

Filter Summary Report: TIA,simple,Z4,ZL

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10.25INVALID-ORDER-25	$Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$	23

10.26INVALID-ORDER-26	$Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4s}, \infty, L_Ls + R_L + \frac{1}{C_Ls} \right)$	23
10.27INVALID-ORDER-27	$Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4s}, \infty, \frac{1}{C_Ls + \frac{1}{R_L} + \frac{1}{L_Ls}} \right)$	24
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10.34INVALID-ORDER-34	$Z(s) = \left(\infty, \infty, \infty, L_4s + \frac{1}{C_4s}, \infty, \frac{L_Ls}{C_LL_Ls^2+1} \right)$	25
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10.39INVALID-ORDER-39	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, \frac{1}{C_Ls} \right)$	26
10.40INVALID-ORDER-40	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, R_L + \frac{1}{C_Ls} \right)$	26
10.41INVALID-ORDER-41	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, L_Ls + \frac{1}{C_Ls} \right)$	26
10.42INVALID-ORDER-42	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, \frac{L_Ls}{C_LL_Ls^2+1} \right)$	26
10.43INVALID-ORDER-43	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, L_Ls + R_L + \frac{1}{C_Ls} \right)$	27
10.44INVALID-ORDER-44	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, \frac{L_Ls}{C_LL_Ls^2+1} + R_L \right)$	27
10.45INVALID-ORDER-45	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, \frac{R_L \left(L_Ls + \frac{1}{C_Ls} \right)}{L_Ls + R_L + \frac{1}{C_Ls}} \right)$	27
10.46INVALID-ORDER-46	$Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, \frac{1}{C_Ls} \right)$	27
10.47INVALID-ORDER-47	$Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, \frac{R_L}{C_LR_Ls+1} \right)$	27

10.48INVALID-ORDER-48	$Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, R_L + \frac{1}{C_Ls} \right)$	28
10.49INVALID-ORDER-49	$Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, L_Ls + \frac{1}{C_Ls} \right)$	28
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10.55INVALID-ORDER-55	$Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4s + \frac{1}{R_4} + \frac{1}{L_4s}}, \infty, R_L + \frac{1}{C_Ls} \right)$	29
10.56INVALID-ORDER-56	$Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4s + \frac{1}{R_4} + \frac{1}{L_4s}}, \infty, L_Ls + \frac{1}{C_Ls} \right)$	29
10.57INVALID-ORDER-57	$Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4s + \frac{1}{R_4} + \frac{1}{L_4s}}, \infty, L_Ls + R_L + \frac{1}{C_Ls} \right)$	29
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10.59INVALID-ORDER-59	$Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4s + \frac{1}{R_4} + \frac{1}{L_4s}}, \infty, \frac{R_L \left(L_Ls + \frac{1}{C_Ls} \right)}{L_Ls + R_L + \frac{1}{C_Ls}} \right)$	30
10.60INVALID-ORDER-60	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1} + R_4, \infty, \frac{1}{C_Ls} \right)$	30
10.61INVALID-ORDER-61	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1} + R_4, \infty, \frac{R_L}{C_LR_Ls+1} \right)$	30
10.62INVALID-ORDER-62	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1} + R_4, \infty, R_L + \frac{1}{C_Ls} \right)$	30
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10.64INVALID-ORDER-64	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1} + R_4, \infty, \frac{L_Ls}{C_LL_Ls^2+1} \right)$	31
10.65INVALID-ORDER-65	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1} + R_4, \infty, L_Ls + R_L + \frac{1}{C_Ls} \right)$	31
10.66INVALID-ORDER-66	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1} + R_4, \infty, \frac{1}{C_Ls + \frac{1}{R_L} + \frac{1}{L_Ls}} \right)$	31
10.67INVALID-ORDER-67	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1} + R_4, \infty, \frac{L_Ls}{C_LL_Ls^2+1} + R_L \right)$	31
10.68INVALID-ORDER-68	$Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1} + R_4, \infty, \frac{R_L \left(L_Ls + \frac{1}{C_Ls} \right)}{L_Ls + R_L + \frac{1}{C_Ls}} \right)$	32

10.69INVALID-ORDER-69	$Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{1}{C_L s} \right)$	32
10.70INVALID-ORDER-70	$Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{R_L}{C_L R_L s + 1} \right)$	32
10.71INVALID-ORDER-71	$Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, R_L + \frac{1}{C_L s} \right)$	32
10.72INVALID-ORDER-72	$Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, L_L s + \frac{1}{C_L s} \right)$	32
10.73INVALID-ORDER-73	$Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$	33
10.74INVALID-ORDER-74	$Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$	33
10.75INVALID-ORDER-75	$Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$	33
10.76INVALID-ORDER-76	$Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$	33
10.77INVALID-ORDER-77	$Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$	33

1 Examined $H(z)$ for TIA simple Z4 ZL: $\frac{Z_4 Z_L g_m}{Z_4 g_m + 2 Z_L g_m}$

$$H(z) = \frac{Z_4 Z_L g_m}{Z_4 g_m + 2 Z_L g_m}$$

2 HP

3 BP

3.1 BP-1 $Z(s) = \left(\infty, \infty, \infty, R_4, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L R_4 s}{C_L L_L R_4 s^2 + 2 L_L s + R_4}$$

Parameters:

$$Q: \frac{C_L R_4 \sqrt{\frac{1}{C_L L_L}}}{2}$$

$$\text{wo: } \sqrt{\frac{1}{C_L L_L}}$$

$$\text{bandwidth: } \frac{2}{C_L R_4}$$

$$\text{K-LP: } 0$$

$$\text{K-HP: } 0$$

$$\text{K-BP: } \frac{R_4}{2}$$

$$\text{QZ: } 0$$

$$\text{WZ: None}$$

3.2 BP-2 $Z(s) = \left(\infty, \infty, \infty, R_4, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

$$H(s) = \frac{L_L R_4 R_L s}{C_L L_L R_4 R_L s^2 + L_L R_4 s + 2 L_L R_L s + R_4 R_L}$$

Parameters:

Q: $\frac{C_L R_4 R_L \sqrt{\frac{1}{C_L L_L}}}{R_4 + 2R_L}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{R_4 + 2R_L}{C_L R_4 R_L}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_4 R_L}{R_4 + 2R_L}$
 QZ: 0
 WZ: None

3.3 BP-3 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

$$H(s) = \frac{L_L R_L s}{2C_4 L_L R_L s^2 + C_L L_L R_L s^2 + L_L s + R_L}$$

Parameters:

Q: $R_L \sqrt{\frac{1}{L_L (2C_4 + C_L)}} (2C_4 + C_L)$
 wo: $\sqrt{\frac{1}{L_L (2C_4 + C_L)}}$
 bandwidth: $\frac{1}{R_L (2C_4 + C_L)}$
 K-LP: 0
 K-HP: 0
 K-BP: R_L
 QZ: 0
 WZ: None

3.4 BP-4 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L R_4 s}{2C_4 L_L R_4 s^2 + C_L L_L R_4 s^2 + 2L_L s + R_4}$$

Parameters:

Q: $\frac{R_4 \sqrt{\frac{1}{L_L (2C_4 + C_L)}} (2C_4 + C_L)}{2}$

wo: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
 bandwidth: $\frac{2}{R_4(2C_4+C_L)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_4}{2}$
 QZ: 0
 Wz: None

3.5 BP-5 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

$$H(s) = \frac{L_L R_4 R_L s}{2C_4 L_L R_4 R_L s^2 + C_L L_L R_4 R_L s^2 + L_L R_4 s + 2L_L R_L s + R_4 R_L}$$

Parameters:

Q: $\frac{R_4 R_L \sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$
 wo: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
 bandwidth: $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_4 R_L}{R_4+2R_L}$
 QZ: 0
 Wz: None

3.6 BP-6 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \infty, R_L \right)$

$$H(s) = \frac{L_4 R_L s}{2C_4 L_4 R_L s^2 + L_4 s + 2R_L}$$

Parameters:

Q: $2C_4 R_L \sqrt{\frac{1}{C_4 L_4}}$
 wo: $\sqrt{\frac{1}{C_4 L_4}}$

bandwidth: $\frac{1}{2C_4R_L}$
 K-LP: 0
 K-HP: 0
 K-BP: R_L
 QZ: 0
 Wz: None

3.7 BP-7 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, \frac{R_L}{C_LR_Ls+1} \right)$

$$H(s) = \frac{L_4R_Ls}{2C_4L_4R_Ls^2 + C_LR_4R_Ls^2 + L_4s + 2R_L}$$

Parameters:

Q: $\sqrt{2}R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}} (2C_4 + C_L)$
 wo: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
 bandwidth: $\frac{1}{R_L(2C_4+C_L)}$
 K-LP: 0
 K-HP: 0
 K-BP: R_L
 QZ: 0
 Wz: None

3.8 BP-8 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}} \right)$

$$H(s) = \frac{L_4L_LR_Ls}{2C_4L_4L_LR_Ls^2 + C_LL_4L_LR_Ls^2 + L_4L_Ls + L_4R_L + 2L_LR_L}$$

Parameters:

Q: $R_L\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}} (2C_4 + C_L)$
 wo: $\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}$
 bandwidth: $\frac{1}{R_L(2C_4+C_L)}$

K-LP: 0
K-HP: 0
K-BP: R_L
QZ: 0
Wz: None

3.9 BP-9 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}}, \infty, R_L \right)$

$$H(s) = \frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2R_4 R_L}$$

Parameters:

Q: $\frac{2C_4 R_4 R_L \sqrt{\frac{1}{C_4 L_4}}}{R_4 + 2R_L}$
wo: $\sqrt{\frac{1}{C_4 L_4}}$
bandwidth: $\frac{R_4 + 2R_L}{2C_4 R_4 R_L}$
K-LP: 0
K-HP: 0
K-BP: $\frac{R_4 R_L}{R_4 + 2R_L}$
QZ: 0
Wz: None

3.10 BP-10 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}}, \infty, \frac{1}{C_L s} \right)$

$$H(s) = \frac{L_4 R_4 s}{2C_4 L_4 R_4 s^2 + C_L L_4 R_4 s^2 + 2L_4 s + 2R_4}$$

Parameters:

Q: $\frac{\sqrt{2} R_4 \sqrt{\frac{1}{L_4 (2C_4 + C_L)}} (2C_4 + C_L)}{2}$
wo: $\sqrt{2} \sqrt{\frac{1}{L_4 (2C_4 + C_L)}}$
bandwidth: $\frac{2}{R_4 (2C_4 + C_L)}$
K-LP: 0

K-HP: 0
K-BP: $\frac{R_4}{2}$
QZ: 0
Wz: None

$$\mathbf{3.11 \quad BP-11} \quad Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}}, \infty, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2 + C_L L_4 R_4 R_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2R_4 R_L}$$

Parameters:

Q: $\frac{\sqrt{2} R_4 R_L \sqrt{\frac{1}{L_4 (2C_4 + C_L)}} (2C_4 + C_L)}{R_4 + 2R_L}$
wo: $\sqrt{2} \sqrt{\frac{1}{L_4 (2C_4 + C_L)}}$
bandwidth: $\frac{R_4 + 2R_L}{R_4 R_L (2C_4 + C_L)}$
K-LP: 0
K-HP: 0
K-BP: $\frac{R_4 R_L}{R_4 + 2R_L}$
QZ: 0
Wz: None

$$\mathbf{3.12 \quad BP-12} \quad Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$$

$$H(s) = \frac{L_4 L_L R_4 s}{2C_4 L_4 L_L R_4 s^2 + C_L L_4 L_L R_4 s^2 + 2L_4 L_L s + L_4 R_4 + 2L_L R_4}$$

Parameters:

Q: $\frac{R_4 \sqrt{\frac{L_4 + 2L_L}{L_4 L_L (2C_4 + C_L)}} (2C_4 + C_L)}{2}$
wo: $\sqrt{\frac{L_4 + 2L_L}{L_4 L_L (2C_4 + C_L)}}$
bandwidth: $\frac{2}{R_4 (2C_4 + C_L)}$
K-LP: 0

K-HP: 0
K-BP: $\frac{R_4}{2}$
QZ: 0
Wz: None

3.13 BP-13 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}}, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

$$H(s) = \frac{L_4 L_L R_4 R_L s}{2C_4 L_4 L_L R_4 R_L s^2 + C_L L_4 L_L R_4 R_L s^2 + L_4 L_L R_4 s + 2L_4 L_L R_L s + L_4 R_4 R_L + 2L_L R_4 R_L}$$

Parameters:

Q: $\frac{R_4 R_L \sqrt{\frac{L_4 + 2L_L}{L_4 L_L (2C_4 + C_L)}} (2C_4 + C_L)}{R_4 + 2R_L}$

wo: $\sqrt{\frac{L_4 + 2L_L}{L_4 L_L (2C_4 + C_L)}}$

bandwidth: $\frac{R_4 + 2R_L}{R_4 R_L (2C_4 + C_L)}$

K-LP: 0

K-HP: 0

K-BP: $\frac{R_4 R_L}{R_4 + 2R_L}$

QZ: 0

Wz: None

4 LP

5 BS

5.1 BS-1 $Z(s) = \left(\infty, \infty, \infty, R_4, \infty, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_4 (C_L L_L s^2 + 1)}{2C_L L_L s^2 + C_L R_4 s + 2}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L \sqrt{\frac{1}{C_L L_L}}}{R_4} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{R_4}{2L_L} \\ \text{K-LP: } & \frac{R_4}{2} \\ \text{K-HP: } & \frac{R_4}{2} \\ \text{K-BP: } & 0 \\ \text{QZ: } & \text{None} \\ \text{WZ: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

$$\mathbf{5.2 \quad BS-2} \quad Z(s) = \left(\infty, \infty, \infty, R_4, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

$$H(s) = \frac{R_4 R_L (C_L L_L s^2 + 1)}{C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + C_L R_4 R_L s + R_4 + 2R_L}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}} (R_4 + 2R_L)}{R_4 R_L} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{R_4 R_L}{L_L (R_4 + 2R_L)} \\ \text{K-LP: } & \frac{R_4 R_L}{R_4 + 2R_L} \\ \text{K-HP: } & \frac{R_4 R_L}{R_4 + 2R_L} \\ \text{K-BP: } & 0 \\ \text{QZ: } & \text{None} \\ \text{WZ: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

$$\mathbf{5.3 \quad BS-3} \quad Z(s) = \left(\infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, \infty, R_L \right)$$

$$H(s) = \frac{R_L (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + 2C_4 R_L s + 1}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{L_4 \sqrt{\frac{1}{C_4 L_4}}}{2R_L} \\ \text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\ \text{bandwidth: } & \frac{2R_L}{L_4} \\ \text{K-LP: } & R_L \\ \text{K-HP: } & R_L \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_4 L_4}} \end{aligned}$$

5.4 BS-4 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, R_L \right)$

$$H(s) = \frac{R_4 R_L (C_4 L_4 s^2 + 1)}{C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + 2C_4 R_4 R_L s + R_4 + 2R_L}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{L_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 + 2R_L)}{2R_4 R_L} \\ \text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\ \text{bandwidth: } & \frac{2R_4 R_L}{L_4 (R_4 + 2R_L)} \\ \text{K-LP: } & \frac{R_4 R_L}{R_4 + 2R_L} \\ \text{K-HP: } & \frac{R_4 R_L}{R_4 + 2R_L} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_4 L_4}} \end{aligned}$$

6 GE

6.1 GE-1 $Z(s) = \left(\infty, \infty, \infty, R_4, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_4 (C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L s^2 + C_L R_4 s + 2C_L R_L s + 2}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L \sqrt{\frac{1}{C_L L_L}}}{R_4 + 2R_L} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{R_4 + 2R_L}{2L_L} \\ \text{K-LP: } & \frac{R_4}{2} \\ \text{K-HP: } & \frac{R_4}{2} \\ \text{K-BP: } & \frac{R_4 R_L}{R_4 + 2R_L} \\ \text{Qz: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.2 GE-2 $Z(s) = \left(\infty, \infty, \infty, R_4, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{R_4 (C_L L_L R_L s^2 + L_L s + R_L)}{C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + 2L_L s + R_4 + 2R_L}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_L \sqrt{\frac{1}{C_L L_L}} (R_4 + 2R_L)}{2} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2}{C_L (R_4 + 2R_L)} \\ \text{K-LP: } & \frac{R_4 R_L}{R_4 + 2R_L} \\ \text{K-HP: } & \frac{R_4 R_L}{R_4 + 2R_L} \\ \text{K-BP: } & \frac{R_4}{2} \\ \text{Qz: } & C_L R_L \sqrt{\frac{1}{C_L L_L}} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.3 GE-3 $Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, R_L \right)$

$$H(s) = \frac{R_L (C_4L_4s^2 + C_4R_4s + 1)}{C_4L_4s^2 + C_4R_4s + 2C_4R_Ls + 1}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{L_4 \sqrt{\frac{1}{C_4L_4}}}{R_4 + 2R_L} \\ \text{wo: } & \sqrt{\frac{1}{C_4L_4}} \\ \text{bandwidth: } & \frac{R_4 + 2R_L}{L_4} \\ \text{K-LP: } & R_L \\ \text{K-HP: } & R_L \\ \text{K-BP: } & \frac{R_4R_L}{R_4 + 2R_L} \\ \text{QZ: } & \frac{L_4 \sqrt{\frac{1}{C_4L_4}}}{R_4} \\ \text{WZ: } & \sqrt{\frac{1}{C_4L_4}} \end{aligned}$$

6.4 GE-4 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2 + 1} + R_4, \infty, R_L \right)$

$$H(s) = \frac{R_L (C_4L_4R_4s^2 + L_4s + R_4)}{C_4L_4R_4s^2 + 2C_4L_4R_Ls^2 + L_4s + R_4 + 2R_L}$$

Parameters:

$$\begin{aligned} \text{Q: } & C_4 \sqrt{\frac{1}{C_4L_4}} (R_4 + 2R_L) \\ \text{wo: } & \sqrt{\frac{1}{C_4L_4}} \\ \text{bandwidth: } & \frac{1}{C_4(R_4 + 2R_L)} \\ \text{K-LP: } & \frac{R_4R_L}{R_4 + 2R_L} \\ \text{K-HP: } & \frac{R_4R_L}{R_4 + 2R_L} \\ \text{K-BP: } & R_L \\ \text{QZ: } & C_4R_4 \sqrt{\frac{1}{C_4L_4}} \end{aligned}$$

$$W_z: \sqrt{\frac{1}{C_4 L_4}}$$

7 AP

8 INVALID-NUMER

$$8.1 \quad \text{INVALID-NUMER-1} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{R_4 (C_L R_L s + 1)}{2C_4 C_L R_4 R_L s^2 + 2C_4 R_4 s + C_L R_4 s + 2C_L R_L s + 2}$$

Parameters:

$$Q: \frac{2C_4 C_L R_4 R_L \sqrt{\frac{1}{C_4 C_L R_4 R_L}}}{2C_4 R_4 + C_L R_4 + 2C_L R_L}$$

$$w_0: \sqrt{\frac{1}{C_4 C_L R_4 R_L}}$$

$$\text{bandwidth: } \frac{2C_4 R_4 + C_L R_4 + 2C_L R_L}{2C_4 C_L R_4 R_L}$$

$$\text{K-LP: } \frac{R_4}{2}$$

$$\text{K-HP: } 0$$

$$\text{K-BP: } \frac{C_L R_4 R_L}{2C_4 R_4 + C_L R_4 + 2C_L R_L}$$

$$Q_z: 0$$

$$W_z: \text{None}$$

$$8.2 \quad \text{INVALID-NUMER-2} \quad Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L (C_4 R_4 s + 1)}{C_4 C_L R_4 R_L s^2 + C_4 R_4 s + 2C_4 R_L s + C_L R_L s + 1}$$

Parameters:

$$Q: \frac{C_4 C_L R_4 R_L \sqrt{\frac{1}{C_4 C_L R_4 R_L}}}{C_4 R_4 + 2C_4 R_L + C_L R_L}$$

wo: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$
 bandwidth: $\frac{C_4 R_4 + 2C_4 R_L + C_L R_L}{C_4 C_L R_4 R_L}$
 K-LP: R_L
 K-HP: 0
 K-BP: $\frac{C_4 R_4 R_L}{C_4 R_4 + 2C_4 R_L + C_L R_L}$
 QZ: 0
 Wz: None

9 INVALID-WZ

10 INVALID-ORDER

10.1 INVALID-ORDER-1 $Z(s) = (\infty, \infty, \infty, R_4, \infty, R_L)$

$$H(s) = \frac{R_4 R_L}{R_4 + 2R_L}$$

10.2 INVALID-ORDER-2 $Z(s) = \left(\infty, \infty, \infty, R_4, \infty, \frac{1}{C_L s}\right)$

$$H(s) = \frac{R_4}{C_L R_4 s + 2}$$

10.3 INVALID-ORDER-3 $Z(s) = \left(\infty, \infty, \infty, R_4, \infty, \frac{R_L}{C_L R_L s + 1}\right)$

$$H(s) = \frac{R_4 R_L}{C_L R_4 R_L s + R_4 + 2R_L}$$

10.4 INVALID-ORDER-4 $Z(s) = \left(\infty, \infty, \infty, R_4, \infty, R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_4 (C_L R_L s + 1)}{C_L R_4 s + 2 C_L R_L s + 2}$$

10.5 INVALID-ORDER-5 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, R_L \right)$

$$H(s) = \frac{R_L}{2 C_4 R_L s + 1}$$

10.6 INVALID-ORDER-6 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, \frac{1}{C_L s} \right)$

$$H(s) = \frac{1}{s (2 C_4 + C_L)}$$

10.7 INVALID-ORDER-7 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L}{2 C_4 R_L s + C_L R_L s + 1}$$

10.8 INVALID-ORDER-8 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{C_L R_L s + 1}{s (2 C_4 C_L R_L s + 2 C_4 + C_L)}$$

10.9 INVALID-ORDER-9 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{C_L L_L s^2 + 1}{s (2 C_4 C_L L_L s^2 + 2 C_4 + C_L)}$$

10.10 INVALID-ORDER-10 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s}{2C_4 L_L s^2 + C_L L_L s^2 + 1}$$

10.11 INVALID-ORDER-11 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{C_L L_L s^2 + C_L R_L s + 1}{s(2C_4 C_L L_L s^2 + 2C_4 C_L R_L s + 2C_4 + C_L)}$$

10.12 INVALID-ORDER-12 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{C_L L_L R_L s^2 + L_L s + R_L}{2C_4 C_L L_L R_L s^3 + 2C_4 L_L s^2 + 2C_4 R_L s + C_L L_L s^2 + 1}$$

10.13 INVALID-ORDER-13 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s}, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$

$$H(s) = \frac{R_L (C_L L_L s^2 + 1)}{2C_4 C_L L_L R_L s^3 + 2C_4 R_L s + C_L L_L s^2 + C_L R_L s + 1}$$

10.14 INVALID-ORDER-14 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, R_L \right)$

$$H(s) = \frac{R_4 R_L}{2C_4 R_4 R_L s + R_4 + 2R_L}$$

10.15 INVALID-ORDER-15 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_4}{2C_4 R_4 s + C_L R_4 s + 2}$$

10.16 INVALID-ORDER-16 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

$$H(s) = \frac{R_4 R_L}{2C_4 R_4 R_L s + C_L R_4 R_L s + R_4 + 2R_L}$$

10.17 INVALID-ORDER-17 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_4 (C_L L_L s^2 + 1)}{2C_4 C_L L_L R_4 s^3 + 2C_4 R_4 s + 2C_L L_L s^2 + C_L R_4 s + 2}$$

10.18 INVALID-ORDER-18 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_4 (C_L L_L s^2 + C_L R_L s + 1)}{2C_4 C_L L_L R_4 s^3 + 2C_4 C_L R_4 R_L s^2 + 2C_4 R_4 s + 2C_L L_L s^2 + C_L R_4 s + 2C_L R_L s + 2}$$

10.19 INVALID-ORDER-19 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{R_4 (C_L L_L R_L s^2 + L_L s + R_L)}{2C_4 C_L L_L R_4 R_L s^3 + 2C_4 L_L R_4 s^2 + 2C_4 R_4 R_L s + C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + 2L_L s + R_4 + 2R_L}$$

10.20 INVALID-ORDER-20 $Z(s) = \left(\infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$

$$H(s) = \frac{R_4 R_L (C_L L_L s^2 + 1)}{2C_4 C_L L_L R_4 R_L s^3 + 2C_4 R_4 R_L s + C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + C_L R_4 R_L s + R_4 + 2R_L}$$

10.21 INVALID-ORDER-21 $Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, R_L \right)$

$$H(s) = \frac{R_L (C_4 R_4 s + 1)}{C_4 R_4 s + 2C_4 R_L s + 1}$$

10.22 INVALID-ORDER-22 $Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, \frac{1}{C_L s} \right)$

$$H(s) = \frac{C_4 R_4 s + 1}{s (C_4 C_L R_4 s + 2C_4 + C_L)}$$

10.23 INVALID-ORDER-23 $Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(C_4 R_4 s + 1) (C_L R_L s + 1)}{s (C_4 C_L R_4 s + 2C_4 C_L R_L s + 2C_4 + C_L)}$$

10.24 INVALID-ORDER-24 $Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(C_4 R_4 s + 1) (C_L L_L s^2 + 1)}{s (2C_4 C_L L_L s^2 + C_4 C_L R_4 s + 2C_4 + C_L)}$$

10.25 INVALID-ORDER-25 $Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (C_4 R_4 s + 1)}{C_4 C_L L_L R_4 s^3 + 2C_4 L_L s^2 + C_4 R_4 s + C_L L_L s^2 + 1}$$

10.26 INVALID-ORDER-26 $Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(C_4 R_4 s + 1) (C_L L_L s^2 + C_L R_L s + 1)}{s (2C_4 C_L L_L s^2 + C_4 C_L R_4 s + 2C_4 C_L R_L s + 2C_4 + C_L)}$$

10.27 INVALID-ORDER-27 $Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

$$H(s) = \frac{L_L R_L s (C_4 R_4 s + 1)}{C_4 C_L L_L R_4 R_L s^3 + C_4 L_L R_4 s^2 + 2C_4 L_L R_L s^2 + C_4 R_4 R_L s + C_L L_L R_L s^2 + L_L s + R_L}$$

10.28 INVALID-ORDER-28 $Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{(C_4 R_4 s + 1) (C_L L_L R_L s^2 + L_L s + R_L)}{C_4 C_L L_L R_4 s^3 + 2C_4 C_L L_L R_L s^3 + 2C_4 L_L s^2 + C_4 R_4 s + 2C_4 R_L s + C_L L_L s^2 + 1}$$

10.29 INVALID-ORDER-29 $Z(s) = \left(\infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$

$$H(s) = \frac{R_L (C_4 R_4 s + 1) (C_L L_L s^2 + 1)}{C_4 C_L L_L R_4 s^3 + 2C_4 C_L L_L R_L s^3 + C_4 C_L R_4 R_L s^2 + C_4 R_4 s + 2C_4 R_L s + C_L L_L s^2 + C_L R_L s + 1}$$

10.30 INVALID-ORDER-30 $Z(s) = \left(\infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, \infty, \frac{1}{C_L s} \right)$

$$H(s) = \frac{C_4 L_4 s^2 + 1}{s (C_4 C_L L_4 s^2 + 2C_4 + C_L)}$$

10.31 INVALID-ORDER-31 $Z(s) = \left(\infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (C_4 L_4 s^2 + 1)}{C_4 C_L L_4 R_L s^3 + C_4 L_4 s^2 + 2C_4 R_L s + C_L R_L s + 1}$$

10.32 INVALID-ORDER-32 $Z(s) = \left(\infty, \infty, \infty, L_4s + \frac{1}{C_4s}, \infty, R_L + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{(C_4L_4s^2 + 1)(C_LR_Ls + 1)}{s(C_4C_LL_4s^2 + 2C_4C_LR_Ls + 2C_4 + C_L)}$$

10.33 INVALID-ORDER-33 $Z(s) = \left(\infty, \infty, \infty, L_4s + \frac{1}{C_4s}, \infty, L_Ls + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{(C_4L_4s^2 + 1)(C_LL_Ls^2 + 1)}{s(C_4C_LL_4s^2 + 2C_4C_LL_Ls^2 + 2C_4 + C_L)}$$

10.34 INVALID-ORDER-34 $Z(s) = \left(\infty, \infty, \infty, L_4s + \frac{1}{C_4s}, \infty, \frac{L_Ls}{C_LL_Ls^2 + 1} \right)$

$$H(s) = \frac{L_Ls(C_4L_4s^2 + 1)}{C_4C_LL_4L_Ls^4 + C_4L_4s^2 + 2C_4L_Ls^2 + C_LL_Ls^2 + 1}$$

10.35 INVALID-ORDER-35 $Z(s) = \left(\infty, \infty, \infty, L_4s + \frac{1}{C_4s}, \infty, L_Ls + R_L + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{(C_4L_4s^2 + 1)(C_LL_Ls^2 + C_LR_Ls + 1)}{s(C_4C_LL_4s^2 + 2C_4C_LL_Ls^2 + 2C_4C_LR_Ls + 2C_4 + C_L)}$$

10.36 INVALID-ORDER-36 $Z(s) = \left(\infty, \infty, \infty, L_4s + \frac{1}{C_4s}, \infty, \frac{1}{C_Ls + \frac{1}{R_L} + \frac{1}{L_Ls}} \right)$

$$H(s) = \frac{L_LR_Ls(C_4L_4s^2 + 1)}{C_4C_LL_4L_LR_Ls^4 + C_4L_4L_Ls^3 + C_4L_4R_Ls^2 + 2C_4L_LR_Ls^2 + C_LL_LR_Ls^2 + L_Ls + R_L}$$

10.37 INVALID-ORDER-37 $Z(s) = \left(\infty, \infty, \infty, L_4s + \frac{1}{C_4s}, \infty, \frac{L_Ls}{C_LL_Ls^2+1} + R_L \right)$

$$H(s) = \frac{(C_4L_4s^2 + 1)(C_LL_LR_Ls^2 + L_Ls + R_L)}{C_4C_LL_4L_Ls^4 + 2C_4C_LL_LR_Ls^3 + C_4L_4s^2 + 2C_4L_Ls^2 + 2C_4R_Ls + C_LL_Ls^2 + 1}$$

10.38 INVALID-ORDER-38 $Z(s) = \left(\infty, \infty, \infty, L_4s + \frac{1}{C_4s}, \infty, \frac{R_L(L_Ls + \frac{1}{C_Ls})}{L_Ls + R_L + \frac{1}{C_Ls}} \right)$

$$H(s) = \frac{R_L(C_4L_4s^2 + 1)(C_LL_Ls^2 + 1)}{C_4C_LL_4L_Ls^4 + C_4C_LL_4R_Ls^3 + 2C_4C_LL_LR_Ls^3 + C_4L_4s^2 + 2C_4R_Ls + C_LL_Ls^2 + C_LR_Ls + 1}$$

10.39 INVALID-ORDER-39 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, \frac{1}{C_Ls} \right)$

$$H(s) = \frac{L_4s}{2C_4L_4s^2 + C_LL_4s^2 + 2}$$

10.40 INVALID-ORDER-40 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, R_L + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{L_4s(C_LR_Ls + 1)}{2C_4C_LL_4R_Ls^3 + 2C_4L_4s^2 + C_LL_4s^2 + 2C_LR_Ls + 2}$$

10.41 INVALID-ORDER-41 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, L_Ls + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{L_4s(C_LL_Ls^2 + 1)}{2C_4C_LL_4L_Ls^4 + 2C_4L_4s^2 + C_LL_4s^2 + 2C_LL_Ls^2 + 2}$$

10.42 INVALID-ORDER-42 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, \infty, \frac{L_Ls}{C_LL_Ls^2+1} \right)$

$$H(s) = \frac{L_4L_Ls}{2C_4L_4L_Ls^2 + C_LL_4L_Ls^2 + L_4 + 2L_L}$$

10.43 INVALID-ORDER-43 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{L_4 s (C_L L_L s^2 + C_L R_L s + 1)}{2C_4 C_L L_4 L_L s^4 + 2C_4 C_L L_4 R_L s^3 + 2C_4 L_4 s^2 + C_L L_4 s^2 + 2C_L L_L s^2 + 2C_L R_L s + 2}$$

10.44 INVALID-ORDER-44 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{L_4 s (C_L L_L R_L s^2 + L_L s + R_L)}{2C_4 C_L L_4 L_L R_L s^4 + 2C_4 L_4 L_L s^3 + 2C_4 L_4 R_L s^2 + C_L L_4 L_L s^3 + 2C_L L_L R_L s^2 + L_4 s + 2L_L s + 2R_L}$$

10.45 INVALID-ORDER-45 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$

$$H(s) = \frac{L_4 R_L s (C_L L_L s^2 + 1)}{2C_4 C_L L_4 L_L R_L s^4 + 2C_4 L_4 R_L s^2 + C_L L_4 L_L s^3 + C_L L_4 R_L s^2 + 2C_L L_L R_L s^2 + L_4 s + 2R_L}$$

10.46 INVALID-ORDER-46 $Z(s) = \left(\infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, \infty, \frac{1}{C_L s} \right)$

$$H(s) = \frac{C_4 L_4 s^2 + C_4 R_4 s + 1}{s (C_4 C_L L_4 s^2 + C_4 C_L R_4 s + 2C_4 + C_L)}$$

10.47 INVALID-ORDER-47 $Z(s) = \left(\infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (C_4 L_4 s^2 + C_4 R_4 s + 1)}{C_4 C_L L_4 R_L s^3 + C_4 C_L R_4 R_L s^2 + C_4 L_4 s^2 + C_4 R_4 s + 2C_4 R_L s + C_L R_L s + 1}$$

10.48 INVALID-ORDER-48 $Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, R_L + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{(C_LR_Ls + 1)(C_4L_4s^2 + C_4R_4s + 1)}{s(C_4C_LL_4s^2 + C_4C_LR_4s + 2C_4C_LR_Ls + 2C_4 + C_L)}$$

10.49 INVALID-ORDER-49 $Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, L_Ls + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{(C_LL_Ls^2 + 1)(C_4L_4s^2 + C_4R_4s + 1)}{s(C_4C_LL_4s^2 + 2C_4C_LL_Ls^2 + C_4C_LR_4s + 2C_4 + C_L)}$$

10.50 INVALID-ORDER-50 $Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, \frac{L_Ls}{C_LL_Ls^2 + 1} \right)$

$$H(s) = \frac{L_Ls(C_4L_4s^2 + C_4R_4s + 1)}{C_4C_LL_4L_Ls^4 + C_4C_LL_LR_4s^3 + C_4L_4s^2 + 2C_4L_Ls^2 + C_4R_4s + C_LL_Ls^2 + 1}$$

10.51 INVALID-ORDER-51 $Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, L_Ls + R_L + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{(C_4L_4s^2 + C_4R_4s + 1)(C_LL_Ls^2 + C_LR_Ls + 1)}{s(C_4C_LL_4s^2 + 2C_4C_LL_Ls^2 + C_4C_LR_4s + 2C_4C_LR_Ls + 2C_4 + C_L)}$$

10.52 INVALID-ORDER-52 $Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, \frac{1}{C_Ls + \frac{1}{R_L} + \frac{1}{L_Ls}} \right)$

$$H(s) = \frac{L_LR_Ls(C_4L_4s^2 + C_4R_4s + 1)}{C_4C_LL_4L_LR_Ls^4 + C_4C_LL_LR_4R_Ls^3 + C_4L_4L_Ls^3 + C_4L_4R_Ls^2 + C_4L_LR_4s^2 + 2C_4L_LR_Ls^2 + C_4R_4R_Ls + C_LL_LR_Ls^2 + L_Ls + R_L}$$

10.53 INVALID-ORDER-53 $Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, \frac{L_Ls}{C_LL_Ls^2+1} + R_L \right)$

$$H(s) = \frac{(C_4L_4s^2 + C_4R_4s + 1)(C_LL_LR_Ls^2 + L_Ls + R_L)}{C_4C_LL_4L_Ls^4 + C_4C_LL_LR_4s^3 + 2C_4C_LL_LR_Ls^3 + C_4L_4s^2 + 2C_4L_Ls^2 + C_4R_4s + 2C_4R_Ls + C_LL_Ls^2 + 1}$$

10.54 INVALID-ORDER-54 $Z(s) = \left(\infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \infty, \frac{R_L(L_Ls + \frac{1}{C_Ls})}{L_Ls + R_L + \frac{1}{C_Ls}} \right)$

$$H(s) = \frac{R_L(C_LL_Ls^2 + 1)(C_4L_4s^2 + C_4R_4s + 1)}{C_4C_LL_4L_Ls^4 + C_4C_LL_4R_Ls^3 + C_4C_LL_LR_4s^3 + 2C_4C_LL_LR_Ls^3 + C_4C_LR_4R_Ls^2 + C_4L_4s^2 + C_4R_4s + 2C_4R_Ls + C_LL_Ls^2 + C_LR_Ls + 1}$$

10.55 INVALID-ORDER-55 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4s + \frac{1}{R_4} + \frac{1}{L_4s}}, \infty, R_L + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{L_4R_4s(C_LR_Ls + 1)}{2C_4C_LL_4R_4R_Ls^3 + 2C_4L_4R_4s^2 + C_LL_4R_4s^2 + 2C_LL_4R_Ls^2 + 2C_LR_4R_Ls + 2L_4s + 2R_4}$$

10.56 INVALID-ORDER-56 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4s + \frac{1}{R_4} + \frac{1}{L_4s}}, \infty, L_Ls + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{L_4R_4s(C_LL_Ls^2 + 1)}{2C_4C_LL_4L_LR_4s^4 + 2C_4L_4R_4s^2 + 2C_LL_4L_Ls^3 + C_LL_4R_4s^2 + 2C_LL_LR_4s^2 + 2L_4s + 2R_4}$$

10.57 INVALID-ORDER-57 $Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4s + \frac{1}{R_4} + \frac{1}{L_4s}}, \infty, L_Ls + R_L + \frac{1}{C_Ls} \right)$

$$H(s) = \frac{L_4R_4s(C_LL_Ls^2 + C_LR_Ls + 1)}{2C_4C_LL_4L_LR_4s^4 + 2C_4C_LL_4R_4R_Ls^3 + 2C_4L_4R_4s^2 + 2C_LL_4L_Ls^3 + C_LL_4R_4s^2 + 2C_LL_LR_4s^2 + 2C_LR_4R_Ls + 2L_4s + 2R_4}$$

$$10.58 \quad \text{INVALID-ORDER-58} \quad Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$$

$$H(s) = \frac{L_4 R_4 s (C_L L_L R_L s^2 + L_L s + R_L)}{2C_4 C_L L_4 L_L R_4 R_L s^4 + 2C_4 L_4 L_L R_4 s^3 + 2C_4 L_4 R_4 R_L s^2 + C_L L_4 L_L R_4 s^3 + 2C_L L_4 L_L R_L s^3 + 2C_L L_L R_4 R_L s^2 + 2L_4 L_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2L_L R_4 s + 2R_4 R_L}$$

$$10.59 \quad \text{INVALID-ORDER-59} \quad Z(s) = \left(\infty, \infty, \infty, \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}}, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

$$H(s) = \frac{L_4 R_4 R_L s (C_L L_L s^2 + 1)}{2C_4 C_L L_4 L_L R_4 R_L s^4 + 2C_4 L_4 R_4 R_L s^2 + C_L L_4 L_L R_4 s^3 + 2C_L L_4 L_L R_L s^3 + C_L L_4 R_4 R_L s^2 + 2C_L L_L R_4 R_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2R_4 R_L}$$

$$10.60 \quad \text{INVALID-ORDER-60} \quad Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \infty, \frac{1}{C_L s} \right)$$

$$H(s) = \frac{C_4 L_4 R_4 s^2 + L_4 s + R_4}{C_4 C_L L_4 R_4 s^3 + 2C_4 L_4 s^2 + C_L L_4 s^2 + C_L R_4 s + 2}$$

$$10.61 \quad \text{INVALID-ORDER-61} \quad Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \infty, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L (C_4 L_4 R_4 s^2 + L_4 s + R_4)}{C_4 C_L L_4 R_4 R_L s^3 + C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + C_L L_4 R_L s^2 + C_L R_4 R_L s + L_4 s + R_4 + 2R_L}$$

$$10.62 \quad \text{INVALID-ORDER-62} \quad Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \infty, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(C_L R_L s + 1) (C_4 L_4 R_4 s^2 + L_4 s + R_4)}{C_4 C_L L_4 R_4 s^3 + 2C_4 C_L L_4 R_L s^3 + 2C_4 L_4 s^2 + C_L L_4 s^2 + C_L R_4 s + 2C_L R_L s + 2}$$

10.63 INVALID-ORDER-63 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \infty, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(C_L L_L s^2 + 1)(C_4 L_4 R_4 s^2 + L_4 s + R_4)}{2C_4 C_L L_4 L_L s^4 + C_4 C_L L_4 R_4 s^3 + 2C_4 L_4 s^2 + C_L L_4 s^2 + 2C_L L_L s^2 + C_L R_4 s + 2}$$

10.64 INVALID-ORDER-64 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (C_4 L_4 R_4 s^2 + L_4 s + R_4)}{C_4 C_L L_4 L_L R_4 s^4 + 2C_4 L_4 L_L s^3 + C_4 L_4 R_4 s^2 + C_L L_4 L_L s^3 + C_L L_L R_4 s^2 + L_4 s + 2L_L s + R_4}$$

10.65 INVALID-ORDER-65 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(C_L L_L s^2 + C_L R_L s + 1)(C_4 L_4 R_4 s^2 + L_4 s + R_4)}{2C_4 C_L L_4 L_L s^4 + C_4 C_L L_4 R_4 s^3 + 2C_4 C_L L_4 R_L s^3 + 2C_4 L_4 s^2 + C_L L_4 s^2 + 2C_L L_L s^2 + C_L R_4 s + 2C_L R_L s + 2}$$

10.66 INVALID-ORDER-66 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

$$H(s) = \frac{L_L R_L s (C_4 L_4 R_4 s^2 + L_4 s + R_4)}{C_4 C_L L_4 L_L R_4 R_L s^4 + C_4 L_4 L_L R_4 s^3 + 2C_4 L_4 L_L R_L s^3 + C_4 L_4 R_4 R_L s^2 + C_L L_4 L_L R_L s^3 + C_L L_L R_4 R_L s^2 + L_4 L_L s^2 + L_4 R_L s + L_L R_4 s + 2L_L R_L s + R_4 R_L}$$

10.67 INVALID-ORDER-67 $Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{(C_4 L_4 R_4 s^2 + L_4 s + R_4)(C_L L_L R_L s^2 + L_L s + R_L)}{C_4 C_L L_4 L_L R_4 s^4 + 2C_4 C_L L_4 L_L R_L s^4 + 2C_4 L_4 L_L s^3 + C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + C_L L_4 L_L s^3 + C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + L_4 s + 2L_L s + R_4 + 2R_L}$$

$$10.68 \quad \text{INVALID-ORDER-68} \quad Z(s) = \left(\infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

$$H(s) = \frac{R_L (C_L L_L s^2 + 1) (C_4 L_4 R_4 s^2 + L_4 s + R_4)}{C_4 C_L L_4 L_L R_4 s^4 + 2C_4 C_L L_4 L_L R_L s^4 + C_4 C_L L_4 R_4 R_L s^3 + C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + C_L L_4 L_L s^3 + C_L L_4 R_L s^2 + C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + C_L R_4 R_L s + L_4 s + R_4 + 2R_L}$$

$$10.69 \quad \text{INVALID-ORDER-69} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{1}{C_L s} \right)$$

$$H(s) = \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 C_L L_4 R_4 s^3 + 2C_4 L_4 s^2 + 2C_4 R_4 s + C_L R_4 s + 2}$$

$$10.70 \quad \text{INVALID-ORDER-70} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_4 R_L (C_4 L_4 s^2 + 1)}{C_4 C_L L_4 R_4 R_L s^3 + C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + 2C_4 R_4 R_L s + C_L R_4 R_L s + R_4 + 2R_L}$$

$$10.71 \quad \text{INVALID-ORDER-71} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{R_4 (C_4 L_4 s^2 + 1) (C_L R_L s + 1)}{C_4 C_L L_4 R_4 s^3 + 2C_4 C_L L_4 R_L s^3 + 2C_4 C_L R_4 R_L s^2 + 2C_4 L_4 s^2 + 2C_4 R_4 s + C_L R_4 s + 2C_L R_L s + 2}$$

$$10.72 \quad \text{INVALID-ORDER-72} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, L_L s + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{R_4 (C_4 L_4 s^2 + 1) (C_L L_L s^2 + 1)}{2C_4 C_L L_4 L_L s^4 + C_4 C_L L_4 R_4 s^3 + 2C_4 C_L L_L R_4 s^3 + 2C_4 L_4 s^2 + 2C_4 R_4 s + 2C_L L_L s^2 + C_L R_4 s + 2}$$

$$\mathbf{10.73 \quad INVALID-ORDER-73} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$$

$$H(s) = \frac{L_L R_4 s (C_4 L_4 s^2 + 1)}{C_4 C_L L_4 L_L R_4 s^4 + 2C_4 L_4 L_L s^3 + C_4 L_4 R_4 s^2 + 2C_4 L_L R_4 s^2 + C_L L_L R_4 s^2 + 2L_L s + R_4}$$

$$\mathbf{10.74 \quad INVALID-ORDER-74} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{R_4 (C_4 L_4 s^2 + 1) (C_L L_L s^2 + C_L R_L s + 1)}{2C_4 C_L L_4 L_L s^4 + C_4 C_L L_4 R_4 s^3 + 2C_4 C_L L_4 R_L s^3 + 2C_4 C_L L_L R_4 s^3 + 2C_4 C_L R_4 R_L s^2 + 2C_4 L_4 s^2 + 2C_4 R_4 s + 2C_L L_L s^2 + C_L R_4 s + 2C_L R_L s + 2}$$

$$\mathbf{10.75 \quad INVALID-ORDER-75} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$$

$$H(s) = \frac{L_L R_4 R_L s (C_4 L_4 s^2 + 1)}{C_4 C_L L_4 L_L R_4 R_L s^4 + C_4 L_4 L_L R_4 s^3 + 2C_4 L_4 L_L R_L s^3 + C_4 L_4 R_4 R_L s^2 + 2C_4 L_L R_4 R_L s^2 + C_L L_L R_4 R_L s^2 + L_L R_4 s + 2L_L R_L s + R_4 R_L}$$

$$\mathbf{10.76 \quad INVALID-ORDER-76} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$$

$$H(s) = \frac{R_4 (C_4 L_4 s^2 + 1) (C_L L_L R_L s^2 + L_L s + R_L)}{C_4 C_L L_4 L_L R_4 s^4 + 2C_4 C_L L_4 L_L R_L s^4 + 2C_4 C_L L_L R_4 R_L s^3 + 2C_4 L_4 L_L s^3 + C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + 2C_4 L_L R_4 s^2 + 2C_4 R_4 R_L s + C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + 2L_L s + R_4}$$

$$\mathbf{10.77 \quad INVALID-ORDER-77} \quad Z(s) = \left(\infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

$$H(s) = \frac{R_4 R_L (C_4 L_4 s^2 + 1) (C_L L_L s^2 + 1)}{C_4 C_L L_4 L_L R_4 s^4 + 2C_4 C_L L_4 L_L R_L s^4 + C_4 C_L L_4 R_4 R_L s^3 + 2C_4 C_L L_L R_4 R_L s^3 + C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + 2C_4 R_4 R_L s + C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + C_L R_4 R_L s + R_4 + 2L_L}$$