

## Using MMICAD to Design Lumped Element Filters

This application note shows how easy it is for users of MMICAD to synthesize a broad range of filter designs.

Starting with MMICAD Version 5.08, you can now create lumped element filters with the aid of FAISYN™, a stand alone program accessed from the LINKS menu within MMICAD. All you need to do is specify:

- the terminating impedances;
- the number of transfer function poles;
- the response characteristic (Chebyshev, Butterworth or user-defined).

FAISYN will then synthesize the appropriate ladder network that will realize the desired filter characteristic. Users may also transform low pass designs into bandpass or highpass circuits. In addition, the designer may shift the cutoff frequency of low pass designs.

To illustrate, we will design a 5 pole, 1 to 3 GHz Chebyshev bandpass filter. Ripple in the passband is specified not to exceed 0.1 dB, and both the source and load terminating impedances are set at 50 ohms.

The ladder network synthesized by FAISYN is shown in Figure 1, the MMICAD circuit file written by FAISYN is shown in Figure 2. The results of the MMICAD simulation (shown in Figures 3-5) clearly show that all the design goals have been met.

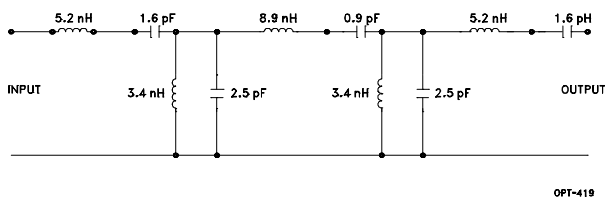


Figure 1

```

===== FILTER SYNTHESIS PROGRAM V1.0 =====
!
! Chebyshev Band Pass Filter
! N= 5
! Lower 3 dB frequency= 1.0000*1E9
! Upper 3 dB frequency= 3.0000*1E9
! FILENAME= BANDPASS.CKT
!
!===== (c) 1992: OPTOTEK / K.FAISON =====

GLOBAL
DIM  FREQ=1E9 CAP=1E-12 IND=1E-9

CKT
SLC 1 2 L= 5.1777 C= 1.6307
PRLC 2 0 L= 3.4096 C= 2.4764 R= 1E10
SLC 2 3 L= 8.9169 C= 0.9469
PRLC 3 0 L= 3.4096 C= 2.4764 R= 1E10
SLC 3 4 L= 5.1777 C= 1.6307
DEF2P 1 4 FILTER

RES 1 0 R= 50
DEF1P 1 rsource

RES 1 0 R= 50
DEF1P 1 rload

TERM
FILTER rsource RLOAD

FREQ
SWEEP 0 6 0.007

OUT
FILTER DB[S21] TRANS1
FILTER DB[S11] TRANS1 R
FILTER DB[S21] TRANS2
FILTER DB[S11] TRANS2 R
FILTER S11 SMITH
FILTER SPAR SPAR

GRID
RANGE 0 6 1
TRANS1 -50 0 10 R -60 0
RANGE 1.0000 3.0000 0.4000
TRANS2 -5 0 0.5 R -60 0

LABEL
Chebyshev Bandpass filter
    
```

Figure 2

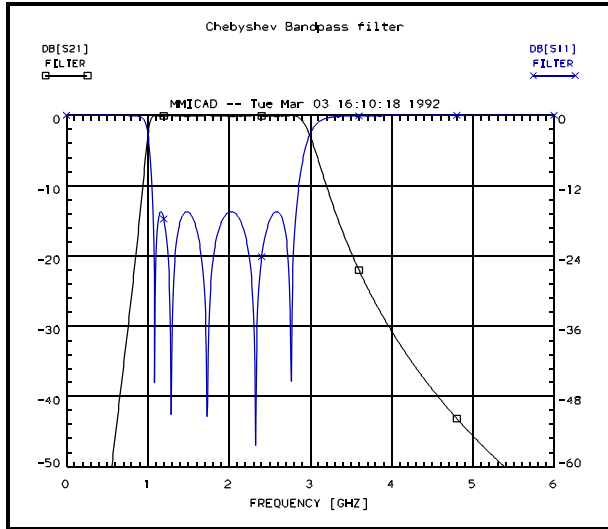


Figure 3

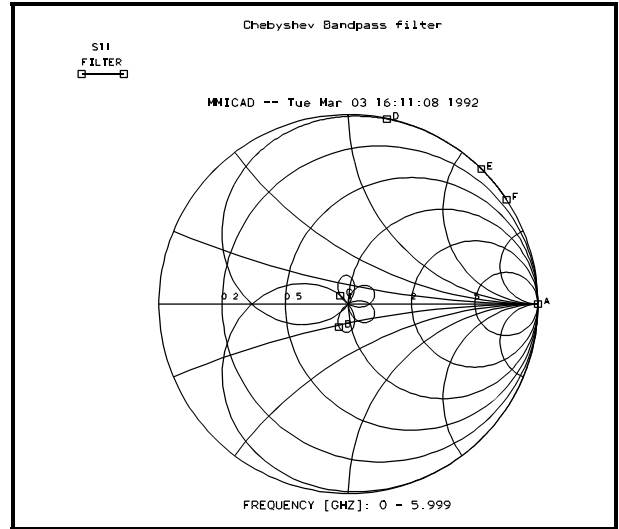


Figure 5

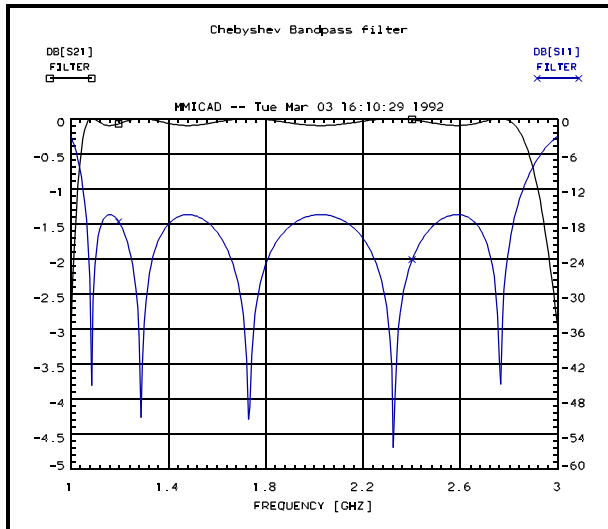


Figure 4