

Filter Summary Report: TIA simple Z5 ZL

Generated by MacAnalog-Symbolix

December 4, 2024

Contents

1 Examined $H(z)$ for TIA simple Z5 ZL: $\frac{Z_L(Z_5g_m-1)}{Z_5g_m+2Z_Lg_m+1}$

$$H(z) = \frac{Z_L(Z_5g_m-1)}{Z_5g_m+2Z_Lg_m+1}$$

2 HP

3 BP

3.1 BP-1 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{L_Ls}{C_LL_Ls^2+1}\right)$

$$H(s) = \frac{L_Ls(R_4g_m-1)}{C_LL_LR_4g_ms^2+C_LL_Ls^2+2L_Lg_ms+R_4g_m+1}$$

Parameters:

Q: $\frac{C_L\sqrt{\frac{1}{C_LL_L}}(R_4g_m+1)}{2g_m}$

wo: $\sqrt{\frac{1}{C_LL_L}}$

bandwidth: $\frac{2g_m}{C_L(R_4g_m+1)}$

K-LP: 0

K-HP: 0

K-BP: $\frac{R_4g_m-1}{2g_m}$

Qz: 0

Wz: None

3.2 BP-2 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

$$H(s) = \frac{L_LR_Ls(R_4g_m-1)}{C_LL_LR_4R_Lg_ms^2+C_LL_LR_Ls^2+L_LR_4g_ms+2L_LR_Lg_ms+L_Ls+R_4R_Lg_m+R_L}$$

Parameters:

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

4 LP

5 BS

$$5.1 \quad \text{BS-1 } Z(s) = \left(R_1, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$$

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

Parameters:

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

5.2 BS-2 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{R_L(L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$

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

Parameters:

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

6 GE

6.1 GE-1 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

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

Parameters:

Q: $\frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{R_4 g_m + 2R_L g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{R_4 g_m + 2R_L g_m + 1}{2L_L g_m}$

$$\begin{aligned}
\text{K-LP: } & \frac{R_4 g_m - 1}{2g_m} \\
\text{K-HP: } & \frac{R_4 g_m - 1}{2g_m} \\
\text{K-BP: } & \frac{R_L(R_4 g_m - 1)}{R_4 g_m + 2R_L g_m + 1} \\
\text{QZ: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\
\text{WZ: } & \sqrt{\frac{1}{C_L L_L}}
\end{aligned}$$

6.2 GE-2 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

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

Parameters:

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

6.3 GE-3 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L \right)$

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

Parameters:

$$\text{Q: } \frac{L_4 g_m \sqrt{\frac{1}{C_4 L_4}}}{2R_L g_m + 1}$$

$$\begin{aligned}
\text{wO: } & \sqrt{\frac{1}{C_4 L_4}} \\
\text{bandwidth: } & \frac{2R_L g_m + 1}{L_4 g_m} \\
\text{K-LP: } & R_L \\
\text{K-HP: } & R_L \\
\text{K-BP: } & -\frac{R_L}{2R_L g_m + 1} \\
\text{QZ: } & -L_4 g_m \sqrt{\frac{1}{C_4 L_4}} \\
\text{WZ: } & \sqrt{\frac{1}{C_4 L_4}}
\end{aligned}$$

6.4 GE-4 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L \right)$

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

Parameters:

$$\begin{aligned}
\text{Q: } & \frac{C_4 \sqrt{\frac{1}{C_4 L_4}} (2R_L g_m + 1)}{g_m} \\
\text{wO: } & \sqrt{\frac{1}{C_4 L_4}} \\
\text{bandwidth: } & \frac{g_m}{C_4 (2R_L g_m + 1)} \\
\text{K-LP: } & -\frac{R_L}{2R_L g_m + 1} \\
\text{K-HP: } & -\frac{R_L}{2R_L g_m + 1} \\
\text{K-BP: } & R_L \\
\text{QZ: } & -\frac{C_4 \sqrt{\frac{1}{C_4 L_4}}}{g_m} \\
\text{WZ: } & \sqrt{\frac{1}{C_4 L_4}}
\end{aligned}$$

6.5 GE-5 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, R_L \right)$

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

Parameters:

$$\begin{aligned}
\text{Q: } & \frac{L_4 g_m \sqrt{\frac{1}{C_4 L_4}}}{R_4 g_m + 2R_L g_m + 1} \\
\text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\
\text{bandwidth: } & \frac{R_4 g_m + 2R_L g_m + 1}{L_4 g_m} \\
\text{K-LP: } & R_L \\
\text{K-HP: } & R_L \\
\text{K-BP: } & \frac{R_L (R_4 g_m - 1)}{R_4 g_m + 2R_L g_m + 1} \\
\text{QZ: } & \frac{L_4 g_m \sqrt{\frac{1}{C_4 L_4}}}{R_4 g_m - 1} \\
\text{WZ: } & \sqrt{\frac{1}{C_4 L_4}}
\end{aligned}$$

6.6 GE-6 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L \right)$

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

Parameters:

$$\begin{aligned}
\text{Q: } & \frac{C_4 R_4 \sqrt{\frac{1}{C_4 L_4}} (2R_L g_m + 1)}{R_4 g_m + 2R_L g_m + 1} \\
\text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\
\text{bandwidth: } & \frac{R_4 g_m + 2R_L g_m + 1}{C_4 R_4 (2R_L g_m + 1)} \\
\text{K-LP: } & -\frac{R_L}{2R_L g_m + 1} \\
\text{K-HP: } & -\frac{R_L}{2R_L g_m + 1} \\
\text{K-BP: } & \frac{R_L (R_4 g_m - 1)}{R_4 g_m + 2R_L g_m + 1} \\
\text{QZ: } & -\frac{C_4 R_4 \sqrt{\frac{1}{C_4 L_4}}}{R_4 g_m - 1} \\
\text{WZ: } & \sqrt{\frac{1}{C_4 L_4}}
\end{aligned}$$

6.7 GE-7 $Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, R_L \right)$

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

Parameters:

$$\begin{aligned}
\text{Q: } & \frac{C_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 g_m + 2R_L g_m + 1)}{g_m} \\
\text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\
\text{bandwidth: } & \frac{g_m}{C_4 (R_4 g_m + 2R_L g_m + 1)} \\
\text{K-LP: } & \frac{R_L (R_4 g_m - 1)}{R_4 g_m + 2R_L g_m + 1} \\
\text{K-HP: } & \frac{R_L (R_4 g_m - 1)}{R_4 g_m + 2R_L g_m + 1} \\
\text{K-BP: } & R_L \\
\text{QZ: } & \frac{C_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 g_m - 1)}{g_m} \\
\text{WZ: } & \sqrt{\frac{1}{C_4 L_4}}
\end{aligned}$$

6.8 GE-8 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, R_L \right)$

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

Parameters:

$$\begin{aligned}
\text{Q: } & \frac{L_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 g_m + 2R_L g_m + 1)}{R_4 (2R_L g_m + 1)} \\
\text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\
\text{bandwidth: } & \frac{R_4 (2R_L g_m + 1)}{L_4 (R_4 g_m + 2R_L g_m + 1)} \\
\text{K-LP: } & \frac{R_L (R_4 g_m - 1)}{R_4 g_m + 2R_L g_m + 1} \\
\text{K-HP: } & \frac{R_L (R_4 g_m - 1)}{R_4 g_m + 2R_L g_m + 1} \\
\text{K-BP: } & -\frac{R_L}{2R_L g_m + 1} \\
\text{QZ: } & \frac{L_4 \sqrt{\frac{1}{C_4 L_4}} (-R_4 g_m + 1)}{R_4} \\
\text{WZ: } & \sqrt{\frac{1}{C_4 L_4}}
\end{aligned}$$

7 AP

8 INVALID-NUMER

8.1 INVALID-NUMER-1 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_4 C_L R_L \sqrt{\frac{g_m}{C_4 C_L R_L}}}{2C_4 R_L g_m + C_4 + C_L R_L g_m} \\ \text{wo: } & \sqrt{\frac{g_m}{C_4 C_L R_L}} \\ \text{bandwidth: } & \frac{2C_4 R_L g_m + C_4 + C_L R_L g_m}{C_4 C_L R_L} \\ \text{K-LP: } & R_L \\ \text{K-HP: } & 0 \\ \text{K-BP: } & -\frac{C_4 R_L}{2C_4 R_L g_m + C_4 + C_L R_L g_m} \\ \text{QZ: } & 0 \\ \text{WZ: } & \text{None} \end{aligned}$$

8.2 INVALID-NUMER-2 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

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

Parameters:

$$\begin{aligned} \text{Q: } & \frac{\sqrt{2} C_4 C_L R_4 \sqrt{\frac{g_m}{C_4 C_L R_4}}}{2C_4 R_4 g_m + C_L R_4 g_m + C_L} \\ \text{wo: } & \sqrt{2} \sqrt{\frac{g_m}{C_4 C_L R_4}} \\ \text{bandwidth: } & \frac{2C_4 R_4 g_m + C_L R_4 g_m + C_L}{C_4 C_L R_4} \\ \text{K-LP: } & \frac{R_4 g_m - 1}{2g_m} \\ \text{K-HP: } & 0 \\ \text{K-BP: } & -\frac{C_4 R_4}{2C_4 R_4 g_m + C_L R_4 g_m + C_L} \\ \text{QZ: } & 0 \\ \text{WZ: } & \text{None} \end{aligned}$$

8.3 INVALID-NUMER-3 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

Parameters:

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

8.4 INVALID-NUMER-4 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

Parameters:

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

9 INVALID-WZ

9.1 INVALID-WZ-1 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

Parameters:

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

10 INVALID-ORDER

10.1 INVALID-ORDER-1 $Z(s) = (R_1, \infty, \infty, \infty, \infty, R_L)$

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

10.2 INVALID-ORDER-2 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

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

10.3 INVALID-ORDER-3 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

10.4 INVALID-ORDER-4 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

10.5 INVALID-ORDER-5 $Z(s) = (L_1 s, \infty, \infty, \infty, \infty, R_L)$

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

10.6 INVALID-ORDER-6 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

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

10.7 INVALID-ORDER-7 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

10.8 INVALID-ORDER-8 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

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

10.9 INVALID-ORDER-9 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

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

10.10 INVALID-ORDER-10 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

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

10.11 INVALID-ORDER-11 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

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

10.12 INVALID-ORDER-12 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

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

10.13 INVALID-ORDER-13 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$

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

10.14 INVALID-ORDER-14 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L \right)$

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

10.15 INVALID-ORDER-15 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

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

10.16 INVALID-ORDER-16 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

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

10.17 INVALID-ORDER-17 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

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

$$10.18 \quad \text{INVALID-ORDER-18} \quad Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$$

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

$$10.19 \quad \text{INVALID-ORDER-19} \quad Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$$

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

$$10.20 \quad \text{INVALID-ORDER-20} \quad Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

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

$$10.21 \quad \text{INVALID-ORDER-21} \quad Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, R_L \right)$$

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

$$10.22 \quad \text{INVALID-ORDER-22} \quad Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$$

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

10.23 INVALID-ORDER-23 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

10.24 INVALID-ORDER-24 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

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

10.25 INVALID-ORDER-25 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

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

10.26 INVALID-ORDER-26 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

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

10.27 INVALID-ORDER-27 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

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

10.28 INVALID-ORDER-28 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

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

10.29 INVALID-ORDER-29 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$

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

10.30 INVALID-ORDER-30 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

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

10.31 INVALID-ORDER-31 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

10.32 INVALID-ORDER-32 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

10.33 INVALID-ORDER-33 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

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

10.34 INVALID-ORDER-34 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

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

10.35 INVALID-ORDER-35 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

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

10.36 INVALID-ORDER-36 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

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

10.37 INVALID-ORDER-37 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

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

10.38 INVALID-ORDER-38 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$

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

10.39 INVALID-ORDER-39 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

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

10.40 INVALID-ORDER-40 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

10.41 INVALID-ORDER-41 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

10.42 INVALID-ORDER-42 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

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

10.43 INVALID-ORDER-43 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

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

10.44 INVALID-ORDER-44 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

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

$$10.45 \quad \text{INVALID-ORDER-45} \quad Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$$

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

$$10.46 \quad \text{INVALID-ORDER-46} \quad Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$$

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

$$10.47 \quad \text{INVALID-ORDER-47} \quad Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

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

$$10.48 \quad \text{INVALID-ORDER-48} \quad Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$$

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

$$10.49 \quad \text{INVALID-ORDER-49} \quad Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$$

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

10.50 INVALID-ORDER-50 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

10.51 INVALID-ORDER-51 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

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

10.52 INVALID-ORDER-52 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

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

10.53 INVALID-ORDER-53 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

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

10.54 INVALID-ORDER-54 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

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

10.55 INVALID-ORDER-55 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

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

10.56 INVALID-ORDER-56 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$

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

10.57 INVALID-ORDER-57 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

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

10.58 INVALID-ORDER-58 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

10.59 INVALID-ORDER-59 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

10.60 INVALID-ORDER-60 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

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

10.61 INVALID-ORDER-61 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

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

10.62 INVALID-ORDER-62 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

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

10.63 INVALID-ORDER-63 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

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

10.64 INVALID-ORDER-64 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

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

10.65 INVALID-ORDER-65 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$

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

10.66 INVALID-ORDER-66 $Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

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

10.67 INVALID-ORDER-67 $Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

10.68 INVALID-ORDER-68 $Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

10.69 INVALID-ORDER-69 $Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

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

$$\mathbf{10.70 \quad INVALID-ORDER-70} \quad Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$$

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

$$\mathbf{10.71 \quad INVALID-ORDER-71} \quad Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$$

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

$$\mathbf{10.72 \quad INVALID-ORDER-72} \quad Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$$

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

$$\mathbf{10.73 \quad INVALID-ORDER-73} \quad Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$$

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

$$\mathbf{10.74 \quad INVALID-ORDER-74} \quad Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

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

10.75 INVALID-ORDER-75 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

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

10.76 INVALID-ORDER-76 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

10.77 INVALID-ORDER-77 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

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

10.78 INVALID-ORDER-78 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

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

10.79 INVALID-ORDER-79 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

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

10.80 INVALID-ORDER-80 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

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

10.81 INVALID-ORDER-81 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

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

10.82 INVALID-ORDER-82 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

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

$$\text{10.83} \quad \text{INVALID-ORDER-83} \quad Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

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