XPEEDIC
ACCELERATE YOUR IC DESIGN

CHIP   CHIPLET   PACKAGE   SYSTEM

1 Market Driver for Semiconductor Industry

The tectonic shift in computing from traditional PCs and smart phones to the Internet of Things (IoT) and cloud computing has brought explosive growth in data. Collection, storage, analysis and transmission of the massive data create vast opportunities for semiconductor industry.

Driven by the data economy, coupled with the continued commercialization of 5G and AI, emerging applications such as mobile communications, data centers, edge computing, and autonomous driving are reshaping the semiconductor industry landscape.
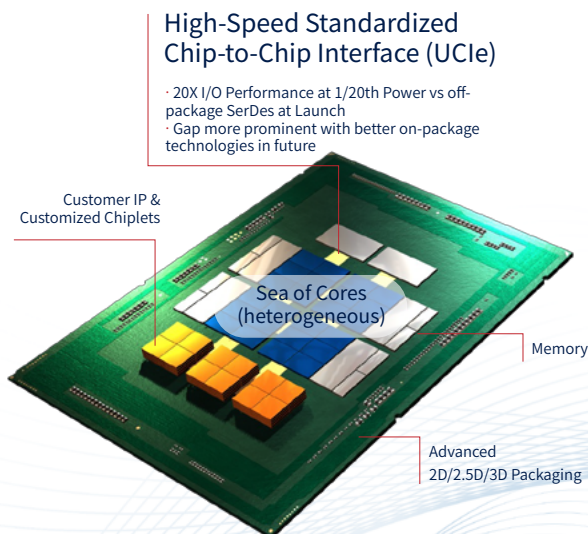
All these emerging applications demands SoC and system with better performance, power and area (PPA) and better integration, which in turn drives the innovation in every aspect of the semiconductor supply chain including process, packaging, system realizations and even design methodology to meet these demands.

2 Innovation In Semiconductor Industry

Semiconductor industry has been developing rapidly in accordance with Moore's Law for more than fifty years, providing the bonus of PPA (power, performance and area): reducing power consumption, enhancing performance and reducing costs. However, the advanced process is evolving towards 3nm and 2nm, and this trend is closing to the end with the physical limit.

Heterogeneous integration is a promising way to continue Moore's Law and can achieve the best PPA at the system level. The semiconductor industry is demanding more advanced technology in every aspect of its supply chain from IC design, foundry, packaging to final system.

OPEN CHIPLET: PLATFORM ON A PACKAGE

High-Speed Standardized Chip-to-Chip Interface (UCIe)

· 20X I/O Performance at 1/20th Power vs off-package SerDes at Launch
· Gap more prominent with better on-package technologies in future

Customer IP & Customized Chiplets

Sea of Cores (heterogeneous)

Memory

Advanced 2D/2.5D/3D Packaging

CHIP (+) **Advanced Nodes**
The process technology continues to evolve to 3nm and 2nm with Moore's Law.

PACKAGE (+) **Advanced Packaging**
Heterogeneous integration which allows ICs from different processes, e.g. digital, analog, RF and MEMS, into a system-in-package delivers More-than-Moore. Advanced packaging technologies such as 2.5D interposer with TSV and 3DIC wafer level packaging are the recent examples in this wave of packaging technology development.

SYSTEM (+) **High Speed/Frequency**
5G mobile communications are shifting to higher frequencies and wider bandwidths, and the data transmission rate has increased to gigabit level. High speed serial/parallel link is ubiquitous to realize data processing, storage and transmission.

3 Challenges and Opportunities For EDA

All the aforementioned technology advances in IC, packaging, and system have posed great challenges to the EDA/IP industry. The traditional design methodology or even the underlying algorithm must be revised to meet the new demand arising from the new technology. Xpeedic was founded with this new requirement in mind and committed to offer the EDA/IP solution to better serve this rapidly growing market. Various advanced electromagnetic field solver technologies have been developed to tackle the specific challenges.

Metis

Metis provides powerful chip-interposer-package co-simulation capability at the entire system level with innovative 2.5D/3DIC Chiplet advanced packaging solver technology.

Hermes

Hermes provides efficient package-level signal integrity solutions with its innovative domain decomposition solver technology.

IRIS

IRIS provides accurate EM modeling and simulation for passives and interconnects in advanced process nodes with unprecedented speed.

Notus

Notus adopts the most advanced hybrid electromagnetic algorithm and electrothermal coupling algorithm to solve SI/PI/Thermal challenges in 2.5D/3D multi-chip, packaging and circuit board design.

4 Xpeedic Business Overview

Xpeedic's mission is to empower its customers with differentiating technologies to meet their ever-increasing challenges. Xpeedic is committed to keeping up with the latest technology progress and developing the best product to solve the application-specific problems.

EDA /

Xpeedic is a leading provider of EDA solutions to accelerate designs and simulations across chip, package and system levels for next generation high-frequency, high-speed intelligent electronic products. The product is backed with multiple home-grown proprietary solver technologies, covering both electro-magnetic and circuit simulation domains; AI-based mesh technology, supporting multi-scale simulation needs from nano-meter to centimeter level; advanced multi-core and multi-machine parallel computing technologies, realizing Xpeedic EDA cloud solution on AWS.
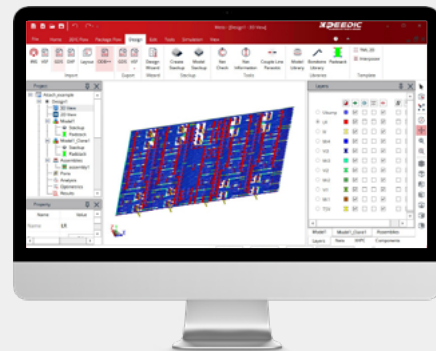
Xpeedic EDA Overview

Simulation EDA from Chip to System

System
Infrastructure/terminals, Data centers, Automotives

Multi-physics simulation including EM/Thermal/
Stress analysis, System-level verification

Interconnection
**System(Infrastructure/terminals, Data centers, Automotives), Connectors/
cables/fibers and other arbitrary interconnection structures**

3D full-wave EM simulation, Electrical performance post simulation

PCB
**PCB System (Infrastructure/terminals, High-performance computing and Storage,
Network switching and routing)**

Signal/Power Integrity, Multi-physics simulation including EM/Thermal/Stress analysis,
System-level verification

Module
RF devices/modules, Power devices, Optical modules, antennas, Decoupling capacitors design

Signal/Power Integrity, Multi-physics simulation including EM/Thermal/Stress analysis,
System-level verification

Package
Conventional/Advanced packaging (SiP, 2.5D/3D, Chiplet heterogeneous integration) design

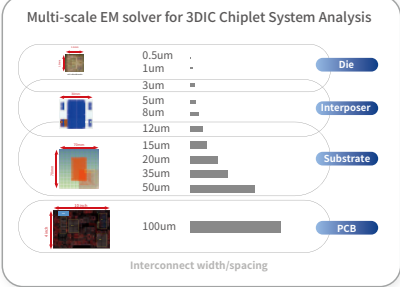Signal/Power Integrity design, Multi-physics simulation including EM/Thermal/Stress analysis

Chip
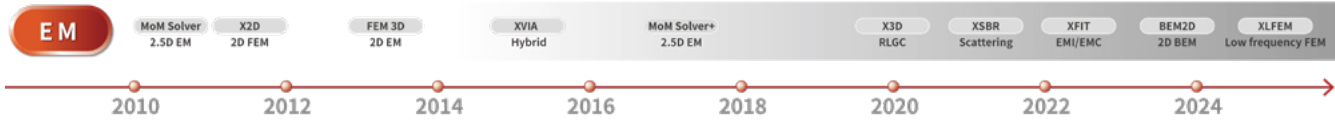**Analog/RF Chip Design on Silicon/ Compound Semiconductor Processes**

Passive PDK generation, EM simulation, Spice circuit simulation, and Circuit-EM co-simulation
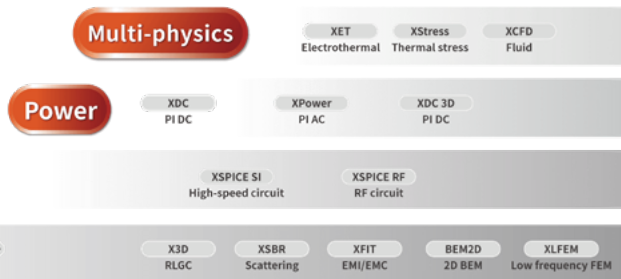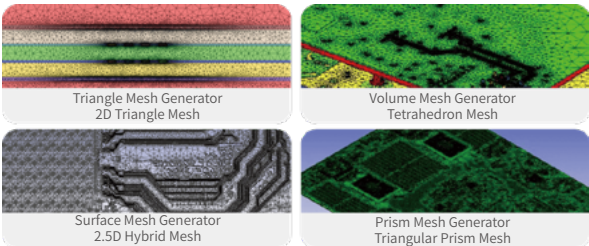
Xpeedic EDA Core Technologies

Multi-scale EM solver for 3DIC Chiplet System Analysis

0.5um	·	**Die**
1um	·	
3um		
5um	▪	**Interposer**
8um	▪	
12um	▬	
15um	▬	**Substrate**
20um	▬▬	
35um	▬▬▬	
50um	▬▬▬▬	
100um	▬▬▬▬▬	**PCB**

Interconnect width/spacing

① Industry Leading Solver Technology

Multi physics solver technology from circuit, electromagnetic, thermal to stress simulation

Multi-physics
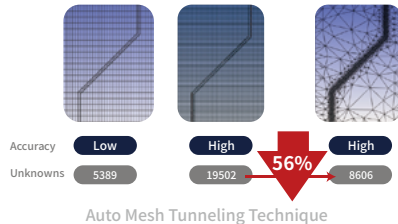
| XET Electrothermal | XStress Thermal stress | XCFD Fluid |

Power

| XDC PI DC | XPower PI AC | XDC 3D PI DC |

Circuit

XStateEye Eye diagram

| XSPICE SI High-speed circuit | XSPICE RF RF circuit |

EM

| MoM Solver 2.5D EM | X2D 2D FEM | FEM 3D 2D EM | XVIA Hybrid | MoM Solver+ 2.5D EM | X3D RLGC | XSBR Scattering | XFIT EMI/EMC | BEM2D 2D BEM | XLFEM Low frequency FEM |

2010 2012 2014 2016 2018 2020 2022 2024

② AI-based Mesh Technology

Multiple Adaptive Mesh Technology For Different Application Scenarios

Triangle Mesh Generator
2D Triangle Mesh

Volume Mesh Generator
Tetrahedron Mesh

Surface Mesh Generator
2.5D Hybrid Mesh

Prism Mesh Generator
Triangular Prism Mesh

Convergent Results With Minimum Number Of Mesh Elements

Accuracy	Low	High	High
Unknowns	5389	19502	8606

56%

Auto Mesh Tunneling Technique

③ High Performance Distributed Parallel Computing Technology

Matrix-level Distributed Parallel Computing By MPI

10X

	N1	N3	N5	N8
Reference	7	15	80	103
Xpeedic	1.2	3.7	6.6	10.7

Unit: hour

Success Cases: Use Metis for Advanced Packaging Simulation
Result: Metis delivers 10X simulation speed comparing to the other tools
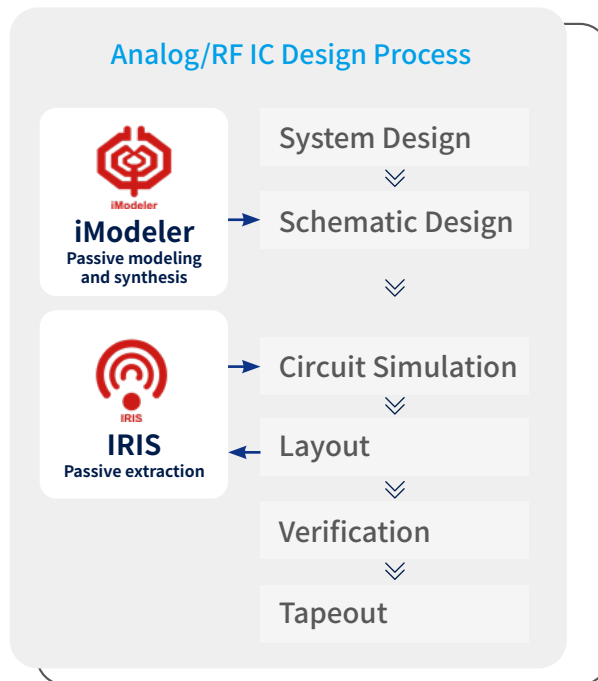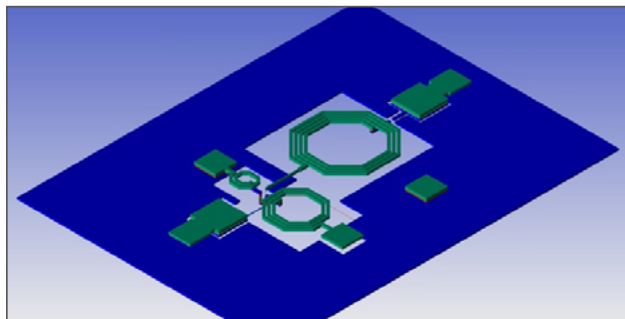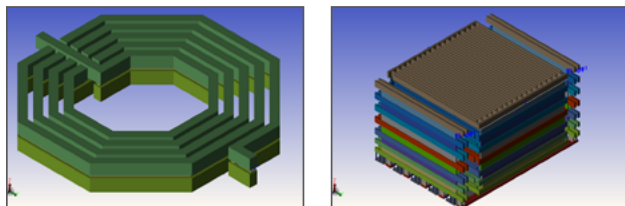
■ Xpeedic
■ Reference
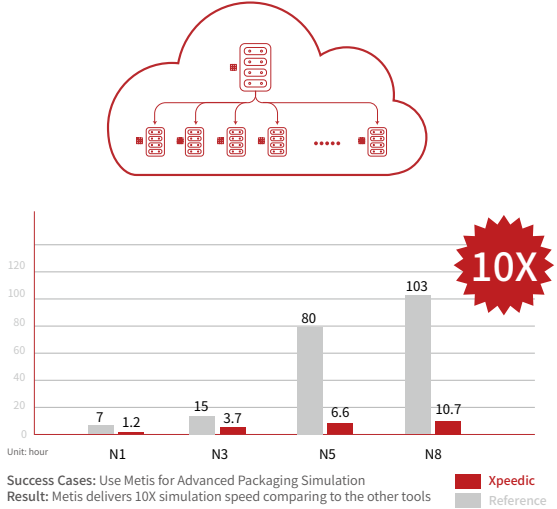
On-Chip Modeling for Advanced Process

Accurate and fast EM simulation to enable RF and analog IC designs

*IRIS: State-of-the-art 3D planar EM simulator
*iModeler: Fast passive component modeling and synthesis

Analog/RF IC Design Process

iModeler
Passive modeling and synthesis → System Design → Schematic Design → Circuit Simulation

IRIS
Passive extraction → Layout → Verification → Tapeout

IRIS has been adopted by fabless on mainstream foundry nodes

Bulk	FinFET	FD-SOI	RF-SOI	SiGe BiCMOS	GaAs	IPD
tsmc 40nm 28nm 22nm	GlobalFoundries 12LP	GlobalFoundries 22FDX	GlobalFoundries 8SW	GlobalFoundries 8HP 9HP	win SEMICONDUCTORS	SMIC tsmc
UMC 28nm 40nm 22nm	SAMSUNG 14LPP 8LPP	SAMSUNG 28FDS	TPSCo TPS90	TOWERJAZZ SBC18	A	ST ON Semiconductor
SMIC 55nm 40nm 28nm			HHGrace	ST B55		HR Silicon TGV

2.5D/3DIC Chiplet Advanced Packaging

Large-capacity EM solver to enable multi-die 2.5D/3D IC Chiplet SI/PI analysis

HBM Die TSV XPU Die
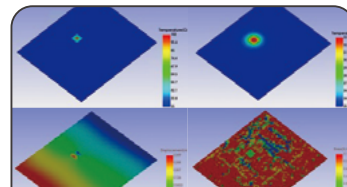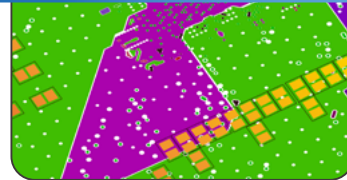
Interposer Package Substrate

SI

PI
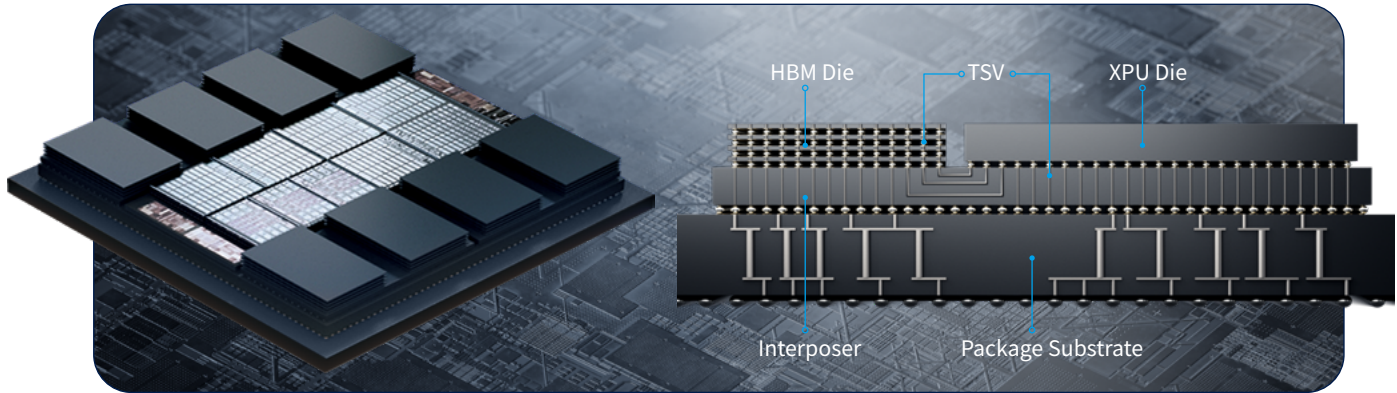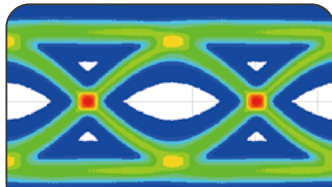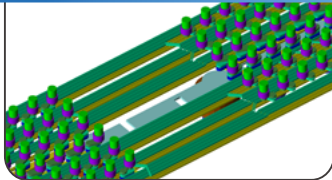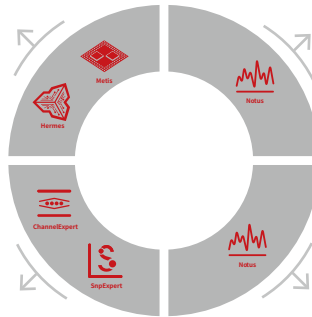
System

**Multiphysics**

Xpeedic Takes 2023 3D InCites Herb Reiter   Design Tool Provider of the Year Award

❶ Multi-scale EM solver for 3DIC Chiplet System Analysis

❷ AI-based Mesh Technology

❸ High Performance Distributed Parallel Computing Technology

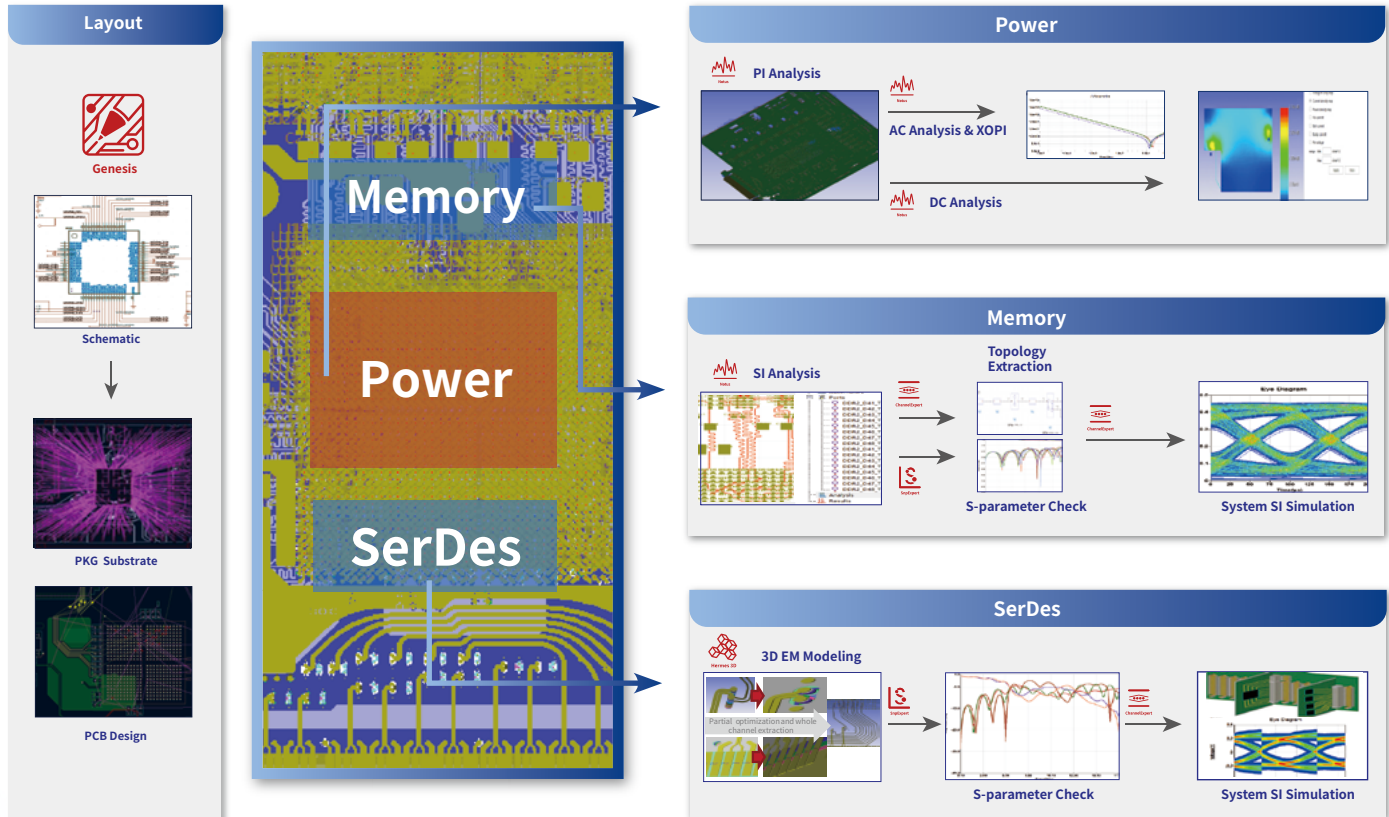❹ Support Die-Interposer-Substrate Co-Simulation

Multi-physics Simulation Platform

Power integrity, Electrothermal, and Thermal stress multi-physics analysis
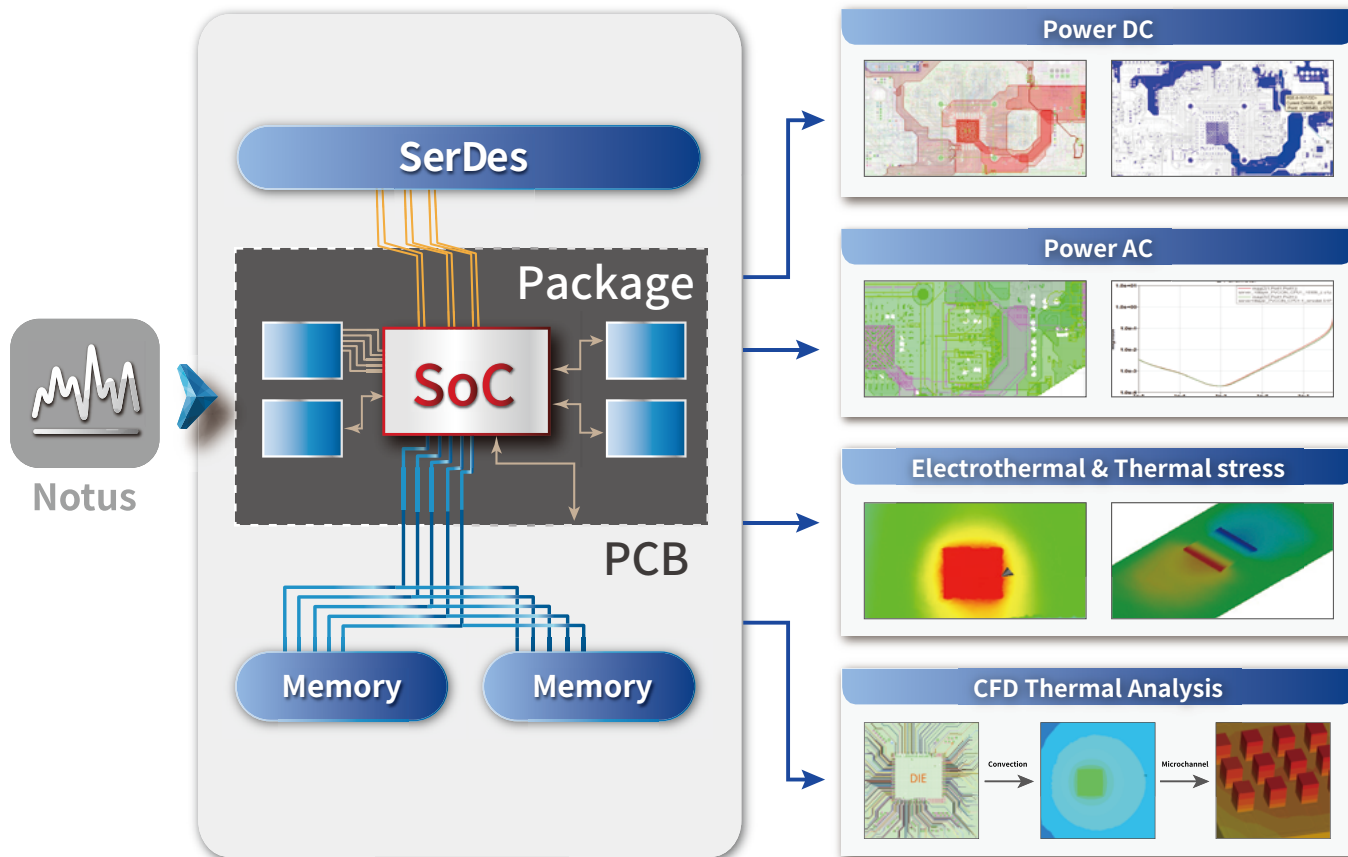
High Speed Digital SI/PI Analysis

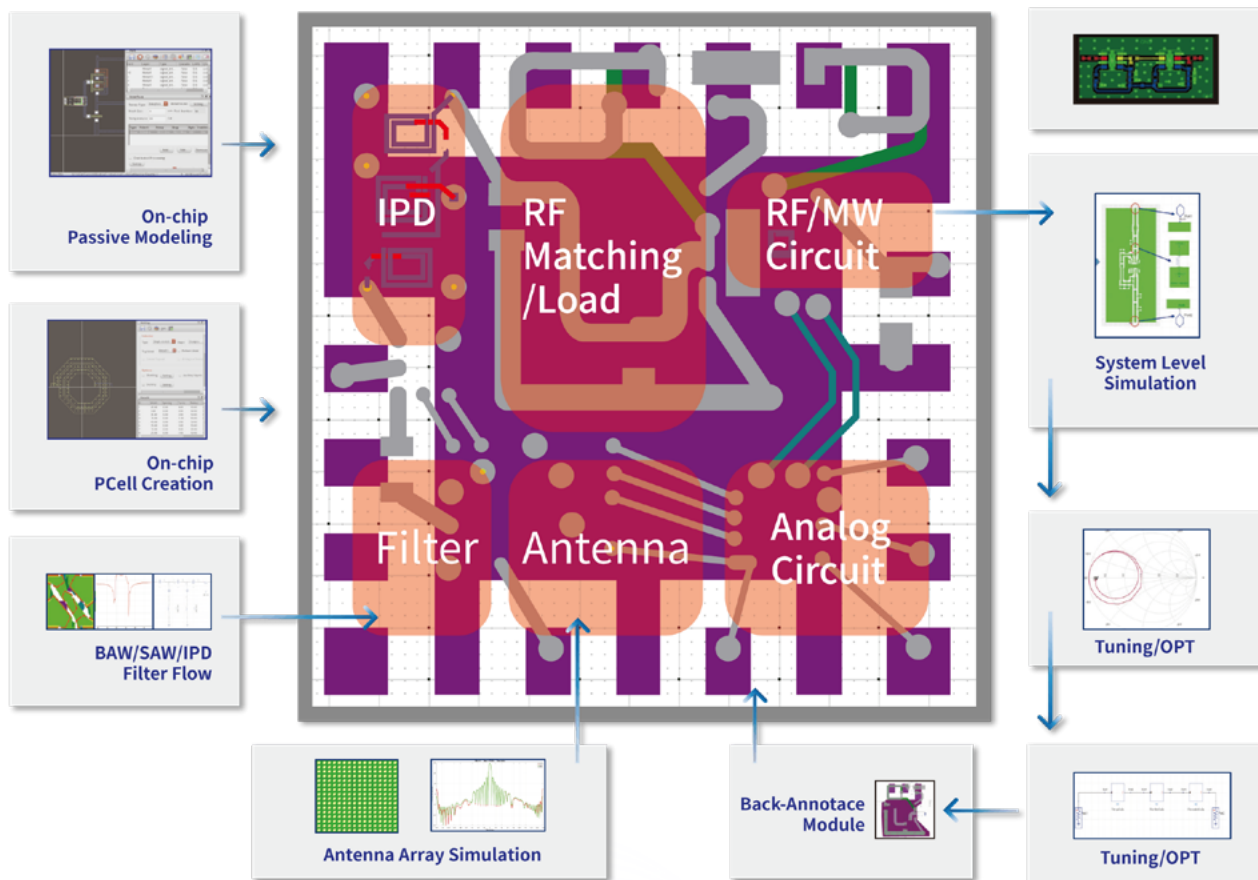A comprehensive platform supporting high-speed serial/parallel interfaces

Layout

Genesis

Schematic

PKG Substrate

PCB Design

Memory

Power

SerDes

Power

PI Analysis

AC Analysis & XOPI

DC Analysis

Memory

SI Analysis

Topology Extraction

S-parameter Check

System SI Simulation

SerDes

3D EM Modeling

Partial optimization and whole channel extraction

S-parameter Check

System SI Simulation

Power Integrity | Signal Integrity

RF/Microwave System Analysis

An integrated platform to support chip-package-module-board designs

**On-chip Passive Modeling**

On-chip PCell Creation

BAW/SAW/IPD Filter Flow

IPD

RF Matching /Load

RF/MW Circuit

Filter

Antenna

Analog Circuit

Antenna Array Simulation

Back-Annotace Module

System Level Simulation

Tuning/OPT

Tuning/OPT

RF/Analog IC	RF Module	RF PCB

# Package and PCB Design Platform
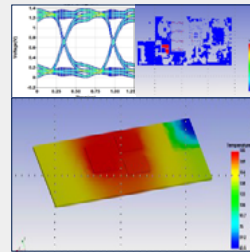
Simulation-driven Design

Design Element Database(Schematic symbols, package library, PCB library···)
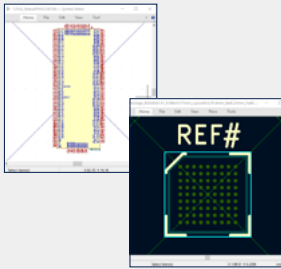
Schematic design and layout planning based on physical model field circuit analysis.
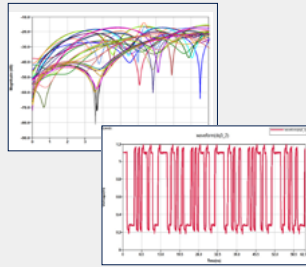
Layout, routing, stacking, and component constraints based on SI, PI, thermal and stress analysis convergence

AI → Design Input → Schematic → Pre-Simulation → Layout → AI → Post-Simulation → Verification → Measurement
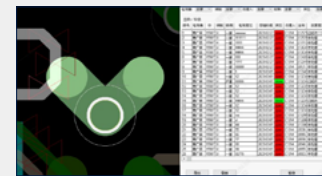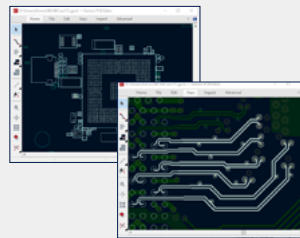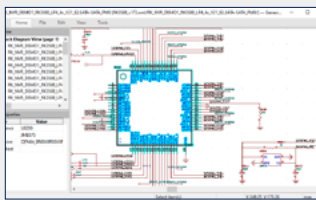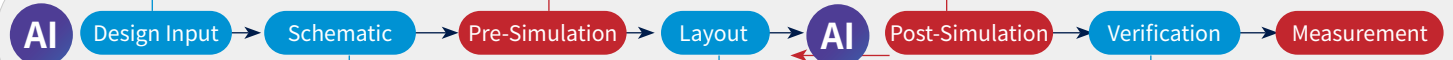

- **Simulation-driven PCB design to improve iteration efficiency, and has intelligent learning capabilities**
- **AI-empowered fully automatic or interactive routing mode**
- **Computing cloud support for collaborative design and distributed cloud computing technology**
- **Differentiated positioning supports efficiency improvement in automatic library construction, automatic layout, automatic routing**
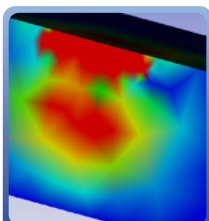
More Applications

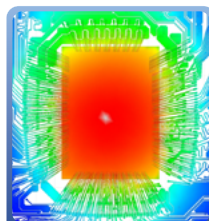**12 applications to accelerate electronic system design**
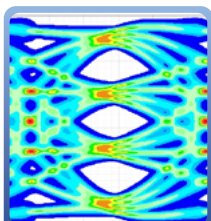
Signal Integrity
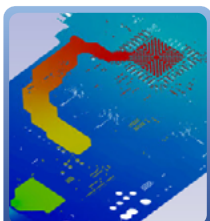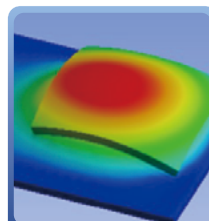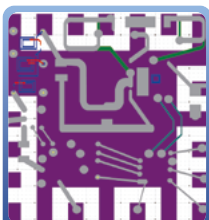

Power Integrity

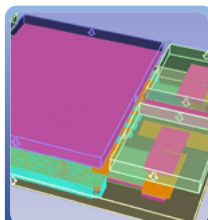Electromagnetic Compatibility
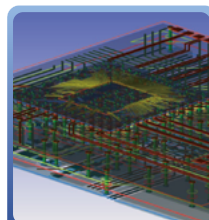

Electro-Thermal Analysis

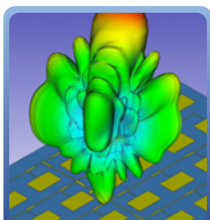Stress and Reliability

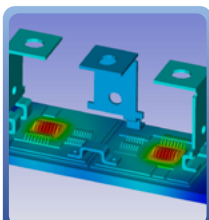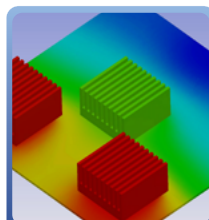Radio Frequency System

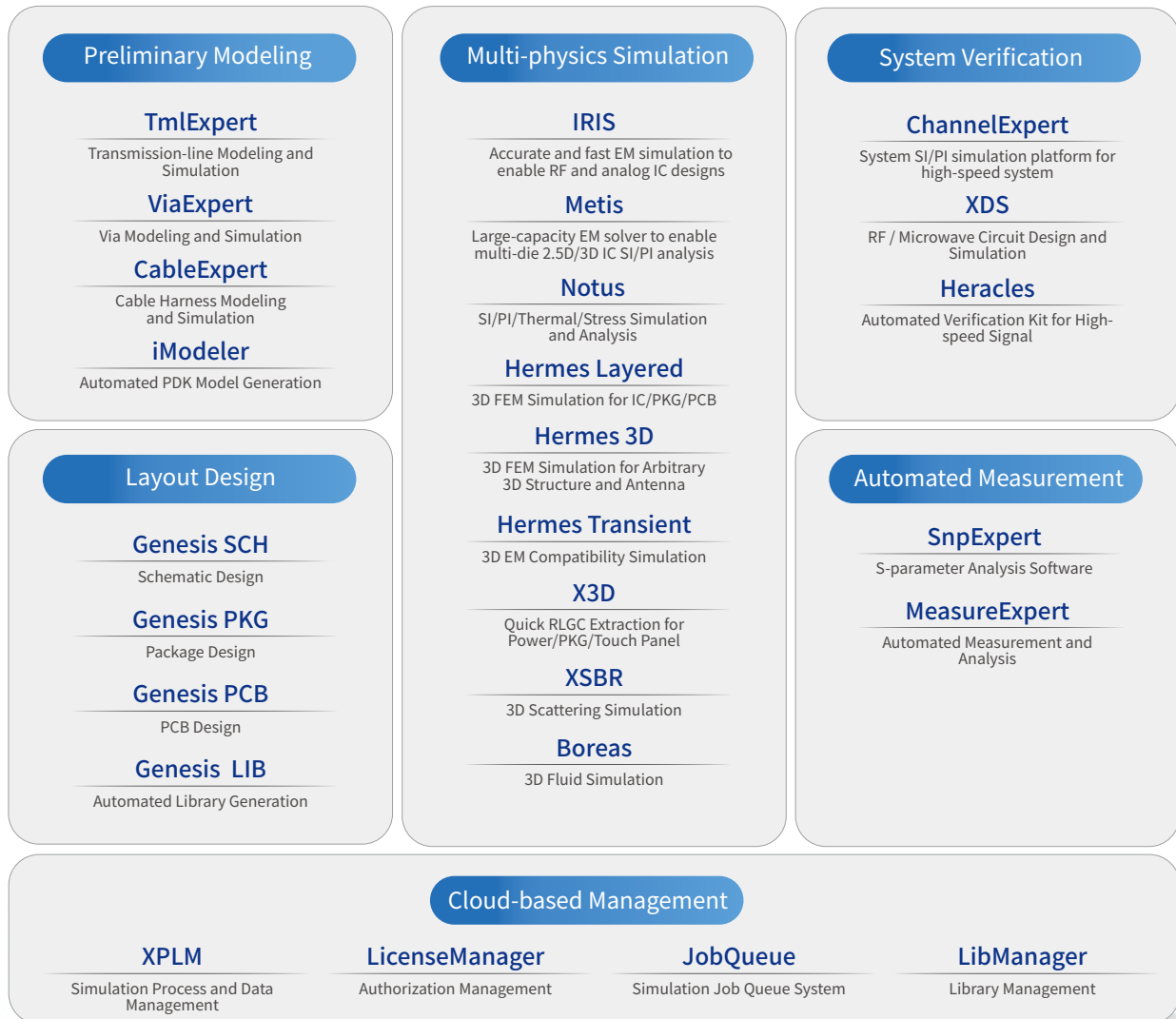Package Substrate

3DIC Chiplet

PCB Board

Planar Antenna

Power Semiconductor Device

CFD Thermal Analysis

Product Family

To enable next generation intelligent electronic system

Preliminary Modeling

TmlExpert

Transmission-line Modeling and Simulation

ViaExpert

Via Modeling and Simulation

CableExpert

Cable Harness Modeling and Simulation

iModeler

Automated PDK Model Generation

Layout Design

Genesis SCH

Schematic Design

Genesis PKG

Package Design

Genesis PCB

PCB Design

Genesis LIB

Automated Library Generation

Multi-physics Simulation

IRIS

Accurate and fast EM simulation to enable RF and analog IC designs

Metis

Large-capacity EM solver to enable multi-die 2.5D/3D IC SI/PI analysis

Notus

SI/PI/Thermal/Stress Simulation and Analysis

Hermes Layered

3D FEM Simulation for IC/PKG/PCB

Hermes 3D

3D FEM Simulation for Arbitrary 3D Structure and Antenna

Hermes Transient

3D EM Compatibility Simulation

X3D

Quick RLGC Extraction for Power/PKG/Touch Panel

XSBR

3D Scattering Simulation

Boreas

3D Fluid Simulation

System Verification

ChannelExpert

System SI/PI simulation platform for high-speed system

XDS

RF / Microwave Circuit Design and Simulation

Heracles

Automated Verification Kit for High-speed Signal

Automated Measurement

SnpExpert

S-parameter Analysis Software

MeasureExpert

Automated Measurement and Analysis

Cloud-based Management

XPLM

Simulation Process and Data Management

LicenseManager

Authorization Management

JobQueue

Simulation Job Queue System

LibManager

Library Management

Xpeedic EDA Ecosystem

Connect design and manufacturing, providing comprehensive reliability, compatibility and usability

EDA Partners

- SYNOPSYS
- cadence
- Mentor (A Siemens Business)
- ANSYS

Cloud Partners

- aws
- Microsoft Azure
- HUAWEI 华为云

Foundry Partners

- tsmc
- SAMSUNG
- SMIC
- TOWERJAZZ (The Global Specialty Foundry Leader)
- ST
- ON (ON Semiconductor)
- GlobalFoundries
- XMC
- HLMC
- CSMC
- HHGrace

Association Member

- semi
- ESDA Electronic System Design Alliance
- OPEN Compute Project
- UCIe Universal Chiplet Interconnect Express
- SOI Industry Consortium

About Xpeedic

Xpeedic is a leading EDA provider to accelerate designs and simulations of next generation high-frequency, high-speed intelligent electronic products. Powered by its proprietary electromagnetic, circuit, and multi-physics solver technologies, Xpeedic is addressing challenges in designing IC in advanced nodes, 3D-IC with advanced packaging, high-speed digital, and RF systems for the markets including data center, automotive, communication, mobile, and IoT.

Founded in 2010, Xpeedic has offices in both US and China. For more information, please visit www.xpeedic.com.

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