



AUBURN UNIVERSITY

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AEROSPACE

AERO 4970/7970 Fundamentals of Aeroacoustics SET III
Acoustic Energy, Decibel Scales and Human Hearing

1. Plot the spectrum of the 500 Hz square wave with an amplitude of A :

$$P = \begin{cases} -A; & -0.001 < t < 0 \\ +A; & 0 < t < 0.001 \end{cases} \quad t \text{ in seconds.}$$

2. A rather typical sound wave has a pressure amplitude of 2×10^{-2} Pa and a frequency of 10^3 Hz. Assuming the wave is a plane wave propagating to the right in air with $a_0 = 343$ m/s, and $\rho_0 = 1.21$ kg/m³:
- What is the acoustic intensity associated with the wave?
 - If the wave is in a tube with an area of 0.1 m², how much power, in horsepower, is required to produce the wave? (Hint: 1 kW = 1.34 hp).
3. Normal speech has a level of about 70 dB at a distance of about 1m. Determine the RMS amplitude of the waves. Determine the acoustic power necessary for speech if it normally produces a level of 70 dB on a spherical surface of radius 1 m.
4. Several noise sources each produce a sound level of 80 dB at an observer's location when each operates alone.
- Determine the level when two operate.
 - When three operate.