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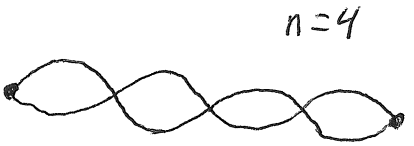
A 600 Hz tuning fork sets up a standing wave pattern on a string with fixed ends. If $v_{wave} = 400. m/s$ and the string has four loops with amplitude 2.0 mm.

(1) Determine the length of the string.

(2) Write an equation for the displacement of the string as a function of position and time.

solution:



$$f_4 = \frac{4v}{2L}$$

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

(1)

$$L = \frac{4v}{2f_4} = \frac{4(400. m/s)}{2(600 Hz)}$$

$$= 1.33 m$$

(2)

$$y(x,t) = [2y_m \sin kx] \cos \omega t$$

$$\omega = 2\pi f = 2\pi\, 600\,Hz = 3.77E3\, s^{-1}$$

$$k = \frac{2\pi}{\lambda} = \frac{2\pi}{\left(\frac{1.33m}{2}\right)} = 9.45\, m^{-1}$$

$$2\lambda = 1.33m$$

$$y(x,t) = \underbrace{[2y_m \sin kx]}_{\text{Amplitude}} \cos \omega t$$

max when $\sin kx \to 1$

our max amplitude = 2.0mm

$$y(x,t) = [2.0E{-}3m \sin(9.45m^{-1}x)] \cos(3.77E3\, s^{-1} t)$$