

Definitive Screening Designs

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Definitive Screening Designs

- A class of statistically designed experiments that may be used for both screening and optimization.
- Handle both quantitative and categorical factors.
- Quantitative factors are run at 3 levels, which allows the estimation of both linear and quadratic effects.
- First described by Bradley Jones and Christopher Nachtsheim in a 2011 article in the Journal of Quality Technology.

Properties

1. The required number of runs is very small, usually between 1 and 3 more than twice the number of factors.
2. Main effects are independent of two-factor interactions.
3. Two-factor interactions are not perfectly confounded with other two-factor interactions, although they are correlated.
4. For continuous factors, all of the quadratic effects can be estimated.
5. Quadratic effects are orthogonal to linear main effects and only partially confounded with two-factor interactions.
6. For designs involving 6 through 12 factors, the full second-order model can be estimated for any 3 or less factors.

DOE Wizard

- The Statgraphics DOE Wizard provides DSDs for any combination of 4 to 16 factors.
- Both blocked and unblocked designs are available.

Example #1

- Optimization of a chemical reaction from Statistics for Experimenters by Box, Hunter and Hunter (2005).
- Response variable Y: *percent reacted*
- Experimental factors:
 - X1: *feed rate*
 - X2: *amount of catalyst*
 - X3: *agitation rate*
 - X4: *temperature*
 - X5: *concentration*

Step 1: Define Responses

Design of Experiments Wizard - Define Responses X

Design file: <untitled>

Comment:

Number of responses:

Response	Name	Units	Analyze	Goal	Target	Impact (1-5)	Sensitivity	Minimum	Maximum
1	reacted	%	Mean	Maximize	0.5	3.0	Medium	80	100
2	Var_2		Mean	Maximize	0.5	3.0	Medium		
3	Var_3		Mean	Maximize	0.5	3.0	Medium		
4	Var_4		Mean	Maximize	0.5	3.0	Medium		
5	Var_5		Mean	Maximize	0.5	3.0	Medium		
6	Var_6		Mean	Maximize	0.5	3.0	Medium		
7	Var_7		Mean	Maximize	0.5	3.0	Medium		
8	Var_8		Mean	Maximize	0.5	3.0	Medium		
9	Var_9		Mean	Maximize	0.5	3.0	Medium		
10	Var_10		Mean	Maximize	0.5	3.0	Medium		
11	Var_11		Mean	Maximize	0.5	3.0	Medium		
12	Var_12		Mean	Maximize	0.5	3.0	Medium		
13	Var_13		Mean	Maximize	0.5	3.0	Medium		
14	Var_14		Mean	Maximize	0.5	3.0	Medium		
15	Var_15		Mean	Maximize	0.5	3.0	Medium		
16	Var_16		Mean	Maximize	0.5	3.0	Medium		

Step 2: Define Experimental Factors

Design of Experiments Wizard - Define Factors X

Design file: dsd.sgx

Comment:

Number of controllable process factors: Number of controllable mixture components: Number of noise factors:

Factor	Name	Units	Type	Role	Low	High	Levels
A	<input type="text" value="feed rate"/>	<input type="text" value="liters/min"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>	Controllable	<input type="text" value="10.0"/>	<input type="text" value="15.0"/>	<input type="text" value="10.0,15.0"/>
B	<input type="text" value="catalyst"/>	<input style="font-size: small; font-family: monospace;" type="text" value="%"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>	Controllable	<input type="text" value="1.0"/>	<input type="text" value="2.0"/>	<input type="text" value="1.0,2.0"/>
C	<input type="text" value="agitation"/>	<input type="text" value="rpm"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>	Controllable	<input type="text" value="100.0"/>	<input type="text" value="120.0"/>	<input type="text" value="100.0,120.0"/>
D	<input type="text" value="temperature"/>	<input type="text" value="degrees"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>	Controllable	<input type="text" value="140.0"/>	<input type="text" value="180.0"/>	<input type="text" value="140.0,180.0"/>
E	<input type="text" value="concentration"/>	<input style="font-size: small; font-family: monospace;" type="text" value="%"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>	Controllable	<input type="text" value="3.0"/>	<input type="text" value="6.0"/>	<input type="text" value="3.0,6.0"/>
F	<input type="text" value="Factor_F"/>	<input type="text"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
G	<input type="text" value="Factor_G"/>	<input type="text"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
H	<input type="text" value="Factor_H"/>	<input type="text"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
I	<input type="text" value="Factor_I"/>	<input type="text"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
J	<input type="text" value="Factor_J"/>	<input type="text"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
K	<input type="text" value="Factor_K"/>	<input type="text"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
L	<input type="text" value="Factor_L"/>	<input type="text"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
M	<input type="text" value="Factor_M"/>	<input type="text"/>	<input type="text" value="Continuous"/> <input type="button" value="▼"/>		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>

Total for controllable mixture components:

Step 3: Select Design

Design of Experiments Wizard - Select Design

Design file: dsd.sgx

Comment: Definitive screening design for 5 factors

Robust Parameter Design

- Combined array
- Crossed array

	Segment	Factors	Runs	Blocks	Design
Options...	Process factors	5	0	0	Press the Options button.
Options...	Mixture components	0	0	0	
Options...		0	0	0	
	COMBINED	5			

Designs for Continuous or Two-Level Factors

Design Class

- Screening
- Response Surface
- Multilevel Factorial
- Orthogonal Array
- Computer Generated

OK Cancel Help

BLOCK	feed rate liters/min	temperature degrees	concentration %
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OK Cancel Rerandomize Constraints Help

Step 3: Select Design (cont.)

Design of Experiments Wizard - Select Design

Design file: dsd.sgx

Comment: Definitive screening design for 5 factors

Robust Parameter Design

- Combined array
- Crossed array

Segment	Factors	Runs	Blocks	Design
Options... Process factors	5	0	0	Press the Options button.
Options... Mixtu				
Options... COM				

BLOCK

centration %

Screening Design Selection

Name	Runs	Resolution	Error d.f.	Block Size	
Factorial	2 ⁵	32	V+	16	32
Factorial	2 ⁵	32	V+	16	32
Factorial in 2 blocks	2 ⁵	32	V+	15	16
Factorial in 4 blocks	2 ⁵	32	V+	13	8
Factorial in 8 blocks	2 ⁵	32	IV*	11	4
Factorial in 16 blocks	2 ⁵	32	IV*	11	2
Half fraction	2 ⁵⁻¹	16	V	0	16
Irregular fraction	2 ^{5+3/8}	12	~IV	1	12
Quarter fraction	2 ⁵⁻²	8	III	0	8
Mixed level fraction	3*2 ⁴⁻¹	24	~V	7	24
Mixed level fraction	3*2 ⁴⁻²	12	~IV	1	12
Half fraction in 2 blocks	2 ⁵⁻¹	16	IV*	0	8
Definitive screening design	13	IV	0	13	
Blocked definitive screening design	13	IV	0	7	
User-specified design					

Display Blocked Designs

OK Cancel Back Help

OK Cancel Rerandomize Constraints Help

Step 3: Select Design (cont.)

Design of Experiments Wizard - Select Design

Design file: dsd.sgx

Comment: Definitive screening design for 5 factors

Robust Parameter Design

- Combined array
- Crossed array

Options...	Segment	Factors	Runs	Blocks	Design
Options...	Process factors	5	0	1	Definitive screening design
Options...	Mixture components	0	0	0	
Options...		0			
	COMBINED	5			

Definitive Screening Design Options

Centerpoints

Number: 3

Placement

- Random
- Spaced
- First
- Last

Replicate Design

Number: 0

Randomize

OK Cancel Help

OK Cancel Rerandomize Constraints Help

Step 3: Select Design (cont.)

Design of Experiments Wizard - Select Design

Design file: dsd.sgx

Comment: Definitive screening design for 5 factors

Robust Parameter Design

- Combined array
- Crossed array

Options...	Segment	Factors	Runs	Blocks	Design
Options...	Process factors	5	16	1	Definitive screening design
Options...	Mixture components	0	0	0	
Options...		0	0	0	
	COMBINED	5	16	1	Samples per run: 1

BLOCK	feed rate liters/min	catalyst %	agitation rpm	temperature degrees	cncentration %
1 1	15.0	1.0	100.0	180.0	4.5
2 1	10.0	1.0	110.0	180.0	6.0
3 1	15.0	1.0	120.0	140.0	6.0
4 1	10.0	2.0	120.0	140.0	4.5
5 1	12.5	1.0	100.0	140.0	3.0
6 1	12.5	2.0	120.0	180.0	6.0
7 1	12.5	1.5	110.0	160.0	4.5
8 1	12.5	1.5	110.0	160.0	4.5
9 1	10.0	1.5	100.0	140.0	6.0
10 1	15.0	1.5	120.0	180.0	3.0
11 1	12.5	1.5	110.0	160.0	4.5
12 1	12.5	1.5	110.0	160.0	4.5
13 1	10.0	1.0	120.0	160.0	3.0
14 1	10.0	2.0	100.0	180.0	3.0
15 1	15.0	2.0	100.0	160.0	6.0
16 1	15.0	2.0	110.0	140.0	3.0

OK Cancel Rerandomize Constraints Help

Step 4: Specify Model

DOE Wizard Model Options

Process Factors Model

- Mean
- Linear (Main Effects)
- 2-Factor Interactions
- Quadratic
- Cubic

Mixture Components Model

- Mean
- Linear
- Quadratic
- Special Cubic
- Cubic

Include:

- A: feed rate
- B: catalyst
- C: agitation
- D: temperature
- E: concentration
- AA
- BB
- CC
- DD
- EE

Exclude:

- AB
- AC
- AD
- AE
- BC
- BD
- BE
- CD
- CE
- DE

OK

Cancel

Help

Step 5: Select Runs

- Not required since the design already has the desired number of runs. This step is used for a computer generated design (such as a D-optimal design) when a subset of a large set of candidate runs needs to be selected.

Step 6: Evaluate Design

ANOVA Table

Source	D.F.
Model	10
Total Error	5
Lack-of-fit	2
Pure error	3
Total (corr.)	15

Step 6: Evaluate Design (cont.)

Model Coefficients

				<i>Power at</i>	<i>Power at</i>	<i>Power at</i>
<i>Coefficient</i>	<i>Standard Error</i>	<i>VIF</i>	<i>Ri-Squared</i>	<i>SN = 0.5</i>	<i>SN = 1.0</i>	<i>SN = 2.0</i>
constant	0.494152			7.01%	13.19%	37.52%
A	0.316228	1.0	0.0	9.96%	25.18%	71.61%
B	0.316228	1.0	0.0	9.96%	25.18%	71.61%
C	0.316228	1.0	0.0	9.96%	25.18%	71.61%
D	0.316228	1.0	0.0	9.96%	25.18%	71.61%
E	0.316228	1.0	0.0	9.96%	25.18%	71.61%
AA	0.646997	1.56977	0.362963	6.17%	9.74%	24.28%
BB	0.646997	1.56977	0.362963	6.17%	9.74%	24.28%
CC	0.646997	1.56977	0.362963	6.17%	9.74%	24.28%
DD	0.646997	1.56977	0.362963	6.17%	9.74%	24.28%
EE	0.646997	1.56977	0.362963	6.17%	9.74%	24.28%

alpha = 5.0%, sigma estimated from total error with 5 d.f.

Step 6: Evaluate Design (cont.)

Alias Matrix

Effect	AB	AC	AD	AE	BC	BD	BE	CD	CE	DE
constant	0.1163	-0.1163	0.1163	-0.1163	0.1163	-0.1163	0.1163	0.1163	-0.1163	0.1163
A										
B										
C										
D										
E										
AA	0.1628	-0.1628	0.1628	-0.1628	-0.8372	-1.1628	-0.8372	-0.8372	-1.1628	-0.8372
BB	0.1628	-1.1628	-0.8372	0.8372	0.1628	-0.1628	0.1628	-0.8372	0.8372	1.1628
CC	-0.8372	-0.1628	1.1628	0.8372	0.1628	0.8372	1.1628	0.1628	-0.1628	-0.8372
DD	-0.8372	0.8372	0.1628	-1.1628	1.1628	-0.1628	-0.8372	0.1628	0.8372	0.1628
EE	1.1628	0.8372	-0.8372	-0.1628	-0.8372	0.8372	0.1628	1.1628	-0.1628	0.1628

Step 6: Evaluate Design (cont.)

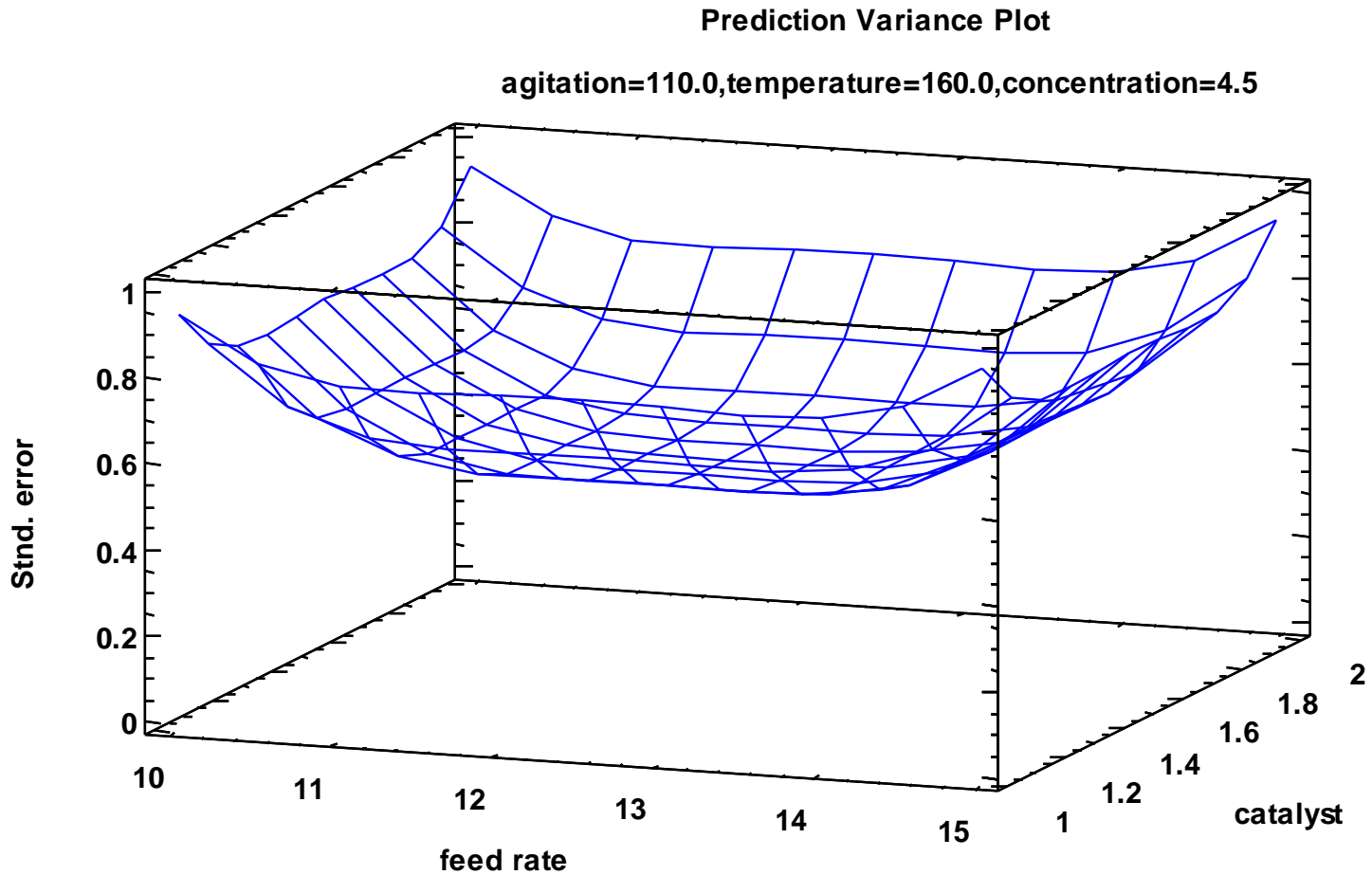
Correlation Matrix

	A	B	C	D	E	AA	BB	CC	DD	EE
A	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
B	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AA	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.4667	0.4667	0.4667	0.4667
BB	0.0000	0.0000	0.0000	0.0000	0.0000	0.4667	1.0000	0.4667	0.4667	0.4667
CC	0.0000	0.0000	0.0000	0.0000	0.0000	0.4667	0.4667	1.0000	0.4667	0.4667
DD	0.0000	0.0000	0.0000	0.0000	0.0000	0.4667	0.4667	0.4667	1.0000	0.4667
EE	0.0000	0.0000	0.0000	0.0000	0.0000	0.4667	0.4667	0.4667	0.4667	1.0000

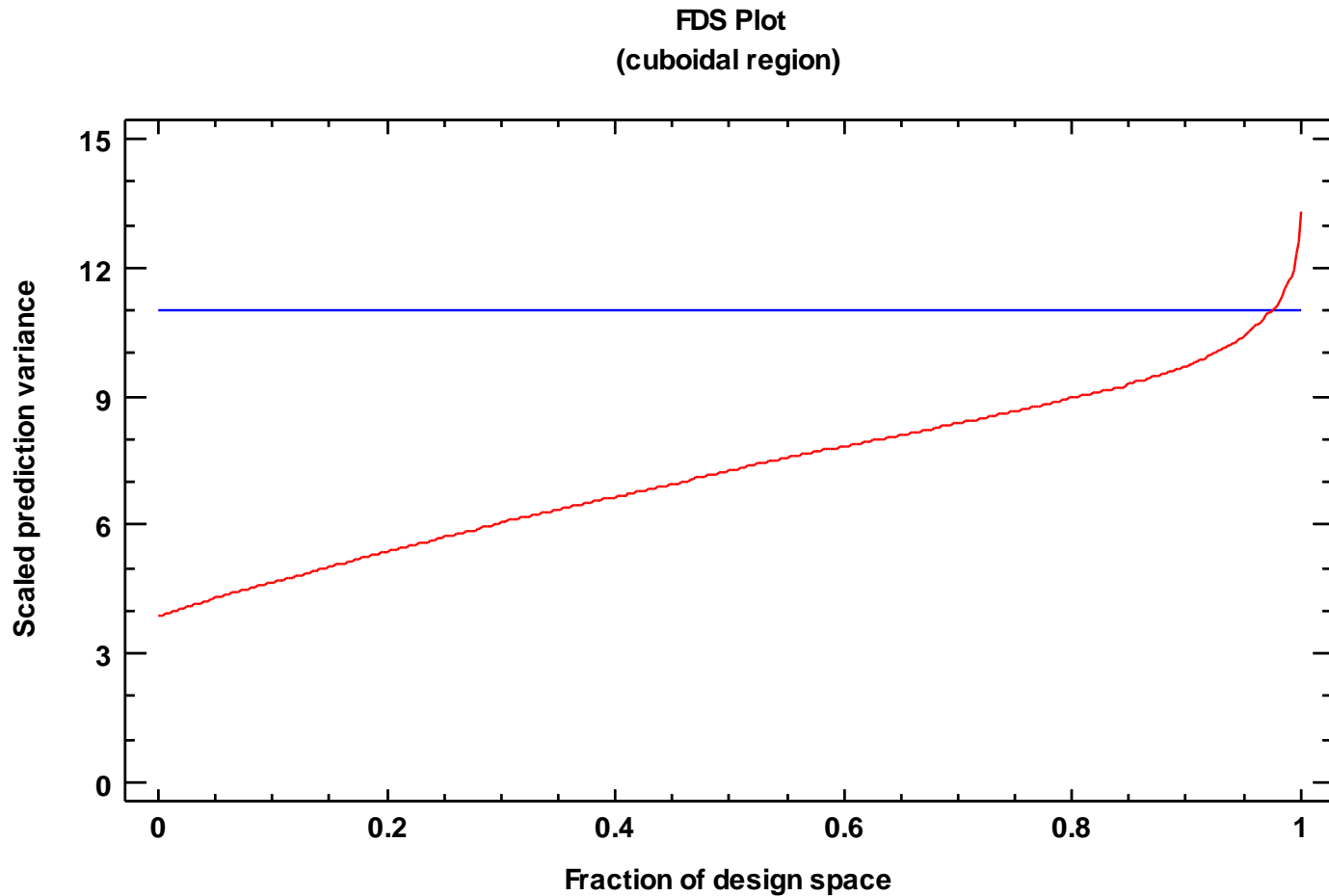
Step 6: Evaluate Design (cont.)

15	feed rate											
10												
2				catalyst								
1												
120				agitation								
100												
180							temperature					
140												
6										concentration		
3												

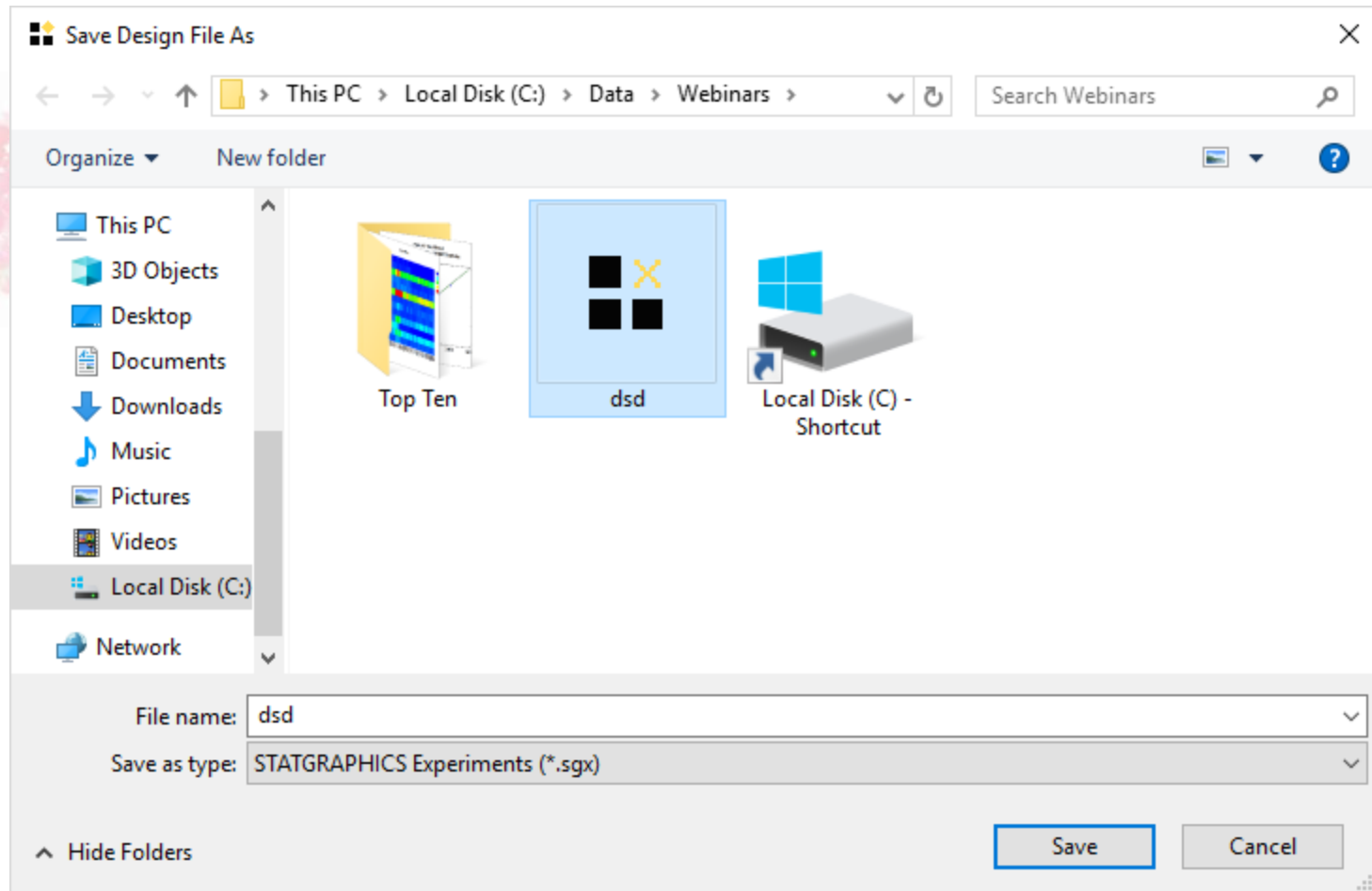
Step 6: Evaluate Design (cont.)



Step 6: Evaluate Design (cont.)



Step 7: Save Experiment



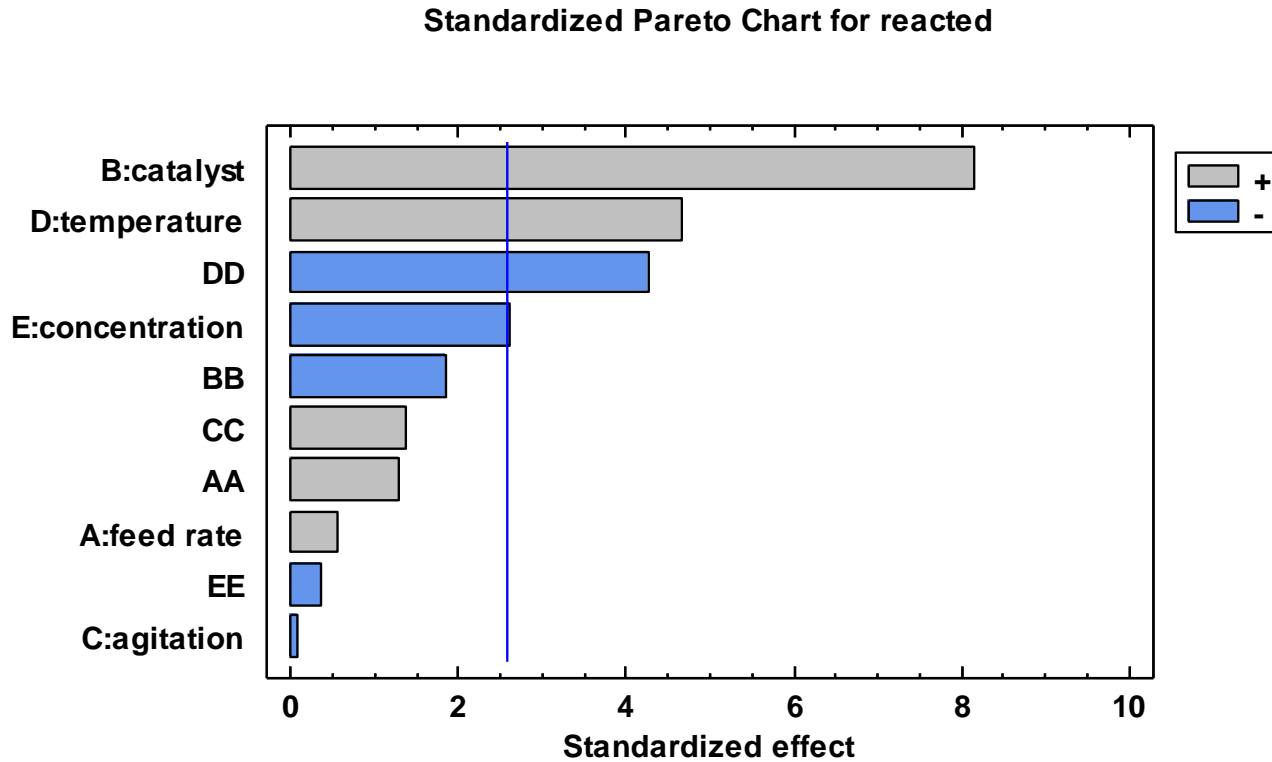
Step 8: Analyze Experiment

Design of Experiments Wizard - Analyze Data

Response reacted

Transformation	Power	Addend
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0
None	1.0	0

Pareto Chart of Effects



Collapse Design

Exclude Effects Options

Include:

- B: catalyst
- BB
- BD
- BE
- D: temperature
- DD
- DE
- E: concentration
- EE

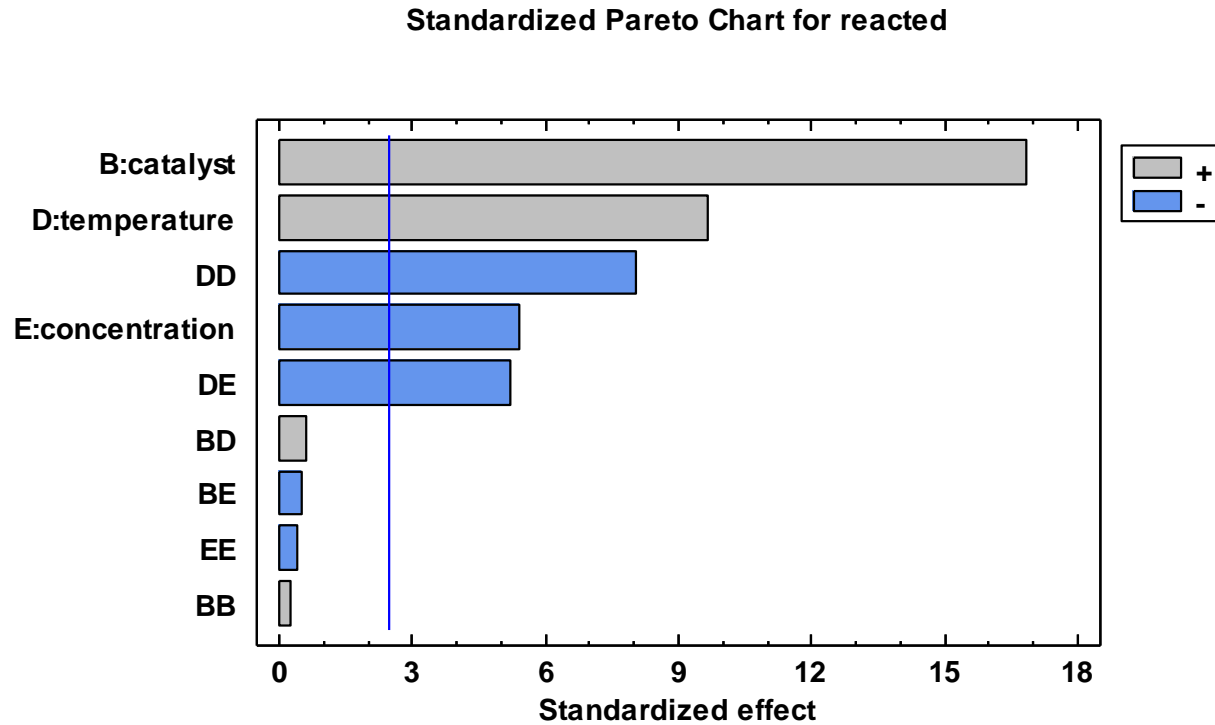
Exclude:

- A: feed rate
- AA
- AB
- AC
- AD
- AE
- BC
- C: agitation
- CC
- CD
- CE

Ignore Block Numbers

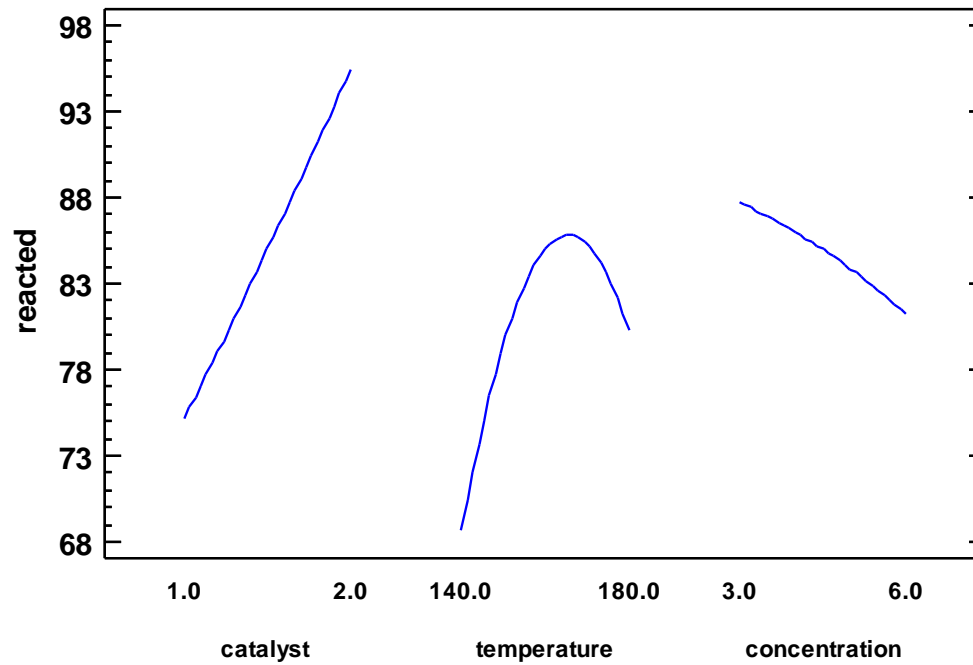
OK Cancel Help

Pareto Chart for Collapsed Design



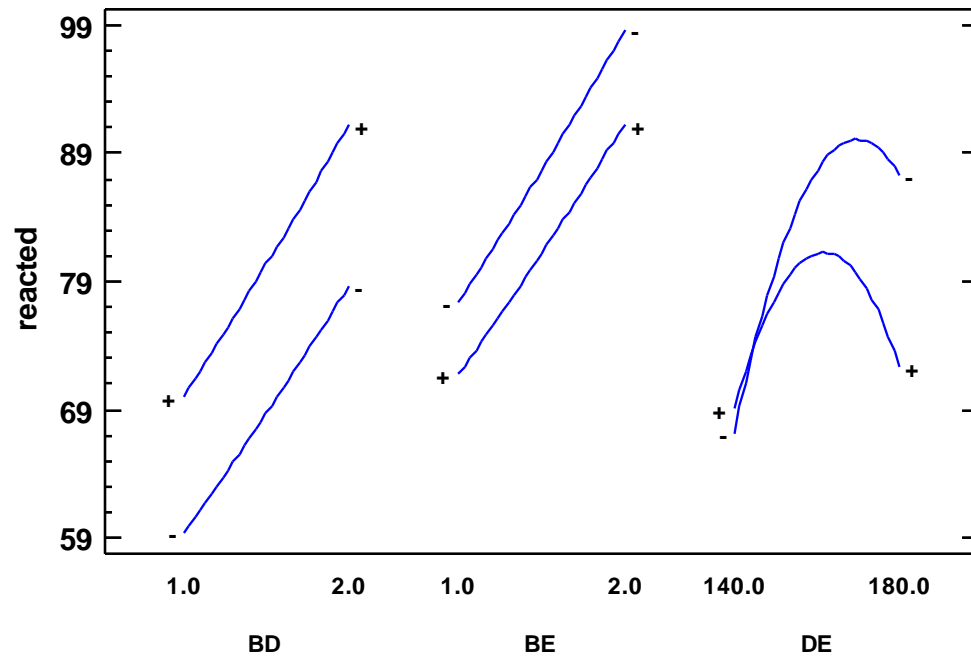
Main Effects Plot

Main Effects Plot for reacted



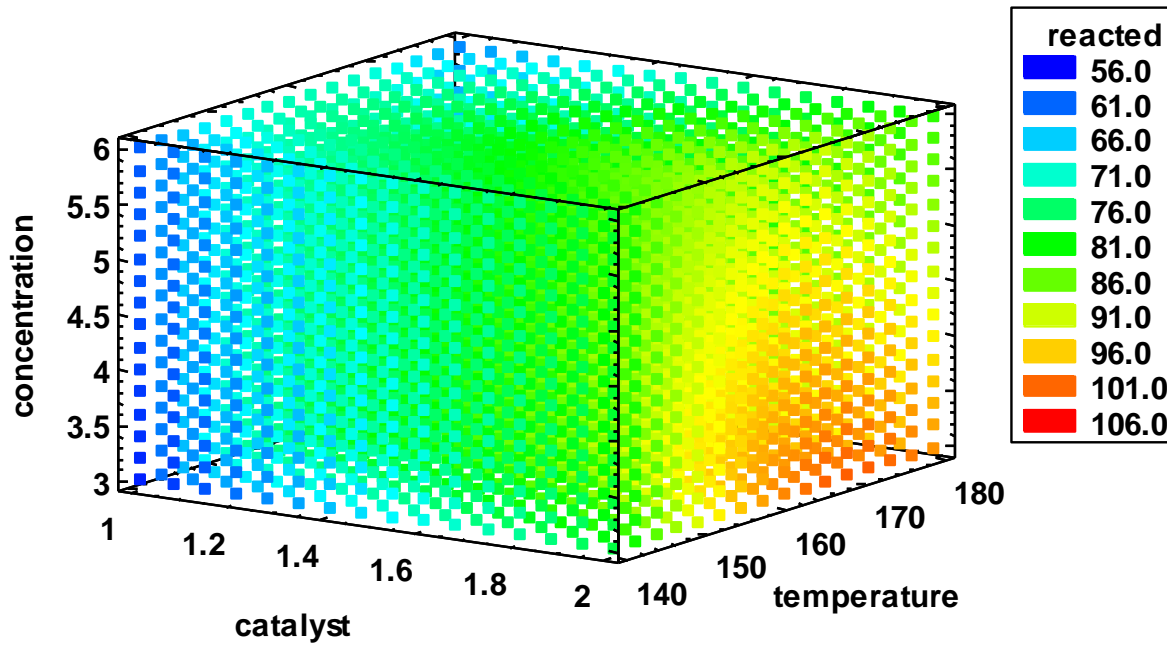
Interactions Plot

Interaction Plot for reacted

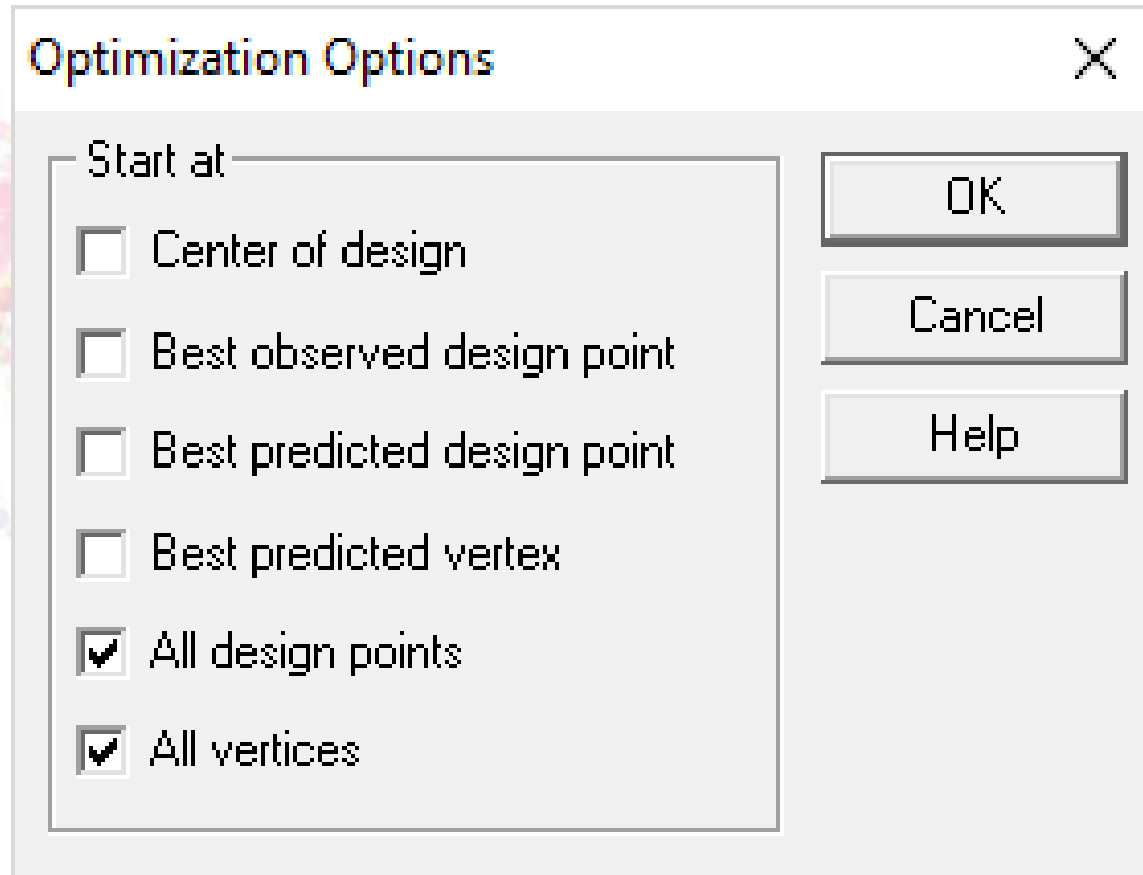


Mesh Plot

Estimated Response Surface Mesh
feed rate=12.5,agitation=110.0



Step 9: Optimize Responses



The image shows a software dialog box titled "Optimization Options" with a close button (X) in the top right corner. The dialog is set against a background of a scatter plot with pink, yellow, and green data points. The dialog contains a "Start at" section with a list of six options, each with a checkbox. To the right of the list are three buttons: "OK", "Cancel", and "Help".

Optimization Options

Start at

- Center of design
- Best observed design point
- Best predicted design point
- Best predicted vertex
- All design points
- All vertices

OK

Cancel

Help

Step 9: Optimize Responses (cont.)

Step 9: Optimize the responses

Response Values at Optimum

<i>Response</i>	<i>Optimized</i>	<i>Prediction</i>	<i>Lower 95.0% Limit</i>	<i>Upper 95.0% Limit</i>	<i>Desirability</i>
reacted	yes	100.484	96.4202	104.548	1.0

Factor Settings at Optimum

<i>Factor</i>	<i>Setting</i>
feed rate	11.1915
catalyst	1.99574
agitation	110.873
temperature	174.566
concentration	3.01764

Designs with Categorical Factors

- DSDs may also contain 2-level categorical factors.
- The next example shows a design with 4 continuous factors and 2 categorical factors.

Example #2

Design of Experiments Wizard - Define Factors X

Design file: <untitled>
Comment:

Number of controllable process factors:
Number of controllable mixture components:
Number of noise factors:

Factor	Name	Units	Type	Role	Low	High	Levels
A	<input type="text" value="Factor_A"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼	Controllable	<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
B	<input type="text" value="Factor_B"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼	Controllable	<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
C	<input type="text" value="Factor_C"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼	Controllable	<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
D	<input type="text" value="Factor_D"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼	Controllable	<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
E	<input type="text" value="Factor_E"/>	<input type="text"/>	<input type="text" value="Categorical"/> ▼	Controllable	<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2"/>
F	<input type="text" value="Factor_F"/>	<input type="text"/>	<input type="text" value="Categorical"/> ▼	Controllable	<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2"/>
G	<input type="text" value="Factor_G"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
H	<input type="text" value="Factor_H"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
I	<input type="text" value="Factor_I"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
J	<input type="text" value="Factor_J"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
K	<input type="text" value="Factor_K"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
L	<input type="text" value="Factor_L"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>
M	<input type="text" value="Factor_M"/>	<input type="text"/>	<input type="text" value="Continuous"/> ▼		<input type="text" value="-1.0"/>	<input type="text" value="1.0"/>	<input type="text" value="1,2,3,4"/>

Total for controllable mixture components:

Example #2 (cont.)

Design of Experiments Wizard - Select Design

Design file: <untitled>

Comment:

Robust Parameter Design

- Combined array
- Crossed array

Segment	Factors	Runs	Blocks	Design	
Options...	Process factors	6	0	0	Press the Options button.
Options...	Mixtu				
Options...	COM				

SCREENING DESIGN SELECTION

Name	Runs	Resolution	Error d.f.	Block Size	
Definitive screening design	14	IV	0	14	
Factorial in 8 blocks	2 ⁶	64	V*	35	8
Factorial in 16 blocks	2 ⁶	64	IV*	31	4
Factorial in 32 blocks	2 ⁶	64	IV*	26	2
Half fraction	2 ⁶⁻¹	32	V+	10	32
Half fraction in 2 blocks	2 ⁶⁻¹	32	V*	9	16
Folded Plackett-Burman	2 ^{6*3/8}	24	IV	17	24
Irregular fraction	2 ^{6*3/8}	24	~V	2	24
Quarter fraction	2 ⁶⁻²	16	IV	2	16
Plackett-Burman	2 ^{6*3/16}	12	III	5	12
Irregular fraction	2 ^{6*3/16}	12	~IV	0	12
Eighth fraction	2 ⁶⁻³	8	III	0	8
Definitive screening design	14	IV	0	14	
Blocked definitive screening design	16	IV	0	16	
User-specified design					

Display Blocked Designs

OK Cancel Back Help

OK Cancel Rerandomize Constraints Help

Example #2 (cont.)

Design of Experiments Wizard - Select Design

Design file: <untitled>

Comment:

Robust Parameter Design

- Combined array
- Crossed array

Options...	Segment	Factors	Runs	Blocks	Design
Options...	Process factors	6	14	1	Definitive screening design
Options...	Mixture components	0	0	0	
Options...		0	0	0	
	COMBINED	6	14	1	Samples per run: <input type="text" value="1"/>

BLOCK	Factor_A	Factor_B	Factor_C	Factor_D	Factor_E	Factor_F
1	1.0	-1.0	1.0	-1.0	2	1
2	-1.0	1.0	-1.0	1.0	1	2
3	1.0	0.0	1.0	1.0	1	1
4	-1.0	-1.0	0.0	1.0	2	1
5	0.0	0.0	0.0	0.0	2	2
6	1.0	1.0	0.0	-1.0	1	2
7	-1.0	0.0	-1.0	-1.0	2	2
8	-1.0	1.0	1.0	-1.0	2	1
9	0.0	0.0	0.0	0.0	1	1
10	0.0	-1.0	-1.0	-1.0	1	1
11	-1.0	-1.0	1.0	0.0	1	2
12	1.0	1.0	-1.0	0.0	2	1
13	1.0	-1.0	-1.0	1.0	1	2
14	0.0	1.0	1.0	1.0	2	2

OK Cancel Rerandomize Constraints Help

Designs with Blocking

- DSDs may be run in more than one block.
- The next example shows a design with 6 continuous factors divided into 2 blocks.

Example #3

Design of Experiments Wizard - Select Design

Design file: <untitled>

Comment:

Robust Parameter Design

Combined array

Crossed array

Segment	Factors	Runs	Blocks	Design	
Options...	Process factors	6	0	0	Press the Options button.
Options...	Mixtu				
Options...	COM				

BLOCK

factor_E

OK Cancel Rerandomize Constraints Help

Screening Design Selection

Name	Runs	Resolution	Error d.f.	Block Size	
Blocked definitive screening design	13	IV	0	7	
Factorial in 8 blocks	2 ⁶	64	V*	35	8
Factorial in 16 blocks	2 ⁶	64	IV*	31	4
Factorial in 32 blocks	2 ⁶	64	IV*	26	2
Half fraction	2 ⁶⁻¹	32	V+	10	32
Half fraction in 2 blocks	2 ⁶⁻¹	32	V*	9	16
Folded Plackett-Burman	2 ^{6+3/8}	24	IV	17	24
Irregular fraction	2 ^{6+3/8}	24	~V	2	24
Quarter fraction	2 ⁶⁻²	16	IV	2	16
Plackett-Burman	2 ^{6+3/16}	12	III	5	12
Irregular fraction	2 ^{6+3/16}	12	~IV	0	12
Eighth fraction	2 ⁶⁻³	8	III	0	8
Definitive screening design	13	IV	0	13	
Blocked definitive screening design	13	IV	0	7	
User-specified design					

Display Blocked Designs

OK Cancel Back Help

Example #3 (cont.)

Design of Experiments Wizard - Select Design

Design file: <untitled>

Comment:

Robust Parameter Design

- Combined array
- Crossed array

Segment	Factors	Runs	Blocks	Design	
Options...	Process factors	6	0	0	Press the Options button.
Options...	Mixture components	0	0	0	
Options...		0			
	COMBINED	6			

Definitive Screening Design Options

Centerpoints

Number:

Placement

- Random
- Spaced
- First
- Last

Replicate Design

Number:

Randomize

Number of blocks:

OK Cancel Help

OK Cancel Rerandomize Constraints Help

Example #3 (cont.)

Design of Experiments Wizard - Select Design

Design file: <untitled>

Comment:

Robust Parameter Design

- Combined array
- Crossed array

	Segment	Factors	Runs	Blocks	Design
<input type="button" value="Options..."/>	Process factors	6	14	2	Blocked definitive screening design
<input type="button" value="Options..."/>	Mixture components	0	0	0	
<input type="button" value="Options..."/>		0	0	0	
	COMBINED	6	14	2	Samples per run: <input type="text" value="1"/>

	BLOCK	Factor_A	Factor_B	Factor_C	Factor_D	Factor_E	Factor_F
1	1	1.0	-1.0	1.0	-1.0	1.0	0.0
2	1	1.0	-1.0	-1.0	1.0	0.0	1.0
3	2	1.0	1.0	-1.0	0.0	1.0	-1.0
4	1	0.0	-1.0	-1.0	-1.0	-1.0	-1.0
5	2	-1.0	0.0	-1.0	-1.0	1.0	1.0
6	2	0.0	0.0	0.0	0.0	0.0	0.0
7	2	-1.0	-1.0	0.0	1.0	1.0	-1.0
8	1	-1.0	1.0	-1.0	1.0	-1.0	0.0
9	1	-1.0	1.0	1.0	-1.0	0.0	-1.0
10	2	1.0	0.0	1.0	1.0	-1.0	-1.0
11	2	-1.0	-1.0	1.0	0.0	-1.0	1.0
12	1	0.0	0.0	0.0	0.0	0.0	0.0
13	2	1.0	1.0	0.0	-1.0	-1.0	1.0
14	1	0.0	1.0	1.0	1.0	1.0	1.0

References

StatFolios and data files are at: www.statgraphics.com/webinars

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