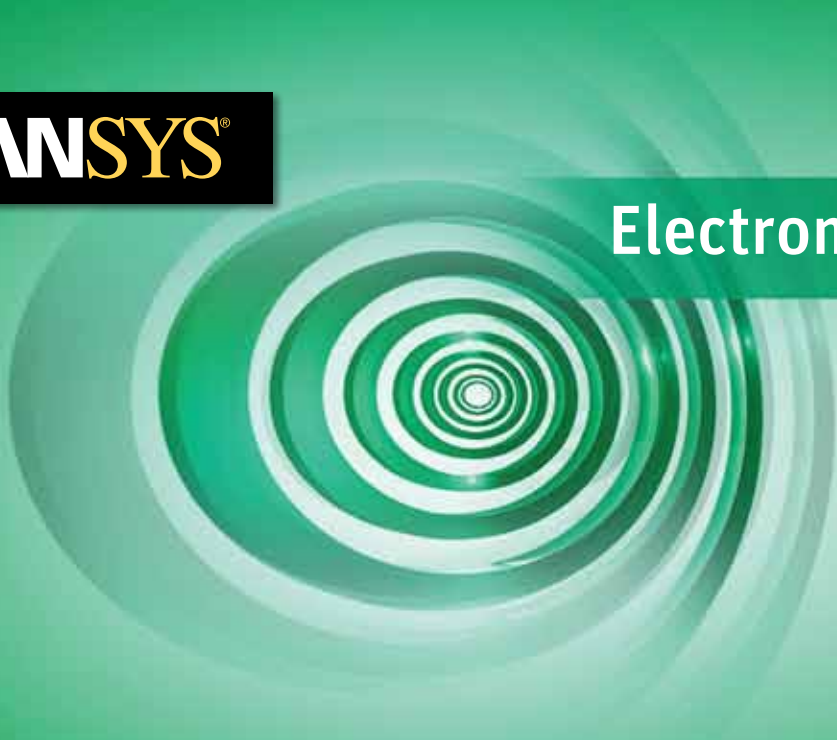**Realize Your Product Promise™**

ANSYS®

Electromagnetics

Electromagnetics
Realize Your Product Promise

Robust, industry-leading solutions from ANSYS simulate electromagnetic fields and compute electrical parameters that govern electronic device behavior — enabling you to optimize your product's performance.

Hundreds of devices that we use every day — from computers, automobiles, mobile communication devices and wireless networks to the electrical grid — depend on advanced electromagnetic equipment. Optimizing the performance of these complex designs requires accurate modeling of electromagnetic fields, circuit details and system validation.

Engineering simulation software — which enables product development and optimization in a virtual environment — has revolutionized electronics design. R&D teams define device architecture, verify specifications for functional blocks, design circuits and components, evaluate component- and system-level interactions, and optimize circuit or system performance under actual operating conditions.

No matter the discipline or industry, you can readily put these numerical tools to work to virtually optimize electrical performance and component interactions, sometimes with minimal investment in physical testing.

When you leverage this power, you have the opportunity to slash the time and costs traditionally associated with designing sophisticated electrical devices.

Consumers demand features that make electromagnetics design more complex. As a result, the opportunity to differentiate in the marketplace has been never been so pronounced. At the same time, the downside risk of product failure and its consequences can be catastrophic.

In defense and aerospace industries, companies use our software to design advanced electronics systems such as avionics, fly-by-wire controls and airborne communications (including antennas, their supporting structures, rotor effects and radar cross section). Meeting high safety and reliability standards can be accomplished cost effectively with our electromagnetics and multiphysics analysis tools.

ANSYS: Powered by Technology Leadership

ANSYS advanced simulation technologies create a high level of confidence that the complex devices you design will perform reliably under real-world conditions, enabling you to fulfill your critical product promise to customers.

With proven industry-standard electromagnetic field solvers such as ANSYS HFSS,® we have emerged as the clear industry leader in electromagnetics simulation, with unmatched technology depth and breadth. Spanning the full spectrum of electromagnetic analysis and design, our tools enable companies to leverage best-in-class technology to confidently predict device behavior, dramatically reduce prototype and physical testing costs, and launch innovative, competitive products faster.

No other software provider offers the broad, overarching perspective on device performance that is made possible by the comprehensive ANSYS simulation suite. From component design and baseline physics analysis to system integration and optimization, this is the ANSYS promise: to offer robust, industry-leading capabilities — so you can realize your performance promise of a wide range of low- and high-frequency/high-speed and electromechanical devices.

"All our customers want answers to their questions really fast. And it's implicit that they want accurate answers. There are plenty of tools around that give you an answer very quickly, but it's more difficult to find a tool that is both accurate and quick at the same time. That's ANSYS."
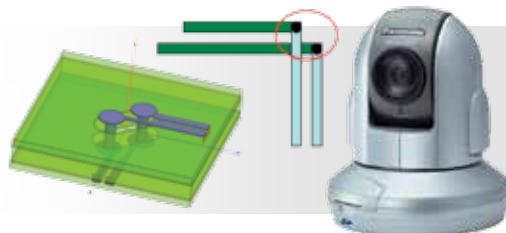**Jonas Persson**
Technical Manager
ST-Ericsson

One rising trend in wind turbine generation is permanent magnet generators, offering higher efficiency and design flexibility. Indar Electric used our tools to reach the ambitious target of 97.7 percent level efficiency at rated load in converting mechanical to electrical energy.

"The electromagnetic and fluid flow simulations provided far more diagnostic information than was available from physical testing. Simulation made it possible to achieve this challenging performance goal in less than half the time that would have been required using conventional build-and-test methods."
Jon Vaquerizo
Project Manager
Indar Electric

Using ANSYS electronics simulation software, Panasonic improved signal integrity for a remote surveillance camera. By adopting a circuit and 3-D electromagnetic cosimulation approach, the design team saved almost three months in development time.

Signaling a New Era in Product Integrity

ANSYS helps you deliver on your product promise — by ensuring optimal power and signal integrity.

For high-speed digital devices, there are few issues more critical than achieving consistent power and signal integrity and avoiding EMI. Realizing uncompromised signal fidelity requires detailed design of component, circuit and system levels in addition to gigabit-speed interconnections for chip-to-chip, package-to-board or board-to-board communications.

At the same time, delivering a high level of power integrity requires innovative product design that eliminates electronic power fluctuations within the PCB or device.

Ensuring signal fidelity at state-of-the-art GHz or Gb/s speeds requires a new generation of design strategies along with tools that accurately characterize signal transmission. Thirty years ago, signal integrity was not so great a design challenge, but data rates in today's products have higher speeds, requiring greater bandwidth, while product size is decreasing. All of this contributes to SI complexity.

When a high-frequency signal travels between its source and termination, it can resonate and emit electromagnetic energy that interferes with other components in the product — as well as other products that happen to be in the area.

Simulation software from ANSYS empowers you to analyze power and signal integrity as well as EMI early in the design cycle, when the change process is most efficient and cost effective. With our broad range of high-frequency and signal integrity tools, your engineers can identify performance issues such as ringing, crosstalk, ground bounce and power supply noise.

We have strengthened our position as a technology pioneer with the integration of advanced low-power electromagnetic simulation technologies from Apache Design Solutions, Inc. These tools are critical for designing a range of portable electronics — including smartphones, tablets and laptops — with complex power issues due to their video, GPS, recording and conferencing features that are supported by lightweight, energy-efficient batteries.
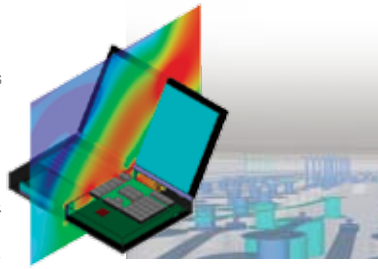
$Pn = Po \times 2^n$

"Signal integrity is a whole new field. In the future, we will have to change the way we do things. Hardware product developers want to sell computers that operate at 10 GHz in the next generation, then probably 30 GHz after that, and 100 GHz after that."
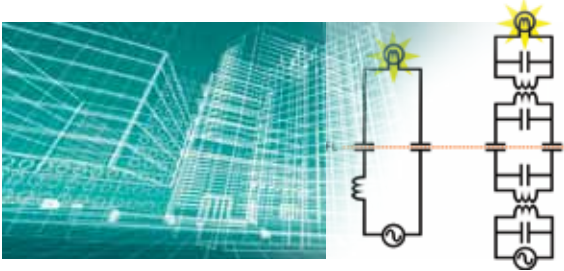
Dr. Paul G. Huray
Professor, Dept. of Electrical Engineering
University of South Carolina

Our technology can handle the complexity of modern interconnect design from die to die across ICs, packages, connectors and boards. By leveraging advanced electromagnetic field simulators dynamically linked to powerful circuit and system simulation, engineers can understand the performance of high-speed electronic products long before building a prototype in hardware.

Architectural firm Takenaka Corporation develops wireless power supply systems that are embedded in the walls and floors of buildings. In designing the circuit for this system, the company coupled several ANSYS tools to determine capacitance between electrodes, to create the inductor design, and to analyze the electromagnetic radiation characteristic.

By incorporating on-chip power integrity analysis from Apache, our software delivers the capability to simulate and analyze power integrity at the chip, board and package levels. We provide the full range of capabilities needed to balance high-energy outputs with extreme energy efficiency via analysis at both the component and system levels.

ANSYS: A Transmitter for Innovation

Signal and power integrity are essential to consistent performance of a wide range of digital and electronic products. No matter the industry, engineers are using ANSYS tools to take this central product competency to new levels of reliability and innovation via early-stage engineering simulation.

For example, designers of high-speed and fast-switching circuits rely on ANSYS for the parametric data and time-domain circuit models they need to verify and tune package performance — before costly final assembly occurs.

ANSYS software helps integrated circuit engineers meet growing market demands for lower cost, lighter weight and longer battery life by supporting the functional integration of disparate circuit components. We also help product developers bring to market new mixed-signal designs that incorporate embedded high-performance analog blocks with complex digital circuitry on a single chip.

Isolated product failures can damage an organization in the form of reputation, sales, stock price, warranty claims, legal costs and credit rating. Product integrity is emerging as a potential problem at a time when the cost of delivering a faulty product to customers has never been higher. In complex systems such as cars and airplanes, electronic and electromechanical components are developed by multiple vendors, increasing the opportunity for crosstalk and EMI.
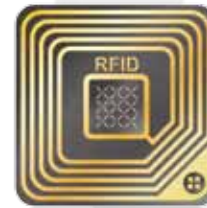
In designing high-performance graphics solutions, one of the hardest challenges is ensuring that the communication link is clear between pixel generation and pixel display. Visual computing technology leader NVIDIA uses ANSYS tools as an extension to the traditional SPICE-level simulation approach to attack the problem head on.

Taking High-Frequency Performance to a New Level

By supporting full-wave electromagnetic field simulation dynamically linked with circuit- and system-level simulation, ANSYS tools help you quickly and cost-effectively optimize RF and microwave product performance.

RF and microwave applications represent one of the fastest-growing segments of the high-performance electronics market, in which ongoing innovation is critical. High-frequency components and circuits in the transmitter/receiver portions of communication systems, as well as radar systems, satellites and cellular telephones, are under special scrutiny. Manufacturers compete intensely to meet market needs for reduced cost, size, weight and many other performance criteria — and now even "green" — demands.

As a result, high-performance electronics feature ever-increasing design complexity and density, including package parasitics and chip-to-chip interactions. We offer the broad RF and microwave simulation capabilities needed to address these challenges, including full-system verification, multi-chip simulation and package interconnect parasitic extraction. This technology enables high-frequency device manufacturers to take their product performance to the next level, realizing increased reliability and customer loyalty.

In the healthcare industry, manufacturers must comply with specific absorption rate (SAR) regulations, a measure of how the body absorbs energy when exposed to an RF electromagnetic field. Our software is approved for validating both SAR and RF emissions, as in an implanted device that transfers physiological data to a doctor via wireless communication.

Electromagnetic fields are frequently employed in advanced medical applications like MRI. As these devices become more complex, design simulation can maintain advanced functionality while addressing safety concerns. In an open MRI system, the details of the radio-frequency coils, a human body model, and the large volume of the exam room must all be included in sufficient fidelity in a simulation model to determine the resulting field accurately. Our software is ideally suited to this task.
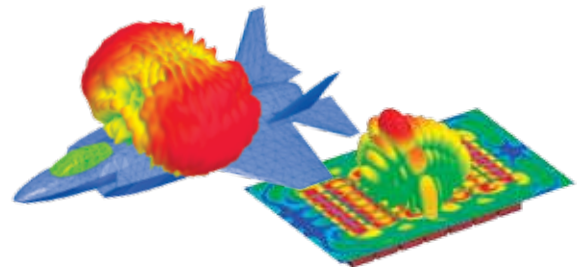
ANSYS: A Super-Charged, System-Level Perspective

ANSYS technology delivers transistor-level detail for complex, highly nonlinear circuits. To launch high-frequency innovations rapidly and cost effectively — while maintaining a high level of product confidence — manufacturers have shifted from analyzing individual components to looking at system-level performance and behavior. As a result, RF and microwave engineers are simulating larger and more sophisticated design problems every day. From amps and switches to mixers and filters, today's high-frequency engineering analysis focuses on fulfilling the product promise at the system level.
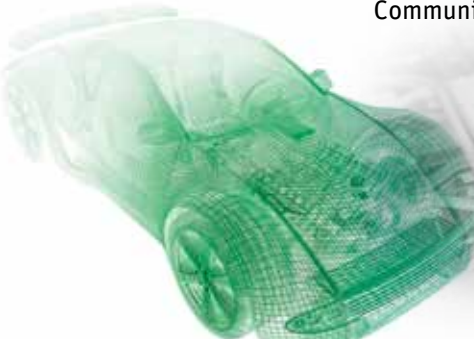
For example, phased-array antenna system designers are simulating not only antenna elements but supporting feed networks and the active circuits that drive the array. Other antenna system designers focus on the environment in which the antenna operates, such as performance of an antenna beneath a radome or the effects of a mobile handset on a human hand or head.

Organizations in the medical equipment sector use our industry-leading FEM electromagnetic field simulation to validate their transceiver designs for medical devices that must communicate with other similar devices — in the process meeting U.S. Federal Communications Commission standards.

We stand alone as the only software provider to accommodate the system-level approach and the resulting simulation depth and breadth required to design next-generation wireless and communication systems. High-performance computing capabilities enable you to manage large-scale RF and microwave simulations once thought unsolvable.

ANSYS tools are ideal in helping design antennas that achieve higher gain, allow multiple frequency operation, provide directional control over mobile handset emissions, provide wider bandwidth for data rate requirements, and are less obtrusive. You can analyze full-system performance by including supporting feed network and active circuits behind the antenna.

Our solutions are instrumental in designing smart vehicle communication systems. Capabilities enable design of car-to-car communication, car-to-roadside infrastructure and sophisticated telematics equipment. These features can dramatically improve driver safety, comfort and convenience.
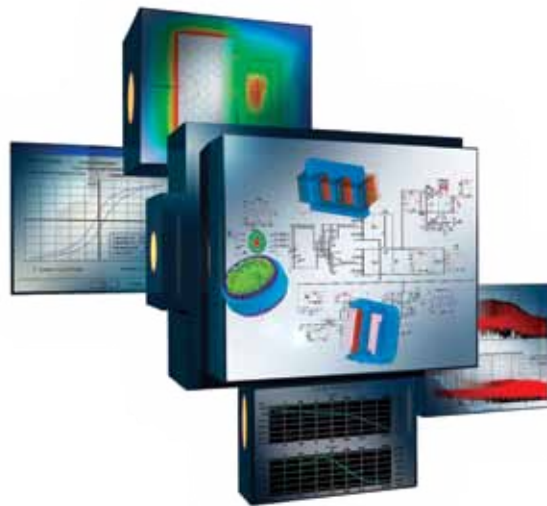
Driving Low-Frequency Product Innovations

ANSYS delivers the industry-leading technologies you need to support multi-domain, multi-level and multi-organizational design of advanced electromechanical systems.

Electromechanical systems bring together electromagnetic, mechanical, electronic and control technologies to create synergistic physical systems mainly for the automotive, aerospace and industrial sectors. Engineering and designing these multi-domain systems cannot rely on iterative analysis of individual components. Instead, it must comprise a well-considered study of system-level performance — as well as interoperability of components and circuits — from the earliest design stage.

Because of the complexity of these systems, design development requires use of multiple simulation techniques, along with input across multiple engineering disciplines, to accomplish business objectives: lowering design costs, reducing errors and speeding time to market.

Electromechanical solutions from ANSYS capture the interactions between electromechanical components, electronic circuits and control logic — revealing the underlying forces that determine ultimate product performance. By leveraging our industry-leading simulation technologies, engineers can accurately model, simulate and validate performance at the component, circuit and system levels. Multi-organizational engineering teams leverage our engineering knowledge management capabilities to share data and seamlessly manage multidisciplinary simulation projects.

The ANSYS low-frequency approach analyzes the underlying physics that govern all electrical behavior, allowing engineers to accurately model, simulate and validate the component-, circuit- and system-level performance required for optimal product design.

Norvento Energía Distribuida uses coupled multiphysics software from ANSYS in developing an innovative wind turbine specially designed for distributed energy applications.

"Our technical team was challenged to develop a fast, efficient and innovative way to design a turbine that would give us a competitive advantage. We chose ANSYS for coupling multiphysics analysis where needed, at the aerodynamic, structural, component and electromechanical levels."
Miguel Hoyos
Technical Director
Norvento Energía Distribuida

In the power transformer industry, design engineers are developing complex next-generation power transformers within demanding time frames. Simulating systems allows engineers to optimize components to reduce size and cost while ensuring that the unit meets all design requirements, including the ability to withstand surges and short circuits while avoiding excessive temperatures and reducing noise. Using our software, Pennsylvania Transformer Technology Inc. developed a simulation-driven design methodology that reaches across physics, across engineering disciplines and across departments to optimize transformer design.
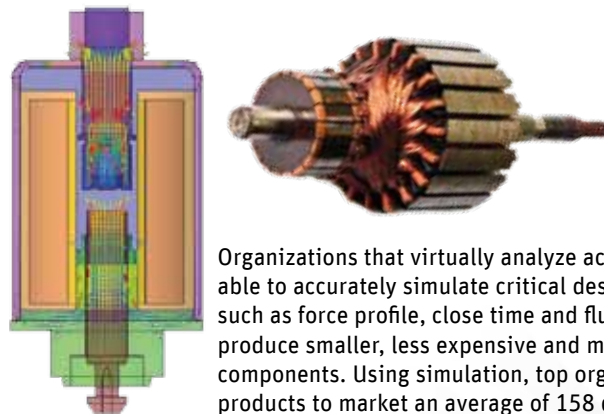
ANSYS: Helping Customers Advance in Every Industry

Electromechanical solutions from ANSYS help leading manufacturers in diverse industries keep pace with market demand for innovative products.

For example, multidisciplinary engineering teams (electromagnetics, electronics, structural mechanics, fluid dynamics, hydraulics and control technology) in the automotive industry rely on our tools to design next-generation electric and hybrid-electric propulsion, safety systems, electronic engine and chassis control technologies, and active suspensions. The design process must incorporate many levels of simulation detail for modeling and analyzing electromechanical components, circuits and systems. Our deep and broad solutions provide a common, collaborative platform for both OEMs and their various supplier tiers around the world — an example of multi-organizational analysis benefits.

In the aerospace industry, ANSYS plays a central role in developing the "more electric aircraft" concept, which represents a major industry driver for airlines trying to multiply the effects of technology improvements and lower costs. Electromechanical software helps aerospace engineers confidently and reliably replace traditional mechanical and hydraulic systems with fault-tolerant, lightweight electric power systems.

Engineering teams in the industrial automation sector leverage the power of our solutions to design a spectrum of products — including power electronics, motors, drives and critical electromechanical components such as actuators, sensors, relays and converters. These sophisticated systems require global supply chains, and ANSYS provides the ideal platform for information-sharing and engineering knowledge management.

Organizations that virtually analyze actuators are able to accurately simulate critical design parameters such as force profile, close time and flux density to produce smaller, less expensive and more reliable components. Using simulation, top organizations get products to market an average of 158 days sooner and with $1.9 million lower development costs.

The ANSYS distributed solve capability allows a single user to distribute parametric studies or frequency sweeps across a number of computers, expediting total simulation time. Engineers can explore variations in geometry, materials, boundaries and excitations as well as distribute frequency sweeps. This allows your team to easily optimize designs and perform statistical and sensitivity analyses.
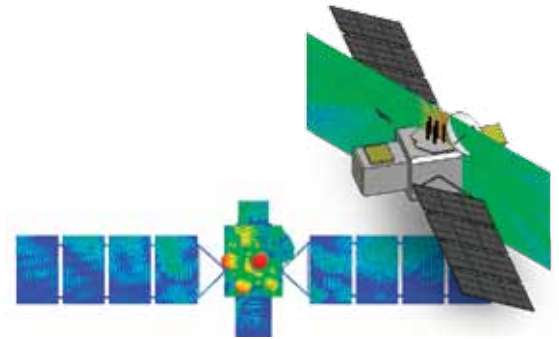
Undisputed Technology Leadership

ANSYS offers the industry's widest range of electromagnetics simulation technologies, spanning integrated circuit, low power, signal integrity, power integrity, RF, microwave and electromechanics.

The design of sophisticated electronic devices means the creation of numerically large models, with highly detailed geometries and extremely complex physics. ANSYS delivers HPC capabilities that enable rapid parallel processing of even the toughest, most high-fidelity electromagnetic simulations. Furthermore, domain decomposition divides large simulations across multiple processors — offering near-linear speedup with each additional processor.

We offer a distributed-solve capability, which allows a single user to distribute parametric studies or frequency sweeps across a number of machines, dramatically accelerating the solution time for parametric studies and design optimization.

To support collaborative design efforts of global engineering teams, ANSYS software incorporates an outstanding capability for engineering knowledge management. Multiple engineers can work collaboratively on low-power, signal-integrity, power-integrity, mechanical, thermal and RF/microwave problems, across multiple companies and geographies. This high level of collaboration saves time, reduces design mistakes, and minimizes product recalls.

Advanced HPC technology called domain decomposition delivers parallel processing, enabling high-capacity simulations of very large models by accessing the memory of a network of computers. This powerful computational method fosters innovation, as it allows engineers to solve problems that were previously thought of as unsolvable.

"ANSYS has certain features that we really like. We can import CAD models directly into the ANSYS electromagnetic simulation package. The coupled thermal and electromagnetic tools provide us with insight into interactions between pacemakers and MRI scanners, which is a complex problem. Using simulation allows us to really understand the problem, so that we can mitigate the hazards."
Mariya Lazebnik
Senior Scientist
Medtronic

Automotive OEMs are engaged in a global contest to build and mass-market HEVs and EVs. For critical traction motor components, engineers must maximize electrical and magnetic losses to deliver maximum range and fuel efficiency to consumers. At the same time, engineers need to consider structural, thermal and electromagnetic issues that play a crucial role in vehicle performance, reliability and cost. ANSYS integrated multiphysics simulation technology helps to address these challenges by enabling engineers to rapidly evaluate — prior to physical prototyping — functionality, performance and cost of a wide range of design alternatives.
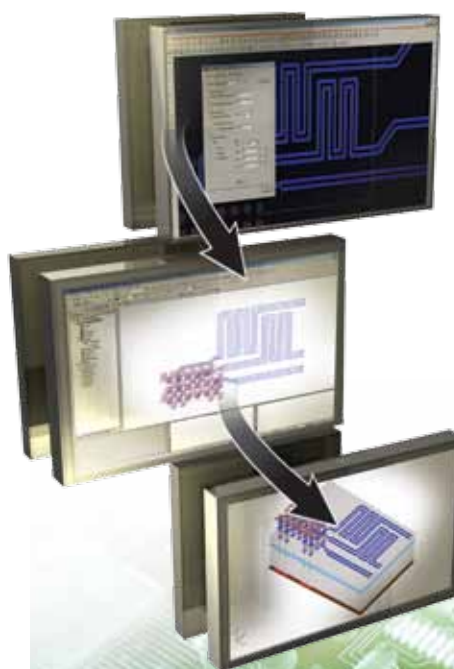
Powerful Partnerships that Fuel Innovation

To continue our technology innovation and leadership, ANSYS actively partners with other leading electromagnetics providers. These collaborations provide your business with the best-in-class solutions you need to optimize product performance and improve product development processes.

Our EDA partnerships mean that you can use existing design geometries in electromagnetics analyses to meet aggressive development costs and schedule goals. Our revolutionary Solver on Demand® technology delivers a new level of usability to EDA users, enabling you to solve simulations directly from your EDA layout tool.

ANSYS also collaborates with the leading CAD companies to provide a seamless transfer of 3-D CAD geometry into our electromagnetic simulation software. The linkage dramatically reduces the overall design cycle.

Successful design engineers around the world are beginning to understand the issues that require full chip–package–board analysis with ANSYS tools. Are you?

Our software streamlines the transfer of design databases from popular third-party EDA layout tools and mechanical CAD (MCAD) packages for electromagnetic field analysis. EDA links are available for tools offered by Cadence,® Zuken,™ Mentor Graphics,® and Synopsys,® while MCAD links support common file formats, such as IGES, STEP and Pro/ENGINEER.®

Organizations cannot afford to view IC design with a silo-based approach, in which the chip, package and board process as independent projects. This silo-based method results in over-design for margins. The addition of Apache low-power tools to the ANSYS suite is driving energy-efficient electronic product development in the 21st century.

ANSYS®

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ANSYS is dedicated exclusively to developing engineering simulation software that fosters rapid and innovative product design. Our technology enables you to predict with confidence that your product will thrive in the real world. For more than 40 years, customers in the most demanding markets have trusted our solutions to help ensure the integrity of their products and drive business success through innovation.

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