Plate With a Hole Optimization - Input & Output Parameters

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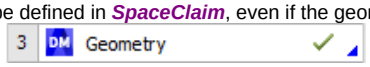
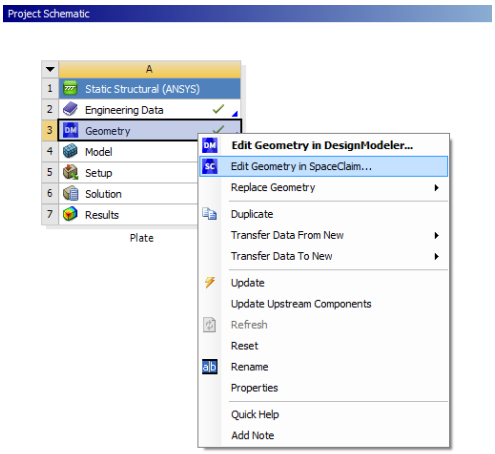
Input & Output Parameters

To set up the input and output parameters for a geometry created in Workbench, simply follow the steps below. To set up parameters for a geometry created in SolidWorks, follow the instructions **here.**

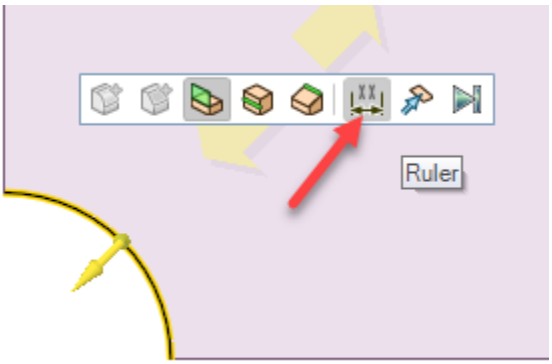
Design Variables: Hole Radius (*SpaceClaim*)

Parameters can be defined in ***SpaceClaim***, even if the geometry was created in ***DesignModeler*** or another CAD software, as is the case for us. To do this, right-click on 

from the Project Schematic window and choose "Edit Geometry in SpaceClaim..." as shown below:

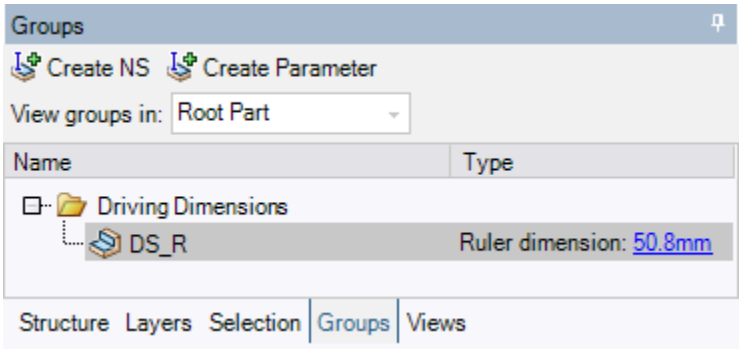


Once ***SpaceClaim*** has opened, go into the Design tab and choose the Pull tool. Select the arc that represents our hole and then choose the Ruler option from the mini toolbar that appears:



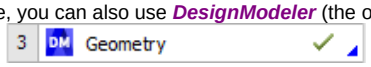
Now move the cursor until it snaps to the center of the arc:

Now, click the box with the "P" to the right of the dimension. You can also go into the Groups tab and choose "Create Parameter" near the top of that window. This will create a parameter named Group1 under a folder called Driving Dimensions. Call the parameter "DS_R". You can always go back and rename your parameters by right-clicking on them and choosing "Rename" in the context menu that appears. If you click on your parameter, you can see the current dimension being used in the model. Make sure your Groups tab looks like the image below before continuing:

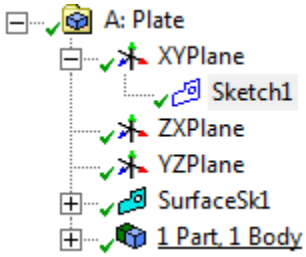


SpaceClaim can now be closed.

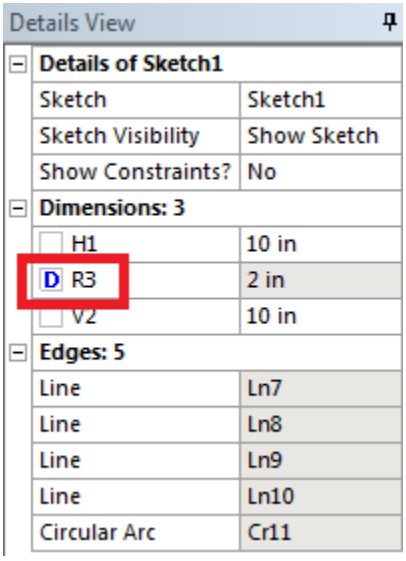
Design Variables: Hole Radius (*DesignModeler*)

This section applies only if you do not have access to ***SpaceClaim.*** In that case, you can also use ***DesignModeler*** (the older geometry engine) to specify your parameters. In order to do so, open ***DesignModeler*** by double-clicking on 

from the Project Schematic window. Then expand ***XYPlane***. Next, highlight ***Sketch1***.



Now, check the box to the left of "R3", which will be in the "Dimensions: 3" part of the "Details View" table. When you check the box an uppercase "D" will appear within the box and you will be asked what to call the parameter. Call the parameter "DS_R".



Details View	
Details of Sketch1	
Sketch	Sketch1
Sketch Visibility	Show Sketch
Show Constraints?	No
Dimensions: 3	
H1	10 in
D R3	2 in
V2	10 in
Edges: 5	
Line	Ln7
Line	Ln8
Line	Ln9
Line	Ln10
Circular Arc	Cr11

DesignModeler can now be closed.

Objective Function: Minimize Volume (& Mass)

This particular optimization problem has two output parameters: the volume of the quarter plate and the maximum Von Mises stress. In order to specify the volume output parameters, first ***(Open) Mechanical > (Expand) Geometry > (Highlight) Surface Body***. In the "Details of "Surface Body"" table expand ***Properties*** then check the box to the left of ***Volume***. A "P" should now be located within the box.

Additionally, if mass is also a desired parameter, check the box to the left of ***Mass.***

Graphics Properties	
Definition	
Suppressed	No
Stiffness Behavior	Flexible
Coordinate System	Default Coordinate System
Reference Temperature	By Environment
Thickness	2.54e-003 m
Thickness Mode	Refresh on Update
Material	
Assignment	Cornellium
Nonlinear Effects	Yes
Thermal Strain Effects	Yes
Bounding Box	
Properties	
P Volume	1.5872e-004 m^3
Mass	0. kg
Centroid X	0.1304 m
Centroid Y	0.1304 m
Centroid Z	0. m
Moment of Inertia Ip1	0. $kg \cdot m^2$

Constraints: Maximum Von Mises Stress < 32.5 ksi

Now, the maximum Von Mises Stress will be specified as an output parameter. In order to do so, ***(Expand) Solution > (Highlight) Equivalent Stress***. In the "Details of "Equivalent Stress"" window, underneath ***Results***, check the box to the left of ***Maximum***. Once again a "P" should appear to the left of the box to illustrate to the user that the maximum Von Mises stress has been designated as an output parameter.

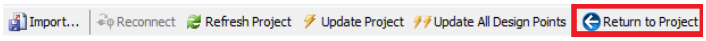
Scope	
Scoping Method	Geometry Selection
Geometry	All Bodies
Definition	
Type	Equivalent (von-Mises) Stress
By	Time
Display Time	Last
Calculate Time History	Yes
Identifier	
Integration Point Results	
Display Option	Averaged
Results	
Minimum	3.9719 psi
Maximum	33308 psi
Information	

At this point the ***Mechanical*** window can be closed and you should save the project.

Let's review the input and output parameters that will be used in the optimization process. In the main Project Schematic window, double click on ***Parameter Set***.

Input Parameters		
Plate (A1)		
P1	DS_R	2
New input parameter	New name	New expression
Output Parameters		
Plate (A1)		
P2	Surface Body Volume	0.00015872
P3	Equivalent (von-Mises) Stress Maximum	33308

After doing so, we can see that DS_R is the input parameter, and the volume and max. value of the von Mises Stress are the output parameters. Now, return to the main window by clicking on the Project tab, or in older versions by selecting ***Return to Project***.



Note: Make sure your parameters are using the correct units! If they are not, you will need to go back into Mechanical and change the units before unchecking and rechecking the box next to the parameters of interest. This should reset the units on the parameters in the Parameter Set window, but beware that this may cause the entire optimization process to need updated and repeated.

Go to Step 4: Design of Experiments

Go to all ANSYS Learning Modules