

Version 10.0

- Better navigate decisions to find improved designs with optimization algorithms
- Create fast running approximations of long running simulations
- Graphically automate any application that runs off input/output files
- Automate simulation workflows without programming or scripting

PHX ModelCenter® 10.0 features new, enhanced modules to: navigate through thousands of design choices to improve designs; find non-intuitive solutions and innovate against conventional wisdom; solve complex problems with multi-disciplinary design; and resolve common problems with high-fidelity simulations using response surface models, fast-running approximations ideal for practical design optimization and exploration.

Optimization Pak

A collection of optimization algorithms packaged into a single trade study tool within PHX ModelCenter. Users can specify Model variables as objectives (minimize, maximize, or solve for), design variables (discrete or continuous), and constraints.

When run, the optimization tool then systematically varies design variables in an attempt to optimize the objectives while not violating any constraints. Resulting charts and reports detail solutions found by the optimizer and help educate the user.

- **Multiple Algorithms from Leading Research Organizations.**

Choose from over 30 algorithms from Boeing, Sandia Labs, VR&D, SwarmOps and more.

Figure 1.

- **Unified User Interface.**

Trying a new algorithm has never been easier. Configure your study once and then simply change algorithms from a single drop down list.

Figure 2.

- **Algorithm Selection Wizard.**

Eliminate confusion surrounding which algorithm to use. The Wizard asks you questions about your problem and makes recommendations in a Consumer Reports style view.

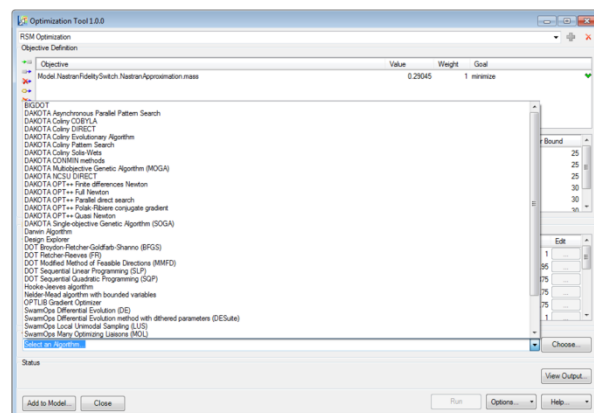


Figure 1. Over 30 algorithms to choose from or easily add your own.

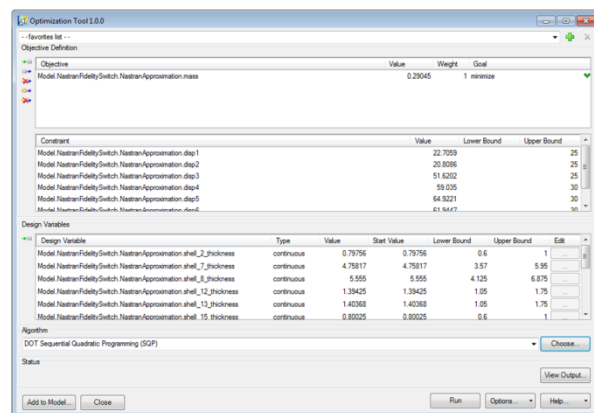


Figure 2. Access optimization algorithms through a single drop down list. Get help choosing an algorithm with the Algorithm Selection Wizard.

- **Benchmark Reports.**

We have benchmarked all included algorithms against over 20 design problems. Leverage this report to identify a problem similar to yours, then see how each algorithm performed against the problem.

- **Pareto Design.**

Evaluate multi-objective tradeoffs by evaluating the Pareto set—the family of solutions where one objective cannot be improved without negatively impacting the other objective. *Figure 4.*

- **Optimization Reports.**

View detailed reports of the optimization convergence history to understand results and debug problems.

- **Software Development Kit.**

Add your own algorithms to the Optimization Pak by implementing a few simple methods using either .NET or Java. Use our Optimization Software Development Kit (SDK) to get started! *Figure 5.*

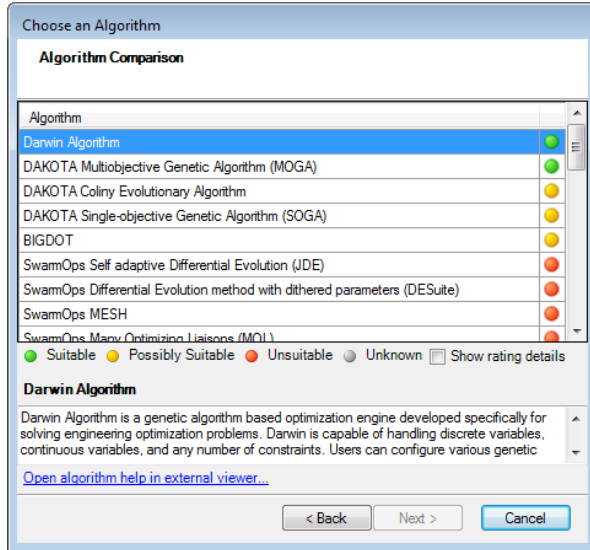


Figure 3. Wizard steps the user through multiple questions and recommends appropriate algorithms in a ranked list of algorithms. Details can be expanded to show individual criteria. Additional help is also available to understand how each algorithm works.

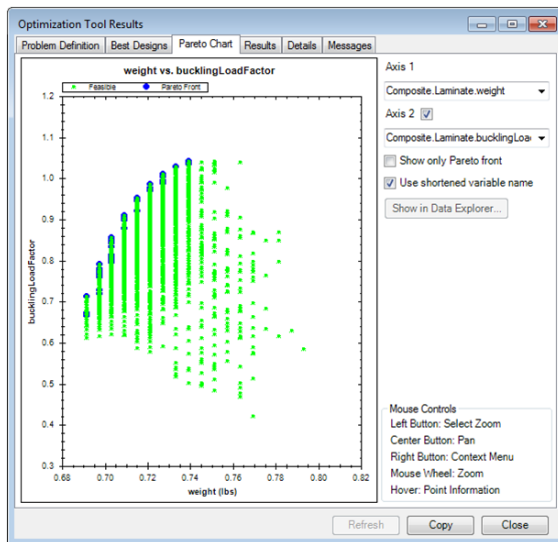


Figure 4. Pareto Plots show two competing objectives on the same chart. The Pareto Front (in blue) is the set of solutions where one objective cannot be improved without compromising the other.

RSM Toolkit 3.0

A general purpose multi-dimensional “curve fitting” tool. Given a set of data points the RSM Toolkit can generate a mathematical set of equations that approximate the data. The source data can be generated from a long running simulation or originate from experimental tests.

The RSM Toolkit uses a number of different approximation techniques to find a model that works best for your data. Once a response surface is created, it can then be added back into your PHX ModelCenter model where it can be run just like any other component.

- **RSM Components.**

Create response surfaces that can be run as components in PHX ModelCenter. Multiple fit types are supported including polynomial and Kriging fits. *Figure 5.*

- **Intelligent Wizards.**

Multiple wizards enable you to create RSM Components. These wizards allow you to collect data using the DOE tool and assist in selecting the right fit types and settings to best match your data. *Figure 6.*

- **Fidelity Switches.**

RSM Components can be inserted into models using fidelity switches that easily allow the user to choose between running the real simulation or the response surface.

- **Fit Quality Statistics and Plots.**

View the fit quality of the response surfaces using multiple plots and statistics: R^2 measures, comparison plots with source data, error plots and more.

- **Auto-Improve Results.**

If fit qualities are not high enough, automatically perform additional PHX ModelCenter runs to improve response surfaces until desired qualities are achieved. *Figure 7.*

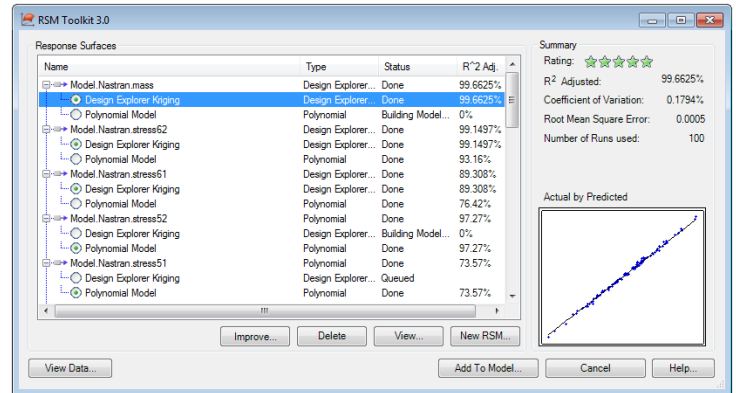


Figure 5. Response surfaces can be created from any data in a Data Explorer. Press the RSM Toolkit button to get started. The RSM Toolkit will ask you about which variables you would like to use to create your Response Surface.

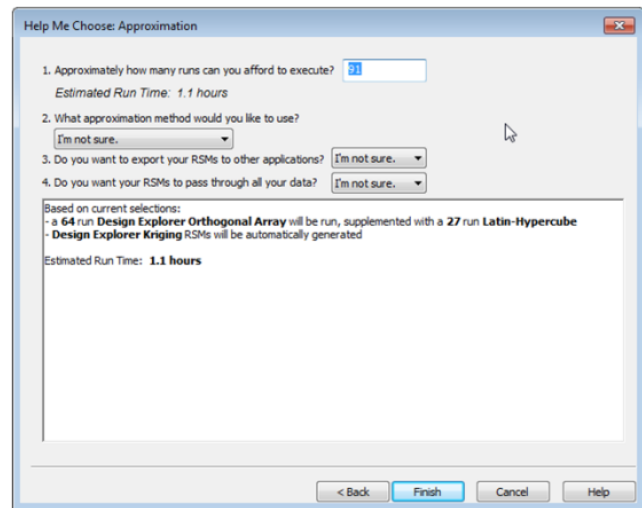


Figure 6. Wizard first prompts user for the variables to be used in the response surface, then provides advice about the best Design of Experiments (DOE) to run.

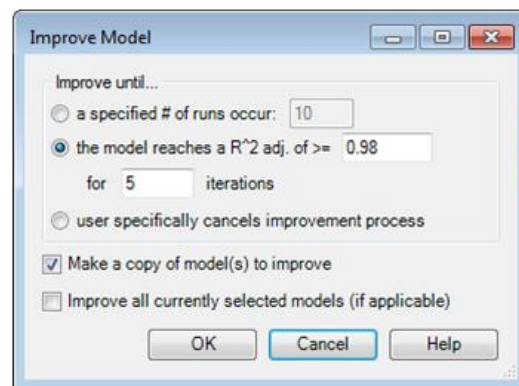


Figure 7. Automatically perform more runs to collection additional data if you do not like the quality of a particular fit. Then refit the surface until desired quality measures are achieved.

QuickWrap 3.0

QuickWrap is a tool for automating batch mode programs within the Phoenix modeling environment. It can operate as a plug-in to PHX ModelCenter thus enabling it to directly automate file input/output applications. It can also run independently and generate wrappers that can run on Analysis Server.

In either mode, QuickWrap provides a graphical application that allows users to point and click to specify variables within files. No programming or scripting is required to automate the application.

- Point and Click ASCII File Wrapping.**
 Specify values easily by clicking on input and output files in a graphical viewer. *Figure 8.*

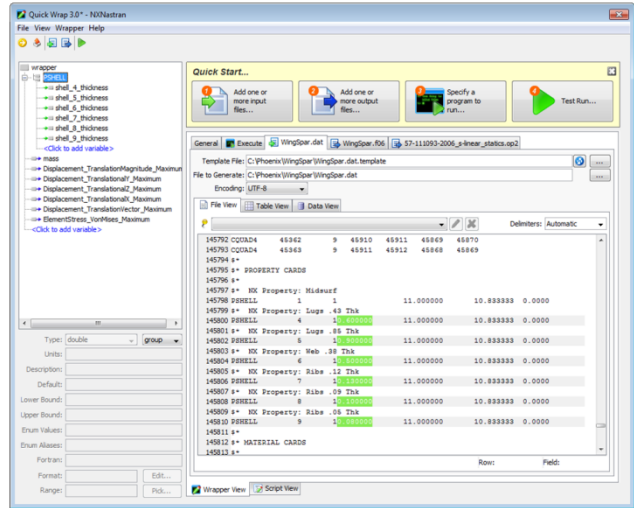


Figure 8. Variables can be created in files by highlighting the value and selecting “Add Variable”.

- Pattern Matching Rules Engine.**
 If your file conforms to formatting rules, patterns can be created to automatically detect values and speed the process of wrapping an application. Example patterns include FORTRAN name lists, name-value pairs, and argument statements.

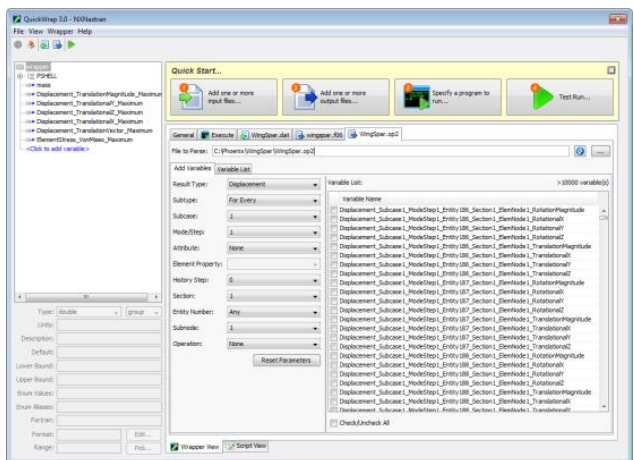


Figure 9. Specify criteria and QuickWrap lists values that exist in binary CAE files.

- Enhanced CAE Pak.**
 A new set of QuickWrap customizations make wrapping CAE applications, including NASTRAN, ANSYS, ABAQUS, DYNA, and ADAMS, even easier. *Figure 9.*
- Scripting.**
 While QuickWrap is designed to eliminate scripting, the power of scripting is still available for the power user. As the user performs graphical operations, script code for ScriptWrapper is simultaneously generated. The user can switch to this view to insert custom scripting commands or simple to learn the syntax of ScriptWrappers. *Figure 10.*

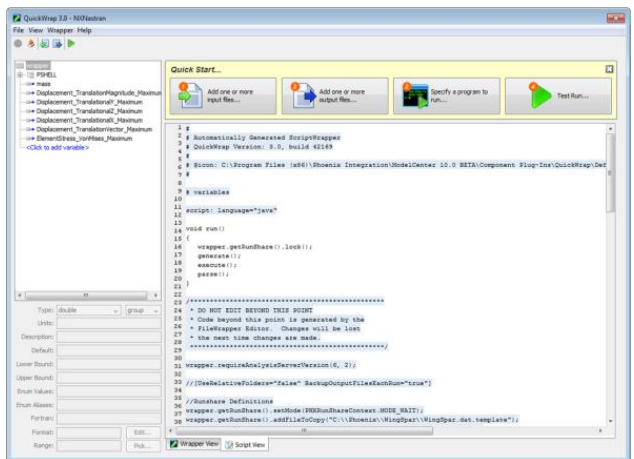


Figure 10. Access script codes generated “behind the scenes” as desired.

Enhanced Workflow

PHX ModelCenter is a general purpose automation tool for modeling and simulation applications. Workflows can be graphically constructed and executed in an easy to use environment without programming or scripting. The resulting workflows are easy to visually understand and can be executed multiple times for purposes of design exploration and optimization.

- **Graphical Editor.**

Constructing a process is a graphical, point-and-click, drag-and-drop experience. Resulting workflows are displayed as easy-to-understand “flowchart” models.

- **Live Execution.**

Workflow figures are not just fancy diagrams. They are real working models that can be executed. Model inputs can be changed, components executed, and the results viewed all from the workflow editor.

- **Workflow Statements.**

Construction a workflow requires a rich set of execution logic—leverage Sequential Flow, If-Blocks & Switches, Parallel Braches, Looping, and Optimization. *Figure 11 and 12.*

- **Link Editor.**

Building a workflow is more than just specifying a sequence of components to run, it is also about passing data (values, arrays, files, objects) between components. This graphical tool that allows you to wire together inputs and outputs from component.

- **Simulation Components.**

The simulations that execute within the workflow:

- **Analysis:** Automated simulation tools running on the local desktop or on the remote servers. CAD, CAE, Excel, Matlab, and even internal tools!
- **Placeholder:** Even if you don't yet have your simulations read, you can build your workflows using placeholder components. Replace them when your simulation is ready.
- **User Task:** Not all components automatically run. Some require user intervention and this type of component prompts the user for an action before proceeding. *Figure 13.*
- **Script:** While most simulations will run externally to a workflow, it is also possible to embed custom scripts within a workflow to insert custom modeling.

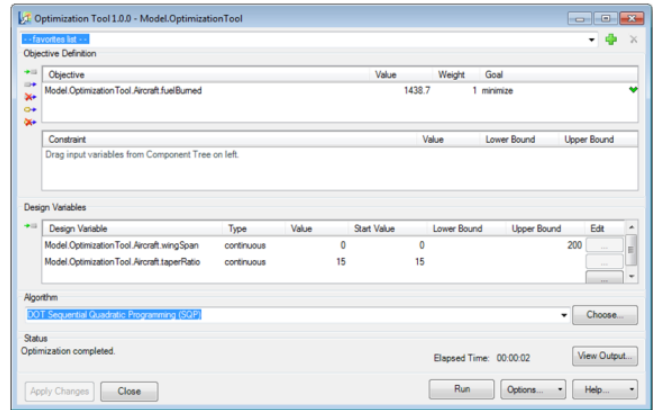


Figure 11. Optimization loop runs until an embedded optimization tool converges.

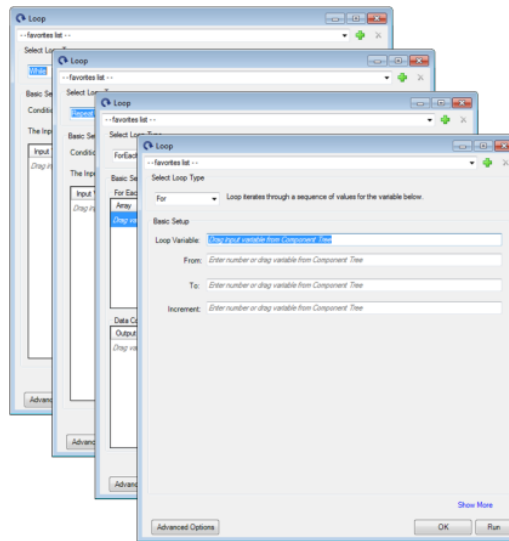


Figure 12. Multiple forms of looping control include “While”, “Do Until”, “For”, and “For Each”.

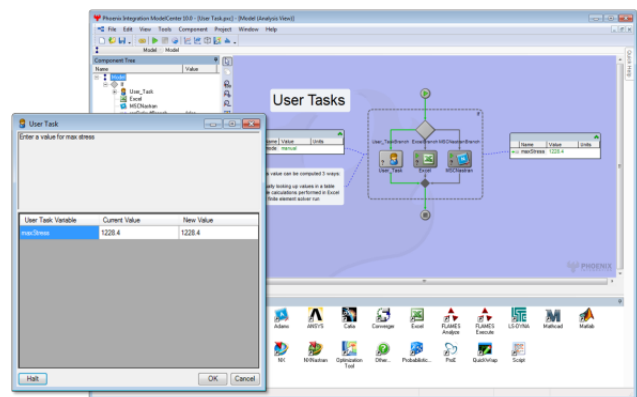


Figure 13. User Task Component prompts the user for values before continuing execution.

Specifications

Hardware Minimum

- 1GHz CPU
- 512MB RAM
- 1GB Hard disk space plus space for user data to run
- 800x600 video resolution

Hardware Recommended

- 2GHz Dual Core CPU
- 2GB RAM
- 1GB Hard disk space plus space for user data
- 1024x768 video resolution

Operating System

- MS Windows XP, MS Windows XP x64, MS Vista, MS Vista x64, MS Windows 7 x64

Optional Software

- Microsoft Excel 97 or greater
- Mathcad 2000i or greater
- Matlab

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