

AIR TUBE INFLATION LAB

PURPOSE: The main purpose is to give you some experience with inflation waves in a long plastic tube. You will measure the inflation speed and compare with theory.

SETUP: The setup consists of an air blower which is connected to one end of a long plastic tube.

PROCEDURE: Set the speed of the blower. Turn on the blower and measure the time it takes for an inflation wave to propagate down a section of the tube.

OBSERVATIONS: Calculate the propagation speed of the inflation wave and compare with propagation theories.

INFLATION SPEEDS

The specification sheet for the blower gives its flow rate Q . Flow moves down a tube which when inflated has cross sectional area A . A potential inflation speed is:

$$S = Q/A \quad A = \pi D^2/4$$

Another potential inflation speed is the wave speed for a flexible tube. This is

$$a = \sqrt{[K/\rho]}$$

$$K = K / [1 + [DK]/[Ee]]$$

where K is the Bulk Modulus for air, ρ is the density of air, D is the tube diameter, e is the wall thickness and E is the Elastic Modulus of plastic. The tube diameter is 385mm and the wall thickness is 0.15mm. The Elastic Modulus of plastic is 400MPa and the Bulk Modulus of air is 0.14MPa. The density of atmospheric air is 1.2kg/m^3 .

