2021 ASAS Homework 5: Sinusoidal modeling. Part I: Analysis.

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Due on Sunday April 25.

Part 1 (50%) recommended for the first week.

Write a matlab script to decode the phone number from "unknown_phonenum.wav". In the starting material, you will find <ASAS2021_HW5CreateDualTones.m> which generates arbitrary phone-button tone sequences. You should report on the choice of window type, and what is the shortest window length that enables accurate estimation of tone frequencies.

Part 2 (50%) recommended for the second week, or any time after Part 1.

In the starting material, you will find the following .m files:

- <AsasHwSinMod_2017.m> is the main file, which uses
  - <MyAdditivesynth.m>: base line synthesizer for sinusoidal modeling.
  - <mySpecgram.m>: my custom-made spectrogram function.
  - <setFontSizeForAll.m>: a script that changes the fontsize for all the current figures.

In this week's homework, **your job is to implement the function**

```
[ampdB,freqindex] = MyFindpeaks(Xw(1:N/2),maxPeaks);
```

which takes the first N/2 bins of a windowed block's FFT and returns an array of size `maxPeaks * 2` that describes a list of largest peaks:

- Its first column should record the magnitudes of these peaks in dB scale.
- Its second column should contain their respective frequencies in rad/sample (i.e., π is equivalent to the Nyquist frequency).
- For the best effect with the baseline synthesizer, please sort the peaks according to the frequencies (either in the ascending or descending order). In the report, please discuss why I make this suggestion. The function for

Quick review of important concepts:

1. Note that the FFT length is much longer than the frame length in this starter code.

```
N = 2^(1+floor(log2(5*M+1)));
```

   The reason for padding so many zeros is to increase the frequency *resolution*.

2. Let's say the number of peaks to keep track of is 20 for the sake of discussion. In your peak finder, please first locate the 20 biggest local maxima in the magnitude

spectrum. Then, fit a parabola (拋物線) to the log magnitude for each local maximum to get a refined estimation of peak frequency and peak magnitude. We shall discuss the details in class.

Please note the **Page limit of this report is 4.**