

# Filter Summary Report: CG,TIA,simple,Z1,Z2

Generated by MacAnalog-Symbolix

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## Contents

<b>1</b>	<b>Examined <math>H(z)</math> for CG TIA simple Z1 Z2:</b>	$\frac{Z_1 Z_2 Z_L g_m + Z_1 Z_L}{Z_1 Z_2 g_m + Z_1 + Z_2 + Z_L}$	<b>4</b>
<b>2</b>	<b>HP</b>		<b>4</b>
<b>3</b>	<b>BP</b>		<b>4</b>
3.1	BP-1 $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, R_2, \infty, \infty, \infty \right)$		4
3.2	BP-2 $Z(s) = \left( \frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1}, R_2, \infty, \infty, \infty \right)$		4
<b>4</b>	<b>LP</b>		<b>4</b>
<b>5</b>	<b>BS</b>		<b>4</b>
5.1	BS-1 $Z(s) = \left( L_1 s + \frac{1}{C_1 s}, R_2, \infty, \infty, \infty \right)$		5
5.2	BS-2 $Z(s) = \left( \frac{R_1 (C_1 L_1 s^2 + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1}, R_2, \infty, \infty, \infty \right)$		5
<b>6</b>	<b>GE</b>		<b>5</b>
6.1	GE-1 $Z(s) = \left( R_1, L_2 s + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		5
6.2	GE-2 $Z(s) = \left( R_1, L_2 s + R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		6
6.3	GE-3 $Z(s) = \left( R_1, \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \infty, \infty, \infty \right)$		6
6.4	GE-4 $Z(s) = \left( R_1, \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \infty, \infty, \infty \right)$		6
6.5	GE-5 $Z(s) = \left( L_1 s + R_1 + \frac{1}{C_1 s}, R_2, \infty, \infty, \infty \right)$		7
6.6	GE-6 $Z(s) = \left( \frac{C_1 L_1 R_1 s^2 + L_1 s + R_1}{C_1 L_1 s^2 + 1}, R_2, \infty, \infty, \infty \right)$		7
<b>7</b>	<b>AP</b>		<b>7</b>
<b>8</b>	<b>INVALID-NUMER</b>		<b>7</b>
8.1	INVALID-NUMER-1 $Z(s) = \left( L_1 s, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		7
8.2	INVALID-NUMER-2 $Z(s) = \left( L_1 s, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$		8
8.3	INVALID-NUMER-3 $Z(s) = \left( L_1 s, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		8
8.4	INVALID-NUMER-4 $Z(s) = \left( \frac{1}{C_1 s}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		8
8.5	INVALID-NUMER-5 $Z(s) = \left( \frac{1}{C_1 s}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$		9
8.6	INVALID-NUMER-6 $Z(s) = \left( \frac{1}{C_1 s}, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		9
8.7	INVALID-NUMER-7 $Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		9
8.8	INVALID-NUMER-8 $Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$		10
8.9	INVALID-NUMER-9 $Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		10
<b>9</b>	<b>INVALID-WZ</b>		<b>10</b>
9.1	INVALID-WZ-1 $Z(s) = \left( R_1 + \frac{1}{C_1 s}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		10
9.2	INVALID-WZ-2 $Z(s) = \left( R_1 + \frac{1}{C_1 s}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$		11
9.3	INVALID-WZ-3 $Z(s) = \left( R_1 + \frac{1}{C_1 s}, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$		11

<b>10 INVALID-ORDER</b>	<b>11</b>
10.1 INVALID-ORDER-1 $Z(s) = (R_1, R_2, \infty, \infty, \infty)$	11
10.2 INVALID-ORDER-2 $Z(s) = \left(R_1, \frac{1}{C_2s}, \infty, \infty, \infty\right)$	11
10.3 INVALID-ORDER-3 $Z(s) = \left(R_1, \frac{R_2}{C_2R_2s+1}, \infty, \infty, \infty\right)$	11
10.4 INVALID-ORDER-4 $Z(s) = \left(R_1, R_2 + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	12
10.5 INVALID-ORDER-5 $Z(s) = (L_1s, R_2, \infty, \infty, \infty)$	12
10.6 INVALID-ORDER-6 $Z(s) = \left(L_1s, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	12
10.7 INVALID-ORDER-7 $Z(s) = \left(L_1s, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	12
10.8 INVALID-ORDER-8 $Z(s) = \left(L_1s, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty\right)$	12
10.9 INVALID-ORDER-9 $Z(s) = \left(L_1s, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty\right)$	12
10.10INVALID-ORDER-10 $Z(s) = \left(\frac{1}{C_1s}, R_2, \infty, \infty, \infty\right)$	12
10.11INVALID-ORDER-11 $Z(s) = \left(\frac{1}{C_1s}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	12
10.12INVALID-ORDER-12 $Z(s) = \left(\frac{1}{C_1s}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	12
10.13INVALID-ORDER-13 $Z(s) = \left(\frac{1}{C_1s}, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty\right)$	12
10.14INVALID-ORDER-14 $Z(s) = \left(\frac{1}{C_1s}, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty\right)$	13
10.15INVALID-ORDER-15 $Z(s) = \left(\frac{R_1}{C_1R_1s+1}, R_2, \infty, \infty, \infty\right)$	13
10.16INVALID-ORDER-16 $Z(s) = \left(\frac{R_1}{C_1R_1s+1}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	13
10.17INVALID-ORDER-17 $Z(s) = \left(\frac{R_1}{C_1R_1s+1}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	13
10.18INVALID-ORDER-18 $Z(s) = \left(\frac{R_1}{C_1R_1s+1}, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty\right)$	13
10.19INVALID-ORDER-19 $Z(s) = \left(\frac{R_1}{C_1R_1s+1}, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty\right)$	13
10.20INVALID-ORDER-20 $Z(s) = \left(R_1 + \frac{1}{C_1s}, R_2, \infty, \infty, \infty\right)$	13
10.21INVALID-ORDER-21 $Z(s) = \left(R_1 + \frac{1}{C_1s}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	13
10.22INVALID-ORDER-22 $Z(s) = \left(R_1 + \frac{1}{C_1s}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	13
10.23INVALID-ORDER-23 $Z(s) = \left(R_1 + \frac{1}{C_1s}, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty\right)$	14
10.24INVALID-ORDER-24 $Z(s) = \left(R_1 + \frac{1}{C_1s}, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty\right)$	14
10.25INVALID-ORDER-25 $Z(s) = \left(L_1s + \frac{1}{C_1s}, \frac{1}{C_2s}, \infty, \infty, \infty\right)$	14
10.26INVALID-ORDER-26 $Z(s) = \left(L_1s + \frac{1}{C_1s}, \frac{R_2}{C_2R_2s+1}, \infty, \infty, \infty\right)$	14
10.27INVALID-ORDER-27 $Z(s) = \left(L_1s + \frac{1}{C_1s}, R_2 + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	14
10.28INVALID-ORDER-28 $Z(s) = \left(L_1s + \frac{1}{C_1s}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	14
10.29INVALID-ORDER-29 $Z(s) = \left(L_1s + \frac{1}{C_1s}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	14
10.30INVALID-ORDER-30 $Z(s) = \left(L_1s + \frac{1}{C_1s}, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty\right)$	14
10.31INVALID-ORDER-31 $Z(s) = \left(L_1s + \frac{1}{C_1s}, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty\right)$	14
10.32INVALID-ORDER-32 $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1}, \frac{1}{C_2s}, \infty, \infty, \infty\right)$	15
10.33INVALID-ORDER-33 $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1}, \frac{R_2}{C_2R_2s+1}, \infty, \infty, \infty\right)$	15
10.34INVALID-ORDER-34 $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1}, R_2 + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	15
10.35INVALID-ORDER-35 $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	15
10.36INVALID-ORDER-36 $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty\right)$	15
10.37INVALID-ORDER-37 $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1}, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty\right)$	15
10.38INVALID-ORDER-38 $Z(s) = \left(\frac{L_1s}{C_1L_1s^2+1}, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty\right)$	15
10.39INVALID-ORDER-39 $Z(s) = \left(L_1s + R_1 + \frac{1}{C_1s}, \frac{1}{C_2s}, \infty, \infty, \infty\right)$	15

10.40INVALID-ORDER-40	$Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, \frac{R_2}{C_2R_2s+1}, \infty, \infty, \infty \right)$	15
10.41INVALID-ORDER-41	$Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	16
10.42INVALID-ORDER-42	$Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	16
10.43INVALID-ORDER-43	$Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	16
10.44INVALID-ORDER-44	$Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty \right)$	16
10.45INVALID-ORDER-45	$Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty \right)$	16
10.46INVALID-ORDER-46	$Z(s) = \left( \frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1}, \frac{1}{C_2s}, \infty, \infty, \infty \right)$	16
10.47INVALID-ORDER-47	$Z(s) = \left( \frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1}, \frac{R_2}{C_2R_2s+1}, \infty, \infty, \infty \right)$	16
10.48INVALID-ORDER-48	$Z(s) = \left( \frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1}, R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	16
10.49INVALID-ORDER-49	$Z(s) = \left( \frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	16
10.50INVALID-ORDER-50	$Z(s) = \left( \frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	17
10.51INVALID-ORDER-51	$Z(s) = \left( \frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1}, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty \right)$	17
10.52INVALID-ORDER-52	$Z(s) = \left( \frac{L_1R_1s}{C_1L_1R_1s^2+L_1s+R_1}, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty \right)$	17
10.53INVALID-ORDER-53	$Z(s) = \left( \frac{C_1L_1R_1s^2+L_1s+R_1}{C_1L_1s^2+1}, \frac{1}{C_2s}, \infty, \infty, \infty \right)$	17
10.54INVALID-ORDER-54	$Z(s) = \left( \frac{C_1L_1R_1s^2+L_1s+R_1}{C_1L_1s^2+1}, \frac{R_2}{C_2R_2s+1}, \infty, \infty, \infty \right)$	17
10.55INVALID-ORDER-55	$Z(s) = \left( \frac{C_1L_1R_1s^2+L_1s+R_1}{C_1L_1s^2+1}, R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	17
10.56INVALID-ORDER-56	$Z(s) = \left( \frac{C_1L_1R_1s^2+L_1s+R_1}{C_1L_1s^2+1}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	17
10.57INVALID-ORDER-57	$Z(s) = \left( \frac{C_1L_1R_1s^2+L_1s+R_1}{C_1L_1s^2+1}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	17
10.58INVALID-ORDER-58	$Z(s) = \left( \frac{C_1L_1R_1s^2+L_1s+R_1}{C_1L_1s^2+1}, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty \right)$	17
10.59INVALID-ORDER-59	$Z(s) = \left( \frac{C_1L_1R_1s^2+L_1s+R_1}{C_1L_1s^2+1}, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty \right)$	18
10.60INVALID-ORDER-60	$Z(s) = \left( \frac{R_1(C_1L_1s^2+1)}{C_1L_1s^2+C_1R_1s+1}, \frac{1}{C_2s}, \infty, \infty, \infty \right)$	18
10.61INVALID-ORDER-61	$Z(s) = \left( \frac{R_1(C_1L_1s^2+1)}{C_1L_1s^2+C_1R_1s+1}, \frac{R_2}{C_2R_2s+1}, \infty, \infty, \infty \right)$	18
10.62INVALID-ORDER-62	$Z(s) = \left( \frac{R_1(C_1L_1s^2+1)}{C_1L_1s^2+C_1R_1s+1}, R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	18
10.63INVALID-ORDER-63	$Z(s) = \left( \frac{R_1(C_1L_1s^2+1)}{C_1L_1s^2+C_1R_1s+1}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	18
10.64INVALID-ORDER-64	$Z(s) = \left( \frac{R_1(C_1L_1s^2+1)}{C_1L_1s^2+C_1R_1s+1}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$	18
10.65INVALID-ORDER-65	$Z(s) = \left( \frac{R_1(C_1L_1s^2+1)}{C_1L_1s^2+C_1R_1s+1}, \frac{C_2L_2R_2s^2+L_2s+R_2}{C_2L_2s^2+1}, \infty, \infty, \infty \right)$	18
10.66INVALID-ORDER-66	$Z(s) = \left( \frac{R_1(C_1L_1s^2+1)}{C_1L_1s^2+C_1R_1s+1}, \frac{R_2(C_2L_2s^2+1)}{C_2L_2s^2+C_2R_2s+1}, \infty, \infty, \infty \right)$	18

<b>11 PolynomialError</b>	<b>18</b>
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## 1 Examined $H(z)$ for CG TIA simple Z1 Z2: $\frac{Z_1 Z_2 Z_L g_m + Z_1 Z_L}{Z_1 Z_2 g_m + Z_1 + Z_2 + Z_L}$

$$H(z) = \frac{Z_1 Z_2 Z_L g_m + Z_1 Z_L}{Z_1 Z_2 g_m + Z_1 + Z_2 + Z_L}$$

## 2 HP

## 3 BP

### 3.1 BP-1 $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, R_2, \infty, \infty, \infty \right)$

$$H(s) = \frac{s (L_1 R_2 Z_L g_m + L_1 Z_L)}{R_2 + Z_L + s^2 (C_1 L_1 R_2 + C_1 L_1 Z_L) + s (L_1 R_2 g_m + L_1)}$$

Parameters:

$$\text{Q: } \frac{C_1 R_2 \sqrt{\frac{1}{C_1 L_1}} + C_1 Z_L \sqrt{\frac{1}{C_1 L_1}}}{R_2 g_m + 1}$$

$$\text{wo: } \sqrt{\frac{1}{C_1 L_1}}$$

$$\text{bandwidth: } \frac{\sqrt{\frac{1}{C_1 L_1}} (R_2 g_m + 1)}{C_1 R_2 \sqrt{\frac{1}{C_1 L_1}} + C_1 Z_L \sqrt{\frac{1}{C_1 L_1}}}$$

K-LP: 0

K-HP: 0

K-BP:  $Z_L$

Qz: None

Wz: None

### 3.2 BP-2 $Z(s) = \left( \frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1}, R_2, \infty, \infty, \infty \right)$

$$H(s) = \frac{s (L_1 R_1 R_2 Z_L g_m + L_1 R_1 Z_L)}{R_1 R_2 + R_1 Z_L + s^2 (C_1 L_1 R_1 R_2 + C_1 L_1 R_1 Z_L) + s (L_1 R_1 R_2 g_m + L_1 R_1 + L_1 R_2 + L_1 Z_L)}$$

Parameters:

$$\text{Q: } \frac{C_1 R_1 R_2 \sqrt{\frac{1}{C_1 L_1}} + C_1 R_1 Z_L \sqrt{\frac{1}{C_1 L_1}}}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$$

$$\text{wo: } \sqrt{\frac{1}{C_1 L_1}}$$

$$\text{bandwidth: } \frac{\sqrt{\frac{1}{C_1 L_1}} (R_1 R_2 g_m + R_1 + R_2 + Z_L)}{C_1 R_1 R_2 \sqrt{\frac{1}{C_1 L_1}} + C_1 R_1 Z_L \sqrt{\frac{1}{C_1 L_1}}}$$

K-LP: 0

K-HP: 0

K-BP:  $\frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$

Qz: None

Wz: None

## 4 LP

## 5 BS

**5.1 BS-1**  $Z(s) = \left( L_1 s + \frac{1}{C_1 s}, R_2, \infty, \infty, \infty \right)$

$$H(s) = \frac{R_2 Z_L g_m + Z_L + s^2 (C_1 L_1 R_2 Z_L g_m + C_1 L_1 Z_L)}{R_2 g_m + s^2 (C_1 L_1 R_2 g_m + C_1 L_1) + s (C_1 R_2 + C_1 Z_L) + 1}$$

**Parameters:**

Q:  $\frac{L_1 R_2 g_m \sqrt{\frac{1}{C_1 L_1}} + L_1 \sqrt{\frac{1}{C_1 L_1}}}{R_2 + Z_L}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{\sqrt{\frac{1}{C_1 L_1}} (R_2 + Z_L)}{L_1 R_2 g_m \sqrt{\frac{1}{C_1 L_1}} + L_1 \sqrt{\frac{1}{C_1 L_1}}}$   
 K-LP:  $Z_L$   
 K-HP:  $Z_L$   
 K-BP: 0  
 Qz: None  
 Wz:  $\sqrt{\frac{1}{C_1 L_1}}$

**5.2 BS-2**  $Z(s) = \left( \frac{R_1 (C_1 L_1 s^2 + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1}, R_2, \infty, \infty, \infty \right)$

$$H(s) = \frac{R_1 R_2 Z_L g_m + R_1 Z_L + s^2 (C_1 L_1 R_1 R_2 Z_L g_m + C_1 L_1 R_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^2 (C_1 L_1 R_1 R_2 g_m + C_1 L_1 R_1 + C_1 L_1 R_2 + C_1 L_1 Z_L) + s (C_1 R_1 R_2 + C_1 R_1 Z_L)}$$

**Parameters:**

Q:  $\frac{L_1 R_1 R_2 g_m \sqrt{\frac{1}{C_1 L_1}} + L_1 R_1 \sqrt{\frac{1}{C_1 L_1}} + L_1 R_2 \sqrt{\frac{1}{C_1 L_1}} + L_1 Z_L \sqrt{\frac{1}{C_1 L_1}}}{R_1 R_2 + R_1 Z_L}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{\sqrt{\frac{1}{C_1 L_1}} (R_1 R_2 + R_1 Z_L)}{L_1 R_1 R_2 g_m \sqrt{\frac{1}{C_1 L_1}} + L_1 R_1 \sqrt{\frac{1}{C_1 L_1}} + L_1 R_2 \sqrt{\frac{1}{C_1 L_1}} + L_1 Z_L \sqrt{\frac{1}{C_1 L_1}}}$   
 K-LP:  $\frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$   
 K-HP:  $\frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$   
 K-BP: 0  
 Qz: None  
 Wz:  $\sqrt{\frac{1}{C_1 L_1}}$

## 6 GE

**6.1 GE-1**  $Z(s) = \left( R_1, L_2 s + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_2 R_1 Z_L g_m s^2 + C_2 R_1 Z_L s + R_1 Z_L g_m}{R_1 g_m + s^2 (C_2 L_2 R_1 g_m + C_2 L_2) + s (C_2 R_1 + C_2 Z_L) + 1}$$

**Parameters:**

Q:  $\frac{L_2 R_1 g_m \sqrt{\frac{1}{C_2 L_2}} + L_2 \sqrt{\frac{1}{C_2 L_2}}}{R_1 + Z_L}$   
 wo:  $\sqrt{\frac{1}{C_2 L_2}}$   
 bandwidth:  $\frac{\sqrt{\frac{1}{C_2 L_2}} (R_1 + Z_L)}{L_2 R_1 g_m \sqrt{\frac{1}{C_2 L_2}} + L_2 \sqrt{\frac{1}{C_2 L_2}}}$   
 K-LP:  $\frac{R_1 Z_L g_m}{R_1 g_m + 1}$   
 K-HP:  $\frac{R_1 Z_L g_m}{R_1 g_m + 1}$   
 K-BP:  $\frac{R_1 Z_L}{R_1 + Z_L}$   
 Qz:  $L_2 g_m \sqrt{\frac{1}{C_2 L_2}}$   
 Wz:  $\sqrt{\frac{1}{C_2 L_2}}$

**6.2 GE-2**  $Z(s) = \left( R_1, L_2 s + R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_2 R_1 Z_L g_m s^2 + R_1 Z_L g_m + s (C_2 R_1 R_2 Z_L g_m + C_2 R_1 Z_L)}{R_1 g_m + s^2 (C_2 L_2 R_1 g_m + C_2 L_2) + s (C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L) + 1}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_2 R_1 g_m \sqrt{\frac{1}{C_2 L_2}} + L_2 \sqrt{\frac{1}{C_2 L_2}}}{R_1 R_2 g_m + R_1 + R_2 + Z_L} \\ \text{wo: } & \sqrt{\frac{1}{C_2 L_2}} \\ \text{bandwidth: } & \frac{\sqrt{\frac{1}{C_2 L_2}} (R_1 R_2 g_m + R_1 + R_2 + Z_L)}{L_2 R_1 g_m \sqrt{\frac{1}{C_2 L_2}} + L_2 \sqrt{\frac{1}{C_2 L_2}}} \\ \text{K-LP: } & \frac{R_1 Z_L g_m}{R_1 g_m + 1} \\ \text{K-HP: } & \frac{R_1 Z_L g_m}{R_1 g_m + 1} \\ \text{K-BP: } & \frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L} \\ \text{QZ: } & \frac{L_2 g_m \sqrt{\frac{1}{C_2 L_2}}}{R_2 g_m + 1} \\ \text{WZ: } & \sqrt{\frac{1}{C_2 L_2}} \end{aligned}$$

**6.3 GE-3**  $Z(s) = \left( R_1, \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{L_2 R_1 Z_L g_m s + R_1 R_2 Z_L g_m + R_1 Z_L + s^2 (C_2 L_2 R_1 R_2 Z_L g_m + C_2 L_2 R_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^2 (C_2 L_2 R_1 R_2 g_m + C_2 L_2 R_1 + C_2 L_2 R_2 + C_2 L_2 Z_L) + s (L_2 R_1 g_m + L_2)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_2 R_1 R_2 g_m \sqrt{\frac{1}{C_2 L_2}} + C_2 R_1 \sqrt{\frac{1}{C_2 L_2}} + C_2 R_2 \sqrt{\frac{1}{C_2 L_2}} + C_2 Z_L \sqrt{\frac{1}{C_2 L_2}}}{R_1 g_m + 1} \\ \text{wo: } & \sqrt{\frac{1}{C_2 L_2}} \\ \text{bandwidth: } & \frac{\sqrt{\frac{1}{C_2 L_2}} (R_1 g_m + 1)}{C_2 R_1 R_2 g_m \sqrt{\frac{1}{C_2 L_2}} + C_2 R_1 \sqrt{\frac{1}{C_2 L_2}} + C_2 R_2 \sqrt{\frac{1}{C_2 L_2}} + C_2 Z_L \sqrt{\frac{1}{C_2 L_2}}} \\ \text{K-LP: } & \frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L} \\ \text{K-HP: } & \frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L} \\ \text{K-BP: } & \frac{R_1 Z_L g_m}{R_1 g_m + 1} \\ \text{QZ: } & \frac{C_2 R_2 g_m \sqrt{\frac{1}{C_2 L_2}} + C_2 \sqrt{\frac{1}{C_2 L_2}}}{g_m} \\ \text{WZ: } & \sqrt{\frac{1}{C_2 L_2}} \end{aligned}$$

**6.4 GE-4**  $Z(s) = \left( R_1, \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 R_1 R_2 Z_L s + R_1 R_2 Z_L g_m + R_1 Z_L + s^2 (C_2 L_2 R_1 R_2 Z_L g_m + C_2 L_2 R_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^2 (C_2 L_2 R_1 R_2 g_m + C_2 L_2 R_1 + C_2 L_2 R_2 + C_2 L_2 Z_L) + s (C_2 R_1 R_2 + C_2 R_2 Z_L)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{L_2 R_1 R_2 g_m \sqrt{\frac{1}{C_2 L_2}} + L_2 R_1 \sqrt{\frac{1}{C_2 L_2}} + L_2 R_2 \sqrt{\frac{1}{C_2 L_2}} + L_2 Z_L \sqrt{\frac{1}{C_2 L_2}}}{R_1 R_2 + R_2 Z_L} \\ \text{wo: } & \sqrt{\frac{1}{C_2 L_2}} \\ \text{bandwidth: } & \frac{\sqrt{\frac{1}{C_2 L_2}} (R_1 R_2 + R_2 Z_L)}{L_2 R_1 R_2 g_m \sqrt{\frac{1}{C_2 L_2}} + L_2 R_1 \sqrt{\frac{1}{C_2 L_2}} + L_2 R_2 \sqrt{\frac{1}{C_2 L_2}} + L_2 Z_L \sqrt{\frac{1}{C_2 L_2}}} \\ \text{K-LP: } & \frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L} \\ \text{K-HP: } & \frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L} \\ \text{K-BP: } & \frac{R_1 Z_L}{R_1 + Z_L} \\ \text{QZ: } & \frac{L_2 R_2 g_m \sqrt{\frac{1}{C_2 L_2}} + L_2 \sqrt{\frac{1}{C_2 L_2}}}{R_2} \\ \text{WZ: } & \sqrt{\frac{1}{C_2 L_2}} \end{aligned}$$

**6.5 GE-5**  $Z(s) = \left( L_1 s + R_1 + \frac{1}{C_1 s}, R_2, \infty, \infty, \infty \right)$

$$H(s) = \frac{R_2 Z_L g_m + Z_L + s^2 (C_1 L_1 R_2 Z_L g_m + C_1 L_1 Z_L) + s (C_1 R_1 R_2 Z_L g_m + C_1 R_1 Z_L)}{R_2 g_m + s^2 (C_1 L_1 R_2 g_m + C_1 L_1) + s (C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L) + 1}$$

**Parameters:**

Q:  $\frac{L_1 R_2 g_m \sqrt{\frac{1}{C_1 L_1}} + L_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{\sqrt{\frac{1}{C_1 L_1}} (R_1 R_2 g_m + R_1 + R_2 + Z_L)}{L_1 R_2 g_m \sqrt{\frac{1}{C_1 L_1}} + L_1 \sqrt{\frac{1}{C_1 L_1}}}$   
 K-LP:  $Z_L$   
 K-HP:  $Z_L$   
 K-BP:  $\frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$   
 Qz:  $\frac{L_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1}$   
 Wz:  $\sqrt{\frac{1}{C_1 L_1}}$

**6.6 GE-6**  $Z(s) = \left( \frac{C_1 L_1 R_1 s^2 + L_1 s + R_1}{C_1 L_1 s^2 + 1}, R_2, \infty, \infty, \infty \right)$

$$H(s) = \frac{R_1 R_2 Z_L g_m + R_1 Z_L + s^2 (C_1 L_1 R_1 R_2 Z_L g_m + C_1 L_1 R_1 Z_L) + s (L_1 R_2 Z_L g_m + L_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^2 (C_1 L_1 R_1 R_2 g_m + C_1 L_1 R_1 + C_1 L_1 R_2 + C_1 L_1 Z_L) + s (L_1 R_2 g_m + L_1)}$$

**Parameters:**

Q:  $\frac{C_1 R_1 R_2 g_m \sqrt{\frac{1}{C_1 L_1}} + C_1 R_1 \sqrt{\frac{1}{C_1 L_1}} + C_1 R_2 \sqrt{\frac{1}{C_1 L_1}} + C_1 Z_L \sqrt{\frac{1}{C_1 L_1}}}{R_2 g_m + 1}$   
 wo:  $\sqrt{\frac{1}{C_1 L_1}}$   
 bandwidth:  $\frac{\sqrt{\frac{1}{C_1 L_1}} (R_2 g_m + 1)}{C_1 R_1 R_2 g_m \sqrt{\frac{1}{C_1 L_1}} + C_1 R_1 \sqrt{\frac{1}{C_1 L_1}} + C_1 R_2 \sqrt{\frac{1}{C_1 L_1}} + C_1 Z_L \sqrt{\frac{1}{C_1 L_1}}}$   
 K-LP:  $\frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$   
 K-HP:  $\frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$   
 K-BP:  $Z_L$   
 Qz:  $C_1 R_1 \sqrt{\frac{1}{C_1 L_1}}$   
 Wz:  $\sqrt{\frac{1}{C_1 L_1}}$

## 7 AP

## 8 INVALID-NUMER

**8.1 INVALID-NUMER-1**  $Z(s) = \left( L_1 s, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 Z_L s^2 + L_1 Z_L g_m s}{C_2 L_1 s^2 + s (C_2 Z_L + L_1 g_m) + 1}$$

**Parameters:**

Q:  $\frac{C_2 L_1 \sqrt{\frac{1}{C_2 L_1}}}{C_2 Z_L + L_1 g_m}$   
 wo:  $\sqrt{\frac{1}{C_2 L_1}}$   
 bandwidth:  $\frac{C_2 Z_L + L_1 g_m}{C_2 L_1}$   
 K-LP: 0  
 K-HP:  $Z_L$   
 K-BP:  $\frac{L_1 Z_L g_m}{C_2 Z_L + L_1 g_m}$   
 Qz: None

Wz: None

## 8.2 INVALID-NUMER-2 $Z(s) = \left( L_1 s, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 R_2 Z_L s^2 + s (L_1 R_2 Z_L g_m + L_1 Z_L)}{C_2 L_1 R_2 s^2 + R_2 + Z_L + s (C_2 R_2 Z_L + L_1 R_2 g_m + L_1)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_2 L_1 R_2 \sqrt{\frac{1}{C_2 L_1} + \frac{Z_L}{C_2 L_1 R_2}}}{C_2 R_2 Z_L + L_1 R_2 g_m + L_1} \\ \text{wo: } & \sqrt{\frac{R_2 + Z_L}{C_2 L_1 R_2}} \\ \text{bandwidth: } & \frac{\sqrt{\frac{R_2 + Z_L}{C_2 L_1 R_2}} (C_2 R_2 Z_L + L_1 R_2 g_m + L_1)}{C_2 L_1 R_2 \sqrt{\frac{1}{C_2 L_1} + \frac{Z_L}{C_2 L_1 R_2}}} \end{aligned}$$

K-LP: 0

K-HP:  $Z_L$

K-BP:  $\frac{L_1 R_2 Z_L g_m + L_1 Z_L}{C_2 R_2 Z_L + L_1 R_2 g_m + L_1}$

Qz: None

Wz: None

## 8.3 INVALID-NUMER-3 $Z(s) = \left( L_1 s, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{L_1 Z_L g_m s + s^2 (C_2 L_1 R_2 Z_L g_m + C_2 L_1 Z_L)}{s^2 (C_2 L_1 R_2 g_m + C_2 L_1) + s (C_2 R_2 + C_2 Z_L + L_1 g_m) + 1}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_2 L_1 R_2 g_m \sqrt{\frac{1}{C_2 L_1 R_2 g_m + C_2 L_1}} + C_2 L_1 \sqrt{\frac{1}{C_2 L_1 R_2 g_m + C_2 L_1}}}{C_2 R_2 + C_2 Z_L + L_1 g_m} \\ \text{wo: } & \sqrt{\frac{1}{C_2 L_1 R_2 g_m + C_2 L_1}} \\ \text{bandwidth: } & \frac{(C_2 R_2 + C_2 Z_L + L_1 g_m) \sqrt{\frac{1}{C_2 L_1 R_2 g_m + C_2 L_1}}}{C_2 L_1 R_2 g_m \sqrt{\frac{1}{C_2 L_1 R_2 g_m + C_2 L_1}} + C_2 L_1 \sqrt{\frac{1}{C_2 L_1 R_2 g_m + C_2 L_1}}} \end{aligned}$$

K-LP: 0

K-HP:  $Z_L$

K-BP:  $\frac{L_1 Z_L g_m}{C_2 R_2 + C_2 Z_L + L_1 g_m}$

Qz: None

Wz: None

## 8.4 INVALID-NUMER-4 $Z(s) = \left( \frac{1}{C_1 s}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 Z_L s + Z_L g_m}{C_1 C_2 Z_L s^2 + g_m + s (C_1 + C_2)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_1 C_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 Z_L}}}{C_1 + C_2} \\ \text{wo: } & \sqrt{\frac{g_m}{C_1 C_2 Z_L}} \\ \text{bandwidth: } & \frac{C_1 + C_2}{C_1 C_2 Z_L} \\ \text{K-LP: } & Z_L \\ \text{K-HP: } & 0 \\ \text{K-BP: } & \frac{C_2 Z_L}{C_1 + C_2} \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \text{None} \end{aligned}$$



## 8.5 INVALID-NUMER-5 $Z(s) = \left( \frac{1}{C_1 s}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 R_2 Z_L s + R_2 Z_L g_m + Z_L}{C_1 C_2 R_2 Z_L s^2 + R_2 g_m + s(C_1 R_2 + C_1 Z_L + C_2 R_2) + 1}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_1 C_2 R_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_2 Z_L}}}{C_1 R_2 + C_1 Z_L + C_2 R_2} \\ \text{wo: } & \sqrt{\frac{R_2 g_m + 1}{C_1 C_2 R_2 Z_L}} \\ \text{bandwidth: } & \frac{\sqrt{\frac{R_2 g_m + 1}{C_1 C_2 R_2 Z_L}} (C_1 R_2 + C_1 Z_L + C_2 R_2)}{C_1 C_2 R_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_2 Z_L}}} \\ \text{K-LP: } & Z_L \\ \text{K-HP: } & 0 \\ \text{K-BP: } & \frac{C_2 R_2 Z_L}{C_1 R_2 + C_1 Z_L + C_2 R_2} \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \text{None} \end{aligned}$$

## 8.6 INVALID-NUMER-6 $Z(s) = \left( \frac{1}{C_1 s}, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{Z_L g_m + s(C_2 R_2 Z_L g_m + C_2 Z_L)}{g_m + s^2(C_1 C_2 R_2 + C_1 C_2 Z_L) + s(C_1 + C_2 R_2 g_m + C_2)}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_1 C_2 R_2 \sqrt{\frac{g_m}{C_1 C_2 R_2 + C_1 C_2 Z_L}} + C_1 C_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 R_2 + C_1 C_2 Z_L}}}{C_1 + C_2 R_2 g_m + C_2} \\ \text{wo: } & \sqrt{\frac{g_m}{C_1 C_2 R_2 + C_1 C_2 Z_L}} \\ \text{bandwidth: } & \frac{\sqrt{\frac{g_m}{C_1 C_2 R_2 + C_1 C_2 Z_L}} (C_1 + C_2 R_2 g_m + C_2)}{C_1 C_2 R_2 \sqrt{\frac{g_m}{C_1 C_2 R_2 + C_1 C_2 Z_L}} + C_1 C_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 R_2 + C_1 C_2 Z_L}}} \\ \text{K-LP: } & Z_L \\ \text{K-HP: } & 0 \\ \text{K-BP: } & \frac{C_2 R_2 Z_L g_m + C_2 Z_L}{C_1 + C_2 R_2 g_m + C_2} \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \text{None} \end{aligned}$$

## 8.7 INVALID-NUMER-7 $Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 R_1 Z_L s + R_1 Z_L g_m}{C_1 C_2 R_1 Z_L s^2 + R_1 g_m + s(C_1 R_1 + C_2 R_1 + C_2 Z_L) + 1}$$

**Parameters:**

$$\begin{aligned} \text{Q: } & \frac{C_1 C_2 R_1 Z_L \sqrt{\frac{g_m}{C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_1 Z_L}}}{C_1 R_1 + C_2 R_1 + C_2 Z_L} \\ \text{wo: } & \sqrt{\frac{R_1 g_m + 1}{C_1 C_2 R_1 Z_L}} \\ \text{bandwidth: } & \frac{\sqrt{\frac{R_1 g_m + 1}{C_1 C_2 R_1 Z_L}} (C_1 R_1 + C_2 R_1 + C_2 Z_L)}{C_1 C_2 R_1 Z_L \sqrt{\frac{g_m}{C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_1 Z_L}}} \\ \text{K-LP: } & \frac{R_1 Z_L g_m}{R_1 g_m + 1} \\ \text{K-HP: } & 0 \\ \text{K-BP: } & \frac{C_2 R_1 Z_L}{C_1 R_1 + C_2 R_1 + C_2 Z_L} \\ \text{Qz: } & \text{None} \\ \text{Wz: } & \text{None} \end{aligned}$$

## 8.8 INVALID-NUMER-8 $Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 R_1 R_2 Z_L s + R_1 R_2 Z_L g_m + R_1 Z_L}{C_1 C_2 R_1 R_2 Z_L s^2 + R_1 R_2 g_m + R_1 + R_2 + Z_L + s(C_1 R_1 R_2 + C_1 R_1 Z_L + C_2 R_1 R_2 + C_2 R_2 Z_L)}$$

Parameters:

Q:  $\frac{C_1 C_2 R_1 R_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2}}}{C_1 R_1 R_2 + C_1 R_1 Z_L + C_2 R_1 R_2 + C_2 R_2 Z_L}$

wo:  $\sqrt{\frac{R_1 R_2 g_m + R_1 + R_2 + Z_L}{C_1 C_2 R_1 R_2 Z_L}}$

bandwidth:  $\frac{\sqrt{\frac{R_1 R_2 g_m + R_1 + R_2 + Z_L}{C_1 C_2 R_1 R_2 Z_L}} (C_1 R_1 R_2 + C_1 R_1 Z_L + C_2 R_1 R_2 + C_2 R_2 Z_L)}{C_1 C_2 R_1 R_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2}}}$

K-LP:  $\frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$

K-HP: 0

K-BP:  $\frac{C_2 R_1 R_2 Z_L}{C_1 R_1 R_2 + C_1 R_1 Z_L + C_2 R_1 R_2 + C_2 R_2 Z_L}$

Qz: None

Wz: None

## 8.9 INVALID-NUMER-9 $Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{R_1 Z_L g_m + s(C_2 R_1 R_2 Z_L g_m + C_2 R_1 Z_L)}{R_1 g_m + s^2(C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L) + s(C_1 R_1 + C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L) + 1}$$

Parameters:

Q:  $\frac{C_1 C_2 R_1 R_2 \sqrt{\frac{R_1 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}} + C_1 C_2 R_1 Z_L \sqrt{\frac{R_1 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}}}{C_1 R_1 + C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L}$

wo:  $\sqrt{\frac{R_1 g_m + 1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}}$

bandwidth:  $\frac{\sqrt{\frac{R_1 g_m + 1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}} (C_1 R_1 + C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L)}{C_1 C_2 R_1 R_2 \sqrt{\frac{R_1 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}} + C_1 C_2 R_1 Z_L \sqrt{\frac{R_1 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}}}$

K-LP:  $\frac{R_1 Z_L g_m}{R_1 g_m + 1}$

K-HP: 0

K-BP:  $\frac{C_2 R_1 R_2 Z_L g_m \sqrt{\frac{g_m}{C_1 C_2 R_2 + C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}} + C_2 R_1 Z_L \sqrt{\frac{g_m}{C_1 C_2 R_2 + C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}}}{C_1 R_1 \sqrt{\frac{R_1 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}} + C_2 R_1 R_2 g_m \sqrt{\frac{R_1 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}} + C_2 R_1 \sqrt{\frac{R_1 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}} + C_2 R_2 \sqrt{\frac{R_1 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}} + C_2 Z_L \sqrt{\frac{R_1 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L}}}$

Qz: None

Wz: None

## 9 INVALID-WZ

### 9.1 INVALID-WZ-1 $Z(s) = \left( R_1 + \frac{1}{C_1 s}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_1 C_2 R_1 Z_L s^2 + Z_L g_m + s(C_1 R_1 Z_L g_m + C_2 Z_L)}{g_m + s^2(C_1 C_2 R_1 + C_1 C_2 Z_L) + s(C_1 R_1 g_m + C_1 + C_2)}$$

Parameters:

Q:  $\frac{C_1 C_2 R_1 \sqrt{\frac{g_m}{C_1 C_2 R_1 + C_1 C_2 Z_L}} + C_1 C_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 R_1 + C_1 C_2 Z_L}}}{C_1 R_1 g_m + C_1 + C_2}$

wo:  $\sqrt{\frac{g_m}{C_1 C_2 R_1 + C_1 C_2 Z_L}}$

bandwidth:  $\frac{\sqrt{\frac{g_m}{C_1 C_2 R_1 + C_1 C_2 Z_L}} (C_1 R_1 g_m + C_1 + C_2)}{C_1 C_2 R_1 \sqrt{\frac{g_m}{C_1 C_2 R_1 + C_1 C_2 Z_L}} + C_1 C_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 R_1 + C_1 C_2 Z_L}}}$

K-LP:  $Z_L$

K-HP:  $\frac{R_1 Z_L}{R_1 + Z_L}$

K-BP:  $\frac{C_1 R_1 Z_L g_m + C_2 Z_L}{C_1 R_1 g_m + C_1 + C_2}$

Qz: None

Wz:  $\sqrt{\frac{g_m}{C_1 C_2 R_1}}$

## 9.2 INVALID-WZ-2 $Z(s) = \left( R_1 + \frac{1}{C_1 s}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_1 C_2 R_1 R_2 Z_L s^2 + R_2 Z_L g_m + Z_L + s (C_1 R_1 R_2 Z_L g_m + C_1 R_1 Z_L + C_2 R_2 Z_L)}{R_2 g_m + s^2 (C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L) + s (C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L + C_2 R_2) + 1}$$

Parameters:

$$\text{Q: } \frac{C_1 C_2 R_1 R_2 \sqrt{\frac{R_2 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}} + C_1 C_2 R_2 Z_L \sqrt{\frac{R_2 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}}}{C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L + C_2 R_2}$$

$$\text{wo: } \sqrt{\frac{R_2 g_m + 1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}}$$

$$\text{bandwidth: } \frac{\sqrt{\frac{R_2 g_m + 1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}} (C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L + C_2 R_2)}{C_1 C_2 R_1 R_2 \sqrt{\frac{R_2 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}} + C_1 C_2 R_2 Z_L \sqrt{\frac{R_2 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}}}$$

$$\text{K-LP: } Z_L$$

$$\text{K-HP: } \frac{R_1 Z_L}{R_1 + Z_L}$$

$$\text{K-BP: } \frac{C_1 R_1 R_2 Z_L g_m \sqrt{\frac{g_m}{C_1 C_2 R_1 + C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}} + C_1 R_1 Z_L \sqrt{\frac{g_m}{C_1 C_2 R_1 + C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}} + C_2 R_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 R_1 + C_1 C_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}}}{C_1 R_1 R_2 g_m \sqrt{\frac{R_2 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}} + C_1 R_1 \sqrt{\frac{R_2 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}} + C_1 R_2 \sqrt{\frac{R_2 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}} + C_1 Z_L \sqrt{\frac{R_2 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}} + C_2 R_2 \sqrt{\frac{R_2 g_m}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L} + \frac{1}{C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L}}}$$

$$\text{Qz: None}$$

$$\text{Wz: } \sqrt{\frac{R_2 g_m + 1}{C_1 C_2 R_1 R_2}}$$

## 9.3 INVALID-WZ-3 $Z(s) = \left( R_1 + \frac{1}{C_1 s}, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{Z_L g_m + s^2 (C_1 C_2 R_1 R_2 Z_L g_m + C_1 C_2 R_1 Z_L) + s (C_1 R_1 Z_L g_m + C_2 R_2 Z_L g_m + C_2 Z_L)}{g_m + s^2 (C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L) + s (C_1 R_1 g_m + C_1 + C_2 R_2 g_m + C_2)}$$

Parameters:

$$\text{Q: } \frac{C_1 C_2 R_1 R_2 g_m \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}} + C_1 C_2 R_1 \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}} + C_1 C_2 R_2 \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}} + C_1 C_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}}}{C_1 R_1 g_m + C_1 + C_2 R_2 g_m + C_2}$$

$$\text{wo: } \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}}$$

$$\text{bandwidth: } \frac{\sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}} (C_1 R_1 g_m + C_1 + C_2 R_2 g_m + C_2)}{C_1 C_2 R_1 R_2 g_m \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}} + C_1 C_2 R_1 \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}} + C_1 C_2 R_2 \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}} + C_1 C_2 Z_L \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L}}}$$

$$\text{K-LP: } Z_L$$

$$\text{K-HP: } \frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$$

$$\text{K-BP: } \frac{C_1 R_1 Z_L g_m + C_2 R_2 Z_L g_m + C_2 Z_L}{C_1 R_1 g_m + C_1 + C_2 R_2 g_m + C_2}$$

$$\text{Qz: None}$$

$$\text{Wz: } \sqrt{\frac{g_m}{C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1}}$$

## 10 INVALID-ORDER

### 10.1 INVALID-ORDER-1 $Z(s) = (R_1, R_2, \infty, \infty, \infty)$

$$H(s) = \frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L}$$

### 10.2 INVALID-ORDER-2 $Z(s) = \left( R_1, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 R_1 Z_L s + R_1 Z_L g_m}{R_1 g_m + s (C_2 R_1 + C_2 Z_L) + 1}$$

### 10.3 INVALID-ORDER-3 $Z(s) = \left( R_1, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 R_1 R_2 Z_L s + R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s (C_2 R_1 R_2 + C_2 R_2 Z_L)}$$

**10.4 INVALID-ORDER-4**  $Z(s) = \left( R_1, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{R_1 Z_L g_m + s (C_2 R_1 R_2 Z_L g_m + C_2 R_1 Z_L)}{R_1 g_m + s (C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L) + 1}$$

**10.5 INVALID-ORDER-5**  $Z(s) = (L_1 s, R_2, \infty, \infty, \infty)$

$$H(s) = \frac{s (L_1 R_2 Z_L g_m + L_1 Z_L)}{R_2 + Z_L + s (L_1 R_2 g_m + L_1)}$$

**10.6 INVALID-ORDER-6**  $Z(s) = \left( L_1 s, L_2 s + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 L_2 Z_L g_m s^3 + C_2 L_1 Z_L s^2 + L_1 Z_L g_m s}{C_2 L_1 L_2 g_m s^3 + s^2 (C_2 L_1 + C_2 L_2) + s (C_2 Z_L + L_1 g_m) + 1}$$

**10.7 INVALID-ORDER-7**  $Z(s) = \left( L_1 s, L_2 s + R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 L_2 Z_L g_m s^3 + L_1 Z_L g_m s + s^2 (C_2 L_1 R_2 Z_L g_m + C_2 L_1 Z_L)}{C_2 L_1 L_2 g_m s^3 + s^2 (C_2 L_1 R_2 g_m + C_2 L_1 + C_2 L_2) + s (C_2 R_2 + C_2 Z_L + L_1 g_m) + 1}$$

**10.8 INVALID-ORDER-8**  $Z(s) = \left( L_1 s, \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{L_1 L_2 Z_L g_m s^2 + s^3 (C_2 L_1 L_2 R_2 Z_L g_m + C_2 L_1 L_2 Z_L) + s (L_1 R_2 Z_L g_m + L_1 Z_L)}{R_2 + Z_L + s^3 (C_2 L_1 L_2 R_2 g_m + C_2 L_1 L_2) + s^2 (C_2 L_2 R_2 + C_2 L_2 Z_L + L_1 L_2 g_m) + s (L_1 R_2 g_m + L_1 + L_2)}$$

**10.9 INVALID-ORDER-9**  $Z(s) = \left( L_1 s, \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 R_2 Z_L s^2 + s^3 (C_2 L_1 L_2 R_2 Z_L g_m + C_2 L_1 L_2 Z_L) + s (L_1 R_2 Z_L g_m + L_1 Z_L)}{R_2 + Z_L + s^3 (C_2 L_1 L_2 R_2 g_m + C_2 L_1 L_2) + s^2 (C_2 L_1 R_2 + C_2 L_2 R_2 + C_2 L_2 Z_L) + s (C_2 R_2 Z_L + L_1 R_2 g_m + L_1)}$$

**10.10 INVALID-ORDER-10**  $Z(s) = \left( \frac{1}{C_1 s}, R_2, \infty, \infty, \infty \right)$

$$H(s) = \frac{R_2 Z_L g_m + Z_L}{R_2 g_m + s (C_1 R_2 + C_1 Z_L) + 1}$$

**10.11 INVALID-ORDER-11**  $Z(s) = \left( \frac{1}{C_1 s}, L_2 s + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_2 Z_L g_m s^2 + C_2 Z_L s + Z_L g_m}{C_1 C_2 L_2 s^3 + g_m + s^2 (C_1 C_2 Z_L + C_2 L_2 g_m) + s (C_1 + C_2)}$$

**10.12 INVALID-ORDER-12**  $Z(s) = \left( \frac{1}{C_1 s}, L_2 s + R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_2 Z_L g_m s^2 + Z_L g_m + s (C_2 R_2 Z_L g_m + C_2 Z_L)}{C_1 C_2 L_2 s^3 + g_m + s^2 (C_1 C_2 R_2 + C_1 C_2 Z_L + C_2 L_2 g_m) + s (C_1 + C_2 R_2 g_m + C_2)}$$

**10.13 INVALID-ORDER-13**  $Z(s) = \left( \frac{1}{C_1 s}, \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{L_2 Z_L g_m s + R_2 Z_L g_m + Z_L + s^2 (C_2 L_2 R_2 Z_L g_m + C_2 L_2 Z_L)}{R_2 g_m + s^3 (C_1 C_2 L_2 R_2 + C_1 C_2 L_2 Z_L) + s^2 (C_1 L_2 + C_2 L_2 R_2 g_m + C_2 L_2) + s (C_1 R_2 + C_1 Z_L + L_2 g_m) + 1}$$

$$10.14 \quad \text{INVALID-ORDER-14} \quad Z(s) = \left( \frac{1}{C_1 s}, \frac{R_2(C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_2 R_2 Z_L s + R_2 Z_L g_m + Z_L + s^2 (C_2 L_2 R_2 Z_L g_m + C_2 L_2 Z_L)}{R_2 g_m + s^3 (C_1 C_2 L_2 R_2 + C_1 C_2 L_2 Z_L) + s^2 (C_1 C_2 R_2 Z_L + C_2 L_2 R_2 g_m + C_2 L_2) + s (C_1 R_2 + C_1 Z_L + C_2 R_2) + 1}$$

$$10.15 \quad \text{INVALID-ORDER-15} \quad Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, R_2, \infty, \infty, \infty \right)$$

$$H(s) = \frac{R_1 R_2 Z_L g_m + R_1 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s (C_1 R_1 R_2 + C_1 R_1 Z_L)}$$

$$10.16 \quad \text{INVALID-ORDER-16} \quad Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, L_2 s + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_2 L_2 R_1 Z_L g_m s^2 + C_2 R_1 Z_L s + R_1 Z_L g_m}{C_1 C_2 L_2 R_1 s^3 + R_1 g_m + s^2 (C_1 C_2 R_1 Z_L + C_2 L_2 R_1 g_m + C_2 L_2) + s (C_1 R_1 + C_2 R_1 + C_2 Z_L) + 1}$$

$$10.17 \quad \text{INVALID-ORDER-17} \quad Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, L_2 s + R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_2 L_2 R_1 Z_L g_m s^2 + R_1 Z_L g_m + s (C_2 R_1 R_2 Z_L g_m + C_2 R_1 Z_L)}{C_1 C_2 L_2 R_1 s^3 + R_1 g_m + s^2 (C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L + C_2 L_2 R_1 g_m + C_2 L_2) + s (C_1 R_1 + C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L) + 1}$$

$$10.18 \quad \text{INVALID-ORDER-18} \quad Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{L_2 R_1 Z_L g_m s + R_1 R_2 Z_L g_m + R_1 Z_L + s^2 (C_2 L_2 R_1 R_2 Z_L g_m + C_2 L_2 R_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^3 (C_1 C_2 L_2 R_1 R_2 + C_1 C_2 L_2 R_1 Z_L) + s^2 (C_1 L_2 R_1 + C_2 L_2 R_1 R_2 g_m + C_2 L_2 R_1 + C_2 L_2 R_2 + C_2 L_2 Z_L) + s (C_1 R_1 R_2 + C_1 R_1 Z_L + L_2 R_1 g_m + L_2)}$$

$$10.19 \quad \text{INVALID-ORDER-19} \quad Z(s) = \left( \frac{R_1}{C_1 R_1 s + 1}, \frac{R_2(C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_2 R_1 R_2 Z_L s + R_1 R_2 Z_L g_m + R_1 Z_L + s^2 (C_2 L_2 R_1 R_2 Z_L g_m + C_2 L_2 R_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^3 (C_1 C_2 L_2 R_1 R_2 + C_1 C_2 L_2 R_1 Z_L) + s^2 (C_1 C_2 R_1 R_2 Z_L + C_2 L_2 R_1 R_2 g_m + C_2 L_2 R_1 + C_2 L_2 R_2 + C_2 L_2 Z_L) + s (C_1 R_1 R_2 + C_1 R_1 Z_L + C_2 R_1 R_2 + C_2 R_2 Z_L)}$$

$$10.20 \quad \text{INVALID-ORDER-20} \quad Z(s) = \left( R_1 + \frac{1}{C_1 s}, R_2, \infty, \infty, \infty \right)$$

$$H(s) = \frac{R_2 Z_L g_m + Z_L + s (C_1 R_1 R_2 Z_L g_m + C_1 R_1 Z_L)}{R_2 g_m + s (C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L) + 1}$$

$$10.21 \quad \text{INVALID-ORDER-21} \quad Z(s) = \left( R_1 + \frac{1}{C_1 s}, L_2 s + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_2 R_1 Z_L g_m s^3 + Z_L g_m + s^2 (C_1 C_2 R_1 Z_L + C_2 L_2 Z_L g_m) + s (C_1 R_1 Z_L g_m + C_2 Z_L)}{g_m + s^3 (C_1 C_2 L_2 R_1 g_m + C_1 C_2 L_2) + s^2 (C_1 C_2 R_1 + C_1 C_2 Z_L + C_2 L_2 g_m) + s (C_1 R_1 g_m + C_1 + C_2)}$$

$$10.22 \quad \text{INVALID-ORDER-22} \quad Z(s) = \left( R_1 + \frac{1}{C_1 s}, L_2 s + R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_2 R_1 Z_L g_m s^3 + Z_L g_m + s^2 (C_1 C_2 R_1 R_2 Z_L g_m + C_1 C_2 R_1 Z_L + C_2 L_2 Z_L g_m) + s (C_1 R_1 Z_L g_m + C_2 R_2 Z_L g_m + C_2 Z_L)}{g_m + s^3 (C_1 C_2 L_2 R_1 g_m + C_1 C_2 L_2) + s^2 (C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L + C_2 L_2 g_m) + s (C_1 R_1 g_m + C_1 + C_2 R_2 g_m + C_2)}$$

$$10.23 \quad \text{INVALID-ORDER-23} \quad Z(s) = \left( R_1 + \frac{1}{C_1 s}, \quad \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{R_2 Z_L g_m + Z_L + s^3 (C_1 C_2 L_2 R_1 R_2 Z_L g_m + C_1 C_2 L_2 R_1 Z_L) + s^2 (C_1 L_2 R_1 Z_L g_m + C_2 L_2 R_2 Z_L g_m + C_2 L_2 Z_L) + s (C_1 R_1 R_2 Z_L g_m + C_1 R_1 Z_L + L_2 Z_L g_m)}{R_2 g_m + s^3 (C_1 C_2 L_2 R_1 R_2 g_m + C_1 C_2 L_2 R_1 + C_1 C_2 L_2 R_2 + C_1 C_2 L_2 Z_L) + s^2 (C_1 L_2 R_1 g_m + C_1 L_2 + C_2 L_2 R_2 g_m + C_2 L_2) + s (C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L + L_2 g_m) + 1}$$

$$10.24 \quad \text{INVALID-ORDER-24} \quad Z(s) = \left( R_1 + \frac{1}{C_1 s}, \quad \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{R_2 Z_L g_m + Z_L + s^3 (C_1 C_2 L_2 R_1 R_2 Z_L g_m + C_1 C_2 L_2 R_1 Z_L) + s^2 (C_1 C_2 R_1 R_2 Z_L + C_2 L_2 R_2 Z_L g_m + C_2 L_2 Z_L) + s (C_1 R_1 R_2 Z_L g_m + C_1 R_1 Z_L + C_2 R_2 Z_L)}{R_2 g_m + s^3 (C_1 C_2 L_2 R_1 R_2 g_m + C_1 C_2 L_2 R_1 + C_1 C_2 L_2 R_2 + C_1 C_2 L_2 Z_L) + s^2 (C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L + C_2 L_2 R_2 g_m + C_2 L_2) + s (C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L + C_2 R_2) + 1}$$

$$10.25 \quad \text{INVALID-ORDER-25} \quad Z(s) = \left( L_1 s + \frac{1}{C_1 s}, \quad \frac{1}{C_2 s}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 Z_L s^3 + C_1 L_1 Z_L g_m s^2 + C_2 Z_L s + Z_L g_m}{C_1 C_2 L_1 s^3 + g_m + s^2 (C_1 C_2 Z_L + C_1 L_1 g_m) + s (C_1 + C_2)}$$

$$10.26 \quad \text{INVALID-ORDER-26} \quad Z(s) = \left( L_1 s + \frac{1}{C_1 s}, \quad \frac{R_2}{C_2 R_2 s + 1}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 R_2 Z_L s^3 + C_2 R_2 Z_L s + R_2 Z_L g_m + Z_L + s^2 (C_1 L_1 R_2 Z_L g_m + C_1 L_1 Z_L)}{C_1 C_2 L_1 R_2 s^3 + R_2 g_m + s^2 (C_1 C_2 R_2 Z_L + C_1 L_1 R_2 g_m + C_1 L_1) + s (C_1 R_2 + C_1 Z_L + C_2 R_2) + 1}$$

$$10.27 \quad \text{INVALID-ORDER-27} \quad Z(s) = \left( L_1 s + \frac{1}{C_1 s}, \quad R_2 + \frac{1}{C_2 s}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 L_1 Z_L g_m s^2 + Z_L g_m + s^3 (C_1 C_2 L_1 R_2 Z_L g_m + C_1 C_2 L_1 Z_L) + s (C_2 R_2 Z_L g_m + C_2 Z_L)}{g_m + s^3 (C_1 C_2 L_1 R_2 g_m + C_1 C_2 L_1) + s^2 (C_1 C_2 R_2 + C_1 C_2 Z_L + C_1 L_1 g_m) + s (C_1 + C_2 R_2 g_m + C_2)}$$

$$10.28 \quad \text{INVALID-ORDER-28} \quad Z(s) = \left( L_1 s + \frac{1}{C_1 s}, \quad L_2 s + \frac{1}{C_2 s}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 L_2 Z_L g_m s^4 + C_1 C_2 L_1 Z_L s^3 + C_2 Z_L s + Z_L g_m + s^2 (C_1 L_1 Z_L g_m + C_2 L_2 Z_L g_m)}{C_1 C_2 L_1 L_2 g_m s^4 + g_m + s^3 (C_1 C_2 L_1 + C_1 C_2 L_2) + s^2 (C_1 C_2 Z_L + C_1 L_1 g_m + C_2 L_2 g_m) + s (C_1 + C_2)}$$

$$10.29 \quad \text{INVALID-ORDER-29} \quad Z(s) = \left( L_1 s + \frac{1}{C_1 s}, \quad L_2 s + R_2 + \frac{1}{C_2 s}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 L_2 Z_L g_m s^4 + Z_L g_m + s^3 (C_1 C_2 L_1 R_2 Z_L g_m + C_1 C_2 L_1 Z_L) + s^2 (C_1 L_1 Z_L g_m + C_2 L_2 Z_L g_m) + s (C_2 R_2 Z_L g_m + C_2 Z_L)}{C_1 C_2 L_1 L_2 g_m s^4 + g_m + s^3 (C_1 C_2 L_1 R_2 g_m + C_1 C_2 L_1 + C_1 C_2 L_2) + s^2 (C_1 C_2 R_2 + C_1 C_2 Z_L + C_1 L_1 g_m + C_2 L_2 g_m) + s (C_1 + C_2 R_2 g_m + C_2)}$$

$$10.30 \quad \text{INVALID-ORDER-30} \quad Z(s) = \left( L_1 s + \frac{1}{C_1 s}, \quad \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 L_1 L_2 Z_L g_m s^3 + L_2 Z_L g_m s + R_2 Z_L g_m + Z_L + s^4 (C_1 C_2 L_1 L_2 R_2 Z_L g_m + C_1 C_2 L_1 L_2 Z_L) + s^2 (C_1 L_1 R_2 Z_L g_m + C_1 L_1 Z_L + C_2 L_2 R_2 Z_L g_m + C_2 L_2 Z_L)}{R_2 g_m + s^4 (C_1 C_2 L_1 L_2 R_2 g_m + C_1 C_2 L_1 L_2) + s^3 (C_1 C_2 L_2 R_2 + C_1 C_2 L_2 Z_L + C_1 L_1 L_2 g_m) + s^2 (C_1 L_1 R_2 g_m + C_1 L_1 + C_1 L_2 + C_2 L_2 R_2 g_m + C_2 L_2) + s (C_1 R_2 + C_1 Z_L + L_2 g_m) + 1}$$

$$10.31 \quad \text{INVALID-ORDER-31} \quad Z(s) = \left( L_1 s + \frac{1}{C_1 s}, \quad \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 R_2 Z_L s^3 + C_2 R_2 Z_L s + R_2 Z_L g_m + Z_L + s^4 (C_1 C_2 L_1 L_2 R_2 Z_L g_m + C_1 C_2 L_1 L_2 Z_L) + s^2 (C_1 L_1 R_2 Z_L g_m + C_1 L_1 Z_L + C_2 L_2 R_2 Z_L g_m + C_2 L_2 Z_L)}{R_2 g_m + s^4 (C_1 C_2 L_1 L_2 R_2 g_m + C_1 C_2 L_1 L_2) + s^3 (C_1 C_2 L_1 R_2 + C_1 C_2 L_2 R_2 + C_1 C_2 L_2 Z_L) + s^2 (C_1 C_2 R_2 Z_L + C_1 L_1 R_2 g_m + C_1 L_1 + C_2 L_2 R_2 g_m + C_2 L_2) + s (C_1 R_2 + C_1 Z_L + C_2 R_2) + 1}$$

**10.32 INVALID-ORDER-32**  $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 Z_L s^2 + L_1 Z_L g_m s}{C_1 C_2 L_1 Z_L s^3 + s^2 (C_1 L_1 + C_2 L_1) + s (C_2 Z_L + L_1 g_m) + 1}$$

**10.33 INVALID-ORDER-33**  $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 R_2 Z_L s^2 + s (L_1 R_2 Z_L g_m + L_1 Z_L)}{C_1 C_2 L_1 R_2 Z_L s^3 + R_2 + Z_L + s^2 (C_1 L_1 R_2 + C_1 L_1 Z_L + C_2 L_1 R_2) + s (C_2 R_2 Z_L + L_1 R_2 g_m + L_1)}$$

**10.34 INVALID-ORDER-34**  $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{L_1 Z_L g_m s + s^2 (C_2 L_1 R_2 Z_L g_m + C_2 L_1 Z_L)}{s^3 (C_1 C_2 L_1 R_2 + C_1 C_2 L_1 Z_L) + s^2 (C_1 L_1 + C_2 L_1 R_2 g_m + C_2 L_1) + s (C_2 R_2 + C_2 Z_L + L_1 g_m) + 1}$$

**10.35 INVALID-ORDER-35**  $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, L_2 s + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 L_2 Z_L g_m s^3 + C_2 L_1 Z_L s^2 + L_1 Z_L g_m s}{C_1 C_2 L_1 L_2 s^4 + s^3 (C_1 C_2 L_1 Z_L + C_2 L_1 L_2 g_m) + s^2 (C_1 L_1 + C_2 L_1 + C_2 L_2) + s (C_2 Z_L + L_1 g_m) + 1}$$

**10.36 INVALID-ORDER-36**  $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, L_2 s + R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 L_2 Z_L g_m s^3 + L_1 Z_L g_m s + s^2 (C_2 L_1 R_2 Z_L g_m + C_2 L_1 Z_L)}{C_1 C_2 L_1 L_2 s^4 + s^3 (C_1 C_2 L_1 R_2 + C_1 C_2 L_1 Z_L + C_2 L_1 L_2 g_m) + s^2 (C_1 L_1 + C_2 L_1 R_2 g_m + C_2 L_1 + C_2 L_2) + s (C_2 R_2 + C_2 Z_L + L_1 g_m) + 1}$$

**10.37 INVALID-ORDER-37**  $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{L_1 L_2 Z_L g_m s^2 + s^3 (C_2 L_1 L_2 R_2 Z_L g_m + C_2 L_1 L_2 Z_L) + s (L_1 R_2 Z_L g_m + L_1 Z_L)}{R_2 + Z_L + s^4 (C_1 C_2 L_1 L_2 R_2 + C_1 C_2 L_1 L_2 Z_L) + s^3 (C_1 L_1 L_2 + C_2 L_1 L_2 R_2 g_m + C_2 L_1 L_2) + s^2 (C_1 L_1 R_2 + C_1 L_1 Z_L + C_2 L_2 R_2 + C_2 L_2 Z_L + L_1 L_2 g_m) + s (L_1 R_2 g_m + L_1 + L_2)}$$

**10.38 INVALID-ORDER-38**  $Z(s) = \left( \frac{L_1 s}{C_1 L_1 s^2 + 1}, \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 R_2 Z_L s^2 + s^3 (C_2 L_1 L_2 R_2 Z_L g_m + C_2 L_1 L_2 Z_L) + s (L_1 R_2 Z_L g_m + L_1 Z_L)}{R_2 + Z_L + s^4 (C_1 C_2 L_1 L_2 R_2 + C_1 C_2 L_1 L_2 Z_L) + s^3 (C_1 C_2 L_1 R_2 Z_L + C_2 L_1 L_2 R_2 g_m + C_2 L_1 L_2) + s^2 (C_1 L_1 R_2 + C_1 L_1 Z_L + C_2 L_1 R_2 + C_2 L_2 R_2 + C_2 L_2 Z_L) + s (C_2 R_2 Z_L + L_1 R_2 g_m + L_1)}$$

**10.39 INVALID-ORDER-39**  $Z(s) = \left( L_1 s + R_1 + \frac{1}{C_1 s}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_1 C_2 L_1 Z_L s^3 + Z_L g_m + s^2 (C_1 C_2 R_1 Z_L + C_1 L_1 Z_L g_m) + s (C_1 R_1 Z_L g_m + C_2 Z_L)}{C_1 C_2 L_1 s^3 + g_m + s^2 (C_1 C_2 R_1 + C_1 C_2 Z_L + C_1 L_1 g_m) + s (C_1 R_1 g_m + C_1 + C_2)}$$

**10.40 INVALID-ORDER-40**  $Z(s) = \left( L_1 s + R_1 + \frac{1}{C_1 s}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_1 C_2 L_1 R_2 Z_L s^3 + R_2 Z_L g_m + Z_L + s^2 (C_1 C_2 R_1 R_2 Z_L + C_1 L_1 R_2 Z_L g_m + C_1 L_1 Z_L) + s (C_1 R_1 R_2 Z_L g_m + C_1 R_1 Z_L + C_2 R_2 Z_L)}{C_1 C_2 L_1 R_2 s^3 + R_2 g_m + s^2 (C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L + C_1 L_1 R_2 g_m + C_1 L_1) + s (C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L + C_2 R_2) + 1}$$

**10.41 INVALID-ORDER-41**  $Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{Z_L g_m + s^3 (C_1 C_2 L_1 R_2 Z_L g_m + C_1 C_2 L_1 Z_L) + s^2 (C_1 C_2 R_1 R_2 Z_L g_m + C_1 C_2 R_1 Z_L + C_1 L_1 Z_L g_m) + s (C_1 R_1 Z_L g_m + C_2 R_2 Z_L g_m + C_2 Z_L)}{g_m + s^3 (C_1 C_2 L_1 R_2 g_m + C_1 C_2 L_1) + s^2 (C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L + C_1 L_1 g_m) + s (C_1 R_1 g_m + C_1 + C_2 R_2 g_m + C_2)}$$

**10.42 INVALID-ORDER-42**  $Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, L_2s + \frac{1}{C_2s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_1 C_2 L_1 L_2 Z_L g_m s^4 + Z_L g_m + s^3 (C_1 C_2 L_1 Z_L + C_1 C_2 L_2 R_1 Z_L g_m) + s^2 (C_1 C_2 R_1 Z_L + C_1 L_1 Z_L g_m + C_2 L_2 Z_L g_m) + s (C_1 R_1 Z_L g_m + C_2 Z_L)}{C_1 C_2 L_1 L_2 g_m s^4 + g_m + s^3 (C_1 C_2 L_1 + C_1 C_2 L_2 R_1 g_m + C_1 C_2 L_2) + s^2 (C_1 C_2 R_1 + C_1 C_2 Z_L + C_1 L_1 g_m + C_2 L_2 g_m) + s (C_1 R_1 g_m + C_1 + C_2)}$$

**10.43 INVALID-ORDER-43**  $Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, L_2s + R_2 + \frac{1}{C_2s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_1 C_2 L_1 L_2 Z_L g_m s^4 + Z_L g_m + s^3 (C_1 C_2 L_1 R_2 Z_L g_m + C_1 C_2 L_1 Z_L + C_1 C_2 L_2 R_1 Z_L g_m) + s^2 (C_1 C_2 R_1 R_2 Z_L g_m + C_1 C_2 R_1 Z_L + C_1 L_1 Z_L g_m + C_2 L_2 Z_L g_m) + s (C_1 R_1 Z_L g_m + C_2 R_2 Z_L g_m + C_2 Z_L)}{C_1 C_2 L_1 L_2 g_m s^4 + g_m + s^3 (C_1 C_2 L_1 R_2 g_m + C_1 C_2 L_1 + C_1 C_2 L_2 R_1 g_m + C_1 C_2 L_2) + s^2 (C_1 C_2 R_1 R_2 g_m + C_1 C_2 R_1 + C_1 C_2 R_2 + C_1 C_2 Z_L + C_1 L_1 g_m + C_2 L_2 g_m) + s (C_1 R_1 g_m + C_1 + C_2 R_2 g_m + C_2)}$$

**10.44 INVALID-ORDER-44**  $Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{R_2 Z_L g_m + Z_L + s^4 (C_1 C_2 L_1 L_2 R_2 Z_L g_m + C_1 C_2 L_1 L_2 Z_L) + s^3 (C_1 C_2 L_2 R_1 R_2 Z_L g_m + C_1 C_2 L_2 R_1 Z_L + C_1 L_1 L_2 Z_L g_m) + s^2 (C_1 L_1 R_2 Z_L g_m + C_1 L_1 Z_L + C_1 L_2 R_1 Z_L g_m + C_2 L_2 R_2 Z_L g_m + C_2 L_2 Z_L) + s (C_1 R_1 R_2 Z_L g_m + C_1 R_1 Z_L + L_2 Z_L g_m)}{R_2 g_m + s^4 (C_1 C_2 L_1 L_2 R_2 g_m + C_1 C_2 L_1 L_2) + s^3 (C_1 C_2 L_2 R_1 R_2 g_m + C_1 C_2 L_2 R_1 + C_1 C_2 L_2 R_2 + C_1 C_2 L_2 Z_L + C_1 L_1 L_2 g_m) + s^2 (C_1 L_1 R_2 g_m + C_1 L_1 + C_1 L_2 R_1 g_m + C_1 L_2 + C_2 L_2 R_2 g_m + C_2 L_2) + s (C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L + L_2 g_m) + 1}$$

**10.45 INVALID-ORDER-45**  $Z(s) = \left( L_1s + R_1 + \frac{1}{C_1s}, \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{R_2 Z_L g_m + Z_L + s^4 (C_1 C_2 L_1 L_2 R_2 Z_L g_m + C_1 C_2 L_1 L_2 Z_L) + s^3 (C_1 C_2 L_1 R_2 Z_L + C_1 C_2 L_2 R_1 R_2 Z_L g_m + C_1 C_2 L_2 R_1 Z_L) + s^2 (C_1 C_2 R_1 R_2 Z_L + C_1 L_1 R_2 Z_L g_m + C_1 L_1 Z_L + C_2 L_2 R_2 Z_L g_m + C_2 L_2 Z_L) + s (C_1 R_1 R_2 Z_L g_m + C_1 R_1 Z_L + C_2 R_2 Z_L)}{R_2 g_m + s^4 (C_1 C_2 L_1 L_2 R_2 g_m + C_1 C_2 L_1 L_2) + s^3 (C_1 C_2 L_1 R_2 + C_1 C_2 L_2 R_1 R_2 g_m + C_1 C_2 L_2 R_1 + C_1 C_2 L_2 R_2 + C_1 C_2 L_2 Z_L) + s^2 (C_1 C_2 R_1 R_2 + C_1 C_2 R_2 Z_L + C_1 L_1 R_2 g_m + C_1 L_1 + C_2 L_2 R_2 g_m + C_2 L_2) + s (C_1 R_1 R_2 g_m + C_1 R_1 + C_1 R_2 + C_1 Z_L + C_2 R_2) + 1}$$

**10.46 INVALID-ORDER-46**  $Z(s) = \left( \frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 R_1 Z_L s^2 + L_1 R_1 Z_L g_m s}{C_1 C_2 L_1 R_1 Z_L s^3 + R_1 + s^2 (C_1 L_1 R_1 + C_2 L_1 R_1 + C_2 L_1 Z_L) + s (C_2 R_1 Z_L + L_1 R_1 g_m + L_1)}$$

**10.47 INVALID-ORDER-47**  $Z(s) = \left( \frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 R_1 R_2 Z_L s^2 + s (L_1 R_1 R_2 Z_L g_m + L_1 R_1 Z_L)}{C_1 C_2 L_1 R_1 R_2 Z_L s^3 + R_1 R_2 + R_1 Z_L + s^2 (C_1 L_1 R_1 R_2 + C_1 L_1 R_1 Z_L + C_2 L_1 R_1 R_2 + C_2 L_1 R_2 Z_L) + s (C_2 R_1 R_2 Z_L + L_1 R_1 R_2 g_m + L_1 R_1 + L_1 R_2 + L_1 Z_L)}$$

**10.48 INVALID-ORDER-48**  $Z(s) = \left( \frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1}, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{L_1 R_1 Z_L g_m s + s^2 (C_2 L_1 R_1 R_2 Z_L g_m + C_2 L_1 R_1 Z_L)}{R_1 + s^3 (C_1 C_2 L_1 R_1 R_2 + C_1 C_2 L_1 R_1 Z_L) + s^2 (C_1 L_1 R_1 + C_2 L_1 R_1 R_2 g_m + C_2 L_1 R_1 + C_2 L_1 R_2 + C_2 L_1 Z_L) + s (C_2 R_1 R_2 + C_2 R_1 Z_L + L_1 R_1 g_m + L_1)}$$

**10.49 INVALID-ORDER-49**  $Z(s) = \left( \frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1}, L_2 s + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$

$$H(s) = \frac{C_2 L_1 L_2 R_1 Z_L g_m s^3 + C_2 L_1 R_1 Z_L s^2 + L_1 R_1 Z_L g_m s}{C_1 C_2 L_1 L_2 R_1 s^4 + R_1 + s^3 (C_1 C_2 L_1 R_1 Z_L + C_2 L_1 L_2 R_1 g_m + C_2 L_1 L_2) + s^2 (C_1 L_1 R_1 + C_2 L_1 R_1 + C_2 L_1 Z_L + C_2 L_2 R_1) + s (C_2 R_1 Z_L + L_1 R_1 g_m + L_1)}$$



$$\mathbf{10.50 \quad INVALID-ORDER-50} \quad Z(s) = \left( \frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1}, \quad L_2 s + R_2 + \frac{1}{C_2 s}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_2 L_1 L_2 R_1 Z_L g_m s^3 + L_1 R_1 Z_L g_m s + s^2 (C_2 L_1 R_1 R_2 Z_L g_m + C_2 L_1 R_1 Z_L)}{C_1 C_2 L_1 L_2 R_1 s^4 + R_1 + s^3 (C_1 C_2 L_1 R_1 R_2 + C_1 C_2 L_1 R_1 Z_L + C_2 L_1 L_2 R_1 g_m + C_2 L_1 L_2) + s^2 (C_1 L_1 R_1 + C_2 L_1 R_1 R_2 g_m + C_2 L_1 R_1 + C_2 L_1 R_2 + C_2 L_1 Z_L + C_2 L_2 R_1) + s (C_2 R_1 R_2 + C_2 R_1 Z_L + L_1 R_1 g_m + L_1)}$$

$$\mathbf{10.51 \quad INVALID-ORDER-51} \quad Z(s) = \left( \frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1}, \quad \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{L_1 L_2 R_1 Z_L g_m s^2 + s^3 (C_2 L_1 L_2 R_1 R_2 Z_L g_m + C_2 L_1 L_2 R_1 Z_L) + s (L_1 R_1 R_2 Z_L g_m + L_1 R_1 Z_L)}{R_1 R_2 + R_1 Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 + C_1 C_2 L_1 L_2 R_1 Z_L) + s^3 (C_1 L_1 L_2 R_1 + C_2 L_1 L_2 R_1 R_2 g_m + C_2 L_1 L_2 R_1 + C_2 L_1 L_2 R_2 + C_2 L_1 L_2 Z_L) + s^2 (C_1 L_1 R_1 R_2 + C_1 L_1 R_1 Z_L + C_2 L_2 R_1 R_2 + C_2 L_2 R_1 Z_L + L_1 L_2 R_1 g_m + L_1 L_2) + s (L_1 R_1 R_2 g_m + L_1 R_1 + L_1 R_2 + L_1 Z_L + L_1)}$$

$$\mathbf{10.52 \quad INVALID-ORDER-52} \quad Z(s) = \left( \frac{L_1 R_1 s}{C_1 L_1 R_1 s^2 + L_1 s + R_1}, \quad \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_2 L_1 R_1 R_2 Z_L s^2 + s^3 (C_2 L_1 L_2 R_1 R_2 Z_L g_m + C_2 L_1 L_2 R_1 Z_L) + s (L_1 R_1 R_2 Z_L g_m + L_1 R_1 Z_L)}{R_1 R_2 + R_1 Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 + C_1 C_2 L_1 L_2 R_1 Z_L) + s^3 (C_1 C_2 L_1 R_1 R_2 Z_L + C_2 L_1 L_2 R_1 R_2 g_m + C_2 L_1 L_2 R_1 + C_2 L_1 L_2 R_2 + C_2 L_1 L_2 Z_L) + s^2 (C_1 L_1 R_1 R_2 + C_1 L_1 R_1 Z_L + C_2 L_2 R_1 R_2 + C_2 L_2 R_1 Z_L + L_1 L_2 R_1 g_m + L_1 L_2) + s (C_2 R_1 R_2 Z_L + L_1 R_1 R_2 g_m + L_1 R_1 + L_1 R_2 + L_1 Z_L + L_1)}$$

$$\mathbf{10.53 \quad INVALID-ORDER-53} \quad Z(s) = \left( \frac{C_1 L_1 R_1 s^2 + L_1 s + R_1}{C_1 L_1 s^2 + 1}, \quad \frac{1}{C_2 s}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 R_1 Z_L s^3 + R_1 Z_L g_m + s^2 (C_1 L_1 R_1 Z_L g_m + C_2 L_1 Z_L) + s (C_2 R_1 Z_L + L_1 Z_L g_m)}{R_1 g_m + s^3 (C_1 C_2 L_1 R_1 + C_1 C_2 L_1 Z_L) + s^2 (C_1 L_1 R_1 g_m + C_1 L_1 + C_2 L_1) + s (C_2 R_1 + C_2 Z_L + L_1 g_m) + 1}$$

$$\mathbf{10.54 \quad INVALID-ORDER-54} \quad Z(s) = \left( \frac{C_1 L_1 R_1 s^2 + L_1 s + R_1}{C_1 L_1 s^2 + 1}, \quad \frac{R_2}{C_2 R_2 s + 1}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 R_1 R_2 Z_L s^3 + R_1 R_2 Z_L g_m + R_1 Z_L + s^2 (C_1 L_1 R_1 R_2 Z_L g_m + C_1 L_1 R_1 Z_L + C_2 L_1 R_2 Z_L) + s (C_2 R_1 R_2 Z_L + L_1 R_2 Z_L g_m + L_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^3 (C_1 C_2 L_1 R_1 R_2 + C_1 C_2 L_1 R_2 Z_L) + s^2 (C_1 L_1 R_1 R_2 g_m + C_1 L_1 R_1 + C_1 L_1 R_2 + C_1 L_1 Z_L + C_2 L_1 R_2) + s (C_2 R_1 R_2 + C_2 R_2 Z_L + L_1 R_2 g_m + L_1)}$$

$$\mathbf{10.55 \quad INVALID-ORDER-55} \quad Z(s) = \left( \frac{C_1 L_1 R_1 s^2 + L_1 s + R_1}{C_1 L_1 s^2 + 1}, \quad R_2 + \frac{1}{C_2 s}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{R_1 Z_L g_m + s^3 (C_1 C_2 L_1 R_1 R_2 Z_L g_m + C_1 C_2 L_1 R_1 Z_L) + s^2 (C_1 L_1 R_1 Z_L g_m + C_2 L_1 R_2 Z_L g_m + C_2 L_1 Z_L) + s (C_2 R_1 R_2 Z_L g_m + C_2 R_1 Z_L + L_1 Z_L g_m)}{R_1 g_m + s^3 (C_1 C_2 L_1 R_1 R_2 g_m + C_1 C_2 L_1 R_1 + C_1 C_2 L_1 R_2 + C_1 C_2 L_1 Z_L) + s^2 (C_1 L_1 R_1 g_m + C_1 L_1 + C_2 L_1 R_2 g_m + C_2 L_1) + s (C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L + L_1 g_m) + 1}$$

$$\mathbf{10.56 \quad INVALID-ORDER-56} \quad Z(s) = \left( \frac{C_1 L_1 R_1 s^2 + L_1 s + R_1}{C_1 L_1 s^2 + 1}, \quad L_2 s + \frac{1}{C_2 s}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 L_2 R_1 Z_L g_m s^4 + R_1 Z_L g_m + s^3 (C_1 C_2 L_1 R_1 Z_L + C_2 L_1 L_2 Z_L g_m) + s^2 (C_1 L_1 R_1 Z_L g_m + C_2 L_1 Z_L + C_2 L_2 R_1 Z_L g_m) + s (C_2 R_1 Z_L + L_1 Z_L g_m)}{R_1 g_m + s^4 (C_1 C_2 L_1 L_2 R_1 g_m + C_1 C_2 L_1 L_2) + s^3 (C_1 C_2 L_1 R_1 + C_1 C_2 L_1 Z_L + C_2 L_1 L_2 g_m) + s^2 (C_1 L_1 R_1 g_m + C_1 L_1 + C_2 L_1 + C_2 L_2 R_1 g_m + C_2 L_2) + s (C_2 R_1 + C_2 Z_L + L_1 g_m) + 1}$$

$$\mathbf{10.57 \quad INVALID-ORDER-57} \quad Z(s) = \left( \frac{C_1 L_1 R_1 s^2 + L_1 s + R_1}{C_1 L_1 s^2 + 1}, \quad L_2 s + R_2 + \frac{1}{C_2 s}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 L_2 R_1 Z_L g_m s^4 + R_1 Z_L g_m + s^3 (C_1 C_2 L_1 R_1 R_2 Z_L g_m + C_1 C_2 L_1 R_1 Z_L + C_2 L_1 L_2 Z_L g_m) + s^2 (C_1 L_1 R_1 Z_L g_m + C_2 L_1 R_2 Z_L g_m + C_2 L_1 Z_L + C_2 L_2 R_1 Z_L g_m) + s (C_2 R_1 R_2 Z_L g_m + C_2 R_1 Z_L + L_1 Z_L g_m)}{R_1 g_m + s^4 (C_1 C_2 L_1 L_2 R_1 g_m + C_1 C_2 L_1 L_2) + s^3 (C_1 C_2 L_1 R_1 R_2 g_m + C_1 C_2 L_1 R_1 + C_1 C_2 L_1 R_2 + C_1 C_2 L_1 Z_L + C_2 L_1 L_2 g_m) + s^2 (C_1 L_1 R_1 g_m + C_1 L_1 + C_2 L_1 R_2 g_m + C_2 L_1 + C_2 L_2 R_1 g_m + C_2 L_2) + s (C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L + L_1 g_m) + 1}$$

$$\mathbf{10.58 \quad INVALID-ORDER-58} \quad Z(s) = \left( \frac{C_1 L_1 R_1 s^2 + L_1 s + R_1}{C_1 L_1 s^2 + 1}, \quad \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \quad \infty, \quad \infty, \quad \infty \right)$$

$$H(s) = \frac{R_1 R_2 Z_L g_m + R_1 Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 Z_L g_m + C_1 C_2 L_1 L_2 R_1 Z_L) + s^3 (C_1 L_1 L_2 R_1 Z_L g_m + C_2 L_1 L_2 R_2 Z_L g_m + C_2 L_1 L_2 Z_L) + s^2 (C_1 L_1 R_1 R_2 Z_L g_m + C_1 L_1 R_1 Z_L + C_2 L_2 R_1 R_2 Z_L g_m + C_2 L_2 R_1 Z_L + L_1 L_2 Z_L g_m) + s (L_1 R_2 Z_L g_m + L_1 R_2 Z_L + L_1 Z_L g_m)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 g_m + C_1 C_2 L_1 L_2 R_1 + C_1 C_2 L_1 L_2 R_2 + C_1 C_2 L_1 L_2 Z_L) + s^3 (C_1 L_1 L_2 R_1 g_m + C_1 L_1 L_2 + C_2 L_1 L_2 R_2 g_m + C_2 L_1 L_2) + s^2 (C_1 L_1 R_1 R_2 g_m + C_1 L_1 R_1 + C_1 L_1 R_2 + C_1 L_1 Z_L + C_2 L_2 R_1 R_2 g_m + C_2 L_2 R_1 + C_2 L_2 R_2 + C_2 L_2 Z_L) + s (C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L + L_1 g_m) + 1}$$

$$\mathbf{10.59 \quad INVALID-ORDER-59} \quad Z(s) = \left( \frac{C_1 L_1 R_1 s^2 + L_1 s + R_1}{C_1 L_1 s^2 + 1}, \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{R_1 R_2 Z_L g_m + R_1 Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 Z_L g_m + C_1 C_2 L_1 L_2 R_1 Z_L) + s^3 (C_1 C_2 L_1 R_1 R_2 Z_L + C_2 L_1 L_2 R_2 Z_L g_m + C_2 L_1 L_2 Z_L) + s^2 (C_1 L_1 R_1 R_2 Z_L g_m + C_1 L_1 R_1 Z_L + C_2 L_1 R_2 Z_L + C_2 L_2 R_1 R_2 Z_L g_m + C_2 L_2 R_1 Z_L) + s (C_2 R_1 R_2 Z_L g_m + C_2 R_1 Z_L) + R_2 Z_L}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 g_m + C_1 C_2 L_1 L_2 R_1 + C_1 C_2 L_1 L_2 R_2 + C_1 C_2 L_1 L_2 Z_L) + s^3 (C_1 C_2 L_1 R_1 R_2 + C_1 C_2 L_1 R_2 Z_L + C_2 L_1 L_2 R_2 g_m + C_2 L_1 L_2) + s^2 (C_1 L_1 R_1 R_2 g_m + C_1 L_1 R_1 + C_1 L_1 R_2 + C_1 L_1 Z_L + C_2 L_1 R_2 + C_2 L_2 R_1 R_2 g_m + C_2 L_2 R_1 + C_2 L_2 R_2) + s (C_2 R_1 R_2 + C_2 R_1 + C_2 R_2 + C_2 Z_L) + 1}$$

$$\mathbf{10.60 \quad INVALID-ORDER-60} \quad Z(s) = \left( \frac{R_1 (C_1 L_1 s^2 + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1}, \frac{1}{C_2 s}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 R_1 Z_L s^3 + C_1 L_1 R_1 Z_L g_m s^2 + C_2 R_1 Z_L s + R_1 Z_L g_m}{R_1 g_m + s^3 (C_1 C_2 L_1 R_1 + C_1 C_2 L_1 Z_L) + s^2 (C_1 C_2 R_1 Z_L + C_1 L_1 R_1 g_m + C_1 L_1) + s (C_1 R_1 + C_2 R_1 + C_2 Z_L) + 1}$$

$$\mathbf{10.61 \quad INVALID-ORDER-61} \quad Z(s) = \left( \frac{R_1 (C_1 L_1 s^2 + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1}, \frac{R_2}{C_2 R_2 s + 1}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 R_1 R_2 Z_L s^3 + C_2 R_1 R_2 Z_L s + R_1 R_2 Z_L g_m + R_1 Z_L + s^2 (C_1 L_1 R_1 R_2 Z_L g_m + C_1 L_1 R_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^3 (C_1 C_2 L_1 R_1 R_2 + C_1 C_2 L_1 R_2 Z_L) + s^2 (C_1 C_2 R_1 R_2 Z_L + C_1 L_1 R_1 R_2 g_m + C_1 L_1 R_1 + C_1 L_1 R_2 + C_1 L_1 Z_L) + s (C_1 R_1 R_2 + C_1 R_1 Z_L + C_2 R_1 R_2 + C_2 R_2 Z_L) + 1}$$

$$\mathbf{10.62 \quad INVALID-ORDER-62} \quad Z(s) = \left( \frac{R_1 (C_1 L_1 s^2 + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1}, R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_1 L_1 R_1 Z_L g_m s^2 + R_1 Z_L g_m + s^3 (C_1 C_2 L_1 R_1 R_2 Z_L g_m + C_1 C_2 L_1 R_1 Z_L) + s (C_2 R_1 R_2 Z_L g_m + C_2 R_1 Z_L)}{R_1 g_m + s^3 (C_1 C_2 L_1 R_1 R_2 g_m + C_1 C_2 L_1 R_1 + C_1 C_2 L_1 R_2 + C_1 C_2 L_1 Z_L) + s^2 (C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L + C_1 L_1 R_1 g_m + C_1 L_1) + s (C_1 R_1 + C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L) + 1}$$

$$\mathbf{10.63 \quad INVALID-ORDER-63} \quad Z(s) = \left( \frac{R_1 (C_1 L_1 s^2 + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1}, L_2 s + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 L_2 R_1 Z_L g_m s^4 + C_1 C_2 L_1 R_1 Z_L s^3 + C_2 R_1 Z_L s + R_1 Z_L g_m + s^2 (C_1 L_1 R_1 Z_L g_m + C_2 L_2 R_1 Z_L g_m)}{R_1 g_m + s^4 (C_1 C_2 L_1 L_2 R_1 g_m + C_1 C_2 L_1 L_2) + s^3 (C_1 C_2 L_1 R_1 + C_1 C_2 L_1 Z_L + C_1 C_2 L_2 R_1) + s^2 (C_1 C_2 R_1 Z_L + C_1 L_1 R_1 g_m + C_1 L_1 + C_2 L_2 R_1 g_m + C_2 L_2) + s (C_1 R_1 + C_2 R_1 + C_2 Z_L) + 1}$$

$$\mathbf{10.64 \quad INVALID-ORDER-64} \quad Z(s) = \left( \frac{R_1 (C_1 L_1 s^2 + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1}, L_2 s + R_2 + \frac{1}{C_2 s}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 L_2 R_1 Z_L g_m s^4 + R_1 Z_L g_m + s^3 (C_1 C_2 L_1 R_1 R_2 Z_L g_m + C_1 C_2 L_1 R_1 Z_L) + s^2 (C_1 L_1 R_1 Z_L g_m + C_2 L_2 R_1 Z_L g_m) + s (C_2 R_1 R_2 Z_L g_m + C_2 R_1 Z_L)}{R_1 g_m + s^4 (C_1 C_2 L_1 L_2 R_1 g_m + C_1 C_2 L_1 L_2) + s^3 (C_1 C_2 L_1 R_1 R_2 g_m + C_1 C_2 L_1 R_1 + C_1 C_2 L_1 R_2 + C_1 C_2 L_1 Z_L + C_1 C_2 L_2 R_1) + s^2 (C_1 C_2 R_1 R_2 + C_1 C_2 R_1 Z_L + C_1 L_1 R_1 g_m + C_1 L_1 + C_2 L_2 R_1 g_m + C_2 L_2) + s (C_1 R_1 + C_2 R_1 R_2 g_m + C_2 R_1 + C_2 R_2 + C_2 Z_L) + 1}$$

$$\mathbf{10.65 \quad INVALID-ORDER-65} \quad Z(s) = \left( \frac{R_1 (C_1 L_1 s^2 + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1}, \frac{C_2 L_2 R_2 s^2 + L_2 s + R_2}{C_2 L_2 s^2 + 1}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_1 L_1 L_2 R_1 Z_L g_m s^3 + L_2 R_1 Z_L g_m s + R_1 R_2 Z_L g_m + R_1 Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 Z_L g_m + C_1 C_2 L_1 L_2 R_1 Z_L) + s^2 (C_1 L_1 R_1 R_2 Z_L g_m + C_1 L_1 R_1 Z_L + C_2 L_2 R_1 R_2 Z_L g_m + C_2 L_2 R_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 g_m + C_1 C_2 L_1 L_2 R_1 + C_1 C_2 L_1 L_2 R_2 + C_1 C_2 L_1 L_2 Z_L) + s^3 (C_1 C_2 L_2 R_1 R_2 + C_1 C_2 L_2 R_1 Z_L + C_1 L_1 L_2 R_1 g_m + C_1 L_1 L_2) + s^2 (C_1 L_1 R_1 R_2 g_m + C_1 L_1 R_1 + C_1 L_1 R_2 + C_1 L_1 Z_L + C_1 L_2 R_1 + C_2 L_2 R_1 R_2 g_m + C_2 L_2 R_1 + C_2 L_2 R_2) + s (C_2 R_1 R_2 + C_2 R_1 + C_2 R_2 + C_2 Z_L) + 1}$$

$$\mathbf{10.66 \quad INVALID-ORDER-66} \quad Z(s) = \left( \frac{R_1 (C_1 L_1 s^2 + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1}, \frac{R_2 (C_2 L_2 s^2 + 1)}{C_2 L_2 s^2 + C_2 R_2 s + 1}, \infty, \infty, \infty \right)$$

$$H(s) = \frac{C_1 C_2 L_1 R_1 R_2 Z_L s^3 + C_2 R_1 R_2 Z_L s + R_1 R_2 Z_L g_m + R_1 Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 Z_L g_m + C_1 C_2 L_1 L_2 R_1 Z_L) + s^2 (C_1 L_1 R_1 R_2 Z_L g_m + C_1 L_1 R_1 Z_L + C_2 L_2 R_1 R_2 Z_L g_m + C_2 L_2 R_1 Z_L)}{R_1 R_2 g_m + R_1 + R_2 + Z_L + s^4 (C_1 C_2 L_1 L_2 R_1 R_2 g_m + C_1 C_2 L_1 L_2 R_1 + C_1 C_2 L_1 L_2 R_2 + C_1 C_2 L_1 L_2 Z_L) + s^3 (C_1 C_2 L_1 R_1 R_2 + C_1 C_2 L_1 R_2 Z_L + C_1 C_2 L_2 R_1 R_2 + C_1 C_2 L_2 R_1 Z_L) + s^2 (C_1 C_2 R_1 R_2 Z_L + C_1 L_1 R_1 R_2 g_m + C_1 L_1 R_1 + C_1 L_1 R_2 + C_1 L_1 Z_L + C_2 L_2 R_1 R_2 g_m + C_2 L_2 R_1 + C_2 L_2 R_2) + s (C_2 R_1 R_2 + C_2 R_1 + C_2 R_2 + C_2 Z_L) + 1}$$

## 11 PolynomialError