8. Manipulating spectrum data

More MATLAB techniques (External resource) (1.0 points possible)

The inverse FFT of the FFT

In this problem we talk about how we can manipulate the data in the frequency spectrum and go back to a sound signal using the inverse FFT

```
Y = fft(signal);
%Do something to modify Y
newsignal = ifft(Y);
```

(Note this is essentially how all audio processing works. Audio processing works by manipulating signals in the frequency spectrum. The fact that we can get back to the time series -- and audio signal -- is what makes this work!)

Here is an outline of how this process works:

1. Listen to your signal. Oh no! Something is wrong.
2. Take the FFT of your signal, and look at the single sided frequency spectrum. See what it can tell you about what is wrong with the signal.
3. Now recreate the symmetric signal coming from a real sound wave (undoing the processing needed to view single sided spectrum)
4. Take the inverse FFT to get a signal back. Try listening to see if it sounds better!

In this problem, we are going to remove the frequencies less than 300 in the signal of our voice singing an A. What do you think will happen? Will it sound like an A sung at 440hz or not? Discuss on the forum. You'll need to copy and paste this code into MATLAB online to listen to the new signal!

Script

Save Reset MATLAB Documentation (https://www.mathworks.com/help/)

```
[y,Fs] = audioread('1803_musicdata_voice1.wav'); %The audio file is already loaded for you
y = y(:,1); %Take first channel of signal
% sound(y,Fs); % uncomment this command in MATLAB online to hear the sound
n = length(y);  %length of signal
t = (0:n-1)*(1/Fs);  %time series vector

figure(1)
plot(t, y);  %plot the sound signal

%NOTE we do not take the one sided signal here because we need both sides to
%recreate the sound signal using ifft command

Y = fftshift(fft(y));   %Take the Fourier series and take a symmetric shift
fshift = (-n/2:n/2-1)*(Fs/n);   %Determine the frequency vector (shifted)
```

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Topic: Unit 1: Fourier Series / 8. Manipulating spectrum data

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Sound A similar in both cases I hear the sound many times but can't able to distinguish between two sounds. Can anyone have the same experience ? If yes, please elaborate more on it (staff also).	2
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