Avant!

Star-Hspice and AvanWaves Release Notes

Version 2001.2

June 2001

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1. Introduction

These release notes describe the changes to Star-Hspice and AvanWaves for the 2001.2 Release, which include:

- Device model additions and upgrades: New BSIM-SOI-DD Model, New Junction Cap Model, Mextram Level 504 Upgrade, BSIM-SOI-PD Model Upgrade, BSIM4 Model Upgrade, Philips MOS9 Model Upgrade, BSIM4 Noise Model, IBIS Model Enhancements
- G Element Enhancements
- Metaencrypt Enhancements
- New Star-Hspice syntax and options: MEASFAIL, PUTMEAS, MODSRH, POST_VERSION, BIASCHK
- HSPUI Improvements
- Documentation improvements
- Platform support changes
- AvanWaves ease-of-use enhancements
- Resolved defects for Star-Hspice and AvanWaves

Star-Hspice and AvanWaves enhancements are described in more detail in the appropriate user manuals.

Avant! provides DE numbers that refer to the enhancement and problem tracking system within Avant! Corporation. For more information on a resolved defect, please contact your Avant! Technical Support Engineer (TSE) with the DE number.

2. Star-Hspice Model Updates and Product Enhancements

The following enhancements are released in Hspice version 2001.2.

2.1 New BSIM-SOI-DD Model

Hspice now supports the UC Berkeley BSIM3DD2.2 for dynamically depleted (DD) SOI devices as MOSFET level 60.

This model introduces many advanced concepts to allow transition between PD and FD operation dynamically. The major features of this new model are:

- DD approach is applied on both I-V and C-V
- Supports external body bias and backgate bias; a total of 6 nodes
- Real floating body simulation in both I-V and C-V
- Self-heating implementation improved
- Improved impact ionization current model
- Various diode leakage components and parasitic bipolar current included
- New depletion charge model (EBCI) introduced for better accuracy
- Single I-V expression to ensure continuities of Ids, Gds, GM and their derivatives for all bias conditions

For a complete description of the model, syntax, notes, and parameters, please see the Star-Hspice manual.

2.2 New Junction Cap Model

The Juncap model is a new diode feature. The model is intended to describe source, drain, or well-to-bulk junction devices, limited to the case of reverse biasing for these junctions. Similar to the MOS model, the current equations are formulated and AC effects are modeled via charge equations using quasi-static approximation.

For a complete description of the model, syntax, parameters, and equations, please see the Star-Hspice manual.

2.3 Mextram Level 504 Model Upgrade

The new version of the MEXTRAM model has been added to Star-Hspice as BJT LEVEL 6. You can now specify the VERS parameter to choose MEXTRAM level 503 or 504. The default value of the VERS parameter is 504.

MEXTRAM 504 gives better results for the description of first and higher-order characteristic derivatives than MEXTRAM 503. This effect is noticeable in the output-conductance, the cut-off frequency, and the low-frequency third order distortion.

See the Star-Hspice Manual for additional information.

2.4 BSIM-SOI-PD Model Upgrade

Hspice's implementation of the partially depleted BSIM SOI model (MOSFET level 57) has been upgraded to support version 2.2.2 of that model.

2.5 BSIM4 Model Upgrade

The BSIM4 model (MOSFET Level 54) has been upgraded to support version 4.2 of that model.

The improvements incorporated into BSIM4.2 are bug fixes and two new parameters: XL and XW.

2.6 Philips MOS9 Model Upgrade

New scaling rules have been implemented in MOS Model 9 (MOSFET level 50) for the parameters in the electrical model indicated in the following:

β	gain factor
k_0	body effect at low back-bias
k	body effect at high back-bias
V_{T0}	threshold voltage
$V0_0$	drain-induced barrier-lowering
0_1	mobility reduction

2.7 BSIM4 Noise Model

The BSIM4 noise model has been implemented in both versions 4.1 and 4.2.

2.8 IBIS Enhancements

Nine new features have been added to the Input/Output Buffer Information Specification (IBIS) models. These enhancements include the following:

- Frequency analysis (.AC)
- Input or enabled node connected to ground directly
- Input or enabled node connected to I, E, F, G, H elements
- IV curves are scalable
- Supply voltage variations scale the IV curves
- VT curves and ramps are scalable
- Improved accuracy for VT curves
- Syntax for “file= . . .” works in conjunction with .SEARCH
- Ramp_fwf and ramp_rwf default to 2

Additional details and examples are provided in the Star-Hspice 2001.2 manual.

2.9 G Element Enhancements

Three new parameters have been added to the Frequency Response Table for the G element: accuracy, extrapolation, and interpolation. In addition, a circular convolution example for the G element has been added to the documentation.

Please see the Star-Hspice manual section on "Modeling Filters and Networks" for additional information.

2.10 Metaencrypt Enhancements

A new 8-byte key encryption feature based on a 56-bit DES is now available in metaencrypt, beginning with version 2001.2. You can insert data into an include file and encrypt this file using 8-byte key encryption. The encrypted data is in binary format.

.Lib and .inc encryption is available in the 2001.2 release. You can use the former encryption method by using .lib or .inc to an encrypted file.

Please refer to "Appendix E: Performing Library Encryption" in the 2001.2 Star-Hspice manual for the complete encryption structure and syntax examples.

2.11 MEASFAIL Option

Reference number: 27720

A new option has been added to Hspice to decide which value takes place of the measure result when the .measure statement fails.

The syntax is:

```
.option measfail = 1|0
```

The default value is 1.

If measfail = 0, then Hspice will produce 0 as the measure result into .mt#, .ms# or .ma# files and "failed" into the listing file (.lis file) when it cannot be calculated.

If measfail = 1, then Hspice will produce "failed" as the measure result into the .mt#, .ms# or .ma# files and the listing file (.lis file) when it cannot be calculated.

2.12 PUTMEAS Option

Reference number: 29914

The .putmeas option enables users to control the output variables listed in the .measure statment. The syntax is:

```
.option putmeas=0 <1>
```

The default value is 1.

If PUTMEAS=0, then Hspice will not produce the values of the variables listed in the .measure statement. This option will decrease the size of the output file.

If PUTMEAS=1, then Hspice will produce the values of the variables listed in the .measure statement.

2.13 Post_version=2001 Option

Reference number: 29918

The syntax is:

```
.option post_version=2001
```

By using this new post_option, the user will see a new output file header which includes the correct number of ouput variables rather than **** when the number exceeds 9999.

When `.option post_version=2001 post=2` is specified in the netlist, the user will receive more accurate ASCII results in the output files than in previous Hspice releases.

2.14 MODSRH (new model analysis option)

Reference number: 29438

This option will shorten the Hspice run time when many models are referenced but are not being called by an element in the netlist.

The default value is MODSRH=0.

Please see the Star-Hspice manual for details and examples.

2.15 BIASCHK Statement

The .BIASCHK statement will monitor the bias based on user defined limits. Bias monitoring will check the bias that you want to monitor during transient analysis and report the following:

- element name
- time
- terminal
- bias exceeding the limit
- number of times the bias exceeds the limit for an appointed element

This command is for MOS only in release 2001.2.

Syntax:

```
.biaschk type terminal1=t1 terminal2=t2 limit=lim <noise=ns>
+ <name=devname1><name=devname2>... <mname=modelname1><mname=modelname2>...
```

Refer to the "Performing Transient Analysis" chapter in the Star-Hspice manual.

2.16 HSPUI Improvements

- The HSPUI toolbars have been enhanced for user’s convenience. More than one file can be selected to simulate in Multi-jobs by using the shift-key or control-key.
- HSPUI can be unloaded completely by pressing the close button.

- On the Win95 and Win98 platforms, the Winoldap process can be closed when one simulation finishes.
- HSPUI can still work normally after an exception exit.

2.17 COMPACT232.OCX Automatic Install (PC Only)

If you receive the following error message:

"Component 'COMCT232.OCX' or one of its dependencies is not correctly registered: a file is missing or invalid."

then that message indicates the COMCT232.OCX has not been registered. In 2001.2 version, it can be registered automically by the install program.

Excecute the following using a windows command line:

```
c:\windows\system\Regsvr32 COMCT232.OCX
```

There will be one message: "DLLRegisterServer in COMCT232.OCX succeeded."

Use this method to resolve this error manually in previous Hspice releases.

3. AvanWaves Enhancements

The following enhancements have been released in the 2001.2 version of AvanWaves.

3.1 New Header for Option "post_version=2001"

AvanWaves can now read a new header, which is produced by Hspice when option "post_version=2001"is specified. This new header can display the number of the output variables in the .print, .probe, or .plot statements, which exceed 9999.

3.2 New Data Format for Option "post_version=2001"

AvanWaves can now read a new data format, which is produced by Hpsice when the options "post_version=2001" and "post=2" are specified. This new format can display more precise data.

3.3 Improved Stability

AvanWaves is now more stable on Compaq Alpha OS and can support IBM AIX4_3 OS.

4. Star-Hspice User Manual Improvements

The following improvements were made to the Star-Hspice User Manual set.

4.1 Updated Customer Support Information

The customer support information has been updated to include a new e-mail address, telephone number, and revised business hours. Additionally, Application Engineers (AE's) are now referred to as Technical Support Engineers (TSE's).

E-mail Address hspice_nw@avanticorp.com

Telephone 1-800-346-5953

Business Hours 8:00 a.m. through 5:00 p.m. Pacific Standard Time (PST)

5. Platform Support

Linux RedHat 7.0 is now supported in Star-Hspice 2001.2.

- No waveform viewers are currently available on Linux. However, Cosmos-Scope is scheduled to be released in August 2001 for Linux.
- This version does not support MOSFET level 29 and level 45.

Metaencrypt is now supported on Linux RedHat 7.0 and PC Windows platforms.

NOTICE: Star-Hspice December 2001.4 Platform Support Changes

- The 2001.4 release scheduled for December will not support the older IBM OS, AIX4.1. However, AIX4.3 will continue to be supported.
- Star-Hspice's 2001.4 release scheduled for December will be the last Star-Hspice release to support Sun's older Sparc processors. Sparc Ultra processors will continue to be supported.

6. Resolved Defects

The following known defects were addressed for Release 2001.2.

6.1 Star-Hspice Resolved Defects

Reference Number	Description	Status
NA	W Element Accuracy Enhancement	Completed
NA	W Element - cut off frequency of G(f) is disabled by default	Completed
NA	W Element Field Solver Enhancement - resolved partial impedance handling issue	Completed
01341	If one temp fails, the user is unaware of the failure	Corrected
01342	Unused model aborts when TLEV=1	Corrected
01352	Autostop malfunction with certain .measure commands	Corrected
01362	Number of .probe nodes limited to 10000	Corrected
01385	Error if parameter used before it is defined	Corrected
01390	Enhancement: print warning or error message when initializing nodes that do not exist	Finished
02163	Encryption enhancement to allow use of .LIB statement	Finished
02238	Enhancement: use full subckt path name in tr0 header	Finished
02356	Enhancement: improve error message for parenthesis mismatch	Corrected
02476	Element template print command ignored if first print command in netlist	Corrected
03015	Hspice aborts if netlist references multiple vector files	Corrected
03022	.vec incompatible with .alter	Corrected

Reference Number	Description	Status
03101	.vec misses breakpoints if falltime not equal to risetime	Corrected
03434	Colon referenced elements in quotes not working	Corrected
03949	Core dump when march, artist, psf options are used	Corrected
04093	Enhancement: remove printout of obsolete options rmaxdc, diorscal	Corrected
04882	Parse error if tstep parameterized on .tran with sweep	Corrected
05321	Incorrect element noise contribution data for post=3	Corrected
05653	Enhancement: print warning message for floating BULK	Finished
06294, 21407	Enhancement: metaencrypt max line length increased from 80 to 254	Corrected
07629	OCT sweep increment is 2x instead of 8x	Corrected
07929	Enhancement: Shift key in HSPUI to select range of data	Completed
08654, 09319	Parse error on Vitesse L6 model unless dummy model precedes it	Corrected
09132	99.2 HSPUI batch mode has misleading highlight in multiple job selection	Corrected
09141	Enhancement: Hspice gives inadequate error message for nodename violation	Corrected
09143	When element name >16 characters, then cannot list whole name in resume and node table	Corrected
09319	See reference number 08654 above	
09757	.alter <title_string> does not accept 72 character string	Corrected
09925	Enhancement: vec include file ported to Win 95/98/NT	Corrected
10282	Implementation of .vec file inconsistent with manual description	Corrected
11380	Hspice should abort when POWER=off for B element	Corrected

Reference Number	Description	Status
11754	Pulse voltage source and post=2 produces incorrect waveforms	Corrected
12515	Enhancement: Printback of SOI body charge	Completed
13779	Vbic case failed on pc_mt	Corrected
14159	Error message with E-element and .dc command	Corrected
15017	IBIS parsor ignores the case sensitivity in file path	Corrected
16486	HSPUI is not unloaded if the X button is used	Corrected
16489	Winoldap (winoa386.mod) does not become unloaded after Hspice is run from HSPUI	Corrected
16523	Simulate button grayed out in HSPUI	Corrected
16642	cos(2) requires expression quotes	Corrected
16770	Hspice aborts job when lmax and lmin are not specified in the model statement	Corrected
16859	.mt0 file contains 0 if measurement not found	Corrected
16967	Warning message should use full subckt path name	Corrected
17061	SOI model (Level 57) problems changing libraries of SOI models using .alter	Corrected
17873	Enhancement: improve warnings and errors for metaencrypt	Corrected
18049	If META_QUEUE=1, LM_LICENSE_FILE=port@host, queued job causes core file	Corrected
18395	Printback MEXTRAM model parameters in *.lis file	Corrected
18398	Setting Level=5 for a BJT model does not give an error	Corrected
18467	Enhancement: warning message for capac-itance values of 0	Finished
18469	Error if diode model name contains ’.’ and model has model parameters set	Corrected

Reference Number	Description	Status
19361	Enhancement: BSIM4 Model Implemented	Completed
19790	Hspice does not use digital input files correctly	Corrected
19806	optime does not work on PC	Corrected
19871	No DC convergence for SOI model level 57 in 99.4	Corrected
20218	Different values for noise calcs in 99.2 and 99.4	Corrected
21154	Using .alter gives floating node error messages but concludes as separate jobs	Corrected
21407	See reference number 06294 above	
21470	G Element Enhancement	Added; still requires additional enhancements
21613	Enhancement: add model selection capability to wire RC models	Finished
21838	Extra blank lines printed in *.lis file with multiple analyses	Corrected
22069	Memory request error with an E and V element	Corrected
22160	.rlc file causes Hspice to hang	Corrected
22165	Enhancement: improve encryption security	Finished
22458	Output report from VBIC model analysis	Corrected
22988	Vector file that starts with a number produces an error	Corrected
23476	NLEV value not correctly printed ou in *.lis file	Corrected
23673	Duplicate op printout at t=100u	Corrected
23757	Enhancement: no warning message when coupling (K) is -1> or parameterized	Finished
24248	Field solver problem with only one conductor	Corrected
24379, 25131	Hspice aborted on HP workstation	Corrected
24579	Enhancement: improve error message when BJT model parameters are out of range	Finished

Reference Number	Description	Status
24800	Capacitance template LV1 is disregarding temperature effects	Corrected
24877	Hspice truncates lines from .inc files at 255 characters	Corrected
25034	Vector format is different for Hspice and Star-Sim	Corrected
25131	See reference number 24379 above	
25377	Measure file is generated automatically although .meas does not exist	Corrected
25407	Measurements are truncated at 16 characters in the .mt# files	Corrected
25467	PC hspice_mt for multithreading not working correctly	Corrected
25621	Monte Carol analysis not reporting errors with wrong parameters specified	Corrected
25621	Monte Carlo analysis cannot report error when parameter definition is wrong	Corrected
25733	Open button in HSPUI's GUI causes "Run-Time error 32765"	Corrected
25774	Hspice fails to refer if level of hierarchy is more than 5	Corrected
25999, 29634	Hspice vbic model does not converge without print statement	Corrected
26010	Enhancement: upgrade IBIS parser and allow node names of up to 60 chars	Finished
26233	Using alters increases "errchk" time by a factor of around 8-10	Corrected
26423	Enhancement: MOSFET region of operation in .op output	Finished
26630	Measure file header shows incorrect version	Corrected
26639	Hspice cannot give error information when the netlist is wrong	Corrected
27031	Wrong error message for u-model	Corrected
27350	v2000.4 Level 57 bug	Corrected
27524	Wrong results when .measure is out of range	Corrected

Reference Number	Description	Status
27573	Out of memory error on Alpha for W element nine-conductor lossless line	Corrected
27675	Core dump on Alpha	Corrected
27788	Parser cannot find user-defined function if defined in a subcircuit	Corrected
27817	Out of memory error on IBM4.1	Corrected
27849	Netlist is order sensitive if both BSIM3 and BSIM4 libraries are used	Corrected
27932	Incorrect "err2" .measure result	Corrected
27947	Hspice cannot recognize "~" as user's home directory on HP workstation	Corrected
28344	No convergence in operating point	Corrected
28411	Problems using encrypted model libraries	Corrected
28638	W Element overflow issue and AIX complex library issue	Corrected
28934	IBIS seg fault on missing corner data	Corrected
29634	See reference number 25999 above	
30450	Incorrect noise analysis results with CMI models when M factor!=1	Corrected
30452	BSIM4 model aborts when rdsmod=1	Corrected

6.2 AvanWaves Resolved Defects

Reference Number	Description	Status
10318	Provide a more descriptive warning message when AvanWave opens CSDF formatted files	Corrected
15191	AvanWaves failed on alpha when using add arrow function	Corrected
20707	X-axis labels overlap each other when you zoom in	Corrected
22551	AvanWaves displays "out of memory" error when attempting to view waveform	Corrected
28149	AvanWaves cannot display the output file with a new format produced by Hspice	Corrected

