

SIwave 5.0

SIwave™ analyzes entire printed circuit boards (PCBs) and IC packages including packages merged onto boards for complete channel analysis. The tool allows engineers to perform complete signal- and power-integrity analyses from DC to beyond 10 Gb/s. SIwave extracts frequency-dependent circuit models of signal nets and power distribution networks directly from electrical CAD layout (E-CAD) databases. These analyses aid in the identification of signal and power integrity problems and are critical to designers seeking first-pass system success. Entire design paths from package to board to package can be analyzed using a full-wave electromagnetic simulator realizing coupling effects between packages and boards that are often ignored. With the IC die network modeler, first order silicon effects can be included in the analyses for a complete channel description. The inclusion of Apache RedHawk™ die models enables analysis of dynamic switching effects.

Signal- and Power-Integrity Analysis

SIwave employs specialized full-wave finite-element algorithms to compute resonances, reflections, inter-trace coupling, simultaneous switching noise, power/ground bounce, DC voltage/current distributions, near- and far-field radiation patterns on high-speed PCBs and complex IC packages.

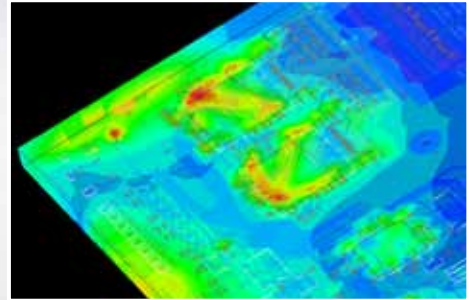
Easy Layout Extraction

SIwave can extract complete designs (which include multiple, arbitrarily shaped power/ground layers, vias, signal traces and circuit elements) with unprecedented accuracy and speed, without requiring potentially laborious layout partitioning by the user. SIwave extracts S, Y, and Z-parameters; IBIS interconnect models(ICM), displays 3-D electromagnetic fields and generates Full-Wave SPICE™ models for subsequent time- and frequency-domain analyses within DesignerSI™, DesignerRF™ Nexxim®, Simplorer®, or third-party SPICE-compatible circuit tools such as Synopsys® HSPICE® and Cadence® PSpice®.

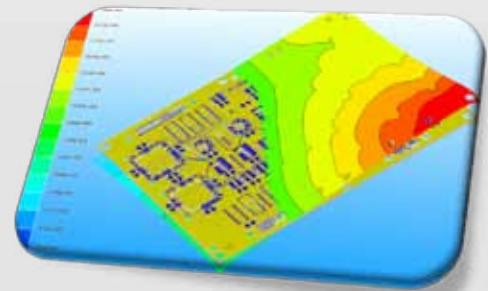
Integrated DC Voltage, Current and Powerless Computation Module

SIwave allows engineers to perform pre- and post-layout DC voltage drop, DC current density, and DC power density analyses to ensure that power distribution networks (PDN) can source the proper power to integrated circuits by ensuring the PDN has the proper bump, ball and pin sizes as well as proper copper weighting to minimize losses.

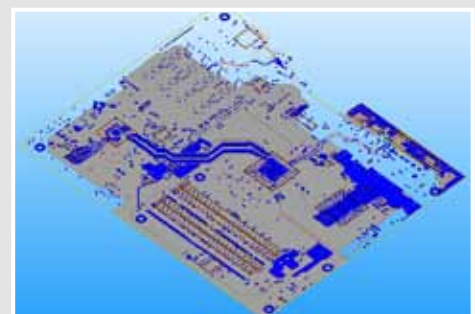
Industry Solutions



DC voltage drop visualization



Eigenmode visualization showing resonant energy



Full-wave package and board extraction for SI, PI and EMI

Product Features

SYZ Network Analysis for Signal- and Power-Integrity PCB and Package Applications

- Integrated SYZ reporter with filters for insertion and return loss
- Mixed mode SYZ reporting
- Differential net tagging
- Automated decoupling analysis
- Capacitor library browser
- Simple PI lumped analysis
- Trapezoidal and hexagonal trace cross-sections
- Frequency dependent dielectric and copper loss
- Surface roughness loss
- Finite element method based via solutions
- 2-D MoM "real-time" trace characterization (Z_0 , T_d , R , L , C , G , ...)

DC I2R Solver for PCBs and Packages

- Adaptive mesh refinement
- DC Voltage drop, current density and power density analyses
- Accurate 3-D via and wire bond analysis
- Loop resistance analysis
- Distributed resistive network outputs in SPICE format from the DC solver
- Linkage to ANSYS® Icepak™ for thermal analysis

Radiation Field Solvers PCBs and Packages

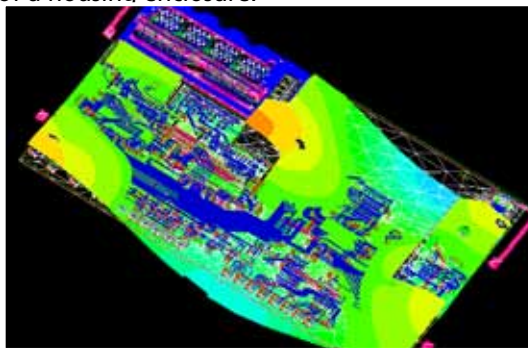
- Resonant cavity analysis including Touchstone parasitics for devices
- Near-field analyses
 - Component $|E_{x,y,z}|$ and $|H_{x,y,z}|$
- Far-field analyses
- Data dependent EMI/EMC simulations when combined with Ansoft Designer or DesignerSI
- Slwave links to HFSS and acts as a radiation excitation source

Automated Package and Board Validation Checking and Correction

- Simulation dependent validation rules
- Self-intersecting polygons and identical/overlapping vias
- Bondwire collisions and illegal connections
- DC shorted nets and disjoint nets
- Misalignments and unreferenced trace segments

Electromagnetic Interference/Compatibility

EMI/EMC testing can be performed for both near and far-field problems. Slwave leverages algorithms from HFSS™ to provide accurate, detailed descriptions of field interactions above and below boards and packages. Combining this with resonant mode simulations allows the user to predict field radiation patterns prior to manufacturing thus reducing the number of fabrication spins needed to meet the user's needs. Slwave provides valuable insight not obtainable through measurements and enables engineers to troubleshoot sources of EMI. In addition, design engineers can quantify directional electric and magnetic fields via 3-D plotting mechanisms using IEX, Y,ZI and IHX, Y,ZI. This provides confidence that any changes made will correct the problems found during testing. Coupling of Slwave with DesignerSI, DesignerRF and HFSS provides the unique ability to study data dependent radiation patterns from PCBs and packages inside of a housing enclosure.



AC Voltage visualization in the frequency domain

High-Performance Computing

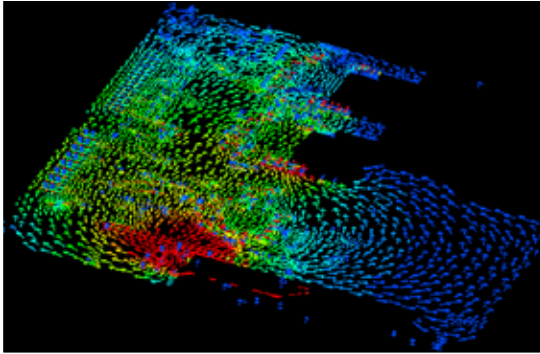
Slwave solver technology computes solutions by using multiple threads, cores, and processors allowing it to solve large simulations with shorter solve times. This parallelization helps enable full packages merged to board solutions for signal-, power-integrity, and electromagnetic interference.

Slwave PI Advisor

Slwave 5.0 introduces the new optional PI Advisor to address the ever growing need for smaller form factors and lower cost solutions. This leading edge, full-wave electromagnetic field solver solution can automatically optimize package and board decoupling capacitors using a ground breaking genetic algorithm. This technology greatly simplifies power integrity analysis and results in reduced costs and time to market. See the PI Advisor section for more information.

Macro Modeling

Slwave provides an unprecedented level of accuracy for complete board and package designs that enables full channel transient simulation in multiple circuit simulator platforms. Slwave uses patent pending TWA technology that enable users to check and enforce passivity and causality. This technology eliminates errors introduced when trying to simulate time domain circuit analyses using different simulation platforms. SPICE level models using HSPICE and PSpice syntax are supported along with native Nexxim and Simplorer state space models.



DC current density visualization of Vddcore and ground return path

Comprehensive Multiphysics

Slwave links with the ANSYS software portfolio for multiphysics simulation of electronic components. One option is the ability to export a power distribution map from Slwave into ANSYS Icepak. This multiphysics solution enables accurate thermal modeling of IC packages and PCBs using DC power loss from Slwave as a heat source. Icepak simulation technology solves the challenges associated with the dissipation of thermal energy from electronic components that may cause premature component failure due to overheating.

Design Automation

Slwave seamlessly integrates into existing design flows by importing design geometry directly from EDA layout tools (such as Cadence Allegro®/APD, Sigrity Unified Package Designer™ (UPD) Mentor Graphics Board Station®, Expedition™ and PADS®, Zuken CR5000) and manufacturing standard ODB++. The resulting SYZ networks or Full-Wave SPICE™ models can be imported into existing circuit tools, such as DesignerSI, DesignerRF, Simplorer, or other SPICE compatible tools.

Product Features

Macro Modeling Environment

- Passivity/Causality checking and enforcement
- Touchstone output (s-parameters)
- IBIS ICM output
- Lumped RLGC output
- Full Wave Spice output
- Nexxim and Simplorer state space models
- HSPICE and PSpice
- Spectre

Layout and Editing of PCBs and Packages

- Clipping of designs from PCBs and packages
- Allows for re-use of older designs
- Removes extraneous portions of complex designs
- Merging of multiple packages onto a PCB
- Artwork creation
- Trace drawing utility
- Via padstack editor and designer
- Rectangular and polygon drawing utility
- Capacitor regions
- Pin grouping capability, clusters pins into a single node
- Pin grouping of multiple components
- Circuit element placement
- Pin swapping
- Circuit elements, sources, and probes
- Ports, voltage sources, current sources
- Resistor, capacitor, and inductor elements
- Touchstone files
- Design validation checker with automatic correction
- Measuring utility
- Pads to vias for solder ball/bump emulation
- JEDEC standard wire bond creation utility
- Non-standard wire bond creation utility
- Solder bump/ball creation utility
- Library management
- *Exporting/Importing of:*
 - Stack up files
 - Component mapping files
 - Slwave templates
 - Visual basic scripting

Applications

Signal- and Power-Integrity

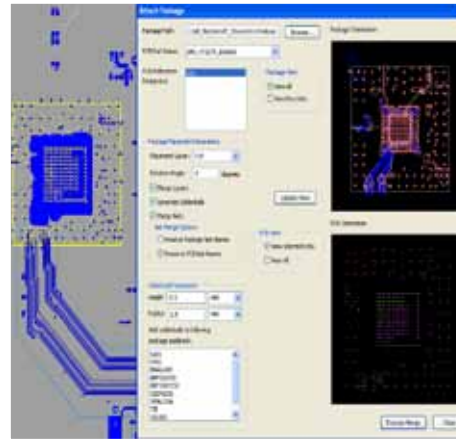
- SSN/SSO
- High-speed serial analysis
- Capacitor decoupling analysis
- Package and PCB co-simulation

PCB and Package DC Analysis

- Solves distributed resistive network using 3-D FEM
- Provides 1-D and 3-D results
- Thermal analysis

EMI/EMC Analysis for PCBs and Packages

- Visualization of near fields: IEI and IHI
- Component IEX,Y,ZI and IHX,Y,ZI
- Visualization of far-fields
- Data dependent EMI/EMC simulations when combined with Ansoft Designer
- Slwave dynamic link to HFSS acts as a radiation excitation source for enclosure studies



Package and board merging utility

The ANSYS Advantage

With the unequalled depth and unparalleled breadth of ANSYS engineering simulation solutions, companies are transforming their leading edge design concepts into innovative products and processes that work. Today, almost all of the top 100 industrial companies on the "FORTUNE Global 500" invest in engineering simulation as a key strategy to win in a globally competitive environment. They choose ANSYS as their simulation partner, deploying the world's most comprehensive multiphysics solutions to solve their complex engineering challenges. The engineered scalability of solutions from ANSYS delivers the flexibility customers need, within an architecture that is adaptable to the processes and design systems of their choice. No wonder the world's most successful companies turn to ANSYS — with a track record of 40 years as the industry leader — for the best in engineering simulation.

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