

# Filter Summary Report: TIA,simple,Z1,ZL

Generated by MacAnalog-Symbolix

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**1 Examined  $H(z)$  for TIA 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:**

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

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

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

**Parameters:**

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: 0  
 K-HP: 0  
 K-BP:  $R_L$   
 Qz: 0

Wz: None

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

**Parameters:**

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

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

## 4 LP

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

**Parameters:**

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

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

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

**Parameters:**

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

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

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

**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: 0  
 Qz: None  
 Wz: None

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

**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: 0  
 Qz: None  
 Wz: None

## 5 BS

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

**Parameters:**

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

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

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

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

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

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

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

**Parameters:**

Q:  $\frac{L_1 g_m \sqrt{\frac{1}{C_1 L_1}}}{R_1 g_m + 1}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{R_1 g_m + 1}{L_1 g_m}$   
 K-LP:  $R_L$   
 K-HP:  $R_L$   
 K-BP:  $\frac{R_1 R_L g_m}{R_1 g_m + 1}$   
 Qz:  $\frac{L_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1}$   
 Wz:  $\sqrt{\frac{1}{C_1 L_1}}$

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

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

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



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

**Parameters:**

Q:  $\frac{C_1 \sqrt{\frac{1}{C_1 L_1}} (R_1 g_m + 1)}{g_m}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{g_m}{C_1 (R_1 g_m + 1)}$   
 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:  $R_L$   
 Qz:  $C_1 R_1 \sqrt{\frac{1}{C_1 L_1}}$   
 Wz:  $\sqrt{\frac{1}{C_1 L_1}}$

## 7 AP

## 8 INVALID-NUMER

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

**Parameters:**

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

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

**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

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

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

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

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

**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

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

## 9 INVALID-WZ

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

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

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

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

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

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

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

**Parameters:**

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

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

**Parameters:**

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

## 10 INVALID-ORDER

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**10.71 INVALID-ORDER-71**  $Z(s) = \left( \frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

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

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

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

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

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

**10.74 INVALID-ORDER-74**  $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1} \right)$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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