



Realize Your Product Promise™

ANSYS DesignXplorer 15.0 P3



Fluid Dynamics

Structural Mechanics

Electromagnetics

Systems and Multiphysics

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DesignXplorer (DX)

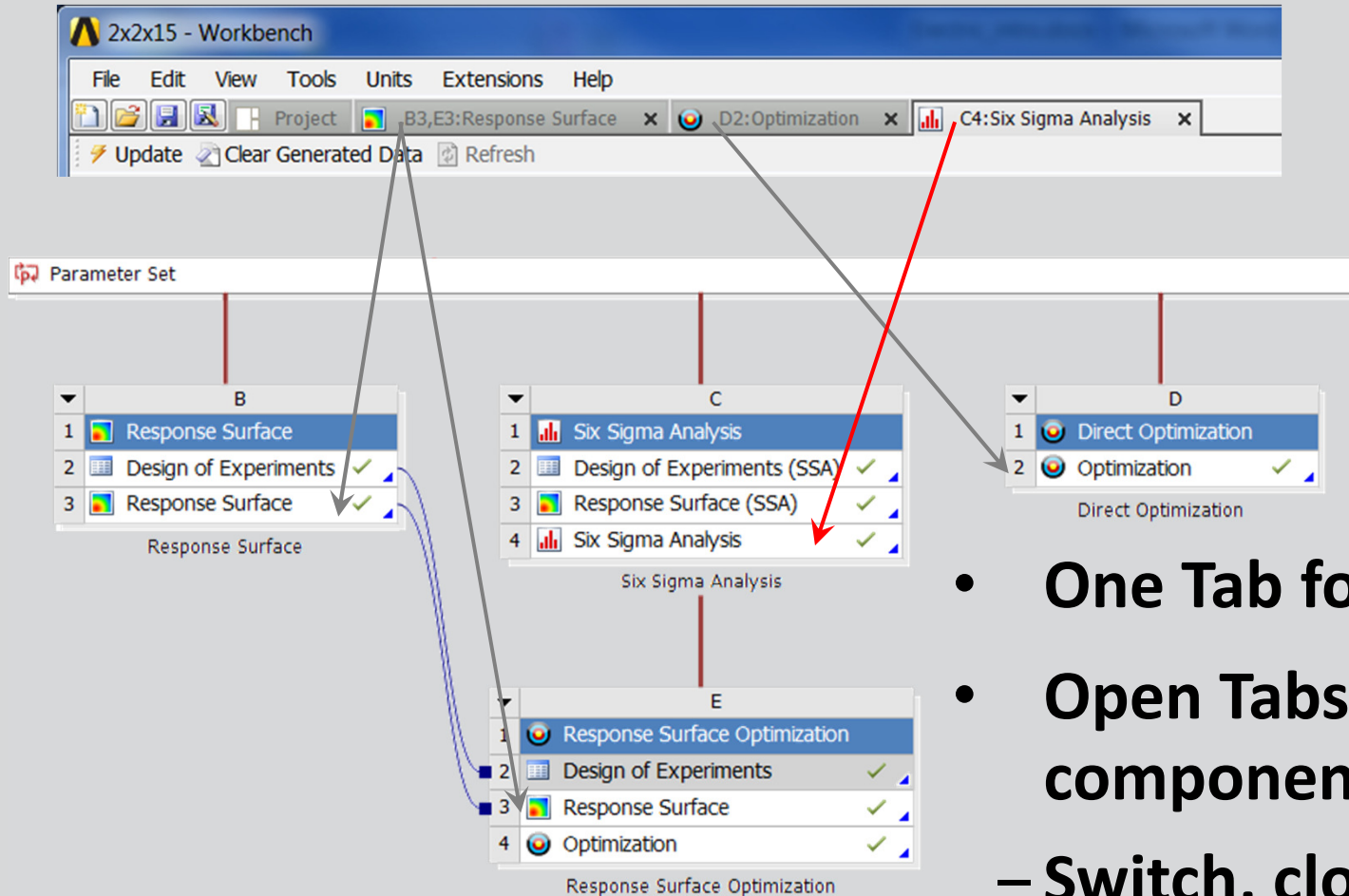
R 15 Development Themes



- **Open** Optimization Platform
- Parameter **relationships**
- Usability enhancements
 - **Enhance** current optimization toolset
 - Remove road blocks, improve efficiency, robustness, ease of use, etc.

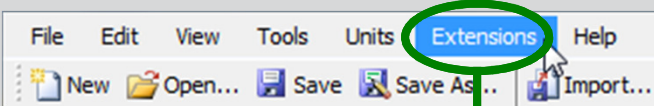


- New Workbench tabs



- One Tab for the project
- Open Tabs for each DX component
 - Switch, close or rearrange tabs

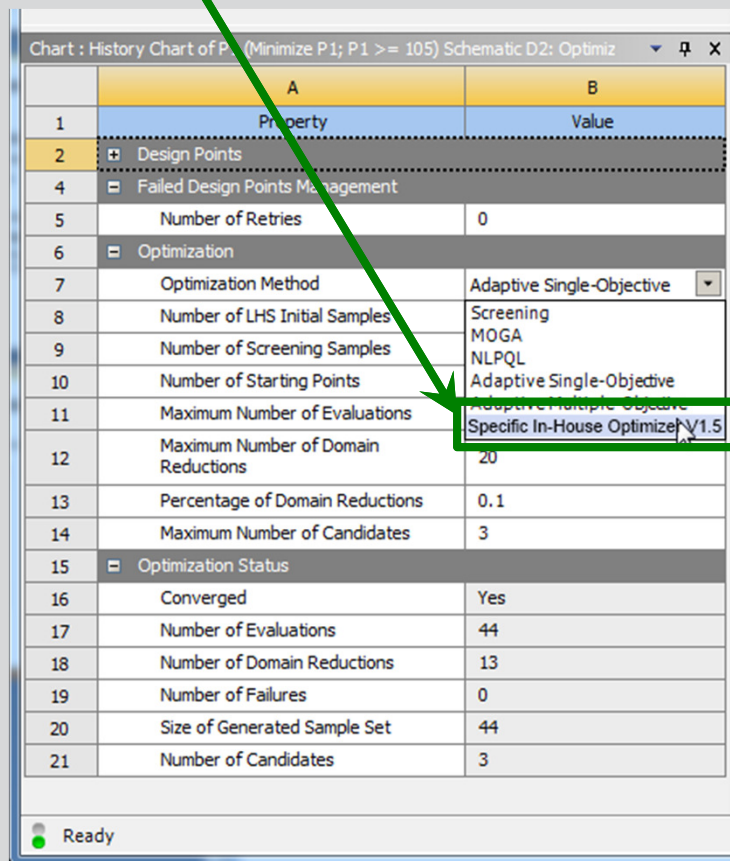
Open Optimization Platform



- **Activate extension**



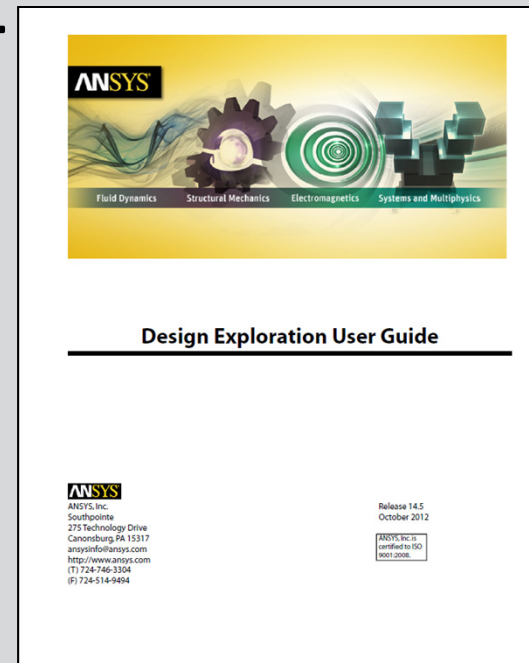
- **Settings & status from the external optimizer**



- **Select external method**

Open Optimization Platform

- Uses the **ANSYS Customization Toolkit (ACT)**
- Hookup is XML & Python, but optimization algorithm can be Python, C/C++, C#, Fortran, etc.
- DX extracts all **results** to generate post-processing tables and charts, including history charts, etc.
- Well **Documented**
 - <http://support.ansys.com/documentation>
 - ACT Developers Guide & Reference Guide
 - Design Exploration User Guide



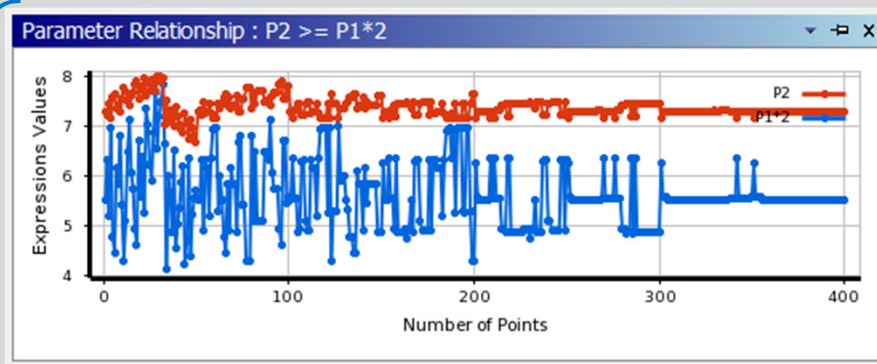
Parameter Relationship Constraints

File View Tools Units Extensions Help			
Project C2:Optimization x			
Update Clear Generated Data Refresh			
Outline of Schematic C2: Optimization			
	A	B	C
1		Enabled	Monitoring
2	✓ Optimization		
3	Objectives and Constraints		
4	Minimize P5		
5	P6 >= 0		
6	P7 >= 0		
7	P8 >= 0		
8	P9 >= 0		
9	P10 >= 0		
10	P11 >= 0		
11	Domain		
12	Microsoft Office Excel (A1)		
13	P1 - a_1	✓	
14	P2 - a_2	✓	
15	P3 - force		
16	P4 - h		
17	Parameter Relationships		
18	P1 <= P2	✓	
19	P2 >= P1*2	✓	
20	✓ Raw Optimization Data		
21	✓ Convergence Criteria		
22	Results		
23	✓ Candidate Points		
24	✓ Tradeoff		
25	✓ Samples		

Can define **relationships** to define which combinations of parameters are permitted.

This example will only permit design points where $P2 \geq P1 * 2$

- Direct and RS Optimization
- Screening, MOGA, NLPQL, MISQP and Adaptive Multiple Objective



Optimization Enhancements

- **Enhanced Algorithms**
– AMO, ASO and MOGA
- **Progress monitoring**

2x2x15 - Workbench

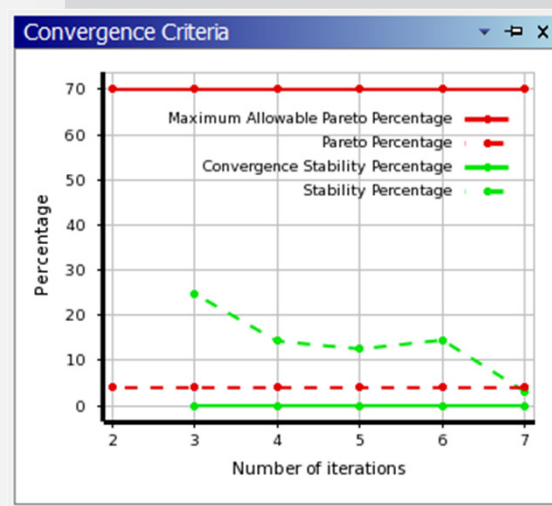
File Edit View Tools Units Extensions Help

Project D2:Optimization C4:Six Sigma Analysis

Update Clear Generated Data Refresh

Outline of Schematic D2: Optimization

	A	B	C
1		Enabled	Monitoring
2	✓ Optimization		
3	▢ Objectives and Constraints		
4	Maximize P3		
5	Maximize P4		
6	▢ Domain		
7	Microsoft Office Excel (A1)		
8	P1 - WB_X	✓	
9	P2 - WB_Y	✓	
10	▢ Parameter Relationships		
11	P2 ≤ P1	✓	
12	✓ Raw Optimization Data		
13	✓ Convergence Criteria		
14	▢ Results		
15	✓ Candidate Points		
16	✓ Tradeoff		
17	✓ Samples		
18	✓ Sensitivities		

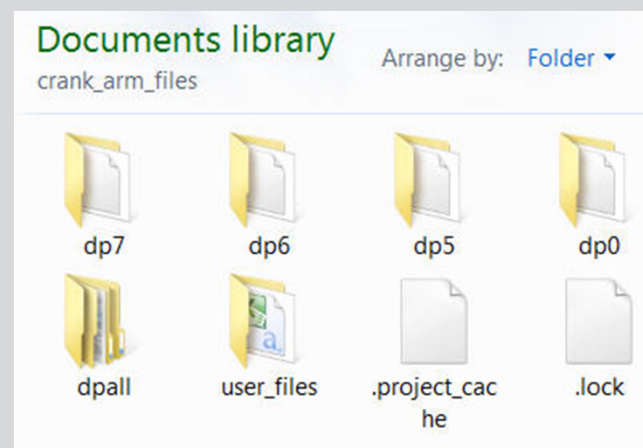


Retained Data

- Added (Beta) option to the Table of Design Points so you can choose which design points are retained...

	A	B	C	D	E	F	G	H	I	J	K
1	Name	P2 - ds_web	P5 - Mesh Element Size	P6 - Cylinde...	P1 - 1st Frequency Mode In Range Frequency	P3 - Mesh Nodes	P4 - Mesh Min	P7 - Solid Mass	<input type="checkbox"/> Retained	Retained Data	Note
2	Units		m	mm	Hz			kg			
3	DP 0(Current)	20	0.01	80	243.22	32922	0.061653	25.353	<input checked="" type="checkbox"/>	✓	
4	DP 1	15	0.01	80	162.59	32587	0.059233	25.353	<input type="checkbox"/>		Generated from Design of Experiments
5	DP 2	15	0.025	80	163.04	10864	0.019215	25.353	<input type="checkbox"/>		Generated from Design of Experiments
6	DP 3	15	0.04	80	164.24	6752	0.059665	24.539	<input type="checkbox"/>		Generated from Design of Experiments
7	DP 4	20	0.01	80	243.27	32494	0.061224	25.353	<input type="checkbox"/>		Generated from Design of Experiments
8	DP 5	20	0.025	80	244.89	11043	0.041881	25.353	<input checked="" type="checkbox"/>	✓	Generated from Design of Experiments
9	DP 6	20	0.04	80	245.47	6815	0.059978	25.353	<input checked="" type="checkbox"/>	✓	Generated from Design of Experiments
10	DP 7	25	0.01	80	331.11	32484	0.061224	26.167	<input checked="" type="checkbox"/>	✓	Generated from Design of Experiments
11	DP 8	25	0.025	80	332.15	11189	0.055102	25.353	<input type="checkbox"/>		Generated from Design of Experiments
12	DP 9	25	0.04	80	334.54	6884	0.050767	25.353	<input type="checkbox"/>		Generated from Design of Experiments

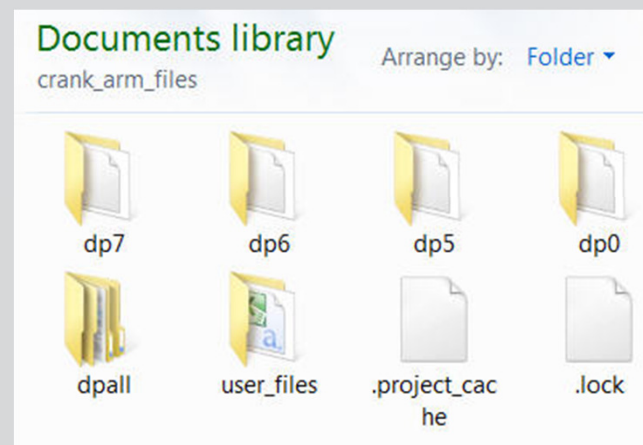
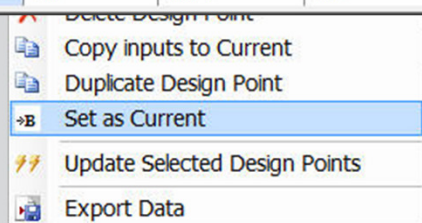
- Currently, this option is controlled by an Environment Variable



Retained Data

- You can change a design point to current with a simple right click selection, and since the files are already in the project, it happens instantly.

Table of Design Points											
	A	B	C	D	E	F	G	H	I	J	K
1	Name	P2 - ds_web	P5 - Mesh Element Size	P6 - Cylinde...	P1 - 1st Frequency Mode In Range Frequency	P3 - Mesh Nodes	P4 - Mesh Min	P7 - Solid Mass	<input type="checkbox"/> Retained	Retained Data	Note
2	Units		m	mm	Hz			kg			
3	DP 0	20	0.01	80	243.22	32922	0.061653	25.353	<input checked="" type="checkbox"/>	✓	
4	DP 1	15	0.01	80	162.59	32587	0.059233	25.353	<input type="checkbox"/>		Generated from Design of Experiments
5	DP 2	15	0.025	80	163.04	10864	0.019215	25.353	<input type="checkbox"/>		Generated from Design of Experiments
6	DP 3	15	0.04	80	164.24	6752	0.059665	24.539	<input type="checkbox"/>		Generated from Design of Experiments
7	DP 4	20	0.01	80	243.27	32494	0.061224	25.353	<input type="checkbox"/>		Generated from Design of Experiments
8	DP 5(Current)	20	0.025	80	244.89	11043	0.041881	25.353	<input checked="" type="checkbox"/>	✓	Generated from Design of Experiments
9	DP 6	20	0.04	80	245.47	6815	0.059978	25.353	<input checked="" type="checkbox"/>	✓	Generated from Design of Experiments
10	DP 7	25	0.01	80	331.11	32484	0.061224	26.167	<input checked="" type="checkbox"/>	✓	Generated from Design of Experiments
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12	DP 9	25	0.04	80	334.54	6884	0.050767	25.353	<input type="checkbox"/>		Generated from Design of Experiments



Design Point indication

Table of Schematic B2: Design of Experiments (Central Composite Design : Auto Defined)

	A	B	C	D	E	F
1	Name	P2 - ds_web	P5 - Mesh Element Size (m)	P1 - 1st Frequency Mode In Range Frequency (Hz)	P3 - Mesh Nodes	P4 - Mesh Min
2	1 (DP 5)	20	0.025	⚡	⚡	⚡
3	2 (DP 2)	15	0.025	163.04	10864	0.019215
4	3 (DP 8)	25	0.025	⚡	⚡	⚡
5	4 (DP 4)	20	0.01	⚡	⚡	⚡
6	5 (DP 6)	20	0.04	⚡	⚡	⚡
7	6 (DP 1)	15	0.01	162.59	32587	0.059233
8	7 (DP 7)	25	0.01	⚡	⚡	⚡
9	8 (DP 3)	15	0.04	⚡	⚡	⚡
10	9 (DP 9)	25	0.04	⚡	⚡	⚡

- Each row in the table of design points, etc. will show which design point it was built from...

- Candidates also include Design Point numbers so you can easily access the preserved files

Table of Schematic C2: Optimization

	A	B	C	D
1	Optimization Study			
2	Seek P1 = 200 Hz	Goal, Seek P1 = (Default Importance)		
3	Optimization Method			
4	Adaptive Single-Objective	The Adaptive Single-Objective method is a gradient-based algorithm to provide a refined, global, optimization result. It supports a single objective, multiple constraints and aims at finding the global optimum. It is limited to continuous input parameters.		
5	Configuration	Find 3 candidates in a maximum of 40 evaluations and 20 domain reductions.		
6	Status	Not Converged because the Maximum Number of Evaluation is reached.		
7	Candidate Points			
8		Candidate Point 1 (DP 55)	Candidate Point 2 (DP 81)	Candidate Point 3 (DP 51)
9	P2 - ds_web	16.901	17.016	17.7
10	P6 - CylinderExtrude_Half (mm)	75.31	76.524	83.057
11	P1 - 1st Frequency Mode In Range Frequency (Hz)	★★★ 200	★★★ 199.99	★★★ 200.03

Optimization Enhancements

- **Keep things simple with the option to hide (or show) advanced options**
- **Increased control for optimization algorithms (new options)**
 - Additional stopping criteria, etc.

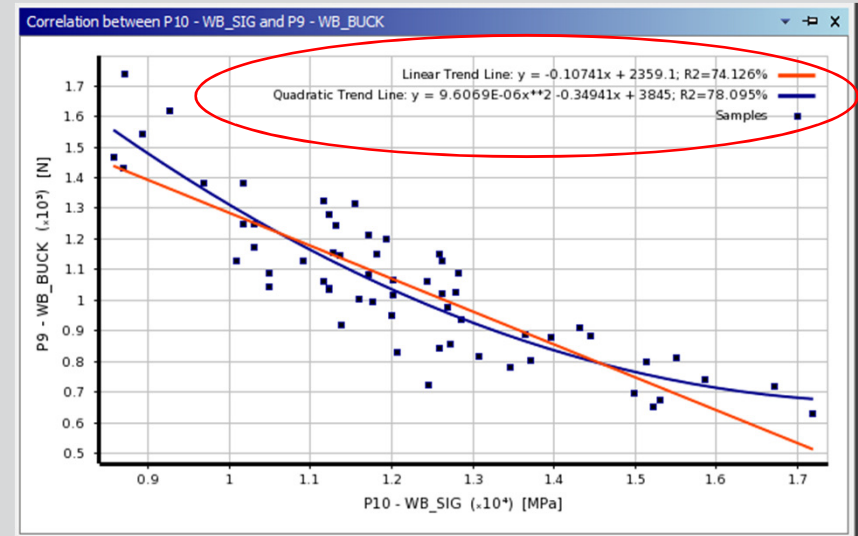
Adaptive Single Objective

Properties of Outline : Method			Properties of Outline : Method		
	A	B		A	B
1	Property	Value	1	Property	Value
2	[-] Design Points		2	[-] Design Points	
3	Preserve Design Points After DX Run	<input type="checkbox"/>	3	Preserve Design Points After DX Run	<input type="checkbox"/>
4	[-] Failed Design Points Management		4	[-] Failed Design Points Management	
5	Number of Retries	0	5	Number of Retries	0
6	[-] Optimization		6	[-] Optimization	
7	Method Name	Adaptive Single-Objective	7	Method Name	Adaptive Single-Objective
8	Number of Initial Samples	6	8	Number of Initial Samples	6
9	Maximum Number of Evaluations	60	9	Random Seed Generator	0
10	Convergence Tolerance	1E-06	10	Maximum Number of Cycles	10
11	Maximum Number of Candidates	3	11	Number of Screening Samples	200
12	[-] Optimization Status		12	Number of Starting Points	6
13	Converged	Yes	13	Maximum Number of Evaluations	60
14	Number of Evaluations	13	14	Maximum Number of Domain Reductions	20
15	Number of Domain Reductions	1	15	Percentage of Domain Reductions	0.1
16	Number of Failures	0	16	Convergence Tolerance	1E-06
17	Size of Generated Sample Set	13	17	Retained Domain per Iteration (%)	40
18	Number of Candidates	3	18	Maximum Number of Candidates	3
			19	[-] Optimization Status	
			20	Converged	Yes
			21	Number of Evaluations	13
			22	Number of Domain Reductions	1
			23	Number of Failures	0
			24	Size of Generated Sample Set	13
			25	Number of Candidates	3

Adaptive Multiple Objective

Properties of Outline A2: Method		
	A	B
	Property	Value
1	Property	Value
2	[-] Design Points	
3	Preserve Design Points After DX Run	<input type="checkbox"/>
4	[-] Failed Design Points Management	
5	Number of Retries	0
6	[-] Optimization	
7	Method Name	Adaptive Multiple-Objective
8	Type of Initial Sampling	Screening
9	Number of Initial Samples	50
10	Number of Samples Per Iteration	25
11	Maximum Allowable Pareto Percentage	70
12	Convergence Stability Percentage	0
13	Maximum Number of Iterations	7
14	Mutation Probability	0.01
15	Crossover Probability	0.98
16	Maximum Number of Candidates	3
17	[-] Optimization Status	
18	Converged	No
19	Pareto Percentage	4
20	Stability Percentage	3.7545
21	Number of Iterations	7
22	Number of Evaluations	75
23	Number of Failures	0
24	Size of Generated Sample Set	25
25	Number of Candidates	3

- Equations for Correlation Trend lines
- Added “Do not Show Again” checkbox to DX popup dialogs
- Released “Export Data” operation for the Workbench Table of Design Points



General Enhancements

- **Project Reporting for Direct Optimization systems**
- **Ability to exceed the recommended number of parameters for some DOE types.**
 - If more than 20 input parameters are defined, it will warn the user but allow them to continue
 - CCD and Box Behnken are still limited
- **Certification**
 - Windows 8
 - Remote Display Support for Windows Remote Desktop and OpenText Exceed
- **Fixed defects**

