## Experiment: TIA Z2 Z4 ZL

### Filter 1

Invalid filter
$Z(s)$: $(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ R_L)$

### Filter 2

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 3

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 4

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 5

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ L_L s+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_L L_L s^2+1\right)}{2C_L L_L s^2+C_L R_4 s+2}$
**Q:** $\frac{2L_L\sqrt{\frac{1}{C_L L_L}}}{R_4}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4}{2L_L}$

### Filter 6

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L R_4 s}{C_L L_L R_4 s^2+2L_L s+R_4}$
**Q:** $\frac{C_L R_4\sqrt{\frac{1}{C_L L_L}}}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L R_4}$

### Filter 7

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_L L_L s^2+C_L R_L s+1\right)}{2C_L L_L s^2+C_L R_4 s+2C_L R_L s+2}$
**Q:** $\frac{2L_L\sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{2L_L}$
**Qz:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}}{R_L}$

### Filter 8

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L+\frac{1}{L_L s}}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{C_L R_4\sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{C_L R_4 R_L}$

### Filter 9

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$
$H(s)$: $\frac{R_4\left(C_L L_L R_L s^2+L_L s+R_L\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+2L_L s+R_4+2R_L}$
**Q:** $\frac{C_L\sqrt{\frac{1}{C_L L_L}}\left(R_4+2R_L\right)}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L(R_4+2R_L)}$
**Qz:** $C_L R_L\sqrt{\frac{1}{C_L L_L}}$

### Filter 10

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_L L_L s^2+1\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}\left(R_4+2R_L\right)}{R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4 R_L}{L_L(R_4+2R_L)}$

### Filter 11

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 12

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 13

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 14

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 15

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 16

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 17

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 18

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s}{2C_4 L_L R_L s^2+C_L L_L R_L s^2+L_L s+R_L}$
**Q:** $R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 19

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 20

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_L(C_L L_L s^2+1)}{2C_4 C_L L_L R_L s^3+2C_4 R_L s+C_L L_L s^2+C_L R_L s+1}$
**Q:** $\frac{C_L L_L+\sqrt{C_L L_L}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_L L_L}$

### Filter 21

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L\right)$

### Filter 22

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 23

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 24

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L + \frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L R_L s+1)}{2C_4 C_L R_4 R_L s^2+2C_4 R_4 s+C_L R_4 s+2C_L R_L s+2}$
**Q:** $\frac{2C_4 C_L R_4 R_L\sqrt{\frac{1}{C_4 C_L R_4 R_L}}}{2C_4 R_4+C_L R_4+2C_L R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$
**Bandwidth:** $\frac{2C_4 R_4+C_L R_4+2C_L R_L}{2C_4 C_L R_4 R_L}$

### Filter 25

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L L_L s^2+1)}{2C_4 C_L L_L R_4 s^2+2C_4 R_4 s+2C_L L_L s^2+C_L R_4 s+2}$
**Q:** $\frac{2C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_4(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_L L_L}$

### Filter 26

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L R_4 s}{2C_4 L_L R_4 s^2+C_L L_L R_4 s^2+2L_L s+R_4}$
**Q:** $\frac{R_4\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 27

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 28

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{2C_4 L_L R_4 R_L s^2+C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{R_4 R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$

### Filter 29

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 30

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

$H(s)$: $\frac{R_4R_L(C_LL_Ls^2+1)}{2C_4C_LL_LR_4R_Ls^3+2C_4R_4R_Ls+C_LL_LR_4s^2+2C_LL_LR_Ls^2+C_LR_4R_Ls+R_4+2R_L}$

**Q:** $\frac{C_LL_L\sqrt{\frac{1}{C_LL_L}}(R_4+2R_L)}{R_4R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4R_L(2C_4+C_L)}{C_LL_L(R_4+2R_L)}$

### Filter 31

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ R_L\right)$

### Filter 32

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 33

**Filter Type:** Invalid011

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

$H(s)$: $\frac{R_L(C_4R_4s+1)}{C_4C_LR_4R_Ls^2+C_4R_4s+2C_4R_Ls+C_LR_Ls+1}$

**Q:** $\frac{C_4C_LR_4R_L\sqrt{\frac{1}{C_4C_LR_4R_L}}}{C_4R_4+2C_4R_L+C_LR_L}$

$\omega_0$: $\sqrt{\frac{1}{C_4C_LR_4R_L}}$

**Bandwidth:** $\frac{C_4R_4+2C_4R_L+C_LR_L}{C_4C_LR_4R_L}$

### Filter 34

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 35

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 36

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

$H(s)$: $\frac{L_Ls(C_4R_4s+1)}{C_4C_LL_LR_4s^3+2C_4L_Ls^2+C_4R_4s+C_LL_Ls+1}$

**Q:** $\frac{L_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{C_4R_4}$

$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{C_4R_4}{L_L(2C_4+C_L)}$

### Filter 37

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 38

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L+\frac{1}{L_Ls}}}\right)$

$H(s)$: $\frac{L_LR_Ls(C_4R_4s+1)}{C_4C_LL_LR_4s^3+C_4L_LR_4s^2+2C_4L_LR_Ls^2+C_4R_4R_Ls+C_LL_LR_Ls^2+L_Ls+R_L}$

**Q:** $\frac{L_L\sqrt{\frac{R_L}{L_L(C_4R_4+2C_4R_L+C_LR_L)}}(C_4R_4+2C_4R_L+C_LR_L)}{C_4R_4R_L+L_L}$

$\omega_0$: $\sqrt{\frac{R_L}{L_L(C_4R_4+2C_4R_L+C_LR_L)}}$

**Bandwidth:** $\frac{C_4R_4R_L+L_L}{L_L(C_4R_4+2C_4R_L+C_LR_L)}$

### Filter 39

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 40

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 41

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L(C_4L_4s^2+1)}{C_4L_4s^2+2C_4R_Ls+1}$

**Q:** $\frac{L_4\sqrt{\frac{1}{C_4L_4}}}{2R_L}$

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

**Bandwidth:** $\frac{2R_L}{L_4}$

### Filter 42

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 43

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

$H(s)$: $\frac{R_L(C_4L_4s^2+1)}{C_4C_LL_LR_4s^3+C_4L_4s^2+2C_4R_Ls+C_LR_Ls+1}$

**Q:** $\frac{C_4L_4\sqrt{\frac{1}{C_4L_4}}}{R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_4L_4}$

### Filter 44

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 45

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 46

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 47

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 48

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L + \frac{1}{L_L s}}}\right)$

### Filter 49

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 50

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 51

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2 + L_4 s + 2R_L}$
**Q:** $2C_4 R_L \sqrt{\frac{1}{C_4 L_4}}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{1}{2C_4 R_L}$

### Filter 52

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 53

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2 + C_4 L_4 L_L s^2 + L_4 s + 2R_L}$
**Q:** $\sqrt{2} R_L \sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4 + C_L)$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 54

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L + \frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_L s^3 + 2C_4 L_4 s^2 + C_L L_4 s^2 + 2C_L R_L s + 2}$
**Q:** $\frac{\sqrt{2} L_4 \sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4+C_L)}{2C_L R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2C_L R_L}{L_4(2C_4+C_L)}$

### Filter 55

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 56

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 57

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 58

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L + \frac{1}{L_L s}}}\right)$
$H(s)$: $\frac{L_4 L_L R_L s}{2C_4 L_4 L_L R_L s^2 + C_L L_4 L_L R_L s^2 + L_4 L_L s + L_4 R_L + 2L_L R_L}$
**Q:** $R_L \sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}\,(2C_4 + C_L)$
$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 59

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 60

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 61

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L\left(C_4 L_4 s^2 + C_4 R_4 s + 1\right)}{C_4 L_4 s^2 + C_4 R_4 s + 2C_4 R_L s + 1}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4 + 2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4 + 2R_L}{L_4}$
**Qz:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4}$

### Filter 62

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 63

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s + 1}\right)$

### Filter 64

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 65

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 66

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1}\right)$

### Filter 67

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 68

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

### Filter 69

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

### Filter 70

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 71

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2R_4 R_L}$
**Q:** $\frac{2C_4 R_4 R_L\sqrt{\frac{1}{C_4 L_4}}}{R_4 + 2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4 + 2R_L}{2C_4 R_4 R_L}$

### Filter 72

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 R_4 s}{2C_4 L_4 R_4 s^2 + C_L L_4 R_4 s^2 + 2L_4 s + 2R_4}$
**Q:** $\frac{\sqrt{2}R_4\sqrt{\frac{1}{L_4(2C_4 + C_L)}}(2C_4 + C_L)}{2}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{2}{L_4(2C_4 + C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4 + C_L)}$

### Filter 73

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s + 1}\right)$
$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2 + C_L L_4 R_4 R_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2R_4 R_L}$
**Q:** $\frac{\sqrt{2}R_4 R_L\sqrt{\frac{1}{L_4(2C_4 + C_L)}}(2C_4 + C_L)}{R_4 + 2R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4 + C_L)}}$
**Bandwidth:** $\frac{R_4 + 2R_L}{R_4 R_L(2C_4 + C_L)}$

### Filter 74

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ R_L + \frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 R_4 s(C_L R_L s + 1)}{2C_4 C_L L_4 R_4 R_L s^3 + 2C_4 L_4 R_4 s^2 + C_L L_4 R_4 s^2 + 2C_L L_4 R_L s^2 + 2C_L R_4 R_L s + 2L_4 s + 2R_4}$
**Q:** $\frac{\sqrt{2L_4}\sqrt{\frac{R_4}{L_4(2C_4 R_4 + C_L R_4 + 2C_L R_L)}}(2C_4 R_4 + C_L R_4 + 2C_L R_L)}{2(C_L R_4 R_L + L_4)}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{R_4}{L_4(2C_4 R_4 + C_L R_4 + 2C_L R_L)}}$
**Bandwidth:** $\frac{2(C_L R_4 R_L + L_4)}{L_4(2C_4 R_4 + C_L R_4 + 2C_L R_L)}$

### Filter 75

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 76

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_4 L_L R_4 s}{2C_4 L_4 L_L R_4 s^2+C_L L_4 L_L R_4 s^2+2L_4 L_L s+L_4 R_4+2L_L R_4}$
**Q:** $\frac{R_4\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 77

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+L_4 s}},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 78

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+L_4 s}},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_4 L_L R_4 R_L s}{2C_4 L_4 L_L R_4 R_L s^2+C_L L_4 L_L R_4 R_L s^2+L_4 L_L R_4 s+2L_4 L_L R_L s+L_4 R_4 R_L+2L_L R_4 R_L}$
**Q:** $\frac{R_4 R_L\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$

### Filter 79

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 80

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+L_4 s}},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 81

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L(C_4 L_4 R_4 s^2+L_4 s+R_4)}{C_4 L_4 R_4 s^2+2C_4 L_4 R_L s^2+L_4 s+R_4+2R_L}$
**Q:** $C_4\sqrt{\frac{1}{C_4 L_4}}(R_4+2R_L)$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{1}{C_4(R_4+2R_L)}$
**Qz:** $C_4 R_4\sqrt{\frac{1}{C_4 L_4}}$

### Filter 82

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 83

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 84

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 85

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 86

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 87

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 88

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 89

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 90

Invalid filter
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 91

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 L_4 R_4 s^2+2C_4 L_4 R_L s^2+2C_4 R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}(R_4+2R_L)}{2R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{2R_4 R_L}{L_4(R_4+2R_L)}$

### Filter 92

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{1}{C_Ls}\right)$

$H(s)$: $\frac{R_4\left(C_4L_4s^2+1\right)}{C_4C_LL_4R_4s^3+2C_4L_4s^2+2C_4R_4s+C_LR_4s+2}$

**Q:** $\frac{2C_4L_4\sqrt{\frac{1}{C_4L_4}}}{R_4(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_4L_4}$

### Filter 93

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{R_Ls}{C_LR_Ls+1}\right)$

$H(s)$: $\frac{R_4R_L\left(C_4L_4s^2+1\right)}{C_4C_LL_4R_4R_Ls^3+C_4L_4R_4s^2+2C_4L_4R_Ls^2+2C_4R_4R_Ls+C_LR_4R_Ls+R_4+2R_L}$

**Q:** $\frac{C_4L_4\sqrt{\frac{1}{C_4L_4}}(R_4+2R_L)}{R_4R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4R_L(2C_4+C_L)}{C_4L_4(R_4+2R_L)}$

### Filter 94

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 95

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 96

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 97

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 98

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

### Filter 99

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 100

Invalid filter

$Z(s)$: $\left(\infty,\ R_2,\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 101

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ R_L\right)$

### Filter 102

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 103

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

### Filter 104

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 105

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

$H(s)$: $\frac{R_4\left(C_LL_Ls^2+1\right)}{2C_LL_Ls^2+C_LR_4s+2}$

**Q:** $\frac{2L_L\sqrt{\frac{1}{C_LL_L}}}{R_4}$

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

**Bandwidth:** $\frac{R_L}{2L_L}$

### Filter 106

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

$H(s)$: $\frac{L_LR_4s}{C_LL_LR_4s^2+2L_Ls+R_4}$

**Q:** $\frac{C_LR_4\sqrt{\frac{1}{C_LL_L}}}{2}$

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

**Bandwidth:** $\frac{2}{C_LR_4}$

### Filter 107

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ \frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

$H(s)$: $\frac{R_4\left(C_LL_Ls^2+C_LR_Ls+1\right)}{2C_LL_Ls^2+C_LR_4s+2C_LR_Ls+2}$

**Q:** $\frac{2L_L\sqrt{\frac{1}{C_LL_L}}}{R_4+2R_L}$

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

**Bandwidth:** $\frac{R_4+2R_L}{2L_L}$

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

### Filter 108

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{C_L R_4 R_L\sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{C_L R_4 R_L}$

### Filter 109

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$
$H(s)$: $\frac{R_L\left(C_L L_L R_L s^2+L_L s+R_L\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+2L_L s+R_4+2R_L}$
**Q:** $\frac{C_L\sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L(R_4+2R_L)}$
**Qz:** $C_L R_L\sqrt{\frac{1}{C_L L_L}}$

### Filter 110

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_L L_L s^2+1\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L R_L}{L_L(R_4+2R_L)}$

### Filter 111

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 112

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 113

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 114

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 115

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 116

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 117

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 118

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s}{2C_4 L_L R_L s^2+C_L L_L R_L s^2+L_L s+R_L}$
**Q:** $R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 119

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 120

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_L\left(C_L L_L s^2+1\right)}{2C_4 C_L L_L R_L s^3+2C_4 R_L s+C_L L_L s^2+C_L R_L s+1}$
**Q:** $\frac{C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_L L_L}$

### Filter 121

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L\right)$

### Filter 122

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 123

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 124

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L L_L s^2+1)}{2C_4 C_L R_4 R_L s^2+2C_4 R_4 s+C_L R_4 s^2+2C_L R_L s+2}$
**Q:** $\frac{2C_4 C_L R_4 R_L \sqrt{C_4 C_L R_4 R_L}}{2C_4 R_4+C_L R_4+2C_L R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$
**Bandwidth:** $\frac{2C_4 R_4+C_L R_4+2C_L R_L}{2C_4 C_L R_4 R_L}$

### Filter 125

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L L_L s^2+1)}{2C_4 C_L L_L R_4 s^3+2C_4 R_4 s+2C_L L_L s^2+C_L R_4 s+2}$
**Q:** $\frac{2C_4 L_L \sqrt{\frac{1}{C_L L_L}}}{R_4(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_L L_L}$

### Filter 126

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L R_4 s}{2C_4 L_L R_4 s^2+C_L L_L R_4 s^2+2L_L s+R_4}$
**Q:** $\frac{R_4\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 127

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 128

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{2C_4 L_L R_4 R_L s^2+C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{R_4 R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$

### Filter 129

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 130

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L(C_L L_L s^2+1)}{2C_4 C_L L_L R_4 R_L s^3+2C_4 R_4 R_L s+C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{C_L L_L\sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{R_4 R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4 R_L(2C_4+C_L)}{C_L L_L(R_4+2R_L)}$

### Filter 131

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 132

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 133

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{R_4(C_4 R_4 s+1)}{C_4 C_L R_4 R_L s^2+C_4 R_4 s+2C_4 R_L s+C_L R_L s+1}$
**Q:** $\frac{C_4 C_L R_4 R_L\sqrt{\frac{1}{C_4 C_L R_4 R_L}}}{C_4 R_4+2C_4 R_L+C_L R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$
**Bandwidth:** $\frac{C_L R_4+2C_4 R_L+C_L R_L}{C_4 C_L R_4 R_L}$

### Filter 134

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 135

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 136

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L s(C_4 R_4 s+1)}{C_4 C_L L_L R_4 s^3+2C_4 L_L s^2+C_4 R_4 s+C_L L_L s^2+1}$
**Q:** $\frac{L_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{C_4 R_4}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{C_4 R_4}{L_L(2C_4+C_L)}$

### Filter 137

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 138

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s(C_4 R_4 s+1)}{C_4 C_L L_L R_4 R_L s^3+C_4 L_L R_4 s^2+2C_4 L_L R_L s^2+C_4 R_4 R_L s+C_L L_L R_L s^2+L_L s+R_L}$
**Q:** $\frac{L_L\sqrt{\frac{R_L}{L_L(C_4 R_4+2C_4 R_L+C_L R_L)}}(C_4 R_4+2C_4 R_L+C_L R_L)}{C_4 R_4 R_L+L_L}$
$\omega_0$: $\sqrt{\frac{R_L}{L_L(C_4 R_4+2C_4 R_L+C_L R_L)}}$
**Bandwidth:** $\frac{C_4 R_4 R_L+L_L}{L_L(C_4 R_4+2C_4 R_L+C_L R_L)}$

### Filter 139

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 140

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 141

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L(C_4 L_4 s^2+1)}{C_4 L_4 s^2+2C_4 R_L s+1}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{2R_L}{L_4}$

### Filter 142

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 143

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{R_L(C_4 L_4 s^2+1)}{C_4 C_L L_4 R_L s^3+C_4 L_4 s^2+2C_4 R_L s+C_L R_L s+1}$
**Q:** $\frac{C_4 L_4\sqrt{\frac{1}{C_4 L_4}}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_4 L_4}$

### Filter 144

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 145

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 146

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 147

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 148

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 149

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 150

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 151

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+L_4 s+2R_L}$
**Q:** $2C_4 R_L\sqrt{\frac{1}{C_4 L_4}}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{1}{2C_4 R_L}$

### Filter 152

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 153

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+C_4 L_4+R_L s^2+L_4 s+2R_L}$
**Q:** $\sqrt{2}R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 154

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_L s^3+2C_4 L_4 s^2+C_L L_4 s^2+2C_L R_L s+2}$
**Q:** $\frac{\sqrt{2}L_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2C_L R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2C_L R_L}{L_4(2C_4+C_L)}$

### Filter 155

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 156

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 157

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 158

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L+\frac{1}{C_L s}}}\right)$
$H(s)$: $\frac{L_4 L_L R_L s}{2C_4 L_4 L_L R_L s^2+C_L L_4 L_L R_L s^2+L_4 L_L s+L_4 R_L+2L_L R_L}$
**Q:** $R_L\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 159

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 160

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 161

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L\left(C_4 L_4 s^2+C_4 R_4 s+1\right)}{C_4 L_4 s^2+C_4 R_4 s+2C_4 R_L s+1}$
**Q:** $\frac{L_4\sqrt{C_4^{-1}L_4^{-1}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{C_4^{-1}L_4^{-1}}$
**Bandwidth:** $\frac{R_4+2R_L}{L_4}$
**Qz:** $\frac{L_4\sqrt{C_4^{-1}L_4^{-1}}}{R_4}$

### Filter 162

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 163

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 164

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 165

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 166

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 167

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 168

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L+\frac{1}{C_L s}}}\right)$

### Filter 169

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 170

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 171

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ R_L\right)$

$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2R_4 R_L}$

**Q:** $\frac{2C_4 R_4 R_L \sqrt{\frac{1}{C_4 L_4}}}{R_4 + 2R_L}$

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

**Bandwidth:** $\frac{R_4 + 2R_L}{2C_4 R_4 R_L}$

### Filter 172

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$

$H(s)$: $\frac{L_4 R_4 s}{2C_4 L_4 R_4 s^2 + C_L L_4 L_L R_4 s^2 + 2L_4 s + 2R_4}$

**Q:** $\frac{\sqrt{2}R_4 \sqrt{\frac{1}{L_4(2C_4 + C_L)}}(2C_4 + C_L)}{2}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4 + C_L)}}$

**Bandwidth:** $\frac{2}{R_4(2C_4 + C_L)}$

### Filter 173

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s + 1}\right)$

$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2 + C_L L_4 R_4 R_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2R_4 R_L}$

**Q:** $\frac{\sqrt{2}R_4 R_L \sqrt{\frac{1}{L_4(2C_4 + C_L)}}(2C_4 + C_L)}{R_4 + 2R_L}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4 + C_L)}}$

**Bandwidth:** $\frac{R_4 + 2R_L}{R_4 R_L(2C_4 + C_L)}$

### Filter 174

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ R_L + \frac{1}{C_L s}\right)$

$H(s)$: $\frac{L_4 R_4 s(C_L R_L s + 1)}{2C_4 C_L L_4 R_4 R_L s^3 + 2C_4 L_4 R_4 s^2 + C_L L_4 R_4 s^2 + 2C_L L_4 R_L s^2 + 2C_L R_4 R_L s + 2L_4 s + 2R_4}$

**Q:** $\frac{R_4 \sqrt{\frac{1}{L_4(2C_4 R_4 + C_L R_4 + 2C_L R_L)}}(2C_4 R_4 + C_L R_4 + 2C_L R_L)}{2(C_L R_4 R_L + L_4)}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{R_4}{L_4(2C_4 R_4 + C_L R_4 + 2C_L R_L)}}$

**Bandwidth:** $\frac{2(C_L R_4 R_L + L_4)}{L_4(2C_4 R_4 + C_L R_4 + 2C_L R_L)}$

### Filter 175

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 176

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$H(s)$: $\frac{L_4 L_L R_4 s}{2C_4 L_4 L_L R_4 R_L s^2 + C_L L_4 L_L R_4 s^2 + L_4 L_L s + L_4 R_4 s + 2L_L R_4 s + 2R_4}$

**Q:** $\frac{R_4 \sqrt{\frac{L_4 + 2L_L}{L_4 L_L(2C_4 + C_L)}}(2C_4 + C_L)}{L_4 + 2L_L}$

$\omega_0$: $\sqrt{\frac{L_4 + 2L_L}{L_4 L_L(2C_4 + C_L)}}$

**Bandwidth:** $\frac{R_4 + 2R_L}{R_4 L_L(2C_4 + C_L)}$

### Filter 177

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 178

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

$H(s)$: $\frac{L_4 L_L R_4 R_L s}{2C_4 L_4 L_L R_4 R_L s^2 + C_L L_4 L_L R_4 R_L s^2 + L_4 L_L R_4 s + 2L_4 L_L R_L s + L_4 R_4 R_L s + 2L_L R_4 R_L}$

**Q:** $\frac{R_4 R_L \sqrt{\frac{L_4 + 2L_L}{L_4 L_L(2C_4 + C_L)}}(2C_4 + C_L)}{R_4 + 2R_L}$

$\omega_0$: $\sqrt{\frac{L_4 + 2L_L}{L_4 L_L(2C_4 + C_L)}}$

**Bandwidth:** $\frac{R_4 + 2R_L}{R_4 R_L(2C_4 + C_L)}$

### Filter 179

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

### Filter 180

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 181

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L(C_4 L_4 R_4 s^2 + L_4 s + R_4)}{2C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + L_4 s + R_4 + 2R_L}$

**Q:** $C_4 \sqrt{\frac{1}{C_4 L_4}}\,(R_4 + 2R_L)$

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

**Bandwidth:** $\frac{1}{C_4(R_4 + 2R_L)}$

**Qz:** $C_4 R_4 \sqrt{\frac{1}{C_4 L_4}}$

### Filter 182

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 183

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 184

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 185

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 186

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 187

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 188

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 189

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 190

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 191

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 L_4 R_4 s^2+2C_4 L_4 R_L s^2+2C_4 R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}\left(R_4+2R_L\right)}{2R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{2R_4 R_L}{L_4\left(R_4+2R_L\right)}$

### Filter 192

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_L R_4 s^3+2C_4 L_4 s^2+2C_4 R_4 s+C_L R_4 s+2}$
**Q:** $\frac{2C_4 L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4\left(2C_4+C_L\right)}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4\left(2C_4+C_L\right)}{2C_4 L_4}$

### Filter 193

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_L R_4 R_L s^3+C_4 L_4 R_4 s^2+2C_4 L_4 R_L s^2+2C_4 R_4 R_L s+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{C_4 L_4\sqrt{\frac{1}{C_4 L_4}}\left(R_4+2R_L\right)}{R_4 R_L\left(2C_4+C_L\right)}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4 R_L\left(2C_4+C_L\right)}{C_4 L_4\left(R_4+2R_L\right)}$

### Filter 194

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 195

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 196

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 197

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 198

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 199

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 200

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 201

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ R_L\right)$

### Filter 202

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 203

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ \frac{R_4}{C_LR_Ls+1}\right)$

### Filter 204

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 205

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$
$H(s)$: $\frac{R_4\left(C_LL_Ls^2+1\right)}{2C_LL_Ls^2+C_LR_4s+2}$
**Q:** $\frac{2L_L\sqrt{\frac{1}{C_LL_L}}}{R_4}$
$\omega_0$: $\sqrt{\frac{1}{C_LL_L}}$
**Bandwidth:** $\frac{R_4}{2L_L}$

### Filter 206

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$
$H(s)$: $\frac{L_LR_4s}{C_LL_LR_4s^2+2L_Ls+R_4}$
**Q:** $\frac{C_LR_4\sqrt{\frac{1}{C_LL_L}}}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_LL_L}}$
**Bandwidth:** $\frac{2}{C_LR_4}$

### Filter 207

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$
$H(s)$: $\frac{R_4\left(C_LL_Ls^2+C_LR_Ls+1\right)}{2C_LL_Ls^2+C_LR_4s+2C_LR_Ls+2}$
**Q:** $\frac{2L_L\sqrt{\frac{1}{C_LL_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_LL_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{2L_L}$
**Qz:** $\frac{L_L\sqrt{\frac{1}{C_LL_L}}}{R_L}$

### Filter 208

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_LR_Ls+\frac{L_L}{R_L}+\frac{1}{C_Ls}}\right)$
$H(s)$: $\frac{L_LR_4R_Ls}{C_LL_LR_4R_Ls^2+L_LR_4s^2+2L_LR_Ls+R_4R_L}$
**Q:** $\frac{C_LR_4R_L\sqrt{\frac{1}{C_LL_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_LL_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{C_LR_4R_L}$

### Filter 209

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$
$H(s)$: $\frac{R_4\left(C_LL_LR_Ls^2+L_Ls+R_L\right)}{C_LL_LR_4s^2+2C_LL_LR_Ls^2+2L_Ls+R_4+2R_L}$
**Q:** $\frac{C_L\sqrt{\frac{1}{C_LL_L}}(R_4+2R_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_LL_L}}$
**Bandwidth:** $\frac{2}{C_L(R_4+2R_L)}$
**Qz:** $C_LR_L\sqrt{\frac{1}{C_LL_L}}$

### Filter 210

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4,\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$
$H(s)$: $\frac{R_4R_L\left(C_LL_Ls^2+1\right)}{C_LL_LR_4s^2+2C_LL_LR_Ls^2+C_LR_4R_Ls+R_4+2R_L}$
**Q:** $\frac{L_L\sqrt{\frac{1}{C_LL_L}}(R_4+2R_L)}{R_4R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_LL_L}}$
**Bandwidth:** $\frac{R_4R_L}{L_L(R_4+2R_L)}$

### Filter 211

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ R_L\right)$

### Filter 212

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 213

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

### Filter 214

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 215

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 216

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 217

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 218

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L+\frac{1}{L_Ls}}}\right)$
$H(s)$: $\frac{L_LR_Ls}{2C_4L_LR_Ls^2+C_4L_LR_Ls+L_Ls+R_L}$
**Q:** $R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 219

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 220

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$
$H(s)$: $\frac{R_L(C_4L_Ls^2+1)}{2C_4C_LL_LR_Ls^3+2C_4R_Ls+C_LL_Ls^2+C_LR_Ls+2R_L}$
**Q:** $\frac{C_LL_L\sqrt{\frac{1}{C_LL_L}}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_LL_L}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_LL_L}$

### Filter 221

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ R_L\right)$

### Filter 222

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 223

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

### Filter 224

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$
$H(s)$: $\frac{R_4(C_LR_Ls+1)}{2C_4C_LR_LR_4s^2+2C_4R_4s+C_LR_4s+2C_LR_Ls+2}$
**Q:** $\frac{2C_4C_LR_4R_L\sqrt{\frac{1}{C_4C_LR_4R_L}}}{2C_4R_4+C_LR_4+2C_LR_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4C_LR_4R_L}}$
**Bandwidth:** $\frac{2C_4R_4+C_LR_4+2C_LR_L}{2C_4C_LR_4R_L}$

### Filter 225

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$
$H(s)$: $\frac{R_4(C_LL_Ls^2+1)}{2C_4C_LL_LR_4s^3+2C_4R_4s+2C_LL_Ls^2+C_LR_4s+2}$
**Q:** $\frac{2C_LL_L\sqrt{\frac{1}{C_LL_L}}}{R_4(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_LL_L}}$
**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_LL_L}$

### Filter 226

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$
$H(s)$: $\frac{L_LR_Ls}{2C_4L_LR_4s^2+C_4L_LR_4s^2+2L_Ls+R_4}$
**Q:** $\frac{R_4\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 227

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 228

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L+\frac{1}{L_Ls}}}\right)$
$H(s)$: $\frac{L_LR_LR_4s}{2C_4L_LR_4R_Ls^2+C_LL_LR_4R_Ls^2+L_LR_4s+2L_LR_Ls+R_4R_L}$
**Q:** $\frac{R_4R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_4+2R_L}{R_4R_L(2C_4+C_L)}$

### Filter 229

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 230

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4}{C_4R_4s+1},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_Ls+\frac{R_L}{C_Ls}}\right)$

$H(s)$: $\frac{R_4R_L(C_LL_Ls^2+1)}{2C_4C_LL_LR_4R_Ls^3+2C_4R_4R_Ls+C_LL_LR_4s^2+2C_LL_LR_Ls^2+C_LR_4R_Ls+R_4+2R_L}$

**Q:** $\frac{C_LL_L\sqrt{\frac{1}{C_LL_L}}(R_4+2R_L)}{R_4R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4R_L(2C_4+C_L)}{C_LL_L(R_4+2R_L)}$

### Filter 231

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ R_L\right)$

### Filter 232

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 233

**Filter Type:** Invalid011

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

$H(s)$: $\frac{R_L(C_4R_4s+1)}{C_4C_LR_4R_Ls^2+C_4R_4s+2C_4R_Ls+C_LR_Ls+1}$

**Q:** $\frac{C_4C_LR_4R_L\sqrt{\frac{1}{C_4C_LR_4R_L}}}{C_4R_4+2C_4R_L+C_LR_L}$

$\omega_0$: $\sqrt{\frac{1}{C_4C_LR_4R_L}}$

**Bandwidth:** $\frac{C_4R_4+2C_4R_L+C_LR_L}{C_4C_LR_4R_L}$

### Filter 234

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 235

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 236

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

$H(s)$: $\frac{L_Ls(C_4R_4s+1)}{C_4C_LL_LR_4s^3+2C_4L_Ls^2+C_4R_4s+C_LL_Ls^2+1}$

**Q:** $\frac{L_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{C_4R_4}$

$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{C_4R_4}{L_L(2C_4+C_L)}$

### Filter 237

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 238

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

$H(s)$: $\frac{L_LR_Ls(C_4R_4s+1)}{C_4C_LL_LR_4R_Ls^3+C_4L_LR_4s^2+2C_4L_LR_Ls^2+C_4R_4R_Ls+C_LL_LR_Ls^2+L_Ls+R_L}$

**Q:** $\frac{L_L\sqrt{\frac{R_L}{L_L(C_4R_4+2C_4R_L+C_LR_L)}}(C_4R_4+2C_4R_L+C_LR_L)}{C_4R_4R_L+L_L}$

$\omega_0$: $\sqrt{\frac{R_L}{L_L(C_4R_4+2C_4R_L+C_LR_L)}}$

**Bandwidth:** $\frac{C_4R_4R_L+L_L}{L_L(C_4R_4+2C_4R_L+C_LR_L)}$

### Filter 239

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 240

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 241

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L(C_4L_4s^2+1)}{C_4L_4s^2+2C_4R_Ls+1}$

**Q:** $\frac{L_4\sqrt{\frac{C_4}{L_4}}}{2R_L}$

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

**Bandwidth:** $\frac{2R_L}{L_4}$

### Filter 242

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 243

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

$H(s)$: $\frac{R_L(C_4L_4s^2+1)}{C_4C_LL_LR_4s^3+C_4L_4s^2+2C_4R_Ls+C_LR_Ls+1}$

**Q:** $\frac{C_4L_4\sqrt{\frac{C_4}{L_4}}}{R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_4L_4}$

### Filter 244

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 245

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 246

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 247

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 248

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L+\frac{1}{L_Ls}}}\right)$

### Filter 249

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 250

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 251

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4R_Ls}{2C_4L_4R_Ls^2+L_4s+2R_L}$
**Q:** $2C_4R_L\sqrt{\frac{1}{C_4L_4}}$
$\omega_0$: $\sqrt{\frac{1}{C_4L_4}}$
**Bandwidth:** $\frac{1}{2C_4R_L}$

### Filter 252

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 253

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$
$H(s)$: $\frac{L_4R_Ls}{2C_4L_4R_Ls^2+C_LL_4R_Ls^2+L_4s+2R_L}$
**Q:** $\sqrt{2}R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}\left(2C_4+C_L\right)$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_L(2C_4+C_L)}$

### Filter 254

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$
$H(s)$: $\frac{L_4s(C_LR_Ls+1)}{2C_4C_LL_4R_Ls^3+2C_4L_4s^2+C_LL_4s^2+2C_LR_Ls+2}$
**Q:** $\frac{\sqrt{2}L_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2C_LR_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2C_LR_L}{L_4(2C_4+C_L)}$

### Filter 255

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 256

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 257

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 258

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L+\frac{1}{L_Ls}}}\right)$
$H(s)$: $\frac{L_4L_Ls}{2C_4L_4L_LR_Ls^2+C_LL_4L_LR_Ls^2+L_4L_Ls+L_4R_Ls+2L_LR_L}$
**Q:** $R_L\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}\left(2C_4+C_L\right)$
$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 259

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 260

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 261

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L(C_4L_4s^2+C_4R_4s+1)}{C_4L_4s^2+C_4R_4s+2C_4R_Ls+1}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4L_4}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4L_4}}$
**Bandwidth:** $\frac{R_4+2R_L}{L_4}$
**Qz:** $\frac{L_4\sqrt{\frac{1}{C_4L_4}}}{R_4}$

### Filter 262

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 263

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

### Filter 264

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 265

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 266

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 267

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 268

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

### Filter 269

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 270

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 271

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4R_4R_Ls}{2C_4L_4R_4R_Ls^2+L_4R_4s+2L_4R_Ls+2R_4R_L}$
**Q:** $\frac{2C_4R_4R_L\sqrt{\frac{1}{C_4L_4}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4L_4}}$
**Bandwidth:** $\frac{R_4+2R_L}{2C_4R_4R_L}$

### Filter 272

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{1}{C_Ls}\right)$
$H(s)$: $\frac{L_4R_4s}{2C_4L_4R_4s^2+C_4L_4R_4s^2+2L_4s+2R_4}$
**Q:** $\frac{\sqrt{2}R_4\sqrt{\frac{2}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{2}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 273

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$
$H(s)$: $\frac{L_4R_4R_Ls}{2C_4L_4R_4R_Ls^2+C_4L_4R_4R_Ls^2+L_4R_4s+2L_4R_Ls+2R_4R_L}$
**Q:** $\frac{\sqrt{2}R_4R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_4+2R_L}{R_4R_L(2C_4+C_L)}$

### Filter 274

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$
$H(s)$: $\frac{L_4R_4s(C_LR_Ls+1)}{2C_4C_LL_4R_4R_Ls^3+2C_4L_4R_4s^2+C_LL_4R_4s^2+2C_LL_4R_Ls^2+2C_LR_4R_Ls+2L_4s+2R_4}$
**Q:** $\frac{\sqrt{2}L_4\sqrt{\frac{R_4}{L_4(2C_4R_4+C_LR_4+2C_LR_L)}}(2C_4R_4+C_LR_4+2C_LR_L)}{2(C_LR_4R_L+L_4)}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{R_4}{L_4(2C_4R_4+C_LR_4+2C_LR_L)}}$
**Bandwidth:** $\frac{2(C_LR_4R_L+L_4)}{L_4(2C_4R_4+C_LR_4+2C_LR_L)}$

### Filter 275

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 276

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

$H(s)$: $\frac{L_4L_LR_4s}{2C_4L_4L_LR_4s^2+C_LL_4L_LR_4s^2+2L_4L_Ls+L_4R_4+2L_LR_4}$

**Q:** $\frac{R_4\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}(2C_4+C_L)}{2}$

$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 277

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 278

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

$H(s)$: $\frac{L_4L_LR_4R_Ls}{2C_4L_4L_LR_4R_Ls^2+C_LL_4L_LR_4R_Ls^2+L_4L_LR_4s+2L_4L_LR_Ls+L_4R_4R_L+2L_LR_4R_L}$

**Q:** $\frac{R_4R_L\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$

$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{R_4+2R_L}{R_4R_L(2C_4+C_L)}$

### Filter 279

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 280

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 281

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L(C_4L_4R_4s^2+L_4s+R_4)}{C_4L_4R_4s^2+2C_4L_4R_Ls^2+L_4s+R_4+2R_L}$

**Q:** $C_4\sqrt{\frac{1}{C_4L_4}}\left(R_4+2R_L\right)$

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

**Bandwidth:** $\frac{1}{C_4(R_4+2R_L)}$

**Qz:** $C_4R_4\sqrt{\frac{1}{C_4L_4}}$

### Filter 282

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 283

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

### Filter 284

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 285

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 286

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 287

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 288

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

### Filter 289

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 290

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 291

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_4R_L(C_4L_4s^2+1)}{C_4L_4R_4s^2+2C_4L_4R_Ls^2+2C_4R_4R_Ls+R_4+2R_L}$

**Q:** $\frac{L_4\sqrt{\frac{1}{C_4L_4}}(R_4+2R_L)}{2R_4R_L}$

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

**Bandwidth:** $\frac{2R_4R_L}{L_4(R_4+2R_L)}$

### Filter 292

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{1}{C_Ls}\right)$

$H(s)$: $\frac{R_4\left(C_4L_4s^2+1\right)}{C_4C_LL_4R_4s^3+2C_4L_4s^2+2C_4R_4s+C_LR_4s+2}$

**Q:** $\frac{2C_4L_4\sqrt{\frac{1}{C_4L_4}}}{R_4(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_4L_4}$

### Filter 293

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

$H(s)$: $\frac{R_4R_L\left(C_4L_4s^2+1\right)}{C_4C_LL_4R_4R_Ls^3+C_4L_4R_4s^2+2C_4L_4R_Ls^2+2C_4R_4R_Ls+C_LR_4R_Ls+R_4+2R_L}$

**Q:** $\frac{C_4L_4\sqrt{\frac{1}{C_4L_4}}(R_4+2R_L)}{R_4R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4R_L(2C_4+C_L)}{C_4L_4(R_4+2R_L)}$

### Filter 294

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 295

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 296

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 297

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 298

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

### Filter 299

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 300

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2}{C_2R_2s+1},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{R_4\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 301

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ R_L\right)$

### Filter 302

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 303

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

### Filter 304

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 305

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

$H(s)$: $\frac{R_4\left(C_LL_Ls^2+1\right)}{2C_LL_Ls^2+C_LR_4s+2}$

**Q:** $\frac{2L_L\sqrt{\frac{1}{C_LL_L}}}{R_4}$

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

**Bandwidth:** $\frac{R_4}{2L_L}$

### Filter 306

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

$H(s)$: $\frac{L_LR_4s}{C_LL_LR_4s^2+2L_Ls+R_4}$

**Q:** $\frac{C_LR_4\sqrt{\frac{1}{C_LL_L}}}{2}$

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

**Bandwidth:** $\frac{2}{C_LR_4}$

### Filter 307

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2s},\ \infty,\ R_4,\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

$H(s)$: $\frac{R_4\left(C_LL_Ls^2+C_LR_Ls+1\right)}{2C_LL_Ls^2+C_LR_4s+2C_LR_Ls+2}$

**Q:** $\frac{2L_L\sqrt{\frac{1}{C_LL_L}}}{R_4+2R_L}$

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

**Bandwidth:** $\frac{R_4+2R_L}{2L_L}$

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

### Filter 308

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{C_L R_4 R_L\sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{C_L R_4 R_L}$

### Filter 309

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$
$H(s)$: $\frac{R_4\left(C_L L_L R_L s^2+L_L s+R_L\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+2L_L s+R_4+2R_L}$
**Q:** $\frac{C_L\sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L(R_4+2R_L)}$
**Qz:** $C_L R_L\sqrt{\frac{1}{C_L L_L}}$

### Filter 310

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_L L_L s^2+1\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4 R_L}{L_L(R_4+2R_L)}$

### Filter 311

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 312

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 313

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 314

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 315

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 316

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 317

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 318

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s}{2C_4 L_L R_L s^2+C_L L_L R_L s^2+L_L s+R_L}$
**Q:** $R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 319

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 320

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_L\left(C_L L_L s^2+1\right)}{2C_4 C_L L_L R_L s^3+2C_4 R_L s+C_L L_L s^2+C_L R_L s+1}$
**Q:** $\frac{C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_L L_L}$

### Filter 321

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L\right)$

### Filter 322

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 323

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 324

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L R_L s+1)}{2C_4 C_L R_4 R_L s^2+2C_4 R_4+C_L R_4 s+2C_L R_L s+2}$
**Q**: $\frac{2C_4 C_L R_4 R_L \sqrt{C_4 C_L R_4 R_L}}{2C_4 R_4+C_L R_4+2C_L R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$
**Bandwidth**: $\frac{2C_4 R_4+C_L R_4+2C_L R_L}{2C_4 C_L R_4 R_L}$

### Filter 325

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L L_L s^2+1)}{2C_4 C_L L_L R_4 s^3+2C_4 R_4 s+2C_L L_L s^2+C_L R_4 s+2}$
**Q**: $\frac{2C_4 L_L \sqrt{\frac{1}{C_4 C_L}}}{R_4(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth**: $\frac{R_4(2C_4+C_L)}{2C_L L_L}$

### Filter 326

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L R_4 s}{2C_4 L_L R_4 s^2+C_L L_L R_4 s^2+2L_L s+R_4}$
**Q**: $\frac{R_4\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth**: $\frac{2}{R_4(2C_4+C_L)}$

### Filter 327

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 328

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L+\frac{1}{L_L s}}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{2C_4 L_L R_4 R_L s^2+C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$
**Q**: $\frac{R_4 R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth**: $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$

### Filter 329

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 330

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L(C_L L_L s^2+1)}{2C_4 C_L L_L R_4 R_L s^3+2C_4 R_4 R_L s+C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$
**Q**: $\frac{C_L L_L\sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{R_4 R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth**: $\frac{R_4 R_L(2C_4+C_L)}{C_L L_L(R_4+2R_L)}$

### Filter 331

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 332

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 333

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{R_4(C_4 R_4 s+1)}{C_4 C_L R_4 R_L s^2+C_4 R_4 s+2C_4 R_L s+C_L R_L s+1}$
**Q**: $\frac{C_4 C_L R_4 R_L\sqrt{\frac{1}{C_4 C_L R_4 R_L}}}{C_4 R_4+2C_4 R_L+C_L R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$
**Bandwidth**: $\frac{C_4 R_4+2C_4 R_L+C_L R_L}{C_4 C_L R_4 R_L}$

### Filter 334

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 335

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 336

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L s(C_4 R_4 s+1)}{C_4 C_L L_L R_4 s^3+2C_4 L_L s^2+C_4 R_4 s+C_L L_L s^2+1}$
**Q**: $\frac{L_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{C_4 R_4}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth**: $\frac{C_4 R_4}{L_L(2C_4+C_L)}$

### Filter 337

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 338

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s(C_4 R_4 s+1)}{C_4 C_L L_L R_4 R_L s^3+C_4 L_L R_4 s^2+2C_4 L_L R_L s^2+C_4 R_4 R_L s+C_L L_L R_L s^2+L_L s+R_L}$
**Q:** $\frac{L_L\sqrt{\frac{R_L}{L_L(C_4 R_4+2C_4 R_L+C_L R_L)}}(C_4 R_4+2C_4 R_L+C_L R_L)}{C_4 R_4 R_L+L_L}$
$\omega_0$: $\sqrt{\frac{R_L}{L_L(C_4 R_4+2C_4 R_L+C_L R_L)}}$
**Bandwidth:** $\frac{C_4 R_4 R_L+L_L}{L_L(C_4 R_4+2C_4 R_L+C_L R_L)}$

### Filter 339

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 340

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 341

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L(C_4 L_4 s^2+1)}{C_4 L_4 s^2+2C_4 R_L s+1}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{2R_L}{L_4}$

### Filter 342

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 343

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{R_L(C_4 L_4 s^2+1)}{C_4 C_L L_4 R_L s^3+C_4 L_4 s^2+2C_4 R_L s+C_L R_L s+1}$
**Q:** $\frac{C_4 L_4\sqrt{\frac{1}{C_4 L_4}}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_4 L_4}$

### Filter 344

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 345

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 346

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 347

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 348

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 349

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 350

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 351

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+L_4 s+2R_L}$
**Q:** $2C_4 R_L\sqrt{\frac{1}{C_4 L_4}}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{1}{2C_4 R_L}$

### Filter 352

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 353

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+C_4 L_4 R_L s^2+L_4 s+2R_L}$
**Q:** $\sqrt{2}R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 354

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_L s^3+2C_4 L_4 s^2+C_L L_4 s^2+2C_L R_L s+2}$
**Q:** $\frac{\sqrt{2}L_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2C_L R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2C_L R_L}{L_4(2C_4+C_L)}$

### Filter 355

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 356

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 357

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 358

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_4 L_L R_L s}{2C_4 L_4 L_L R_L s^2+C_L L_4 L_L R_L s^2+L_4 L_L s+L_4 R_L+2L_L R_L}$
**Q:** $R_L\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 359

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 360

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 361

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L(C_4 L_4 s^2+C_4 R_4 s+1)}{C_4 L_4 s^2+C_4 R_4 s+2C_4 R_L s+1}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4+2R_L}{L_4}$
**Qz:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4}$

### Filter 362

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 363

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 364

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 365

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 366

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 367

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 368

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 369

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 370

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 371

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ R_L\right)$

$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2+L_4 R_4 s+2L_4 R_L s+2R_4 R_L}$

**Q:** $\frac{2C_4 R_4 R_L \sqrt{\frac{1}{C_4 L_4}}}{R_4+2R_L}$

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

**Bandwidth:** $\frac{R_4+2R_L}{2C_4 R_4 R_L}$

### Filter 372

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ \frac{1}{C_L s}\right)$

$H(s)$: $\frac{L_4 R_4 s}{2C_4 L_4 R_4 s^2+C_L L_4 R_4 s^2+2L_4 s+2R_4}$

**Q:** $\frac{\sqrt{2}R_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$

**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 373

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2+C_L L_4 R_4 R_L s^2+L_4 R_4 s+2L_4 R_L s+2R_4 R_L}$

**Q:** $\frac{\sqrt{2}R_4 R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$

**Bandwidth:** $\frac{R_4+2R_L}{R_4R_L(2C_4+C_L)}$

### Filter 374

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

$H(s)$: $\frac{L_4 R_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_4 R_L s^3+2C_4 L_4 R_4 s^2+C_L L_4 R_4 s^2+2C_L L_4 R_L s^2+2C_L R_4 R_L s+2L_4 s+2R_4}$

**Q:** $\frac{R_4\sqrt{\frac{1}{L_4(2C_4+C_L R_4+2C_L R_L)}}(2C_4 R_4+C_L R_4+2C_L R_L)}{2(C_L R_4 R_L+L_4)}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4 R_4+C_L R_4+2C_L R_L)}}$

**Bandwidth:** $\frac{2(C_L R_4 R_L+L_4)}{L_4(2C_4 R_4+C_L R_4+2C_L R_L)}$

### Filter 375

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 376

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

$H(s)$: $\frac{L_4 L_L R_4 s}{2C_4 L_4 L_L R_4 s^2+C_L L_4 L_L R_4 s^2+L_4 L_L s+2L_4 L_L s+L_4 R_4+2L_L R_4}$

**Q:** $\frac{R_4\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$

$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 377

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 378

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

$H(s)$: $\frac{L_4 L_L R_4 R_L s}{2C_4 L_4 L_L R_4 R_L s^2+C_L L_4 L_L R_4 R_L s^2+L_4 L_L R_4 s+2L_4 L_L R_L s+L_4 R_4 R_L+2L_L R_4 R_L}$

**Q:** $\frac{R_4 R_L\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$

$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{R_4+2R_L}{R_4R_L(2C_4+C_L)}$

### Filter 379

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 380

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4+\frac{1}{L_4 s}}},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 381

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L(C_4 L_4 R_4 s^2+L_4 s+R_4)}{C_4 L_4 R_4 s^2+2C_4 L_4 R_L s^2+L_4 s+R_4+2R_L}$

**Q:** $C_4\sqrt{\frac{1}{C_4 L_4}}\,(R_4+2R_L)$

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

**Bandwidth:** $\frac{1}{C_4(R_4+2R_L)}$

**Qz:** $C_4 R_4\sqrt{\frac{1}{C_4 L_4}}$

### Filter 382

Invalid filter

$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 383

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 384

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 385

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 386

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 387

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 388

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L+\frac{1}{L_L s}}}\right)$

### Filter 389

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 390

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 391

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 L_4 R_4 s^2+2C_4 L_4 R_L s^2+2C_4 R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}\left(R_4+2R_L\right)}{2R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{2R_4 R_L}{L_4\left(R_4+2R_L\right)}$

### Filter 392

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_L R_4 s^3+2C_4 L_4 s^2+2C_4 R_4 s+C_L R_4 s+2}$
**Q:** $\frac{2C_4 L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_4 L_4}$

### Filter 393

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_L R_4 R_L s^3+C_4 L_4 R_4 s^2+2C_4 L_4 R_L s^2+2C_4 R_4 R_L s+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{C_4 L_4\sqrt{\frac{1}{C_4 L_4}}\left(R_4+2R_L\right)}{R_4 R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4 R_L(2C_4+C_L)}{C_4 L_4\left(R_4+2R_L\right)}$

### Filter 394

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 395

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 396

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 397

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 398

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L+\frac{1}{L_L s}}}\right)$

### Filter 399

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 400

Invalid filter
$Z(s)$: $\left(\infty,\ R_2+\frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 401

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ R_L\right)$

### Filter 402

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 403

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 404

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 405

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ L_L s+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_L L_L s^2+1\right)}{2C_L L_L s^2+C_L R_4 s+2}$
**Q:** $\frac{2L_L\sqrt{\frac{1}{C_L L_L}}}{R_4}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4}{2L_L}$

### Filter 406

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L R_4 s}{C_L L_L R_4 s^2+2L_L s+R_4}$
**Q:** $\frac{C_L R_4\sqrt{\frac{1}{C_L L_L}}}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L R_4}$

### Filter 407

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_L L_L s^2+C_L R_L s+1\right)}{2C_L L_L s^2+C_L R_4 s+2C_L R_L s+2}$
**Q:** $\frac{2L_L\sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{2L_L}$
**Qz:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}}{R_L}$

### Filter 408

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{C_L L_L R_4 R_L s^2+L_L R_4 s^2+2L_L R_L s^2+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{C_L R_4 R_L\sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{C_L R_4 R_L}$

### Filter 409

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$
$H(s)$: $\frac{R_4\left(C_L L_L R_L s^2+L_L s+R_L\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+2L_L s+R_4+2R_L}$
**Q:** $\frac{C_L\sqrt{\frac{1}{C_L L_L}}\left(R_4+2R_L\right)}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L\left(R_4+2R_L\right)}$
**Qz:** $C_L R_L\sqrt{\frac{1}{C_L L_L}}$

### Filter 410

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_L L_L s^2+1\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}\left(R_4+2R_L\right)}{R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4 R_L}{L_L\left(R_4+2R_L\right)}$

### Filter 411

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 412

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 413

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 414

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 415

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 416

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 417

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 418

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s}{2C_4 L_L R_L s^2 + C_L L_L R_L s^2 + L_L s + R_L}$
**Q:** $R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4 + C_L)$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 419

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 420

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{R_L}{C_L s}}\right)$
$H(s)$: $\frac{R_L(C_L L_L s^2+1)}{2C_4 C_L L_L R_L s^3 + 2C_4 R_L s + C_L L_L s^2 + C_L R_L s + 1}$
**Q:** $\frac{C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_L L_L}$

### Filter 421

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_L}{C_4 R_L s+1},\ \infty,\ R_L\right)$

### Filter 422

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_L}{C_4 R_L s+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 423

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_L}{C_4 R_L s+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 424

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_L}{C_4 R_L s+1},\ \infty,\ R_L + \frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_L(C_L R_L s+1)}{2C_4 C_L R_L R_L s^2 + 2C_4 R_L s + C_L R_L s + 2C_L R_L s + 2}$
**Q:** $\frac{2C_4 C_L R_L R_L\sqrt{\frac{1}{C_L C_4 R_L R_L}}}{2C_4 R_L + C_L R_L + 2C_L R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L C_4 R_L R_L}}$
**Bandwidth:** $\frac{2C_4 R_L + C_L R_L + 2C_L R_L}{2C_4 C_L R_L R_L}$

### Filter 425

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_L}{C_4 R_L s+1},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_L(C_L L_L s^2+1)}{2C_4 C_L L_L R_L s^3 + 2C_4 R_L s + 2C_L L_L s^2 + C_L R_L s + 2}$
**Q:** $\frac{2C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{2C_L L_L}$

### Filter 426

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_L}{C_4 R_L s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L R_L s}{2C_4 L_L R_L s^2 + C_L L_L R_L s^2 + 2L_L s + R_L}$
**Q:** $\frac{R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_L(2C_4+C_L)}$

### Filter 427

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_L}{C_4 R_L s+1},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 428

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_L}{C_4 R_L s+1},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L R_L s}{2C_4 L_L R_L R_L s^2 + C_L L_L R_L R_L s^2 + L_L R_L s + 2L_L R_L s + R_L R_L}$
**Q:** $\frac{R_L R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)}{R_L+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_L+2R_L}{R_L R_L(2C_4+C_L)}$

### Filter 429

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_L}{C_4 R_L s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 430

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

$H(s)$: $\frac{R_4 R_L (C_L L_L s^2+1)}{2C_4 C_L L_L R_4 R_L s^3+2C_4 R_4 R_L s+C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$

**Q:** $\frac{C_L L_L \sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{R_4 R_L (2C_4+C_L)}$

$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$

**Bandwidth:** $\frac{R_4 R_L (2C_4+C_L)}{C_L L_L (R_4+2R_L)}$

### Filter 431

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 432

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 433

**Filter Type:** Invalid011

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

$H(s)$: $\frac{R_L (C_4 R_4 s+1)}{C_4 C_L R_4 R_L s^2+C_4 R_4 s+2C_4 R_L s+2C_4 R_L s+C_L R_L s+1}$

**Q:** $\frac{C_4 C_L R_4 R_L \sqrt{\frac{1}{C_4 C_L R_4 R_L}}}{C_4 R_4+2C_4 R_L+C_L R_L}$

$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$

**Bandwidth:** $\frac{C_4 R_4+2C_4 R_L+C_L R_L}{C_4 C_L R_4 R_L}$

### Filter 434

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 435

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 436

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

$H(s)$: $\frac{L_L s (C_4 R_4 s+1)}{C_4 C_L L_L R_4 s^3+2C_4 L_L s^2+C_4 R_4 s+C_L L_L s^2+1}$

**Q:** $\frac{L_L \sqrt{\frac{1}{L_L (2C_4+C_L)}}(2C_4+C_L)}{C_4 R_4}$

$\omega_0$: $\sqrt{\frac{1}{L_L (2C_4+C_L)}}$

**Bandwidth:** $\frac{C_4 R_4}{L_L (2C_4+C_L)}$

### Filter 437

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 438

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

$H(s)$: $\frac{L_L R_L s (C_4 R_4 s+1)}{C_4 C_L L_L R_4 R_L s^3+C_4 L_L R_4 s^2+2C_4 L_L R_L s^2+C_4 R_4 R_L s+C_L L_L R_L s^2+L_L s+R_L}$

**Q:** $\frac{L_L \sqrt{\frac{R_L}{L_L (C_4 R_4+2C_4 R_L+C_L R_L)}}(C_4 R_4+2C_4 R_L+C_L R_L)}{C_4 R_4 R_L+L_L}$

$\omega_0$: $\sqrt{\frac{R_L}{L_L (C_4 R_4+2C_4 R_L+C_L R_L)}}$

**Bandwidth:** $\frac{C_4 R_4 R_L+L_L}{L_L (C_4 R_4+2C_4 R_L+C_L R_L)}$

### Filter 439

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 440

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 441

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L (C_4 L_4 s^2+1)}{C_4 L_4 s^2+2C_4 R_L s+1}$

**Q:** $\frac{L_4 \sqrt{\frac{1}{C_4 L_4}}}{2R_L}$

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

**Bandwidth:** $\frac{2R_L}{L_4}$

### Filter 442

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 443

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

$H(s)$: $\frac{R_L (C_4 L_4 s^2+1)}{C_4 C_L L_4 R_L s^3+C_4 L_4 s^2+2C_4 R_L s+C_L R_L s+1}$

**Q:** $\frac{C_4 L_4 \sqrt{\frac{1}{C_4 L_4}}}{R_L (2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_L (2C_4+C_L)}{C_4 L_4}$

### Filter 444

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 445

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 446

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 447

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 448

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 449

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 450

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 451

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+L_4 s+2R_L}$
**Q:** $2C_4 R_L\sqrt{\frac{1}{C_4 L_4}}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{1}{2C_4 R_L}$

### Filter 452

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 453

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+C_L L_4 R_L s^2+L_4 s+2R_L}$
**Q:** $\sqrt{2}R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_L(2C_4+C_L)}$

### Filter 454

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_L s^3+2C_4 L_4 s^2+C_L L_4 s^2+2C_L R_L s+2}$
**Q:** $\frac{\sqrt{2}L_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2C_L R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2C_L R_L}{L_4(2C_4+C_L)}$

### Filter 455

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 456

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 457

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 458

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_4 L_L R_L s}{2C_4 L_4 L_L R_L s^2+C_L L_4 L_L R_L s^2+L_4 L_L s+L_4 R_L+2L_L R_L}$
**Q:** $R_L\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 459

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 460

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 461

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L\left(C_4 L_4 s^2+C_4 R_4 s+1\right)}{C_4 L_4 s^2+C_4 R_4 s+2 C_4 R_L s+1}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4+2R_L}{L_4}$
**Qz:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4}$

### Filter 462

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 463

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 464

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 465

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 466

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 467

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 468

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 469

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 470

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 471

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2+L_4 R_4 s+2L_4 R_L s+2R_4 R_L}$
**Q:** $\frac{2C_4 R_4 R_L\sqrt{\frac{1}{C_4 L_4}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4+2R_L}{2C_4 R_4 R_L}$

### Filter 472

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 R_4 s}{2C_4 L_4 R_4 s^2+C_L L_4 R_4 s^2+2L_4 s+2R_4}$
**Q:** $\frac{\sqrt{2}R_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{2}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 473

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2+C_L L_4 R_4 R_L s^2+L_4 R_4 s+2L_4 R_L s+2R_4 R_L}$
**Q:** $\frac{\sqrt{2}R_4 R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$

### Filter 474

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 R_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_4 R_L s^3+2C_4 L_4 R_4 s^2+C_L L_4 R_4 s^2+2C_L L_4 R_L s^2+2C_L R_4 R_L s+2L_4 s+2R_4}$
**Q:** $\frac{\sqrt{2}L_4\sqrt{\frac{R_4}{L_4(2C_4 R_4+C_L R_4+2C_L R_L)}}(2C_4 R_4+C_L R_4+2C_L R_L)}{2(C_L R_4 R_L+L_4)}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{R_4}{L_4(2C_4 R_4+C_L R_4+2C_L R_L)}}$
**Bandwidth:** $\frac{2(C_L R_4 R_L+L_4)}{L_4(2C_4 R_4+C_L R_4+2C_L R_L)}$

### Filter 475

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s+\frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 476

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$H(s)$: $\frac{L_4 L_L R_4 s}{2C_4 L_4 L_L R_4 s^2 + C_L L_4 L_L R_4 s^2 + 2L_4 L_L s + L_4 R_4 + 2L_L R_4}$

**Q:** $\frac{R_4 \sqrt{\frac{L_4 + 2L_L}{L_4 L_L (2C_4 + C_L)}} (2C_4 + C_L)}{2}$

$\omega_0$: $\sqrt{\frac{L_4 + 2L_L}{L_4 L_L (2C_4 + C_L)}}$

**Bandwidth:** $\frac{2}{R_4 (2C_4 + C_L)}$

### Filter 477

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 478

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

$H(s)$: $\frac{L_4 L_L R_4 R_L s}{2C_4 L_4 L_L R_4 R_L s^2 + C_L L_4 L_L R_4 R_L s^2 + L_4 L_L R_4 s + 2L_4 L_L R_L s + L_4 R_4 R_L + 2L_L R_4 R_L}$

**Q:** $\frac{R_4 R_L \sqrt{\frac{L_4 + 2L_L}{L_4 L_L (2C_4 + C_L)}} (2C_4 + C_L)}{R_4 + 2R_L}$

$\omega_0$: $\sqrt{\frac{L_4 + 2L_L}{L_4 L_L (2C_4 + C_L)}}$

**Bandwidth:** $\frac{R_4 + 2R_L}{R_4 R_L (2C_4 + C_L)}$

### Filter 479

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

### Filter 480

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 481

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L (C_4 L_4 R_4 s^2 + L_4 s + R_4)}{C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + L_4 s + R_4 + 2R_L}$

**Q:** $C_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 + 2R_L)$

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

**Bandwidth:** $\frac{1}{C_4 (R_4 + 2R_L)}$

**Qz:** $C_4 R_4 \sqrt{\frac{1}{C_4 L_4}}$

### Filter 482

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 483

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ \frac{R_L}{C_L R_L s + 1}\right)$

### Filter 484

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 485

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 486

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1}\right)$

### Filter 487

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 488

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

### Filter 489

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

### Filter 490

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ \frac{R_L \left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 491

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4 \left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_4 R_L (C_4 L_4 s^2 + 1)}{C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + 2C_4 R_4 R_L s + R_4 + 2R_L}$

**Q:** $\frac{L_4 \sqrt{\frac{1}{C_4 L_4}} (R_4 + 2R_L)}{2R_4 R_L}$

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

**Bandwidth:** $\frac{2R_4 R_L}{L_4 (R_4 + 2R_L)}$

### Filter 492

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$

$H(s)$: $\frac{R_4\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_2 R_4 s^3+2 C_4 L_4 s^2+2 C_4 R_4 s+C_L R_4 s+2}$

**Q:** $\frac{2 C_4 L_4 \sqrt{\frac{1}{C_4 L_4}}}{R_4(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_4 L_4}$

### Filter 493

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_2 R_4 R_L s^3+C_4 L_4 R_4 s^2+2 C_4 L_4 R_L s^2+2 C_4 R_4 R_L s+C_L R_4 R_L s+R_4+2 R_L}$

**Q:** $\frac{C_4 L_4 \sqrt{\frac{1}{C_4 L_4}}(R_4+2R_L)}{R_4 R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4 R_L(2C_4+C_L)}{C_4 L_4(R_4+2R_L)}$

### Filter 494

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 495

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 496

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 497

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 498

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

### Filter 499

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 500

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 501

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ R_L\right)$

### Filter 502

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 503

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 504

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 505

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

$H(s)$: $\frac{R_4\left(C_L L_L s^2+1\right)}{2 C_L L_L s^2+C_L R_4 s+2}$

**Q:** $\frac{2 L_L \sqrt{\frac{1}{C_L L_L}}}{R_4}$

$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$

**Bandwidth:** $\frac{R_4}{2L_L}$

### Filter 506

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

$H(s)$: $\frac{L_L R_4 s}{C_L L_L R_4 s^2+2 L_L s+R_4}$

**Q:** $\frac{C_L R_4 \sqrt{\frac{1}{C_L L_L}}}{2}$

$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$

**Bandwidth:** $\frac{2}{C_L R_4}$

### Filter 507

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

$H(s)$: $\frac{R_4\left(C_L L_L s^2+C_L R_L s+1\right)}{2 C_L L_L s^2+C_L R_4 s+2 C_L R_L s+2}$

**Q:** $\frac{2 L_L \sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$

$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$

**Bandwidth:** $\frac{R_4+2R_L}{2L_L}$

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

### Filter 508

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{C_L L_L R_4 R_L s^2 + L_L R_4 s + 2L_L R_L s + R_4 R_L}$
**Q:** $\frac{C_L R_4 R_L \sqrt{\frac{1}{C_L L_L}}}{R_4 + 2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4 + 2R_L}{C_L R_4 R_L}$

### Filter 509

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$
$H(s)$: $\frac{R_4\left(C_L L_L R_L s^2 + L_L s + R_L\right)}{C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + 2L_L s + R_4 + 2R_L}$
**Q:** $\frac{C_L\sqrt{\frac{1}{C_L L_L}}(R_4 + 2R_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L(R_4 + 2R_L)}$
**Qz:** $C_L R_L \sqrt{\frac{1}{C_L L_L}}$

### Filter 510

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4,\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_L L_L s^2 + 1\right)}{C_L L_L R_4 s^2 + 2C_L L_L R_L s^2 + C_L R_4 R_L s + R_4 + 2R_L}$
**Q:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}(R_4 + 2R_L)}{R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4 R_L}{L_L(R_4 + 2R_L)}$

### Filter 511

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 512

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 513

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s + 1}\right)$

### Filter 514

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 515

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 516

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1}\right)$

### Filter 517

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 518

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s}{2C_4 L_L R_L s^2 + C_L L_L R_L s^2 + L_L s + R_L}$
**Q:** $R_L\sqrt{\frac{1}{L_L(2C_4 + C_L)}}\,(2C_4 + C_L)$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4 + C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4 + C_L)}$

### Filter 519

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

### Filter 520

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_L\left(C_L L_L s^2 + 1\right)}{2C_4 C_L L_L R_L s^3 + 2C_4 R_L s + C_L L_L s^2 + C_L R_L s + 1}$
**Q:** $\frac{C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_L(2C_4 + C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L(2C_4 + C_L)}{C_L L_L}$

### Filter 521

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s + 1},\ \infty,\ R_L\right)$

### Filter 522

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s + 1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 523

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 524

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L + \frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L R_L s+1)}{2C_4 C_L R_4 R_L s^2+2C_4 R_4 s+C_L R_4 s+2C_L R_L s+2}$
**Q:** $\frac{2C_4 C_L R_4 R_L \sqrt{C_4 C_L R_4 R_L}}{2C_4 R_4+C_L R_4+2C_L R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$
**Bandwidth:** $\frac{2C_4 R_4+C_L R_4+2C_L R_L}{2C_4 C_L R_4 R_L}$

### Filter 525

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L L_L s^2+1)}{2C_4 C_L L_L R_4 s^3+2C_4 R_4 s+2C_L L_L s^2+C_L R_4 s+2}$
**Q:** $\frac{2C_4 L_L \sqrt{\frac{1}{C_4 C_L}}}{R_4(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_L L_L}$

### Filter 526

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L R_4 s}{2C_4 L_L R_4 s^2+C_L L_L R_4 s^2+2L_L s+R_4}$
**Q:** $\frac{R_4\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 527

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 528

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{2C_4 L_L R_4 R_L s^2+C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{R_4 R_L \sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$

### Filter 529

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 530

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L(C_L L_L s^2+1)}{2C_4 C_L L_L R_4 R_L s^3+2C_4 R_4 R_L s+C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{C_L L_L \sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{R_4 R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4 R_L(2C_4+C_L)}{C_L L_L(R_4+2R_L)}$

### Filter 531

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 532

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 533

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{R_4(C_4 R_4 s+1)}{C_4 C_L R_4 R_L s^2+C_4 R_4 s+2C_4 R_L s+C_L R_L s+1}$
**Q:** $\frac{C_4 C_L R_4 R_L \sqrt{\frac{1}{C_4 C_L R_4 R_L}}}{C_4 R_4+2C_4 R_L+C_L R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$
**Bandwidth:** $\frac{C_4 R_4+2C_4 R_L+C_L R_L}{C_4 C_L R_4 R_L}$

### Filter 534

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 535

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 536

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L s(C_4 R_4 s+1)}{C_4 C_L L_L R_4 s^3+2C_4 L_L s^2+C_4 R_4 s+C_L L_L s^2+1}$
**Q:** $\frac{L_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{C_4 R_4}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{C_4 R_4}{L_L(2C_4+C_L)}$

### Filter 537

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 538

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s(C_4 R_4 s+1)}{C_4 C_L L_L R_4 R_L s^3 + C_4 L_L R_4 s^2 + 2C_4 L_L R_L s^2 + C_4 R_4 R_L s + C_L L_L R_L s^2 + L_L s + R_L}$
**Q:** $\frac{L_L \sqrt{\frac{R_L}{L_L(C_4 R_4 + 2C_4 R_L + C_L R_L)}}(C_4 R_4 + 2C_4 R_L + C_L R_L)}{C_4 R_4 R_L + L_L}$
$\omega_0$: $\sqrt{\frac{R_L}{L_L(C_4 R_4 + 2C_4 R_L + C_L R_L)}}$
**Bandwidth:** $\frac{C_4 R_4 R_L + L_L}{L_L(C_4 R_4 + 2C_4 R_L + C_L R_L)}$

### Filter 539

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

### Filter 540

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_{L^2}}\right)}{L_L s + R_L + \frac{1}{C_{L^2}}}\right)$

### Filter 541

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L(C_4 L_4 s^2+1)}{C_4 L_4 s^2 + 2C_4 R_L s + 1}$
**Q:** $\frac{L_4 \sqrt{\frac{1}{C_4 L_4}}}{2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{2R_L}{L_4}$

### Filter 542

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 543

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s + 1}\right)$
$H(s)$: $\frac{R_L(C_4 L_4 s^2+1)}{C_4 C_L L_4 R_L s^3 + C_4 L_4 s^2 + 2C_4 R_L s + C_L R_L s + 1}$
**Q:** $\frac{C_4 L_4 \sqrt{\frac{1}{C_4 L_4}}}{R_L(2C_4 + C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_L(2C_4 + C_L)}{C_4 L_4}$

### Filter 544

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 545

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 546

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1}\right)$

### Filter 547

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 548

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

### Filter 549

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

### Filter 550

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_{L^2}}\right)}{L_L s + R_L + \frac{1}{C_{L^2}}}\right)$

### Filter 551

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2 + L_4 s + 2R_L}$
**Q:** $2C_4 R_L \sqrt{\frac{1}{C_4 L_4}}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{1}{2C_4 R_L}$

### Filter 552

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 553

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2 + C_4 L_4 R_L s^2 + L_4 s + 2R_L}$
**Q:** $\sqrt{2} R_L \sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4 + C_L)$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 554

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L + \frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_L s^3 + 2C_4 L_4 s^2 + C_L L_4 s^2 + 2C_L R_L s + 2}$
**Q:** $\frac{\sqrt{2} L_4 \sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4+C_L)}{2C_L R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2C_L R_L}{L_4(2C_4+C_L)}$

### Filter 555

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 556

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 557

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 558

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_4 L_L R_L s}{2C_4 L_4 L_L R_L s^2 + C_L L_4 L_L R_L s^2 + L_4 L_L s + L_4 R_L + 2L_L R_L}$
**Q:** $R_L \sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}\,(2C_4 + C_L)$
$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 559

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 560

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 561

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L\left(C_4 L_4 s^2 + C_4 R_4 s + 1\right)}{C_4 L_4 s^2 + C_4 R_4 s + 2C_4 R_L s + 1}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4 + 2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4 + 2R_L}{L_4}$
**Qz:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4}$

### Filter 562

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 563

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 564

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 565

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 566

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 567

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 568

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

### Filter 569

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 570

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ L_4 s + R_4 + \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 571

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ R_L\right)$

$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2R_4 R_L}$

**Q:** $\frac{2C_4 R_4 R_L \sqrt{\frac{1}{C_4 L_4}}}{R_4 + 2R_L}$

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

**Bandwidth:** $\frac{R_4 + 2R_L}{2C_4 R_4 R_L}$

### Filter 572

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$

$H(s)$: $\frac{L_4 R_4 s}{2C_4 L_4 R_4 s^2 + C_L L_4 R_4 s^2 + 2L_4 s + 2R_4}$

**Q:** $\frac{\sqrt{2}R_4 \sqrt{\frac{1}{L_4(2C_4 + C_L)}}(2C_4 + C_L)}{2}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4 + C_L)}}$

**Bandwidth:** $\frac{2}{R_4(2C_4 + C_L)}$

### Filter 573

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s + 1}\right)$

$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2 + C_L L_4 R_4 R_L s^2 + L_4 R_4 s + 2L_4 R_L s + 2R_4 R_L}$

**Q:** $\frac{\sqrt{2}R_4 R_L \sqrt{\frac{1}{L_4(2C_4 + C_L)}}(2C_4 + C_L)}{R_4 + 2R_L}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4 + C_L)}}$

**Bandwidth:** $\frac{R_4 + 2R_L}{R_4 R_L(2C_4 + C_L)}$

### Filter 574

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ R_L + \frac{1}{C_L s}\right)$

$H(s)$: $\frac{L_4 R_4 s(C_L R_L s + 1)}{2C_4 C_L L_4 R_4 R_L s^3 + 2C_4 L_4 R_4 s^2 + C_L L_4 R_4 s^2 + 2C_L L_4 R_L s^2 + 2C_L R_4 R_L s + 2L_4 s + 2R_4}$

**Q:** $\frac{R_4 \sqrt{\frac{L_4 + 2L_L}{L_4 L_L(2C_4 + C_L)}}(2C_4 + C_L)}{2(C_L R_4 R_L + L_4)}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{R_4}{L_4(2C_4 R_4 + C_L R_4 + 2C_L R_L)}}$

**Bandwidth:** $\frac{2(C_L R_4 R_L + L_4)}{L_4(2C_4 R_4 + C_L R_4 + 2C_L R_L)}$

### Filter 575

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 576

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1}\right)$

$H(s)$: $\frac{L_4 L_L R_4 s}{2C_4 L_4 L_L R_4 R_L s^2 + C_L L_4 L_L R_4 s^2 + 2L_4 L_L s + L_4 R_4 s + 2L_L R_4}$

**Q:** $\frac{R_4 \sqrt{\frac{L_4 + 2L_L}{L_4 L_L(2C_4 + C_L)}}(2C_4 + C_L)}{2}$

$\omega_0$: $\sqrt{\frac{1}{L_4 L_L(2C_4 + C_L)}}$

**Bandwidth:** $\frac{R_4}{L_4 L_L(2C_4 + C_L)}$

### Filter 577

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 578

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

$H(s)$: $\frac{L_4 L_L R_4 R_L s}{2C_4 L_4 L_L R_4 R_L R_L s^2 + C_L L_4 L_L R_4 R_L s^2 + L_4 L_L R_4 s + 2L_4 L_L R_L s + L_4 R_4 R_L s + 2L_L R_4 R_L}$

**Q:** $\frac{R_4 R_L \sqrt{\frac{L_4 + 2L_L}{L_4 L_L(2C_4 + C_L)}}(2C_4 + C_L)}{R_4 + 2R_L}$

$\omega_0$: $\sqrt{\frac{L_4 + 2L_L}{L_4 L_L(2C_4 + C_L)}}$

**Bandwidth:** $\frac{R_4 + 2R_L}{R_4 R_L(2C_4 + C_L)}$

### Filter 579

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2 + 1} + R_L\right)$

### Filter 580

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{1}{C_4 s + \frac{1}{R_4} + \frac{1}{L_4 s}},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 581

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L(C_4 L_4 R_4 s^2 + L_4 s + R_4)}{C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + L_4 s + R_4 + 2R_L}$

**Q:** $C_4 \sqrt{\frac{1}{C_4 L_4}}\,(R_4 + 2R_L)$

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

**Bandwidth:** $\frac{1}{C_4(R_4 + 2R_L)}$

**Qz:** $C_4 R_4 \sqrt{\frac{1}{C_4 L_4}}$

### Filter 582

Invalid filter

$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2 + 1} + R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 583

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1} + R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 584

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1} + R_4,\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 585

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1} + R_4,\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 586

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1} + R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 587

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1} + R_4,\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 588

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1} + R_4,\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

### Filter 589

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1} + R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 590

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1} + R_4,\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 591

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + 2C_4 R_4 R_L s + R_4 + 2R_L}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}\left(R_4+2R_L\right)}{2R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{2R_4 R_L}{L_4(R_4+2R_L)}$

### Filter 592

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_L R_4 s^3 + 2C_4 L_4 R_4 s^2 + 2C_4 R_4 s + C_L R_4 s + 2}$
**Q:** $\frac{2C_4 L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_4 L_4}$

### Filter 593

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_L R_4 R_L s^3 + C_4 L_4 R_4 s^2 + 2C_4 L_4 R_L s^2 + 2C_4 R_4 R_L s + C_L R_4 R_L s + R_4 + 2R_L}$
**Q:** $\frac{C_4 L_4\sqrt{\frac{1}{C_4 L_4}}\left(R_4+2R_L\right)}{R_4 R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4 R_L(2C_4+C_L)}{C_4 L_4(R_4+2R_L)}$

### Filter 594

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ R_L + \frac{1}{C_L s}\right)$

### Filter 595

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ L_L s + \frac{1}{C_L s}\right)$

### Filter 596

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 597

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ L_L s + R_L + \frac{1}{C_L s}\right)$

### Filter 598

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s + \frac{1}{R_L} + \frac{1}{L_L s}}\right)$

### Filter 599

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1} + R_L\right)$

### Filter 600

Invalid filter
$Z(s)$: $\left(\infty,\ L_2 s + R_2 + \frac{1}{C_2 s},\ \infty,\ \frac{R_4\left(L_4 s + \frac{1}{C_4 s}\right)}{L_4 s + R_4 + \frac{1}{C_4 s}},\ \infty,\ \frac{R_L\left(L_L s + \frac{1}{C_L s}\right)}{L_L s + R_L + \frac{1}{C_L s}}\right)$

### Filter 601

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ R_L\right)$

### Filter 602

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 603

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 604

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 605

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ L_L s+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_L L_L s^2+1\right)}{2C_L L_L s^2+C_L R_4 s+2}$
**Q:** $\frac{2L_L\sqrt{\frac{1}{C_L L_L}}}{R_4}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4}{2L_L}$

### Filter 606

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L R_4 s}{C_L L_L R_4 s^2+2L_L s+R_4}$
**Q:** $\frac{C_L R_4\sqrt{\frac{1}{C_L L_L}}}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L R_4}$

### Filter 607

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_L L_L s^2+C_L R_L s+1\right)}{2C_L L_L s^2+C_L R_4 s+2C_L R_L s+2}$
**Q:** $\frac{2L_L\sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{2L_L}$
**Qz:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}}{R_L}$

### Filter 608

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L+L_L s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{C_L L_L R_4 R_L s^2+L_L R_4 s^2+2L_L R_L s^2+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{C_L R_4 R_L\sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{C_L R_4 R_L}$

### Filter 609

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$
$H(s)$: $\frac{R_4\left(C_L L_L R_L s^2+L_L s+R_L\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+2L_L s+R_4+2R_L}$
**Q:** $\frac{C_L\sqrt{\frac{1}{C_L L_L}}\left(R_4+2R_L\right)}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L\left(R_4+2R_L\right)}$
**Qz:** $C_L R_L\sqrt{\frac{1}{C_L L_L}}$

### Filter 610

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_L L_L s^2+1\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}\left(R_4+2R_L\right)}{R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4 R_L}{L_L\left(R_4+2R_L\right)}$

### Filter 611

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 612

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 613

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 614

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 615

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 616

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 617

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 618

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s}{2C_4 L_L R_L s^2+C_L L_L R_L s^2+L_L s+R_L}$
**Q:** $R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 619

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 620

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_{L'}}\right)}{L_L s+R_L+\frac{1}{C_{L'}s}}\right)$
$H(s)$: $\frac{R_L(C_L L_L s^2+1)}{2C_4 C_L L_L R_L s^3+2C_4 R_L s^2+C_L L_L s^2+C_L R_L s+1}$
**Q:** $\frac{C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_L L_L}$

### Filter 621

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L\right)$

### Filter 622

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 623

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 624

**Filter Type:** Invalid011
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L R_L s+1)}{2C_4 C_L R_4 R_L s^2+2C_4 R_4 s+C_L R_4 s+2C_L R_L s+2}$
**Q:** $\frac{2C_4 C_L R_4 R_L\sqrt{\frac{1}{C_L C_4 R_4 R_L}}}{2C_4 R_4+C_L R_4+2C_L R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$
**Bandwidth:** $\frac{2C_4 R_4+C_L R_4+2C_L R_L}{2C_4 C_L R_4 R_L}$

### Filter 625

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4(C_L L_L s^2+1)}{2C_4 C_L L_L R_4 s^3+2C_4 R_4 s^2+2C_L L_L s^2+C_L R_4 s+2}$
**Q:** $\frac{2C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_4(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_L L_L}$

### Filter 626

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$
$H(s)$: $\frac{L_L R_4 s}{2C_4 L_L R_4 s^2+C_L L_L R_4 s^2+2L_L s+R_4}$
**Q:** $\frac{R_4\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 627

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 628

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_{L'}s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{2C_4 L_L R_4 R_L s^2+C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{R_4 R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$

### Filter 629

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 630

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

$H(s)$: $\frac{R_4 R_L (C_L L_L s^2+1)}{2C_4 C_L L_L R_4 R_L s^3+2C_4 R_4 R_L s+C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$

**Q:** $\frac{C_L L_L \sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{R_4 R_L (2C_4+C_L)}$

$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$

**Bandwidth:** $\frac{R_4 R_L (2C_4+C_L)}{C_L L_L (R_4+2R_L)}$

### Filter 631

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 632

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 633

**Filter Type:** Invalid011

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

$H(s)$: $\frac{R_L (C_4 R_4 s+1)}{C_4 C_L R_4 R_L s^2+C_4 R_4 s+2C_4 R_L s+C_L R_L s+1}$

**Q:** $\frac{C_4 C_L R_4 R_L \sqrt{\frac{1}{C_4 C_L R_4 R_L}}}{C_4 R_4+2C_4 R_L+C_L R_L}$

$\omega_0$: $\sqrt{\frac{1}{C_4 C_L R_4 R_L}}$

**Bandwidth:** $\frac{C_4 R_4+2C_4 R_L+C_L R_L}{C_4 C_L R_4 R_L}$

### Filter 634

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 635

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ L_L 8+\frac{1}{C_L s}\right)$

### Filter 636

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

$H(s)$: $\frac{L_L s (C_4 R_4 s+1)}{C_4 C_L L_L R_4 s^3+2C_4 L_L s^2+C_4 R_4 s+C_L L_L s+1}$

**Q:** $\frac{L_L \sqrt{\frac{1}{L_L (2C_4+C_L)}}(2C_4+C_L)}{C_4 R_4}$

$\omega_0$: $\sqrt{\frac{1}{L_L (2C_4+C_L)}}$

**Bandwidth:** $\frac{C_4 R_4}{L_L (2C_4+C_L)}$

### Filter 637

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ L_L 8+R_L+\frac{1}{C_L s}\right)$

### Filter 638

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L+\frac{1}{L_L s}}}\right)$

$H(s)$: $\frac{L_L R_L s (C_4 R_4 s+1)}{C_4 C_L L_L R_4 R_L s^3+C_4 L_L R_4 s^2+2C_4 L_L R_L s^2+C_4 R_4 R_L s+C_L L_L R_L s^2+L_L s+R_L}$

**Q:** $\frac{L_L \sqrt{\frac{R_L}{L_L (C_4 R_4+2C_4 R_L+C_L R_L)}}(C_4 R_4+2C_4 R_L+C_L R_L)}{C_4 R_4 R_L+L_L}$

$\omega_0$: $\sqrt{\frac{R_L}{L_L (C_4 R_4+2C_4 R_L+C_L R_L)}}$

**Bandwidth:** $\frac{C_4 R_4 R_L+L_L}{L_L (C_4 R_4+2C_4 R_L+C_L R_L)}$

### Filter 639

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 640

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 641

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L (C_4 L_4 s^2+1)}{C_4 L_4 s^2+2C_4 R_L s+1}$

**Q:** $\frac{L_4 \sqrt{\frac{1}{C_4 L_4}}}{2R_L}$

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

**Bandwidth:** $\frac{2R_L}{L_4}$

### Filter 642

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 643

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

$H(s)$: $\frac{R_L (C_4 L_4 s^2+1)}{C_4 C_L L_4 R_L s^3+C_4 L_4 s^2+2C_4 R_L s+C_L R_L s+1}$

**Q:** $\frac{C_4 L_4 \sqrt{\frac{1}{C_4 L_4}}}{R_L (2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_L (2C_4+C_L)}{C_4 L_4}$

### Filter 644

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 645

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 646

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 647

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 648

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 649

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 650

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 651

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+L_4 s+2R_L}$
**Q:** $2C_4 R_L\sqrt{\frac{1}{C_4 L_4}}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{1}{2C_4 R_L}$

### Filter 652

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 653

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+C_L L_4 R_L s^2+2L_4 s+L_4 s+2R_L}$
**Q:** $\sqrt{2}R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 654

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_L s^3+2C_4 L_4 s^2+C_L L_4 s^2+2C_L R_L s+2}$
**Q:** $\frac{\sqrt{2}L_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2C_L R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2C_L R_L}{L_4(2C_4+C_L)}$

### Filter 655

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 656

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 657

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 658

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_4 L_L R_L s}{2C_4 L_4 L_L R_L s^2+C_L L_4 L_L R_L s^2+L_4 L_L s+L_4 R_L+2L_L R_L}$
**Q:** $R_L\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 659

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 660

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 661

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$
$H(s)$: $\frac{R_L\left(C_4 L_4 s^2+C_4 R_4 s+1\right)}{C_4 L_4 s^2+C_4 R_4 s+2C_4 R_L s+1}$
**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4+2R_L}{L_4}$
**Qz:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4}$

### Filter 662

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 663

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 664

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 665

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 666

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 667

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 668

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 669

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 670

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 671

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ R_L\right)$
$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2+L_4 R_4 s+2L_4 R_L s+2R_4 R_L}$
**Q:** $\frac{2C_4 R_4 R_L\sqrt{\frac{1}{C_4 L_4}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_4 L_4}}$
**Bandwidth:** $\frac{R_4+2R_L}{2C_4 R_4 R_L}$

### Filter 672

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 R_4 s}{2C_4 L_4 R_4 s^2+C_L L_4 R_4 s^2+2L_4 s+2R_4}$
**Q:** $\frac{\sqrt{2}R_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 673

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$
$H(s)$: $\frac{L_4 R_4 R_L s}{2C_4 L_4 R_4 R_L s^2+C_L L_4 R_4 R_L s^2+L_4 R_4 s+2L_4 R_L s+2R_4 R_L}$
**Q:** $\frac{\sqrt{2}R_4 R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$
**Bandwidth:** $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$

### Filter 674

**Filter Type:** Invalid110
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{L_4 R_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_4 R_L s^3+2C_4 L_4 R_4 s^2+C_L L_4 R_4 s^2+2C_L L_4 R_L s^2+2C_L R_4 R_L s+2L_4 s+2R_4}$
**Q:** $\frac{\sqrt{2L_4}\sqrt{\frac{R_4}{L_4(2C_4 R_4+C_L R_4+2C_L R_L)}}(2C_4 R_4+C_L R_4+2C_L R_L)}{2(C_L R_4 R_L+L_4)}$
$\omega_0$: $\sqrt{2}\sqrt{\frac{R_4}{L_4(2C_4 R_4+C_L R_4+2C_L R_L)}}$
**Bandwidth:** $\frac{2(C_L R_4 R_L+L_4)}{L_4(2C_4 R_4+C_L R_4+2C_L R_L)}$

### Filter 675

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 676

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

$H(s)$: $\frac{L_4 L_L R_4 s}{2C_4 L_4 L_L R_4 s^2+C_L L_4 L_L R_4 s^2+2L_4 L_L s+L_4 R_4+2L_L R_4}$

**Q:** $\frac{R_4\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}(2C_4+C_L)}{2}$

$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 677

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 678

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

$H(s)$: $\frac{L_4 L_L R_4 R_L s}{2C_4 L_4 L_L R_4 R_L s^2+C_L L_4 L_L R_4 R_L s^2+L_4 L_L R_4 s+2L_4 L_L R_L s+L_4 R_4 R_L+2L_L R_4 R_L}$

**Q:** $\frac{R_4 R_L\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$

$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{R_4+2R_L}{R_4 R_L(2C_4+C_L)}$

### Filter 679

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 680

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 681

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L\left(C_4 L_4 R_4 s^2+L_4 s+R_4\right)}{C_4 L_4 R_4 s^2+2C_4 L_4 R_L s^2+L_4 s+R_4+2R_L}$

**Q:** $C_4\sqrt{\frac{1}{C_4 L_4}}\left(R_4+2R_L\right)$

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

**Bandwidth:** $\frac{1}{C_4(R_4+2R_L)}$

**Qz:** $C_4 R_4\sqrt{\frac{1}{C_4 L_4}}$

### Filter 682

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 683

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 684

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 685

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 686

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 687

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 688

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 689

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 690

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 691

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 L_4 R_4 s^2+2C_4 L_4 R_L s^2+2C_4 R_4 R_L s+R_4+2R_L}$

**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}(R_4+2R_L)}{2R_4 R_L}$

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

**Bandwidth:** $\frac{2R_4 R_L}{L_4(R_4+2R_L)}$

### Filter 692

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s}\right)$

$H(s)$: $\frac{R_4\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_2 R_4 s^3+2 C_4 L_4 s^2+2 C_4 R_4 s+C_L R_4 s+2}$

**Q:** $\frac{2C_4L_4\sqrt{\frac{1}{C_4L_4}}}{R_4(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_4L_4}$

### Filter 693

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

$H(s)$: $\frac{R_4 R_L\left(C_4 L_4 s^2+1\right)}{C_4 C_L L_2 R_4 R_L s^3+C_4 L_4 R_4 s^2+2 C_4 L_4 R_L s^2+2 C_4 R_4 R_L s+C_L R_4 R_L s+R_4+2 R_L}$

**Q:** $\frac{C_4L_4\sqrt{\frac{1}{C_4L_4}}(R_4+2R_L)}{R_4R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4R_L(2C_4+C_L)}{C_4L_4(R_4+2R_L)}$

### Filter 694

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 695

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 696

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 697

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 698

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 699

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 700

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{L_2 s}{C_2 L_2 s^2+1}+R_2,\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 701

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ R_L\right)$

### Filter 702

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 703

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 704

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 705

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

$H(s)$: $\frac{R_4\left(C_L L_L s^2+1\right)}{2C_L L_L s^2+C_L R_4 s+2}$

**Q:** $\frac{2L_L\sqrt{\frac{1}{C_LL_L}}}{R_4}$

$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$

**Bandwidth:** $\frac{R_4}{2L_L}$

### Filter 706

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

$H(s)$: $\frac{L_L R_4 s}{C_L L_L R_4 s^2+2 L_L s+R_4}$

**Q:** $\frac{C_LR_4\sqrt{\frac{1}{C_LL_L}}}{2}$

$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$

**Bandwidth:** $\frac{2}{C_L R_4}$

### Filter 707

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$
$H(s)$: $\frac{R_4\left(C_L L_L s^2+C_L R_L s+1\right)}{2C_L L_L s^2+2C_L R_4 s+2C_L R_L s+2}$
**Q:** $\frac{2L_L\sqrt{\frac{1}{C_L L_L}}}{R_L+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L+2R_L}{2L_L}$
**Qz:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}}{R_L}$

### Filter 708

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_4 R_L s}{C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$
**Q:** $\frac{C_L R_4 R_L\sqrt{\frac{1}{C_L L_L}}}{R_4+2R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4+2R_L}{C_L R_4 R_L}$

### Filter 709

**Filter Type:** GE
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$
$H(s)$: $\frac{R_4\left(C_L L_L R_L s^2+L_L s+R_L\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+2L_L s+R_4+2R_L}$
**Q:** $\frac{C_L\sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{2}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{2}{C_L(R_4+2R_L)}$
**Qz:** $C_L R_L\sqrt{\frac{1}{C_L L_L}}$

### Filter 710

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4,\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_4 R_L\left(C_L L_L s^2+1\right)}{C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$
**Q:** $\frac{L_L\sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{R_4 R_L}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_4 R_L}{L_L(R_4+2R_L)}$

### Filter 711

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 712

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 713

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 714

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 715

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 716

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 717

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 718

**Filter Type:** BP
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$
$H(s)$: $\frac{L_L R_L s}{2C_4 L_L R_L s^2+C_L L_L R_L s^2+L_L s+R_L}$
**Q:** $R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}\,(2C_4+C_L)$
$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$
**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 719

Invalid filter
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 720

**Filter Type:** BS
$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{1}{C_4 s},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$
$H(s)$: $\frac{R_L\left(C_L L_L s^2+1\right)}{2C_4 C_L L_L R_L s^3+2C_4 R_L s+C_L L_L s^2+C_L R_L s+1}$
**Q:** $\frac{C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_L(2C_4+C_L)}$
$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$
**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_L L_L}$

### Filter 721

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L\right)$

### Filter 722

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 723

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 724

**Filter Type:** Invalid011

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

$H(s)$: $\frac{R_4(C_L R_L s+1)}{2C_4C_L R_4 R_L s^2+2C_4 R_4 s+C_L R_4 s+2C_L R_L s+2}$

**Q:** $\frac{2C_4C_L R_4 R_L\sqrt{\frac{1}{C_4C_L R_4 R_L}}}{2C_L R_4+C_L R_4+2C_L R_L}$

$\omega_0$: $\sqrt{\frac{1}{C_4C_L R_4 R_L}}$

**Bandwidth:** $\frac{2C_4 R_4+C_L R_4+2C_L R_L}{2C_4C_L R_4 R_L}$

### Filter 725

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

$H(s)$: $\frac{R_4(C_L L_L s^2+1)}{2C_4C_L L_L R_4 s^3+2C_4 R_4 s+2C_L L_L R_4 s+2C_L L_L s^2+C_L R_4 s+2}$

**Q:** $\frac{2C_L L_L\sqrt{\frac{1}{C_L L_L}}}{R_4(2C_4+C_L)}$

$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$

**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_L L_L}$

### Filter 726

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

$H(s)$: $\frac{L_L R_4 s}{2C_4L_L R_4 s^2+C_L L_L R_4 s^2+2C_4 R_4 s+C_L L_L s^2+2L_L s+R_4}$

**Q:** $\frac{R_4\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{2}$

$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 727

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 728

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{r_L s}}\right)$

$H(s)$: $\frac{L_L R_4 R_L s}{2C_4L_L R_4 R_L s^2+C_L L_L R_4 R_L s^2+L_L R_4 s+2L_L R_L s+R_4 R_L}$

**Q:** $\frac{R_4 R_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$

$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{R_4+2R_L}{R_4R_L(2C_4+C_L)}$

### Filter 729

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 730

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4}{C_4 R_4 s+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

$H(s)$: $\frac{R_4R_L(C_L L_L s^2+1)}{2C_4C_L L_L R_4 R_L s^2+2C_4 R_4 R_L s+C_L L_L R_4 s^2+2C_L L_L R_L s^2+C_L R_4 R_L s+R_4+2R_L}$

**Q:** $\frac{C_L L_L\sqrt{\frac{1}{C_L L_L}}(R_4+2R_L)}{R_4R_L(2C_4+C_L)}$

$\omega_0$: $\sqrt{\frac{1}{C_L L_L}}$

**Bandwidth:** $\frac{R_4R_L(2C_4+C_L)}{C_L L_L(R_4+2R_L)}$

### Filter 731

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$

### Filter 732

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 733

**Filter Type:** Invalid011

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

$H(s)$: $\frac{R_4(C_L R_L s+1)}{C_4C_L R_4 R_L s^2+C_L R_4 s+2C_4 R_L s+C_L R_L s+1}$

**Q:** $\frac{C_4C_L R_4 R_L\sqrt{\frac{1}{C_4C_L R_4 R_L}}}{C_L R_4+2C_4 R_L+C_L R_L}$

$\omega_0$: $\sqrt{\frac{1}{C_4C_L R_4 R_L}}$

**Bandwidth:** $\frac{C_L R_4+2C_4 R_L+C_L R_L}{C_4C_L R_4 R_L}$

### Filter 734

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 735

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 736

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

$H(s)$: $\frac{L_Ls(C_4R_4s+1)}{C_4C_LL_LR_4s^3+2C_LL_Ls^2+C_4R_4s+C_LL_Ls^2+1}$

**Q:** $\frac{L_L\sqrt{\frac{1}{L_L(2C_4+C_L)}}(2C_4+C_L)}{C_4R_4}$

$\omega_0$: $\sqrt{\frac{1}{L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{C_4R_4}{L_L(2C_4+C_L)}$

### Filter 737

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 738

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

$H(s)$: $\frac{L_LR_Ls(C_4R_4s+1)}{C_4C_LL_LR_4R_Ls^3+C_4L_LR_4s^2+2C_4L_LR_Ls^2+C_4R_4R_Ls+C_LL_LR_Ls^2+L_Ls+R_L}$

**Q:** $\frac{L_L\sqrt{\frac{R_L}{L_L(C_4R_4+2C_4R_L+C_LR_L)}}(C_4R_4+2C_4R_L+C_LR_L)}{C_4R_4R_L+L_L}$

$\omega_0$: $\sqrt{\frac{R_L}{L_L(C_4R_4+2C_4R_L+C_LR_L)}}$

**Bandwidth:** $\frac{C_4R_4R_L+L_L}{L_L(C_4R_4+2C_4R_L+C_LR_L)}$

### Filter 739

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 740

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ R_4+\frac{1}{C_4s},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 741

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L\left(C_4L_4s^2+1\right)}{C_4L_4s^2+2C_4R_Ls+1}$

**Q:** $\frac{L_4\sqrt{\frac{1}{C_4L_4}}}{2R_L}$

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

**Bandwidth:** $\frac{2R_L}{L_4}$

### Filter 742

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 743

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

$H(s)$: $\frac{R_L\left(C_4L_4s^2+1\right)}{C_4C_LL_LR_Ls^3+C_4L_4s^2+2C_4R_Ls+C_LR_Ls+1}$

**Q:** $\frac{C_4L_4\sqrt{\frac{1}{C_4L_4}}}{R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_L(2C_4+C_L)}{C_4L_4}$

### Filter 744

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 745

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 746

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 747

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 748

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

### Filter 749

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 750

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+\frac{1}{C_4s},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 751

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L\right)$

$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+L_4 s+2R_L}$

**Q:** $2C_4 R_L\sqrt{\frac{1}{C_4 L_4}}$

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

**Bandwidth:** $\frac{1}{2C_4 R_L}$

### Filter 752

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 753

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

$H(s)$: $\frac{L_4 R_L s}{2C_4 L_4 R_L s^2+C_L L_4 R_L s^2+L_4 s+2R_L}$

**Q:** $\sqrt{2}R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4+C_L)$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$

**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 754

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

$H(s)$: $\frac{L_4 s(C_L R_L s+1)}{2C_4 C_L L_4 R_L s^3+2C_4 L_4 s^2+C_L L_4 s^2+2C_L R_L s+2}$

**Q:** $\frac{\sqrt{2}L_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}\,(2C_4+C_L)}{2C_L R_L}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$

**Bandwidth:** $\frac{2C_L R_L}{L_4(2C_4+C_L)}$

### Filter 755

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 756

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 757

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 758

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{1}{\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

$H(s)$: $\frac{L_4 L_L R_L s}{2C_4 L_4 L_L R_L s^2+C_L L_4 L_L R_L s^2+L_4 L_L s+L_4 R_L+2L_L R_L}$

**Q:** $R_L\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}\,(2C_4+C_L)$

$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4 L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{1}{R_L(2C_4+C_L)}$

### Filter 759

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 760

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$

### Filter 761

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L(C_4 L_4 s^2+C_4 R_4 s+1)}{C_4 L_4 s^2+C_4 R_4 s+2C_4 R_L s+1}$

**Q:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4+2R_L}$

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

**Bandwidth:** $\frac{R_4+2R_L}{L_4}$

**Qz:** $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4}$

### Filter 762

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{1}{C_L s}\right)$

### Filter 763

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ \frac{R_L}{C_L R_L s+1}\right)$

### Filter 764

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ R_L+\frac{1}{C_L s}\right)$

### Filter 765

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ \infty,\ L_L s+\frac{1}{C_L s}\right)$

### Filter 766

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 767

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 768

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

### Filter 769

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 770

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ L_4s+R_4+\frac{1}{C_4s},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 771

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ R_L\right)$

$H(s)$: $\frac{L_4R_4R_Ls}{2C_4L_4R_4R_Ls^2+L_4R_4s+2L_4R_Ls+2R_4R_L}$

**Q:** $\frac{2C_4R_4R_L\sqrt{\frac{1}{C_4L_4}}}{R_4+2R_L}$

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

**Bandwidth:** $\frac{R_4+2R_L}{2C_4R_4R_L}$

### Filter 772

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}}\right)$

$H(s)$: $\frac{L_4R_4s}{2C_4L_4R_4s^2+C_4L_4R_4s+2L_4s+2R_4}$

**Q:** $\frac{\sqrt{2}R_4\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{2}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$

**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 773

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

$H(s)$: $\frac{L_4R_4R_Ls}{2C_4L_4R_4R_Ls^2+C_4L_4R_4R_Ls+2C_4L_4R_4s^2+L_4R_4s+2L_4R_Ls+2R_4R_L}$

**Q:** $\frac{\sqrt{2}R_4R_L\sqrt{\frac{1}{L_4(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{1}{L_4(2C_4+C_L)}}$

**Bandwidth:** $\frac{R_4+2R_L}{R_4R_L(2C_4+C_L)}$

### Filter 774

**Filter Type:** Invalid110

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

$H(s)$: $\frac{L_4R_4R_Ls}{2C_4C_LL_4R_4R_Ls^3+2C_4L_4R_4s^2+C_LL_4R_4s^2+2C_4L_4R_Ls^2+2C_LR_4R_Ls+2L_4s+2R_4}$

**Q:** $\frac{\sqrt{2}L_4\sqrt{\frac{R_4}{L_4(2C_4R_4+C_LR_4+2C_LR_L)}}(2C_4R_4+C_LR_4+2C_LR_L)}{2(C_LR_4R_L+L_4)}$

$\omega_0$: $\sqrt{2}\sqrt{\frac{R_4}{L_4(2C_4R_4+C_LR_4+2C_LR_L)}}$

**Bandwidth:** $\frac{2(C_LR_4R_L+L_4)}{L_4(2C_4R_4+C_LR_4+2C_LR_L)}$

### Filter 775

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 776

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

$H(s)$: $\frac{L_4L_LR_4s}{2C_4L_4L_LR_4s^2+C_LL_4L_LR_4s^2+2L_4L_Ls+L_4R_4+2L_LR_4}$

**Q:** $\frac{R_4\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}(2C_4+C_L)}{2}$

$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{2}{R_4(2C_4+C_L)}$

### Filter 777

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 778

**Filter Type:** BP

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

$H(s)$: $\frac{L_4L_LR_4R_Ls}{2C_4L_4L_LR_4R_Ls^2+C_LL_4L_LR_4R_Ls^2+L_4L_LR_4s+2L_4L_LR_Ls+L_4R_4R_L+2L_LR_4R_L}$

**Q:** $\frac{R_4R_L\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}(2C_4+C_L)}{R_4+2R_L}$

$\omega_0$: $\sqrt{\frac{L_4+2L_L}{L_4L_L(2C_4+C_L)}}$

**Bandwidth:** $\frac{R_4+2R_L}{R_4R_L(2C_4+C_L)}$

### Filter 779

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4s+\frac{1}{R_4}+\frac{1}{L_4s}},\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}+R_L\right)$

### Filter 780

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{1}{C_4Ls+\frac{1}{R_4}+\frac{1}{C_4s}},\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 781

**Filter Type:** GE

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_L\left(C_4L_4R_4s^2+L_4s+R_4\right)}{C_4L_4R_Ls^2+2C_4L_4R_4s^2+2C_4L_4R_Ls^2+L_4s+R_4+2R_L}$

**Q:** $C_4\sqrt{\frac{1}{C_4L_4}}\left(R_4+2R_L\right)$

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

**Bandwidth:** $\frac{1}{C_4(R_4+2R_L)}$

**Qz:** $C_4R_4\sqrt{\frac{1}{C_4L_4}}$

### Filter 782

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{1}{C_Ls}\right)$

### Filter 783

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

### Filter 784

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 785

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 786

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{L_Ls}{C_LL_Ls^2+1}\right)$

### Filter 787

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ L_Ls+R_L+\frac{1}{C_Ls}\right)$

### Filter 788

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{1}{C_Ls+\frac{1}{R_L}+\frac{1}{L_Ls}}\right)$

### Filter 789

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_L\right)$

### Filter 790

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{L_4s}{C_4L_4s^2+1}+R_4,\ \infty,\ \frac{R_L\left(L_Ls+\frac{1}{C_Ls}\right)}{L_Ls+R_L+\frac{1}{C_Ls}}\right)$

### Filter 791

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ R_L\right)$

$H(s)$: $\frac{R_4R_L\left(C_4L_4s^2+1\right)}{C_4L_4R_4s^2+2C_4L_4R_Ls^2+2C_4R_4R_Ls+R_4+2R_L}$

**Q:** $\frac{L_4\sqrt{\frac{1}{C_4L_4}}\left(R_4+2R_L\right)}{2R_4R_L}$

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

**Bandwidth:** $\frac{2R_4R_L}{L_4(R_4+2R_L)}$

### Filter 792

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{1}{C_Ls}\right)$

$H(s)$: $\frac{R_4\left(C_4L_4s^2+1\right)}{C_4C_LL_4R_4s^3+2C_4L_4s^2+2C_4R_4s+C_LR_4s+2}$

**Q:** $\frac{2C_4L_4\sqrt{\frac{1}{C_4L_4}}}{R_4(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4(2C_4+C_L)}{2C_4L_4}$

### Filter 793

**Filter Type:** BS

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ \frac{R_L}{C_LR_Ls+1}\right)$

$H(s)$: $\frac{R_4R_L\left(C_4L_4s^2+1\right)}{C_4C_LL_4R_4R_Ls^3+C_4L_4R_4s^2+2C_4L_4R_Ls^2+2C_4R_4R_Ls+C_LR_4R_Ls+R_4+2R_L}$

**Q:** $\frac{C_4L_4\sqrt{\frac{1}{C_4L_4}}\left(R_4+2R_L\right)}{R_4R_L(2C_4+C_L)}$

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

**Bandwidth:** $\frac{R_4R_L(2C_4+C_L)}{C_4L_4(R_4+2R_L)}$

### Filter 794

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ R_L+\frac{1}{C_Ls}\right)$

### Filter 795

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2s+\frac{1}{C_2s}\right)}{L_2s+R_2+\frac{1}{C_2s}},\ \infty,\ \frac{R_4\left(L_4s+\frac{1}{C_4s}\right)}{L_4s+R_4+\frac{1}{C_4s}},\ \infty,\ L_Ls+\frac{1}{C_Ls}\right)$

### Filter 796

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}\right)$

### Filter 797

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ L_L s+R_L+\frac{1}{C_L s}\right)$

### Filter 798

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{1}{C_L s+\frac{1}{R_L}+\frac{1}{L_L s}}\right)$

### Filter 799

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{L_L s}{C_L L_L s^2+1}+R_L\right)$

### Filter 800

Invalid filter

$Z(s)$: $\left(\infty,\ \frac{R_2\left(L_2 s+\frac{1}{C_2 s}\right)}{L_2 s+R_2+\frac{1}{C_2 s}},\ \infty,\ \frac{R_4\left(L_4 s+\frac{1}{C_4 s}\right)}{L_4 s+R_4+\frac{1}{C_4 s}},\ \infty,\ \frac{R_L\left(L_L s+\frac{1}{C_L s}\right)}{L_L s+R_L+\frac{1}{C_L s}}\right)$