Environmental Acoustics

Exercises

Question 1

The normalized ground impedance Z can be written as $Z = Z'/Z_0$, with the specific impedance of the ground material and $Z_0 = \rho c$ the specific impedance of air.

a) Compute the plane wave reflection coefficient R_p, when Z =1 and $\theta = 0$ and $\theta = \frac{\pi}{2}$? Are these results as expected?
b) Assume now $Z = 10 + j10$ and compute R_p for $\theta = \frac{\pi}{4}$. What is the phase of R_p and what does this mean?

Question 2

A source and receiver are both located at a height of 1 m above a rigid ground surface, and are separated by 100 m. Compute the frequencies corresponding to the first 3 destructive interferences.

Question 3

a) Using a ray approach, what is the maximum height that a sound ray receiving at the receiver has reached in a downward refracting atmosphere wind logarithmic wind speed profile with b = 2, source-receiver distance = 200 m, c_0 = 340 m/s?
b) When the source and receiver are both located at a height of 1 m, what is approximately the level increase ΔL due to the meteorological conditions? What did you assume for the impedance of the ground surface?

Question 4

Can you explain why the Fresnel number at p.738 of the course book depends on λ?

Question 5

Compute the transmission loss TL of concrete wall with thickness d = 0.2 m and density ρ = 2500 kg/m^3 for the frequencies 100 and 200 Hz. What can we do to improve the sound insulation?