



Your True Partner for
CAE × CFD
ICSC2016



基于仿真的研发创新平台及**ANSYS CFD** 新功能



ANSYS China 技术部

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- 企业仿真应用成熟度

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- 系统工程
- 多物理仿真
- 系统仿真
- 仿真知识管理

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- Fluent新功能
- CFX新功能

仿真与产品研发的发展趋势

将伟大的想法转变成创新的产品

挑战	<ul style="list-style-type: none"> 在产品研发过程中发现问题太晚 新的设计概念总是存在很多不确定性 创新缓慢，无重大突破
解决方案	<ul style="list-style-type: none"> 在产品研发流程的早期实施仿真 对全部有前景的新概念进行快速可行性研究 在产品研发过程中建立完整的模型
影响	<ul style="list-style-type: none"> 尝试10到30个以上的设计方案 设计成本降低2到4倍 产品上市速度提高2到5倍

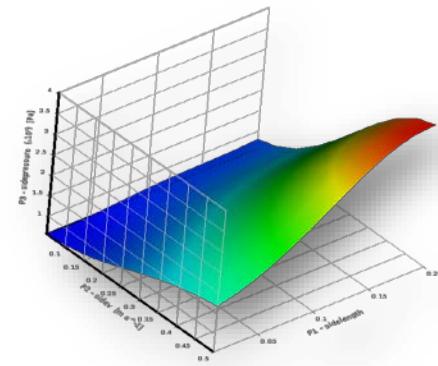
- 每天测试10种设计方案。
- 通过响应表面分析在一天内完成设计改进



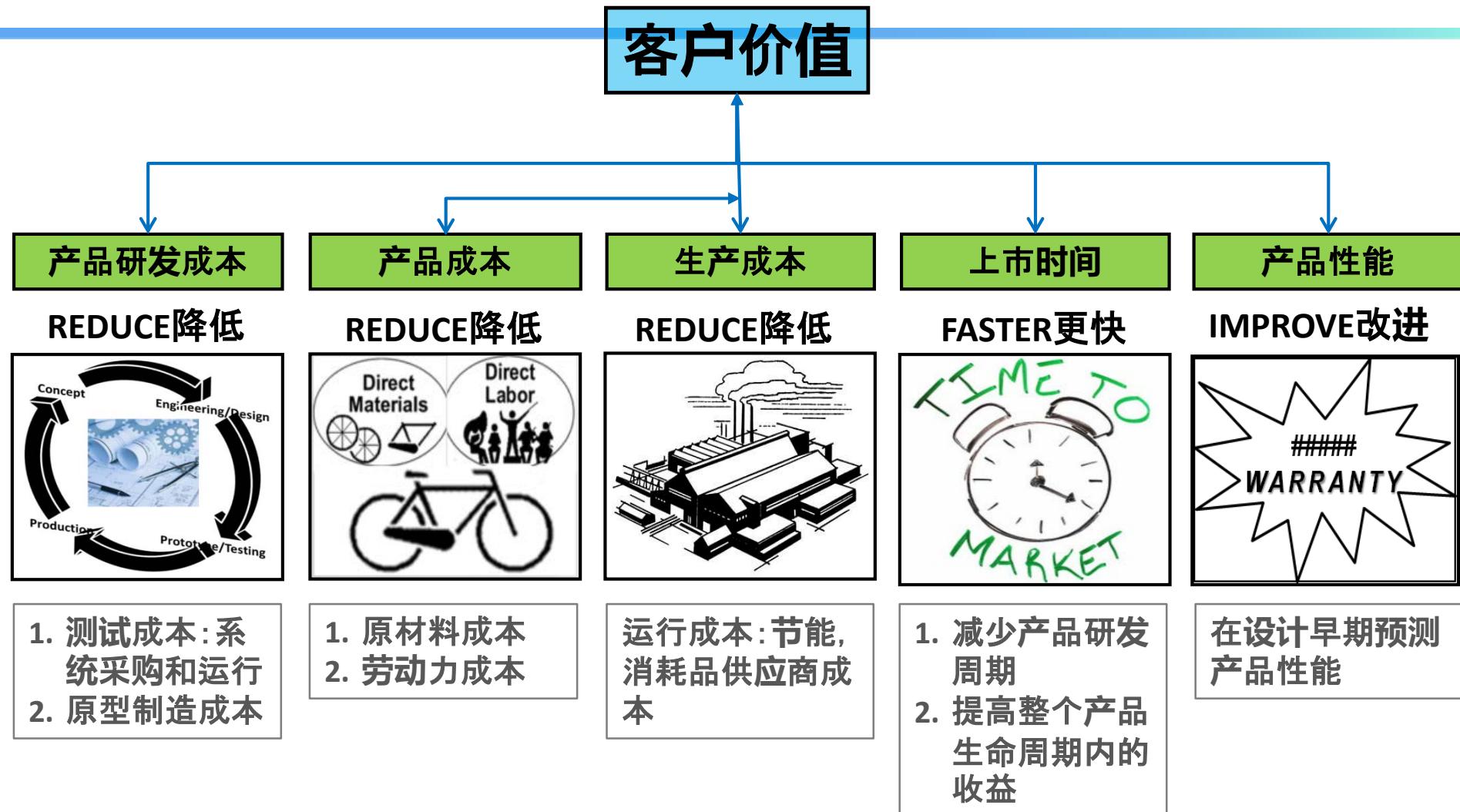
“仅仅利用**10**个物理原型的预算和**3**个原型制造的时间，戴森的工程师就测试了**200**多种不同产品设计。”



- 风扇的效率比普通风扇提高250%以上。
- 进/出气比从6倍提高到15倍。



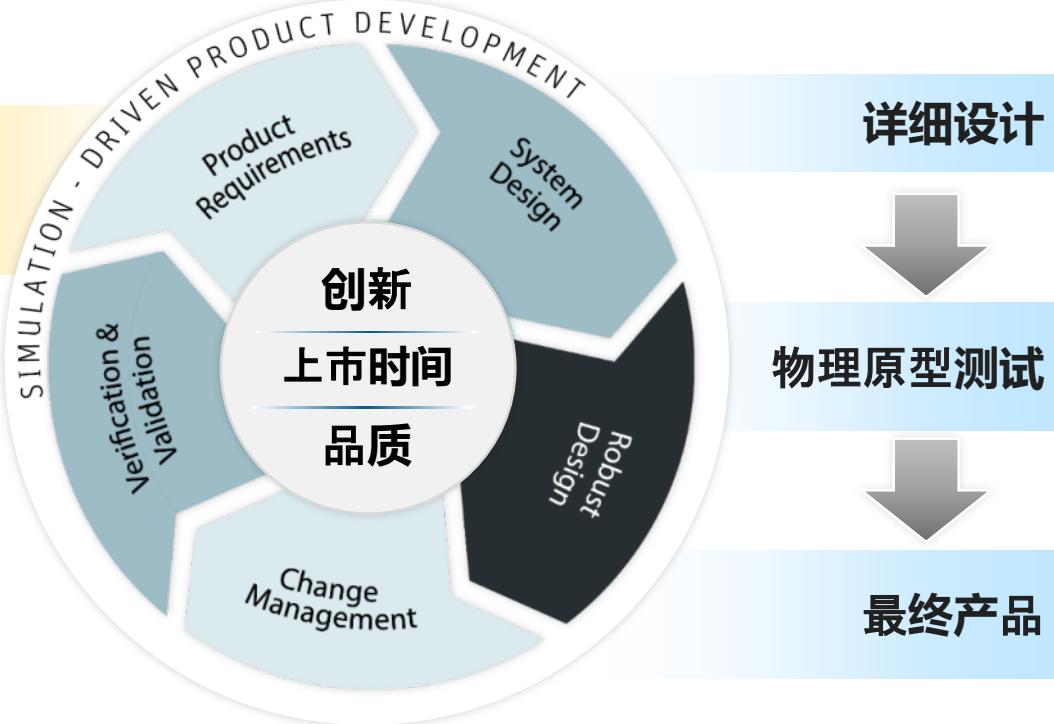
仿真影响的5种损益类型



在产品开发全过程中应用仿真技术

基于仿真驱动产品研发
(SDPD) 的产品研发流程

概念设计



传统的产品研发流程



每个工程师都将使用仿真工具

我们最具创新力的客户都在快速和深入地利用仿真工具



1 in 22

1 in 6

ALL

2005

2015

2020

从3个维度提高仿真应用成熟度

仿真的广度

- 5. 计算资源的智能化访问
- 6. 软件许可证集中式管理



- 7. 稳健性设计优化
- 8. 在设计早期进行可靠性预测与仿真

- 9. 完备全面的多物理场仿真
- 10. 系统架构与功能建模

软件使用者

- 1. 培训与认证
- 2. 协同仿真环境, 直接和参数化建模



- 3. 在设计早期系统化地应用仿真
- 4. 实现设计决策民主化

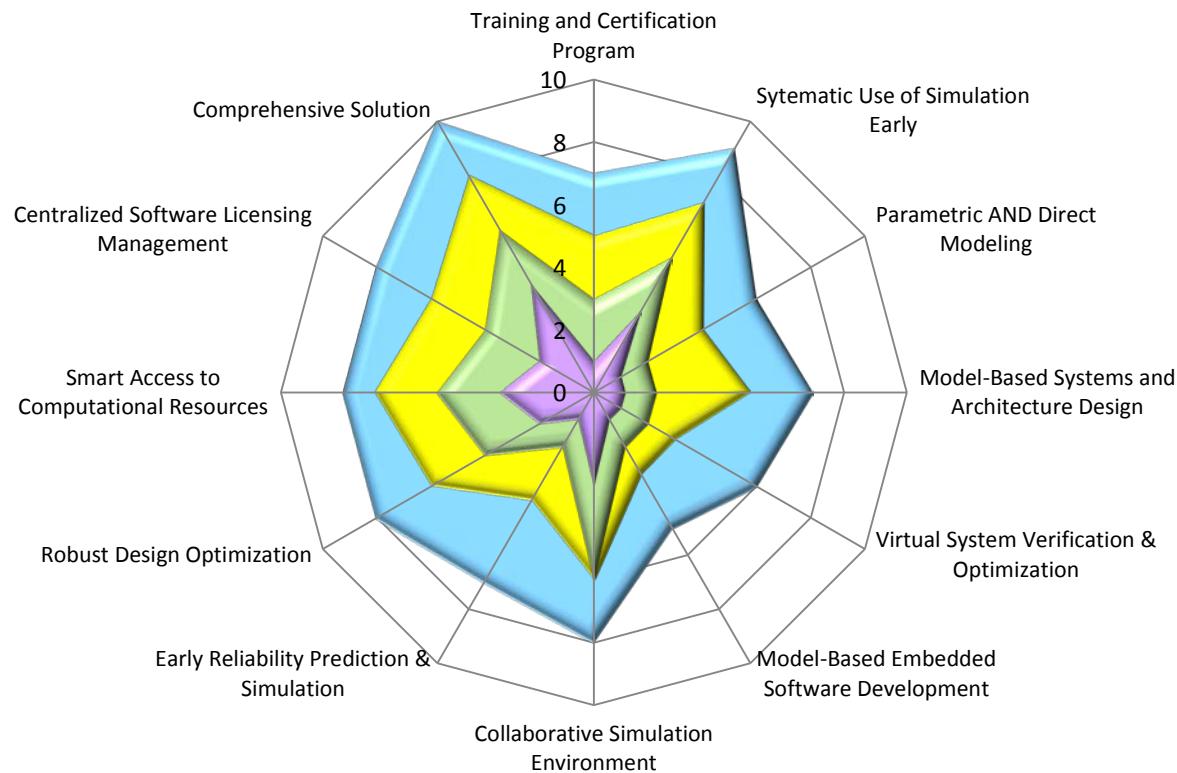
仿真的深度

- 11. 系统、部件、代码协同设计
- 12. 集成化降阶模型, 嵌入式软件建模

ANSYS 帮助企业推进仿真应用成熟度

Level 1 → **Level 2** → **Level 3** → **Level 4**

Quantity/Fidelity of Simulation





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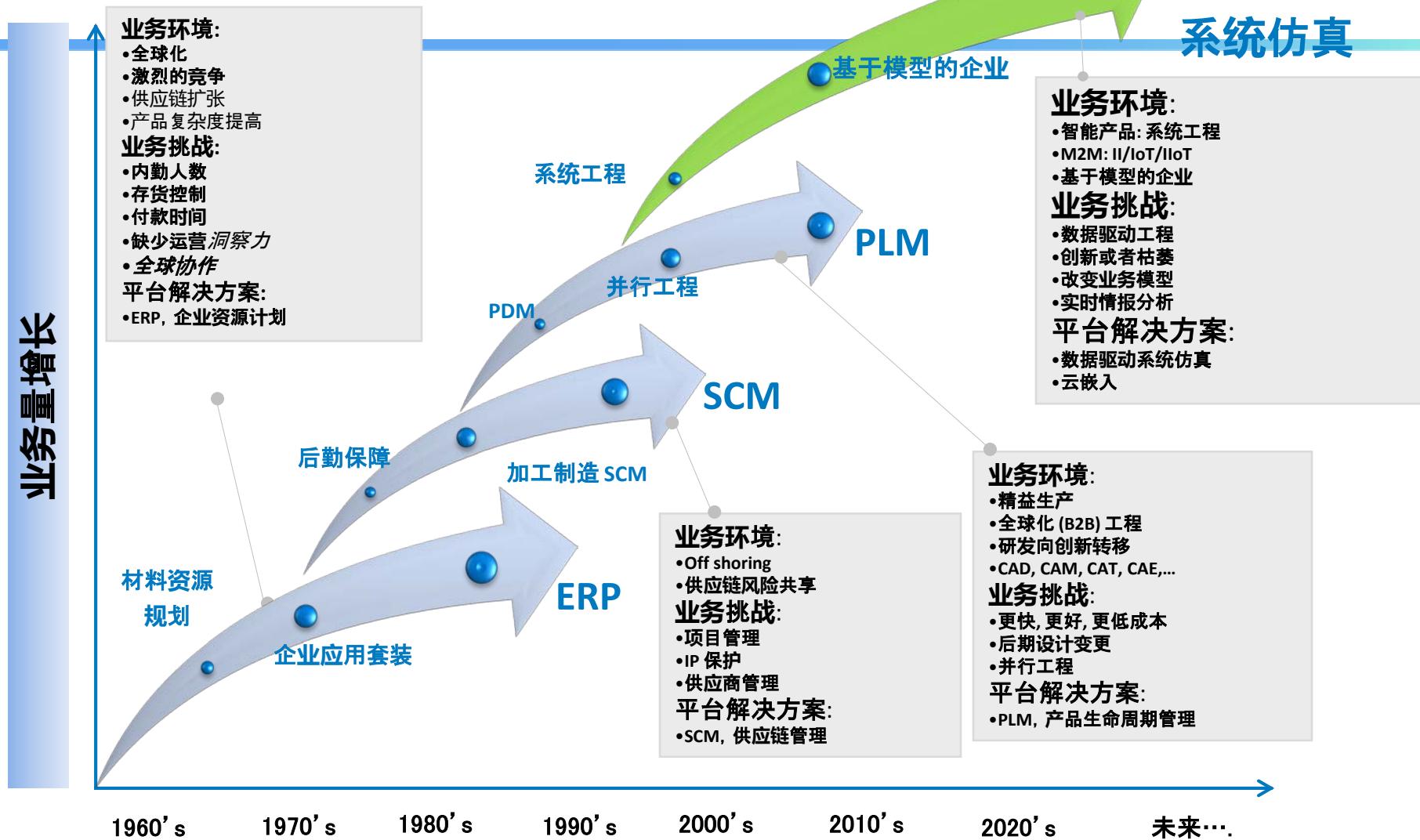
ICSC2016

IDAJ CAE
Solution
Conference

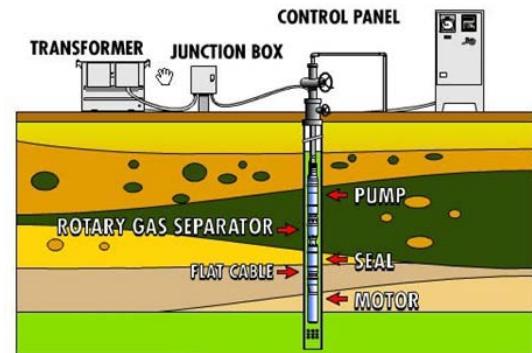
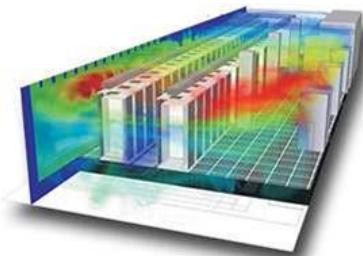
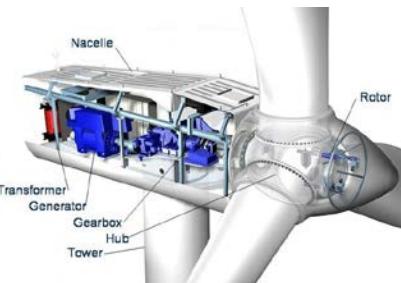
ANSYS®

仿真平台建设

平台的演化与发展



系统 - 无处不在



这是一个创新的机会.....

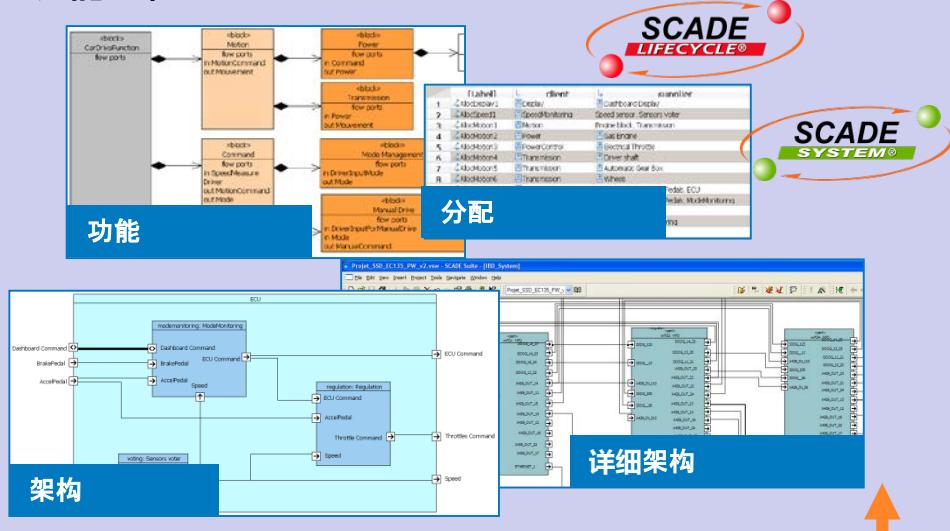
- 以新的方式供电, 驱动, 传感, 控制产品

.....获益良多

- 更好的性能
- 更高的效率
- 更低的成本
- 更高的可靠性

ANSYS 提供了系统工程框架与仿真平台，帮助客户实现仿真驱动产品研发

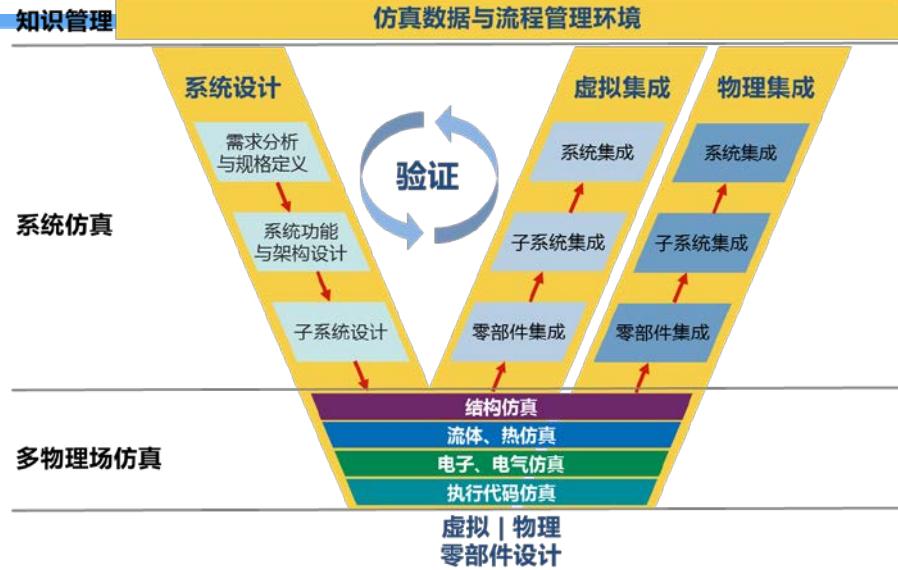
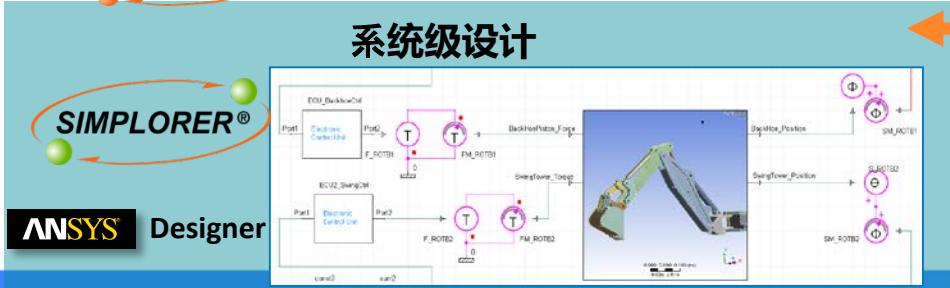
功能工程



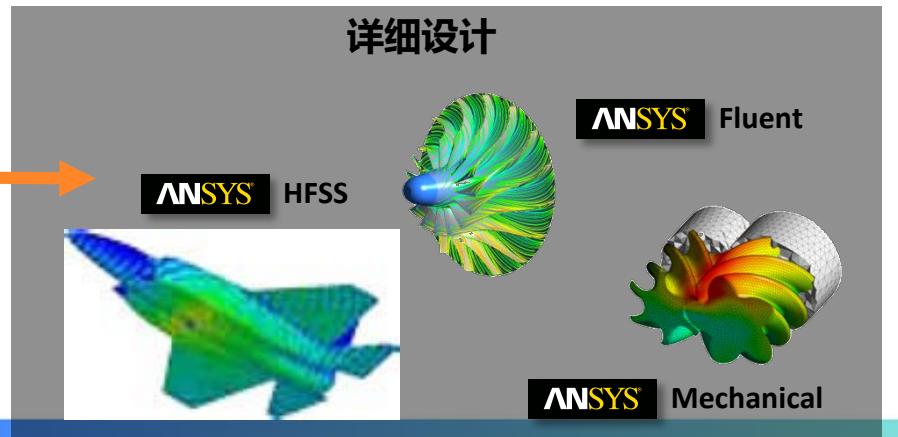
软件工程



系统级设计



详细设计





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IDAJ CAE
Solution
Conference

独立研究机构的结论 : Aberdeen集团

统一了公司的
仿真平台以后：

24%

更好地达到产品上市时间目标



\$\$\$
↓

50%

更显著地减少了仿真工具的12个月TCO(总拥有成本)

37%

更多地减少了研发周期



Source: Aberdeen Group

ANSYS: 仿真行业的引领者

在每一个学科, ANSYS 均提供了市场领先深度和广度的仿真产品,
并且在交叉学科领域提供集成化的仿真方案。

系统

ANSYS Simplorer

ANSYS SCADE

ANSYS HPC

ANSYS Engineering Knowledge Manager

ANSYS DesignXplorer

流体



ANSYS FLUENT

ANSYS CFX

ANSYS POLYFLOW

ANSYS Icepak

结构



ANSYS Mechanical

ANSYS AUTODYN

ANSYS LS-DYNA

ANSYS nCode

电子



ANSYS HFSS

ANSYS Maxwell

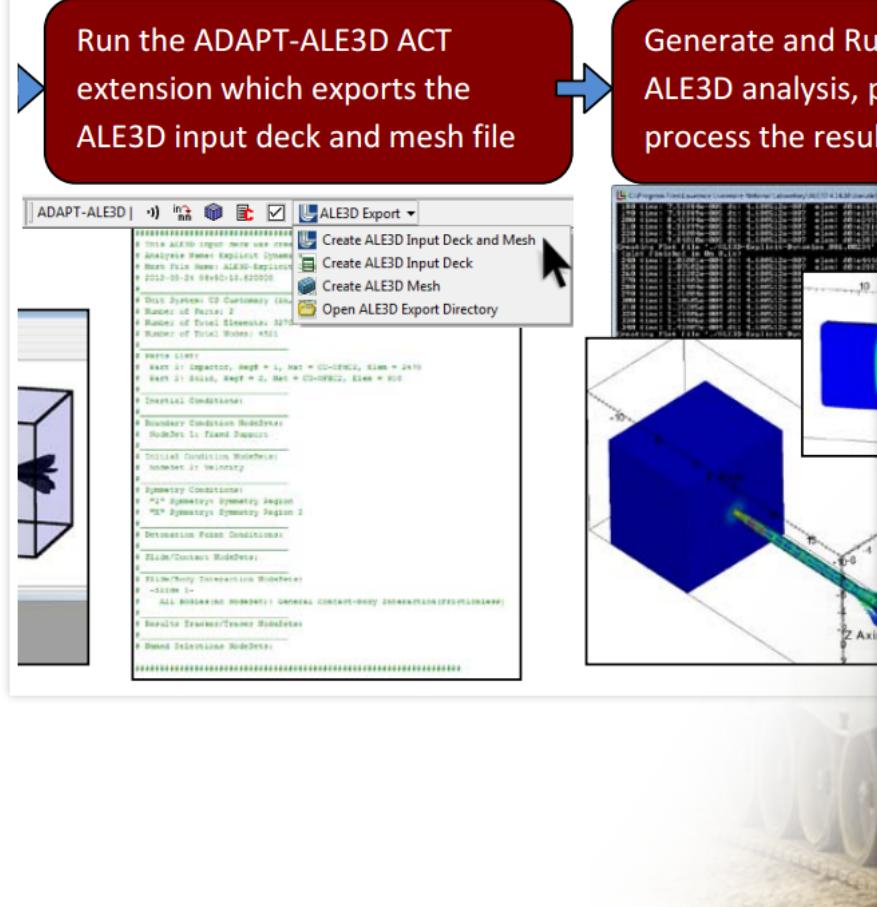
ANSYS Designer

Apache RedHawk

开放的构架与定制化开发

Run the ADAPT-ALE3D ACT extension which exports the ALE3D input deck and mesh file

Generate and Run ALE3D analysis, post-process the results



ANSYS Customer Portal

Acoustics Extension

R16.0

ACT Extensions (R16.0)

- Acoustics Extension** Version: 4.0 **FREE** Target Application: Workbench Mechanical Expose 3D acoustics solver capabilities
- Beam End Release** Version: 1.0 **FREE** Target Application: Workbench Mechanical Expose the end release feature for beam elements and enable advanced graphic post-processing for beam results
- Beam Results Viewer** Version: 1.0 **FREE** Target Application: Workbench Mechanical Expose advanced graphic post-processing features for beam elements
- CMS/Supplements** Version: 4.4 **PAID** Target Application: Workbench Mechanical Make it easy to generate, use, export, import, and expand supplements in ANSYS Mechanical
- Convection Extension** Version: 4.0 **FREE** Target Application: Workbench Mechanical Expose convection with pilot node capability in steady-state and transient thermal analyses
- Coupled Diffusion** Version: 3.0 **FREE** Target Application: Workbench Mechanical Introduce coupled diffusion analysis (structural diffusion, thermal diffusion, and structural thermal diffusion) in both static and full transient analysis
- Coupled Field Physics Extension** Version: 2.0 **FREE** Target Application: Workbench Mechanical Expose piezoelectric, thermal-piezoelectric, and electro-magnetic field physics capabilities
- DDAM** Version: 2.0 **FREE** Target Application: Workbench Mechanical Expose the Dynamic Design Analysis Method (DDAM) interface
- Design Modeler Utility** Version: 2.0 **FREE** Target Application: Design Modeler Expose some useful functions in DM Interface

ACT Templates

- ACT templates R16.0
- ACT Templates for DM
- ACT Templates for DX
- ACT Advanced Template

Help & Support

- Contact Local Support
- ACT Module Doc
- Online Reference Guide
- Download Reference Guide
- ACT Overview Video
- ACT Intro Training
- Installation Procedure
- ACT R14.5 to R15 Migration Notes

ANSYS 基于仿真的研发创新平台框架

知识管理

仿真数据与流程管理环境

系统仿真

系统设计

需求分析
与规格定义

系统功能
与架构设计

子系统设计

虚拟集成

系统集成

子系统集成

零部件集成

物理集成

系统集成

零部件集成

验证

多物理场仿真

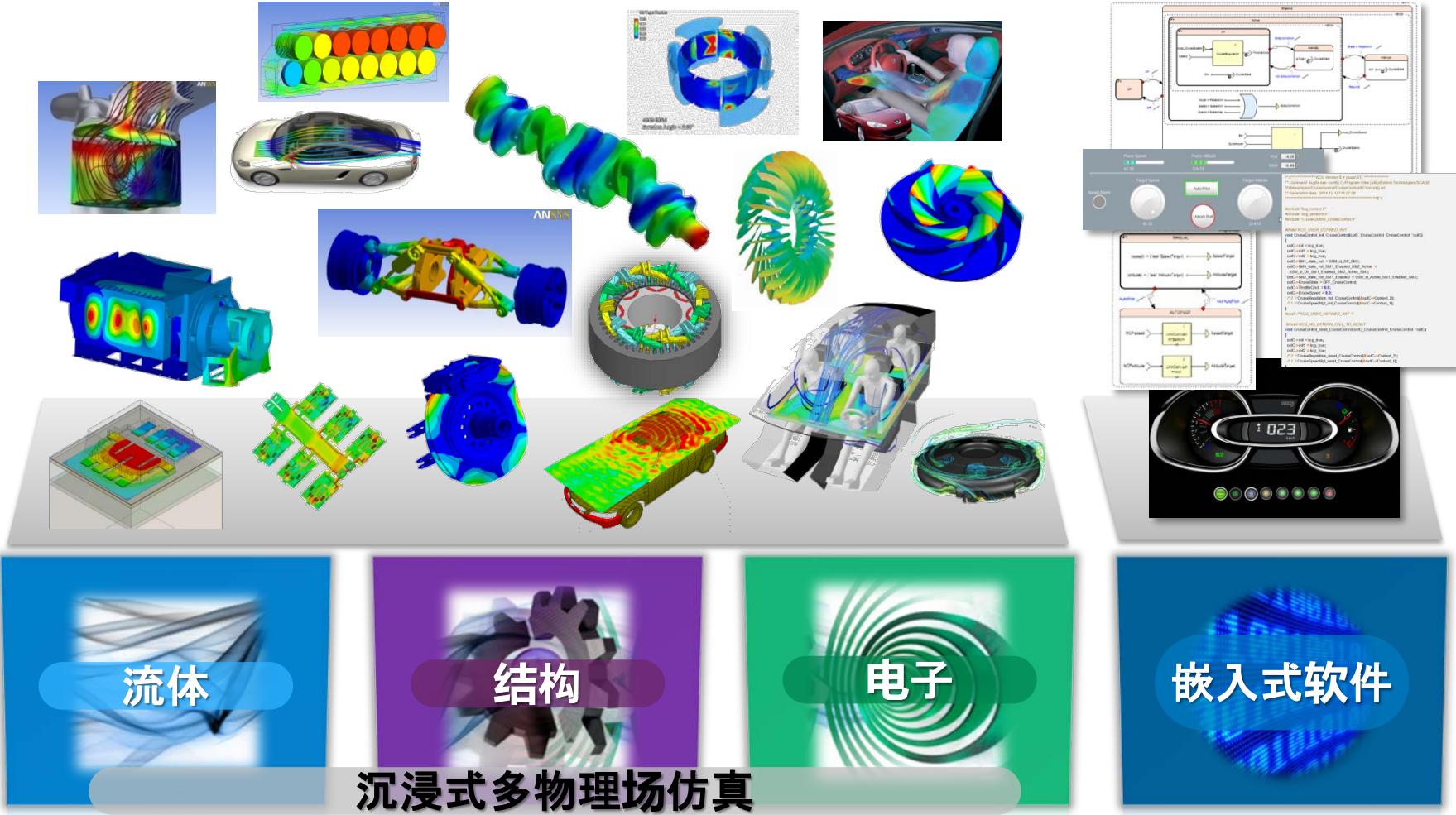
结构仿真

流体、热仿真

执行代码仿真

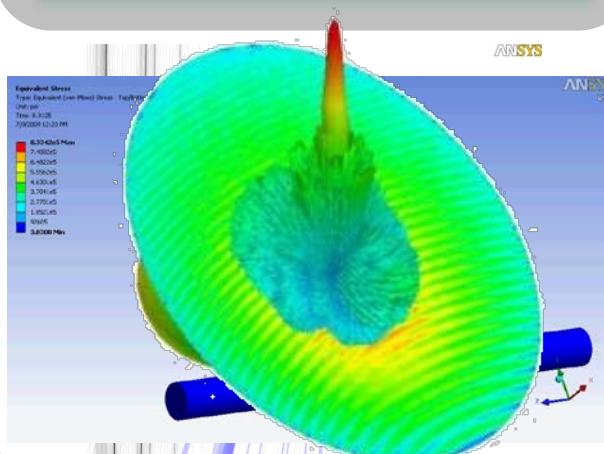
虚拟 | 物理
零部件设计

全面的部件级设计



多物理场耦合仿真确保设计质量

Electromagnetics



Coupled Physics

Structural Mechanics



Coupled Physics

Fluid Dynamics



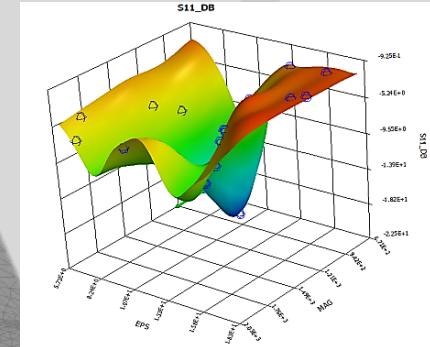
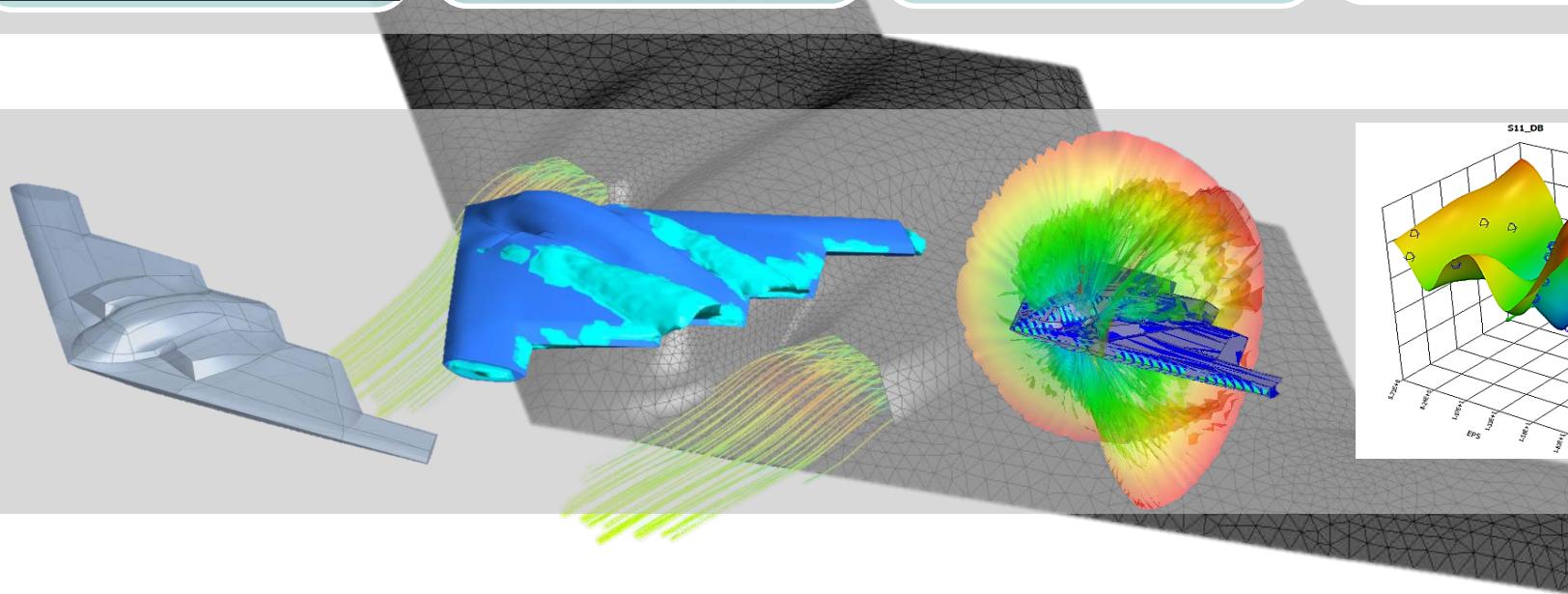
多学科设计探索与优化开拓创新思维

几何预处理

空气动力学性能

雷达散射截面
(RCS)

设计空间探索



SCDM & DM:
模型简化、修复
与参数化

Fluent:
流体动力学仿真

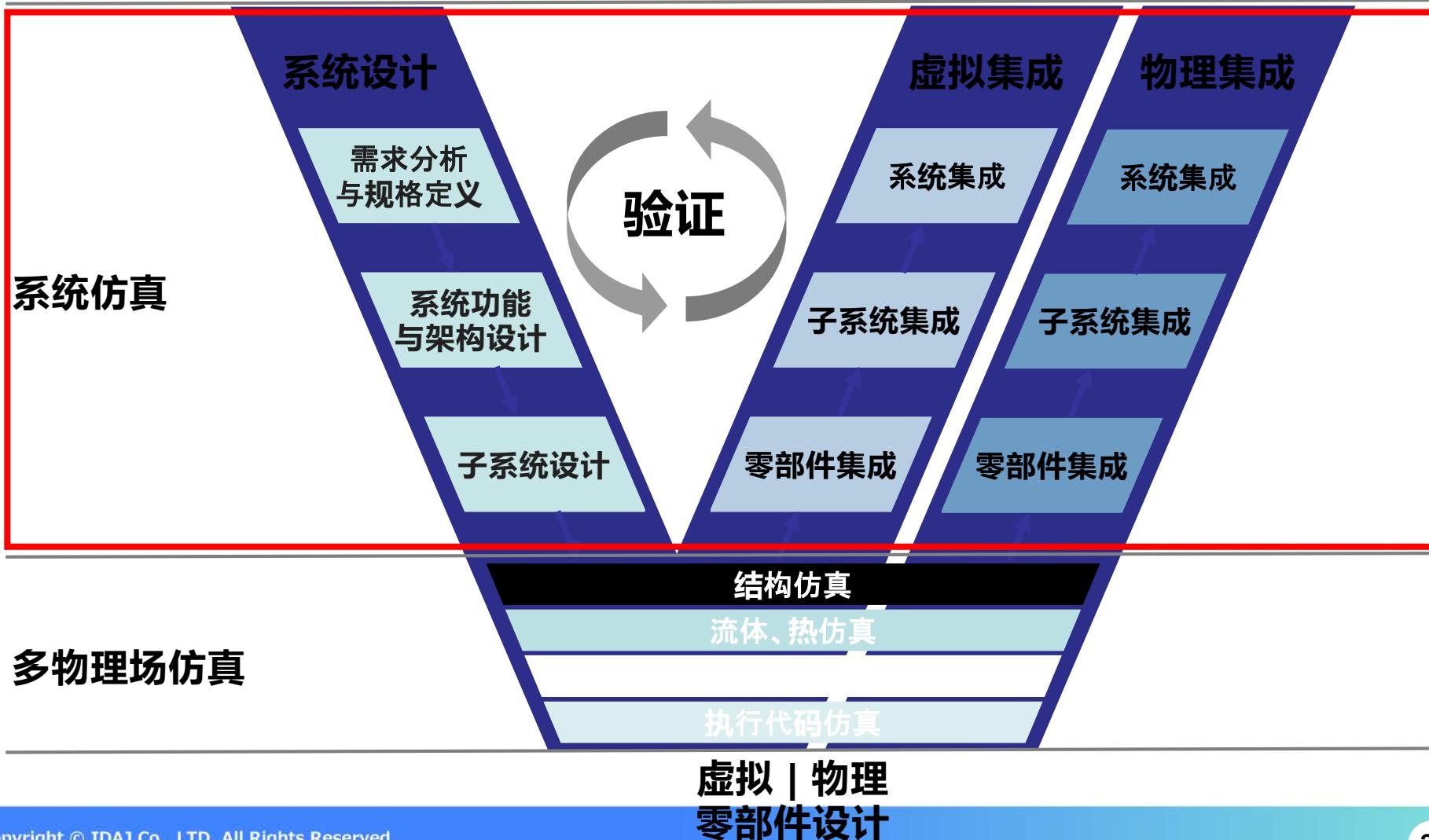
HFSS:
高频电磁场仿真

DesignXplorer:
稳健性设计探索

ANSYS 基于仿真的研发创新平台框架

知识管理

仿真数据与流程管理环境



...with Complex Interactions

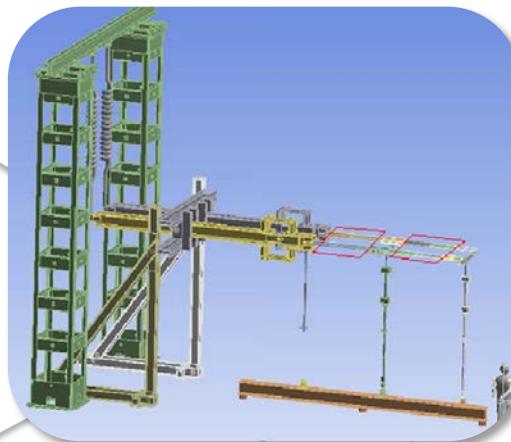
Simplorer



Electronic Control



Actuators



Sensors

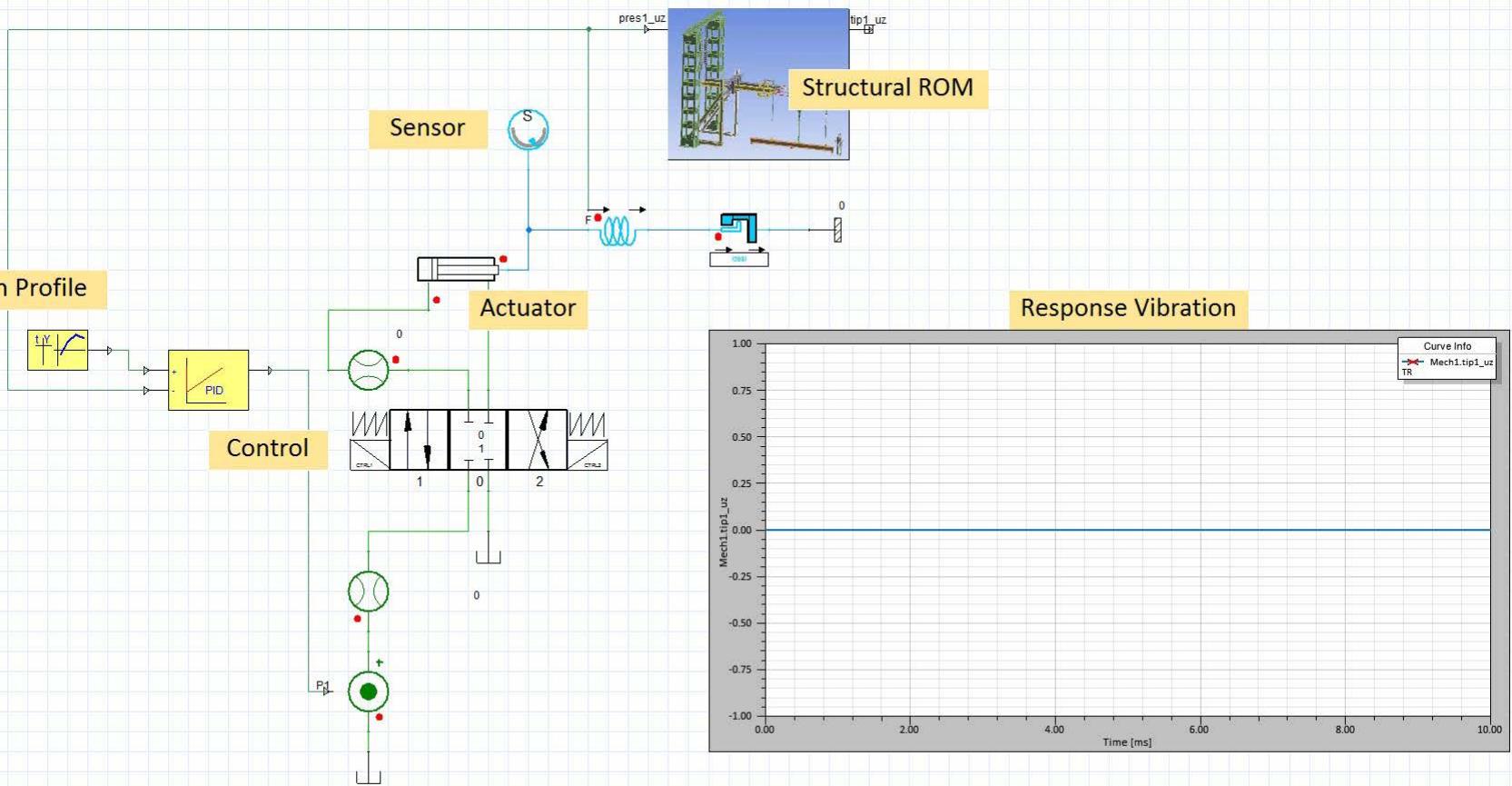


Mission Profiles

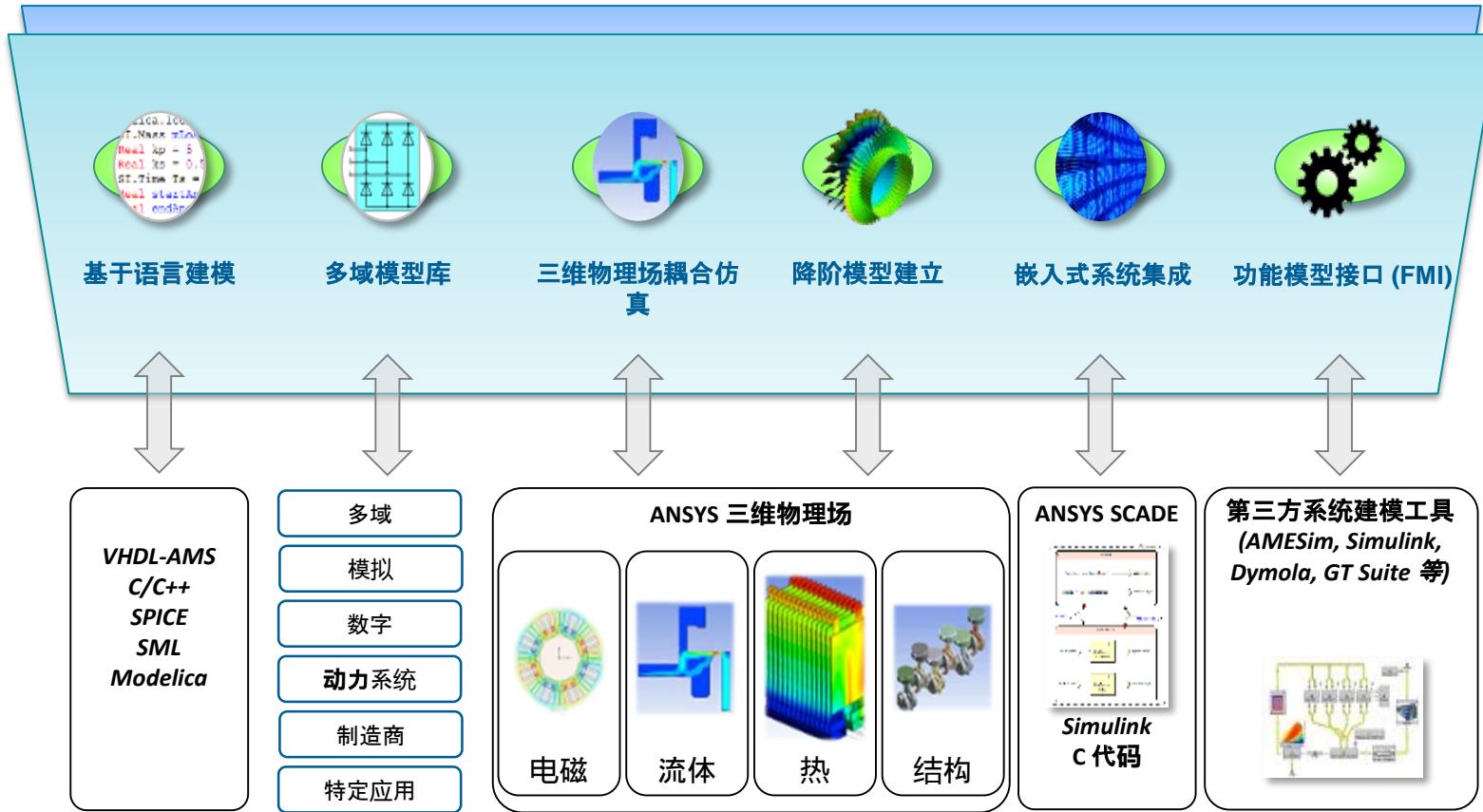


Operating Conditions

Simplorer: Simulate System Interactions



全系统建模



ANSYS 基于仿真的研发创新平台框架

知识管理

仿真数据与流程管理环境

系统仿真

多物理场仿真

系统设计

需求分析
与规格定义

系统功能
与架构设计

子系统设计

验证

虚拟集成

系统集成

子系统集成

零部件集成

物理集成

系统集成

子系统集成

零部件集成

结构仿真

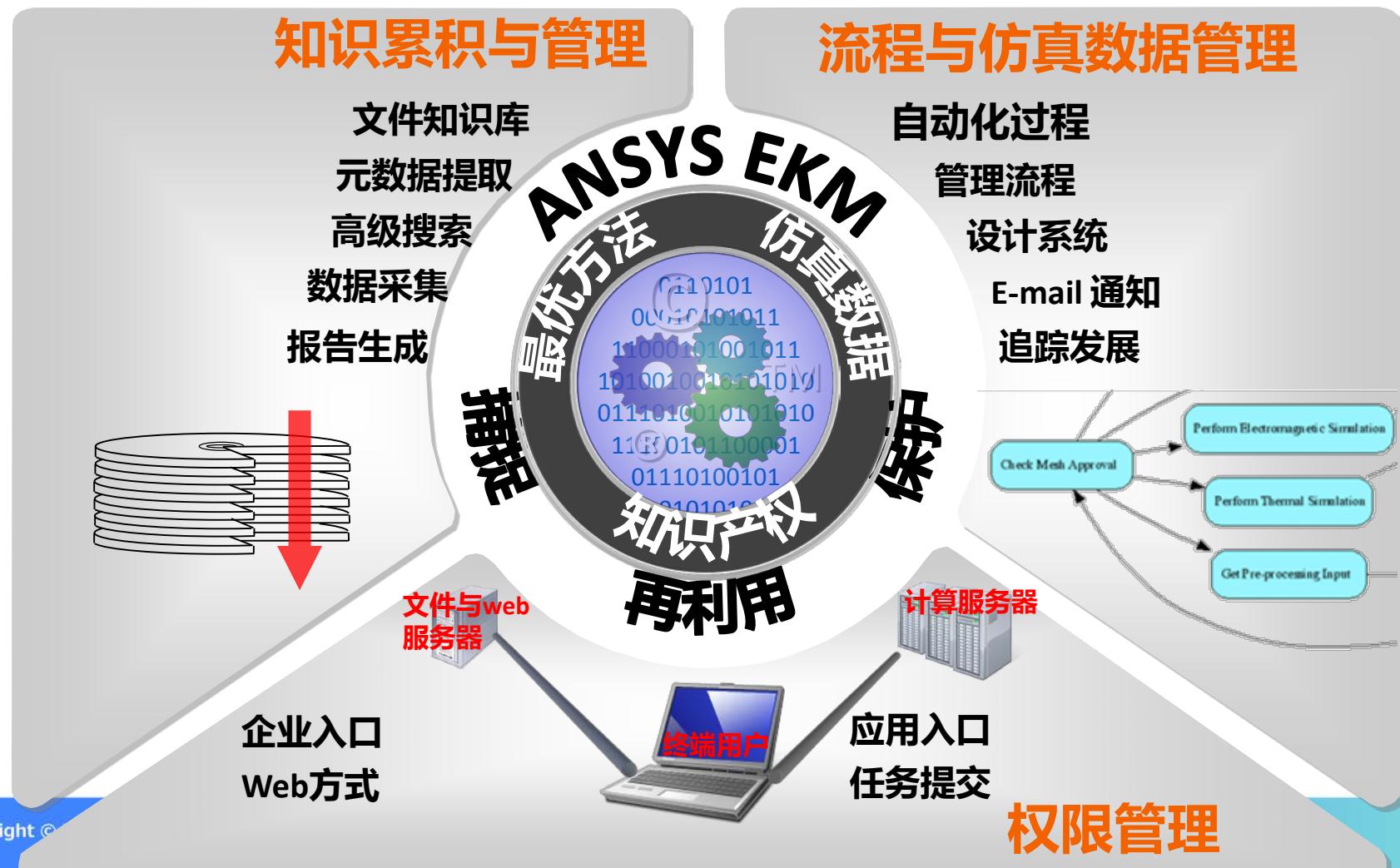
流体、热仿真

执行代码仿真

虚拟 | 物理
零部件设计

仿真知识管理系统

仿真设计方案的分类、归类整理和有序管理与复用
设计数据、仿真结果和设计经验的数据备份和归档



仿真数据库、模板库定制与管理

Data ▾ Simulation Portal based on ANSYS EKM

Enter keyword for search Advanced My Data Shared Data Starred Recent Extraction Monitor

Shared Data > CAE Data >

New Delete Edit Upload Download More

Name	Size	Type	Date modified	Modified by	Image
3Channels_NotAdiabatic_001.res	2,554 KB	CFX Result	8/22/14 11:51 AM	svbhide	
CFD-Optimization.wbz	2,173 KB	Workbench Project Archive File	8/22/14 11:52 AM	svbhide	
MDXER-1-finished.scdoc	599 KB	ANSYS SpaceClaim Geometry File	8/22/14 11:48 AM	svbhide	
OptimTee3.hfss	2,321 KB	HFSS File	8/22/14 11:52 AM	svbhide	
Rotational_Act_TR.mnw	456 KB	Maxwell File	8/22/14 11:52 AM	svbhide	
Taurus-V02.key	3,416 KB	LSDYNA Input file	8/22/14 11:48 AM	svbhide	
airfoil.cas	492 KB	Fluent Case	8/22/14 11:48 AM	svbhide	
bracket2.op2	76 KB	NASTRAN OP2 file	8/22/14 11:48 AM	svbhide	
cylinder.fil	1,964 KB	Abaqus Result	8/22/14 11:48 AM	svbhide	
cylinder.inp	3,145 KB	Abaqus Input	8/22/14 11:48 AM	svbhide	
fan1.cas	113,047 KB	Fluent Case	8/22/14 11:53 AM	svbhide	
file.st					
heater2.4.0.ccm					
scenario_1.rth					
test2.t6					
type12.bdf					

List Details Discussions

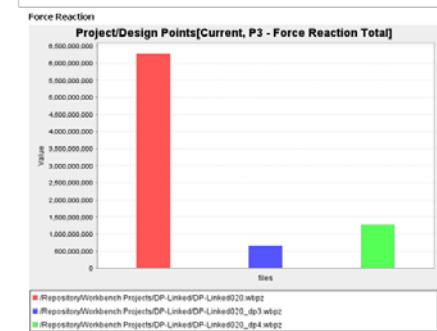
Design Points

Name	P1 - Acceleration Magnitude	P5 - DS_L2	P6 - DS_L1	P7 - DS_EXT	P2 - Total Deformation Maximum	P3 - Force Reaction Total	P4 - Total Deformation Load Multiplier
Units	m s^-2				m	N	
Current	1E+07	200	200	2000	0.77977	6.28E+09	1.0293
DP 1	1E+06	100	100	2000	0.078224	1.57E+08	10.086
DP 2	1.5E+07	400	400	4000	4.6786	7.536E+10	0.34311
DP 3	2.5E+07	300	300	3000	4.3862	5.2988E+10	0.27449

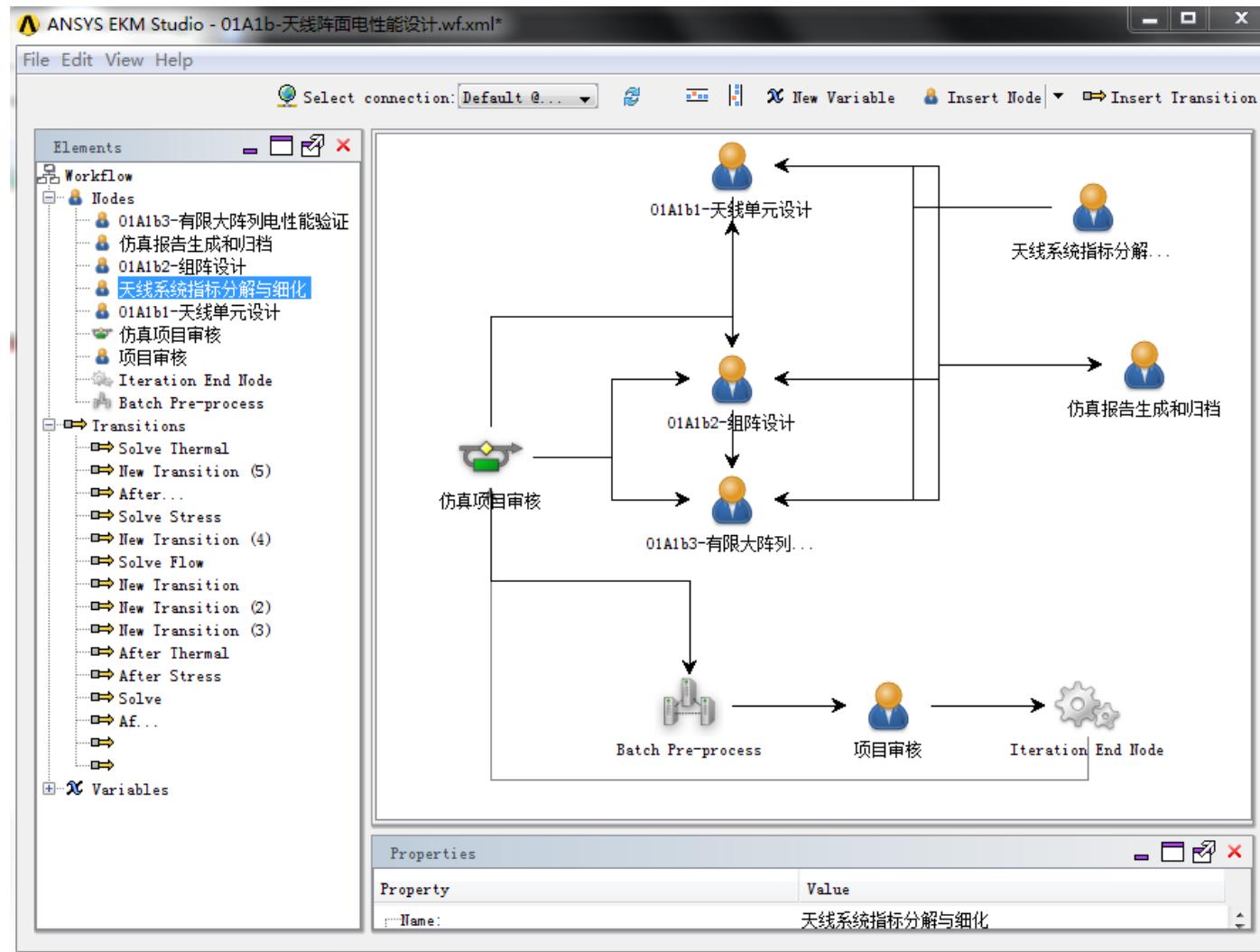
Outline of All Parameters

ID	Parameter Name	Value	Unit
Input Parameters			
Static Structural (ANSYS)			
P1	Acceleration Magnitude	1E+07	m s^-2
P5	DS_L2	200	
P6	DS_L1	200	
P7	DS_EXT	2000	
Output Parameters			
Static Structural (ANSYS)			
P2	Total Deformation Maximum	0.77977	m
P3	Force Reaction Total	6.28E+09	N
Linear Buckling (ANSYS)			
P4	Total Deformation Load Multiplier	1.0293	

快速生成不同设计和
仿真结果的对比报告
 • Tabular
 • Graphical



仿真工作流程定制与管理



ANSYS CFD新功能

Fluent

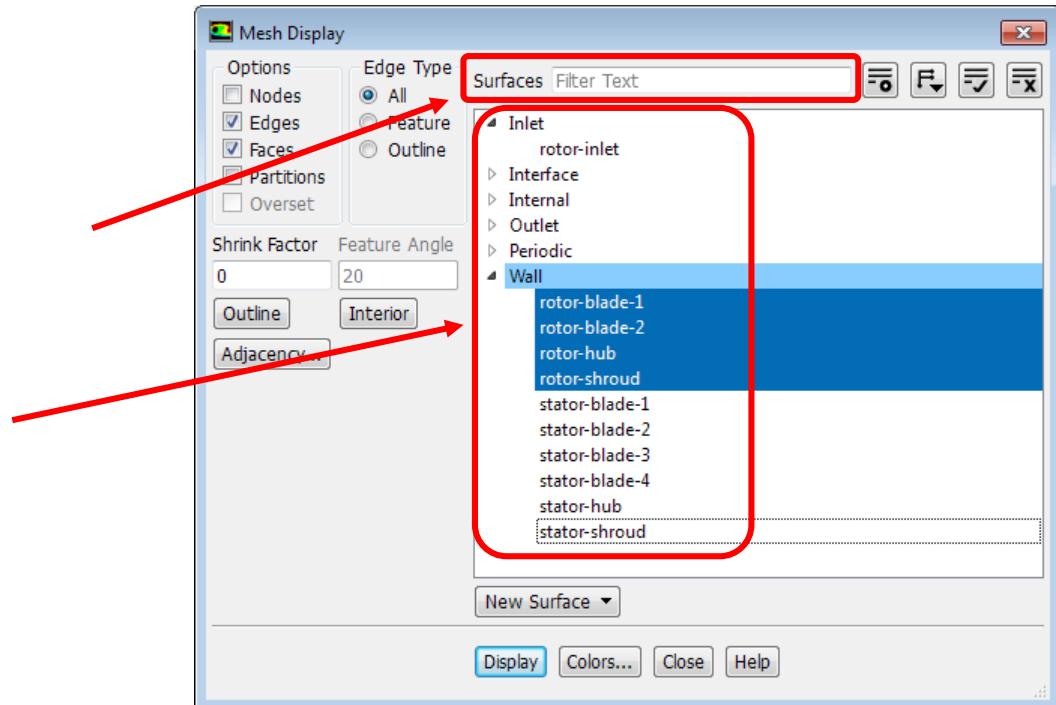
长列表的工作流程改进

添加过滤器

- Field variable lists
- Surface lists

项目分组

- Surface/Zone type
- Name



更强的后处理显示功能

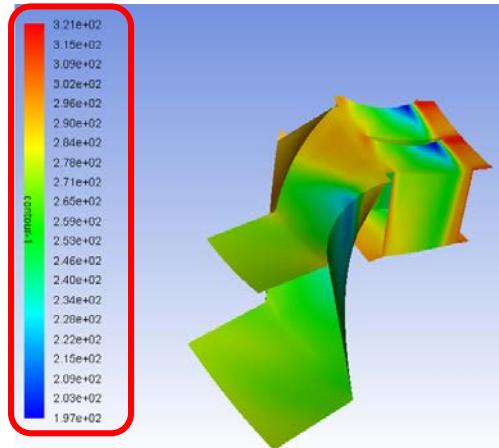
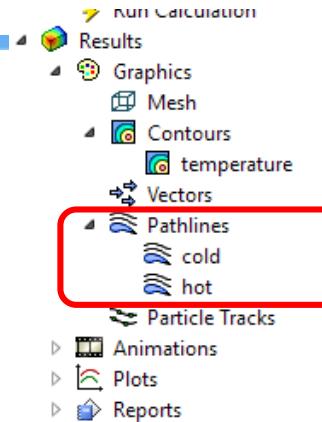
New Persistent Graphics Object types

- Mesh
- Pathline
- Particle Track
- Plot

Pathlines can now be plotted on arbitrary Eulerian phases.

Smooth contour option in addition to default banded

Legend for contours/vectors can be interactively resized and moved



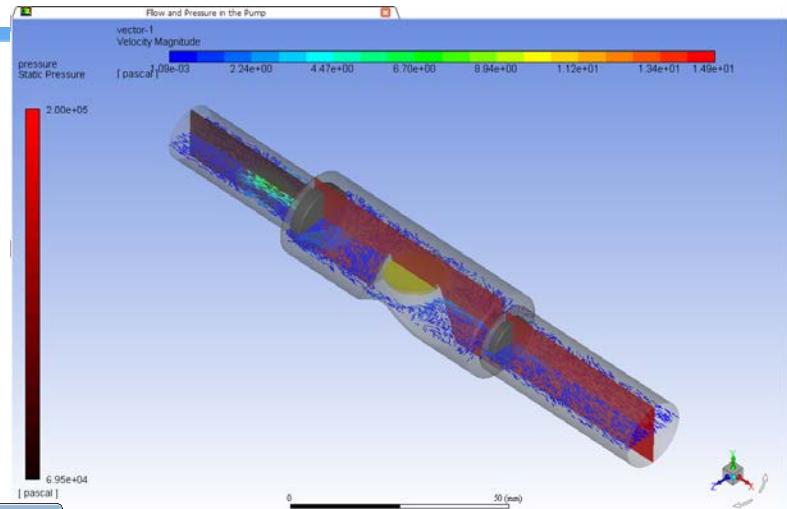
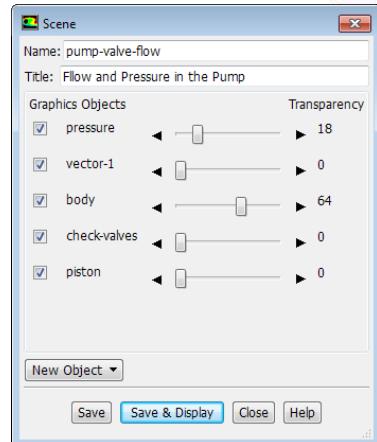
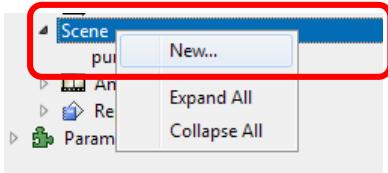
更轻松的构建复合图形显示

Easily display multiple types of graphics (mesh, contours, or vectors) without complex overlay workflow

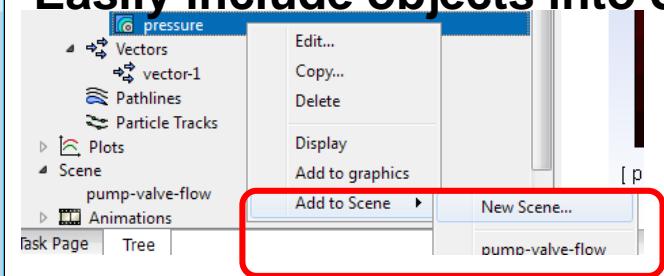
Easily apply / adjust transparency

Support for multiple colormaps for different solution quantities

Built on the concept of Graphics Objects.



Easily include objects into Scene



在求解过程中诊断并标记问题网格单元

Easily identify problematic cells during solution iteration

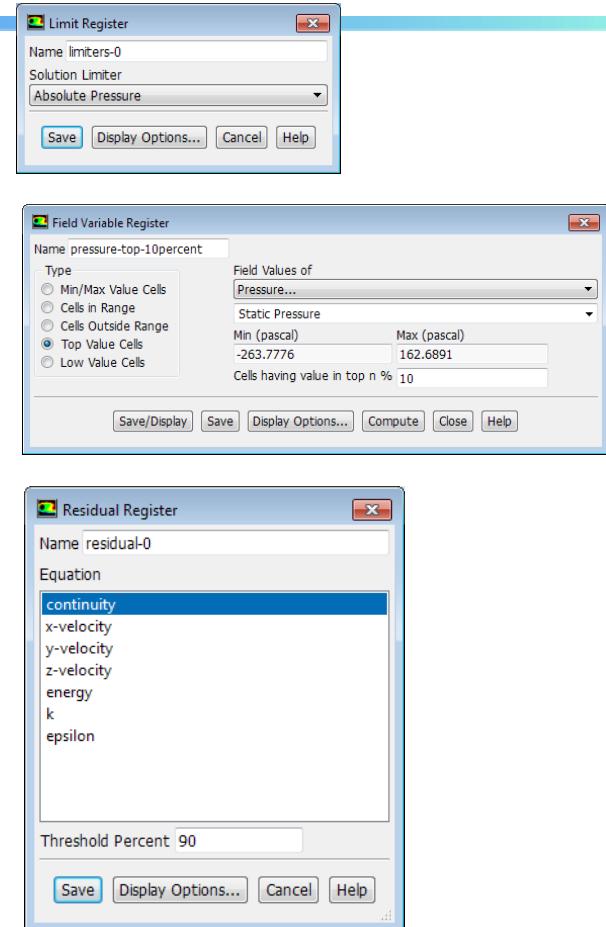
Use Cell Registers to mark cells according to solution criteria:

- Variable Limiter: Mark cells where selected solution variable has been limited by the solver
- Field Variable
 - Min- and Max-value cells
 - Cells with value inside or outside a range
 - Top / Bottom value cells (Cells whose value is > or < X% of the Min/Max)
- Residual: Mark cells where a given equation residual is above a threshold percentage of the maximum residual in the domain.

Registers are updated during solution and definitions are saved with case file

Registers are named objects in the tree and can be displayed, adapted, selected for poor-mesh numerics

- Display settings (color, symbol, etc.) are register-specific and persistent



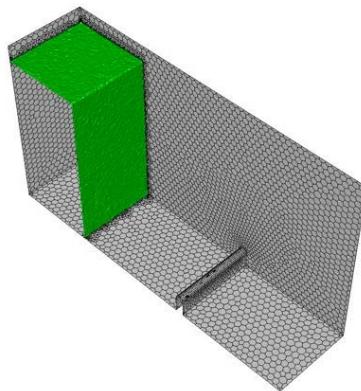
多面体网格自适应(BETA)

- Polyhedral Unstructured Mesh Adaption (PUMA) method
- Compatible with all cell types
- Refinement and coarsening supported

> /adapt/set/method

Adaption method (0 = Hanging-nodes)

JMA 3D) [2] 2

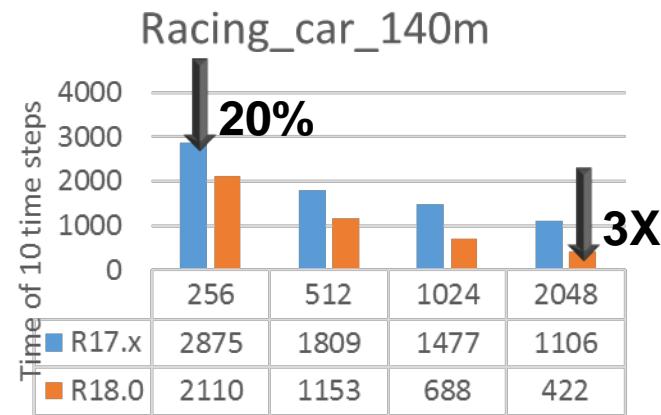
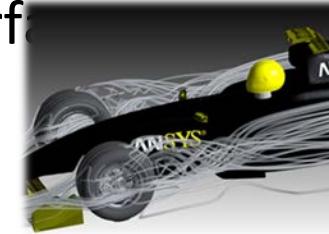


滑移交界面并行计算能力加强

- Large scalability improvements for sliding interface

• Results

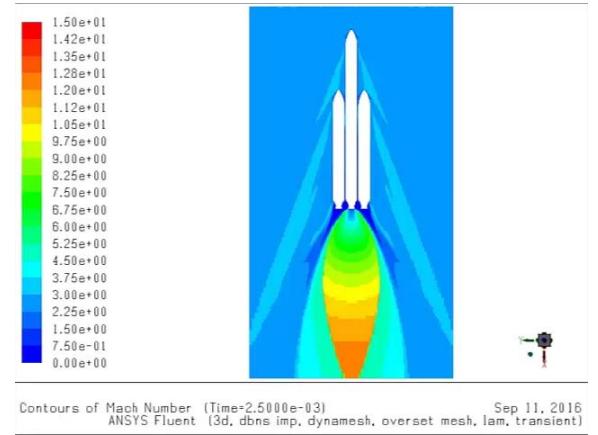
- Test case
 - 140 million hex-core cells
 - F1 car with 4 wheels as SI
- Close to 3X speedup at 2048 cores



Run on CRAY XE6

重叠网格功能扩展

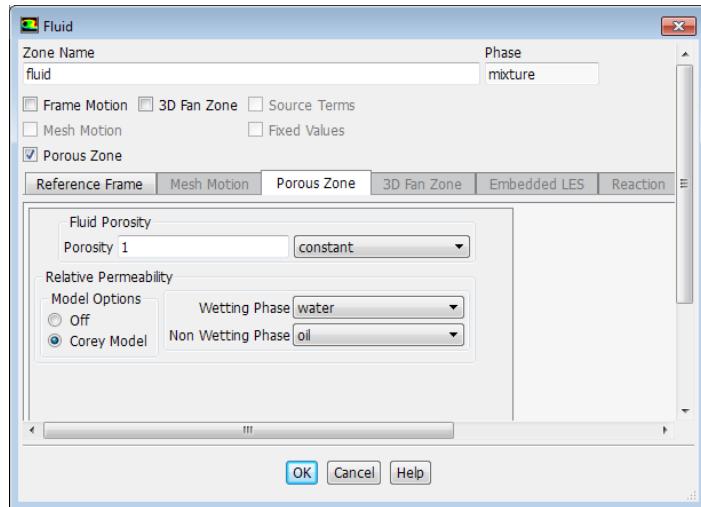
- Compatibility with density-based solver
 - Suitable for high Ma compressible flows
- Full support for compressible flow if using density-based solver
- 2nd order in time for stationary mesh zones
- Moving mesh zone compatibility (previously beta)
 - 1st order in time only
- Hybrid Initialization
 - Use Hybrid method by default in same scenarios as for non-overset cases
 - No longer necessary to set rpvar for interpolation method as in 17.2
- Performance improvements, particularly in parallel



Booster Separation with Ma=14 Engine Plume (Density-Based Solver)

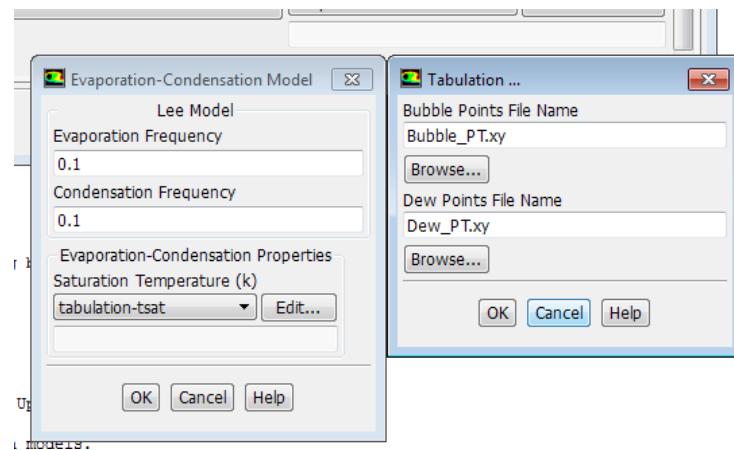
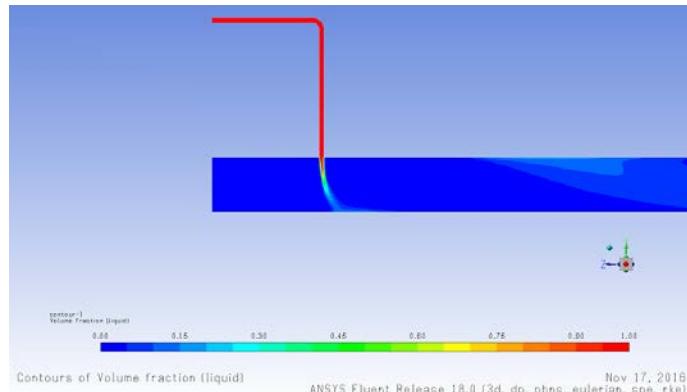
多孔介质中两相相对渗透率

- Corey model for 2-phase relative permeability (previously Beta)
- Any pair of phases may be chosen as wetting and non-wetting
- Other phases may be present but are not included in the formulation
- Target application: accurate simulation of water-oil displacement in reservoir production.



基于饱和线插值表的两相流相变 (Beta)

- For flashing and similar applications it is important to consider the composition-dependent bubble / dew point curves in the mass transfer model
- Previously this required UDFs. New option permits import of tabulated saturation curves for single components or binary mixtures



- Up to 20% speed-up for PDF combustion using real gas model
- Surface reactions can now be computed using the Chemkin-CFD solver in Fluent
- Limit list of species for boundary specification, and residual monitoring

ANSYS CFD新功能

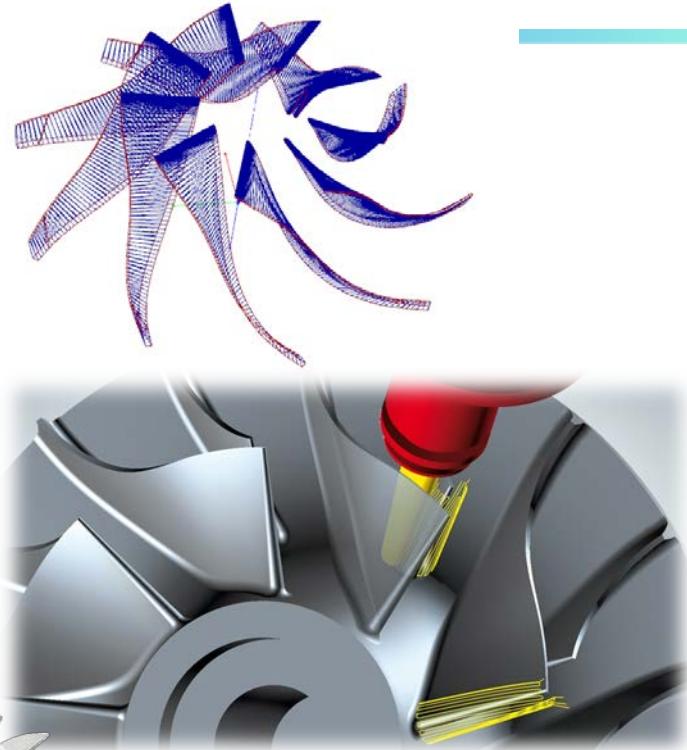
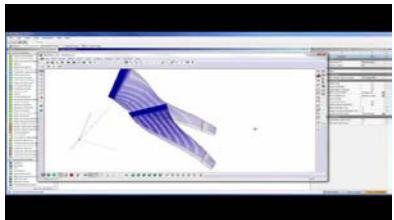
CFX

切削加工的叶片模型

New Flank Milled mode added to BladeModeler with controls for blade ruling line distributions

Introduced consistent geometry representation between tools for flank milled blades (design, aerodynamic analysis, mechanical analysis and manufacturing)

Customer impact: primarily automotive turbocharger and industrial compressor manufacturers



TurboGrid CAD Support

Available in 18.0

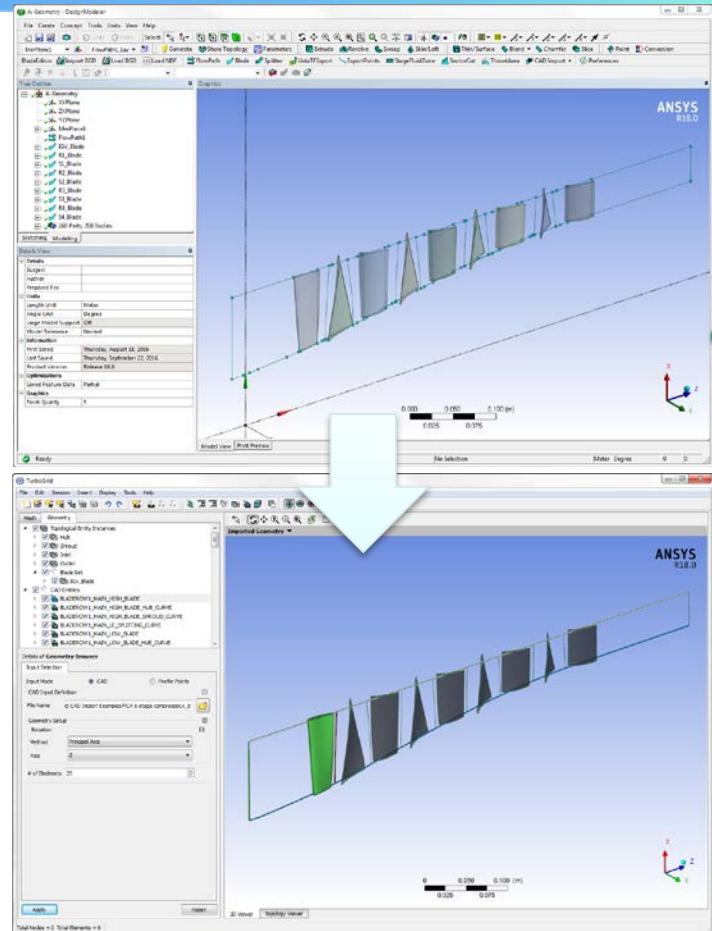
Improved fidelity and robustness by importing CAD models directly into TurboGrid

- BladeRow

R18.0 Capabilities

- Transfer via workbench schematic
 - BladeEditor (DM) exports underlying, native blade surfaces from and meridional flowpath in Parasolids format
 - Blade modifications via general DM features such as fillets are not currently transferred via schematic
 - BladeGen to TurboGrid connection still uses blade profile points
- Direct import
 - Supports Parasolids (.x_b, .x_t) and ICEM CFD Tetin (.tin)
 - User must assign faces and curves to appropriate turbo topology
 - Further refinements to come throughout 2017

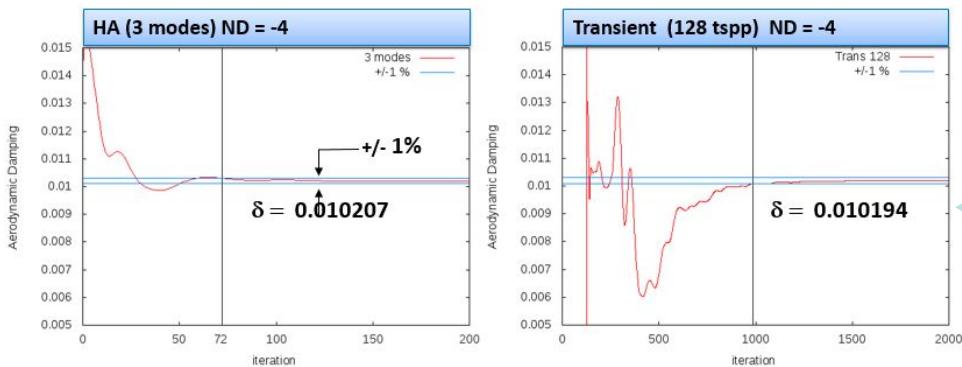
Customer impact: all BladeEditor/TurboGrid users



CFX Harmonic Analysis (HA)

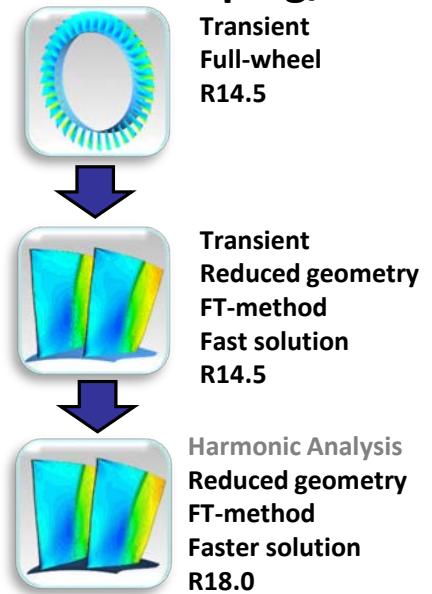
Release focus: Aeromechanics of blades

- Blade Flutter (1st use case under HA method)
- Fast solution to transient periodic flow 10x to 100x faster than transient time integration



Transient simulation can
take between 15 to 30
vibration cycle to
converge

Aerodamping/Flutter

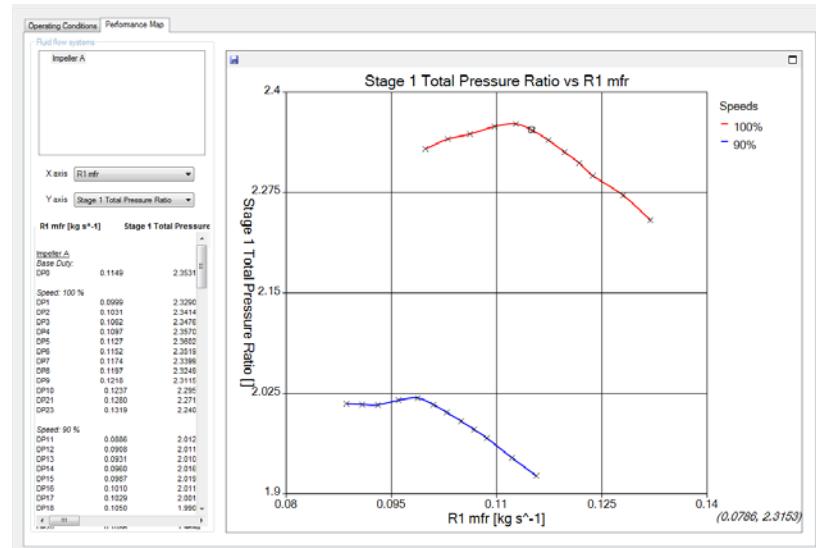


Turbo Performance Maps in Workbench

Provide easy setup for running turbo performance maps (multiple operating points)

Provide simple charting tool for viewing and comparing performance maps

Leverage Workbench DPs to automate concurrent solution of operating points



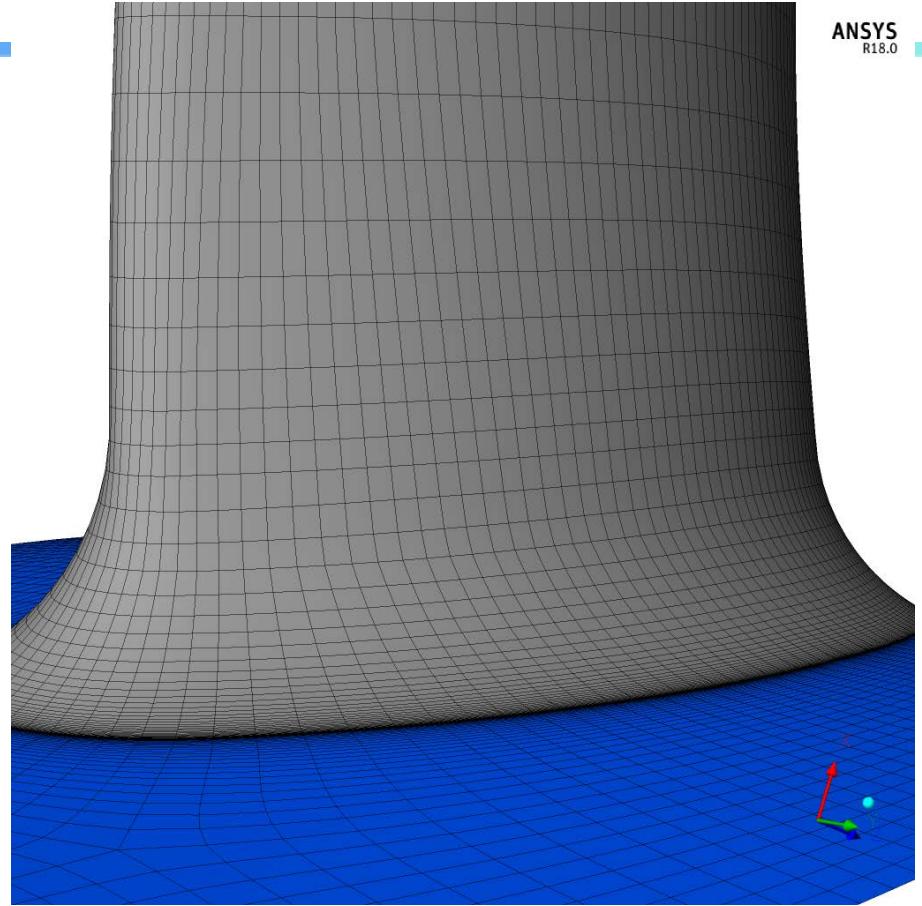
Fillets from CAD import

CAD surface imported and assigned to topology

Exact representation

High quality parameterization

High quality mesh



感谢聆听！