

# Filter Summary Report: TIA,simple,Z4,Z5

Generated by MacAnalog-Symbolix

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10.44INVALID-ORDER-44	$Z(s) = \left( \infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, L_5s + R_5 + \frac{1}{C_5s}, \infty \right)$	12



10.82INVALID-ORDER-82	$Z(s) = \left( \infty, \infty, \infty, \frac{R_4(C_4L_4s^2+1)}{C_4L_4s^2+C_4R_4s+1}, \frac{L_5s}{C_5L_5s^2+1} + R_5, \infty \right)$	16
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**1 Examined  $H(z)$  for TIA simple Z4 Z5:**  $\frac{Z_4(Z_5g_m-1)}{2Z_4g_m+2Z_5g_m+2}$

$$H(z) = \frac{Z_4 (Z_5g_m - 1)}{2Z_4g_m + 2Z_5g_m + 2}$$

**2 HP**

**3 BP**

**3.1 BP-1**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4s}{C_4L_4s^2+1}, R_5, \infty \right)$

$$H(s) = \frac{s (L_4R_5g_m - L_4)}{2L_4g_ms + 2R_5g_m + s^2 (2C_4L_4R_5g_m + 2C_4L_4) + 2}$$

**Parameters:**

Q:  $\frac{C_4\sqrt{\frac{1}{C_4L_4}}(R_5g_m+1)}{g_m}$   
 wo:  $\sqrt{\frac{1}{C_4L_4}}$   
 bandwidth:  $\frac{g_m}{C_4(R_5g_m+1)}$   
 K-LP: 0  
 K-HP: 0  
 K-BP:  $\frac{R_5g_m-1}{2g_m}$   
 Qz: 0  
 Wz: None

**3.2 BP-2**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4R_4s}{C_4L_4R_4s^2+L_4s+R_4}, R_5, \infty \right)$

$$H(s) = \frac{s (L_4R_4R_5g_m - L_4R_4)}{2R_4R_5g_m + 2R_4 + s^2 (2C_4L_4R_4R_5g_m + 2C_4L_4R_4) + s (2L_4R_4g_m + 2L_4R_5g_m + 2L_4)}$$

**Parameters:**

Q:  $\frac{C_4R_4\sqrt{\frac{1}{C_4L_4}}(R_5g_m+1)}{R_4g_m+R_5g_m+1}$   
 wo:  $\sqrt{\frac{1}{C_4L_4}}$   
 bandwidth:  $\frac{R_4g_m+R_5g_m+1}{C_4R_4(R_5g_m+1)}$   
 K-LP: 0  
 K-HP: 0  
 K-BP:  $\frac{R_4(R_5g_m-1)}{2(R_4g_m+R_5g_m+1)}$   
 Qz: 0  
 Wz: None

**4 LP**

**5 BS**

**5.1 BS-1**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, R_5, \infty \right)$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_4 g_m \sqrt{\frac{1}{C_4 L_4}}}{R_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\ \text{bandwidth: } & \frac{R_5 g_m + 1}{L_4 g_m} \\ \text{K-LP: } & \frac{R_5 g_m - 1}{2 g_m} \\ \text{K-HP: } & \frac{R_5 g_m - 1}{2 g_m} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_4 L_4}} \end{aligned}$$

**5.2 BS-2**  $Z(s) = \left( \infty, \infty, \infty, \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + C_4 R_4 s + 1}, R_5, \infty \right)$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 g_m + R_5 g_m + 1)}{R_4 (R_5 g_m + 1)} \\ \text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\ \text{bandwidth: } & \frac{R_4 (R_5 g_m + 1)}{L_4 (R_4 g_m + R_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_4 (R_5 g_m - 1)}{2 (R_4 g_m + R_5 g_m + 1)} \\ \text{K-HP: } & \frac{R_4 (R_5 g_m - 1)}{2 (R_4 g_m + R_5 g_m + 1)} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_4 L_4}} \end{aligned}$$

## 6 GE

**6.1 GE-1**  $Z(s) = \left( \infty, \infty, \infty, R_4, L_5 s + \frac{1}{C_5 s}, \infty \right)$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_5 g_m \sqrt{\frac{1}{C_5 L_5}}}{R_4 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_5 L_5}} \\ \text{bandwidth: } & \frac{R_4 g_m + 1}{L_5 g_m} \\ \text{K-LP: } & \frac{R_4}{2} \\ \text{K-HP: } & \frac{R_4}{2} \\ \text{K-BP: } & -\frac{R_4}{2 R_4 g_m + 2} \\ \text{Qz: } & -L_5 g_m \sqrt{\frac{1}{C_5 L_5}} \\ \text{Wz: } & \sqrt{\frac{1}{C_5 L_5}} \end{aligned}$$

$$H(s) = \frac{R_5 g_m + s^2 (C_4 L_4 R_5 g_m - C_4 L_4) - 1}{2 C_4 L_4 g_m s^2 + 2 g_m + s (2 C_4 R_5 g_m + 2 C_4)}$$

$$H(s) = \frac{R_4 R_5 g_m - R_4 + s^2 (C_4 L_4 R_4 R_5 g_m - C_4 L_4 R_4)}{2 R_4 g_m + 2 R_5 g_m + s^2 (2 C_4 L_4 R_4 g_m + 2 C_4 L_4 R_5 g_m + 2 C_4 L_4) + s (2 C_4 R_4 R_5 g_m + 2 C_4 R_4) + 2}$$

$$H(s) = \frac{C_5 L_5 R_4 g_m s^2 - C_5 R_4 s + R_4 g_m}{2 C_5 L_5 g_m s^2 + 2 g_m + s (2 C_5 R_4 g_m + 2 C_5)}$$

**6.2 GE-2**  $Z(s) = \left( \infty, \infty, \infty, R_4, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \infty \right)$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_5 \sqrt{\frac{1}{C_5 L_5}} (R_4 g_m + 1)}{g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_5 L_5}} \\ \text{bandwidth: } & \frac{g_m}{C_5 (R_4 g_m + 1)} \\ \text{K-LP: } & -\frac{R_4}{2R_4 g_m + 2} \\ \text{K-HP: } & -\frac{R_4}{2R_4 g_m + 2} \\ \text{K-BP: } & \frac{R_4}{2} \\ \text{QZ: } & -\frac{C_5 \sqrt{\frac{1}{C_5 L_5}}}{g_m} \\ \text{WZ: } & \sqrt{\frac{1}{C_5 L_5}} \end{aligned}$$

**6.3 GE-3**  $Z(s) = \left( \infty, \infty, \infty, R_4, L_5 s + R_5 + \frac{1}{C_5 s}, \infty \right)$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_5 g_m \sqrt{\frac{1}{C_5 L_5}}}{R_4 g_m + R_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_5 L_5}} \\ \text{bandwidth: } & \frac{R_4 g_m + R_5 g_m + 1}{L_5 g_m} \\ \text{K-LP: } & \frac{R_4}{2} \\ \text{K-HP: } & \frac{R_4}{2} \\ \text{K-BP: } & \frac{R_4 (R_5 g_m - 1)}{2(R_4 g_m + R_5 g_m + 1)} \\ \text{QZ: } & \frac{L_5 g_m \sqrt{\frac{1}{C_5 L_5}}}{R_5 g_m - 1} \\ \text{WZ: } & \sqrt{\frac{1}{C_5 L_5}} \end{aligned}$$

**6.4 GE-4**  $Z(s) = \left( \infty, \infty, \infty, R_4, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \infty \right)$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_5 R_5 \sqrt{\frac{1}{C_5 L_5}} (R_4 g_m + 1)}{R_4 g_m + R_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_5 L_5}} \\ \text{bandwidth: } & \frac{R_4 g_m + R_5 g_m + 1}{C_5 R_5 (R_4 g_m + 1)} \\ \text{K-LP: } & -\frac{R_4}{2R_4 g_m + 2} \\ \text{K-HP: } & -\frac{R_4}{2R_4 g_m + 2} \\ \text{K-BP: } & \frac{R_4 (R_5 g_m - 1)}{2(R_4 g_m + R_5 g_m + 1)} \\ \text{QZ: } & -\frac{C_5 R_5 \sqrt{\frac{1}{C_5 L_5}}}{R_5 g_m - 1} \\ \text{WZ: } & \sqrt{\frac{1}{C_5 L_5}} \end{aligned}$$

$$H(s) = \frac{-C_5 L_5 R_4 s^2 + L_5 R_4 g_m s - R_4}{2L_5 g_m s + 2R_4 g_m + s^2 (2C_5 L_5 R_4 g_m + 2C_5 L_5) + 2}$$

$$H(s) = \frac{C_5 L_5 R_4 g_m s^2 + R_4 g_m + s (C_5 R_4 R_5 g_m - C_5 R_4)}{2C_5 L_5 g_m s^2 + 2g_m + s (2C_5 R_4 g_m + 2C_5 R_5 g_m + 2C_5)}$$

$$H(s) = \frac{-C_5 L_5 R_4 R_5 s^2 - R_4 R_5 + s (L_5 R_4 R_5 g_m - L_5 R_4)}{2R_4 R_5 g_m + 2R_5 + s^2 (2C_5 L_5 R_4 R_5 g_m + 2C_5 L_5 R_5) + s (2L_5 R_4 g_m + 2L_5 R_5 g_m + 2L_5)}$$

**6.5 GE-5**  $Z(s) = \left( \infty, \infty, \infty, R_4, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \infty \right)$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_5 \sqrt{\frac{1}{C_5 L_5}} (R_4 g_m + R_5 g_m + 1)}{g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_5 L_5}} \\ \text{bandwidth: } & \frac{g_m}{C_5 (R_4 g_m + R_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_4 (R_5 g_m - 1)}{2(R_4 g_m + R_5 g_m + 1)} \\ \text{K-HP: } & \frac{R_4 (R_5 g_m - 1)}{2(R_4 g_m + R_5 g_m + 1)} \\ \text{K-BP: } & \frac{R_4}{2} \\ \text{QZ: } & \frac{C_5 \sqrt{\frac{1}{C_5 L_5}} (R_5 g_m - 1)}{g_m} \\ \text{WZ: } & \sqrt{\frac{1}{C_5 L_5}} \end{aligned}$$

**6.6 GE-6**  $Z(s) = \left( \infty, \infty, \infty, R_4, \frac{R_5 (C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \infty \right)$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_5 \sqrt{\frac{1}{C_5 L_5}} (R_4 g_m + R_5 g_m + 1)}{R_5 (R_4 g_m + 1)} \\ \text{wo: } & \sqrt{\frac{1}{C_5 L_5}} \\ \text{bandwidth: } & \frac{R_5 (R_4 g_m + 1)}{L_5 (R_4 g_m + R_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_4 (R_5 g_m - 1)}{2(R_4 g_m + R_5 g_m + 1)} \\ \text{K-HP: } & \frac{R_4 (R_5 g_m - 1)}{2(R_4 g_m + R_5 g_m + 1)} \\ \text{K-BP: } & -\frac{R_4}{2R_4 g_m + 2} \\ \text{QZ: } & \frac{L_5 \sqrt{\frac{1}{C_5 L_5}} (-R_5 g_m + 1)}{R_5} \\ \text{WZ: } & \sqrt{\frac{1}{C_5 L_5}} \end{aligned}$$

**6.7 GE-7**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, R_5, \infty \right)$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_4 g_m \sqrt{\frac{1}{C_4 L_4}}}{R_4 g_m + R_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\ \text{bandwidth: } & \frac{R_4 g_m + R_5 g_m + 1}{L_4 g_m} \\ \text{K-LP: } & \frac{R_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{R_5 g_m - 1}{2g_m} \\ \text{K-BP: } & \frac{R_4 (R_5 g_m - 1)}{2(R_4 g_m + R_5 g_m + 1)} \\ \text{QZ: } & \frac{L_4 \sqrt{\frac{1}{C_4 L_4}}}{R_4} \\ \text{WZ: } & \sqrt{\frac{1}{C_4 L_4}} \end{aligned}$$

$$H(s) = \frac{L_5 R_4 g_m s + R_4 R_5 g_m - R_4 + s^2 (C_5 L_5 R_4 R_5 g_m - C_5 L_5 R_4)}{2L_5 g_m s + 2R_4 g_m + 2R_5 g_m + s^2 (2C_5 L_5 R_4 g_m + 2C_5 L_5 R_5 g_m + 2C_5 L_5) + 2}$$

$$H(s) = \frac{-C_5 R_4 R_5 s + R_4 R_5 g_m - R_4 + s^2 (C_5 L_5 R_4 R_5 g_m - C_5 L_5 R_4)}{2R_4 g_m + 2R_5 g_m + s^2 (2C_5 L_5 R_4 g_m + 2C_5 L_5 R_5 g_m + 2C_5 L_5) + s (2C_5 R_4 R_5 g_m + 2C_5 R_5) + 2}$$

$$H(s) = \frac{R_5 g_m + s^2 (C_4 L_4 R_5 g_m - C_4 L_4) + s (C_4 R_4 R_5 g_m - C_4 R_4) - 1}{2C_4 L_4 g_m s^2 + 2g_m + s (2C_4 R_4 g_m + 2C_4 R_5 g_m + 2C_4)}$$



**6.8 GE-8**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, R_5, \infty \right)$

$$H(s) = \frac{R_4 R_5 g_m - R_4 + s^2 (C_4 L_4 R_4 R_5 g_m - C_4 L_4 R_4) + s (L_4 R_5 g_m - L_4)}{2 L_4 g_m s + 2 R_4 g_m + 2 R_5 g_m + s^2 (2 C_4 L_4 R_4 g_m + 2 C_4 L_4 R_5 g_m + 2 C_4 L_4) + 2}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 g_m + R_5 g_m + 1)}{g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_4 L_4}} \\ \text{bandwidth: } & \frac{g_m}{C_4 (R_4 g_m + R_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_4 (R_5 g_m - 1)}{2 (R_4 g_m + R_5 g_m + 1)} \\ \text{K-HP: } & \frac{R_4 (R_5 g_m - 1)}{2 (R_4 g_m + R_5 g_m + 1)} \\ \text{K-BP: } & \frac{R_5 g_m - 1}{2 g_m} \\ \text{Qz: } & C_4 R_4 \sqrt{\frac{1}{C_4 L_4}} \\ \text{Wz: } & \sqrt{\frac{1}{C_4 L_4}} \end{aligned}$$

## 7 AP

## 8 INVALID-NUMER

**8.1 INVALID-NUMER-1**  $Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, \frac{R_5}{C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_5 R_5 s + R_5 g_m - 1}{2 C_4 C_5 R_5 s^2 + 2 g_m + s (2 C_4 R_5 g_m + 2 C_4 + 2 C_5 R_5 g_m)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_4 C_5 R_5 \sqrt{\frac{g_m}{C_4 C_5 R_5}}}{C_4 R_5 g_m + C_4 + C_5 R_5 g_m} \\ \text{wo: } & \sqrt{\frac{g_m}{C_4 C_5 R_5}} \\ \text{bandwidth: } & \frac{C_4 R_5 g_m + C_4 + C_5 R_5 g_m}{C_4 C_5 R_5} \\ \text{K-LP: } & \frac{R_5 g_m - 1}{2 g_m} \\ \text{K-HP: } & 0 \\ \text{K-BP: } & -\frac{C_5 R_5}{2 C_4 R_5 g_m + 2 C_4 + 2 C_5 R_5 g_m} \\ \text{Qz: } & 0 \\ \text{Wz: } & \text{None} \end{aligned}$$

**8.2 INVALID-NUMER-2**  $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{-C_5 R_4 s + R_4 g_m}{2 C_4 C_5 R_4 s^2 + 2 g_m + s (2 C_4 R_4 g_m + 2 C_5 R_4 g_m + 2 C_5)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_4 C_5 R_4 \sqrt{\frac{g_m}{C_4 C_5 R_4}}}{C_4 R_4 g_m + C_5 R_4 g_m + C_5} \\ \text{wo: } & \sqrt{\frac{g_m}{C_4 C_5 R_4}} \\ \text{bandwidth: } & \frac{C_4 R_4 g_m + C_5 R_4 g_m + C_5}{C_4 C_5 R_4} \\ \text{K-LP: } & \frac{R_4}{2} \\ \text{K-HP: } & 0 \\ \text{K-BP: } & -\frac{C_5 R_4}{2 C_4 R_4 g_m + 2 C_5 R_4 g_m + 2 C_5} \\ \text{Qz: } & 0 \\ \text{Wz: } & \text{None} \end{aligned}$$

### 8.3 INVALID-NUMER-3 $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \frac{R_5}{C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_5 R_4 R_5 s + R_4 R_5 g_m - R_4}{2C_4 C_5 R_4 R_5 s^2 + 2R_4 g_m + 2R_5 g_m + s(2C_4 R_4 R_5 g_m + 2C_4 R_4 + 2C_5 R_4 R_5 g_m + 2C_5 R_5) + 2}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_4 C_5 R_4 R_5 \sqrt{\frac{R_4 g_m + R_5 g_m + 1}{C_4 C_5 R_4 R_5}}}{C_4 R_4 R_5 g_m + C_4 R_4 + C_5 R_4 R_5 g_m + C_5 R_5} \\ \text{wo: } & \sqrt{\frac{R_4 g_m + R_5 g_m + 1}{C_4 C_5 R_4 R_5}} \\ \text{bandwidth: } & \frac{C_4 R_4 R_5 g_m + C_4 R_4 + C_5 R_4 R_5 g_m + C_5 R_5}{C_4 C_5 R_4 R_5} \\ \text{K-LP: } & \frac{R_4 (R_5 g_m - 1)}{2(R_4 g_m + R_5 g_m + 1)} \\ \text{K-HP: } & 0 \\ \text{K-BP: } & -\frac{C_5 R_4 R_5}{2C_4 R_4 R_5 g_m + 2C_4 R_4 + 2C_5 R_4 R_5 g_m + 2C_5 R_5} \\ \text{QZ: } & 0 \\ \text{WZ: } & \text{None} \end{aligned}$$

### 8.4 INVALID-NUMER-4 $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{R_4 g_m + s(C_5 R_4 R_5 g_m - C_5 R_4)}{2g_m + s^2(2C_4 C_5 R_4 R_5 g_m + 2C_4 C_5 R_4) + s(2C_4 R_4 g_m + 2C_5 R_4 g_m + 2C_5 R_5 g_m + 2C_5)}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_4 C_5 R_4 \sqrt{\frac{g_m}{C_4 C_5 R_4 (R_5 g_m + 1)}} (R_5 g_m + 1)}{C_4 R_4 g_m + C_5 R_4 g_m + C_5 R_5 g_m + C_5} \\ \text{wo: } & \sqrt{\frac{g_m}{C_4 C_5 R_4 (R_5 g_m + 1)}} \\ \text{bandwidth: } & \frac{C_4 R_4 g_m + C_5 R_4 g_m + C_5 R_5 g_m + C_5}{C_4 C_5 R_4 (R_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_4}{2} \\ \text{K-HP: } & 0 \\ \text{K-BP: } & \frac{C_5 R_4 (R_5 g_m - 1)}{2(C_4 R_4 g_m + C_5 R_4 g_m + C_5 R_5 g_m + C_5)} \\ \text{QZ: } & 0 \\ \text{WZ: } & \text{None} \end{aligned}$$

## 9 INVALID-WZ

### 9.1 INVALID-WZ-1 $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \frac{R_5}{C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 R_4 R_5 s^2 + R_5 g_m + s(C_4 R_4 R_5 g_m - C_4 R_4 - C_5 R_5) - 1}{2g_m + s^2(2C_4 C_5 R_4 R_5 g_m + 2C_4 C_5 R_5) + s(2C_4 R_4 g_m + 2C_4 R_5 g_m + 2C_4 + 2C_5 R_5 g_m)}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_4 C_5 R_5 \sqrt{\frac{g_m}{C_4 C_5 R_5 (R_4 g_m + 1)}} (R_4 g_m + 1)}{C_4 R_4 g_m + C_4 R_5 g_m + C_4 + C_5 R_5 g_m} \\ \text{wo: } & \sqrt{\frac{g_m}{C_4 C_5 R_5 (R_4 g_m + 1)}} \\ \text{bandwidth: } & \frac{C_4 R_4 g_m + C_4 R_5 g_m + C_4 + C_5 R_5 g_m}{C_4 C_5 R_5 (R_4 g_m + 1)} \\ \text{K-LP: } & \frac{R_5 g_m - 1}{2g_m} \\ \text{K-HP: } & -\frac{R_4}{2R_4 g_m + 2} \\ \text{K-BP: } & \frac{\frac{C_4 R_4 R_5 g_m}{2} - \frac{C_4 R_4}{2} - \frac{C_5 R_5}{2}}{C_4 R_4 g_m + C_4 R_5 g_m + C_4 + C_5 R_5 g_m} \\ \text{QZ: } & \frac{C_4 C_5 R_4 R_5 \sqrt{\frac{g_m}{C_4 C_5 R_5 (R_4 g_m + 1)}}}{-C_4 R_4 R_5 g_m + C_4 R_4 + C_5 R_5} \\ \text{WZ: } & \sqrt{\frac{-R_5 g_m + 1}{C_4 C_5 R_4 R_5}} \end{aligned}$$

## 10 INVALID-ORDER

$$10.1 \quad \text{INVALID-ORDER-1} \quad Z(s) = (\infty, \infty, \infty, R_4, R_5, \infty)$$

$$H(s) = \frac{R_4 R_5 g_m - R_4}{2R_4 g_m + 2R_5 g_m + 2}$$

$$10.2 \quad \text{INVALID-ORDER-2} \quad Z(s) = \left( \infty, \infty, \infty, R_4, \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{-C_5 R_4 s + R_4 g_m}{2g_m + s(2C_5 R_4 g_m + 2C_5)}$$

$$10.3 \quad \text{INVALID-ORDER-3} \quad Z(s) = \left( \infty, \infty, \infty, R_4, \frac{R_5}{C_5 R_5 s + 1}, \infty \right)$$

$$H(s) = \frac{-C_5 R_4 R_5 s + R_4 R_5 g_m - R_4}{2R_4 g_m + 2R_5 g_m + s(2C_5 R_4 R_5 g_m + 2C_5 R_5) + 2}$$

$$10.4 \quad \text{INVALID-ORDER-4} \quad Z(s) = \left( \infty, \infty, \infty, R_4, R_5 + \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{R_4 g_m + s(C_5 R_4 R_5 g_m - C_5 R_4)}{2g_m + s(2C_5 R_4 g_m + 2C_5 R_5 g_m + 2C_5)}$$

$$10.5 \quad \text{INVALID-ORDER-5} \quad Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, R_5, \infty \right)$$

$$H(s) = \frac{R_5 g_m - 1}{2g_m + s(2C_4 R_5 g_m + 2C_4)}$$

$$10.6 \quad \text{INVALID-ORDER-6} \quad Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{-C_5 s + g_m}{2C_4 C_5 s^2 + s(2C_4 g_m + 2C_5 g_m)}$$

$$10.7 \quad \text{INVALID-ORDER-7} \quad Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, R_5 + \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{g_m + s(C_5 R_5 g_m - C_5)}{s^2(2C_4 C_5 R_5 g_m + 2C_4 C_5) + s(2C_4 g_m + 2C_5 g_m)}$$

$$10.8 \quad \text{INVALID-ORDER-8} \quad Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, L_5 s + \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{C_5 L_5 g_m s^2 - C_5 s + g_m}{2C_4 C_5 L_5 g_m s^3 + 2C_4 C_5 s^2 + s(2C_4 g_m + 2C_5 g_m)}$$

$$10.9 \quad \text{INVALID-ORDER-9} \quad Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \infty \right)$$

$$H(s) = \frac{-C_5 L_5 s^2 + L_5 g_m s - 1}{2C_4 C_5 L_5 s^3 + 2C_4 s + 2g_m + s^2(2C_4 L_5 g_m + 2C_5 L_5 g_m)}$$

$$10.10 \quad \text{INVALID-ORDER-10} \quad Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, L_5 s + R_5 + \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{C_5 L_5 g_m s^2 + g_m + s(C_5 R_5 g_m - C_5)}{2C_4 C_5 L_5 g_m s^3 + s^2(2C_4 C_5 R_5 g_m + 2C_4 C_5) + s(2C_4 g_m + 2C_5 g_m)}$$

**10.11 INVALID-ORDER-11**  $Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \infty \right)$

$$H(s) = \frac{-C_5 L_5 R_5 s^2 - R_5 + s (L_5 R_5 g_m - L_5)}{2C_4 C_5 L_5 R_5 s^3 + 2R_5 g_m + s^2 (2C_4 L_5 R_5 g_m + 2C_4 L_5 + 2C_5 L_5 R_5 g_m) + s (2C_4 R_5 + 2L_5 g_m)}$$

**10.12 INVALID-ORDER-12**  $Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \infty \right)$

$$H(s) = \frac{L_5 g_m s + R_5 g_m + s^2 (C_5 L_5 R_5 g_m - C_5 L_5) - 1}{2g_m + s^3 (2C_4 C_5 L_5 R_5 g_m + 2C_4 C_5 L_5) + s^2 (2C_4 L_5 g_m + 2C_5 L_5 g_m) + s (2C_4 R_5 g_m + 2C_4)}$$

**10.13 INVALID-ORDER-13**  $Z(s) = \left( \infty, \infty, \infty, \frac{1}{C_4 s}, \frac{R_5 (C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_5 R_5 s + R_5 g_m + s^2 (C_5 L_5 R_5 g_m - C_5 L_5) - 1}{2g_m + s^3 (2C_4 C_5 L_5 R_5 g_m + 2C_4 C_5 L_5) + s^2 (2C_4 C_5 R_5 + 2C_5 L_5 g_m) + s (2C_4 R_5 g_m + 2C_4 + 2C_5 R_5 g_m)}$$

**10.14 INVALID-ORDER-14**  $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, R_5, \infty \right)$

$$H(s) = \frac{R_4 R_5 g_m - R_4}{2R_4 g_m + 2R_5 g_m + s (2C_4 R_4 R_5 g_m + 2C_4 R_4) + 2}$$

**10.15 INVALID-ORDER-15**  $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, L_5 s + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_5 L_5 R_4 g_m s^2 - C_5 R_4 s + R_4 g_m}{2C_4 C_5 L_5 R_4 g_m s^3 + 2g_m + s^2 (2C_4 C_5 R_4 + 2C_5 L_5 g_m) + s (2C_4 R_4 g_m + 2C_5 R_4 g_m + 2C_5)}$$

**10.16 INVALID-ORDER-16**  $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \infty \right)$

$$H(s) = \frac{-C_5 L_5 R_4 s^2 + L_5 R_4 g_m s - R_4}{2C_4 C_5 L_5 R_4 s^3 + 2R_4 g_m + s^2 (2C_4 L_5 R_4 g_m + 2C_5 L_5 R_4 g_m + 2C_5 L_5) + s (2C_4 R_4 + 2L_5 g_m) + 2}$$

**10.17 INVALID-ORDER-17**  $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, L_5 s + R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_5 L_5 R_4 g_m s^2 + R_4 g_m + s (C_5 R_4 R_5 g_m - C_5 R_4)}{2C_4 C_5 L_5 R_4 g_m s^3 + 2g_m + s^2 (2C_4 C_5 R_4 R_5 g_m + 2C_4 C_5 R_4 + 2C_5 L_5 g_m) + s (2C_4 R_4 g_m + 2C_5 R_4 g_m + 2C_5 R_5 g_m + 2C_5)}$$

**10.18 INVALID-ORDER-18**  $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \infty \right)$

$$H(s) = \frac{-C_5 L_5 R_4 R_5 s^2 - R_4 R_5 + s (L_5 R_4 R_5 g_m - L_5 R_4)}{2C_4 C_5 L_5 R_4 R_5 s^3 + 2R_4 R_5 g_m + 2R_5 + s^2 (2C_4 L_5 R_4 R_5 g_m + 2C_4 L_5 R_4 + 2C_5 L_5 R_4 R_5 g_m + 2C_5 L_5 R_5) + s (2C_4 R_4 R_5 + 2L_5 R_4 g_m + 2L_5 R_5 g_m + 2L_5)}$$

**10.19 INVALID-ORDER-19**  $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \infty \right)$

$$H(s) = \frac{L_5 R_4 g_m s + R_4 R_5 g_m - R_4 + s^2 (C_5 L_5 R_4 R_5 g_m - C_5 L_5 R_4)}{2R_4 g_m + 2R_5 g_m + s^3 (2C_4 C_5 L_5 R_4 R_5 g_m + 2C_4 C_5 L_5 R_4) + s^2 (2C_4 L_5 R_4 g_m + 2C_5 L_5 R_4 g_m + 2C_5 L_5 R_5 g_m + 2C_5 L_5) + s (2C_4 R_4 R_5 g_m + 2C_4 R_4 + 2L_5 g_m) + 2}$$

**10.20 INVALID-ORDER-20**  $Z(s) = \left( \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \frac{R_5 (C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_5 R_4 R_5 s + R_4 R_5 g_m - R_4 + s^2 (C_5 L_5 R_4 R_5 g_m - C_5 L_5 R_4)}{2R_4 g_m + 2R_5 g_m + s^3 (2C_4 C_5 L_5 R_4 R_5 g_m + 2C_4 C_5 L_5 R_4) + s^2 (2C_4 C_5 R_4 R_5 + 2C_5 L_5 R_4 g_m + 2C_5 L_5 R_5 g_m + 2C_5 L_5) + s (2C_4 R_4 R_5 g_m + 2C_4 R_4 + 2C_5 R_4 R_5 g_m + 2C_5 R_5) + 2}$$

**10.21 INVALID-ORDER-21**  $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, R_5, \infty \right)$

$$H(s) = \frac{R_5 g_m + s (C_4 R_4 R_5 g_m - C_4 R_4) - 1}{2g_m + s (2C_4 R_4 g_m + 2C_4 R_5 g_m + 2C_4)}$$

**10.22 INVALID-ORDER-22**  $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 R_4 s^2 + g_m + s (C_4 R_4 g_m - C_5)}{s^2 (2C_4 C_5 R_4 g_m + 2C_4 C_5) + s (2C_4 g_m + 2C_5 g_m)}$$

**10.23 INVALID-ORDER-23**  $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{g_m + s^2 (C_4 C_5 R_4 R_5 g_m - C_4 C_5 R_4) + s (C_4 R_4 g_m + C_5 R_5 g_m - C_5)}{s^2 (2C_4 C_5 R_4 g_m + 2C_4 C_5 R_5 g_m + 2C_4 C_5) + s (2C_4 g_m + 2C_5 g_m)}$$

**10.24 INVALID-ORDER-24**  $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, L_5 s + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_4 C_5 L_5 R_4 g_m s^3 + g_m + s^2 (-C_4 C_5 R_4 + C_5 L_5 g_m) + s (C_4 R_4 g_m - C_5)}{2C_4 C_5 L_5 g_m s^3 + s^2 (2C_4 C_5 R_4 g_m + 2C_4 C_5) + s (2C_4 g_m + 2C_5 g_m)}$$

**10.25 INVALID-ORDER-25**  $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_5 R_4 s^3 + s^2 (C_4 L_5 R_4 g_m - C_5 L_5) + s (-C_4 R_4 + L_5 g_m) - 1}{2g_m + s^3 (2C_4 C_5 L_5 R_4 g_m + 2C_4 C_5 L_5) + s^2 (2C_4 L_5 g_m + 2C_5 L_5 g_m) + s (2C_4 R_4 g_m + 2C_4)}$$

**10.26 INVALID-ORDER-26**  $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, L_5 s + R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_4 C_5 L_5 R_4 g_m s^3 + g_m + s^2 (C_4 C_5 R_4 R_5 g_m - C_4 C_5 R_4 + C_5 L_5 g_m) + s (C_4 R_4 g_m + C_5 R_5 g_m - C_5)}{2C_4 C_5 L_5 g_m s^3 + s^2 (2C_4 C_5 R_4 g_m + 2C_4 C_5 R_5 g_m + 2C_4 C_5) + s (2C_4 g_m + 2C_5 g_m)}$$

**10.27 INVALID-ORDER-27**  $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_5 R_4 R_5 s^3 - R_5 + s^2 (C_4 L_5 R_4 R_5 g_m - C_4 L_5 R_4 - C_5 L_5 R_5) + s (-C_4 R_4 R_5 + L_5 R_5 g_m - L_5)}{2R_5 g_m + s^3 (2C_4 C_5 L_5 R_4 R_5 g_m + 2C_4 C_5 L_5 R_5) + s^2 (2C_4 L_5 R_4 g_m + 2C_4 L_5 R_5 g_m + 2C_4 L_5 + 2C_5 L_5 R_5 g_m) + s (2C_4 R_4 R_5 g_m + 2C_4 R_5 + 2L_5 g_m)}$$

**10.28 INVALID-ORDER-28**  $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \infty \right)$

$$H(s) = \frac{R_5 g_m + s^3 (C_4 C_5 L_5 R_4 R_5 g_m - C_4 C_5 L_5 R_4) + s^2 (C_4 L_5 R_4 g_m + C_5 L_5 R_5 g_m - C_5 L_5) + s (C_4 R_4 R_5 g_m - C_4 R_4 + L_5 g_m) - 1}{2g_m + s^3 (2C_4 C_5 L_5 R_4 g_m + 2C_4 C_5 L_5 R_5 g_m + 2C_4 C_5 L_5) + s^2 (2C_4 L_5 g_m + 2C_5 L_5 g_m) + s (2C_4 R_4 g_m + 2C_4 R_5 g_m + 2C_4)}$$

**10.29 INVALID-ORDER-29**  $Z(s) = \left( \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \frac{R_5(C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{R_5 g_m + s^3 (C_4 C_5 L_5 R_4 R_5 g_m - C_4 C_5 L_5 R_4) + s^2 (-C_4 C_5 R_4 R_5 + C_5 L_5 R_5 g_m - C_5 L_5) + s (C_4 R_4 R_5 g_m - C_4 R_4 - C_5 R_5) - 1}{2g_m + s^3 (2C_4 C_5 L_5 R_4 g_m + 2C_4 C_5 L_5 R_5 g_m + 2C_4 C_5 L_5) + s^2 (2C_4 C_5 R_4 R_5 g_m + 2C_4 C_5 R_5 + 2C_5 L_5 g_m) + s (2C_4 R_4 g_m + 2C_4 R_5 g_m + 2C_4 + 2C_5 R_5 g_m)}$$

**10.30 INVALID-ORDER-30**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_4 s^3 + C_4 L_4 g_m s^2 - C_5 s + g_m}{2C_4 C_5 L_4 g_m s^3 + 2C_4 C_5 s^2 + s (2C_4 g_m + 2C_5 g_m)}$$

**10.31 INVALID-ORDER-31**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, \frac{R_5}{C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_4 R_5 s^3 - C_5 R_5 s + R_5 g_m + s^2 (C_4 L_4 R_5 g_m - C_4 L_4) - 1}{2C_4 C_5 L_4 R_5 g_m s^3 + 2g_m + s^2 (2C_4 C_5 R_5 + 2C_4 L_4 g_m) + s (2C_4 R_5 g_m + 2C_4 + 2C_5 R_5 g_m)}$$

**10.32 INVALID-ORDER-32**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_4 L_4 g_m s^2 + g_m + s^3 (C_4 C_5 L_4 R_5 g_m - C_4 C_5 L_4) + s (C_5 R_5 g_m - C_5)}{2C_4 C_5 L_4 g_m s^3 + s^2 (2C_4 C_5 R_5 g_m + 2C_4 C_5) + s (2C_4 g_m + 2C_5 g_m)}$$

**10.33 INVALID-ORDER-33**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, L_5 s + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_4 C_5 L_4 L_5 g_m s^4 - C_4 C_5 L_4 s^3 - C_5 s + g_m + s^2 (C_4 L_4 g_m + C_5 L_5 g_m)}{2C_4 C_5 s^2 + s^3 (2C_4 C_5 L_4 g_m + 2C_4 C_5 L_5 g_m) + s (2C_4 g_m + 2C_5 g_m)}$$

**10.34 INVALID-ORDER-34**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_4 L_5 s^4 + C_4 L_4 L_5 g_m s^3 + L_5 g_m s + s^2 (-C_4 L_4 - C_5 L_5) - 1}{2C_4 C_5 L_4 L_5 g_m s^4 + 2C_4 C_5 L_5 s^3 + 2C_4 s + 2g_m + s^2 (2C_4 L_4 g_m + 2C_4 L_5 g_m + 2C_5 L_5 g_m)}$$

**10.35 INVALID-ORDER-35**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, L_5 s + R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_4 C_5 L_4 L_5 g_m s^4 + g_m + s^3 (C_4 C_5 L_4 R_5 g_m - C_4 C_5 L_4) + s^2 (C_4 L_4 g_m + C_5 L_5 g_m) + s (C_5 R_5 g_m - C_5)}{s^3 (2C_4 C_5 L_4 g_m + 2C_4 C_5 L_5 g_m) + s^2 (2C_4 C_5 R_5 g_m + 2C_4 C_5) + s (2C_4 g_m + 2C_5 g_m)}$$

**10.36 INVALID-ORDER-36**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_4 L_5 R_5 s^4 - R_5 + s^3 (C_4 L_4 L_5 R_5 g_m - C_4 L_4 L_5) + s^2 (-C_4 L_4 R_5 - C_5 L_5 R_5) + s (L_5 R_5 g_m - L_5)}{2C_4 C_5 L_4 L_5 R_5 g_m s^4 + 2R_5 g_m + s^3 (2C_4 C_5 L_5 R_5 + 2C_4 L_4 L_5 g_m) + s^2 (2C_4 L_4 R_5 g_m + 2C_4 L_5 R_5 g_m + 2C_4 L_5 + 2C_5 L_5 R_5 g_m) + s (2C_4 R_5 + 2L_5 g_m)}$$

**10.37 INVALID-ORDER-37**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \infty \right)$

$$H(s) = \frac{C_4 L_4 L_5 g_m s^3 + L_5 g_m s + R_5 g_m + s^4 (C_4 C_5 L_4 L_5 R_5 g_m - C_4 C_5 L_4 L_5) + s^2 (C_4 L_4 R_5 g_m - C_4 L_4 + C_5 L_5 R_5 g_m - C_5 L_5) - 1}{2C_4 C_5 L_4 L_5 g_m s^4 + 2g_m + s^3 (2C_4 C_5 L_5 R_5 g_m + 2C_4 C_5 L_5) + s^2 (2C_4 L_4 g_m + 2C_4 L_5 g_m + 2C_5 L_5 g_m) + s (2C_4 R_5 g_m + 2C_4)}$$

**10.38 INVALID-ORDER-38**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, \frac{R_5(C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_4 R_5 s^3 - C_5 R_5 s + R_5 g_m + s^4 (C_4 C_5 L_4 L_5 R_5 g_m - C_4 C_5 L_4 L_5) + s^2 (C_4 L_4 R_5 g_m - C_4 L_4 + C_5 L_5 R_5 g_m - C_5 L_5) - 1}{2C_4 C_5 L_4 L_5 g_m s^4 + 2g_m + s^3 (2C_4 C_5 L_4 R_5 g_m + 2C_4 C_5 L_5 R_5 g_m + 2C_4 C_5 L_5) + s^2 (2C_4 C_5 R_5 + 2C_4 L_4 g_m + 2C_5 L_5 g_m) + s (2C_4 R_5 g_m + 2C_4 + 2C_5 R_5 g_m)}$$

**10.39 INVALID-ORDER-39**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{-C_5 L_4 s^2 + L_4 g_m s}{2C_4 C_5 L_4 s^3 + 2C_5 s + 2g_m + s^2 (2C_4 L_4 g_m + 2C_5 L_4 g_m)}$$

**10.40 INVALID-ORDER-40**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \frac{R_5}{C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_5 L_4 R_5 s^2 + s (L_4 R_5 g_m - L_4)}{2C_4 C_5 L_4 R_5 s^3 + 2R_5 g_m + s^2 (2C_4 L_4 R_5 g_m + 2C_4 L_4 + 2C_5 L_4 R_5 g_m) + s (2C_5 R_5 + 2L_4 g_m) + 2}$$

**10.41 INVALID-ORDER-41**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{L_4 g_m s + s^2 (C_5 L_4 R_5 g_m - C_5 L_4)}{2g_m + s^3 (2C_4 C_5 L_4 R_5 g_m + 2C_4 C_5 L_4) + s^2 (2C_4 L_4 g_m + 2C_5 L_4 g_m) + s (2C_5 R_5 g_m + 2C_5)}$$

**10.42 INVALID-ORDER-42**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, L_5 s + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_5 L_4 L_5 g_m s^3 - C_5 L_4 s^2 + L_4 g_m s}{2C_4 C_5 L_4 L_5 g_m s^4 + 2C_4 C_5 L_4 s^3 + 2C_5 s + 2g_m + s^2 (2C_4 L_4 g_m + 2C_5 L_4 g_m + 2C_5 L_5 g_m)}$$

**10.43 INVALID-ORDER-43**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \infty \right)$

$$H(s) = \frac{-C_5 L_4 L_5 s^3 + L_4 L_5 g_m s^2 - L_4 s}{2C_4 C_5 L_4 L_5 s^4 + s^3 (2C_4 L_4 L_5 g_m + 2C_5 L_4 L_5 g_m) + s^2 (2C_4 L_4 + 2C_5 L_5) + s (2L_4 g_m + 2L_5 g_m) + 2}$$

**10.44 INVALID-ORDER-44**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, L_5 s + R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_5 L_4 L_5 g_m s^3 + L_4 g_m s + s^2 (C_5 L_4 R_5 g_m - C_5 L_4)}{2C_4 C_5 L_4 L_5 g_m s^4 + 2g_m + s^3 (2C_4 C_5 L_4 R_5 g_m + 2C_4 C_5 L_4) + s^2 (2C_4 L_4 g_m + 2C_5 L_4 g_m + 2C_5 L_5 g_m) + s (2C_5 R_5 g_m + 2C_5)}$$

**10.45 INVALID-ORDER-45**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \infty \right)$

$$H(s) = \frac{-C_5 L_4 L_5 R_5 s^3 - L_4 R_5 s + s^2 (L_4 L_5 R_5 g_m - L_4 L_5)}{2C_4 C_5 L_4 L_5 R_5 s^4 + 2R_5 + s^3 (2C_4 L_4 L_5 R_5 g_m + 2C_4 L_4 L_5 + 2C_5 L_4 L_5 R_5 g_m) + s^2 (2C_4 L_4 R_5 + 2C_5 L_5 R_5 + 2L_4 L_5 g_m) + s (2L_4 R_5 g_m + 2L_5 R_5 g_m + 2L_5)}$$

**10.46 INVALID-ORDER-46**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \infty \right)$

$$H(s) = \frac{L_4 L_5 g_m s^2 + s^3 (C_5 L_4 L_5 R_5 g_m - C_5 L_4 L_5) + s (L_4 R_5 g_m - L_4)}{2R_5 g_m + s^4 (2C_4 C_5 L_4 L_5 R_5 g_m + 2C_4 C_5 L_4 L_5) + s^3 (2C_4 L_4 L_5 g_m + 2C_5 L_4 L_5 g_m) + s^2 (2C_4 L_4 R_5 g_m + 2C_4 L_4 + 2C_5 L_5 R_5 g_m + 2C_5 L_5) + s (2L_4 g_m + 2L_5 g_m) + 2}$$

**10.47 INVALID-ORDER-47**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, \frac{R_5 (C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_5 L_4 R_5 s^2 + s^3 (C_5 L_4 L_5 R_5 g_m - C_5 L_4 L_5) + s (L_4 R_5 g_m - L_4)}{2 R_5 g_m + s^4 (2 C_4 C_5 L_4 L_5 R_5 g_m + 2 C_4 C_5 L_4 L_5) + s^3 (2 C_4 C_5 L_4 R_5 + 2 C_5 L_4 L_5 g_m) + s^2 (2 C_4 L_4 R_5 g_m + 2 C_4 L_4 + 2 C_5 L_4 R_5 g_m + 2 C_5 L_5 R_5 g_m + 2 C_5 L_5) + s (2 C_5 R_5 + 2 L_4 g_m) + 2}$$

**10.48 INVALID-ORDER-48**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_4 s^3 + g_m + s^2 (-C_4 C_5 R_4 + C_4 L_4 g_m) + s (C_4 R_4 g_m - C_5)}{2 C_4 C_5 L_4 g_m s^3 + s^2 (2 C_4 C_5 R_4 g_m + 2 C_4 C_5) + s (2 C_4 g_m + 2 C_5 g_m)}$$

**10.49 INVALID-ORDER-49**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, \frac{R_5}{C_5 R_5 s + 1}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_4 R_5 s^3 + R_5 g_m + s^2 (-C_4 C_5 R_4 R_5 + C_4 L_4 R_5 g_m - C_4 L_4) + s (C_4 R_4 R_5 g_m - C_4 R_4 - C_5 R_5) - 1}{2 C_4 C_5 L_4 R_5 g_m s^3 + 2 g_m + s^2 (2 C_4 C_5 R_4 R_5 g_m + 2 C_4 C_5 R_5 + 2 C_4 L_4 g_m) + s (2 C_4 R_4 g_m + 2 C_4 R_5 g_m + 2 C_4 + 2 C_5 R_5 g_m)}$$

**10.50 INVALID-ORDER-50**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{g_m + s^3 (C_4 C_5 L_4 R_5 g_m - C_4 C_5 L_4) + s^2 (C_4 C_5 R_4 R_5 g_m - C_4 C_5 R_4 + C_4 L_4 g_m) + s (C_4 R_4 g_m + C_5 R_5 g_m - C_5)}{2 C_4 C_5 L_4 g_m s^3 + s^2 (2 C_4 C_5 R_4 g_m + 2 C_4 C_5 R_5 g_m + 2 C_4 C_5) + s (2 C_4 g_m + 2 C_5 g_m)}$$

**10.51 INVALID-ORDER-51**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, L_5 s + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_4 C_5 L_4 L_5 g_m s^4 + g_m + s^3 (-C_4 C_5 L_4 + C_4 C_5 L_5 R_4 g_m) + s^2 (-C_4 C_5 R_4 + C_4 L_4 g_m + C_5 L_5 g_m) + s (C_4 R_4 g_m - C_5)}{s^3 (2 C_4 C_5 L_4 g_m + 2 C_4 C_5 L_5 g_m) + s^2 (2 C_4 C_5 R_4 g_m + 2 C_4 C_5) + s (2 C_4 g_m + 2 C_5 g_m)}$$

**10.52 INVALID-ORDER-52**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_4 L_5 s^4 + s^3 (-C_4 C_5 L_5 R_4 + C_4 L_4 L_5 g_m) + s^2 (-C_4 L_4 + C_4 L_5 R_4 g_m - C_5 L_5) + s (-C_4 R_4 + L_5 g_m) - 1}{2 C_4 C_5 L_4 L_5 g_m s^4 + 2 g_m + s^3 (2 C_4 C_5 L_5 R_4 g_m + 2 C_4 C_5 L_5) + s^2 (2 C_4 L_4 g_m + 2 C_4 L_5 g_m + 2 C_5 L_5 g_m) + s (2 C_4 R_4 g_m + 2 C_4)}$$

**10.53 INVALID-ORDER-53**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, L_5 s + R_5 + \frac{1}{C_5 s}, \infty \right)$

$$H(s) = \frac{C_4 C_5 L_4 L_5 g_m s^4 + g_m + s^3 (C_4 C_5 L_4 R_5 g_m - C_4 C_5 L_4 + C_4 C_5 L_5 R_4 g_m) + s^2 (C_4 C_5 R_4 R_5 g_m - C_4 C_5 R_4 + C_4 L_4 g_m + C_5 L_5 g_m) + s (C_4 R_4 g_m + C_5 R_5 g_m - C_5)}{s^3 (2 C_4 C_5 L_4 g_m + 2 C_4 C_5 L_5 g_m) + s^2 (2 C_4 C_5 R_4 g_m + 2 C_4 C_5 R_5 g_m + 2 C_4 C_5) + s (2 C_4 g_m + 2 C_5 g_m)}$$

**10.54 INVALID-ORDER-54**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \infty \right)$

$$H(s) = \frac{-C_4 C_5 L_4 L_5 R_5 s^4 - R_5 + s^3 (-C_4 C_5 L_5 R_4 R_5 + C_4 L_4 L_5 R_5 g_m - C_4 L_4 L_5) + s^2 (-C_4 L_4 R_5 + C_4 L_5 R_4 R_5 g_m - C_4 L_5 R_4 - C_5 L_5 R_5) + s (-C_4 R_4 R_5 + L_5 R_5 g_m - L_5)}{2 C_4 C_5 L_4 L_5 R_5 g_m s^4 + 2 R_5 g_m + s^3 (2 C_4 C_5 L_5 R_4 R_5 g_m + 2 C_4 C_5 L_5 R_5 + 2 C_4 L_4 L_5 g_m) + s^2 (2 C_4 L_4 R_5 g_m + 2 C_4 L_5 R_4 g_m + 2 C_4 L_5 R_5 g_m + 2 C_4 L_5 + 2 C_5 L_5 R_5 g_m) + s (2 C_4 R_4 R_5 g_m + 2 C_4 R_5 + 2 L_5 g_m)}$$

**10.55 INVALID-ORDER-55**  $Z(s) = \left( \infty, \infty, \infty, L_4 s + R_4 + \frac{1}{C_4 s}, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \infty \right)$

$$H(s) = \frac{R_5 g_m + s^4 (C_4 C_5 L_4 L_5 R_5 g_m - C_4 C_5 L_4 L_5) + s^3 (C_4 C_5 L_5 R_4 R_5 g_m - C_4 C_5 L_5 R_4 + C_4 L_4 L_5 g_m) + s^2 (C_4 L_4 R_5 g_m - C_4 L_4 + C_4 L_5 R_4 g_m + C_5 L_5 R_5 g_m - C_5 L_5) + s (C_4 R_4 R_5 g_m - C_4 R_4 + L_5 g_m) - 1}{2 C_4 C_5 L_4 L_5 g_m s^4 + 2 g_m + s^3 (2 C_4 C_5 L_5 R_4 g_m + 2 C_4 C_5 L_5 R_5 g_m + 2 C_4 C_5 L_5) + s^2 (2 C_4 L_4 g_m + 2 C_4 L_5 g_m + 2 C_5 L_5 g_m) + s (2 C_4 R_4 g_m + 2 C_4 R_5 g_m + 2 C_4)}$$



**10.56 INVALID-ORDER-56**  $Z(s) = \left( \infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, \frac{R_5(C_5L_5s^2+1)}{C_5L_5s^2+C_5R_5s+1}, \infty \right)$

$$H(s) = \frac{R_5g_m + s^4(C_4C_5L_4L_5R_5g_m - C_4C_5L_4L_5) + s^3(-C_4C_5L_4R_5 + C_4C_5L_5R_4R_5g_m - C_4C_5L_5R_4) + s^2(-C_4C_5R_4R_5 + C_4L_4R_5g_m - C_4L_4 + C_5L_5R_5g_m - C_5L_5) + s(C_4R_4R_5g_m - C_4R_4 - C_5R_5) - 1}{2C_4C_5L_4L_5g_ms^4 + 2g_m + s^3(2C_4C_5L_4R_5g_m + 2C_4C_5L_5R_4g_m + 2C_4C_5L_5R_5g_m + 2C_4C_5L_5) + s^2(2C_4C_5R_4R_5g_m + 2C_4C_5R_5 + 2C_4L_4g_m + 2C_5L_5g_m) + s(2C_4R_4g_m + 2C_4R_5g_m + 2C_4 + 2C_5R_5g_m)}$$

**10.57 INVALID-ORDER-57**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4R_4s}{C_4L_4R_4s^2+L_4s+R_4}, \frac{1}{C_5s}, \infty \right)$

$$H(s) = \frac{-C_5L_4R_4s^2 + L_4R_4g_ms}{2C_4C_5L_4R_4s^3 + 2R_4g_m + s^2(2C_4L_4R_4g_m + 2C_5L_4R_4g_m + 2C_5L_4) + s(2C_5R_4 + 2L_4g_m)}$$

**10.58 INVALID-ORDER-58**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4R_4s}{C_4L_4R_4s^2+L_4s+R_4}, \frac{R_5}{C_5R_5s+1}, \infty \right)$

$$H(s) = \frac{-C_5L_4R_4R_5s^2 + s(L_4R_4R_5g_m - L_4R_4)}{2C_4C_5L_4R_4R_5s^3 + 2R_4R_5g_m + 2R_4 + s^2(2C_4L_4R_4R_5g_m + 2C_4L_4R_4 + 2C_5L_4R_4R_5g_m + 2C_5L_4R_5) + s(2C_5R_4R_5 + 2L_4R_4g_m + 2L_4R_5g_m + 2L_4)}$$

**10.59 INVALID-ORDER-59**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4R_4s}{C_4L_4R_4s^2+L_4s+R_4}, R_5 + \frac{1}{C_5s}, \infty \right)$

$$H(s) = \frac{L_4R_4g_ms + s^2(C_5L_4R_4R_5g_m - C_5L_4R_4)}{2R_4g_m + s^3(2C_4C_5L_4R_4R_5g_m + 2C_4C_5L_4R_4) + s^2(2C_4L_4R_4g_m + 2C_5L_4R_4g_m + 2C_5L_4R_5g_m + 2C_5L_4) + s(2C_5R_4R_5g_m + 2C_5R_4 + 2L_4g_m)}$$

**10.60 INVALID-ORDER-60**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4R_4s}{C_4L_4R_4s^2+L_4s+R_4}, L_5s + \frac{1}{C_5s}, \infty \right)$

$$H(s) = \frac{C_5L_4L_5R_4g_ms^3 - C_5L_4R_4s^2 + L_4R_4g_ms}{2C_4C_5L_4L_5R_4g_ms^4 + 2R_4g_m + s^3(2C_4C_5L_4R_4 + 2C_5L_4L_5g_m) + s^2(2C_4L_4R_4g_m + 2C_5L_4R_4g_m + 2C_5L_4 + 2C_5L_5R_4g_m) + s(2C_5R_4 + 2L_4g_m)}$$

**10.61 INVALID-ORDER-61**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4R_4s}{C_4L_4R_4s^2+L_4s+R_4}, \frac{L_5s}{C_5L_5s^2+1}, \infty \right)$

$$H(s) = \frac{-C_5L_4L_5R_4s^3 + L_4L_5R_4g_ms^2 - L_4R_4s}{2C_4C_5L_4L_5R_4s^4 + 2R_4 + s^3(2C_4L_4L_5R_4g_m + 2C_5L_4L_5R_4g_m + 2C_5L_4L_5) + s^2(2C_4L_4R_4 + 2C_5L_5R_4 + 2L_4L_5g_m) + s(2L_4R_4g_m + 2L_4 + 2L_5R_4g_m)}$$

**10.62 INVALID-ORDER-62**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4R_4s}{C_4L_4R_4s^2+L_4s+R_4}, L_5s + R_5 + \frac{1}{C_5s}, \infty \right)$

$$H(s) = \frac{C_5L_4L_5R_4g_ms^3 + L_4R_4g_ms + s^2(C_5L_4R_4R_5g_m - C_5L_4R_4)}{2C_4C_5L_4L_5R_4g_ms^4 + 2R_4g_m + s^3(2C_4C_5L_4R_4R_5g_m + 2C_4C_5L_4R_4 + 2C_5L_4L_5g_m) + s^2(2C_4L_4R_4g_m + 2C_5L_4R_4g_m + 2C_5L_4R_5g_m + 2C_5L_4 + 2C_5L_5R_4g_m) + s(2C_5R_4R_5g_m + 2C_5R_4 + 2L_4g_m)}$$

**10.63 INVALID-ORDER-63**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4R_4s}{C_4L_4R_4s^2+L_4s+R_4}, \frac{L_5R_5s}{C_5L_5R_5s^2+L_5s+R_5}, \infty \right)$

$$H(s) = \frac{-C_5L_4L_5R_4R_5s^3 - L_4R_4R_5s + s^2(L_4L_5R_4R_5g_m - L_4L_5R_4)}{2C_4C_5L_4L_5R_4R_5s^4 + 2R_4R_5 + s^3(2C_4L_4L_5R_4R_5g_m + 2C_4L_4L_5R_4 + 2C_5L_4L_5R_4R_5g_m + 2C_5L_4L_5R_5) + s^2(2C_4L_4R_4R_5 + 2C_5L_5R_4R_5 + 2L_4L_5R_4g_m + 2L_4L_5R_5g_m + 2L_4L_5) + s(2L_4R_4R_5g_m + 2L_4R_5 + 2L_5R_4R_5g_m + 2L_5R_4)}$$

**10.64 INVALID-ORDER-64**  $Z(s) = \left( \infty, \infty, \infty, \frac{L_4R_4s}{C_4L_4R_4s^2+L_4s+R_4}, \frac{L_5s}{C_5L_5s^2+1} + R_5, \infty \right)$

$$H(s) = \frac{L_4L_5R_4g_ms^2 + s^3(C_5L_4L_5R_4R_5g_m - C_5L_4L_5R_4) + s(L_4R_4R_5g_m - L_4R_4)}{2R_4R_5g_m + 2R_4 + s^4(2C_4C_5L_4L_5R_4R_5g_m + 2C_4C_5L_4L_5R_4) + s^3(2C_4L_4L_5R_4g_m + 2C_5L_4L_5R_4g_m + 2C_5L_4L_5R_5g_m + 2C_5L_4L_5) + s^2(2C_4L_4R_4R_5g_m + 2C_4L_4R_4 + 2C_5L_5R_4R_5g_m + 2C_5L_5R_4 + 2L_4L_5g_m) + s(2L_4R_4g_m + 2L_4R_5g_m + 2L_4 + 2L_5R_4g_m)}$$

$$10.65 \quad \text{INVALID-ORDER-65} \quad Z(s) = \left( \infty, \infty, \infty, \frac{L_4 R_4 s}{C_4 L_4 R_4 s^2 + L_4 s + R_4}, \frac{R_5 (C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \infty \right)$$

$$H(s) = \frac{-C_5 L_4 R_4 R_5 s^2 + s^3 (C_5 L_4 L_5 R_4 R_5 g_m - C_5 L_4 L_5 R_4) + s (L_4 R_4 R_5 g_m - L_4 R_4)}{2 R_4 R_5 g_m + 2 R_4 + s^4 (2 C_4 C_5 L_4 L_5 R_4 R_5 g_m + 2 C_4 C_5 L_4 L_5 R_4) + s^3 (2 C_4 C_5 L_4 R_4 R_5 + 2 C_5 L_4 L_5 R_4 g_m + 2 C_5 L_4 L_5 R_5 g_m + 2 C_5 L_4 L_5) + s^2 (2 C_4 L_4 R_4 R_5 g_m + 2 C_4 L_4 R_4 + 2 C_5 L_4 R_4 R_5 g_m + 2 C_5 L_4 R_5 + 2 C_5 L_5 R_4 R_5 g_m + 2 C_5 L_5 R_4) + s (2 C_5 R_4 R_5 + 2 L_4 R_4 g_m + 2 L_4 R_5)}$$

$$10.66 \quad \text{INVALID-ORDER-66} \quad Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{-C_4 C_5 L_4 R_4 s^3 + R_4 g_m + s^2 (C_4 L_4 R_4 g_m - C_5 L_4) + s (-C_5 R_4 + L_4 g_m)}{2 g_m + s^3 (2 C_4 C_5 L_4 R_4 g_m + 2 C_4 C_5 L_4) + s^2 (2 C_4 L_4 g_m + 2 C_5 L_4 g_m) + s (2 C_5 R_4 g_m + 2 C_5)}$$

$$10.67 \quad \text{INVALID-ORDER-67} \quad Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \frac{R_5}{C_5 R_5 s + 1}, \infty \right)$$

$$H(s) = \frac{-C_4 C_5 L_4 R_4 R_5 s^3 + R_4 R_5 g_m - R_4 + s^2 (C_4 L_4 R_4 R_5 g_m - C_4 L_4 R_4 - C_5 L_4 R_5) + s (-C_5 R_4 R_5 + L_4 R_5 g_m - L_4)}{2 R_4 g_m + 2 R_5 g_m + s^3 (2 C_4 C_5 L_4 R_4 R_5 g_m + 2 C_4 C_5 L_4 R_5) + s^2 (2 C_4 L_4 R_4 g_m + 2 C_4 L_4 R_5 g_m + 2 C_4 L_4 + 2 C_5 L_4 R_5 g_m) + s (2 C_5 R_4 R_5 g_m + 2 C_5 R_5 + 2 L_4 g_m) + 2}$$

$$10.68 \quad \text{INVALID-ORDER-68} \quad Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, R_5 + \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{R_4 g_m + s^3 (C_4 C_5 L_4 R_4 R_5 g_m - C_4 C_5 L_4 R_4) + s^2 (C_4 L_4 R_4 g_m + C_5 L_4 R_5 g_m - C_5 L_4) + s (C_5 R_4 R_5 g_m - C_5 R_4 + L_4 g_m)}{2 g_m + s^3 (2 C_4 C_5 L_4 R_4 g_m + 2 C_4 C_5 L_4 R_5 g_m + 2 C_4 C_5 L_4) + s^2 (2 C_4 L_4 g_m + 2 C_5 L_4 g_m) + s (2 C_5 R_4 g_m + 2 C_5 R_5 g_m + 2 C_5)}$$

$$10.69 \quad \text{INVALID-ORDER-69} \quad Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, L_5 s + \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{C_4 C_5 L_4 L_5 R_4 g_m s^4 + R_4 g_m + s^3 (-C_4 C_5 L_4 R_4 + C_5 L_4 L_5 g_m) + s^2 (C_4 L_4 R_4 g_m - C_5 L_4 + C_5 L_5 R_4 g_m) + s (-C_5 R_4 + L_4 g_m)}{2 C_4 C_5 L_4 L_5 g_m s^4 + 2 g_m + s^3 (2 C_4 C_5 L_4 R_4 g_m + 2 C_4 C_5 L_4) + s^2 (2 C_4 L_4 g_m + 2 C_5 L_4 g_m + 2 C_5 L_5 g_m) + s (2 C_5 R_4 g_m + 2 C_5)}$$

$$10.70 \quad \text{INVALID-ORDER-70} \quad Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \infty \right)$$

$$H(s) = \frac{-C_4 C_5 L_4 L_5 R_4 s^4 - R_4 + s^3 (C_4 L_4 L_5 R_4 g_m - C_5 L_4 L_5) + s^2 (-C_4 L_4 R_4 - C_5 L_5 R_4 + L_4 L_5 g_m) + s (-L_4 + L_5 R_4 g_m)}{2 R_4 g_m + s^4 (2 C_4 C_5 L_4 L_5 R_4 g_m + 2 C_4 C_5 L_4 L_5) + s^3 (2 C_4 L_4 L_5 g_m + 2 C_5 L_4 L_5 g_m) + s^2 (2 C_4 L_4 R_4 g_m + 2 C_4 L_4 + 2 C_5 L_5 R_4 g_m + 2 C_5 L_5) + s (2 L_4 g_m + 2 L_5 g_m) + 2}$$

$$10.71 \quad \text{INVALID-ORDER-71} \quad Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, L_5 s + R_5 + \frac{1}{C_5 s}, \infty \right)$$

$$H(s) = \frac{C_4 C_5 L_4 L_5 R_4 g_m s^4 + R_4 g_m + s^3 (C_4 C_5 L_4 R_4 R_5 g_m - C_4 C_5 L_4 R_4 + C_5 L_4 L_5 g_m) + s^2 (C_4 L_4 R_4 g_m + C_5 L_4 R_5 g_m - C_5 L_4 + C_5 L_5 R_4 g_m) + s (C_5 R_4 R_5 g_m - C_5 R_4 + L_4 g_m)}{2 C_4 C_5 L_4 L_5 g_m s^4 + 2 g_m + s^3 (2 C_4 C_5 L_4 R_4 g_m + 2 C_4 C_5 L_4 R_5 g_m + 2 C_4 C_5 L_4) + s^2 (2 C_4 L_4 g_m + 2 C_5 L_4 g_m + 2 C_5 L_5 g_m) + s (2 C_5 R_4 g_m + 2 C_5 R_5 g_m + 2 C_5)}$$

$$10.72 \quad \text{INVALID-ORDER-72} \quad Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \infty \right)$$

$$H(s) = \frac{-C_4 C_5 L_4 L_5 R_4 R_5 s^4 - R_4 R_5 + s^3 (C_4 L_4 L_5 R_4 R_5 g_m - C_4 L_4 L_5 R_4 - C_5 L_4 L_5 R_5) + s^2 (-C_4 L_4 R_4 R_5 - C_5 L_5 R_4 R_5 + L_4 L_5 R_5 g_m - L_4 L_5) + s (-L_4 R_5 + L_5 R_4 R_5 g_m - L_5 R_4)}{2 R_4 R_5 g_m + 2 R_5 + s^4 (2 C_4 C_5 L_4 L_5 R_4 R_5 g_m + 2 C_4 C_5 L_4 L_5 R_5) + s^3 (2 C_4 L_4 L_5 R_4 g_m + 2 C_4 L_4 L_5 R_5 g_m + 2 C_4 L_4 L_5 + 2 C_5 L_4 L_5 R_5 g_m) + s^2 (2 C_4 L_4 R_4 R_5 g_m + 2 C_4 L_4 R_5 + 2 C_5 L_5 R_4 R_5 g_m + 2 C_5 L_5 R_5 + 2 L_4 L_5 g_m) + s (2 L_4 R_5 g_m + 2 L_5 R_4 g_m + 2 L_5 R_5 g_m + 2 L_5)}$$

$$10.73 \quad \text{INVALID-ORDER-73} \quad Z(s) = \left( \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \infty \right)$$

$$H(s) = \frac{R_4 R_5 g_m - R_4 + s^4 (C_4 C_5 L_4 L_5 R_4 R_5 g_m - C_4 C_5 L_4 L_5 R_4) + s^3 (C_4 L_4 L_5 R_4 g_m + C_5 L_4 L_5 R_5 g_m - C_5 L_4 L_5) + s^2 (C_4 L_4 R_4 R_5 g_m - C_4 L_4 R_4 + C_5 L_5 R_4 R_5 g_m - C_5 L_5 R_4 + L_4 L_5 g_m) + s (L_4 R_5 g_m - L_4 + L_5 R_4 g_m)}{2 R_4 g_m + 2 R_5 g_m + s^4 (2 C_4 C_5 L_4 L_5 R_4 g_m + 2 C_4 C_5 L_4 L_5 R_5 g_m + 2 C_4 C_5 L_4 L_5) + s^3 (2 C_4 L_4 L_5 g_m + 2 C_5 L_4 L_5 g_m) + s^2 (2 C_4 L_4 R_4 g_m + 2 C_4 L_4 R_5 g_m + 2 C_4 L_4 + 2 C_5 L_5 R_4 g_m + 2 C_5 L_5 R_5 g_m + 2 C_5 L_5) + s (2 L_4 g_m + 2 L_5 g_m) + 2}$$

$$10.74 \quad \text{INVALID-ORDER-74} \quad Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, \quad \frac{R_5 (C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \quad \infty \right)$$

$$H(s) = \frac{R_4 R_5 g_m - R_4 + s^4 (C_4 C_5 L_4 L_5 R_4 R_5 g_m - C_4 C_5 L_4 L_5 R_4) + s^3 (-C_4 C_5 L_4 R_4 R_5 + C_5 L_4 L_5 R_5 g_m - C_5 L_4 L_5) + s^2 (C_4 L_4 R_4 R_5 g_m - C_4 L_4 R_4 - C_5 L_4 R_5 + C_5 L_5 R_4 R_5 g_m - C_5 L_5 R_4) + s (-C_5 R_4 R_5 + L_4 R_5 g_m - L_4)}{2 R_4 g_m + 2 R_5 g_m + s^4 (2 C_4 C_5 L_4 L_5 R_4 g_m + 2 C_4 C_5 L_4 L_5 R_5 g_m + 2 C_4 C_5 L_4 L_5) + s^3 (2 C_4 C_5 L_4 R_4 R_5 g_m + 2 C_4 C_5 L_4 R_5 + 2 C_5 L_4 L_5 g_m) + s^2 (2 C_4 L_4 R_4 g_m + 2 C_4 L_4 R_5 g_m + 2 C_4 L_4 + 2 C_5 L_4 R_5 g_m + 2 C_5 L_5 R_4 g_m + 2 C_5 L_5 R_5 g_m + 2 C_5 L_5) + s (2 C_5 R_4 R_5 g_m + 2 C_5 R_5 + 2 L_4 R_5 g_m - L_4)}$$

$$10.75 \quad \text{INVALID-ORDER-75} \quad Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + C_4 R_4 s + 1}, \quad \frac{1}{C_5 s}, \quad \infty \right)$$

$$H(s) = \frac{-C_4 C_5 L_4 R_4 s^3 + C_4 L_4 R_4 g_m s^2 - C_5 R_4 s + R_4 g_m}{2 g_m + s^3 (2 C_4 C_5 L_4 R_4 g_m + 2 C_4 C_5 L_4) + s^2 (2 C_4 C_5 R_4 + 2 C_4 L_4 g_m) + s (2 C_4 R_4 g_m + 2 C_5 R_4 g_m + 2 C_5)}$$

$$10.76 \quad \text{INVALID-ORDER-76} \quad Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + C_4 R_4 s + 1}, \quad \frac{R_5}{C_5 R_5 s + 1}, \quad \infty \right)$$

$$H(s) = \frac{-C_4 C_5 L_4 R_4 R_5 s^3 - C_5 R_4 R_5 s + R_4 R_5 g_m - R_4 + s^2 (C_4 L_4 R_4 R_5 g_m - C_4 L_4 R_4)}{2 R_4 g_m + 2 R_5 g_m + s^3 (2 C_4 C_5 L_4 R_4 R_5 g_m + 2 C_4 C_5 L_4 R_5) + s^2 (2 C_4 C_5 R_4 R_5 + 2 C_4 L_4 R_4 g_m + 2 C_4 L_4 R_5 g_m + 2 C_4 L_4) + s (2 C_4 R_4 R_5 g_m + 2 C_4 R_4 + 2 C_5 R_4 R_5 g_m + 2 C_5 R_5) + 2}$$

$$10.77 \quad \text{INVALID-ORDER-77} \quad Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + C_4 R_4 s + 1}, \quad R_5 + \frac{1}{C_5 s}, \quad \infty \right)$$

$$H(s) = \frac{C_4 L_4 R_4 g_m s^2 + R_4 g_m + s^3 (C_4 C_5 L_4 R_4 R_5 g_m - C_4 C_5 L_4 R_4) + s (C_5 R_4 R_5 g_m - C_5 R_4)}{2 g_m + s^3 (2 C_4 C_5 L_4 R_4 g_m + 2 C_4 C_5 L_4 R_5 g_m + 2 C_4 C_5 L_4) + s^2 (2 C_4 C_5 R_4 R_5 g_m + 2 C_4 C_5 R_4 + 2 C_4 L_4 g_m) + s (2 C_4 R_4 g_m + 2 C_5 R_4 g_m + 2 C_5 R_5 g_m + 2 C_5)}$$

$$10.78 \quad \text{INVALID-ORDER-78} \quad Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + C_4 R_4 s + 1}, \quad L_5 s + \frac{1}{C_5 s}, \quad \infty \right)$$

$$H(s) = \frac{C_4 C_5 L_4 L_5 R_4 g_m s^4 - C_4 C_5 L_4 R_4 s^3 - C_5 R_4 s + R_4 g_m + s^2 (C_4 L_4 R_4 g_m + C_5 L_5 R_4 g_m)}{2 C_4 C_5 L_4 L_5 g_m s^4 + 2 g_m + s^3 (2 C_4 C_5 L_4 R_4 g_m + 2 C_4 C_5 L_4 + 2 C_4 C_5 L_5 R_4 g_m) + s^2 (2 C_4 C_5 R_4 + 2 C_4 L_4 g_m + 2 C_5 L_5 g_m) + s (2 C_4 R_4 g_m + 2 C_5 R_4 g_m + 2 C_5)}$$

$$10.79 \quad \text{INVALID-ORDER-79} \quad Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + C_4 R_4 s + 1}, \quad \frac{L_5 s}{C_5 L_5 s^2 + 1}, \quad \infty \right)$$

$$H(s) = \frac{-C_4 C_5 L_4 L_5 R_4 s^4 + C_4 L_4 L_5 R_4 g_m s^3 + L_5 R_4 g_m s - R_4 + s^2 (-C_4 L_4 R_4 - C_5 L_5 R_4)}{2 R_4 g_m + s^4 (2 C_4 C_5 L_4 L_5 R_4 g_m + 2 C_4 C_5 L_4 L_5) + s^3 (2 C_4 C_5 L_5 R_4 + 2 C_4 L_4 L_5 g_m) + s^2 (2 C_4 L_4 R_4 g_m + 2 C_4 L_4 + 2 C_4 L_5 R_4 g_m + 2 C_5 L_5 R_4 g_m + 2 C_5 L_5) + s (2 C_4 R_4 + 2 L_5 g_m) + 2}$$

$$10.80 \quad \text{INVALID-ORDER-80} \quad Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + C_4 R_4 s + 1}, \quad L_5 s + R_5 + \frac{1}{C_5 s}, \quad \infty \right)$$

$$H(s) = \frac{C_4 C_5 L_4 L_5 R_4 g_m s^4 + R_4 g_m + s^3 (C_4 C_5 L_4 R_4 R_5 g_m - C_4 C_5 L_4 R_4) + s^2 (C_4 L_4 R_4 g_m + C_5 L_5 R_4 g_m) + s (C_5 R_4 R_5 g_m - C_5 R_4)}{2 C_4 C_5 L_4 L_5 g_m s^4 + 2 g_m + s^3 (2 C_4 C_5 L_4 R_4 g_m + 2 C_4 C_5 L_4 R_5 g_m + 2 C_4 C_5 L_4 + 2 C_4 C_5 L_5 R_4 g_m) + s^2 (2 C_4 C_5 R_4 R_5 g_m + 2 C_4 C_5 R_4 + 2 C_4 L_4 g_m + 2 C_5 L_5 g_m) + s (2 C_4 R_4 g_m + 2 C_5 R_4 g_m + 2 C_5 R_5 g_m + 2 C_5)}$$

$$10.81 \quad \text{INVALID-ORDER-81} \quad Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + C_4 R_4 s + 1}, \quad \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \quad \infty \right)$$

$$H(s) = \frac{-C_4 C_5 L_4 L_5 R_4 R_5 s^4 - R_4 R_5 + s^3 (C_4 L_4 L_5 R_4 R_5 g_m - C_4 L_4 L_5 R_4) + s^2 (-C_4 L_4 R_4 R_5 - C_5 L_5 R_4 R_5) + s (L_5 R_4 R_5 g_m - L_5 R_4)}{2 R_4 R_5 g_m + 2 R_5 + s^4 (2 C_4 C_5 L_4 L_5 R_4 R_5 g_m + 2 C_4 C_5 L_4 L_5 R_5) + s^3 (2 C_4 C_5 L_5 R_4 R_5 + 2 C_4 L_4 L_5 R_4 g_m + 2 C_4 L_4 L_5 R_5 g_m + 2 C_4 L_4 L_5) + s^2 (2 C_4 L_4 R_4 R_5 g_m + 2 C_4 L_4 R_5 + 2 C_4 L_5 R_4 R_5 g_m + 2 C_4 L_5 R_4 + 2 C_5 L_5 R_4 R_5 g_m + 2 C_5 L_5 R_5) + s (2 C_4 R_4 R_5 + 2 L_5 R_4 g_m + 2 L_5 R_5)}$$

$$10.82 \quad \text{INVALID-ORDER-82} \quad Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{R_4 (C_4 L_4 s^2 + 1)}{C_4 L_4 s^2 + C_4 R_4 s + 1}, \quad \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \quad \infty \right)$$

$$H(s) = \frac{C_4 L_4 L_5 R_4 g_m s^3 + L_5 R_4 g_m s + R_4 R_5 g_m - R_4 + s^4 (C_4 C_5 L_4 L_5 R_4 R_5 g_m - C_4 C_5 L_4 L_5 R_4) + s^2 (C_4 L_4 R_4 R_5 g_m - C_4 L_4 R_4 + C_5 L_5 R_4 R_5 g_m - C_5 L_5 R_4)}{2 R_4 g_m + 2 R_5 g_m + s^4 (2 C_4 C_5 L_4 L_5 R_4 g_m + 2 C_4 C_5 L_4 L_5 R_5 g_m + 2 C_4 C_5 L_4 L_5) + s^3 (2 C_4 C_5 L_5 R_4 R_5 g_m + 2 C_4 C_5 L_5 R_4 + 2 C_4 L_4 L_5 g_m) + s^2 (2 C_4 L_4 R_4 g_m + 2 C_4 L_4 R_5 g_m + 2 C_4 L_4 + 2 C_4 L_5 R_4 g_m + 2 C_5 L_5 R_4 g_m + 2 C_5 L_5 R_5 g_m + 2 C_5 L_5) + s (2 C_4 R_4 R_5 g_m + 2 C_4 R_4 + 2 L_5 R_4 g_m - L_4)}$$

10.83    INVALID-ORDER-83

$$Z(s) = \left( \infty, \quad \infty, \quad \infty, \quad \frac{R_4(C_4L_4s^2+1)}{C_4L_4s^2+C_4R_4s+1}, \quad \frac{R_5(C_5L_5s^2+1)}{C_5L_5s^2+C_5R_5s+1}, \quad \infty \right)$$

$$H(s) = \frac{-C_4C_5L_4R_4R_5s^3 - C_5R_4R_5s + R_4R_5g_m - R_4 + s^4(C_4C_5L_4L_5R_4R_5g_m - C_4C_5L_4L_5R_4) + s^2(C_4L_4R_4R_5g_m - C_4L_4R_4 + C_5L_5R_4R_5g_m - C_5L_5R_4)}{2R_4g_m + 2R_5g_m + s^4(2C_4C_5L_4L_5R_4g_m + 2C_4C_5L_4L_5R_5g_m + 2C_4C_5L_4L_5) + s^3(2C_4C_5L_4R_4R_5g_m + 2C_4C_5L_4R_5 + 2C_4C_5L_5R_4R_5g_m + 2C_4C_5L_5R_4) + s^2(2C_4C_5R_4R_5 + 2C_4L_4R_4g_m + 2C_4L_4R_5g_m + 2C_4L_4 + 2C_5L_5R_4g_m + 2C_5L_5R_5g_m + 2C_5L_5) + s(2C_4R_4 + 2C_5R_5)}$$

11    PolynomialError