The speed of sound is

Imagine a wave moving along the -x-axis with a speed and we are moving with one of the pulses, which has a pressure. An element of air of width relative to us will move with a speed toward the +x-axis.

Let us assume that pulse is stationary and the element of air is moving toward it with speed .

A

There will be a net force on the air element due to the difference in pressure.

Now

And

Therefore

Substitute from last equation in (1) we get

If s(x,t) represent the distance of small volume element measured from its equilibrium position moving in simple harmonic motion we can express it as

What would be the change in pressure in medium that caused by the propagation of the wave?

Let us concentrate on a small volume element somewhere in between two pulses. The side of the element will experience different pressure according to their location therefore, they will move with different speed.

Let us call the left side of the element side 1 and the right side one side 2.

A

2

1

At t=0

At some other timet=0

1

2

Since

The gives us

Which can be written as