University of Waterloo
MATH 213, Spring 2015
Assignment 9

Simulation

The three included pictures `derv1.jpg`, `derv2.jpg`, and `derv3.jpg` show the derivation of the pressure equation. In summary,

$$p(x,t) = \sum_{n=1}^{\infty} -\frac{8L}{(2n-1)^2\pi^2} \cos\left(\frac{\pi(2n-1)}{2L}x\right) \cos\left(\frac{\pi(2n-1)}{2L}ct\right)$$

The length of the tube, L, that creates the 440Hz A note is

$$\begin{aligned} L &= \frac{\lambda}{4} \\ &= \frac{c}{4f} \\ &= \frac{340.29}{4 * 440} && \text{(c given by Google)} \\ &= 0.1933\text{m} && \text{(approx)} \end{aligned}$$

See included `har[1, 5, 10, 20].wav` files for the sound of 1, 5, 10, 20 harmonics being retained, respectively.
See `solver.m` for the Matlab code used to generate the `.wav` files.