Plate With a Hole - Numerical Solution

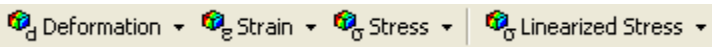
Author: Benjamin Mullen, Cornell University

Numerical Solution

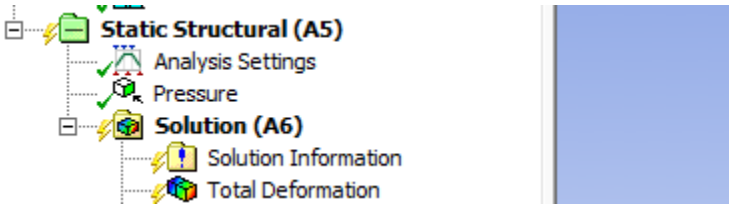
Now we are ready to choose what kind of results we would like to see.

Deformation

To add deformation to the solution, first click ***Solution*** to add the solution sub menu to menu bar



Now in the solution sub menu click ***Deformation > Total*** to add the total deformation to the solution. It should appear in the outline tree.



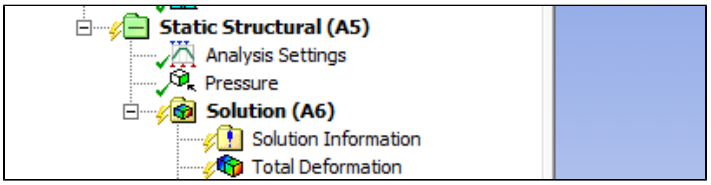
Normal Stresses

Sigma_xx

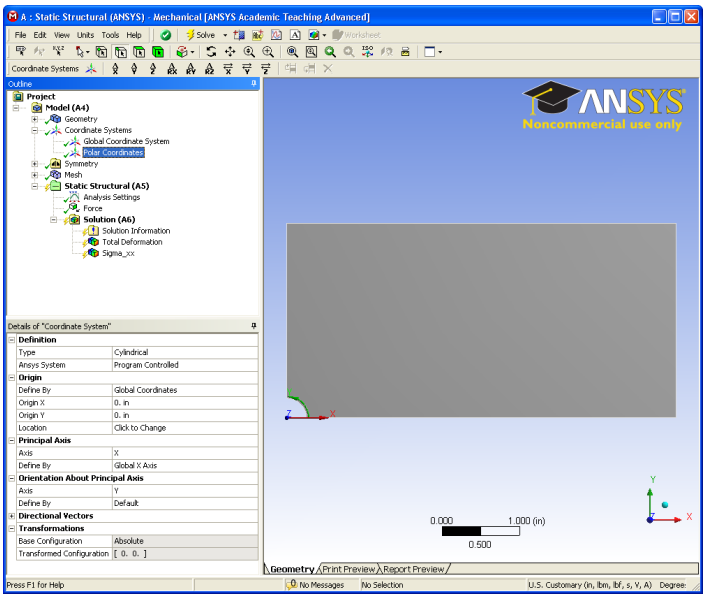
To add the normal stress in the x-direction, in the solution sub menu go to ***Stress > Normal***. In the details view window ensure that the ***Orientation*** is set to ***X Axis***. Let's rename the stress to `Stress_xx` by right clicking the stress, and going to rename.

Sigma_r

To add the polar stresses, we need to first define a polar coordinate system. In the outline tree, right click ***Coordinate System > Insert > Coordinate System***.



This will create a new Cartesian Coordinate System. To make the new coordinate system a polar one, look to the details view and change the ***Type*** Parameter from Cartesian to Cylindrical. To define the origin, change the ***Define By*** parameter from Geometry to Global Coordinate System. Put the origin coincident with the global coordinate systems origin (x = 0, y = 0). Now that the polar coordinates have been created, lets rename the coordinate system to make it more distinguishable. Right click on the coordinate system you just created, and go to ***Rename***. For simplicity sake, let's just name it `Polar Coordinates`.



Click here to enlarge image

Now, we can define the radial stress using the new coordinate system. Click ***Solution > Stress > Normal***. This will create "Normal Stress 2", and list its parameters in the details view. We want to change the coordinate system to the polar one we just created; so in the details view window, change the ***Coordinate System*** parameter from "Global Coordinate System" to "Polar Coordinates". Ensure that the orientation is set to the x-axis, as defined by our polar coordinate system. Now the stress is ready. Let's rename it to `Sigma_r` and keep going.

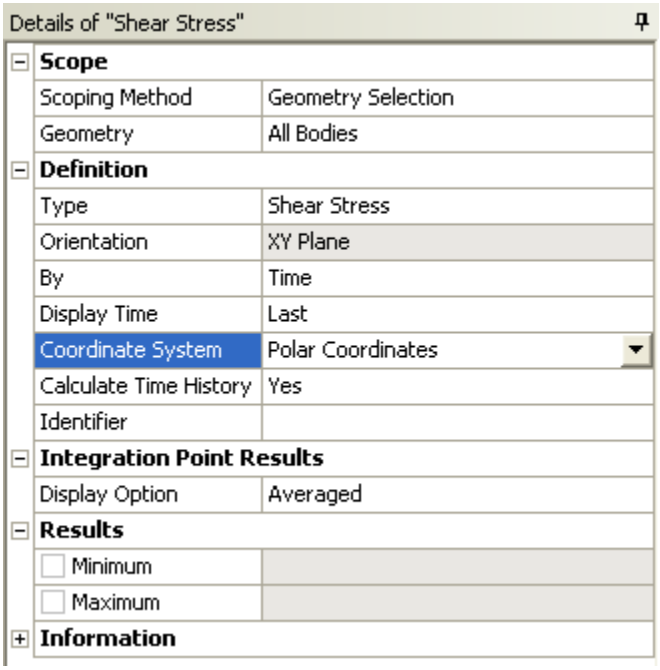
Sigma_theta

Now let's add the theta stress. This is too a normal stress, so create a new normal stress as you did for Sigma_xx and Sigma_r. Now, change the coordinate system to Polar Coordinates, as you did for Sigma-r. Next, change the Orientation to the Y axis. The Y axis should be in the theta direction by default. Rename the stress to `Sigma_theta`.

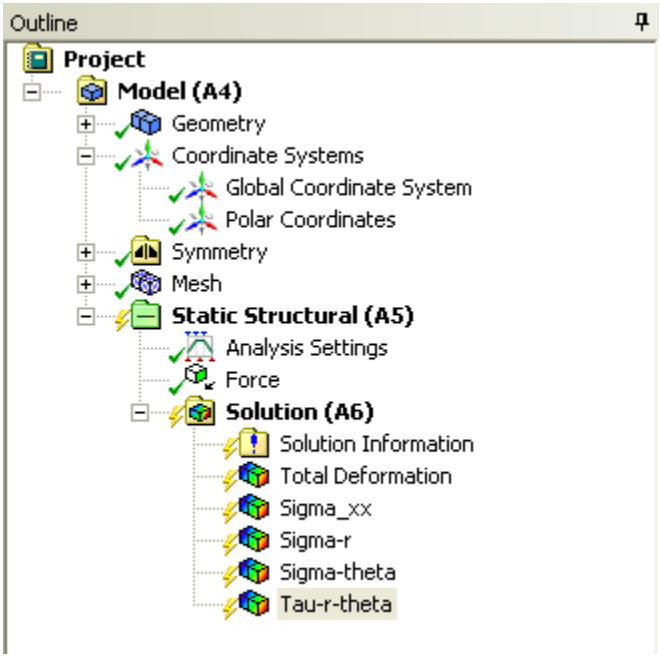
Scope	
Scoping Method	Geometry Selection
Geometry	All Bodies
Definition	
Type	Normal Stress
Orientation	Y Axis
By	Time
Display Time	Last
Coordinate System	Polar Coordinates
Calculate Time History	Yes
Identifier	
Integration Point Results	
Display Option	Averaged
Results	
Minimum	
Maximum	
Information	

Tau_r-theta

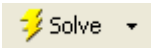
Finally, let's add the shear stress in the r-theta direction. To do this, we go to ***Solution > Stress > Shear***. You'll notice that now, in the details view window, the stress needs two directions to define it. In order to solve for the r-theta shear, we need to change the ***Coordinate System*** parameter from the Global Coordinate System to Polar Coordinates. Also, ensure that the Orientation is in the XY direction (in polar, this will be r_theta by the coordinate system we created). Rename the stress to `Tau_r-theta`.



This is what your outline tree should look like at this point:



Solve!

To solve for the stresses and deformation, we now hit the solve button. 

Keep going! Almost done!

Go to Step 6: Numerical Results

Go to all ANSYS Learning Modules