week8_hw

Student

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Total Points

100 / 100 pts

Question 1

frequency domain   **30** / 30 pts

✔ **− 0 pts** Click here to replace this description.

Question 2

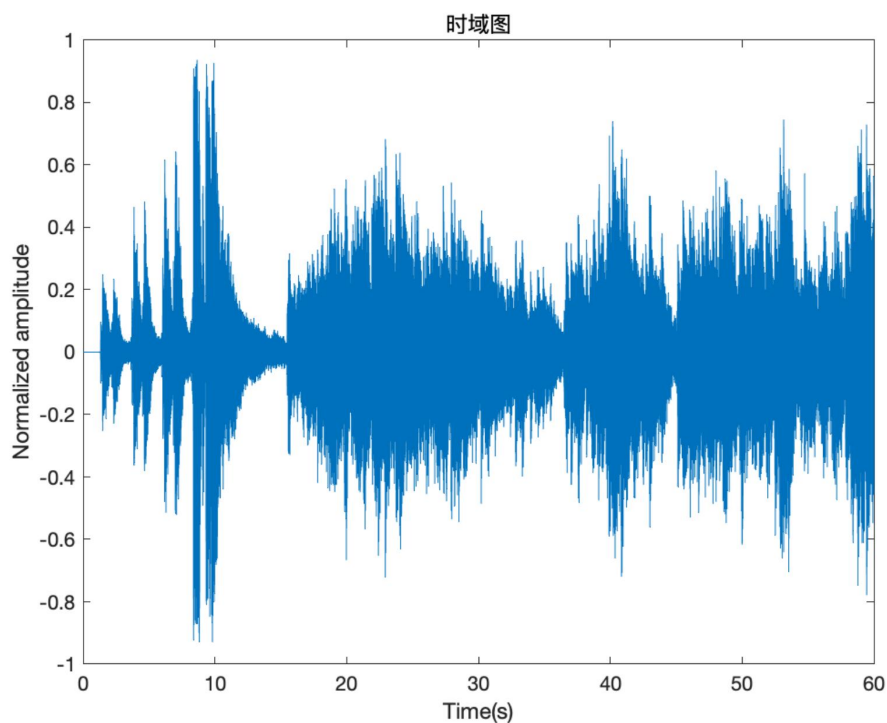**filter**   **40** / 40 pts

✔ **− 0 pts** Correct

Question 3

sound acquisition   **30** / 30 pts

✔ **− 0 pts** Correct

Task 1

```
clear;clf;
% read in the audio and slice the data
[magnet_mp3, fs] = audioread("magnet.mp3");
first_minutes_sound = magnet_mp3(1:fs*60,1);
% initialize
dt = 1/fs;
t = 0:dt:60-dt;
```

```
% 时域图
figure,plot(t,first_minutes_sound);
title("时域图");
xlabel("Time(s)");
ylabel("Normalized amplitude");
```
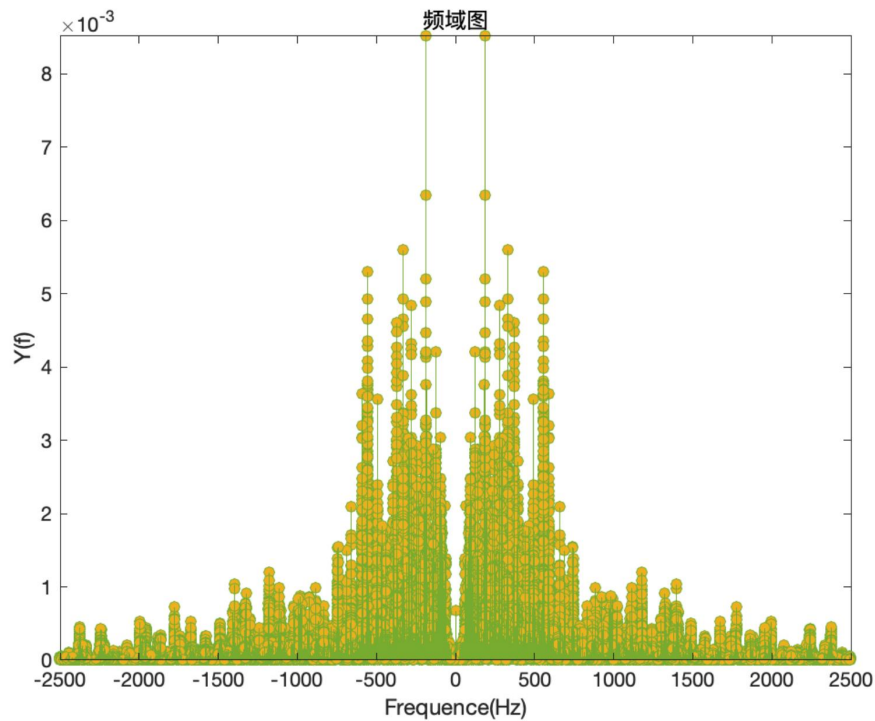


```
% 频域图
N = length(first_minutes_sound);
f = (-N/2:N/2-1)*fs/N;
Y = abs(fftshift(fft(first_minutes_sound))/N);
figure,
```

```matlab
st = stem(f,Y);
axis([-2500 2500 0 inf]);
st.Color = "#77AC30";
st.MarkerFaceColor = "#EDB120";
title("频域图");
xlabel("Frequence(Hz)");
ylabel("Y(f)");
```



```matlab
% dynamic plotting
unit_N = N/60;
unit_f = (-unit_N/2:unit_N/2-1)*fs/unit_N;
for i = 1:60
    tic;
    slice_per_sec = (i-1)*fs+1:i*fs;
    sound_per_sec = first_minutes_sound(slice_per_sec);
    sound(sound_per_sec,fs);
    % 时域图
    t_per_sec = t(slice_per_sec);
    subplot(2,1,1);
    plot(t_per_sec,sound_per_sec);
    ylim([-1 1])
```
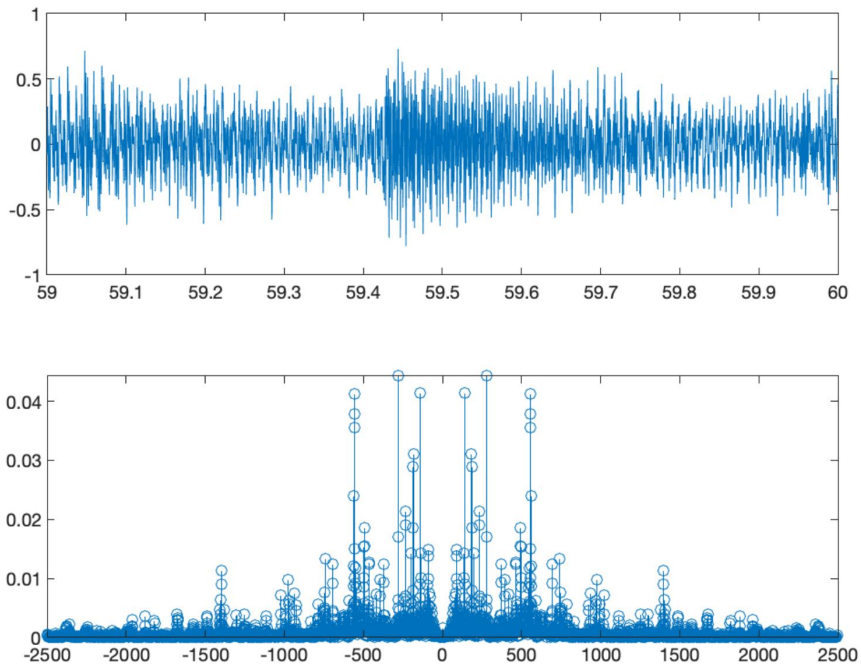
```matlab
    % 频域图
    Y_per_sec = abs(fftshift(fft(sound_per_sec))/(N/60));
    subplot(2,1,2);
    stem(unit_f,Y_per_sec);
    axis([-2500 2500 0 inf]);
    totlal_time = toc;
    pause(1 - totlal_time);
end
```


Task 2

```matlab
% initialization
clear;clf;
[magnet_mp3, fs] = audioread("magnet.mp3");
% 源代码此处为下拉框，选项为高通滤波器、低通滤波器和带通滤波器，
% 此处以带通滤波器为样例。
filter_mod = "带通滤波器";
% 如果这种方式不行，请将运行接下来的注释代码（去掉注释）：
% filter_mod = input("输入滤波器（用引号将中文扩起来）：")
% --如果不行请去掉上述代码的注释--
% filtering
switch filter_mod
```

```matlab
    case "高通滤波器"
        [B,A] = butter(6,800/(fs/2),'high');
    case "低通滤波器"
        [B,A] = butter(6,500/(fs/2),'low');
    case "带通滤波器"
        [B,A] = butter(3,[500 800]./(fs/2));
end
filtered_y = filter(B,A,magnet_mp3);
% plot
N = length(filtered_y);
f = (-N/2:N/2-1)*fs/N;
Y = abs(fftshift(fft(filtered_y))/N);
figure,
subplot(2,1,1)
stem(f,Y(:,1));
axis([-2500 2500 0 inf]);
title(filter_mod + ": 第一声道频域图");
xlabel("Frequence(Hz)");
ylabel("Y(f)");
subplot(2,1,2)
stem(f,Y(:,2));
axis([-2500 2500 0 inf]);
title(filter_mod + ": 第二声道频域图");
xlabel("Frequence(Hz)");
ylabel("Y(f)");
```

带通滤波器: 第一声道频域图

带通滤波器: 第二声道频域图
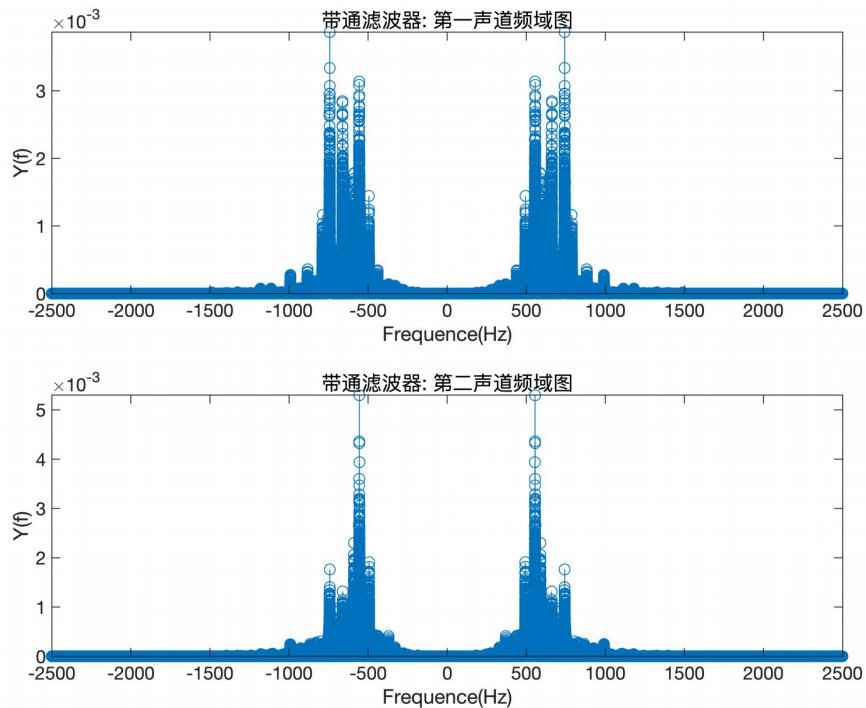
```
% play
sound(filtered_y,fs);
```

Task 3

```
clear;clf;
% read from microphone
deviceReader = audioDeviceReader;
setup(deviceReader)
deviceWriter = audioDeviceWriter('SampleRate',44100);
setup(deviceWriter,zeros(deviceReader.SamplesPerFrame,1));
fileWriter = dsp.AudioFileWriter('myaudio.wav','FileFormat','WAV');
tic
while toc < 32
    acquiredAudio = deviceReader();
    deviceWriter(acquiredAudio);
    fileWriter(acquiredAudio);
end
disp('Recording complete.')
```
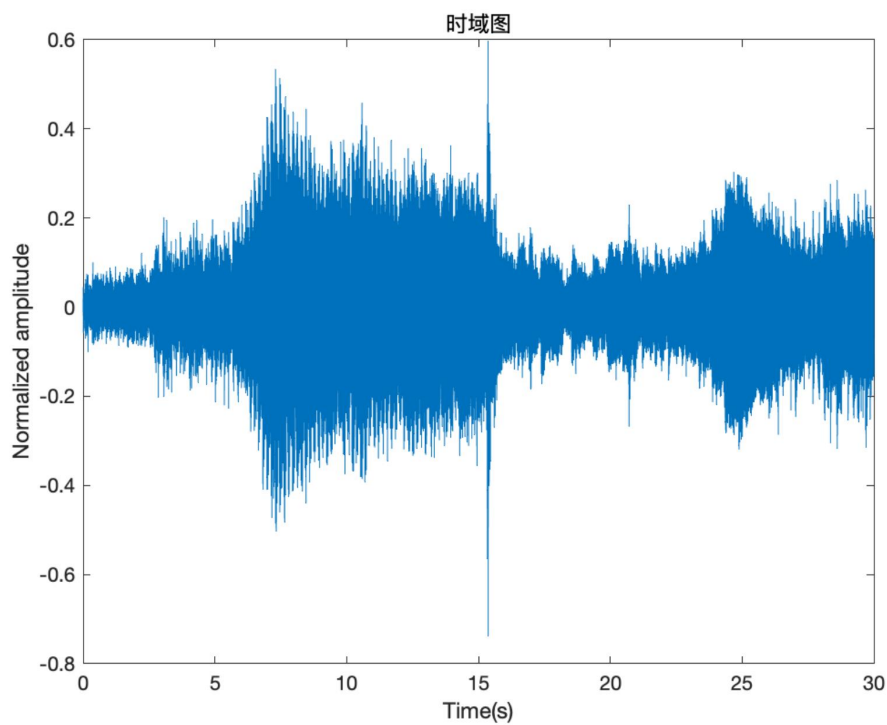
```
Recording complete.
```

```
release(deviceReader)
release(fileWriter)
release(deviceWriter)
```

```matlab
[my_audio, fs] = audioread("myaudio.wav");
my_audio = my_audio(1:44100*30);
```

```matlab
dt = 1/fs;
t = 0:dt:30-dt;
figure,plot(t,my_audio);
title("时域图");
xlabel("Time(s)");
ylabel("Normalized amplitude");
```



```matlab
% 频域图
N = length(my_audio);
f = (-N/2:N/2-1)*fs/N;
Y = abs(fftshift(fft(my_audio))/N);
```

```
figure,
st = stem(f,Y);
st.Color = "#77AC30";
st.MarkerFaceColor = "#EDB120";
title("频域图");
xlabel("Frequence(Hz)");
ylabel("Y(f)");
```