Plate With a Hole Optimization - Exercises

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- 2. Initial Solution
- 3. Input & Output Parameters
- 4. Design of Experiments
- 5. Response Surface
- 6. Optimization
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Exercises

Exercise 1

First, go through the prior tutorial. Then, repeat the optimization problem in the tutorial but with four design variables: H, W, R, T (thickness). Use the same Young's modulus and Poisson ratio: 30 x 10^3 ksi and 0.3, respectively.



Constraints

Maximum effective stress < yield value (32.5 ksi)

Bounds:

Parameter	Minimum Value	Maximum Value
Height (H)	10 in	15 in
Width (W)	10 in	15 in
Thickness (T)	0.1 in	0.25 in
Radius (R)	1.0 in	2.5 in

Submit:

1. Results from the Design of Experiments step

2. 3D response surface: (R,H) vs. Volume. In other words, plot R on the x-axis, H on the y-axis and Volume on the z-axis. See tip below for how to create such a plot in ANSYS.

- 3. 3D response surface: (R,H) vs. max. effective stress
- 4. Selected design point and the corresponding volume and max. effective stress
- 5. Effective (or Von Mises) stress variation in the plate at the design point

Tips

- One can pick the optimum value of the thickness just by inspection since the maximum effective stress doesn't vary with thickness for this
 problem. So you don't need to input thickness as a design variable in ANSYS, saving you work and time. Note: In a 2D problem, the thickness is
 used only to calculate the traction from an applied force (through dividing the force by an appropriate area). The thickness does not enter
 anywhere else in the 2D mathematical model. In this problem, the traction is a pressure load, which is independent of the thickness.
- In both Workbench (the main project page) as well as Mechanical (where you set up the mesh, boundary conditions etc.), there is a menu option near the top to change units. You can use this to make sure you are working in consistent units.
- Updating the Design of Experiments step can take 30+ minutes especially if you have a slowpoke computer. This is because calculating the
 maximum effective stress for each DOE point involves a BIG stiffness matrix inversion.
- To plot the response surfaces, you need to set the x, y and z axes highlighted in the snapshot below. Double-click on Response Surface in the Pr
 oject Schematic to get to this menu.

Outlin	e of Schematic B3: Response Surface					▼ 9
	А		В			
1			Enabled			
2	Response Surface			1		
3	Input Parameters			1		
4	Bracket (refined mesh) (A1)			1		
5	P11 - DS_Wprime		V			
6	P12 - DS_Hprime		V	1		
7	P13 - DS_R1		V	1		
8	P14 - DS_R2		V	1		
9	Output Parameters					
10	Bracket (refined mesh) (A1)			1		
11	P7 - Equivalent Stress	laximum				
12	P8 - Geometry Volume					
13	✓ 🔀 Min-Max Search		V			
14	Metrics					
15	Response Points					
16	🗉 🗸 Response Point					
17	√ 🛞 Spider					
18	🐔 💶 Local Sensitivity					
19	🕖 📰 Response					
*	New Response Point					
Prope	rties of Outline A19: Response					▼ Ģ
	A			В		
1	Property			Value	e	
6	Number of Points on Y	10				
7	Show Design Points					
8	= Axes					
9	X Axis	P11 - DS	Wprime		1	
10	Y Axis	P12 - DS_Hprime			•	
11	Z Axis	P7 - Equivalent Stress Maximum				
12	 Input Parameters 					
						27.5
13	P11 - DS_Wprime					2715
				•		
14	P12 - DS_Hprime					7.5

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Go to all ANSYS Learning Modules