

**13.61**  $1.304 \angle 62.92^\circ \text{ A}$

**13.63**  $19.55 \angle 83.32^\circ \text{ V}$ ,  $68.47 \angle 46.4^\circ \text{ V}$ ,  $0.4434 \angle -92.6^\circ \text{ A}$

**13.65**  $4.028 \angle -52.38^\circ$ ,  $2.019 \angle -52.11^\circ$ ,  $1.338 \angle -52.2^\circ \text{ A}$

**13.67**  $7.5 \text{ k}\Omega$

**13.69**  $315 \text{ W}$

**13.71** (a) 0.1, (b) 25 turns, (c) 1.667 A, 16.67 A

**13.73** (a) 112 V, (b) 0.2613 A, 11.2 A, (c) 1254 W

**13.75** (a) 733.4 V, (b) 440 V

### Chapter 14

**14.1**  $\frac{j\omega/\omega_o}{1 + j\omega/\omega_o}$ ,  $\omega_o = \frac{1}{RC}$

**14.3** (a)  $\frac{1}{s^2R^2C^2 + 3sRC + 1}$ , (b)  $-4.787$ ,  $-32.712$

**14.5** (a)  $\frac{1}{1 + j\omega RC - \omega^2 LC}$ , (b)  $\frac{j\omega L - \omega^2 RLC}{R + j\omega L - \omega^2 RLC}$

**14.7** (a) 1.005773, (b) 0.4898, (c)  $1.718 \times 10^5$

**14.9** See Fig. E.20.

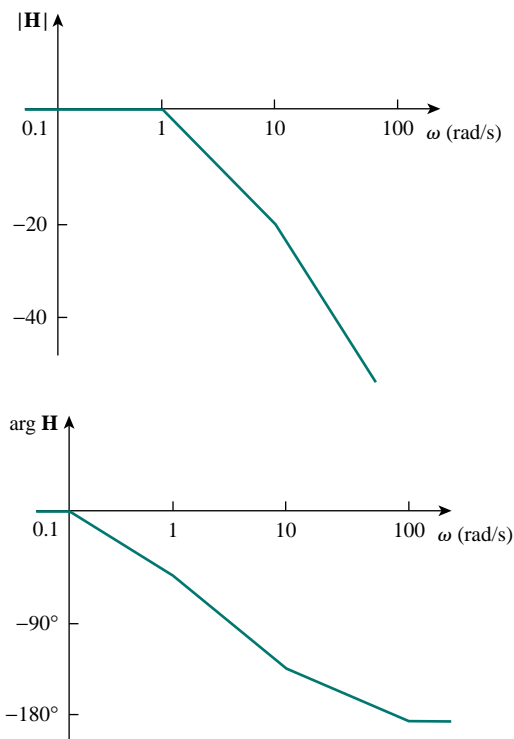


Figure E.20 For Prob. 14.9.

14.11 See Fig. E.21.

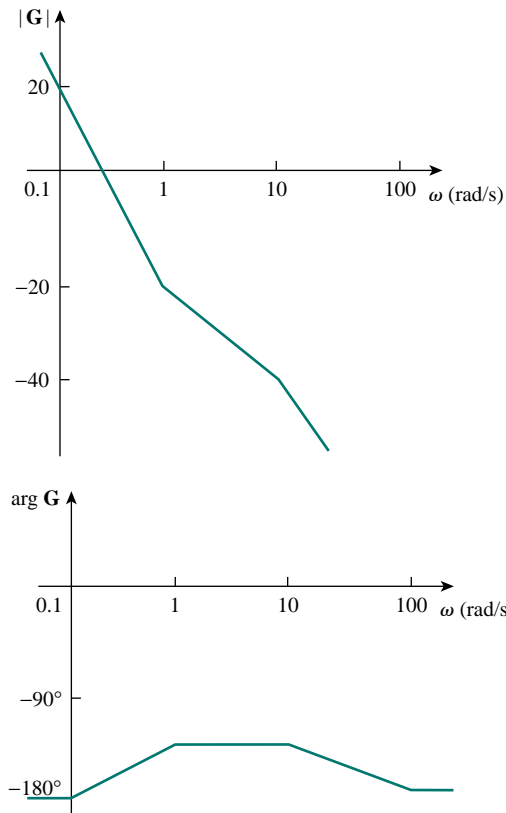


Figure E.21 For Prob. 14.11.

14.13 See Fig. E.22.

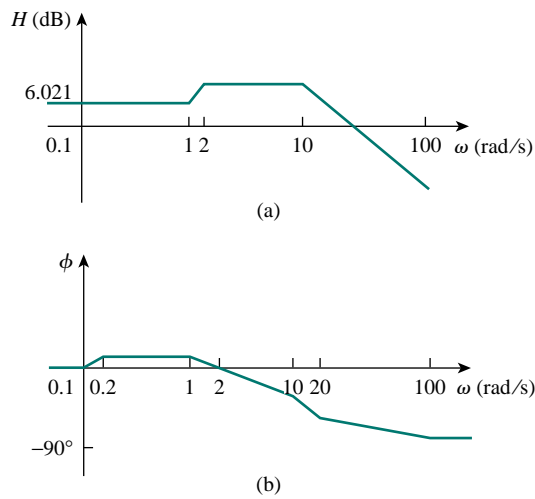


Figure E.22 For Prob. 14.13: (a) magnitude plot, (b) phase plot.

14.15 See Fig. E.23.

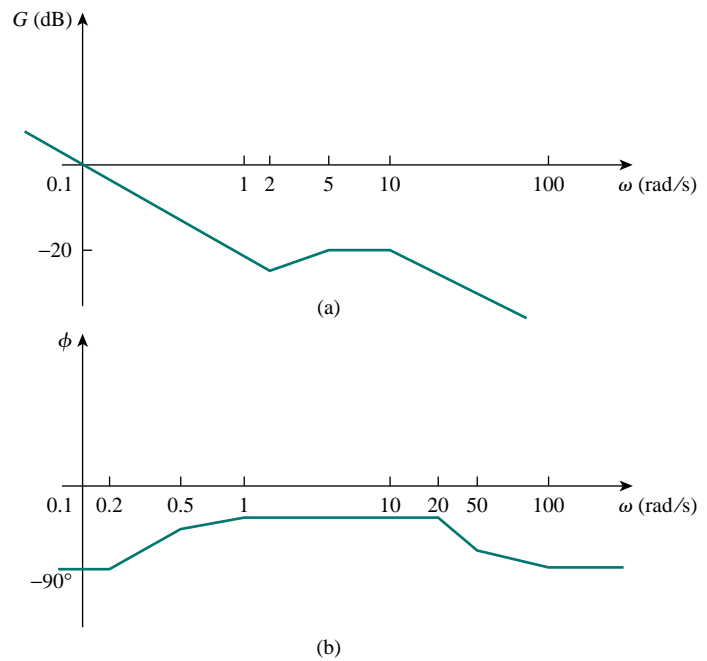


Figure E.23 For Prob. 14.15: (a) magnitude plot, (b) phase plot.

14.17 See Fig. E.24.

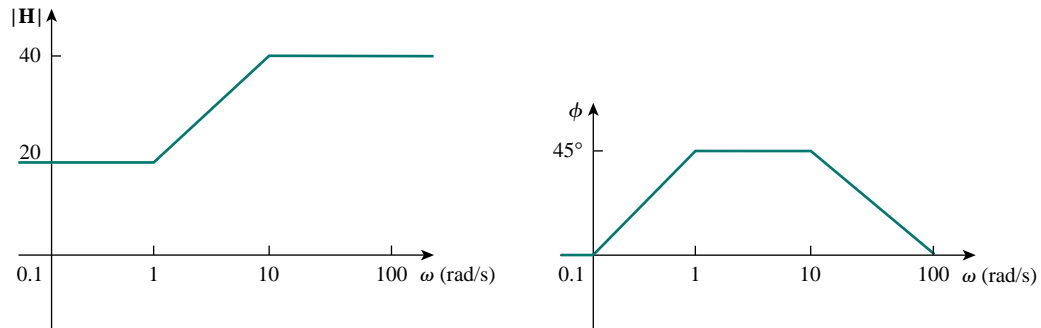


Figure E.24 For Prob. 14.17.

$$14.19 \quad \frac{10^4(2 + j\omega)}{(20 + j\omega)(100 + j\omega)}$$

$$14.21 \quad \frac{Kj\omega}{(1 + j\omega)(100 + j\omega)}, \quad K = \text{constant}$$

$$14.23 \quad R = 10 \, \Omega, \quad L = 16 \, \text{H}, \quad C = 25 \, \mu\text{F}, \quad 0.625 \, \text{rad/s}$$

$$14.25 \quad 0.7861 \, \text{rad/s}$$

$$14.27 \quad 50 \, \text{rad/s}, \quad 5.975 \times 10^6 \, \text{rad/s}, \quad 6.025 \times 10^6 \, \text{rad/s}$$

- 14.29**  $2 \text{ k}\Omega$ ,  $0.6154 + j0.923 \text{ k}\Omega$ ,  $1.471 + j0.8824 \text{ k}\Omega$ ,  $1.471 - j0.8824 \text{ k}\Omega$ ,  $0.6154 - j0.923 \text{ k}\Omega$
- 14.31** (a)  $5 \text{ rad/s}$ ,  $0.625$ ,  $8 \text{ rad/s}$ , (b)  $5 \text{ krad/s}$ ,  $20$ ,  $250 \text{ rad/s}$
- 14.33** (a)  $3.333 \text{ krad/s}$ , (b)  $0.9997 \angle 1.205^\circ \Omega$
- 14.35** (a)  $\frac{j\omega}{2(1 + j\omega)^2}$ , (b)  $0.25$
- 14.37**  $\frac{R}{R + j\omega L - \omega^2 RLC}$ , Proof
- 14.39** Highpass filter,  $318.3 \text{ Hz}$
- 14.41**  $31.42 \text{ k}\Omega$
- 14.43**  $1.56 \text{ kHz} < f < 1.59 \text{ kHz}$ ,  $25$
- 14.45** (a)  $1 \text{ rad/s}$ ,  $3 \text{ rad/s}$ , (b)  $1 \text{ rad/s}$ ,  $3 \text{ rad/s}$
- 14.47**  $9.6 \text{ krad/s}$ ,  $5 \text{ krad/s}$
- 14.49** (a)  $23.53 \text{ mV}$ , (b)  $107.3 \text{ mV}$ , (c)  $119.4 \text{ mV}$
- 14.51**  $\left(1 + \frac{R_f}{R_i}\right), \frac{1}{RC}$
- 14.53** If  $R_f = 20 \text{ k}\Omega$ , then  $R_i = 80 \text{ k}\Omega$  and  $C = 31.83 \text{ nF}$ .
- 14.55** Let  $R = 10 \text{ k}\Omega$ , then  $R_f = 25 \text{ k}\Omega$ ,  $C = 7.96 \text{ nF}$ .
- 14.57**  $K_f = 2 \times 10^{-4}$ ,  $K_m = 5 \times 10^{-3}$
- 14.59**  $9.6 \text{ M}\Omega$ ,  $32 \mu\text{H}$ ,  $0.375 \text{ pF}$
- 14.61** See Fig. E.25.

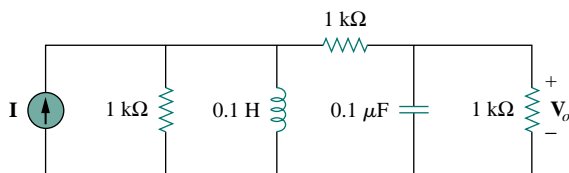


Figure E.25 For Prob. 14.61.

- 14.63** (a) See Fig. E.26, (b)  $894.4 \angle 26.7^\circ \Omega$

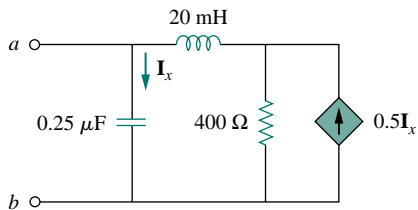
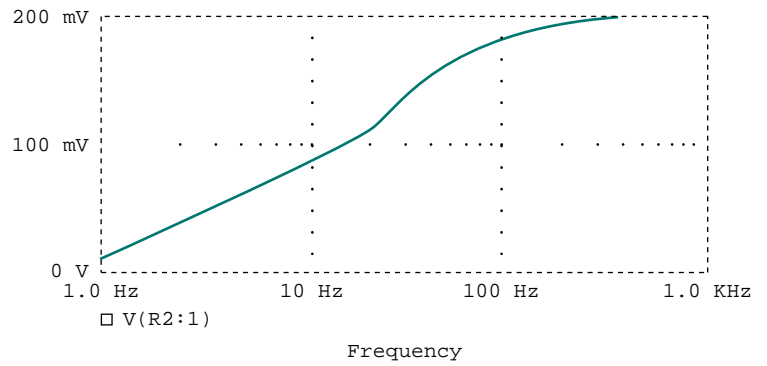
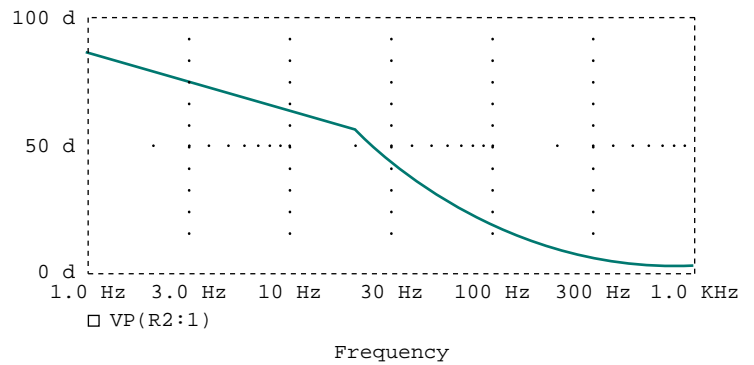


Figure E.26 For Prob. 14.63.

14.65 See Fig. E.27.



(a)



(b)

Figure E.27 For Prob. 14.65.

14.67 See Fig. E.28; high pass filter,  $f_0 = 1.2$  Hz.

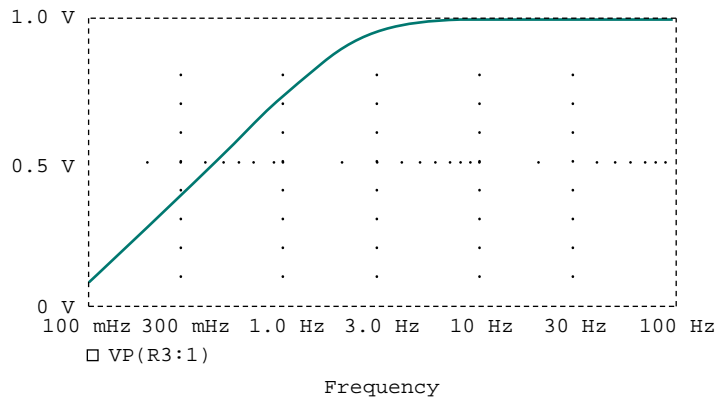


Figure E.28 For Prob. 14.67.

14.69 See Fig. E.29.

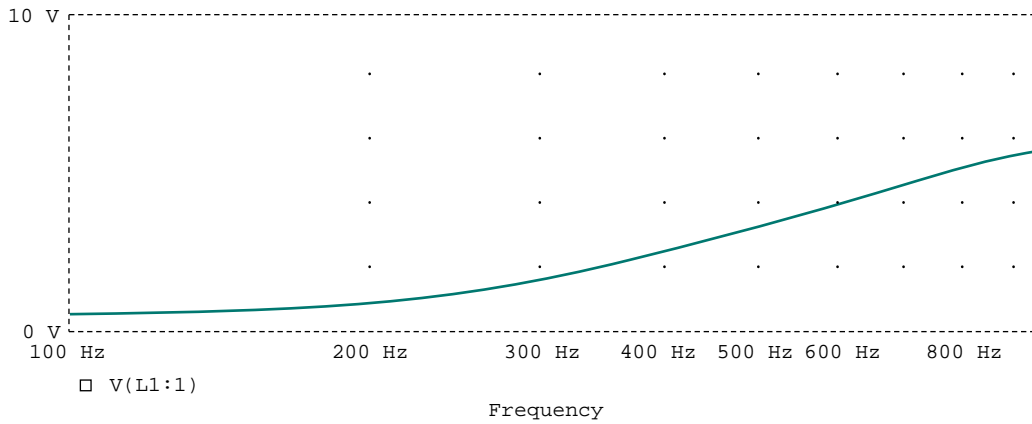


Figure E.29 For Prob. 14.69.

14.71 See Fig. E.30;  $f_o = 800$  Hz.

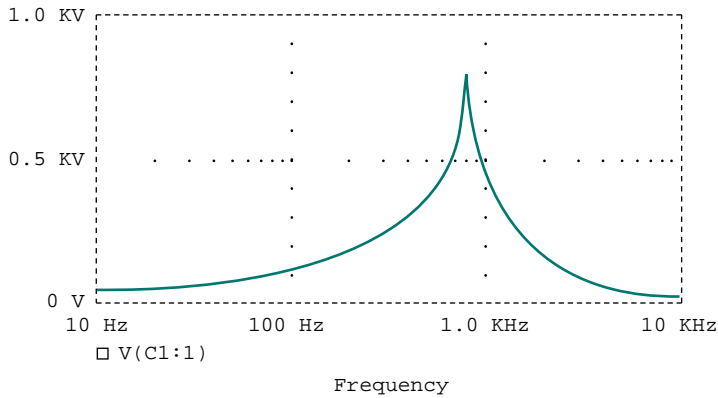


Figure E.30 For Prob. 14.71.

14.73 938 kHz, remains the same

14.75 
$$\frac{R_L(R_L + sL + s^2R_LLC_2)}{(R_L + sL + s^2R_LC_2L)(sL + R_L + s^2R_LLC_2 + R_i + sR_iR_LC_2 + s^3R_iR_LC_2 + sR_iR_LC_1 + s^3R_iR_LLC_1C_2)}$$

14.77 440 Hz

14.79 15.91  $\Omega$

14.81 (a) 2 kHz, (b) 1.59 kHz

14.83 See Fig. E.31.

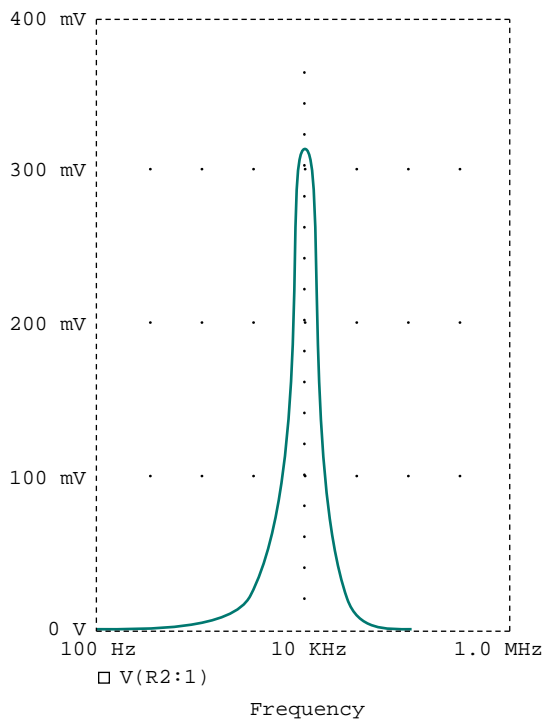


Figure E.31 For Prob. 14.83.

## Chapter 15

15.1 (a)  $\frac{s}{s^2 - a^2}$ , (b)  $\frac{a}{s^2 - a^2}$

15.3 (a)  $\frac{s+2}{(s+2)^2+9}$ , (b)  $\frac{4}{(s+2)^2+16}$ , (c)  $\frac{s+3}{(s+3)^2-4}$ , (d)  $\frac{1}{(s+4)^2-1}$ ,

(e)  $\frac{4(s+1)}{[(s+1)^2-4]^4}$

15.5 (a)  $2e^{-s}$ , (b)  $\frac{10}{s}e^{-2s}$ , (c)  $\frac{1}{s^2} + \frac{1}{s}$ , (d)  $\frac{2e^{-4s}}{e^4(s+1)}$

15.7 (a)  $\frac{3}{2} + \frac{6}{s} + \frac{4}{s+2} - \frac{10}{s+3}$ , (b)  $\frac{e^{-(s+1)}}{(s+1)^2} + \frac{e^{-(s+1)}}{s+1}$ , (c)  $\frac{se^{-s}}{s^2+4}$ ,

(d)  $\frac{4}{s^2+16}(1 - e^{-\pi s})$

15.9 (a)  $-\frac{(s+2)}{s^2+2s+2}$ , (b)  $\frac{-(s+2)}{s^2+2s+2}$

15.11  $\frac{5}{s^2}(1 - 2e^{-s} + e^{-2s})$

15.13  $\frac{1}{s}(5 - 3e^{-s} + 3e^{-3s} - 5e^{-4s})$