#1309: HyperStudy – Best Practices for Fit

Product: HyperStudy
Product Version: HyperStudy 2017.2.2 or above

Topic Objective

Best Practices for Fit.

Topic Details

In order to help you using on the best manner Fit with HyperStudy, let's answer some questions.

1. Which DOE Method should I use as Input Matrix for Fit?
From the list of space filling DOE available in HyperStudy the recommended Top 3 chart is:

- 1st choice: **MELS**

You can either keep the default number of runs (not recommended to decrease it) or increase it. If you have runs from another approach it's recommended to leverage it as Inclusion matrix. The best performance can be expected when the inclusion is an existing data set from a MELS DOE

- 2nd choice: **Hammersley**

It allows distributing the points evenly within the design space and it is well suited to fit highly nonlinear response surface. Same as for MELS, you can leverage available runs as inclusion
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- 3rd choice: **Latin Hypercube**

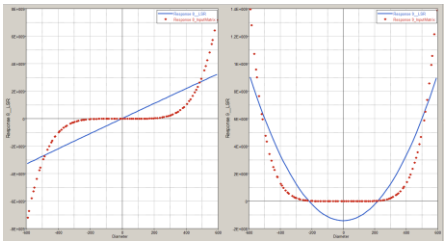
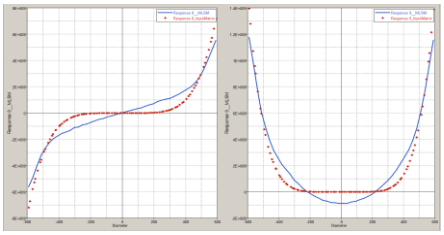
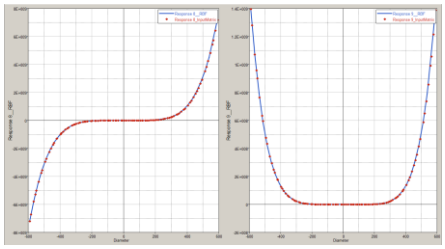
It is also well suited for fitting highly nonlinear response surface but it is a less good space filler. You can also leverage in data from another DOE if available.

Method	Space filling quality	Suited for highly nonlinear response surface	Inclusion matrix
MELS	★★★	✓	✓
Hammersley	★★	✓	✓
Latin Hypercube	★	✓	✓

2. Which DOE Method should I use as Testing Matrix for Fit?
The recommended Top 3 chart is the same as for Input matrix. You can use MELS, Hammersley or Latin Hypercube as Testing matrices, but with smaller number of runs.
Note that if you have used MELS as Input matrix, and you would like to use another MELS as Testing matrix, you should be aware that the resulting Testing matrix could be a subset of the MELS based Input matrix due to the extensible property of MELS.
Ex. For instance if you create a MELS_1 with 40 runs and create another one MELS_2 with 4 runs; the 4 runs of MELS_2 would be the same designs as the first four designs of MELS_1. As a result, if you use MELS_1 as an Input matrix and MELS_2 as a Testing matrix to Fit, you are essentially validating against the same runs as you are creating the fit and hence not really validating it.

To prevent this from happening, you have to change the Random Seed setting of the Testing matrix to be a number larger than the number of runs in the Input data before building it.
Ex. MELS_1 (Input matrix): 40 runs, Random seed=1; MELS_2 (Testing matrix): 4 runs, Random seed=41.

3. Which Approximation Method should I use?
FAST is the recommended choice as it allows building automatically best fitting functions by testing all the methods below and their settings:

Method	Equation	Application	Behavior
Least Squares Regression (LSR)	Available	Linear or low nonlinear functions	
Moving Least Squares Method (MLSM)	Not available	Noisy and/or nonlinear functions	
HyperKriging (HK)	Not available	Nonlinear functions without noise	
Radial Basis Functions (RBF)	Not available	Nonlinear functions without noise	

4. What should I do if the quality of the Fit obtained with FAST is not satisfactory?
FAST will test all the methods and hence will provide the best fit on the studied function. If the quality is still not satisfactory, you have to inspect the function behavior (ex. Discontinuity).