

Noise Engineering & Aeroacoustics
Prof. Soogab Lee

Class 2017_Fall
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HomeWork #2 (Due 10/30)

1. A noise is generated by 60 pure tones having identical power. Each pure tone has a sound pressure level of 80 dB. Determine the sound pressure level of the total noise when

- (a) the tones have different frequencies.
- (b) the tones have same frequencies and they are in-phase.

2. An underwater sonar beam of diameter 0.5 m carries 100 watts of acoustic power in a plane wave of frequency 20 kHz. Determine the followings.

- (a) Wavelength
- (b) Sound pressure level in dB
- (c) Maximum particle velocity in the beam of sound
- (d) Maximum particle acceleration

3. A boundary vibrates in water at a frequency of 10Hz with a displacement amplitude 10^{-5} m. Determine the SPL generated by that vibration at a distance 1km from the boundary when

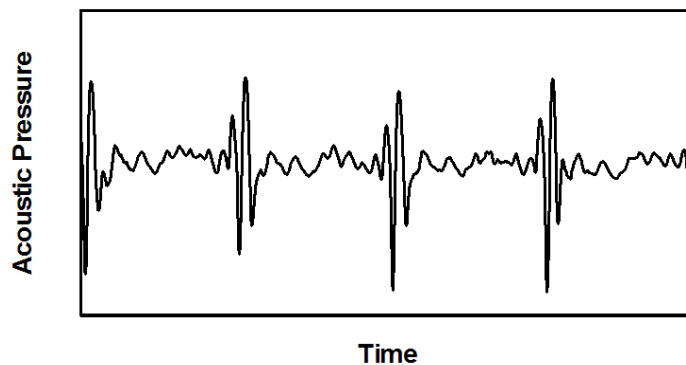
- (a) the boundary is a plane surface with uniform normal displacement
- (b) the boundary is a circular cylinder of radius 50cm with axially uniform displacement
- (c) the boundary is a sphere of radius 50cm with symmetric radial displacement.

4. The table below shows some noise measurements of a small weapon in shooting range. The noise was measured for 2 seconds and its sample interval is 0.1s. Obtain the sound level (L_{Aeq}) during the measurement.

Time(s)	L_{Aeq}	Time(s)	L_{Aeq}	Time(s)	L_{Aeq}	Time(s)	L_{Aeq}
0.1	45.0	0.6	42.6	1.1	69.3	1.6	78.3
0.2	43.7	0.7	37.2	1.2	65.1	1.7	74.2
0.3	40.2	0.8	80.8	1.3	67.5	1.8	69.6
0.4	42.6	0.9	79.7	1.4	66.1	1.9	67.0
0.5	45.2	1.0	73.4	1.5	66.3	2.0	68.3

5. Noise from a helicopter rotor in BVI (blade-vortex interaction) operating condition was measured during one rotating period as shown in the figure below. When the sampling frequency was 40 kHz ($\Delta t = 2.5 \times 10^{-5}$ sec),

- (a) Plot the narrow band frequency spectrum of this acoustic signal.
- (b) Obtain L_{eq} and L_{Aeq} .
- (c) Plot the octave band and 1/3 octave band frequency spectrums.



(# the raw data of acoustic pressure are on the homepage)