

Experiment Summary

Filter 1

Invalid filter

Filter 2

Invalid filter

Filter 3

Invalid filter

Filter 4

Invalid filter

Filter 5

Invalid filter

Filter 6

Filter Type: BS

$Z(s)\text{: } (\infty, \infty, \infty, \infty, R_4, LLs + \frac{1}{CLs})$

$H(s)\text{: } \frac{(R_4gm-1)(CLLLs^2+1)}{2CLLLgms^2+CLR_4gms+CLs+2gm}$

$\mathbf{Q}\text{: } \frac{2LLgm\sqrt{\frac{1}{CLLL}}}{R_4gm+1}$

$\omega_0\text{: } \sqrt{\frac{1}{CLLL}}$

Bandwidth: $\frac{R_4gm+1}{2LLgm}$

Filter 7

Filter Type: BP

$Z(s)\text{: } (\infty, \infty, \infty, \infty, R_4, \frac{LLs}{CLLLs^2+1})$

$H(s)\text{: } \frac{LLs(R_4gm-1)}{CLLLR_4gms^2+CLLLs^2+2LLgms+R_4gm+1}$

$\mathbf{Q}\text{: } \frac{CL\sqrt{\frac{1}{CLLL}}(R_4gm+1)}{2gm}$

$\omega_0\text{: } \sqrt{\frac{1}{CLLL}}$

Bandwidth: $\frac{2gm}{CL(R_4gm+1)}$

Filter 8

Filter Type: GE

$Z(s)\text{: } (\infty, \infty, \infty, \infty, R_4, LLs + RL + \frac{1}{CLs})$

$H(s)\text{: } \frac{(R_4gm-1)(CLLLs^2+CLRLs+1)}{2CLLLgms^2+CLR_4gms+2CLRLgms+CLs+2gm}$

$\mathbf{Q}\text{: } \frac{2LLgm\sqrt{\frac{1}{CLLL}}}{R_4gm+2RLgm+1}$

$\omega_0\text{: } \sqrt{\frac{1}{CLLL}}$

Bandwidth: $\frac{R_4gm+2RLgm+1}{2LLgm}$

Qz: $\frac{LL\sqrt{\frac{1}{CLLL}}}{RL}$

Filter 9

Filter Type: BP

$$Z(s): \left(\infty, \infty, \infty, \infty, R_4, \frac{1}{CLs + \frac{1}{RL} + \frac{1}{LLs}} \right)$$

$$H(s): \frac{LLRLs(R_4gm-1)}{CLLLR_4RLgms^2 + CLLLLRLs^2 + LLR_4gms + 2LLRLgms + LLs + R_4RLgm + RL}$$

Q: $\frac{CLRL\sqrt{\frac{1}{CLLL}}(R_4gm+1)}{R_4gm+2RLgm+1}$

$\omega_0:$ $\sqrt{\frac{1}{CLLL}}$

Bandwidth: $\frac{R_4gm+2RLgm+1}{CLRL(R_4gm+1)}$

Filter 10

Filter Type: GE

$$Z(s): \left(\infty, \infty, \infty, \infty, R_4, \frac{LLs}{CLLLs^2+1} + RL \right)$$

$$H(s): \frac{(R_4gm-1)(CLLLRLs^2+LLs+RL)}{CLLLR_4gms^2 + 2CLLLRLgms^2 + CLLLLs^2 + 2LLgms + R_4gm + 2RLgm + 1}$$

Q: $\frac{CL\sqrt{\frac{1}{CLLL}}(R_4gm+2RLgm+1)}{2gm}$

$\omega_0:$ $\sqrt{\frac{1}{CLLL}}$

Bandwidth: $\frac{2gm}{CL(R_4gm+2RLgm+1)}$

Qz: $CLRL\sqrt{\frac{1}{CLLL}}$

Filter 11

Filter Type: BS

$$Z(s): \left(\infty, \infty, \infty, \infty, R_4, \frac{RL(LLs + \frac{1}{CLs})}{LLs + RL + \frac{1}{CLs}} \right)$$

$$H(s): \frac{RL(R_4gm-1)(CLLLs^2+1)}{CLLLR_4gms^2 + 2CLLLRLgms^2 + CLLLLs^2 + CLR_4RLgms + CLRLs + R_4gm + 2RLgm + 1}$$

Q: $\frac{LL\sqrt{\frac{1}{CLLL}}(R_4gm+2RLgm+1)}{RL(R_4gm+1)}$

$\omega_0:$ $\sqrt{\frac{1}{CLLL}}$

Bandwidth: $\frac{RL(R_4gm+1)}{LL(R_4gm+2RLgm+1)}$

Filter 12

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Filter 13

Invalid filter

Filter 14

Filter Type: Invalid011

$$Z(s): \left(\infty, \infty, \infty, \infty, L_4s, \frac{1}{CLs} \right)$$

$$H(s): \frac{L_4gms-1}{CLL_4gms^2 + CLs + 2gm}$$

Q: $\sqrt{2}L_4gm\sqrt{\frac{1}{CLL_4}}$
 ω_0 : $\sqrt{2}\sqrt{\frac{1}{CLL_4}}$
Bandwidth: $\frac{1}{L_4gm}$

Filter 15

Filter Type: Invalid011

$Z(s)$: $\left(\infty, \infty, \infty, \infty, L_4s, \frac{RL}{CLR Ls+1}\right)$
 $H(s)$: $\frac{RL(L_4gms-1)}{CLL_4RLgms^2+CLR Ls+L_4gms+2RLgm+1}$
Q: $\frac{CLL_4RLgm\sqrt{\frac{2RLgm+1}{CLL_4RLgm}}}{CLR L+L_4gm}$
 ω_0 : $\sqrt{\frac{2RLgm+1}{CLL_4RLgm}}$
Bandwidth: $\frac{CLR L+L_4gm}{CLL_4RLgm}$

Filter 16

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Filter 17

Invalid filter

Filter 18

Filter Type: Invalid110

$Z(s)$: $\left(\infty, \infty, \infty, \infty, L_4s, \frac{LLs}{CLLLs^2+1}\right)$
 $H(s)$: $\frac{LLs(L_4gms-1)}{CLL_4LLgms^3+CLLLs^2+L_4gms+2LLgms+1}$
Q: $\frac{CLLL\sqrt{\frac{1}{CLLL}}}{gm(L_4+2LL)}$
 ω_0 : $\sqrt{\frac{1}{CLLL}}$
Bandwidth: $\frac{gm(L_4+2LL)}{CLLL}$

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Filter 20

Filter Type: Invalid110

$Z(s)$: $\left(\infty, \infty, \infty, \infty, L_4s, \frac{1}{CLs+\frac{1}{RL}+\frac{1}{LLs}}\right)$
 $H(s)$: $\frac{LLRLs(L_4gms-1)}{CLL_4LLRLgms^3+CLLLRLs^2+L_4LLgms^2+L_4RLgms+2LLRLgms+LLs+RL}$
Q: $\frac{LL\sqrt{\frac{RL}{LL(CLR L+L_4gm)}}(CLR L+L_4gm)}{L_4RLgm+2LLRLgm+LL}$
 ω_0 : $\sqrt{\frac{RL}{LL(CLR L+L_4gm)}}$
Bandwidth: $\frac{L_4RLgm+2LLRLgm+LL}{LL(CLR L+L_4gm)}$

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Filter 24

Filter Type: Invalid110

$$Z(s)\text{: } \left(\infty, \infty, \infty, \infty, \frac{1}{C_4 s}, LLs \right)$$

$$H(s)\text{: } \frac{LLs(-C_4 s+gm)}{2C_4 LLgm s^2+C_4 s+gm}$$

$$\mathbf{Q}\text{: } \sqrt{2}LLgm\sqrt{\frac{1}{C_4 LL}}$$

$$\omega_0\text{: } \frac{\sqrt{2}\sqrt{\frac{1}{C_4 LL}}}{2}$$

$$\mathbf{Bandwidth}\text{: } \frac{1}{2LLgm}$$

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Filter 26

Filter Type: Invalid011

$$Z(s)\text{: } \left(\infty, \infty, \infty, \infty, \frac{1}{C_4 s}, \frac{RL}{CLRLs+1} \right)$$

$$H(s)\text{: } \frac{RL(-C_4 s+gm)}{C_4 CLRLs^2+2C_4 RLgm s+C_4 s+CLRLgm s+gm}$$

$$\mathbf{Q}\text{: } \frac{C_4 CLRL\sqrt{\frac{gm}{C_4 CLRL}}}{2C_4 RLgm+C_4+CLRLgm}$$

$$\omega_0\text{: } \sqrt{\frac{gm}{C_4 CLRL}}$$

$$\mathbf{Bandwidth}\text{: } \frac{2C_4 RLgm+C_4+CLRLgm}{C_4 CLRL}$$

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Filter 29

Filter Type: Invalid110

$$Z(s)\text{: } \left(\infty, \infty, \infty, \infty, \frac{1}{C_4 s}, \frac{LLs}{CLLLs^2+1} \right)$$

$$H(s)\text{: } \frac{LLs(-C_4 s+gm)}{C_4 CLLLs^3+2C_4 LLgm s^2+C_4 s+CLLLgm s^2+gm}$$

$$\begin{aligned} \mathbf{Q}: & \frac{LLgm\sqrt{\frac{1}{LL(2C_4+CL)}}(2C_4+CL)}{C_4} \\ \omega_0: & \sqrt{\frac{1}{LL(2C_4+CL)}} \\ \mathbf{Bandwidth}: & \frac{C_4}{LLgm(2C_4+CL)} \end{aligned}$$

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Filter 31

Filter Type: Invalid110

$$\begin{aligned} Z(s): & \left(\infty, \infty, \infty, \infty, \frac{1}{C_4s}, \frac{1}{CLs+\frac{1}{RL}+\frac{1}{LLs}} \right) \\ H(s): & \frac{LLRLs(-C_4s+gm)}{C_4CLLLRLs^3+2C_4LLRLgms^2+C_4LLs^2+C_4RLs+CLLLRLgms^2+LLgms+RLgm} \\ \mathbf{Q}: & \frac{LL\sqrt{\frac{RLgm}{LL(2C_4RLgm+C_4+CLRLgm)}}(2C_4RLgm+C_4+CLRLgm)}{C_4RL+LLgm} \\ \omega_0: & \sqrt{\frac{RLgm}{LL(2C_4RLgm+C_4+CLRLgm)}} \\ \mathbf{Bandwidth}: & \frac{C_4RL+LLgm}{LL(2C_4RLgm+C_4+CLRLgm)} \end{aligned}$$

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Filter 35

Filter Type: Invalid110

$$\begin{aligned} Z(s): & \left(\infty, \infty, \infty, \infty, \frac{R_4}{C_4R_4s+1}, LLs \right) \\ H(s): & \frac{LLs(-C_4R_4s+R_4gm-1)}{2C_4LLR_4gms^2+C_4R_4s+2LLgms+R_4gm+1} \\ \mathbf{Q}: & \frac{\sqrt{2}C_4LLR_4gm\sqrt{\frac{R_4gm+1}{C_4LLR_4gm}}}{C_4R_4+2LLgm} \\ \omega_0: & \frac{\sqrt{2}\sqrt{\frac{R_4gm+1}{C_4LLR_4gm}}}{2} \\ \mathbf{Bandwidth}: & \frac{C_4R_4+2LLgm}{2C_4LLR_4gm} \end{aligned}$$

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Filter Type: Invalid011

$$\begin{aligned} Z(s): & \left(\infty, \infty, \infty, \infty, \frac{R_4}{C_4R_4s+1}, \frac{1}{CLs} \right) \\ H(s): & \frac{-C_4R_4s+R_4gm-1}{C_4CLR_4s^2+2C_4R_4gms+CLR_4gms+CLs+2gm} \\ \mathbf{Q}: & \frac{\sqrt{2}C_4CLR_4\sqrt{\frac{gm}{C_4CLR_4}}}{2C_4R_4gm+CLR_4gm+CL} \end{aligned}$$

$$\omega_0: \sqrt{2} \sqrt{\frac{gm}{C_4 CLR_4}}$$

$$\text{Bandwidth: } \frac{2C_4 R_4 gm + CLR_4 gm + CL}{C_4 CLR_4}$$

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Filter Type: Invalid011

$$Z(s): \left(\infty, \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \frac{RL}{CLR_4 s + 1} \right)$$

$$H(s): \frac{RL(-C_4 R_4 s + R_4 gm - 1)}{C_4 CLR_4 RL s^2 + 2C_4 R_4 RL gm s + C_4 R_4 s + CLR_4 RL gm s + CLR_4 s + R_4 gm + 2RL gm + 1}$$

$$\mathbf{Q}: \frac{C_4 CLR_4 RL \sqrt{\frac{R_4 gm + 2RL gm + 1}{C_4 CLR_4 RL}}}{2C_4 R_4 RL gm + C_4 R_4 + CLR_4 RL gm + CLR_4 RL}$$

$$\omega_0: \sqrt{\frac{R_4 gm + 2RL gm + 1}{C_4 CLR_4 RL}}$$

$$\text{Bandwidth: } \frac{2C_4 R_4 RL gm + C_4 R_4 + CLR_4 RL gm + CLR_4 RL}{C_4 CLR_4 RL}$$

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Filter 40

Filter Type: Invalid110

$$Z(s): \left(\infty, \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \frac{LLs}{CLLLs^2 + 1} \right)$$

$$H(s): \frac{LLs(-C_4 R_4 s + R_4 gm - 1)}{C_4 CLLLR_4 s^3 + 2C_4 LLR_4 RL gm s^2 + C_4 R_4 s + CLLLR_4 RL gm s^2 + CLLLs^2 + 2LL gm s + R_4 gm + 1}$$

$$\mathbf{Q}: \frac{LL \sqrt{\frac{R_4 gm + 1}{LL(2C_4 R_4 gm + CLR_4 gm + CL)}} (2C_4 R_4 gm + CLR_4 gm + CL)}{C_4 R_4 + 2LL gm}$$

$$\omega_0: \sqrt{\frac{R_4 gm + 1}{LL(2C_4 R_4 gm + CLR_4 gm + CL)}}$$

$$\text{Bandwidth: } \frac{C_4 R_4 + 2LL gm}{LL(2C_4 R_4 gm + CLR_4 gm + CL)}$$

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Filter Type: Invalid110

$$Z(s): \left(\infty, \infty, \infty, \infty, \frac{R_4}{C_4 R_4 s + 1}, \frac{1}{CLs + \frac{1}{RL} + \frac{1}{LLs}} \right)$$

$$H(s): \frac{LLRLs(-C_4 R_4 s + R_4 gm - 1)}{C_4 CLLLR_4 RL s^3 + 2C_4 LLR_4 RL gm s^2 + C_4 LLR_4 s^2 + C_4 R_4 RL s + CLLLR_4 RL gm s^2 + CLLLRLs^2 + LLR_4 gm s + 2LLRL gm s + LLs + R_4 RL gm + RL}$$

$$\mathbf{Q}: \frac{LL \sqrt{\frac{RL(R_4 gm + 1)}{LL(2C_4 R_4 RL gm + C_4 R_4 + CLR_4 RL gm + CLR_4 RL)}} (2C_4 R_4 RL gm + C_4 R_4 + CLR_4 RL gm + CLR_4 RL)}{C_4 R_4 RL + LLR_4 gm + 2LLRL gm + LL}$$

$$\omega_0: \sqrt{\frac{RL(R_4 gm + 1)}{LL(2C_4 R_4 RL gm + C_4 R_4 + CLR_4 RL gm + CLR_4 RL)}}$$

$$\text{Bandwidth: } \frac{C_4 R_4 RL + LLR_4 gm + 2LLRL gm + LL}{LL(2C_4 R_4 RL gm + C_4 R_4 + CLR_4 RL gm + CLR_4 RL)}$$

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Filter 46

Filter Type: Invalid110

$Z(s)\text{: } \left(\infty, \infty, \infty, \infty, R_4 + \frac{1}{C_4s}, LLs \right)$

$H(s)\text{: } \frac{LLs(C_4R_4gms-C_4s+gm)}{2C_4LLgms^2+C_4R_4gms+C_4s+gm}$

$\mathbf{Q}\text{: } \frac{\sqrt{2}LLgm\sqrt{\frac{1}{C_4LL}}}{R_4gm+1}$

$\omega_0\text{: } \frac{\sqrt{2}\sqrt{\frac{1}{C_4LL}}}{2}$

Bandwidth: $\frac{R_4gm+1}{2LLgm}$

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Filter 48

Filter Type: Invalid011

$Z(s)\text{: } \left(\infty, \infty, \infty, \infty, R_4 + \frac{1}{C_4s}, \frac{RL}{CLR Ls+1} \right)$

$H(s)\text{: } \frac{RL(C_4R_4gms-C_4s+gm)}{C_4CLR_4RLgms^2+C_4CLR Ls^2+C_4R_4gms+2C_4RLgms+C_4s+CLR Lgms+gm}$

$\mathbf{Q}\text{: } \frac{C_4CLR L\sqrt{\frac{gm}{C_4CLR L(R_4gm+1)}}(R_4gm+1)}{C_4R_4gm+2C_4RLgm+C_4+CLR Lgm}$

$\omega_0\text{: } \sqrt{\frac{gm}{C_4CLR L(R_4gm+1)}}$

Bandwidth: $\frac{C_4R_4gm+2C_4RLgm+C_4+CLR Lgm}{C_4CLR L(R_4gm+1)}$

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Filter 50

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Filter 51

Filter Type: Invalid110

$$Z(s): \left(\infty, \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \frac{LLs}{CLLLs^2+1} \right)$$

$$H(s): \frac{LLs(C_4 R_4 gms - C_4 s + gm)}{C_4 C L L L R_4 gms^3 + C_4 C L L L s^3 + 2C_4 L L gms^2 + C_4 R_4 gms + C_4 s + C L L L gms^2 + gm}$$

$$\mathbf{Q}: \frac{LLgm \sqrt{\frac{1}{LL(2C_4+CL)}} (2C_4+CL)}{C_4(R_4gm+1)}$$

$$\omega_0: \sqrt{\frac{1}{LL(2C_4+CL)}}$$

$$\mathbf{Bandwidth}: \frac{C_4(R_4gm+1)}{LLgm(2C_4+CL)}$$

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Invalid filter

Filter 53

Filter Type: Invalid110

$$Z(s): \left(\infty, \infty, \infty, \infty, R_4 + \frac{1}{C_4 s}, \frac{1}{CLs + \frac{1}{RL} + \frac{1}{LLs}} \right)$$

$$H(s): \frac{LLRLs(C_4 R_4 gms - C_4 s + gm)}{C_4 C L L L R_4 RLgms^3 + C_4 C L L L RLs^3 + C_4 L L R_4 gms^2 + 2C_4 L L RLgms^2 + C_4 L L s^2 + C_4 R_4 RLgms + C_4 RLs + C L L L RLgms^2 + LLgms + RLgm}$$

$$\mathbf{Q}: \frac{LL \sqrt{\frac{RLgm}{LL(C_4 R_4 gm + 2C_4 RLgm + C_4 + CLRLgm)}} (C_4 R_4 gm + 2C_4 RLgm + C_4 + CLRLgm)}{C_4 R_4 RLgm + C_4 RL + LLgm}$$

$$\omega_0: \sqrt{\frac{RLgm}{LL(C_4 R_4 gm + 2C_4 RLgm + C_4 + CLRLgm)}}$$

$$\mathbf{Bandwidth}: \frac{C_4 R_4 RLgm + C_4 RL + LLgm}{LL(C_4 R_4 gm + 2C_4 RLgm + C_4 + CLRLgm)}$$

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Filter 56

Filter Type: GE

$$Z(s): \left(\infty, \infty, \infty, \infty, L_4 s + \frac{1}{C_4 s}, RL \right)$$

$$H(s): \frac{RL(C_4 L_4 gms^2 - C_4 s + gm)}{C_4 L_4 gms^2 + 2C_4 RLgms + C_4 s + gm}$$

$$\mathbf{Q}: \frac{L_4 gm \sqrt{\frac{1}{C_4 L_4}}}{2RLgm+1}$$

$$\omega_0: \sqrt{\frac{1}{C_4 L_4}}$$

$$\mathbf{Bandwidth}: \frac{2RLgm+1}{L_4 gm}$$

$$\mathbf{Qz}: -L_4 gm \sqrt{\frac{1}{C_4 L_4}}$$

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Filter 59

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Filter 60

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Filter 62

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Filter 63

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Filter 67

Filter Type: GE

$Z(s)\text{: } \left(\infty, \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1}, RL \right)$

$H(s)\text{: } \frac{RL(-C_4 L_4 s^2 + L_4 gms - 1)}{2C_4 L_4 RLgms^2 + C_4 L_4 s^2 + L_4 gms + 2RLgm + 1}$

$\mathbf{Q}\text{: } \frac{C_4 \sqrt{\frac{1}{C_4 L_4}} (2RLgm + 1)}{gm}$

$\omega_0\text{: } \sqrt{\frac{1}{C_4 L_4}}$

Bandwidth: $\frac{gm}{C_4 (2RLgm + 1)}$

$\mathbf{Qz}\text{: } -\frac{C_4 \sqrt{\frac{1}{C_4 L_4}}}{gm}$

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Filter 70

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Filter 71

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Filter 78

Filter Type: GE

$Z(s)\text{: } \left(\infty, \infty, \infty, \infty, L_4s + R_4 + \frac{1}{C_4s}, RL \right)$

$H(s)\text{: } \frac{RL(C_4L_4gms^2+C_4R_4gms-C_4s+gm)}{C_4L_4gms^2+C_4R_4gms+2C_4RLgms+C_4s+gm}$

$Q\text{: } \frac{L_4gm\sqrt{\frac{1}{C_4L_4}}}{R_4gm+2RLgm+1}$

$\omega_0\text{: } \sqrt{\frac{1}{C_4L_4}}$

Bandwidth:

$$\frac{R_4gm+2RLgm+1}{L_4gm}$$

Qz:

$$\frac{L_4gm\sqrt{\frac{1}{C_4L_4}}}{R_4gm-1}$$

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Filter 89

Filter Type: GE

$$\begin{aligned} Z(s) &\text{: } \left(\infty, \infty, \infty, \infty, \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}}, RL \right) \\ H(s) &\text{: } \frac{RL \left(-C_4 L_4 R_4 s^2 + L_4 R_4 g m s - L_4 s - R_4 \right)}{2 C_4 L_4 R_4 R L g m s^2 + C_4 L_4 R_4 s^2 + L_4 R_4 g m s + 2 L_4 R L g m s + L_4 s + 2 R_4 R L g m + R_4} \\ \mathbf{Q} &\text{: } \frac{C_4 R_4 \sqrt{\frac{1}{C_4 L_4}} (2 R L g m + 1)}{R_4 g m + 2 R L g m + 1} \\ \omega_0 &\text{: } \sqrt{\frac{1}{C_4 L_4}} \\ \text{Bandwidth} &\text{: } \frac{R_4 g m + 2 R L g m + 1}{C_4 R_4 (2 R L g m + 1)} \\ \mathbf{Qz} &\text{: } -\frac{C_4 R_4 \sqrt{\frac{1}{C_4 L_4}}}{R_4 g m - 1} \end{aligned}$$

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Filter 99

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Filter 100

Filter Type: GE

$Z(s)\text{: } \left(\infty, \infty, \infty, \infty, \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4, RL\right)$

$H(s)\text{: } \frac{RL(C_4 L_4 R_4 g m s^2 - C_4 L_4 s^2 + L_4 g m s + R_4 g m - 1)}{C_4 L_4 R_4 g m s^2 + 2 C_4 L_4 R L g m s^2 + C_4 L_4 s^2 + L_4 g m s + R_4 g m + 2 R L g m + 1}$

$\mathbf{Q}\text{: } \frac{C_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 g m + 2 R L g m + 1)}{g m}$

$\omega_0\text{: } \sqrt{\frac{1}{C_4 L_4}}$

Bandwidth: $\frac{g m}{C_4 (R_4 g m + 2 R L g m + 1)}$

$\mathbf{Qz}\text{: } \frac{C_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 g m - 1)}{g m}$

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Filter 103

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Filter 104

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Filter 107

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Filter 109

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Filter 110

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Filter 111

Filter Type: GE

$Z(s)\text{: } \left(\infty, \infty, \infty, \infty, \frac{R_4 \left(L_4 s + \frac{1}{C_4 s} \right)}{L_4 s + R_4 + \frac{1}{C_4 s}}, RL \right)$

$H(s)\text{: } \frac{RL \left(C_4 L_4 R_4 g m s^2 - C_4 L_4 s^2 - C_4 R_4 s + R_4 g m - 1 \right)}{C_4 L_4 R_4 g m s^2 + 2 C_4 L_4 R L g m s^2 + C_4 L_4 s^2 + 2 C_4 R_4 R L g m s + C_4 R_4 s + R_4 g m + 2 R L g m + 1}$

$\mathbf{Q}\text{: } \frac{L_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 g m + 2 R L g m + 1)}{R_4 (2 R L g m + 1)}$

$\omega_0\text{: } \sqrt{\frac{1}{C_4 L_4}}$

Bandwidth: $\frac{R_4 (2 R L g m + 1)}{L_4 (R_4 g m + 2 R L g m + 1)}$

$\mathbf{Qz}\text{: } \frac{L_4 \sqrt{\frac{1}{C_4 L_4}} (-R_4 g m + 1)}{R_4}$

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