cadence®

Spectre® Circuit Simulator What's New

Product Version 23.1
June 2023

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Contents

What’s New in Spectre Circuit Simulator

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This document contains the following sections:

Supported Platforms and Operating Systems

The following platforms and operating systems are supported:

Platform and Architecture	**Linux (64)** x86_64 (lnx86)
Development OS	RHEL 7.4
Additional Supported OS	RHEL 7.4 and above RHEL 8 RHEL 9 SLES 12 SLES 15

Licensing Changes

Starting with the SPECTRE 20.1 ISR5 release, all Spectre products have been integrated with FlexNet version 11.16.4.0. As a result, these products also require a compatible Cadence license server version, which is integrated with FlexNet, version 11.16.4.0. Therefore, you must upgrade your license server version before you run SPECTRE 20.1 ISR5 or newer versions of the products. Otherwise, the products will not be able to use the licenses and will fail to run.

To upgrade your license server, you must download and install the latest Cadence `Lic+Config_Utils` release (LCU04.30.000 and later). This version is already integrated with FlexNet version 11.16.4.0 and is available from the Cadence Downloads page (`Lic+Config_Utils`).

You can check the version of your license server by running the following commands in a terminal of the machine on which the license server is installed:

- `lmgrd -v`
- `cdslmd -v`

Note: The `lmgrd` command does not work on RHEL 9.0. To check the license server, run these commands on RHEL 7.4 or RHEL 8.

For information on licensing, refer to the *Licensing* section of the *Spectre Classic Simulator, Spectre APS, Spectre X, and Spectre XPS User Guide*.

New and Enhanced Features in Spectre 23.1

The following sections provide a high-level overview of the features introduced in the various Spectre product areas.

Spectre X

Using GPU with Spectre X

Starting from version 23.1 Spectre X supports Nvidia's GPU platform. The GPU solution targets to provide a significant performance gain over regular multi-core Spectre X simulation by deploying GPU additional to multi-core CPU. Target applications are long transient simulation of large advanced node and postlayout designs that require high accuracy. The solution is expected to provide the same accuracy as Spectre X on CPU only. Since the Spectre X GPU solution is limited release in Spectre 23.1, contact your Cadence Customer Support team to evaluate the GPU solution. For more details, refer to Using GPU with Spectre X.

Performance Enhancements in Transient Noise in MX mode

In Spectre 23.1, the performance of transient noise analysis has been significantly improved when using `+preset=mx`.

Spectre Statistical Analysis

Spectre FMC

This release introduces a high-sigma monte carlo analysis called Spectre Fast Monte Carlo (Spectre FMC). Spectre FMC Analysis deploys an advanced ML-based algorithm to accelerate high-sigma yield estimation. It targets 3-6 sigma analyses of analog, RF, and memory blocks as well as I/O and standard cells. It identifies the worst-case monte carlo samples for a user-specified sigma and provides yield information. Compared to the brute-force monte carlo analysis, Spectre FMC Analysis provides a significant speed up since much less samples need to be analyzed. The Spectre FMC solution is available in Spectre, Virtuoso® ADE Suite, Liberate™ MX and Tempus™.

Circuit and Device Checks

The following enhancements have been introduced in circuit and device checks:

- Support has been provided for assert-related waveform creation using the assert=wfdebug option. This value enables Spectre to store all time-varying current and voltage waveforms used in an assert expression. Spectre starts saving a waveform only when the assert is violated and the violation lasts longer than the duration.

- A dynamic power density check, dyn_powerdensity, has been introduced. It reports the time window with the highest power density for each MOSFET device. It is based on shifting the power measurement time window over the operating time window.
- A new static MOSFET stack count check, static_stack, has been introduced. It counts PMOS and NMOS transistor stacks and reports stacks that are larger than the specified count.

Spectre RF

Distributed Shooting

Distributed single shooting PSS simulation is now supported. This feature is useful for designs that need large memory and cannot be run on a single machine as it lets you use cores from different machines when the required number of cores is not available on one machine. It supports PSS and small-signal analyses pac, pnoise, pxf, and pstb for both driven, and oscillator circuits.

Envelope-based Tstab Flow

A new envelope-based tstab flow has been introduced to accelerate the tstab calculation for designs with long settling time. For designs that use a large number of clock periods to reach a steady state, you can achieve more than 5x increase in performance with this new flow.

Performance Enhancements

The following performance enhancements have been introduced:

- Mtline Performance Optimizations have been made default for the tran, pss, and hb analyses.
- Performance of `interp=linear` has been enhanced.
- For RX passband and baseband, fast envelope analysis has been enabled to handle memory effects.
- BBSpice has been improved to run faster on s-Parameter files with many ports.

Enhanced PAM3

For IEEE compliance, PAM3 has been supported for vsource, isource and port.

Wlan11ax Improvements

The following enhancements have been done for Wlan11ax:

- The Wlan11ax wireless source now supports 320M and 160+160M bandwidths.
- The wlan11ax component allows partial channel occupation and position within the channel.

Generate Osc Macro Source in PSS andPnoise

A new option, `Generate Osc Macro Source`, which has been added to PSS and Pnoise, enables you to create an oscillator source model containing the harmonics and the phase noise data of the oscillator.

Nport auto_switch default for XDP

For XDP, the `nport_default_interp` option is now automatically set to `auto_switch`. Possible values are `spline`, `rational`, `linear`, `bbspice`, and `auto_switch`.

With this, nport automatically chooses the following:

- bbspice for analyses such as pss and the tstab interval of hb and pss
- linear for analyses, such as ac, dc, tran, and sp

In addition, all nport elements in the netlist that do not have `interp` set, will have `interp` set to the value specified in the global option `nport_default_interp`. For nport instances that have the `interp` option explicitly specified, the instance option will take priority over the global option.

Wireless Envelope Noise and Distortion Separation

In the setup for Envelop analysis, you can now select the new *Enable Noise and Distortion Separation* check box to enable separate plotting of distortion with or without noise.

EMIR Analysis

Spectre EMIR Voltus-XFi

The Spectre EMIR Voltus-XFi technology is enabled with the +emirpreset command-line option that predefines all the first- and second-stage EMIR settings. It provides a simplified iterated method use model, and enables you to trade between accuracy and performance.

LDO Support for IR Drop

IR drop analysis is now supported for the nets driven by LDOs, voltage generators, or regulators. The IR drop calculation considers the voltage on the LDO output as voltage reference.

Legato Reliability Analyses

Aging Analysis

In addition to the performance and memory enhancements, the aging analysis has been enhanced to support distributed XDP simulation, XF analysis, and Spectre FMC analysis.

Fault Analysis

The following incremental enhancements have been delivered for Spectre legato fault solution:

- To follow P2427 standard, Spectre skips a fault when its weight equals zero and prints a message indicating the same in the log file.
- A new parameter, `faultlayer`, has been added to info analysis to enable layout-based fault generation.
- A new parameter, `faultmerge`, has been added to info analysis to deal with iterative and parallel device instances during fault list generation.
- A new parameter, `faultuniverse`, has been added to info analysis to specify the db file name in which the fault universe details can be saved.
- The `faultres` parameter has been enhanced to support defect parameter sweeping.
- Parametric fault generation has been enhanced by using the `faultalter` parameter.

- Support has been provided to run a one-step simulation with custom faults in Spectre X and Spectre APS.
- Provided a new command-line option, `+fsa`, which automatically saves the functional safety report.
- Enhancements have been provided in `spectre_ddmrpt` to:
  - provide estimated coverage
  - report the coverage with hierarchical information
  - report the coverage per element or model type
  - group fault coverage based on fault name prefix or wildcard string
  - add sampling method in fault output files
  - add a header to the report
- Enhancements have been provided in `spectre_fsrpt` to:
  - support report merging based on fault parameters instead of the fault name
  - generate a report based on the name of signals/asserts
  - group fault coverage based on hierarchy or design scope in the netlist
- Fault analysis now supports DHE to calculate device area with `dheparams` in info analysis
- Support for fault generation for post-layout netlist.
- You can now save the fault table file in the binary format.
- A new parameter, `faultduplicate`, has been introduced in TFA and DFA to let you make a choice whether to remove duplicate faults.

Electrothermal Analysis

This release provides multiple enhancements for the electrothermal analysis. These include an auto-adaptive mesh creation for the thermal network, the support of DC analysis, and the capability to add other analysis after the electrothermal DC or transient simulation. In addition, an overall improvement in performance has been delivered.

Spectre FX

The following enhancements have been added to Spectre FX:

Integration with Xcelium AMS FX flow

The Spectre FX simulator can be enabled in Cadence® Xcelium™ AMS Designer by using a command-line option or through Virtuoso® ADE Suite.

Integration with Virtuoso ADE Suite

The Spectre FX simulator has been fully integrated in Virtuoso ADE. The use model is consistent with Spectre and Spectre X, with the Spectre FX-specific options selected for this flow.

Integration with Liberate MX + FX SRAM Characterization Flow

The Spectre FX simulator has been fully integrated in Liberate MX.

Enhanced Support

The Spectre FX simulator now supports the following:

- AC analysis
- DC analysis
- Monte Carlo analysis
- Reliability analysis
- Spectre FX EMIR analysis (Direct and iterated modes)
- DRAM, Flash, SRAM and large analog and mixed-signal simulation

New Device Models

The following new device models have been introduced:

- L-UTSOI version 102.60
- BSIM-BULK version 107.1
- BSIMCMG v111.2, v111.2.1
- PSP v103.8.1, v103.8.2
- HiSIM2 v3.2.0

- BSIMSOI_s version 100.0.0 - new bsimsoi model
- OMI (open model interface) support for bsimimg and hisim_hv
- R3 version 1.1.0 and 1.1.1
- R2 version 1.0.1
- BSIMIMG version 102.9.6
- ASM-HEMT version 101.3.0
- HISIMSOI version 1.5.0