Our world is more connected than ever, thanks to the growing web of visible and unseen electronics that surround us every day. ANSYS provides the comprehensive suite of simulation software to reliably and cost-effectively engineer high-performance electronic devices and systems.

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Today we live in a world based on connectivity and communication, in which a burgeoning network of electronic systems and devices helps us navigate our days.

Smartphones, tablets and GPS systems are the most obvious examples, but consider the increasingly sophisticated electronics in cars, homes, hotels and offices that keep us secure and comfortable, or the medical implants and prosthetics on which many people rely for everyday health. When we visit theme parks or attend concerts, we are likely to scan a wristband or smartphone for admittance. Wearable wristbands and activity trackers can monitor our physical movements, vital signs and sleep patterns. Today, high-tech devices are inescapable.

The high-tech industry has coined the term “Internet of Things” (IoT) to describe this proliferation of electronic devices and systems. There can be no doubt that the Internet of Things is poised to change the way we live, work, interact and seek out entertainment. As consumers, we can look forward to many conveniences; for businesses, the IoT represents an incredible opportunity to revolutionize the product development value chain. While 2 billion smart devices were sold in 2006, it’s estimated that this figure will grow to 200 billion by 2020. Devices will outnumber people by a ratio of 26 to one. [1]

**BIG GROWTH, BIG CHALLENGES**

This rapid growth brings significant challenges. As devices proliferate, consumers’ expectations for connectivity, energy efficiency, reliability, ease of use and structural strength will only increase. Electronics must be not only innovative and high-performing, but also attractive. And, of course, all this functionality and beauty must be delivered at a low price.

How can high-tech engineering teams manage these pressures? Since the industry’s inception, market leaders have relied on simulation-driven product development to launch their devices quickly, cost-effectively and with a high degree of confidence that they will perform as expected in the real world.

For high-tech manufacturers, engineering simulation is the key. Designing products in a risk-free, low-cost virtual space enables engineers to quickly consider thousands of designs, without investing time and money in physical prototypes. They can choose a few promising designs, then subject them to thousands of operating parameters — again, with no investment in physical testing. Engineers can perfect product components or optimize entire systems. They can consider one physics area or the complete range of forces that will be brought to bear on their designs.

**ANSYS: A HIGH-TECH RESOURCE FOR HIGH-TECH TEAMS**

When we talked to industry expert Ed Godshalk at Maxim Integrated — a world leader in analog semiconductors — he said, “When you consider the complexity of designing and packaging an electronic system, it’s really impressive that ANSYS software can support that full development cycle.” (Read more insights from Godshalk in the feature on page 11.)

That range of capabilities is the result of focused software development investments, as well as strategic acquisitions, that have positioned ANSYS to support the complete design cycle for high-tech devices, including integrated circuits (ICs) and embedded software. Throughout this issue of ANSYS Advantage, you’ll see how customers are leveraging ANSYS software every day, and at every stage of the development cycle.

Recently, ANSYS has developed comprehensive solutions for both robust electronic systems design and advanced material systems design for high-tech engineers. These solutions address key challenges for high-tech designers: improving speed and bandwidth, maximizing power and energy efficiency, optimizing antenna performance, and incorporating advanced materials. The sections that follow provide greater insight into these challenges as well as relevant ANSYS solutions.

**Functionality and beauty must be delivered at a low price.**
RAMPING UP SPEED AND BANDWIDTH

As mobile devices proliferate, more and more data is being transmitted and received, driving the need for faster wired and wireless communications networks. Video streaming, interactive gaming and high-speed web service are pushing the limits of not only mobile devices, but also servers, routers and switches. Improving speed and bandwidth is an industry imperative, but design complexity poses a significant challenge.

For example, designing printed circuit boards (PCBs) for high-speed, double data rate memory buses or serial communication channels requires extreme care. High data rates combined with low operating voltages can cause signal and power loss. In today’s device-crowded world, electromagnetic interference (EMI) and electromagnetic compatibility (EMC) issues also affect power integrity (PI) and signal integrity (SI).

The ANSYS Nexxim circuit simulator (part of the ANSYS HFSS SI option and ANSYS SIwave) offers an efficient way to design and test memory channels for servers that power our cloud-computing world. When this simulator is used in combination with IBIS-AMI, or Nexxim’s QuickEye and VerifEye models, it represents the industry’s leading solution for high-speed communication channel design.

End-to-end design and optimization for complex high-speed electronic devices is faster, easier and more accurate thanks to new functionality in the ANSYS SIwave electromagnetic simulation suite for the design of high-speed PCB and IC packages. This functionality is available via three targeted products: SIwave-DC, SIwave-PI and SIwave. Engineers can quickly identify potential power and signal integrity problems with increased flexibility, and more easily access a complete set of analysis capabilities that they can leverage throughout the design cycle.

High-tech-industry product development teams routinely use coupled multiphysics software from ANSYS to analyze the trade-offs among speed, bandwidth, signal integrity, power integrity, thermal performance and EMI/EMC. For example, a smartphone manufacturer recently leveraged a suite of ANSYS software — including ANSYS HFSS, ANSYS Icepak, ANSYS Mechanical and ANSYS SIwave-DC, SIwave-PI and SIwave. Engineers can quickly identify potential power and signal integrity problems with increased flexibility, and more easily access a complete set of analysis capabilities that they can leverage throughout the design cycle.

As the sophistication of electronics increases, engineers must consider the comprehensive characteristics of the environment in which the equipment will operate — for example a cell phone within a car.
DesignXplorer — to significantly accelerate the development of a smartphone shielding system to maximize data speed and throughput.

At Alcatel-Lucent, engineers are using ANSYS HFSS to ensure integrity and reliability, while also minimizing costs, as they link ICs on two separate boards across a high-speed channel. (See story on page 35.)

**OPTIMIZING POWER AND EFFICIENCY**

Few issues are as important in the high-tech industry as effective power management. To help address this issue, ANSYS has created a strategic initiative centered on supporting the design of robust, power-efficient electronics.

Traditionally, engineers analyzed power consumption and delivery issues via a siloed approach, looking separately at the chip, board and package. Today, ANSYS supports the industry’s only truly integrated chip–package–system (CPS) design methodology, which allows component optimization — as well as co-analysis and co-optimization across the entire system. This approach balances the lower operating voltages needed to conserve power with the consistency and reliability required to eliminate field failures.

By combining advanced physics solvers with industry-leading solutions for power-efficient electronics design, engineers can confidently predict systems-level performance at an early design stage, long before lab system integration. The resulting capabilities for full electromagnetic extraction, SI/PI/EMI analysis, chip-level power optimization and reliability verification, and thermal and mechanical stress simulation are unmatched in the high-tech industry.

ANSYS also fosters partnerships with high-tech industry leaders to create unique simulation capabilities. For example, ANSYS and Intel® Custom Foundry teams have developed reference flows using ANSYS RedHawk for system-on-chip (SoC) power and electromigration sign-off, ANSYS Totem for custom intellectual property (IP) power — and EM — integrity, and ANSYS PathFinder for full-chip electrostatic discharge validation.

This collaboration extends the work on the Intel Custom Foundry 22 nm process design platform to the 14 nm platform. The 14 nm Tri-Grate process technology enables chips to operate at lower voltages with lower leakage, providing chip designers with the flexibility to choose transistors targeted for low power or high performance, depending on the application.

ANSYS is continually developing newer and better methods to ensure design robustness at the earliest possible stage.

**STAYING CONNECTED**

The proliferation of wireless devices creates new performance demands for antennas and radio systems, which need to deliver uninterrupted connectivity.

In designing antenna systems, engineers must consider the comprehensive characteristics of the environment in which the antenna will operate. This can include modeling such effects as a plastic covering over the antenna, the interaction of a mobile handset with the human hand, or the way an antenna is installed in an automobile. With so much functionality crowded into devices — and so many wireless systems residing in close proximity — EMI is on the rise.
Engineers are also challenged to develop new antenna technologies that require multiple frequency bands and greater efficiency, all within a smaller physical profile.

ANSYS is the industry leader in simulating the performance of antenna, microwave, wireless and radio frequency (RF) systems. With new solver capabilities in ANSYS HFSS — such as finite element method (FEM) domain decomposition, 3-D method of moment (MoM) and hybrid FEM–MoM — antenna engineers can rapidly solve electrically large, full-wave electromagnetic models. These models can accommodate regions of complex materials, as well as geometries with outer regions that are electrically large. In addition, transient solutions allow engineers to examine the behavior and scattering of radiation across time and space.

While antenna models are very large, high-performance computing (HPC) capabilities from ANSYS allow engineers to increase problem size and complexity while minimizing time-to-solution. Engineers at Synapse — a leader in wearable electronics — have used ANSYS HFSS in an HPC environment to increase antenna range by a factor of five, while reducing their overall design cycle by 25 percent.

At Vortis, engineers are applying ANSYS software to solve the problem of wasted RF energy in cell phones, which not only reduces battery life but also creates acoustic noise. The company’s innovative new phased-array antenna system is just one example of how simulation-driven product development is impacting the future of the IoT. (See page 28.)

INCORPORATING ADVANCED MATERIALS

At ANSYS, today there is a cross-industry strategic initiative aimed at supporting the incorporation of advanced composite materials into the product development process — and with good reason. Composite materials are no longer used only by automakers and aerospace manufacturers.

Today, high-tech companies turn to advanced lightweight, yet strong, materials to create flexible mobile and wearable electronics. However, a range of complex issues must be considered when evaluating new materials — including electrical conduction properties, structural strength, dimensional stability over time and resistance to thermal build-up. Design for manufacturability is also an important consideration.

High-tech engineers simulate the assembly of composite layers and conduct finite element analysis via ANSYS Composite PrepPost and other specialized modeling tools, subjecting these models to a range of real-world conditions. Electrical performance is verified using ANSYS HFSS and ANSYS Siwave, while ANSYS Icepak analyzes the thermal performance of electronic systems and devices.

ANSYS offers the industry’s most comprehensive solution for evaluating the potential of advanced materials to reduce weight, while also optimizing conductivity, signal integrity, dimensional stability and thermal management within devices. For example, 3M recently published a groundbreaking study on how a novel embedded-capacitance composite material affected the electrical performance of a printed circuit board, relying on ANSYS Siwave to model the new board versus a conventional PCB. [2]

At the University of Pittsburgh and Carnegie Mellon University, engineers are using ANSYS PExprt and ANSYS RMxprt to assess the performance of new nano-composites that have the potential to revolutionize power transformer technology. (Learn more in our Web Exclusive.)

INVESTING IN THE FUTURE

Since the earliest days of the high-tech revolution, simulation-driven product development has been a critical strategy for satisfying consumers’ increasing demand for device functionality, speed, bandwidth, aesthetics and other product characteristics — while still meeting revenue and margin goals. ANSYS has helped hundreds of high-tech companies launch their game-changing designs quickly, cost-effectively and confidently, creating market leadership and building some of the industry’s strongest brand reputations.

Historical trends enable us to confidently predict that high-tech manufacturers will continue to deliver incredibly innovative products that we cannot even imagine today. We can also be confident that — with a commitment to strategic acquisitions as well as development of new software features and functionality — ANSYS will continue to invest in our high-tech customers’ success. ▲

References


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