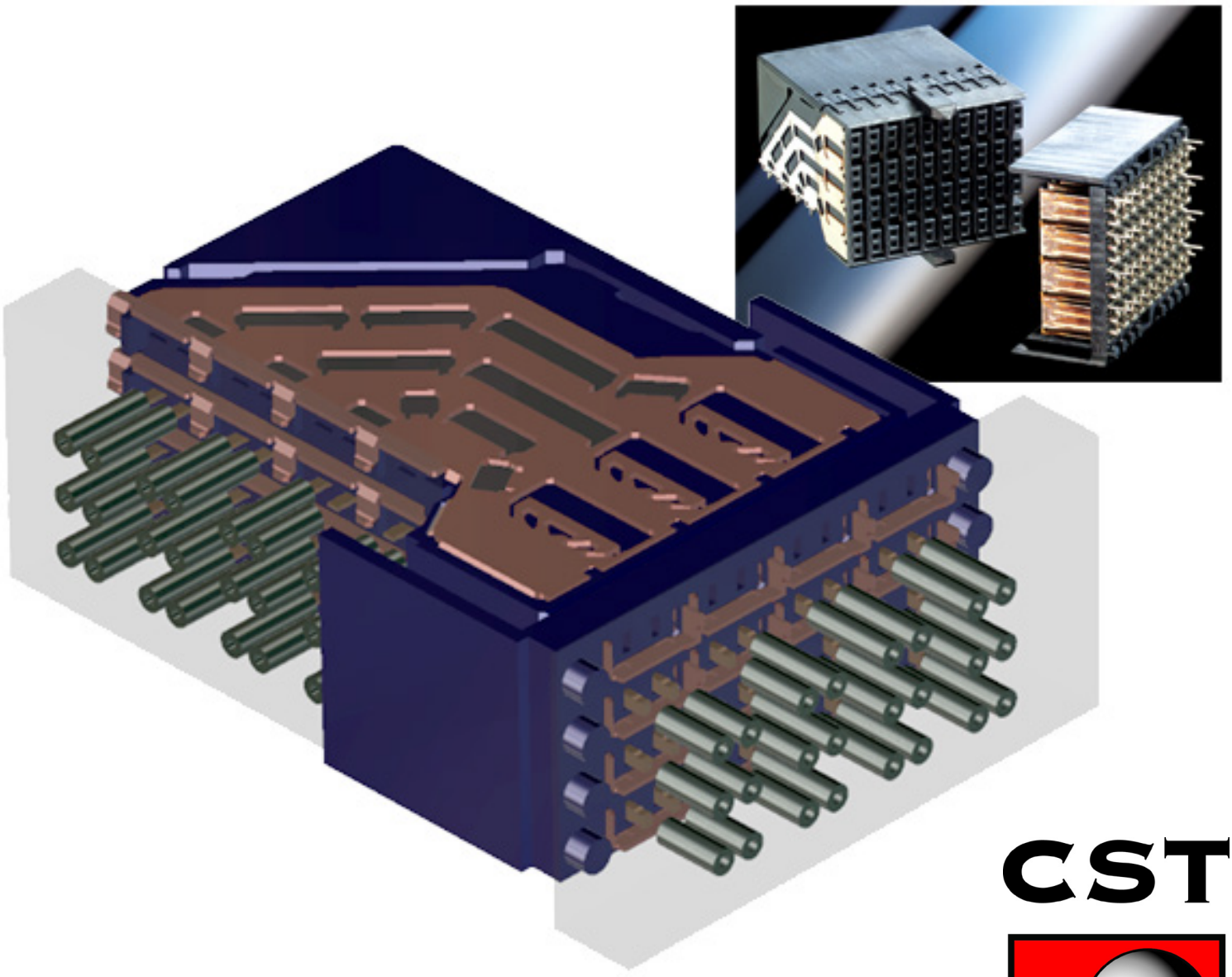
DASSAULT SYSTEMES

SPATIAL

CST



CST

Computer Simulation Technology (CST) develops and markets high performance 3D electromagnetic simulation tools designed to simulate electromagnetic fi elds in all frequency bands.

Market:
3D Electromagnetic Simulation

Product:
ACIS® Modeling, 3D InterOp Translators Suite

CHALLENGES

CST needed a 3D modeling kernel for its electromagnetic simulation software, however it lacked the development resources or domain knowledge to meet functional and time-to-market requirements

Solutions:
Spatial 3D ACIS modeling engine integrated into CST software in 1994; subsequently integrated InterOp software to perform all high-end CAD translations

Results:

- **Delivers high performance software with powerful geometry kernel – particularly important is robust Boolean capabilities**
- **Permits in-house developers to work on company's competitive advantage - interface usability**
- **Enables CST customers to prototype more rapidly**

COMPANY

CST develops and markets high performance 3D electromagnetic simulation tools designed for the analysis of electromagnetic fi elds in all frequency bands. These solver tools reduce product development cycles and therefore, time to market.

CST serves a variety of industries including mobile communications; automotive; medical; aerospace and defense; and fundamental research for particle accelerators. The company's global customers include IBM, Intel, Mitsubishi, Samsung and Siemens. CST simulation tools are used for a wide-variety of applications including couplers, fi lters, planar structures, connectors, EMC and SAR problems, all kind of antennas, packages, LTCC structures, inductors, capacitors, waveguides, plasma sources, optical devices, sensors, recording units, actuators, motors, and electromagnetic brakes.

CST's 3D electromagnetic simulation solutions off er built in modeling capabilities as well as interfaces with CAD and electronic design automation (EDA) tools to enable product designers to model and run simulations. These simulations are run on the actual design in a virtual environment to accurately determine electrical performance of the fi nal product, greatly reducing the design risk and saving development cycles.

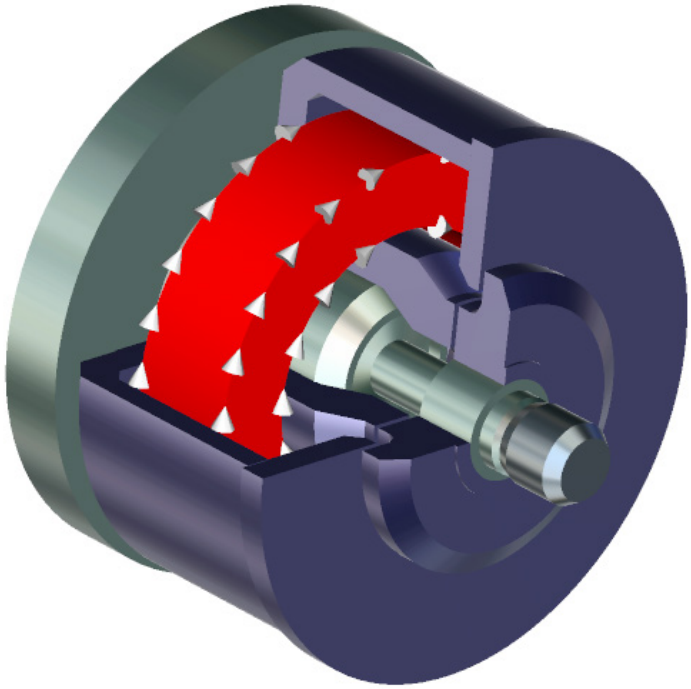
The company's electromagnetic simulation software CST STUDIO SUITE™ is the culmination of many years of research and development into the most effi cient and accurate computational solutions to electromagnetic design. It features a range of electromagnetic simulation modules including CST DESIGN ENVIRONMENT™, CST MICROWAVE STUDIO®, CST DESIGN STUDIO™, CST EM STUDIO®, CST PARTICLE STUDIO®, CST PCB STUDIO™, and CST CABLE STUDIO™.

CHALLENGE

When CST was founded in 1992, the requirements for computational power were relatively small – for instance modeling a simple antenna to get a general sense of how it might ultimately function in production was suffi cient. Today analysis requires close proximity to real world conditions and at the same time, considerations for many more factors due to more compact designs. Analysis for the mobile phone industry, for example, needs to consider the antenna inside of the phone and alongside a camera, while the phone still must be able to be held safely next to the user's head and fi t comfortably in his hand.

> "Working with Spatial enables us to focus on our core technology competence. Because we have a reliable modeling engine available to us, we are able to concentrate our eff orts on the usability part of the interface. I think this has been very well recognized in the market; and it's something that would not be possible without Spatial""
>
> *-- Martin Timm, Marketing Director, CST*

Prior to developing CST STUDIO SUITE, CST's founders had developed its MAFIA electromagnetic simulation software, which included a self-built modeling kernel. But the modeling engine was developed by engineers who specialized in electromagnetic fi elds and not graphics operations, therefore the modeler was not sophisticated enough to handle many real-world requirements. In the mid-1990s, as CST went into new markets with more complex requirements, the company introduced CST MICROWAVE STUDIO.



CST considered developing its own modeling kernel for the new product but soon realized the eff ort needed much more manpower than the company could aff ord because it required hiring new staff with domain expertise in building 3D geometry kernels. The long learning curve necessary to understand both 3D geometry construction and electromagnetic technology meant that the company had no chance to meet its time-to-market requirements. CST was concerned that the end result of a 3D geometry engine built internally would not be versatile enough to match the high level of accuracy, effi ciency, fl exibility and functionality that are hallmarks of CST technology solutions.

SOLUTION

CST's success is based on the implementation of unique, leading edge technology in a user-friendly interface. Early in its company life, CST recognized that a collaborative approach with select vendors would yield the competitive advantage it sought in the electromagnetic simulation solution market.

CST developers fi rst heard about Spatial in the early 1990s: the company was getting a lot of attention for its ACIS 3D modeling engine. CST considered the Parasolid kernel but decided Spatial met its criteria better because of its stability and handling of Boolean operations. The company decided to purchase the technology for their CST STUDIO SUITE. The team found it easy to integrate ACIS into their solution and have been able to readily take advantage of new capabilities in each subsequent release of ACIS. The development cycle is an ongoing process – eight CST developers work mainly with ACIS, and many more are involved to a lesser extent.

"The Spatial functionality that was most critical to our development plans was the modeler itself," says Martin Timm, CST Marketing Director. "When we started building CST MWS, our competition looked more like MAFIA - complicated to use. We wanted to provide our users with a truly interactive interface and modeling capability; this was, in addition to our proprietary simulation technology, crucial and Spatial ACIS contributed a lot to this."

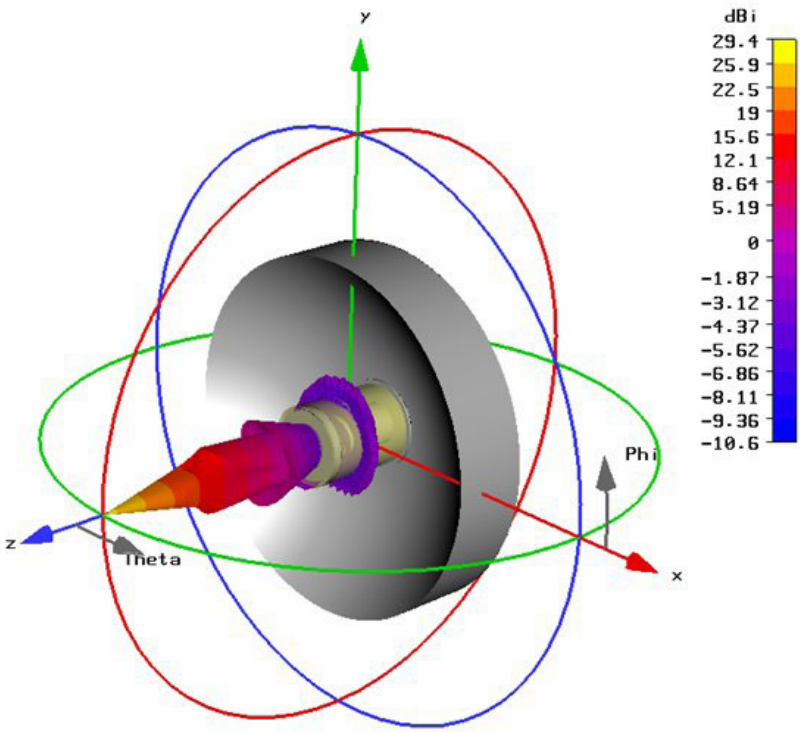
The workflow for CST MWS is a three-phase process involving input, analysis, and output:

Input: The user sets up the geometric problem by either importing a model from a third party CAD or EDA software package or by creating the model within CST MWS using Spatial's ACIS modeling kernel. If the model is imported from another tool Spatial's InterOp translators are used to bring in the CAD model data in any number of formats including CATIA V5, CATIA V4, IGES, STEP and VDA-FS. The 3D InterOp translators enabled CST developers to easily integrate advanced 3D data interoperability capabilities into CST MWS and the other CST STUDIO SUITE modules.

f the model is imported, the Spatial translators perform automatic healing and simplifi cation. The ACIS modeling kernel is used to fi ll gaps and smooth edges and facilitates easy modifi cation of the imported structure. Whether imported or developed within CST MWS, the model is then parameterized to set up material property attributes and boundary conditions to ensure that the free space outside the boundary or behind the reflective wall is factored in.

Analysis: The model, with its assigned material properties, is filled into a mesh and a matrix is created. The user can cross check with the ACIS model to see where the lines will be and whether it will be filled with a particular material. Then the solution process begins to generate results primarily in the form of electromagnetic fields.

Output: The output varies based on the application. For example, if the model is an antenna the output could be the far fi eld results for how well the antenna is radiating and in what direction. If it's a PCB, the critical nets can be analyzed to produce a SPICE compatible model of the behavior. Many results can be visualized or manipulated in order to generate the required output.



Based on the results, the user can decide to change the parameters in the original model whether imported or created in CST MWS; ACIS will rebuild the structure automatically, based on changed parameters and the process will start again. In the end the user wants geometry that is going to fulfi ll initial requirements. Depending on the application, the user could export geometry – as an IGES or SAT fi le using Spatial translators, which can then be fed into a prototyping machine in order to build the prototype.

In addition to the core integration of ACIS and 3D InterOp translators into CST STUDIO SUITE, Spatial professional services worked with CST on two custom projects: 1) an EDA project to simplify the import of structures from an EDA tool such as Cadence and 2) developing a wrapping mechanism that enable sheets to bend around other objects (e.g., conformal antennas).

"We benefit tremendously by sourcing technology from Spatial so that we can focus on our core competence of electromagnetic simulation," comments Timm. "With MAFIA we used to do everything on our own; now licensing technology from Spatial is crucial to our success."

RESULTS

By integrating Spatial technology into CST STUDIO SUITE, CST can focus on its core competence of numerical simulation technology development. Through this powerful combination CST's customers benefi t shorter prototyping cycles, which translates into faster time to market and lower development costs.

The use of ACIS enables CST to devote its resources to optimizing the user experience While CST's competitors also use ACIS, there is a diff erence in the usability. CST off ers special features that aren't found in competitive products. "Spatial has given us a competitive edge because we've been able to take advantage of the full scope of capabilities that ACIS provides," says Timm. "For example, CST was the fi rst in the market to off er an interactive mouse input interface that facilitates unlimited redo/undo."

Today CST maintains its competitive advantage by utilizing as much of the ACIS functionality as possible, while concentrating on developing leading edge numerical technology. Did Spatial meet CST's expectations? "Absolutely. We expected a stable and versatile 3D geometry kernel and that was truly fulfi lled. Spatial's powerful kernel enabled us to use functionality for building geometries that we couldn't provide on our own. Spatial has defi nitely fulfi lled our expectations," comments Timm. "If I had to pick one feature that has proven most critical to the success of CST STUDIO SUITE it would be how well ACIS handles Boolean operations, which are complicated in our industry and most appreciated by our users."

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