Altair

HyperWorks

Altair HyperStudy 2019 Tutorials

HS-1015: Working with an Internal Math Model

HS-1015: Working with an Internal Math Model

In this tutorial you will learn how to setup a study on simple functions defined using an **Internal Math** model. In this study you will set up a beverage can design of experiments to see how input variables effect the output responses. The beverage can has two input variables: Diameter and Height and two output responses: Material Cost and Volume.

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, select ***Internal Math*** and click ***OK***.
6. Go to the **Define Input Variables** step.
7. Create two input variables.
   a. Click ***Add Input Variable*** twice.
   b. In the work area, **Label** column, change the labels for the two input variables to Diameter and Height.
   c. Change both input variable's lower, initial, and upper bounds to the values indicated in the image below.

	Active	Label	Varname	Lower Bound	Nominal	Upper Bound
1	☑	Diameter	var_1	30.000000	60.000000	90.000000
2	☑	Height	var_2	60.000000	120.00000	180.00000

8. 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***. An `approach/nom_1/` directory is created inside the study directory.
5. Go to the **Define Output Responses** step.

Step 3: Create and Define Output Responses

In this step you will create and define the output responses, Cost and Volume.

1. Create two output responses.
   a. Click ***Add Output Response*** two times.
   b. In the work area, **Label** column, change the labels for the output responses to Cost and Volume.
2. In the **Expression** column, enter the following:
   a. For **Cost**, enter `2*(pi*var_1^2/4)+var_2*pi*var_1`.
   b. For **Volume**, enter `(pi*var_1^2/4)*var_2`.
3. Click ***Evaluate*** to extract the output response values.

	Active	Label	Varname	Expression	Value
1	☑	Cost	r_1	2*(pi*var_1^2/4)+var_2*pi*v...	28274.334
2	☑	Volume	r_2	(pi*var_1^2/4)*var_2	339292.01

Step 4: Run a DOE Study

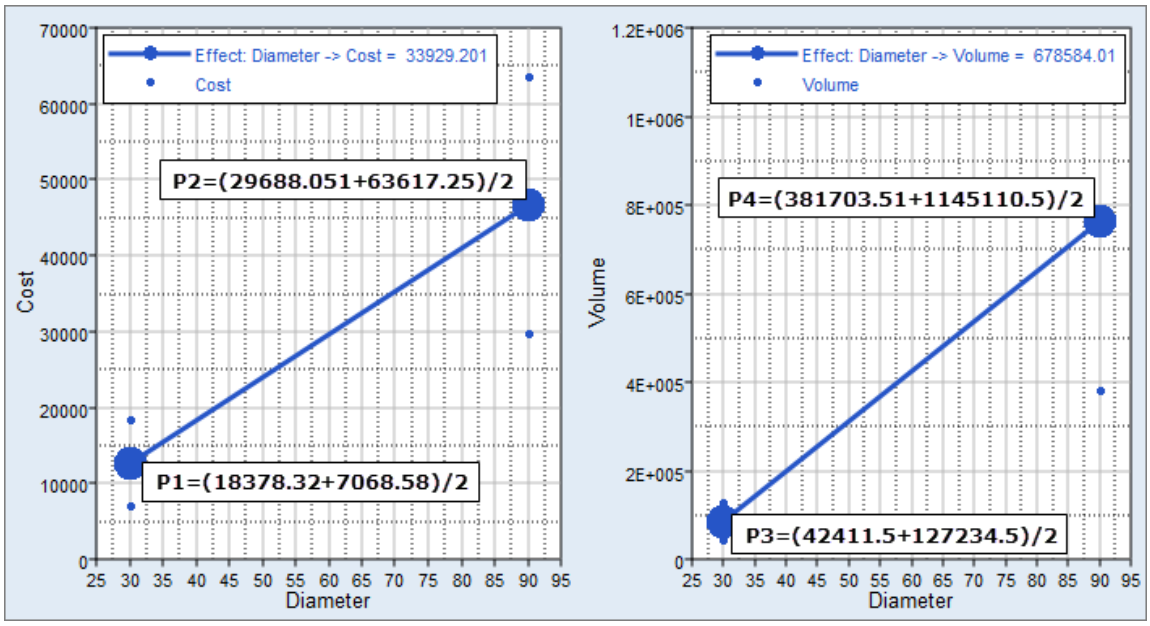
1. In the **Explorer**, right-click and select ***Add*** from the context menu.
2. In the **Add - HyperStudy** dialog, select ***DOE*** and click ***OK***.
3. Go to the **Specifications** step.
4. In the work area, set the **Mode** to ***Full Factorial***.
5. Click ***Apply***.
6. Go to the **Evaluate** step.
7. Click ***Evaluate Tasks***.
8. Go to the **Post-Processing** step.
9. Click the ***Summary*** tab.

   Note that there are two input variables with lower and upper bounds which result in $2^2 = 4$ runs.

	Diameter	Height	Cost	Volume
1	30.000000	60.000000	7068.5835	42411.501
2	30.000000	180.00000	18378.317	127234.50
3	90.000000	60.000000	29688.051	381703.51
4	90.000000	180.00000	63617.251	1145110.5

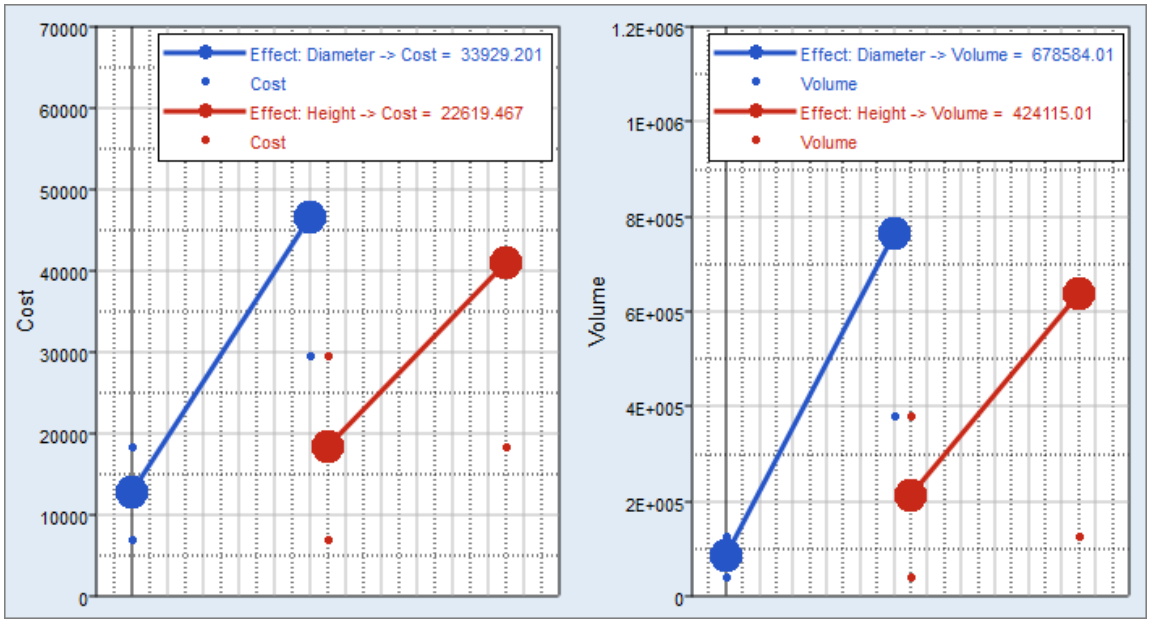
10. Click the ***Linear Effects*** tab.

    The data collected in the Summary tab is used to calculate the linear effects of the Diameter and Height input variables on the Cost and Volume output responses. A line is drawn between the average value of the output response when the input variable is at its lower bound and the average value of the output response when the input variable is at its upper bound.



Effects computation of Diameter on Cost and Volume

The effects of the input variable Height on the output responses Cost and Volume are computed in the same manner. By displaying both input variables and output responses in the same plot, you can compare the effects.



The slope of the lines could be positive or negative. In this example, both effects have a

positive slope which indicates that increasing the input variable's values will also increase the output responses.

Last modified: v2017.2 (9.1144596)