Quiz 4, Monday, October 2, 2006
ECE 598 AL
The Speech Chain

Problem 1 (3 points)

A 340Hz tone (roughly equal in pitch to the F# above middle C) is carried, backward through space, by the following wave, where $c = 340m/s$ is the speed of sound:

$$p(x,t) = e^{j(680\pi(t+x/c))} \text{ Pa}$$

(a) Plot $p(x,t)$ as a function of time, at the position $x = 0$.

(b) Plot $p(x,t)$ as a function of time, at the position $x = 25$cm.

(c) Plot the snapshot $p(x,t)$ as a function of x at time $t = 0$.

(d) Plot the snapshot $p(x,t)$ as a function of x at time $t = 1/680$ second.

Problem 2 (4 points)

Suppose that you blow across the end of a bottle. The bottle is open at $x = 0$ (the position of your lips). The bottle is closed at $x = B$ (the position of the bottom of the bottle).

(a) What is the boundary condition at $x = 0$, in terms of $p(x,t)$ and/or $v(x,t)$?

(b) Re-write the boundary condition at $x = 0$ in terms of the forward-going wave phasor p_+ and the backward-going wave phasor p_-.

(c) What is the boundary condition at $x = B$, in terms of $p(x,t)$ and/or $v(x,t)$?

(d) Re-write the boundary condition at $x = B$ in terms of the forward-going wave phasor p_+ and the backward-going wave phasor p_-.