1.1 A 2-kHz sound wave traveling in the x-direction in air was observed to have a differential pressure $p(x,t) = 10\ \text{N/m}^2$ at $x = 0$ and $t = 50\ \mu\text{s}$. If the reference phase of $p(x,t)$ is 36°, find a complete expression for $p(x,t)$. The velocity of sound in air is 330 m/s.

1.4 A wave traveling along a string is given by

$$y(x,t) = 2\sin(4\pi t + 10\pi x) \qquad \text{(cm)},$$

where x is the distance along the string in meters and y is the vertical displacement. Determine: (a) the direction of wave travel, (b) the reference phase ϕ_0, (c) the frequency, (d) the wavelength, and (e) the phase velocity.

1.7 A wave traveling along a string in the $+x$ direction is given by

$$y_1(x,t) = A\cos(\omega t - \beta x),$$

where $x = 0$ is the end of the string, which is tied rigidly to a wall, as shown in Fig. P1.7. When wave $y_1(x,t)$ arrives at the wall, a reflected wave $y_2(x,t)$ is generated. Hence, at any location on the string, the vertical displacement y_s is the sum of the incident and reflected waves:

$$y_s(x,t) = y_1(x,t) + y_2(x,t).$$

(a) Write an expression for $y_2(x,t)$, keeping in mind its direction of travel and the fact that the end of the string cannot move.

(b) Generate plots of $y_1(x,t)$, $y_2(x,t)$ and $y_s(x,t)$ versus x over the range $-2\lambda \le x \le 0$ at $\omega t = \pi/4$ and at $\omega t = \pi/2$.

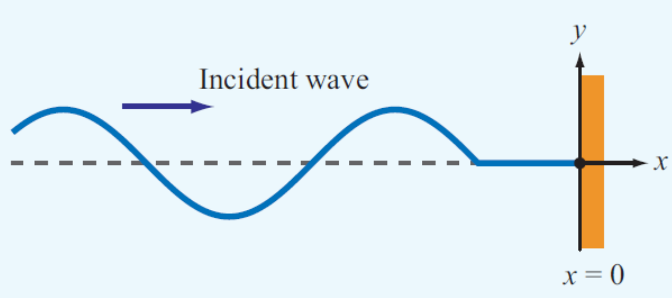

Figure P1.7 Wave on a string tied to a wall at $x = 0$ (Problem 1.7).

1.9 Give expressions for $y(x,t)$ for a sinusoidal wave traveling along a string in the negative x-direction, given that $y_{max} = 40$ cm, $\lambda = 30$ cm, $f = 10$ Hz, and

(a) $y(x,0) = 0$ at $x = 0$,
(b) $y(x,0) = 0$ at $x = 3.75$ cm.

1.25 A voltage source given by

$$\upsilon_s(t) = 25\cos(2\pi \times 10^3 t - 30°) \qquad \text{(V)}$$

is connected to a series RC load as shown in Fig. 1-20. If $R = 1$ MΩ and $C = 200$ pF, obtain an expression for $\upsilon_c(t)$, the voltage across the capacitor.

1.26 Find the phasors of the following time functions:

(a) $\upsilon(t) = 9\cos(\omega t - \pi/3)$ (V)
(b) $\upsilon(t) = 12\sin(\omega t + \pi/4)$ (V)
(c) $i(x,t) = 5e^{-3x}\sin(\omega t + \pi/6)$ (A)
(d) $i(t) = -2\cos(\omega t + 3\pi/4)$ (A)
(e) $i(t) = 4\sin(\omega t + \pi/3) + 3\cos(\omega t - \pi/6)$ (A)

1.27 Find the instantaneous time sinusoidal functions corresponding to the following phasors:

(a) $\widetilde{V} = -5e^{j\pi/3}$ (V)
(b) $\widetilde{V} = j6e^{-j\pi/4}$ (V)
(c) $\tilde{I} = (6 + j8)$ (A)
(d) $\tilde{I} = -3 + j2$ (A)
(e) $\tilde{I} = j$ (A)
(f) $\tilde{I} = 2e^{j\pi/6}$ (A)

1.29 The voltage source of the circuit shown in Fig. P1.29 is given by

$$v_s(t) = 25\cos(4 \times 10^4 t - 45°) \qquad \text{(V)}.$$

Obtain an expression for $i_L(t)$, the current flowing through the inductor.