RELEASE NOTES
SIMETRIX 5.4

NOTES

This document describes the new features and changes for version 5.4.

LICENSING

If you have current maintenance, you should already have been issued with a license file that will support version 5.4. If you haven't installed this license, you should do so now. If you were not issued with the license or have mislaid it, please contact sales@catena.uk.com to receive the new license.

CHANGES TO FILE STRUCTURE

Some changes to the file structure have been made especially the structure of the files located in the application data path. In particular the following has changed.

1. The Application data directory path name has changed to incluse the version number. (See 5.4 Users Manual page 328)
2. The configuration file has moved to a subdirectory "config" under the application data path
3. Examples in windows have moved from "Program Files" to the application data directory
4. The user script directory has moved to a location under the "My Documents" folder in windows. This directory is not created by the installer but will be created by SIMetrix when one of the script menus under "File | Scripts" is run.
5. The free demo version has its own application data folder

Some of the above changes have been made to accommodate Windows Vista "User Access Control" which write protects the "Program Files" tree.

Also, the above changes mean that different versions operate independently as does the the free demo.

GENERAL ENHANCEMENTS

SAVE AND RESTORE SESSION

This saves the current schematics, graphs and simulation data for later retriveal. Schematics that have been edited will be saved in their current state even if the original file has not been updated.

This feature allows SIMetrix to be shut down and the machine switched off without the need to save work.

SCHEMATIC AND GRAPH TAB MENU

A right click menu is now provided on the tabs for graphs and schematics. The menu items included for both graphs and schematics are "Close" and "Close All But This" (closes all windows except the one selected). For schematics only there is also, "Save", "Copy Full Path" (copies file path of schematic to the clipboard) and "Open Containing Folder" (opens a windows explorer window in the directory where the schematic resides. Not available in Linux).

SCHEMATIC

HIERARCHICAL HIGHLIGHTING

The highlight system will now work through a hierarchy. If you highlight a net at one level, all nets connected to that point throughout the hierarchy will be highlighted. New sheets opened will be updated with to reflect nets that are highlighted elsewhere.

AUTO-SAVE

Schematics will be saved to a temporary location at user defined regular intervals. Note that this feature is currently off by default. To enable, go to File | Options | General... and set the auto-save time in the schematic sheet.

INTERACTIVE PROPERTY MOVE

It is now possible to pick up labels and move them without using menus. This feature needs to be explicitly enabled - go to File | Options | General... then select “Enable GUI Property edits”

Note: Our philosophy since the inception of SIMetrix is that moving property labels is a “bad thing”. We still retain this view and as ever we encourage users to think hard before moving labels; think about moving the device instead, your schematic will be more readable that way.

WAVEFORM VIEWER

GAIN AND PHASE MARGIN FUNCTIONS

Two new functions - GainMargin and PhaseMargin - have been developed. These can be used with Performance Analysis and MC Histograms. These functions are implemented using the script based user defined function system.

STACKING CURVES

This feature will separate curves so that they all have their own grid. Two menus are available for this, one operates on all curves in a graph, the other operates only on selected curves. See Curves menu.

GLOBAL FIXED PROBE PERSISTENCE OPTION

You can now set the persistence for fixed probes globally using the File | Options | General... box. Go to Graph/Probe/Data/Analysis then set Default persistence. This is zero by default meaning infinite persistence which is consistent with the behaviour of earlier versions.

In the probe settings dialog, you can choose to use the default value as described above, or you can override this with a new value.

4GBYTE SUPPORT

Not new for 5.4, this actually came in with version 5.3h. The following affects Windows only.

In common with most applications, previous versions of SIMetrix had access to a maximum 2GByte address space even on machines fitted with more than 2G of RAM. Microsoft have provided a program option that allows applications to use up to 3GBytes on 32 bit operating systems and the full 4GBytes on 64 bit operating systems. Applications need to be explicitly enabled by the developers to use this feature. This we have done from version 5.3h.

With 32 bit operating systems, you also need to apply a special setting in the boot.ini file to enable this. See http://www.microsoft.com/whdc/system/platform/server/PAE/PAEmem.mspx for details.

This feature increases the size of the largest vector that can be plotted. Actual values are system dependent, but typically, without the extra space, it is not possible to plot results containing more than about 25Meg points even on systems fitted with 4G of RAM. With the extra address space, this increases to about 62Meg points for 32 bit systems and 125Meg points for 64 bit systems.

SIMULATOR

NEW DEVICE MODELS

SIMetrix 5.4 has two brand new models for IC design and these will be made available in the Micron versions. These models are the **PSP MOSFET** and the **Hicum BJT**. Notes on using these are given at the end of this document.

In addition, **BSIM4.6** and **BSIM4.61** have been added, PSpice style **Quasi-saturation** for BJTs has been added and some further parameters have been added to the diode, resistor and BJT models to improve PSpice compatibility.

BSIM4 BINNING

BSIM4 devices in previous versions were binned according to their total width and not width per finger as they should have been. This has now been corrected.

STIMULUS SPECIFICATION

A new feature has been added to voltage and current sources allowing much more sophisticated stimulus specification. This uses the PSpice derived REPEAT and ENDREPEAT syntax allowing PWL definitions to be specified with a repeating sequence. The original PSpice syntax has been extended to allow the specification of Sines and Pulses within the PWL sequence. This allows waveshapes such as tone-bursts to be easily created. Further the Sine specification used in this manner has some additional parameters not available in the standard Sine source. These are “minpoints” which specifies the minimum number of points that may be used to fabricate the sine signal, and “ramp” which specifies a frequency gradient. This allow the implementation of swept sine sources.

The new feature uses this syntax:

Vxxx n1 n2 PWLS *specification*

specification will accept the PSpice PWL syntax using REPEAT, ENDREPEAT and FOREVER along with the scaling parameters. Note that currently the PWL syntax (as opposed to PWLS) only accepts the fixed standard SPICE PWL syntax.

‘M’ FOR SUBCIRCUITS

The ‘M’ multiplier parameter may now be applied to subcircuit instances. This is implemented by scaling all devices within the subcircuit and works for all analysis modes including noise. There is therefore no performance penalty specifying this parameter. However, not all devices support it and an error will be raised if a subcircuit containing unsupported devices is instantiated with M not equal to unity. Currently unsupported devices include all digital devices and the lossy transmission line. All other analog devices support this including the new PSP and Hicum models.

In addition ‘M’ may be applied individually to all devices except those exceptions mentioned above.

IMPORTANT NOTE: because ‘M’ is now an implicit subcircuit instance parameter, its use as a regular parameter can introduce problems. For this reason you cannot use ‘M’ as a regular parameter unless it is also defined with the subcircuit definition, e.g.:

```
.SUBCKT subname 1 2 3 params: M=1
```

If you use the above, ‘M’ as a multiplier will be disabled and instead it will treated as a regular parameter. If the defintion of M in the .SUBCKT line is omitted, an error will be raised if any attempt to access ‘M’ in an expression is made. This can mean that some circuits that successfully run in 5.3 and earlier could fail in 5.4. This can be worked around by adding this option setting:

```
.OPTIONS DisableSubcktMultiplier
```

‘MOD’ Parameters can be Parameterised

Many model selector parameters used in BSIM3 and BSIM4 could not accept parameter expressions and only constants were allowed. This has been corrected for all model selector parameters in BSIM3 and BSIM4.

Scripts In Netlists

The SIMetrix script engine has now been incorporated into the simulator. This allows a script to be called from the new simulator statement **.post_process**. This will call a specified script when an analysis successfully completes. In addition, the script code can be embedded in the netlist using the .FILE/.ENDF syntax.

The above will work even if the simulation is called in non-GUI mode.

.LIB Performance Improvement

The performance of the Hspice style .LIB file import feature has been improved. Some large files were taking about to a minute to read in. This has been reduced in most cases to under a second.

SOA Enhancements

The Safe operating area feature has been extended as follows:

1. Limit values may now use parameter expressions
2. A per definition derating factor has been added and this can be defined using a parameter expression.
3. It is possible to specify limits on the mean value during the course of the run
4. A report can be generated showing the margin within which all devices are operating even if they did not violate the absolute limits. This information is available via a script function if required
5. A .option setting can specify start and end times during a run over which SOA is active

SIMPLIS

POP Enhancements

SIMPLIS now provides some options on the behaviour following a POP run where POP failed to converge. The options are:

1. Abort
2. Run a time domain analysis with stop time of 100 x the max period.
3. Run a time domain analysis with user specified stop time

In some applications, running a long transient can place the circuit into a periodic state that, while not completely stable, is nevertheless stable enough to perform some meaningful measurements. For example lightly loaded switching systems can enter a pulse frequency mode of operation and in this mode it is difficult to achieve POP convergence. In this situation a semi-stable state achieved with a long time domain analysis would be sufficient to study load or line regulation.

Laplace Models

2nd and 3rd order Laplace blocks have been added to the building block library. See menu “Place | From building block library | Control elements” then select “Laplace transfer functions” on the right hand side.

A more general SIMPLIS Laplace model is planned for a future release.

PSP and Hicum Models

PSP Model

This is a model jointly developed by NXP (formerly Philips Semiconductor) and Pensylvania State University.

The model provided is version 101.0, non-binning, non-NQS geometric version. It is a four terminal device and should be accessed using the SPICE letter ‘M’.

The model was implemented from Verilog-A code using a Verilog-A compiler that is currently under development.

Model Syntax

NMOS Devices:

```
.MODEL name nmos LEVEL=1010 parameters
```

OR

```
.MODEL name PSP101 type=1 parameters
```

PMOS Devices

```
.MODEL name pmos LEVEL=1010 parameters
```

OR

```
.MODEL name PSP101 type=-1 parameters
```

Instance Syntax

```
Mxxx d g s b name instance_parameters
```

Instance parameters are W, L, AS, AD, PS, PD, MULT, SA, SB, ABSOURCE, LSSOURCE, LGSOURCE, ABDRAIN, LSDRAIN, LGDRAIN

THE HICUM MODEL

The model provided is “Level 2 version 2.11”. It is a four terminal device and should be accessed using the SPICE device letter‘Q’.

The model was implemented from Verilog-A code using a Verilog-A compiler that is currently under development. . It has received only minor changes from the original supplied by the developers. These changes are to implement PNP devices and to overcome a problem in the original model whereby it is possible for it to converge to an erroneous state.

The SIMetrix implementation of this model has been tested using the benchmark results provided by the developers. The majority of the tests showed a match of better than 0.1%. A few were over 1% with one deviating by 7%. These were investigated and it was found that the reference data was in error probably because of insufficient convergence tolerance.

MODEL SYNTAX

NPN Devices

```
.MODEL name npn LEVEL=8 parameters
```

OR

```
.MODEL name hicum_211 PNP=0 parameters
```

PNP devices

```
.MODEL name pnp LEVEL=8 parameters
```

OR

```
.MODEL name hicum_311 PNP=1 parameters
```

INSTANCE SYNTAX

```
Qxxx c b e s name
```

There are currently no instance parameters for this device.