Filter Summary Report: TIA,some,parasitic,Z1,ZL

Generated by MacAnalog-Symbolix

December 5, 2024

Contents

1	Exan	nined $H(z)$ f	for TIA so	me para	sitic Z1 Z	$\mathbf{L} : \frac{Z_1}{Z_1 g_m}$	$\frac{Z_L(g_mr_o+1)}{r_o+Z_1+Z_L}$	$\frac{1}{c+r_o}$										5
2	HP																	ţ
3	BP																	;
	3.1	BP-1 Z(s) =	(R_1, ∞, ∞)	∞ , ∞ , ∞ ,	$\frac{L_L s}{C_L L_L s^2 + 1}$)			 	 5								
	3.2	BP-2 Z(s) =	(R_1, ∞, \circ)	∞ , ∞ , ∞	$\frac{1}{C_L s + \frac{1}{R_L} + \cdots}$	$\frac{1}{L_L s}$.			 	 5								
	3.3	BP-3 Z(s) =	(L_1s, ∞, ∞)	∞, ∞, ∞	$\left(\frac{1}{C_L s} \right)$.				 	 Ę								
	3.4	BP-4 Z(s) =	(L_1s, ∞, ∞)	∞ , ∞ , ∞	$, \frac{R_L}{C_L R_L s + 1}$)			 	 6								
	3.5	BP-5 Z(s) =	$\left(\frac{L_1s}{C_1L_1s^2+1},\right.$	∞ , ∞ , o	∞, ∞, R_L)			 	 . 6								
	3.6	BP-6 $Z(s) =$	$\left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{R_1}}\right)$	$\frac{1}{\sqrt{1^s}}$, ∞ , o	$\infty, \infty, \infty, \infty$	R_L) .			 	 (
4	\mathbf{LP}																	7
	4.1	LP-1 Z(s) = $LP-2 Z(s) =$	$\left(\frac{1}{C_1s}, \infty, \infty\right)$	∞ , ∞ , ∞	$, \frac{R_L}{C_L R_L s + 1}$)			 	 7								
	4.2	LP-2 Z(s) =	$\left(\frac{R_1}{C_1R_1s+1},\right)$	∞ , ∞ , ∞	$(0, \infty, \frac{1}{C_L s})$)			 	 7								
	4.3	LP-3 Z(s) =	$\left(\frac{R_1}{C_1R_1s+1},\right)$	∞ , ∞ , ∞	$o, \infty, \frac{R_I}{C_L R_I}$	$\left(\frac{L}{L}s+1\right)$			 	 7								
5	\mathbf{BS}		,			`												8
		BS-1 $Z(s) =$	\			/												
	5.2	BS-2 Z(s) =	(R_1, ∞, ∞)	$\infty, \infty, \infty,$	$\frac{R_L \left(L_L s + \frac{1}{C}\right)}{L_L s + R_L + \frac{1}{C}}$	$\left(\frac{\frac{1}{C_{L}s}}{\frac{1}{C_{L}s}}\right)$			 	 8								
	5.3	BS-3 $Z(s) =$	$(L_1s + \frac{1}{C_1s})$	$, \infty, \infty,$	∞ , ∞ , R_L	, , , , , , , , , , , , , , , , , , ,			 	 . 8								
	5.4	BS-4 $Z(s) =$	$\left(\frac{R_1\left(L_1s + \frac{1}{C_1}\right)}{L_1s + R_1 + \frac{1}{C_1}}\right)$	$\frac{\left(\frac{\overline{s}}{s}\right)}{\frac{1}{1}s}$, ∞ , o	$\infty, \ \infty, \ \infty,$	R_L .			 	 (
6	GE																	ç
	6.1	GE-1 $Z(s) =$																
	6.2	GE-2 $Z(s) =$	(R_1, ∞, ∞)	∞ , ∞ , ∞ ,	$\frac{L_L s}{C_L L_L s^2 + 1}$	$+R_L$			 	 10								
	6.3	GE-3 $Z(s) =$	$(L_1s + R_1)$	$+\frac{1}{C_1s}, \infty$	$, \infty, \infty, \infty$	∞ , R_L			 	 10								
	6.4	GE-4 Z(s) =	$\left(\frac{L_1s}{C_1L_1s^2+1}\right)$	$+R_1, \infty,$	∞ , ∞ , ∞	(R_L)			 	 10								
7	AP																	1
8	INV	ALID-NUM	ER	. /-			n 1	\										11
	8.1	INVALID-NU	MER-1 $Z(x)$	$s) = (L_1 s)$	$, \infty, \infty, \infty$	$\infty, \infty, 1$	$R_L + \frac{1}{C_L s}$)	 	 11								
	8.2	ALID-NUM INVALID-NU INVALID-NU	MER-2 $Z(x)$	$S = \left(\frac{I}{C_1 R} \right)$	$\frac{\mathcal{C}_1}{\mathcal{C}_1 s+1}, \ \infty, \ \mathcal{C}_1$	∞ , ∞ ,	∞ , R_L +	$\left(\frac{1}{C_L s}\right)$	 	 11								
	8.3	INVALID-NU	MER-3 $Z(x)$	$s) = (R_1 \cdot$	$+\frac{1}{C_1s}, \infty,$	∞ , ∞ ,	∞ , $\frac{R}{C_L R}$	$\left(\frac{R_L}{R_L s+1}\right)$.	 	 11								

9 INVALID-WZ

10 INVALID-ORDER $10.1 \text{ INVALID-ORDER-1 } Z(s) = (R_1, \infty, \infty, \infty, \infty, \infty, R_L) \qquad \dots $	12 12
10.2 INVALID-ORDER-2 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{1}{C_{r,s}}\right)$	
10.3 INVALID-ORDER-3 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1}\right)$	12
10.4 INVALID-ORDER-4 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s}\right)$	19
10.5 INVALID-ORDER-5 $Z(s) = \begin{pmatrix} n_1, & \infty, & \infty, & \infty, & \infty, & n_L + C_{Ls} \end{pmatrix}$	12
10.6 INVALID-ORDER-6 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_{L,s}}\right)$	12
10.7 INVALID-ORDER-7 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$	12
10.8 INVALID-ORDER-8 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$	13
10.9 INVALID-ORDER-9 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$	
10.10INVALID-ORDER-10 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$	13
10.11INVALID-ORDER-11 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)'$	13
$10.12 \text{INVALID-ORDER-} 12 \ Z(s) = \left(\frac{1}{C_1 s}, \ \infty, \ $	13
10.13INVALID-ORDER-13 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \frac{1}{C_L s}\right)$	13
10.14INVALID-ORDER-14 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s}\right)$	13
10.15INVALID-ORDER-15 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$	13
10.16INVALID-ORDER-16 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)'$	13
10.17INVALID-ORDER-17 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$	14
$10.18 \text{INVALID-ORDER-} 18 \ Z(s) = \left(\frac{1}{C_1 s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right) \ \dots $	
$10.19 \text{INVALID-ORDER-19 } Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right) \dots \dots$	14
$10.20 \text{INVALID-ORDER-20 } Z(s) = \left(\frac{1}{C_1 s}, \ \infty, \ $	
$10.21 \text{INVALID-ORDER-} 21 \ Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ R_L \right) \dots $	14
$10.22 \text{INVALID-ORDER-} 22 \ Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ L_L s + \frac{1}{C_L s}\right) \ \dots $	14
$10.23 \text{INVALID-ORDER-} 23 \ Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{L_L s}{C_L L_L s^2 + 1}\right) \qquad \dots $	14
$10.24 \text{INVALID-ORDER-} 24 \ Z(s) = \left(\frac{R_1}{C_1 R_1 s+1}, \ \infty, \ $	14
$10.25 \text{INVALID-ORDER-} 25 \ Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{1}{C_L s + \frac{1}{R_I} + \frac{1}{L_I s}}\right) \dots $	15
$10.26 \text{INVALID-ORDER-} 26 \ Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{L_L s}{C_L L_L s^2 + 1} + R_L \right) \dots $	
$10.27 \text{INVALID-ORDER-} 27 \ Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right) \ \dots $	15
$10.28 \text{INVALID-ORDER-} 28 \ Z(s) = \left(R_1 + \frac{1}{C_1 s}, \ \infty, \ $	15
10.29INVALID-ORDER-29 $Z(s) = \left(R_1 + \frac{1}{2}, \infty, \infty, \infty, \infty, \frac{1}{2}\right)$	15
10.30INVALID-ORDER-30 $Z(s) = (R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s})$	15
10.31INVALID-ORDER-31 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$	15
$10.32 \text{INVALID-ORDER-} 32 \ Z(s) = \left\langle R_1 + \frac{1}{C_1 s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{L_L s}{C_1 L_1 s^2 + 1} \right\rangle \dots $	15
10.30INVALID-ORDER-30 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s}\right)$ 10.31INVALID-ORDER-31 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$ 10.32INVALID-ORDER-32 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$ 10.33INVALID-ORDER-33 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$	15
\	

10.34INVALID-ORDER-34 $Z(s) =$	$=\left(R_1+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{1}{C_Ls+rac{1}{R_L}+rac{1}{L_Ls}} ight)$	16
10.35INVALID-ORDER-35 $Z(s) =$	$= \left(R_1 + \frac{1}{C_1 s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right) \ \dots $	16
10.36INVALID-ORDER-36 $Z(s) =$	$= \left(R_1 + \frac{1}{C_1 s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right) \dots $	16
10.37INVALID-ORDER-37 $Z(s) =$	$=\left(L_1s+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{1}{C_Ls} ight)$	16
10.38INVALID-ORDER-38 $Z(s) =$	$=\left(L_1s+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{R_L}{C_LR_Ls+1} ight)\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots$	16
10.39INVALID-ORDER-39 $Z(s) =$	$=\left(L_1s+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;\infty,\;R_L+rac{1}{C_Ls} ight)$	16
10.40INVALID-ORDER-40 $Z(s) =$	$=\left(L_1s+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;L_Ls+rac{1}{C_Ls} ight)\;\ldots$	16
10.41INVALID-ORDER-41 $Z(s) =$	$=\left(L_1s+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{L_Ls}{C_LL_Ls^2+1} ight)$	16
10.42INVALID-ORDER-42 $Z(s) =$	$=\left(L_1s+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;L_Ls+R_L+rac{1}{C_Ls} ight)$	17
10.43INVALID-ORDER-43 $Z(s) =$	$=\left(L_{1}s+rac{1}{C_{1}s},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{1}{C_{L}s+rac{1}{R_{L}}+rac{1}{L_{L}s}} ight)$	17
10.44INVALID-ORDER-44 $Z(s) =$	$=\left(L_1s+rac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ rac{L_Ls}{C_LL_Ls^2+1}+R_L ight)$	17
10.45INVALID-ORDER-45 $Z(s) =$	$= \left(L_1 s + \frac{1}{C_1 s}, \ \infty, \ \infty, \ \infty, \ \frac{R_L \left(L_L s + \frac{1}{C_L s} \right)}{L_L s + R_L + \frac{1}{C_L s}} \right) \ . \ . \ . \ . \ . \ . \ . \ . \ . \ $	17
10.46INVALID-ORDER-46 $Z(s) =$	$=\left(rac{L_1s}{C_1L_1s^2+1},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{1}{C_Ls} ight)$	17
10.47 INVALID-ORDER-47 $Z(s)=$	$=\left(rac{L_1s}{C_1L_1s^2+1},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{R_L}{C_LR_Ls+1} ight)$	17
10.48INVALID-ORDER-48 $Z(s) =$	$=\left(rac{L_1s}{C_1L_1s^2+1},\;\infty,\;\infty,\;\infty,\;\infty,\;R_L+rac{1}{C_Ls} ight)$	17
10.49INVALID-ORDER-49 $Z(s) =$	$=\left(rac{L_1s}{C_1L_1s^2+1},\;\infty,\;\infty,\;\infty,\;\infty,\;L_Ls+rac{1}{C_Ls} ight)$	17
10.50INVALID-ORDER-50 $Z(s) =$	$=\left(\frac{L_1s}{C_1L_1s^2+1},\;\infty,\;\infty,\;\infty,\;\infty,\;\frac{L_Ls}{C_LL_Ls^2+1}\right)^{'}$	18
10.51 INVALID-ORDER-51 $Z(s)=$	$= \left(\frac{L_{1}s}{C_{1}L_{1}s^{2}+1}, \ \infty, \ \infty, \ \infty, \ \infty, \ L_{L}s + R_{L} + \frac{1}{C_{L}s}\right) \dots $	18
10.52INVALID-ORDER-52 $Z(s) =$	$=\left(rac{L_{1}s}{C_{1}L_{1}s^{2}+1},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{1}{C_{L}s+rac{1}{R_{L}}+rac{1}{L_{L}s}} ight)\;\dots$	18
10.53INVALID-ORDER-53 $Z(s) =$	$= \left(\frac{L_1s}{C_1L_1s^2+1}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{L_Ls}{C_LL_Ls^2+1} + R_L\right) \ \dots $	18
10.54INVALID-ORDER-54 $Z(s) =$	$=\left(rac{L_{1}s}{C_{1}L_{1}s^{2}+1},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{R_{L}\left(L_{L}s+rac{1}{C_{L}s} ight)}{L_{L}s+R_{L}+rac{1}{C_{L}s}} ight)$	18
10.55 INVALID-ORDER-55 $Z(s)=$	$=\left(L_1s+R_1+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;\infty,\;rac{1}{C_Ls} ight)$	18
10.56INVALID-ORDER-56 $Z(s) =$	$= \left(L_1 s + R_1 + \frac{1}{C_1 s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{R_L}{C_L R_L s + 1}\right) \qquad \cdots \qquad $	18
10.57INVALID-ORDER-57 $Z(s) =$	$= \left(L_1 s + R_1 + \frac{1}{C_1 s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ R_L + \frac{1}{C_L s}\right) \qquad \dots $ $= \left(L_1 s + R_1 + \frac{1}{C_1 s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ L_L s + \frac{1}{C_L s}\right) \qquad \dots $	18
10.58INVALID-ORDER-58 $Z(s) =$	$=\left(L_1s+R_1+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;\infty,\;L_Ls+rac{1}{C_Ls} ight)\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots\;\ldots$	19
10.59INVALID-ORDER-59 $Z(s) =$	$=\left(L_1s+R_1+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;\infty,\;rac{L_Ls}{C_LL_Ls^2+1} ight)^{\prime}$	19
10.60 INVALID-ORDER-60 $Z(s)=$	$\left(L_1s+R_1+rac{1}{C_1s},\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+R_L+rac{1}{C_Ls} ight)$	19
10.61INVALID-ORDER-61 $Z(s) =$	$= \left(L_1s + R_1 + \frac{1}{C_1s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{C_LL_Ls^2 + 1}{C_Ls}\right)$ $= \left(L_1s + R_1 + \frac{1}{C_1s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{1}{C_Ls + \frac{1}{R_L} + \frac{1}{L_Ls}}\right)$ $= \left(L_1s + R_1 + \frac{1}{C_1s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{L_Ls}{R_L + \frac{1}{L_Ls}} + R_L\right)$ $= \left(L_1s + R_1 + \frac{1}{C_1s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{L_Ls}{C_LL_Ls^2 + 1} + R_L\right)$	19
10.62INVALID-ORDER-62 $Z(s) =$	$=\left(L_1s+R_1+rac{1}{C_1s},\;\infty,\;\infty,\;\infty,\;\infty,\;rac{L_Ls}{C_LL_Ls^2+1}+R_L ight)$	19
10.63INVALID-ORDER-63 $Z(s) =$	$= \left(L_1 s + R_1 + \frac{1}{C_1 s}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right) $ $= \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \ \infty, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{1}{C_L s}\right) $	19
10.64INVALID-ORDER-64 $Z(s) =$	$\left(\frac{1}{C_1s+\frac{1}{R_1}+\frac{1}{L_1s}},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls}\right)$	19
10.65INVALID-ORDER-65 $Z(s) =$	$ \frac{\left(\frac{1}{C_{1}s+\frac{1}{R_{1}}+\frac{1}{L_{1}s}}, \infty, \infty, \infty, \infty, \frac{R_{L}}{C_{L}R_{L}s+1}\right)}{\left(\frac{1}{C_{1}s+\frac{1}{R_{1}}+\frac{1}{L_{1}s}}, \infty, \infty, \infty, \infty, \infty, R_{L}+\frac{1}{C_{L}s}\right)} \dots \dots$	19
10.66 INVALID-ORDER-66 $Z(s)=$	$=\left(\frac{1}{C_{1}s+\frac{1}{R_{1}}+\frac{1}{L_{1}s}},\;\infty,\;\infty,\;\infty,\;\infty,\;R_{L}+\frac{1}{C_{L}s}\right)$	20

10.67 INVALID-ORDER-67 $Z(s)=$	$\left(\frac{1}{C_1s+\frac{1}{R_1}+\frac{1}{L_1s}}, \ \infty, \ \infty, \ \infty, \ \infty, \ L_Ls+\frac{1}{C_Ls}\right) \dots \dots \dots \dots \dots \dots \dots \dots \dots $	20
10.68 INVALID-ORDER-68 $Z(s)=$	$\left(\frac{1}{C_{1}s+\frac{1}{R_{1}}+\frac{1}{L_{1}s}},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_{L}s}{C_{L}L_{L}s^{2}+1}\right) \ . \ . \ . \ . \ . \ . \ . \ . \ . \ $	20
10.69 INVALID-ORDER-69 $Z(s)=$	$\left(\frac{1}{C_{1}s+\frac{1}{R_{1}}+\frac{1}{L_{1}s}}, \infty, \infty, \infty, \infty, \infty, L_{L}s+R_{L}+\frac{1}{C_{L}s}\right) \dots $	20
10.70INVALID-ORDER-70 $Z(s) =$	$\left(\frac{1}{C_{1}s + \frac{1}{R_{1}} + \frac{1}{L_{1}s}}, \infty, \infty, \infty, \infty, \frac{1}{C_{L}s + \frac{1}{R_{L}} + \frac{1}{L_{L}s}}\right) \dots \dots \dots \dots \dots \dots \dots \dots \dots $	20
10.71 INVALID-ORDER-71 $Z(s)=$	$\left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$	20
10.72INVALID-ORDER-72 $Z(s) =$	$\left(\frac{1}{C_{1}s+\frac{1}{R_{1}}+\frac{1}{L_{1}s}}, \infty, \infty, \infty, \infty, \infty, \frac{R_{L}\left(L_{L}s+\frac{1}{C_{L}s}\right)}{L_{L}s+R_{L}+\frac{1}{C_{L}s}}\right) \dots $	20
10.73INVALID-ORDER-73 $Z(s) =$	$\left(\frac{L_1s}{C_1L_1s^2+1}+R_1,\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls}\right)$	20
10.74 INVALID-ORDER-74 $Z(s)=$	$\left(\frac{L_1s}{C_1L_1s^2+1}+R_1,\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$	21
10.75 INVALID-ORDER-75 $Z(s)=$	$\left(\frac{L_1s}{C_1L_1s^2+1}+R_1,\ \infty,\ \infty,\ \infty,\ \infty,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$	21
10.76 INVALID-ORDER-76 $Z(s)=$	$\left(\frac{L_1s}{C_1L_1s^2+1}+R_1,\ \infty,\ \infty,\ \infty,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$	21
10.77 INVALID-ORDER-77 $Z(s) = \displaystyle$	$\left(\frac{L_1s}{C_1L_1s^2+1}+R_1,\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right) \dots $	21
10.78INVALID-ORDER-78 $Z(s)=$	$\left(\frac{L_1s}{C_1L_1s^2+1} + R_1, \ \infty, \ \infty, \ \infty, \ \infty, \ L_Ls + R_L + \frac{1}{C_Ls}\right)$	21
10.79INVALID-ORDER-79 $Z(s) =$	$\left(\frac{L_1s}{C_1L_1s^2+1}+R_1,\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$	21
10.80 INVALID-ORDER-80 $Z(s)=$	$\left(\frac{L_1s}{C_1L_1s^2+1}+R_1,\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)\ \dots$	21
10.81INVALID-ORDER-81 $Z(s) =$	$\left(\frac{L_{1}s}{C_{1}L_{1}s^{2}+1}+R_{1},\ \infty,\ \infty,\ \infty,\ \infty,\ \frac{R_{L}\left(L_{L}s+\frac{1}{C_{L}s}\right)}{L_{L}s+R_{L}+\frac{1}{C_{L}s}}\right)$	21
10.82INVALID-ORDER-82 $Z(s) =$	$\left(\frac{R_1\left(L_1s+\frac{1}{C_1s}\right)}{L_1s+R_1+\frac{1}{C_1s}}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{1}{C_Ls}\right) \ \dots $	22
10.83INVALID-ORDER-83 $Z(s) =$	$\left(\frac{R_1\left(L_1s + \frac{1}{C_1s}\right)}{L_1s + R_1 + \frac{1}{C_1s}}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{R_L}{C_L R_L s + 1}\right) \dots $	22
10.84INVALID-ORDER-84 $Z(s) =$	$\left(\frac{R_1\left(L_1s + \frac{1}{C_1s}\right)}{L_1s + R_1 + \frac{1}{C_1s}}, \infty, \infty, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_Ls}\right) \dots $	22
10.85INVALID-ORDER-85 $Z(s) =$	$\left(\frac{R_1\left(L_1s + \frac{1}{C_1s}\right)}{L_1s + R_1 + \frac{1}{C_1s}}, \infty, \infty, $	22
10.86INVALID-ORDER-86 $Z(s) =$	$\left(\frac{R_1\left(L_1s+\frac{1}{C_1s}\right)}{L_1s+R_1+\frac{1}{C_1s}}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{L_Ls}{C_LL_Ls^2+1}\right)'$ $\left(\frac{R_1\left(L_1s+\frac{1}{C_1s}\right)}{L_1s+\frac{1}{C_1s}}\right)$	22
10.87INVALID-ORDER-87 $Z(s) =$	$\left(\frac{R_1\left(L_1S+\overline{C_1s}\right)}{L_1S+R_1+\frac{1}{2}}, \infty, \infty, \infty, \infty, \infty, L_LS+R_L+\frac{1}{C_Ls}\right)$	22
10.88INVALID-ORDER-88 $Z(s) =$	$\left(\frac{R_1\left(L_1s + \frac{1}{C_1s}\right)}{L_1s + R_1 + \frac{1}{C_1s}}, \infty, \infty, \infty, \infty, \frac{1}{C_Ls + \frac{1}{R_L} + \frac{1}{L_Ls}}\right) \dots $	22
10.89INVALID-ORDER-89 $Z(s) =$	$ \left(\frac{R_1\left(L_1s+\frac{1}{C_1s}\right)}{L_1s+R_1+\frac{1}{C_1s}}, \infty, \infty, \infty, \infty, \infty, \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right) \\ \left(\frac{R_1\left(L_1s+\frac{1}{C_1s}\right)}{L_1s+R_1+\frac{1}{C_1s}}, \infty, \infty, \infty, \infty, \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Is}}\right) \\ \dots \\ \dots$	22
10.90INVALID-ORDER-90 $Z(s) =$	$\left(\frac{R_1\left(L_1s + \frac{1}{C_1s}\right)}{L_1s + R_1 + \frac{1}{C_1s}}, \infty, \infty, \infty, \infty, \frac{R_L\left(L_Ls + \frac{1}{C_Ls}\right)}{L_Ls + R_L + \frac{1}{C_Ls}}\right) \right) \dots $	23

1 Examined H(z) for TIA some parasitic Z1 ZL: $\frac{Z_1Z_L(g_mr_o+1)}{Z_1g_mr_o+Z_1+Z_L+r_o}$

$$H(z) = \frac{Z_1 Z_L \left(g_m r_o + 1\right)}{Z_1 g_m r_o + Z_1 + Z_L + r_o} \label{eq:hamiltonian}$$

- 2 HP
- 3 BP
- 3.1 BP-1 $Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

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

Parameters:

Q:
$$C_L \sqrt{\frac{1}{C_L L_L}} \left(R_1 g_m r_o + R_1 + r_o \right)$$

wo: $\sqrt{\frac{1}{C_L L_L}}$
bandwidth: $\frac{1}{C_L (R_1 g_m r_o + R_1 + r_o)}$
K-LP: 0
K-HP: 0
K-BP: $R_1 \left(g_m r_o + 1 \right)$
Qz: 0
Wz: None

3.2 BP-2
$$Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$$

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

Parameters:

$$\begin{array}{l} \text{Q:} \ \frac{C_L R_L \sqrt{\frac{1}{C_L L_L}} (R_1 g_m r_o + R_1 + r_o)}{R_1 g_m r_o + R_1 + R_L + r_o} \\ \text{wo:} \ \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth:} \ \frac{R_1 g_m r_o + R_1 + R_L + r_o}{C_L R_L (R_1 g_m r_o + R_1 + r_o)} \\ \text{K-LP:} \ 0 \\ \text{K-HP:} \ 0 \\ \text{K-BP:} \ \frac{R_1 R_L (g_m r_o + 1)}{R_1 g_m r_o + R_1 + R_L + r_o} \\ \text{Qz:} \ 0 \\ \text{Wz:} \ \text{None} \end{array}$$

3.3 BP-3
$$Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{1}{C_L s}\right)$$

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

Q:
$$\frac{L_1\sqrt{\frac{1}{C_L L_1(g_m r_o + 1)}}(g_m r_o + 1)}{r_o}$$

wo:
$$\sqrt{\frac{1}{C_L L_1(g_m r_o + 1)}}$$

bandwidth: $\frac{r_o}{L_1(g_m r_o + 1)}$
K-LP: 0
K-HP: 0
K-BP: $\frac{L_1(g_m r_o + 1)}{C_L r_o}$
Qz: 0
Wz: None

3.4 BP-4
$$Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1}\right)$$

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

Parameters:

$$\begin{array}{l} \text{Q:} \ \frac{C_L L_1 R_L \sqrt{\frac{R_L + r_o}{C_L L_1 R_L (g_m r_o + 1)}} (g_m r_o + 1)}{C_L R_L r_o + L_1 g_m r_o + L_1} \\ \text{wo:} \ \sqrt{\frac{R_L + r_o}{C_L L_1 R_L (g_m r_o + 1)}} \\ \text{bandwidth:} \ \frac{C_L R_L r_o + L_1 g_m r_o + L_1}{C_L L_1 R_L (g_m r_o + 1)} \\ \text{K-LP:} \ 0 \\ \text{K-HP:} \ 0 \\ \text{K-BP:} \ \frac{L_1 R_L (g_m r_o + 1)}{C_L R_L r_o + L_1 g_m r_o + L_1} \\ \text{Qz:} \ 0 \\ \text{Wz:} \ \text{None} \end{array}$$

3.5 BP-5
$$Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \infty, R_L\right)$$

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

Parameters:

$$Q: \frac{C_1\sqrt{\frac{1}{C_1L_1}}(R_L+r_o)}{\frac{g_mr_o+1}{G_1L_1}}$$
 wo: $\sqrt{\frac{1}{C_1L_1}}$ bandwidth: $\frac{g_mr_o+1}{C_1(R_L+r_o)}$ K-LP: 0 K-HP: 0 K-BP: R_L Qz: 0 Wz: None

3.6 BP-6
$$Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \infty, \infty, \infty, \infty, \infty, R_L\right)$$

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

Q:
$$\frac{C_1 R_1 \sqrt{\frac{1}{C_1 L_1}} (R_L + r_o)}{R_1 g_m r_o + R_1 + R_L + r_o}$$
wo:
$$\sqrt{\frac{1}{C_1 L_1}}$$
bandwidth:
$$\frac{R_1 g_m r_o + R_1 + R_L + r_o}{C_1 R_1 (R_L + r_o)}$$

K-LP: 0 K-HP: 0 K-BP: $\frac{R_1R_L(g_mr_o+1)}{R_1g_mr_o+R_1+R_L+r_o}$ Qz: 0 Wz: None

4 LP

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

 $H(s) = \frac{R_L \left(g_m r_o + 1 \right)}{C_1 C_L R_L r_o s^2 + C_1 R_L s + C_1 r_o s + C_L R_L g_m r_o s + C_L R_L s + g_m r_o + 1}$

Parameters:

 $\begin{array}{l} \text{Q: } \frac{C_{1}C_{L}R_{L}r_{o}\sqrt{\frac{g_{m}r_{o}+1}{C_{1}C_{L}R_{L}r_{o}}}}{C_{1}R_{L}+C_{1}r_{o}+C_{L}R_{L}g_{m}r_{o}+C_{L}R_{L}}\\ \text{wo: } \sqrt{\frac{g_{m}r_{o}+1}{C_{1}C_{L}R_{L}r_{o}}}\\ \text{bandwidth: } \frac{C_{1}R_{L}+C_{1}r_{o}+C_{L}R_{L}g_{m}r_{o}+C_{L}R_{L}}{C_{1}C_{L}R_{L}r_{o}}\\ \text{K-LP: } R_{L}\\ \text{K-HP: } 0\\ \text{K-BP: } 0\\ \text{Qz: None}\\ \text{Wz: None} \end{array}$

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

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

Parameters:

Q: $\frac{C_{1}C_{L}R_{1}r_{o}\sqrt{\frac{1}{C_{1}C_{L}R_{1}r_{o}}}}{C_{1}R_{1}+C_{L}R_{1}g_{m}r_{o}+C_{L}R_{1}+C_{L}r_{o}}}$ wo: $\sqrt{\frac{1}{C_{1}C_{L}R_{1}r_{o}}}$ bandwidth: $\frac{C_{1}R_{1}+C_{L}R_{1}g_{m}r_{o}+C_{L}R_{1}+C_{L}r_{o}}{C_{1}C_{L}R_{1}r_{o}}}$ K-LP: $R_{1}\left(g_{m}r_{o}+1\right)$ K-HP: 0 K-BP: 0 Qz: None Wz: None

4.3 LP-3 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1}\right)$

 $H(s) = \frac{R_1 R_L \left(g_m r_o + 1\right)}{C_1 C_L R_1 R_L r_o s^2 + C_1 R_1 R_L s + C_1 R_1 r_o s + C_L R_1 R_L g_m r_o s + C_L R_1 R_L s + C_L R_L r_o s + R_1 g_m r_o + R_1 + R_L + r_o}$

Parameters:

 $\text{Q: } \frac{C_{1}C_{L}R_{1}R_{L}r_{o}\sqrt{\frac{R_{1}g_{m}r_{o}+R_{1}+R_{L}+r_{o}}{C_{1}C_{L}R_{1}R_{L}r_{o}}}}{C_{1}R_{1}R_{L}+C_{1}R_{1}r_{o}+C_{L}R_{1}R_{L}g_{m}r_{o}+C_{L}R_{1}R_{L}+C_{L}R_{L}r_{o}}} \\ \text{wo: } \sqrt{\frac{R_{1}g_{m}r_{o}+R_{1}+R_{L}+r_{o}}{C_{1}C_{L}R_{1}R_{L}r_{o}}}} \\ \text{bandwidth: } \frac{C_{1}R_{1}R_{L}+C_{1}R_{1}r_{o}+C_{L}R_{1}R_{L}g_{m}r_{o}+C_{L}R_{1}R_{L}+C_{L}R_{L}r_{o}}{C_{1}C_{L}R_{1}R_{L}r_{o}} \\$

```
K-LP: \frac{R_1R_L(g_mr_o+1)}{R_1g_mr_o+R_1+R_L+r_o} K-HP: 0
 K-BP: 0
 Qz: None
 Wz: None
```

5 BS

5.1 BS-1
$$Z(s) = \left(R_1, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{R_1 (g_m r_o + 1) (C_L L_L s^2 + 1)}{C_L L_L s^2 + C_L R_1 g_m r_o s + C_L R_1 s + C_L r_o s + 1}$$

Parameters:

$$\begin{array}{l} \text{Q: } \frac{L_L \sqrt{\frac{1}{C_L L_L}}}{R_1 g_m r_o + R_1 + r_o} \\ \text{wo: } \sqrt{\frac{1}{C_L L_L}} \\ \text{bandwidth: } \frac{R_1 g_m r_o + R_1 + r_o}{L_L} \\ \text{K-LP: } R_1 \left(g_m r_o + 1 \right) \\ \text{K-HP: } R_1 \left(g_m r_o + 1 \right) \\ \text{K-BP: } 0 \\ \text{Qz: None} \\ \text{Wz: } \sqrt{\frac{1}{C_L L_L}} \end{array}$$

5.2 BS-2
$$Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$$

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

Parameters:

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

5.3 BS-3
$$Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L\right)$$

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

Q:
$$\frac{L_1\sqrt{\frac{1}{C_1L_1}}(g_mr_o+1)}{R_L+r_o}$$

wo:
$$\sqrt{\frac{1}{C_1L_1}}$$
 bandwidth: $\frac{R_L+r_o}{L_1(g_mr_o+1)}$ K-LP: R_L K-HP: R_L K-BP: 0 Qz: None Wz: $\sqrt{\frac{1}{C_1L_1}}$

5.4 BS-4
$$Z(s) = \left(\frac{R_1\left(L_1 s + \frac{1}{C_1 s}\right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, R_L\right)$$

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

Parameters:

Q:
$$\frac{L_{1}\sqrt{\frac{1}{C_{1}L_{1}}}(R_{1}g_{m}r_{o}+R_{1}+R_{L}+r_{o})}{R_{1}(R_{L}+r_{o})}$$
wo:
$$\sqrt{\frac{1}{C_{1}L_{1}}}$$
bandwidth:
$$\frac{R_{1}(R_{L}+r_{o})}{L_{1}(R_{1}g_{m}r_{o}+R_{1}+R_{L}+r_{o})}$$
K-LP:
$$\frac{R_{1}R_{L}(g_{m}r_{o}+1)}{R_{1}g_{m}r_{o}+R_{1}+R_{L}+r_{o}}$$
K-HP:
$$\frac{R_{1}R_{L}(g_{m}r_{o}+1)}{R_{1}g_{m}r_{o}+R_{1}+R_{L}+r_{o}}$$
K-BP: 0
Qz: None
Wz:
$$\sqrt{\frac{1}{C_{1}L_{1}}}$$

6 GE

6.1 GE-1
$$Z(s) = \left(R_1, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{R_1 \left(g_m r_o + 1 \right) \left(C_L L_L s^2 + C_L R_L s + 1 \right)}{C_L L_L s^2 + C_L R_1 g_m r_o s + C_L R_1 s + C_L R_L s + C_L r_o s + 1}$$

Q:
$$\frac{L_{L}\sqrt{\frac{1}{C_{L}L_{L}}}}{R_{1}g_{m}r_{o}+R_{1}+R_{L}+r_{o}}$$
wo:
$$\sqrt{\frac{1}{C_{L}L_{L}}}$$
bandwidth:
$$\frac{R_{1}g_{m}r_{o}+R_{1}+R_{L}+r_{o}}{L_{L}}$$
K-LP:
$$R_{1}\left(g_{m}r_{o}+1\right)$$
K-HP:
$$R_{1}\left(g_{m}r_{o}+1\right)$$
K-BP:
$$\frac{R_{1}R_{L}\left(g_{m}r_{o}+1\right)}{R_{1}g_{m}r_{o}+R_{1}+R_{L}+r_{o}}$$
Qz:
$$\frac{L_{L}\sqrt{\frac{1}{C_{L}L_{L}}}}{R_{L}}$$
Wz:
$$\sqrt{\frac{1}{C_{L}L_{L}}}$$

6.2 GE-2
$$Z(s) = \left(R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$$

$$H(s) = \frac{R_1 \left(g_m r_o + 1 \right) \left(C_L L_L R_L s^2 + L_L s + R_L \right)}{C_L L_L R_1 g_m r_o s^2 + C_L L_L R_1 s^2 + C_L L_L R_L s^2 + C_L L_L r_o s^2 + L_L s + R_1 g_m r_o + R_1 + R_L + r_o}$$

Parameters:

Q:
$$C_L \sqrt{\frac{1}{C_L L_L}} \left(R_1 g_m r_o + R_1 + R_L + r_o \right)$$

wo: $\sqrt{\frac{1}{C_L L_L}}$
bandwidth: $\frac{1}{C_L (R_1 g_m r_o + R_1 + R_L + r_o)}$
K-LP: $\frac{R_1 R_L (g_m r_o + 1)}{R_1 g_m r_o + R_1 + R_L + r_o}$
K-HP: $\frac{R_1 R_L (g_m r_o + 1)}{R_1 g_m r_o + R_1 + R_L + r_o}$
K-BP: $R_1 \left(g_m r_o + 1 \right)$
Qz: $C_L R_L \sqrt{\frac{1}{C_L L_L}}$
Wz: $\sqrt{\frac{1}{C_L L_L}}$

6.3 GE-3
$$Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L\right)$$

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

Parameters:

$$\begin{aligned} & \text{Q: } \frac{L_1 \sqrt{\frac{1}{C_1 L_1}} (g_m r_o + 1)}{R_1 g_m r_o + R_1 + R_L + r_o} \\ & \text{wo: } \sqrt{\frac{1}{C_1 L_1}} \\ & \text{bandwidth: } \frac{R_1 g_m r_o + R_1 + R_L + r_o}{L_1 (g_m r_o + 1)} \\ & \text{K-LP: } R_L \\ & \text{K-HP: } R_L \\ & \text{K-BP: } \frac{R_1 R_L (g_m r_o + 1)}{R_1 g_m r_o + R_1 + R_L + r_o} \\ & \text{Qz: } \frac{L_1 \sqrt{\frac{1}{C_1 L_1}}}{R_1} \\ & \text{Wz: } \sqrt{\frac{1}{C_1 L_1}} \end{aligned}$$

6.4 GE-4
$$Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \infty, R_L\right)$$

$$H(s) = \frac{R_L \left(g_m r_o + 1\right) \left(C_1 L_1 R_1 s^2 + L_1 s + R_1\right)}{C_1 L_1 R_1 g_m r_o s^2 + C_1 L_1 R_1 s^2 + C_1 L_1 R_2 s^2 + C_1 L_1 r_o s^2 + L_1 g_m r_o s + L_1 s + R_1 g_m r_o + R_1 + R_L + r_o}$$

$$\begin{aligned} & \text{Q:} & \frac{C_1 \sqrt{\frac{1}{C_1 L_1}} (R_1 g_m r_o + R_1 + R_L + r_o)}{g_m r_o + 1} \\ & \text{wo:} & \sqrt{\frac{1}{C_1 L_1}} \\ & \text{bandwidth:} & \frac{g_m r_o + 1}{C_1 (R_1 g_m r_o + R_1 + R_L + r_o)} \\ & \text{K-LP:} & \frac{R_1 R_L (g_m r_o + 1)}{R_1 g_m r_o + R_1 + R_L + r_o} \\ & \text{K-HP:} & \frac{R_1 R_L (g_m r_o + 1)}{R_1 g_m r_o + R_1 + R_L + r_o} \\ & \text{K-BP:} & R_L \\ & \text{Qz:} & C_1 R_1 \sqrt{\frac{1}{C_1 L_1}} \end{aligned}$$

7 AP

8 INVALID-NUMER

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

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

Parameters:

$$\begin{array}{l} \text{Q:} \ \frac{L_1\sqrt{\frac{1}{C_LL_1(g_mr_o+1)}}(g_mr_o+1)}{R_L+r_o} \\ \text{wo:} \ \sqrt{\frac{1}{C_LL_1(g_mr_o+1)}} \\ \text{bandwidth:} \ \frac{R_L+r_o}{L_1(g_mr_o+1)} \\ \text{K-LP:} \ 0 \\ \text{K-HP:} \ R_L \\ \text{K-BP:} \ \frac{L_1(g_mr_o+1)}{C_L(R_L+r_o)} \\ \text{Qz:} \ C_LR_L\sqrt{\frac{1}{C_LL_1(g_mr_o+1)}} \\ \text{Wz:} \ \text{None} \end{array}$$

8.2 INVALID-NUMER-2 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s}\right)$

$$H(s) = \frac{R_1 \left(g_m r_o + 1 \right) \left(C_L R_L s + 1 \right)}{C_1 C_L R_1 R_L s^2 + C_1 C_L R_1 r_o s^2 + C_1 R_1 s + C_L R_1 g_m r_o s + C_L R_1 s + C_L R_L s + C_L r_o s + 1}$$

Parameters:

$$\begin{array}{l} \text{Q:} \ \frac{C_{1}C_{L}R_{1}\sqrt{\frac{1}{C_{1}C_{L}R_{1}(R_{L}+r_{o})}}(R_{L}+r_{o})}{C_{1}R_{1}+C_{L}R_{1}g_{m}r_{o}+C_{L}R_{1}+C_{L}R_{L}+C_{L}r_{o}}}\\ \text{wo:} \ \sqrt{\frac{1}{C_{1}C_{L}R_{1}(R_{L}+r_{o})}}\\ \text{bandwidth:} \ \frac{C_{1}R_{1}+C_{L}R_{1}g_{m}r_{o}+C_{L}R_{1}+C_{L}R_{L}+C_{L}r_{o}}{C_{1}C_{L}R_{1}(R_{L}+r_{o})}\\ \text{K-LP:} \ R_{1}\left(g_{m}r_{o}+1\right)\\ \text{K-HP:} \ 0\\ \text{K-BP:} \ \frac{C_{L}R_{1}R_{L}\left(g_{m}r_{o}+1\right)}{C_{1}R_{1}+C_{L}R_{1}g_{m}r_{o}+C_{L}R_{1}+C_{L}R_{L}+C_{L}r_{o}}\\ \text{Qz:} \ 0\\ \text{Wz:} \ \text{None} \end{array}$$

8.3 INVALID-NUMER-3 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1}\right)$

$$H(s) = \frac{{R_L}\left({{g_m}{r_o} + 1} \right)\left({{C_1}{R_1}s + 1} \right)}{{{C_1}{C_L}{R_1}{R_L}{g_m}{r_o}{s^2} + {C_1}{C_L}{R_1}{R_L}{s^2} + {C_1}{C_L}{R_L}{r_o}{s^2} + {C_1}{R_1}{g_m}{r_o}{s} + {C_1}{R_1}{s} + {C_1}{R_L}{s} + {C_1}{r_o}{s} + {C_L}{R_L}{g_m}{r_o}{s} + {C_L}{R_L}{s} + {g_m}{r_o} + 1}}$$

$$\begin{array}{l} \text{Q:} \ \frac{C_{1}C_{L}R_{L}\sqrt{\frac{g_{m}r_{o}+1}{C_{1}C_{L}R_{L}(R_{1}g_{m}r_{o}+R_{1}+r_{o})}}}{C_{1}R_{1}g_{m}r_{o}+C_{1}R_{1}+C_{1}R_{L}+C_{1}r_{o}+C_{L}R_{L}g_{m}r_{o}+C_{L}R_{L}}}\\ \text{wo:} \ \sqrt{\frac{g_{m}r_{o}+1}{C_{1}C_{L}R_{L}(R_{1}g_{m}r_{o}+R_{1}+r_{o})}}\\ \text{bandwidth:} \ \frac{C_{1}R_{1}g_{m}r_{o}+C_{1}R_{1}+C_{1}R_{L}+C_{1}r_{o}+C_{L}R_{L}g_{m}r_{o}+C_{L}R_{L}}{C_{1}C_{L}R_{L}(R_{1}g_{m}r_{o}+R_{1}+r_{o})}\\ \text{K-LP:} \ R_{L}\\ \text{K-HP:} \ 0\\ \text{K-BP:} \ \frac{C_{1}R_{1}R_{L}(g_{m}r_{o}+1)}{C_{1}R_{1}g_{m}r_{o}+C_{L}R_{L}}\\ \end{array}$$

9 INVALID-WZ

10 INVALID-ORDER

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

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

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

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

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

$$H(s) = \frac{R_1 R_L (g_m r_o + 1)}{C_L R_1 R_L g_m r_o s + C_L R_1 R_L s + C_L R_L r_o s + R_1 g_m r_o + R_1 + R_L + r_o}$$

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

$$H(s) = \frac{R_1 (g_m r_o + 1) (C_L R_L s + 1)}{C_L R_1 g_m r_o s + C_L R_1 s + C_L R_L s + C_L r_o s + 1}$$

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

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

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

$$H(s) = \frac{L_1 s (g_m r_o + 1) (C_L L_L s^2 + 1)}{C_L L_1 g_m r_o s^2 + C_L L_1 s^2 + C_L L_L s^2 + C_L r_o s + 1}$$

10.7 INVALID-ORDER-7 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$$H(s) = \frac{L_1 L_L s^2 \left(g_m r_o + 1\right)}{C_L L_1 L_L g_m r_o s^3 + C_L L_1 L_L s^3 + C_L L_L r_o s^2 + L_1 g_m r_o s + L_1 s + L_L s + r_o}$$

10.8 INVALID-ORDER-8
$$Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{L_1 s \left(g_m r_o + 1\right) \left(C_L L_L s^2 + C_L R_L s + 1\right)}{C_L L_1 g_m r_o s^2 + C_L L_1 s^2 + C_L L_L s^2 + C_L R_L s + C_L r_o s + 1}$$

10.9 INVALID-ORDER-9
$$Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$$

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

10.10 INVALID-ORDER-10 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

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

10.11 INVALID-ORDER-11 $Z(s) = \left(L_1 s, \infty, \infty, \infty, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_T s}}\right)$

10.12 INVALID-ORDER-12 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, R_L\right)$

$$H(s) = \frac{R_L (g_m r_o + 1)}{C_1 R_L s + C_1 r_o s + g_m r_o + 1}$$

10.13 INVALID-ORDER-13 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s}\right)$

$$H(s) = \frac{g_m r_o + 1}{s (C_1 C_L r_o s + C_1 + C_L g_m r_o + C_L)}$$

10.14 INVALID-ORDER-14 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s}\right)$

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

10.15 INVALID-ORDER-15 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$

$$H(s) = \frac{(g_m r_o + 1) (C_L L_L s^2 + 1)}{s (C_1 C_L L_L s^2 + C_1 C_L r_o s + C_1 + C_L q_m r_o + C_L)}$$

10.16 INVALID-ORDER-16 $Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$$H(s) = \frac{L_L s (g_m r_o + 1)}{C_1 C_L L_L r_o s^3 + C_1 L_L s^2 + C_1 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + g_m r_o + 1}$$

10.17 INVALID-ORDER-17
$$Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$$

$$H(s) = \frac{(g_m r_o + 1) (C_L L_L s^2 + C_L R_L s + 1)}{s (C_1 C_L L_L s^2 + C_1 C_L R_L s + C_1 C_L r_o s + C_1 + C_L g_m r_o + C_L)}$$

10.18 INVALID-ORDER-18
$$Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$$

$$H(s) = \frac{L_L R_L s \left(g_m r_o + 1\right)}{C_1 C_L L_L R_L r_o s^3 + C_1 L_L R_L s^2 + C_1 L_L r_o s^2 + C_1 R_L r_o s + C_L L_L R_L g_m r_o s^2 + C_L L_L R_L s^2 + L_L g_m r_o s + L_L s + R_L g_m r_o + R_L r_o s^2 + C_L r_o s^2 +$$

10.19 INVALID-ORDER-19
$$Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$$

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

10.20 INVALID-ORDER-20
$$Z(s) = \left(\frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$$

$$H(s) = \frac{R_L \left(g_m r_o + 1 \right) \left(C_L L_L s^2 + 1 \right)}{C_1 C_L L_L R_L s^3 + C_1 C_L L_L r_o s^3 + C_1 C_L R_L r_o s^2 + C_1 R_L s + C_1 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + C_L R_L g_m r_o s + C_L R_L s + g_m r_o + 1}$$

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

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

10.22 INVALID-ORDER-22 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$

$$H(s) = \frac{R_1 \left(g_m r_o + 1 \right) \left(C_L L_L s^2 + 1 \right)}{C_1 C_L L_L R_1 s^3 + C_1 C_L R_1 r_o s^2 + C_1 R_1 s + C_L L_L s^2 + C_L R_1 g_m r_o s + C_L R_1 s + C_L r_o s + 1}$$

10.23 INVALID-ORDER-23 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

10.24 INVALID-ORDER-24 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$

$$H(s) = \frac{R_1 \left(g_m r_o + 1 \right) \left(C_L L_L s^2 + C_L R_L s + 1 \right)}{C_1 C_L L_L R_1 s^3 + C_1 C_L R_1 R_L s^2 + C_1 C_L R_1 r_o s^2 + C_1 R_1 s + C_L L_L s^2 + C_L R_1 g_m r_o s + C_L R_1 s + C_L R_L s + C_L r_o s + 1}$$

10.25 INVALID-ORDER-25
$$Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$$

$$H(s) = \frac{L_L R_1 R_L s \left(g_m r_o + 1\right)}{C_1 C_L L_L R_1 R_L r_o s^3 + C_1 L_L R_1 R_L s^2 + C_1 L_L R_1 R_L r_o s + C_L L_L R_1 R_L g_m r_o s^2 + C_L L_L R_1 R_L s^2 + C_L L_L R_1 R_L r_o s^2 + L_L R_1 g_m r_o s + L_L R_1 s + L_L R_1 s + L_L R_1 s + L_L R_1 r_o s + R_1 R_L g_m r_o + R_1 R_L r_o s +$$

10.26 INVALID-ORDER-26 $Z(s) = \left(\frac{R_1}{C_1 R_1 s + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

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

$$H(s) = \frac{R_1 R_L \left(g_m r_o + 1\right) \left(C_L L_L s^2 + 1\right)}{C_1 C_L L_L R_1 R_L s^3 + C_1 C_L L_L R_1 r_o s^3 + C_1 C_L R_1 R_L s + C_1 R_1 r_o s^2 + C_L L_L R_1 g_m r_o s^2 + C_L L_L R_1 s^2 + C_L R_1 R_L s + C_L R_1 R_L s + C_L R_1 r_o s + R_1 g_m r_o s + R_1 g_m r_o s + R_1 g_m r_o s + C_L R_1 R_L s + C_L R_1 r_o s + R_1 g_m r_$$

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

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

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

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

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

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

10.31 INVALID-ORDER-31 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$

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

10.32 INVALID-ORDER-32 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$$H(s) = \frac{L_L s \left(g_m r_o + 1\right) \left(C_1 R_1 s + 1\right)}{C_1 C_L L_L R_1 g_m r_o s^3 + C_1 C_L L_L R_1 s^3 + C_1 C_L L_L r_o s^3 + C_1 L_L s^2 + C_1 R_1 g_m r_o s + C_1 R_1 s + C_1 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + g_m r_o + 1}$$

10.33 INVALID-ORDER-33 $Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$

$$H(s) = \frac{(g_m r_o + 1) (C_1 R_1 s + 1) (C_L L_L s^2 + C_L R_L s + 1)}{s (C_1 C_L L_L s^2 + C_1 C_L R_1 g_m r_o s + C_1 C_L R_1 s + C_1 C_L R_L s + C_1 C_L r_o s + C_1 + C_L g_m r_o + C_L)}$$

10.34 INVALID-ORDER-34
$$Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$$

$$H(s) = \frac{L_L R_L s \left(g_m r_o + 1\right) \left(C_1 R_1 s + 1\right)}{C_1 C_L L_L R_1 R_L g_m r_o s^3 + C_1 C_L L_L R_1 R_L s^3 + C_1 C_L L_L R_1 g_m r_o s^2 + C_1 L_L R_1 g_m r_o s + C_1 R_1 R_L s + C_1 R_L r_o s + C_L L_L R_L g_m r_o s^2 + C_L L_L R_L s^2 + L_L g_m r_o s + L_L s + R_L g_m r_o s + R_L g_m r_o s + C_L R_L g_m r_o s^2 + C_L R_L g_m r_o s^2 + C_L R_L g_m r_o s + C_L R_L g_m r_o s^2 + C_L R_L g_m r_o s + C_L R_L g_m r_o s^2 + C_L$$

10.35 INVALID-ORDER-35
$$Z(s) = \left(R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$$

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

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

$$H(s) = \frac{R_L \left(g_m r_o + 1\right) \left(C_1 R_1 s + 1\right) \left(C_L L_L s^2 + 1\right)}{C_1 C_L L_L R_1 g_m r_o s^3 + C_1 C_L L_L R_1 s^3 + C_1 C_L L_L r_o s^3 + C_1 C_L R_1 R_L g_m r_o s^2 + C_1 C_L R_1 R_L s^2 + C_1 C_L R_1 r_o s^2 + C_1 R_1 g_m r_o s + C_1 R_1 s + C_1 R_L s + C_1 r_o s + C_L L_L g_m r_o s^2 + C_L L_L g_m r_o s + C_L R_L g_$$

10.37 INVALID-ORDER-37 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \frac{1}{C_L s}\right)$

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

10.38 INVALID-ORDER-38 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1}\right)$

$$H(s) = \frac{R_L \left(g_m r_o + 1\right) \left(C_1 L_1 s^2 + 1\right)}{C_1 C_L L_1 R_L g_m r_o s^3 + C_1 C_L L_1 R_L s^3 + C_1 C_L R_L r_o s^2 + C_1 L_1 g_m r_o s^2 + C_1 L_1 s^2 + C_1 R_L s + C_1 r_o s + C_L R_L g_m r_o s + C_L R_L s + g_m r_o + 1}$$

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

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

10.40 INVALID-ORDER-40 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$

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

10.41 INVALID-ORDER-41 $Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$$H(s) = \frac{L_L s \left(g_m r_o + 1\right) \left(C_1 L_1 s^2 + 1\right)}{C_1 C_L L_1 L_L g_m r_o s^4 + C_1 C_L L_1 L_L s^4 + C_1 C_L L_L r_o s^3 + C_1 L_1 g_m r_o s^2 + C_1 L_1 s^2 + C_1 L_L s^2 + C_1 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + g_m r_o + 1}$$

10.42 INVALID-ORDER-42
$$Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$$

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

10.43 INVALID-ORDER-43
$$Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$$

$$H(s) = \frac{L_L R_L s \left(g_m r_o + 1\right) \left(C_1 L_1 s^2 + 1\right)}{C_1 C_L L_1 L_L R_L g_m r_o s^4 + C_1 C_L L_L L_L R_L r_o s^3 + C_1 L_1 L_L g_m r_o s^3 + C_1 L_1 L_L g_m r_o s^3 + C_1 L_1 L_L g_m r_o s^2 + C_1 L_L R_L s^2 + C_1 L_L R_L s^2 + C_1 L_L R_L g_m r_o s^2 + C_L R_L g_m r_o s^2$$

10.44 INVALID-ORDER-44
$$Z(s) = \left(L_1 s + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$$

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

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

$$H(s) = \frac{R_L\left(g_m r_o + 1\right)\left(C_1 L_1 s^2 + 1\right)\left(C_L L_L s^2 + 1\right)}{C_1 C_L L_1 L_L g_m r_o s^4 + C_1 C_L L_1 R_L g_m r_o s^3 + C_1 C_L L_1 R_L s^3 + C_1 C_L L_L r_o s^3 + C_1 C_L L_L r_o s^3 + C_1 C_L R_L r_o s^2 + C_1 L_1 g_m r_o s^2 + C_1 L_1 g_m r_o s^2 + C_L L_L g_m r_o s^2 + C_L R_L g_m r_o s^2 + C_L$$

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

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

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

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

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

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

$$H(s) = \frac{L_1 s \left(g_m r_o + 1\right) \left(C_L L_L s^2 + 1\right)}{C_1 C_L L_1 L_L s^4 + C_1 C_L L_1 r_o s^3 + C_1 L_1 s^2 + C_L L_1 q_m r_o s^2 + C_L L_1 s^2 + C_L L_1$$

10.50 INVALID-ORDER-50
$$Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$$

10.51 INVALID-ORDER-51
$$Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$$

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

10.52 INVALID-ORDER-52
$$Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$$

$$H(s) = \frac{L_1 L_L R_L s^2 \left(g_m r_o + 1\right)}{C_1 C_L L_1 L_L R_L r_o s^4 + C_1 L_1 L_L R_L s^3 + C_1 L_1 L_L r_o s^3 + C_1 L_1 L_L R_L g_m r_o s^3 + C_L L_1 L_L R_L s^3 + C_L L_L R_L r_o s^2 + L_1 L_L g_m r_o s^2 + L_1 L_L g_m r_o s^2 + L_1 L_L g_m r_o s + L_1 R_L s + L_L R_L s + L_L R_L s + L_L R_L r_o s + R_L r_o s$$

10.53 INVALID-ORDER-53
$$Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$$

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

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

10.55 INVALID-ORDER-55
$$Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \frac{1}{C_L s}\right)$$

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

10.56 INVALID-ORDER-56
$$Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \infty, \frac{R_L}{C_L R_L s + 1}\right)$$

$$H(s) = \frac{R_L\left(g_m r_o + 1\right)\left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{C_1 C_L L_1 R_L g_m r_o s^3 + C_1 C_L L_1 R_L g_m r_o s^2 + C_1 C_L R_1 R_L g^2 + C_1 C_L R_1 R_L s^2 + C_1 L_1 g_m r_o s^2 + C_1 L_1 g_m r_o s^2 + C_1 L_1 g_m r_o s + C_1 R_1 s + C_1 R_L s + C_1 r_o s + C_L R_L g_m r_o s +$$

10.57 INVALID-ORDER-57
$$Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s}\right)$$

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

10.58 INVALID-ORDER-58
$$Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$$

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

10.59 INVALID-ORDER-59 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$$H(s) = \frac{L_L s \left(g_m r_o + 1\right) \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{C_1 C_L L_1 L_L g_m r_o s^4 + C_1 C_L L_L R_1 g_m r_o s^3 + C_1 C_L L_L R_1 s^3 + C_1 C_L L_L r_o s^3 + C_1 L_1 g_m r_o s^2 + C_1 L_1 s^2 + C_1 L_1 s^2 + C_1 R_1 g_m r_o s + C_1 R_1 s + C_1 r_o s + C_L L_L g_m r_o s^2 + C_L L_L s^2 + g_m r_o + 1}$$

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

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

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

$$H(s) = \frac{L_L R_L s \left(g_m r_o + 1\right) \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{C_1 C_L L_1 L_L R_L g_m r_o s^4 + C_1 C_L L_L R_1 R_L g_m r_o s^3 + C_1 L_L L_L R_1 R_L g_m r_o s^3 + C_1 L_L L_L R_3 + C_1 L_L R_1 g_m r_o s^3 + C_1 L_L R_$$

10.62 INVALID-ORDER-62 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

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

10.63 INVALID-ORDER-63 $Z(s) = \left(L_1 s + R_1 + \frac{1}{C_1 s}, \infty, \infty, \infty, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

$$R_L \left(g_m r_o + 1 \right) \left(C_L L_L s^2 + 1 \right) \left(C_1 L_1 s^2 + C_1 R_1 s + 1 \right)$$

$$H(s) = \frac{R_L \left(g_m r_o + 1\right) \left(C_L L_L s^2 + 1\right) \left(C_1 L_1 s^2 + C_1 R_1 s + 1\right)}{C_1 C_L L_1 L_L g_m r_o s^4 + C_1 C_L L_1 R_L g_m r_o s^3 + C_1 C_L L_1 R_1 g_m r_o s^3 + C_1 C_L L_L R_1 s^3 + C_1 C_L R_1 R_L s^3 + C_$$

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

$$H(s) = \frac{L_1 R_1 s \left(g_m r_o + 1\right)}{C_1 C_L L_1 R_1 r_o s^3 + C_1 L_1 R_1 s^2 + C_L L_1 R_1 g_m r_o s^2 + C_L L_1 R_1 s^2 + C_L L_1 r_o s^2 + C_L R_1 r_o s + L_1 s + R_1}$$

10.65 INVALID-ORDER-65 $Z(s) = \left(\frac{1}{C_1 s + \frac{1}{R_1} + \frac{1}{L_1 s}}, \ \infty, \ \infty, \ \infty, \ \infty, \ \frac{R_L}{C_L R_L s + 1}\right)$

$$H(s) = \frac{L_1 R_1 R_L s \left(g_m r_o + 1\right)}{C_1 C_L L_1 R_1 R_L r_o s^3 + C_1 L_1 R_1 R_L s^2 + C_1 L_1 R_1 R_L g_m r_o s^2 + C_L L_1 R_1 R_L s^2 + C_L L_1 R_1 R_L r_o s^2 + C_L L_1 R_1 R_L r_o s^2 + C_L L_1 R_1 R_L r_o s^2 + C_L R_1 R_L r_o s + L_1 R_1 g_m r_o s + L_1 R_1 s + L_1 R_L s + L_1 r_o s + R_1 R_L + R_1 r_o s + R_1 R_L r_o$$

10.66 INVALID-ORDER-65
$$Z(s) = \left(\frac{c_1s_1s_2s_1s_2s_1}{c_1s_2s_2s_2}, \infty, \infty, \infty, \infty, \infty, R_k + \frac{c_1s_2}{c_1s_2}\right)$$

$$E_2(R_2(s_2s_1R_1R_2s^2) + C_2(s_1R_2s^2) + C$$

 $H(s) = \frac{(g_m r_o + 1) \left(C_1 L_1 R_1 s^2 + L_1 s + R_1 \right)}{C_1 C_L L_1 R_1 q_m r_o s^3 + C_1 C_L L_1 R_1 s^3 + C_1 C_L L_1 r_o s^3 + C_1 L_1 s^2 + C_L L_1 q_m r_o s^2 + C_L L_1 s^2 + C_L R_1 q_m r_o s + C_L R_1 s + C_L r_o s + 1}$

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

$$H(s) = \frac{R_L \left(g_m r_o + 1\right) \left(C_1 L_1 R_1 s^2 + L_1 s + R_1\right)}{C_1 C_L L_1 R_1 R_L g_m r_o s^3 + C_1 C_L L_1 R_L r_o s^3 + C_1 L_1 R_1 g_m r_o s^2 + C_1 L_1 R_L s^2 + C_1 L_1 R_L g^2 + C_L L_1 R_L g_m r_o s^2 + C_L L_1 R_L g_m r_o s + C_L R_1 R_L g_m r_o s + C_L R_1 R_L g_m r_o s + L_1 s + R_1 g_m r_o s + L_1 g_m r_o s +$$

10.75 INVALID-ORDER-75 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, R_L + \frac{1}{C_L s}\right)$

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

10.76 INVALID-ORDER-76 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, L_L s + \frac{1}{C_L s}\right)$

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

10.77 INVALID-ORDER-77 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$$H(s) = \frac{L_L s \left(g_m r_o + 1\right) \left(C_1 L_1 R_1 s^2 + L_1 s + R_1\right)}{C_1 C_L L_1 L_L R_1 g_m r_o s^4 + C_1 C_L L_1 L_L R_1 s^4 + C_1 C_L L_1 L_L s^3 + C_1 L_1 R_1 g_m r_o s^2 + C_1 L_1 R_1 s^2 + C_1 L_1 L_L g_m r_o s^3 + C_L L_1 L_L g_m r_o s^3 + C_L L_L R_1 g_m r_o s^2 + C_L R_1 g_m r_o s^2$$

10.78 INVALID-ORDER-78 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, L_L s + R_L + \frac{1}{C_L s}\right)$

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

10.79 INVALID-ORDER-79 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

$$H(s) = \frac{L_L R_L s \left(g_m r_o + 1\right) \left(C_1 L_1 R_1 s^2 + L_1 s + R_1\right)}{C_1 C_L L_1 L_L R_1 R_L g_m r_o s^4 + C_1 C_L L_1 L_L R_1 g_m r_o s^3 + C_1 L_1 L_L R_1 s^3 + C_1 L_1 L_1 R_1 s^3 + C_1 L_1 L_$$

10.80 INVALID-ORDER-80 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

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

10.81 INVALID-ORDER-81 $Z(s) = \left(\frac{L_1 s}{C_1 L_1 s^2 + 1} + R_1, \infty, \infty, \infty, \infty, \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

$$H(s) = \frac{R_L \left(g_m r_o + 1\right) \left(C_L L_L s^2 + 1\right) \left(C_1 L_1 R_1 s^2 + L_1 s + R_1\right)}{C_1 C_L L_1 L_L R_1 g_m r_o s^4 + C_1 C_L L_1 L_L R_1 s^4 + C_1 C_L L_1 L_L R_1 g_m r_o s^3 + C_1 C_L L_1 R_1 R_L g_m r_o s^3 + C_1 L_1 R_1 g_m r_o s^3 + C_1 L_1 R_1$$

10.82 INVALID-ORDER-82
$$Z(s) = \begin{pmatrix} R_1(s_{12},s_{12}) \\ R_2(s_{12},s_{12}) \\ R_3(s_{12},s_{12}) \end{pmatrix} \times \infty = \infty = \frac{R_1(s_{12},s_{12}+1)}{C_1C_2L_2R_2R_2s^2s^2 + C_1C_2L_2r_2s^2 + C_1C_2L_2r_2s^2 + C_1C_2L_2r_2s^2 + C_1L_2r_2s^2 + C_1L_2r$$

 $H(s) = \frac{R_1 \left(g_m r_o + 1\right) \left(C_1 L_1 s^2 + 1\right) \left(C_L L_L R_L s^2 + L_L s + R_L\right)}{C_1 C_L L_1 L_L R_1 g_m r_o s^4 + C_1 C_L L_1 L_L R_1 s^4 + C_1 C_L L_1 L_L R_1 s^4 + C_1 C_L L_L R_1 R_L s^3 + C_1 L_L R_1 r_o s^3 + C_1 L_1 R_1 g_m r_o s^2 + C_1 L_1 R_1 s^2 + C_1 R_1 R_1 s^2 +$

10.90 INVALID-ORDER-90 $Z(s) = \left(\frac{R_1\left(L_1 s + \frac{1}{C_1 s}\right)}{L_1 s + R_1 + \frac{1}{C_1 s}}, \infty, \infty, \infty, \infty, \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

 $H(s) = \frac{R_1 R_L \left(g_m r_o + 1\right) \left(C_1 L_1 s^2 + 1\right) \left(C_1 L_1 s^2 + 1\right) \left(C_L L_L s^2 + 1\right)}{C_1 C_L L_1 L_L R_1 g_m r_o s^4 + C_1 C_L L_1 L_L R_1 s^4 + C_1 C_L L_1 L_L R_1 g_m r_o s^3 + C_1 C_L L_1 R_1 R_L s^3 + C_1 C_L L_L R_1 R_L s^3 + C_1 C_L R_1 R_L s^3 +$