RaptorX

**ANSYS RaptorX** is a novel, pre-LVS EM modeling software for the electromagnetic expert and the IC design engineer. The limitless capacity of its engine, in combination with highly accurate results and blazing fast modeling times, differentiates it from currently available, traditional EM tools.

**Pushing the limits on capacity**
Due to increasing complexity, your circuit design may include hundreds of ports or nets. RaptorX is the only product on the market that can calculate RLCk parasitics for highly complex circuits such as full custom blocks, power grids and clock trees.

RaptorX can accurately extract any arbitrary routing and layouts with planes (solid or perforated), round shapes, MiM/MoM capacitors, etc.

**Unprecedented modeling and simulation speed**
With RaptorX, RLCk modeling and simulation is completed in minutes compared to other solutions that can take hours. Furthermore, its speed accelerates linearly with the number of cores.

**Proven accuracy**
ANSYS benchmarks the accuracy of its modeling engine against lab-measured data from hundreds of devices implemented in silicon every year. The pool of measured devices now numbers more than 3,000 and covers all production technology nodes. Models are benchmarked against measurements up to 110 GHz. A large number of designs based on ANSYS models are in production across multiple customers and serving multiple market applications.
**Helps meet area reduction goals: Model spirals over dense routing**

The exploding costs of nanoscale silicon processes force design managers to come up with innovative design architectures, such as the placement of actives under or inside the white space of inductors. Risky design techniques that were considered “science fiction” a few years ago are now becoming the trend. To alleviate risk and minimize re-spins that cost money and time, designers need a very high-capacity and accurate modeling tool like RaptorX, which can meet their toughest capacity demands and allow them to model the electromagnetic effect of inductors over dense routing, capacitor arrays and active devices.

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**Extremely user-friendly**

- Allows point-and-click net-based net selection process
- Provides easy handling of one type of port or use of existing layout pins and labels
- Allows addition and exclusion of nets through a very easy-to-use interface, enabling what-if analysis for the evaluation of crosstalk among blocks
- Supports batch runs for routine jobs
- Eliminates the need to define boundary conditions and special types of ports required by other EM solvers
- Facilitates debugging of discrepancies between silicon measurements and circuit simulations

**Output models support all circuit analyses**

- RaptorX produces models that are guaranteed to be causal and passive
- The tool produces RLCk netlist models and S-parameter models simultaneously
- The RLCk netlist is highly compacted and enables very efficient time-domain analyses like transient, noise and shooting analyses
- The S-parameter models are accurate to DC and well-suited for AC, harmonic balance, SP and other frequency-domain analyses
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Layout processing
The need to model electromagnetic effects from DC up to mm-wave frequencies calls for special handling of layouts. A novel, full 3D-meshing algorithm segments the conductors’ volume into small cells suitable for accurate modeling of capacitance, inductance and resistance. The engine computes all the layout-dependent effects (LDE) before the meshing step.

Capacitance extraction
ANSYS’ 3D capacitance extraction methodology uses a sophisticated stochastic sampling algorithm based on the random walk theory for calculating the electric field along the Gaussian surfaces and corresponding coupling capacitances between arbitrary-shaped conductors. The solver calculates with the highest accuracy the distributed 3D electric field, using stochastic sampling and a sophisticated numerical solution of the multilayer Green’s function. The method does not use any kind of pattern-matching lookup tables or averaging, and is free of conductor discretization bottlenecks. It scales better with circuit size than boundary or volume meshing methods and demonstrates the best computing efficiency (random walk is an inherently parallel and extremely fast algorithm).

Substrate model extraction
ANSYS’ unique extraction engine models substrate coupling effects with a distributed RC network. A stochastic Monte Carlo-based methodology and a 3D substrate model allows for very fast and accurate extraction of the distributed RC substrate network. The method employs a random walk algorithm that allows characterization of multiple substrate layers using appropriate Green’s functions without needing 3D discretization. The parallel nature of both capacitance and substrate modeling algorithms offers scalability and extraction times superior to any other method.

Inductance and resistance modeling
This capability combines the accuracy of a full-wave electromagnetic (EM) modeling engine with the flexibility and interoperability of SPICE netlist output. Extracted models fully capture inductance and resistance behavior from DC up to mm-wave frequencies. They are extremely accurate, capturing all electromagnetic phenomena, including current distributions, skin and proximity effects.