

# Filter Summary Report: TEST simple Z1 ZL

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## Contents

**1 Examined  $H(z)$  for TEST simple Z1 ZL:  $\frac{Z_1 Z_L g_m}{Z_1 g_m + 1}$**

$$H(z) = \frac{Z_1 Z_L g_m}{Z_1 g_m + 1}$$

**2 HP**

**3 BP**

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

$$H(s) = \frac{L_L R_1 R_L g_m s}{(R_1 g_m + 1) (C_L L_L R_L s^2 + L_L s + R_L)}$$

**Parameters:**

Q:  $C_L R_L \sqrt{\frac{1}{C_L L_L}}$

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

bandwidth:  $\frac{1}{C_L R_L}$

K-LP: 0

K-HP: 0

K-BP:  $\frac{R_1 R_L g_m}{R_1 g_m + 1}$

Qz: 0

Wz: None

**3.2 BP-2**  $Z(s) = \left( L_1 s, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

$$H(s) = \frac{L_1 R_L g_m s}{(C_L R_L s + 1) (L_1 g_m s + 1)}$$

**Parameters:**

$$\begin{aligned}
\text{Q: } & \frac{C_L L_1 R_L g_m \sqrt{\frac{1}{C_L L_1 R_L g_m}}}{C_L R_L + L_1 g_m} \\
\text{wo: } & \sqrt{\frac{1}{C_L L_1 R_L g_m}} \\
\text{bandwidth: } & \frac{C_L R_L + L_1 g_m}{C_L L_1 R_L g_m} \\
\text{K-LP: } & 0 \\
\text{K-HP: } & 0 \\
\text{K-BP: } & \frac{L_1 R_L g_m}{C_L R_L + L_1 g_m} \\
\text{QZ: } & 0 \\
\text{Wz: } & \text{None}
\end{aligned}$$

$$\mathbf{3.3 \quad BP-3} \quad Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, R_L \right)$$

$$H(s) = \frac{L_1 R_L g_m s}{C_1 L_1 s^2 + L_1 g_m s + 1}$$

**Parameters:**

$$\begin{aligned}
\text{Q: } & \frac{C_1 \sqrt{\frac{1}{C_1 L_1}}}{g_m} \\
\text{wo: } & \sqrt{\frac{1}{C_1 L_1}} \\
\text{bandwidth: } & \frac{g_m}{C_1} \\
\text{K-LP: } & 0 \\
\text{K-HP: } & 0 \\
\text{K-BP: } & R_L \\
\text{QZ: } & 0 \\
\text{Wz: } & \text{None}
\end{aligned}$$

$$\mathbf{3.4 \quad BP-4} \quad Z(s) = \left( \frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, R_L \right)$$

$$H(s) = \frac{L_1 R_1 R_L g_m s}{C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1}$$

**Parameters:**

Q:  $\frac{C_1 R_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1 g_m + 1}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{R_1 g_m + 1}{C_1 R_1}$   
 K-LP: 0  
 K-HP: 0  
 K-BP:  $\frac{R_1 R_L g_m}{R_1 g_m + 1}$   
 QZ: 0  
 Wz: None

## 4 LP

**4.1 LP-1**  $Z(s) = \left( \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L g_m}{(C_1 s + g_m)(C_L R_L s + 1)}$$

**Parameters:**

Q:  $\frac{C_1 C_L R_L \sqrt{\frac{g_m}{C_1 C_L R_L}}}{C_1 + C_L R_L g_m}$   
 wo:  $\sqrt{\frac{g_m}{C_1 C_L R_L}}$   
 bandwidth:  $\frac{C_1 + C_L R_L g_m}{C_1 C_L R_L}$   
 K-LP:  $R_L$   
 K-HP: 0  
 K-BP: 0  
 QZ: None  
 Wz: None

**4.2 LP-2**  $Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

$$H(s) = \frac{R_1 R_L g_m}{(C_L R_L s + 1)(C_1 R_1 s + R_1 g_m + 1)}$$

**Parameters:**

$$\begin{aligned}
Q: & \frac{C_1 C_L R_1 R_L \sqrt{\frac{R_1 g_m + 1}{C_1 C_L R_1 R_L}}}{C_1 R_1 + C_L R_1 R_L g_m + C_L R_L} \\
\text{wo:} & \sqrt{\frac{R_1 g_m + 1}{C_1 C_L R_1 R_L}} \\
\text{bandwidth:} & \frac{C_1 R_1 + C_L R_1 R_L g_m + C_L R_L}{C_1 C_L R_1 R_L} \\
\text{K-LP:} & \frac{R_1 R_L g_m}{R_1 g_m + 1} \\
\text{K-HP:} & 0 \\
\text{K-BP:} & 0 \\
\text{Qz:} & \text{None} \\
\text{Wz:} & \text{None}
\end{aligned}$$

**4.3 LP-3**  $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

$$H(s) = \frac{L_1 g_m}{C_L (C_1 L_1 s^2 + L_1 g_m s + 1)}$$

**Parameters:**

$$\begin{aligned}
Q: & \frac{C_1 \sqrt{\frac{1}{C_1 L_1}}}{g_m} \\
\text{wo:} & \sqrt{\frac{1}{C_1 L_1}} \\
\text{bandwidth:} & \frac{g_m}{C_1} \\
\text{K-LP:} & \frac{L_1 g_m}{C_L} \\
\text{K-HP:} & 0 \\
\text{K-BP:} & 0 \\
\text{Qz:} & \text{None} \\
\text{Wz:} & \text{None}
\end{aligned}$$

**4.4 LP-4**  $Z(s) = \left( \frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right)$

$$H(s) = \frac{L_1 R_1 g_m}{C_L (C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_1 R_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_1 L_1}} \\ \text{bandwidth: } & \frac{R_1 g_m + 1}{C_1 R_1} \\ \text{K-LP: } & \frac{L_1 g_m}{C_L} \\ \text{K-HP: } & 0 \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \text{None} \end{aligned}$$

## 5 BS

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

$$H(s) = \frac{R_1 R_L g_m (C_L L_L s^2 + 1)}{(R_1 g_m + 1) (C_L L_L s^2 + C_L R_L s + 1)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{R_L}{L_L} \\ \text{K-LP: } & \frac{R_1 R_L g_m}{R_1 g_m + 1} \\ \text{K-HP: } & \frac{R_1 R_L g_m}{R_1 g_m + 1} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

**5.2 BS-2**  $Z(s) = \left( L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L \right)$

$$H(s) = \frac{R_L g_m (C_1 L_1 s^2 + 1)}{C_1 L_1 g_m s^2 + C_1 s + g_m}$$

**Parameters:**

Q:  $L_1 g_m \sqrt{\frac{1}{C_1 L_1}}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{1}{L_1 g_m}$   
 K-LP:  $R_L$   
 K-HP:  $R_L$   
 K-BP: 0  
 Qz: None  
 Wz:  $\sqrt{\frac{1}{C_1 L_1}}$

**5.3 BS-3**  $Z(s) = \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, R_L \right)$

$$H(s) = \frac{R_1 R_L g_m (C_1 L_1 s^2 + 1)}{C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1}$$

**Parameters:**

Q:  $\frac{L_1 \sqrt{\frac{1}{C_1 L_1}} (R_1 g_m + 1)}{R_1}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{R_1}{L_1 (R_1 g_m + 1)}$   
 K-LP:  $\frac{R_1 R_L g_m}{R_1 g_m + 1}$   
 K-HP:  $\frac{R_1 R_L g_m}{R_1 g_m + 1}$   
 K-BP: 0  
 Qz: None  
 Wz:  $\sqrt{\frac{1}{C_1 L_1}}$

## 6 GE

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

$$H(s) = \frac{R_L g_m (C_1 L_1 s^2 + C_1 R_1 s + 1)}{C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_1 g_m \sqrt{\frac{1}{C_1 L_1}}}{R_1 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_1 L_1}} \\ \text{bandwidth: } & \frac{R_1 g_m + 1}{L_1 g_m} \\ \text{K-LP: } & R_L \\ \text{K-HP: } & R_L \\ \text{K-BP: } & \frac{R_1 R_L g_m}{R_1 g_m + 1} \\ \text{QZ: } & \frac{L_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1} \\ \text{Wz: } & \sqrt{\frac{1}{C_1 L_1}} \end{aligned}$$

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

$$H(s) = \frac{R_L g_m (C_1 L_1 R_1 s^2 + L_1 s + R_1)}{C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_1 \sqrt{\frac{1}{C_1 L_1}} (R_1 g_m + 1)}{g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_1 L_1}} \\ \text{bandwidth: } & \frac{g_m}{C_1 (R_1 g_m + 1)} \\ \text{K-LP: } & \frac{R_1 R_L g_m}{R_1 g_m + 1} \\ \text{K-HP: } & \frac{R_1 R_L g_m}{R_1 g_m + 1} \\ \text{K-BP: } & R_L \end{aligned}$$



$$\begin{aligned} \text{Qz: } & C_1 R_1 \sqrt{\frac{1}{C_1 L_1}} \\ \text{Wz: } & \sqrt{\frac{1}{C_1 L_1}} \end{aligned}$$

## 7 AP

## 8 INVALID-NUMER

$$8.1 \quad \text{INVALID-NUMER-1} \quad Z(s) = \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L g_m (C_1 R_1 s + 1)}{(C_L R_L s + 1) (C_1 R_1 g_m s + C_1 s + g_m)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_1 C_L R_L \sqrt{\frac{g_m}{C_1 C_L R_L (R_1 g_m + 1)}} (R_1 g_m + 1)}{C_1 R_1 g_m + C_1 + C_L R_L g_m} \\ \text{wo: } & \sqrt{\frac{g_m}{C_1 C_L R_L (R_1 g_m + 1)}} \\ \text{bandwidth: } & \frac{C_1 R_1 g_m + C_1 + C_L R_L g_m}{C_1 C_L R_L (R_1 g_m + 1)} \\ \text{K-LP: } & R_L \\ \text{K-HP: } & 0 \\ \text{K-BP: } & \frac{C_1 R_1 R_L g_m}{C_1 R_1 g_m + C_1 + C_L R_L g_m} \\ \text{Qz: } & 0 \\ \text{Wz: } & \text{None} \end{aligned}$$

$$8.2 \quad \text{INVALID-NUMER-2} \quad Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{L_1 g_m (C_L R_L s + 1)}{C_L (C_1 L_1 s^2 + L_1 g_m s + 1)}$$

**Parameters:**

Q:  $\frac{C_1 \sqrt{\frac{1}{C_1 L_1}}}{g_m}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{g_m}{C_1}$   
 K-LP:  $\frac{L_1 g_m}{C_L}$   
 K-HP: 0  
 K-BP:  $R_L$   
 QZ: 0  
 Wz: None

**8.3 INVALID-NUMER-3**  $Z(s) = \left( \frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{L_1 R_1 g_m (C_L R_L s + 1)}{C_L (C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1)}$$

**Parameters:**

Q:  $\frac{C_1 R_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1 g_m + 1}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{R_1 g_m + 1}{C_1 R_1}$   
 K-LP:  $\frac{L_1 g_m}{C_L}$   
 K-HP: 0  
 K-BP:  $\frac{R_1 R_L g_m}{R_1 g_m + 1}$   
 QZ: 0  
 Wz: None

## 9 INVALID-WZ

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

$$H(s) = \frac{L_1 g_m (C_L L_L s^2 + 1)}{C_L (C_1 L_1 s^2 + L_1 g_m s + 1)}$$

**Parameters:**

Q:  $\frac{C_1 \sqrt{\frac{1}{C_1 L_1}}}{g_m}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{g_m}{C_1}$   
 K-LP:  $\frac{L_1 g_m}{C_L}$   
 K-HP:  $\frac{L_L g_m}{C_1}$   
 K-BP: 0  
 Qz: None  
 Wz:  $\sqrt{\frac{1}{C_L L_L}}$

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

$$H(s) = \frac{L_1 g_m (C_L L_L s^2 + C_L R_L s + 1)}{C_L (C_1 L_1 s^2 + L_1 g_m s + 1)}$$

**Parameters:**

Q:  $\frac{C_1 \sqrt{\frac{1}{C_1 L_1}}}{g_m}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{g_m}{C_1}$   
 K-LP:  $\frac{L_1 g_m}{C_L}$   
 K-HP:  $\frac{L_L g_m}{C_1}$   
 K-BP:  $R_L$   
 Qz:  $\frac{L_L \sqrt{\frac{1}{C_1 L_1}}}{R_L}$   
 Wz:  $\sqrt{\frac{1}{C_L L_L}}$

**9.3 INVALID-WZ-3**  $Z(s) = \left( \frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{L_1 R_1 g_m (C_L L_L s^2 + 1)}{C_L (C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1)}$$

**Parameters:**

Q:  $\frac{C_1 R_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1 g_m + 1}$

wo:  $\sqrt{\frac{1}{C_1 L_1}}$

bandwidth:  $\frac{R_1 g_m + 1}{C_1 R_1}$

K-LP:  $\frac{L_1 g_m}{C_L}$

K-HP:  $\frac{L_L g_m}{C_1}$

K-BP: 0

Qz: None

Wz:  $\sqrt{\frac{1}{C_L L_L}}$

**9.4 INVALID-WZ-4**  $Z(s) = \left( \frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{L_1 R_1 g_m (C_L L_L s^2 + C_L R_L s + 1)}{C_L (C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1)}$$

**Parameters:**

Q:  $\frac{C_1 R_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1 g_m + 1}$

wo:  $\sqrt{\frac{1}{C_1 L_1}}$

bandwidth:  $\frac{R_1 g_m + 1}{C_1 R_1}$

K-LP:  $\frac{L_1 g_m}{C_L}$

K-HP:  $\frac{L_L g_m}{C_1}$

K-BP:  $\frac{R_1 R_L g_m}{R_1 g_m + 1}$

Qz:  $\frac{L_L \sqrt{\frac{1}{C_1 L_1}}}{R_L}$

$$W_Z: \sqrt{\frac{1}{C_L L_L}}$$

## 10 INVALID-ORDER

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

$$H(s) = \frac{R_1 R_L g_m}{R_1 g_m + 1}$$

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

$$H(s) = \frac{R_1 g_m}{C_L s (R_1 g_m + 1)}$$

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

$$H(s) = \frac{R_1 R_L g_m}{(R_1 g_m + 1) (C_L R_L s + 1)}$$

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

$$H(s) = \frac{R_1 g_m (C_L R_L s + 1)}{C_L s (R_1 g_m + 1)}$$

**10.5 INVALID-ORDER-5**  $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$

$$H(s) = \frac{R_1 g_m (C_L L_L s^2 + 1)}{C_L s (R_1 g_m + 1)}$$

**10.6 INVALID-ORDER-6**  $Z(s) = \left( R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L R_1 g_m s}{(R_1 g_m + 1)(C_L L_L s^2 + 1)}$$

**10.7 INVALID-ORDER-7**  $Z(s) = \left( R_1, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_1 g_m (C_L L_L s^2 + C_L R_L s + 1)}{C_L s (R_1 g_m + 1)}$$

**10.8 INVALID-ORDER-8**  $Z(s) = \left( R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{R_1 g_m (C_L L_L R_L s^2 + L_L s + R_L)}{(R_1 g_m + 1)(C_L L_L s^2 + 1)}$$

**10.9 INVALID-ORDER-9**  $Z(s) = (L_1 s, \infty, \infty, \infty, \infty, R_L)$

$$H(s) = \frac{L_1 R_L g_m s}{L_1 g_m s + 1}$$

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

$$H(s) = \frac{L_1 g_m}{C_L (L_1 g_m s + 1)}$$

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

$$H(s) = \frac{L_1 g_m (C_L R_L s + 1)}{C_L (L_1 g_m s + 1)}$$

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

$$H(s) = \frac{L_1 g_m (C_L L_L s^2 + 1)}{C_L (L_1 g_m s + 1)}$$

**10.13 INVALID-ORDER-13**  $Z(s) = \left( L_1 s, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_1 L_L g_m s^2}{(C_L L_L s^2 + 1) (L_1 g_m s + 1)}$$

**10.14 INVALID-ORDER-14**  $Z(s) = \left( L_1 s, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{L_1 g_m (C_L L_L s^2 + C_L R_L s + 1)}{C_L (L_1 g_m s + 1)}$$

**10.15 INVALID-ORDER-15**  $Z(s) = \left( L_1 s, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

$$H(s) = \frac{L_1 L_L R_L g_m s^2}{(L_1 g_m s + 1) (C_L L_L R_L s^2 + L_L s + R_L)}$$

**10.16 INVALID-ORDER-16**  $Z(s) = \left( L_1 s, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{L_1 g_m s (C_L L_L R_L s^2 + L_L s + R_L)}{(C_L L_L s^2 + 1) (L_1 g_m s + 1)}$$

$$10.17 \quad \text{INVALID-ORDER-17} \quad Z(s) = \left( L_1 s, \infty, \infty, \infty, \infty, \frac{R_L \left( L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

$$H(s) = \frac{L_1 R_L g_m s (C_L L_L s^2 + 1)}{(L_1 g_m s + 1) (C_L L_L s^2 + C_L R_L s + 1)}$$

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

$$H(s) = \frac{R_L g_m}{C_1 s + g_m}$$

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

$$H(s) = \frac{g_m}{C_L s (C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_L R_L s + 1)}{C_L s (C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_L L_L s^2 + 1)}{C_L s (C_1 s + g_m)}$$

$$10.22 \quad \text{INVALID-ORDER-22} \quad Z(s) = \left( \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$$

$$H(s) = \frac{L_L g_m s}{(C_1 s + g_m) (C_L L_L s^2 + 1)}$$



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

$$H(s) = \frac{g_m (C_L L_L s^2 + C_L R_L s + 1)}{C_L s (C_1 s + g_m)}$$

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

$$H(s) = \frac{L_L R_L g_m s}{(C_1 s + g_m) (C_L L_L R_L s^2 + L_L s + R_L)}$$

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

$$H(s) = \frac{g_m (C_L L_L R_L s^2 + L_L s + R_L)}{(C_1 s + g_m) (C_L L_L s^2 + 1)}$$

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

$$H(s) = \frac{R_L g_m (C_L L_L s^2 + 1)}{(C_1 s + g_m) (C_L L_L s^2 + C_L R_L s + 1)}$$

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

$$H(s) = \frac{R_1 R_L g_m}{C_1 R_1 s + R_1 g_m + 1}$$

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

$$H(s) = \frac{R_1 g_m}{C_L s (C_1 R_1 s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{R_1 g_m (C_L R_L s + 1)}{C_L s (C_1 R_1 s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{R_1 g_m (C_L L_L s^2 + 1)}{C_L s (C_1 R_1 s + R_1 g_m + 1)}$$

**10.31 INVALID-ORDER-31**  $Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L R_1 g_m s}{(C_L L_L s^2 + 1) (C_1 R_1 s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{R_1 g_m (C_L L_L s^2 + C_L R_L s + 1)}{C_L s (C_1 R_1 s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{L_L R_1 R_L g_m s}{(C_1 R_1 s + R_1 g_m + 1) (C_L L_L R_L s^2 + L_L s + R_L)}$$

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

$$H(s) = \frac{R_1 g_m (C_L L_L R_L s^2 + L_L s + R_L)}{(C_L L_L s^2 + 1) (C_1 R_1 s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{R_1 R_L g_m (C_L L_L s^2 + 1)}{(C_1 R_1 s + R_1 g_m + 1) (C_L L_L s^2 + C_L R_L s + 1)}$$

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

$$H(s) = \frac{R_L g_m (C_1 R_1 s + 1)}{C_1 R_1 g_m s + C_1 s + g_m}$$

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

$$H(s) = \frac{g_m (C_1 R_1 s + 1)}{C_L s (C_1 R_1 g_m s + C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_1 R_1 s + 1) (C_L R_L s + 1)}{C_L s (C_1 R_1 g_m s + C_1 s + g_m)}$$

$$10.39 \quad \text{INVALID-ORDER-39} \quad Z(s) = \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{g_m (C_1 R_1 s + 1) (C_L L_L s^2 + 1)}{C_L s (C_1 R_1 g_m s + C_1 s + g_m)}$$

10.40 INVALID-ORDER-40  $Z(s) = \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L g_m s (C_1 R_1 s + 1)}{(C_L L_L s^2 + 1) (C_1 R_1 g_m s + C_1 s + g_m)}$$

10.41 INVALID-ORDER-41  $Z(s) = \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{g_m (C_1 R_1 s + 1) (C_L L_L s^2 + C_L R_L s + 1)}{C_L s (C_1 R_1 g_m s + C_1 s + g_m)}$$

10.42 INVALID-ORDER-42  $Z(s) = \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

$$H(s) = \frac{L_L R_L g_m s (C_1 R_1 s + 1)}{(C_1 R_1 g_m s + C_1 s + g_m) (C_L L_L R_L s^2 + L_L s + R_L)}$$

10.43 INVALID-ORDER-43  $Z(s) = \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{g_m (C_1 R_1 s + 1) (C_L L_L R_L s^2 + L_L s + R_L)}{(C_L L_L s^2 + 1) (C_1 R_1 g_m s + C_1 s + g_m)}$$

10.44 INVALID-ORDER-44  $Z(s) = \left( R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$

$$H(s) = \frac{R_L g_m (C_1 R_1 s + 1) (C_L L_L s^2 + 1)}{(C_L L_L s^2 + C_L R_L s + 1) (C_1 R_1 g_m s + C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_1 L_1 s^2 + 1)}{C_L s (C_1 L_1 g_m s^2 + C_1 s + g_m)}$$

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

$$H(s) = \frac{R_L g_m (C_1 L_1 s^2 + 1)}{(C_L R_L s + 1) (C_1 L_1 g_m s^2 + C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_1 L_1 s^2 + 1) (C_L R_L s + 1)}{C_L s (C_1 L_1 g_m s^2 + C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_1 L_1 s^2 + 1) (C_L L_L s^2 + 1)}{C_L s (C_1 L_1 g_m s^2 + C_1 s + g_m)}$$

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

$$H(s) = \frac{L_L g_m s (C_1 L_1 s^2 + 1)}{(C_L L_L s^2 + 1) (C_1 L_1 g_m s^2 + C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_1 L_1 s^2 + 1) (C_L L_L s^2 + C_L R_L s + 1)}{C_L s (C_1 L_1 g_m s^2 + C_1 s + g_m)}$$

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

$$H(s) = \frac{L_L R_L g_m s (C_1 L_1 s^2 + 1)}{(C_1 L_1 g_m s^2 + C_1 s + g_m) (C_L L_L R_L s^2 + L_L s + R_L)}$$

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

$$H(s) = \frac{g_m (C_1 L_1 s^2 + 1) (C_L L_L R_L s^2 + L_L s + R_L)}{(C_L L_L s^2 + 1) (C_1 L_1 g_m s^2 + C_1 s + g_m)}$$

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

$$H(s) = \frac{R_L g_m (C_1 L_1 s^2 + 1) (C_L L_L s^2 + 1)}{(C_L L_L s^2 + C_L R_L s + 1) (C_1 L_1 g_m s^2 + C_1 s + g_m)}$$

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

$$H(s) = \frac{L_1 R_L g_m s}{(C_L R_L s + 1) (C_1 L_1 s^2 + L_1 g_m s + 1)}$$

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

$$H(s) = \frac{L_1 L_L g_m s^2}{(C_L L_L s^2 + 1) (C_1 L_1 s^2 + L_1 g_m s + 1)}$$

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

$$H(s) = \frac{L_1 L_L R_L g_m s^2}{(C_1 L_1 s^2 + L_1 g_m s + 1)(C_L L_L R_L s^2 + L_L s + R_L)}$$

$$10.57 \quad \text{INVALID-ORDER-57} \quad Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$$

$$H(s) = \frac{L_1 g_m s (C_L L_L R_L s^2 + L_L s + R_L)}{(C_L L_L s^2 + 1)(C_1 L_1 s^2 + L_1 g_m s + 1)}$$

$$10.58 \quad \text{INVALID-ORDER-58} \quad Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right)$$

$$H(s) = \frac{L_1 R_L g_m s (C_L L_L s^2 + 1)}{(C_1 L_1 s^2 + L_1 g_m s + 1)(C_L L_L s^2 + C_L R_L s + 1)}$$

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

$$H(s) = \frac{g_m (C_1 L_1 s^2 + C_1 R_1 s + 1)}{C_L s (C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m)}$$

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

$$H(s) = \frac{R_L g_m (C_1 L_1 s^2 + C_1 R_1 s + 1)}{(C_L R_L s + 1)(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_L R_L s + 1) (C_1 L_1 s^2 + C_1 R_1 s + 1)}{C_L s (C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_L L_L s^2 + 1) (C_1 L_1 s^2 + C_1 R_1 s + 1)}{C_L s (C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m)}$$

**10.63 INVALID-ORDER-63**  $Z(s) = \left( L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L g_m s (C_1 L_1 s^2 + C_1 R_1 s + 1)}{(C_L L_L s^2 + 1) (C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m)}$$

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

$$H(s) = \frac{g_m (C_1 L_1 s^2 + C_1 R_1 s + 1) (C_L L_L s^2 + C_L R_L s + 1)}{C_L s (C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m)}$$

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

$$H(s) = \frac{L_L R_L g_m s (C_1 L_1 s^2 + C_1 R_1 s + 1)}{(C_L L_L R_L s^2 + L_L s + R_L) (C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m)}$$



$$10.66 \quad \text{INVALID-ORDER-66} \quad Z(s) = \left( L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$$

$$H(s) = \frac{g_m (C_1 L_1 s^2 + C_1 R_1 s + 1) (C_L L_L R_L s^2 + L_L s + R_L)}{(C_L L_L s^2 + 1) (C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m)}$$

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

$$H(s) = \frac{R_L g_m (C_L L_L s^2 + 1) (C_1 L_1 s^2 + C_1 R_1 s + 1)}{(C_L L_L s^2 + C_L R_L s + 1) (C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m)}$$

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

$$H(s) = \frac{L_1 R_1 R_L g_m s}{(C_L R_L s + 1) (C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1)}$$

$$10.69 \quad \text{INVALID-ORDER-69} \quad Z(s) = \left( \frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$$

$$H(s) = \frac{L_1 L_L R_1 g_m s^2}{(C_L L_L s^2 + 1) (C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1)}$$

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

$$H(s) = \frac{L_1 L_L R_1 R_L g_m s^2}{(C_L L_L R_L s^2 + L_L s + R_L) (C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1)}$$

$$\begin{aligned}
10.71 \quad \text{INVALID-ORDER-71} \quad Z(s) &= \left( \frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right) \\
H(s) &= \frac{L_1 R_1 g_m s (C_L L_L R_L s^2 + L_L s + R_L)}{(C_L L_L s^2 + 1) (C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1)}
\end{aligned}$$

$$\begin{aligned}
10.72 \quad \text{INVALID-ORDER-72} \quad Z(s) &= \left( \frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{R_L (L_L s + \frac{1}{C_L s})}{L_L s + R_L + \frac{1}{C_L s}} \right) \\
H(s) &= \frac{L_1 R_1 R_L g_m s (C_L L_L s^2 + 1)}{(C_L L_L s^2 + C_L R_L s + 1) (C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1)}
\end{aligned}$$

$$\begin{aligned}
10.73 \quad \text{INVALID-ORDER-73} \quad Z(s) &= \left( \frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{1}{C_L s} \right) \\
H(s) &= \frac{g_m (C_1 L_1 R_1 s^2 + L_1 s + R_1)}{C_L s (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1)}
\end{aligned}$$

$$\begin{aligned}
10.74 \quad \text{INVALID-ORDER-74} \quad Z(s) &= \left( \frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right) \\
H(s) &= \frac{R_L g_m (C_1 L_1 R_1 s^2 + L_1 s + R_1)}{(C_L R_L s + 1) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1)}
\end{aligned}$$

$$\begin{aligned}
10.75 \quad \text{INVALID-ORDER-75} \quad Z(s) &= \left( \frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right) \\
H(s) &= \frac{g_m (C_L R_L s + 1) (C_1 L_1 R_1 s^2 + L_1 s + R_1)}{C_L s (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1)}
\end{aligned}$$

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

$$H(s) = \frac{g_m (C_L L_L s^2 + 1) (C_1 L_1 R_1 s^2 + L_1 s + R_1)}{C_L s (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{L_L g_m s (C_1 L_1 R_1 s^2 + L_1 s + R_1)}{(C_L L_L s^2 + 1) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{g_m (C_L L_L s^2 + C_L R_L s + 1) (C_1 L_1 R_1 s^2 + L_1 s + R_1)}{C_L s (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{L_L R_L g_m s (C_1 L_1 R_1 s^2 + L_1 s + R_1)}{(C_L L_L R_L s^2 + L_L s + R_L) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{g_m (C_1 L_1 R_1 s^2 + L_1 s + R_1) (C_L L_L R_L s^2 + L_L s + R_L)}{(C_L L_L s^2 + 1) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{R_L g_m (C_L L_L s^2 + 1) (C_1 L_1 R_1 s^2 + L_1 s + R_1)}{(C_L L_L s^2 + C_L R_L s + 1) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{R_1 g_m (C_1 L_1 s^2 + 1)}{C_L s (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1)}$$

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

$$H(s) = \frac{R_1 R_L g_m (C_1 L_1 s^2 + 1)}{(C_L R_L s + 1) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1)}$$

**10.84 INVALID-ORDER-84**  $Z(s) = \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_1 g_m (C_1 L_1 s^2 + 1) (C_L R_L s + 1)}{C_L s (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1)}$$

**10.85 INVALID-ORDER-85**  $Z(s) = \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_1 g_m (C_1 L_1 s^2 + 1) (C_L L_L s^2 + 1)}{C_L s (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1)}$$

**10.86 INVALID-ORDER-86**  $Z(s) = \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L R_1 g_m s (C_1 L_1 s^2 + 1)}{(C_L L_L s^2 + 1) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1)}$$

**10.87 INVALID-ORDER-87**  $Z(s) = \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{R_1 g_m (C_1 L_1 s^2 + 1) (C_L L_L s^2 + C_L R_L s + 1)}{C_L s (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1)}$$

**10.88 INVALID-ORDER-88**  $Z(s) = \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}} \right)$

$$H(s) = \frac{L_L R_1 R_L g_m s (C_1 L_1 s^2 + 1)}{(C_L L_L R_L s^2 + L_L s + R_L) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1)}$$

**10.89 INVALID-ORDER-89**  $Z(s) = \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{R_1 g_m (C_1 L_1 s^2 + 1) (C_L L_L R_L s^2 + L_L s + R_L)}{(C_L L_L s^2 + 1) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1)}$$

**10.90 INVALID-ORDER-90**  $Z(s) = \left( \frac{R_1 \left( L_1 s + \frac{1}{C_1 s} \right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{R_L \left( L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right)$

$$H(s) = \frac{R_1 R_L g_m (C_1 L_1 s^2 + 1) (C_L L_L s^2 + 1)}{(C_L L_L s^2 + C_L R_L s + 1) (C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1)}$$