

LE FILTRON

FILTRES POUR HAUT-PARLEURS

Forr, ébauche 23 octobre 2018

INTRO

VF1 sortie filtre voie aigüe, courbes en rouge sur les graphiques

VF2 sortie filtre voie grave, courbes en vert sur les graphiques

sum sommation des voies, courbes vert olive sur les graphiques

coincid courbe de réponse en coïncidence étalée par post-process, en violet sur les graphiques. La courbe en coïncidence est la courbe de sommation des voies obtenue si l'on ignore le déphasage entre elles. Mathématiquement c'est la somme des modules. Elle donne un avant-goût du comportement en phase des voies autour de la fréquence de croisement. Les courbes de phase des voies par rapport au signal d'entrée sont à la fois plus explicites et plus riches en informations.

time le graphique portant ce nom est la courbe du temps de propagation de groupe (on dit aussi retard de groupe ou *group delay*). Il s'agit du retard que prend un signal sinusoïdal avec la fréquence. Avec un filtre Butterworth d'ordre 3, ce retard est d'environ 315 μ s en dessous de 100 Hz et pratiquement nul à 10 kHz. Acoustiquement, cela correspond à un recul de la source d'émission de 11 cm.

=> donne des précisions sur le calcul des filtres.

-> donne une indication.

Sur certains schémas, un retard négatif (U0, -320 μ s) qui est autorisée par le programme est appliqué à tout le circuit. Cela permet de caler le retard sur une valeur nulle pour avoir, sans calcul la place de variation du temps de propagation.

FILTRAGES STANDARD

00 indique un filtre standard à pentes d'atténuation identiques pour les deux voies

!

! indique la pente d'atténuation en dB/o

! !

! !

0006_BUT (ordre 1, Butterworth n'y a rien à voir)

0012_BES (Bessel)

0012_BUT (Butterworth)

0012_LIR (Linkwitz-Riley)

0018_BUT (Butterworth)

0024_LIR (Linkwitz-Riley)

FILTRES QUASI-OPTIMAUX

Ces filtres visent à réduire les variations du temps de propagation de groupe avec la fréquence sans modifier de manière sensible la réponse en fréquence.

! pente d'atténuation de la voie inférieure en dB/o

!

! pente d'atténuation de la voie supérieure en dB/o

! !

! !

1212_JMB (Jimbee)

1224_HARSCH (Harsch)

La configuration de Harsch utilise deux filtres d'ordre pair de pentes différentes et n'a pas de polarité inversée sur l'un des voies.

On en parle beaucoup sur le forum DiyAudio en raison de la séduction qu'exerce sa réponse aux carrés.

Sur le schéma, un retard négatif ($U0$, $-320 \mu s$) qui est autorisée par le progiciel est appliqué à tout le circuit. Cela permet de caler le retard sur une valeur nulle pour avoir, sans calcul la place de variation du temps de propagation.

1818_BROOKE (Brooke)

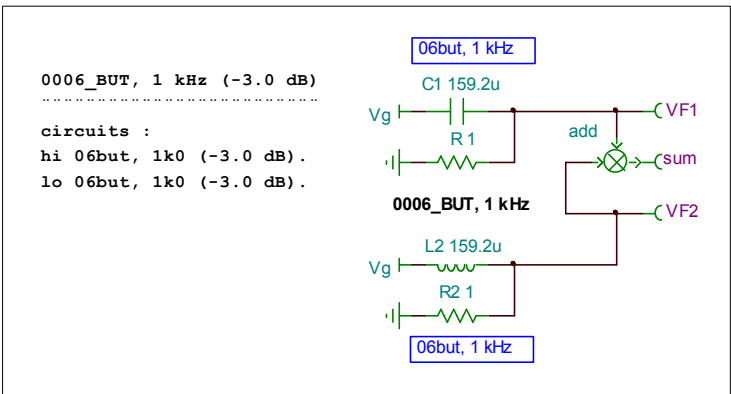
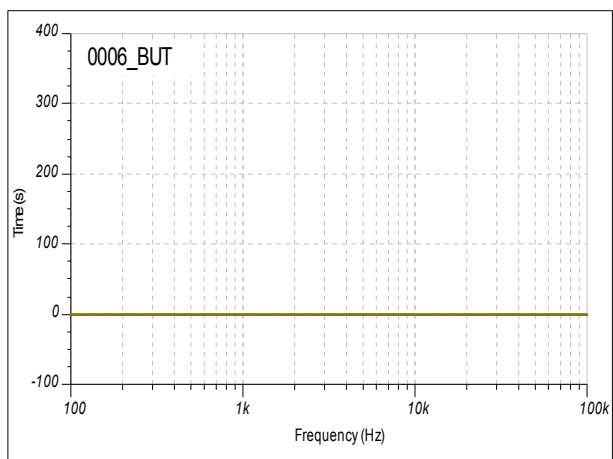
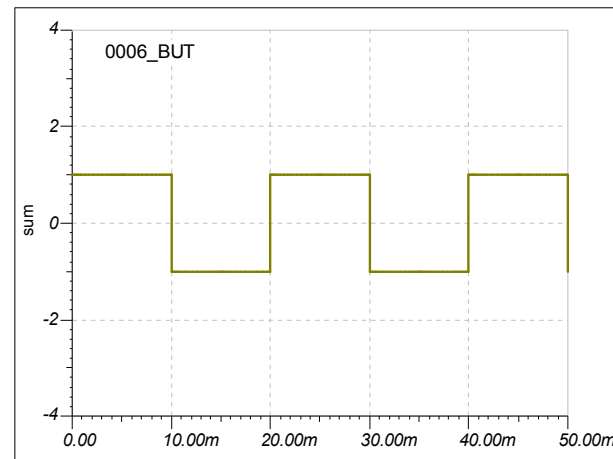
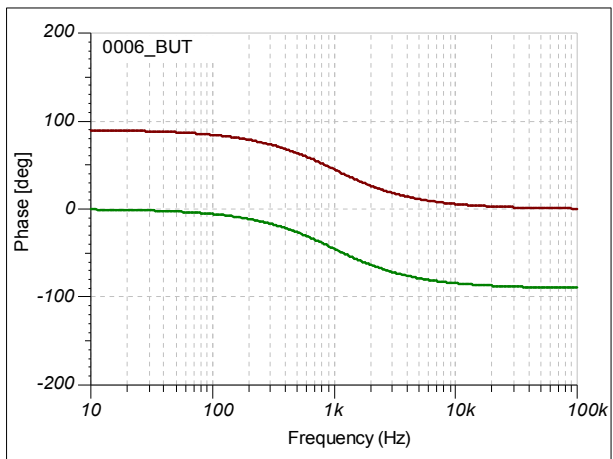
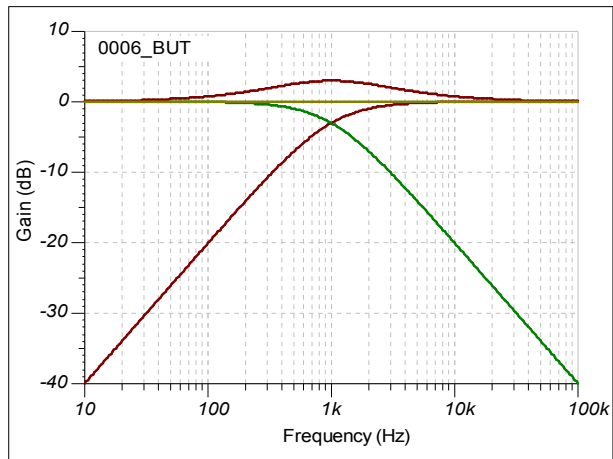
1818_JMLC (Le Cleac'h)

1818_LEB (Lebbolo)

2424_JMLC (Le Cleac'h)

A suivre...

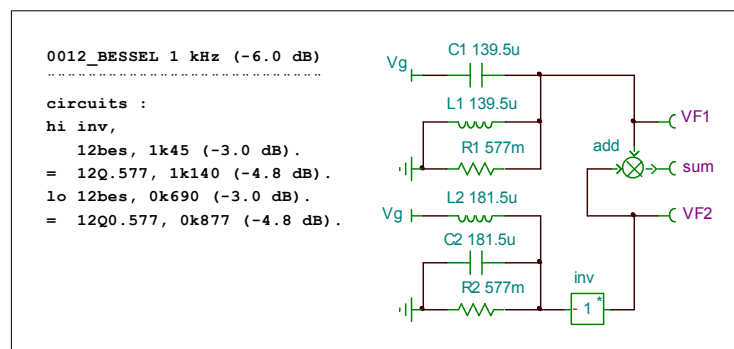
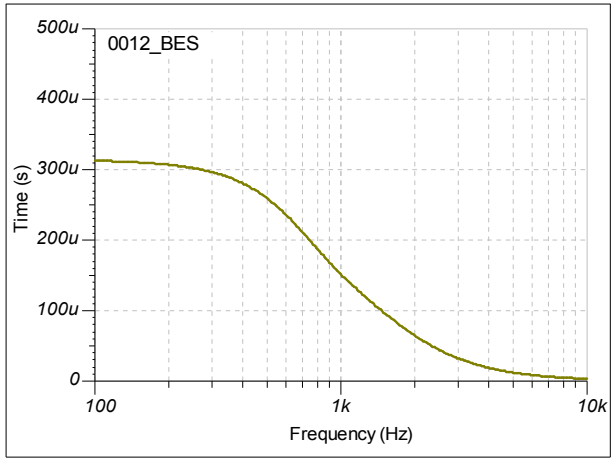
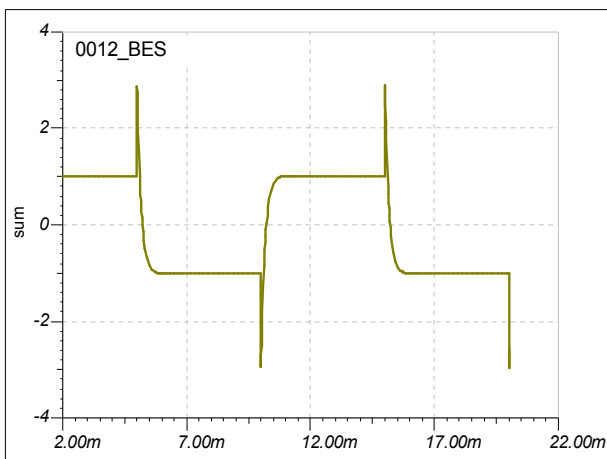
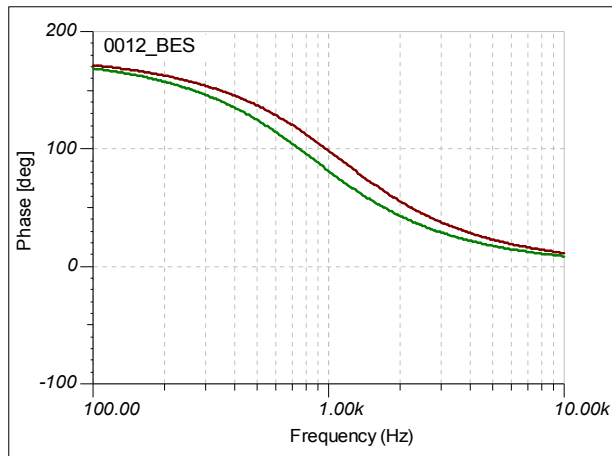
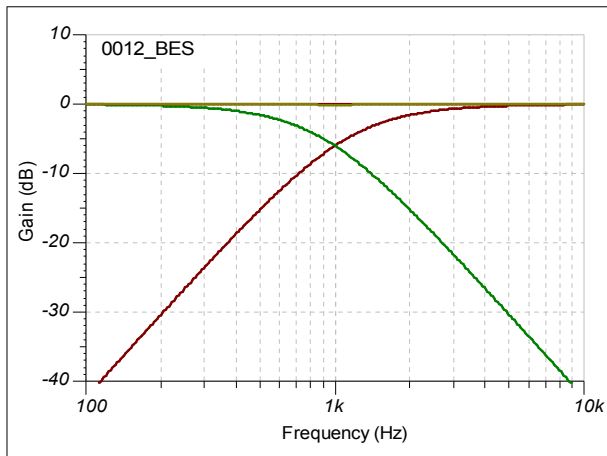
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+-----+
! 0006_BUT, 1 kHz (-3.0 dB) !
! ..... !
! sum variations : !
! axis ripple      0.0 dB !
! coincid ripple   3.0 dB !
! group delay      0 µs !
+-----+
! channels : !
! gain      Hz      lo/hi !
! -20.0 dB   100     90° !
!  -3.0 dB   1k0     90° !
! -20.0 dB  10k0     90° !
+-----+
```



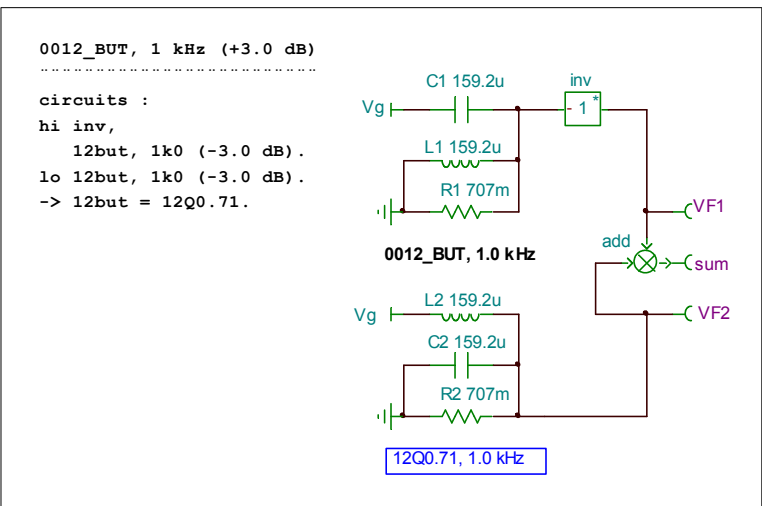
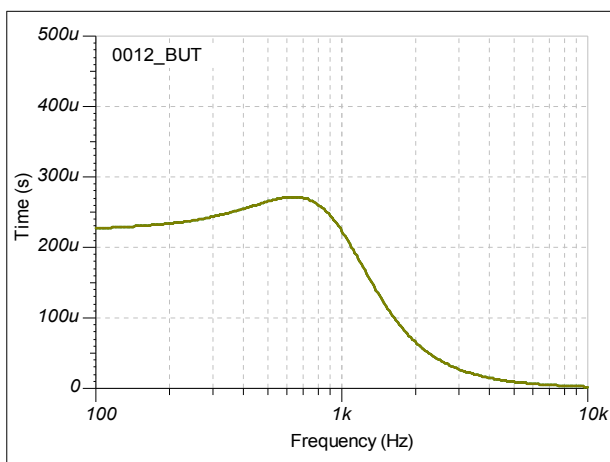
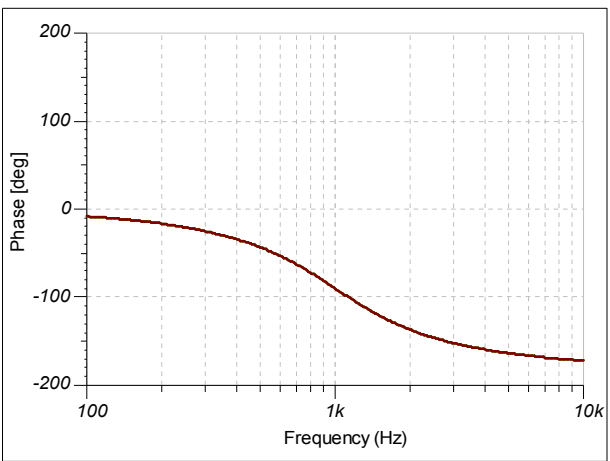
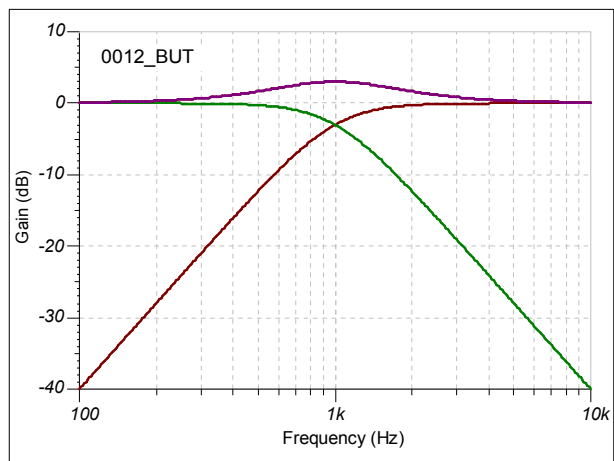
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+-----+
! 0012 BESSEL 1.0 kHz (-6.0 dB) !
! ..... !
! sum variations : !
! axis ripple      0.2 dB !
! coincid ripple   0.1 dB !
! group delay      313 µs !
+-----+
! channels : !
! gain      Hz      lo/hi !
! -20.0 dB   371     10° !
!  -6.0 dB  1k00     17° !
! -20.0 dB  2k70     10° !
+-----+

```



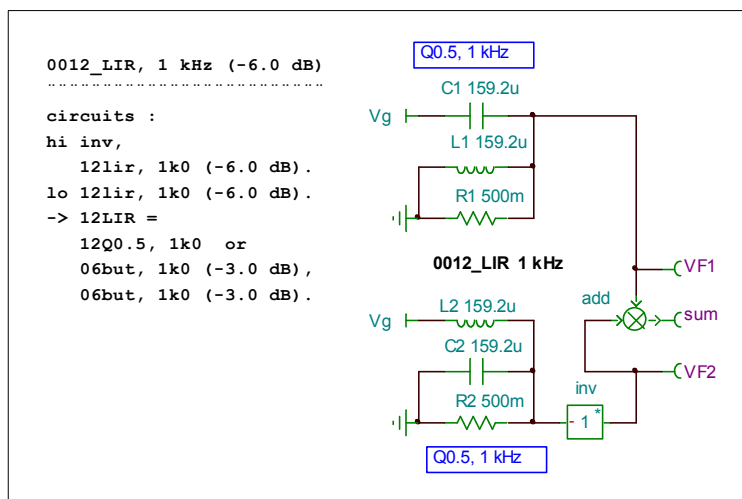
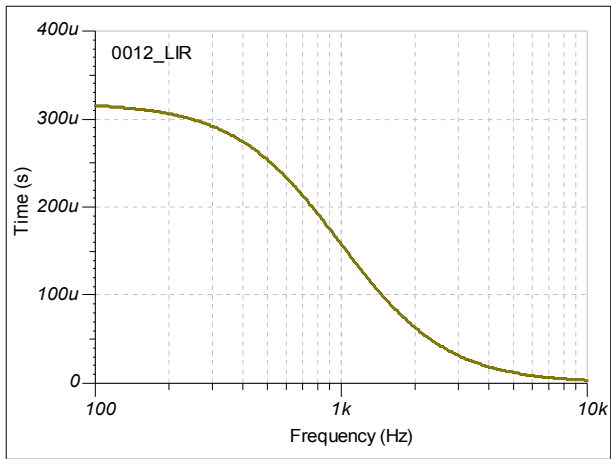
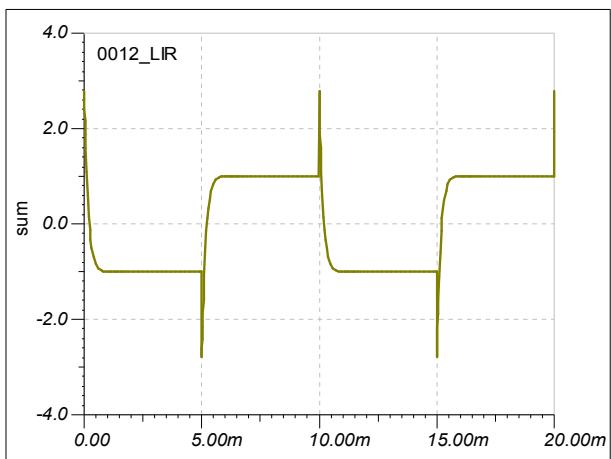
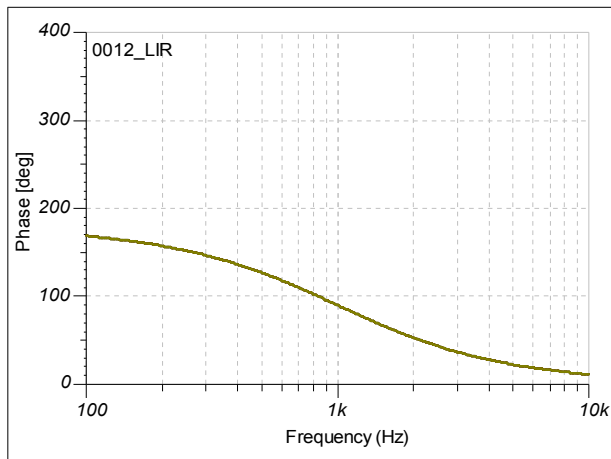
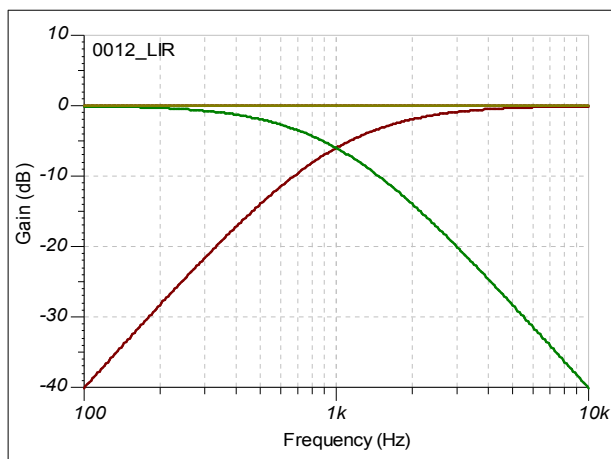
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+-----+
! 0012 BUT, 1 kHz (+3.0dB) !
! ..... !
! sum : !
! axis var          3.0 dB !
! coincid var       3.0 dB !
! group delay var   269 µS !
+-----+
! channels : !
! gain      Hz      lo/hi !
! -20.0 dB   317      0° !
!  -3.0 dB  1k00      0° !
! -20.0 dB  3k15      0° !
+-----+
```



```

+-----+
! 0012_LIR, 1 kHz (-6.0 dB) !
! ..... !
! sum variations : !
! axis          0.0 dB !
! coincid       0.0 dB !
! group delay   297 µS !
+-----+
! channels : !
! gain      Hz      lo/hi !
! -20.0 dB   0.33     0° !
!  -6.0 dB   1k00     0° !
! -20.0 dB   3.00     0° !
+-----+

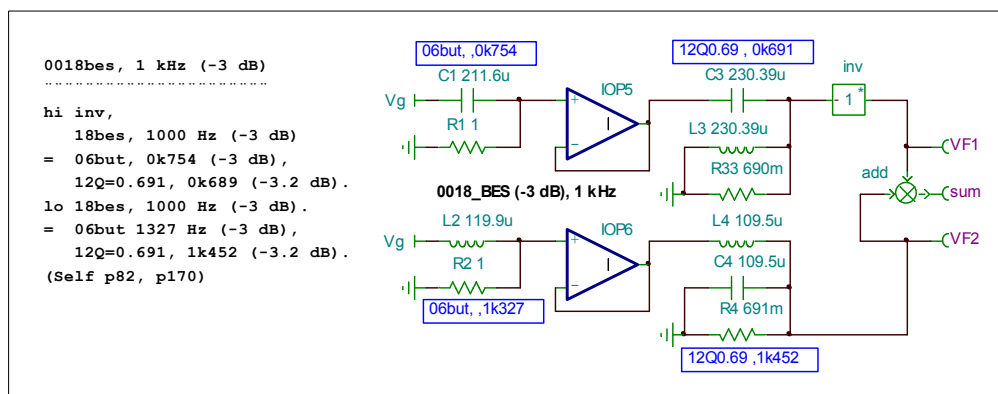
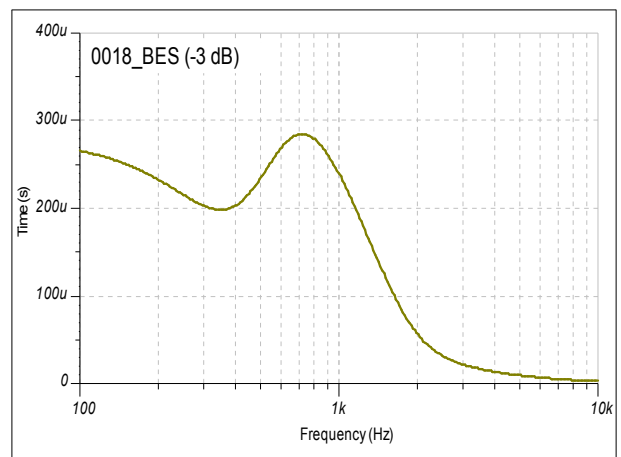
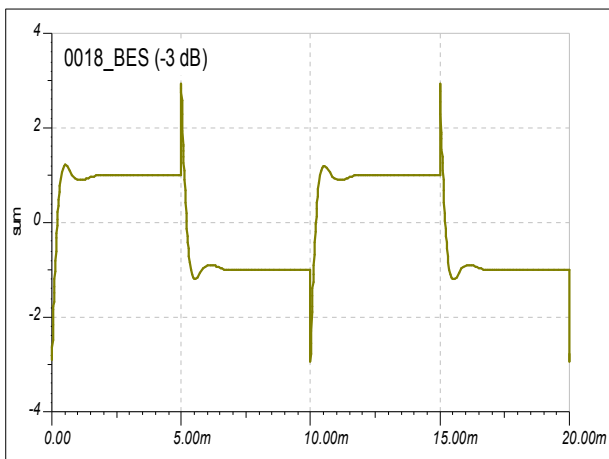
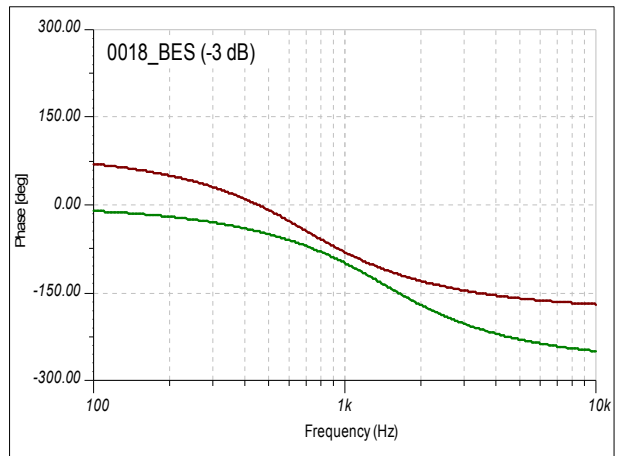
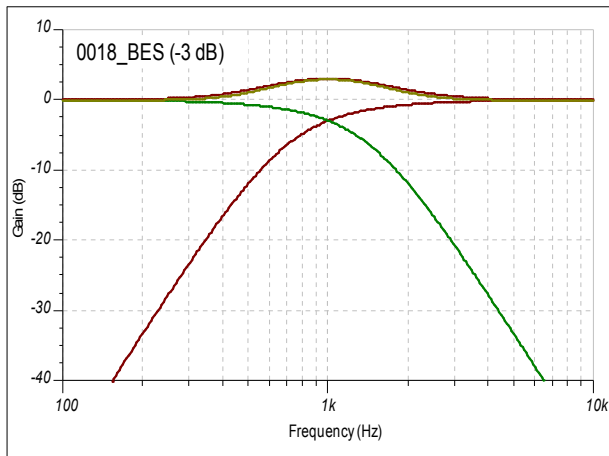
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+-----+
! 0018BES, 1 kHz (-3 dB) !
! ..... !
! !
! sum variations : !
! axis ripple      +2.9 dB !
! coincid ripple   +3.0 dB !
! group delay      285 µs !
+-----+
! channels : !
! level          Hz !
! -20 dB         342   -56° !
! -3 dB          1k00  -18° !
! -20.0dB z      2k90  -56° !
+-----+

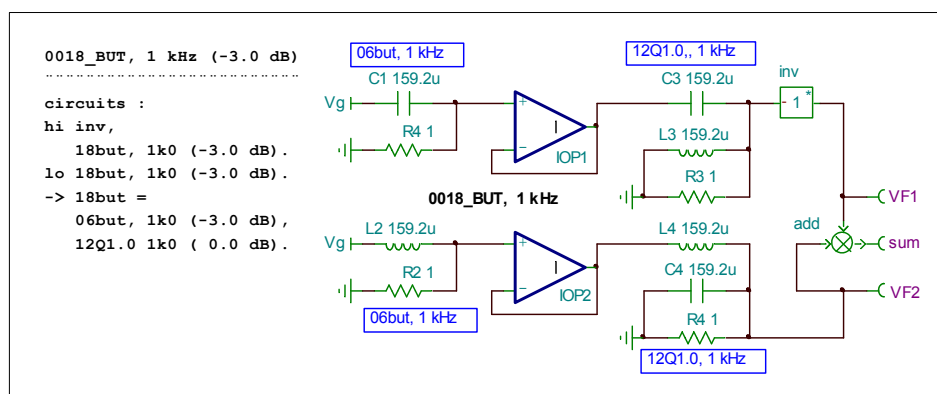
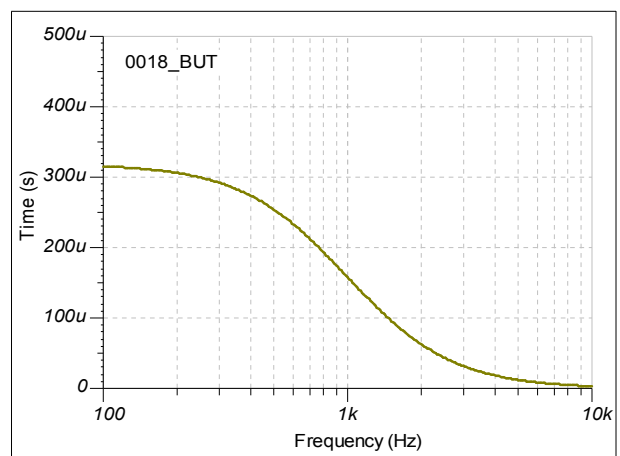
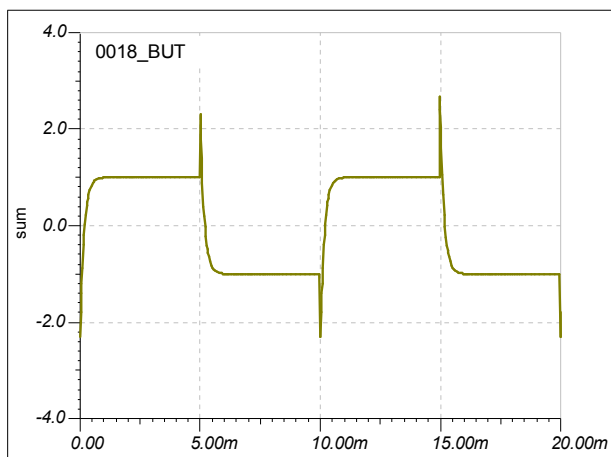
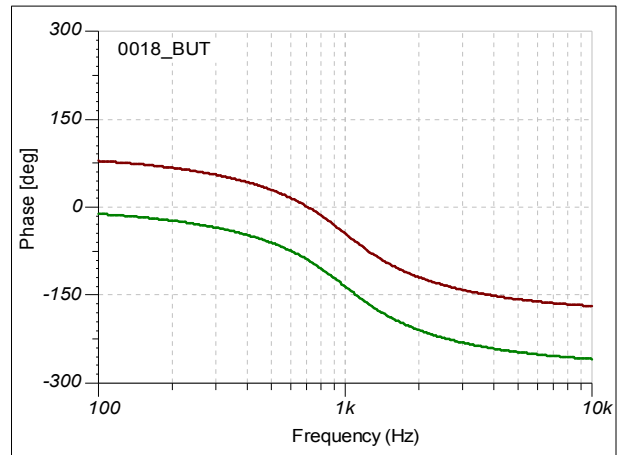
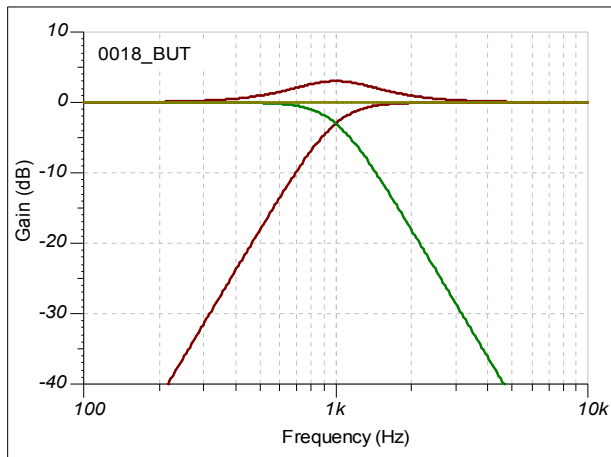
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+-----+
! 0018_BUT, 1 kHz (-3.0 dB) !
! ..... !
! sum variations : !
! axis ripple      0.0 dB !
! concid ripple    3.0 dB !
! group delay      312 µs !
+-----+
! channels : !
! gain            Hz      lo/hi !
! -20.0 dB        426      90° !
! -3.0 dB         1k00      90° !
! -20.0 dB        2k14      90° !
+-----+

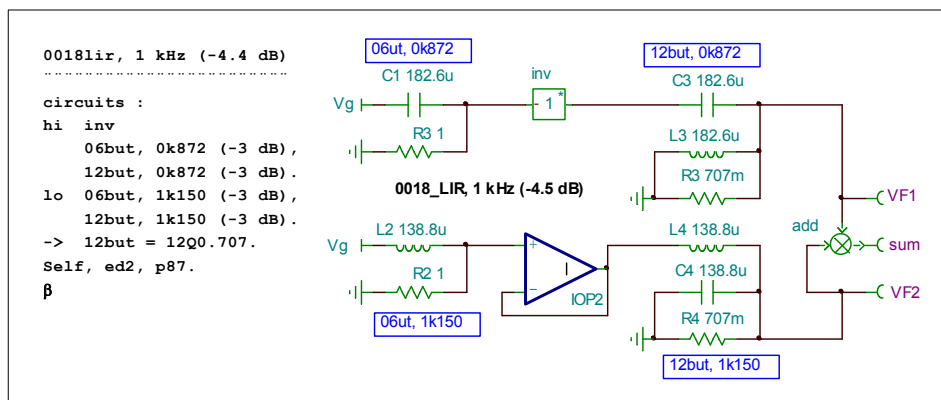
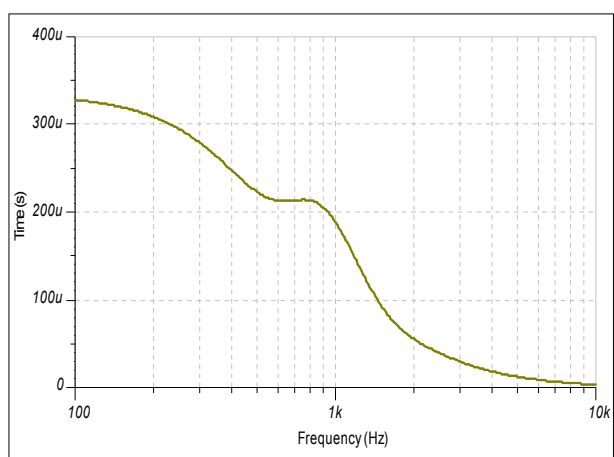
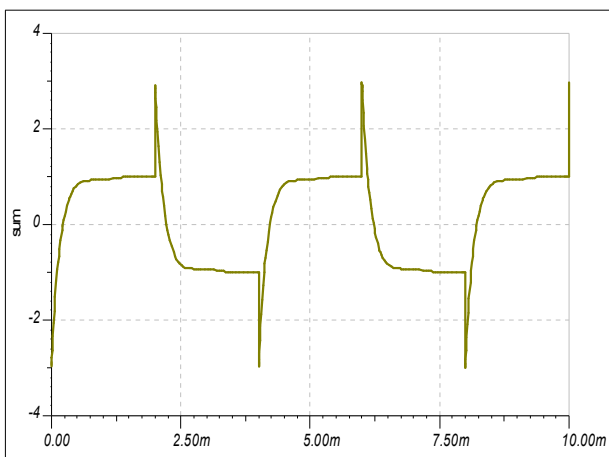
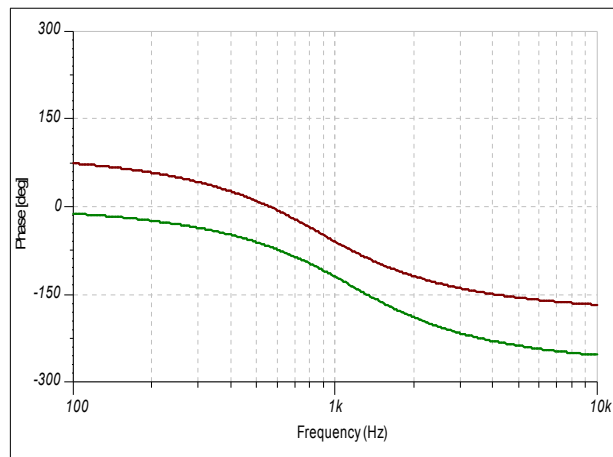
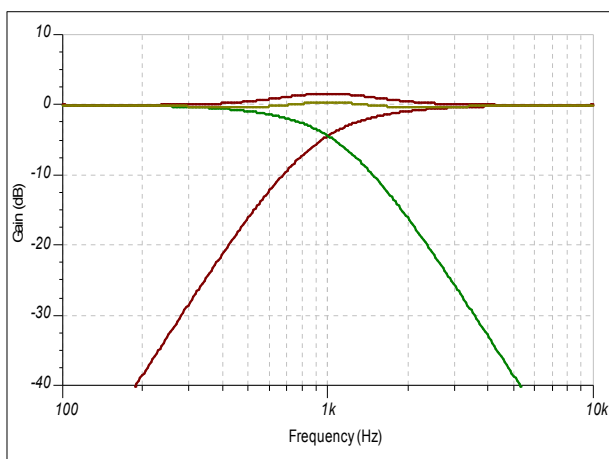
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+-----+
! 0018_LIR, 1 kHz (-4.4 dB) !
! ..... !
! sum variations : !
! axis ripple      0.7 dB !
! coincid ripple   1.5 dB !
! group delay      296 µs !
+-----+
! channels : !
! gain      Hz      lo/hi !
! -20.0 dB   423     -74° !
!  -4.5 dB  1k00     -60° !
! -20.0 dB  2k36     -74° !
+-----+

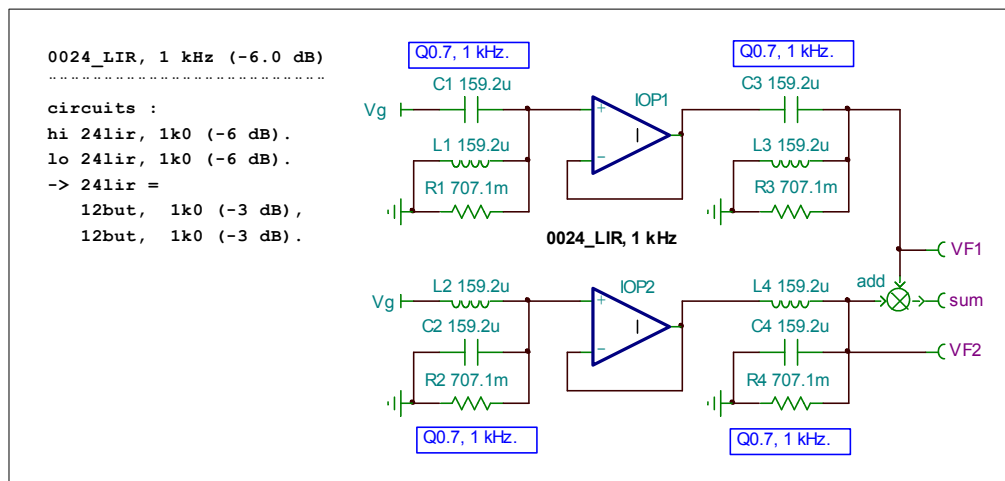
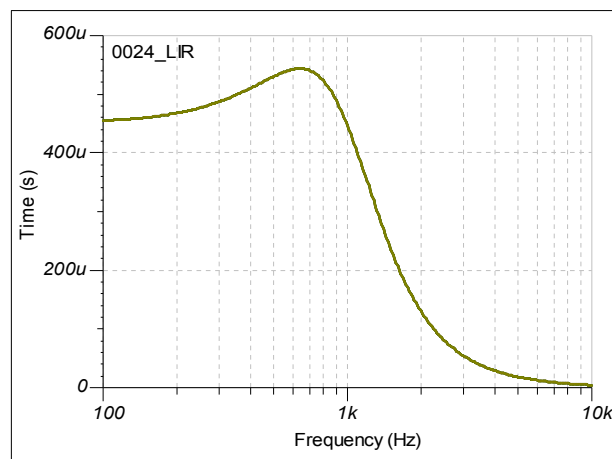
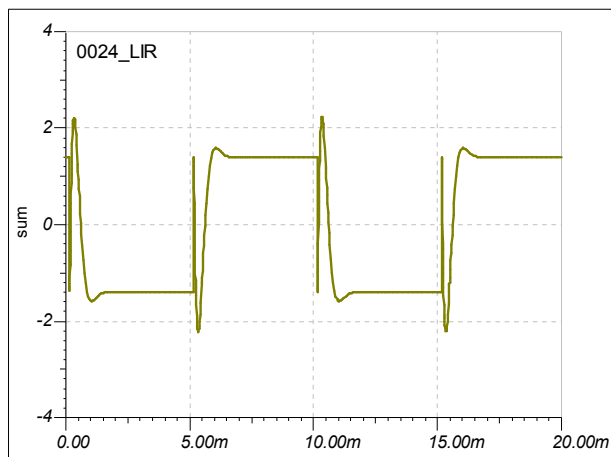
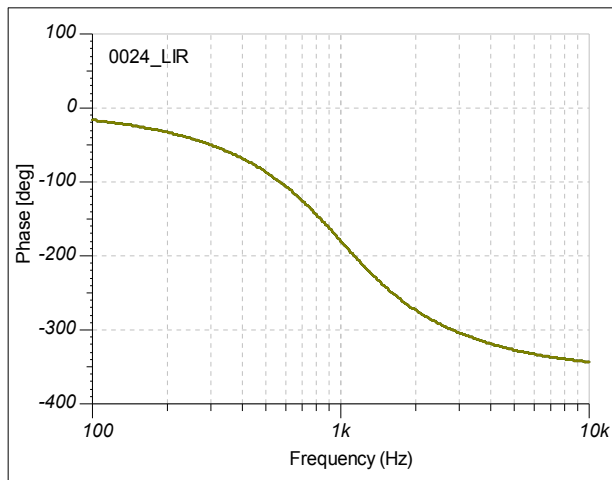
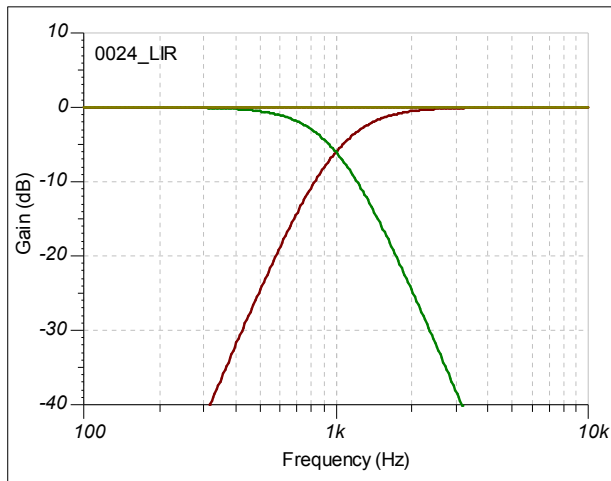
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+-----+
! 0024_LIR, 1 kHz (-6.0 dB) !
! ..... !
! sum variations : !
! axis          0.0 dB !
! coincid       0.0 dB !
! group delay   514 µs !
+-----+
! channels : !
! gain          Hz    hi/lo !
! -20.0 dB      575     0° !
!  -6.0 dB      1k00     0° !
! -20.0 dB      1k73     0° !
+-----+

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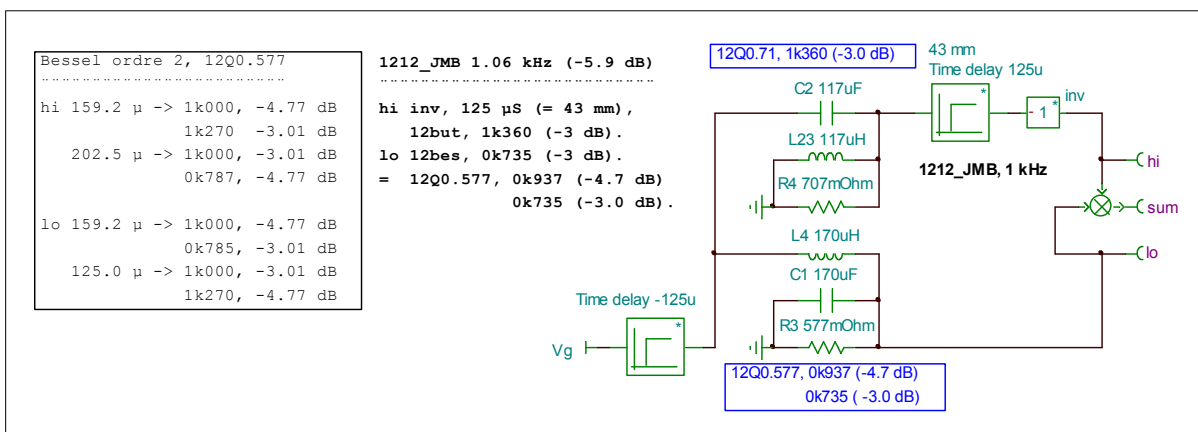
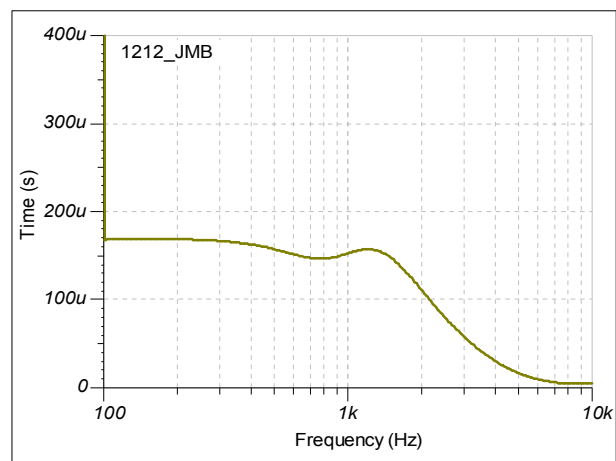
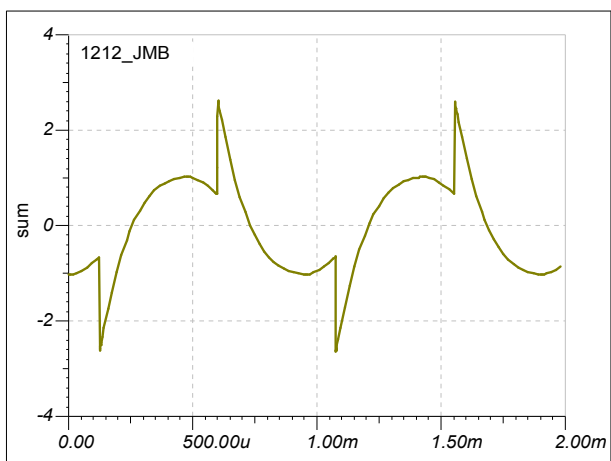
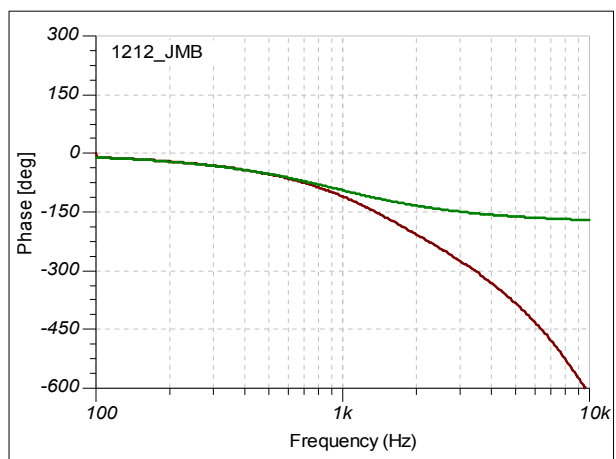
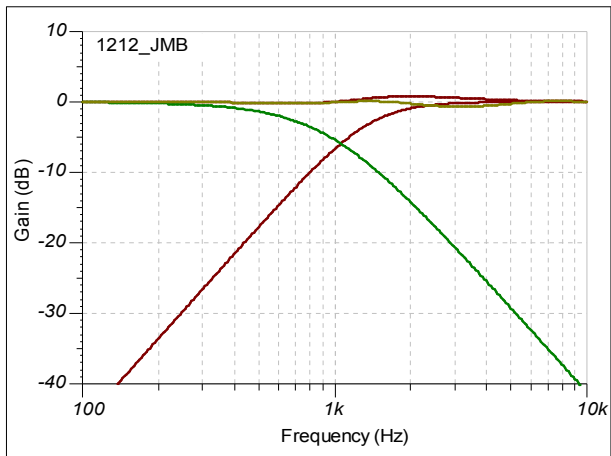


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+-----+
! 1212_JMB 1.06 kHz (-5.9 dB) !
! .....!
! sum variations :           !
! X at 1060 Hz,              -5.9 dB !
! axis ripple                0.7 dB !
! coincid ripple             0.8 dB !
! delay                      170 µs !
+-----+

! channels :      Hz      lo/hi !
! -20.0 dB       438       0° !
! -5.9 dB        1k06      -19° !
! -20.0 dB       2k88      -120° !
+-----+

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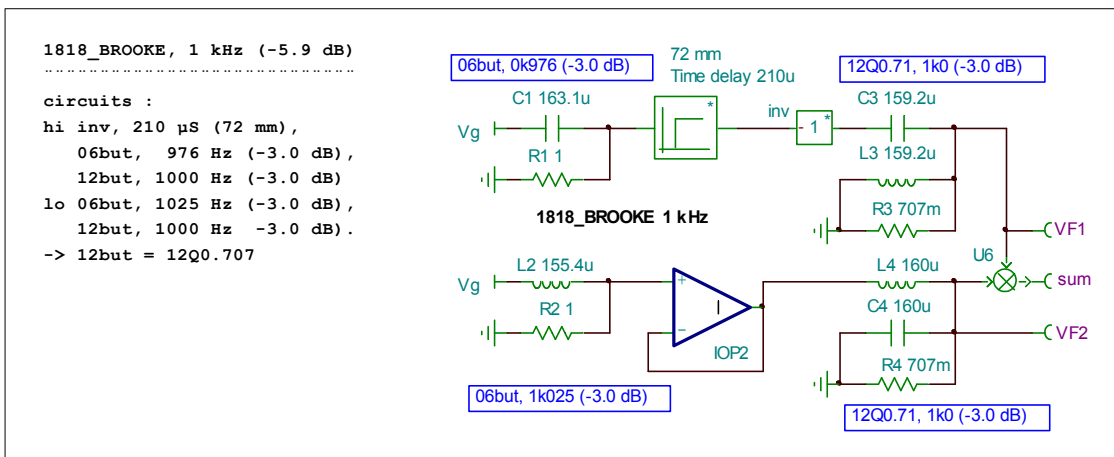
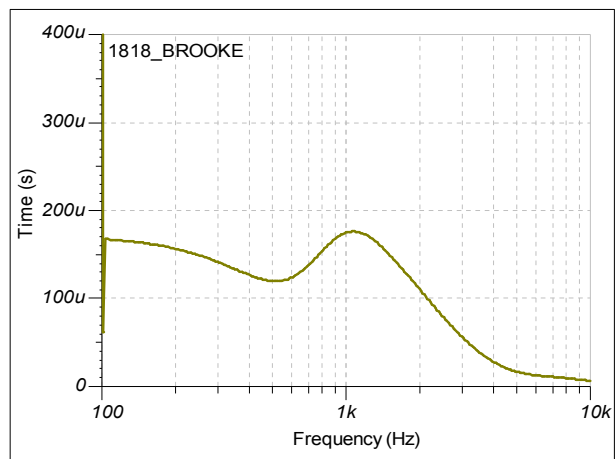
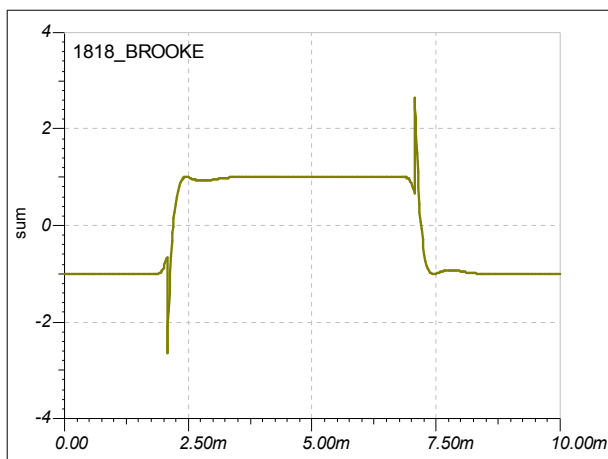
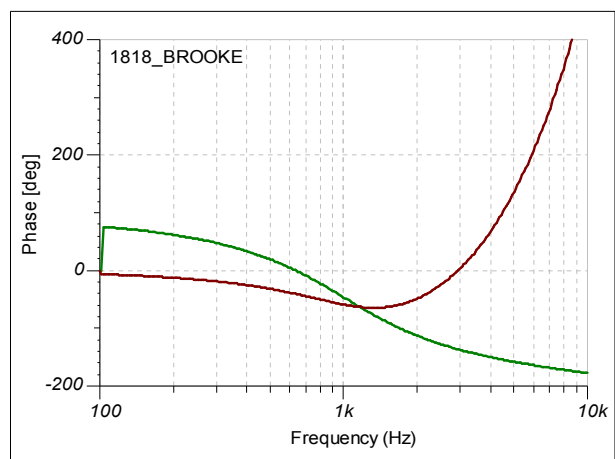
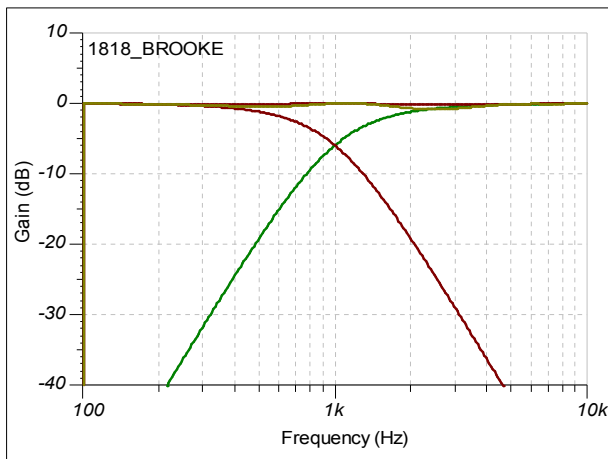


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+-----+
! 1818_BROOKE, 1 kHz (-5.9 dB) !
! ..... !
! sum variations : !
! axis           0.82 dB !
! coincid        0.22 dB !
! group delay    144 µS !
+-----+

! channels : !
! gain      Hz    lo/hi !
! -20 dB    490    54° !
! -5.9 dB   1k00    16° !
! -20 dB    2k06   -65° !
+-----+

```

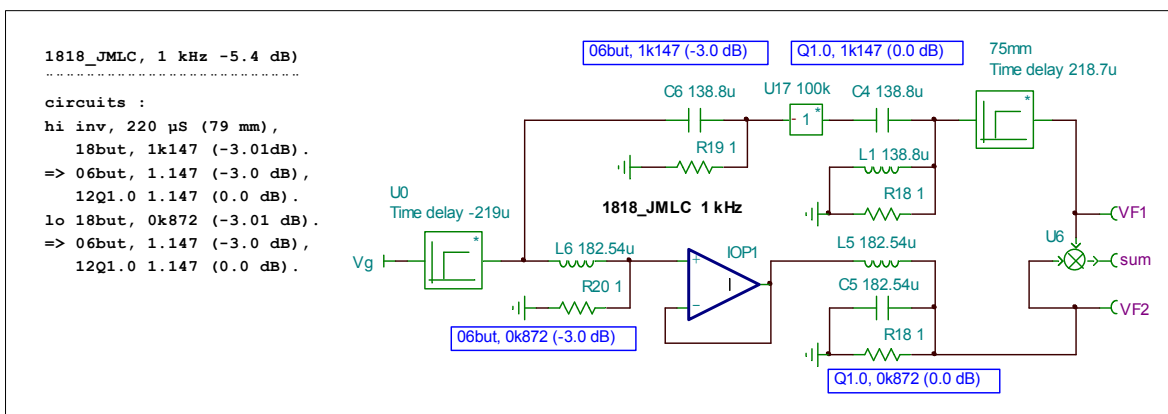
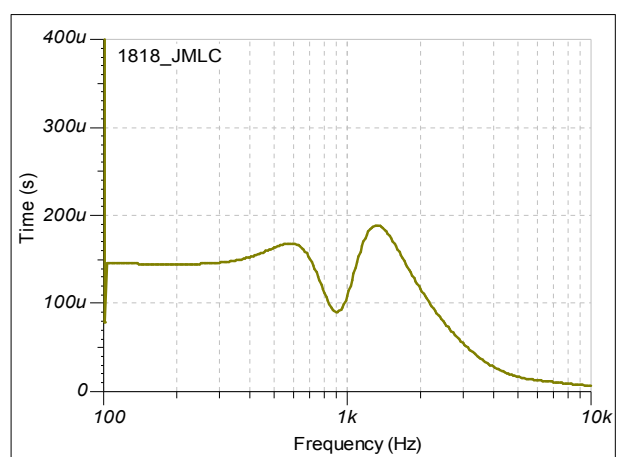
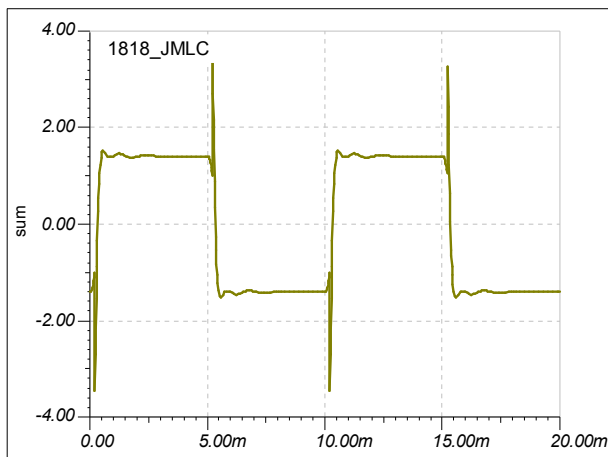
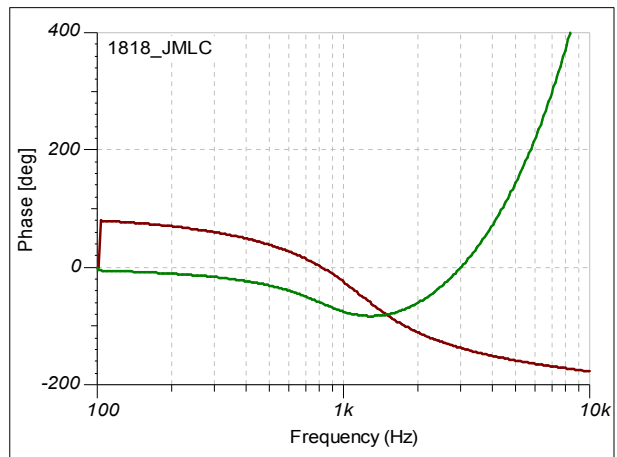
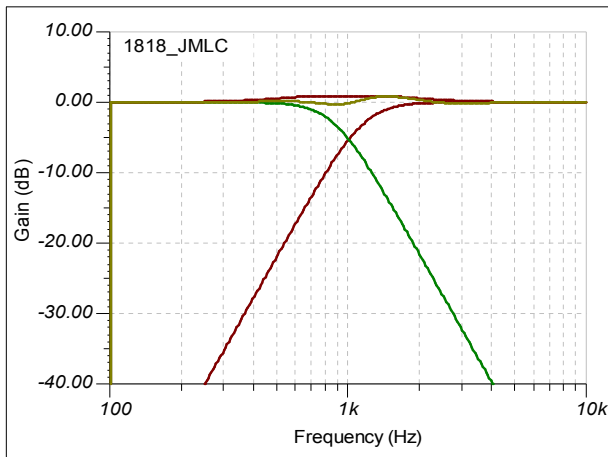


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+-----+
! 1818_JMLC, 1 kHz (-5.4 dB) !
! ..... !
! sum variations : !
! axis          0.97 dB !
! coincid       0.91 dB !
! group delay   186 µS !
+-----+
! channels : !
! gain      Hz    lo~hi !
! -20 dB    533    -69° !
! -5.1 dB   1k00    -51° !
! -20 dB    1k89    +48° !
!           1k50     0° !
+-----+

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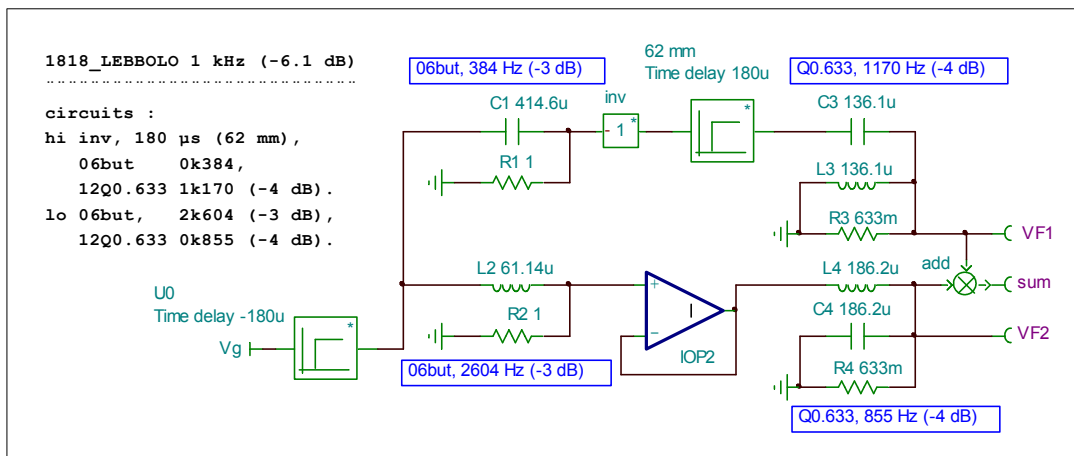
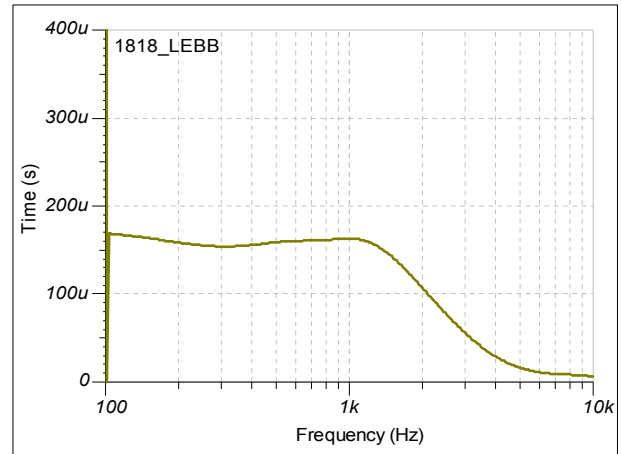
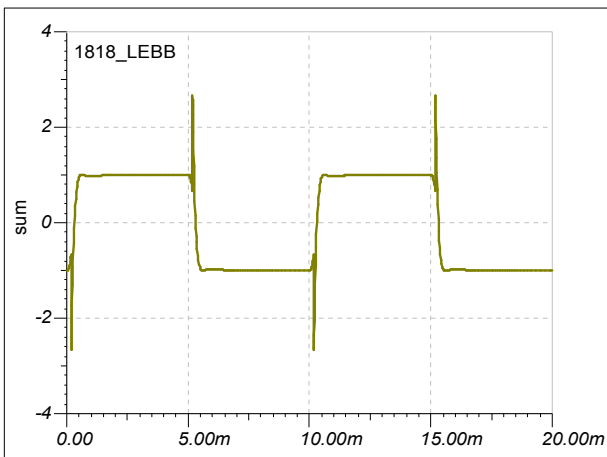
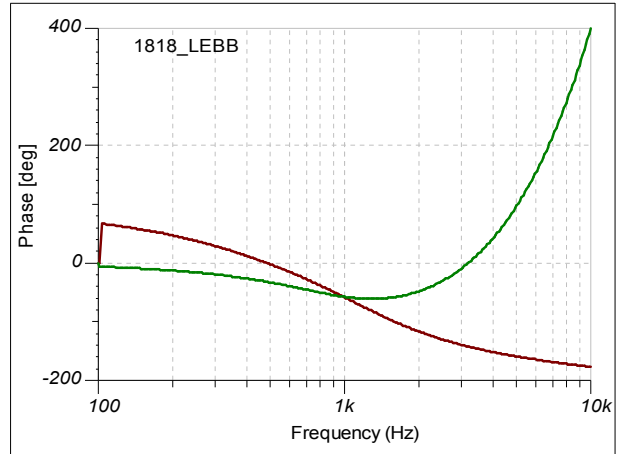
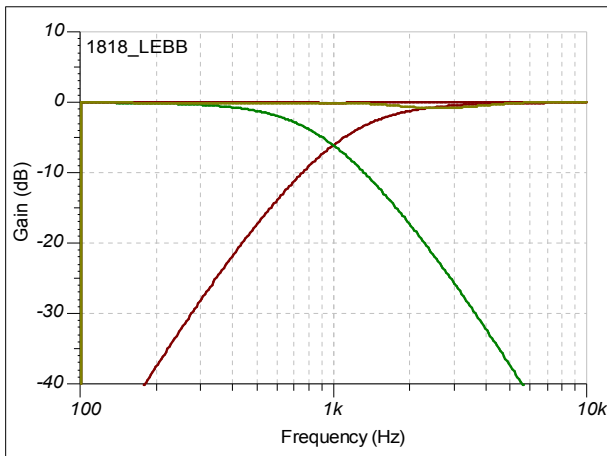
Jean-Michel Le Cleac'h (JMLC) a été le grand promoteur des filtres qu'il appelés "quasi-optimaux". La configuration qu'il a proposée est la première apparue sous cette dénomination et reste la plus connue.



```

+-----+
! 1818_LEB 1 kHz (-6.1 dB) !
! ..... !
! sum variations : !
! axe var          0.82 dB !
! coincid var      0.17 dB !
! grp delay 100-10k 164 µs !
+-----+
! channels : !
! gain      Hz    lo~hi !
! -20.0 dB   436   -36° !
!  -6.1 dB  1k000   +1° !
! -20.0 dB  2k300  +84° !
+-----+

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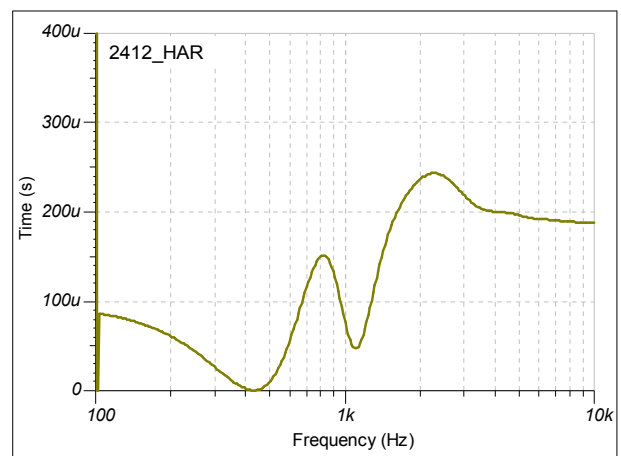
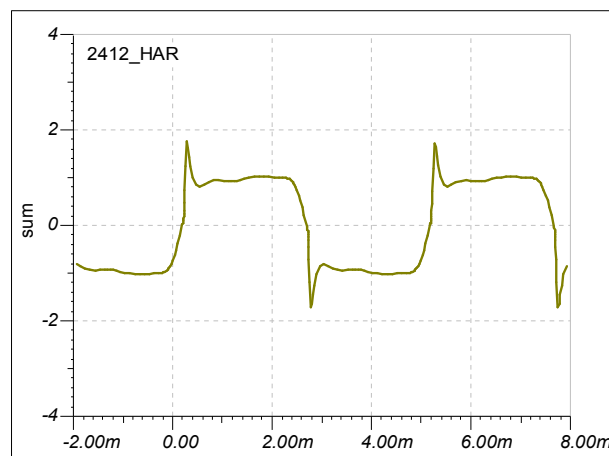
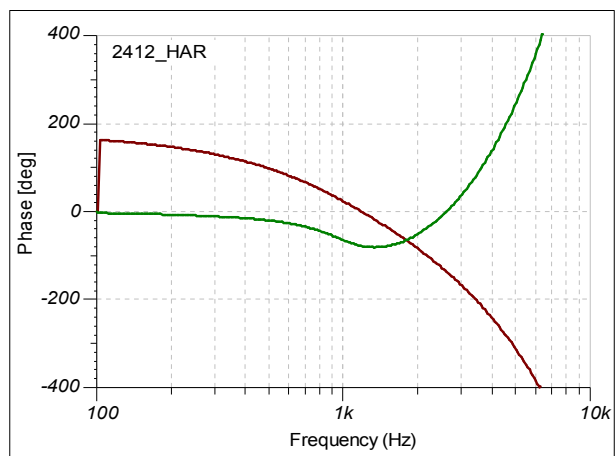
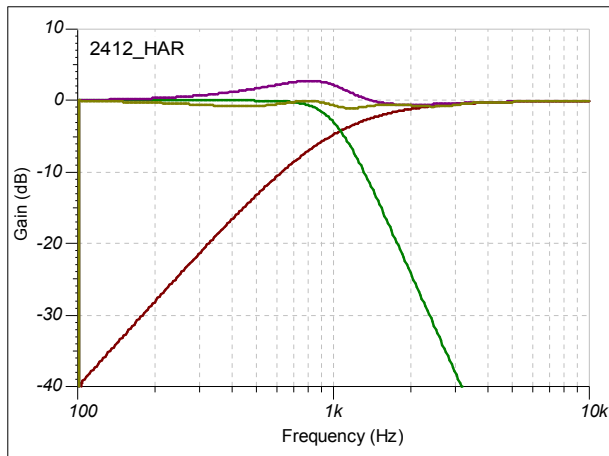


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+-----+
! 1224 HARSCH, 1.070 kHz (-4.3 dB) !
! ..... !
! sum variations : !
! axis ripple      1.07 dB !
! coincid ripple   3.32 dB !
! group delay      238 µs !
+-----+
! channels : !
! gain            Hz      lo/hi !
! -20.0 dB        325     139° !
! -4.3 dB         1k070    86° !
! -20.0 dB        1k770    3°  !
+-----+

```

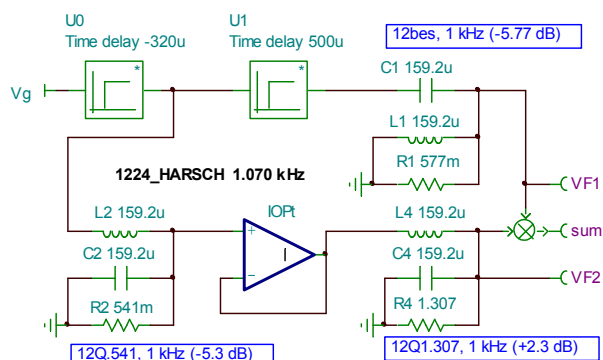
La configuration de Samuel Harsch vise une bonne reproduction des signaux carrés. Elle est connue depuis 2008 mais ce n'est que récemment que certains membres du forum DiyAudio s'y sont intéressés. Elle utilise deux filtres d'ordre pair de pentes différentes et n'a pas de polarité inversée sur l'un des voies.



```

2412_HARSCH, 1.070 kHz (-4.3 dB)
.....
circuits :
hi 500 µS (172 mm),
  12bes, 1k0 (-4.77 dB)
-> 12bes = 12Q0.57.
lo 24but, 1 kHz (-3.0 dB)
-> 24but =
  12Q0.541, 1k0 (-5.3 dB),
  12Q1.307, 1k0 (+2.3 dB).

```



```

+-----+
! 2424_JMLC, 1 kHz (-4.7 dB) !
! ..... !
! sum variations : !
! axis ripple      0.5 dB !
! coincid ripple   1.7 dB !
! group delay      139 µs !
+-----+
! channels : !
! gain      Hz      lo/hi !
! -20.0     535     -107° !
! -4.9      1k00     -66° !
! -20.0     1k63      4° !
+-----+

```

