SIEMENS
Ingenuity for life

STAR-CCM+ for electronics cooling

Efficiently exploring design alternatives for electronic devices

Benefits

- Accelerate electronics thermal simulation
- Increase model building efficiency
- Import complex geometry from external systems
- Support fast, scalable computations
- Facilitate broad-based design exploration for optimal results

Features

- Automated, easy-to-use workflows
- Intelligent simulation components
- Streamlined integration with ECAD and MCAD
- Multiple virtual prototype options

Summary

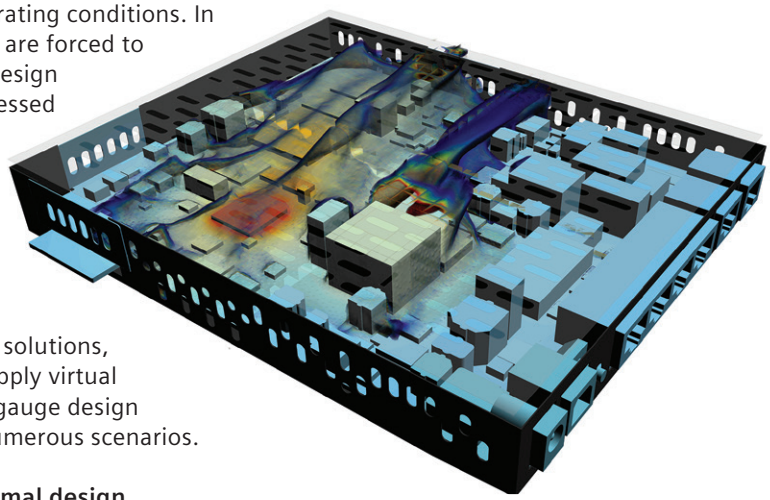
The electronics industry, and consumer electronics in particular, is one of the most rapidly growing sectors in the world with stringent requirements for thermal solutions. The design of electronics devices is a complex, demanding task that necessitates balancing numerous competing objectives. Designers often work with stringent temperature constraints, size restrictions, weight limitations and widely varying operating conditions. In addition, designers are forced to evaluate multiple design scenarios in compressed schedules, making physical prototyping too time consuming and costly. To address these challenges, designers are using thermal simulation solutions, allowing them to apply virtual testing in order to gauge design performance for numerous scenarios.

Simulation of thermal design

The proven physics and computational capabilities of STAR-CCM+ software supply the foundation for efficiently exploring thermal design alternatives. The electronics cooling toolset in STAR-CCM+ provides an efficient build-test-assess workflow for forced and natural convection simulations so designers can quickly understand thermal performance.

Flexible options for building virtual prototypes using STAR-CCM+ include:

- The ability to import printed circuit board (PCB) and component data using the standard intermediate data format (IDF)
- Building geometry using standard templates for heat sinks, chips, PCBs, fans, resistances and enclosures
- Importing geometry from any 3D computer-aided design (CAD) program using either native- or standard-data formats



Chip temperatures and convection flow through a wireless router.

STAR-CCM+ for electronics cooling

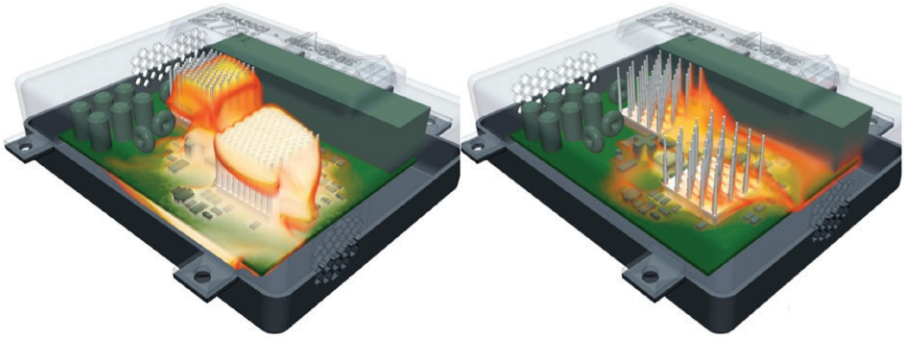
Using intelligent simulation components
The STAR-CCM+ solution includes a feature called QuickParts that enables you to group geometry, mesh and physics within one electronic component to more easily bring the data into larger assemblies. By using quickparts to create an intelligent simulation component, you can define virtual test conditions and create a library of standard parts unique to your organization. General test conditions can include:

- A combination of the airflow environment, such as temperature, known speed and ambient pressure
- Fan curves
- Gravity
- Component heat dissipations
- Contact resistances
- Component thermal network models
- PCB characteristics and materials

Advanced physics simulations often require additional details, which you can also fully define with STAR-CCM+.

Calculating simulation results
To calculate simulation results with STAR-CCM+, you first generate a computational mesh that can be used to solve principal equations. You can generate default mesh settings on a particular model and provide a fast, accurate initial solution. In addition, you can add local and global controls to focus the mesh on the most critical areas of the model; and the efficient algorithms will allow you to automatically distribute the mesh generation among available computing cores.

Principal equations can be solved by using the robust, accurate solver in STAR-CCM+. With proven and efficient scalability, the solver will utilize whatever computing capabilities you have, from one to thousands of cores. By using the STAR-CCM+ solver, you will be able to quickly generate results and investigate system performance as you explore design alternatives.



Base design (left) and optimized design (right) showing improved thermal behavior of a heat sink design.

Improving system performance
There are many variables to consider in thermal design of electronics devices, including: chip locations; heat sink geometry such as the number of fins and their spacing, height, thickness and material; fan operating speed; fan location and enclosure venting. During the process of solving equations for these variables, you can investigate results in real time. Upon completion of computations, you can access additional methods to gain further insight into system performance to help guide decisions and recommendations for system improvement, such as:

- Quantitative data analysis tools for evaluating peak chip temperatures, heat flux rates, air flow speeds and pressure drop
- Qualitative tools to visualize multi-dimensional flow patterns with surface plots, section views, vectors, streamlines and isosurfaces

Using STAR-CCM+ allows you to communicate results using static images, animations and data exported to a text file or spreadsheet software. In addition, you can export and review portable 3D results using the free viewer, STAR-View+, which requires no license and can be easily downloaded and installed. By using STAR-View+, results can be viewed, rotated, zoomed and animated.

Advantages
STAR-CCM+ provides you with a powerful simulation solution to explore a broad range of design options to improve your electronic device. By contrast, the process of manually reviewing variations is too tedious, takes far too much time and often results in only minor improvements. Automated exploration allows you to simplify the process, add learning algorithms to intelligently search the design space and clearly show the impact of proposed design alternatives. STAR-CCM+ is built for automated exploration and is well suited to help you efficiently explore design alternatives.

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