SIM_1F_AC

* dsauersanjose@aol.com 1/15/09
* www.idea2ic.com

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*
*
*
*                                                  |‾‾| NLF
*                                                  |  |
*                              BSUM1  NHFP      |‾‾|  |
*                                               |  |  |
*                           |‾‾‾‾‾|      _||_  _|  |_/\ /\ /\ _
*        _____|     |____|  |__|      \/ \/ \/  |
*      |        R1          |     |         |‾‾|  CNLP      7/7
*      |_/\ /\ /\_|         |_____|         L1
*      |  \/ \/  |       ___ ___          |‾‾|    GHFP
*      |          VIN1   /\/\/\           |  |
*      |             |__|( )( )|__      |‾‾|  |
*   ___|             |           |      |  |  |
* |‾VIN|            _|_          |_     _|  |_/\ /\ /\ _
* |____|            C1 ||                |‾‾|  \/ \/ \/  |
*      |                ||        7/7    |  |         7/7
*      |_____|  |  CGHFP
*                                       CGHFP
*
*
*
*                                                  |‾‾| NHF
*                                                  |  |
*                           BSUM2 NLFP          |‾‾|  |
*                                               |  |  |
*                           |‾‾‾‾‾|      _/\ /\ /\_||_ _|  |
*        _____|     |___/\/ \/ \/   |  |    |
*      |        R2          |     |              CNL 7/7
*      |_/\ /\ /\_|         |_____|         L2
*      |  \/ \/  |       ___ ___          |‾‾|    GLFP
*      |          VIN2   /\/\/\           |  |
*      |             |__|( )( )|__      |‾‾|  |
*   ___|             |           |      |  |  |
* |‾VIN|            _|_          |_     _/\ /\ /\_||_ _|  |
* |____|            C2 ||                \/ \/ \/ |  |    |
*      |                ||        7/7            CNL 7/7
*      |_____|
*
*
```

```
.OPTIONS    GMIN = 1e-18
VIN         VIN    0    SIN( 0 50n 10k) AC 50n
R1          VIN    VIN1 1k
C1          VIN1   0    160u
L1          VIN1   0    160
BSUM1       NHFP   0    V  = V(VIN) + V(VIN1)*50
RNLP        NLF    0    10k
CNLP        NHFP   NLF  0.016u
RGHFP       GHFP   0    10k
CGHFP       VIN    GHFP 0.016u


R2          VIN    VIN2 30k
C2          VIN2   0    16n
L2          VIN2   0    16m
```

```
BSUM2           NLFP  0     V   = V(VIN)   +V(VIN2)*50
RLP             NLFP  NHF  10k
ClP             NHF   0     0.016u
RLF             VIN   GLFP 10k
ClF             GLFP  0     0.016u


.control
set pensize = 2

ac              dec       100       1       100k
plot            v(nhfp) v(nlfp)  loglog ylimit 10n 10u
plot            v(nhfp) v(nlfp)  v(ghfp) v(glfp) loglog ylimit 100p 10u
plot            mag(nlf) mag(nhf)    loglog


.endc

.end
```
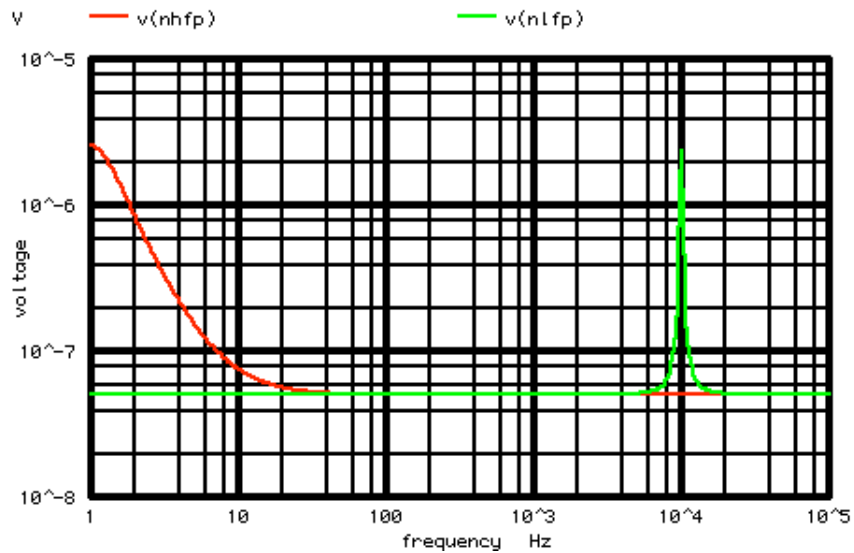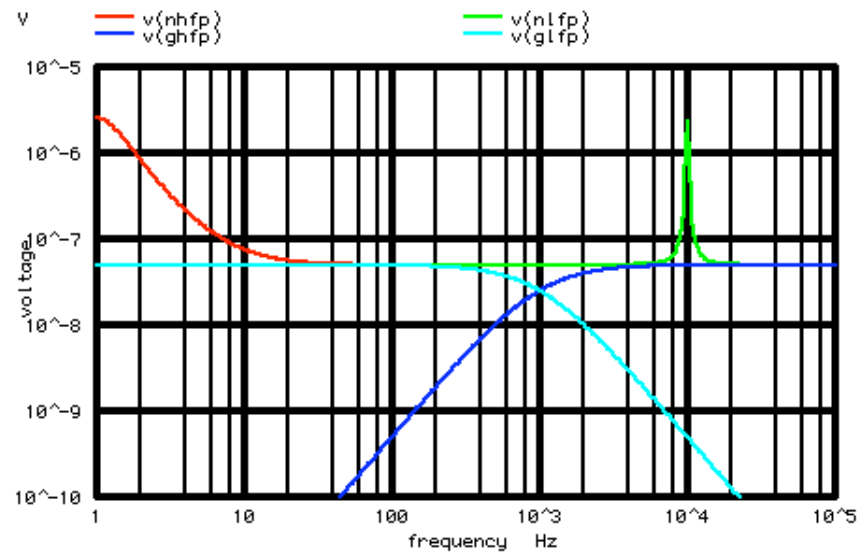
====================END_OF_SPICE============================

**The composite amplifier has consists of a normal
OP Amp which has normal offset and normal 1/f
noise and a chopper amplifier which has effective
modulated all undesirable signal sround a 10KHz
chopper frequency.**

The normal amplifier is going to dominate the gain above 1kHz while the chopper will dominate the gain below 1kHz.

The dominate gain of the chopper will be attenuating both offset and 1/f noise of the normal Op Amp at frequencies below

1kHz. It will be at the flatband noise of
the chopper input stage which is defined
by is dynamic input impedance in terms of
1/gm or Rgm.

V   ── mag(nlf)   ── mag(nhf)

10^-6

10^-7

voltage

10^-8

10^-9

10^-10
         1   10   100   10^3   10^4   10^5
                        frequency   Hz
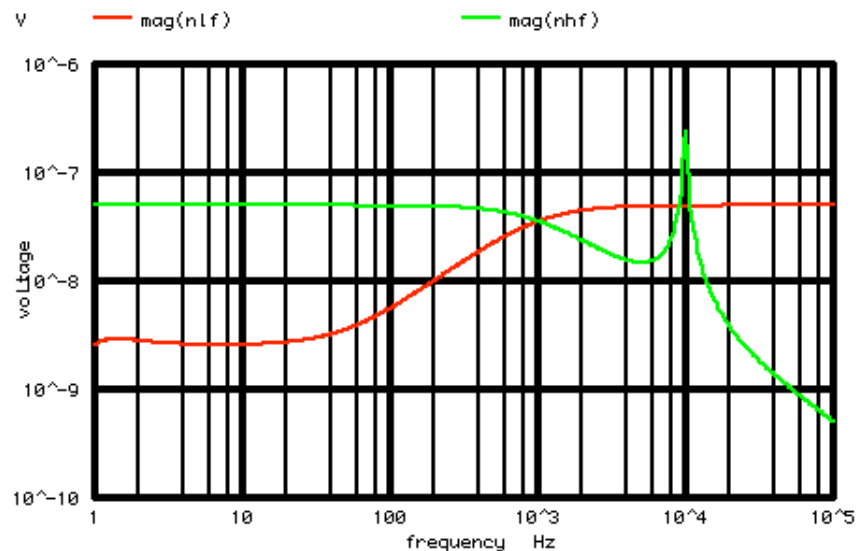
Above 1kHz the normal Op Amps flat band noise
will no longer be attentuated by the chopper
and the modulated undesirable signal from the
chopper will tend to be attenuated by it own integrator.
At one time the LMC2001 set up in just this way
to verify what the spread spectrum would do what
it was expected to do. As expected, the spread spectrum
would somewhat reduce and spread out the undesireable
signal. But there was also no reason why the clock
frequency could not be increased to effectively bury
the chopper noise in flatband noise.

So at one time the LMC2001 showed that it was possible
for both amplifiers in a composite amplifier to
bury their 1/f noise and offset in each other's flatband noise.
If the input impedances which define the flatband noise
are about the same, then the noise appears to be flat
from DC to the unity gain of the normal op amp.

The goal was not to just frequency shift the 1/f noise.
At one time it was possible to actually remove all of it.