

CST STUDIO SUITE 2009

Overview



CST MICROWAVE STUDIO® | CST PARTICLE STUDIO® | CST EM STUDIO®
CST PCB STUDIO™ | CST CABLE STUDIO™ | CST DESIGN STUDIO™



CST – COMPUTER SIMULATION TECHNOLOGY



Founded in 1992, CST offers the market's widest range of 3D electromagnetic field simulation tools.

CST's ground breaking »complete technology« complements its market and technology leading time domain solver, thus offering unparalleled accuracy and versatility for all applications.

Customers operate in industries as diverse as Telecommunications, Defense, Automotive, Electronics, and Medical Equipment, and include market leaders such as IBM, Intel, Mitsubishi, Samsung, and Siemens.

CST provides timely local support through its direct sales and technical support forces. Together with its highly qualified distributors and representatives, CST supports its EM products in over 30 countries.

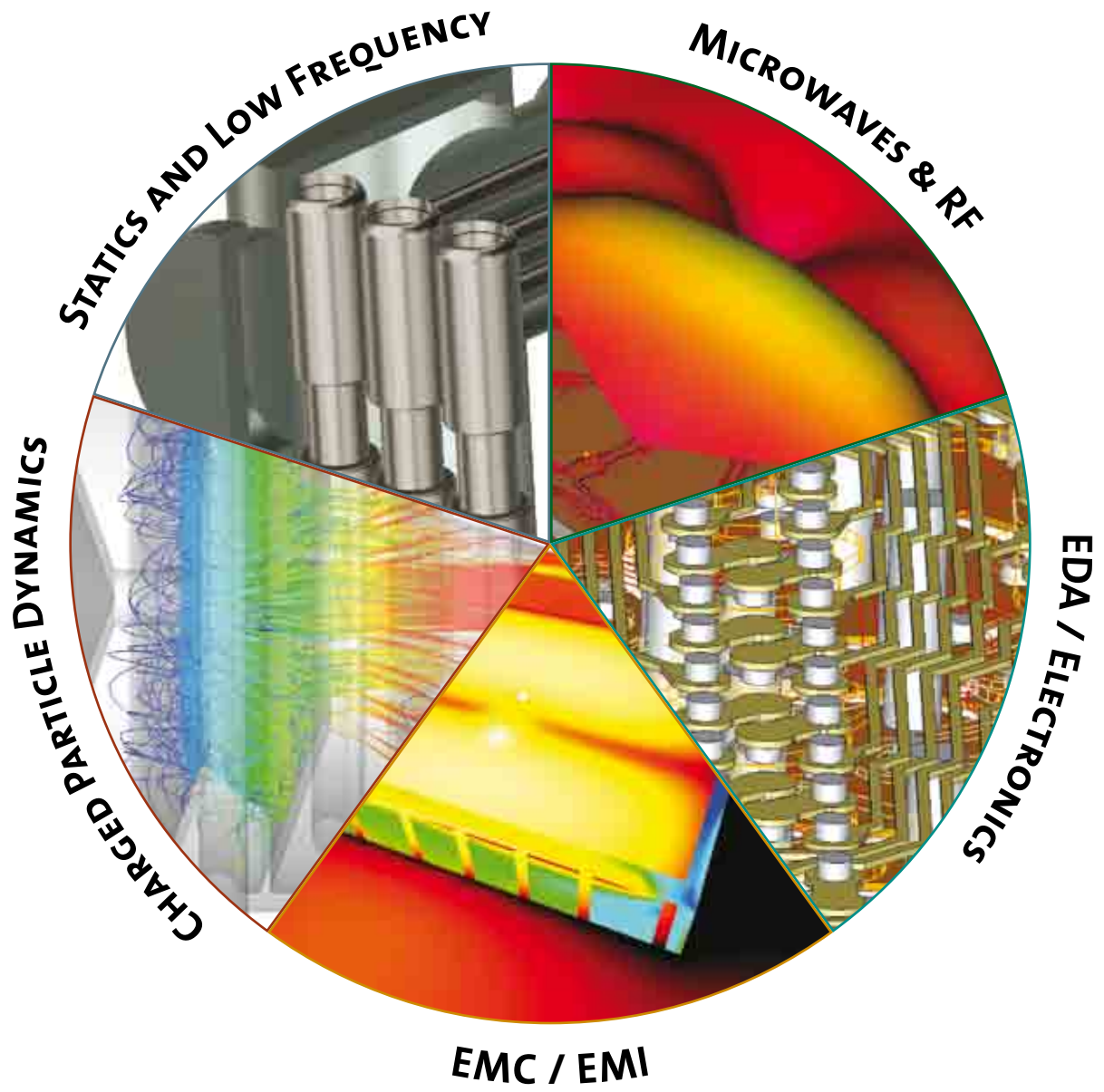
FOUNDATION OF CST'S SUCCESS

CST's success is based on the implementation of leading edge technology in a user-friendly interface.

With the introduction of the proprietary PERFECT BOUNDARY APPROXIMATION [PBA][®] in 1998 with the first version of CST MICROWAVE STUDIO[®] [CST MWS], CST's flagship product, CST established a profound technical advantage.

CST has built on this success, encouraging innovation and investing in product development. The resulting expansion in solver technology has created CST's »complete technology« approach to simulation. This enables users to select the most appropriate method for their application and can offer additional security through cross verification.

Today CST employs more than 150 sales, development, and support personnel, and enjoys a market share of over 30% in high frequency 3D EM simulation.



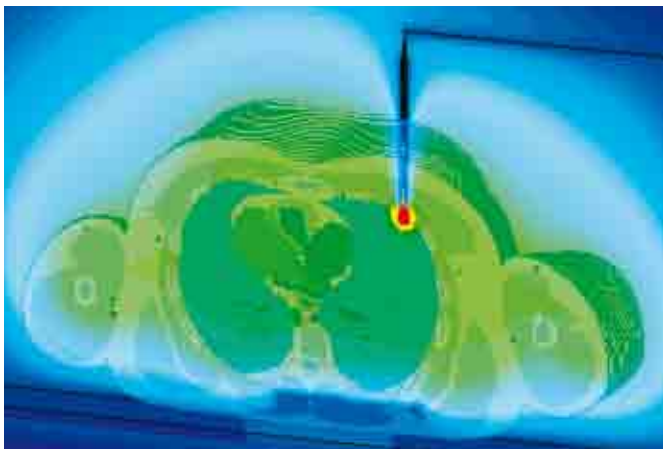
CST STUDIO SUITE

CST STUDIO SUITE™ 2009 is the culmination of many years of research and development into the most accurate and efficient computational solutions to electromagnetic designs. It comprises CST's tools for the 3D EM design and optimization of static to optical frequency applications, as well as synthesis and circuit simulation.

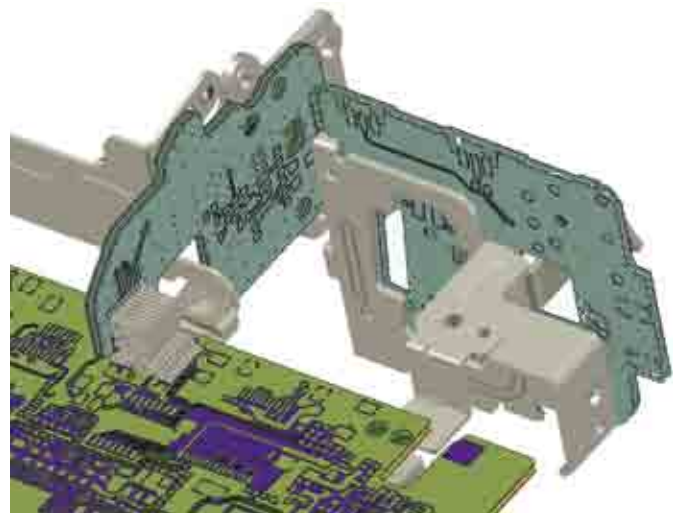
All programs are accessible through a common interface, CST DESIGN ENVIRONMENT™, which facilitates multi-physics and co-simulation.



The CST STUDIO SUITE graphical user interface illustrating the 3D EM simulation of a mobile phone.

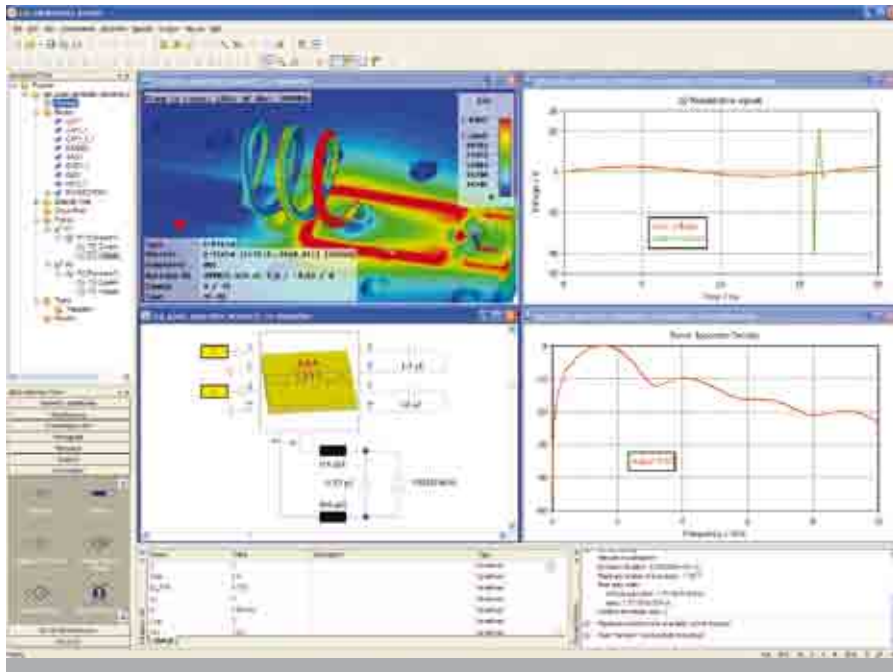


Cancer treatment by RF thermoablation: a catheter is used to apply a 40 W signal at 375 MHz to a tumor in the liver. The bioheat equation solver is used for the realistic simulation of the resulting temperature distribution.



Detail of a camcorder: the complete device was modeled, simulated and consequently modified to comply with FCC Class-B.

CST DESIGN ENVIRONMENT



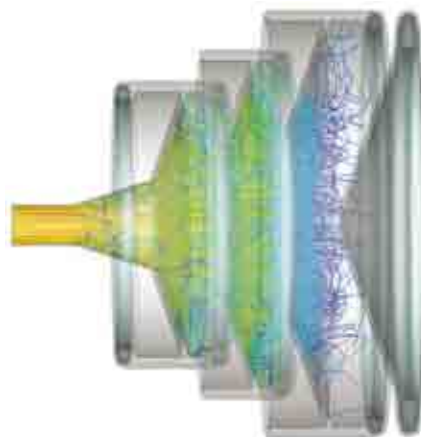
The true transient EM/circuit co-simulation of a sub-nanosecond pulse generator: a 60 MHz signal is converted into a sharp pulse by a strongly non-linear step-recovery diode (SRD).

CST DESIGN ENVIRONMENT™ (CST DE) is the access point to CST's entire range of solver technology* and was developed in response to the growing demand for coupled problems and co-simulation:

- EM/circuit co-simulation using CST DESIGN STUDIO™ (CST DS).
- Thermal analysis using all 3D electric loss results.
- Magnetostatic analysis of current flow fields.
- Charged particle simulation with 3D static and eigenmode fields.
- Trace and cable currents for full 3D EMC/EMI analysis.

CST MWS models can also be embedded in other RF/microwave circuit systems for which various circuit analysis types are available.

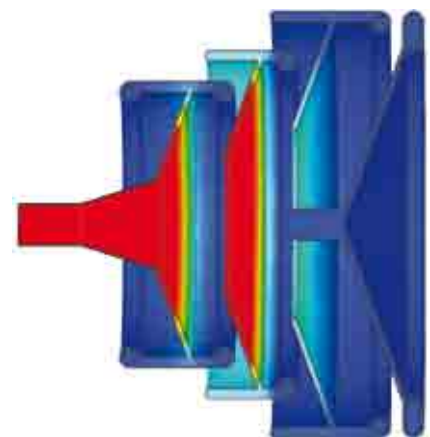
The intuitive and easy-to-use graphical user interface is common to all of the CST 3D simulators. Several projects can be opened simultaneously in a single front-end using the multiple document interface.



The integrated optimizer operates within and between the solver modules. Projects can be controlled using the VBA macro language and COM/DCOM implementation. Distributed computing and the job control center facilitate the management of projects and distribution of simulations on a network.

CST DS, CST STUDIO SUITE's schematic tool, can facilitate the co-simulation of multiple blocks (EM, circuit, 3rd party). For each CST MWS model, an associated CST DS schematic is created automatically. With version 2009, true transient 3D EM/circuit co-simulation provides a powerful means to include non-linear elements in 3D EM simulations to speed up multi-port EM/circuit co-simulation. Furthermore, a divide and conquer approach can be used in CST DS for the decomposition of large microwave components into smaller sub-components which can be handled with greater ease and speed.

*See inside back cover.



Depressed collector: electrons are decelerated by electrostatic fields and absorbed by the metal, secondary electron emission is considered. Particle trajectory (left) and resulting temperature distribution (right).

SIMULATION PERFORMANCE

Simulation performance can be measured best by the time required to arrive at an accurate numerical simulation result from the initial design idea. The quest to solve ever larger and more complex models demands continuously increased performance. CST products have consistently achieved excellent performance improvements on various levels: design intent capture in the modeler, workflow integration, advanced numerical algorithms, high performance computing, and automated evaluation and optimization. These are the essential ingredients for fast and successful design.



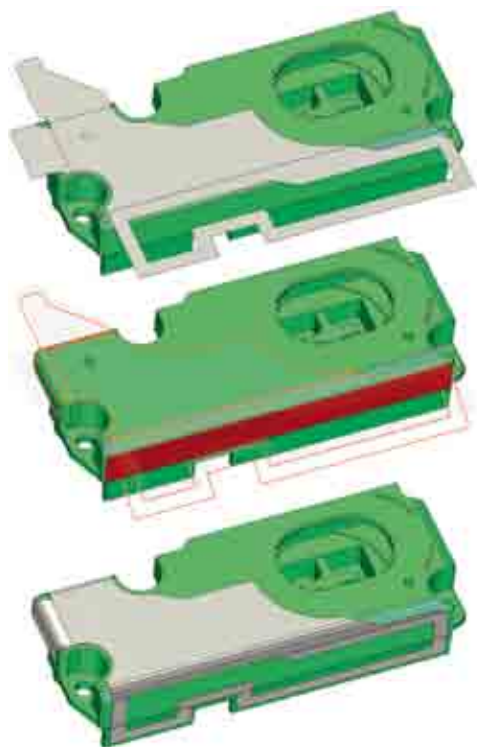
Various meshing strategies for a simple sphere: staircase, tetrahedral, and CST's proprietary technology PBA.

PERFECT BOUNDARY APPROXIMATION

CST gained a major competitive advantage with the introduction of PERFECT BOUNDARY APPROXIMATION [PBA][®] technology into the Finite Integration Technique (FIT).

The standard FDTD staircase grid is pretty efficient for a large number of mesh cells, but it does have a major drawback when it comes to the geometrical approximation of arbitrarily shaped structures.

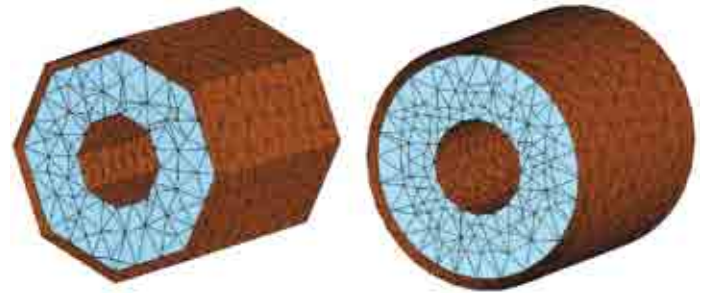
In a convergence study, the achieved accuracy of a staircase model improves slowly and unsteadily, and takes a large number of iterations. The geometrical precision achieved thanks to PBA, enables smooth broadband convergence with a minimum number of passes. Tetrahedral meshing has more or less the opposite strengths and weaknesses. PBA combines the advantages of both standard approaches and offers a superior solution for most applications.



Advanced features such as the new bending facility in CST DE, can facilitate and speed-up the modeling process.

TRUE GEOMETRY ADAPTATION

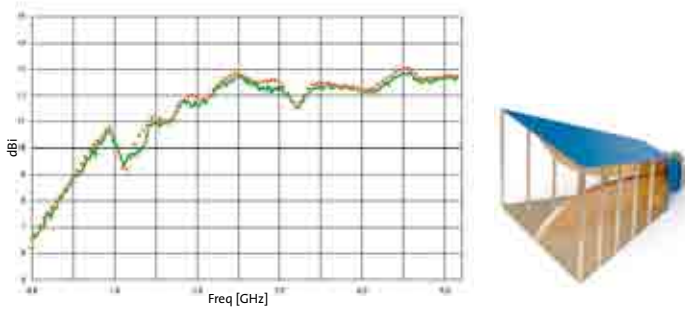
Mesh refinement of traditional tetrahedral frequency domain solvers does not improve upon the initial faceted representation of the structure. CST's true geometry adaptation (snapping) projects the refined mesh back onto the original model to achieve higher accuracy.



Coaxial waveguide after traditional (left) and true geometry (right) mesh adaptation.

BROADBAND SIMULATION

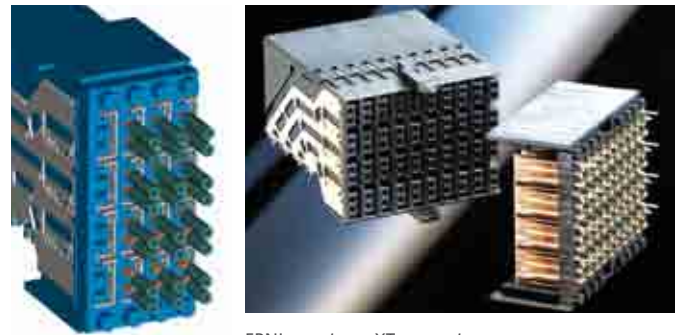
Time domain simulation with CST MWS delivers a multitude of time and frequency domain results such as time signals and s-parameters, and farfields in time and frequency domain. A transient simulation can provide results at many frequency points with an arbitrarily fine frequency resolution in just one simulation run.



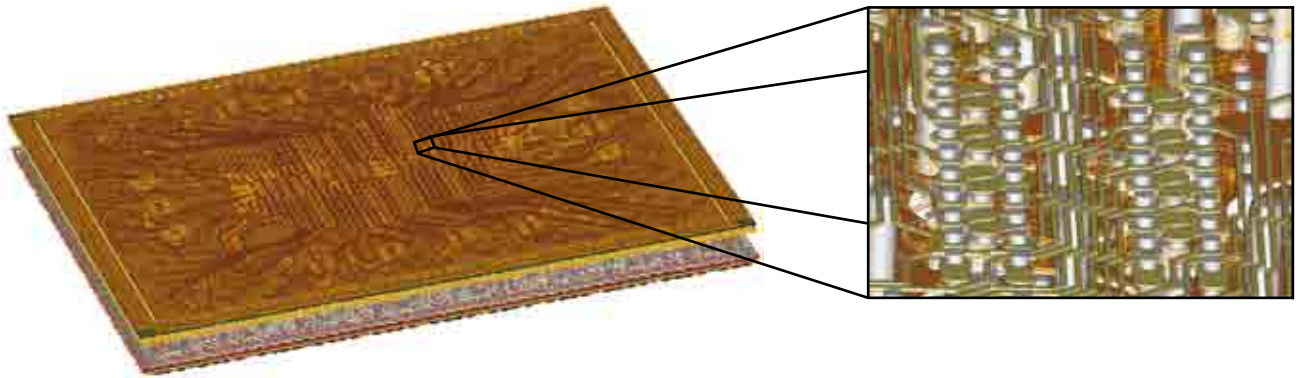
Excellent agreement between measured and simulated broadband gain of a Satimo dual-ridge horn antenna.

»The ERNI Ermet zeroXT connector is able to transmit differential signals up to a data rate of 10 Gbit/s [of a non-return zero code]. The complete design support, including the electromagnetic field analysis, the impedance calculation and the crosstalk analysis, was done using CST MICROWAVE STUDIO. Due to the accurate results, the connector could be manufactured, without a major re-design, in one pass.«

Dr. Thomas Gneiting, AdMOS



ERNI ermet zeroXT connector.



IBM benchmark package for signal integrity analysis.

WINNING PERFORMANCE

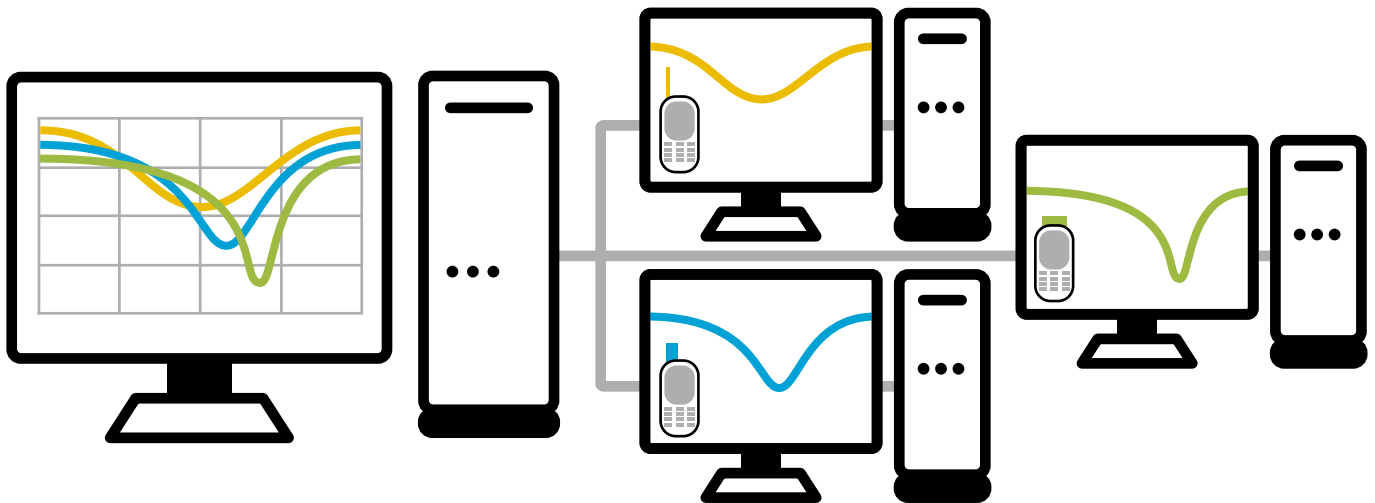
CST's leading-edge position was convincingly demonstrated at the 15th Conference on Electrical Performance of Electronic Packaging [www.epep.org].

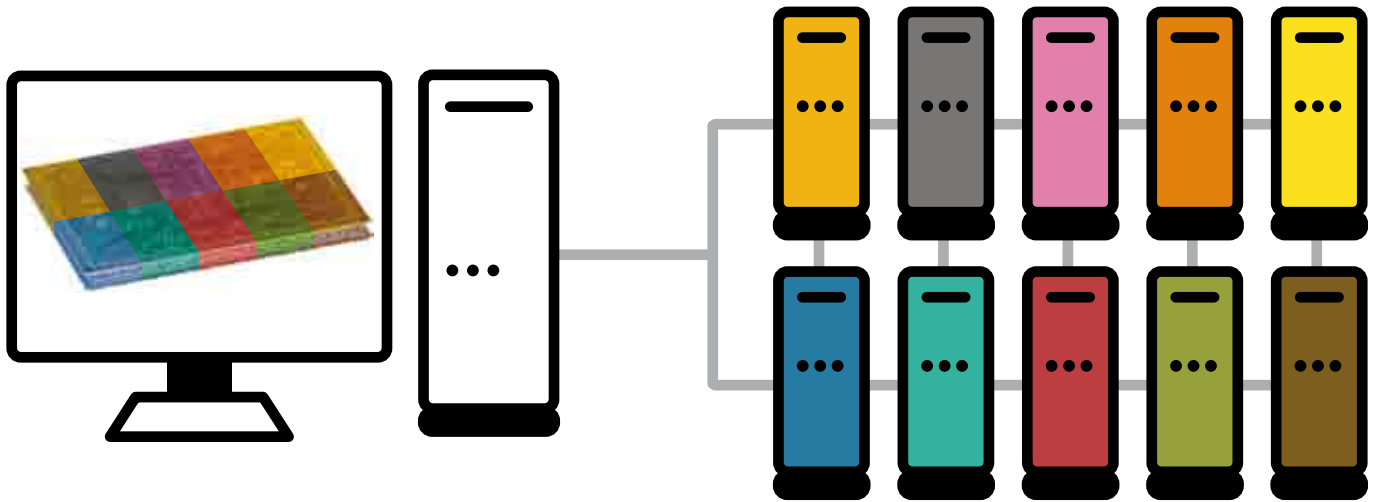
IBM created a benchmark with a complete IC package, with 8 metallization layers and a total of 40,000 geometrical entities. CST was the only vendor whose software was capable of solving the original benchmark

DISTRIBUTED COMPUTING

In order to get your designs right quickly, you need automatic optimization and parameter studies. Wouldn't it be nice to go onto your next task, while the simulation is performed in the back ground on another, dedicated machine?

Or even better, run this job in parallel and cut down optimization time. CST's distributed computing offers you a cost effective means of doing just this.





Domain decomposition of a complex package: MPI is used to distribute the various parts over a network.

CODE OPTIMIZATION AND HARDWARE ACCELERATION

Accurate conformal methods improve simulation performance by orders of magnitude compared to standard approaches. Additionally, efficient implementation on powerful hardware delivers a competitive edge.

CST and Intel are collaborating to provide optimal performance on the latest multicore hardware platforms for users of CST STUDIO SUITE technology.

Besides mainstream CPU development, graphics processing units (GPUs) enable low-cost, high performance computing. CST is at the forefront of development, employing this technology to speed up accurate simulation.

MESSAGE PASSING INTERFACE

CST's parallelization based on the Message Passing Interface (MPI) enables the usage of computers in a network. It increases performance in 2 ways:

1. Reduction of simulation time through parallel use of CPUs on several computer systems.
2. Ability to simulate models previously too large to solve through domain decomposition and distribution over the memory of several computers.



Farfield pattern of a rear screen antenna at 100 MHz.

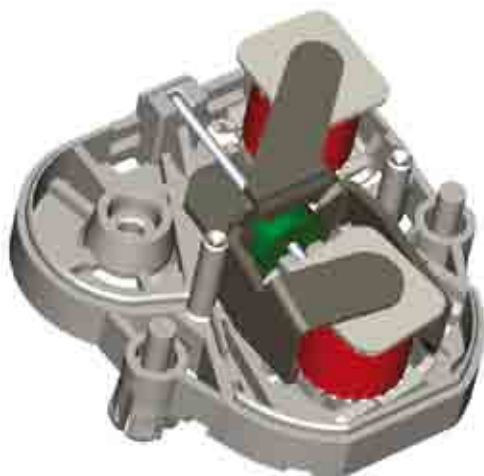
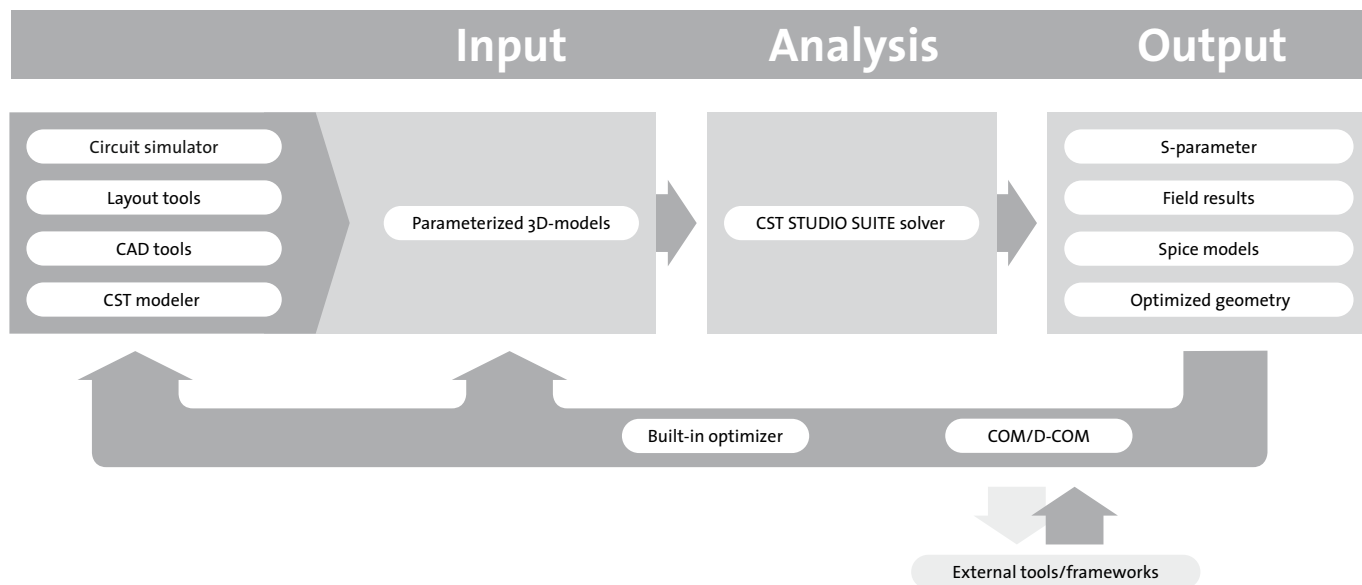


WORKFLOW INTEGRATION

USING THE BEST-IN-CLASS

CST consistently promotes the best-in-class approach. We specialize in developing 3D EM software and provide straight-forward, easy-to-use links with other best-in-class vendors, connecting all available expertise. A wide range of import/export filters enable the easy exchange of geometrical data with CAD tools. Furthermore, imported structures can be modified and parameterized, and used for optimization and design studies.

Special interfaces to various EDA tools for signal integrity analysis, and to RF circuit/system simulators for EM/circuit co-simulation, enhance and unite the capabilities of different worlds. Moreover the powerful VBA based and OLE-compatible macro language allows direct communication with programs like MATLAB® or MS Excel®.



Gauge for a speedometer driven by a stepping motor imported through IGES interface.



Position and cross-section of a cable harness inside a car: surface currents can be used for EMC analysis.

The import and export of structural information is fundamental to embedding a simulator in a design flow. CST STUDIO SUITE filter options include: SAT, STL, IGES, STEP, Nastran, VDA-FS, Autodesk Inventor®, Pro/ENGINEER®, CATIA® v4 and v5, DXF™, GDSII, Multilayer Gerber, ODB++, Cadence® Allegro®, Mentor Graphics® Expedition™, Mentor Graphics® PADS®, Zuken CR5000, Agilent ADS layouts, AWR Microwave Office® layouts, Sonnet® models, biological voxel data.

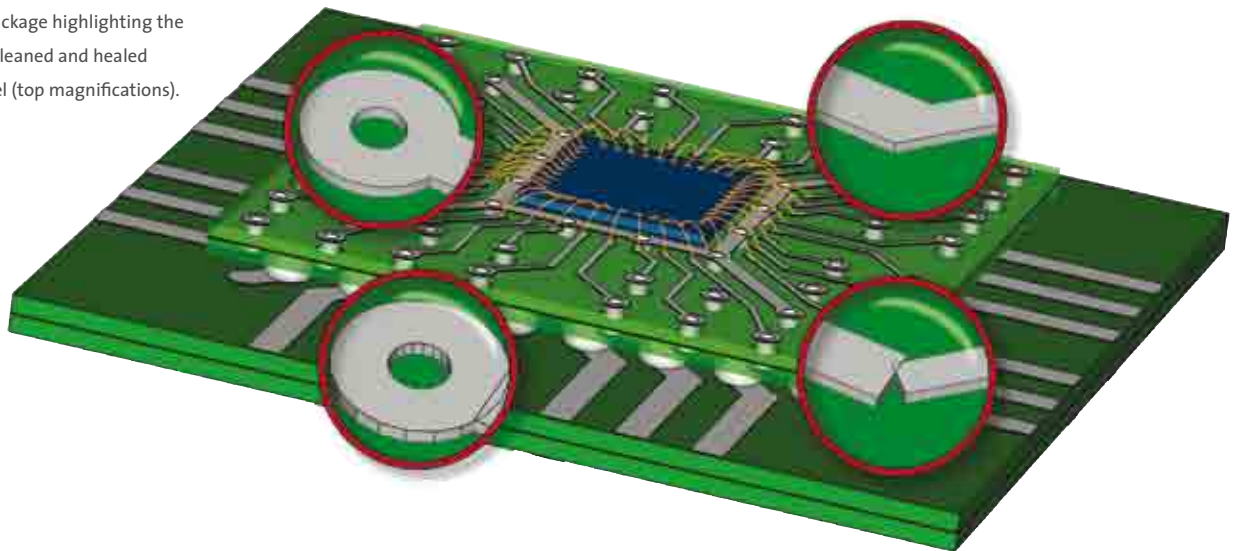
IMPORT QUALITY

Import options are available in the majority of simulation tools nowadays, but their effectiveness is often impaired by seemingly insignificant details.

There is nothing more frustrating than successfully importing 98 % of a structure, as the missing 2 % may make it impossible to continue and it could cost days to fix the problem.

Imports from EDA tools are particularly prone to small gaps and edges which unnecessarily complicate the simulation model. CST MWS contains a sophisticated cleaning procedure as well as automatic healing; these features, combined with the robust mesher, enable effective simulation, even for quite corrupt CAD data.

An imported package highlighting the automatically cleaned and healed CST MWS model (top magnifications).



EM field distribution of a Sony Ericsson mobile phone at 1.8 GHz for SAR analysis: the mobile phone's CAD data was imported using the STEP interface and combined with a hand and SAM model.

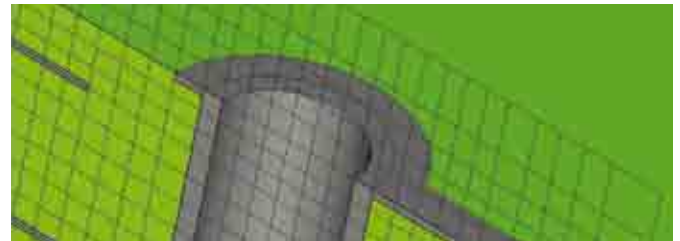
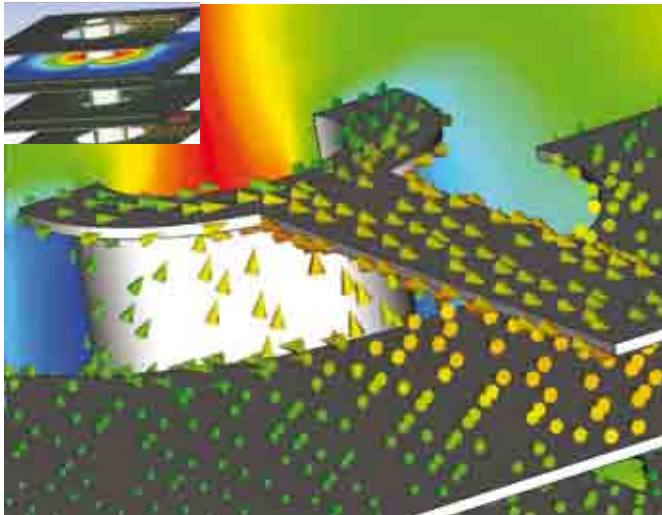
»CST specializes in passive 3D EM field simulation, and through partnerships with best-in-class active simulation tools, has made true co-simulation and co-optimization an everyday task. CST MICROWAVE STUDIO contains a powerful and easy to use solid modeler, and its powerful import filters enable the successful import and parameterization of complex geometrical data.«
3D EM Application Team, Infineon Technologies AG

COMPLETE TECHNOLOGY

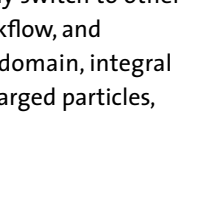
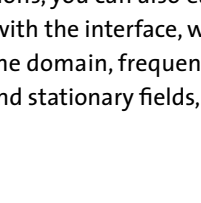
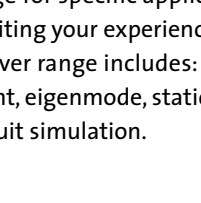
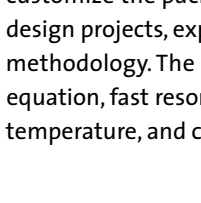
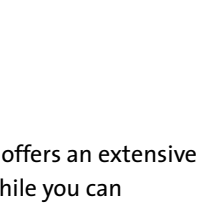
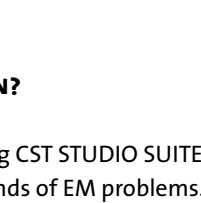
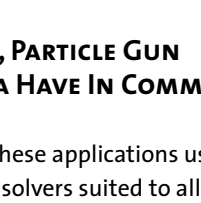
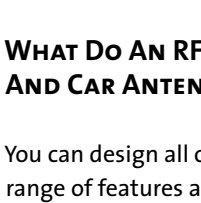
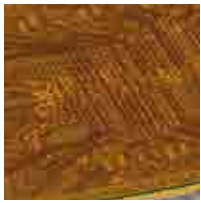
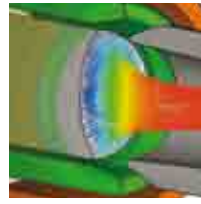
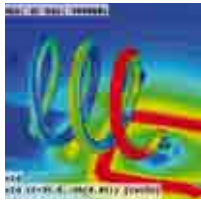
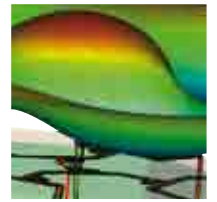
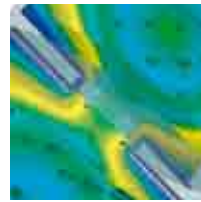
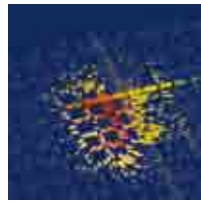
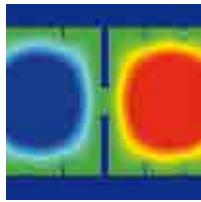
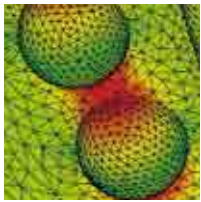
Just a decade ago, experts argued which technology would dominate the 3D EM simulation market: time or frequency domain? Time domain was known for its ability to solve problems with a large number of mesh cells, whereas frequency domain – using tetrahedral instead of rectangular gridding – often offered

better geometry approximation. Both methods have evolved a great deal since then; CST's achievement in overcoming the disadvantages associated with the time domain's staircase approximation has proved especially important. But it's still true that no one method is perfect for every application. With this in mind,

CST has developed frequency domain technology which complements the time domain as a general purpose solver. Moreover, CST has also added an Integral Equation solver [including MLFMM], which uses surface discretization, thus further enhancing the range of choices for its users.

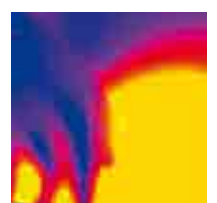
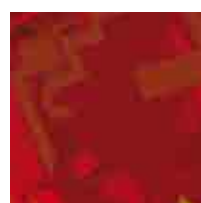
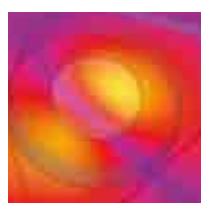
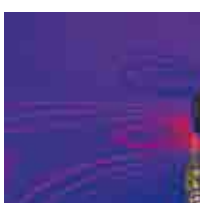
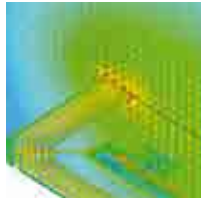
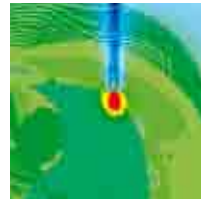
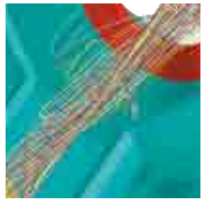


Fields and surface currents of a via: mesh view of PBA and tetrahedral discretization.

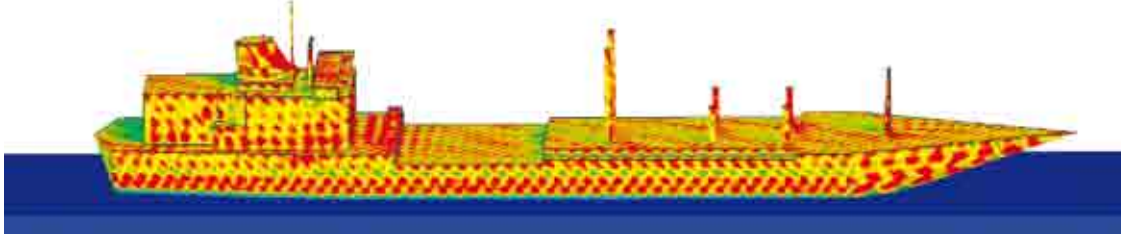


WHAT DO AN RFID, PARTICLE GUN AND CAR ANTENNA HAVE IN COMMON?

You can design all of these applications using CST STUDIO SUITE. It offers an extensive range of features and solvers suited to all kinds of EM problems. While you can customize the package for specific applications, you can also easily switch to other design projects, exploiting your experience with the interface, workflow, and methodology. The solver range includes: time domain, frequency domain, integral equation, fast resonant, eigenmode, static and stationary fields, charged particles, temperature, and circuit simulation.



WHY IS IT IMPORTANT TO HAVE A COMPLETE SOLUTION?



Current distribution on the metallic surface of a 130 m long ship excited by a plane wave of 125 MHz: the relative permittivity (ϵ_1) and conductivity (0.01 S/m) of salt water are considered in the simulation.

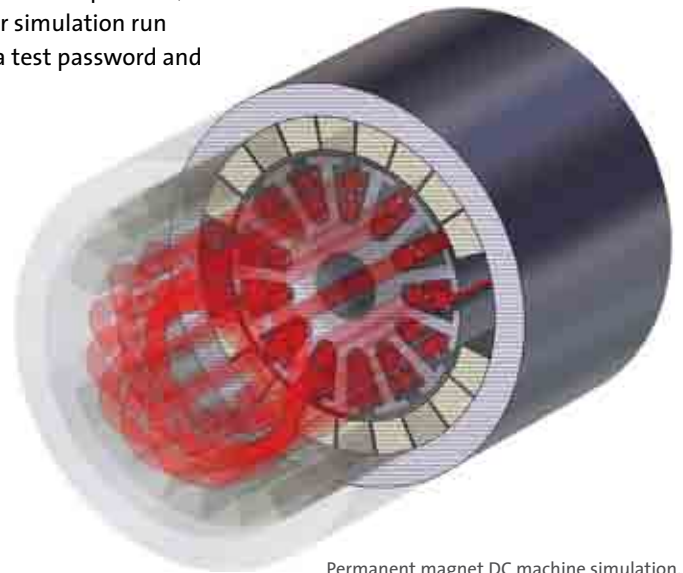
Imagine you have been happy with your software, but one day you get an application whose simulation time threatens to be in the order of days rather than hours. You know you won't meet the deadline unless you find a way of accelerating the simulation time significantly.

CST software allows you to switch from one solver to another easily, without changing the model and parametric settings. So you can choose the most appropriate method for each problem, thus minimizing your simulation run time. You only need a test password and

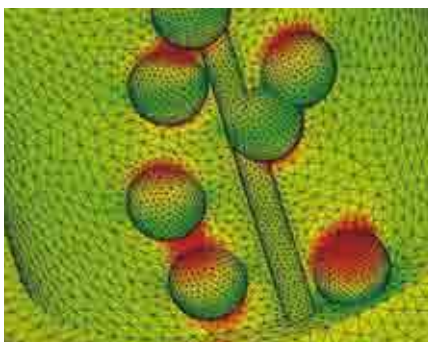
you can try out any feature or solver. A nice side effect of this is that adding an additional solver is far more economical than buying a whole new package.

CONFIDENCE THROUGH CROSS VERIFICATION

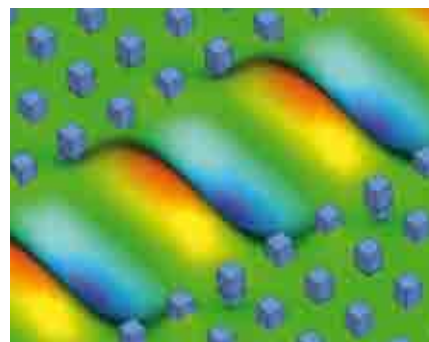
Sometimes simulation and measurements just don't agree, but why? If the measurement was made by another work group they may quickly come to the conclusion that the simulation must be wrong. By running a simulation with both time and frequency domain solvers you can greatly increase confidence in your results. Reaching agreement with two different numerical methods proves that the deviation must have been caused by another factor, such as wrong material values or measurement failure.



Permanent magnet DC machine simulation.



Electroquasistatic simulation of a high voltage insulator contaminated by water drops.



Line defect waveguide in a photonic crystal.

»Everything is going well with our use of CST, and your support is much appreciated. In fact, such prompt support is a major reason that WD will continue to utilize CST in the future (in addition to its technical advantages).«

William Huber, Western Digital Corporation

CST STUDIO SUITE



CST DESIGN ENVIRONMENT™ (CST DE): the access point to and framework for all CST STUDIO SUITE™ modules.



CST MICROWAVE STUDIO® (CST MWS): the leading edge tool for the fast and accurate simulation of high frequency devices. Markets include Microwaves & RF, EDA/ Electronics, and EMC/EMI.



CST EM STUDIO® (CST EMS): for the simulation of static and low frequency EM, and thermal applications, such as sensors, actuators, transformers, and shielding effects.



CST PARTICLE STUDIO® (CST PS): a highly specialized product for the fully consistent simulation of free moving charged particles. Applications include electron guns, cathode ray tubes, magnetrons and wake fields.



CST DESIGN STUDIO™ (CST DS): a versatile tool that facilitates the breaking down of large simulations into small parts, as well as 3D EM/circuit co-simulation.



CST CABLE STUDIO™ (CST CS): for signal integrity and EMC/EMI analysis of cable harnesses.



CST PCB STUDIO™ (CST PCBS): for the simulation of SI/PI and EMC/EMI on printed circuit boards.

Trademarks

CST STUDIO SUITE, CST DESIGN ENVIRONMENT, CST MICROWAVE STUDIO, CST EM STUDIO, CST PARTICLE STUDIO, CST DESIGN STUDIO, CST CABLE STUDIO, CST PCB STUDIO are trademarks or registered trademarks of CST. Other brands and their products are trademarks or registered trademarks of their respective holders and should be noted as such.





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