VisualDOC

LIST OF NEW FEATURES

VERSION 8.0

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VisualDOC 8.0

VisualDOC 8.0 includes several major and minor changes aimed at improving the user-interface and performance as compared to version 7.2. The highlight of this release is Kriging model for response surface construction and a new ANSYS component which communicates data with the ANSYS Workbench software directly. The new ANSYS component does not require the user to manually specify how to read/write ANSYS data files. The following is the list of additions and enhancements in this release of VisualDOC.

Kriging Model

Kriging model is implemented in VisualDOC 8.0. The model is very flexible due to a wide range selection of correlation functions. It can be applied to approxiate many different and complex response functions. The Kriging model is added to the DOE approximation module as shown in **Figure 1**.

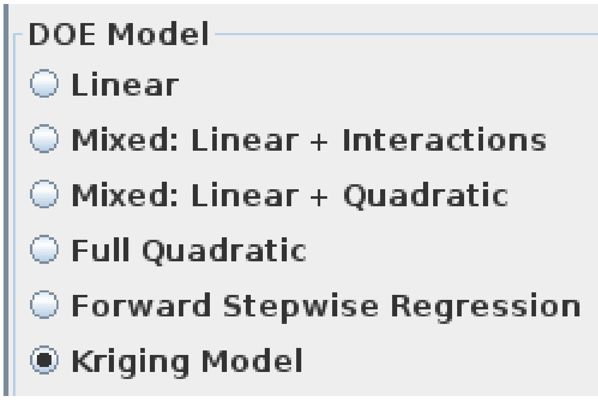

Figure 1 Overview of DOE Model

Kriging model is composed by a regression model (polynomial function) and a stochastic correlation model. In VisualDOC 8.0, Kriging model includes five options for regression models which are constant, linear, linear plus interactions, linear plus pure quadratic, and full quadratic as shown in **Figure 2**. Also, it includes five options for correlation functions which are absolute exponential function, squared exponential/Gaussian function, generalized exponential function, linear function, and cubic function as shown in **Figure 3**. The detailed description of the regression models and correlation functions is presented in the UsersManual in Chapter 3.

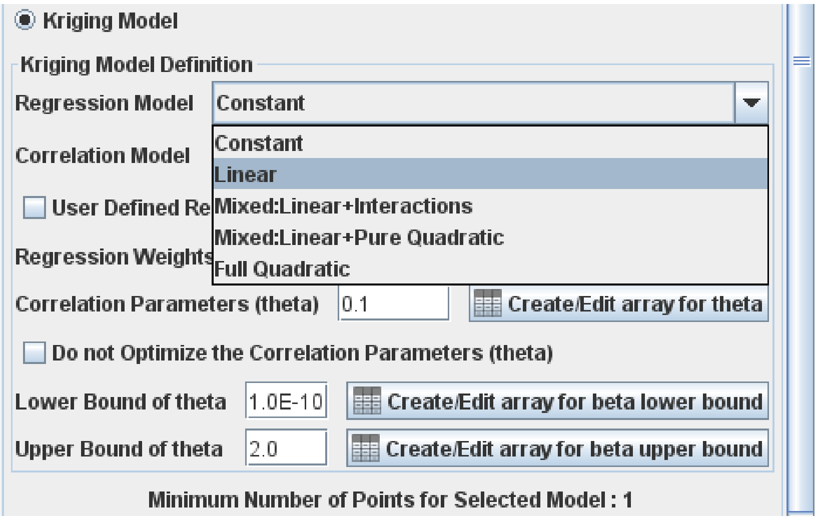

Figure 2 Options for Regression Model

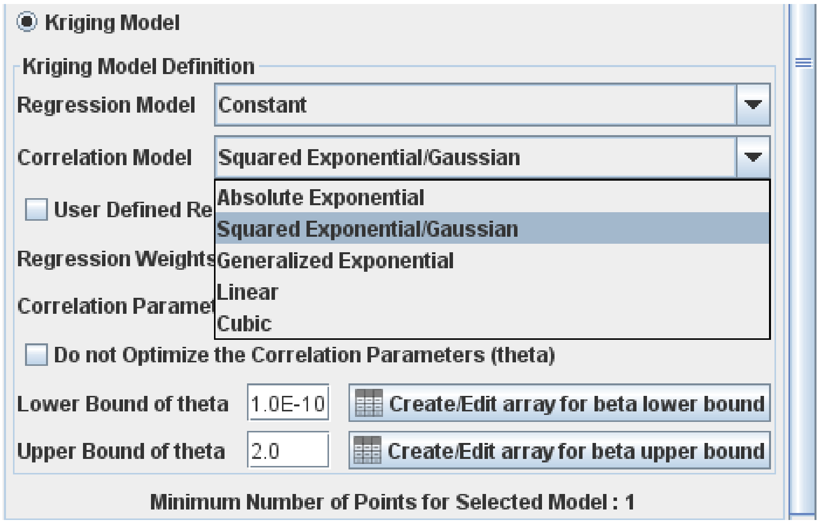

Figure 3 Options for Correlation Function

In addition, the implemented Kriging model provides extra flexibility to the user for solving different problems.

1. The user can input the regression weights by checking the checkbox “User Defined Regression Weights (beta)” when using VisualDOC GUI or by leaving the beta array empty when using VisualDOC API. VisualDOC will not optimize regression weights in this case. The regression weights provided by the user will be used directly to build the model.
2. The user can define their own correlation parameters (theta) by checking the checkbox “Do not Optimize the Correlation Parameters(theta) when using VisualDOC GUI or by leaving the thetaLowerBound and thetaUpperBound array empty when using VisualDOC API. VisualDOC will not optimize the correlation parameters (theta) in this case. The correlation parameters provided by the user will be used to build the model directly.
3. For each parameter, the VisualDOC GUI provides a table that allows user to define the array with certain values that are different from the default value. It is very convenient for big system. For example, if user wants to define an array of theta with all the values to be 0.1 except one design variable which should be 0.2. In this case, the user only needs to insert 0.1 in the text box as default value, and then click the button “Create/Edit array for theta” to launch the table. Then inserts 0.2 in the row corresponding to the design variable and leave all the other rows empty as shown in **Figure 4**.
4. The Kriging model is available for VisualDOC API. The user needs to call DOE() method to build model and call krigResp() method to evaluate the response values for unknow points. The detailed desctiption on how to use the Kriging model for VisualDOC API is presented in C_API in Chapter 2.

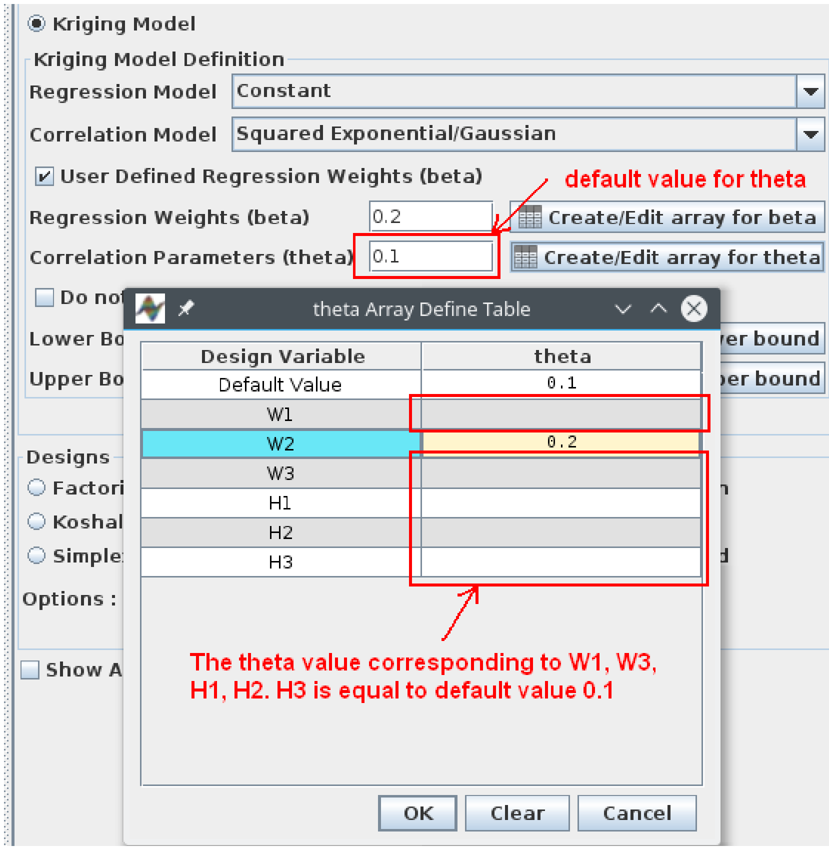

Figure 4 Correlation Parameters (theta) Setting Table

New ANSYS Component

The new ANSYS component is an integrated file IO component that talks directly to ANSYS Workbench. The property editor of the ANSYS component is shown in **Figure 5**.

Compared with File I/O component, the user does not need to create search/modify/extract actions by working with the .wbpj files, which is tedious and error prone in general. Instead, the user only needs to specify the location of the .wbpj file and click "LoadData" button. ANSYS component automatically parses and shows the input and output data in two separate tables as shown in **Figure 6**. The "Use" checkbox allows the corresponding data be added/removed from the database. The tool bar under the table can be used to manipulate the data in the table. The "Select All" icon and the "Deselect All" icon allows the user to select or deselect all the data in the table.

The ANSYS component also supports both remote run and parallel run.

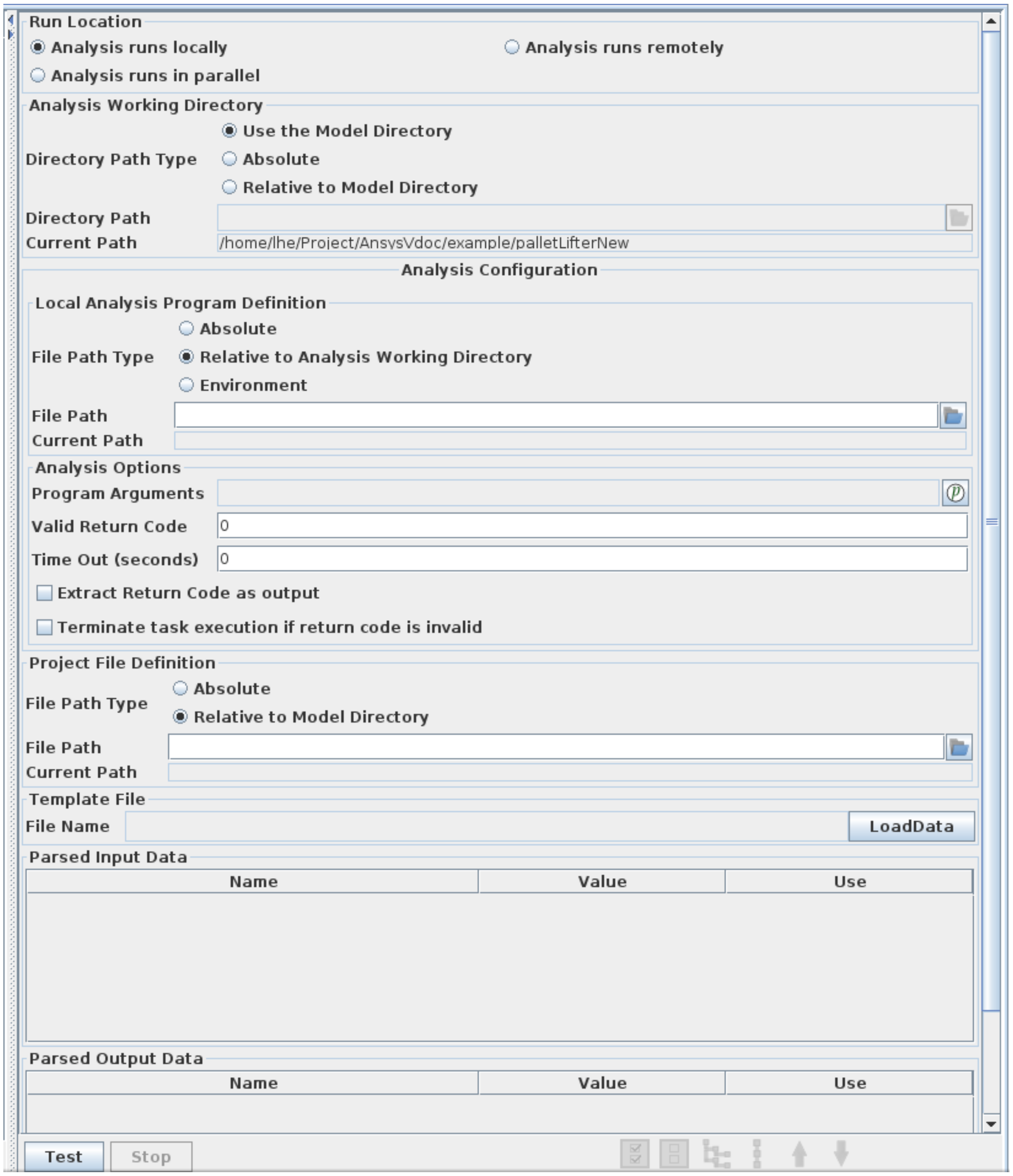

Figure 5 ANSYS Component Property Editor

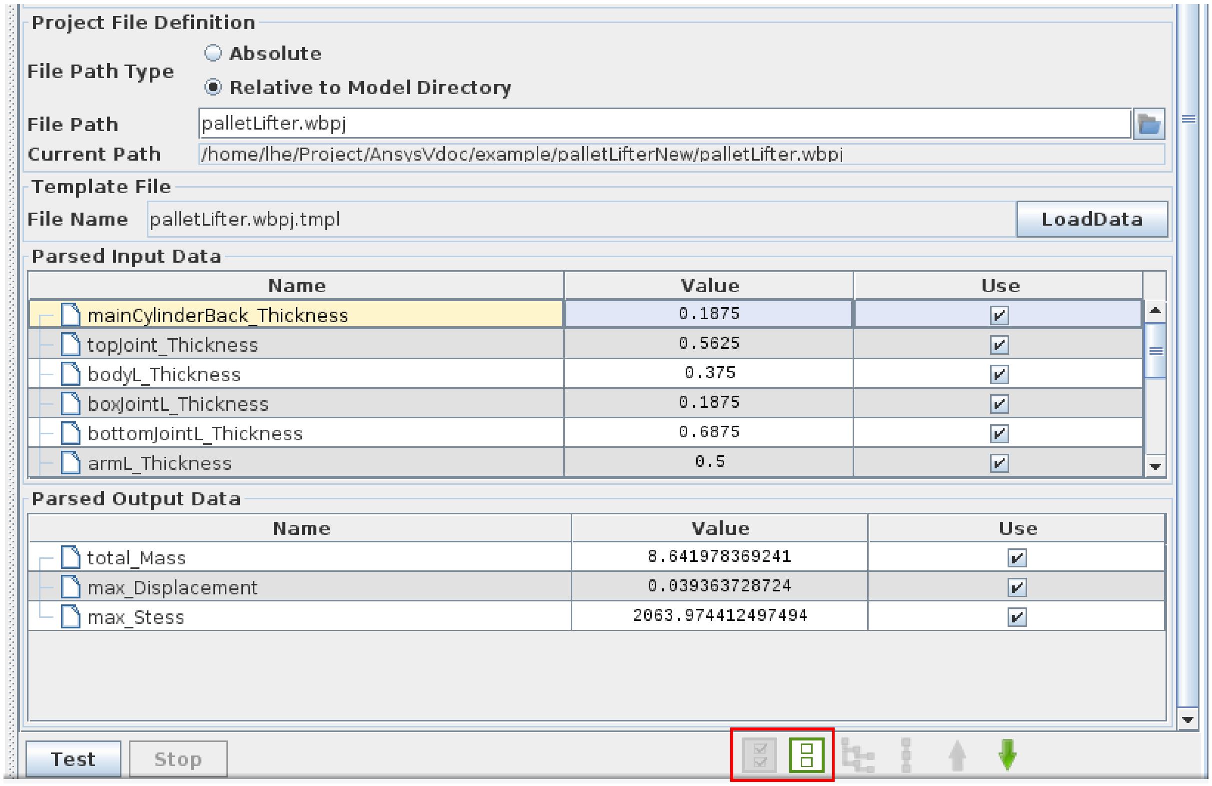

Figure 6 Parsed Data for ANSYS Workbench Project File

DOT 7.2

DOT Version 7.2 includes several enhancements of Version 6.0, most of which are minor. One important fix is that, in some cases, the final values of the constraints returned from DOT are not consistent with the final values of the design variables (the constraint values printed in the DOT output file are consistent). The major enhancement in DOT 7.2 is the ability to do multi-level optimization.

Multi-level optimization is useful in two key situations.

The first is where the sensitivity of the objective and constraints is markedly different such in combined shape and sizing structural optimization. Such problems may be difficult to solve considering all variables together. By separating them into two sets, the reliability of the optimization may be significantly improved.

The second situation where this is useful is in Multidiscipline Design Optimization, or MDO. For example, in designing an aircraft, the system level variables may include the shape of the fuselage and wings while sub-system variables include aerodynamic shape and structural sizing.

With this method, the gradients are required for all system and sub-system variables and all variables are included at the system level. This provides a search direction that is best for both levels of variables. Then, during the system level one-dimensional search, the sub-system optimization is performed in terms of the sub-system variables, including all system and sub-system constraints.

New Examples and Documentation

Four new examples showcasing the new and advanced features of VisualDOC have been added with this release. The new examples are as follows.

1. MixingElbow: This example showcases how to coupling ANSYS Workbench fluent simulation module with VisualDOC MDO options using the new ANSYS component.
2. PalletLifter: This example showcases how to coupling ANSYS Workbench mechanical simulation module with VisualDOC MDO options using the new ANSYS component.
3. beam_doe_Kriging: This example showcases how to set up the Kriging model in the DOE module to build the response surface. It also shows how to use the Kriging approximation model to perform optimization with the approximations.
4. chemical_process_conversion_API: This example showcases how to use VisualDOC API for DOE with Kriging model.

All the accompanying manuals have been updated for this new release.