MASSACHUSETTS INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

2.26 Spring 2004 — Problem Set 1

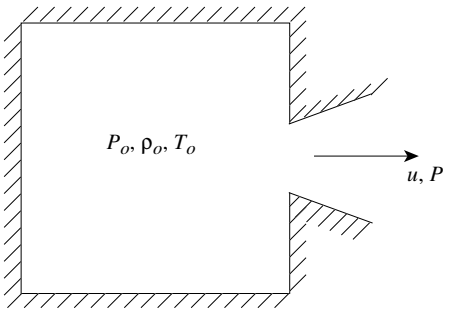
Set: February 17, 2004
Due: February 27, 2004 @ 5:00 PM

0. Warm-up Problems:

   (a) In class we showed that the pressure, P, resulting from an infinitessimal disturbance in an isentropic (1D) fluid medium at rest, is governed by a second-order linear wave equation.

   Show that the velocity, u, and the density, ρ, are also governed by a wave equation.

   (b)



   Consider a reservoir with an orifice as shown in the figure. In class we showed that for an isentropic fluid, the maximum exit velocity, $u_{\max}$, is given by

$$u_{\max} = \sqrt{2h_o} \quad \text{or} \quad u_{\max} = c_o \sqrt{\frac{2}{\gamma - 1}} \; .$$

   Show that these two statements are equivalent.

1. Fluid Mechanics Review: 1.18 in Thompson
2. Thermodynamics Review: 2.16 in Thompson
3. Thompson 6.1
4. Thompson 6.2
5. Thompson 6.6