STANDING WAVES ON A STRING 3B22.10

Oscillations and Waves | Wave Motion | Standing Waves

2nd Harmonic at 20Hz

Concept:

A standing wave is the superposition of traveling waves constrained between two fixed boundaries, resulting in a discrete set of modes. The wavelength of each mode λ_n is completely determined by the distance between the fixed boundaries L by the relation:

$$\lambda_n = \frac{2L}{n}$$

Thus, the frequency of each mode (f_n) is:

$$f_n = \frac{\mathrm{v}}{\lambda_n} \text{ where v is the wave speed.}$$

Equipment:

- Function Generator (HP 33120A)
- Pasco Mechanical Vibrator
- BNC-Banana Cable
- Thin Elastic Cord
- Support Stand
- Rod Clamp
- Slotted End Clamp

Procedure:

1. Connect the BNC “Output” of the function generator to the banana inputs of the mechanical vibrator.
2. Slot the knotted end of the cord in the vibrator pole and clamp the other end of the cord to the clamp.
3. Verify that the vibrator is unlocked, turn on the function generator and select “RECALL”, “↑”, “ENTER” to recall preset #1 for the demonstration. (Preset Values: Amplitude = 6 VPP, Frequency = 10 Hz.)
4. If needed, adjust the tension in the elastic cord until the fundamental frequency occurs exactly at 10Hz.
5. 2nd harmonic = 20 Hz, 3rd harmonic = 30 Hz, 4th harmonic = 40 Hz…

Notes and Extras:

- Video Link: http://blip.tv/file/1511388/
- The amplitude of the vibrating string in this demo is only 2 cm and thus may be difficult to see by a distant audience. The Standing Waves on a Long Spring or Standing Waves on a Rope demonstrations are the recommended alternatives for displaying large amplitude standing waves.