

ELECTRONICS COMPANIES AROUND THE WORLD DEPEND ON FLOMERICS FOR DESIGN OPTIMIZATION

Flomerics customers in the electronics industry include every major computer manufacturer, all major telecom switching manufacturers, the top five networking hardware vendors, and the world's largest semiconductor producers.

- | | | |
|--------------------------------|--|--------------------------|
| Aerospace & Defense | Computers | Power Electronics |
| Airbus | Apple | Astec |
| Alenia Marconi | Bull | Celestica |
| Allied Signal | Dell Computers | CPI |
| BAE Systems | EMC | ELDEC Corp. |
| Ball Aerospace | Foxconn | Emerson |
| Bechtel | Fujitsu | Legrand |
| Boeing | Hewlett-Packard | Lucent Technologies |
| China Aviation | IBM | Marconi |
| EADS | ICL | Powerwave |
| Elta | Intel | Schneider Electric |
| ESA | Inventec | Tectrol |
| Galileo Avionica | Mercury | Tyco |
| General Dynamics | Motorola | Ultra |
| Harris | NEC | |
| Lockheed Martin | NCR | Semiconductors |
| Naval Surface Warfare Center | Quanta | 3M |
| Raytheon | Samsung | Agere |
| Rockwell International | Seiko-Epson | Agilent |
| Siemens | Siemens | AMD |
| Siemens | Sony | Amkor |
| Smiths Industries | Storage Technology | Fujitsu |
| THALES | Stratus | IBM |
| TRW Avionics | Sun Microsystems | IDC |
| | Toshiba | Infineon |
| | Unisys | Intel |
| | Wistron | International Rectifier |
| | Xyratex | Micron |
| Communications | | Motorola |
| 3 COM | Consumer | Philips Semiconductor |
| ADC Telecommunications | Blaupunkt-Werke | Rockwell Semiconductor |
| Alcatel Business Systems | Bose | Samsung |
| Alcatel CIT | Hitachi | Siemens |
| Alcatel SEL | InFocus | ST Microelectronics |
| Alcatel Submarine | Konica | Texas Instruments |
| British Telecom | LG Electronics | |
| Cisco | Linn Products | Transportation |
| Ericsson | Pace Micro | Airbus |
| Fujitsu | Philips | Alstom Transport |
| Huawei Technologies | Samsung | Caterpillar |
| Intel | Sony | Chrysler Alcatel |
| Hughes Network Systems | | Delphi-Delco |
| Italtel | | Delphi Packard |
| JDS Uniphase | | Ford Motor Company |
| Lucent Technologies | | Honda |
| Marconi | Contract Design & Manufacturing | Magneti Marelli |
| Motorola | Celestica | Motorola |
| NEC | Foxconn | Otis Elevator |
| Nokia | Flextronics | PSA Peugeot-Citroen |
| Nortel | Sanmina | Robert Bosch |
| Philips PKI | Soletron | Seiko-Epson |
| QUALCOMM | | Siemens Automotive |
| Rockwell International | | SNCF |
| Samsung | Instrumentation | VALEO |
| Scientific Atlanta | Control & Medical | |
| Siemens ICN | Agilent | |
| Tellabs | Analogic | |
| Telrad | General Electric | |
| Thales Communications | Hewlett-Packard | |
| Tyco Telecommunications | Hitachi | |
| | Johnson Controls | |
| | Mitsubishi | |
| | Siemens | |
| | Tektronix | |
| | Teradyne | |
| | Thales | |

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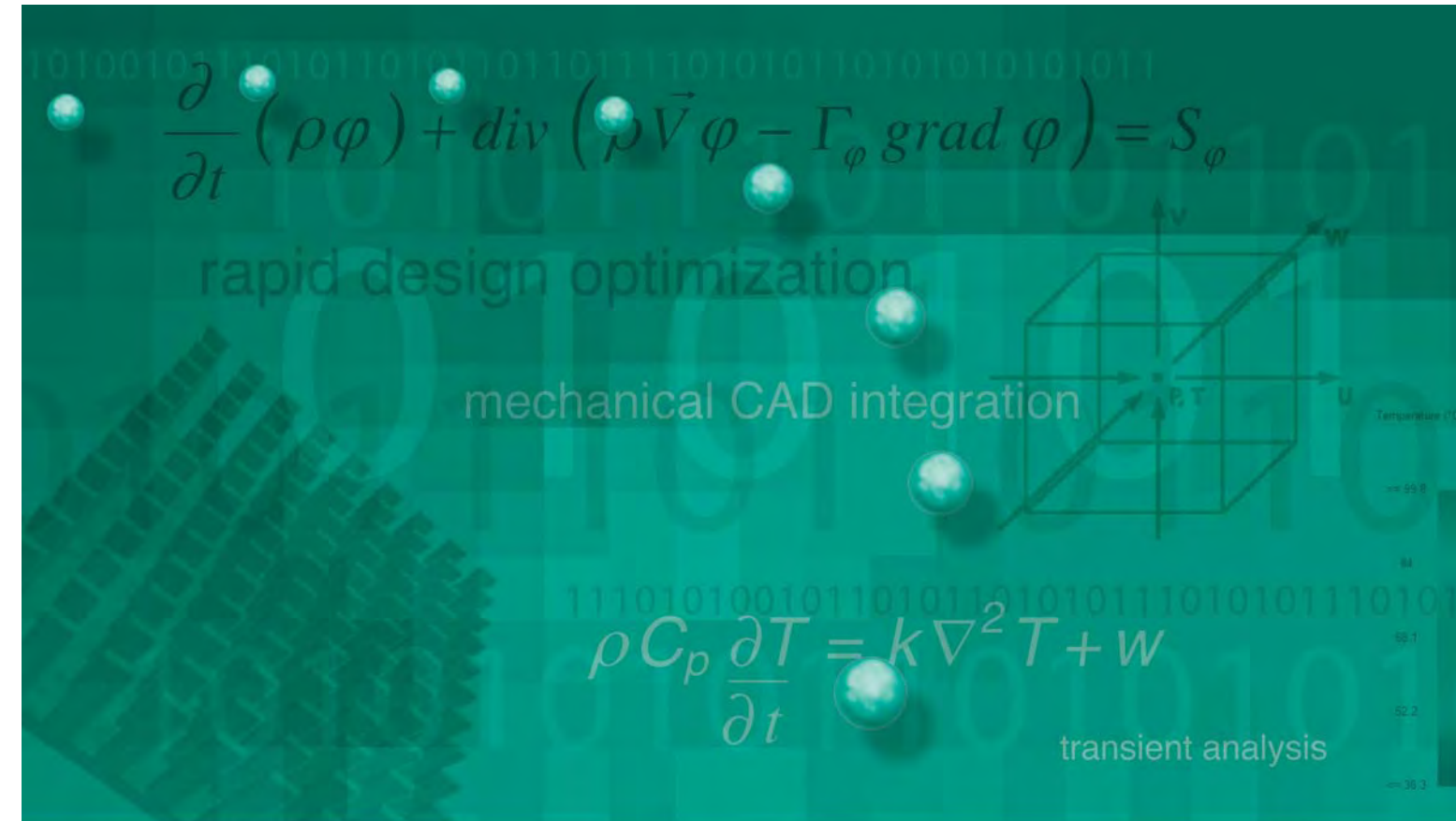
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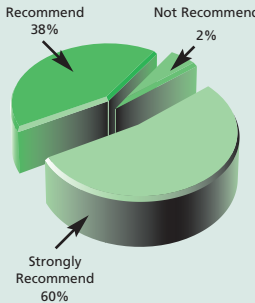
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FLOTHERM

Design-Class Thermal Analysis for Electronics



FLOTHERM

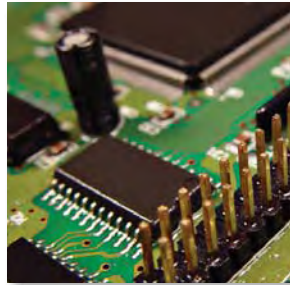


FLOTHERM has more users than all other competing analysis software combined, making it the clear market leader in thermal analysis software for the electronics industry. Small and large companies alike rely on FLOTHERM to perform their thermal-fluid analysis confident of the return on their investment. In a recent survey, 98% of FLOTHERM customers recommended the software to others, confirming FLOTHERM as the #1 software of choice for industry leaders who face the most challenging thermal problems to keep them ahead of their competition.

www.flotherm.com

Overview

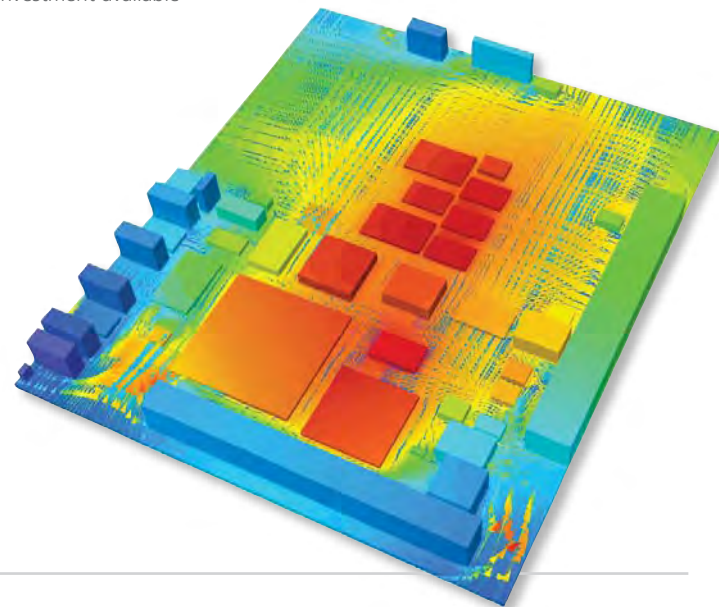
FLOTHERM is powerful 3D simulation software for thermal design of electronic components and systems. It enables engineers to create virtual models of electronic equipment, perform thermal analysis and test design modifications quickly and easily in the early stages of the design process well before any physical prototypes are built. FLOTHERM uses advanced CFD (computational fluid dynamics) techniques to predict airflow, temperature and heat transfer in components, boards and complete systems.



Unlike other thermal simulation software, FLOTHERM is a Design-Class or industry-specific analysis tool specially designed for a wide range of electronic applications that include:

- computers and data processing,
- telecommunications equipment and network systems
- semiconductor devices, ICs and components
- aerospace and defense systems
- automotive and transportation systems
- consumer electronics

As a Design-Class tool, FLOTHERM features specialization, built-in intelligence and automation not found in traditional analysis software. This functionality maximizes productivity for thermal design experts, minimizes the learning curve for mechanical design engineers and provides the highest levels of return on investment available from analysis software.



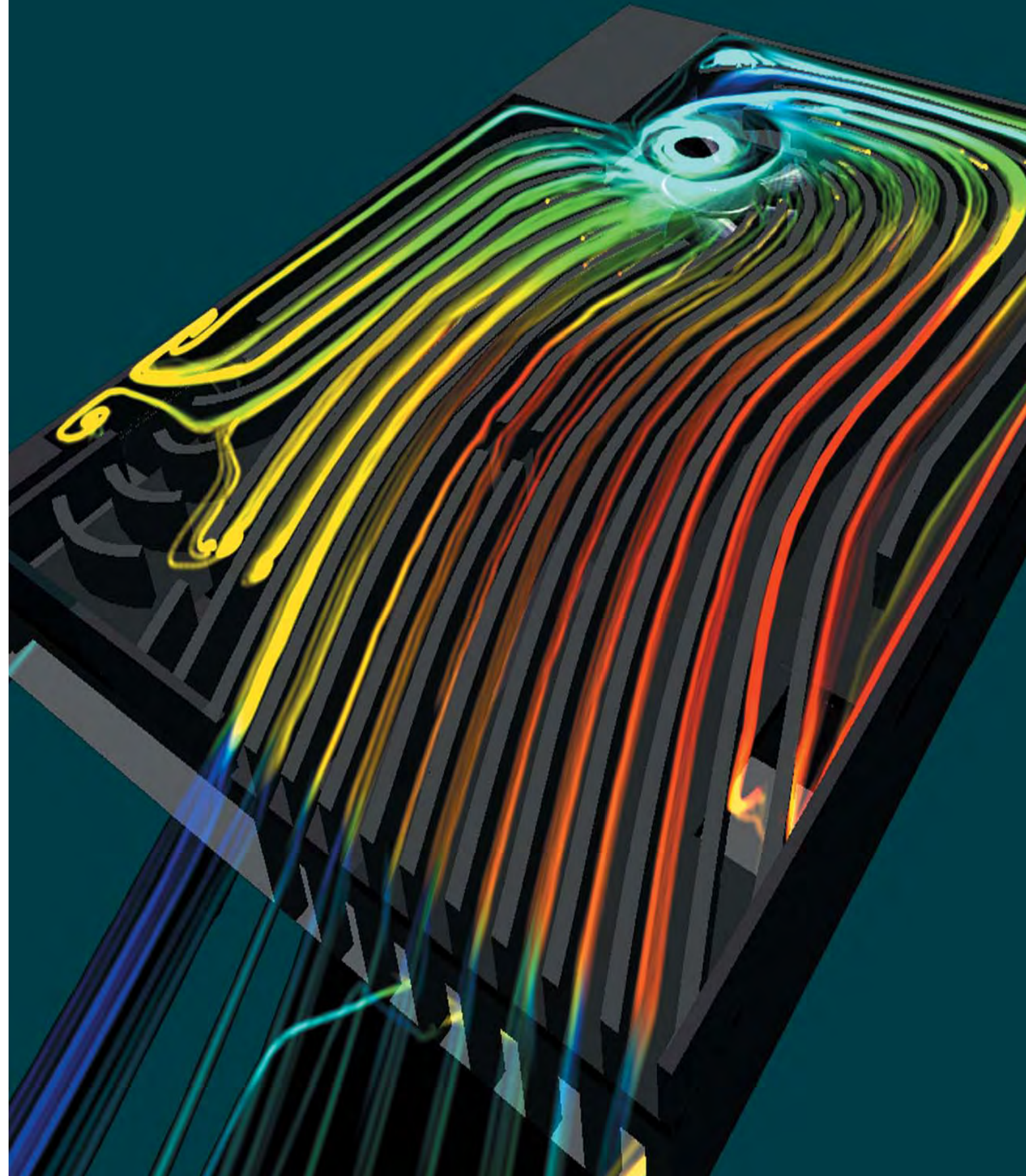
In a small to medium-sized company, FLOTHERM can pay for itself several times over in just one year and even faster as the size of the company increases.

Experience the benefits of using FLOTHERM for thermal design of electronics, that include:

- solving thermal problems before hardware is built
- reducing design re-spins and product unit costs
- improving reliability and overall engineering design

“ Flotherm enabled us to perfect the curvature of our space-saving heat sink without building many prototypes. The Flotherm software produced results that enabled us to put the piece into production sooner, at lower cost and with a greater degree of confidence in its final performance. ”

Anton Sommer, CTO, Ascom Energy Systems



Model Creation

KEY FEATURES:

- Complete set of SmartParts (intelligent model creation macros)
- Multi-level SmartParts (compact and detailed representations in a single object)
- Explorer-style project manager with drag-and-drop functionality
- CAD-style, mouse-driven drawing board using simple draw, drag and drop operations to create and manipulate geometry
- Structured-Cartesian grid that can be "localized" and nested to minimize solve times and enable multi-scale modeling
- Full control of grid constraints for fine, local and global refinement
- Object-associated grid that combines model creation and grid generation into a single step

SmartParts

FLOTHERM features the most complete and technically advanced model creation environment for the thermal design of electronics. Models that range in scale from single ICs on a PCB to full racks of electronics are assembled quickly from a complete set of SmartParts (intelligent model creation macros) that are supplied with FLOTHERM or from SmartParts3D.com™ or from a large list of suppliers from around the globe that use FLOTHERM. SmartParts capture modeling expertise that has been developed within Flomerics over the past 15 years to streamline model creation, minimize solve times and maximize solution accuracy.

Integration with MCAD & EDA

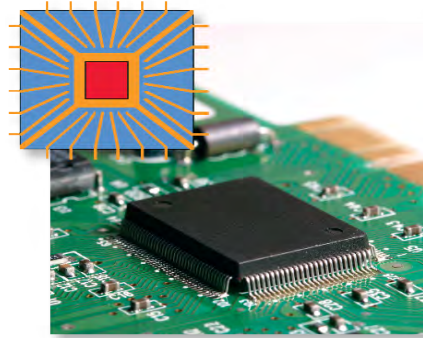
FLOTHERM also features the industry's best solution for integration with MCAD and EDA software. Native data from Pro/Engineer, Solidworks, Catia, Allegro and other MCAD and EDA software can be imported into FLOTHERM. Unlike other CAD to analysis interoperability solutions, FLOTHERM automatically prepares the geometry for efficient and accurate analysis.

Grid

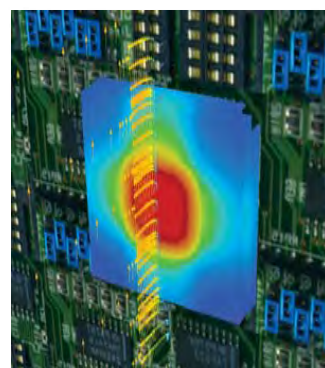
FLOTHERM grid is structured-Cartesian - the most stable and numerically efficient type of grid available. The ability to localize is also included for finer resolution where it is needed, minimizing solution time and avoiding the penalty of grid cells that "bleed".

Grid in FLOTHERM is associated with SmartParts and is generated as part of the model assembly process with refinement under user control. This methodology is intuitive and straightforward enabling engineers to focus on design rather than analysis.

Gridding is instantaneous and reliable in FLOTHERM as compared to traditional tools that require significant time and expertise to master. Finally, FLOTHERM is the only analysis software with object-associated grid that eliminates re-gridding for each model modification.



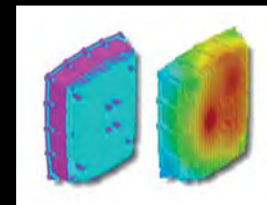
Example of a computer chip with model



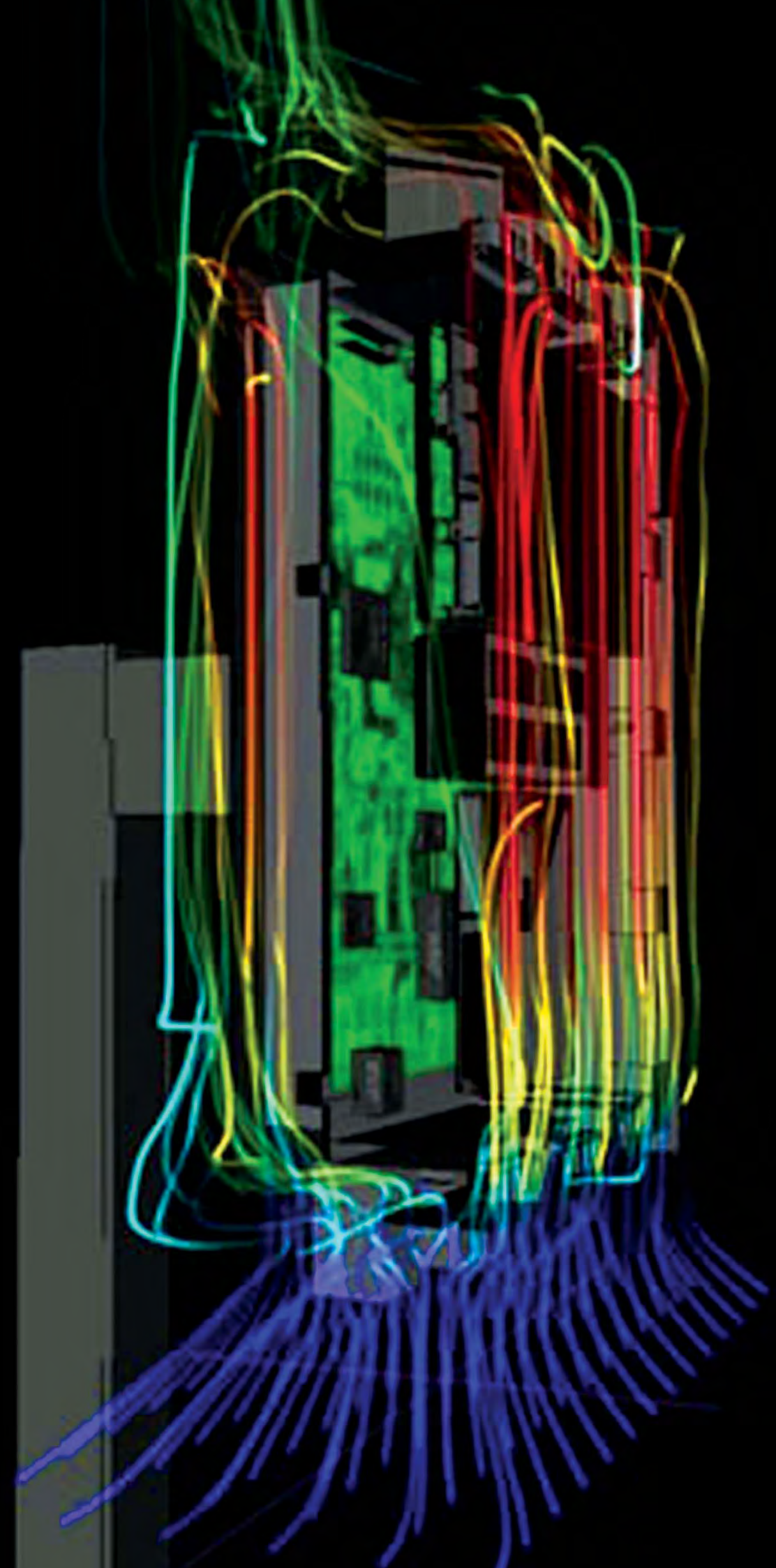
Package on PCB



Cambridge Broadband's VectaStar 3500



"Intelligent integration"
A section of the geometry of this point-to-multipoint broadband wireless access equipment is automatically simplified for speedy thermal analysis



Solver and Design Optimization

Automatic Sequential Optimization

SmartPart-based modeling and structured-cartesian grid enable a feature called "automatic sequential optimization" that is unique to FLOTHERM. This allows users to specify a design goal and then let FLOTHERM do the hard work of finding the right combination of design variables that meet the goal. Common applications of this feature include optimization for heat sink design, PCB component placement, fan/blower selection and other common design scenarios. Automatic sequential optimization enables engineers to find design margin or production cost savings that were impractical in the past.

Design of Experiments Parametric Studies

As an alternative to automatic sequential optimization, a design of experiments (DoE) can be constructed that will automatically analyze the full range of all possible combinations of parametric variations. These models can be solved on a distributed network of computers using the unique "Volunteer" solution technology.

Solver

For over 15 years, the FLOTHERM solver has specifically addressed electronics cooling applications. The solver, based on a cartesian gridding system results in the most accurate results possible and the fastest solution time per grid cell. Massive disparity in geometric length scales are resolved using the unique 'localized-grid' technique which allows for integrally matched, nested, non-conformal grid interfaces between different parts of the solution domain. The conjugate nature of heat transfer within electronic systems is concurrently solved using a preconditioned conjugate residual solver together with a flexible cycle multi-grid solution technique. Pragmatic, unique and accurate solution termination criteria produce useful results in engineering, not academic, time scales.

Transient Analysis

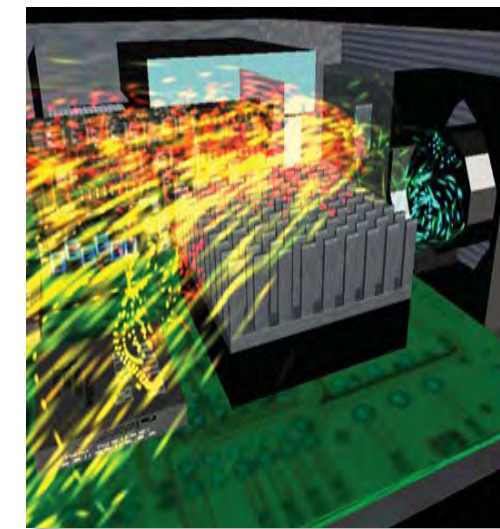
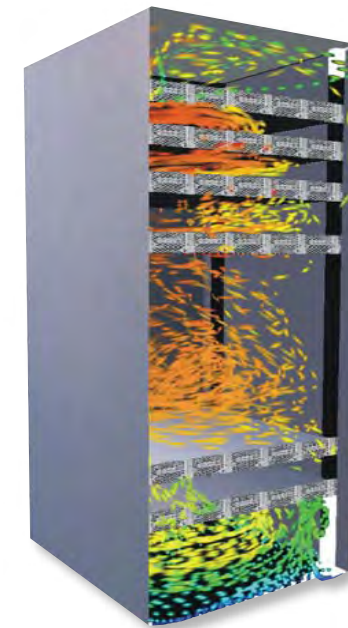
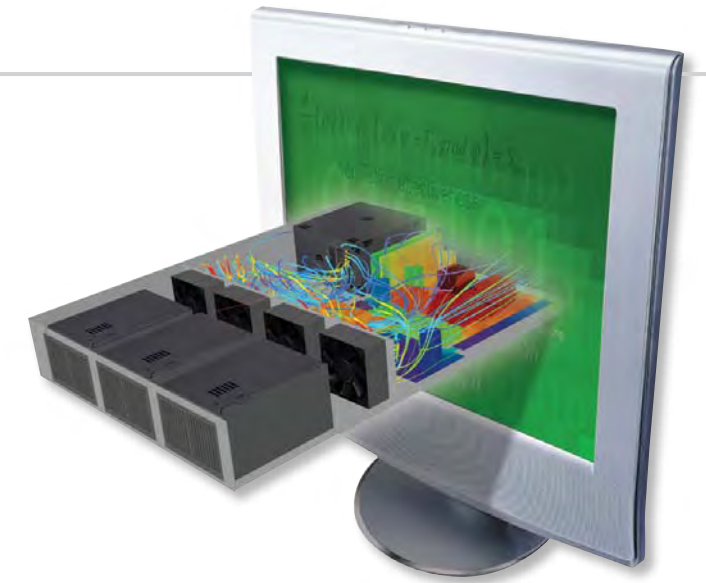
The powerful transient analysis capabilities in FLOTHERM also allow for prediction of a number of different transient behaviors. Time dependent power dissipation in components can be defined via .csv import of power versus time data. An accurate prediction of the thermal response of the component temperature, in time, may then be produced without the conservative assumption of constant "steady state" power consumption.

KEY SOLVER FEATURES:

- Concurrent solution for convective, conductive and radiative heat transfer
- Solution termination optionally based on convergence of user defined monitor points
- Multi-fluids capability
- Ability to simulate either turbulent or laminar flow (turbulent models - revised algebraic, LVEL algebraic, Standard k-e, revised k-e)
- Definition in transient variation in terms of linear ramping, power increase, exponential increase, sinusoidal, periodic or imported .csv pointwise variations
- Fully automatic radiation exchange and view factor calculation
- Automatic solar loading boundary conditions

Visualization

The FLOTHERM visualization toolset is developed specifically to maximize productivity for cooling design of electronics. Fully rendered models, 3D flow animation and tools for dynamic manipulation of temperature, and flow results, enable engineers to pinpoint thermal issues and visualize design improvements quickly and effectively. Texture mapping and AVI output enables communication of thermal-design concepts with non-technical colleagues.



SOME KEY FEATURES:

- Particle animation to visualize complex, 3D airflow
- Contour animation to visualize heat transfer paths
- Isosurfaces and surface temperatures
- Airflow representation by vectors or ribbons colored by temperature or speed
- AVI output of flow animation
- Dynamic particle tracking allowing to gain a better understanding of complex flows
- Image texturing for realistic visualization

“The only way a company like Linn can prosper in a cut-throat marketplace is through a faster design process which delivers products that are demonstrably superior. FLOTHERM helps us achieve this goal.”

Martin Dagleish, Head of Commercial Affairs, Linn Products



Integrated Analysis Environment

- KEY FEATURES:**
- Collaborative design, using a common language to remove unnecessary design iterations and reduce late stage errors
 - Functional definition, mechanical packaging, thermal design and EMC design brought into a single environment
 - Improved product quality
 - Reduced design costs
 - Shorter time-to-market

Integrated Analysis Environment

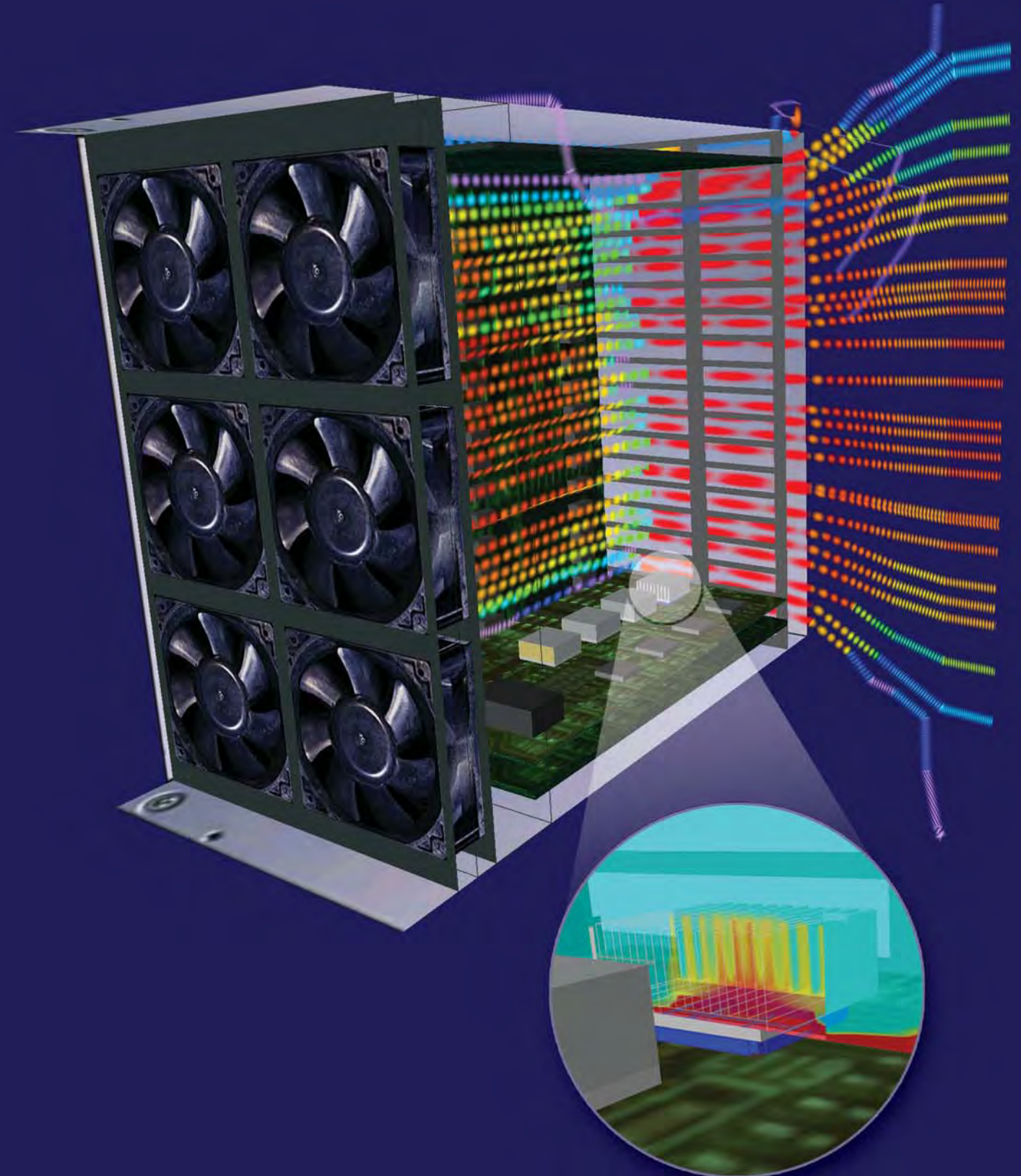
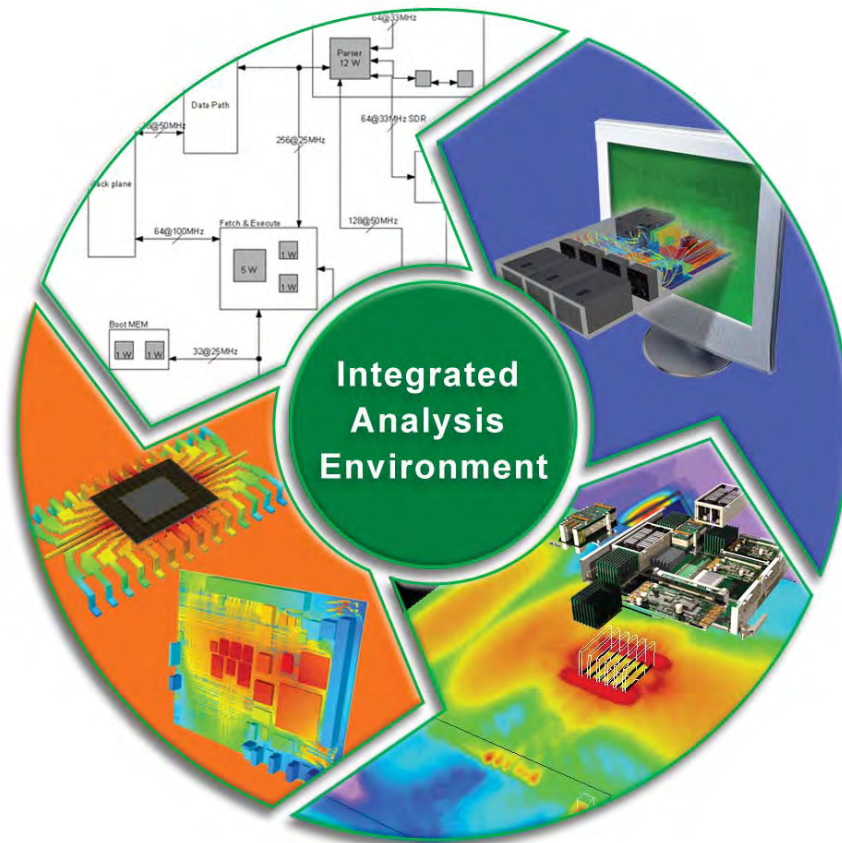
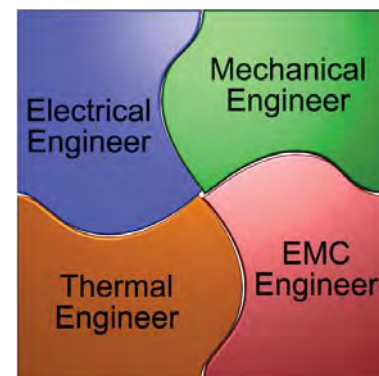
FLOTHERM is a central part of Flomerics' Integrated Analysis Environment - a software suite, that includes: FLOTHERM, FLO/PCB and FLO/EMC.

Integrated Analysis Environment is needed when physical designs are dense and complex, leading to difficult, costly, clashes between mechanical-packaging, thermal-design and design for EMC. Under these conditions, mechanical and electrical engineers must break through communication and collaboration barriers to avoid excessive re-spins and expensive, late-cycle physical design errors.

Integrated Analysis Environment enables electrical, mechanical, thermal and EMC engineers to perform early-stage design trade-offs without delays or communication errors.

Design studies are based on a common virtual model and streamline the process of eliminating design-responsibility specific issues before they are designed and manufactured into the product.

The Integrated Analysis Environment suite of products also includes FLOPACK (www.flopack.com), software for IC SmartParts, and T3Ster™, thermal transient testing hardware for thermal model generation from physical packages under test. FLO/PACK and T3Ster extend the Integrated Analysis Environment to include IC and component manufacturers who must supply critical, timely, design data to system manufacturers for effective physical design of today's high performance electronic products.



FLOTHERM allows detailed analysis of components within system environment

Technical Support and Design Services

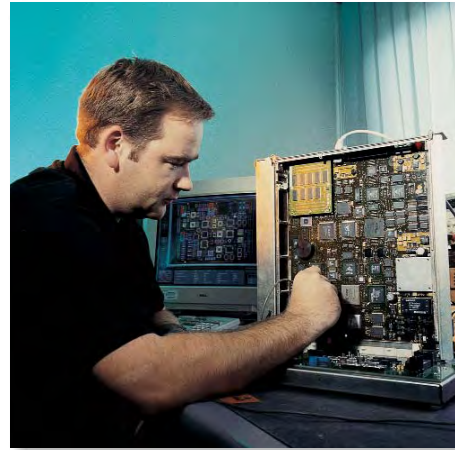
DESIGN-CLASS ANALYSIS

Since 1988, Flomerics has pioneered a different approach to numerical analysis and simulation. Flomerics' software tools and services help bridge the gap between science and industry by embedding complex analysis and optimization software deeply into the design process, in a way which enhances productivity in engineering design. This approach is called "Design-Class Analysis".

Technical Support

Not just a software company, Flomerics also offers customers comprehensive training and phone support.

In addition, the User Support Area allows licensed users to download the software with the latest documentation and to submit questions and support issues. A wide range of application examples and technical papers are also available on the FLOTHERM website (www.flotherm.com).



Design Services

If you prefer to outsource part or all of your physical design, Flomerics Design Services team is ready to help. When you engage us, you effectively add to your staff some of the world's most experienced engineers in thermal and EMC analysis of electronics. Starting with any design information you have, we will quickly plan and execute an assessment, regardless of the stage of your product .

“ Combining FLOPCB and FLOTHERM has helped to reduce the number of engineering prototypes we require, reducing cost and time to market ”

Wei-Pin Wo, Principal Engineer, Johnson Controls



High performance data storage racking

