

UNIVERSITY OF NOTRE DAME
DEPARTMENT OF AEROSPACE AND MECHANICAL ENGINEERING

Professor H.M. Atassi
113 Hessert Center
Tel: 631-5736
Email: atassi@nd.edu

AME-60633
Introduction to Acoustics

Homework 1

- I. If an ideal gas is compressed adiabatically from a state in which the density is ρ_0 and the temperature is T_0 to a state in which the density is ρ and the temperature is T , find T as a function of ρ .
- II. An organ pipe is tuned to a pitch of 440 hertz (sec^{-1}) when the temperature is 25°C . What will the pitch be at a temperature of 0°C ?
- III. Consider a progressive sinusoidal plane wave of frequency ω and a displacement amplitude $\bar{\xi}$ travelling in air. and a wave having the same value of ω and $\bar{\xi}$ travelling in water. How do the pressure amplitudes compare?
- IV. For a plane wave satisfying the one-dimensional wave equation in a uniform fluid medium of infinite extent, assume that the function $\dot{\xi}(x, 0)$, which specifies the initial velocities of all the particles, and the initial pressure distribution, $p(x, 0)$, are given. Find the general expression for $p(x, t)$.
 1. Apply your general result to the special case where

$$\begin{aligned} p(x, 0) &= p_0, & x < 0, \\ p(x, 0) &= 0, & x \geq 0. \end{aligned}$$

Sketch the graph of $p(x, t)$ at some later time.