Date
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MTC - 2

Unit - II

Laplace's correction of Newton's formula.

The Laplace formula is $V = \sqrt{\frac{\gamma P}{\rho}}$

[Error in Newton's formula for velocity of sound in air at N.T.P. →

Normal air pressure = 76 cm
and Hg (Mercury) = $76 \times 13.59 \times 980$ dynes/cm^2 (g)

At 0°C and at normal atmospheric pressure, the density of air = 0.001293 g/cm^3

So, from Newton's formula,

$$V = \sqrt{\frac{76 \times 13.59 \times 980}{0.001293}} \text{ (approx)}$$

This value of velocity of sound is deff = 281 m/s]

the Laplace's correction of Newton's formula is →:

This differences between the experimentally observed value of velocity of sound in air and the calculated value was explained by Laplace. He pointed out that during propagation of sound wave each layer of the medium is alternately compressed and rarefied.

During compression the layer is heated and during rarefaction the layer is cooled on account of the fact that air is bad conductor of heat as well as a bad radiator therefore heat cannot flow quickly from of heated layers to the called layers.

That region propagation of sound waves, takes place under a adiabatic condition.

$$P \cdot V^{\gamma} = \text{constant}$$

where γ is the ratio of specific heat at constant pressure to the specific heat at constant Volume.

Using the above relation Laplace showed that

$$V = \sqrt{\frac{\gamma P}{\rho}}$$

for air $\gamma = 1.41$.

Putting the value of γ we get

$V = 332$ m/s This result was agree with the experimental value.