MATLAB – PROJECT Upload Date: 2020/12/27

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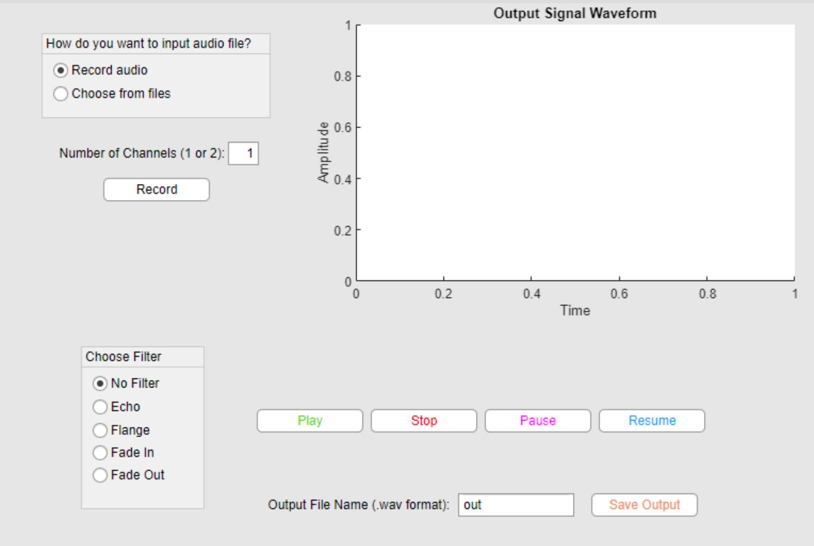
Audacity

This app is used for recording and editing audio based on your selected filters and while working, you can see how your audio waves have changed while listening to the output. At the end, you can also save your final edited audio.



How do you want to input audio file?
● Record audio
○ Choose from files

Number of Channels (1 or 2): 1

Choose Filter
● No Filter
○ Echo
○ Flange
○ Fade In
○ Fade Out

Output File Name (.wav format): out

- To see the code we need to enter "edit audacity.mlapp" in the command window.

First, we have some global variables that we use in different callback functions:

```
hasInput = false;

Fs = 44100;

noc=1;  %number of input channels

nob=16; %number of bits per sample

recObj; % your recording

myRecording; %recorded audio as an array

player; %audio player object

output; %output audio file
```

Monophonic & Stereo

Also, you can choose whether your input audio is a monophonic audio (having one channel) or stereo (having two channels).

Record

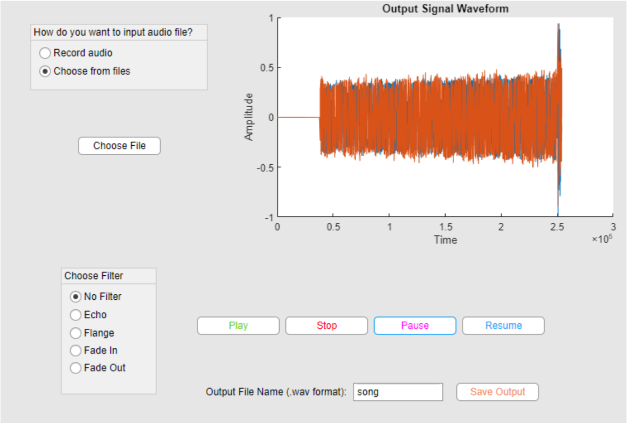
If user chooses recording, after they pressed the record button, stop recording button will appear: (example screenshot shown in filters)

```
value = app.RecordButton.Value;
app.hasInput = true;
app.noc = app.NumberofChannelsEditField.Value;
if value == 1
      app.RecordButton.Text = 'Stop Recording';
      app.recObj = audiorecorder(app.Fs,app.nob,app.noc);
      record(app.recObj);
else
      app.RecordButton.Text = 'Record';
      stop(app.recObj);
      app.myRecording = getaudiodata(app.recObj);
end
```

Choose audio

If user chooses “choose from files” option, the record button will disappear and then they can choose their desired file from their computer:

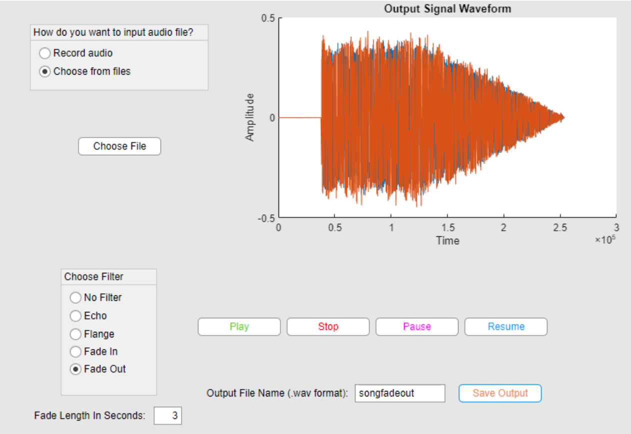
```
[filename, pathname] = uigetfile('.','Choose an audio file');
fullpathname = strcat(pathname, filename);
[app.myRecording,fs] = audioread(num2str(fullpathname));
app.Fs = fs;
```



How do you want to input audio file?
○ Record audio
● Choose from files

Choose Filter
● No Filter
○ Echo
○ Flange
○ Fade In
○ Fade Out

Output File Name (.wav format): song



How do you want to input audio file?
○ Record audio
● Choose from files

Choose Filter
○ No Filter
○ Echo
○ Flange
○ Fade In
● Fade Out

Output File Name (.wav format): songfadeout

Fade Length In Seconds: 3

Play Stop Pause Resume

```
stop(app.player);
pause(app.player);
resume(app.player);
```

And when the ‘play’ button is pressed, based on selected filter, it will start playing.

Filters

We have a ‘choose filter’ box that has 5 options:

1) No filter

2)Echo

3)Flange

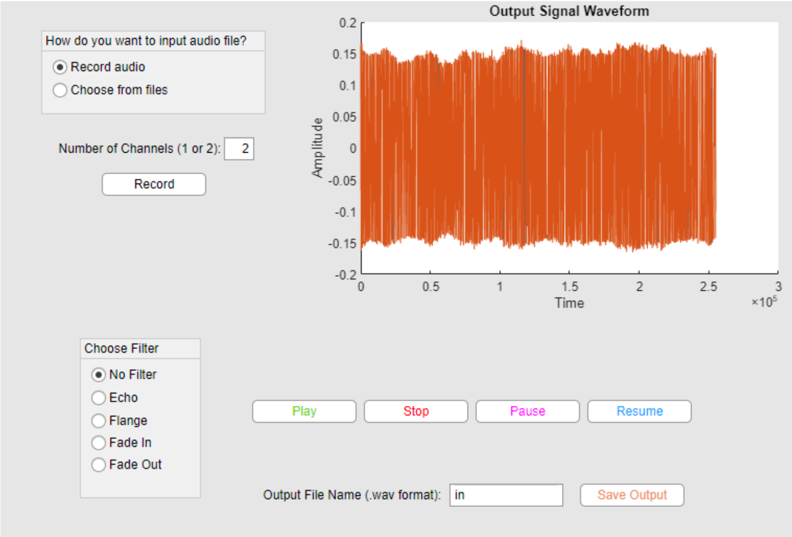
4)Fade In

5)Fade out

No Filter

You can use this option when you want to see waves of your recorded audio or selected audio. Also you can play it, resume or stop playing the audio.

```
if app.NoFilterButton.Value == true
        plot(app.UIAxes,app.myRecording);
        app.player = audioplayer(app.myRecording,app.Fs);
```



How do you want to input audio file?

● Record audio

○ Choose from files

Number of Channels (1 or 2): 2

Choose Filter

● No Filter

○ Echo

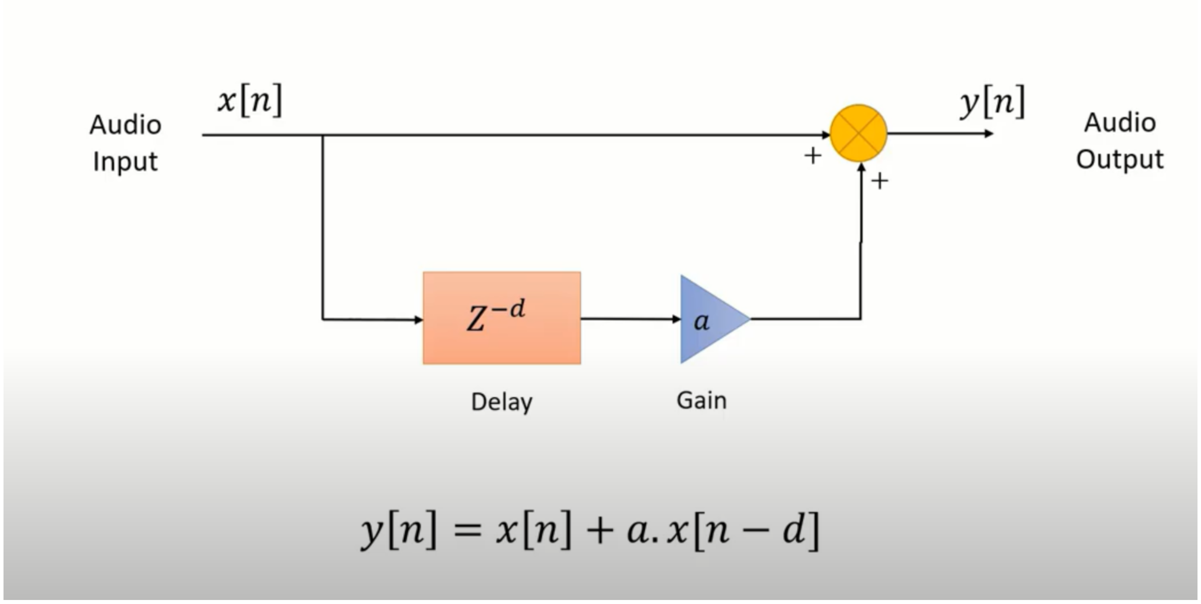
○ Flange

○ Fade In

○ Fade Out

Output File Name (.wav format): in

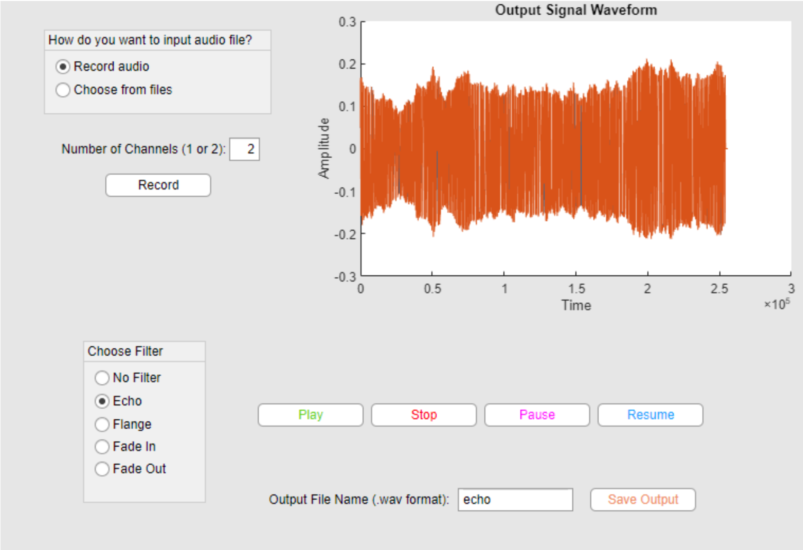
ECHO



$$y[n] = x[n] + a.x[n-d]$$

For this filter, we need two parameters for gain and delay. Based on these, we make the second audio with delay ‘d’, by attenuation factor ‘a’, then we add this second audio to main audio to get the final audio.

```
elseif app.EchoButton.Value == true
      x = app.myRecording;
      n = length(app.myRecording); %Get the length of the music file
      a = 0.5; %Attenuation factor
      d = 800; %delay
      y = zeros(n+d,1); %initialize the output music signal
      xn = padarray(x,[d,0],0,'pre');
      for i = (d+1):1:n
            y(i-d,1) = x(i,1) + a*xn(i-d);
            if app.noc == 2
                  y(i-d,2) = x(i,2) + a*xn(i-d);
            end
      end
      plot(app.UIAxes,y);
      app.player = audioplayer(y,app.Fs);
```



How do you want to input audio file?

● Record audio
○ Choose from files

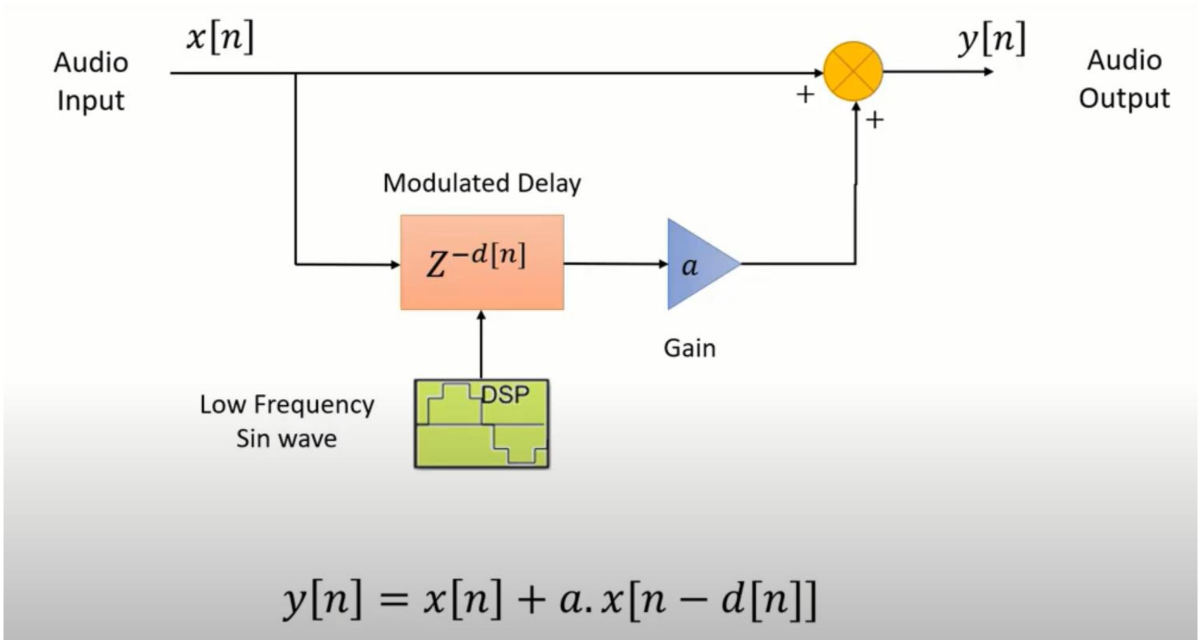
Number of Channels (1 or 2): 2

Choose Filter

○ No Filter
● Echo
○ Flange
○ Fade In
○ Fade Out

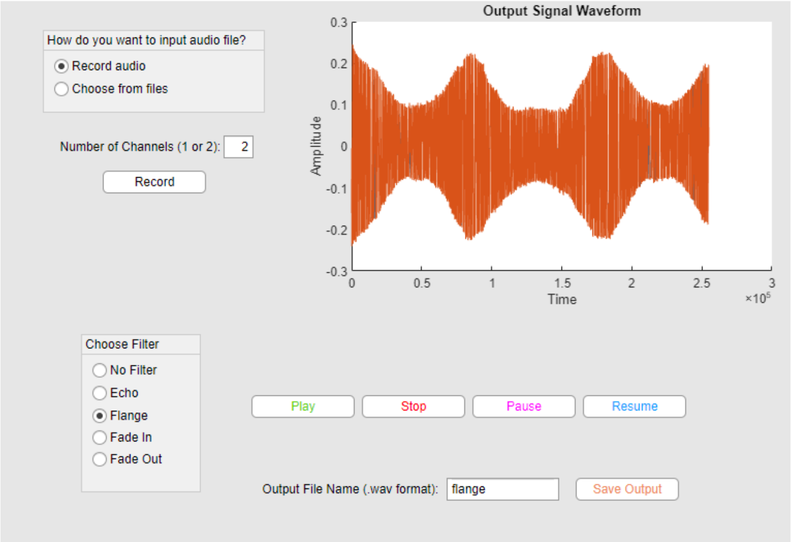
Output File Name (.wav format): echo

Flange



Flange effect is almost the same as the echo effect. The only difference is that the delay in echo was constant, but here in Flange effect, the delay is created using a low frequency sin wave. This means that delay in a period of time increases then it decreases just like a sin wave.

```
elseif app.FlangeButton.Value == true
      x = app.myRecording;
      n = length(x); %get the length of the music file
      tn = n/app.Fs;
      f = 0.25; %Frequency of sin wave in Hz
      t = linspace(0,tn,n);
      d = 100; %delay factor
      modsin = sin(2*pi*f*t);
      modsin1 = round(d*modsin')+d; %variable delay
      y = zeros(n+d,1); %initialize the output music
      a = 0.5; %attenuation factor
      xn = padarray(x,[d,0],0,'pre');
      for i = (d+1):1:n
            y(i-d,1) = x(i,1) + a*xn(i-modsin1(i-d));
            if app.noc == 2
                  y(i-d,2) = x(i,2) + a*xn(i-modsin1(i-d));
            end
      end
      plot(app.UIAxes,y);
      app.player = audioplayer(y,app.Fs);
```



How do you want to input audio file?

● Record audio

○ Choose from files

Number of Channels (1 or 2): 2

Choose Filter

○ No Filter

○ Echo

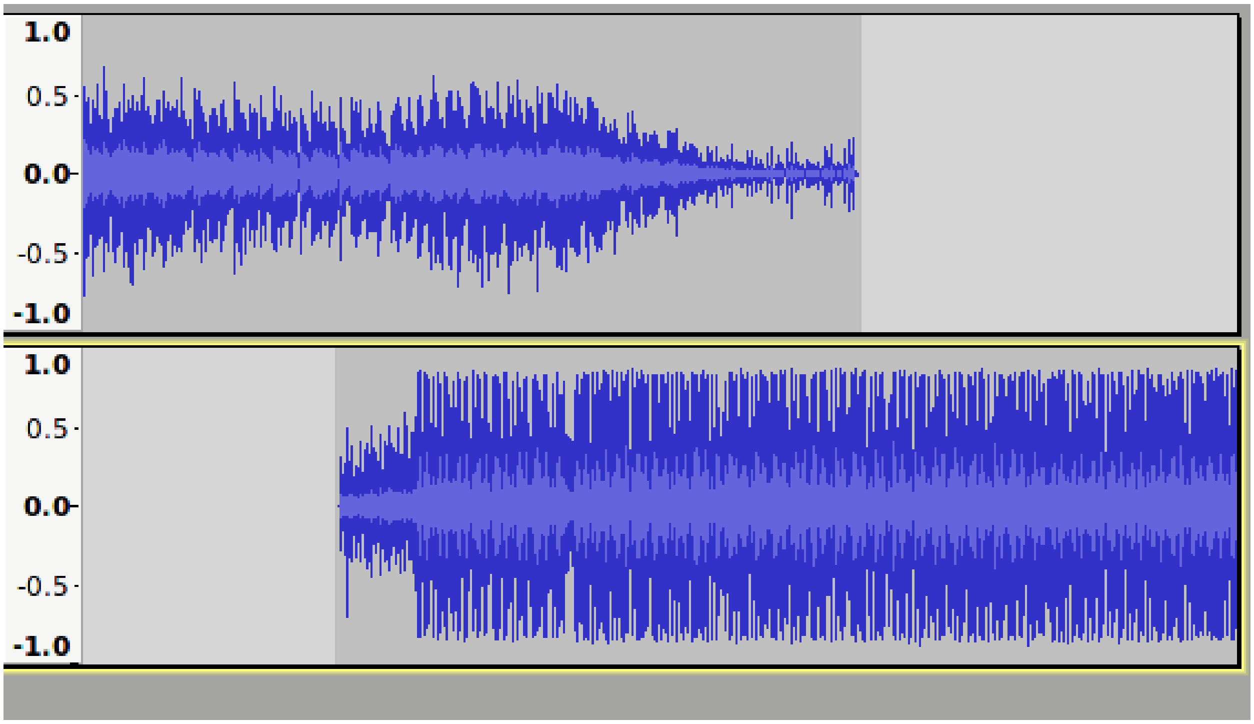
● Flange

○ Fade In

○ Fade Out

Output File Name (.wav format): flange

Fade In & Fade Out

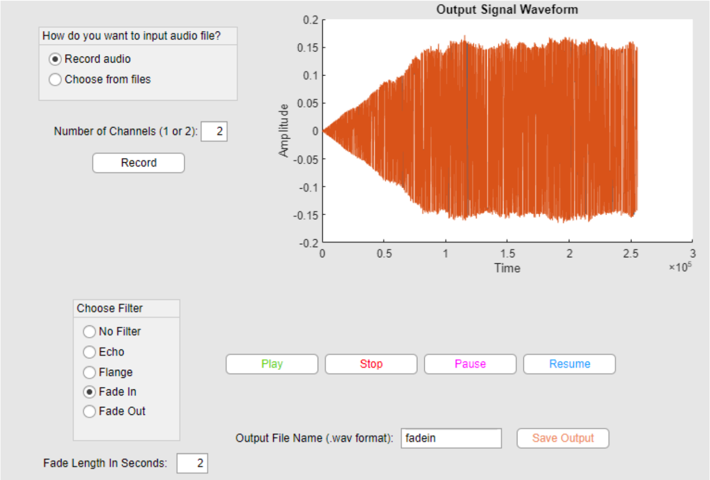


When you choose these filters, a text field will appear that asks you how many seconds you want your audio to be faded in or out. Fade in works on the given first seconds of your audio and fade out works on the given last seconds.

Here we have a vector called linFade (linFadeIn & linFadeOut). This is a vector of numbers in the range of [0,1] for fade in and [1,0] for fade out. The difference between these numbers is based on fade time the user specified since the numbers increase (for fade in) or decrease (for fade out) using fadeTime*Fs.

Finally, we multiply this vector by the main audio to get the faded audio.

```
elseif app.FadeInButton.Value == true
        fadeTime = app.FadeLengthInSecondsEditField.Value;
        linFadeIn = linspace(0,1,app.Fs*fadeTime);
        linFadeIn = linFadeIn(:);
        y = app.myRecording;
        for sample = 1:length(linFadeIn)
                y(sample,1) = app.myRecording(sample,1) * linFadeIn(sample,1);
                if app.noc == 2
                        y(sample,2) = app.myRecording(sample,2) * linFadeIn(sample,1);
                end
        end
        plot(app.UIAxes,y);
        app.player = audioplayer(y,app.Fs);
elseif app.FadeOutButton.Value == true
        y = app.myRecording;
        n = length(y);
        fadeTime = app.FadeLengthInSecondsEditField.Value;
        linFadeOut = linspace(1,0,app.Fs*fadeTime);
        linFadeOut = linFadeOut(:);
        for sample = 1:length(linFadeOut)
                y(n - fadeTime*app.Fs + sample,1) =
        app.myRecording(n - fadeTime*app.Fs + sample,1)*linFadeOut(sample,1);
                if app.noc == 2
                 y(n - fadeTime*app.Fs + sample,2) =
        app.myRecording(n - fadeTime*app.Fs + sample,2) * linFadeOut(sample,1);
                end
        end
        plot(app.UIAxes,y);
        app.player = audioplayer(y,app.Fs);
        app.output = y;
```



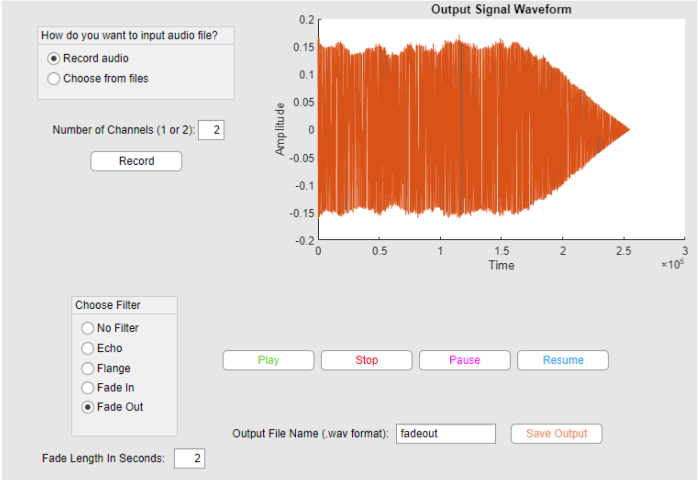
How do you want to input audio file?
● Record audio
○ Choose from files

Number of Channels (1 or 2): 2

Choose Filter
○ No Filter
○ Echo
○ Flange
● Fade In
○ Fade Out

Output File Name (.wav format): fadein

Fade Length In Seconds: 2



How do you want to input audio file?
● Record audio
○ Choose from files

Number of Channels (1 or 2): 2

Choose Filter
○ No Filter
○ Echo
○ Flange
○ Fade In
● Fade Out

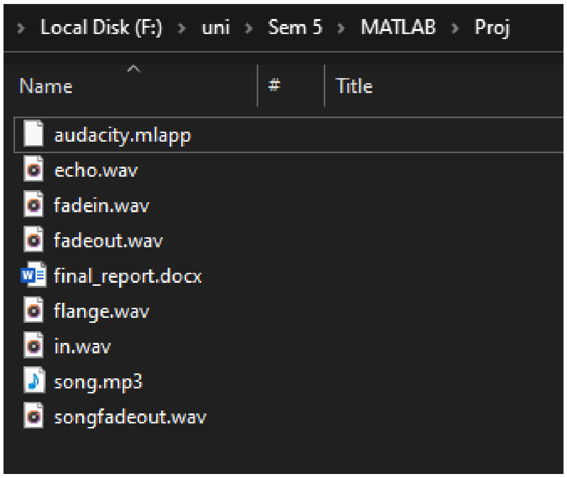
Output File Name (.wav format): fadeout

Fade Length In Seconds: 2

Save Audio

If user wants to save their recorded or edited audio, first they can enter the name of the output file, then it will be saved with format .wav:

```
outFileName = app.OutputFileNamewavformatEditField.Value;
fullOutFileName = strcat(outFileName, '.wav');
audiowrite(fullOutFileName,app.output,app.Fs);
```



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Name	#	Title
audacity.mlapp		
echo.wav		
fadein.wav		
fadeout.wav		
final_report.docx		
flange.wav		
in.wav		
song.mp3		
songfadeout.wav		

Used Resources

https://www.youtube.com/watch?v=J_9SbgLPfMU

https://www.youtube.com/watch?v=Dw0higkGes0

https://www.youtube.com/watch?v=tTUHylE3shQ