

Ansys多物理场仿真平台模块在不同学科应用

林彧昕

ANSYS多物理场仿真平台能力

流体



结构



电磁



半导体



软件



光学



ANSYS / GRANTA



材料数据管理

ANSYS / OPTISLANG



集成自动化及设计优化



ModelCenter® Integrate

ANSYS / MINERVA



仿真协同与数据管理

ANSYS

ANSYS在不同学科的应用模块



材料

Granta MI
Granta Selector
Granta EduPack
Granta MDS



集成工具

optiSlang
Minerva
ModelCenter



云计算

Ansys Cloud



嵌入式软件

SCADE Suite
SCADE Display
SCADE Vision
SCADE Architect
SCADE Test
SCADE Lifecycle



数字孪生

Twin Builder



功能安全分析

Digital Safety Manager
medini analyze
medini analyze for Cybersecurity
medini analyze for Semiconductors



任务工程

STK
ODTK
TETK



3D设计

Discovery



结构

Mechanical
LS-DYNA
Forming
Motion
Sherlock
Additive Solutions
nCode DesignLife
Autodyn



声学仿真设计

Sound



流体

Fluent
CFX
Chemkin-Pro
Forte
Rocky
FENSAP-ICE
EnSight
Turbo Tools
Polyflow
Model Fuel Library



光学和VR

Speos
VRXPERIENCE HMI
VRXPERIENCE Light Simulation
VRXPERIENCE Perceived Quality



电子

HFSS
Maxwell
SIwave
Icepak
Motor-CAD
Q3D Extractor
NuHertz
EMA3D Cable
EMA3D Charge



光子学

Lumerical FDTD
Lumerical FDTD Accelerator
Lumerical MODE
Lumerical Multiphysics
Lumerical INTERCONNECT
Lumerical CML Compiler



半导体

RedHawk-SC
RedHawk-SC Electrothermal
Totem
PowerArtist
RaptorH
RaptorQu
Exalto
VelocERF
PathFinder
Path FX
Clock FX



Zemax光学成像

Zemax OpticStudio
Zemax OpticBuilder
Zemax OpticStudio STAR Module

ANSYS Campus包含模块

43		Ansys Mechanical Enterprise (Mechanical, Autodyn, Fatigue Module, Asas, Aqwa, & more)	模块	
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44		Ansys CFD Enterprise (CFX, Fluent, FENSAP-ICE, Forte, Polyflow, Chemkin)	模块	
45		Ansys Ensignt Enterprise	功能	
46		Ansys Blademodeler	功能	
47		Ansys Rocky	模块	
48		Ansys Forming	功能	
49		Ansys LS-DYNA	模块	
50		Ansys Additive Suite	功能	
51		Ansys Discovery Simulation	功能	
52	Ansys Academic Research	Ansys Motion Enterprise	模块	
53	Mechanical and CFD	Ansys Sound Pro	功能	
54	Ansys Academic Teaching	Ansys Sherlock	模块	
55	Mechanical and CFD	Ansys Electronics Premium Icepak	模块	
56		Ansys Granta Materials Data for Simulation	功能	
57		Ansys Geometry Interfaces for Parasolid & SAT	功能	
58		Ansys Geometry Interfaces for Solidwork, SolidEdge, Autodesk, NX	功能	
59		Ansys Geometry Interface for CATIA V5 & V6 Reader	功能	
60		Ansys Geometry Interface for Creo Parametric & Elements/Direct	功能	
61		Modeling Geometry Interface for JT	模块	
62		Ansys optiSLang Enterprise	功能	
63		Floating LAN Licenses (50 mile radius standard, upgradeable to Country Wide)	功能	
64	Ansys Academic Research	Ansys Zemax OpticStudio Enterprise	模块	
65	Optics	Ansys SPEOS for Creo Parametric	功能	
66	Ansys GRANTA	Ansys SPEOS Enterprise	模块	
67	Ansys Academic Research	Ansys Granta Materials Data for Simulation	模块	
	HPC (额外增加, 不含在 campus中)	Ansys Academic Research HPC 1024核	功能	HPC

1		Ansys Discovery Simulation	功能	
2		Ansys Electronics Premium HFSS	模块	
3		Ansys Electronics Premium Icepak	模块	
4		Ansys Electronics Premium Slwave	模块	
5		Ansys Electronics Premium Q3D Extractor	模块	
6		Ansys Electronics Premium Maxwell	模块	
7		Ansys Motor-CAD Enterprise	模块	
8	Ansys Academic Research	Ansys SynMatrix Filter	功能	
9	electronics enterprise	Ansys Perceive EM	功能	
10		Ansys EMC Plus	功能	
11	Ansys Academic Teaching	Ansys Charge Plus	功能	
12	electronics enterprise	Ansys Medini Analyze Enterprise	模块	
13		Ansys ModelCenter Premium	功能	
14		Ansys MC MBSE Connectors (Windchill, Genesys, and Rhapsody)	功能	
15		Ansys Granta Materials Data for Simulation	功能	
16		Ansys optiSLang Enterprise	模块	
17		Floating LAN Licenses (50 mile radius standard, upgradeable to Country Wide)	功能	
26		Ansys NuHertz FilterSolutions		
27		Ansys RedHawk-SC-Token		
28		Ansys Seascope Worker Group 256 Pack		
29		Ansys RedHawk Signal EM		
30		Ansys RedHawk CTA		
31		Ansys RedHawk Advanced Low Power		
32		Ansys RedHawk-ATP		
33		Ansys RedHawk-SC Electrothermal		
34		Ansys RedHawk-SC Security		
35	Ansys Semiconductor	Ansys PathFinder Static-SC		
36		Ansys PathFinder SOC		
37		Ansys PowerArtist-EX		
38		Ansys PowerArtist-SC-Token		
39		Ansys Totem-MMX		
40		Ansys ParagonX Ultimate		
41		Ansys PowerX Pro		
42		Ansys RaptorX Advanced (includes custom device LVS module) Ansys RaptorX Advanced (includes custom device LVS module) HPM		
18		Floating LAN Licenses (50 mile radius standard, upgradeable to Country Wide)	模块	
19		Ansys Scade One Essential	模块	
20		Ansys SCADE Suite Advanced Modeler Seat	模块	
21		Ansys SCADE Suite KCG Code Generator -C ar	模块	
22	Ansys Academic SCADE	Ansys SCADE Display KCG	功能	
23		Ansys SCADE Architect Advanced Modeler Se	功能	
24		Ansys SCADE LifeCycle Reporter	模块	
25		Ansys SCADE Test Environment for Host	功能	
		Ansys SCADE Test Model Coverage	模块	

电磁大包

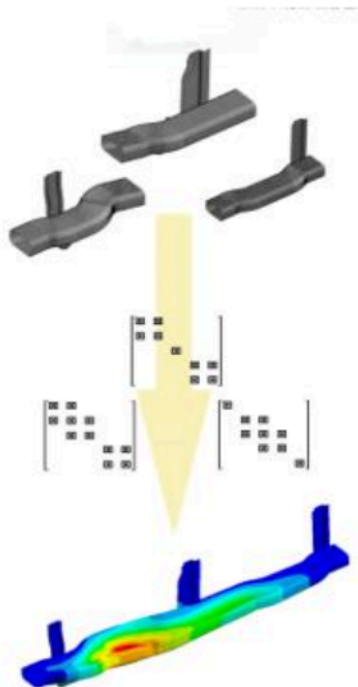
半导体

功能安全适航认证

ANSYS HPC为多物理场仿真提速

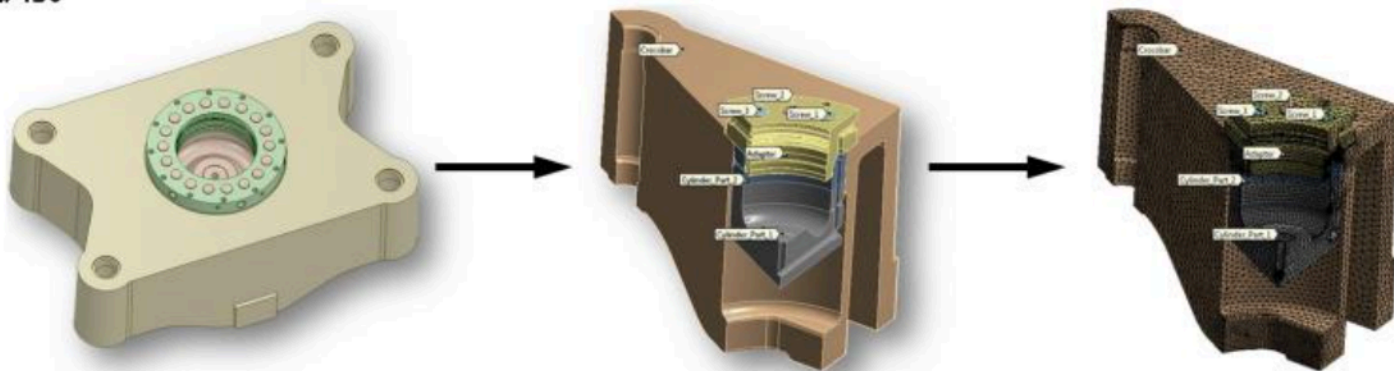
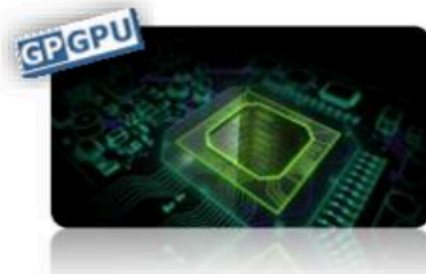
ANSYS HPC:

通过将大规模计算问题分解成可以并行计算的子问题，分配到多个计算核心（CPU或者GPU）上进行并行计算。充分利用计算资源，加速计算。



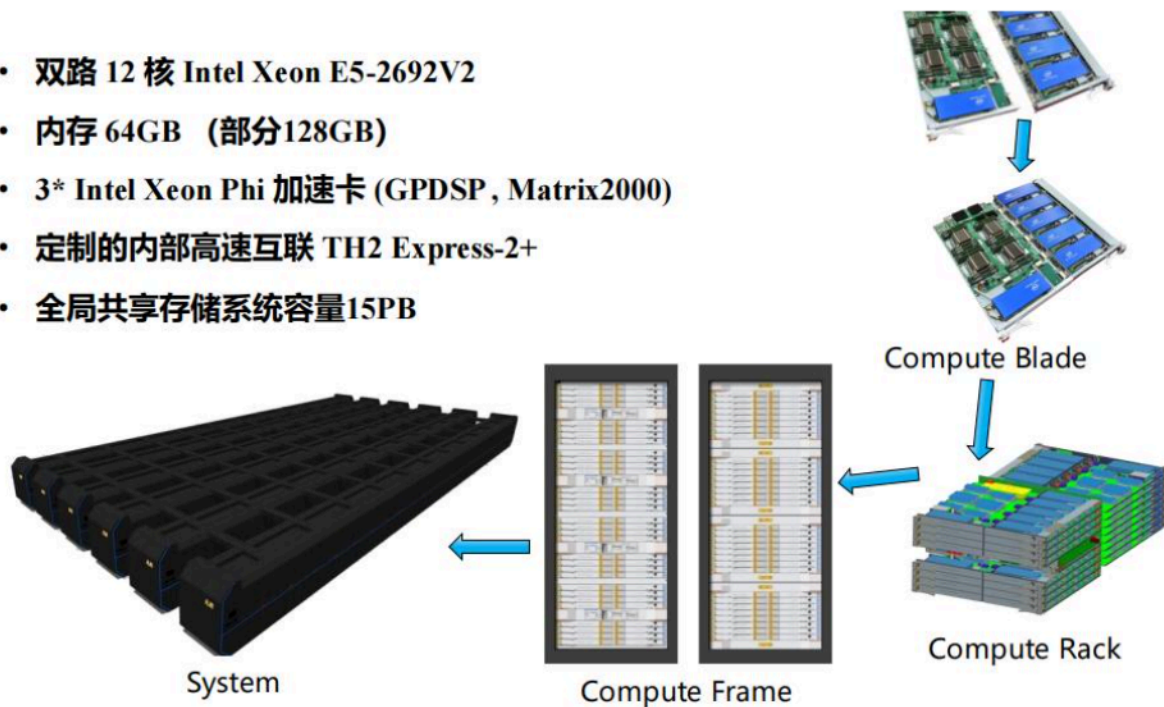
ANSYS HPC Parametric Pack :

将参数化模型的每一组参数设置分配到多个计算节点，同时求解多个不同参数设置的模型，实现加速。可以结合HPC一同使用。

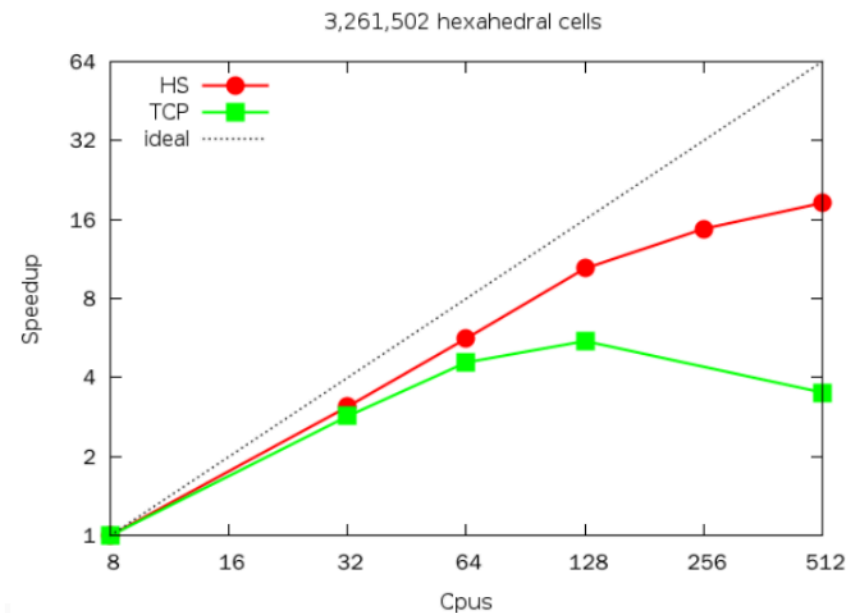


ANSYS HPC加速效果

- 双路 12 核 Intel Xeon E5-2692V2
- 内存 64GB (部分128GB)
- 3* Intel Xeon Phi 加速卡 (GPDSP, Matrix2000)
- 定制的内部高速互联 TH2 Express-2+
- 全局共享存储系统容量15PB



Fluent性能优化



数据来源：广州超算中心2017年于ANSYS大会发布的“ANSYS在广州超算的应用”文档

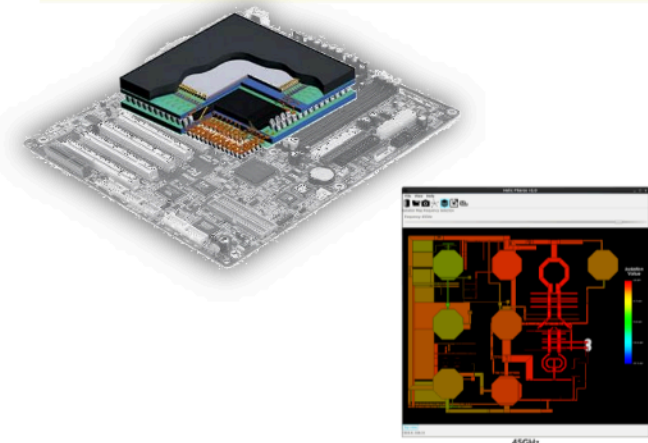
ANSYS 电子和电磁仿真工具 及工程应用

ANSYS电磁领域整体介绍

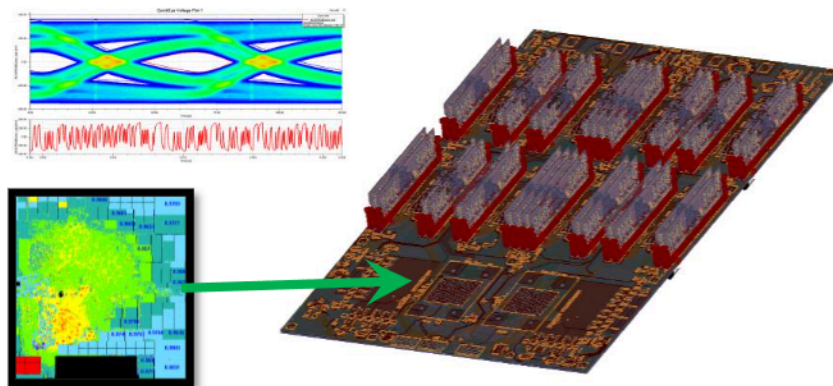


电磁研发中面临的仿真设计挑战

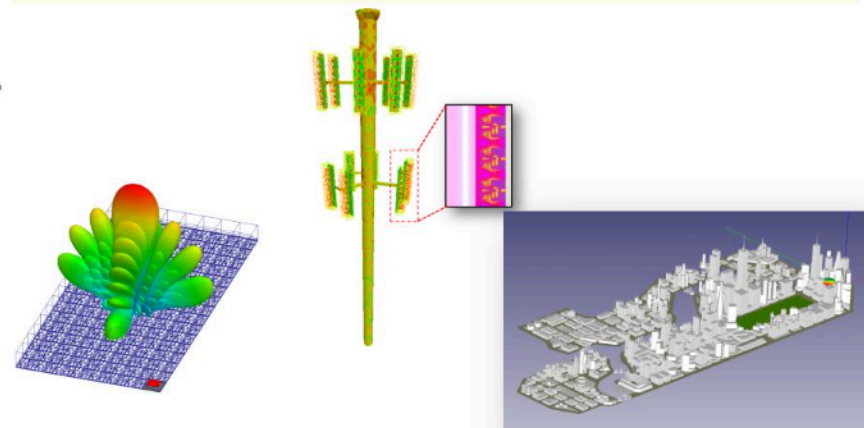
芯片封装系统



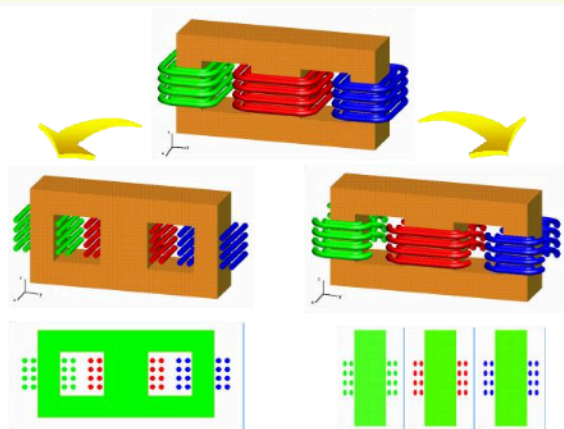
边缘计算，高速SI/PI



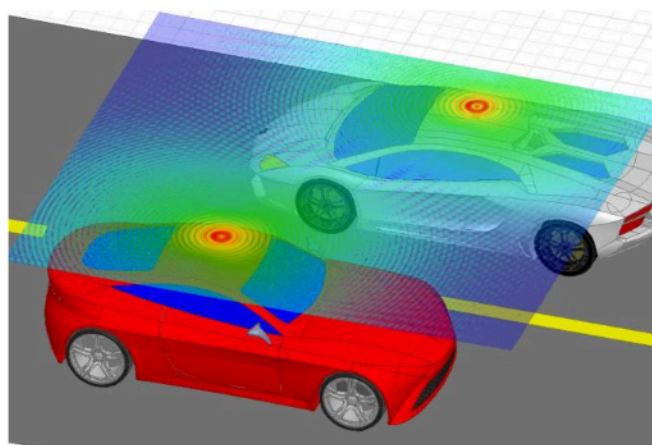
阵列天线和信号覆盖



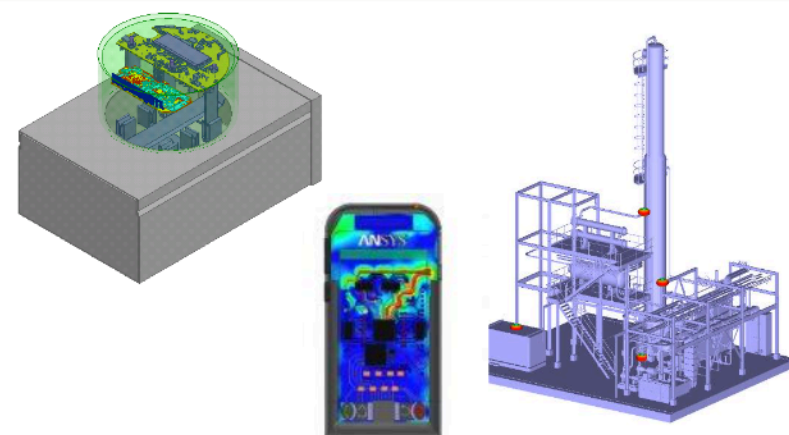
低频器件设计



自动驾驶汽车

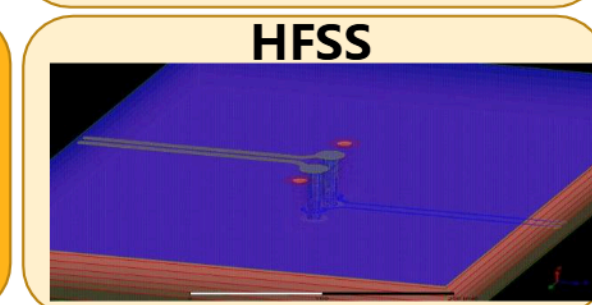
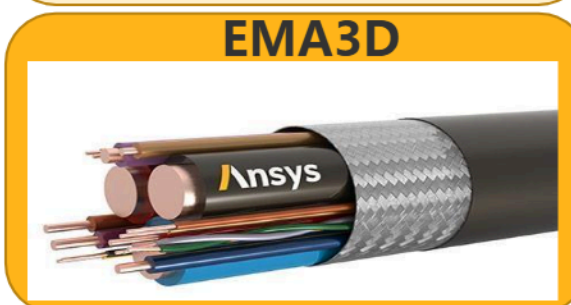
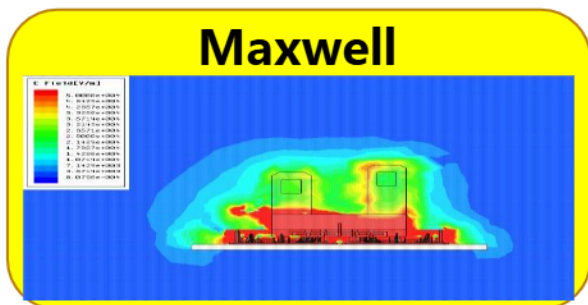
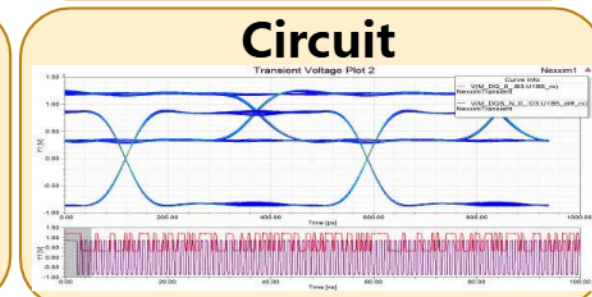
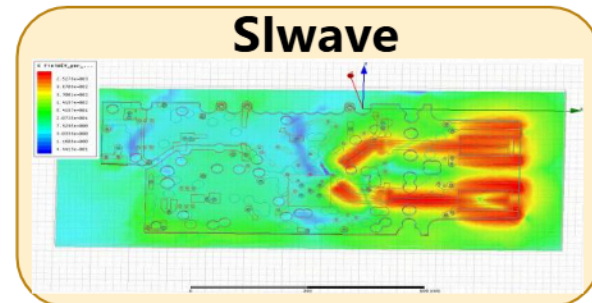
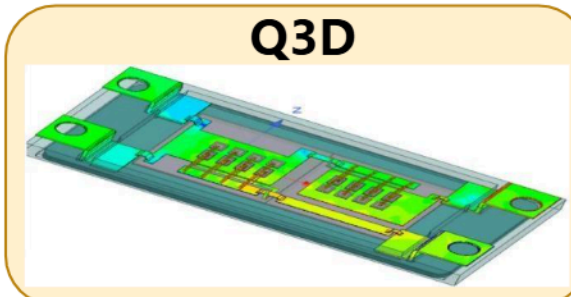
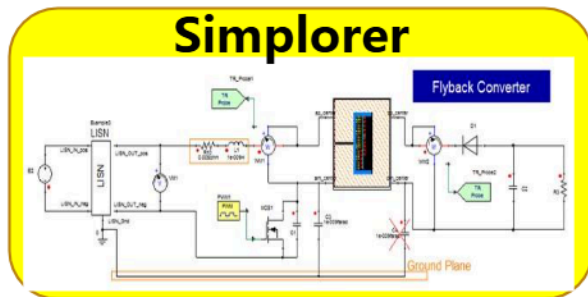
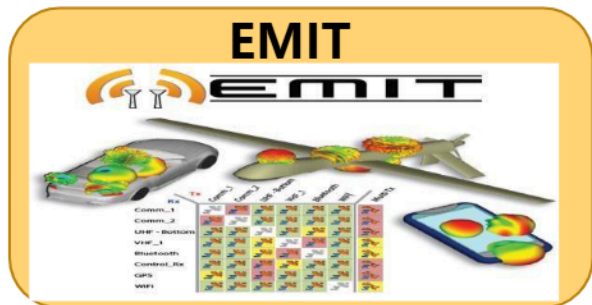


移动通信，物联网和智慧城市



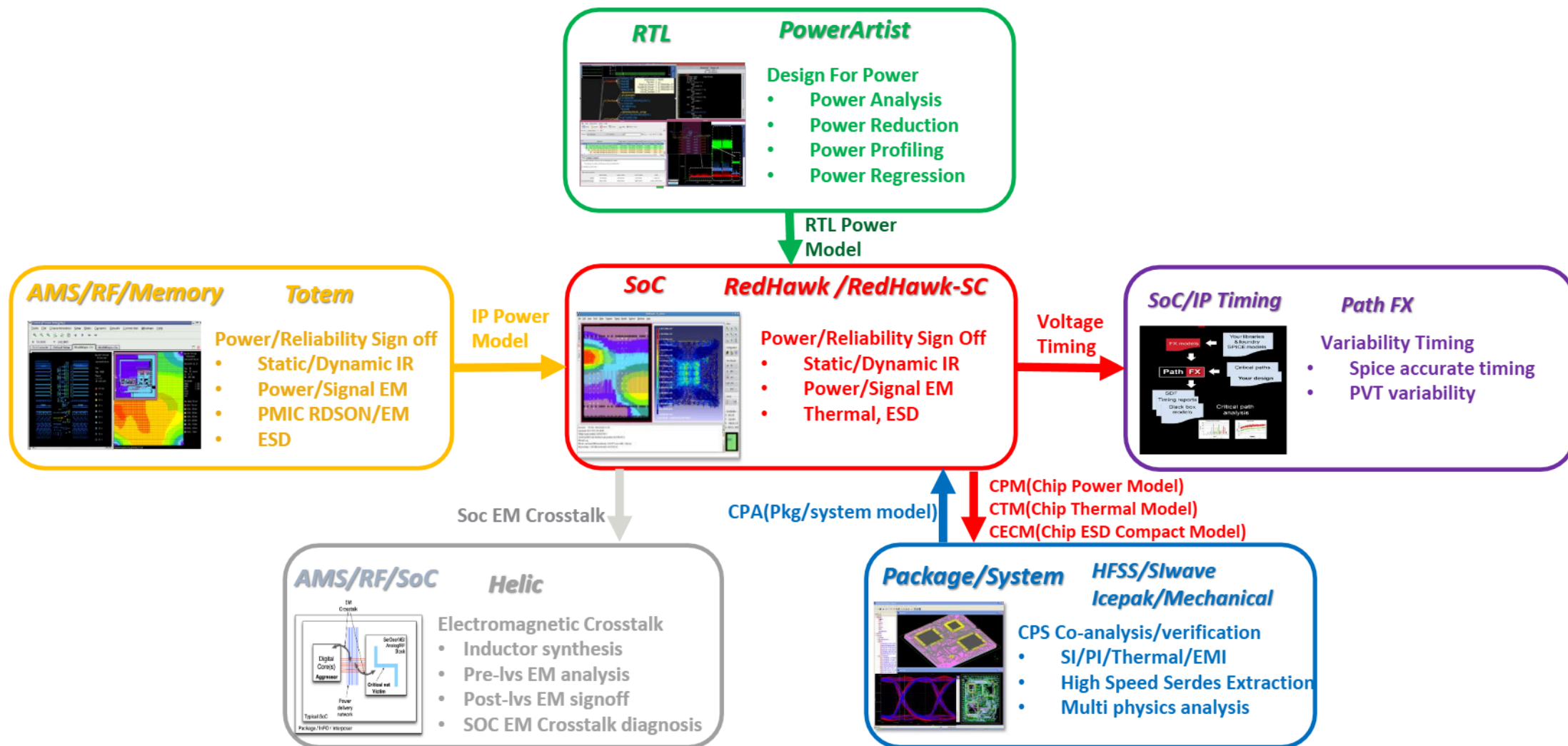
ANSYS 电磁领域模块介绍

- 提供系统化、平台化、流程化的电磁解决模块组合
- 赋能用户，简化高低频电磁分析流程

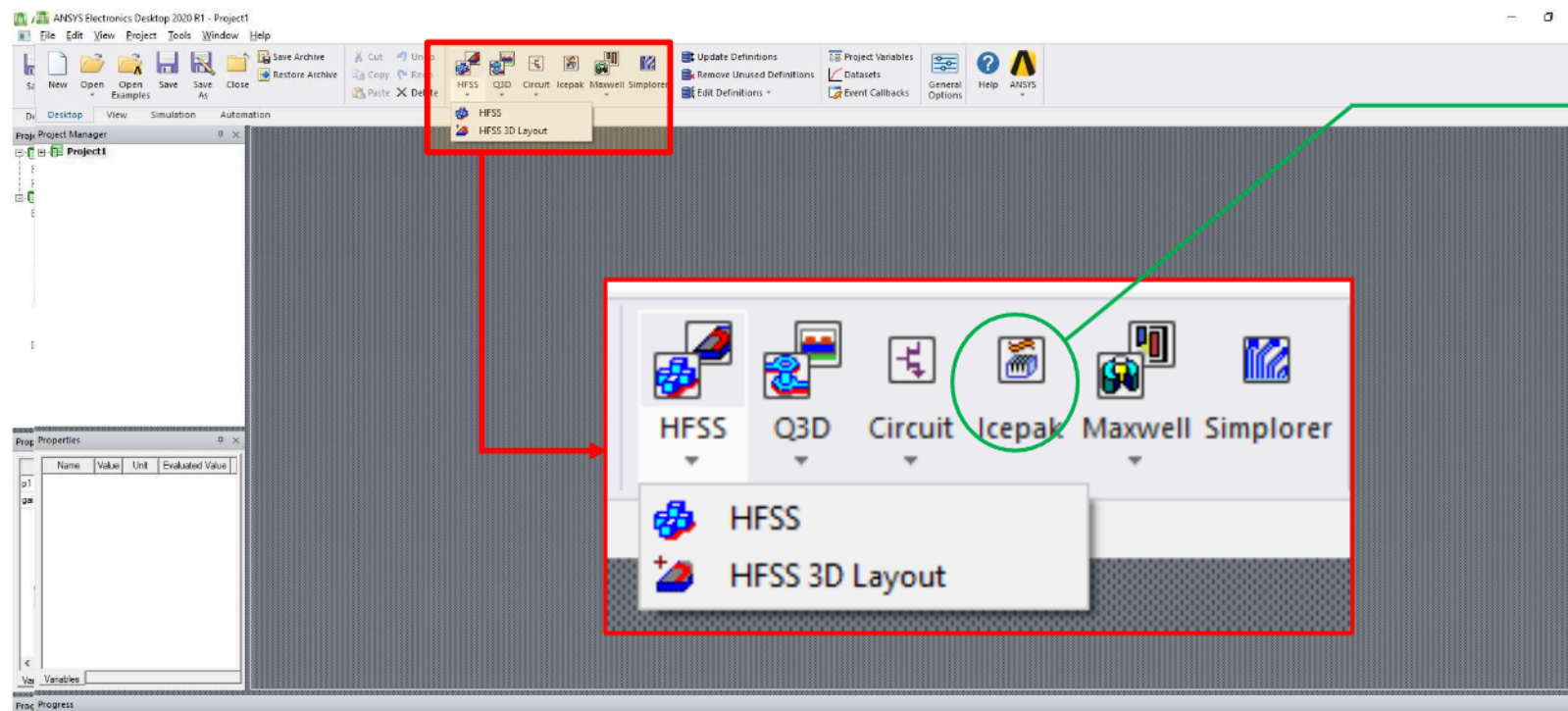


Ansyz电磁仿真模块

ANSYS IC仿真平台



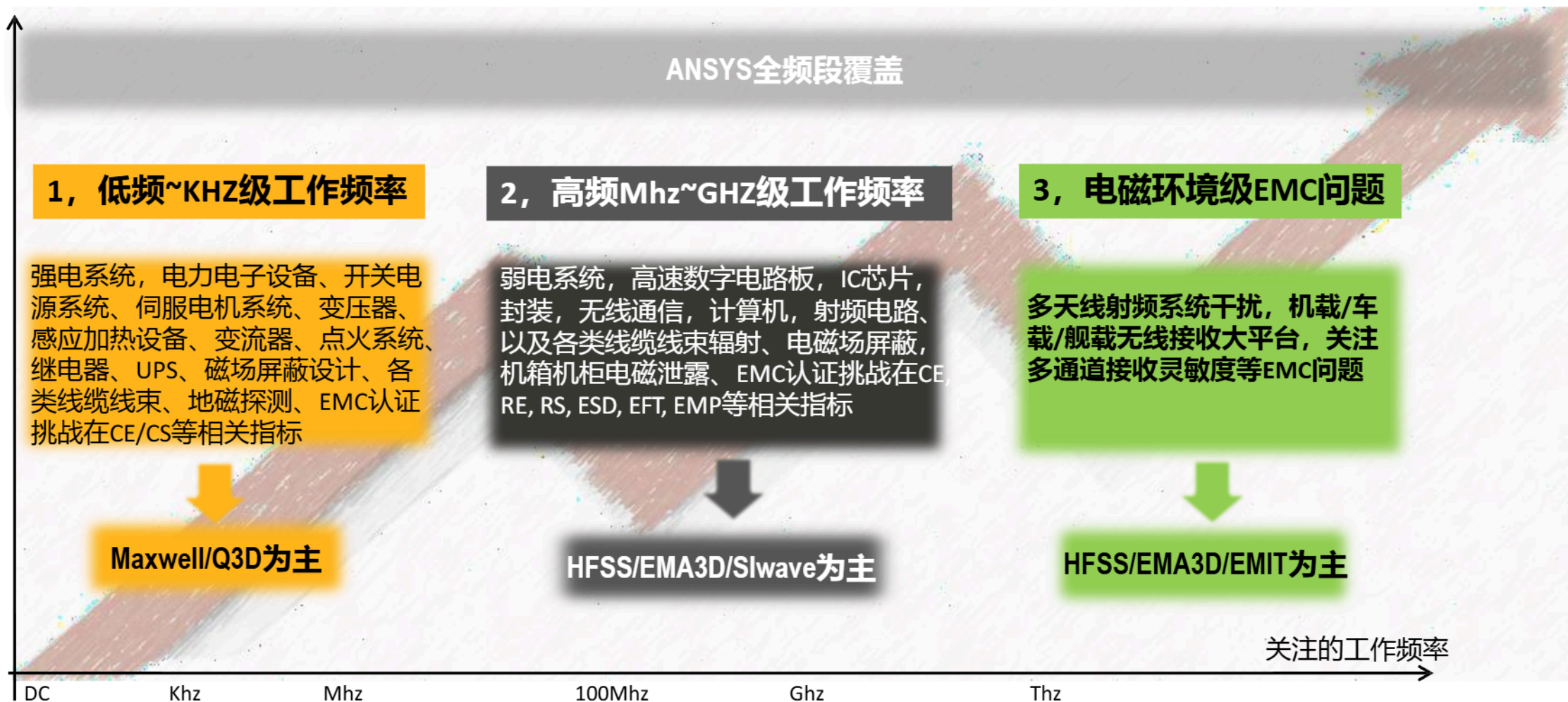
AEDT电子桌面全面集成，统一操作习惯



它还能帮您完成电子产品的电热耦合分析

同一界面实现机电系统、低频电力部件、高速电路系统、天线、线缆、设备级环境级的EMC建模分析

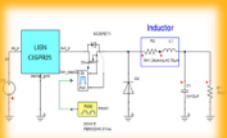
电磁仿真涉及广泛领域，需要根据项目特征选择方案



ANSYS帮助您完成产品全设计周期的电磁分析

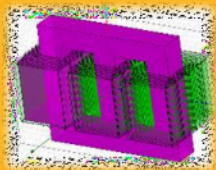
原理图设计

- 滤波电路
- 保护电路
- 激励电路
-



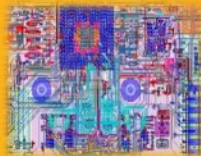
器件选型设计与优化

- 器件特性分析
- 天线性能分析
- EMC设计优化
-



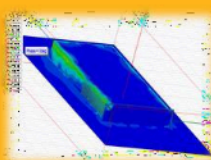
电路系统互连设计

- SI/PI性能分析
- PCB电磁辐射
- PCB噪声源优化
- 电路ESD抗干扰
-



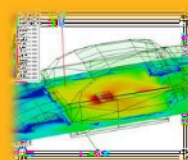
外形结构屏蔽与接地

- 机壳屏蔽性能
- 器件布局
- 空间谐振
-



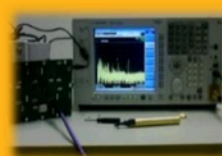
整机系统安装部件互连

- 线缆共模辐射
- 线缆布局
- 系统接地
- 整机辐射发射
-



测试-调试-Debug

- 故障虚拟优化
- 测试数据输入
- 仿真测试验证
-



ANSYS高新技术领域应用案例

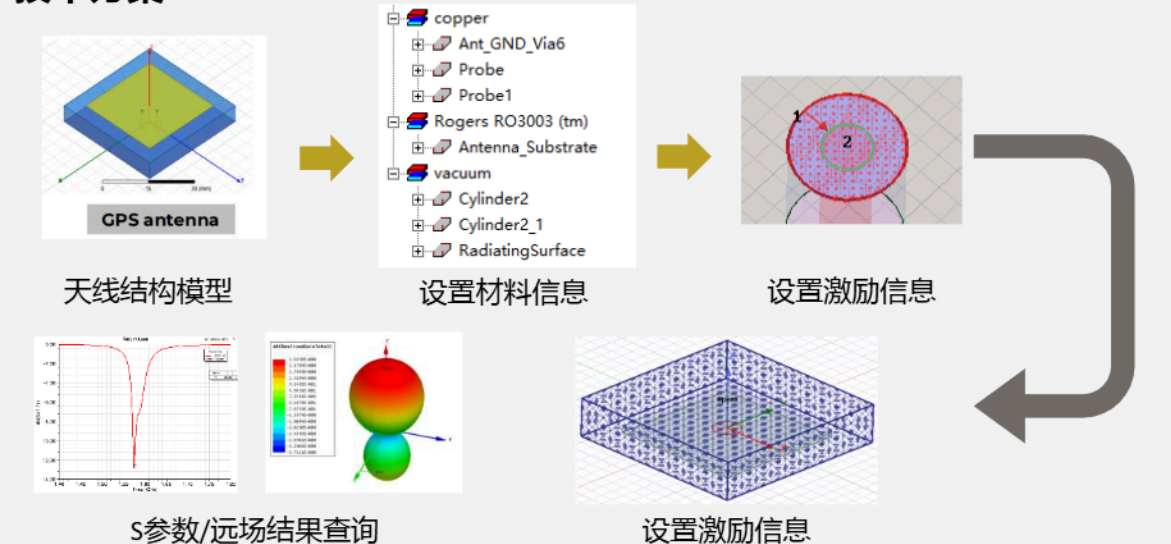


1.单元天线设计

输入条件:

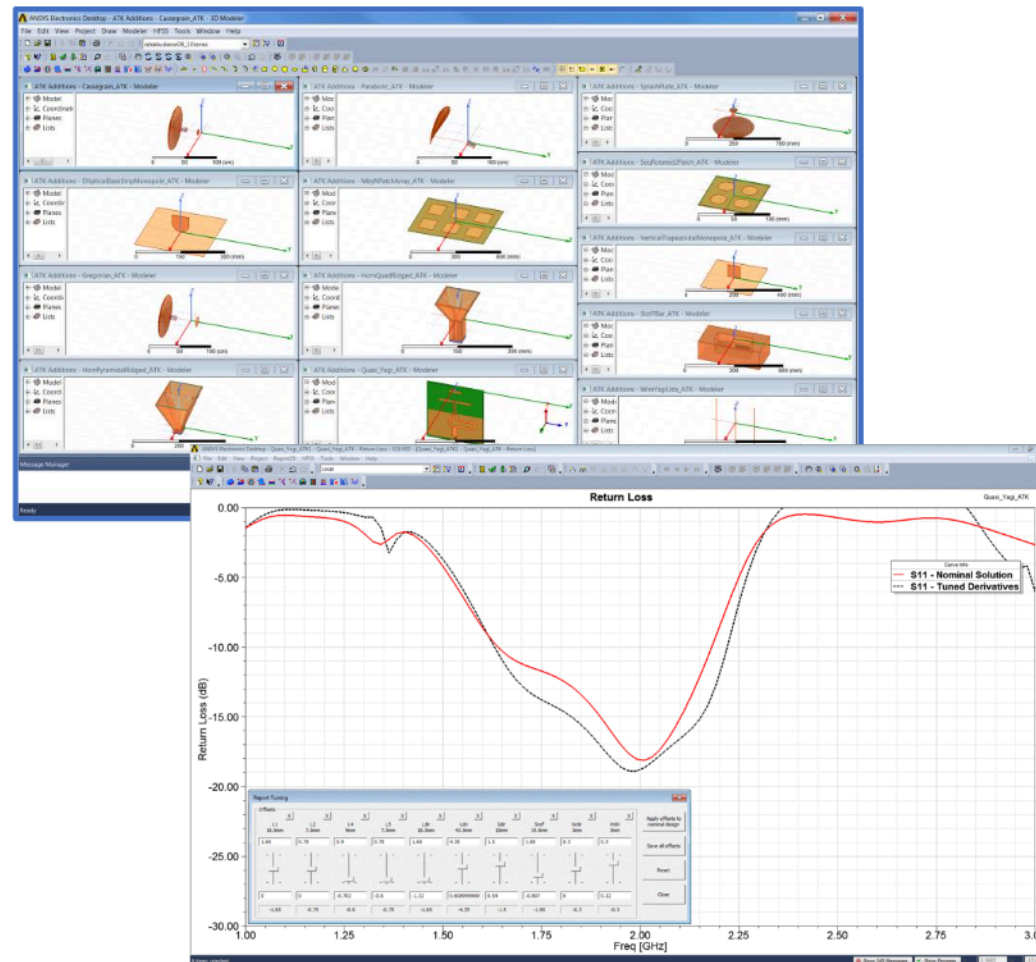
- 天线模型、材料参数、激励条件、边界条件

技术方案:



实现效果:

- HFSS天线工具箱集成上百种天线形式
- 参数化模型，一键完成综合设计，模型复用
- 高效的优化算法加快设计探索效率



涉及模块:

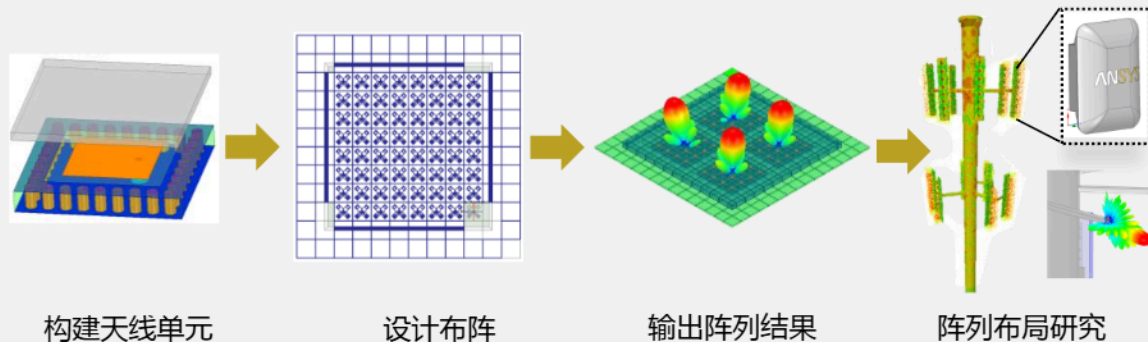
- HFSS 3D, HPC

2.阵列性能与布局设计

输入条件:

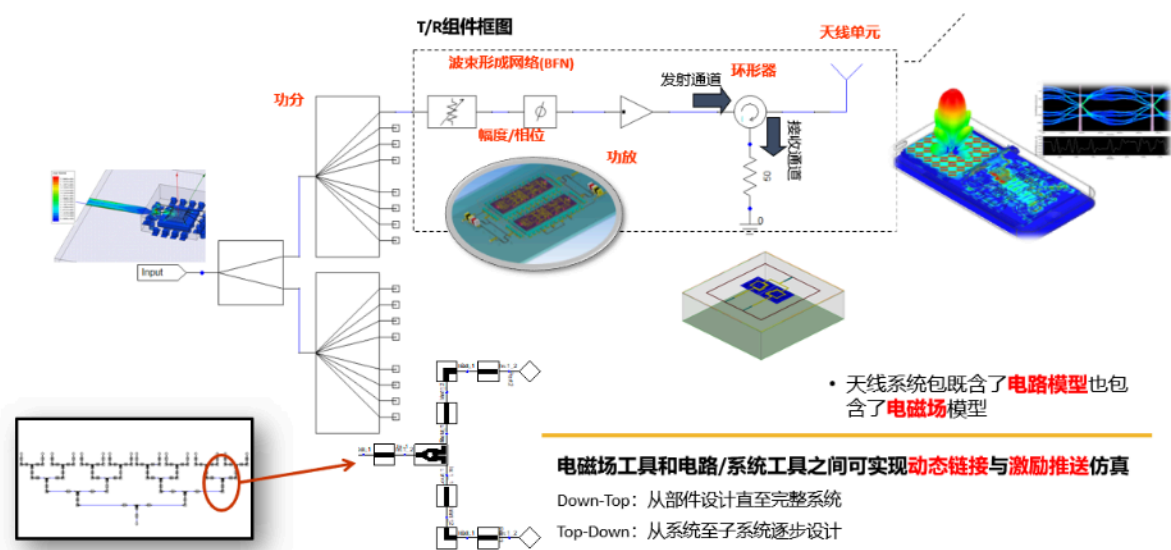
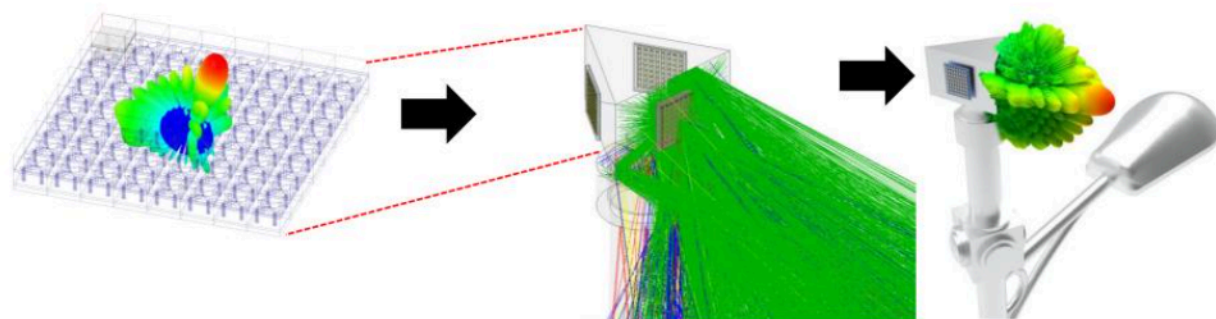
- 结构模型、材料参数、激励条件

技术方案:



实现效果:

- Ansys HFSS可精确求解波束扫描和功率调节的大规模阵列天线
- HFSS独有的有限大阵列技术，可以让用户快速进行建模和求解
- Ansys HFSS SBR+求解器可高效且精确求解电大尺寸问题，如阵列天线的环境布局等



涉及模块:

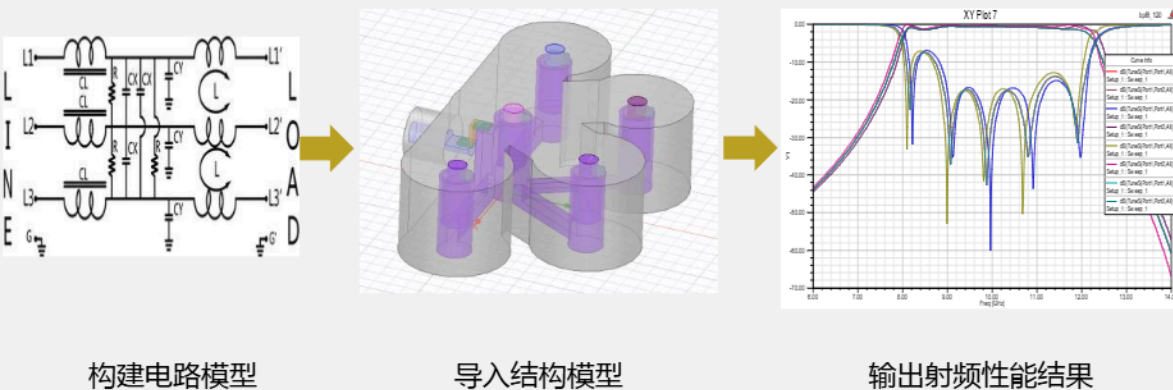
- HFSS 3D, Circuit, HPC

3.射频器件仿真

输入条件:

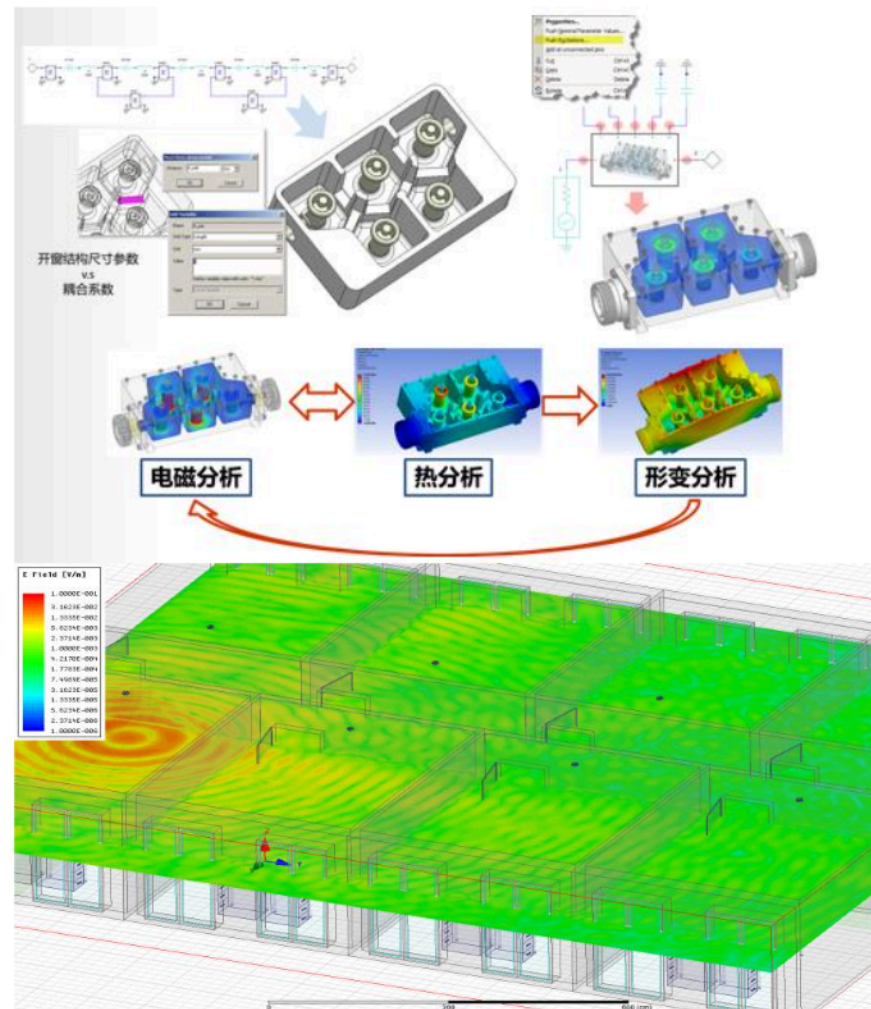
- 电路模型、结构模型、材料参数、激励条件

技术方案:



实现效果:

- 使用有限元算法，对微带无源器件进行高精度仿真求解
- 配合优化和参数扫描功能，对结构关键尺寸进行自动优化，快速得到满足性能目标的设计
- 高性能计算模块则可以帮助设计师高效率完成扫频求解



涉及模块:

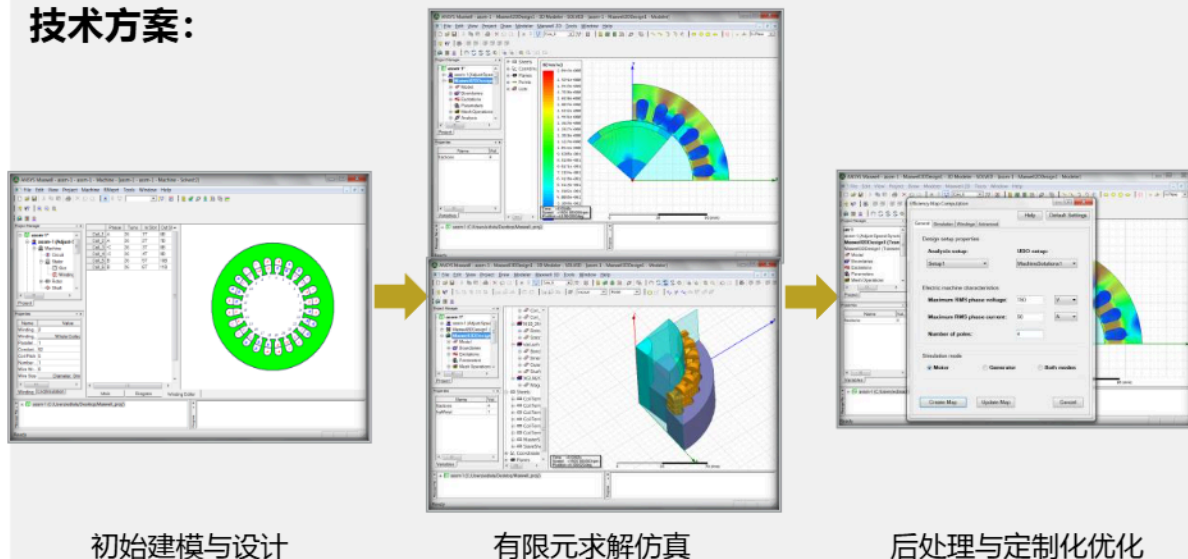
- HFSS 3D, Circuit, HPC

4.电机电磁性能求解

输入条件:

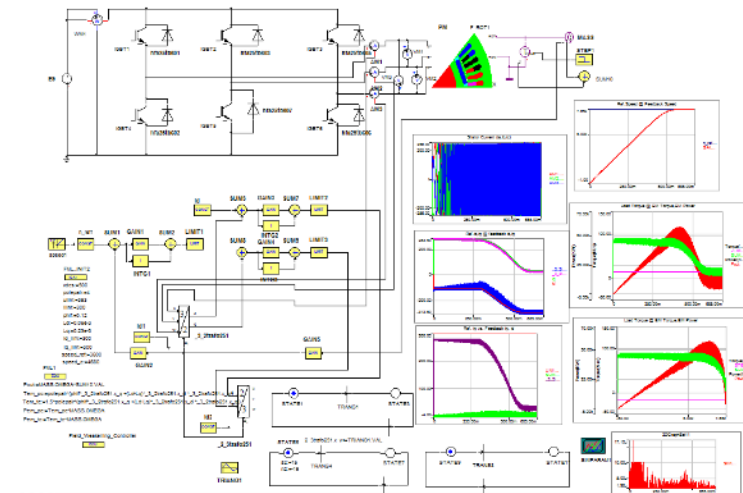
- 电机模型、材料参数、激励条件

技术方案:



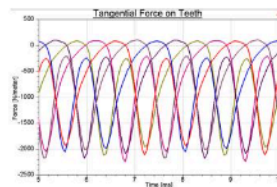
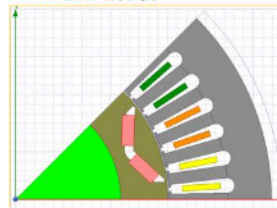
实现效果:

- 通过有限元分析和细节优化,对电机电磁性能进行精确抽取
- 内置大量定制化的分析流程,帮助用户快速进行电机仿真前处理流程
- 数据可无缝衔接至其他物理模块,可进行NVH/温升/电路系统等大型仿真

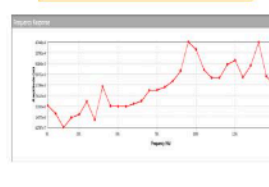
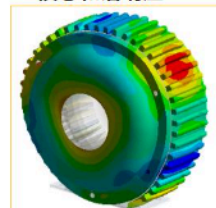


IPM电机弱磁控制

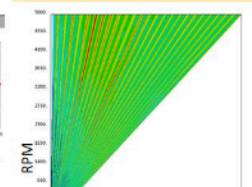
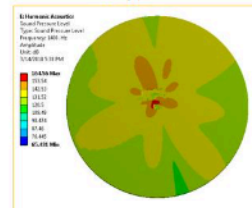
1. 电磁场分析



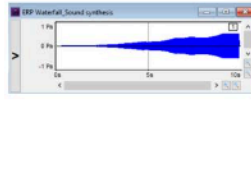
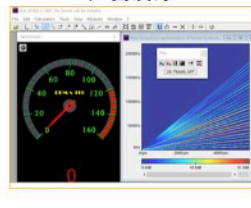
2. 模态和谐响应



3. 噪声



4. 声音设计



涉及模块:

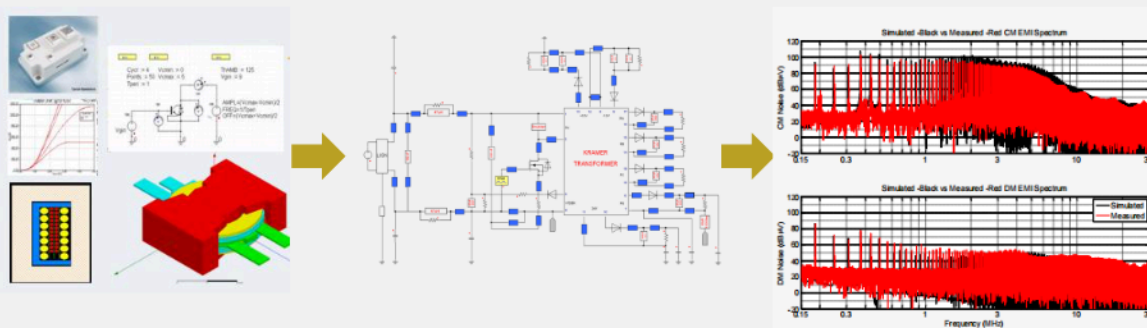
- Maxwell, Motor-CAD, Simplorer, HPC

5.功率半导体器件性能研究

输入条件:

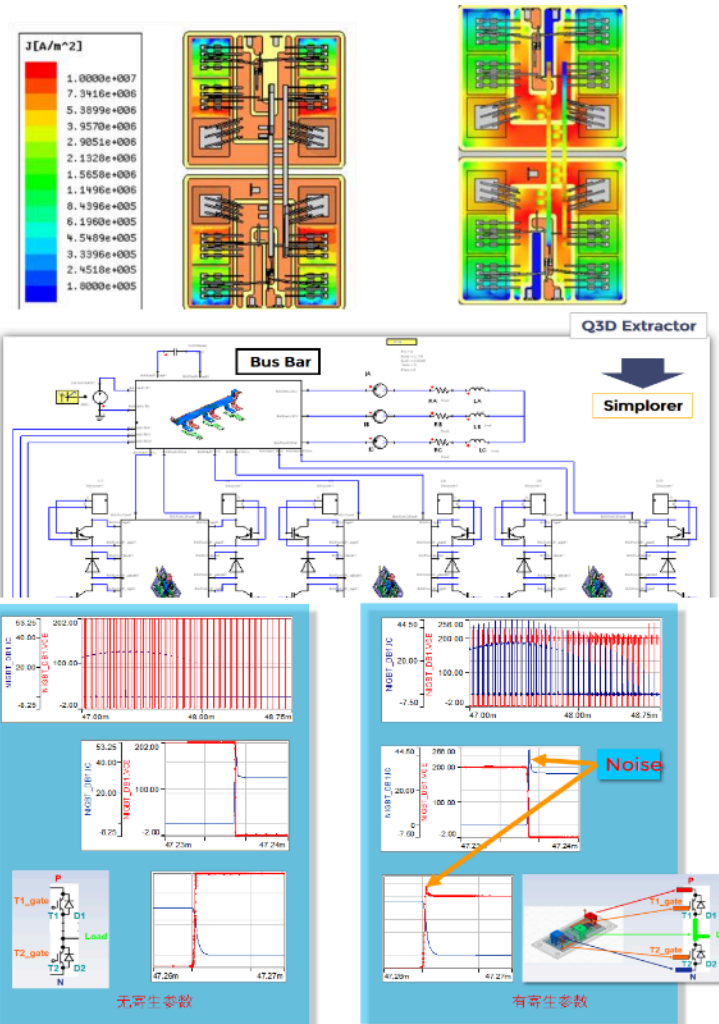
- 结构模型、材料参数、激励条件

技术方案:



实现效果:

- Maxwell可帮助查看功率半导体器件的均流性情况
- 利用Q3D, 对模块器件中不同net之间的寄生参数进行抽取
- 可结合Simplorer, 进行电驱系统的场路结合仿真



涉及模块:

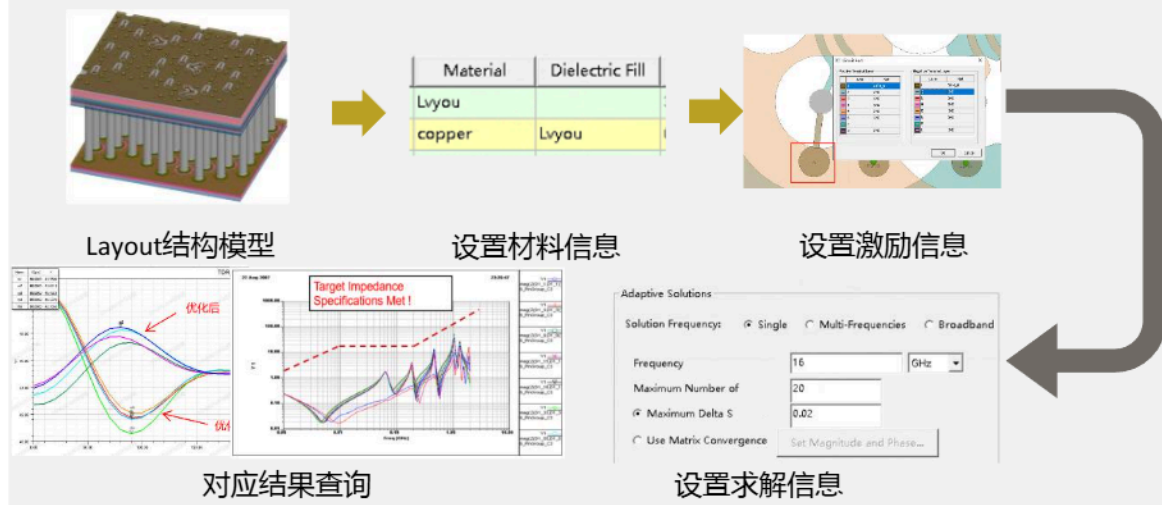
- Maxwell, Q3D, Simplorer, HPC

6.SI/PI性能输出

输入条件:

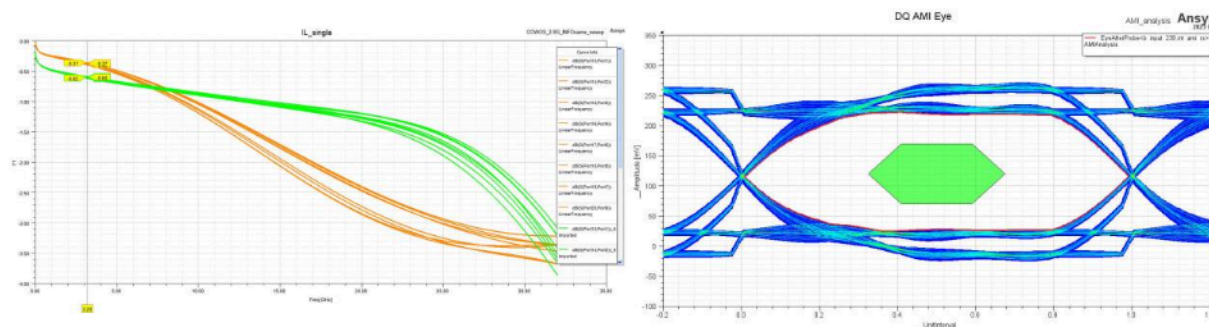
- Package/PCB Layout、材料参数、激励条件

技术方案:

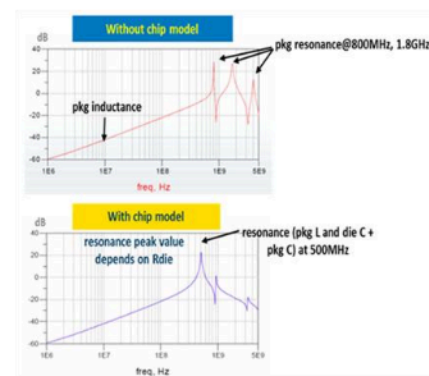


实现效果:

- ANSYS提供完整工具链, 设计/优化Package/PCB高速信号通道 SI性能以支持高数据速率要求
- 进行电源完整性(PI)分析, 通过优化阻抗、去耦电容器和调整优化布线来改善瞬态电源噪声协同进行系统级信号完整性和电源完整性等仿真

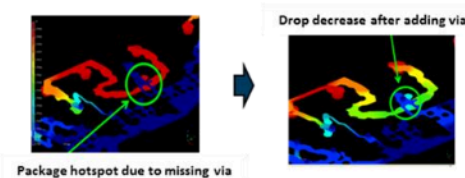


Impedance Optimization

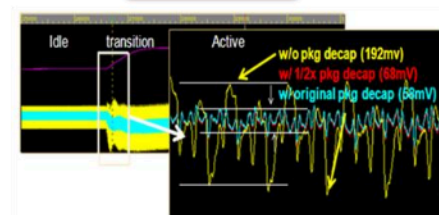


- Overdesign for impedance at resonant freq. of PKG only
- Accurate resonant freq. of 500MHz with CPM model

Weakness Detection



PDN Optimization



涉及模块:

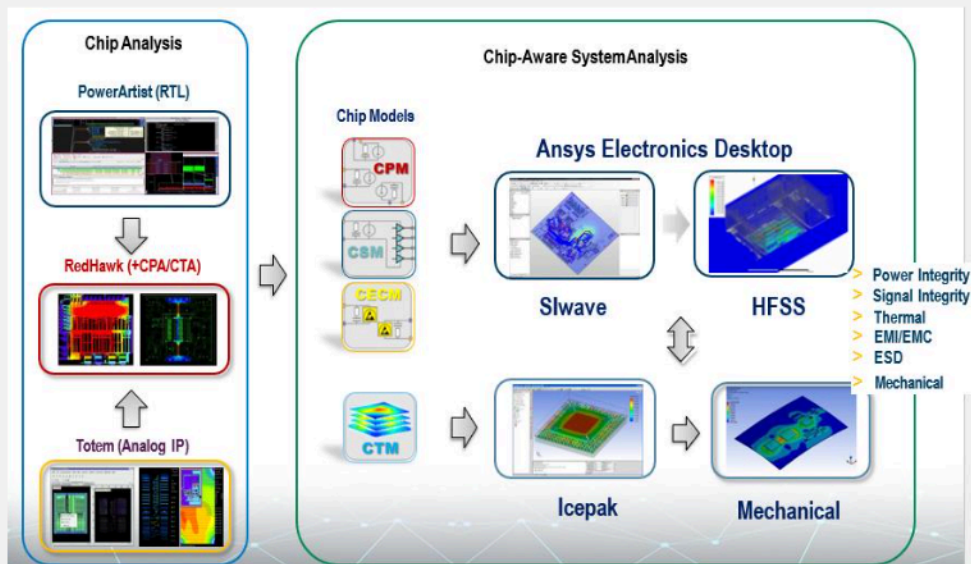
- HFSS 3D Layout, Siwave, Circuit, HPC

7.芯片/封装/系统一体化设计

输入条件:

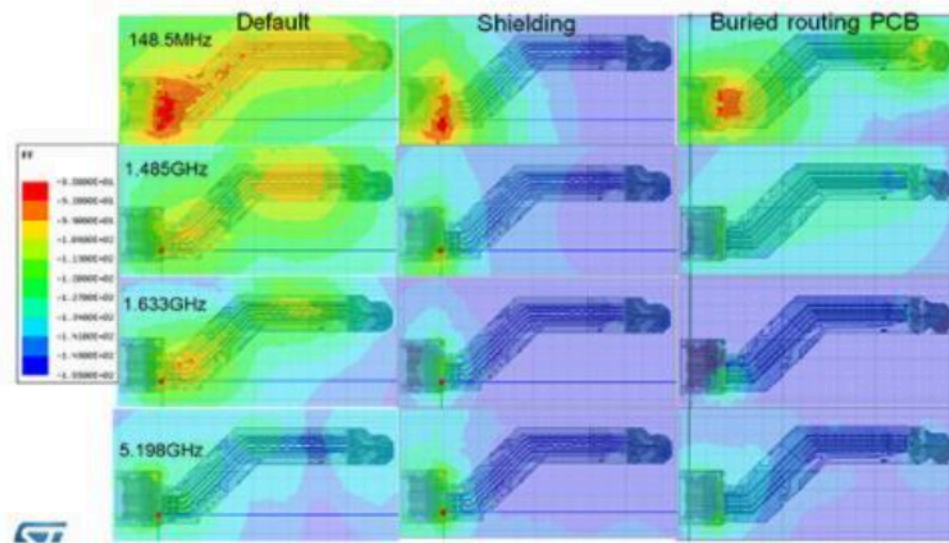
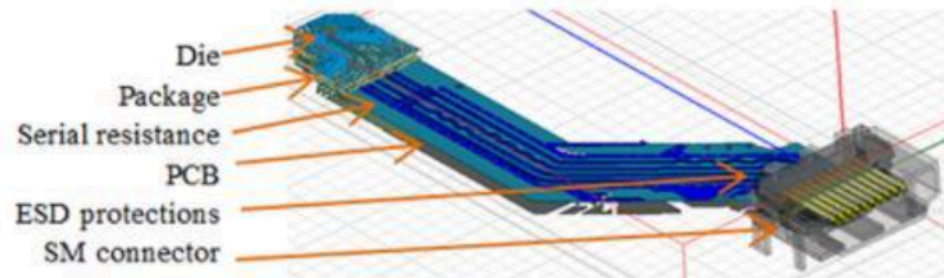
- Package/PCB Layout、材料参数、激励条件、Chip等效模型

技术方案:



实现效果:

- Ansys工具链具备从die到package再到PCB进行完整链路建模和仿真的能力
- 准确提取封装和PCB板上的电磁场参数
- 协同进行系统级信号完整性和电源完整性等仿真



涉及模块:

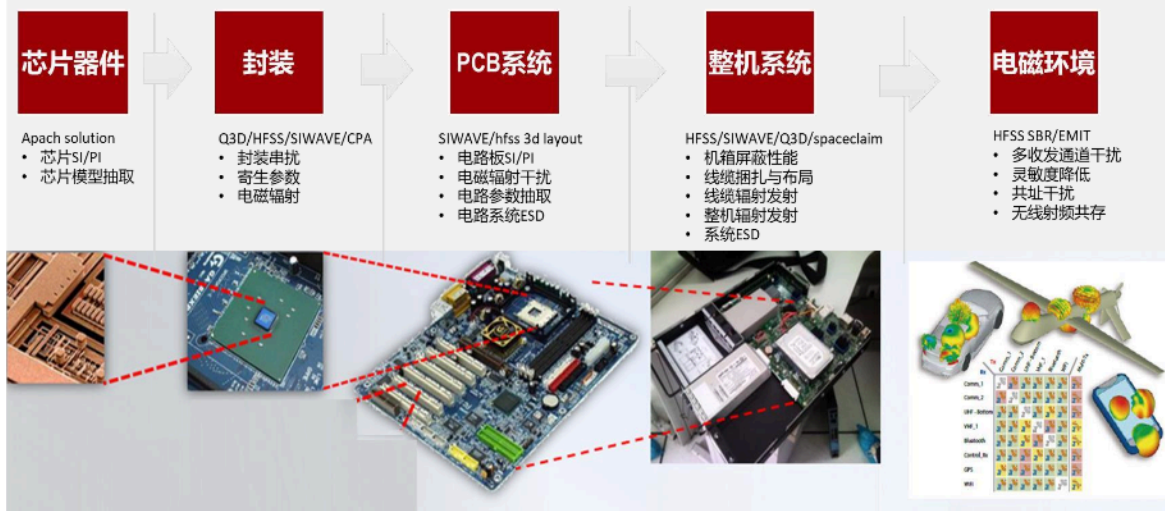
- HFSS 3D Layout, Siwave, Circuit, HPC, Apache系列

8.电子设备EMC分析

输入条件:

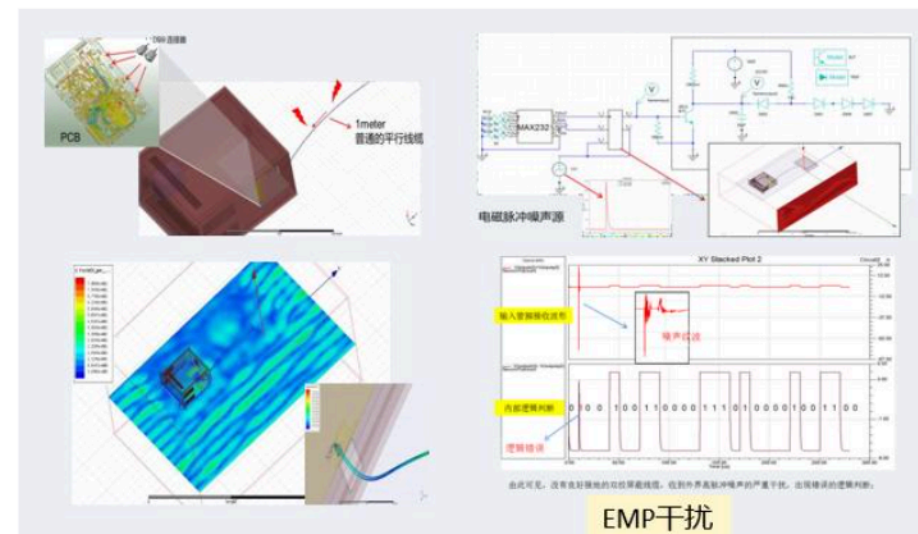
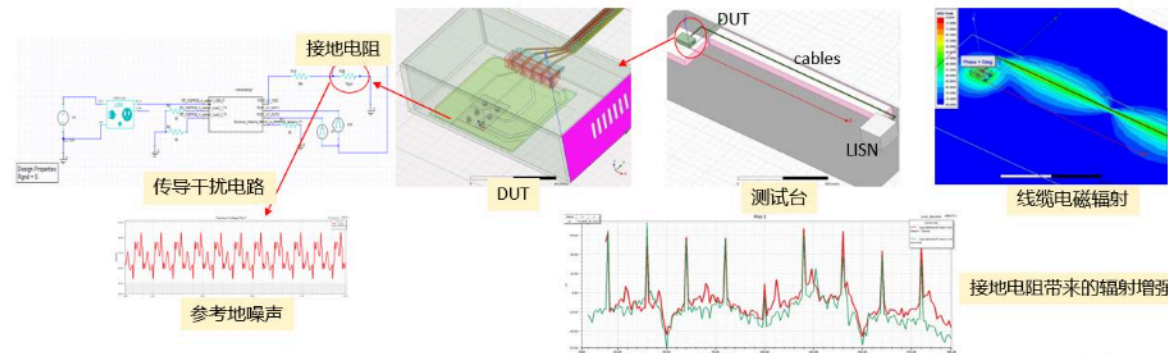
- 结构模型、材料参数、激励条件

技术方案:



实现效果:

- 完整的工具链，可以完成从部件到系统的复杂系统EMC问题分析
- 先进的EM仿真技术与大规模高性能计算(HPC)相结合能够以全波精度仿真已搭建系统
- 在产品早期评估与规避EMC/EMI风险



涉及模块:

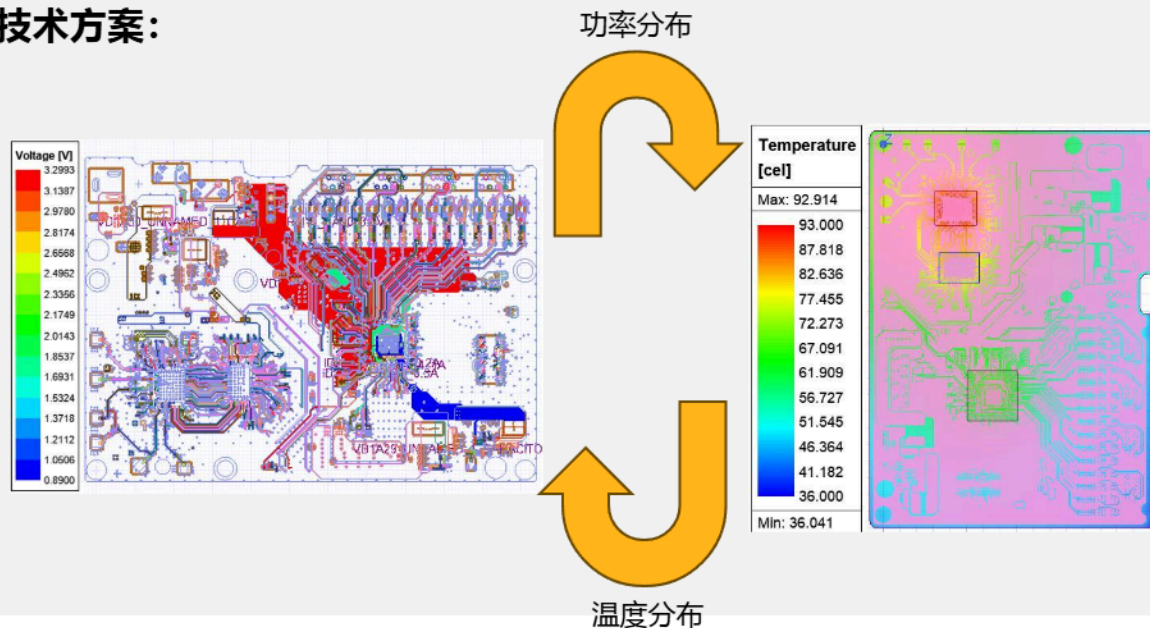
- Electronics Desktop , EMA3D, HPC

9.电热耦合计算

输入条件:

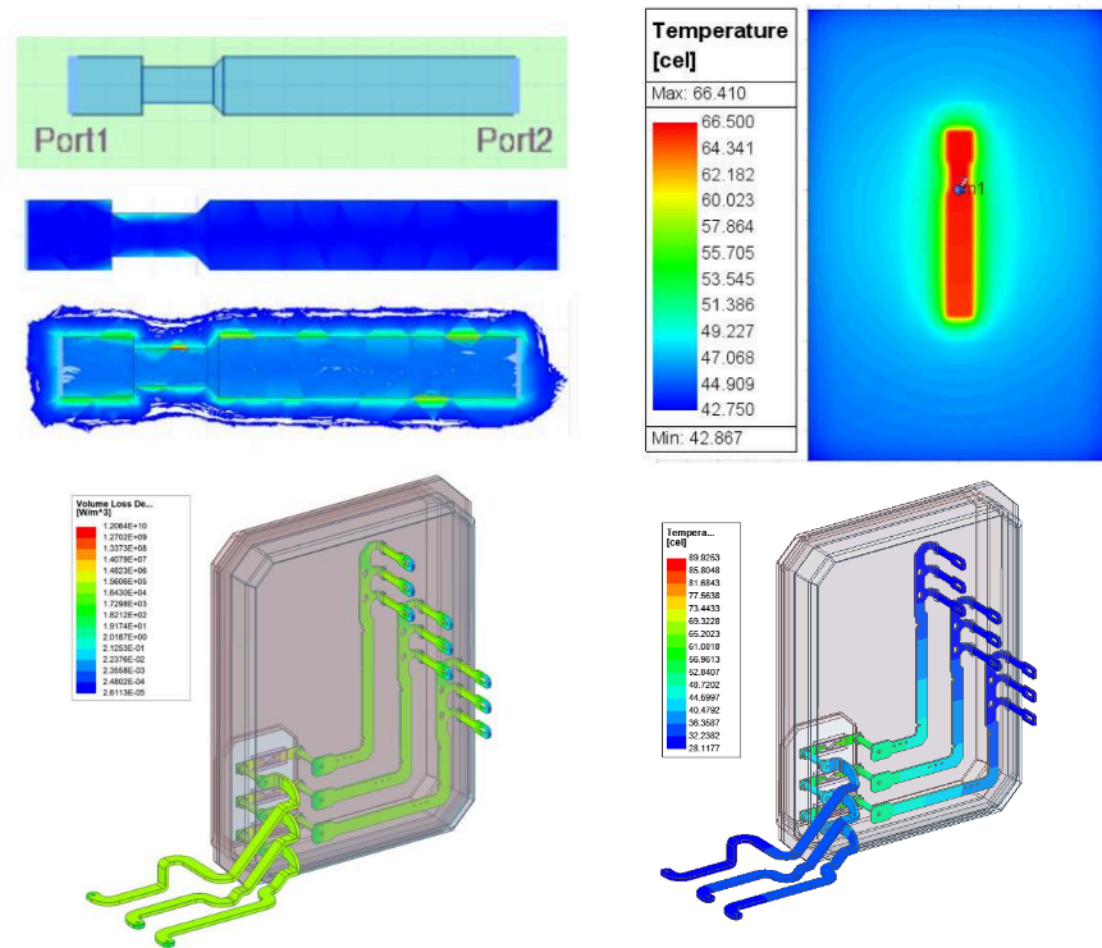
- 结构模型、材料参数（温变曲线等）、激励条件、环境条件

技术方案:



实现效果:

- 所有材料的电参数都具有温变特性。高温改变材料参数，从而影响电性能。高速信号，对材料参数的改变更为敏感。通过高频电磁软件与热仿真软件的双向耦合仿真，用户可获知温度分布对于电性能的影响，反过来也可以获知功率损耗对于器件温度分布的影响



涉及模块:

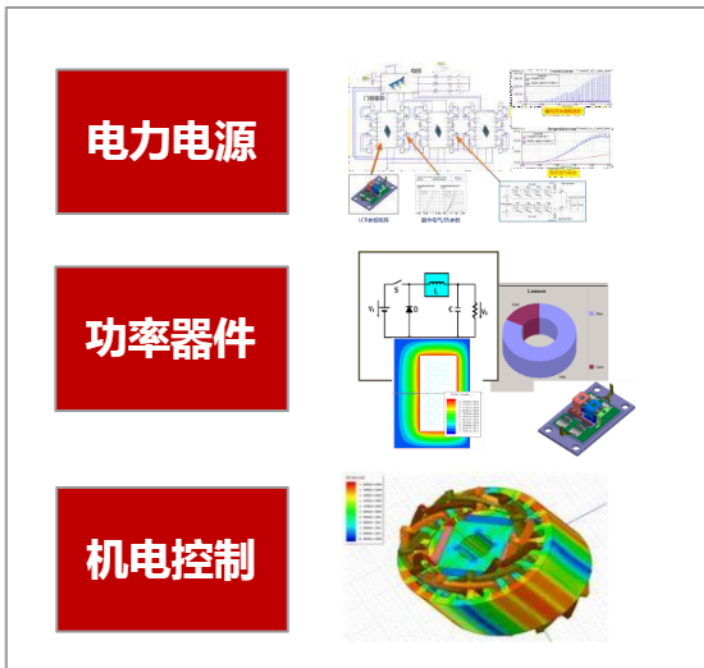
- Electronics Desktop, HPC

ANSYS电磁模块价值

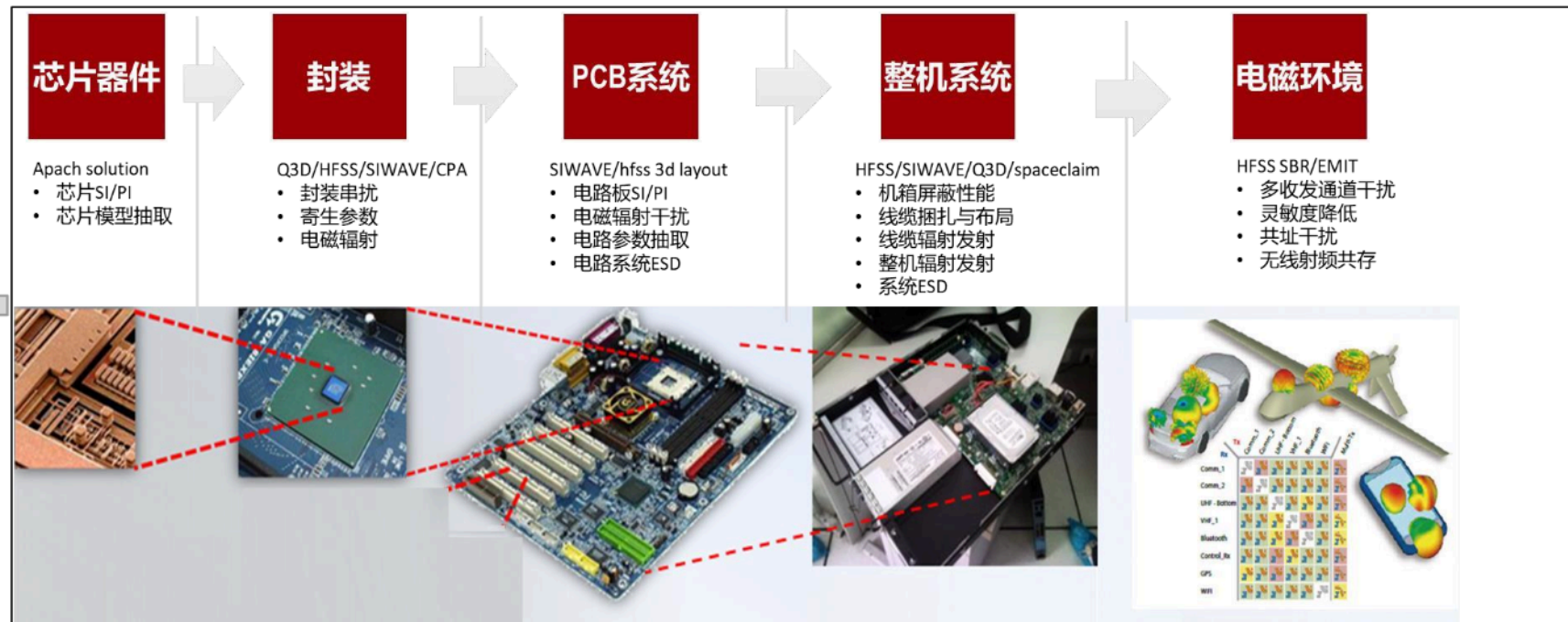


全面的电磁仿真模块组合，支撑多种类别电磁模型的仿真需求

低频电力设备系统



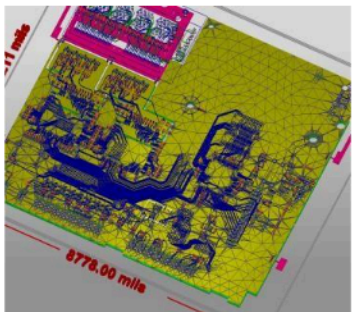
高速射频设备系统及电磁环境



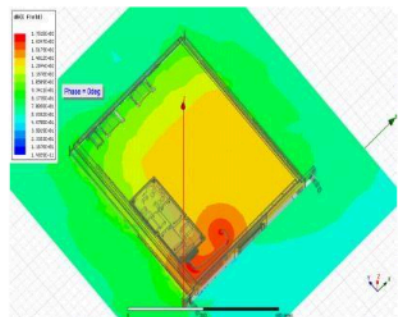
Electronics Desktop涵盖可处理多领域电磁问题的多类模组，根据需要进行选择

多年仿真算法的技术更新迭代，为用户提供准确计算精度

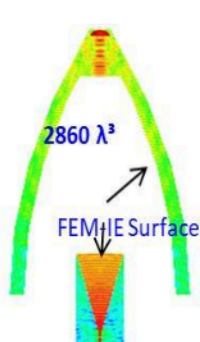
- 针对不同应用场景选用适合的数字算法，保证精度与效率的平衡。



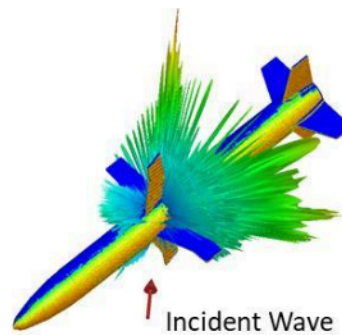
PCB hybrid



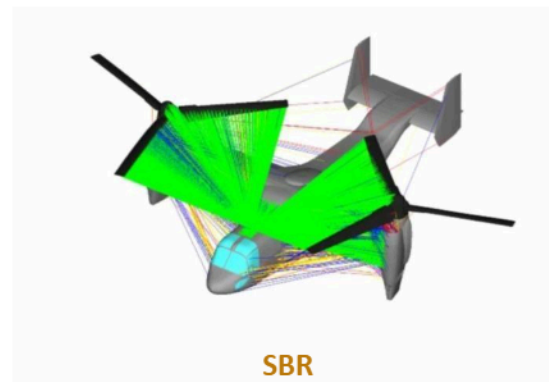
HFSS-FEM



FEM-IE

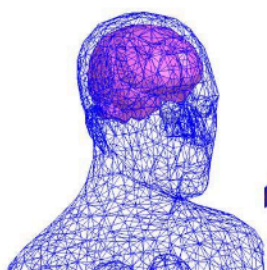


PO

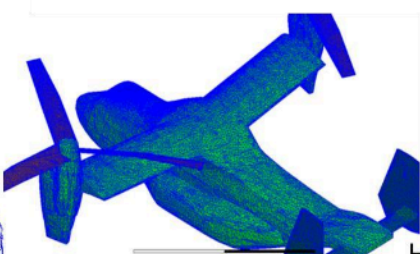


SBR

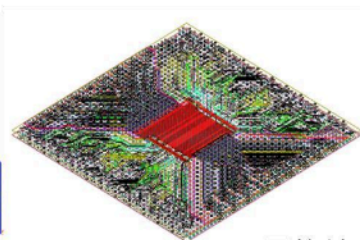
- 自适应网格迭代技术，无需人工干预，同时具备曲面网格，PHI网格技术，保证精度与效率。



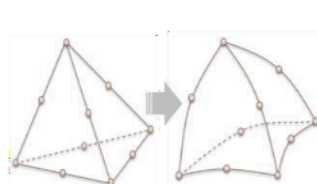
HFSS 四面体网格



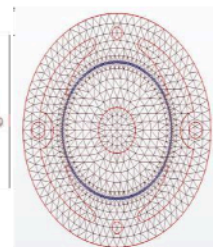
HFSS 三角面元网格



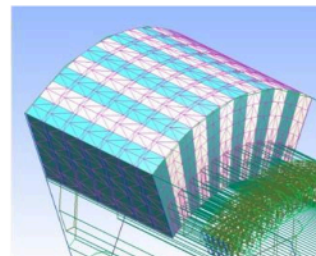
HFSS 3D Layout Phi网格技术
高效处理复杂PCB和封装



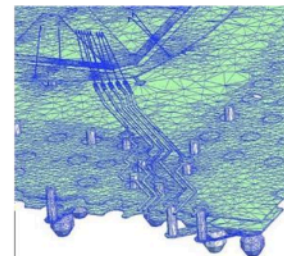
曲面型网格单元
更好剖分曲面结构



Maxwell 2D 网格



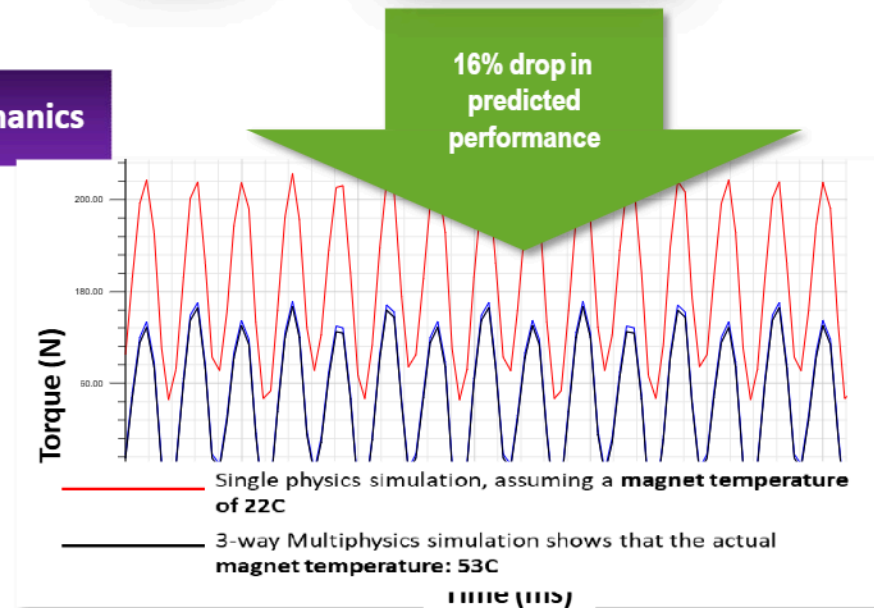
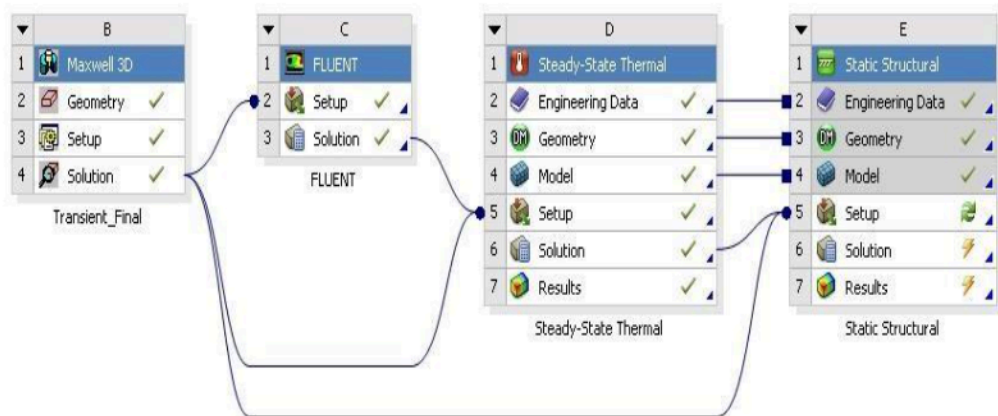
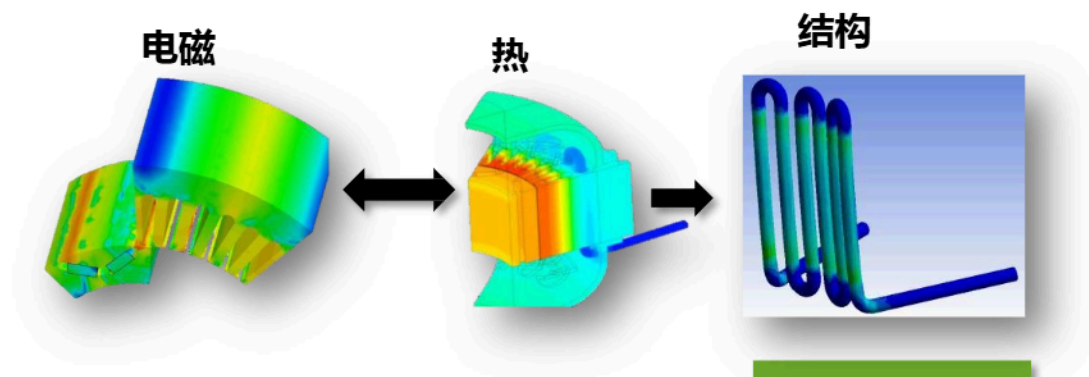
Maxwell 3D 网格



Q3D 网格

多物理场耦合技术提供更广阔的仿真能力扩展空间

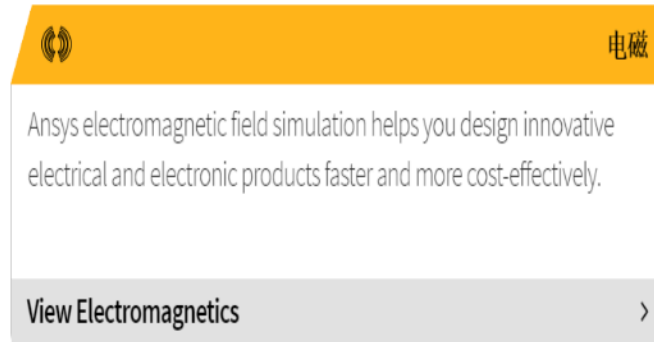
在ANSYS Workbench平台，只需拖放就能实现方便快捷的耦合仿真和自动数据传递，实现电磁和结构、流体的耦合仿真，进行散热设计和热应力仿真



技术支持团队及ALH为您后期技术成长保驾护航



线下技术培训



ANSYS 在线培训中心

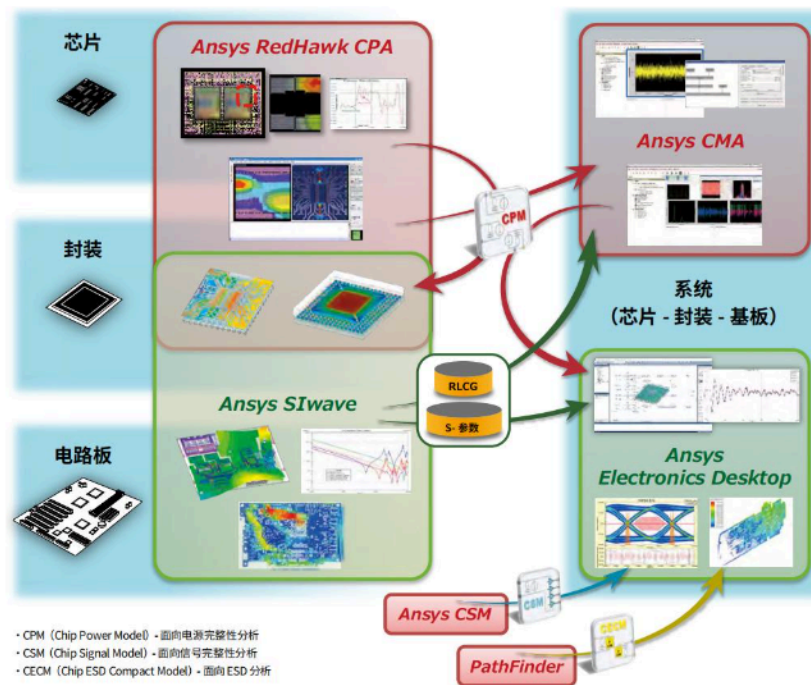
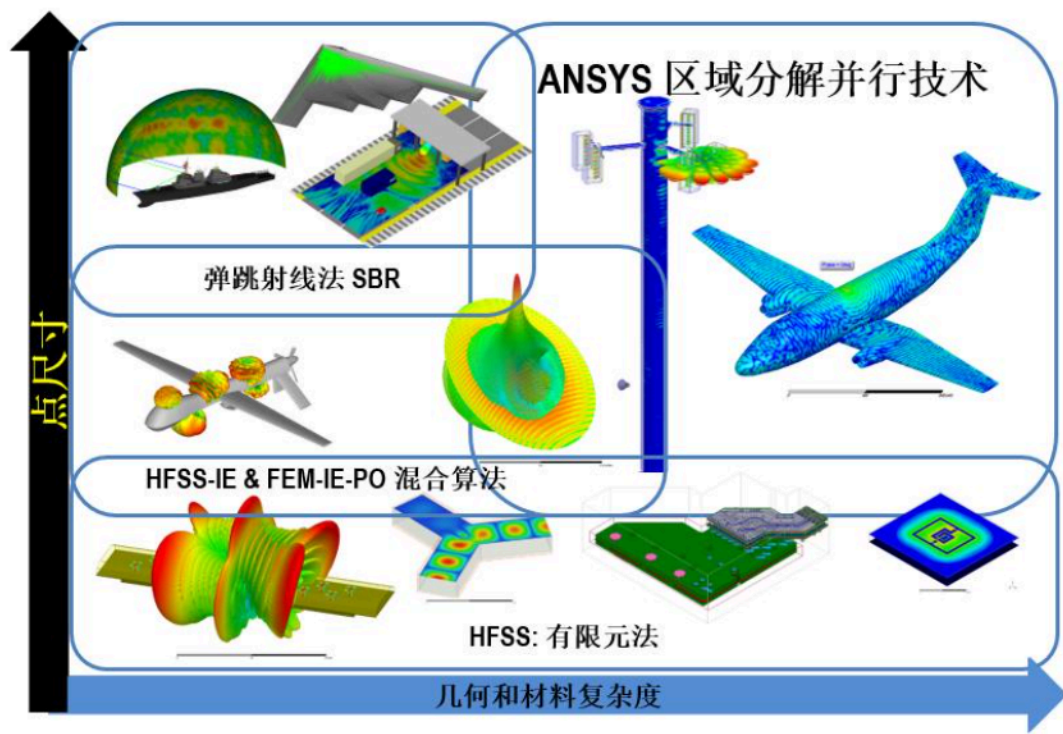


ANSYS Learning Hub全新改版

应用小结

ANSYS电磁领域应用小结

- 智能化的工业软件，让设计人员更专心于探讨物理问题
- 完备灵活的平台体系，覆盖“部件-设备-系统”的设计需求
- 在高新科技领域，ANSYS积累了丰富的解决手段，为高新科技领域设计增添助力



The Ansys logo, featuring a stylized orange and black 'A' followed by the word 'nsys' in black.

