Plate With a Hole Optimization - Verification & Validation

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> ⚠ This tutorial was created with an older version of ANSYS (14.5), where the mesh generator and the refinement process was not as strong as it is now. This will result in a different solution than the one shown. (In ANSYS 16.1, the optimization results in a radius of ~1.25in-1.27in and in ANSYS 2019 R2 the optimization results in a radius of ~1.11-1.13 in)

Verification & Validation

As with any numerical method verification and validation of great significance. As mentioned earlier, there is no analytical solution for the finite plate with a hole. Thus, the results can not be compared to theory. Thus, in this section other verification and validations will be used. First, the solution will be examined as the mesh is refined to see if it has converged. Additionally, the optimization results will be verified by using different optimization methods and comparing results.

Mesh Refinement

The convergence criteria which was inserted earlier was used to view the effect of mesh refinement with a radius of 1.4853 inches.

Number of Elements	Equivalent Von Mises Stress (PSI)	Percent Change
244	32,495	
775	32,712	0.6656

As one can see from the data above, over the course of the mesh refinement, the equivalent Von Mises Stress only changes by less than one percent. Thus, the solution has been verified with respect to mesh refinement. However, notice how the **equivalent Von Mises Stress now lies above our constraint**. While our optimization looked promising, we had not taken into account the slight change in results from a finer mesh.

Optimization Methods

The optimization was carried using each of the four optimization methods offered in ANSYS workbench. Note that the default optimization method in ANSYS was Screening but now is MOGA.

Optimization Method	Radius (In)	Volume (In^3)	Equivalent Von Mises Stress (PSI)
Screening	1.3278	9.8615	32,484
MOGA	1.3267	9.8618	32,500
NLPQL	1.3291	9.8613	32,503

As one can see from the table above, there is no significant differences between the results from the four methods.

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