Experiment Summary

Filter 1

Filter Type: GE
$Z(s)$**:** $\left(\infty,\ \infty,\ \infty,\ \infty,\ R_4,\ LLs + RL + \frac{1}{CLs}\right)$
$H(s)$**:** $\frac{(R_4gm-1)\left(CLLLs^2+CLRLs+1\right)}{CLLLs^2+CLR_4s+CLRLs+1}$
Q: $\frac{LL\sqrt{\frac{1}{CLLL}}}{R_4+RL}$
ω_0**:** $\sqrt{\frac{1}{CLLL}}$
Bandwidth: $\frac{R_4+RL}{LL}$
Qz: $\frac{LL\sqrt{\frac{1}{CLLL}}}{RL}$

Filter 2

Filter Type: GE
$Z(s)$**:** $\left(\infty,\ \infty,\ \infty,\ \infty,\ R_4,\ \frac{LLs}{CLLLs^2+1} + RL\right)$
$H(s)$**:** $\frac{(R_4gm-1)\left(CLLLRLs^2+LLs+RL\right)}{CLLLR_4s^2+CLLLRLs^2+LLs+R_4+RL}$
Q: $CL\sqrt{\frac{1}{CLLL}}\left(R_4 + RL\right)$
ω_0**:** $\sqrt{\frac{1}{CLLL}}$
Bandwidth: $\frac{1}{CL(R_4+RL)}$
Qz: $CLRL\sqrt{\frac{1}{CLLL}}$

Filter 3

Filter Type: GE
$Z(s)$**:** $\left(\infty,\ \infty,\ \infty,\ \infty,\ L_4s + \frac{1}{C_4s},\ RL\right)$
$H(s)$**:** $\frac{RL\left(C_4L_4gms^2-C_4s+gm\right)}{C_4L_4s^2+C_4RLs+1}$
Q: $\frac{L_4\sqrt{\frac{1}{C_4L_4}}}{RL}$
ω_0**:** $\sqrt{\frac{1}{C_4L_4}}$
Bandwidth: $\frac{RL}{L_4}$
Qz: $-L_4gm\sqrt{\frac{1}{C_4L_4}}$

Filter 4

Filter Type: GE
$Z(s)$**:** $\left(\infty,\ \infty,\ \infty,\ \infty,\ L_4s + \frac{1}{C_4s},\ \frac{RL}{CLRLs+1}\right)$
$H(s)$**:** $\frac{RL\left(C_4L_4gms^2-C_4s+gm\right)}{C_4CLL_4RLs^3+C_4L_4s^2+C_4RLs+CLRLs+1}$
Q: $\frac{C_4L_4\sqrt{\frac{1}{C_4L_4}}}{RL(C_4+CL)}$
ω_0**:** $\sqrt{\frac{1}{C_4L_4}}$
Bandwidth: $\frac{RL(C_4+CL)}{C_4L_4}$
Qz: $-L_4gm\sqrt{\frac{1}{C_4L_4}}$

Filter 5

Filter Type: GE
$Z(s)$**:** $\left(\infty,\ \infty,\ \infty,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1},\ RL\right)$
$H(s)$**:** $\frac{RL\left(-C_4 L_4 s^2+L_4 gms-1\right)}{C_4 L_4 RLs^2+L_4 s+RL}$
Q: $C_4 RL\sqrt{\frac{1}{C_4 L_4}}$
ω_0**:** $\sqrt{\frac{1}{C_4 L_4}}$
Bandwidth: $\frac{1}{C_4 RL}$
Qz: $-\frac{C_4\sqrt{\frac{1}{C_4 L_4}}}{gm}$

Filter 6

Filter Type: GE
$Z(s)$**:** $\left(\infty,\ \infty,\ \infty,\ \infty,\ L_4 s+R_4+\frac{1}{C_4 s},\ RL\right)$
$H(s)$**:** $\frac{RL\left(C_4 L_4 gms^2+C_4 R_4 gms-C_4 s+gm\right)}{C_4 L_4 s^2+C_4 R_4 s+C_4 RLs+1}$
Q: $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4+RL}$
ω_0**:** $\sqrt{\frac{1}{C_4 L_4}}$
Bandwidth: $\frac{R_4+RL}{L_4}$
Qz: $\frac{L_4 gm\sqrt{\frac{1}{C_4 L_4}}}{R_4 gm-1}$

Filter 7

Filter Type: GE
$Z(s)$**:** $\left(\infty,\ \infty,\ \infty,\ \infty,\ \frac{1}{C_4 s+\frac{1}{R_4}+\frac{1}{L_4 s}},\ RL\right)$
$H(s)$**:** $\frac{RL\left(-C_4 L_4 R_4 s^2+L_4 R_4 gms-L_4 s-R_4\right)}{C_4 L_4 R_4 RLs^2+L_4 R_4 s+L_4 RLs+R_4 RL}$
Q: $\frac{C_4 R_4 RL\sqrt{\frac{1}{C_4 L_4}}}{R_4+RL}$
ω_0**:** $\sqrt{\frac{1}{C_4 L_4}}$
Bandwidth: $\frac{R_4+RL}{C_4 R_4 RL}$
Qz: $-\frac{C_4 R_4\sqrt{\frac{1}{C_4 L_4}}}{R_4 gm-1}$

Filter 8

Filter Type: GE
$Z(s)$**:** $\left(\infty,\ \infty,\ \infty,\ \infty,\ \frac{L_4 s}{C_4 L_4 s^2+1}+R_4,\ RL\right)$
$H(s)$**:** $\frac{RL\left(C_4 L_4 R_4 gms^2-C_4 L_4 s^2+L_4 gms+R_4 gm-1\right)}{C_4 L_4 R_4 s^2+C_4 L_4 RLs^2+L_4 s+R_4+RL}$
Q: $C_4\sqrt{\frac{1}{C_4 L_4}}\left(R_4+RL\right)$
ω_0**:** $\sqrt{\frac{1}{C_4 L_4}}$
Bandwidth: $\frac{1}{C_4(R_4+RL)}$
Qz: $\frac{C_4\sqrt{\frac{1}{C_4 L_4}}(R_4 gm-1)}{gm}$

Filter 9

Filter Type: GE

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

$H(s)$**:** $\frac{RL\left(C_4 L_4 R_4 gms^2-C_4 L_4 s^2-C_4 R_4 s+R_4 gm-1\right)}{C_4 L_4 R_4 s^2+C_4 L_4 RLs^2+C_4 R_4 RLs+R_4+RL}$

Q: $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}(R_4+RL)}{R_4 RL}$

ω_0**:** $\sqrt{\frac{1}{C_4 L_4}}$

Bandwidth: $\frac{R_4 RL}{L_4(R_4+RL)}$

Qz: $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}(-R_4 gm+1)}{R_4}$

Filter 10

Filter Type: GE

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

$H(s)$**:** $\frac{C_4 L_4 R_4 gms^2-C_4 L_4 s^2-C_4 R_4 s+R_4 gm-1}{C_4 CLL_4 R_4 s^3+C_4 L_4 s^2+C_4 R_4 s+CLR_4 s+1}$

Q: $\frac{C_4 L_4\sqrt{\frac{1}{C_4 L_4}}}{R_4(C_4+CL)}$

ω_0**:** $\sqrt{\frac{1}{C_4 L_4}}$

Bandwidth: $\frac{R_4(C_4+CL)}{C_4 L_4}$

Qz: $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}(-R_4 gm+1)}{R_4}$

Filter 11

Filter Type: GE

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

$H(s)$**:** $\frac{RL\left(C_4 L_4 R_4 gms^2-C_4 L_4 s^2-C_4 R_4 s+R_4 gm-1\right)}{C_4 CLL_4 R_4 RLs^3+C_4 L_4 R_4 s^2+C_4 L_4 RLs^2+C_4 R_4 RLs+CLR_4 RLs+R_4+RL}$

Q: $\frac{C_4 L_4\sqrt{\frac{1}{C_4 L_4}}(R_4+RL)}{R_4 RL(C_4+CL)}$

ω_0**:** $\sqrt{\frac{1}{C_4 L_4}}$

Bandwidth: $\frac{R_4 RL(C_4+CL)}{C_4 L_4(R_4+RL)}$

Qz: $\frac{L_4\sqrt{\frac{1}{C_4 L_4}}(-R_4 gm+1)}{R_4}$