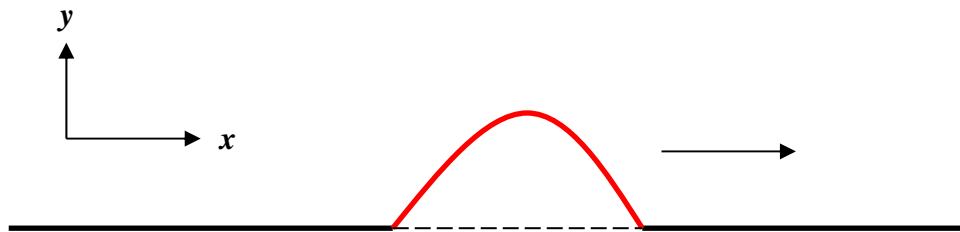


Lecture I:

Introduction

What is Sound?

- The word **Sound** is used to describe two different physical phenomena:
 - Auditory sensation in one's ear(s) (one's brain?) – what is this exactly?
 - Disturbance (= local energy over-density) in a physical medium (*e.g.* air, water – a gas, liquid, or solid) which *propagates* in that medium, which in turn causes an auditory sensation in one's ears/brain.
 - Humans (and many other animal species) have developed ability to *hear* sounds, because sounds/sound waves *exist* in the natural environment. Two ears are the *minimum* requirement for ability to locate the *source* of a sound – evolutionarily an extremely beneficial capability.
- The scientific study of the phenomenon of sound is known as **Acoustics**.
 - Broad interdisciplinary field – physics, engineering, psychology, speech, music, physiology, neuroscience, architecture, etc.
 - Different branches of Acoustics:
 - Physical Acoustics
 - Musical Acoustics
 - Psycho-Acoustics
 - Physiological Acoustics
 - Architectural Acoustics
 - *etc....*
- Sound propagates in a physical medium (gas/liquid/solid) as a **wave**.
 - An acoustical disturbance (localized excess energy) propagates as a *collective* excitation (*i.e.* vibration) of a group of atoms and/or molecules that make up the physical medium.
 - Visualize a pulse traveling down a stretched rope, string or wire:



- This kind of wave is known as a **transverse** wave – because the *displacement*, $y(x)$ of the medium from its equilibrium position due to the disturbance is *transverse* (*i.e.* perpendicular) to the direction of propagation of the disturbance.
- Now visualize an acoustical pulse propagating in a gas, liquid or solid (*e.g.* air, water, or a metal – steel or aluminum).