Homework Hints

6.2.3

(a) air ↑ / water ↓ ↓

(b) ↓ ↑ air / ↓ water

$$T = \frac{2\varepsilon_{r1}}{\varepsilon_{r1} + 1}$$ pressure

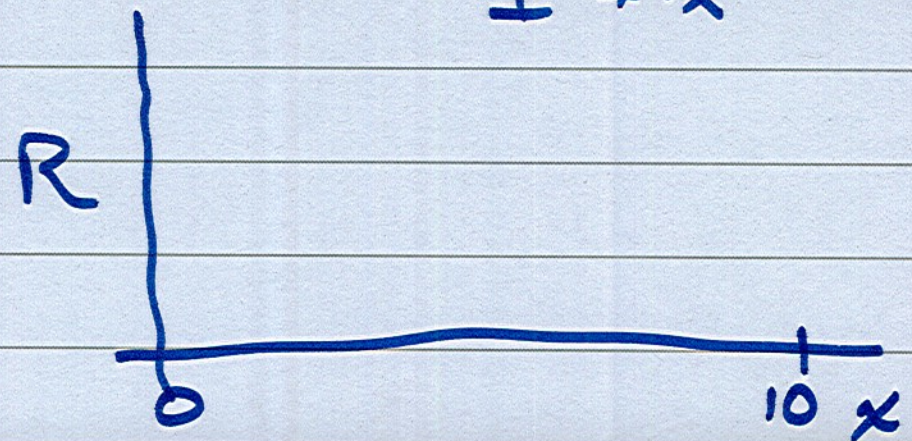
T_I change in media

6.2.6C

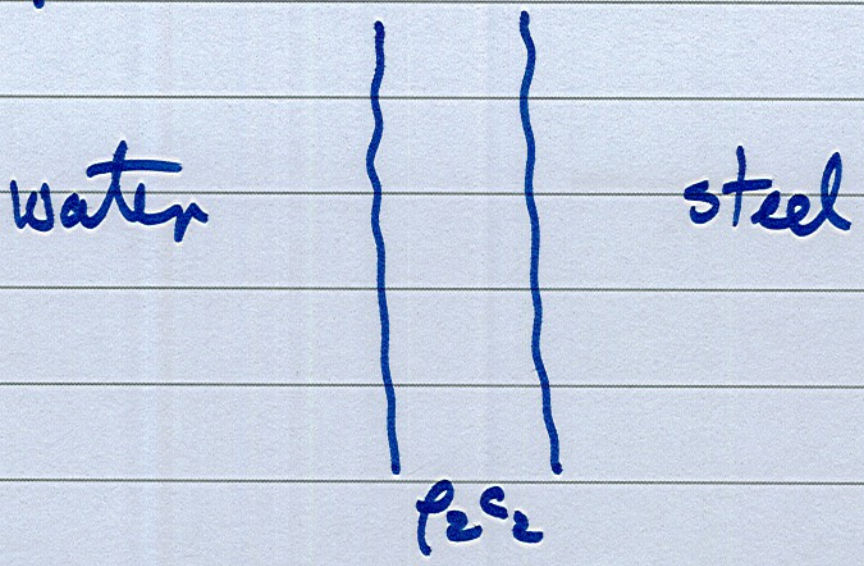
$$R = \frac{r_2 - r_1}{r_2 + r_1} \qquad r_1 = \rho_1 c_1 \qquad r_2 = \rho_2 c_2$$

$$= \frac{1 - \frac{r_1}{r_2}}{1 + \frac{r_1}{r_2}}$$

$$= \frac{1 - x}{1 + x}$$



6.3.4



(a) Eqn 6.3.8
what choice of r_2 makes the
$T_I = 1$
denominator must
equal

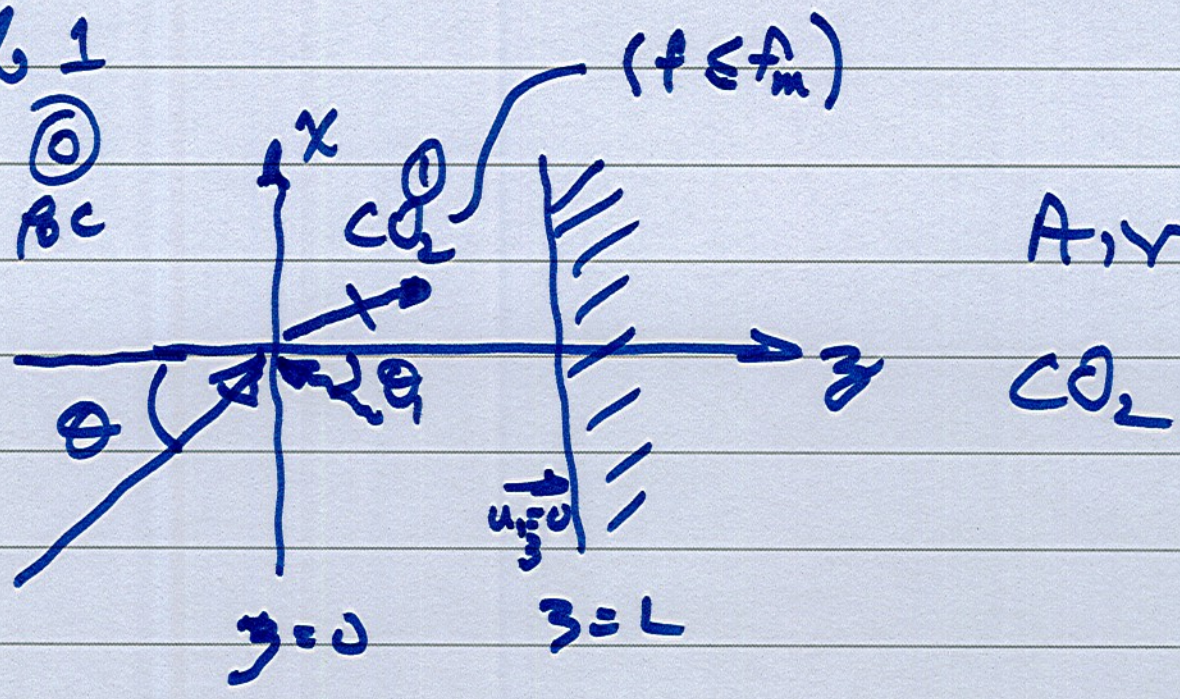
(b) denom = 4 $k_2 \rightarrow c$

6.6.1

Eq. 6.6.5

$$R = \frac{z_n \cot\theta - \beta c}{z_n \cot\theta + \beta c}$$

A. Prob 1



(i) <u>angle θ_1</u> snell's Law

Assume soln

$$p_1 = A e^{-jk_{1z}z} e^{-jk_x x} + B e^{+jk_{1z}z} e^{-jk_x x}$$

$$u_{1z} = -\frac{1}{j\omega\rho}\frac{\partial p_1}{\partial z}$$

Apply hard wall B.C. to eliminate A or B

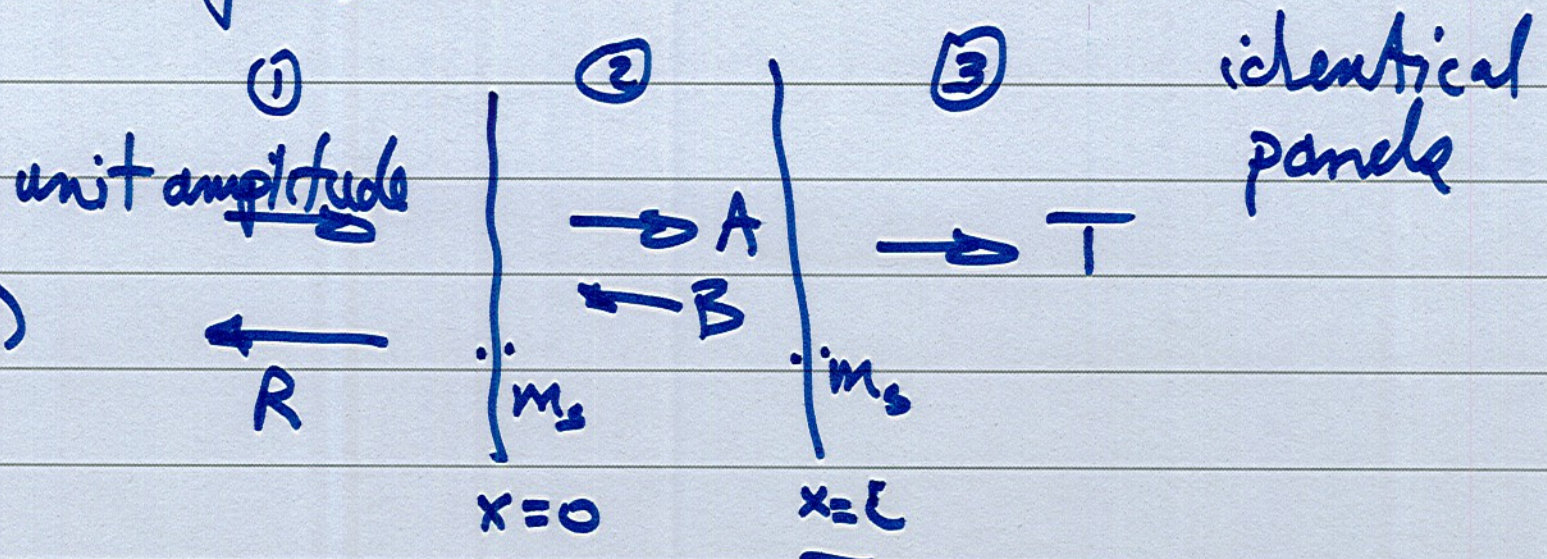
$$z_n = \frac{p_1|_{z=0}}{u_3|_{z=0}}$$

(ii)

Plot 100 Hz to 10 kHz

(iii) $$R = \frac{z_n \cos\theta - f_0 c}{z_n \cos\theta + f_0 c}$$

A. prob 2



(i)

(ii) Write b.c.'s
- velocity -
- pressure - EOM

(iii) create 4 eqns in R, A, B & T

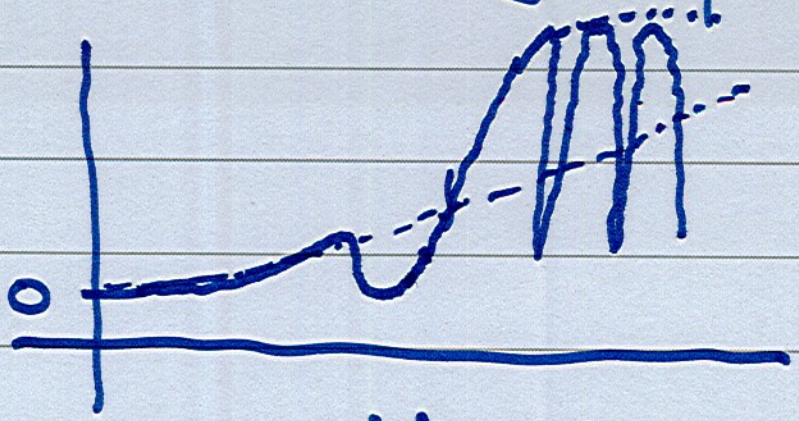
$$\begin{bmatrix} & & & \end{bmatrix} \begin{bmatrix} R \\ A \\ B \\ T \end{bmatrix} = \begin{bmatrix} & \end{bmatrix}$$

(iv) Solve for the TL

$$TL = 10 \log_{10} \frac{1}{|T|^2}$$

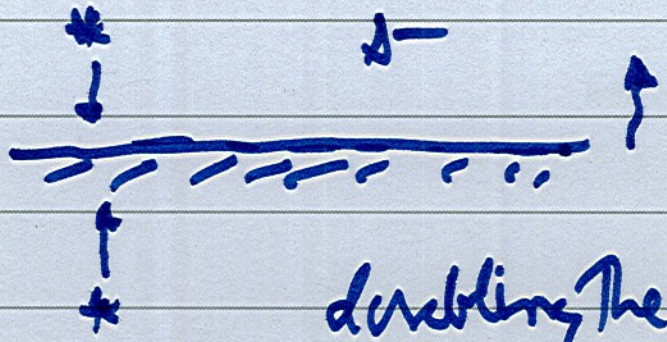
Plot 1 ~~kHz~~ Hz to 10 kHz

log frequency scale

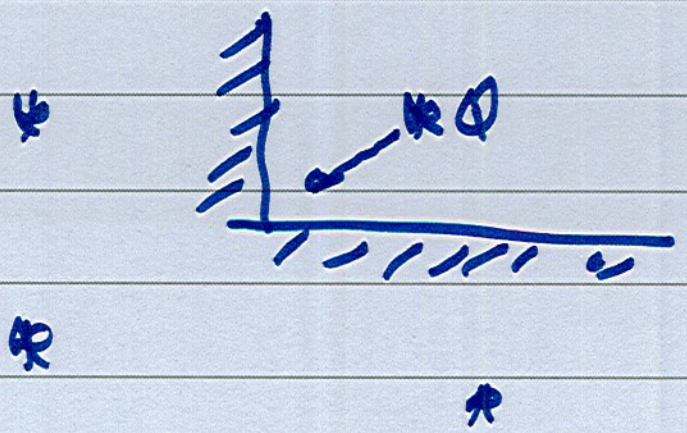


(v) Compare with TL of a single panel

Reflection at a hard surface

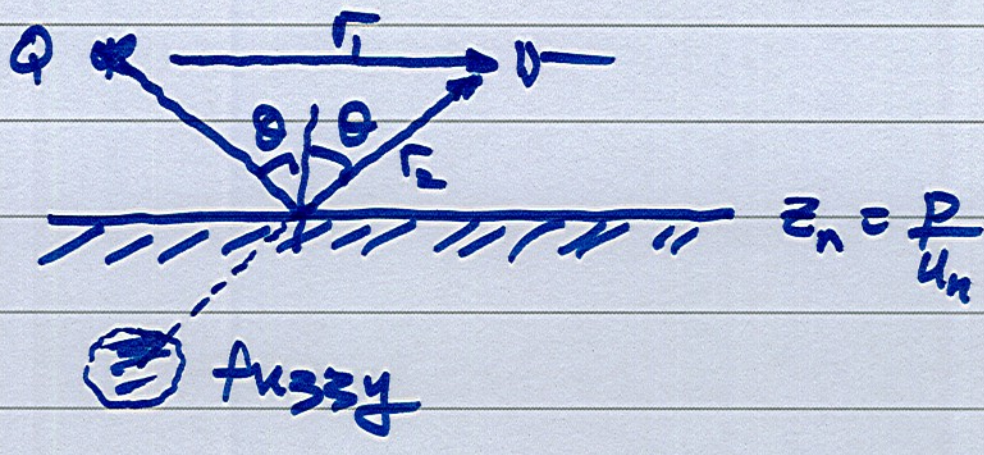


doubling the sound



4 x sound power

5.4.3.1



$$\tilde{p}(r) = A\left\{\frac{e^{-ikr_1}}{r_1} + R(\theta)\frac{e^{-ikr_2}}{r_2} + [1-R(\theta)]F(w)\frac{e^{-ikr_2}}{r_2}\right\}$$

ground waves & surface waves

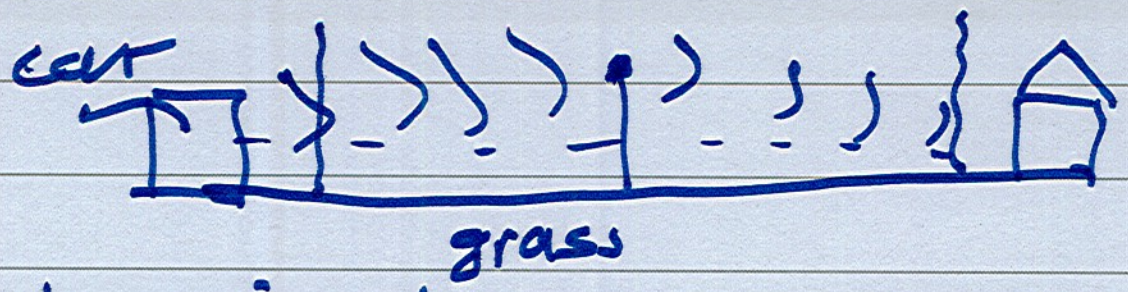
$$R(\theta) = \frac{z_n \cos\theta - \rho c}{z_n \cos\theta + \rho c}$$

At grazing incidence?

$R(\frac{\pi}{2}) \to -1$ at grazing, $r_1 \approx r_2$ are the same

Direct & specular terms
cancel at grazing

- Sound field consists of ~~grou~~ ground & surface waves
  - decay with distance & with height



- plane impedance, grassland, snow, plowed field
- strong attenuation

when $\theta < 75°$

$$\tilde{p}(r) = A\left\{\frac{e^{-ikr_1}}{r_1} + R(\theta)\frac{e^{-ikr_2}}{r_2}\right\}$$