

Gas Dynamics

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HW#4

Due Date: 23/8/1390

- 1- Solve Problems 7-2, 7-4, 7-5, and 7-7 from Modern Compressible Flows, Anderson.
- 2- Plot (C_s/a_1) versus (u_p/a_1) and discuss about C_s values obtained for different u_p magnitudes.
- 3- Show that if an acoustic wave with a strength of Δp is reflected from a closed end, pressure at that closed end will be $2\Delta p$. Additionally, investigate the reflection of this wave from an open end, where $p=p_{atm}$.
- 4- A one dimensional flow is created in the region of $x>0$ with the piston motion in a tube according to:

$$x_p = \begin{cases} 0 & t < 0 \\ \delta \sin\left(\frac{2\pi t}{T}\right) & 0 < t < \frac{T}{2} \\ 0 & t > \frac{T}{2} \end{cases}$$

Before the piston motion, the gas is constant with properties p_1 , ρ_1 , and a_1 , and $\delta \ll a_1 T$.

- a) If the length of tube is very long, find the pressure on the piston in terms of time, i.e., $p=p(t)$.
 - b) Assume the length of tube is L and its end is closed. Assume $L > a_1 T/4$. Find $p(x=L)$ for $0 < t < L/a_1 + T/2$.
- 5- Question 3.6, page 388, from "Elements of Gas Dynamics" by Liepmann and Roshko.