Hz
125 Hz
250 Hz
500 Hz
1K Hz
2K Hz
4K Hz
8K Hz
16K Hz
50
Reset
Effects
Wah Wah
Flanger
Ring Mod
Pitch (x2)
Clear
Controls
Play
Stop
Save
dB
Frequency

Developing Appropriate GUI

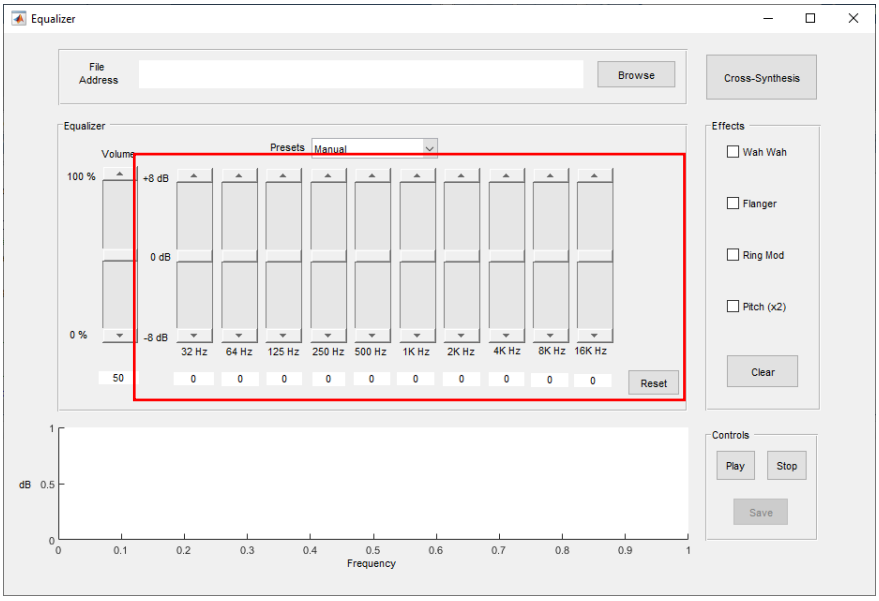
As also said in the Overview this GUI was created using the GUIDE functionalities in MATLAB to create an appropriate and functional Equalizer that is intuitive to use. It uses simple UI elements that can be interacted to access the functionalities of this application. It provides the ability for the user to change imported sound files using equalization filters, to view the sound file on a graph and Play it using the additional controls.





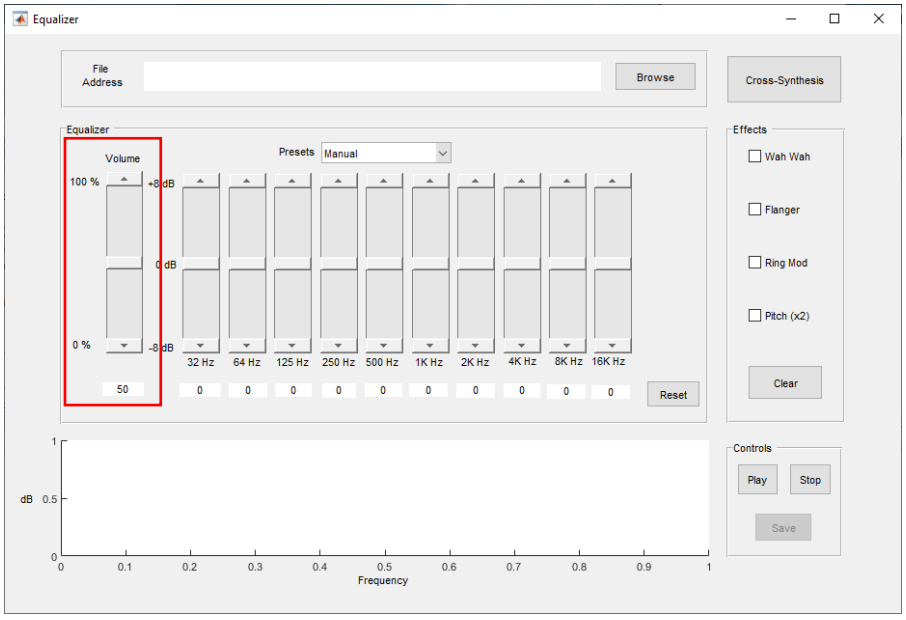
Basic Multi-band Graphic Equalizer

I have used a 10 band Graphic Equalizer on different frequencies ranging from 32Hz up to 16000Hz where the user has to option of changing the gain on those specific frequencies from -8 up to 8 dB. For the 1st band I have used a low shelving filter, for the 2nd to the 9th I have used a peak filter and for the 10th I have used a high shelving filter. These filters used will give the best equalization possibilities for filtering the sound in the lows, mids and highs.



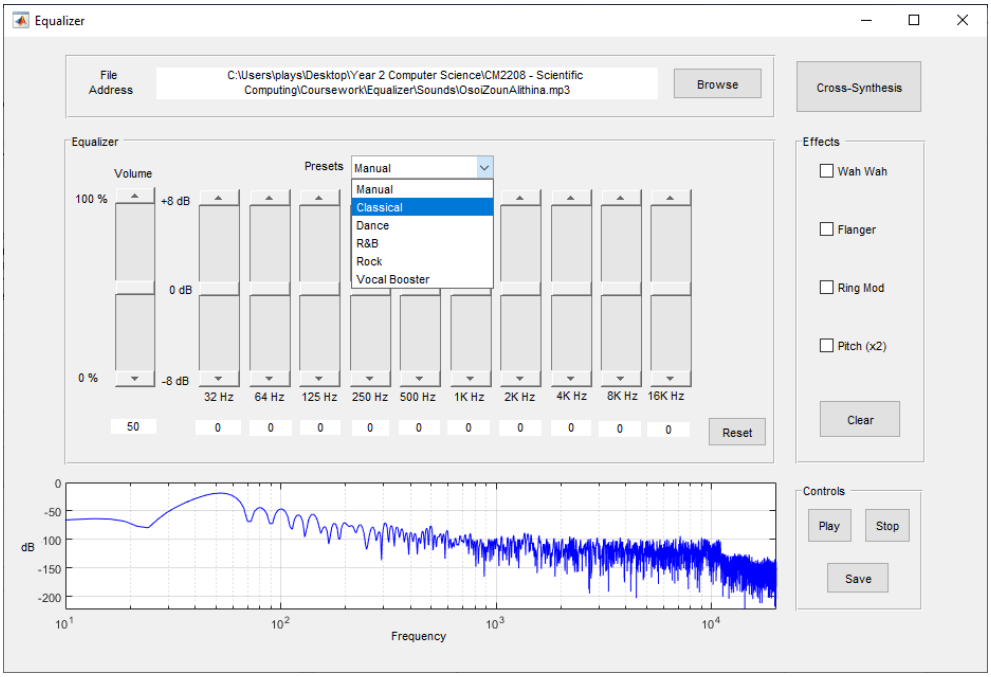
Volume Control

Volume control can be adjusted from the user to change the loudness of the sound file played. It is preset to 50% and can be changed using the slider. The value is shown on a static text box below the slider.



Presets

Several presets are found in the Equalizer and can be recalled and change the sliders to the appropriate values. The user has the option to select amongst Classical, Dance, R&B, Rock, Vocal Booster but also manually change the bands to their likings. For every band change the corresponding values are correctly presented below the bands to assist the user.

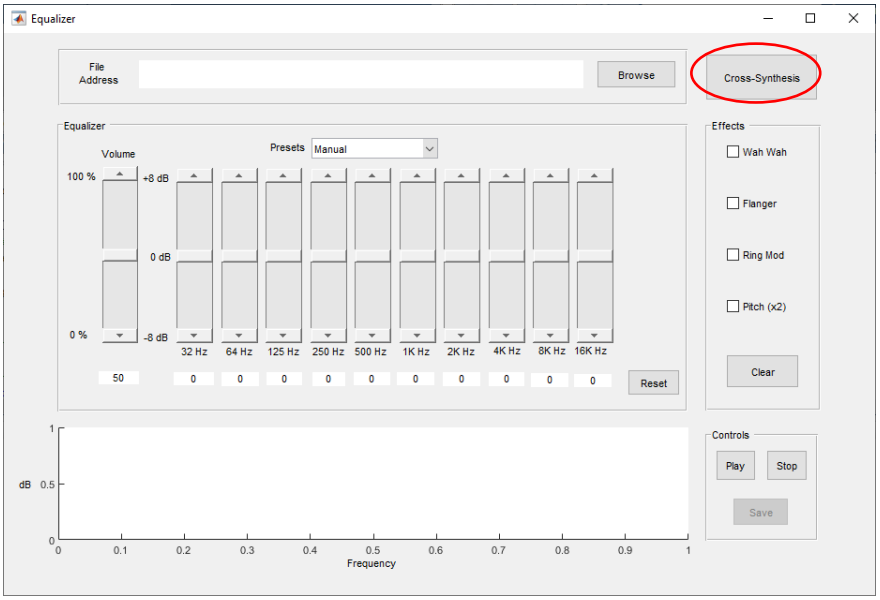


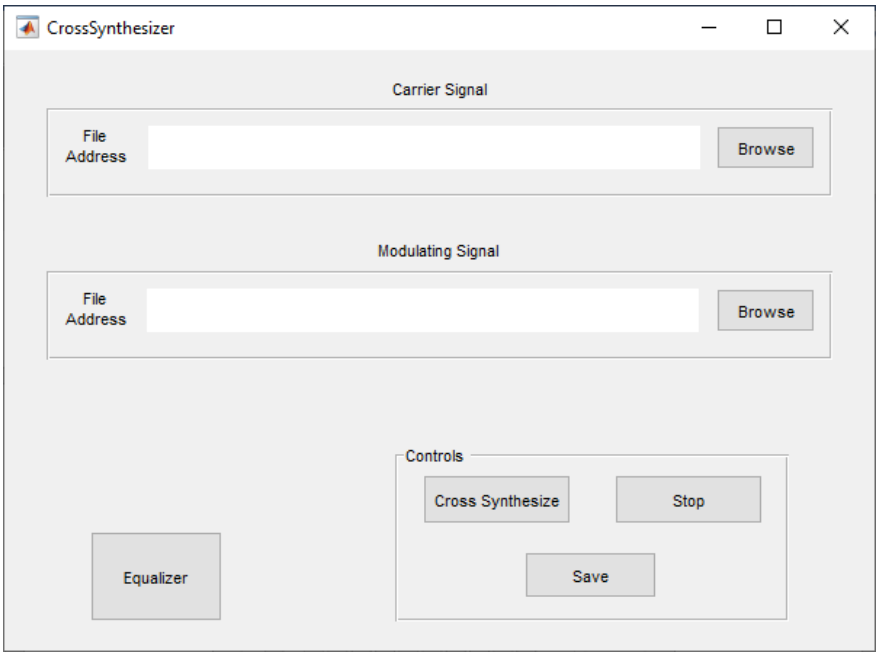
Cross Synthesis

Cross synthesis can be used by changing the active window using the Cross-Synthesis button. This opens a new window with the functionality of combining 2 sound for cross synthesis. This window contains 2 spots where the user can load the 2 sounds. One would be the carrier signal and the other would be the modulating signal. It extracts the spectral envelope of both of the signals and then cross-synthesizes them.

In this window the user is again able to Play and Stop the sound by using the appropriate controls, Save the sound to their extension of choice (wav, flac, MPEG-4) and also go back to the Equalizer Window.

Recommendation: I will attach an additional folder inside the Sounds folder called “Synthesizer Sounds” with some files that are best to use in the CrossSynthesizer to test its functionality. The problem is that several other sound files give an Interpolation Error because the findpeaks() function in the “specenv.m” file gives a 0 results. After loading and testing to find the difference amongst the working and non-working sound files I have still not came up with a conclusion since they are similar in both data types and data ranges for y leaving me with nothing to find the arising problem.

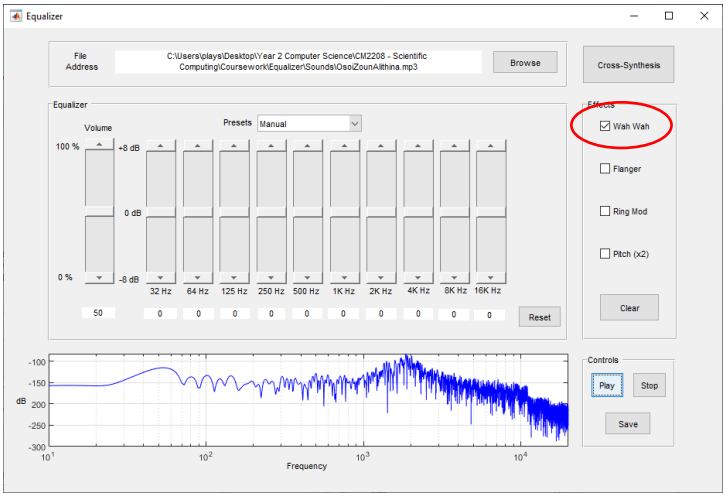




Novel Features

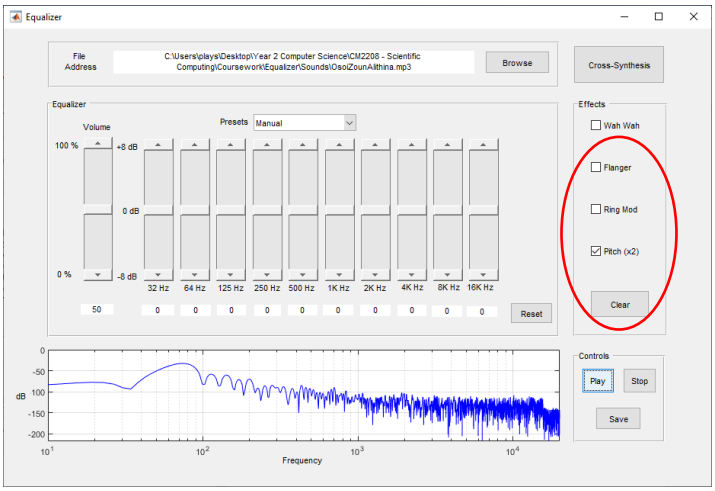
Wah-wah

While a sound file is loaded an effect called “wah-wah” can be added to the sound. This effect alters the tone and the frequencies of the sound by using a damping factor with specific minimum and maximum cutoff frequencies as well as the wah frequency with would specify how many Hz per seconds are cycled through to form the sound.



Filter Effects

Another additional feature that I have added in the Graphical Equalizer is the use of other several effects. These effects added to the sound file to change the way it sounds and bring more variety for the user to customize the sound outcome. I have added a Flanger effect, a Ring modulation effect and a Pitch effect which it will double the pitch making it sound double as High and decrease the time of the sound file in half. These effects can be added to the sound by using the effects panel on the side clicking the relevant checkbox. Then once the sound is played the sound with the effect will be displayed.



Saving

An extra feature that I have added on both windows Equalizer and CrossSynthesizer give the user the option to Save the sound file they have adjusted to their likings using the various bands, volume and effects as well as the cross synthesized file.

In the Equalizer window the Save functionality is disable until they have loaded a sound file to the window. Then they have the option to save the sound with the adjusted settings in different extensions (wav, flac, MPEG-4).

In the CrossSynthesizer window the Save functionality can be pressed but if either place for the sound files have nothing loaded a message to the console will be displayed.