SiMKit
Release Notes

for SiMKit version 3.3

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Preface

These are the release notes for SiMKit version 3.3. All changes with respect to SiMKit 3.2 are reported in these release notes.

Overview

SiMKit is a simulator-independent compact transistor model library.

Simulator-specific connections are handled through so-called adapters that provide the correct interfacing to:
- Spectre, the Cadence circuit simulator
- Pstar, the NXP circuit simulator
- ADS, Agilents circuit simulator

The SiMKit library contains the most recent versions of the NXP transistor models. The following two tables list the SiMKit models. The first lists the 'real' SiMKit models, the second lists the pre-SiMKit models, for which only a Pstar or Spectre implementation is available. For a full description please check:

http://www.nxp.com/models/

In the following tables e/g stands for electric/geometric, t stands for self-heating and s stands for substrate model.

Table 1: Real SiMKit models

model	level	Pstar	Spectre	ADS	e/g	t	s
juncap	1	juncap	juncap	juncap	e	no	no
juncap	200	juncap	juncap200	juncap200	e	no	no
psp	102	pspe	psp102e	psp102e	e*	no	no
psp	1020	psp	psp1020	psp1020	g*	no	no
psp	1021	psp	psp1021	psp1021	g*	no	no
pspnqs	102	pspnqse	pspnqs102e	pspnqs102e	e*	no	no
pspnqs	1020	pspnqs	pspnqs1020	pspnqs1020	g*	no	no
pspnqs	1021	pspnqs	pspnqs1021	pspnqs1021	g*	no	no
psp	103	psp	psp103	psp103	eg	no	no
pspnqs	103	pspnqs	pspnqs103	pspnqs103	eg	no	no
modella	500	tpl	bjt500	bjt500	e	no	no
modella	500	tplt	bjt500t	bjt500t	e	yes	no
mextram	504	tns/tps	bjt504	bjt504	e	no	yes
mextram	504	tnst/tpst	bjt504t	bjt504t	e	yes	yes
mextram	504	tn/tp	bjtd504	bjtd504	e	no	no
mextram	504	tnt/tpt	bjtd504t	bjtd504t	e	yes	no
mos	1100	mne/mpe	mos1100e	mos1100e	e	no	no
mos	1100	mn/mp	mos1100	mos1100	g	no	no
mos	1101	mne/mpe	mos1101e	mos1101e	e	no	no
mos	1101	mnet/mpet	mos1101et	mos1101et	e	yes	no
mos	11010	mn/mp	mos11010	mos11010	g	no	no
mos	11010	mnt/mpt	mos11010t	mos11010t	g	yes	no
mos	11011	mn/mp	mos11011	mos11011	g	no	no
mos	11011	mnt/mpt	mos11011t	mos11011t	g	yes	no
mos	1102	mne/mpe	mos1102e	mos1102e	e	no	no
mos	1102	mnet/mpet	mos1102et	mos1102et	e	yes	no
mos	11020	mn/mp	mos11020	mos11020	g	no	no
mos	11020	mnt/mpt	mos11020t	mos11020t	g	yes	no
mos	11021	mn/mp	mos11021	mos11021	g	no	no
mos	11021	mnt/mpt	mos11021t	mos11021t	g	yes	no
mos	2001	mne/mpe	mos2001e	mos2001e	e	no	no
mos	2001	mnet/mpet	mos2001et	mos2001et	e	yes	no
mos	2001	mn/mp	mos2001	mos2001	g	no	no
mos	2001	mnt/mpt	mos2001t	mos2001t	g	yes	no
mos	2002	mne/mpe	mos2002e	mos2002e	e	no	no
mos	2002	mnet/mpet	mos2002et	mos2002et	e	yes	no
mos	2002	mn/mp	mos2002	mos2002	g	no	no
mos	2002	mnt/mpt	mos2002t	mos2002t	g	yes	no
mos	3100	mn/mp	mos3100	mos3100	e	no	no
mos	3100	mnt/mpt	mos3100t	mos3100t	e	yes	no
mos	40	mn/mp	mos40	mos4000	e	no	no
mos	40	mnt/mpt	mos40t	mos4000t	e	yes	no

* For PSP the electrical model is referred to as the local model and the geometrical model as global.

Table 2: Other (older) models (Pstar and Spectre specific)

model	level	Pstar	Spectre
diode	500	d	dio500
mos	3002	mn/mp	mos3002
mos	902	mn/mp	mos902
mos	902	mne/mpe	-
mos	903	mn/mp	mos903
mos	903	mne/mpe	-
mextram	503	tn/tp	btj503
mextram	503	tns/tps	bjt503
lpnp	301	tpl	bjt301
mos	705	mne/mpe	mos705

Release notes

The release notes can be obtained by entering the following command:

```
cadenv -q simkit
```

1 - Improvements

ADS specific improvements:

SiMKit supports ADS 2009.

SiMKit general improvements:

The SiMKit library has been split up several releases ago into an adapter part and a model part. The model part used to be called libnxp_models.so. When more than one version of the SiMKit library was in the environment (specified with the environment variable LD_LIBRARY_PATH) it could happen that the adapter for one SiMKit version founds the libnxp_models.so library from another SiMKit version. If the match was not correct, an error message is issued - and the simulation would fail.
To avoid these mix-ups, from now on the SiMKit version is appended to the library name, so: libnxp_models_3.3.so for SiMKit 3.3.

Support for APS (Cadence):

The CMI functions pMapSignals() and pInstanceSignalInfo() have been implemented in the spectre adapter. This was required for SiMKit support in APS (parallel simulator from Cadence)

Model Improvements

PSP 103

Added external sheet resistance RSHD for drain diffusion (used when SWJUNASYM=1)

Extended NUD-model to allow for retrograde profiles (GFACNUD > 1)

Added value of gate resistance to OP-output

Bugfix and minor implementation change in NUD-model

Previously, the induced gate noise sources were erroneously connected to the gate terminal rather than to the internal gate node GP. This has been corrected in in this release. This fix may lead to different simulation results at high frequencies.

PSP102

Added value of gate resistance to OP-output

Minor bug fix in conditional for SP-calculation of overlap areas.

Previously, the induced gate noise sources were erroneously connected to the gate terminal rather than to the internal gate node GP. This has been corrected in in this release. This fix may lead to different simulation results at high frequencies.

MM1102

A gate resistance RG has been added to MM1102. This is done in a flexible way, similar to the gate resistance in PSP102 and PSP103, so if the gate resistance equals zero there is no extra node in the model.
Furthermore the model has been extended with multiple finger support.
Model parameters for these extensions are:
For the geometrical and binning scaled models
RGO - gate resistance (Ohm) - default value is 0.0, no clip values;
RINT - contact resistance between silicide and poly (Ohm.m^2) - default value is 0.0, lower clip value is 0.0;
RVPOLY - vertical poly resistance (Ohm.m^2) - default value is 0.0, no clip values;
RSHG - gate electrode diffusion sheet resistance (Ohm/sheet) - default value is 0.0, lower clip value is 0.0;
DLSIL - silicide extension over the physical gate length (m) - default value is 0.0, no clip values;
Instance parameters for these extensions for the geometrical and binning models:
NF - number of fingers (-) - default value is 1 - lower clip value is 1;
NGCON - number of gate contacts (-) - default value is 1 - lower clip value is 1, high clip value is 2;
XGW - distance from the gate contact to the channel edge (m) - default value is 1e-7, no clip values;

For the electrical models:
RG - gate resistance (Ohm) - default value is 0.0, lower clip value is 0;

The gate resistance RG is added to the OP output of the model.

Mextram504

Zener tunneling currents in the Emitter base junction model has been added to the Mextram model. Mextram 504 adopted a model of Zener tunneling current in the emitter-base junction. It describes the Zener tunneling current as it flows in the emitter-base junction when the junction is forced in reverse bias (VEB > 0). In Mextram, in the forward bias regime it is assumed that the Zener tunneling current can always be negelected. This is implemented by formally setting the value of the Zener tunneling current identically equal to zero in forward bias and gives the computational advantage that Zener current does not need to be evaluated in forward bias.
Model parameters for this extension are:
IZEB - Pre-factor of emitter-base Zener tunneling current (A) - default value is 0, lower clip value is 0;
NZEB - Coefficient of emitter-base Zener tunneling current () - default value is 22, lower clip value is 0;
VGZEB - Band-gap at reference temperature relevant to the Zener effect in the emitter-base junction (V) - default value 1.15, lower clip value 0.1;
AVGEB - Temperature scaling coefficient of emitter-base Zener tunneling current (V/K) - default value is 4.73e-4, no clip values;
TVGEB - Temperature scaling coefficient of emitter-base Zener tunneling current (K) - default value is 636, no clip values;
The OP output of Mextram504 has been extended with
Izteb - Zener tunneling current in the emitter base junction;

Improvements for all mos models:

For Spectre and Pstar general overvoltage flagging has been added for all mos models, so MM11*, PSP*, MM20*, MM31 and MM40.
Two new model parameters have been introduced for all the models:
VBOX - Oxide breakdown voltage (V) - default value is 0.0;
VBDS - Drain - Source breakdown voltage (v) - default value is 0.0;
If the specified value of VBOX or VBDS is larger than 0 overvoltage flagging is activated. When activated, a message is printed whenever the oxide or drain-source voltage passes the breakdown voltage.
Checks are done for external (terminal) voltages.
Overvoltage checks for Pstar will only work for Pstar versions after 6.0.
Overvoltage checks are not implemented for ADS.

Known limitations

None for the models.

Flexible Topology in ADS and Spectre

For both Spectre and ADS a model can only choose one topology at a time. This topology must remain fixed throughout the simulation. So, e.g. a sweep of the parameter RGO (gate resistor) in PSP going from zero to another value, or a sweep over SWNQS in PSPNQS is not possible. The simulator will stop with an appropriate message - because continuation would result in erroneous results.

Internal node names in ADS for models with a flexible topology (in SiMKit 3.3 that is PSP, PSPNQS and M1102) might be wrong in the output.

Note: SiMKit 3.3 is only available for RHEL4 and higher. Scripts delivered with SiMKit are converted from ksh to bash.