ANSYS and Ansoft: The Power of Synergy

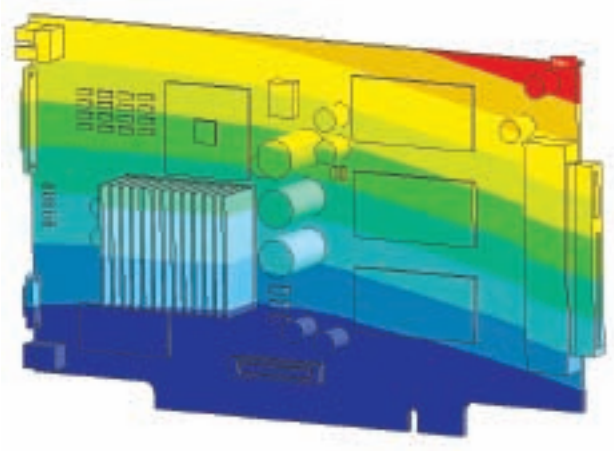
Integrating Ansoft tools with technologies from ANSYS combines the best of both worlds for developing electronic products.

By Fadi Ben Achour, Director of Electronics Industry Marketing, ANSYS, Inc.

The electronics industry faces immense challenges in the global arena in which engineers must address conflicting requirements to increase product functionality while reducing size and weight, lowering energy consumption and complying with stricter government regulations. Pressures from all sides are compounded by shrinking design cycles to meet narrowing windows of business opportunity.

Companies meeting these challenges reap considerable benefits by leveraging growth opportunities in a wide range of electronics segments, including consumer, communications and computational sectors. Furthermore, there is increasing penetration of electronics systems and electromechanical applications in the aerospace, automotive, power generation and power delivery industries. Many of the companies in these industries — large and small, OEMs as well as suppliers — have continued to rely on mechanical and fluid simulation solutions from ANSYS in their product development initiatives. With the recent acquisition of Ansoft, the range of solutions for the electronics engineering community has expanded, complementing the comprehensive capabilities of ANSYS Multiphysics technology.

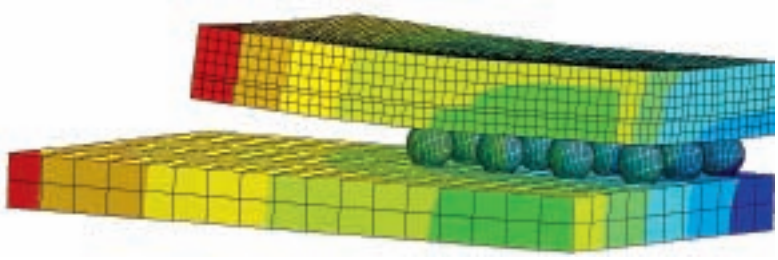
The resulting breadth of solutions from ANSYS is unparalleled, providing electronics engineers with a range of simulation tools across multiple domains. In assessing reliability, design teams can use ANSYS Mechanical software to study structural and thermomechanical stresses in semiconductor components, electronics packages, printed circuit boards and complete systems. Engineers can incorporate nonlinear phenomena — including solder joint fatigue, delamination and creep — into product design and can conduct modal, shock and vibration analysis. They can also use ANSYS AUTODYN software to conduct drop-test simulation for optimizing product reliability and performance.



Drop-test simulation of a graphics card performed in ANSYS AUTODYN software

ANSYS provides a variety of vertical electronics cooling simulation tools as well as powerful general-purpose computational fluid dynamics solutions to meet the requirements of product miniaturization and high-power densities. ANSYS Icepak thermal management software simulates fluid flow, conduction and radiation heat transfer in various package, board and system-level designs. For evaluating advanced cooling systems, fluid dynamics technology from ANSYS can be used in fan and acoustic design, micro-channel analysis, emersion and phase-change cooling. Fluid dynamics solutions also simulate semiconductor manufacturing processes including etching, photolithography and chemical vapor deposition, as well as semiconductor package manufacturing applications such as encapsulation and curing.

The addition of Ansoft solutions to the ANSYS suite of technologies brings electronics engineers an

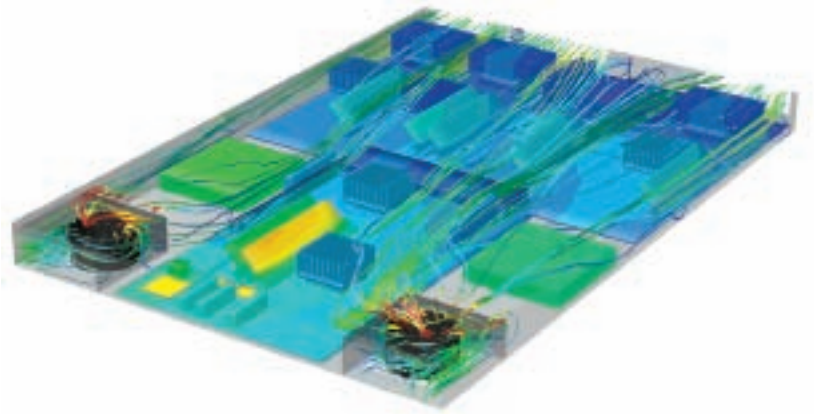


Thermomechanical stress analysis conducted with the ANSYS Mechanical product on a ball grid array IC package

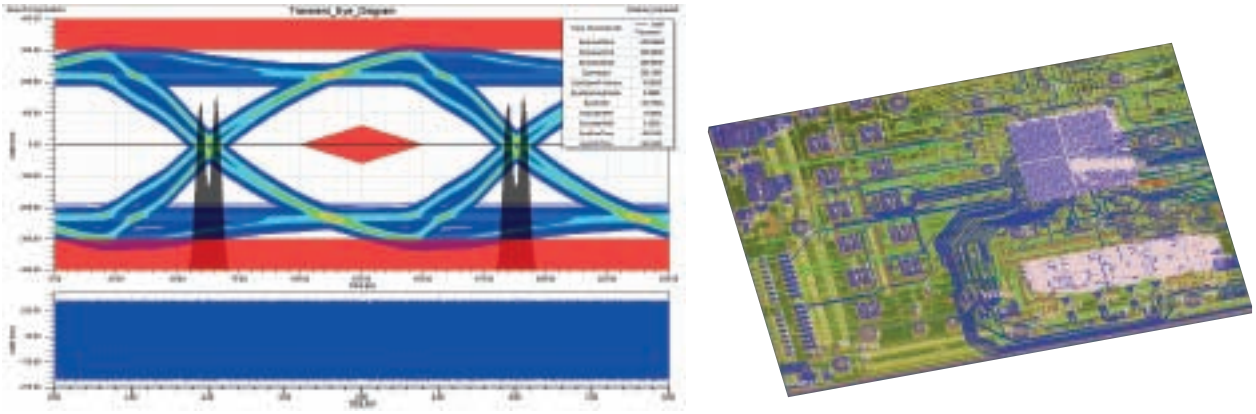
expanded range of electromagnetic simulation capabilities. In high-frequency applications, engineers can use the Ansoft flagship HFSS software to conduct full-wave 3-D electromagnetic simulations essential in designing radio frequency and microwave components and systems widely used in radar, antenna, medical device and various wireless applications. Furthermore, HFSS with Ansoft 2.5-D vertical simulation software (SIwave for full-wave and Turbo Package Analyzer for quasistatic analysis) form a powerful toolset useful in design and analysis for signal– and power-integrity applications and electromagnetic compliance. Such analysis is critical in designing high-speed electronics components and systems, such as semiconductor packages, telecommunication equipment, servers, PCs and hand-held devices. These high-frequency electromagnetic capabilities are dynamically linked to Nexxim software, a state-of-the-art time and frequency domain circuit simulator that provides an integration of high-frequency electromagnetic simulation and advanced circuit design and simulation.

For electromechanical and low-frequency applications, Ansoft expands ANSYS product offerings with general and vertical electromagnetic tools as well as system level simulation tools. Maxwell 3-D electromagnetic field simulation software from Ansoft is used for the design and analysis of motors, transformers and other electromechanical devices common to automotive, aerospace and industrial systems. Specialized vertical low-frequency software from Ansoft includes PExprt software for designing transformers and inductors, and the RMxprt tool for analyzing rotating electric machines. These tools are complemented by Simplorer software — a multi-domain system simulation software used for designing high-performance electromechanical systems. These technologies complement the multiphysics, mechanical and fluid dynamics simulation capabilities from ANSYS.

The combined simulation technologies from ANSYS and Ansoft provide the electronics community with extensive solver, meshing, pre- and post-processing, and system- and circuit-level simulation capabilities. ANSYS offers a range of mechanical simulation technologies including automatic contact detection, extensive material models and element types — such as direct coupled-field elements — as well as rigid body and explicit dynamics capabilities. Fluid dynamics technologies include dynamic and moving mesh features, chemical species mixing and reacting flows, specialized models for rotating machinery, and extensive turbulence models. Physics-based meshing from



Thermal management of a network server simulated with ANSYS Icepak technology



Signal and power integrity studied with Nexxim and Slwave software from Ansoft

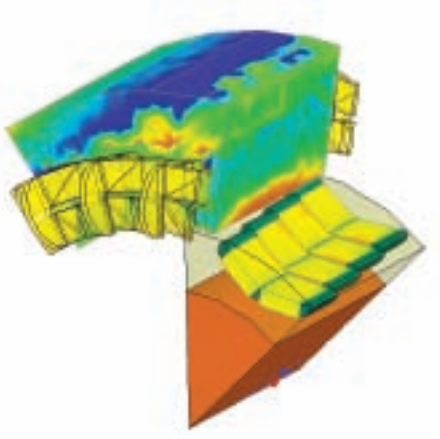
ANSYS has various algorithms and element types including hexahedral and tetrahedral meshes, and prism, pyramid, quad, tri and bar elements. The acquisition of Ansoft further expands these technologies by adding capabilities such as tangential vector finite element formulations, trans-finite element methods and adaptive finite element meshing capabilities.

To tie all this together and improve efficiency and usability, ANSYS has a variety of advanced infrastructure and data management capabilities that provide for automatic data exchange between various solvers. This data exchange — along with two-way MCAD integration and advanced Six Sigma tools — is achieved through the ANSYS Workbench framework. Management of simulation data and processes is handled by ANSYS Engineering Knowledge Manager (EKM) software, which enables multiple levels of the enterprise to address issues associated with data backup and archiving, traceability and audit trail, process automation, collaboration, capture of engineering expertise and intellectual property protection.

The Ansoft acquisition is a continuation of the ANSYS strategy of providing the engineering community with an integrated and comprehensive multiphysics solution. The benefits of this multi-domain approach are highlighted in the development of hybrid vehicles, for example. Here, engineers not only face the challenge of designing the electric motor and battery systems, but also the need to continually improve aerodynamics, engine performance and stability, underhood thermal management, passenger comfort and crash-test rating. The high end of the automobile industry is seeing more electronics-based features, such as accident avoidance and automatic parking systems as well as navigation devices and entertainment centers.

In such automotive applications, the combined ANSYS and Ansoft technologies provide comprehensive mechanical, fluid dynamics and electromagnetics capabilities for all types of multiphysics applications. Using these tools, engineers can study the inter-related effects of various road or weather conditions on vehicle behavior, for example, as well as the complex interactions among various components. In the end, the multiphysics and multi-system design approach will result in automotive designs that achieve an optimal balance between car performance, gas consumption, weight, environmental impact and safety.

Similarly, in the development of products as diverse as global positioning units, cell phones, MP3 players and other hand-held devices, engineers will be able to use multiphysics analyses to optimize thermal design and mechanical reliability, as well as to conduct extensive electromagnetic analysis and design antenna systems. Most important is that designers in a variety of industries will have a unified design approach at their disposal, which enables simulation to drive the entire design process. ■



Maxwell software from Ansoft performing 3-D electromagnetic simulation of an electric motor