

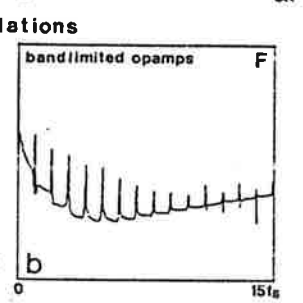
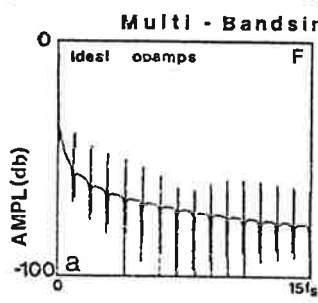
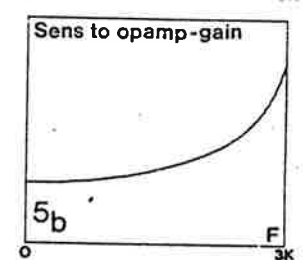
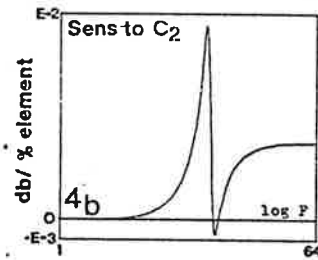
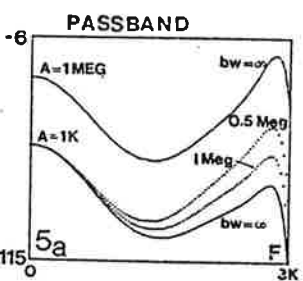
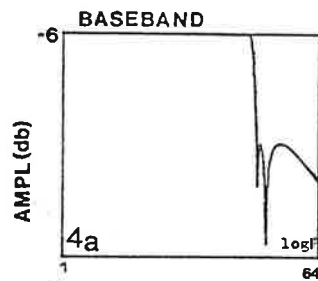
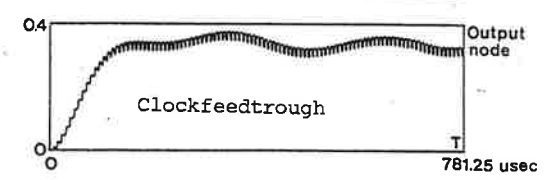
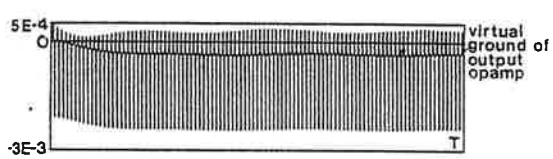
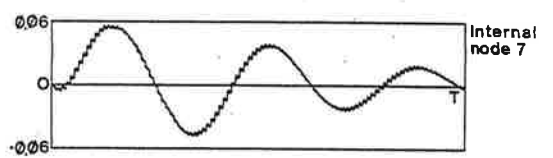
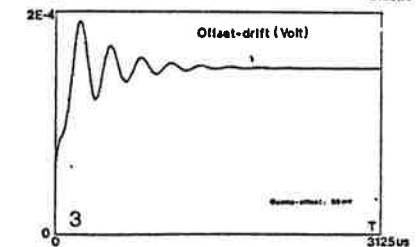
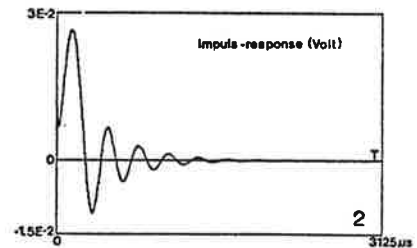
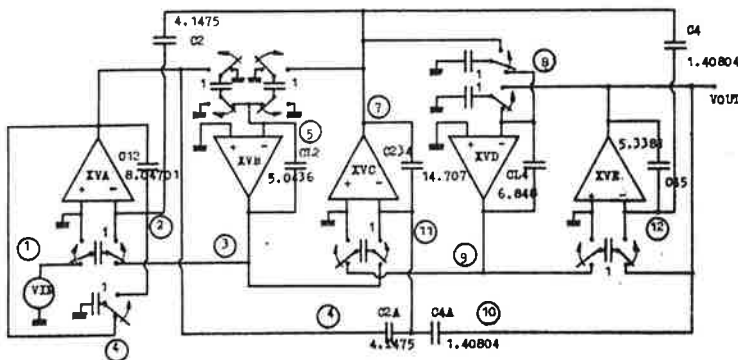
EXAMPLES OF ANALYSIS OF S.C.-CIRCUITS WITH DIANA

L.Claesen, J.Rabaey, H.De Man, J. Vandewalle
 available from : LIISCO-LR&D, Groot Begijnhof, Benedenstraat 59, 3000 Leuven, Belgium
 SILVAR-LISCO, 3172 Porter Drive, Palo Alto, CA. 94304, U.S.A.

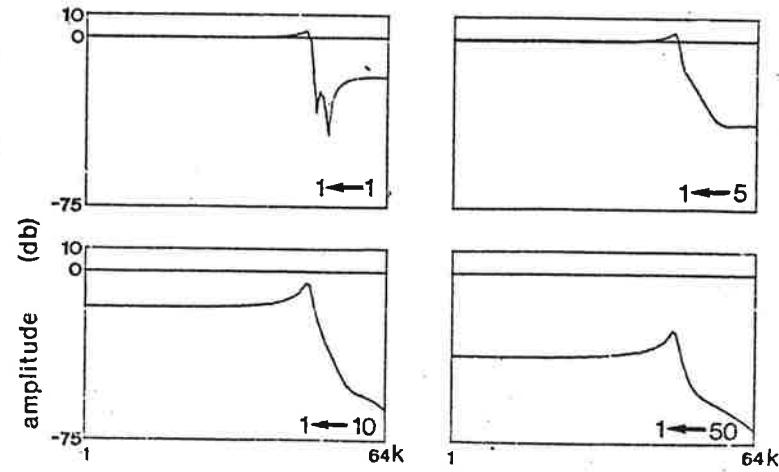
016/229220
 415/8562525

The DIANA program is a general top-down design tool for S.C.-circuits in the time- and frequency domain. It allows the analysis of transferfunctions, sensitivities to network elements and to parasitic node capacitances. Noise, finite switch resistances, finite opamp bandwidths and gains, non linear effects, clockfeedthrough, opamp offset, aliasing, continuous I/O-couplings can be taken into account.

Example 1 : fifth order elliptic filter.



noise transfer functions
 from opamp XVA to the output



Example 2: 4-phase fifth order elliptic filter.
Hierarchical input description by the use of the
macro description language (MDL) of DIANA.

```
ESAT  FIFTH ORDER ELLIPTICAL LOWPASS FILTER
;
; J.A. NOSSEK, G.C. TEMES
; IEEE VOL. CAS-27 NO.6, JUNE 1980 PP.481-491
;

.SCFREQ NLIN=400 FSTART=0 FSTOP=32KHZ FSAH=32KHZ
.SENS NUDE=B1
```

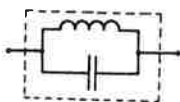
```
; CLOCKING
```

```
INPUT CL1 V-T=0 0 2 1 2 2 0 3 0 8 CYC
INPUT CL2 V-T=0 0 0 2 3 2 4 0 5 0 8 CYC
INPUT CL3 V-T=0 0 0 4 2 5 2 6 0 7 0 8 CYC
INPUT CL4 V-T=2 0 0 1 0 6 2 7 2 8 CYC
INPUT CL14 V-T=2 0 2 2 0 3 0 6 2 7 2 8 CYC
INPUT CL23 V-T=0 0 0 2 2 3 2 6 0 7 0 8 CYC
```

```
$MACRO RESONATOR(<NR>,<IN>,<OUT>,<CVAL>)
```

```
; LC-RESONATOR <NR>
```

```
XVA<NR> F<NR> 0 0 F<NR> 1K
CB<NR> A<NR> B<NR> <CVAL>
CC<NR> C<NR> D<NR> <CVAL>
CD<NR> E<NR> F<NR> <CVAL>
S2A<NR> <IN> C<NR> CL1 U VT=1
S2B<NR> <IN> A<NR> CL3 U VT=1
S2C<NR> <OUT> B<NR> CL3 U VT=1
S2D<NR> <OUT> D<NR> CL1 U VT=1
S2E<NR> C<NR> U CL23 U VT=1
S2F<NR> A<NR> 0 CL14 U VT=1
S2G<NR> B<NR> E<NR> CL4 U VT=1
S2H<NR> D<NR> E<NR> CL2 U VT=1
S2I<NR> D<NR> F<NR> CL3 U VT=1
S2J<NR> B<NR> F<NR> CL1 U VT=1
$END RESONATOR
```



```
$MACRO RESISTOR(<NR>,<IN>,<OUT>,<RVAL>)
```

```
; RESISTOR <NR>
```

```
CE<NR> G<NR> H<NR> <RVAL>
S2K<NR> <IN> G<NR> CL1 U VT=1
S2L<NR> <IN> H<NR> CL3 U VT=1
S2M<NR> <OUT> G<NR> CL3 U VT=1
S2N<NR> <OUT> H<NR> CL1 U VT=1
$END RESISTOR
```



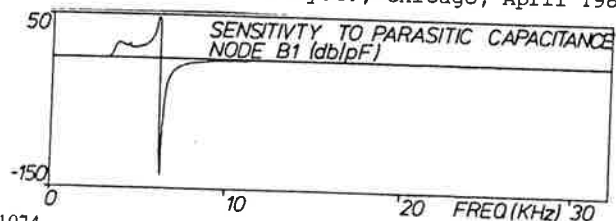
```
; CIRCUIT DESCRIPTION
```

```
VIN 1 0 1
CALL RESISTOR(1,1,2,1.661P)
CALL RESISTOR(2,4,0,1.661P)
CALL RESONATOR(1,2,3,1P)
CALL RESONATOR(2,4,3,1.577P)
C1 2 0 4.382P
C2 2 3 1.763P
C3 3 0 14.382P
C4 3 4 6.929P
C5 4 0 6.162P
PRINT 4
```

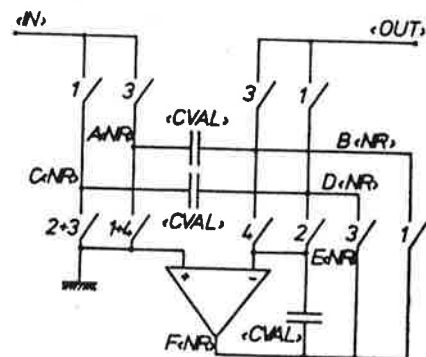
```
.END
```

References.

1. H. De Man, J. Rabaey, G. Arnout and J. Vandewalle, IEEE J. of Solid State Circ., Vol. SC-15, no. 2, pp. 190-200, April 1980.
2. J. Vandewalle, H. De Man and J. Rabaey, IEEE J. of Circ. and Syst., Vol. CAS-28, pp. 186-195, March 1981.
3. J. Vandewalle, H. De Man, J. Rabaey, Intern. Journal of Circuit Theory and Applications, Vol. 9, No. 1, pp. 77-88, Jan. 1981.
4. J. Vandewalle, L. Claesen, H. De Man, IEEE Symp. on Circ. and Syst., Chicago, April 1981.
5. J. Rabaey, J. Vandewalle, H. De Man, IEEE Symp. on Circ. and Syst., Chicago, April 1981.



LC - RESONATOR



RESISTOR

