# cādence®

# Spectre X Simulator

## Verify your largest designs with analog precision

Building upon the foundation of the Cadence® Spectre® Circuit Simulation Platform, the Spectre X Simulator is Cadence's third-generation SPICE simulator for circuits from complex analog, RF, and mixed-signal blocks, to custom IC and subsystems. The Spectre X Simulator delivers best-in-class single-core simulation and provides scalable performance and capacity. Using the same infrastructure technology as the Spectre Circuit Simulator and Spectre Accelerated Parallel Simulator (APS), the Spectre X Simulator provides the same golden simulation results that designers have trusted for more than 20 years. These designs may use millions of transistors and passive components along with billions of parasitic elements.

The Spectre X Simulator was developed to handle the electrical verification of large-scale analog-centric SoC designs (e.g., high-speed SerDes), 5G RFIC designs, and advanced-node IP blocks. It is the perfect solution for a designer who needs analog-type accuracy for designs that require millions of calculations for each time step. The Spectre X Simulator takes advantage of the cloud infrastructure to perform massively distributed simulations required to verify complex full-chip designs in a timely manner.

## Benefits

### Easy to adopt and use

- Features tight integration with the Virtuoso® Analog Design Environment, supporting a common use model along with waveform analysis, cross-probing, and back-annotation capabilities

- Silicon-accurate simulation results with the latest version of all industry-standard device models

- Widely supported in foundry process design kits (PDKs)

- Reads the syntax, netlists, abstractions, behavioral and device models of all the other Simulators in the Spectre Circuit Simulation Platform for true plug-and-play ease to aid quick adoption

- Can be immediately used as the analog solver within Spectre AMS Designer by taking advantage of the AMS Designer Flex use model, enabling users to choose their desired Xcelium™ and Spectre releases
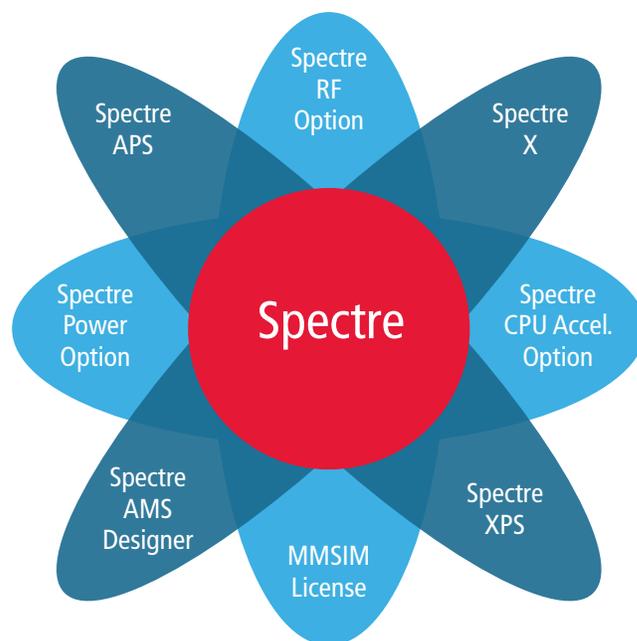


Figure 1: The Spectre Circuit Simulation Platform offers a complete analog, mixed signal, and custom digital simulation platform

Used as the analysis engine within the expanded Cadence ecosystem of design flows and solutions, including:

- Spectre AMS Designer for mixed-signal simulation

- Virtuoso Photonics Platform

- Liberate™ Characterization Portfolio for digital and mixed-signal library characterization

- Voltus™-Fi Custom Power Integrity Solution for interconnect integrity and reliability and EMIR analysis

- Legato™ Reliability Solution for advanced reliability analysis

- Virtuoso RF Solution for system-level design

- Tempus™ Timing Signoff Solution for timing analysis

- Cadence DFM solutions for lithography analysis

## Improved designer productivity

- Spectre simulation platform shares a common use model to minimize the learning curve and speed up adoption.

- Spectre X Simulator introduces additional accuracy and performance tradeoff set-ups to custom IC, mixed-signal, and analog designs.

- Spectre X Simulator significantly speeds up single-core simulation performance for faster simulation of large post-layout analog and subsystems dominated by parasitic devices.

## Scalability in performance

- Spectre X Simulator delivers scalable performance-distributed simulations. Using clusters of machines with multi-core architectures allows faster simulation of designs with higher levels of analog design integration. This functionality requires an additional license and is enabled by the Spectre CPU Accelerator option.

- Spectre X Simulator provides increased simulation by harnessing the power of clusters of multi-core compute platforms.

## Features

### Silicon-accurate modeling

Device models are common across all of the simulators in the Spectre simulation platform, eliminating model-correlation issues and simplifying adoption of new simulation technologies. Using the same model equations assures that silicon-accurate models from existing PDKs can be used with the Spectre X Simulator.

### Language and netlist support

The netlist formats, behavioral modeling languages, parasitic netlist formats, and stimulus files are common across the Spectre simulation platform. Supported formats include:

- Spectre and SPICE netlist formats

- Spectre, SPICE, and PSpice® models

- Verilog-A 2.0 LRM-compliant behavioral models and structural netlists

- DSPF/SPEF parasitic formats

- S-parameter data files in Touchstone, CITI-file, and Spectre formats

- SST2, PSF, PSF XL, and FSDB waveform formats

### Post-Layout Simulation

The Spectre X Simulator uses proprietary techniques to accelerate post-layout simulation. The post-layout simulation supports accelerated DC operating point calculation, advanced matrix solver optimized for RC simulation and large matrices, and accurate optimization of device parasitics. Multiple modes are provided to users that optimize set-ups for different applications: custom IC simulation, analog IC simulation, and EM-IR analysis.

### Native Device Reliability Analysis

The Spectre X Simulator provides a full-chip native reliability simulation and analysis solution, enabling designers to consider reliability effects from the early stages of design until tapeout. Reliability analysis can simulate the degradation of device characteristics as a function of the circuit operation conditions and time, allowing

for designers to assure sufficient performance margin over the product's operating lifetime.

### Native Verilog-A support

The Spectre X Simulator offers design abstraction for faster exploration of the design space allowing better architectural decisions and supports mixed-level simulation to accelerate top-level functional verification. The Spectre X Simulator-supported Verilog A is in full compliance with the Verilog-A 2.0 LRM. The Spectre X Simulator automatically compiles Verilog-A into optimized C-code for high-performance simulation

### Advanced analog and RF circuit analysis techniques

The Spectre X Simulator-provided performance and capacity improvements are not limited to transient analysis. The Spectre X Simulator also accelerates harmonic balance simulation while maintaining the accuracy expected for RFIC design.

## Specifications

### Comprehensive list of device models supported

- Advanced-node models, including the latest versions of BSIM CMG, BSIM IMG, and UTSOI models

- MOSFET models, including the latest versions of BSIM3, BSIM4, BSIM Bulk (BSIM6), PSP, and HiSIM models

- High-voltage MOS models, including the latest versions of HiSIM HV, MOS9, MOS11, and EKV models

- Silicon-on-insulator (SOI), including latest versions of BTASOI, SSIMSOI, BSIMSOI, BSIMSOI PD, and HiSIM SOI models

- Bipolar junction transistor (BJT) models, including the latest versions of VBIC, HICUM, Mextram, HBT, and Gummel-Poon models

- Diode models, including diode, Phillips level 500, CMC diode models

- JFET models, including JFET, Phillips level 100 JFET, and individual dual-gate JFET models

- IGBT models, including PSpice IGBT model and HiSIM IGBT models

- Resistors, including linear resistor, diffused resistor, CMC two-terminal and three-terminal resistor, and physical resistor models

- GaAs MESFET models, including the latest versions of GaAs, TOM2, TOM3, and Angelov models

- GaN MESFET models, including Angelov, ASM, and MVSG models

- Silicon TFT models, including RPI Poly-Silicon and Amorphous Silicon Thin-Film models

- Verilog-A compact device models

- Support for Z and S domain sources

- User-defined compiled model interface (CMI) allows for the rapid inclusion of user-defined models

- Josephson junctions

- Specialized reliability models (AgeMOS) for simulating the effect of HCI and BTI

- Miscellaneous power models, including the relay, transformer, non-linear magnetic core, and winding models

- Miscellaneous RF models, including the dc block, dc feedthrough, microstrip, and stripline elements: bend, cross, corner, curve, open line, and tee models

## Platform support

- x86 32-bit: Red Hat Enterprise V5 and V6, SUSE Linux 9 and 10

- x86 64-bit: Red Hat Enterprise V4, V5, and V6, SUSE Linux 9 and 10

- Commercially available cloud solutions

## Cadence Services and Support

- Cadence application engineers can answer your technical questions by telephone, email, or Internet—they can also provide technical assistance and custom training.

- Cadence-certified instructors teach more than 70 courses and bring their real-world experience into the classroom.

- More than 30 Internet Learning Series (iLS) online courses allow you the flexibility of training at your own computer via the internet.

- Cadence Online Support gives you 24x7 online access to a knowledgebase of the latest solutions, technical documentation, Rapid Adoption Kits, software downloads, and more.

- For more information, please visit www.cadence.com/support for support and www.cadence.com/training for training.