Altair

HyperWorks

Altair HyperStudy 2019 Tutorials

HS-2201: Using Existing Design Data from an Excel Spreadsheet with a Lookup Model

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This tutorial demonstrates how to perform an optimization study for an application where only design data in a `.csv` file is available (that is no simulation model exists).

The objective of this tutorial is to create a fit (approximation) using the designs in the `study.csv` file and then to perform an optimization study using the fit.

The first and second columns contain the values of the two input variables for each design, and the third and fourth columns contain the results of a DOE study previously run. Sixteen designs have been evaluated.

Model Files

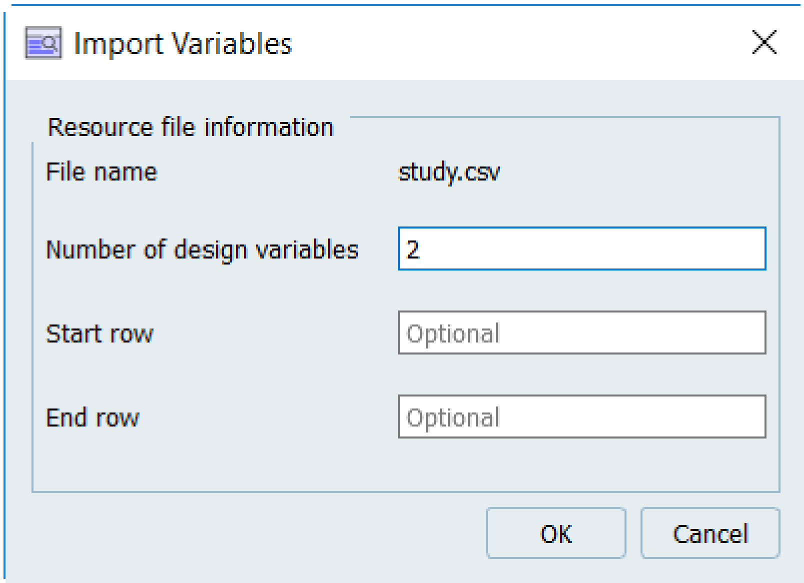
The `study.csv` file used in this tutorial can be found in `<hst.zip>/HS-2201/`. Copy these files to your working directory.

Exercise

Step 1: Perform the Study Setup

1. Start HyperStudy.
2. To start a new study, click **File** > **New** from the menu bar, or click on the toolbar.
3. In the **HyperStudy – Add** dialog, enter a study name, select a location for the study, and click **OK**.
4. Go to the **Define models** step.
5. Add a Lookup model.
    a. Click **Add Model**.
    b. In the **Add - HyperStudy** dialog, select **Lookup** and click **OK**.
    c. In the work area, Resource column, click .
    d. In the **HyperStudy – Load model resource** dialog, navigate to your working directory and open the `study.csv` file.
6. Click **Import Variables**.

7. In the **Import Variables** dialog, enter `2` in the Number of design variables field and click **OK**.



8. Go to the **Define Input Variables** step and review the two input variables that were imported from the `study.csv` file.

	Active	Label	Varname	Lower Bound	Nominal	Upper Bound	Comment
1	☑	DV1	var_1	0.3367880 ...	4.1015411 ...	4.9862686 ...	...
2	☑	DV2	var_2	0.4862686 ...	3.9158816 ...	4.8199886 ...	...

9. Go to the **Specifications** step.

Step 2: Perform the Nominal Run

1. In the work area, set the Mode to **Nominal Run**.

	Mode	Label	Varname	Details
1	◉	Nominal Run	Nom	Run system at nominal values
2	○	System Bounds Check	Chk	Run system at nominal values, then lower and upper values
				Show more ...

2. Click **Apply**.
3. Go to the **Evaluate** step and click **Evaluate Tasks**.
4. Go to the **Define Output Responses** step.

Step 3: Review the Output Responses

1. Review the two output responses that were imported from the `study.csv` file.

	Active	Label	Varname	Expression	Value	Comment
1	☑	Resp1	r_1	ds_1[0] ...	8.0174200	...
2	☑	Resp2	r_2	ds_2[0] ...	-1.5008200	...

2. Go to the **Post-Processing** step.

Step 4: Import the DOE Results from the .csv File

1. In the Explorer, right-click and select **Add** from the context menu.
2. In the **Add - HyperStudy** dialog, select **DOE** and click **OK**.
3. Go to the **Specifications** step.
4. In the work area, set the Mode to **Run Matrix**.
5. From the Settings tab, Matrix File field, click .
6. In the **Open** dialog, navigate to your working directory and open the `study.csv` file.

	Value
Matrix File	C:/HS-2201/study.csv
Use Inclusion Matrix	☐

7. Click **Apply**.
8. Go to the **Evaluate** step and click **Evaluate Tasks**.

Step 5: Create a Fit (Approximation)

1. In the Explorer, right-click and select **Add** from the context menu.
1. In the **Add - HyperStudy** dialog, select **Fit** and click **OK**.
2. Go to the **Select Matrices** step.
3. Add matrix.
    a. Click **Add Matrix**.
    b. In the **Add - HyperStudy** dialog, add one matrix.
4. Click **Import Matrix**.
5. Go to the **Specifications** step.

6. Verify that the Fit Type assigned to each output response is FAST – Fit Automatically Selected by Training.

   Note: By default, FAST automatically selects the best Fit type from all available Fits. You can manually select the Fit types FAST can choose by highlighting one or more responses in the work area and selecting Fits from the Settings tab.

	Label	Fit Type	Fit Specifics
1	Resp1	FAST - Fit Automatically Selected by Training	LSR / MLSM / RBF
2	Resp2	FAST - Fit Automatically Selected by Training	LSR / MLSM / RBF

7. Click **Apply**.
8. Go to the **Evaluate** step and click **Evaluate Tasks**.
9. Go to the **Post-Processing** step.
10. Click the **Diagnostics** tab.

    Resp1 has the best Fit using LSR with custom terms; the Regression Terms tab shows that only linear terms are required. Resp2 has the best results using a MLSM. For Resp2, the R-square value that is based on the Input Matrix shows that the model accuracy is very good. The moderate value for the cross validation indicates that the model may benefit from more data because its accuracy is quite dependent on the complete set of point. Removing any points from the input set can significantly alter the Fit's predictions.

	Label	Fit Type	Fit Specifics	R-Square
1	Resp1	LSR	Custom	1.0000000
2	Resp2	MLSM	linear - 5.9883612	0.5051583

Detailed Diagnostics | Regression Terms | f() Regression Equation | ANOVA

	Criterion	Input Matrix	Cross-Validation Matrix	Testing Matrix
1	R-Square	0.9959063	0.5051583	N/A
2	Relative Average Absolute Error	0.0322481	0.4789133	N/A
3	Maximum Absolute Error	0.1793161	1.2614781	N/A
4	Root Mean Square Error	0.0506083	0.5564140	N/A
5	Number of Samples	16	16	0