3-1) $i = 8\cos(2\pi \times 10^6 t - 0.025x)$ ①

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Chapter #3

a) Direction of Propagation
Positive Propagation

b) Peak Value
$I_p = 8$

c) angular frequency.
$\omega = 2\pi \times 10^6$ rad/s

d) Phase constant
$\beta = 0.025$

e) cyclic frequency
$f = \frac{\omega}{2\pi} = \frac{2\pi 10^6}{2\pi} = 1 mHz$

f) Period
$T = \frac{1}{f} = \frac{1}{1 \times 10^6} = 1 \mu s$

h) Velocity of Propagation.

$v = \frac{\omega}{\beta} = \frac{2\pi \times 10^6}{0.025} = 2.5 \times 10^8$ m/s

3-2).
$V = 15\cos(10^8 t + 0.35x)$

a) Direction of Propagation
negative propagation

b) Peak Value

$V_p = 15V$.

d) Angular frequency.

$\omega = 10^8 \, rad/s$

e) Phase constant

$\beta = 0.35$

e) cyclic frequency.

$f = \frac{\omega}{2\pi} = \frac{10^8}{2\pi} = 15.9 \times 10^6 = 15.9 \, MHz$

f) Period

$T = \frac{1}{f} = \frac{1}{15.9 \times 10^6} = 62.8 \, ns$

g) wavelength

$\lambda = \frac{2\pi}{\beta} = \frac{2\pi}{0.35} = 17.9 \, m$

h) Velocity of Propagation.

$v = \frac{\omega}{\beta} = \frac{10^8}{0.35} = 2.8 \times 10^8 \, m/s$

3-7) sinusoidal current.

$\rightarrow I_p = 2A \,; \, f = 50 \, MHz$

$\rightarrow$ Positive Propagating

$\rightarrow v = 2 \times 10^8 \, m/s$

a) Periods

$T = \frac{1}{f} = \frac{1}{50 \times 10^6} = 20 \, ns$

b) angular frequency.

$\omega = 2\pi f = 2\pi (50 \times 10^6) = 100\pi \times 10^6$

c) Phase constant

$$\beta = \frac{\omega}{v} = \frac{100\pi \times 10^6}{2 \times 10^8} = \tfrac{1}{2}\pi$$

d) wavelength

$$\lambda = \frac{2\pi}{\beta} = \frac{2\pi}{\tfrac{1}{2}\pi} = 4\,m$$

e) an equation for the current.

$$\lambda = 2 \sin(100\pi \times 10^6 t - \tfrac{1}{2}\pi x)$$

3-4) sinusoidal voltage

→ $V_p = 25\,V$ ; $\omega$ 20 Mrad/s

→ negative propagating

→ $v = 3 \times 10^8$ m/s

a) cyclic frequency.

$$f = \frac{\omega}{2\pi} = \frac{20 \times 10^6}{2\pi} = 3.2\,MHz$$

b) Period

$$T = 1/f = \frac{1}{3.2 \times 10^6} = 0.31\,\mu s.$$

c) Phase constant

$$\beta = \frac{\omega}{v} = \frac{20 \times 10^6}{3 \times 10^8} = 0.067$$

d) Wavelength

$$\lambda = \frac{2\pi}{\beta} = \frac{2\pi}{0.067} = 30\pi$$

e) and equation for the voltage.

$$v(t,x) = 25 \sin(20 \times 10^6 t + 0.067 x)$$

3-5) considering Problem 3-1 determine:

a) determine $\bar{I}^+$ or $I^-$

$$I^- = I_p e^{j\phi} = 8\angle 0$$

b) the corresponding distance varying phasor. $\bar{I}(x)$

$$I^-(x) = \bar{I}^- e^{j\beta x} = (8\angle 0)(e^{j0.025x}) = 8\angle 0.025x$$

c) the value of the distance-varying phasor at $x = 100$ m.

$$\bar{I}(100) = 6\angle 0.023(100) = (6\angle 2.5)A$$

6) considering Problem 3-8

a) Determine $V^+$ or $V^-$

$$I^- = V_p e^{j\phi} = 15 e^{j0} = 15\angle 0$$

b) the corresponding distance varying phasor $\bar{V}(x)$

$$\bar{V}(x) = (\bar{V}^-)(e^{j\beta x}) = (15\angle 0)(e^{j0.35x}) = 15\angle 0.35x$$

c) the value of the distance varying phasor $x = 4$ m.

$$\bar{V}(4\,m) = 15\angle 0.35(4) = \boxed{15\angle 1.4\,A}$$

3-7) repeat analysis of problem 3.5 for.

$i = 8\cos(2\pi\times10^6 t - 0.025x + 1.5)$

~~$i = 8\cos$~~

$I^- = 8e^{j1.5} = 8\angle 1.5$

$I(x) = (I^-)e^{j\beta x} = (8\angle 1.5)(1\angle 0.025x)$

$I(x) = 8\angle 1.5 + 0.025x$

$I(100) = 8\angle 1.5 + 0.025(100) = 8\angle 4 \text{ A}$

3-8) repeat analysis of problem 3.6 for.

$v = 15\cos(10^8 t + 0.35x - \pi/3)$

$I^- = 15e^{-j\pi/3} = 15\angle -\pi/3$

$I(x) = (I^-)e^{j\beta x} = 15(\angle -\pi/3)(1\angle 0.35x)$

$I(x) = 15\angle 0.35x - \pi/3$

$I(4) = 15(\angle 0.35(4) - \pi/3) = \boxed{15\angle 0.35 \text{ V}}$

3-17) A table of specifications for versions of RG-8/U 50-Ω coaxial cable indicate that attenuation per 100 ft at 50 MHz is 1.2 dB. At this frequency determine the following:

a) attenuation factor in decibels per foot.

$$\alpha_{dB} = \frac{1.2\,dB}{100\,ft} = 0.012\,\frac{dB}{ft}$$

b) attenuation factor in nepers per foot.

$$\alpha_{Np} = \frac{\alpha_{dB}}{8.686} = \frac{0.012\,dB/ft}{8.686} = 1.38\times10^{-3}\,Np/ft$$

For a length of 300 ft

c) $L_{dB} = \alpha_{dB}\,l = (0.012)(300) = 3.6\,dB$

d) $L = \alpha l = (1.38\times10^{-3})(300) = 0.414\,Np.$

e) $V_2/V_1$ ratio

$$\frac{V_2}{V_1} = 10^{-L_{dB}/20} = 10^{-3.6/20} = \boxed{0.66}$$