

Filter Summary Report: TIA,simple,Z5,ZL

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Contents

1 Examined $H(z)$ for TIA simple Z5 ZL: $\frac{Z_L(Z_5g_m-1)}{Z_5g_m+2Z_Lg_m+1}$

$$H(z) = \frac{Z_L (Z_5g_m - 1)}{Z_5g_m + 2Z_Lg_m + 1}$$

2 HP

3 BP

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

$$H(s) = \frac{L_L s (Z_5g_m - 1)}{C_L L_L Z_5g_m s^2 + C_L L_L s^2 + 2L_L g_m s + Z_5g_m + 1}$$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (Z_5g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (Z_5g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5g_m - 1}{2g_m}$
 Qz: 0
 Wz: None

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

$$H(s) = \frac{L_L R_L s (Z_5g_m - 1)}{C_L L_L R_L Z_5g_m s^2 + C_L L_L R_L s^2 + 2L_L R_L g_m s + L_L Z_5g_m s + L_L s + R_L Z_5g_m + R_L}$$

Parameters:

Q: $\frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (Z_5g_m + 1)}{2R_L g_m + Z_5g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5g_m + 1}{C_L R_L (Z_5g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L (Z_5g_m - 1)}{2R_L g_m + Z_5g_m + 1}$
 Qz: 0
 Wz: None

3.3 BP-3 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (Z_5g_m - 1)}{C_L L_L Z_5g_m s^2 + C_L L_L s^2 + 2L_L g_m s + Z_5g_m + 1}$$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (Z_5g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (Z_5g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5g_m - 1}{2g_m}$

Qz: 0
Wz: None

3.4 BP-4 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, \frac{L_L R_L s}{C_L L_L R_L s^2 + L_L s + R_L} \right)$

$$H(s) = \frac{L_L R_L s (Z_5 g_m - 1)}{C_L L_L R_L Z_5 g_m s^2 + C_L L_L R_L s^2 + 2L_L R_L g_m s + L_L Z_5 g_m s + L_L s + R_L Z_5 g_m + R_L}$$

Parameters:

Q: $\frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2R_L g_m + Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5 g_m + 1}{C_L R_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 Qz: 0
 Wz: None

3.5 BP-5 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (Z_5 g_m - 1)}{C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: 0
 Wz: None

3.6 BP-6 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, \frac{L_L R_L s}{C_L L_L R_L s^2 + L_L s + R_L} \right)$

$$H(s) = \frac{L_L R_L s (Z_5 g_m - 1)}{C_L L_L R_L Z_5 g_m s^2 + C_L L_L R_L s^2 + 2L_L R_L g_m s + L_L Z_5 g_m s + L_L s + R_L Z_5 g_m + R_L}$$

Parameters:

Q: $\frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2R_L g_m + Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5 g_m + 1}{C_L R_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 Qz: 0
 Wz: None

3.7 BP-7 $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (Z_5 g_m - 1)}{C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: 0
 Wz: None

3.8 BP-8 $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, \frac{L_L R_L s}{C_L L_L R_L s^2 + L_L s + R_L} \right)$

$$H(s) = \frac{L_L R_L s (Z_5 g_m - 1)}{C_L L_L R_L Z_5 g_m s^2 + C_L L_L R_L s^2 + 2L_L R_L g_m s + L_L Z_5 g_m s + L_L s + R_L Z_5 g_m + R_L}$$

Parameters:

Q: $\frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2R_L g_m + Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5 g_m + 1}{C_L R_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 Qz: 0
 Wz: None

3.9 BP-9 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (Z_5 g_m - 1)}{C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: 0
 Wz: None

3.10 BP-10 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{L_L R_L s}{C_L L_L R_L s^2 + L_L s + R_L} \right)$

$$H(s) = \frac{L_L R_L s (Z_5 g_m - 1)}{C_L L_L R_L Z_5 g_m s^2 + C_L L_L R_L s^2 + 2L_L R_L g_m s + L_L Z_5 g_m s + L_L s + R_L Z_5 g_m + R_L}$$

Parameters:

Q: $\frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2R_L g_m + Z_5 g_m + 1}$

wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5 g_m + 1}{C_L R_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 Qz: 0
 Wz: None

3.11 BP-11 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (Z_5 g_m - 1)}{C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: 0
 Wz: None

3.12 BP-12 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \frac{L_L R_L s}{C_L L_L R_L s^2 + L_L s + R_L} \right)$

$$H(s) = \frac{L_L R_L s (Z_5 g_m - 1)}{C_L L_L R_L Z_5 g_m s^2 + C_L L_L R_L s^2 + 2L_L R_L g_m s + L_L Z_5 g_m s + L_L s + R_L Z_5 g_m + R_L}$$

Parameters:

Q: $\frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2R_L g_m + Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5 g_m + 1}{C_L R_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 Qz: 0
 Wz: None

3.13 BP-13 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (Z_5 g_m - 1)}{C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: 0
 Wz: None

3.14 BP-14 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{L_L R_L s}{C_L L_L R_L s^2 + L_L s + R_L} \right)$

$$H(s) = \frac{L_L R_L s (Z_5 g_m - 1)}{C_L L_L R_L Z_5 g_m s^2 + C_L L_L R_L s^2 + 2L_L R_L g_m s + L_L Z_5 g_m s + L_L s + R_L Z_5 g_m + R_L}$$

Parameters:

Q: $\frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2R_L g_m + Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5 g_m + 1}{C_L R_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 Qz: 0
 Wz: None

3.15 BP-15 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (Z_5 g_m - 1)}{C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: 0
 Wz: None

3.16 BP-16 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \frac{L_L R_L s}{C_L L_L R_L s^2 + L_L s + R_L} \right)$

$$H(s) = \frac{L_L R_L s (Z_5 g_m - 1)}{C_L L_L R_L Z_5 g_m s^2 + C_L L_L R_L s^2 + 2L_L R_L g_m s + L_L Z_5 g_m s + L_L s + R_L Z_5 g_m + R_L}$$

Parameters:

Q: $\frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2R_L g_m + Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5 g_m + 1}{C_L R_L (Z_5 g_m + 1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 Qz: 0
 Wz: None

3.17 BP-17 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \frac{L_L s}{C_L L_L s^2 + 1} \right)$

$$H(s) = \frac{L_L s (Z_5 g_m - 1)}{C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (Z_5 g_m + 1)}{2g_m}$

wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L(Z_5g_m+1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5g_m-1}{2g_m}$
 Qz: 0
 Wz: None

3.18 BP-18 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5s}{C_5L_5s^2+1} + R_5, \frac{L_LR_Ls}{C_LL_LR_Ls^2+L_Ls+R_L} \right)$

$$H(s) = \frac{L_LR_Ls(Z_5g_m-1)}{C_LL_LR_LZ_5g_ms^2 + C_LL_LR_Ls^2 + 2L_LR_Lg_ms + L_LZ_5g_ms + L_Ls + R_LZ_5g_m + R_L}$$

Parameters:

Q: $\frac{C_LR_L\sqrt{\frac{1}{C_LL_L}}(Z_5g_m+1)}{2R_Lg_m+Z_5g_m+1}$
 wo: $\sqrt{\frac{1}{C_LL_L}}$
 bandwidth: $\frac{2R_Lg_m+Z_5g_m+1}{C_LR_L(Z_5g_m+1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L(Z_5g_m-1)}{2R_Lg_m+Z_5g_m+1}$
 Qz: 0
 Wz: None

3.19 BP-19 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5(C_5L_5s^2+1)}{C_5L_5s^2+C_5R_5s+1}, \frac{L_Ls}{C_LL_Ls^2+1} \right)$

$$H(s) = \frac{L_Ls(Z_5g_m-1)}{C_LL_LZ_5g_ms^2 + C_LL_Ls^2 + 2L_Lg_ms + Z_5g_m + 1}$$

Parameters:

Q: $\frac{C_L\sqrt{\frac{1}{C_LL_L}}(Z_5g_m+1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_LL_L}}$
 bandwidth: $\frac{2g_m}{C_L(Z_5g_m+1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{Z_5g_m-1}{2g_m}$
 Qz: 0
 Wz: None

3.20 BP-20 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5(C_5L_5s^2+1)}{C_5L_5s^2+C_5R_5s+1}, \frac{L_LR_Ls}{C_LL_LR_Ls^2+L_Ls+R_L} \right)$

$$H(s) = \frac{L_LR_Ls(Z_5g_m-1)}{C_LL_LR_LZ_5g_ms^2 + C_LL_LR_Ls^2 + 2L_LR_Lg_ms + L_LZ_5g_ms + L_Ls + R_LZ_5g_m + R_L}$$

Parameters:

Q: $\frac{C_LR_L\sqrt{\frac{1}{C_LL_L}}(Z_5g_m+1)}{2R_Lg_m+Z_5g_m+1}$
 wo: $\sqrt{\frac{1}{C_LL_L}}$
 bandwidth: $\frac{2R_Lg_m+Z_5g_m+1}{C_LR_L(Z_5g_m+1)}$
 K-LP: 0
 K-HP: 0
 K-BP: $\frac{R_L(Z_5g_m-1)}{2R_Lg_m+Z_5g_m+1}$
 Qz: 0
 Wz: None

4 LP

5 BS

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

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

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

Parameters:

$$\begin{aligned} \text{Q: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{R_L (Z_5 g_m + 1)} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{R_L (Z_5 g_m + 1)}{L_L (2R_L g_m + Z_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-HP: } & \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

5.3 BS-3 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, L_L s + \frac{1}{C_L s} \right)$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2g_m}$$

$$H(s) = \frac{R_L (Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2g_m}$$

5.4 BS-4 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{1}{C_5 s}, \frac{R_L(C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{L_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{R_L (Z_5 g_m + 1)}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{R_L (Z_5 g_m + 1)}{L_L (2R_L g_m + Z_5 g_m + 1)}$
 K-LP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-HP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-BP: 0
 Qz: None
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.5 BS-5 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

Q: $\frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{Z_5 g_m + 1}{2L_L g_m}$
 K-LP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-HP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-BP: 0
 Qz: None
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.6 BS-6 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, \frac{R_L(C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{L_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{R_L (Z_5 g_m + 1)}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{R_L (Z_5 g_m + 1)}{L_L (2R_L g_m + Z_5 g_m + 1)}$
 K-LP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-HP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-BP: 0
 Qz: None
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.7 BS-7 $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, L_L s + \frac{1}{C_L s} \right)$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

5.8 BS-8 $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, \frac{R_L (C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{R_L (Z_5 g_m + 1)} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{R_L (Z_5 g_m + 1)}{L_L (2R_L g_m + Z_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-HP: } & \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

5.9 BS-9 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, L_L s + \frac{1}{C_L s} \right)$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & 0 \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2g_m}$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2g_m}$$

5.10 BS-10 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{R_L(C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{L_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{R_L (Z_5 g_m + 1)}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{R_L (Z_5 g_m + 1)}{L_L (2R_L g_m + Z_5 g_m + 1)}$
 K-LP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-HP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-BP: 0
 Qz: None
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.11 BS-11 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

Q: $\frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{Z_5 g_m + 1}{2L_L g_m}$
 K-LP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-HP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-BP: 0
 Qz: None
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.12 BS-12 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \frac{R_L (C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{L_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{R_L (Z_5 g_m + 1)}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{R_L (Z_5 g_m + 1)}{L_L (2R_L g_m + Z_5 g_m + 1)}$
 K-LP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-HP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-BP: 0
 Qz: None
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.13 BS-13 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

Q: $\frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{Z_5 g_m + 1}{2L_L g_m}$
 K-LP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-HP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-BP: 0
 Qz: None
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.14 BS-14 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{R_L (C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{L_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{R_L (Z_5 g_m + 1)}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{R_L (Z_5 g_m + 1)}{L_L (2R_L g_m + Z_5 g_m + 1)}$
 K-LP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-HP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-BP: 0
 Qz: None
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.15 BS-15 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

Q: $\frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{Z_5 g_m + 1}{2L_L g_m}$
 K-LP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-HP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-BP: 0
 Qz: None
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.16 BS-16 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \frac{R_L (C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2 C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2 R_L g_m + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{L_L \sqrt{\frac{1}{C_L L_L}} (2 R_L g_m + Z_5 g_m + 1)}{R_L (Z_5 g_m + 1)}$
wo: $\sqrt{\frac{1}{C_L L_L}}$
bandwidth: $\frac{R_L (Z_5 g_m + 1)}{L_L (2 R_L g_m + Z_5 g_m + 1)}$
K-LP: $\frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1}$
K-HP: $\frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1}$
K-BP: 0
Qz: None
Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.17 BS-17 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, L_L s + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2 C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2 g_m}$$

Parameters:

Q: $\frac{2 L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1}$
wo: $\sqrt{\frac{1}{C_L L_L}}$
bandwidth: $\frac{Z_5 g_m + 1}{2 L_L g_m}$
K-LP: $\frac{Z_5 g_m - 1}{2 g_m}$
K-HP: $\frac{Z_5 g_m - 1}{2 g_m}$
K-BP: 0
Qz: None
Wz: $\sqrt{\frac{1}{C_L L_L}}$

5.18 BS-18 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \frac{R_L (C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_L s + 1} \right)$

$$H(s) = \frac{R_L (Z_5 g_m - 1) (C_L L_L s^2 + 1)}{2 C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2 R_L g_m + Z_5 g_m + 1}$$

Parameters:

Q: $\frac{L_L \sqrt{\frac{1}{C_L L_L}} (2 R_L g_m + Z_5 g_m + 1)}{R_L (Z_5 g_m + 1)}$
wo: $\sqrt{\frac{1}{C_L L_L}}$
bandwidth: $\frac{R_L (Z_5 g_m + 1)}{L_L (2 R_L g_m + Z_5 g_m + 1)}$
K-LP: $\frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1}$
K-HP: $\frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1}$
K-BP: 0
Qz: None
Wz: $\sqrt{\frac{1}{C_L L_L}}$

$$\mathbf{5.19 \quad BS-19} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5(C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, L_L s + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L s^2 + 1)}{2C_L L_L g_m s^2 + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

$$\begin{aligned} \text{Q:} & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{Z_5 g_m + 1} \\ \text{wo:} & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth:} & \frac{Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP:} & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP:} & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP:} & 0 \\ \text{Qz:} & \text{None} \\ \text{Wz:} & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

$$\mathbf{5.20 \quad BS-20} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5(C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \frac{R_L(C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L(Z_5 g_m - 1)(C_L L_L s^2 + 1)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

$$\begin{aligned} \text{Q:} & \frac{L_L \sqrt{\frac{1}{C_L L_L}}(2R_L g_m + Z_5 g_m + 1)}{R_L(Z_5 g_m + 1)} \\ \text{wo:} & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth:} & \frac{R_L(Z_5 g_m + 1)}{L_L(2R_L g_m + Z_5 g_m + 1)} \\ \text{K-LP:} & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-HP:} & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-BP:} & 0 \\ \text{Qz:} & \text{None} \\ \text{Wz:} & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6 GE

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

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L g_m s^2 + 2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

$$\begin{aligned} \text{Q:} & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2R_L g_m + Z_5 g_m + 1} \\ \text{wo:} & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth:} & \frac{2R_L g_m + Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP:} & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP:} & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP:} & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{Qz:} & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{Wz:} & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

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

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (2R_L g_m + Z_5 g_m + 1)}$
 K-LP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-HP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: $C_L R_L \sqrt{\frac{1}{C_L L_L}}$
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

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

Parameters:

Q: $\frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2R_L g_m + Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5 g_m + 1}{2L_L g_m}$
 K-LP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-HP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-BP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 Qz: $\frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L}$
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

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

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (2R_L g_m + Z_5 g_m + 1)}$
 K-LP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-HP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: $C_L R_L \sqrt{\frac{1}{C_L L_L}}$
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L R_L s^2 + L_L s + R_L)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + 2R_L g_m + Z_5 g_m + 1}$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L g_m s^2 + 2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L R_L s^2 + L_L s + R_L)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + 2R_L g_m + Z_5 g_m + 1}$$

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

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L g_m s^2 + 2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2R_L g_m + Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2R_L g_m + Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{QZ: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{WZ: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

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

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L R_L s^2 + L_L s + R_L)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_L \sqrt{\frac{1}{C_L L_L}}(2R_L g_m + Z_5 g_m + 1)}{2g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2g_m}{C_L(2R_L g_m + Z_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-HP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-BP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{QZ: } & C_L R_L \sqrt{\frac{1}{C_L L_L}} \\ \text{WZ: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.7 GE-7 $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L g_m s^2 + 2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2R_L g_m + Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2R_L g_m + Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{QZ: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{WZ: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.8 GE-8 $Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (2R_L g_m + Z_5 g_m + 1)}$
 K-LP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-HP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: $C_L R_L \sqrt{\frac{1}{C_L L_L}}$
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L R_L s^2 + L_L s + R_L)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + 2R_L g_m + Z_5 g_m + 1}$$

6.9 GE-9 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, L_L s + R_L + \frac{1}{C_L s} \right)$

Parameters:

Q: $\frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2R_L g_m + Z_5 g_m + 1}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2R_L g_m + Z_5 g_m + 1}{2L_L g_m}$
 K-LP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-HP: $\frac{Z_5 g_m - 1}{2g_m}$
 K-BP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 Qz: $\frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L}$
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L g_m s^2 + 2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

6.10 GE-10 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

Parameters:

Q: $\frac{C_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{2g_m}$
 wo: $\sqrt{\frac{1}{C_L L_L}}$
 bandwidth: $\frac{2g_m}{C_L (2R_L g_m + Z_5 g_m + 1)}$
 K-LP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-HP: $\frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$
 K-BP: $\frac{Z_5 g_m - 1}{2g_m}$
 Qz: $C_L R_L \sqrt{\frac{1}{C_L L_L}}$
 Wz: $\sqrt{\frac{1}{C_L L_L}}$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L R_L s^2 + L_L s + R_L)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + 2R_L g_m + Z_5 g_m + 1}$$

$$\mathbf{6.11 \quad GE-11} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, L_L s + R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L g_m s^2 + 2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2R_L g_m + Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2R_L g_m + Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{QZ: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{WZ: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

$$\mathbf{6.12 \quad GE-12} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$$

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L R_L s^2 + L_L s + R_L)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_L \sqrt{\frac{1}{C_L L_L}}(2R_L g_m + Z_5 g_m + 1)}{2g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2g_m}{C_L(2R_L g_m + Z_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-HP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-BP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{QZ: } & C_L R_L \sqrt{\frac{1}{C_L L_L}} \\ \text{WZ: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

$$\mathbf{6.13 \quad GE-13} \quad Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, L_L s + R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L g_m s^2 + 2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2R_L g_m + Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2R_L g_m + Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{QZ: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{WZ: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.14 GE-14 $Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L R_L s^2 + L_L s + R_L)}{2 C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2 L_L g_m s + 2 R_L g_m + Z_5 g_m + 1}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_L \sqrt{\frac{1}{C_L L_L}} (2 R_L g_m + Z_5 g_m + 1)}{2 g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2 g_m}{C_L (2 R_L g_m + Z_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1} \\ \text{K-HP: } & \frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1} \\ \text{K-BP: } & \frac{Z_5 g_m - 1}{2 g_m} \\ \text{Qz: } & C_L R_L \sqrt{\frac{1}{C_L L_L}} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.15 GE-15 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L s^2 + C_L R_L s + 1)}{2 C_L L_L g_m s^2 + 2 C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2 g_m}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2 L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2 R_L g_m + Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2 R_L g_m + Z_5 g_m + 1}{2 L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2 g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2 g_m} \\ \text{K-BP: } & \frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1} \\ \text{Qz: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.16 GE-16 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L L_L R_L s^2 + L_L s + R_L)}{2 C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2 L_L g_m s + 2 R_L g_m + Z_5 g_m + 1}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_L \sqrt{\frac{1}{C_L L_L}} (2 R_L g_m + Z_5 g_m + 1)}{2 g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2 g_m}{C_L (2 R_L g_m + Z_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1} \\ \text{K-HP: } & \frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1} \\ \text{K-BP: } & \frac{Z_5 g_m - 1}{2 g_m} \\ \text{Qz: } & C_L R_L \sqrt{\frac{1}{C_L L_L}} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.17 GE-17 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L g_m s^2 + 2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2R_L g_m + Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2R_L g_m + Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{Qz: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.18 GE-18 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right)$

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L R_L s^2 + L_L s + R_L)}{2C_L L_L R_L g_m s^2 + C_L L_L Z_5 g_m s^2 + C_L L_L s^2 + 2L_L g_m s + 2R_L g_m + Z_5 g_m + 1}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{C_L \sqrt{\frac{1}{C_L L_L}} (2R_L g_m + Z_5 g_m + 1)}{2g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2g_m}{C_L (2R_L g_m + Z_5 g_m + 1)} \\ \text{K-LP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-HP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{K-BP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{Qz: } & C_L R_L \sqrt{\frac{1}{C_L L_L}} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.19 GE-19 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5(C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, L_L s + R_L + \frac{1}{C_L s} \right)$

$$H(s) = \frac{(Z_5 g_m - 1)(C_L L_L s^2 + C_L R_L s + 1)}{2C_L L_L g_m s^2 + 2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

Parameters:

$$\begin{aligned} \text{Q: } & \frac{2L_L g_m \sqrt{\frac{1}{C_L L_L}}}{2R_L g_m + Z_5 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } & \frac{2R_L g_m + Z_5 g_m + 1}{2L_L g_m} \\ \text{K-LP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-HP: } & \frac{Z_5 g_m - 1}{2g_m} \\ \text{K-BP: } & \frac{R_L(Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1} \\ \text{Qz: } & \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_L} \\ \text{Wz: } & \sqrt{\frac{1}{C_L L_L}} \end{aligned}$$

6.20 GE-20 $Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5(C_5L_5s^2+1)}{C_5L_5s^2+C_5R_5s+1}, \frac{L_Ls}{C_LL_Ls^2+1} + R_L \right)$

$$H(s) = \frac{(Z_5g_m - 1)(C_LL_LR_Ls^2 + L_Ls + R_L)}{2C_LL_LR_Lg_ms^2 + C_LL_LZ_5g_ms^2 + C_LL_Ls^2 + 2L_Lg_ms + 2R_Lg_m + Z_5g_m + 1}$$

Parameters:

Q: $\frac{C_L\sqrt{\frac{1}{C_LL_L}}(2R_Lg_m+Z_5g_m+1)}{2g_m}$

wo: $\sqrt{\frac{1}{C_LL_L}}$

bandwidth: $\frac{2g_m}{C_L(2R_Lg_m+Z_5g_m+1)}$

K-LP: $\frac{R_L(Z_5g_m-1)}{2R_Lg_m+Z_5g_m+1}$

K-HP: $\frac{R_L(Z_5g_m-1)}{2R_Lg_m+Z_5g_m+1}$

K-BP: $\frac{Z_5g_m-1}{2g_m}$

Qz: $C_LR_L\sqrt{\frac{1}{C_LL_L}}$

Wz: $\sqrt{\frac{1}{C_LL_L}}$

7 AP

8 INVALID-NUMER

9 INVALID-WZ

10 INVALID-ORDER

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

$$H(s) = \frac{R_L(Z_5g_m - 1)}{2R_Lg_m + Z_5g_m + 1}$$

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

$$H(s) = \frac{Z_5g_m - 1}{C_LZ_5g_ms + C_Ls + 2g_m}$$

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

$$H(s) = \frac{R_L(Z_5g_m - 1)}{C_LR_LZ_5g_ms + C_LR_Ls + 2R_Lg_m + Z_5g_m + 1}$$

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

$$H(s) = \frac{(Z_5g_m - 1)(C_LR_Ls + 1)}{2C_LR_Lg_ms + C_LZ_5g_ms + C_Ls + 2g_m}$$

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

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$$

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

$$H(s) = \frac{Z_5 g_m - 1}{C_L Z_5 g_m s + C_L s + 2g_m}$$

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

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

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

$$H(s) = \frac{(Z_5 g_m - 1) (C_L R_L s + 1)}{2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

$$10.9 \quad \text{INVALID-ORDER-9} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, R_L \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$$

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

$$H(s) = \frac{Z_5 g_m - 1}{C_L Z_5 g_m s + C_L s + 2g_m}$$

$$10.11 \quad \text{INVALID-ORDER-11} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

$$10.12 \quad \text{INVALID-ORDER-12} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5}{C_5 R_5 s + 1}, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L R_L s + 1)}{2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

$$10.13 \quad \text{INVALID-ORDER-13} \quad Z(s) = \left(\infty, \infty, \infty, \infty, R_5 + \frac{1}{C_5 s}, R_L \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$$

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

$$H(s) = \frac{Z_5 g_m - 1}{C_L Z_5 g_m s + C_L s + 2g_m}$$

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

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{C_L R_L Z_5 g_m s + C_L R_L s + 2 R_L g_m + Z_5 g_m + 1}$$

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

$$H(s) = \frac{(Z_5 g_m - 1) (C_L R_L s + 1)}{2 C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2 g_m}$$

$$10.17 \quad \text{INVALID-ORDER-17} \quad Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, R_L \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1}$$

$$10.18 \quad \text{INVALID-ORDER-18} \quad Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{1}{C_L s} \right)$$

$$H(s) = \frac{Z_5 g_m - 1}{C_L Z_5 g_m s + C_L s + 2 g_m}$$

$$10.19 \quad \text{INVALID-ORDER-19} \quad Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{C_L R_L Z_5 g_m s + C_L R_L s + 2 R_L g_m + Z_5 g_m + 1}$$

$$10.20 \quad \text{INVALID-ORDER-20} \quad Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + \frac{1}{C_5 s}, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L R_L s + 1)}{2 C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2 g_m}$$

$$10.21 \quad \text{INVALID-ORDER-21} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, R_L \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1}$$

$$10.22 \quad \text{INVALID-ORDER-22} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \frac{1}{C_L s} \right)$$

$$H(s) = \frac{Z_5 g_m - 1}{C_L Z_5 g_m s + C_L s + 2 g_m}$$

$$10.23 \quad \text{INVALID-ORDER-23} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{C_L R_L Z_5 g_m s + C_L R_L s + 2 R_L g_m + Z_5 g_m + 1}$$

$$10.24 \quad \text{INVALID-ORDER-24} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1}, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L R_L s + 1)}{2 C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2 g_m}$$

$$10.25 \quad \text{INVALID-ORDER-25} \quad Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, R_L \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$$

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

$$H(s) = \frac{Z_5 g_m - 1}{C_L Z_5 g_m s + C_L s + 2g_m}$$

$$10.27 \quad \text{INVALID-ORDER-27} \quad Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

$$10.28 \quad \text{INVALID-ORDER-28} \quad Z(s) = \left(\infty, \infty, \infty, \infty, L_5 s + R_5 + \frac{1}{C_5 s}, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L R_L s + 1)}{2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

$$10.29 \quad \text{INVALID-ORDER-29} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, R_L \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$$

$$10.30 \quad \text{INVALID-ORDER-30} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \frac{1}{C_L s} \right)$$

$$H(s) = \frac{Z_5 g_m - 1}{C_L Z_5 g_m s + C_L s + 2g_m}$$

$$10.31 \quad \text{INVALID-ORDER-31} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{C_L R_L Z_5 g_m s + C_L R_L s + 2R_L g_m + Z_5 g_m + 1}$$

$$10.32 \quad \text{INVALID-ORDER-32} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 R_5 s}{C_5 L_5 R_5 s^2 + L_5 s + R_5}, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L R_L s + 1)}{2C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2g_m}$$

$$10.33 \quad \text{INVALID-ORDER-33} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, R_L \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{2R_L g_m + Z_5 g_m + 1}$$

$$10.34 \quad \text{INVALID-ORDER-34} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \frac{1}{C_L s} \right)$$

$$H(s) = \frac{Z_5 g_m - 1}{C_L Z_5 g_m s + C_L s + 2g_m}$$

$$10.35 \quad \text{INVALID-ORDER-35} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{C_L R_L Z_5 g_m s + C_L R_L s + 2 R_L g_m + Z_5 g_m + 1}$$

$$10.36 \quad \text{INVALID-ORDER-36} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{L_5 s}{C_5 L_5 s^2 + 1} + R_5, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L R_L s + 1)}{2 C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2 g_m}$$

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

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{2 R_L g_m + Z_5 g_m + 1}$$

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

$$H(s) = \frac{Z_5 g_m - 1}{C_L Z_5 g_m s + C_L s + 2 g_m}$$

$$10.39 \quad \text{INVALID-ORDER-39} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5 (C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, \frac{R_L}{C_L R_L s + 1} \right)$$

$$H(s) = \frac{R_L (Z_5 g_m - 1)}{C_L R_L Z_5 g_m s + C_L R_L s + 2 R_L g_m + Z_5 g_m + 1}$$

$$10.40 \quad \text{INVALID-ORDER-40} \quad Z(s) = \left(\infty, \infty, \infty, \infty, \frac{R_5 (C_5 L_5 s^2 + 1)}{C_5 L_5 s^2 + C_5 R_5 s + 1}, R_L + \frac{1}{C_L s} \right)$$

$$H(s) = \frac{(Z_5 g_m - 1) (C_L R_L s + 1)}{2 C_L R_L g_m s + C_L Z_5 g_m s + C_L s + 2 g_m}$$