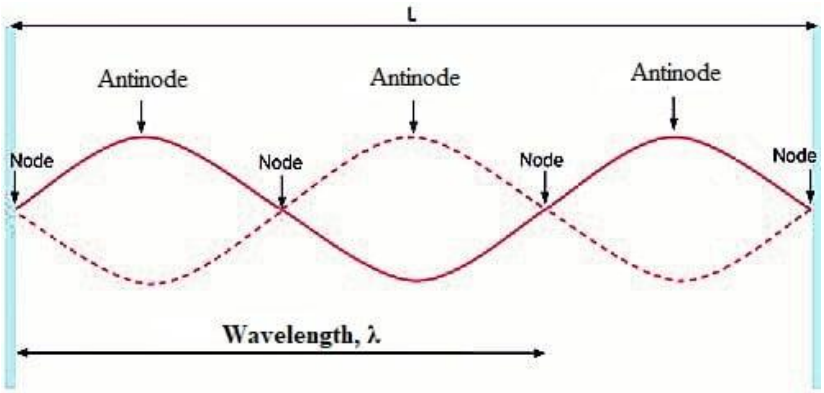
EXPERIMENT 3: FORMATION OF STANDING WAVE ON A STRING

THEORY

When a vibrating body produces waves along a tightly streched string, the waves are reflected at the end og the string which cause two oppositely traveling waves to exist on the sting at the same time. These two waves interfere with each other, creating both constructive and destructive interference in the vibrating string. If the two waves have identical amplitudes, wavelegth and velocities, a standing wave is created.



The constructive and destructive interference patterns caused by the superposition of the two waves create points of minimum displacement called nodes and points of maximum displacement called antinodes.

The wave velocity of a standing wave is dependent on the medium through which the wave travels. The velocity of standing waves propagating through a taunt string, for instance, is dependent on the tension in the string F_T and the linear density of the string μ. For waves of small amplitude this velocity is given by

$$v = \sqrt{\frac{F_T}{\mu}}$$

$$\mu = \frac{m_0}{l_0} \qquad m_0 = mass\ of\ string \qquad l_0 = length\ of\ string$$

PROCEDURE AND CALCULATIONS

1. Switch on the motor of the apparatus.
2. Change the height of the holding arm until a one oscillation antinode.
3. Read off the corresponding force F_1 using dynamometer.
4. By slowly and carefully varying the height of holding arm, determine the forces F_n at which standing waves n=2,3,4 antinodes are formed.
5. Switch of the motor.
6. Calculate velocity of wave using F_n and μ values.
7. Calculate wavelength of the wave using equation

$$\lambda_n = \frac{2s}{n} \qquad ; \qquad s = 0{,}5m$$

8. Calculate frequency of wave for n=1,2,3,4.
9. Plot the graph λ_n vs F_n.

n	F	v	λ	f
1				
2				
3				
4				