Altair

HyperWorks

Altair HyperStudy 2019 Tutorials

HS-2200: Using Existing Design Data from an Excel Spreadsheet

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This tutorial demonstrates how to perform an optimization study for an application where only design data in a Microsoft Excel spreadsheet is available (i.e.: no simulation model exists). The Excel spreadsheet `study.xls` used in this tutorial can be found in `<hst.zip>/HS-2200/` and copied to your working directory.

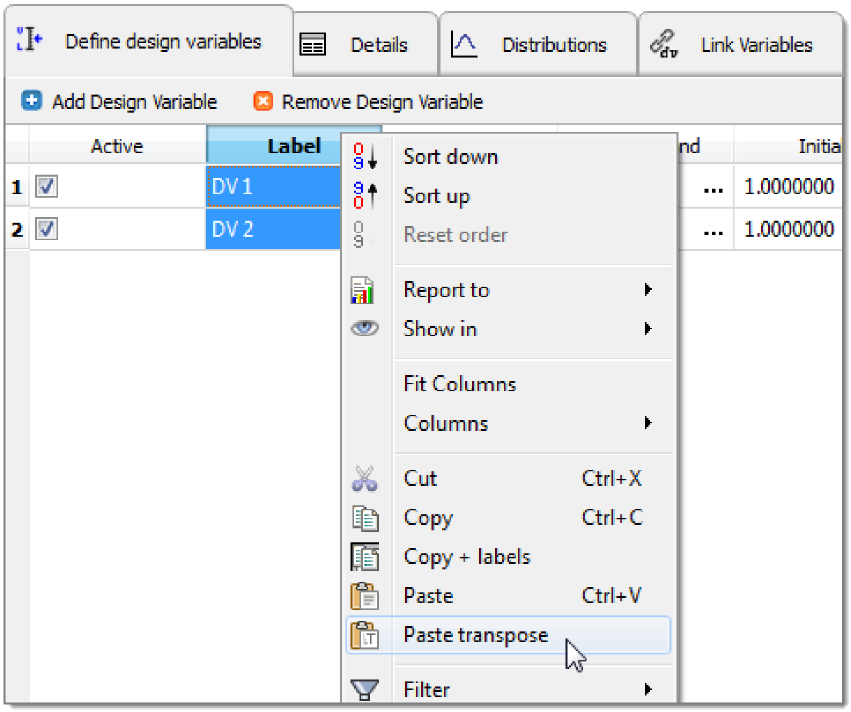
The objective of this tutorial is to create a fit (approximation) using the designs in the spreadsheet and then to perform an optimization study using the fit.

The spreadsheet used here contains five columns. The first column contains the numbering of the designs, the second and third columns contain the values of the two input variables for each design, and the fourth and the fifth columns contain the results of a DOE study previously run. Sixteen designs have been evaluated.

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 an Internal Math model.
   a. Click ***Add Model***.
   b. In the **Add - HyperStudy** dialog, add one **Internal Math** model.
6. Go to the **Define Input Variables** step.
7. Click ***Add Input Variable***.
8. In the **Add - HyperStudy** dialog, add two input variables.
9. Optional. Copy the input variable labels from the `study.xls` spreadsheet, and paste them into the **Labels** column of the work area.

   Note: When you paste the input variable labels into the work area, select ***Paste transpose*** from the context menu.



10. Go to the **Specifications** step.

Step 2: Perform the Nominal Run

1. In the work area, set the **Mode** to ***Nominal Run.***
2. Click ***Apply***.
3. Go to the **Evaluate** step.
4. Click ***Evaluate Tasks***.
5. Go to the **Define Output Responses** step.

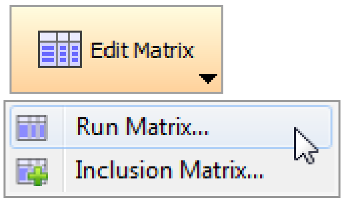
Step 3: Create and Define Output Responses

1. Click ***Add Output Response***.
2. In the **Add - HyperStudy** dialog, add two output responses.
3. Optional. Copy the output response labels from the `study.xls` spreadsheet, and paste them into the **Label** column in the work area.

   Note: When you paste the input variable labels into the work area, select ***Paste transpose*** from the context menu.
4. Go to the **Post processing** step.

Step 4: Import the DOE Results from the Spreadsheet

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 ***None***.
5. Click ***Apply***.
6. In the top, right of the work area, select ***Edit*** > ***Run Matrix***.



7. In the **Run Matrix** dialog, click ***Add Run*** to add 16 runs to the matrix, as there are 16 runs in the `study.xls` spreadsheet.
8. Open the `study.xls` spreadsheet in Excel.
9. Copy all of the input variable and output response data for each run in the spreadsheet.

Design #	DV1	DV2	Resp1	Resp2
1	4.101541	3.915882	8.01742	-1.50082
2	0.962119	2.209682	3.1718	-0.50807
3	1.505328	0.899178	2.40451	-0.22357
4	4.55268	3.340227	7.89291	-1.48097
5	3.824944	1.466227	5.29117	-1.05654
6	3.109682	1.85268	4.96236	-1.13866
7	3.387054	0.501541	3.8886	0.289096
8	1.391876	3.036788	4.42866	-0.95225
9	4.986269	3.791876	8.77814	-1.53573
10	3.599178	2.462119	6.0613	-1.316
11	2.719989	1.321595	4.04158	-0.87569
12	1.921595	2.624944	4.54654	-1.09864
13	0.336788	4.205328	4.54212	1.20702
14	2.415882	4.819989	7.23587	-1.3786
15	2.066227	0.486269	2.5525	0.540451
16	0.640227	4.587054	5.22728	-0.22005

10. In the **Run Matrix** dialog, highlight all of the runs in the matrix.
11. Right-click on the highlighted runs, and select ***Paste*** from the context menu. HyperStudy pastes the input variable and output response data that you copied from the `study.xls` spreadsheet into the run matrix.

	DV1	DV2	Resp1	Resp2
1	4.1015411	3.9158816	8.0174200	-1.5008200
2	0.9621191	2.2096819	3.1718000	-0.5080740
3	1.5053279	0.8991784	2.4045100	-0.2235670
4	4.5526797	3.3402270	7.8929100	-1.4809700
5	3.8249440	1.4662270	5.2911700	-1.0565400
6	3.1096819	1.8526797	4.9623600	-1.1386600
7	3.3870539	0.5015411	3.8886000	0.2890960
8	1.3918759	3.0367880	4.4286600	-0.9522500
9	4.9862686	3.7918759	8.7781400	-1.5357300
10	3.5991784	2.4621191	6.0613000	-1.3160000
11	2.7199886	1.3215948	4.0415800	-0.8756900
12	1.9215948	2.6249440	4.5465400	-1.0986400
13	0.3367880	4.2053279	4.5421200	1.2070200
14	2.4158816	4.8199886	7.2358700	-1.3786000
15	2.0662270	0.4862686	2.5525000	0.5404510
16	0.6402270	4.5870539	5.2272800	-0.2200490

12. Click ***Apply***.
13. Click ***OK***.

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. Click ***Add Matrix***.
4. In the **Add - HyperStudy** dialog, add one matrix.
5. Click ***Import Matrix***.
6. Go to the **Specifications** step.
7. In the work area, set the **Mode** to ***Moving Least Squares (MLSM)***.
8. In the **Settings** tab, change the **Order** to ***3 + interactions***.
9. Click ***Apply***.
10. Go to the **Evaluate** step.
11. Click ***Evaluate Tasks***.
12. Go to the **Post processing** step.
13. Click the ***Residuals*** tab to investigate the accuracy of your approximation. From the table you can see that this approximation is not as good.

	DV 1	DV 2	Response 2	Response 2__MLSM	Error	Percent Error
12	1.9215948	2.6249440	-1.0986400	-1.1830153	0.0843753	-7.6799734
6	3.1096819	1.8526797	-1.1386600	-1.1770224	0.0383624	-3.3690845
10	3.5991784	2.4621191	-1.3160000	-1.3399736	0.0239736	-1.8217026
7	3.3870539	0.5015411	0.2890960	0.2923459	-0.0032499	-1.1241583
14	2.4158816	4.8199886	-1.3786000	-1.3928657	0.0142657	-1.0347928
2	0.9621191	2.2096819	-0.5080740	-0.5089882	9.14e-04	-0.1799333
9	4.9862686	3.7918759	-1.5357300	-1.5376548	0.0019248	-0.1253349
5	3.8249440	1.4662270	-1.0565400	-1.0563188	-2.21e-04	0.0209344
1	4.1015411	3.9158816	-1.5008200	-1.4952780	-0.0055420	0.3692651
13	0.3367880	4.2053279	1.2070200	1.2021515	0.0048685	0.4033470
4	4.5526797	3.3402270	-1.4809700	-1.4726104	-0.0083596	0.5644687
15	2.0662270	0.4862686	0.5404510	0.5270013	0.0134497	2.4886100
11	2.7199886	1.3215948	-0.8756900	-0.8435790	-0.0321110	3.6669395
16	0.6402270	4.5870539	-0.2200490	-0.2112160	-0.0088330	4.0141249
8	1.3918759	3.0367880	-0.9522500	-0.8946483	-0.0576017	6.0490154
3	1.5053279	0.8991784	-0.2235670	-0.2035035	-0.0200635	8.9742863