Ansys Q3D Extractor

Ansys Q3D Extractor is the industry's leading 3D RLCG parasitic extraction solution to tackle the complexities of modern electronic designs. Its powerful 2D and 3D field solvers automatically produce-circuit models for SPICE simulators and provide necessary design insights. It is an ideal choice for designing advanced electronics packages and connectors used in today's high-speed electronic equipment, high-power bus bars, and power converter components used in electrical power distribution, power electronics, and electric drive systems / electrification.

/ Q3D Extractor targets your top 4 challenges:

Problem	Description	How Q3D Extractor Helps
Power Delivery Network (PDN) design at package, PCB level	Power Integrity (PI) is influenced by many factors, such as AC inductance, L*di/dt noise, DC voltage drops, and capacitive coupling. These effects are becoming critical as package dimensions shrink and switching currents rise.	Q3D extracts the inductance and resistance of all parts of the PDN, including package leads, bond wires, vias, power planes, and traces, with full 3D accuracy.
Controlled-Impedance Channel Design	Accurate crosstalk and impedance modeling/calculation is vital for ensuring proper channel performance in today's complex, high-speed signaling environments.	Q3D's 2D field solvers provide characteristic impedance and crosstalk coefficients for single-ended and differential transmission lines, signal buses, and cables.
Capacitive Touchscreen Design	Touchscreen designers need to predict the changes in interline capacitances as fingers move across the screen.	Q3D's 3D capacitance solver models metal, glass, and oxide layers and determines the full capacitance matrix, with finger models in arbitrary locations.
SPICE-Level Circuit Analysis	SPICE simulators focus on accurate transistor modeling, but have only simplistic models of interconnect parasitics.	Q3D exports detailed parasitic models in the form of subcircuits compatible with HSPICE, Pspice, and other circuit simulators.

/ Achieving your top 4 tasks:

Quickly and accurately evaluate if your package, PCB, connector, bus bar, or touch screen device meets its performance requirements.

Easily generate an accurate SPICE-compatible model representing the 3D geometry and use that model in a circuit simulation tool.
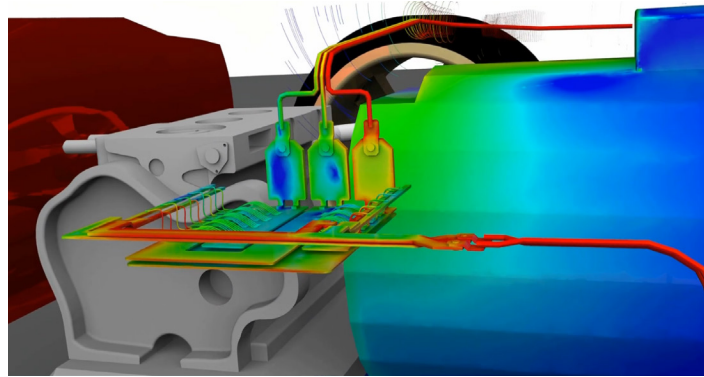
Evaluate if your power electronics system (such as a drive train) will meet EMC standards.
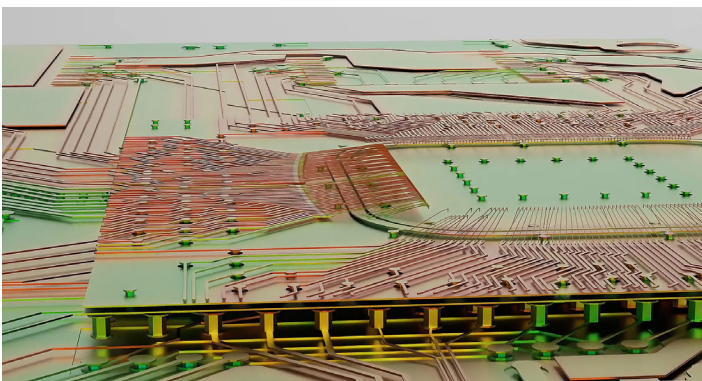
View electric, magnetic fields, and current distributions and explore design variations for the best results.
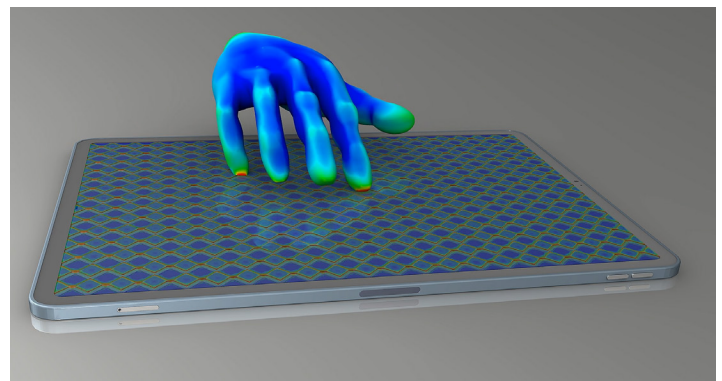
/ Ansys Q3D Extractor caters to various parasitic extraction phenomena:

Power Converter Design with Q3D

Fast, Accurate 3D Parasitic Extraction with Q3D

Touch Screen Design with Q3D

- Q3D uses a finite element solver for **DC analysis to model current flows and electrical resistance in the low-frequency limit.**

- Q3D uses a surface-based solver for **AC analysis to model the skin effect and proximity effect in conductors at high frequency.**

- Q3D's capacitance solver **extracts the self- and coupling-capacitance values** for arbitrary collections of conductors. Q3D also **models lossy frequency**-dependent dielectric materials and extracts the conductance matrix.

- Extract extremely **accurate results from any 3D model** using Q3D's automatic adaptive mesh refinement algorithm.

- Calculate **characteristic impedance and crosstalk** for single-ended and differential signals.

- Calculate **modal propagation velocity and attenuation in cables and transmission lines.**

/ What differentiates Ansys Q3D Extractor?

- Q3D is the only 3D RLCG extraction tool available in the market today.

- It provides a unique ability to run a two-way electrothermal simulation for any 3D geometry - computing the DC ohmic losses in Q3D and couple to Ansys Icepak for a full thermal analysis.

- It accomplishes the difficult task of generating an extremely accurate SPICE model from a 3D model in record time.

- Q3D makes it very easy to interface the solution data with circuit simulation tools.

- It perform integrated parametric analysis and fields post-processing, providing great insights into the operation of your product.

AUTOMATIC ADAPTIVE MESHING

Automatic adaptive meshing techniques require you to specify only the geometry, material properties, and the desired output. The initial mesh is generated automatically using a highly robust, non-uniform meshing technique that includes a multithreading capability to reduce the amount of memory used and accelerate time to simulation. The mesh is progressively refined using information from the solver to ensure an accurate representation of the electromagnetic fields. This proven technology eliminates the complexity of manually building and refining a finite element mesh and makes advanced numerical analysis practical for all levels of your organization.

EQUIVALENT CIRCUIT MODEL CREATION

You can leverage Ansys Q3D Extractor to create equivalent circuit models (SPICE subcircuits/ladder-type lumped models). The type of model that Q3D Extractor produces depends on which solver is used. The 2D and 3D field solvers create common formats such as Simplorer SML, HSPICE Tabular W-Element, PSpice, Spectre, IBIS ICM/PKG models, and Ansys CPP models.

3D QUASI-STATIC FIELD SOLVER

Ansys Q3D Extractor contains an advanced quasi-static 3D electromagnetic field solver based on the method of moments (MoM), and is accelerated by the fast multipole method (FMM). Results include proximity and skin effect, dielectric and ohmic loss, and frequency dependencies. Q3D Extractor easily and quickly provides 3D extraction of resistance (R), partial inductance (L), capacitance (C), and conductance (G).

The 3D DC resistance solver computes the DC resistance (R) matrix and can optionally produce plots of current density, voltage, and Joule power losses.

The 3D DC inductance solver uses the current distributions from the DC resistance solver to calculate the low-frequency limit of the inductance (L) matrix.

The 3D capacitance solver in Q3D extracts the Maxwell capacitance (C) matrix as well as the conductance (G) matrix for frequency-dependent lossy dielectric materials. The solver is fully multithreaded and takes advantage of the fast multipole method (FMM) to speed up the calculations.

SPECTRAL DECOMPOSITION METHOD

The spectral decomposition method (SDM) accelerates frequency sweeps by distributing multiple frequency points in parallel over compute cores and nodes. You can use this method in tandem with multithreading to speed up extraction of individual frequency points, while SDM parallelizes multifrequency point extraction.

2D EXTRACTOR: CABLE AND TRANSMISSION LINE FIELD SOLVER

Ansys Q3D Extractor includes a powerful quasi-static 2D electromagnetic field solver that uses the finite element method (FEM) to determine the per-unit-length RLCG parameters for cable models and transmission lines. It computes characteristic impedance (Z0) matrices, propagation speed, delay, attenuation, effective permittivity, differential, and common-mode parameters, and near- and far-end crosstalk coefficients.

FIELDS POST-PROCESSING:

The fields post-processor allows you to visualize 2D and 3D electric and magnetic fields, current densities, charge density, voltage, and other derived quantities and perform user-defined calculations on them.

PARAMETRIC ANALYSIS

The built-in Optimetrics module provides a way to parameterize the geometry and material properties of a design. You can then explore the effects of varying these design parameters and perform design of experiments and optimizations. Optimetrics has links to Ansys DesignXplorer and optiSLang for more advanced optimization studies. It also offers automatic analysis of parameter permutations and job management across multiple hardware platforms and reassembly of data for parametric tables and studies.

HPC MULTITHREADING

Electronics HPC takes advantage of multiple cores on a single computer to reduce solution time. Multithreading technology speeds up the initial mesh generation, matrix solves, and field recovery.