gEDA/gaf RF Cascade Symbols and Netlister

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1 Overview

This document describes the symbol library and gnetlist backend which support driving RF Cascade (http://rfcascade.sourceforge.net) simulations from the gEDA/gaf system. Cascade is a noise figure and distortion analysis tool geared towards radio receiver design.

The basic steps involved with using gEDA as the frontend for Cascade simulations are:

1. Create schematics of the circuit.

2. Extract the netlist.

3. Run Cascade.

2 Requirements

You will need the following programs to be installed.

1. A recent version of gEDA/gaf. To see if your version is recent enough, see if the directory `$prefix/share/gEDA/sym/cascade` exists. `$prefix` is the installation prefix for gEDA on your system.

2. RF Cascade. The executable is usually called `cascade`. If you do not have Cascade available on your system, you will need to get a copy from http://rfcascade.sourceforge.net.

3 Creating Schematics

When creating a block diagram in the `gschem` schematic editor, use only the symbols from the cascade library. Every block diagram must have a "cascade-source" element. In addition, the block diagram must be a simple cascade. No parallel paths or branches are allowed.

All instances must have a unique reference designator. For a receiver block diagram, this is often times best achieved by manually entering them. The only restriction on reference designator names is that they contain no spaces. A descriptive name such as "RF_Filter" or "First_Mixer" is useful as it will show up in the cascade output report.

4 Extracting the Cascade Input File

To extract the Cascade input file, run

```
gnetlist -g cascade -o test.cas file1.sch [file2.sch ...]
```

For the example file contained in this archive, you can run:

```
gnetlist -g cascade -o example.cas example.sch
```

The netlist will be left in `example.cas`.

5 Running Cascade

Cascade is exceptionally simple to run. Just run

```
cascade example.cas > example.out
```

to run the analysis on the system contained in the file `example.cas` and write the results to the file `example.out`. Refer to the Cascade documentation for complete details.

A Symbols in the Library

Please note that all instances must have the `refdes=` attribute set.

A.1 Sources (cascade-source)

Source.
Attributes:

- **C**=Carrier level in dBm. Optional.

- **CN0**=Carrier to Noise Spectral Density Ratio in dBm/Hz. Optional.

- **CN**=Carrier to Noise Ratio in dB. Optional.

- **BW**=Signal Bandwidth in Hz. Optional, but required if `CN=` is used.

A.2   Defaults (cascade-default)

This symbol sets the default impedance levels as well as the correlation coefficient used for third order distortion calculations. There are two versions of this symbol. One is used to set the defaults at the beginnng of the definition. The other can be placed in series with the cascade to change the defaults part way through. This is useful if you wish to change impedance levels in the middle of the receiver chain.
Attributes:

- **RIN**=Default block input resistance in Ohms. Optional.

- **ROUT**=Default block output resistance in Ohms. Optional.

- **RHO**=Default third order distortion correlation coefficient. Optional.

A.3   Elements

Cascade characterizes each block in a system by its gain and optionally noise figure and third order intercept point. As such, there is no distinction between various elements such as amplifiers, filters, and mixers. The gEDA/gaf RF Cascade symbol library contains different symbols for clarity in the diagram only. The currently available element symbols are: Attributes:

cascade-amp	Amplifier
cascade-filter	Filter
cascade-mixer	Mixer
cascade-transformer	Transformer

Table 1: Element Types

- Gain is specified by one of the following:

  - **G**=Power gain in dB.
  - **GP**=Power gain in dB.
  - **GV**=Voltage gain in dB.

- **NF**=Noise Figure in dB. Optional.

- **IIP3**=Input Third Order Intercept Point in dBm. Optional.

- **RIN**=Block input resistance in Ohms. Optional.

- **ROUT**=Block output resistance in Ohms. Optional.

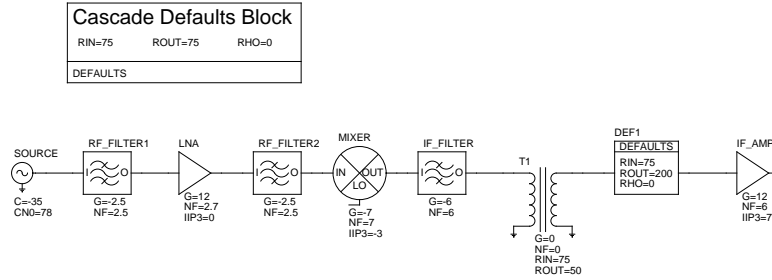- **RHO**=Third order distortion correlation coefficient. Optional.

Figure 1: Simple Receiver Signal Chain Block Diagram

B   Example

This appendix provides a simple example of the entire process of generating a schematic, producing a Cascade input file, running an analysis and looking at the result.

B.1   Example Schematics

Figure 1 shows the schematic of a simple receiver signal chain. Figure 2 shows the contents of the `example.cas` file.

B.2   Netlist the Design

To netlist the design, run:

```
gnetlist -g cascade example.cas example.sch
```

B.3   Run the Analysis

Run the analysis with:

```
cascade example.cas
```

```
# Cascade (http://rfcascade.sourceforge.net)
# Created with gEDA/gnetlist

# Initial global defaults
defaults RIN=75 ROUT=75 RHO=0

source C=-35 CN0=78
RF_FILTER1 G=-2.5 NF=2.5
LNA G=12 NF=2.7 IIP3=0
RF_FILTER2 G=-2.5 NF=2.5
MIXER G=-7 NF=7 IIP3=-3
IF_FILTER G=-6 NF=6
T1 G=0 NF=0 RIN=75 ROUT=50
defaults RIN=75 ROUT=200 RHO=0
IF_AMP G=12 NF=6 IIP3=7

# End of netlist created by gEDA/gnetlist
```

Figure 2: Example RF Cascade Input File, `example.cas`

C   Document Revision History

| December 3rd, 2003 | Created cascade.tex |