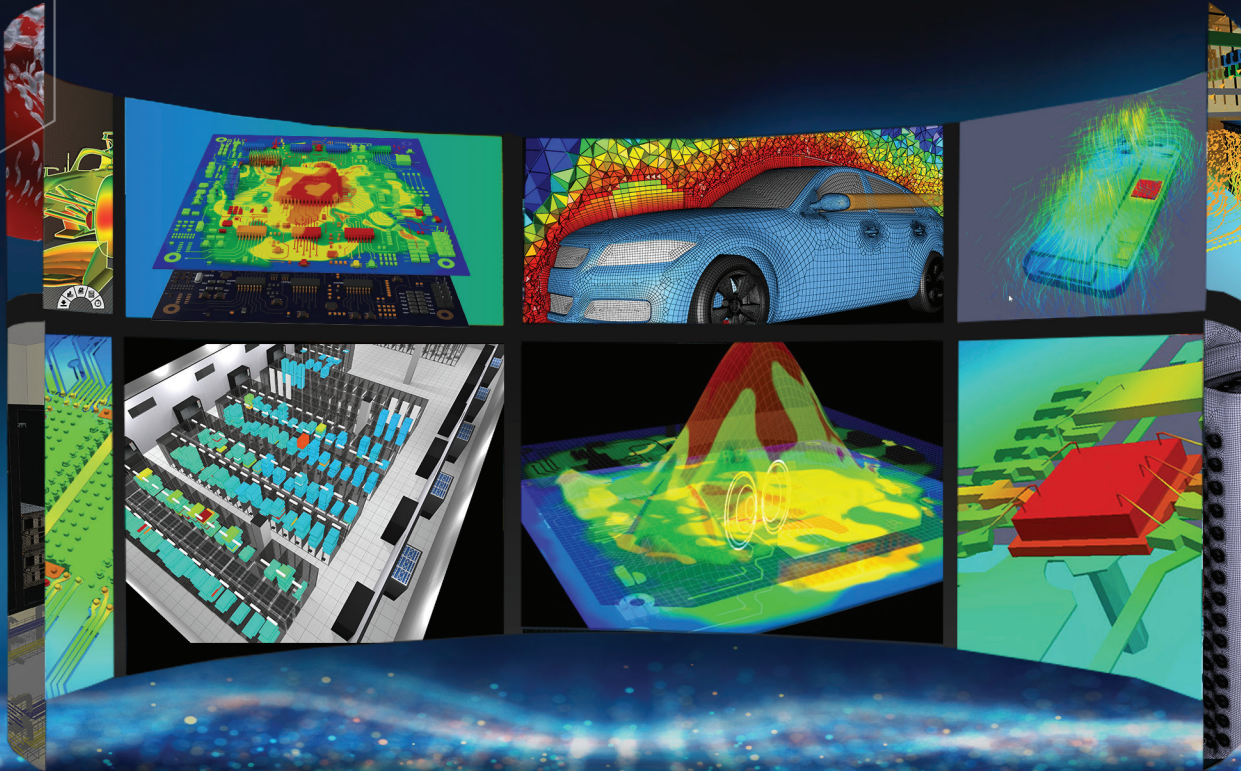


cādence®

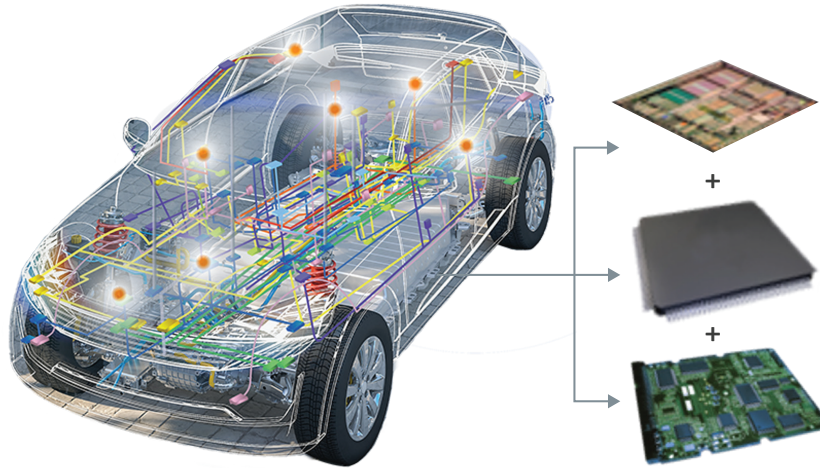


Cadence Multiphysics System Analysis Portfolio

Shift Left and Streamline System Design with
In-Design Multiphysics Analysis

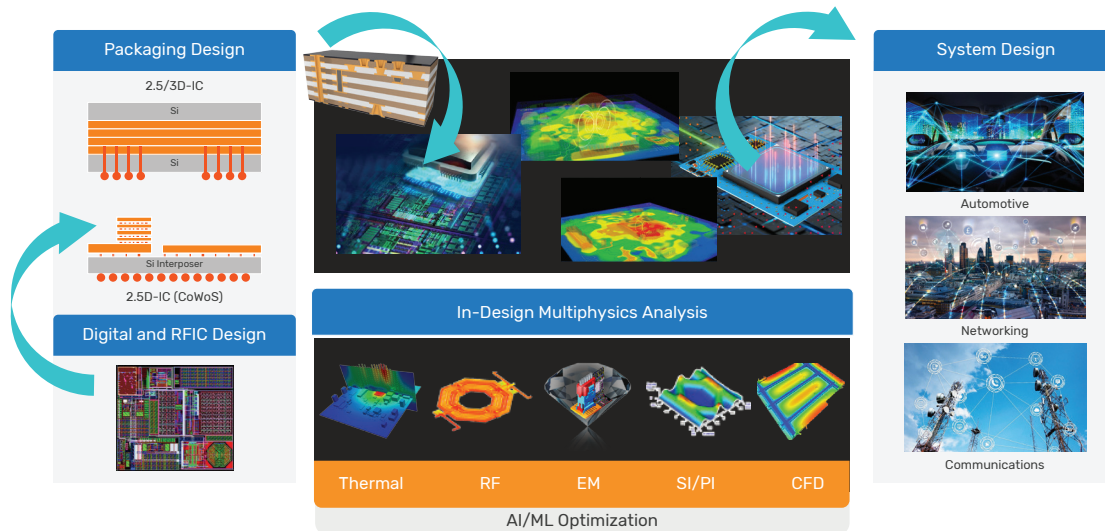
Shift Left In-Design Multiphysics Analysis

To succeed in today's highly competitive electronics markets, a practice called "shift left" is becoming increasingly popular. It serves to find and prevent defects early in the design process/workflow to improve electronic product and system quality and performance by moving engineering tasks to the left as early in the lifecycle as possible. In the world of electronic design automation (EDA), the shift left concept is specifically about driving multiphysics analysis technologies from an afterthought in the workflow to becoming an integral part of each phase of the design process at the chip, package, board, and complete system level.



As nearly every industry is electrifying, what we previously referred to as the electronics market, aka semiconductors, has now expanded to hyperscalers, mobile communications, aerospace and defense, consumer, internet of things (IoT), industrial IoT (IIoT), automotive, and even biomedical markets. Chips are no longer standalone items, but are incorporated into IC packages, placed onto PCBs in multiple configurations, then into enclosures, and so on until they enter the market as complete products, such as automobiles, 5G communications networks, and cell towers.

With the support of its Intelligent System Design™ strategy, Cadence delivers world-class computational software capabilities across all aspects of electronic systems design through end-to-end solutions across chips, IP, packages, PCBs, and systems. As a critical piece of this strategy, Cadence® multiphysics design and analysis products with generative artificial intelligence (AI) and machine learning (ML) technologies analyze and optimize the integration of components and subsystems, improving overall system performance and efficiency.



The Cadence TAT Advantage

Shifting left of analysis into the workflow—starting with design, moving to analysis, and finishing with the realization of the end-product (concept to manufacturing)—is the key advantage Cadence offers customers. The Cadence “superhighway” of in-design multiphysics system analysis solutions empowers users with a seamless workflow that accelerates turnaround time (TAT) while minimizing risk by enabling users to remain within the same environment without the need to exit and plug into outside vendor point tools.

Cadence’s complete and comprehensive systems design and analysis offering encompassed not only the IC, PCB, and IC package design platforms but their inherent multiphysics phenomena as well. This includes signal integrity/power integrity (SI/PI), electromagnetic (EM), thermal, and computational fluid dynamics (CFD), as well as RF/microwave effects. Together, these integrated and interoperable workflows for complex, electrically mechanical, and/or heterogeneous systems deliver unconstrained capacity for analysis and optimization of the complete system; furthermore, they offer unprecedented engineering efficiencies for faster time to market with higher quality products, improved performance and yields, and reduced design cycle TAT with risk mitigation.

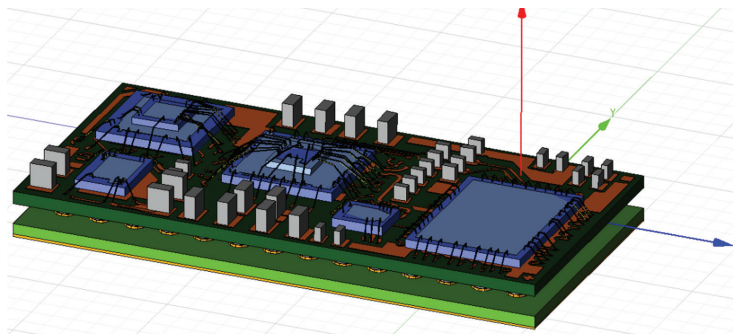
In-Design Multiphysics Analysis Portfolio

Electromagnetics

Clarity High-Frequency/High-Speed 3D EM Platform

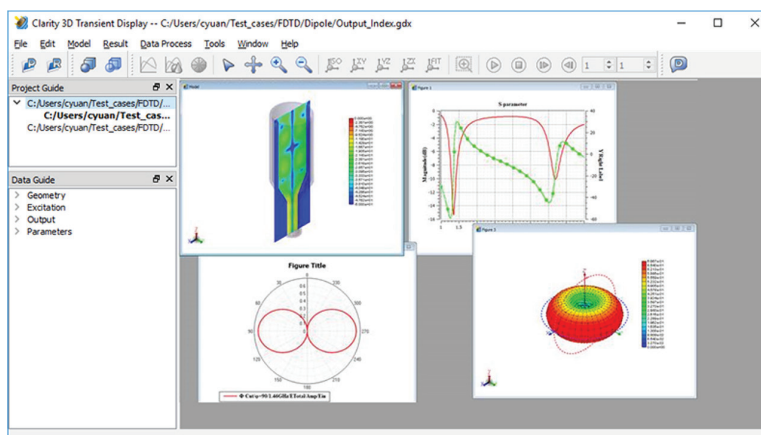
Frequency Domain Electromagnetic Analysis for PCB, IC Package, and SoIC Designs

The Cadence Clarity™ 3D Solver provides fast, accurate 3D EM simulation for designing critical interconnects for PCBs, IC packages, and system on integrated chips (SoIC) designs. The Clarity 3D Solver helps designers tackle the most complex EM challenges when designing systems for 5G, automotive, high-performance computing (HPC), and ML applications with gold-standard accuracy.



Finite Difference Time Domain EM Analysis

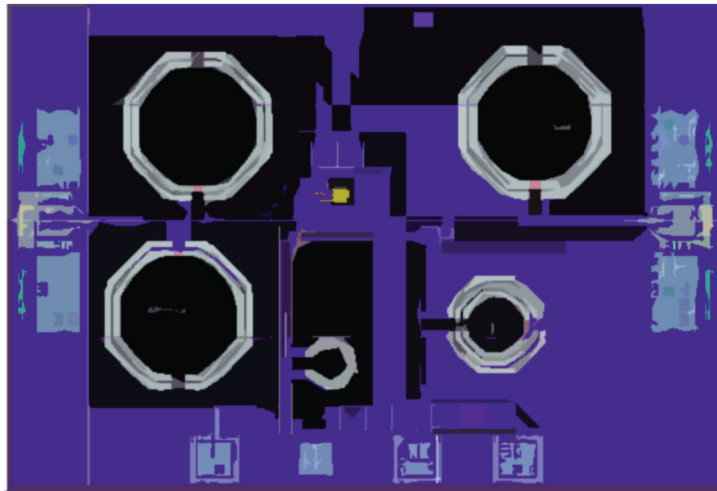
The Clarity 3D Transient Solver is a 3D finite difference time domain (FDTD) EM software tool for simulating complex systems and subsystems for 5G, automotive, HPC, and ML applications with test-measurement accuracy.



EMX 3D Planar EM Platform

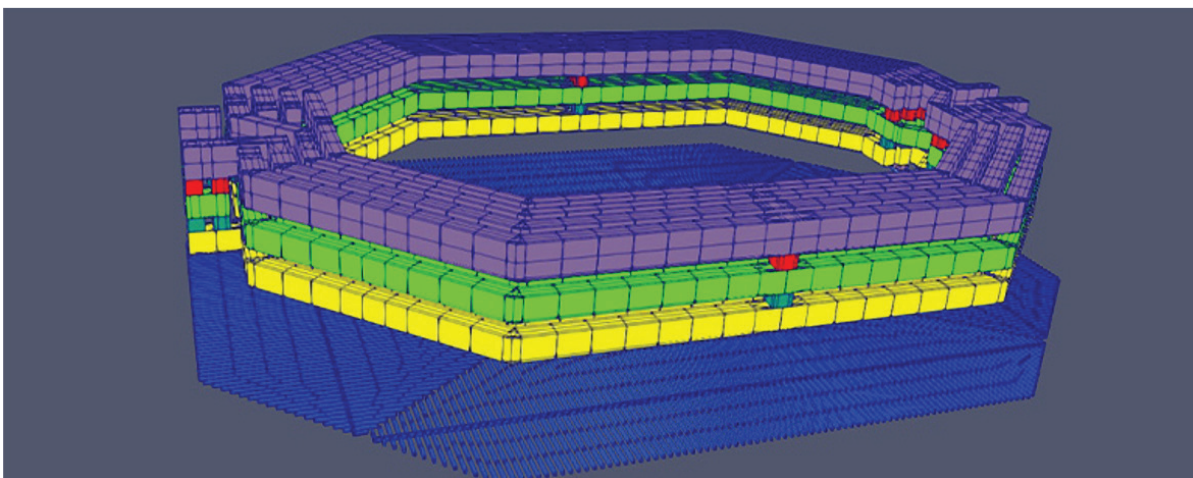
EM Analysis for Silicon IC Designs

The Cadence EMX® Planar 3D Solver simulates high-frequency and high-speed ICs, enabling designers to accurately and efficiently simulate large circuit blocks, characterize the behavior of passive components, and analyze on-chip EM parasitics. The EMX solver is seamlessly integrated with Cadence's custom analog design flow and Virtuoso® releases, as well as with its analog design environment and Spectre® RF Option. An integral part of the Virtuoso RF design flow, the EMX Planar 3D Solver integrates with the Cadence Quantus™ Extraction Solution through the Smart View feature, enabling "EM-aware" parasitic extraction and signoff.



Passive Component Synthesis and Optimization for High-Frequency and High-Speed IC Designs

EMX Designer provides faster and more flexible passive component synthesis and optimization than traditional software tools. Leveraging the proven accuracy of EMX Planar 3D Solver's EM modeling engine, EMX Designer takes split seconds to produce accurate, DRC-clean parametric cells (PCells) of passive structures for any foundry process node down to 3nm. Featuring a complete library of PCell options, EMX Designer supports a wide variety of inductors, transformers, T-coils, and other types of passive devices.

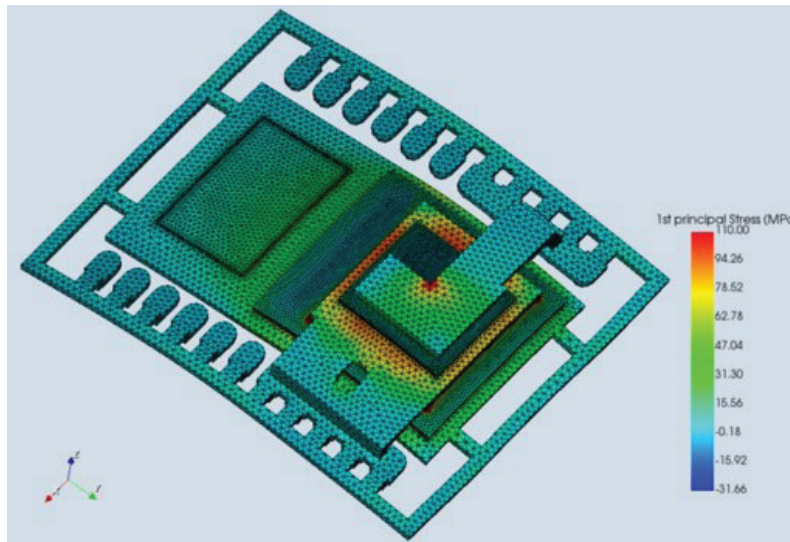


Thermal Analysis

Celsius Studio Platform

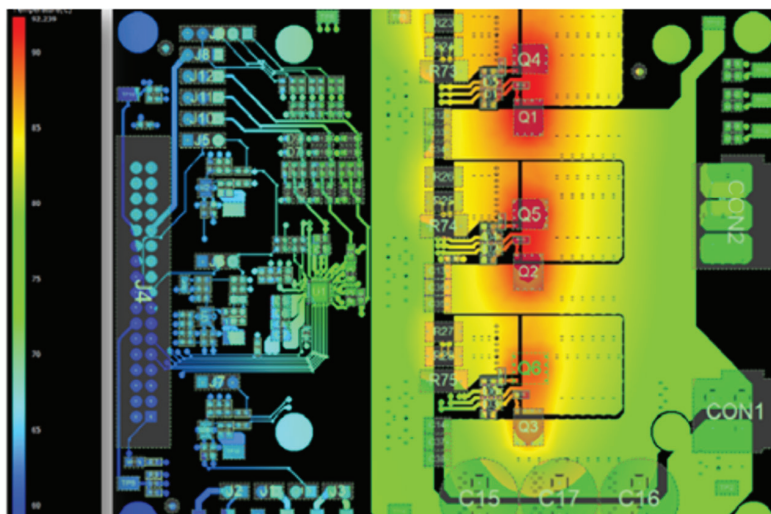
System-Level Thermal Integrity Analysis for PCB, IC Package, and SoIC Designs

Cadence Celsius™ Studio is the industry's first complete AI-enabled thermal platform for electronic systems to address thermal analysis, electronics cooling, thermal stress, and more. Celsius Studio introduces an entirely new approach with a unified platform that lets both electrical and mechanical/thermal engineers concurrently design and analyze from within a single platform without the need for geometry simplification, manipulation, and/or translation. The end result is a streamlined workflow that improves collaboration, reduces design iterations, and allows predictable design schedules, which in turn reduces turnaround times and accelerates time to market.



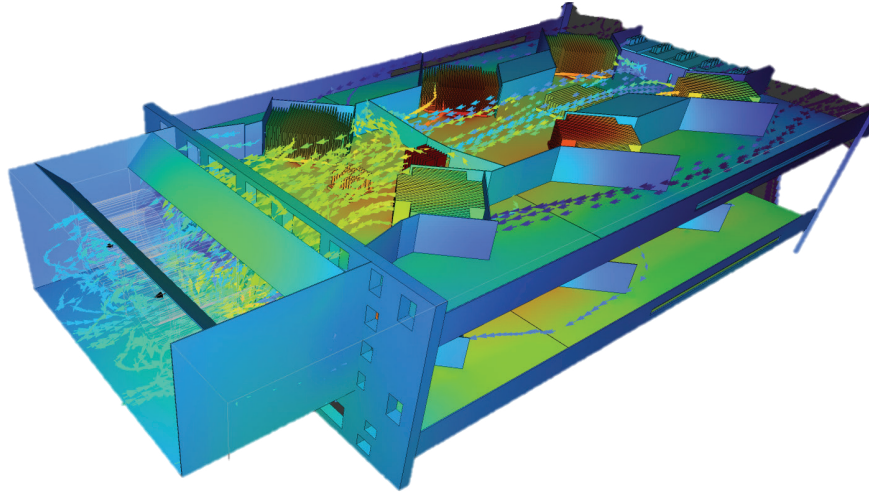
Electrical-Thermal Co-Simulation for Electronic Systems

The Cadence Celsius Thermal Solver is the industry's first complete electrical-thermal co-simulation solution for the full hierarchy of electronic systems from ICs to physical enclosures. Based on a production-proven, massively parallel architecture that delivers up to 10X faster performance than legacy solutions without sacrificing accuracy, the Celsius Thermal Solver seamlessly integrates with Cadence IC, package, and PCB implementation platforms.



Electronics Cooling Analysis and Optimization for System Thermal Efficiency

The Celsius EC Solver electronic cooling simulation software delivers accurate and fast analysis of thermal performance of electronic systems. The technology is designed specifically to enable electronic system designers to analyze the fluid flow and heat transfer of even the most complex electronic systems and address today's most challenging thermal/electronics cooling management problems quickly and accurately.



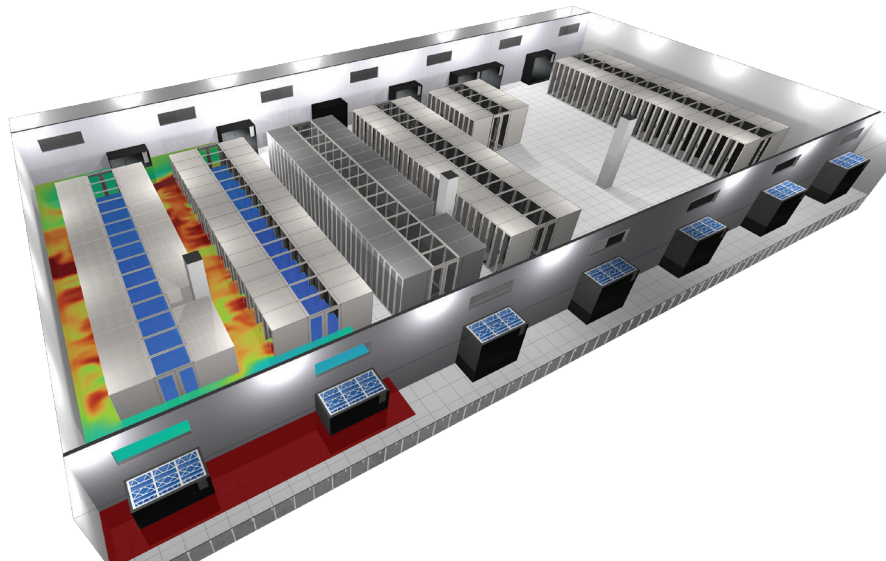
Reality Digital Twin Platform for Data Centers

Electrothermal digital twinning of the data center for efficiency planning and optimization

The Cadence Reality™ DC platform provides performance-aware design and operational planning of data centers through digital twin technology, helping data center professionals to future-proof designs and assess operational decisions in a safe, virtual environment. Data center digital twin offerings allow designers, owners, and operators to balance the need for reliability and efficiency in data centers.

Cadence Reality DC Design enables engineers to design the next generation of data centers, inside and out, with physics-based simulation powered by CFD.

Cadence Reality DC Insight empowers IT and facilities management teams to collaborate on data center energy and performance optimization via a web-based portal when the data center is operational.



System-Level Signal and Power Integrity Analysis

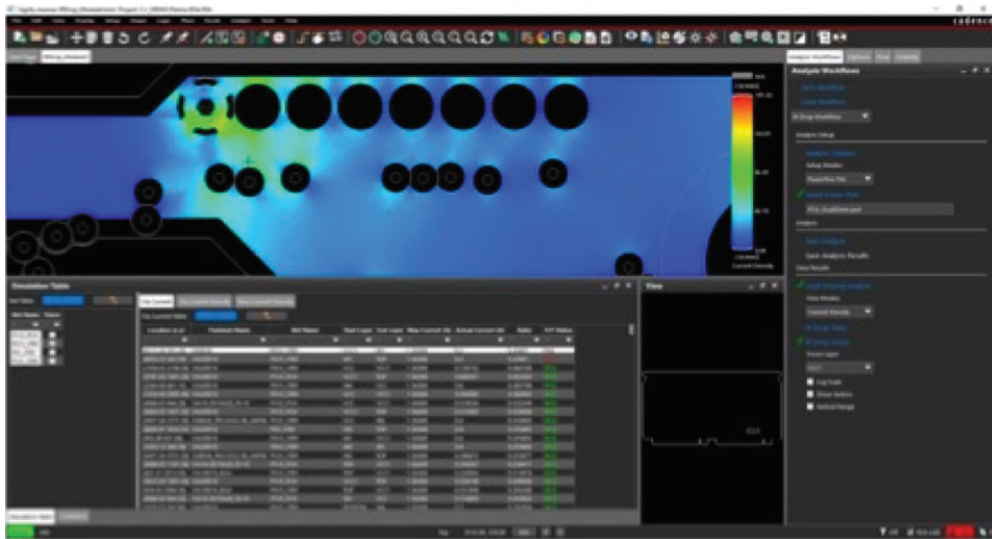
Sigrity X Platform

In-Design Signal and Power Integrity Analysis for PCBs and IC Packages

Cadence Sigrity™ X platform suite provides traditional SI/PI analysis for PCB and IC package designs. Integrated with Cadence's Allegro® PCB editing and routing technologies, Sigrity tools enable users to incorporate in-design analysis early in the design cycle using “what if” exploration scenarios in order to set more accurate design constraints and reduce design iterations. This integration also enables PCB and IC package designers to incorporate end-to-end, multi-fabric, multi-board systems (from transmitter to receiver or power source to power sink) for SI/PI signoff success.

Early in the design process, Sigrity X technology provides first-order SI/PI analysis directly from the Allegro PCB and IC package design environment, empowering design teams to initiate SI/PI analysis early in the design cycle. By detecting SI/PI problems earlier, the design requires fewer iterations during the signoff design phase, and SI/PI experts can put their focus on the more complex problems. This shift-left design methodology helps to produce higher quality designs more efficiently.

As designs approach the signoff stage, the Sigrity X technology suite becomes the platform for signing off on power delivery challenges as well as signal integrity signoff for leading-edge DDR5 and 112G interfaces. The combination of Sigrity X and Clarity gold-standard interconnect modeling combines with time-domain simulation (circuit and channel simulation) for serializer/deserializer (SerDes) analysis with IBIS AMI support. Cadence is uniquely positioned as a one-stop shop for extraction and interface compliance signoff.

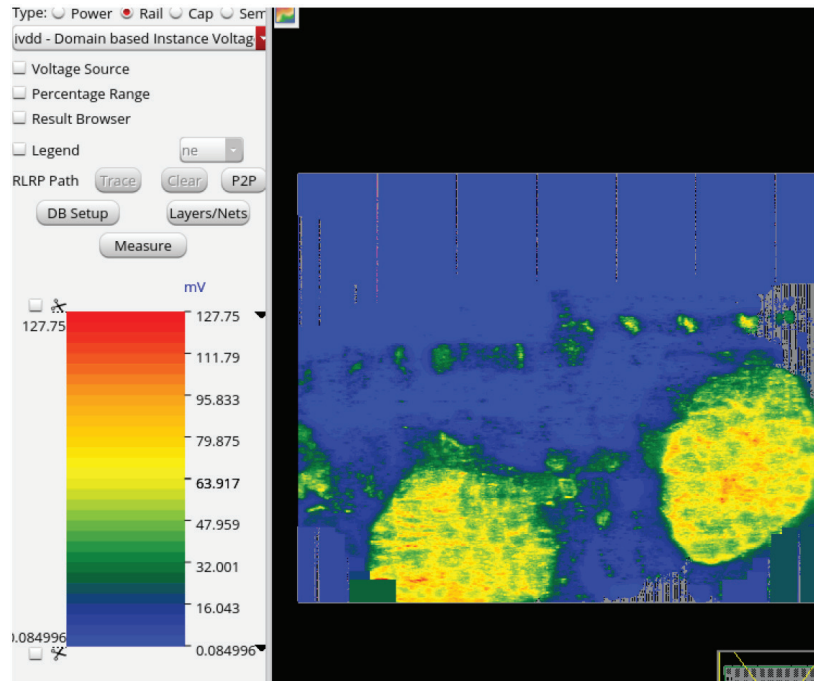


Chip-Level Power Integrity Analysis

Voltus Platform

EM-IR and Power Signoff Closure for SoCs

The Cadence Voltus™ IC Power Integrity Solution is a comprehensive full-chip electromigration, IR drop, and power analysis solution. With its fully distributed architecture and hierarchical analysis capabilities, the Voltus IC Power Integrity Solution provides very fast analysis and has the capacity to handle the largest designs in the industry. The Voltus solution enables IR-aware implementation and rapid design closure through seamless integration with Cadence's Innovus™ Implementation System and Tempus™ Timing Solution. Integration with the Sigrity technologies and Celsius Thermal Solver enables system-level PI and thermal analysis.



Generative AI-Driven Technology for EM-IR Drop Violation Early Detection

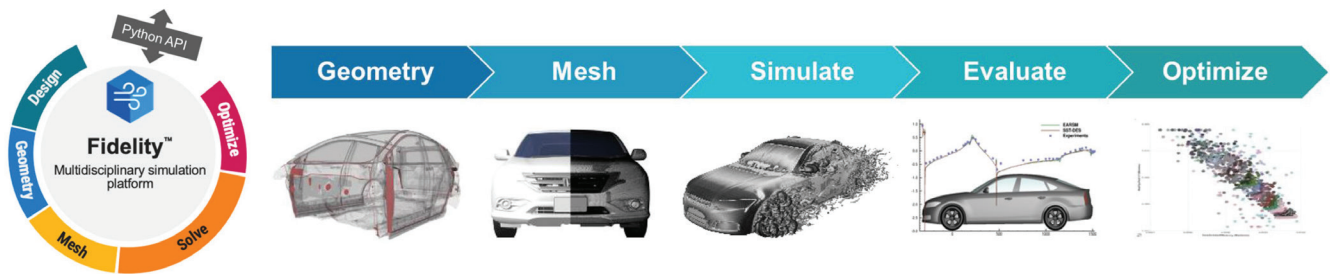
Voltus InsightAI is the industry's first generative AI-driven technology that automatically identifies the root cause of EM-IR drop violations early in the design process and selects and implements the most efficient fixes to improve power, performance, and area (PPA). Using Voltus InsightAI, customers can fix up to 95% of violations prior to signoff, leading to an up to 10X productivity improvement in EM-IR closure.

Computational Fluid Dynamics

Fidelity CFD Platform

End-to-End CFD Analysis/Optimization

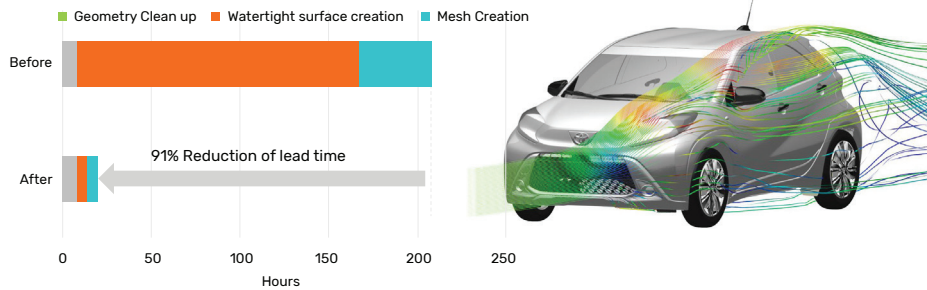
Cadence Fidelity™ CFD Software provides an end-to-end solution for all computational fluid dynamics (CFD)-related applications with a suite of comprehensive CFD solvers that enable customers to extend their multiphysics analysis workflows to address aerodynamics, aeroacoustics, hydrodynamics, propulsion, turbomachinery, heat transfer, and cooling, and combustion. It includes conjugate heat transfer coupling flow and heat transfer, fluid structure interactions, fluid chemistry, and multiphase interactions such as combustion, and aeroacoustics coupling flow and noise. The dedicated tools within the Fidelity CFD environment can solve each step of the simulation process quickly and efficiently.



Pre-Processing and Meshing

Up to 80% of engineering time is still spent on geometry pre-processing and meshing. With Fidelity CFD software, engineers can overcome this bottleneck and cut pre-processing and meshing time from days to hours, creating high-fidelity meshes with 100% viscous layer coverage for highly accurate results.

Pre-processing lead time for external aerodynamics case

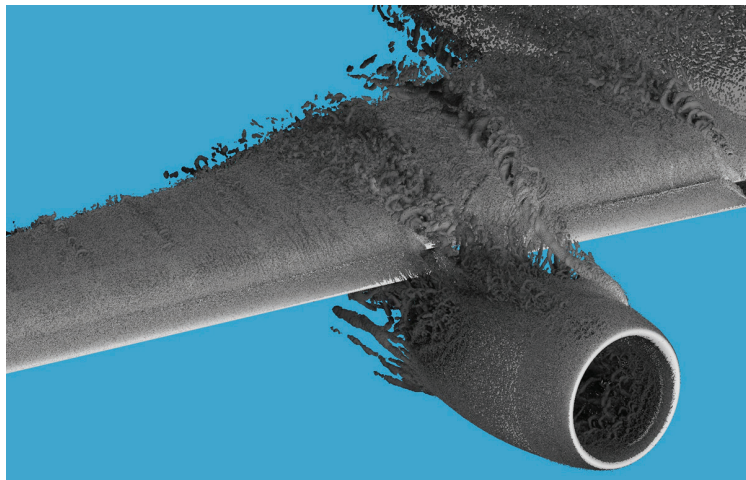


Toyota: "By using Autoseal and Hexpress, we drastically reduced the lead time and necessary manual work of our external aerodynamics pre-processing workflow"

Courtesy of Toyota

High-Fidelity CFD

The Fidelity large eddy simulation (LES) solver provides accelerated, high-accuracy large eddy simulations (LES) for multiphysics CFD. It is the industry's first high-fidelity CFD solver that expands the practical application of LES to a broad range of engineering applications in aerospace, automotive, and turbomachinery. Designed to tackle the toughest fluid dynamics challenges, it accurately predicts traditionally complex problems for CFD in aeroacoustics, aerodynamics, combustion, heat transfer, and multiphase.

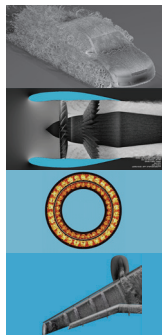


Millennium Enterprise Multiphysics Platform

Fully Turnkey High-Fidelity CFD Supercomputer

The Cadence Millennium™ M1 CFD Supercomputer, the industry's first turnkey CFD solution, overcomes the accuracy and speed limitations of traditional CFD solver technology with a combination of best-in-class graphic processing unit (GPU) resident CFD solvers such as the Cadence Fidelity LES Solver for large eddy simulations (LES) and scalable high-performance computing (HPC) hardware to unleash unprecedented performance. Rapid generation of high-quality synthetic data enables generative AI to quickly identify optimal system design solutions without compromising accuracy.

Millennium M1 extends the practical application of LES in aerospace, automotive, power generation, and turbomachinery applications by reducing turnaround time from days to hours.



Case	Description	Grid size (millions of cells)	Millennium nodes	Turnaround time (hours)
DrivAer Automobile	Drag and wake prediction	144	2	4.6
NASA SDT Turbofan	Turbofan performance and noise	142	2	6.7
GE E3 Combustor	Liner temperature and exit profile	180	2	7.8
JSM Airframe	Max lift polar and stall structure	185	2	13.9

Performance Acceleration

Optimality

Generative AI-Driven Multiphysics Analysis and Optimization for Electronic Systems

Cadence Optimality™ Intelligent System Explorer multiphysics optimization software enables analysis and optimization realization of electronic systems. With the increasing complexity of electronic system design and greater performance requirements, the Optimality Explorer breaks through the limitations of the conventional human-intensive optimization process by replacing a traditional interactive flow of design, test, and refine loop with generative AI-driven technology that results in the optimal system design solution expeditiously and without compromising accuracy.



Universal Accelerators

HPC for Accelerating System Design and Analysis

Today's complex simulations require the speed and accuracy offered by multicore computers and multicomputer clusters to enhance insight and drive productivity. Cadence universal accelerator cores scale for CPU and GPU hardware used in data centers that support AI, data analytics, and other HPC applications.

cadence®

Cadence is a pivotal leader in electronic systems design and computational expertise, using its Intelligent System Design strategy to turn design concepts into reality. Cadence customers are the world's most creative and innovative companies, delivering extraordinary electronic products from chips to boards to complete systems for the most dynamic applications. www.cadence.com

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