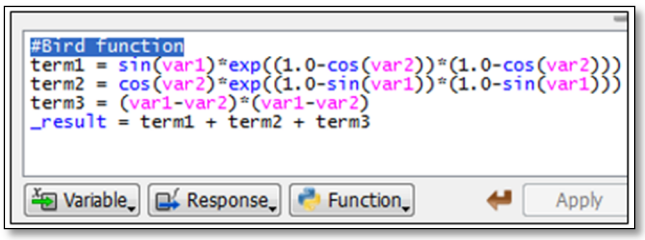
New Features in HEEDS Version 2015.04

Major Features:

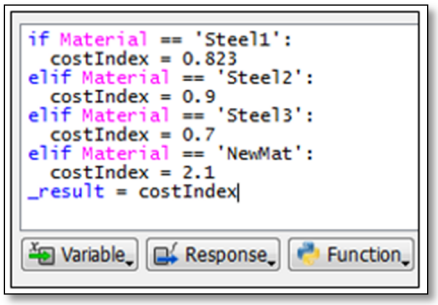
Updated Calculator

The calculator functionality has been enhanced to provide many new capabilities. You can now set up advanced formulas without using an external script or tool. Using the new implementation, you can:

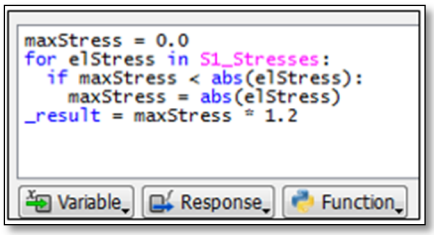
- Easily define complex formulas by breaking up a formula onto several lines using temporary variables.



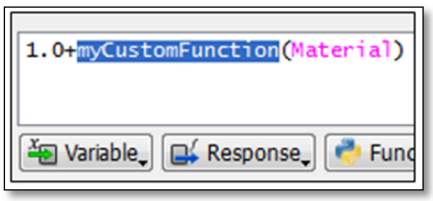
- Include complex logic in your formulas.



- Access any value or set of values from a response array.

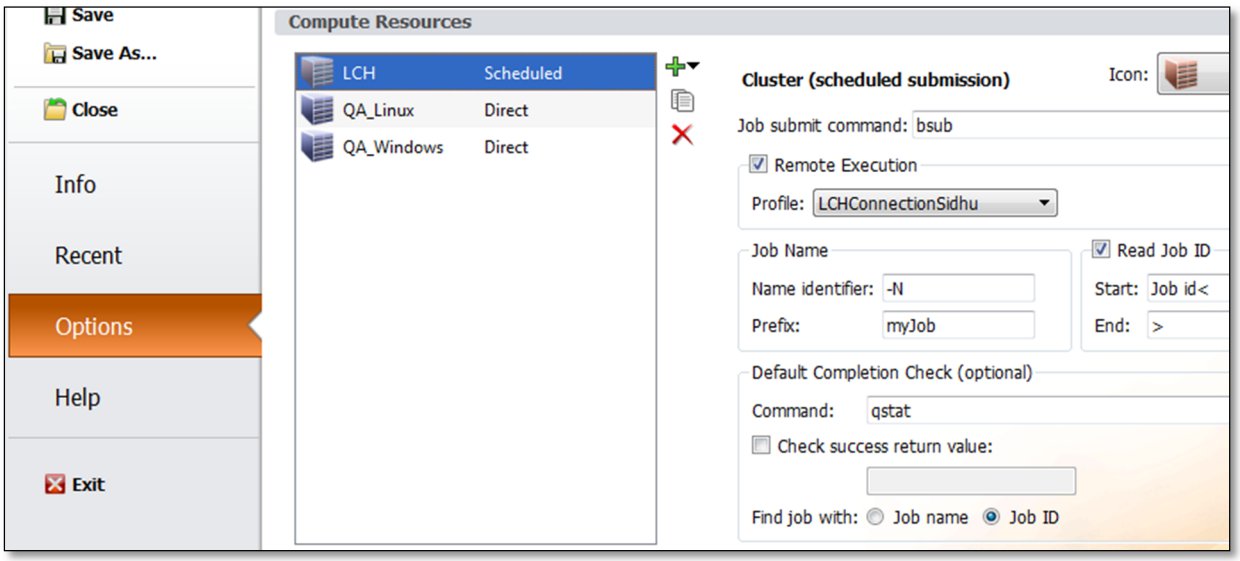


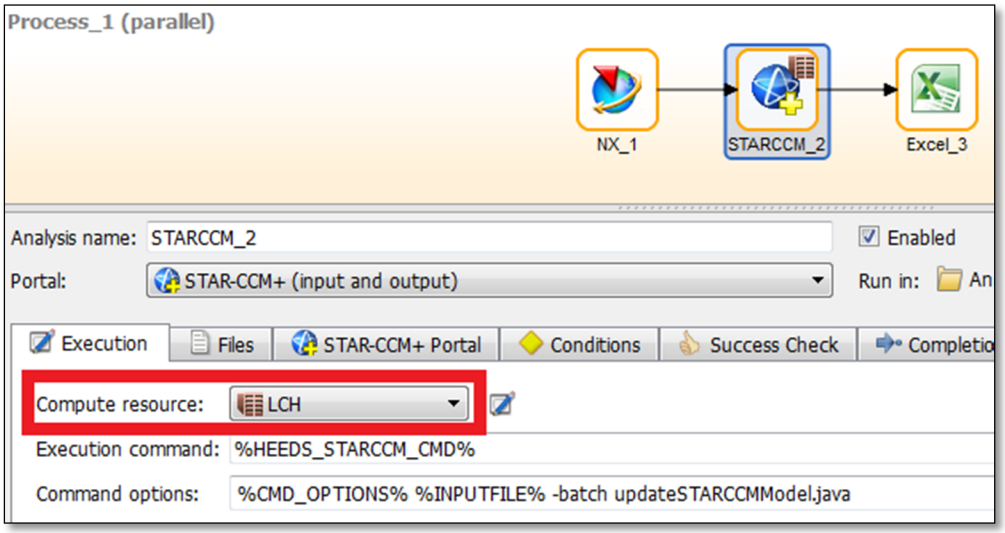
- Extend the calculator by creating your own custom formulas to use in other projects.



Compute Resources

The definition and use of the parallel settings for analysis execution have been streamlined and extended. The design has also been simplified to allow for reuse and to reduce setup time.





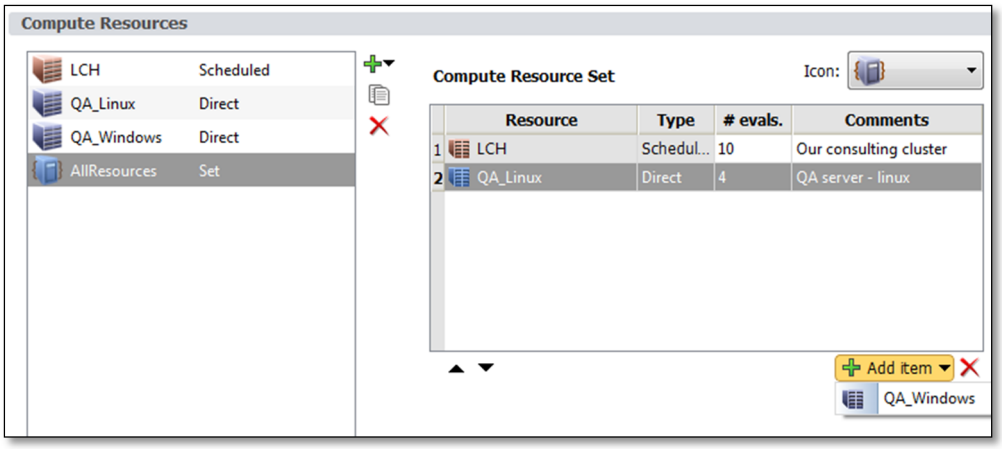
This feature provides the following advantages:

- You can now easily create and maintain the execution and parallel details associated with a hardware resource (cluster, cloud, etc.) in one area of the product.
- You can select from already-defined compute resources to simplify the definition at the analysis level.
- There is now quick access to parallel detail data through the use of icons on the process graph.
- You can switch between serial and parallel mode with one click. This allows you to run a parallel project in serial mode to debug the project setup without having to make any changes to the analysis details.

Compute Resource Set

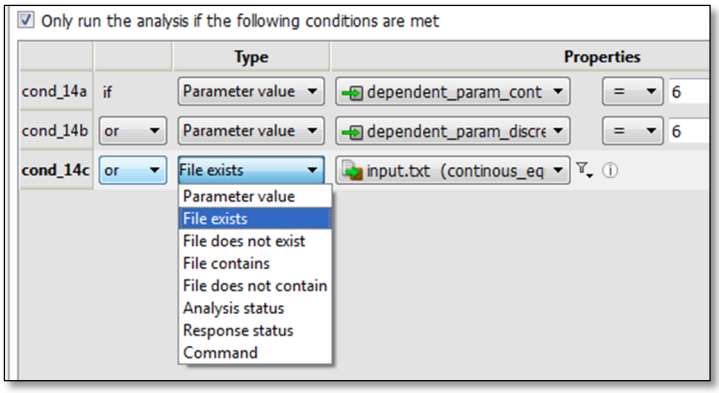
This new feature provides the ability to use multiple computer resources with the parallelization of one or more analysis tools. It allows for tremendous flexibility in the use and management of disparate computer resources. You can use the Compute Resource Set option to:

- Use multiple compute resources, not managed by a third-party scheduler, for design parallelization.
- Use idle workstations to run multiple jobs.
- Manage and balance parallelization between multiple analyses. For example, using this feature you can place a limit on the total number of jobs for AnalysisA + AnalysisB, independent of the number of parallel jobs defined individually for each analysis. This allows for the control of resources when they are hardware constrained, not software constrained.
- Increase the level of parallelization by making use of separate compute resources (for example, 1 cluster + 3 workstations).



Process Branching

There have been several enhancements to the process definition functionality. You can now use logic-based conditions to drive the flow in the analysis process. These conditions, defined at the analysis level, control whether an analysis will be run. In addition, HEEDS now generates a detailed log with the information on the analyses that were executed and the status of the conditions evaluated.

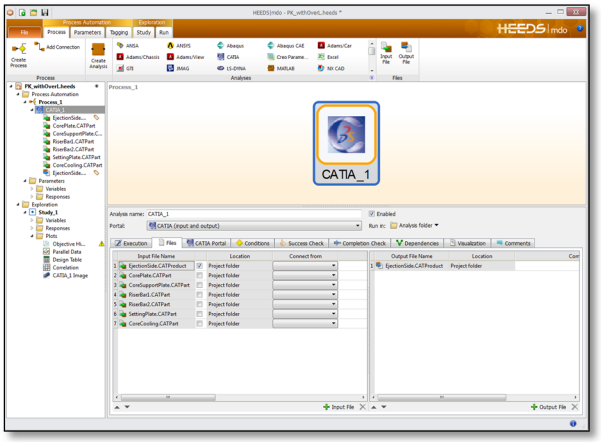


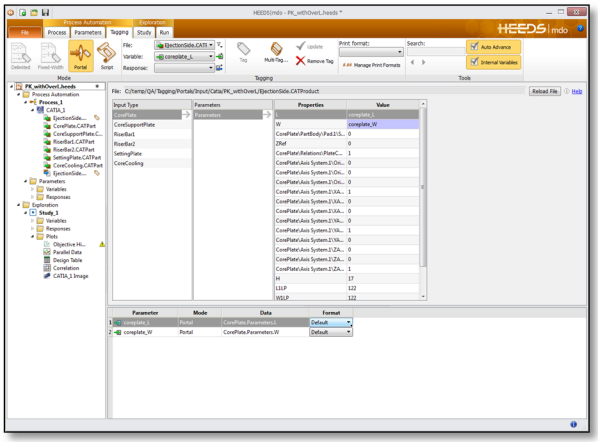
Supported condition types include parameter-based, analysis status based, response status based, and others. The new process definition provides the following advantages:

- You can streamline processes by skipping compute-intensive analyses under specific conditions.
- The setup process is more efficient as there is no longer the need to script special cases in the process flow.
- You now have the option to continue to perform analyses for a design even if an upstream analysis fails.

CATIA Portal

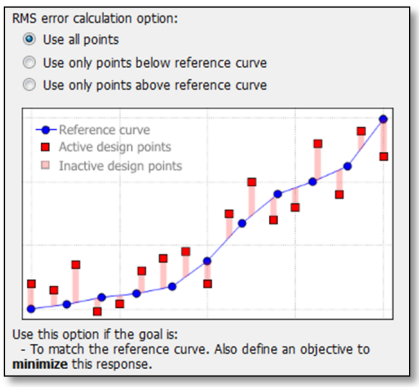
This new portal allows you to easily include CATIA within your analysis process. The CATIA portal is used to update geometry using existing CATIA models. It allows you to modify parameters in the CATIA document (.CATPart or .CATProduct) and supports the inclusion of user macros from inside the portal. You can select to export CAD geometry in a variety of non-native formats.

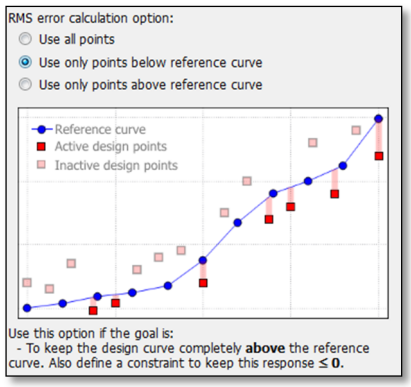


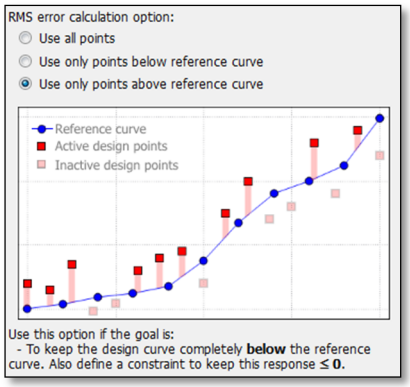


Curve Fitting Enhancement

These options provide the flexibility to ensure that a response curve either lies above or below a reference curve. In prior versions, it was only possible to specify an RMS calculation useful for ensuring that the response curve matched the reference curve as closely as possible.







Data Analysis – Clustering

Using the new *clustering* feature enables you to more easily identify trends in large data sets. It processes a data set and quickly breaks up the data into unique disjointed groups of data. Points that share characteristics are assembled together into a cluster. This feature has been implemented in HEEDS POST using the *k-means* clustering technique, which uses centroids to analyze data sets [1]. It then creates new design sets that represent the different clusters, which allows you to investigate trends in variables and/or responses within a design set. For example, you can look for designs that are most similar within a set based on a subset of variables or responses. This tool can be used to gain additional information about similarities in designs when they may not be visible through the other plots.

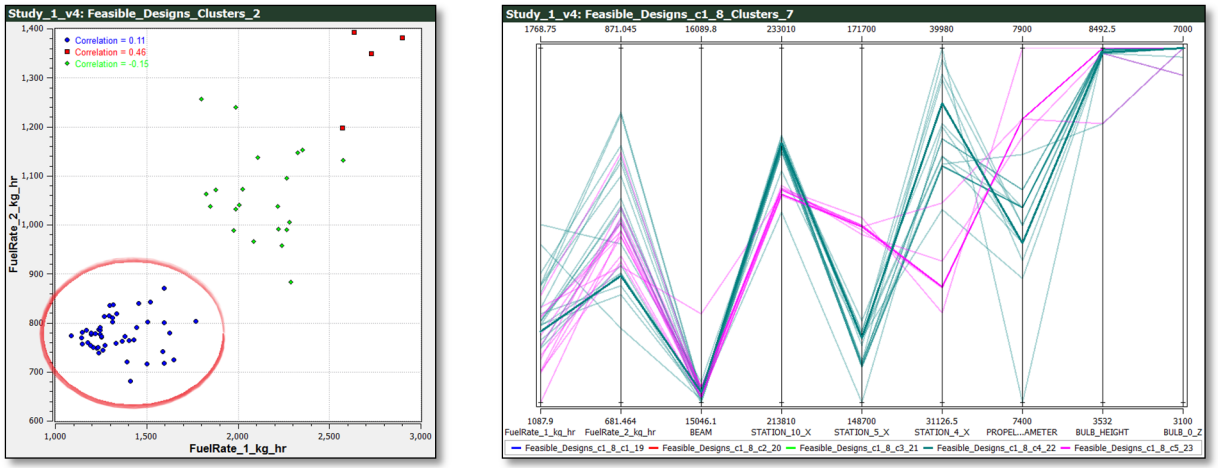
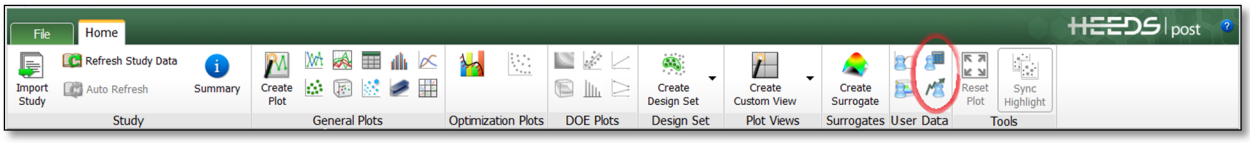


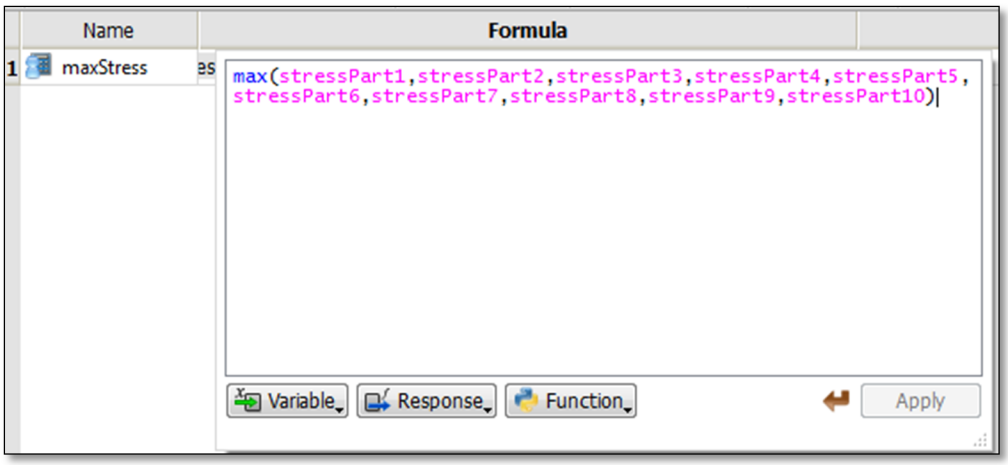
IMAGE ON LEFT - Result of a cluster analysis on a 2D relation plot to identify the designs with high performance metric. IMAGE ON RIGHT - Results of a clustering analysis on the "good designs" identified in the previous analysis to identify any trends in the variable space. The results show two slightly different design concepts that give similar results in terms of design performance.

User Data Tool

With this new feature, you can create custom responses in HEEDS POST based on the design data from the study.

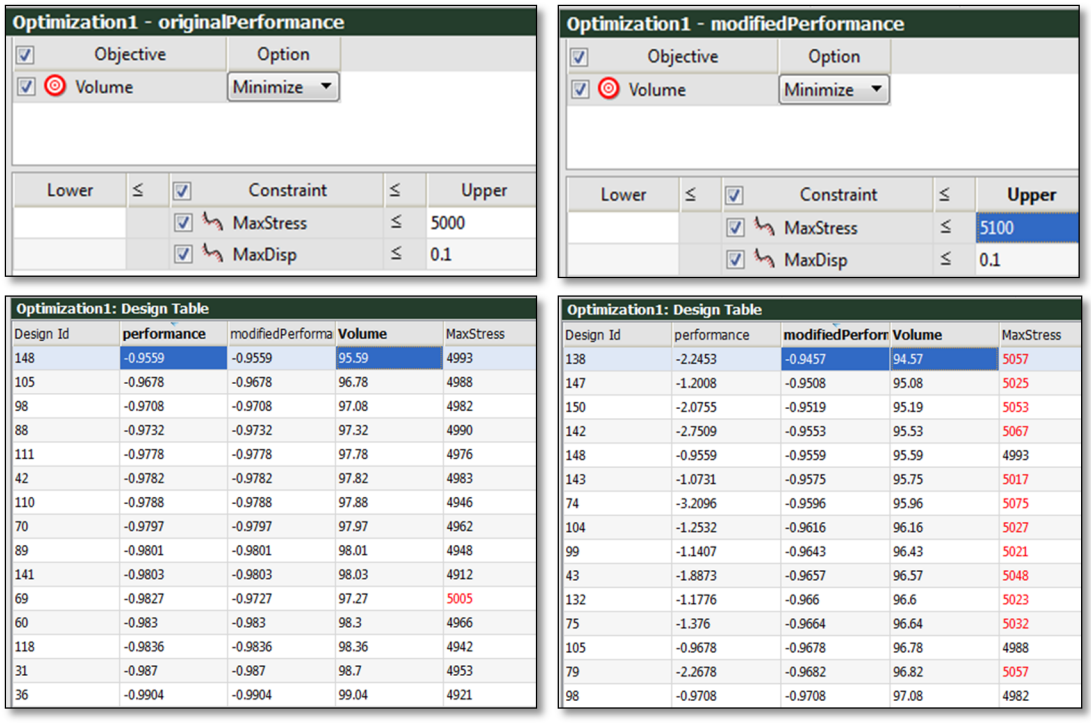


This is useful when the data needed for optimization is different than what you would want to see when post processing. For example, you may have 10 parts where you want to evaluate and constrain stress. However, for the final post processing, you may only want to look at the maximum across all 10 parts. Using this feature, you don't need to create extra variables or responses in the HEEDS MDO project; you can simply create them in HEEDS POST. This simplifies the setup of the HEEDS model since you don't need to include additional variables just for post processing. Moreover, if you forget to define a monitoring response, you can easily add it in HEEDS POST while the study is running.



Performance Tool

The new Performance Tool allows you to easily create custom performance definitions in HEEDS POST for performing certain what-if studies. For example, it is common to have requirements change after an optimization study has been completed. In this case, it is very desirable to update the design ranking based on the updated constraints and objectives on existing study data. There may also be cases where you want to look at the impact of relaxing or tightening constraints on existing study data. The Performance Tool allows you to get new information quickly without running a new study or exporting to an external application.



The figures above show the original and the new modified performance definitions. The design tables show the designs sorted using the performance definition above the table. You can see that with the relaxed constraint in the modified performance, there is a design in the existing set with a lower volume.

Minor features

Several enhancements to the STAR-CMM+ portal

- Transform operations are available through tagging.
- Finer control of analysis operations such as the ability to turn on/off mesh, run, and saving thereby allowing for CAD-robustness studies, running on different machines, and time savings.
- New macro insertion locations for before meshing, after meshing and after running allow for greater customization.
- Global control of visualization file dimensions leads to less errors of aspect ratios.

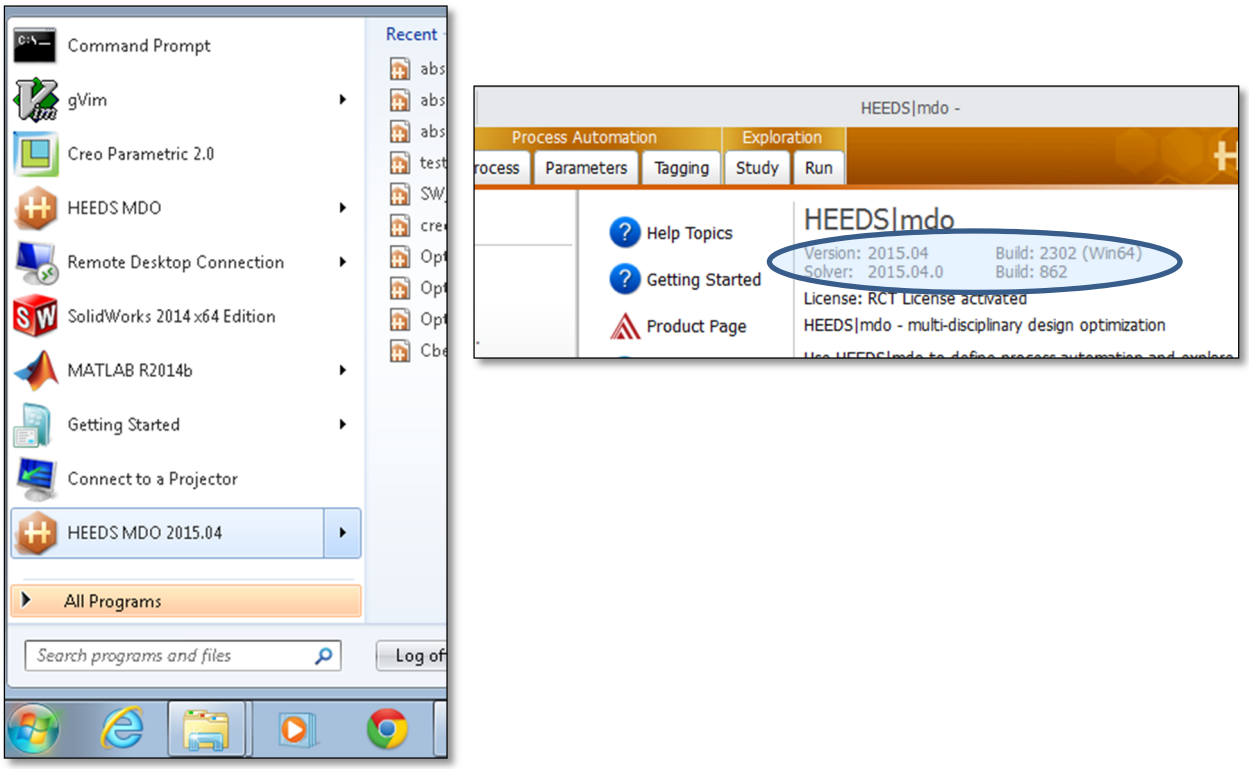
Compute icons on analyses

New icons allow you to easily identify the compute resources being used by an analysis.

Display of version information

The version information is now included in the Start Menu on Windows to easily distinguish between multiple HEEDS versions available on the system.

You can now also see the detailed version information for the Modeler, solver, and portals under the **File-> Help** tab in HEEDS MDO. This allows you to verify that the correct versions are being used, especially with patch releases.



Ability to select a single analysis when evaluating responses

When evaluating responses, you can now select to evaluate a single analysis or all analyses. This saves time by only evaluating the responses you are interested in.

Import results update

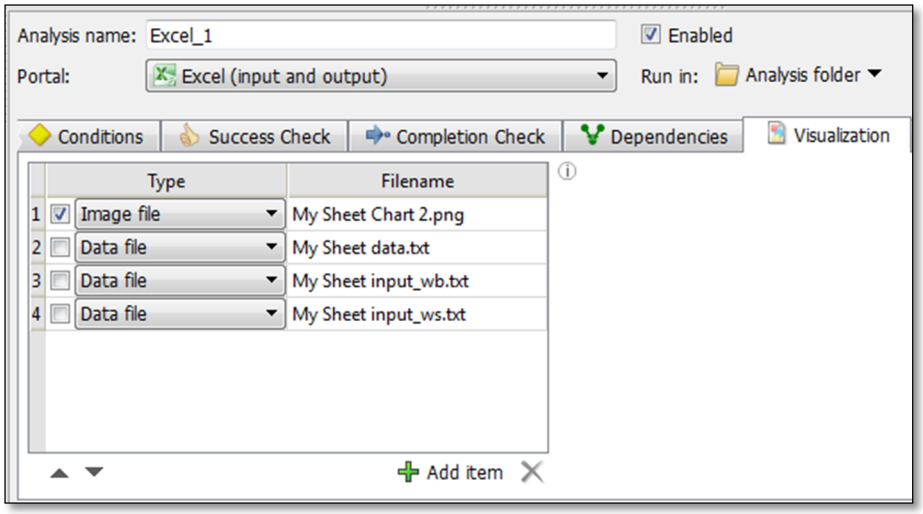
To improve usability when importing study results, HEEDS now browses for the **HEEDS0.res** file.

Additional options in Copy Study

When copying an existing study, you can now copy select parts of the study definition without having to copy all aspects of it. This can save time when copying large studies.

Image export for the Excel portal

The Excel portal now supports the creation of image files from charts in the Excel file. These visualization files can then be viewed in HEEDS POST for an enhanced post-processing experience and better insights into your design space.



Support for visualization of CAD files

The visualization of CAD geometry is now directly and automatically supported.

Ability to create multiple plots

When creating a new plot, you now have the option to create multiple series on the same plot or separate plots for each selection. This allows you to quickly create several plots at once, which in the past would have required numerous clicks and several repetitive tasks.

Several bug fixes

References

[1] MacQueen, J. Some methods for classification and analysis of multivariate observations. Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability, Volume 1: Statistics, 281--297, University of California Press, Berkeley, Calif., 1967.