

Plate With a Hole Optimization - Design of Experiments

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Problem Specification

1. Pre-Analysis & Start-Up
2. Initial Solution
3. Input & Output Parameters
4. Design of Experiments
5. Response Surface
6. Optimization
7. Verification & Validation

Exercises

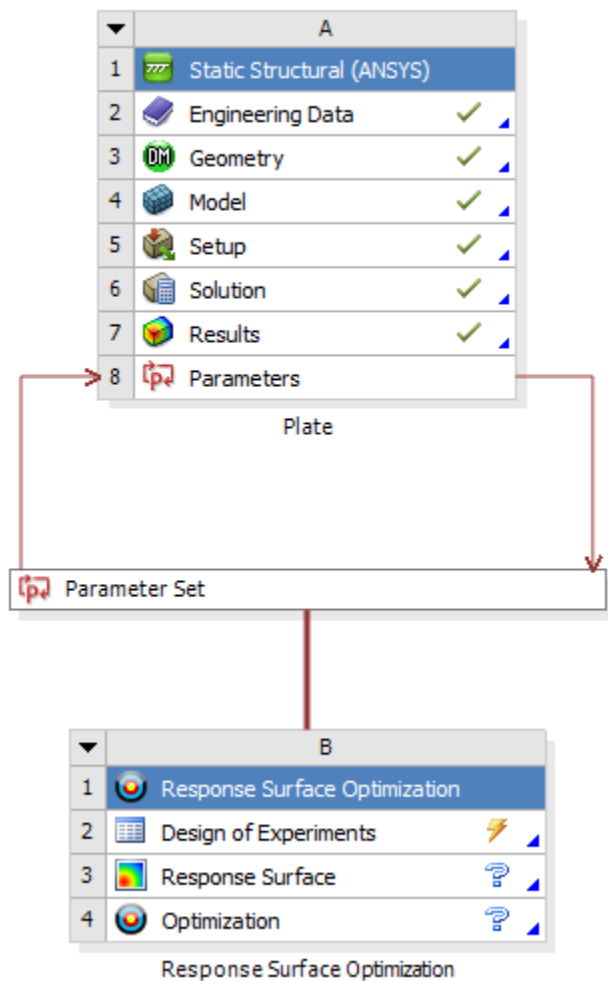
Comments

Design of Experiments

This step samples specific points in the design space. It uses statistical techniques to minimize the number of sampling points since a separate FEA calculation (and associated stiffness matrix inversion) is required for each sampling point. This is the most time-consuming step in the optimization process.

Response Surface Optimization

First, Goal Driven Optimization needs to be placed in the Project Schematic. In the left-hand menu called "toolbox" expand **Design Exploration**. Next, drag **Response Surface Optimization** and drop it right underneath the **Parameter Set**. Your project schematic window, should look comparable to the one below. Note that all the systems are connected.



Next, double-click **Design of Experiments**. Again, we can see our input and output parameters but this time under the Design of Experiments step.

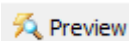
Outline of Schematic B2: Design of Experiments		
	A	B
1		Enabled
2	✓ Design of Experiments	
3	Input Parameters	
4	Plate (A1)	
5	P1 - DS_R	✓
6	Output Parameters	
7	Plate (A1)	
8	P2 - Surface Body Volume	
9	P3 - Equivalent (von-Mises) Stress Maximum	
10	Charts	
11	✓ Parameters Parallel	
12	✓ Design Points vs Parameter	

These parameters are the "Design Variables"

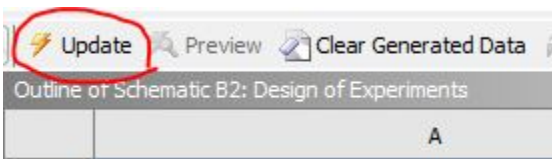
These parameters are used to set the "Objective Function" and "Constraints"

Highlight **P1-DS_R** and change the Lower Bound to 1 inch and the Upper Bound to 2.5 inches.

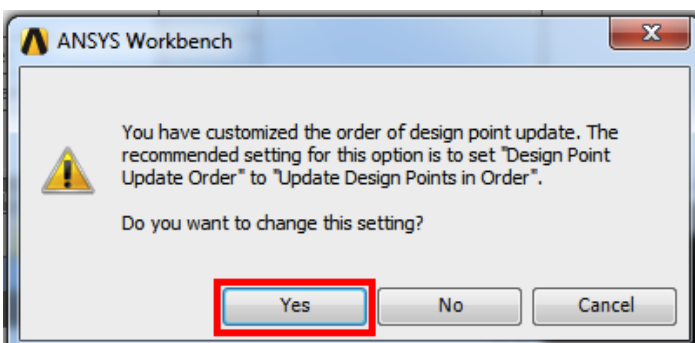
Properties of Schematic B2: Design of Experiments		
	A	B
1	Property	Value
2	General	
3	Units	
4	Type	Design Variable
5	Classification	Continuous
6	Values	
7	Value	1.4433
8	Lower Bound	1
9	Upper Bound	2.5
10	Use Manufacturable Values	☐



Now, that the radius of the hole is properly constrained click on **Preview**. ANSYS just picked what it thinks are the best sampling points according to an algorithm. Note that these sampling points are not necessarily linearly spaced. To get a numerical solution for each of these radii, click **Update**.



If you get the following error, click **Yes**.



Twiddle your thumbs a bit while ANSYS performs some time-consuming matrix inversions.

After the update has completed, click on **Return To Project**. You may want to save again at this point.

[Go to Step 5: Response Surface](#)

[Go to all ANSYS Learning Modules](#)