# Simcenter Flotherm

Close your thermal design faster, minimize rework and physical prototyping, and free up valuable engineering resources for innovation.

Benefits

- Frontloading thermal design prevents late-design re-spins and can eliminate physical prototyping

- Full workflow embedding and supply chain support through drag-and-drop library capability

- Right-by-design cooling solution minimizes product weight and cost

- Use to choose cooling strategy from product conception to final design

- Rapid model creation supported by Smartparts™

Summary

Electronics are increasing the complexity of products across all industry sectors, including automotive and transportation, aerospace and defence, electronics and semiconductor, and consumer products. While product complexity is increasing, the time and budget for product design is shrinking. Miniaturization is forcing the mechanical and electronic design flows to converge, and is increasing power densities. This makes it harder than ever to efficiently remove heat, which causes performance and reliability problems, and can cause safety concerns. Frontloading electronics cooling specific thermal design software is helping companies develop products that are light, thin, silent and lower in cost.
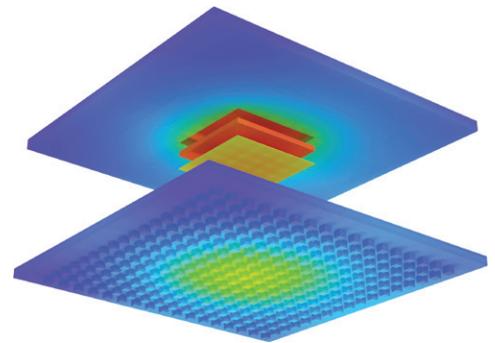
Exploded view of ball grid array package showing surface temperatures on objects.
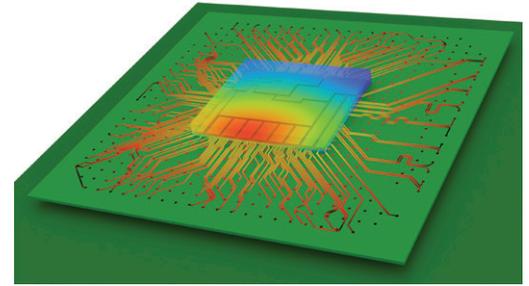
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- Fast and robust meshing and solution supports fully-automated design space exploration and design optimization

- Japanese and Simplified Chinese is supported in the user interface

- Unique Flexx licensing option gives access to run either Simcenter™ Flotherm™ or Simcenter™ Flotherm™ XT

Simcenter Flotherm offers the solution

A complete set of Smartparts, intelligent multi-level model creation macros providing detailed and compact representations in a single object, is provided. Smartparts combine geometry definition, material attributes and grid settings supporting easy model creation, and re-use across different projects. Supported Smartparts cover everything from semiconductor dies to enclosures.

Simcenter Flotherm has a Windows explorer-style Project Manager with drag-and-drop functionality and library system. Model sharing across the electronics supply chain is supported through hundreds of Smartparts-based objects and attributes available in an installed

Traces on package substrate showing voltage.

library including fans, components, heatsinks, materials, thermal interface materials and more. The CAD-style, mouse-driven, Drawing Board delivers simple draw, drag-and-drop and object snap operations to rapidly create and manipulate parametrically-defined models.

Modeling electronics assemblies

At the heart of electronics products are populated printed circuit boards (PCBs). Simcenter Flotherm provides a wide range of PCB modeling levels to maximize solution speed and accuracy as data becomes available across the development workflow.

Simple block models use an analytical approach to calculate the effective PCB thermal conductivity in early design before the details of the board or layout are clear. In late design Simcenter Flotherm's image-based processing of metal distribution efficiently captures the local effect of copper variation across and through the board.
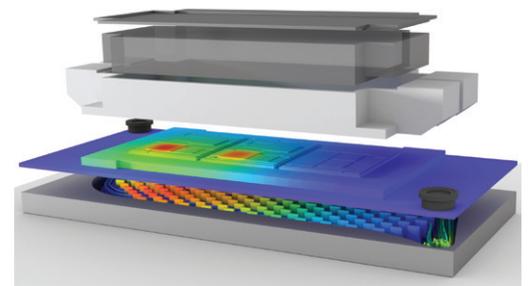
Exploded view liquid-cooled IGBT module showing object temperatures and flow.

Modeling chip packages

Simcenter Flotherm supports the widest range of component thermal models. This enables fast evaluation of architectural choices and design space exploration during conceptual design using simple block and 2-Resistor models. Detailed, 2- Resistor and DELPHI thermal resistor models can be created with Simcenter Flotherm Pack Software-as-a-Service.

Responses of the actual part in different environments can be measured with Simcenter T3STER™ and Simcenter POWERTESTER™. RC ladder models derived from these measurements can be used directly in Simcenter Flotherm for use in transient simulations to investigate transient effects and evaluate temperature control strategies. Detailed thermal models can be calibrated against the measurement data, tuning model parameters to match provides the response of the actual part, to provide greater than 99% model accuracy in both space and time.

Simcenter Flotherm also supports the creation of boundary condition independent reduced order models (BCI ROMs) and SPICE sub-circuit thermal netlist export. BCI ROMs provide very fast simulation for a long duration power verses time profiles such as a drive cycle for battery electric vehicle.

Conduction, convection, radiation, phase change and solar loading

Electronics cooling applications require full conjugate heat transfer as the norm, not as a special case, along with the ability to account for solar loading and thermal radiation between the large numbers of objects that typically make up an electronics system.

Multiphysics simulations are supported, capturing Joule heating in electrical conductors such as power supply nets and power planes, and even in bond wires in power packages. Multiphysics modeling also captures the latent heat effect of packaged phase change materials (PCMs).

Active thermal management strategies

Modern electronics products rely on advanced, software-based thermal management strategies, which are supported through temperature-dependent component powers. Simcenter Flotherm also supports transient frequency-based power control based on monitored temperature and transient thermostatic control.

Working with MCAD data

Simcenter Flotherm imports, heals and simplifies mechanical CAD data through the MCAD Bridge module, importing data from NX™, Solid Edge®, Creo® Parametric, SOLIDWORKS® and CATIA™ V5. The MCAD Bridge module offers intelligent voxelization as an efficient way of dealing with MCAD data of any complexity and quality.

Working with ECAD (EDA) data

Simcenter Flotherm's EDA Bridge module has direct interfaces to Siemens' BoardStation and Xpedition suites, Cadence Allegro and Zuken CR5000. Import of IDF, and ODB++ files are supported, providing support for Mentor's PADS and other EDA software. Using the EDA Bridge module components can be swapped for thermal models from the library, and components can be filtered on import based on size, power, and power density, with thermal power lists imported and exported as .csv files. Joule heating power due to DC IR drop in power and ground planes, etc. can be imported from HyperLynx PI.

Workflow integration

Simcenter Flotherm supports external model creation, manipulation, execution and post-processing through FloXML, and recording and replaying interactive operations with FloSCRIPT. ECXML supports thermal model interchange with tools from other vendors. Simcenter Flotherm imports thermal models in JEDEC JEP30-T100 format.
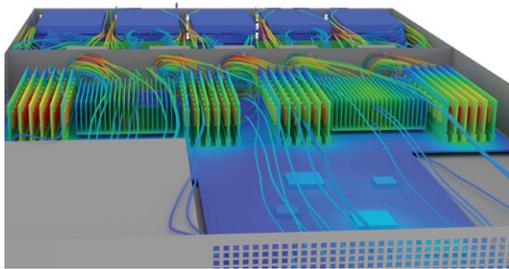
1U server with velocity colored streamlines and surface temperatures.

Fast, robust meshing and solution

Simcenter Flotherm's unstructured Cartesian-based InstaMesh™ technology delivers instantaneous and totally robust meshing, with multicore parallel solvers on Windows and Linux capable of handling the level of complexity and number of discrete objects found in modern electronics products.

Mesh settings are associated with the geometry preserving resolution if objects are moved within the model or added to the library for future use and sharing.

Post-processing

Comprehensive post-processing capabilities provide plane, surface and iso-surface plots, complemented by call-outs on plots to annotate simulation result values. Patented BottleNeck (BN) and ShortCut (SC) numbers help identify aspects of the design that can be exploited to improve cooling. Capture index

for hot and cold aisles for data center applications. Results can be shared across and beyond your organization with the free Simcenter Flotherm Viewer.
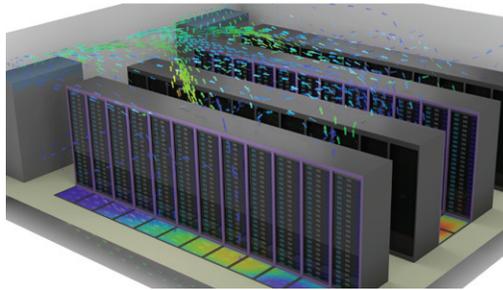
Conventional data center data halls showing complex air flow within aisles.

Design space exploration and optimization

The Command Center module supplied with Simcenter Flotherm includes Design-of-Experiment (DoE) and Response Surface Optimization (RSO), with a correlation matrix to identify which input parameter combinations have the greatest effect on the selected output variables such as component temperatures. Simcenter Flotherm is also accessible through the HEEDS™ portal for multidisciplinary optimization using HEEDS.

Free 30-day cloud-based trial

Not convinced? Try Simcenter Flotherm for yourself with a free 30-day cloud-based trial where you can become proficient in driving the software, and work through a series of self-paced tutorials to explore the full range of features available in Simcenter Flotherm.

Notes:

MCAD Bridge module and model calibration each require an additional license.

Simcenter Flotherm Pack Software-as-a-Service is licensed separately.