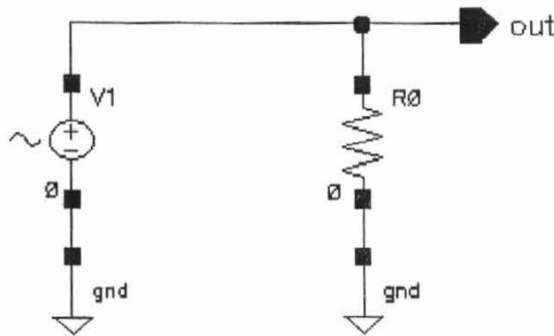


# Appendix A

## *Setting of Analog Options for Spectre Simulator*

### Setting and strategy

Simulator options need to be set properly for getting correct values of THD. For this purpose we used a setup, shown in Fig. A.1. A pure sinusoidal source in parallel with a resistor was simulated and the THD was observed at the output. The Analog Simulator Option and the Transient Analysis options were studied [54].



**Figure A.1 Circuit for THD of Pure Sine Wave**

### A.1 Analog Simulation Options

In the analog simulation options, the options such as RELTOL (Relative Tolerance), IABSTOL (Current Absolute Tolerance Convergence Options), and

VABSTOL (Voltage Absolute Tolerance Convergence Options) have affected the THD calculation. It is studied by following results.

#### A.1.1) RELTOL (Relative Tolerance)

**Table A.1 Effect of RELTOL on THD**

Frequency	Amplitude	RELTOL	THD (db)
10khz	50mv	1e-2	-47.64
10khz	50mv	1e-3	-47.64
10khz	50mv	1e-4	-51.72
10khz	50mv	1e-5	-59.42
10khz	50mv	1e-6	-73.91
10khz	50mv	1e-7	-81.61
10khz	50mv	1e-8	-87.11
10khz	50mv	1e-9	-76.93

From Table A.1, it is observed that THD value increases if RELTOL value is decreased till 1e-8. RELTOL value can be increased only up to 0.01.

#### A.1.2 VABSTOL and IABSTOL

**Table A.2 Effect of VABSTOL and IABSTOL on THD**

Frequency	Amplitude	Accuracy Options	RELTOL	VABSTOL	IABSTOL	THD (db)
10khz	50mv	Moderate	1e-5	1e-9	1e-15	-59.42
10khz	50mv	Moderate	1e-6	1e-9	1e-15	-73.91
10khz	50mv	Moderate	1e-6	1e-8	1e-14	-73.68
10khz	50mv	Moderate	1e-6	1e-10	1e-15	-73.91
10khz	50mv	Moderate	1e-6	1e-10	1e-16	-73.81
10khz	50mv	Moderate	1e-6	1e-11	1e-15	-73.91
10khz	50mv	Moderate	1e-6	1e-11	1e-11	-73.81

Also it is observed from Table A.2 that **RELTOL** accuracy option affects THD value more as compared to **VABSTOL** and **IABSTOL** accuracy options for considered accuracy range of **VABSTOL** and **IABSTOL**.

## A.2 Transient Analysis Options

In case of **Transient Analysis Options** the **conservative** accuracy options leads to slow simulations but it gives more accurate results as compared to **moderate** accuracy options (Table A.3).

**Table A.3 Effect of Accuracy Options on THD**

Frequency	Amplitude	RELTOL	Accuracy Options	THD (db)
10khz	50mv	1e-6	Moderate	-73.91
10khz	50mv	1e-6	Conservative	-86.27
10khz	50mv	1e-7	Moderate	-81.62
10khz	50mv	1e-7	Conservative	-86.22
10khz	50mv	1e-8	Moderate	-87.11
10khz	50mv	1e-8	Conservative	-86.22

Changing **RELTOL** from 1e-3 to 1e-6 and “transient accuracy option” from moderate to conservative give acceptable accuracy in THD values.

In continuation the simulator form for Analog and Transient Analysis options as well as corresponding values of parameters are given in the next section.

## A.3 Simulator Options

In the Analog Design Environment (simulator window) go to:-

Simulation → options → analog

And then check for the following accuracy options (Fig. A.2 (a),(b),(c),(d),(c)).

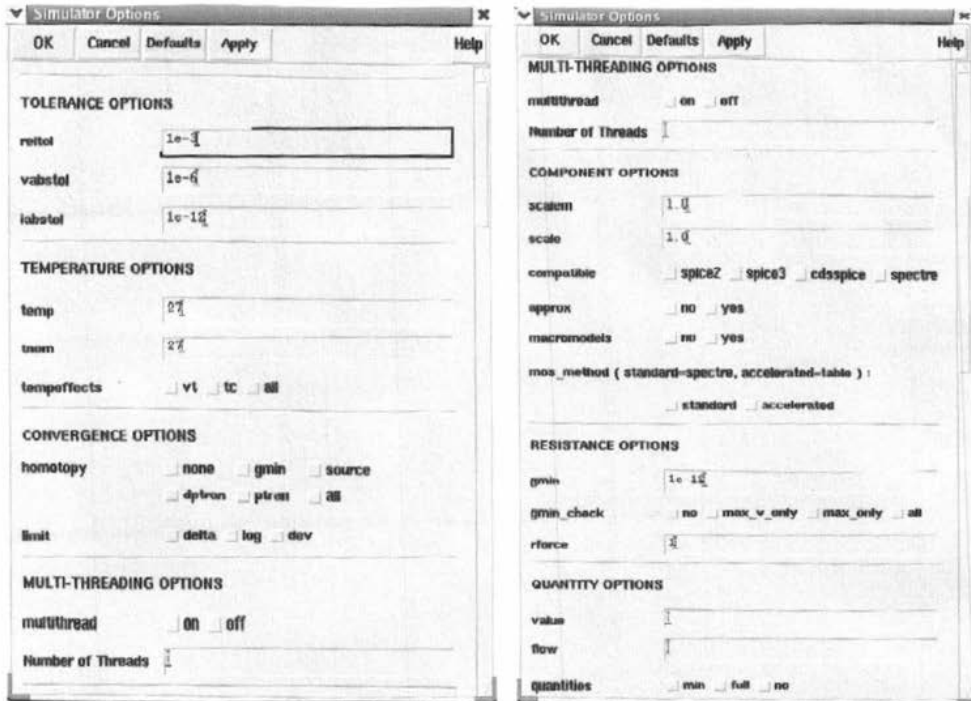


Figure A.2 (a) Analog simulator option setup

Figure A.2 (b) Analog simulator option setup

1) TOLERANCE OPTIONS:

Reltol → 1e-6

Vabstol → 1e-9

Labstol → 1e-15

2) CONVERGENCE OPTIONS

Homotopy → all

3) COMPONENT OPTIONS

Compatible → spectre (If using spectre as simulator)

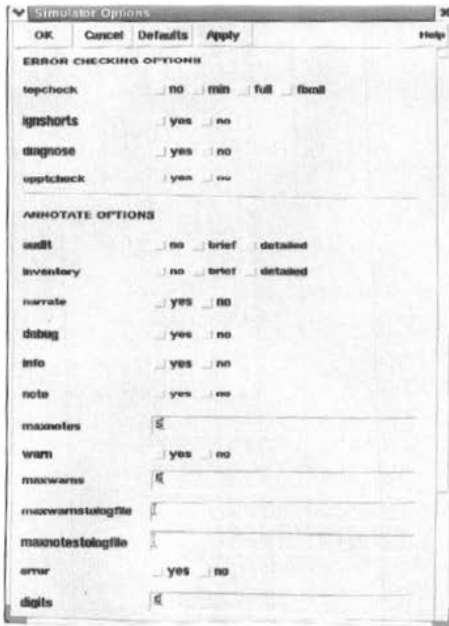


Figure A.2(c) Analog simulator option setup

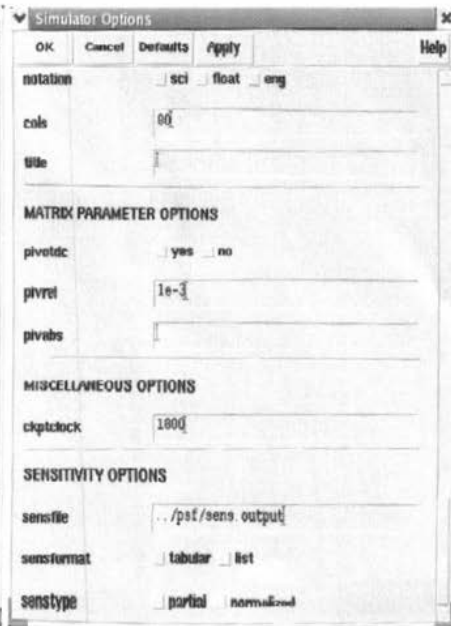


Figure A.2(d) Analog simulator options setup

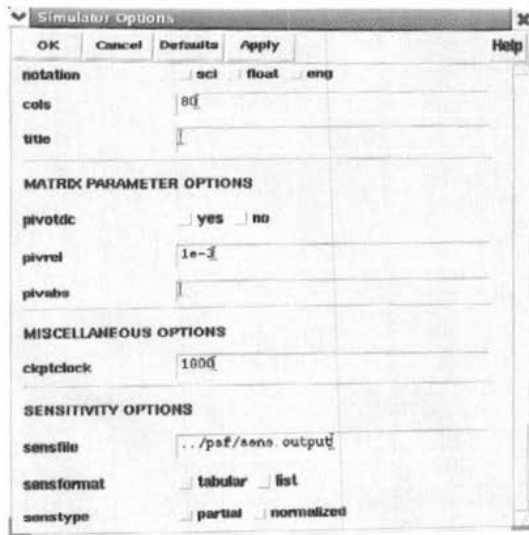


Figure A.3(c) Analog simulator options setup

#### 4) RESISTANCE OPTIONS

$gmin \rightarrow 1e-15$

$gmin\_check \rightarrow max\_v\_only$

#### 5) MATRIX PARAMETER OPTIONS

$Pivrel \rightarrow 1e-5$

### A.4 TRANSIENT ANALYSIS OPTIONS

Transient Analysis options are given below (Fig. A.4 (a),(b),(c),(d))

Accuracy Defaults: **Conservative**

#### 1) INITIAL CONDITION PARAMETERS

$Skipdc \rightarrow no$

#### 2) INTEGRATION METHOD PARAMETER

$Method \rightarrow gear2only$

#### 3) ACCURACY PARAMETER

$Relref \rightarrow Point\ local$

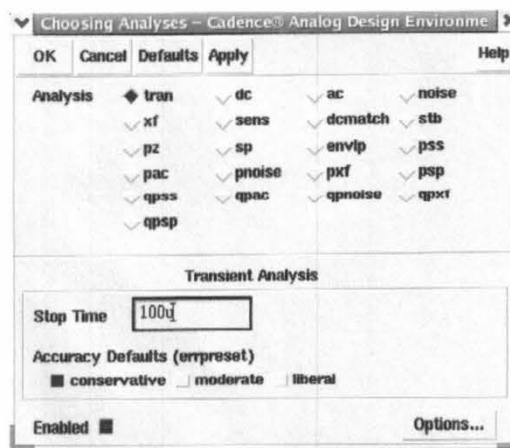


Figure A.4 (a) Transient analysis setup

#### 4) ANNOTATION PARAMETER

Annotate → Status

#### 5) NEWTON PARAMETERS

Maxiters → 50

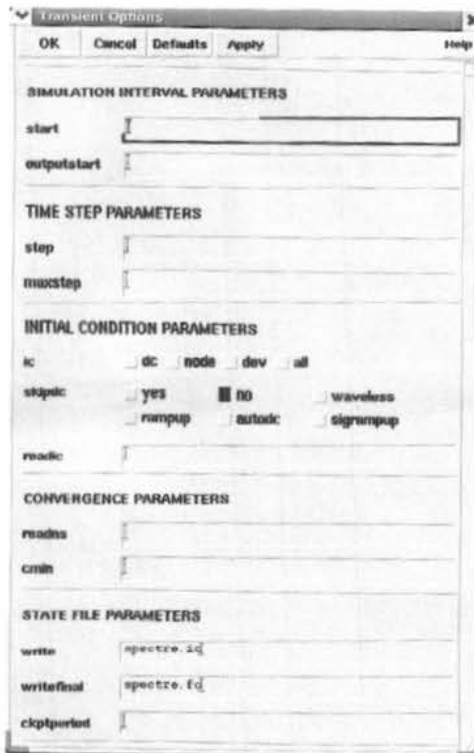


Figure A.4 (b) Transient simulator option setup



Figure A.4 (c) Transient simulator option setup

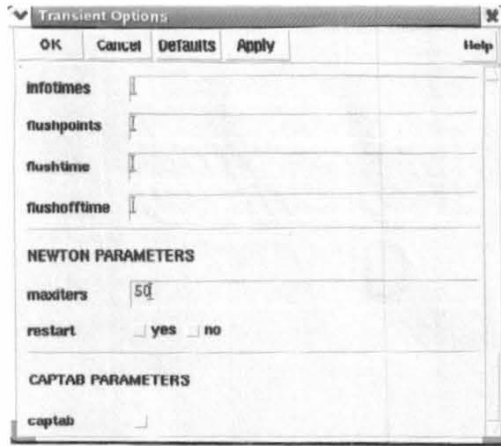


Figure A.4 (d) Transient simulator options setup

