# Filter Summary Report: TIA,simple,Z1,Z3

Generated by MacAnalog-Symbolix

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## Contents

# 1 Examined $H(z)$ for TIA simple Z1 Z3: $\frac{Z_1 Z_3 g_m}{Z_1 g_m + 1}$

$$H(z) = \frac{Z_1 Z_3 g_m}{Z_1 g_m + 1}$$

# 2 HP

# 3 BP

## 3.1 BP-1 $Z(s) = \left(R_1,\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2 + L_3 s + R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_1 R_3 g_m s}{(R_1 g_m + 1)(C_3 L_3 R_3 s^2 + L_3 s + R_3)}$$

**Parameters:**

Q: $C_3 R_3 \sqrt{\frac{1}{C_3 L_3}}$
wo: $\sqrt{\frac{1}{C_3 L_3}}$
bandwidth: $\frac{1}{C_3 R_3}$
K-LP: 0
K-HP: 0
K-BP: $\frac{R_1 R_3 g_m}{R_1 g_m + 1}$
Qz: 0
Wz: None

## 3.2 BP-2 $Z(s) = \left(L_1 s,\ \infty,\ \frac{R_3}{C_3 R_3 s + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_3 g_m s}{(C_3 R_3 s + 1)(L_1 g_m s + 1)}$$

**Parameters:**

Q: $\frac{C_3 L_1 R_3 g_m \sqrt{\frac{1}{C_3 L_1 R_3 g_m}}}{C_3 R_3 + L_1 g_m}$
wo: $\sqrt{\frac{1}{C_3 L_1 R_3 g_m}}$
bandwidth: $\frac{C_3 R_3 + L_1 g_m}{C_3 L_1 R_3 g_m}$
K-LP: 0
K-HP: 0
K-BP: $\frac{L_1 R_3 g_m}{C_3 R_3 + L_1 g_m}$
Qz: 0
Wz: None

## 3.3 BP-3 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1},\ \infty,\ R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_3 g_m s}{C_1 L_1 s^2 + L_1 g_m s + 1}$$

**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: $R_3$
Qz: 0

Wz: None

### 3.4 BP-4 $Z(s) = \left(\frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1},\ \infty,\ R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_1 R_3 g_m s}{C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1}$$

**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: $\frac{R_1 R_3 g_m}{R_1 g_m + 1}$
Qz: 0
Wz: None

## 4 LP

### 4.1 LP-1 $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ \frac{R_3}{C_3 R_3 s + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m}{(C_1 s + g_m)(C_3 R_3 s + 1)}$$

**Parameters:**

Q: $\frac{C_1 C_3 R_3 \sqrt{\frac{g_m}{C_1 C_3 R_3}}}{C_1 + C_3 R_3 g_m}$
wo: $\sqrt{\frac{g_m}{C_1 C_3 R_3}}$
bandwidth: $\frac{C_1 + C_3 R_3 g_m}{C_1 C_3 R_3}$
K-LP: $R_3$
K-HP: 0
K-BP: 0
Qz: None
Wz: None

### 4.2 LP-2 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1},\ \infty,\ \frac{R_3}{C_3 R_3 s + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 R_3 g_m}{(C_3 R_3 s + 1)(C_1 R_1 s + R_1 g_m + 1)}$$

**Parameters:**

Q: $\frac{C_1 C_3 R_1 R_3 \sqrt{\frac{R_1 g_m + 1}{C_1 C_3 R_1 R_3}}}{C_1 R_1 + C_3 R_1 R_3 g_m + C_3 R_3}$
wo: $\sqrt{\frac{R_1 g_m + 1}{C_1 C_3 R_1 R_3}}$
bandwidth: $\frac{C_1 R_1 + C_3 R_1 R_3 g_m + C_3 R_3}{C_1 C_3 R_1 R_3}$
K-LP: $\frac{R_1 R_3 g_m}{R_1 g_m + 1}$
K-HP: 0
K-BP: 0
Qz: None
Wz: None

### 4.3 LP-3 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1},\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m}{C_3\left(C_1 L_1 s^2 + L_1 g_m s + 1\right)}$$

**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: $\frac{L_1 g_m}{C_3}$
K-HP: 0
K-BP: 0
Qz: None
Wz: None

### 4.4 LP-4 $Z(s) = \left(\frac{L_1 R_1 s}{C_1 L_1 R_1 s^2+L_1 s+R_1},\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_1 g_m}{C_3\left(C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1\right)}$$

**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: $\frac{L_1 g_m}{C_3}$
K-HP: 0
K-BP: 0
Qz: None
Wz: None

## 5 BS

### 5.1 BS-1 $Z(s) = \left(R_1,\ \infty,\ \frac{R_3\left(C_3 L_3 s^2+1\right)}{C_3 L_3 s^2+C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 R_3 g_m\left(C_3 L_3 s^2 + 1\right)}{\left(R_1 g_m + 1\right)\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}$$

**Parameters:**

Q: $\frac{L_3\sqrt{\frac{1}{C_3 L_3}}}{R_3}$
wo: $\sqrt{\frac{1}{C_3 L_3}}$
bandwidth: $\frac{R_3}{L_3}$
K-LP: $\frac{R_1 R_3 g_m}{R_1 g_m+1}$
K-HP: $\frac{R_1 R_3 g_m}{R_1 g_m+1}$
K-BP: 0
Qz: None
Wz: $\sqrt{\frac{1}{C_3 L_3}}$

### 5.2 BS-2 $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_1 L_1 s^2 + 1\right)}{C_1 L_1 g_m s^2 + C_1 s + g_m}$$

**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: $R_3$
K-HP: $R_3$
K-BP: 0
Qz: None
Wz: $\sqrt{\frac{1}{C_1 L_1}}$

### 5.3 BS-3 $Z(s) = \left(\frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 R_3 g_m \left(C_1 L_1 s^2 + 1\right)}{C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1}$$

**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: $\frac{R_1 R_3 g_m}{R_1 g_m+1}$
K-HP: $\frac{R_1 R_3 g_m}{R_1 g_m+1}$
K-BP: 0
Qz: None
Wz: $\sqrt{\frac{1}{C_1 L_1}}$

## 6 GE

### 6.1 GE-1 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m}$$

**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: $R_3$
K-HP: $R_3$
K-BP: $\frac{R_1 R_3 g_m}{R_1 g_m+1}$
Qz: $\frac{L_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1}$
Wz: $\sqrt{\frac{1}{C_1 L_1}}$

### 6.2 GE-2 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1} + R_1,\ \infty,\ R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_1 L_1 R_1 s^2 + L_1 s + R_1\right)}{C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1}$$

**Parameters:**

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: $\frac{R_1 R_3 g_m}{R_1 g_m+1}$
K-HP: $\frac{R_1 R_3 g_m}{R_1 g_m+1}$
K-BP: $R_3$
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 $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{R_3}{C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_1 R_1 s + 1\right)}{\left(C_3 R_3 s + 1\right)\left(C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**Parameters:**

Q: $\frac{C_1 C_3 R_3 \sqrt{\frac{g_m}{C_1 C_3 R_3 (R_1 g_m+1)}} (R_1 g_m+1)}{C_1 R_1 g_m+C_1+C_3 R_3 g_m}$
wo: $\sqrt{\frac{g_m}{C_1 C_3 R_3 (R_1 g_m+1)}}$
bandwidth: $\frac{C_1 R_1 g_m+C_1+C_3 R_3 g_m}{C_1 C_3 R_3 (R_1 g_m+1)}$
K-LP: $R_3$
K-HP: 0
K-BP: $\frac{C_1 R_1 R_3 g_m}{C_1 R_1 g_m+C_1+C_3 R_3 g_m}$
Qz: 0
Wz: None

### 8.2 INVALID-NUMER-2 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1},\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m \left(C_3 R_3 s + 1\right)}{C_3 \left(C_1 L_1 s^2 + L_1 g_m s + 1\right)}$$

**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: $\frac{L_1 g_m}{C_3}$
K-HP: 0
K-BP: $R_3$
Qz: 0
Wz: None

### 8.3 INVALID-NUMER-3 $Z(s) = \left(\frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1},\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_1 g_m \left(C_3 R_3 s + 1\right)}{C_3 \left(C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1\right)}$$

**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: $\frac{L_1 g_m}{C_3}$
K-HP: 0
K-BP: $\frac{R_1 R_3 g_m}{R_1 g_m + 1}$
Qz: 0
Wz: None

# 9 INVALID-WZ

### 9.1 INVALID-WZ-1 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1},\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m \left(C_3 L_3 s^2 + 1\right)}{C_3 \left(C_1 L_1 s^2 + L_1 g_m s + 1\right)}$$

**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: $\frac{L_1 g_m}{C_3}$
K-HP: $\frac{L_3 g_m}{C_1}$
K-BP: 0
Qz: None
Wz: $\sqrt{\frac{1}{C_3 L_3}}$

### 9.2 INVALID-WZ-2 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1},\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m \left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 \left(C_1 L_1 s^2 + L_1 g_m s + 1\right)}$$

**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: $\frac{L_1 g_m}{C_3}$
K-HP: $\frac{L_3 g_m}{C_1}$
K-BP: $R_3$
Qz: $\frac{L_3 \sqrt{\frac{1}{C_1 L_1}}}{R_3}$
Wz: $\sqrt{\frac{1}{C_3 L_3}}$

### 9.3 INVALID-WZ-3 $Z(s) = \left(\frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1},\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_1 g_m \left(C_3 L_3 s^2 + 1\right)}{C_3 \left(C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1\right)}$$

**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: $\frac{L_1 g_m}{C_3}$
K-HP: $\frac{L_3 g_m}{C_1}$
K-BP: 0
Qz: None
Wz: $\sqrt{\frac{1}{C_3 L_3}}$

### 9.4 INVALID-WZ-4 $Z(s) = \left(\frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1},\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_1 g_m \left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 \left(C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1\right)}$$

**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: $\frac{L_1 g_m}{C_3}$
K-HP: $\frac{L_3 g_m}{C_1}$
K-BP: $\frac{R_1 R_3 g_m}{R_1 g_m + 1}$
Qz: $\frac{L_3 \sqrt{\frac{1}{C_1 L_1}}}{R_3}$
Wz: $\sqrt{\frac{1}{C_3 L_3}}$

## 10 INVALID-ORDER

### 10.1 INVALID-ORDER-1 $Z(s) = (R_1,\ \infty,\ R_3,\ \infty,\ \infty,\ \infty)$

$$H(s) = \frac{R_1 R_3 g_m}{R_1 g_m + 1}$$

### 10.2 INVALID-ORDER-2 $Z(s) = \left(R_1,\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m}{C_3 s \left(R_1 g_m + 1\right)}$$

### 10.3 INVALID-ORDER-3 $Z(s) = \left(R_1,\ \infty,\ \frac{R_3}{C_3 R_3 s + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 R_3 g_m}{\left(R_1 g_m + 1\right)\left(C_3 R_3 s + 1\right)}$$

**10.4 INVALID-ORDER-4** $Z(s) = \left(R_1,\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m \left(C_3 R_3 s + 1\right)}{C_3 s \left(R_1 g_m + 1\right)}$$

**10.5 INVALID-ORDER-5** $Z(s) = \left(R_1,\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m \left(C_3 L_3 s^2 + 1\right)}{C_3 s \left(R_1 g_m + 1\right)}$$

**10.6 INVALID-ORDER-6** $Z(s) = \left(R_1,\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_1 g_m s}{\left(R_1 g_m + 1\right)\left(C_3 L_3 s^2 + 1\right)}$$

**10.7 INVALID-ORDER-7** $Z(s) = \left(R_1,\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m \left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 s \left(R_1 g_m + 1\right)}$$

**10.8 INVALID-ORDER-8** $Z(s) = \left(R_1,\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m \left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}{\left(R_1 g_m + 1\right)\left(C_3 L_3 s^2 + 1\right)}$$

**10.9 INVALID-ORDER-9** $Z(s) = (L_1 s,\ \infty,\ R_3,\ \infty,\ \infty,\ \infty)$

$$H(s) = \frac{L_1 R_3 g_m s}{L_1 g_m s + 1}$$

**10.10 INVALID-ORDER-10** $Z(s) = \left(L_1 s,\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m}{C_3 \left(L_1 g_m s + 1\right)}$$

**10.11 INVALID-ORDER-11** $Z(s) = \left(L_1 s,\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m \left(C_3 R_3 s + 1\right)}{C_3 \left(L_1 g_m s + 1\right)}$$

**10.12 INVALID-ORDER-12** $Z(s) = \left(L_1 s,\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m \left(C_3 L_3 s^2 + 1\right)}{C_3 \left(L_1 g_m s + 1\right)}$$

**10.13 INVALID-ORDER-13** $Z(s) = \left(L_1 s,\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 L_3 g_m s^2}{\left(C_3 L_3 s^2 + 1\right)\left(L_1 g_m s + 1\right)}$$

**10.14 INVALID-ORDER-14** $Z(s) = \left(L_1 s,\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m \left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 \left(L_1 g_m s + 1\right)}$$

**10.15 INVALID-ORDER-15** $Z(s) = \left(L_1 s,\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2 + L_3 s + R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 L_3 R_3 g_m s^2}{\left(L_1 g_m s + 1\right)\left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}$$

**10.16 INVALID-ORDER-16** $Z(s) = \left(L_1 s,\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m s \left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}{\left(C_3 L_3 s^2 + 1\right)\left(L_1 g_m s + 1\right)}$$

**10.17 INVALID-ORDER-17** $Z(s) = \left(L_1 s,\ \infty,\ \frac{R_3\left(C_3 L_3 s^2 + 1\right)}{C_3 L_3 s^2 + C_3 R_3 s + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_3 g_m s \left(C_3 L_3 s^2 + 1\right)}{\left(L_1 g_m s + 1\right)\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}$$

**10.18 INVALID-ORDER-18** $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m}{C_1 s + g_m}$$

**10.19 INVALID-ORDER-19** $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m}{C_3 s \left(C_1 s + g_m\right)}$$

**10.20 INVALID-ORDER-20** $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_3 R_3 s + 1\right)}{C_3 s \left(C_1 s + g_m\right)}$$

**10.21 INVALID-ORDER-21** $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_3 L_3 s^2 + 1\right)}{C_3 s \left(C_1 s + g_m\right)}$$

**10.22 INVALID-ORDER-22** $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 g_m s}{\left(C_1 s + g_m\right)\left(C_3 L_3 s^2 + 1\right)}$$

**10.23 INVALID-ORDER-23** $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 s \left(C_1 s + g_m\right)}$$

**10.24 INVALID-ORDER-24** $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2 + L_3 s + R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_3 g_m s}{(C_1 s + g_m)\left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}$$

**10.25 INVALID-ORDER-25** $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m\left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}{(C_1 s + g_m)\left(C_3 L_3 s^2 + 1\right)}$$

**10.26 INVALID-ORDER-26** $Z(s) = \left(\frac{1}{C_1 s},\ \infty,\ \frac{R_3\left(C_3 L_3 s^2 + 1\right)}{C_3 L_3 s^2 + C_3 R_3 s + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m\left(C_3 L_3 s^2 + 1\right)}{(C_1 s + g_m)\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}$$

**10.27 INVALID-ORDER-27** $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1},\ \infty,\ R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 R_3 g_m}{C_1 R_1 s + R_1 g_m + 1}$$

**10.28 INVALID-ORDER-28** $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1},\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m}{C_3 s\left(C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.29 INVALID-ORDER-29** $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1},\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m\left(C_3 R_3 s + 1\right)}{C_3 s\left(C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.30 INVALID-ORDER-30** $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1},\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m\left(C_3 L_3 s^2 + 1\right)}{C_3 s\left(C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.31 INVALID-ORDER-31** $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_1 g_m s}{\left(C_3 L_3 s^2 + 1\right)\left(C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.32 INVALID-ORDER-32** $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1},\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 s\left(C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.33 INVALID-ORDER-33** $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1},\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2 + L_3 s + R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_1 R_3 g_m s}{\left(C_1 R_1 s + R_1 g_m + 1\right)\left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}$$

**10.34 INVALID-ORDER-34** $Z(s) = \left(\frac{R_1}{C_1 R_1 s+1},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m \left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}{\left(C_3 L_3 s^2 + 1\right)\left(C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.35 INVALID-ORDER-35** $Z(s) = \left(\frac{R_1}{C_1 R_1 s+1},\ \infty,\ \frac{R_3\left(C_3 L_3 s^2+1\right)}{C_3 L_3 s^2+C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 R_3 g_m \left(C_3 L_3 s^2 + 1\right)}{\left(C_1 R_1 s + R_1 g_m + 1\right)\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}$$

**10.36 INVALID-ORDER-36** $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_1 R_1 s + 1\right)}{C_1 R_1 g_m s + C_1 s + g_m}$$

**10.37 INVALID-ORDER-37** $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 R_1 s + 1\right)}{C_3 s \left(C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.38 INVALID-ORDER-38** $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 R_1 s + 1\right)\left(C_3 R_3 s + 1\right)}{C_3 s \left(C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.39 INVALID-ORDER-39** $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 R_1 s + 1\right)\left(C_3 L_3 s^2 + 1\right)}{C_3 s \left(C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.40 INVALID-ORDER-40** $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 g_m s \left(C_1 R_1 s + 1\right)}{\left(C_3 L_3 s^2 + 1\right)\left(C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.41 INVALID-ORDER-41** $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 R_1 s + 1\right)\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 s \left(C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.42 INVALID-ORDER-42** $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2+L_3 s+R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_3 g_m s \left(C_1 R_1 s + 1\right)}{\left(C_1 R_1 g_m s + C_1 s + g_m\right)\left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}$$

**10.43 INVALID-ORDER-43** $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 R_1 s + 1\right) \left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}{\left(C_3 L_3 s^2 + 1\right) \left(C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.44 INVALID-ORDER-44** $Z(s) = \left(R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{R_3\left(C_3 L_3 s^2+1\right)}{C_3 L_3 s^2+C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_1 R_1 s + 1\right) \left(C_3 L_3 s^2 + 1\right)}{\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right) \left(C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.45 INVALID-ORDER-45** $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 L_1 s^2 + 1\right)}{C_3 s \left(C_1 L_1 g_m s^2 + C_1 s + g_m\right)}$$

**10.46 INVALID-ORDER-46** $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ \frac{R_3}{C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_1 L_1 s^2 + 1\right)}{\left(C_3 R_3 s + 1\right) \left(C_1 L_1 g_m s^2 + C_1 s + g_m\right)}$$

**10.47 INVALID-ORDER-47** $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 L_1 s^2 + 1\right) \left(C_3 R_3 s + 1\right)}{C_3 s \left(C_1 L_1 g_m s^2 + C_1 s + g_m\right)}$$

**10.48 INVALID-ORDER-48** $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 L_1 s^2 + 1\right) \left(C_3 L_3 s^2 + 1\right)}{C_3 s \left(C_1 L_1 g_m s^2 + C_1 s + g_m\right)}$$

**10.49 INVALID-ORDER-49** $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 g_m s \left(C_1 L_1 s^2 + 1\right)}{\left(C_3 L_3 s^2 + 1\right) \left(C_1 L_1 g_m s^2 + C_1 s + g_m\right)}$$

**10.50 INVALID-ORDER-50** $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 L_1 s^2 + 1\right) \left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 s \left(C_1 L_1 g_m s^2 + C_1 s + g_m\right)}$$

**10.51 INVALID-ORDER-51** $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2+L_3 s+R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_3 g_m s \left(C_1 L_1 s^2 + 1\right)}{\left(C_1 L_1 g_m s^2 + C_1 s + g_m\right) \left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}$$

**10.52 INVALID-ORDER-52** $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 L_1 s^2 + 1\right) \left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}{\left(C_3 L_3 s^2 + 1\right) \left(C_1 L_1 g_m s^2 + C_1 s + g_m\right)}$$

**10.53 INVALID-ORDER-53** $Z(s) = \left(L_1 s + \frac{1}{C_1 s},\ \infty,\ \frac{R_3\left(C_3 L_3 s^2+1\right)}{C_3 L_3 s^2+C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_1 L_1 s^2 + 1\right) \left(C_3 L_3 s^2 + 1\right)}{\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right) \left(C_1 L_1 g_m s^2 + C_1 s + g_m\right)}$$

**10.54 INVALID-ORDER-54** $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1},\ \infty,\ \frac{R_3}{C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_3 g_m s}{\left(C_3 R_3 s + 1\right) \left(C_1 L_1 s^2 + L_1 g_m s + 1\right)}$$

**10.55 INVALID-ORDER-55** $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 L_3 g_m s^2}{\left(C_3 L_3 s^2 + 1\right) \left(C_1 L_1 s^2 + L_1 g_m s + 1\right)}$$

**10.56 INVALID-ORDER-56** $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1},\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2+L_3 s+R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 L_3 R_3 g_m s^2}{\left(C_1 L_1 s^2 + L_1 g_m s + 1\right) \left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}$$

**10.57 INVALID-ORDER-57** $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 g_m s \left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}{\left(C_3 L_3 s^2 + 1\right) \left(C_1 L_1 s^2 + L_1 g_m s + 1\right)}$$

**10.58 INVALID-ORDER-58** $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1},\ \infty,\ \frac{R_3\left(C_3 L_3 s^2+1\right)}{C_3 L_3 s^2+C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_3 g_m s \left(C_3 L_3 s^2 + 1\right)}{\left(C_1 L_1 s^2 + L_1 g_m s + 1\right) \left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}$$

**10.59 INVALID-ORDER-59** $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{C_3 s \left(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.60 INVALID-ORDER-60** $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{R_3}{C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{\left(C_3 R_3 s + 1\right) \left(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.61 INVALID-ORDER-61** $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_3 R_3 s + 1\right) \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{C_3 s \left(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.62 INVALID-ORDER-62** $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_3 L_3 s^2 + 1\right) \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{C_3 s \left(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.63 INVALID-ORDER-63** $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 g_m s \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{\left(C_3 L_3 s^2 + 1\right) \left(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.64 INVALID-ORDER-64** $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right) \left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 s \left(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.65 INVALID-ORDER-65** $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2 + L_3 s + R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_3 g_m s \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{\left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right) \left(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.66 INVALID-ORDER-66** $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right) \left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}{\left(C_3 L_3 s^2 + 1\right) \left(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.67 INVALID-ORDER-67** $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s},\ \infty,\ \frac{R_3 \left(C_3 L_3 s^2 + 1\right)}{C_3 L_3 s^2 + C_3 R_3 s + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_3 L_3 s^2 + 1\right) \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right) \left(C_1 L_1 g_m s^2 + C_1 R_1 g_m s + C_1 s + g_m\right)}$$

**10.68 INVALID-ORDER-68** $Z(s) = \left(\frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1},\ \infty,\ \frac{R_3}{C_3 R_3 s + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 R_1 R_3 g_m s}{\left(C_3 R_3 s + 1\right) \left(C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1\right)}$$

**10.69 INVALID-ORDER-69** $Z(s) = \left(\frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2 + 1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1 L_3 R_1 g_m s^2}{\left(C_3 L_3 s^2 + 1\right) \left(C_1 L_1 R_1 s^2 + L_1 R_1 g_m s + L_1 s + R_1\right)}$$

**10.70 INVALID-ORDER-70** $Z(s) = \left(\frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1},\ \infty,\ \frac{L_3R_3s}{C_3L_3R_3s^2+L_3s+R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1L_3R_1R_3g_ms^2}{(C_3L_3R_3s^2 + L_3s + R_3)(C_1L_1R_1s^2 + L_1R_1g_ms + L_1s + R_1)}$$

**10.71 INVALID-ORDER-71** $Z(s) = \left(\frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1},\ \infty,\ \frac{L_3s}{C_3L_3s^2+1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1R_1g_ms\left(C_3L_3R_3s^2 + L_3s + R_3\right)}{(C_3L_3s^2 + 1)(C_1L_1R_1s^2 + L_1R_1g_ms + L_1s + R_1)}$$

**10.72 INVALID-ORDER-72** $Z(s) = \left(\frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1},\ \infty,\ \frac{R_3\left(C_3L_3s^2+1\right)}{C_3L_3s^2+C_3R_3s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_1R_1R_3g_ms\left(C_3L_3s^2 + 1\right)}{(C_3L_3s^2 + C_3R_3s + 1)(C_1L_1R_1s^2 + L_1R_1g_ms + L_1s + R_1)}$$

**10.73 INVALID-ORDER-73** $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1} + R_1,\ \infty,\ \frac{1}{C_3s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m\left(C_1L_1R_1s^2 + L_1s + R_1\right)}{C_3s(C_1L_1R_1g_ms^2 + C_1L_1s^2 + L_1g_ms + R_1g_m + 1)}$$

**10.74 INVALID-ORDER-74** $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1} + R_1,\ \infty,\ \frac{R_3}{C_3R_3s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3g_m\left(C_1L_1R_1s^2 + L_1s + R_1\right)}{(C_3R_3s + 1)(C_1L_1R_1g_ms^2 + C_1L_1s^2 + L_1g_ms + R_1g_m + 1)}$$

**10.75 INVALID-ORDER-75** $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1} + R_1,\ \infty,\ R_3 + \frac{1}{C_3s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m(C_3R_3s + 1)\left(C_1L_1R_1s^2 + L_1s + R_1\right)}{C_3s(C_1L_1R_1g_ms^2 + C_1L_1s^2 + L_1g_ms + R_1g_m + 1)}$$

**10.76 INVALID-ORDER-76** $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1} + R_1,\ \infty,\ L_3s + \frac{1}{C_3s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m\left(C_3L_3s^2 + 1\right)\left(C_1L_1R_1s^2 + L_1s + R_1\right)}{C_3s(C_1L_1R_1g_ms^2 + C_1L_1s^2 + L_1g_ms + R_1g_m + 1)}$$

**10.77 INVALID-ORDER-77** $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1} + R_1,\ \infty,\ \frac{L_3s}{C_3L_3s^2+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3g_ms\left(C_1L_1R_1s^2 + L_1s + R_1\right)}{(C_3L_3s^2 + 1)(C_1L_1R_1g_ms^2 + C_1L_1s^2 + L_1g_ms + R_1g_m + 1)}$$

**10.78 INVALID-ORDER-78** $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1} + R_1,\ \infty,\ L_3s + R_3 + \frac{1}{C_3s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m\left(C_3L_3s^2 + C_3R_3s + 1\right)\left(C_1L_1R_1s^2 + L_1s + R_1\right)}{C_3s(C_1L_1R_1g_ms^2 + C_1L_1s^2 + L_1g_ms + R_1g_m + 1)}$$

**10.79 INVALID-ORDER-79** $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1} + R_1,\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2+L_3 s+R_3},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_3 g_m s \left(C_1 L_1 R_1 s^2 + L_1 s + R_1\right)}{\left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)\left(C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1\right)}$$

**10.80 INVALID-ORDER-80** $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1} + R_1,\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1} + R_3,\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{g_m \left(C_1 L_1 R_1 s^2 + L_1 s + R_1\right)\left(C_3 L_3 R_3 s^2 + L_3 s + R_3\right)}{\left(C_3 L_3 s^2 + 1\right)\left(C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1\right)}$$

**10.81 INVALID-ORDER-81** $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2+1} + R_1,\ \infty,\ \frac{R_3\left(C_3 L_3 s^2+1\right)}{C_3 L_3 s^2+C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_3 g_m \left(C_3 L_3 s^2 + 1\right)\left(C_1 L_1 R_1 s^2 + L_1 s + R_1\right)}{\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)\left(C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + L_1 g_m s + R_1 g_m + 1\right)}$$

**10.82 INVALID-ORDER-82** $Z(s) = \left(\frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m \left(C_1 L_1 s^2 + 1\right)}{C_3 s \left(C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.83 INVALID-ORDER-83** $Z(s) = \left(\frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ \frac{R_3}{C_3 R_3 s+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 R_3 g_m \left(C_1 L_1 s^2 + 1\right)}{\left(C_3 R_3 s + 1\right)\left(C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.84 INVALID-ORDER-84** $Z(s) = \left(\frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m \left(C_1 L_1 s^2 + 1\right)\left(C_3 R_3 s + 1\right)}{C_3 s \left(C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.85 INVALID-ORDER-85** $Z(s) = \left(\frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ L_3 s + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m \left(C_1 L_1 s^2 + 1\right)\left(C_3 L_3 s^2 + 1\right)}{C_3 s \left(C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.86 INVALID-ORDER-86** $Z(s) = \left(\frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{L_3 R_1 g_m s \left(C_1 L_1 s^2 + 1\right)}{\left(C_3 L_3 s^2 + 1\right)\left(C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1\right)}$$

**10.87 INVALID-ORDER-87** $Z(s) = \left(\frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ L_3 s + R_3 + \frac{1}{C_3 s},\ \infty,\ \infty,\ \infty\right)$

$$H(s) = \frac{R_1 g_m \left(C_1 L_1 s^2 + 1\right)\left(C_3 L_3 s^2 + C_3 R_3 s + 1\right)}{C_3 s \left(C_1 L_1 R_1 g_m s^2 + C_1 L_1 s^2 + C_1 R_1 s + R_1 g_m + 1\right)}$$

### 10.88 INVALID-ORDER-88

$$Z(s) = \left( \frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ \frac{L_3 R_3 s}{C_3 L_3 R_3 s^2+L_3 s+R_3},\ \infty,\ \infty,\ \infty \right)$$

$$H(s) = \frac{L_3 R_1 R_3 g_m s \left(C_1 L_1 s^2+1\right)}{\left(C_3 L_3 R_3 s^2+L_3 s+R_3\right)\left(C_1 L_1 R_1 g_m s^2+C_1 L_1 s^2+C_1 R_1 s+R_1 g_m+1\right)}$$

### 10.89 INVALID-ORDER-89

$$Z(s) = \left( \frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ \frac{L_3 s}{C_3 L_3 s^2+1}+R_3,\ \infty,\ \infty,\ \infty \right)$$

$$H(s) = \frac{R_1 g_m \left(C_1 L_1 s^2+1\right)\left(C_3 L_3 R_3 s^2+L_3 s+R_3\right)}{\left(C_3 L_3 s^2+1\right)\left(C_1 L_1 R_1 g_m s^2+C_1 L_1 s^2+C_1 R_1 s+R_1 g_m+1\right)}$$

### 10.90 INVALID-ORDER-90

$$Z(s) = \left( \frac{R_1\left(C_1 L_1 s^2+1\right)}{C_1 L_1 s^2+C_1 R_1 s+1},\ \infty,\ \frac{R_3\left(C_3 L_3 s^2+1\right)}{C_3 L_3 s^2+C_3 R_3 s+1},\ \infty,\ \infty,\ \infty \right)$$

$$H(s) = \frac{R_1 R_3 g_m \left(C_1 L_1 s^2+1\right)\left(C_3 L_3 s^2+1\right)}{\left(C_3 L_3 s^2+C_3 R_3 s+1\right)\left(C_1 L_1 R_1 g_m s^2+C_1 L_1 s^2+C_1 R_1 s+R_1 g_m+1\right)}$$

## 11 PolynomialError