Noise Engineering & Aeroacoustics **Class 2019_Spring**
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HomeWork #1 (Due 03/18)

1. When someone estimates that certain musical sounds weighted by dB(A) and dB(C) were heard similarly, they explain what happens? (10pts)

2. Explain the following noise level indices, and their meaning (15pts)

(Example) SPL: Sound Pressure Level (dB)

$$SPL(dB) = 20\log_{10}\left[\frac{p'_{rms}}{2\times 10^{-5}(N/m^2)}\right]$$

1) PWL
2) L_{eq}
3) PNL

3. A noise is generated by 80 pure tones, of different frequencies but identical power. Each pure tone has a sound pressure level of 60 dB. Determine the sound pressure level of the noise. (10pts)

4. In order to measure the sound pressure level of a source, a engineer checks first the background noise. (Assumption: the frequency inconsistency between the background noise level and the source noise level)

(a) If the difference between the background noise level and the level with the source is greater than 10 dB, show that the background level will not significantly affect the measurement of the source noise level. **(10pts)**

(b) If the background noise level is only 3 dB less than the level with the source, what correction must be applied to the total noise level to get the noise level due to the source individually? **(10pts)**

5. A turbofan engine made an arbitrary sound 'X' for 5 minutes. The sound wave of the X follows as, (45 pts)

$$X = 0.8\sin(2\pi\times100t)+0.7\sin(2\pi\times200t)+0.8\sin(2\pi\times400t)+\sin(2\pi\times600t)+0.8\sin(2\pi\times800t)+$$
$$0.9\sin(2\pi\times1000t)+0.8\sin(2\pi\times2000t)+\sin(2\pi\times3000t)+0.8\sin(2\pi\times5000*t)+0.9\sin(2\pi\times7000t)$$

<Describe the solution in detail as you can, all the x-axis boundary in the frequency domain within 0-10k Hz>

a) Show the graphs of the X in frequency domain and time domain.
(the x-axis boundary in the time domain: 0-0.01 s, Sampling frequency: 20k Hz)
b) Show the dB scale graph of the X in frequency domain and the value at the frequency as a table. (the y-axis boundary: 90-95 dB, Sampling frequency: 20k Hz)
c) Calculate L_{eq} of this sound and show the Noy value at each frequency as a table
d) Calculate the total perceived noisiness and PNL of this sound.
e) Calculate EPNL of this sound. (In practice, the tone correction factor is 3 dB)

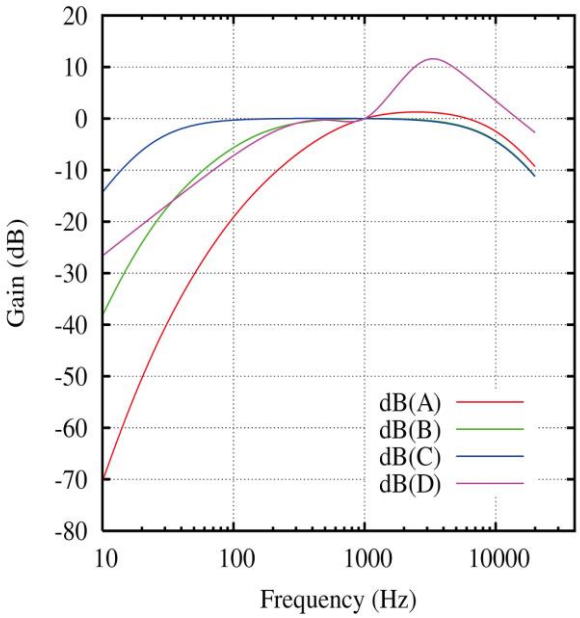

Figure 1 The weighting curves for dBA,B,C,D