

Latest and Future Developments of the Optimization Tool

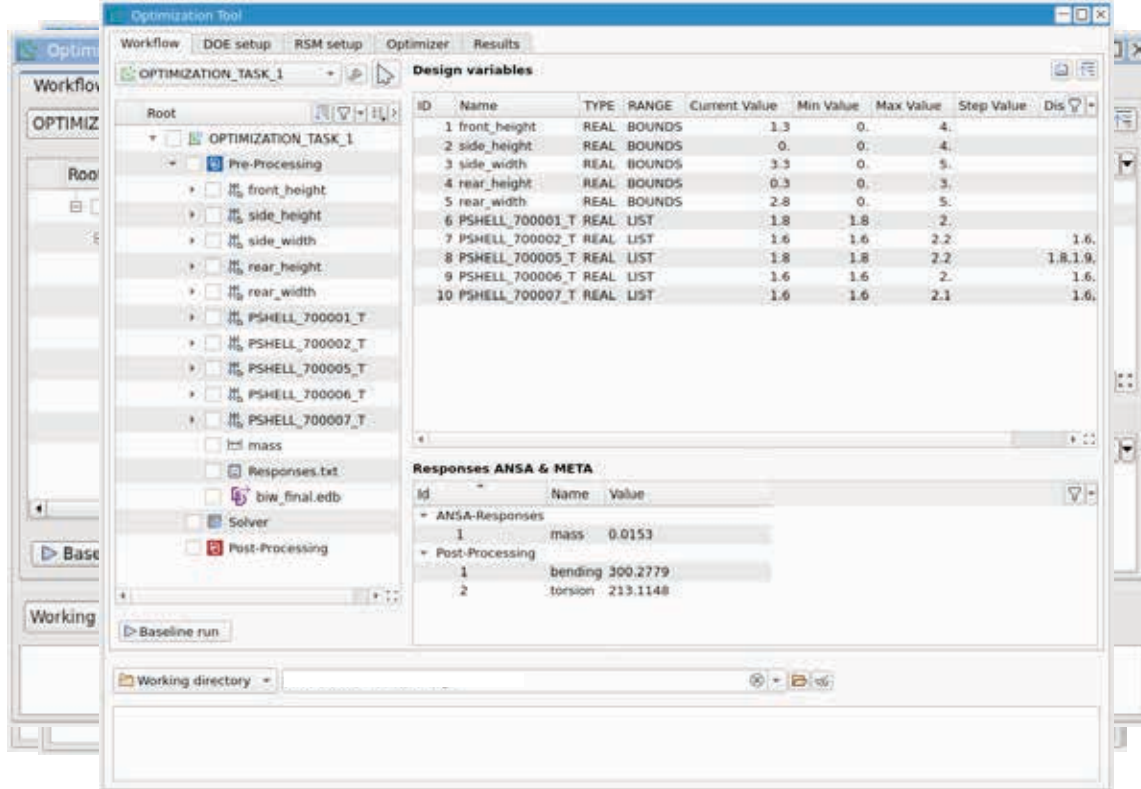
14/6/2023

Latest developments



Optimization Tool
Upgrade

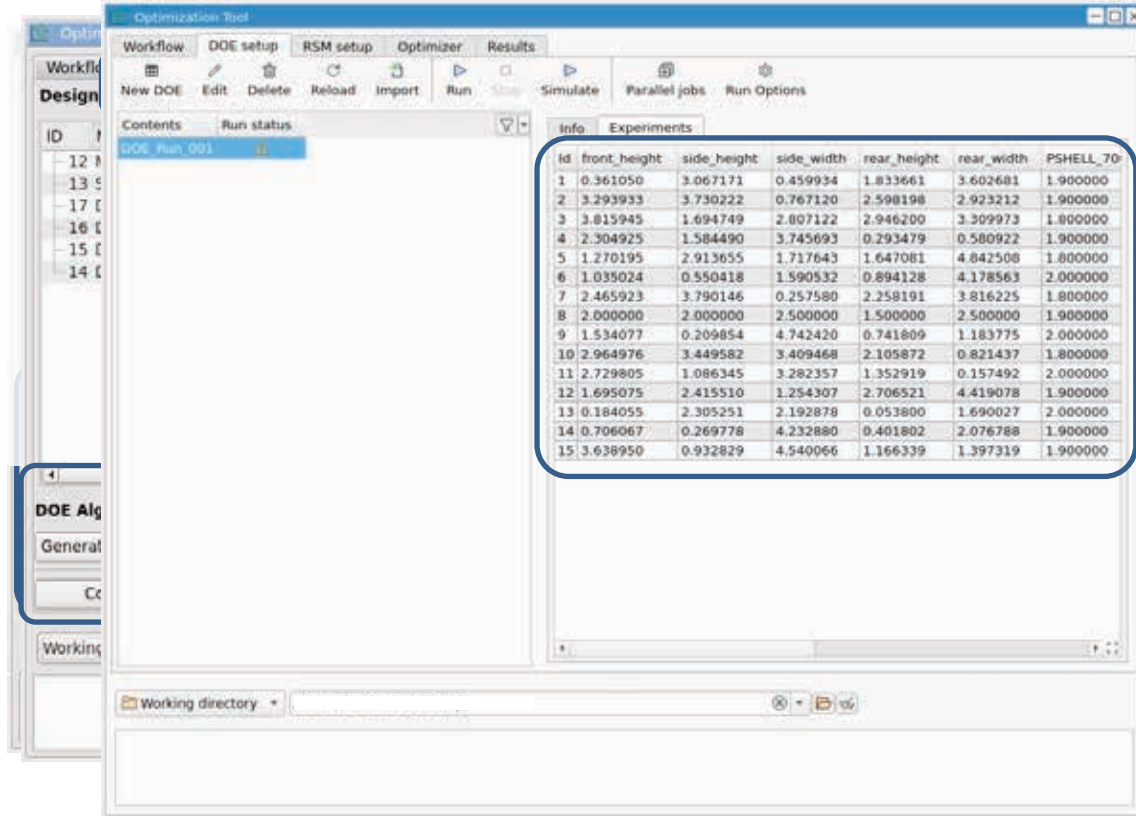
Latest developments



User Interface
Upgrade

Workflow tab

Latest developments

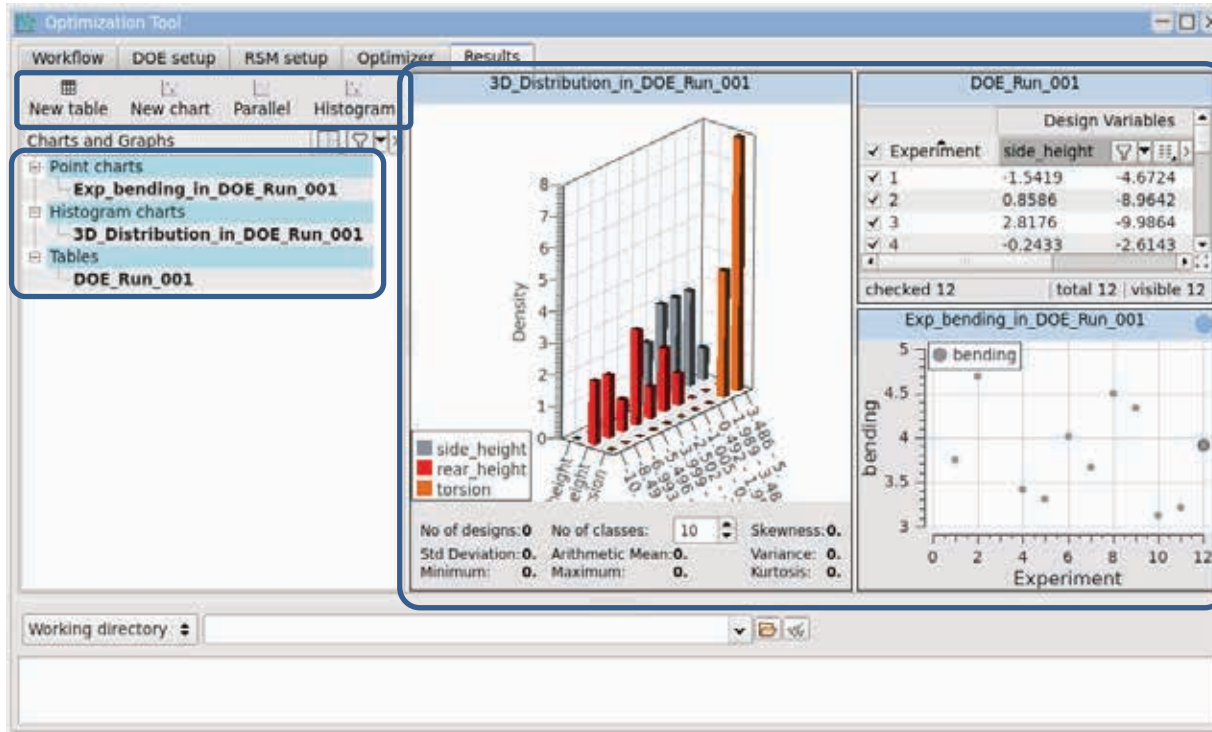


User Interface
Upgrade

Workflow tab

DOE setup tab

Latest developments



User Interface Upgrade

Workflow tab

DOE setup tab

Results tab

Optimization Tool

The screenshot displays the Optimization Tool interface with the following components:

- Workflow:** Workflow, DOE setup, RSM setup, Optimizer, Results.
- Task:** OPTIMIZATION_TASK_1
- Design variables table:**

ID	Name	TYPE	RANGE	Current Value	Min Value	Max Value
1	front_height	REAL	BOUNDS	3.	-2.	5.
2	side_height	REAL	BOUNDS	0.	0.	4.
3	side_width	REAL	BOUNDS	0.	0.	5.
4	rear_height	REAL	BOUNDS	0.	0.	6.
5	rear_width	REAL	BOUNDS	0.	0.	3.
6	PSHELL_700001_T_1	REAL	LIST	1.8	1.8	2.
7	PSHELL_700002_T_1	REAL	LIST	1.6	1.6	2.1
8	PSHELL_700005_T_1	REAL	LIST	1.9	1.9	2.2
9	PSHELL_700006_T_1	REAL	LIST	1.6	1.6	2.
10	PSHELL_700007_T_1	REAL	LIST	1.9	1.9	2.2
- Responses ANSA & META:**

Id	Name	Value
no responses round		
- Working directory:** C:/Users/

Read Design Variables

Automatic creation of DVs from file

Optimization Tool

The screenshot displays the Optimization Tool interface. The left sidebar shows a tree view under 'OPTIMIZATION_TASK_1' with 'Pre-Processing' expanded, listing various simulation options. The 'dynamic_simulation.adm' option is highlighted with a blue box. The main area shows a table of design variables.

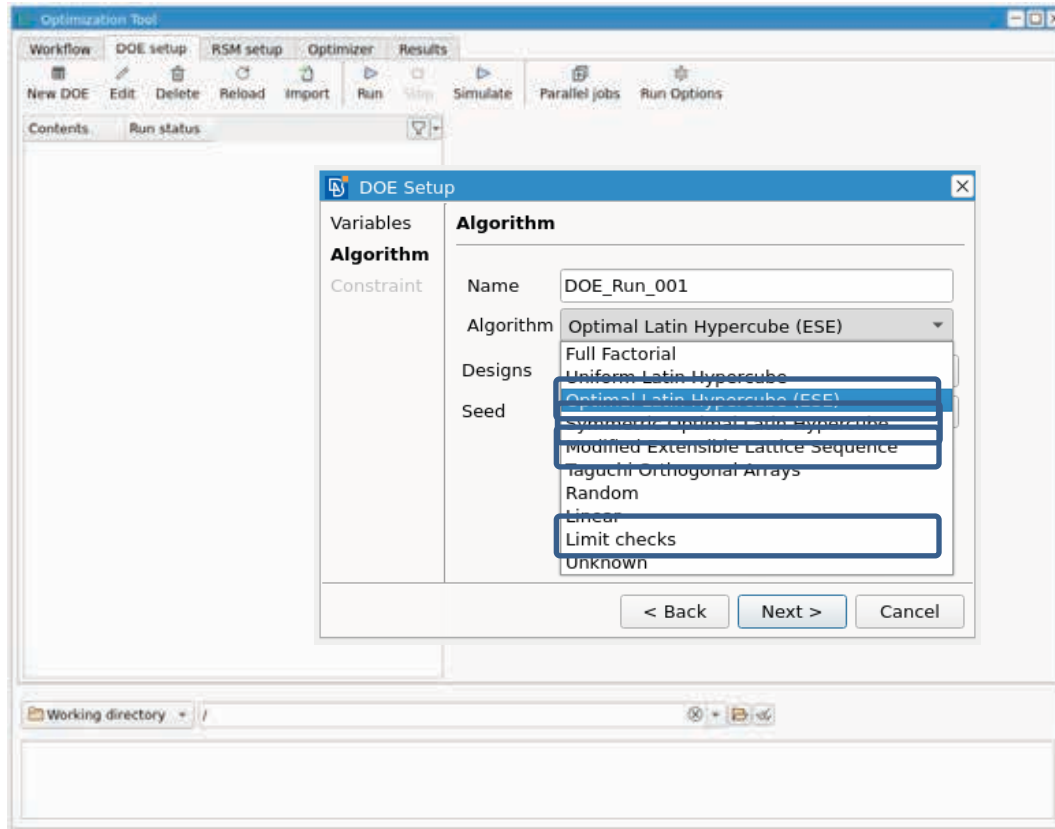
ID	Name	TYPE	RANGE	Current Value	Min Value	Max Value	Step Value	Discret
1	KIN_FORCE_1_C	REAL	BOUNDS	1.4	1.25	1.65		
2	KIN_FORCE_1_K	REAL	BOUNDS	260.	200.	400.		
3	KIN_MOTION_3_DISP_IC_TZ	REAL	BOUNDS	0.	0.	25.		
4	KIN_FORCE_2_FORCE_1	REAL	BOUNDS	55.	40.	100.		
5	KIN_FORCE_1_SPRING_PRELOAD_FORCE	REAL	BOUNDS	120.	100.	220.		
6	KIN_FORCE_3_SPRING_PRELOAD_TORQUE	REAL	BOUNDS	35.	20.	60.		

Below the table, the 'Responses ANSA & META' section is visible, showing a message: 'no responses found' and 'ANSA & META responses will be listed here'. The working directory is set to 'C:/Users/'.

Support ADAMS

ADAMS output

Latest developments



New DOE
algorithms

Optimal Latin
Hypercube

Symmetric Optimal
Latin Hypercube

Modified extensible
Lattice sequence

Limit checks

Optimization Tool

Parallel jobs

The screenshot shows the Optimization Tool interface with the 'Info' tab selected. The table displays the following data:

	id	front_height	side_height	side_width	rear_height	rear_width
0 % 1	1	2.745107	3.744979	3.300000	0.300000	2.800000
0 % 2	2	0.000430	2.281587	3.300000	0.300000	2.800000
0 % 3	3	1.502845	1.354944	3.300000	0.300000	2.800000
0 % 4	4	2.878329	1.794827	3.300000	0.300000	2.800000
0 % 5	5	3.593480	2.891457	3.300000	0.300000	2.800000
0 % 6	6	2.356476	0.282993	3.300000	0.300000	2.800000
0 % 7	7	3.937328	1.002567	3.300000	0.300000	2.800000
0 % 8	8	1.912697	2.464355	3.300000	0.300000	2.800000
0 % 9	9	0.639622	0.410890	3.300000	0.300000	2.800000
0 % 10	10	1.148084	3.390285	3.300000	0.300000	2.800000

DOE created files and directory
Wed May 31 16:34:06 2023
Combinations file: file:///home//DOE_run_001/combinations.txt

Optimization Tool

User Defined DoE

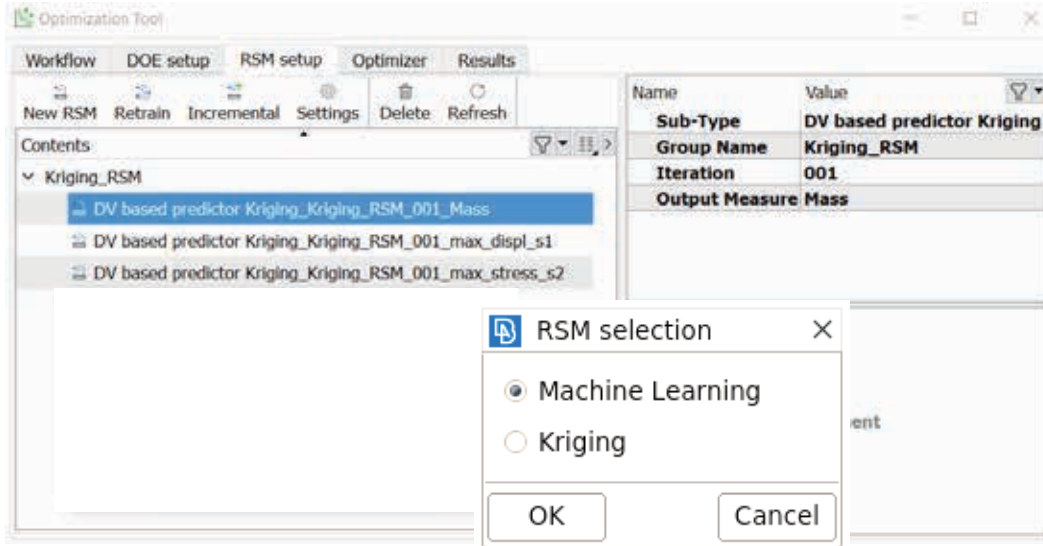
The screenshot displays the Optimization Tool interface. The top menu bar includes Workflow, DOE setup, RSM setup, Optimizer, and Results. Below the menu bar is a toolbar with icons for New DOE, Edit, Delete, Reload, Import, Run, Stop, Simulate, Parallel jobs, and Run Options. The main workspace is divided into two panes. The left pane, titled 'Contents', shows a list of DOE runs with their status: DOE_Run_001 (red X), DOE_Run_002 (green checkmark), and DOE_Run_003 (yellow warning triangle). The right pane, titled 'Info', shows a table of experimental results. The table has columns for Id, front_height, side_height, side_width, rear_height, and rear_width. The data rows are as follows:

Id	front_height	side_height	side_width	rear_height	rear_width
1	0.000430	2.281587	3.300000	0.300000	2.800000
2	2.878329	1.794827	3.300000	0.300000	2.800000
3	3.937328	1.002567	3.300000	0.300000	2.800000

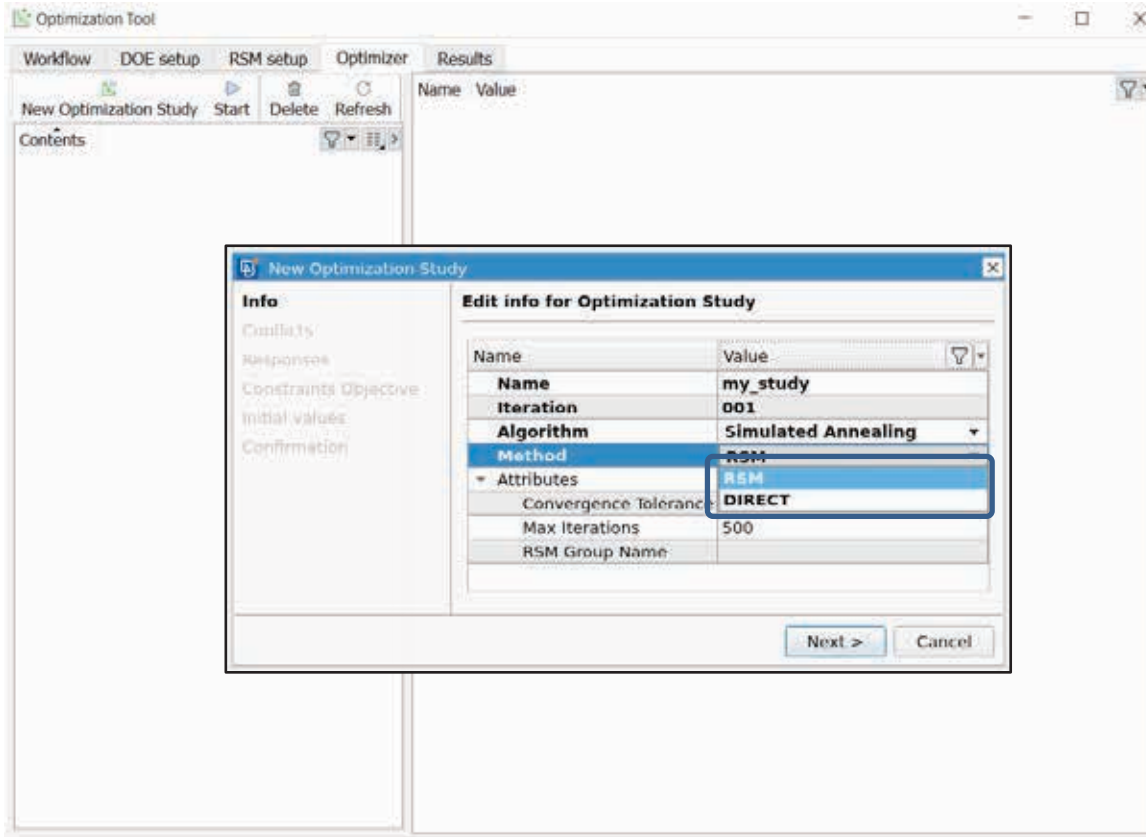
At the bottom of the interface, there is a 'Working directory' field with a dropdown arrow and a file explorer icon.

Optimization Tool

Response Surface Model(RSM)



Optimization Tool

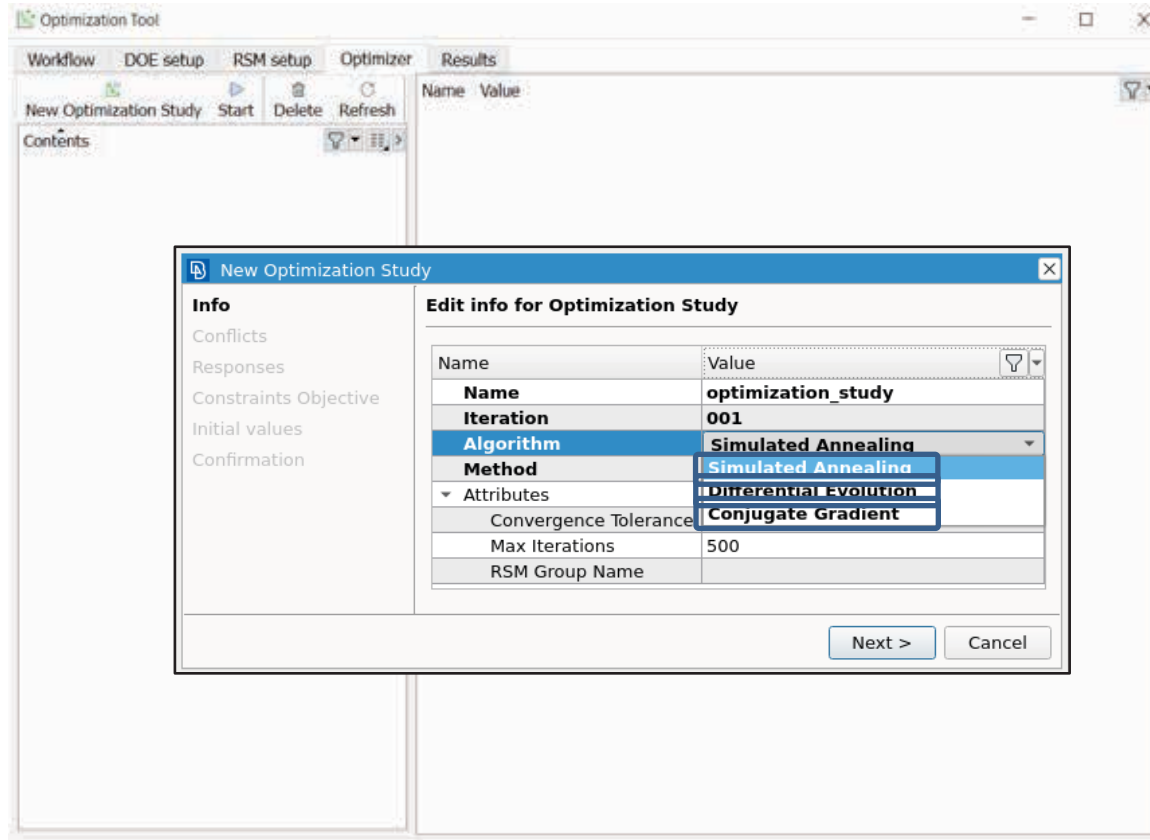


Optimization
studies

Response Surface
Models

Direct

Optimization Tool



Optimization
studies algorithms

Simulated Annealing

Differential Evolution

Conjugate Gradient

Optimization Tool



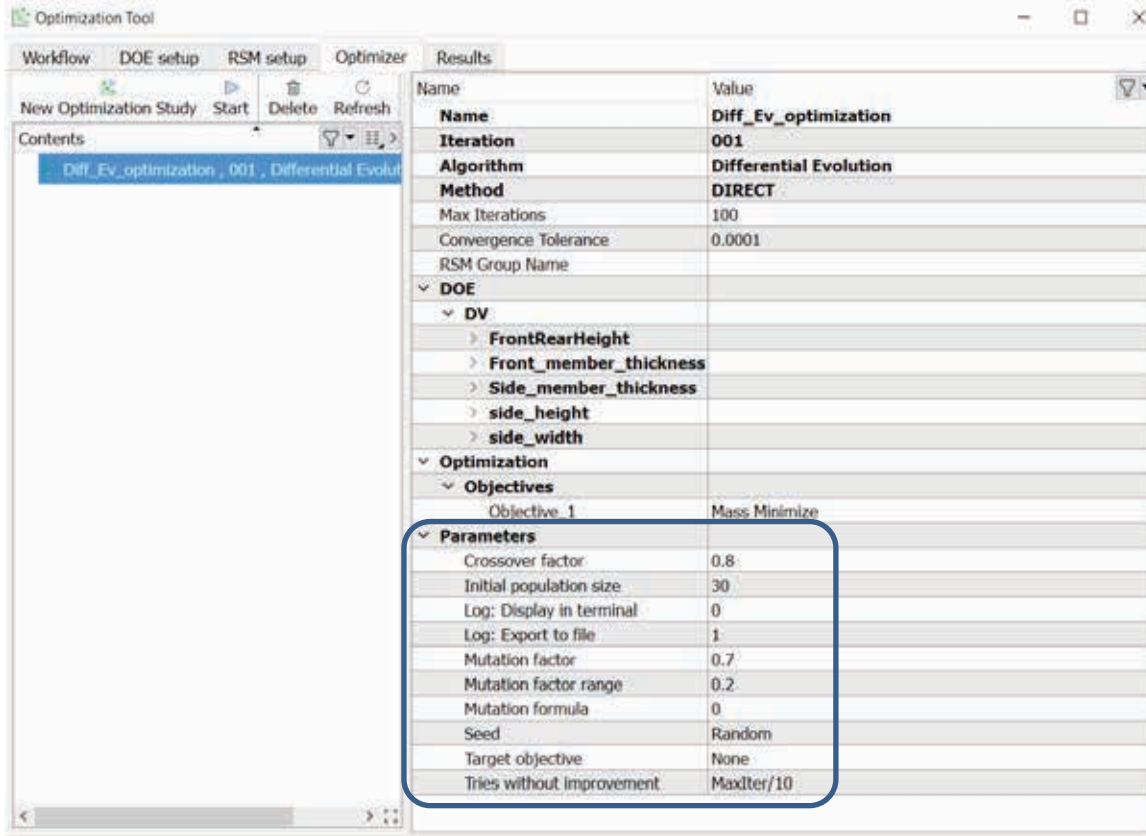
Strength

Weakness

- | | | |
|--------------------------|---------------------------|------------------------------|
| • Simulated Annealing | ✓ Global optima | ✓ Ignores local optima |
| • Differential Evolution | ✓ Design Area Exploration | ✓ Large number of iterations |
| • Conjugate Gradient | ✓ Gradient based | ✓ One global minimum |

Optimization studies algorithms

Optimization Tool



The screenshot shows the Optimization Tool interface with the Results tab selected. The main area displays a table of optimization parameters. A blue rounded rectangle highlights the Parameters section of the table.

Name	Value
Name	Diff_Ev_optimization
Iteration	001
Algorithm	Differential Evolution
Method	DIRECT
Max Iterations	100
Convergence Tolerance	0.0001
RSM Group Name	
DOE	
DV	
> FrontRearHeight	
> Front_member_thickness	
> Side_member_thickness	
> side_height	
> side_width	
Optimization	
Objectives	
Objective_1	Mass Minimize
Parameters	
Crossover factor	0.8
Initial population size	30
Log: Display in terminal	0
Log: Export to file	1
Mutation factor	0.7
Mutation factor range	0.2
Mutation formula	0
Seed	Random
Target objective	None
Tries without improvement	MaxIter/10

Editable algorithm parameters

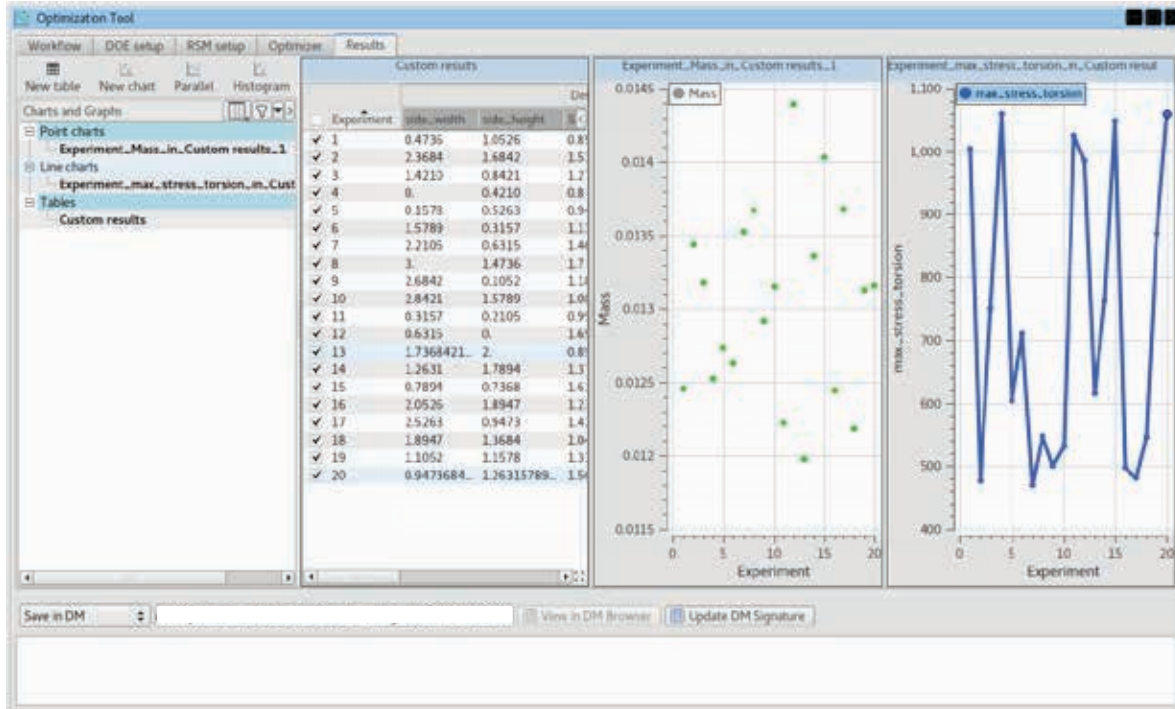
Optimization Tool

The screenshot shows the Optimization Tool software interface. The 'Results' tab is active, displaying a table for 'DOE_Run_001'. The table has columns for 'PSHELL_700006_T', 'PSHELL_700007_T', and 'Design Variables' (bending, torsion, mass). The 'Design Variables' column is expanded to show values for 'bending', 'torsion', and 'mass'. The table contains 15 rows of data. The status bar at the bottom indicates 'checked 15' and 'total 15 | visible 15'.

PSHELL_700006_T	PSHELL_700007_T	bending	torsion	mass
2.		359.8124	239.7711	0.0155
1.8		436.8750	299.9710	0.0162
1.8		409.6458	263.4026	0.0155
1.8		370.1410	253.9215	0.0160
1.6		495.4225	338.6773	0.0157
1.6		484.6094	303.1527	0.0151
2.1		343.0222	235.3992	0.0158
1.8		398.0671	259.0960	0.0158
1.6		455.1782	288.1880	0.0156
2.		339.2102	243.3151	0.0162
2.		353.8862	224.8457	0.0157
1.8		439.6383	270.6796	0.0153
2.		331.8665	221.7507	0.0161
2.		340.6602	238.2029	0.0154
1.8		375.0914	252.7649	0.0161

Active Results tab

Optimization Tool

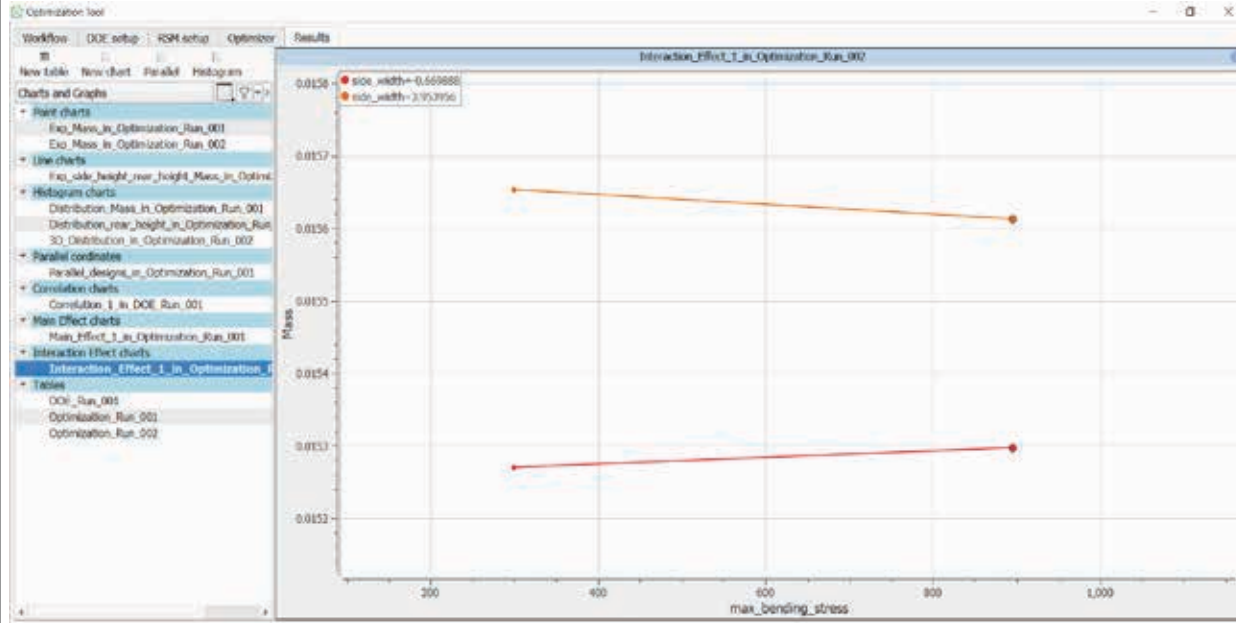


Enhanced Results layout

Drag & Drop tables and charts

Multiple windows

Optimization Tool



Results evaluation

Histograms

Parallel coordinates plot

Correlation matrix

Main effect

Interaction effect

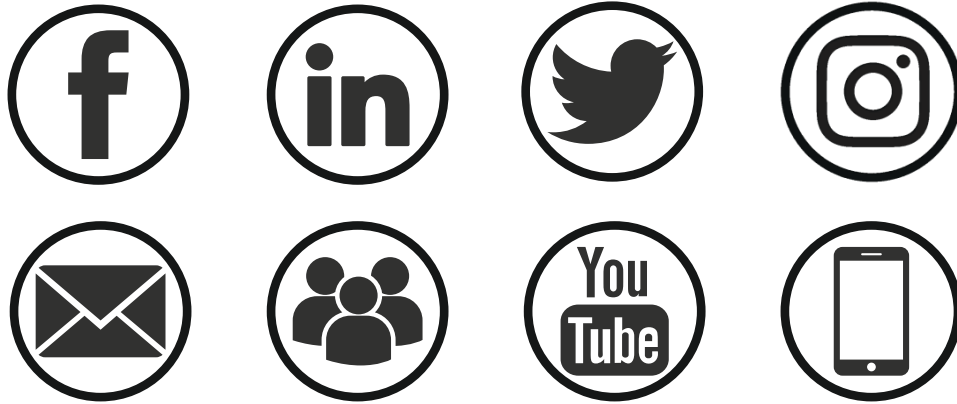
Optimization Tool

```
-----  
Wed Jan 18 10:58:52 2023  
  
Optimization Mode:  
  Minimization  
-----  
Wed Jan 18 10:58:52 2023  
----- Differential Evolution -----  
  
seed: -1924243323  
  
Max Iterations      :110  
Max Tries to improve :5  
Initial Population Size :30  
  
Tolerance           :0.000100  
Crossover Factor    :0.800000  
  
Mutation Factor     :0.600000 to 0.800000  
(Dithering Enabled)  
  
Target Objective Value: NONE  
Mutation Equation   : DE/Best/1  
-----  
Wed Jan 18 11:14:42 2023  
Iteration: 1  
  
Population Info:  
  Best      obj. Value 0.011744  
  mean      obj. Value 0.012338  
  st. dev.  obj. Value 0.000500  
  
Best Objective found in iter.: 1  
-----  
Wed Jan 18 11:22:54 2023  
Iteration: 2  
  
Population Info:  
  Best      obj. Value 0.011744  
  mean      obj. Value 0.012154  
  st. dev.  obj. Value 0.000432
```

Optimization log

Don't miss..

DAY 2	THURSDAY JUNE 15, 2023 - Afternoon Sessions	DAY 3	FRIDAY JUNE 16, 2023 - Morning Sessions
	Demo Session 6G Mars I		Session 9A Audimax Moderator: D. Zouzias
14:00 - 14:30		11:00 - 11:30	Latest & future developments in Crash and Safety Thanassis Fokylidis*, Lambros Rorris BETA CAE Systems
14:30 - 15:00	Find optimal designs of your parametric ANSA model using the embedded Optimizers in the Optimization tool. Eva Ioannou BETA CAE Systems	11:30 - 12:00	Optimization and quick verification of an electric vehicle side-frame design using Machine Learning methods Christina Chatzigeorgiadou*, Athanasios Papadopoulos BETA CAE Systems
15:00 - 15:30	An application example of the next generation approach to Crash Simulation Optimization, incorporating CAD-Design parameters Zafeira Kanellia BETA CAE Systems	12:00 - 12:30	Prediction of Occupant safety utilizing Machine Learning and CARLA Autonomous drive simulation software Dimitris Drougkas*, Panagiota Kagioglou BETA CAE Systems



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