Course: Fundamentals of Acoustics and Sound

Topic: Basic physics of sound, plane wave propagation

- Definitions
- Basic physics of sound
- Wave equation
- Simple sound fields
- Transmission into other media

Literature:

Lawrence E. Kinsler, Austin R. Frey, Alan B. Coppens, and James V. Sanders: "Fundamentals of Acoustics" (4th Edition)

Sections 5.1–5.5 (pp. 113-120), 5.12 (pp. 130–133), and 6.1–6.8 (pp. 149–166).

Sections 5.6–5.10 (pp. 120–126) at your own convenience.

(Optional) Sections 5.13 - 5.16 (pp. 133 - 143)

Exercises:

Part I, Problem 1:

A plane progressive wave in air with frequency $f = 100$ [Hz] has an amplitude of $P_{max} = 3$ [Pa]. Compute (in any order):

(a) Intensity
(b) Intensity level
(c) Energy density
(d) Particle speed amplitude
(e) Particle displacement peak amplitude
(f) Wavelength
(g) Sound pressure (effective, in [Pa]) and
(h) Sound pressure level (relative to 20μPa)

Part II, Problem 1:

A $f = 1$ [kHz] plane wave in water of effective amplitude $P_e = 50$ [Pa], is incident normally on the water-air boundary.

(a) What is the effective pressure of the plane wave transmitted into the air?
(b) What is the intensity of the incident and transmitted waves?
(c) Express as a decibel reduction, the ratio of the intensity of the transmitted wave in air to that of the incident wave in water.
(d) Answer the same three questions for a sound wave incident on a block of ice (consider the ice as an unbounded media).
(e) What is the power reflection coefficient of the block of ice?

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