

Engineering Acoustics – Homework 1

1. Written work

27-18800

ECE 502 - Homework #1

Mikaela Sha

1.1 $A = 50 \text{ dB}$ 50 m overall sound level = 55 dB

$$L_{\text{tot}} = 10 \lg \left(\sum_{i=1}^N 10^{L_i/10} \right) \quad N=2$$

$$55 = 10 \lg \left(10^{50/10} + 10^{L_2/10} \right)$$

$$5.5 = \lg \left(10^5 + 10^{L_2/10} \right)$$

$$10^{5.5} = 10^5 + 10^{L_2/10}$$

$$10^{5.5} - 10^5 = 10^{L_2/10}$$

$$(10^{5.5} - 10^5)^{10} = (10^{L_2/10})^{10}$$

$$(10^{5.5} - 10^5)^{10} = 10^{L_2}$$

$$L_2 = \lg \left((10^{5.5} - 10^5)^{10} \right)$$

$$L_2 = 10 \lg (216227.766) \text{ dB(A)}$$

$$L_2 = 53.35 \text{ dB(A)} \checkmark$$

2. Octave Bandwidth

$$f_u = 2f_l$$

2. Octave Bands

Low Freq	Center Freq	Upper Freq
22.0971	31.25	44.1942
44.1942	62.5	88.3883
88.3883	125	176.7767
176.7767	250	353.5534
353.5534	500	707.1068
707.1068	1000	1414.2136
1414.2136	2000	2828.4271
2828.4271	4000	5656.8542
5656.8542	8000	11313.7085
11313.7085	16000	22627.417

Third Octave Bands

Lower Freq	Center Freq	Upper Freq
17.5385	19.6863	22.0971

22.0971	24.8031	27.8406
27.8406	31.25	35.0769
35.0769	39.3725	44.1942
44.1942	49.6063	55.6812
55.6812	62.5	70.1539
70.1539	78.7451	88.3883
88.3883	99.2126	111.3623
111.3623	125	140.3078
140.3078	157.4901	176.7767
176.7767	198.4251	222.7247
222.7247	250	280.6155
280.6155	314.9803	353.5534
353.5534	396.8503	445.4494
445.4494	500	561.231
561.231	629.9605	707.1068
707.1068	793.7005	890.8987
890.8987	1000	1122.462
1122.462	1259.921	1414.2136
1414.2136	1587.4011	1781.7974
1781.7974	2000	2244.9241
2244.9241	2519.8421	2828.4271
2828.4271	3174.8021	3563.5949
3563.5949	4000	4489.8482
4489.8482	5039.6842	5656.8542
5656.8542	6349.6042	7127.1897
7127.1897	8000	8979.6964
8979.6964	10079.3684	11313.7085
11313.7085	12699.2084	14254.3795
14254.3795	16000	17959.3928
17959.3928	20158.7368	22627.417

3.

Subject Name	Age	Gender	Low Frequency	High Frequency
Amanda Abate	19	Female	20.44 Hz	20 kHz
Mikaela Shannon	21	Female	23 Hz	18.8 KHz

%% Problem #3 - Homework 1 %%

% low sweep frequency range

f11 = 5;

f12 = 40;

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% sample rate
Fs = 44100;

% length of each sweep
endTime = 10;
t = 0:1/Fs:endTime;

flow = linspace(f11, f12, length(t));
lowsweep = square(2*pi.*flow.*t);
audiowrite('lowsweep.wav', lowsweep, Fs);

% high sweep frequency range
fh1 = 16000;
fh2 = 21000;

fhigh = linspace(fh2, fh1, length(t));
highsweep = sin(2*pi.*fhigh.*t);
audiowrite('highsweep.wav', highsweep, Fs);
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