# Filter Summary Report: TIA,some,parasitic,Z5,ZL

# Generated by MacAnalog-Symbolix

# December 5, 2024

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10.67INVALID-ORDER-67 $Z(s) = ($	$\Big(\infty, \ \infty, \ \infty, \ \infty, \ \infty,$	$\frac{L_5s}{C_5L_5s^2+1}+R_5,$	$\frac{R_L}{C_L R_L s + 1}$		 	 	 	 	 	19
10.68INVALID-ORDER-68 $Z(s) = ($	$\left(\infty, \ \infty, \ \infty, \ \infty, \ \infty, \right.$	$\frac{L_5s}{C_5L_5s^2+1} + R_5,$	$R_L + \frac{1}{C_L s}$ .		 	 	 	 	 	19
10.69INVALID-ORDER-69 $Z(s) = ($	$(\infty, \infty, \infty, \infty, \infty,$	$\frac{L_5s}{C_5L_5s^2+1} + R_5,$	$L_L s + \frac{1}{C_L s}$		 	 	 	 	 	19
10.70INVALID-ORDER-70 $Z(s) = ($	$(\infty, \infty, \infty, \infty, \infty,$	$\frac{L_5s}{C_5L_5s^2+1} + R_5,$	$\frac{L_L s}{C_L L_L s^2 + 1}$ .		 	 	 	 	 	19
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10.73INVALID-ORDER-73 $Z(s) = ($										
10.74INVALID-ORDER-74 $Z(s) = 0$	\		~ L ~	/						
10.75INVALID-ORDER-75 $Z(s) = \langle$										
10.76INVALID-ORDER-76 $Z(s) = 0$	$\left(\infty,\;\infty,\;\infty,\;\infty,\;\infty,\;\infty,\;\infty\right)$	$, \frac{R_5\left(L_5s + \frac{1}{C_5s}\right)}{L_5s + R_5 + \frac{1}{C_5s}},$	$\frac{R_L}{C_L R_L s + 1}$		 	 	 	 	 	20
10.77INVALID-ORDER-77 $Z(s) = 0$	$\left(\infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ $	$, \frac{R_5\left(L_5s + \frac{1}{C_5s}\right)}{L_5s + R_5 + \frac{1}{C_5s}},$	$R_L + \frac{1}{C_L s}$ .		 	 	 	 	 	20
10.78INVALID-ORDER-78 $Z(s) = \left(\frac{1}{2}\right)^{-1}$										
10.79INVALID-ORDER-79 $Z(s) = 0$	$\left(\infty,\;\infty,\;\infty,\;\infty,\;\infty,\;\infty\right)$	$, \frac{R_5 \left(L_5 s + \frac{1}{C_5 s}\right)}{L_5 s + R_5 + \frac{1}{C_5 s}},$	$\frac{L_L s}{C_L L_L s^2 + 1}$		 	 	 	 	 	20
10.80INVALID-ORDER-80 $Z(s) = ($	$\left(\infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ $	$, \frac{R_5\left(L_5s + \frac{1}{C_5s}\right)}{L_5s + R_5 + \frac{1}{C_5s}}, $	$L_L s + R_L + \frac{1}{C_L}$	$\left(\frac{1}{\sqrt{s}}\right)$	 	 	 	 	 	21
10.81INVALID-ORDER-81 $Z(s) = 0$	$\left(\infty,\;\infty,\;\infty,\;\infty,\;\infty,\;\infty\right)$	$, \frac{R_5 \left(L_5 s + \frac{1}{C_5 s}\right)}{L_5 s + R_5 + \frac{1}{C_5 s}},$	$\frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$		 	 	 	 	 	21
10.82INVALID-ORDER-82 $Z(s) = ($	$\Big(\infty,\;\infty,\;\infty,\;\infty,$	$, \frac{R_5\left(L_5s + \frac{1}{C_5s}\right)}{L_5s + R_5 + \frac{1}{C_5s}},$	$\frac{L_L s}{C_L L_L s^2 + 1} + R_L$	<u> </u>	 	 	 	 	 	21
10.83INVALID-ORDER-83 $Z(s) = 0$	$\left(\infty, \ \infty, \$	$, \frac{R_5\left(L_5s + \frac{1}{C_5s}\right)}{L_5s + R_5 + \frac{1}{C_5s}},$	$\frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$		 	 	 	 	 	21

1 Examined H(z) for TIA some parasitic Z5 ZL:  $\frac{Z_L(Z_5g_mr_o+Z_5-r_o)}{Z_5g_mr_o+Z_5+2Z_Lg_mr_o+4Z_L+r_o}$ 

$$H(z) = \frac{Z_{L} \left( Z_{5} g_{m} r_{o} + Z_{5} - r_{o} \right)}{Z_{5} g_{m} r_{o} + Z_{5} + 2 Z_{L} g_{m} r_{o} + 4 Z_{L} + r_{o}}$$

- 2 HP
- 3 BP
- 3.1 BP-1  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$$H(s) = \frac{L_L s \left( R_5 g_m r_o + R_5 - r_o \right)}{C_L L_L R_5 g_m r_o s^2 + C_L L_L R_5 s^2 + C_L L_L r_o s^2 + 2 L_L g_m r_o s + 4 L_L s + R_5 g_m r_o + R_5 + r_o}$$

### Parameters:

Q: 
$$\frac{C_L \sqrt{\frac{1}{C_L L_L}} (R_5 g_m r_o + R_5 + r_o)}{2(g_m r_o + 2)}$$
 wo: 
$$\sqrt{\frac{1}{C_L L_L}}$$
 bandwidth: 
$$\frac{2(g_m r_o + 2)}{C_L (R_5 g_m r_o + R_5 + r_o)}$$
 K-LP: 0 K-HP: 0 K-BP: 
$$\frac{R_5 g_m r_o + R_5 - r_o}{2(g_m r_o + 2)}$$
 Qz: 0 Wz: None

**3.2** BP-2 
$$Z(s) = \left(\infty, \infty, \infty, \infty, R_5, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$$

$$H(s) = \frac{L_{L}R_{L}s\left(R_{5}g_{m}r_{o} + R_{5} - r_{o}\right)}{C_{L}L_{L}R_{5}R_{L}g_{m}r_{o}s^{2} + C_{L}L_{L}R_{5}R_{L}s^{2} + C_{L}L_{L}R_{L}r_{o}s^{2} + L_{L}R_{5}g_{m}r_{o}s + L_{L}R_{5}s + 2L_{L}R_{L}g_{m}r_{o}s + 4L_{L}R_{L}s + L_{L}r_{o}s + R_{5}R_{L}g_{m}r_{o} + R_{5}R_{L} + R_{L}r_{o}s + R_{5}R_{L}g_{m}r_{o}s +$$

$$\begin{aligned} & \text{Q: } \frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (R_5 g_m r_o + R_5 + r_o)}{R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o} \\ & \text{wo: } \sqrt{\frac{1}{C_L L_L}} \\ & \text{bandwidth: } \frac{R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o}{C_L R_L (R_5 g_m r_o + R_5 + r_o)} \\ & \text{K-LP: 0} \\ & \text{K-HP: 0} \\ & \text{K-BP: } \frac{R_L (R_5 g_m r_o + R_5 - r_o)}{R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o} \\ & \text{Qz: 0} \end{aligned}$$

- 4 LP
- 5 BS

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

$$H(s) = \frac{\left(C_{L}L_{L}s^{2} + 1\right)\left(R_{5}g_{m}r_{o} + R_{5} - r_{o}\right)}{2C_{L}L_{L}g_{m}r_{o}s^{2} + 4C_{L}L_{L}s^{2} + C_{L}R_{5}g_{m}r_{o}s + C_{L}R_{5}s + C_{L}r_{o}s + 2g_{m}r_{o} + 4}$$

 $\begin{aligned} & \text{Q:} \ \frac{2L_L\sqrt{\frac{1}{C_LL_L}}(g_mr_o + 2)}{R_5g_mr_o + R_5 + r_o} \\ & \text{wo:} \ \sqrt{\frac{1}{C_LL_L}} \\ & \text{bandwidth:} \ \frac{R_5g_mr_o + R_5 + r_o}{2L_L(g_mr_o + 2)} \\ & \text{K-LP:} \ \frac{R_5g_mr_o + R_5 - r_o}{2(g_mr_o + 2)} \\ & \text{K-HP:} \ \frac{R_5g_mr_o + R_5 - r_o}{2(g_mr_o + 2)} \\ & \text{K-BP:} \ 0 \\ & \text{Qz:} \ \text{None} \\ & \text{Wz:} \ \sqrt{\frac{1}{C_LL_L}} \end{aligned}$ 

**5.2** BS-2 
$$Z(s) = \left(\infty, \infty, \infty, \infty, R_5, \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$$

#### Parameters:

$$\begin{aligned} &\text{Q:} \ \frac{L_L \sqrt{\frac{1}{C_L L_L}} (R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o)}{R_L (R_5 g_m r_o + R_5 + r_o)} \\ &\text{wo:} \ \sqrt{\frac{1}{C_L L_L}} \\ &\text{bandwidth:} \ \frac{R_L (R_5 g_m r_o + R_5 + r_o)}{L_L (R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o)} \\ &\text{K-LP:} \ \frac{R_L (R_5 g_m r_o + R_5 - r_o)}{R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o} \\ &\text{K-HP:} \ \frac{R_L (R_5 g_m r_o + R_5 - r_o)}{R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o} \\ &\text{K-BP:} \ 0 \\ &\text{Qz:} \ \text{None} \\ &\text{Wz:} \ \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

# 6 **GE**

**6.1** GE-1 
$$Z(s) = \left(\infty, \infty, \infty, \infty, R_5, L_L s + R_L + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{\left(C_L L_L s^2 + C_L R_L s + 1\right) \left(R_5 g_m r_o + R_5 - r_o\right)}{2C_L L_L g_m r_o s^2 + 4C_L L_L s^2 + C_L R_5 g_m r_o s + C_L R_5 s + 2C_L R_L g_m r_o s + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o + 4C_L R_L s + C_L r_o s + 2g_m r_o s + 2G_L R_L s + 2G_L$$

$$\begin{aligned} &\text{Q: } \frac{2L_L\sqrt{\frac{1}{C_LL_L}}(g_mr_o + 2)}{R_5g_mr_o + R_5 + 2R_Lg_mr_o + 4R_L + r_o} \\ &\text{wo: } \sqrt{\frac{1}{C_LL_L}} \\ &\text{bandwidth: } \frac{R_5g_mr_o + R_5 + 2R_Lg_mr_o + 4R_L + r_o}{2L_L(g_mr_o + 2)} \\ &\text{K-LP: } \frac{R_5g_mr_o + R_5 - r_o}{2(g_mr_o + 2)} \\ &\text{K-HP: } \frac{R_5g_mr_o + R_5 - r_o}{2(g_mr_o + 2)} \\ &\text{K-BP: } \frac{R_L(R_5g_mr_o + R_5 - r_o)}{R_5g_mr_o + R_5 + 2R_Lg_mr_o + 4R_L + r_o} \end{aligned}$$

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

**6.2** GE-2 
$$Z(s) = \left(\infty, \infty, \infty, \infty, R_5, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$$

$$H(s) = \frac{\left(R_{5}g_{m}r_{o} + R_{5} - r_{o}\right)\left(C_{L}L_{L}R_{L}s^{2} + L_{L}s + R_{L}\right)}{C_{L}L_{L}R_{5}g_{m}r_{o}s^{2} + C_{L}L_{L}R_{5}s^{2} + 2C_{L}L_{L}R_{L}g_{m}r_{o}s^{2} + 4C_{L}L_{L}R_{2}s^{2} + C_{L}L_{L}r_{o}s^{2} + 2L_{L}g_{m}r_{o}s + 4L_{L}s + R_{5}g_{m}r_{o} + R_{5} + 2R_{L}g_{m}r_{o} + 4R_{L} + r_{o}}$$

Q: 
$$\frac{C_L \sqrt{\frac{1}{C_L L_L}}}{(R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o)}}{2(g_m r_o + 2)}$$
wo: 
$$\sqrt{\frac{1}{C_L L_L}}$$
bandwidth: 
$$\frac{2(g_m r_o + 2)}{C_L (R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o)}$$
K-LP: 
$$\frac{R_L (R_5 g_m r_o + R_5 - r_o)}{R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o}$$
K-HP: 
$$\frac{R_L (R_5 g_m r_o + R_5 - r_o)}{R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o}$$
K-BP: 
$$\frac{R_5 g_m r_o + R_5 - r_o}{2(g_m r_o + 2)}$$
Qz: 
$$C_L R_L \sqrt{\frac{1}{C_L L_L}}$$
Wz: 
$$\sqrt{\frac{1}{C_L L_L}}$$

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

$$H(s) = \frac{R_L \left( C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 - C_5 r_o s + g_m r_o + 1 \right)}{C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + 2C_5 R_L g_m r_o s + 4C_5 R_L s + C_5 r_o s + g_m r_o + 1}$$

### Parameters:

$$\begin{aligned} & \text{Q: } \frac{L_5 \sqrt{\frac{1}{C_5 L_5}} (g_m r_o + 1)}{2R_L g_m r_o + 4R_L + r_o} \\ & \text{wo: } \sqrt{\frac{1}{C_5 L_5}} \\ & \text{bandwidth: } \frac{2R_L g_m r_o + 4R_L + r_o}{L_5 (g_m r_o + 1)} \\ & \text{K-LP: } R_L \\ & \text{K-HP: } R_L \\ & \text{K-BP: } -\frac{R_L r_o}{2R_L g_m r_o + 4R_L + r_o} \\ & \text{Qz: } \frac{L_5 \sqrt{\frac{1}{C_5 L_5}} (-g_m r_o - 1)}{r_o} \\ & \text{Wz: } \sqrt{\frac{1}{C_5 L_5}} \end{aligned}$$

**6.4** GE-4 
$$Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, R_L\right)$$

$$H(s) = \frac{R_L \left( -C_5 L_5 r_o s^2 + L_5 g_m r_o s + L_5 s - r_o \right)}{2C_5 L_5 R_L g_m r_o s^2 + 4C_5 L_5 R_L s^2 + C_5 L_5 r_o s^2 + L_5 g_m r_o s + L_5 s + 2R_L g_m r_o + 4R_L + r_o}$$

Q: 
$$\frac{C_5\sqrt{\frac{1}{C_5L_5}}(2R_Lg_mr_o+4R_L+r_o)}{g_mr_o+1}$$
 wo: 
$$\sqrt{\frac{1}{C_5L_5}}$$
 bandwidth: 
$$\frac{g_mr_o+1}{C_5(2R_Lg_mr_o+4R_L+r_o)}$$
 K-LP: 
$$-\frac{R_Lr_o}{2R_Lg_mr_o+4R_L+r_o}$$

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

$$H(s) = \frac{R_L \left( C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1 \right)}{C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s + 2 C_5 R_L g_m r_o s + 4 C_5 R_L s + C_5 r_o s + g_m r_o + 1}$$

$$\begin{aligned} &\text{Q: } \frac{L_5\sqrt{\frac{1}{C_5L_5}}(g_mr_o+1)}{R_5g_mr_o+R_5+2R_Lg_mr_o+4R_L+r_o} \\ &\text{wo: } \sqrt{\frac{1}{C_5L_5}} \\ &\text{bandwidth: } \frac{R_5g_mr_o+R_5+2R_Lg_mr_o+4R_L+r_o}{L_5(g_mr_o+1)} \\ &\text{K-LP: } R_L \\ &\text{K-HP: } R_L \\ &\text{K-BP: } \frac{R_L(R_5g_mr_o+R_5-r_o)}{R_5g_mr_o+R_5+2R_Lg_mr_o+4R_L+r_o} \\ &\text{Qz: } \frac{L_5\sqrt{\frac{1}{C_5L_5}}(g_mr_o+1)}{R_5g_mr_o+R_5-r_o} \\ &\text{Wz: } \sqrt{\frac{1}{C_5L_5}} \end{aligned}$$

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

$$H(s) = \frac{R_L \left( -C_5 L_5 R_5 r_o s^2 + L_5 R_5 g_m r_o s + L_5 R_5 s - L_5 r_o s - R_5 r_o \right)}{2 C_5 L_5 R_5 R_L g_m r_o s^2 + 4 C_5 L_5 R_5 R_L s^2 + C_5 L_5 R_5 r_o s^2 + L_5 R_5 g_m r_o s + L_5 R_5 s + 2 L_5 R_L g_m r_o s + 4 L_5 R_L s + L_5 r_o s + 2 R_5 R_L g_m r_o + 4 R_5 R_L + R_5 r_o s + 2 R_5 R_L g_m r_o s + 2 R_5 R_L$$

#### Parameters:

$$Q: \frac{C_5 R_5 \sqrt{\frac{1}{C_5 L_5}} (2R_L g_m r_o + 4R_L + r_o)}{R_5 g_m r_o + R_5 + 2R_L g_m r_o + 4R_L + r_o}$$
wo: 
$$\sqrt{\frac{1}{C_5 L_5}}$$
bandwidth: 
$$\frac{R_5 g_m r_o + R_5 + 2R_L g_m r_o + 4R_L + r_o}{C_5 R_5 (2R_L g_m r_o + 4R_L + r_o)}$$
K-LP: 
$$-\frac{R_L r_o}{2R_L g_m r_o + 4R_L + r_o}$$
K-HP: 
$$-\frac{R_L r_o}{2R_L g_m r_o + 4R_L + r_o}$$
K-BP: 
$$\frac{R_L (R_5 g_m r_o + R_5 - r_o)}{R_5 g_m r_o + R_5 + 2R_L g_m r_o + 4R_L + r_o}$$
Qz: 
$$-\frac{C_5 R_5 r_o \sqrt{\frac{1}{C_5 L_5}}}{R_5 g_m r_o + R_5 - r_o}$$
Wz: 
$$\sqrt{\frac{1}{C_5 L_5}}$$

**6.7** GE-7 
$$Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, R_L\right)$$

Q: 
$$\frac{C_5\sqrt{\frac{1}{C_5L_5}}(R_5g_mr_o + R_5 + 2R_Lg_mr_o + 4R_L + r_o)}{g_mr_o + 1}$$
wo:  $\sqrt{\frac{1}{C_5L_5}}$ 

$$\begin{array}{ll} \text{bandwidth:} & \frac{g_m r_o + 1}{C_5(R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o)} \\ \text{K-LP:} & \frac{R_L(R_5 g_m r_o + R_5 - r_o)}{R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o} \\ \text{K-HP:} & \frac{R_L(R_5 g_m r_o + R_5 - r_o)}{R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o} \\ \text{K-BP:} & R_L \\ \text{Qz:} & \frac{C_5 \sqrt{\frac{1}{C_5 L_5}} (R_5 g_m r_o + R_5 - r_o)}{g_m r_o + 1} \\ \text{Wz:} & \sqrt{\frac{1}{C_5 L_5}} \end{array}$$

**6.8 GE-8** 
$$Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5\left(L_5 s + \frac{1}{C_5 s}\right)}{L_5 s + R_5 + \frac{1}{C_5 s}}, R_L\right)$$

$$H(s) = \frac{R_L \left( C_5 L_5 R_5 g_m r_o s^2 + C_5 L_5 R_5 s^2 - C_5 L_5 r_o s^2 - C_5 R_5 r_o s + R_5 g_m r_o + R_5 - r_o \right)}{C_5 L_5 R_5 g_m r_o s^2 + C_5 L_5 R_5 s^2 + 2 C_5 L_5 R_L g_m r_o s^2 + 4 C_5 L_5 R_L s^2 + C_5 L_5 r_o s^2 + 2 C_5 R_5 R_L g_m r_o s + 4 C_5 R_5 R_L s + C_5 R_5 r_o s + R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o}$$

$$\begin{aligned} &\text{Q:} \ \frac{L_5\sqrt{\frac{1}{C_5L_5}}(R_5g_mr_o + R_5 + 2R_Lg_mr_o + 4R_L + r_o)}{R_5(2R_Lg_mr_o + 4R_L + r_o)} \\ &\text{wo:} \ \sqrt{\frac{1}{C_5L_5}} \\ &\text{bandwidth:} \ \frac{R_5(2R_Lg_mr_o + 4R_L + r_o)}{L_5(R_5g_mr_o + R_5 + 2R_Lg_mr_o + 4R_L + r_o)} \\ &\text{K-LP:} \ \frac{R_L(R_5g_mr_o + R_5 - r_o)}{R_5g_mr_o + R_5 + 2R_Lg_mr_o + 4R_L + r_o} \\ &\text{K-HP:} \ \frac{R_L(R_5g_mr_o + R_5 - r_o)}{R_5g_mr_o + R_5 + 2R_Lg_mr_o + 4R_L + r_o} \\ &\text{K-BP:} \ -\frac{R_Lr_o}{2R_Lg_mr_o + 4R_L + r_o} \\ &\text{Qz:} \ \frac{L_5\sqrt{\frac{1}{C_5L_5}}(-R_5g_mr_o - R_5 + r_o)}{R_5r_o} \\ &\text{Wz:} \ \sqrt{\frac{1}{C_5L_5}} \end{aligned}$$

# **7** AP

## 8 INVALID-NUMER

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

$$H(s) = \frac{R_L \left( -C_5 r_o s + g_m r_o + 1 \right)}{C_5 C_L R_L r_o s^2 + 2 C_5 R_L g_m r_o s + 4 C_5 R_L s + C_5 r_o s + C_L R_L g_m r_o s + C_L R_L s + g_m r_o + 1}$$

Q: 
$$\frac{C_5C_LR_Lr_o\sqrt{\frac{g_mr_o+1}{C_5C_LR_Lr_o}}}{2C_5R_Lg_mr_o+4C_5R_L+C_5r_o+C_LR_Lg_mr_o+C_LR_L}$$
 wo: 
$$\sqrt{\frac{g_mr_o+1}{C_5C_LR_Lr_o}}$$
 bandwidth: 
$$\frac{2C_5R_Lg_mr_o+4C_5R_L+C_5r_o+C_LR_Lg_mr_o+C_LR_L}{C_5C_LR_Lr_o}$$
 K-LP:  $R_L$  K-HP: 0 
K-BP: 
$$-\frac{C_5R_Lr_o}{2C_5R_Lg_mr_o+4C_5R_L+C_5r_o+C_LR_Lg_mr_o+C_LR_L}$$
 Qz: 0 
Wz: None

# 8.2 INVALID-NUMER-2 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, \frac{1}{C_L s}\right)$

$$H(s) = \frac{-C_5 R_5 r_o s + R_5 g_m r_o + R_5 - r_o}{C_5 C_L R_5 r_o s^2 + 2C_5 R_5 g_m r_o s + 4C_5 R_5 s + C_L R_5 g_m r_o s + C_L R_5 s + C_L r_o s + 2g_m r_o + 4C_5 R_5 g_m r_o s + C_L R_5 g_m r_o s + C$$

#### Parameters:

 $\begin{array}{c} \mathbb{Q} \colon \frac{\sqrt{2}C_5C_LR_5r_o\sqrt{\frac{g_mr_o+2}{C_5C_LR_5r_o}}}{2C_5R_5g_mr_o+4C_5R_5+C_LR_5g_mr_o+C_LR_5+C_Lr_o} \\ \text{wo: } \sqrt{2}\sqrt{\frac{g_mr_o+2}{C_5C_LR_5r_o}} \\ \text{bandwidth: } \frac{2C_5R_5g_mr_o+4C_5R_5+C_LR_5g_mr_o+C_LR_5+C_Lr_o}{C_5C_LR_5r_o} \\ \text{K-LP: } \frac{R_5g_mr_o+R_5-r_o}{2(g_mr_o+2)} \\ \text{K-HP: } 0 \\ \text{K-BP: } -\frac{C_5R_5g_mr_o+4C_5R_5+C_LR_5g_mr_o+C_LR_5+C_Lr_o}{2C_5R_5g_mr_o+4C_5R_5+C_LR_5g_mr_o+C_LR_5+C_Lr_o} \\ \text{Qz: } 0 \\ \text{Wz: None} \end{array}$ 

# 8.3 INVALID-NUMER-3 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5R_5s+1}, \frac{R_L}{C_LR_Ls+1}\right)$

$$H(s) = \frac{R_L \left( -C_5 R_5 r_o s + R_5 g_m r_o + R_5 - r_o \right)}{C_5 C_L R_5 R_L r_o s^2 + 2 C_5 R_5 R_L g_m r_o s + 4 C_5 R_5 R_L s + C_5 R_5 r_o s + C_L R_5 R_L g_m r_o s + C_L R_5 R_L s + C_L R_L r_o s + R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o r_o + 2 R_L r_o s + 2 R_L r_o$$

#### Parameters:

Q: 
$$\frac{C_5C_LR_5R_Lr_o\sqrt{\frac{R_5g_mr_o+R_5+2R_Lg_mr_o+4R_L+r_o}{C_5C_LR_5R_Lr_o}}}{\frac{C_5C_LR_5R_Lr_o}{C_5C_LR_5R_Lr_o}}$$
 wo: 
$$\sqrt{\frac{R_5g_mr_o+R_5+2R_Lg_mr_o+4R_L+r_o}{C_5C_LR_5R_Lr_o}}$$
 bandwidth: 
$$\frac{2C_5R_5R_Lg_mr_o+4C_5R_5R_L+C_5R_5r_o+C_LR_5R_Lg_mr_o+C_LR_5R_L+C_LR_Lr_o}{C_5C_LR_5R_Lr_o}$$
 K-LP: 
$$\frac{R_L(R_5g_mr_o+R_5-r_o)}{R_5g_mr_o+R_5+2R_Lg_mr_o+4R_L+r_o}$$
 K-HP: 
$$0$$
 K-BP: 
$$-\frac{C_5R_5R_Lr_o}{2C_5R_5R_Lg_mr_o+4C_5R_5R_L+C_5R_5r_o+C_LR_5R_Lg_mr_o+C_LR_5R_L+C_LR_Lr_o}}{C_5C_LR_5R_Lr_o}$$
 Qz: 
$$0$$
 Wz: None

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

$$H(s) = \frac{R_L \left( C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1 \right)}{C_5 C_L R_5 R_L g_m r_o s^2 + C_5 C_L R_5 R_L s^2 + C_5 C_L R_L r_o s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s + 2 C_5 R_L g_m r_o s + 4 C_5 R_L s + C_5 r_o s + C_L R_L g_m r_o s + C_L R_L s + g_m r_o + 1}$$

#### Parameters:

$$\begin{array}{l} \text{Q:} \ \frac{C_5C_LR_L\sqrt{\frac{g_mr_o+1}{C_5C_LR_L(R_5g_mr_o+R_5+r_o)}}(R_5g_mr_o+R_5+r_o)}{C_5R_5g_mr_o+C_5R_5+2C_5R_Lg_mr_o+4C_5R_L+C_5r_o+C_LR_Lg_mr_o+C_LR_L} \\ \text{wo:} \ \sqrt{\frac{g_mr_o+1}{C_5C_LR_L(R_5g_mr_o+R_5+r_o)}} \\ \text{bandwidth:} \ \frac{C_5R_5g_mr_o+C_5R_5+2C_5R_Lg_mr_o+4C_5R_L+C_5r_o+C_LR_Lg_mr_o+C_LR_L}{C_5C_LR_L(R_5g_mr_o+R_5+r_o)} \\ \text{K-LP:} \ R_L \\ \text{K-HP:} \ 0 \\ \text{K-BP:} \ \frac{C_5R_L(R_5g_mr_o+R_5-r_o)}{C_5R_5g_mr_o+C_5R_5+2C_5R_Lg_mr_o+4C_5R_L+C_5r_o+C_LR_Lg_mr_o+C_LR_L} \\ \text{Qz:} \ 0 \\ \text{Wz:} \ \text{None} \end{array}$$

## 9 INVALID-WZ

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

$$H(s) = -\frac{\left(C_{L}R_{L}s+1\right)\left(C_{5}R_{5}r_{o}s-R_{5}g_{m}r_{o}-R_{5}+r_{o}\right)}{2C_{5}C_{L}R_{5}R_{L}g^{2}+4C_{5}C_{L}R_{5}r_{o}s^{2}+2C_{5}R_{5}g_{m}r_{o}s+4C_{5}R_{5}s+C_{L}R_{5}g_{m}r_{o}s+4C_{L}R_{L}s+2C_{L}R_{L}g_{m}r_{o}s+4C_{L}R_{L}s+C_{L}r_{o}s+2g_{m}r_{o}+4C_{L}R_{L}s+C_{L}r_{o}s+2g_{m}r_{o}+4C_{L}R_{L}s+C_{L}r_{o}s+2g_{m}r_{o}+4C_{L}R_{L}s+C_{L}r_{o}s+2g_{m}r_{o}+4C_{L}R_{L}s+C_{L}r_{o}s+2g_{m}r_{o}+4C_{L}R_{L}s+2C_{L}R_{$$

Parameters:

$$Q: \frac{\sqrt{2}C_5C_LR_5\sqrt{\frac{g_mr_o+2}{C_5C_LR_5(2R_Lg_mr_o+4R_L+r_o)}}}{2C_5R_5g_mr_o+4C_5R_5+C_LR_5g_mr_o+4C_LR_L+C_Lr_o}} (2R_Lg_mr_o+4R_L+r_o)$$

$$Wo: \sqrt{2}\sqrt{\frac{g_mr_o+2}{C_5C_LR_5(2R_Lg_mr_o+4R_L+r_o)}}}$$
bandwidth: 
$$\frac{2C_5R_5g_mr_o+4C_5R_5+C_LR_5g_mr_o+C_LR_5+2C_LR_Lg_mr_o+4C_LR_L+C_Lr_o}{C_5C_LR_5(2R_Lg_mr_o+4R_L+r_o)}$$

$$K-LP: \frac{R_5g_mr_o+R_5-r_o}{2(g_mr_o+2)}$$

$$K-HP: -\frac{R_Lr_o}{2R_Lg_mr_o+4R_L+r_o}$$

$$K-BP: \frac{-C_5R_5r_o+C_LR_5R_Lg_mr_o+C_LR_5R_L-C_LR_Lr_o}{2C_5C_LR_5g_mr_o+4C_5R_5+C_LR_5g_mr_o+C_LR_5+2C_LR_Lg_mr_o+4C_LR_L+C_Lr_o}$$

$$Qz: \frac{\sqrt{2}C_5C_LR_5R_Lr_o\sqrt{\frac{g_mr_o+2}{C_5C_LR_5(2R_Lg_mr_o+4R_L+r_o)}}}{C_5R_5g_mr_o-C_LR_5R_L+C_LR_Lr_o}$$

$$Wz: \sqrt{\frac{-R_5g_mr_o-R_5+r_o}{C_5C_LR_5R_Lr_o}}$$

# 10 INVALID-ORDER

10.1 INVALID-ORDER-1  $Z(s) = (\infty, \infty, \infty, \infty, R_5, R_L)$ 

$$H(s) = \frac{R_L (R_5 g_m r_o + R_5 - r_o)}{R_5 g_m r_o + R_5 + 2R_L g_m r_o + 4R_L + r_o}$$

10.2 INVALID-ORDER-2  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5, \frac{1}{C_L s}\right)$ 

$$H(s) = \frac{R_5 g_m r_o + R_5 - r_o}{C_L R_5 g_m r_o s + C_L R_5 s + C_L r_o s + 2 g_m r_o + 4}$$

10.3 INVALID-ORDER-3  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5, \frac{R_L}{C_L R_L s + 1}\right)$ 

$$H(s) = \frac{R_L \left( R_5 g_m r_o + R_5 - r_o \right)}{C_L R_5 R_L g_m r_o s + C_L R_5 R_L s + C_L R_L r_o s + R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o}$$

10.4 INVALID-ORDER-4  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5, R_L + \frac{1}{C_L s}\right)$ 

$$H(s) = \frac{\left(C_{L}R_{L}s + 1\right)\left(R_{5}g_{m}r_{o} + R_{5} - r_{o}\right)}{C_{L}R_{5}g_{m}r_{o}s + C_{L}R_{5}s + 2C_{L}R_{L}g_{m}r_{o}s + 4C_{L}R_{L}s + C_{L}r_{o}s + 2g_{m}r_{o} + 4C_{L}R_{L}s + C_{L}r_{o}s + 2g_{m}r_{o}s + 2g_{m$$

10.5 INVALID-ORDER-5  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, R_L\right)$ 

$$H(s) = \frac{R_L \left( -C_5 r_o s + g_m r_o + 1 \right)}{2C_5 R_L g_m r_o s + 4C_5 R_L s + C_5 r_o s + g_m r_o + 1}$$

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

$$H(s) = \frac{-C_5 r_o s + g_m r_o + 1}{s \left( C_5 C_L r_o s + 2 C_5 g_m r_o + 4 C_5 + C_L g_m r_o + C_L \right)}$$

10.7 INVALID-ORDER-7 
$$Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, R_L + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{\left(C_L R_L s + 1\right) \left(-C_5 r_o s + g_m r_o + 1\right)}{s \left(2C_5 C_L R_L g_m r_o s + 4C_5 C_L R_L s + C_5 C_L r_o s + 2C_5 g_m r_o + 4C_5 + C_L g_m r_o + C_L\right)}$$

10.8 INVALID-ORDER-8 
$$Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, L_L s + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{\left(C_L L_L s^2 + 1\right) \left(-C_5 r_o s + g_m r_o + 1\right)}{s \left(2C_5 C_L L_L g_m r_o s^2 + 4C_5 C_L L_L s^2 + C_5 C_L r_o s + 2C_5 g_m r_o + 4C_5 + C_L g_m r_o + C_L\right)}$$

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

$$H(s) = \frac{L_L s \left(-C_5 r_o s + g_m r_o + 1\right)}{C_5 C_L L_L r_o s^3 + 2 C_5 L_L g_m r_o s^2 + 4 C_5 L_L s^2 + C_5 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + g_m r_o + 1}$$

10.10 INVALID-ORDER-10 
$$Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, L_L s + R_L + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{\left(-C_5 r_o s + g_m r_o + 1\right) \left(C_L L_L s^2 + C_L R_L s + 1\right)}{s \left(2C_5 C_L L_L g_m r_o s^2 + 4C_5 C_L L_L s^2 + 2C_5 C_L R_L g_m r_o s + 4C_5 C_L R_L s + C_5 C_L r_o s + 2C_5 g_m r_o + 4C_5 + C_L g_m r_o + C_L\right)}$$

**10.11** INVALID-ORDER-11 
$$Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, \frac{1}{C_L s + \frac{1}{R_I} + \frac{1}{L_L s}}\right)$$

$$H(s) = \frac{L_L R_L s \left(-C_5 r_o s + g_m r_o + 1\right)}{C_5 C_L L_L R_L r_o s^3 + 2 C_5 L_L R_L g_m r_o s^2 + 4 C_5 L_L R_L s^2 + C_5 L_L r_o s^2 + C_5 R_L r_o s + C_L L_L R_L g_m r_o s^2 + C_L L_L R_L s^2 + L_L g_m r_o s + L_L s + R_L g_m r_o + R_L r_o s^2 + C_L r_o s^2 +$$

10.12 INVALID-ORDER-12  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$ 

$$H(s) = \frac{\left(-C_5 r_o s + g_m r_o + 1\right) \left(C_L L_L R_L s^2 + L_L s + R_L\right)}{2C_5 C_L L_L R_L g_m r_o s^3 + 4C_5 C_L L_L R_L s^3 + C_5 C_L L_L r_o s^3 + 2C_5 L_L g_m r_o s^2 + 4C_5 L_L s^2 + 2C_5 R_L g_m r_o s + 4C_5 R_L s + C_5 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + g_m r_o + 1}$$

10.13 INVALID-ORDER-13  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$ 

$$H(s) = \frac{R_L \left( C_L L_L s^2 + 1 \right) \left( -C_5 r_o s + g_m r_o + 1 \right)}{2C_5 C_L L_L R_L g_m r_o s^3 + 4C_5 C_L L_L r_o s^3 + C_5 C_L R_L r_o s^2 + 2C_5 R_L g_m r_o s + 4C_5 R_L s + C_5 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + C_L R_L g_m r_o s + C_L R_L s + g_m r_o + 1}$$

10.14 INVALID-ORDER-14  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, R_L\right)$ 

$$H(s) = \frac{R_L \left( -C_5 R_5 r_o s + R_5 g_m r_o + R_5 - r_o \right)}{2 C_5 R_5 R_L g_m r_o s + 4 C_5 R_5 R_L s + C_5 R_5 r_o s + R_5 g_m r_o + R_5 + 2 R_L g_m r_o + 4 R_L + r_o}$$

10.15 INVALID-ORDER-15 
$$Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, L_L s + \frac{1}{C_L s}\right)$$

$$H(s) = -\frac{\left(C_{L}L_{L}s^{2} + 1\right)\left(C_{5}R_{5}r_{o}s - R_{5}g_{m}r_{o} - R_{5} + r_{o}\right)}{2C_{5}C_{L}L_{L}R_{5}g_{m}r_{o}s^{3} + 4C_{5}C_{L}L_{L}R_{5}s^{3} + C_{5}C_{L}R_{5}r_{o}s^{2} + 2C_{5}R_{5}g_{m}r_{o}s + 4C_{5}R_{5}s + 2C_{L}L_{L}g_{m}r_{o}s^{2} + 4C_{L}L_{L}s^{2} + C_{L}R_{5}g_{m}r_{o}s + C_{L}R_{5}s + C_{L}r_{o}s + 2g_{m}r_{o} + 4C_{5}R_{5}s + C_{L}R_{5}s + C_{L}R_{5}$$

10.16 INVALID-ORDER-16  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, \frac{L_L s}{C_L L_L s^2 + 1}\right)$ 

$$H(s) = \frac{L_L s \left(-C_5 R_5 r_o s + R_5 g_m r_o + R_5 - r_o\right)}{C_5 C_L L_L R_5 r_o s^3 + 2 C_5 L_L R_5 g_m r_o s^2 + 4 C_5 L_L R_5 s^2 + C_5 R_5 r_o s + C_L L_L R_5 g_m r_o s^2 + C_L L_L R_5 s^2 + C_L L_L r_o s^2 + 2 L_L g_m r_o s + 4 L_L s + R_5 g_m r_o + R_5 + r_o}$$

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

$$H(s) = -\frac{\left(C_{L}L_{S}^{2} + C_{L}R_{L}s + 1\right)\left(C_{5}R_{5}r_{o}s - R_{5}g_{m}r_{o} - R_{5} + r_{o}\right)}{2C_{5}C_{L}L_{L}R_{5}g_{m}r_{o}s^{3} + 4C_{5}C_{L}L_{L}R_{5}s^{3} + 2C_{5}C_{L}R_{5}R_{L}g_{m}r_{o}s^{2} + 4C_{5}C_{L}R_{5}r_{o}s^{2} + 2C_{5}R_{5}g_{m}r_{o}s + 4C_{5}R_{5}s + 2C_{L}L_{L}g_{m}r_{o}s^{2} + 4C_{L}L_{L}s^{2} + C_{L}R_{5}g_{m}r_{o}s + 4C_{L}R_{5}s + 2C_{L}R_{5}g_{m}r_{o}s + 4C_{L}R_{5}s +$$

**10.18** INVALID-ORDER-18  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$ 

$$H(s) = \frac{L_L R_L s \left(-C_5 R_5 r_o s + R_5 g_m r_o + R_5 - r_o\right)}{C_5 C_L L_L R_5 R_L r_o s^3 + 2 C_5 L_L R_5 R_L g_m r_o s^2 + 4 C_5 L_L R_5 R_L s^2 + C_5 L_L R_5 r_o s^2 + C_L L_L R_5 R_L g_m r_o s^2 + C_L L_L R_5 R_L s^2 + C_L L_L R_5 R_L s^2 + C_L L_L R_5 r_o s^2 + L_L R_5 g_m r_o s + L_L R_5 s + 2 L_L R_L g_m r_o s + 4 L_L R_L s + L_L r_o s + R_5 R_L g_m r_o s + R_5 R_L r_o$$

10.19 INVALID-ORDER-19  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5R_5s+1}, \frac{L_Ls}{C_LL_Ls^2+1} + R_L\right)$ 

$$\frac{\left(C_{L}L_{L}R_{s}^{2}+L_{L}s+R_{L}\right)\left(C_{5}R_{5}r_{o}s-R_{5}g_{m}r_{o}-R_{5}+r_{o}\right)}{2C_{5}C_{L}L_{L}R_{5}R_{L}g_{m}r_{o}s^{3}+4C_{5}C_{L}L_{L}R_{5}r_{o}s^{3}+2C_{5}L_{L}R_{5}g_{m}r_{o}s^{2}+4C_{5}L_{L}R_{5}s^{2}+2C_{5}R_{5}R_{L}g_{m}r_{o}s+4C_{5}R_{5}r_{o}s+C_{L}L_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{L}R_{5}s^{2}+2C_{L}L_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{L}R_{5}s^{2}+2C_{L}L_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{L}R_{5}s^{2}+2C_{L}L_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{L}R_{5}s^{2}+2C_{L}L_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{L}R_{5}s^{2}+2C_{L}L_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{L}R_{5}s^{2}+2C_{L}L_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{L}R_{5}s^{2}+2C_{L}L_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{L}R_{5}g_{m}r_{o}s^$$

10.20 INVALID-ORDER-20  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_T s}}\right)$ 

$$H(s) = -\frac{R_L \left( C_L L_L s^2 + 1 \right) \left( C_5 R_5 r_o s - R_5 g_m r_o - R_5 + r_o \right)}{2 C_5 C_L L_L R_5 R_L g_m r_o s^3 + 4 C_5 C_L L_L R_5 r_o s^3 + C_5 C_L R_5 R_L r_o s^2 + 2 C_5 R_5 R_L g_m r_o s + 4 C_5 R_5 r_o s + C_L L_L R_5 g_m r_o s^2 + C_L L_L R_5 g_m r_o s^2 + 4 C_L L_L R_5 g_m r_o s^2 + C_L L_L R_5 g_m r_o s^2 + C_L L_L R_5 g_m r_o s^2 + C_L R_5 R_L g_m r_o s^2 + C_L R$$

10.21 INVALID-ORDER-21  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, R_L\right)$ 

$$H(s) = \frac{R_L \left( C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1 \right)}{C_5 R_5 q_m r_o s + C_5 R_5 s + 2 C_5 R_L q_m r_o s + 4 C_5 R_L s + C_5 r_o s + q_m r_o + 1}$$

10.22 INVALID-ORDER-22  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, \frac{1}{C_L s}\right)$ 

$$H(s) = \frac{C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1}{s \left( C_5 C_L R_5 g_m r_o s + C_5 C_L R_5 s + C_5 C_L r_o s + 2 C_5 g_m r_o + 4 C_5 + C_L g_m r_o + C_L \right)}$$

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

$$H(s) = \frac{\left(C_{L}R_{L}s + 1\right)\left(C_{5}R_{5}g_{m}r_{o}s + C_{5}R_{5}s - C_{5}r_{o}s + g_{m}r_{o} + 1\right)}{s\left(C_{5}C_{L}R_{5}g_{m}r_{o}s + C_{5}C_{L}R_{L}g_{m}r_{o}s + 4C_{5}C_{L}R_{L}s + C_{5}C_{L}r_{o}s + 2C_{5}g_{m}r_{o} + 4C_{5} + C_{L}g_{m}r_{o} + C_{L}\right)}$$

10.24 INVALID-ORDER-24 
$$Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, L_L s + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{\left(C_L L_L s^2 + 1\right) \left(C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1\right)}{s \left(2 C_5 C_L L_L g_m r_o s^2 + 4 C_5 C_L L_L s^2 + C_5 C_L R_5 g_m r_o s + C_5 C_L R_5 s + C_5 C_L r_o s + 2 C_5 g_m r_o + 4 C_5 + C_L g_m r_o + C_L\right)}$$

10.25 INVALID-ORDER-25  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1}\right)$ 

$$H(s) = \frac{L_L s \left(C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1\right)}{C_5 C_L L_L R_5 g_m r_o s^3 + C_5 C_L L_L R_5 s^3 + C_5 C_L L_L r_o s^3 + 2 C_5 L_L g_m r_o s^2 + 4 C_5 L_L s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s + C_5 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + g_m r_o + 1}$$

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

$$H(s) = \frac{\left(C_{L}L_{L}s^{2} + C_{L}R_{L}s + 1\right)\left(C_{5}R_{5}g_{m}r_{o}s + C_{5}R_{5}s - C_{5}r_{o}s + g_{m}r_{o} + 1\right)}{s\left(2C_{5}C_{L}L_{L}g_{m}r_{o}s^{2} + 4C_{5}C_{L}L_{L}s^{2} + C_{5}C_{L}R_{5}g_{m}r_{o}s + C_{5}C_{L}R_{5}s + 2C_{5}C_{L}R_{L}g_{m}r_{o}s + 4C_{5}C_{L}R_{L}s + C_{5}C_{L}r_{o}s + 2C_{5}g_{m}r_{o} + 4C_{5} + C_{L}g_{m}r_{o} + C_{L}\right)}$$

10.27 INVALID-ORDER-27  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$ 

$$H(s) = \frac{L_L R_L s \left(C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1\right)}{C_5 C_L L_L R_5 R_L g_m r_o s^3 + C_5 C_L L_L R_5 R_L s^3 + C_5 C_L L_L R_5 r_o s^2 + C_5 L_L R_5 g_m r_o s^2 + 2 C_5 L_L R_5 g_m r_o s^2 + 4 C_5 L_L R_5 r_o s^2 + C_5 R_5 R_L g_m r_o s^2 + C_5 R_$$

10.28 INVALID-ORDER-28  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$ 

$$H(s) = \frac{\left(C_{L}L_{L}R_{2}^{2} + L_{L}s + R_{L}\right)\left(C_{5}R_{5}g_{m}r_{o}s + C_{5}R_{5}s - C_{5}r_{o}s + g_{m}r_{o} + 1\right)}{C_{5}C_{L}L_{L}R_{5}g_{m}r_{o}s^{3} + C_{5}C_{L}L_{L}R_{5}g_{m}r_{o}s^{3} + 2C_{5}L_{L}L_{R}L_{g}m_{r}os^{3} + 4C_{5}C_{L}L_{L}R_{s}s^{3} + 2C_{5}L_{L}L_{r}cs^{3} + 2C_{5}L_{L}g_{m}r_{o}s^{2} + 4C_{5}L_{L}s^{2} + C_{5}R_{5}g_{m}r_{o}s + C_{5}R_{5}s + 2C_{5}R_{L}g_{m}r_{o}s + 4C_{5}R_{L}s + C_{5}r_{o}s + C_{L}L_{L}g_{m}r_{o}s^{2} + C_{L}L_{L}s^{2} + g_{m}r_{o} + 1\right)}$$

10.29 INVALID-ORDER-29  $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$ 

$$R_L \left( C_L L_L s^2 + 1 \right) \left( C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1 \right)$$

$$H(s) = \frac{R_L \left( C_L L_L s^2 + 1 \right) \left( C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1 \right)}{C_5 C_L L_L R_5 g_m r_o s^3 + C_5 C_L L_L R_5 g^3 + 2 C_5 C_L L_L R_L g_m r_o s^3 + 4 C_5 C_L L_L R_5 g^3 + C_5 C_L R_5 R_L g_m r_o s^2 + C_5 C_L R_5 R_L g_m r_o s^2 + C_5 C_L R_5 R_L g_m r_o s^2 + C_5 R_5 g_m r_o s + C_5 R_5$$

10.30 INVALID-ORDER-30  $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{1}{C_L s}\right)$ 

$$H(s) = \frac{C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 - C_5 r_o s + g_m r_o + 1}{s \left( C_5 C_L L_5 g_m r_o s^2 + C_5 C_L L_5 s^2 + C_5 C_L r_o s + 2 C_5 g_m r_o + 4 C_5 + C_L g_m r_o + C_L \right)}$$

10.31 INVALID-ORDER-31  $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{R_L}{C_L R_L s + 1}\right)$ 

$$H(s) = \frac{R_L \left( C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 - C_5 r_o s + g_m r_o + 1 \right)}{C_5 C_L L_5 R_L g_m r_o s^3 + C_5 C_L L_5 R_L s^3 + C_5 C_L R_L r_o s^2 + C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + 2 C_5 R_L g_m r_o s + 4 C_5 R_L s + C_5 r_o s + C_L R_L g_m r_o s + C_L R_L s + g_m r_o + 1}$$

10.32 INVALID-ORDER-32 
$$Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, R_L + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{\left(C_L R_L s + 1\right) \left(C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 - C_5 r_o s + g_m r_o + 1\right)}{s \left(C_5 C_L L_5 g_m r_o s^2 + C_5 C_L L_5 s^2 + 2 C_5 C_L R_L g_m r_o s + 4 C_5 C_L R_L s + C_5 C_L r_o s + 2 C_5 g_m r_o + 4 C_5 + C_L g_m r_o + C_L\right)}$$

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

$$H(s) = \frac{\left(C_L L_L s^2 + 1\right) \left(C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 - C_5 r_o s + g_m r_o + 1\right)}{s \left(C_5 C_L L_5 g_m r_o s^2 + C_5 C_L L_5 s^2 + 2 C_5 C_L L_L g_m r_o s^2 + 4 C_5 C_L L_L s^2 + C_5 C_L r_o s + 2 C_5 g_m r_o + 4 C_5 + C_L g_m r_o + C_L\right)}$$

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

$$H(s) = \frac{L_L s \left(C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 - C_5 r_o s + g_m r_o + 1\right)}{C_5 C_L L_5 L_L g_m r_o s^4 + C_5 C_L L_5 L_4 s^4 + C_5 C_L L_L r_o s^3 + C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + 2 C_5 L_4 g_m r_o s^2 + 4 C_5 L_4 s^2 + C_5 r_o s + C_L L_4 g_m r_o s^2 + C_L L_4 s^2 + g_m r_o + 1}$$

10.35 INVALID-ORDER-35  $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, L_L s + R_L + \frac{1}{C_L s}\right)$ 

$$H(s) = \frac{\left(C_L L_L s^2 + C_L R_L s + 1\right) \left(C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 - C_5 r_o s + g_m r_o + 1\right)}{s \left(C_5 C_L L_5 g_m r_o s^2 + C_5 C_L L_5 s^2 + 2 C_5 C_L L_L g_m r_o s^2 + 4 C_5 C_L L_L s^2 + 2 C_5 C_L R_L g_m r_o s + 4 C_5 C_L R_L s + C_5 C_L r_o s + 2 C_5 g_m r_o + 4 C_5 + C_L g_m r_o + C_L\right)}$$

**10.36** INVALID-ORDER-36  $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$ 

$$H(s) = \frac{L_L R_L s \left(C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 - C_5 r_o s + g_m r_o + 1\right)}{C_5 C_L L_5 L_L R_L g_m r_o s^4 + C_5 C_L L_5 L_L R_L r_o s^3 + C_5 L_5 L_L g_m r_o s^3 + C_5 L_5 L_L g_m r_o s^2 + C_5 L_5 R_L g_m r_o s^2 + C_5 L_L R_L g_m r_o s^2$$

10.37 INVALID-ORDER-37  $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$ 

$$H(s) = \frac{\left(C_{L}L_{L}R_{L}s^{2} + L_{L}s + R_{L}\right)\left(C_{5}L_{5}g_{m}r_{o}s^{2} + C_{5}L_{5}s^{2} - C_{5}r_{o}s + g_{m}r_{o} + 1\right)}{C_{5}C_{L}L_{5}L_{L}g_{m}r_{o}s^{4} + C_{5}C_{L}L_{L}R_{L}g_{m}r_{o}s^{3} + 4C_{5}C_{L}L_{L}R_{L}s^{3} + C_{5}C_{L}L_{L}r_{o}s^{3} + C_{5}L_{5}g_{m}r_{o}s^{2} + C_{5}L_{5}s^{2} + 2C_{5}L_{L}g_{m}r_{o}s^{2} + 4C_{5}L_{L}s^{2} + 2C_{5}R_{L}g_{m}r_{o}s + 4C_{5}R_{L}s + C_{5}r_{o}s + C_{L}L_{L}g_{m}r_{o}s^{2} + C_{L}L_{L}s^{2} + g_{m}r_{o} + 1\right)}$$

10.38 INVALID-ORDER-38  $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$ 

$$H(s) = \frac{R_L \left( C_L L_L s^2 + 1 \right) \left( C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 - C_5 r_o s + g_m r_o + 1 \right)}{C_5 C_L L_5 L_L g_m r_o s^4 + C_5 C_L L_5 R_L g_m r_o s^3 + C_5 C_L L_5 R_L g_m r_o s^3 + 4 C_5 C_L L_L R_L g_m r_o s^3 + 4 C_5 C_L L_L R_L g_m r_o s^3 + 4 C_5 C_L L_L R_L g_m r_o s^3 + C_5 C_L L_L r_o s^3 + C_5 C_L R_L r_o s^$$

10.39 INVALID-ORDER-39  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \frac{1}{C_L s}\right)$ 

$$H(s) = \frac{-C_5L_5r_os^2 + L_5g_mr_os + L_5s - r_o}{C_5C_LL_5r_os^3 + 2C_5L_5g_mr_os^2 + 4C_5L_5s^2 + C_LL_5g_mr_os^2 + C_LL_5s^2 + C_Lr_os + 2g_mr_o + 4}$$

10.40 INVALID-ORDER-40 
$$Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \frac{R_L}{C_L R_L s + 1}\right)$$

10.41 INVALID-ORDER-41  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5s}{C_5L_5s^2+1}, R_L + \frac{1}{C_Ls}\right)$ 

$$H(s) = -\frac{\left(C_L R_L s + 1\right) \left(C_5 L_5 r_o s^2 - L_5 g_m r_o s - L_5 s + r_o\right)}{2 C_5 C_L L_5 R_L g_m r_o s^3 + 4 C_5 C_L L_5 r_o s^3 + 2 C_5 L_5 g_m r_o s^2 + 4 C_5 L_5 s^2 + C_L L_5 g_m r_o s^2 + C_L L_5 s^2 + 2 C_L R_L g_m r_o s + 4 C_L R_L s + C_L r_o s + 2 g_m r_o + 4 C_L R_L s + C_L r_o s + 2 g_m r_o s^2 + C_L R_L g_m r_o s^2 + C_L R_L g_m r_o s + 4 C_L R_L g_m r_o$$

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

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

**10.44** INVALID-ORDER-44  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_{5s}}{C_5L_5s^2+1}, L_Ls + R_L + \frac{1}{C_Ls}\right)$ 

$$H(s) = -\frac{\left(C_{L}L_{S}^{2} + C_{L}R_{L}s + 1\right)\left(C_{5}L_{5}r_{o}s^{2} - L_{5}g_{m}r_{o}s - L_{5}s + r_{o}\right)}{2C_{5}C_{L}L_{5}L_{L}g_{m}r_{o}s^{4} + 4C_{5}C_{L}L_{5}R_{L}g_{m}r_{o}s^{3} + 4C_{5}C_{L}L_{5}R_{L}s^{3} + C_{5}C_{L}L_{5}r_{o}s^{3} + 2C_{5}L_{5}g_{m}r_{o}s^{2} + 4C_{L}L_{5}s^{2} + 2C_{L}L_{L}g_{m}r_{o}s^{2} + 4C_{L}L_{L}s^{2} + 2C_{L}R_{L}g_{m}r_{o}s + 4C_{L}R_{L}s + C_{L}r_{o}s + 2g_{m}r_{o}s + 4C_{L}R_{L}s + 2G_{L}R_{L}s + 2G_{L}R_{L}s$$

10.45 INVALID-ORDER-45  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$ 

$$H(s) = \frac{L_L R_L s \left(-C_5 L_5 r_o s^2 + L_5 g_m r_o s + L_5 s - r_o\right)}{C_5 C_L L_5 L_L R_L r_o s^4 + 2 C_5 L_5 L_L R_L g_m r_o s^3 + 4 C_5 L_5 L_L R_L s^3 + C_5 L_5 L_L r_o s^3 + C_5 L_5 L_L R_L g_m r_o s^3 + C_L L_5 L_L R_L g_m r_o s^3 + C_L L_5 L_L R_L g_m r_o s^3 + C_L L_5 L_L R_L g_m r_o s^3 + L_5 L_L g_m r_o s^2 + L_5 L_L g_m r_o s^2 + L_5 L_L g_m r_o s + L_5 R_L g_m r_o s + L$$

10.46 INVALID-ORDER-46  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_{5}s}{C_5L_{5}s^2+1}, \frac{L_{L}s}{C_LL_Ls^2+1} + R_L\right)$ 

$$H(s) = -\frac{\left(C_{L}L_{L}S^{2} + L_{L}s + R_{L}\right)\left(C_{5}L_{5}r_{o}s^{2} - L_{5}g_{m}r_{o}s - L_{5}s + r_{o}\right)}{2C_{5}C_{L}L_{5}L_{L}g_{m}r_{o}s^{4} + 4C_{5}C_{L}L_{5}L_{L}r_{o}s^{4} + 2C_{5}L_{5}L_{L}g_{m}r_{o}s^{3} + 4C_{5}L_{5}L_{L}s^{3} + 2C_{5}L_{5}R_{L}g_{m}r_{o}s^{2} + 4C_{5}L_{5}L_{L}g_{m}r_{o}s^{2} + 4C_{L}L_{L}R_{L}g_{m}r_{o}s^{2} + 4C_$$

10.47 INVALID-ORDER-47  $Z(s) = \left(\infty, \ \infty, \ \infty, \ \frac{L_5 s}{C_5 L_5 s^2 + 1}, \ \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$ 

$$H(s) = -\frac{R_L \left( C_L L_L s^2 + 1 \right) \left( C_5 L_5 r_o s^2 - L_5 g_m r_o s - L_5 s + r_o \right)}{2 C_5 C_L L_5 L_L R_L g_m r_o s^4 + 4 C_5 C_L L_5 L_L r_o s^4 + C_5 C_L L_5 R_L r_o s^3 + 2 C_5 L_5 R_L g_m r_o s^2 + 4 C_5 L_5 R_L g_m r_o s^3 + C_L L_5 L_L g_m r_o s^3 + C_L L_5 R_L g_m r_o s^2 + 4 C_L L_L R_L g_m r_o s^2 + 4 C_L L_L R_L g_m r_o s^2 + 4 C_L L_L R_L g_m r_o s^2 + C_L L_5 R$$

10.48 INVALID-ORDER-48 
$$Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{1}{C_L s}\right)$$

$$H(s) = \frac{C_5L_5g_mr_os^2 + C_5L_5s^2 + C_5R_5g_mr_os + C_5R_5s - C_5r_os + g_mr_o + 1}{s\left(C_5C_LL_5g_mr_os^2 + C_5C_LL_5s^2 + C_5C_LR_5g_mr_os + C_5C_LR_5s + C_5C_Lr_os + 2C_5g_mr_o + 4C_5 + C_Lg_mr_o + C_L\right)}$$

10.49 INVALID-ORDER-49 
$$Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{R_L}{C_L R_L s + 1}\right)$$

$$H(s) = \frac{R_L \left( C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1 \right)}{C_5 C_L L_5 R_L g_m r_o s^3 + C_5 C_L L_5 R_L g_m r_o s^2 + C_5 C_L R_5 R_L g^2 + C_5 C_L R_5 R_L s^2 + C_5 C_L R_5 r_o s^2 + C_5 L_5 g_m r_o s^2 + C_5 L_5 g_m r_o s + C_5 R_5 g_m r_o s + C_5$$

10.50 INVALID-ORDER-50 
$$Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, R_L + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{\left(C_L R_L s + 1\right) \left(C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1\right)}{s \left(C_5 C_L L_5 g_m r_o s^2 + C_5 C_L R_5 g_m r_o s + C_5 C_L R_5 s + 2 C_5 C_L R_L g_m r_o s + 4 C_5 C_L R_L s + C_5 C_L r_o s + 2 C_5 g_m r_o + 4 C_5 + C_L g_m r_o + C_L\right)}$$

10.51 INVALID-ORDER-51 
$$Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, L_L s + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{\left(C_{L}L_{L}s^{2}+1\right)\left(C_{5}L_{5}g_{m}r_{o}s^{2}+C_{5}L_{5}s^{2}+C_{5}R_{5}g_{m}r_{o}s+C_{5}R_{5}s-C_{5}r_{o}s+g_{m}r_{o}+1\right)}{s\left(C_{5}C_{L}L_{5}g_{m}r_{o}s^{2}+C_{5}C_{L}L_{L}g_{m}r_{o}s^{2}+4C_{5}C_{L}L_{L}s^{2}+C_{5}C_{L}R_{5}g_{m}r_{o}s+C_{5}C_{L}R_{5}s+C_{5}C_{L}r_{o}s+2C_{5}g_{m}r_{o}+4C_{5}+C_{L}g_{m}r_{o}+C_{L}\right)}$$

10.52 INVALID-ORDER-52 
$$Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1}\right)$$

$$H(s) = \frac{L_L s \left(C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1\right)}{C_5 C_L L_5 L_L g_m r_o s^4 + C_5 C_L L_L R_5 g_m r_o s^3 + C_5 C_L L_L R_5 s^3 + C_5 C_L L_L r_o s^3 + C_5 L_5 g_m r_o s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s + C_5 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + g_m r_o + 1}$$

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

$$H(s) = \frac{\left(C_L L_L s^2 + C_L R_L s + 1\right) \left(C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1\right)}{s \left(C_5 C_L L_5 g_m r_o s^2 + C_5 C_L L_5 g^2 + 4 C_5 C_L L_5 s^2 + 4 C_5 C_L R_5 g_m r_o s + C_5 C_L R_5 g_m r_o s + 4 C_5 C_L R_5 g_m r_$$

10.54 INVALID-ORDER-54 
$$Z(s) = \left( \infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{1}{C_L s + \frac{1}{R_I} + \frac{1}{L_L s}} \right)$$

$$s) = \frac{L_L R_L s \left(C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1\right)}{C_5 C_L L_5 L_L R_5 r_o s^4 + C_5 C_L L_L R_5 R_L g_m r_o s^3 + C_5 C_L L_L R_5 R_L g_m r_o s^3 + C_5 L_L L_R g_m r_o s^3 + C_5 L_L R_5 g_m r_o s^2 + C_5 L_L R_5$$

10.55 INVALID-ORDER-55 
$$Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$$

$$H(s) = \frac{\left(C_{L}L_{L}R_{L}s^{2} + L_{L}s + R_{L}\right)\left(C_{5}L_{5}g_{m}r_{o}s^{2} + C_{5}L_{5}s^{2} + C_{5}R_{5}g_{m}r_{o}s + C_{5}r_{o}s + g_{m}r_{o} + 1\right)}{C_{5}C_{L}L_{5}L_{L}g_{m}r_{o}s^{4} + C_{5}C_{L}L_{L}R_{5}g_{m}r_{o}s^{3} + C_{5}C_{L}L_{L}R_{5}s^{3} + 2C_{5}C_{L}L_{L}R_{5}s^{3} + 2C_{5}C_{L}L_{L}R_{L}s^{3} + C_{5}C_{L}L_{L}R_{c}s^{3} + C_{5}L_{L}g_{m}r_{o}s^{2} + C_{5}L_{5}s^{2} + 2C_{5}L_{L}g_{m}r_{o}s^{2} + 4C_{5}L_{L}s^{2} + C_{5}R_{5}g_{m}r_{o}s + C_{5}R_{5}s + 2C_{5}R_{L}g_{m}r_{o}s + 4C_{5}R_{L}s + C_{5}r_{o}s + C_{L}L_{L}s^{2} + C_{5}R_{L}s^{2} + C_$$

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10.56 INVALID-ORDER-56 Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)
H(s) = \frac{R_L \left( C_L L_L s^2 + 1 \right) \left( C_5 L_5 g_m r_o s^2 + C_5 L_5 s^2 + C_5 R_5 g_m r_o s + C_5 R_5 s - C_5 r_o s + g_m r_o + 1 \right)}{C_5 C_L L_5 L_L g_m r_o s^4 + C_5 C_L L_5 L_L s^4 + C_5 C_L L_5 R_L g_m r_o s^3 + C_5 C_L L_L R_5 g_m r_o s^3 + C_5 C_L R_5 R_L g_m r_o s^3 
10.57 INVALID-ORDER-57 Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s + \frac{1}{R_5} + \frac{1}{L_5 s}}, \frac{1}{C_L s}\right)
10.58 INVALID-ORDER-58 Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s + \frac{1}{R_5} + \frac{1}{L_5 s}}, \frac{R_L}{C_L R_L s + 1}\right)
  H(s) = \frac{R_L \left( -C_5 L_5 R_5 r_o s^2 + L_5 R_5 g_m r_o s + L_5 R_5 s - L_5 r_o s - R_5 r_o \right)}{C_5 C_L L_5 R_5 R_L r_o s^3 + 2 C_5 L_5 R_5 R_L g_m r_o s^2 + 4 C_5 L_5 R_5 R_L s^2 + C_5 L_5 R_5 R_L g_m r_o s^2 + C_L L_5 R_5 R_L s^2 + C_L L_5 R_5 R_L r_o s^2 + C_L L_5 R_5 R_L r_o s + L_5 R_5 g_m r_o s + L
10.59 INVALID-ORDER-59 Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s + \frac{1}{R_5} + \frac{1}{L_5}}, R_L + \frac{1}{C_L s}\right)
H(s) = -\frac{\left(C_L R_L s + 1\right) \left(C_5 L_5 R_5 r_o s^2 - L_5 R_5 g_m r_o s - L_5 R_5 s + L_5 r_o s + R_5 r_o\right)}{2 C_5 C_L L_5 R_5 R_L g_m r_o s^3 + 4 C_5 C_L L_5 R_5 r_o s^3 + 2 C_5 L_5 R_5 g_m r_o s^2 + 4 C_5 L_5 R_5 g_m r_o s^2 + C_L L_5 R_5 g_m r_o s^2 + 2 C_L L_5 R_L g_m r_o s^2 + 2 C_L L_5 R_L g_m r_o s^2 + 2 C_L L_5 R_L g_m r_o s^2 + 2 C_L L_5 R_5 r_o s^2 + 2 C
10.60 INVALID-ORDER-60 Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s + \frac{1}{R_r} + \frac{1}{L_r s}}, L_L s + \frac{1}{C_L s}\right)
H(s) = -\frac{\left(C_L L_L s^2 + 1\right) \left(C_5 L_5 R_5 r_o s^2 - L_5 R_5 g_m r_o s - L_5 R_5 s + L_5 r_o s + R_5 r_o\right)}{2C_5 C_L L_5 L_L R_5 g_m r_o s^4 + 4C_5 C_L L_5 R_5 r_o s^3 + 2C_5 L_5 R_5 g_m r_o s^2 + 4C_5 L_5 R_5 g_m r_o s^3 + 4C_L L_5 L_L s^3 + C_L L_5 R_5 g_m r_o s^2 + 2C_L L_5 R_5 g_m r_o s^2 + 2C_L L_5 R_5 g_m r_o s^2 + 2C_L L_5 R_5 g_m r_o s^2 + 4C_L L_5 R_5 g_m r_
10.61 INVALID-ORDER-61 Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s + \frac{1}{R_E} + \frac{1}{L_E s}}, \frac{L_L s}{C_L L_L s^2 + 1}\right)
H(s) = \frac{L_L s \left(-C_5 L_5 R_5 r_o s^2 + L_5 R_5 g_m r_o s + L_5 R_5 s - L_5 r_o s - R_5 r_o\right)}{C_5 C_L L_5 L_L R_5 r_o s^4 + 2 C_5 L_5 L_L R_5 g_m r_o s^3 + 4 C_5 L_5 L_L R_5 s^3 + C_5 L_5 R_5 r_o s^2 + C_L L_5 L_L R_5 g_m r_o s^3 + C_L L_5 L_L R_5 r_o s^3 + C_L L_5 L_L R_5 r_o s^2 + 2 L_5 L_L g_m r_o s^2 + 4 L_5 L_L s^2 + L_5 R_5 g_m r_o s + L_5 R_5 s + L_5 r_o s + 2 L_L R_5 g_m r_o s + 4 L_L R_5 r_o s^2 + 2 L_5 R_5 r_o
10.62 INVALID-ORDER-62 Z(s) = \left( \infty, \infty, \infty, \infty, \frac{1}{C_5 s + \frac{1}{R_E} + \frac{1}{L_E s}}, L_L s + R_L + \frac{1}{C_L s} \right)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 (C_L L_L s^2 + C_L R_L s + 1) (C_5 L_5 R_5 r_o s^2 - L_5 R_5 g_m r_o s - L_5 R_5 s + L_5 r_o s + R_5 r_o)
H(s) = -\frac{\left(C_{L}L_{L}s^{2} + C_{L}R_{L}s + 1\right)\left(C_{5}L_{5}R_{5}r_{o}s^{2} - L_{5}R_{5}g_{m}r_{o}s - L_{5}R_{5}s + L_{5}r_{o}s + R_{5}r_{o}\right)}{2C_{5}C_{L}L_{5}L_{L}R_{5}g_{m}r_{o}s^{4} + 4C_{5}C_{L}L_{5}R_{5}g_{m}r_{o}s^{3} + 4C_{5}L_{L}S_{5}R_{5}g_{m}r_{o}s^{3} + 4C_{5}L_{5}R_{5}g_{m}r_{o}s^{3} + 4C_{5}L_{5}R_{5}g_{m}r_{o}s^{2} + 4C_{5}L_{5}
10.63 INVALID-ORDER-63 Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s + \frac{1}{R_5} + \frac{1}{L_5 s}}, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)
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 $\frac{\mathcal{L}_{L}\mathcal{L}_{L}\mathcal{L}_{S}\mathcal{L}_{C}(-C_{5}\mathcal{L}_{5}\mathcal{L}_{C})\sigma^{3} + \mathcal{L}_{5}\mathcal{L}_{S}\mathcal{L}_{S}\sigma^{3} + \mathcal{L}_{5}\mathcal{L}_{S}\mathcal{L}_{S}\sigma^{3} + \mathcal{L}_{5}\mathcal{L}_{L}\mathcal{L}_{S}\mathcal{L}_{S}\sigma^{3} + \mathcal{L}_{5}\mathcal{L}_{L}\mathcal{$ 

 $L_L R_L s \left( -C_5 L_5 R_5 r_o s^2 + L_5 R_5 g_m r_o s + L_5 R_5 s - L_5 r_o s - R_5 r_o \right)$ 

**10.64** INVALID-ORDER-64  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s + \frac{1}{R_5} + \frac{1}{L_5 s}}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$ 

 $(C_L L_L R_L s^2 + L_L s + R_L) (C_5 L_5 R_5 r_o s^2 - L_5 R_5 g_m r_o s - L_5 R_5 g$  $H(s) = -\frac{\left(C_L L_L R_L s^- + L_L s + R_L\right)\left(C_5 L_5 R_5 r_o s^2 - L_5 R_5 g_m r_o s^- - L_5 R_5 g_m r_o s^-$ 

10.65 INVALID-ORDER-65  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s + \frac{1}{R_{\pi}} + \frac{1}{L_{\pi} s}}, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_T s}}\right)$ 

 $R_L \left( C_L L_L s^2 + 1 \right) \left( C_5 L_5 R_5 r_o s^2 - L_5 R_5 g_m r_o s - L_5 R_5 s + 1 \right)$  $\frac{1}{2C_5C_LL_5L_LR_5R_Lg_mr_os^4 + 4C_5C_LL_5L_LR_5R_Ls^4 + C_5C_LL_5L_LR_5r_os^4 + C_5C_LL_5R_5R_Lr_os^3 + 2C_5L_5R_5R_Lg_mr_os^2 + 4C_5L_5R_5R_Ls^2 + C_5L_5R_5R_Ls^2 + C_5L_5L_LR_5g_mr_os^3 + C_LL_5L_LR_5g_mr_os^3 + 4C_LL_5L_LR_5s^3 + 2C_LL_5L_LR_5s^3 + 2$ 

**10.66** INVALID-ORDER-66  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_{5}s}{C_{5}L_{5}s^{2}+1} + R_{5}, \frac{1}{C_{L}s}\right)$ 

 $H(s) = \frac{C_5L_5R_5g_mr_os^2 + C_5L_5R_5s^2 - C_5L_5r_os^2 + L_5g_mr_os + L_5s + R_5g_mr_o + R_5 - r_o}{C_5C_LL_5R_5g_mr_os^3 + C_5C_LL_5R_5s^3 + C_5C_LL_5r_os^3 + 2C_5L_5g_mr_os^2 + 4C_5L_5s^2 + C_LL_5g_mr_os^2 + C_LL_5s^2 + C_LR_5g_mr_os + C_LR_5s + C_Lr_os + 2g_mr_o + 4C_5C_LL_5r_os^3 + C_5C_LL_5r_os^3 + 2C_5C_LL_5r_os^3 + 2C_5C_L$ 

**10.67** INVALID-ORDER-67  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \frac{R_L}{C_L R_L s + 1}\right)$ 

 $H(s) = \frac{R_L \left( C_5 L_5 R_5 g_m r_o s^2 + C_5 L_5 R_5 s^2 - C_5 L_5 r_o s^2 + L_5 g_m r_o s + L_5 s + R_5 g_m r_o + R_5 - r_o \right)}{C_5 C_L L_5 R_5 R_L g_m r_o s^3 + C_5 C_L L_5 R_L s^3 + C_5 C_L L_5 R_L r_o s^3 + C_5 L_5 R_5 g_m r_o s^2 + C_5 L_5 R_5 g_m r_o s^2 + 4 C_5 L_5 R_L s^2 + C_5 L_5 R_L g_m r_o s^2 + C_L L_5 R_L g_m r_o s^2 + C_L L_5 R_L g_m r_o s + C_L R_5 R_L g_m r_o s + L_5 g_m r_o$ 

**10.68** INVALID-ORDER-68  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, R_L + \frac{1}{C_L s}\right)$ 

 $H(s) = \frac{\left(C_L R_L s + 1\right) \left(C_5 L_5 R_5 g_m r_o s^2 + C_5 L_5 R_5 s^2 - C_5 L_5 r_o s^2 + L_5 g_m r_o s + L_5 s + R_5 g_m r_o + R_5 - r_o\right)}{C_5 C_L L_5 R_5 g_m r_o s^3 + C_5 C_L L_5 R_L g_m r_o s^3 + 4 C_5 C_L L_5 R_L s^3 + C_5 C_L L_5 r_o s^3 + 2 C_5 L_5 g_m r_o s^2 + 4 C_5 L_5 g_m r_o s^2 + C_L L_5 g_m r_o s^2 + C_L R_5 g_m r_o s + C_L R_5 s + 2 C_L R_L g_m r_o s + 4 C_L R_L s + C_L r_o s + 2 g_m r_o s + 4 C_L R_5 g_m r_o s^2 + C_L R_5 g_m r_o s^2 + C_L R_5 g_m r_o s^2 + C_L R_5 g_m r_o s + C_L$ 

**10.69** INVALID-ORDER-69  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, L_L s + \frac{1}{C_L s}\right)$ 

 $H(s) = \frac{\left(C_{L}L_{s}^{2}+1\right)\left(C_{5}L_{5}R_{5}g_{m}r_{o}s^{2}+C_{5}L_{5}R_{5}s^{2}-C_{5}L_{5}r_{o}s^{2}+L_{5}g_{m}r_{o}s+L_{5}s+R_{5}g_{m}r_{o}+R_{5}-r_{o}\right)}{2C_{5}C_{L}L_{5}L_{L}g_{m}r_{o}s^{4}+4C_{5}C_{L}L_{5}R_{5}g_{m}r_{o}s^{3}+C_{5}C_{L}L_{5}R_{5}s^{3}+C_{5}C_{L}L_{5}r_{o}s^{3}+2C_{5}L_{5}g_{m}r_{o}s^{2}+4C_{5}L_{5}s^{2}+C_{L}L_{5}g_{m}r_{o}s^{2}+4C_{L}L_{5}s^{2}+2C_{L}L_{2}g_{m}r_{o}s^{2}+4C_{L}L_{5}s^{2}+C_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{5}s^{2}+C_{L}R_{5}g_{m}r_{o}s^{2}+4C_{L}L_{5}s^{2}+C_{L}R_{5}g_{m}r_{o}s^{2}+C_{L}R_{$ 

10.70 INVALID-ORDER-70  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \frac{L_L s}{C_L L_L s^2 + 1}\right)$ 

 $H(s) = \frac{L_L s \left(C_5 L_5 R_5 g_m r_o s^2 + C_5 L_5 R_5 s^2 - C_5 L_5 r_o s^2 + L_5 g_m r_o s + L_5 s + R_5 g_m r_o + R_5 - r_o\right)}{C_5 C_L L_5 L_L R_5 g_m r_o s^4 + C_5 C_L L_5 L_L r_o s^4 + 2 C_5 L_5 L_L g_m r_o s^3 + 4 C_5 L_5 L_L s^3 + C_5 L_5 R_5 g_m r_o s^2 + C_5 L_5 R_5 s^2 + C_5 L_5 r_o s^2 + C_L L_5 L_L g_m r_o s^3 + C_L L_L R_5 g_m r_o s^2 + C_$ 

10.71 INVALID-ORDER-71  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, L_L s + R_L + \frac{1}{C_L s}\right)$ 

 $H(s) = \frac{\left(C_{L}L_{L}s^{2} + C_{L}R_{L}s + 1\right)\left(C_{5}L_{5}R_{5}g_{m}r_{o}s^{2} + C_{5}L_{5}R_{5}s^{2} - C_{5}L_{5}r_{o}s^{2} + L_{5}g_{m}r_{o}s + L_{5}s + R_{5}g_{m}r_{o} + R_{5} - r_{o}\right)}{2C_{5}C_{L}L_{5}L_{L}g_{m}r_{o}s^{4} + 4C_{5}C_{L}L_{5}R_{5}g_{m}r_{o}s^{3} + C_{5}C_{L}L_{5}R_{L}g_{m}r_{o}s^{3} + 2C_{5}L_{L}g_{m}r_{o}s^{2} + 4C_{5}L_{5}s^{2} + C_{L}L_{5}g_{m}r_{o}s^{2} + 4C_{L}L_{5}s^{2} + 2C_{L}L_{2}g_{m}r_{o}s^{2} + 4C_{L}L_{5}s^{2} + 2C_{L}L_{2}g_{m}r_{o}s^{2} + 4C_{L}L_{5}s^{2} + 2C_{L}L_{2}g_{m}r_{o}s^{2} + 4C_{L}L_{5}s^{2} + 2C_{L}L_{5}g_{m}r_{o}s^{2} + 2C_{L}L_{5}g_{m}r$ 

 $H(s) = \frac{L_L R_L s \left( C_5 L_5 R_5 g_m r_o s^4 + C_5 L_5 R_5 g_m r_o s^5 + C_5 L_5 R_5 s^5 - C_5 L_5 r_o s^5 + L_5 g_m r_o s^5 + L_5 g_m r_o s^5 + L_5 r_o$ 

 $L_L R_L s \left( C_5 L_5 R_5 g_m r_o s^2 + C_5 L_5 R_5 s^2 - C_5 L_5 r_o s^2 + L_5 g_m r_o s + L_5 s + R_5 r_o s^2 \right)$ 

10.72 INVALID-ORDER-72  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$ 

10.73 INVALID-ORDER-73  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$ 

10.80 INVALID-ORDER-80  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5\left(L_5 s + \frac{1}{C_5 s}\right)}{L_5 s + R_5 + \frac{1}{C_5 s}}, L_L s + R_L + \frac{1}{C_L s}\right)$ 

 $H(s) = \frac{\left(C_{L}L_{L}s^{2} + C_{L}R_{L}s + 1\right)\left(C_{5}L_{5}R_{5}g_{m}r_{o}s^{2} + C_{5}L_{5}R_{5}s^{2} - C_{5}L_{5}r_{o}s^{2} - C_{5}R_{5}r_{o}s + R_{5}g_{m}r_{o} + R_{5} - r_{o}\right)}{2C_{5}C_{L}L_{5}L_{L}g_{m}r_{o}s^{4} + 4C_{5}C_{L}L_{5}R_{5}g_{m}r_{o}s^{3} + 4C_{5}C_{L}L_{5}R_{5}g_{m}r_{o$ 

10.81 INVALID-ORDER-81  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5\left(L_5 s + \frac{1}{C_5 s}\right)}{L_5 s + R_5 + \frac{1}{C_5 s}}, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$ 

 $H(s) = \frac{L_L R_L s \left(C_5 L_5 R_5 g_m r_o s^2 + C_5 L_5 R_5 s^2 - C_5 L_5 r_o s^2 - C_5 R_5 r_o s + R_5 g_m r_o s^2 + C_5 L_5 R_5 r_o s^2 - C_5 R_5 r_o s^2 - C_5 R_5 r_o s + R_5 g_m r_o s^2 + C_5 L_5 R_5 R_L r_o s^4 + C_5 C_L L_5 L_L R_5 R_L r_o s^3 + C_5 L_5 L_L R_5 r_o s^3 + C_5 L_5 L_L R_5 r_o s^3 + C_5 L_5 R_L r_o s^3 + C_5$ 

10.82 INVALID-ORDER-82  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5\left(L_5 s + \frac{1}{C_5 s}\right)}{L_5 s + R_5 + \frac{1}{C_5 s}}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$ 

 $H(s) = \frac{\left(C_{L}L_{L}S^{2} + L_{L}s + R_{L}\right)\left(C_{5}L_{5}R_{5}g_{m}r_{o}s^{2} + C_{5}L_{5}R_{5}g_{m}r_{o}s^{2} + C_{5}L_{5}R_{5}g_$ 

10.83 INVALID-ORDER-83  $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5\left(L_5s + \frac{1}{C_5s}\right)}{L_5s + R_5 + \frac{1}{C_5s}}, \frac{R_L\left(L_Ls + \frac{1}{C_Ls}\right)}{L_Ls + R_L + \frac{1}{C_Ls}}\right)$ 

 $H(s) = \frac{RL\left(C_LL_LS + 1\right)\left(C_5L_5R_5g_mr_os^4 + C_5C_LL_5L_LR_5g^4 + 2C_5C_LL_5L_LR_5g^4 + 4C_5C_LL_5L_LR_5g^4 + C_5C_LL_5R_5R_Lg^3 + C_5C_LL_5R_Lg^3 + C_5C_LL$