



仿真
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2017 ANSYS 用户技术大会

中国·烟台

Design Exploration 在大型商用空调机组减震器位置优化中的应用

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Contents

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 - ✓ Design Exploration in Isolator Location Optimization
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- Summary & Action in next 总结及展望

英格索兰亚太研发中心

- **Ingersoll Rand**

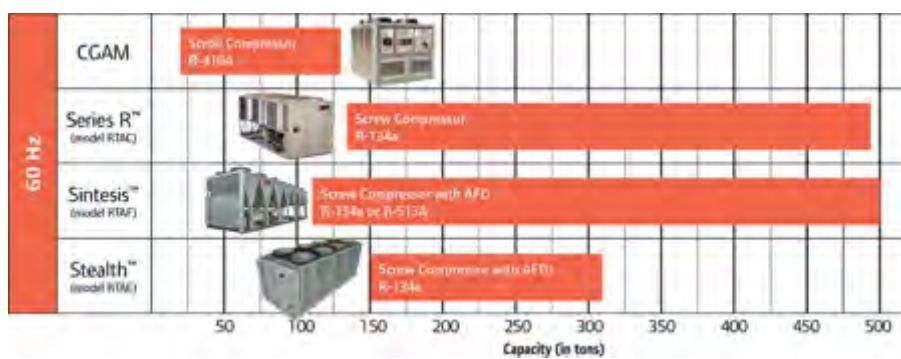
- 1871年成立, 1922年进入中国上海;
- 多元化的工业制造企业，其旗下品牌Trane, Thermo King, IR, Club Car.

- **ETC-AP**

- 400工程师，英格索兰全球最大工程技术中心；
- 研发能力基于暖通设备，向工业设备扩展.



Product Introduction - Air-cooled Chiller



主要用于商场，医院，酒店，工厂，数据中心

Background and problem



Figure 18. Isolator (good)



What is Design Exploration?

What is Design Exploration?

- **W** Design Exploration is a powerful approach used by DesignXplorer for designing and understanding the analysis

**ANSYS design exploration tools lead the way
to Simulation-Driven Product Development.**

Harness the power of parametric analysis to increase innovation
and improve the return on your simulation investment.



ANSYS Design Exploration

The screenshot shows the ANSYS Design Exploration interface. On the left is the Toolbox with various system categories. The 'Design Exploration' category is selected and highlighted with a red border. In the center is the Project Schematic window, which displays a hierarchical tree structure for a project named 'A'. The tree includes nodes for Static Structural, Engineering Data, Geometry, Model, Setup, Solution, Results, and Parameters. A blue arrow points from the 'Design Exploration' section in the Toolbox to the 'Parameters' node in the Project Schematic. To the right is a large panel titled 'Design Exploration' containing five listed methods, each with an associated icon:

- Direct Optimization
- Parameters Correlation
- Response Surface
- Response Surface Optimization
- Six Sigma Analysis

Below this panel is a teal bar with the text 'ANSYS Design Exploration'.

The slide is divided into six sections, each featuring a screenshot of a specific feature or tool within the ANSYS Design Exploration environment:

- Parameterized CAD:** Shows a screenshot of the CAD interface with a parameterized model and its corresponding parameters in the software's interface.
- Design of Experiments:** Shows a screenshot of the DOE interface, displaying a data table with experimental runs and response plots.
- Response Surface Methods:** Shows a 3D surface plot representing a response function.
- Sensitivity/Correlation Analysis:** Shows a screenshot of the interface for analyzing sensitivity and correlation, including a graph of a function and a heatmap.
- Optimization/Robust Design/Six Sigma:** Shows a screenshot of the optimization interface, featuring a 3D surface plot and a histogram.
- Report Generation:** Shows a screenshot of the report generation interface, displaying various charts and graphs.

Application of Design Exploration

- Parameterize analysis model

Input Parameters:	
<input checked="" type="checkbox"/>	Isolator location (A1)
P13	Iso_1
P14	Iso_2
P15	Iso_3
P16	Iso_4
P17	Iso_5
P18	Iso_6



Input parameter

Output Parameters:	
<input checked="" type="checkbox"/>	Iso_1A Maximum Y Axis
P23	Iso_2A Maximum Y Axis
P24	Iso_3A Maximum Y Axis
P25	Iso_4A Maximum Y Axis
P26	Iso_5A Maximum Y Axis
P27	Iso_6A Maximum Y Axis
P28	Iso_1B Maximum Y Axis
P29	Iso_2B Maximum Y Axis
P30	Iso_3B Maximum Y Axis
P31	Iso_4B Maximum Y Axis
P32	Iso_5B Maximum Y Axis
P33	Iso_6B Maximum Y Axis
P34	Iso_6B Maximum Y Axis



Output parameter

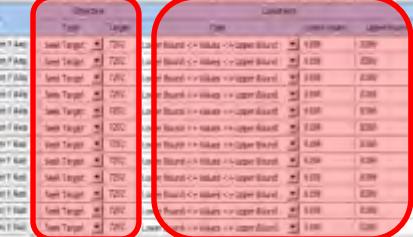
- Define optimization

- Objective
- Constraints
- Domain

Outline of Schematic B2: Optimization			
	A	B	C
1		Enabled	Monitoring
2	<input checked="" type="checkbox"/> Optimization		
3	<input checked="" type="checkbox"/> Objectives and Constraints		
16	<input checked="" type="checkbox"/> Domain		
29	<input checked="" type="checkbox"/> Raw Optimization Data		
30	<input checked="" type="checkbox"/> Results		

Name	Lower Bound	Upper Bound
P13 - Iso_1 (mm)	700	945
P14 - Iso_2 (mm)	1300	3000
P15 - Iso_3 (mm)	3000	4200
P16 - Iso_4 (mm)	4200	5245
P17 - Iso_5 (mm)	5545	7945
P18 - Iso_6 (mm)	8150	9300

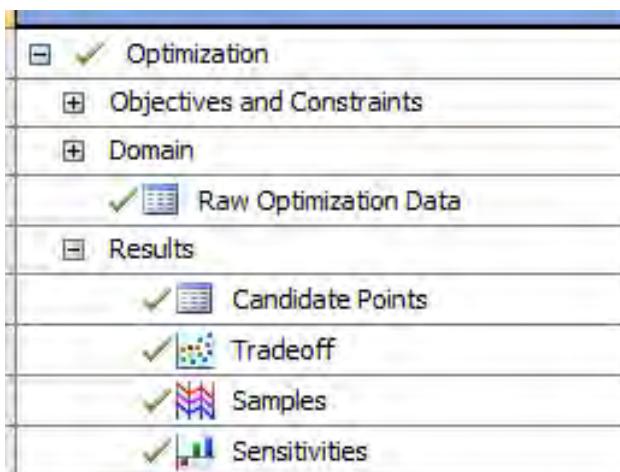
Object	Type	Target	Value	Unit
Isolator P23 = T23(200 * 0.001) + P23_1 * 0.001	Soft Target	700	700	mm
Isolator P24 = T24(200 * 0.001) + P24_1 * 0.001	Soft Target	1300	1300	mm
Isolator P25 = T25(200 * 0.001) + P25_1 * 0.001	Soft Target	3000	3000	mm
Isolator P26 = T26(200 * 0.001) + P26_1 * 0.001	Soft Target	4200	4200	mm
Isolator P27 = T27(200 * 0.001) + P27_1 * 0.001	Soft Target	5545	5545	mm
Isolator P28 = T28(200 * 0.001) + P28_1 * 0.001	Soft Target	8150	8150	mm
Isolator P29 = T29(200 * 0.001) + P29_1 * 0.001	Soft Target	9300	9300	mm
Isolator P30 = T30(200 * 0.001) + P30_1 * 0.001	Soft Target	700	700	mm
Isolator P31 = T31(200 * 0.001) + P31_1 * 0.001	Soft Target	1300	1300	mm
Isolator P32 = T32(200 * 0.001) + P32_1 * 0.001	Soft Target	3000	3000	mm
Isolator P33 = T33(200 * 0.001) + P33_1 * 0.001	Soft Target	4200	4200	mm
Isolator P34 = T34(200 * 0.001) + P34_1 * 0.001	Soft Target	5545	5545	mm
Isolator P35 = T35(200 * 0.001) + P35_1 * 0.001	Soft Target	8150	8150	mm
Isolator P36 = T36(200 * 0.001) + P36_1 * 0.001	Soft Target	9300	9300	mm



YS

Application of Design Exploration

- Optimization results



Candidate Points

Table of Schematic S2: Optimization - Candidate Points

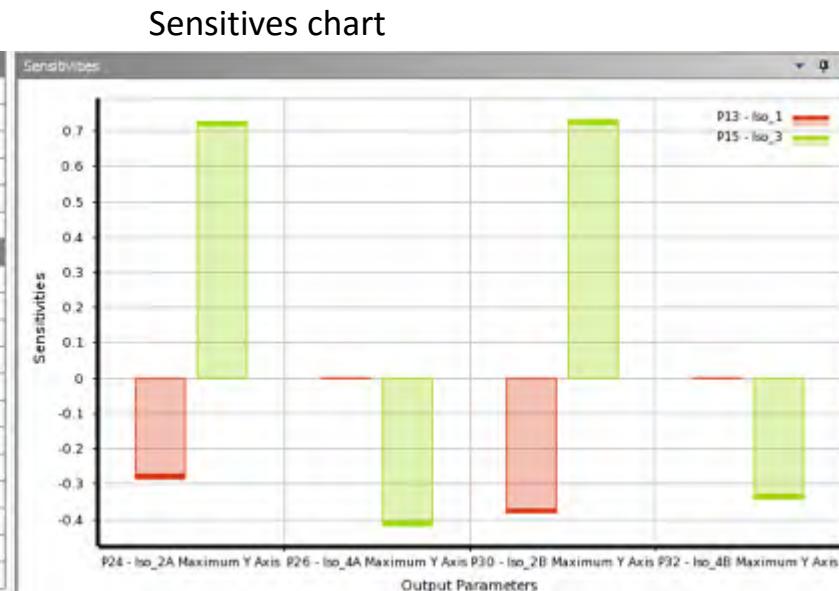
	A	B	C	D	E	F	G	H	
1	Reference	Name	P13 - Iso_1 (mm)	P14 - Iso_2 (mm)	P15 - Iso_3 (mm)	P16 - Iso_4 (mm)	P17 - Iso_5 (mm)	P18 - Iso_6 (mm)	
2									
3		Candidate Point 1	DP 228	927.5	3654.6	3803.5	5162	6584.7	8221.4

Input Parameters

P13 - Iso_1	<input checked="" type="checkbox"/>
P14 - Iso_2	<input type="checkbox"/>
P15 - Iso_3	<input checked="" type="checkbox"/>
P16 - Iso_4	<input type="checkbox"/>
P17 - Iso_5	<input type="checkbox"/>
P18 - Iso_6	<input type="checkbox"/>

Output Parameters

P23 - Iso_1A Maximum Y Axis	<input type="checkbox"/>
P24 - Iso_2A Maximum Y Axis	<input checked="" type="checkbox"/>
P25 - Iso_3A Maximum Y Axis	<input type="checkbox"/>
P26 - Iso_4A Maximum Y Axis	<input checked="" type="checkbox"/>
P27 - Iso_5A Maximum Y Axis	<input type="checkbox"/>
P28 - Iso_6A Maximum Y Axis	<input type="checkbox"/>
P29 - Iso_1B Maximum Y Axis	<input type="checkbox"/>
P30 - Iso_2B Maximum Y Axis	<input checked="" type="checkbox"/>
P31 - Iso_3B Maximum Y Axis	<input type="checkbox"/>
P32 - Iso_4B Maximum Y Axis	<input checked="" type="checkbox"/>
P33 - Iso_5B Maximum Y Axis	<input type="checkbox"/>
P34 - Iso_6B Maximum Y Axis	<input type="checkbox"/>



Summary & Action

- Application of Design Exploration

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Line weight location optimization

Line design optimization

ANSYS



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感谢聆听

