Lab 2 Report ME 371

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Question 1

Use the stress concentration factor finder on mechanicalc.com to find the <u>theoretical value of the maximum stress at the edge of the hole for the geometry under consideration in this lab.</u>

$$\sigma_{Max} = K_t \sigma_{nom}$$

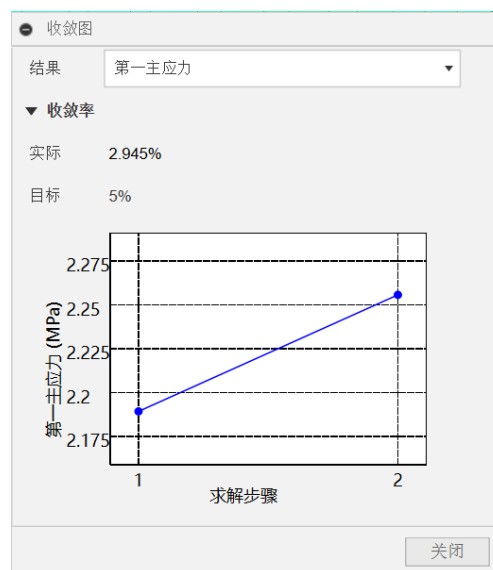From https://mechanicalc.com/calculators/stress-concentration/ we get concentration factor

$$K_t = 2.24$$

$$\sigma_{nom} = \frac{F}{A} = 1 \; MPa$$

$$\boldsymbol{\sigma_{Max} = 2.24 \; MPa}$$

Question 2

While viewing the simulation results from the solution using AMR for mesh refinement, click Results Tools > Convergence Plot along the top ribbon. Submit a screenshot showing the first principal stress convergence rate. <u>How many mesh refinements were necessary to achieve the target relative solution error of 5%?</u>
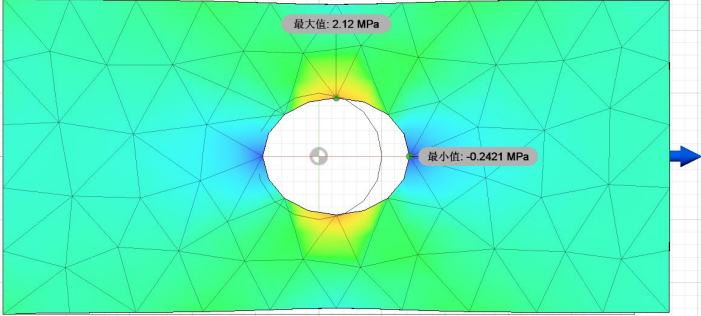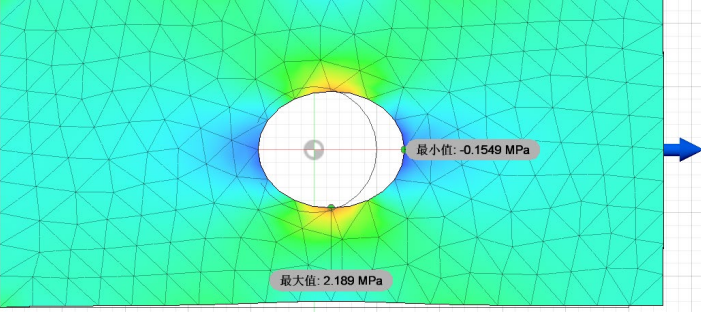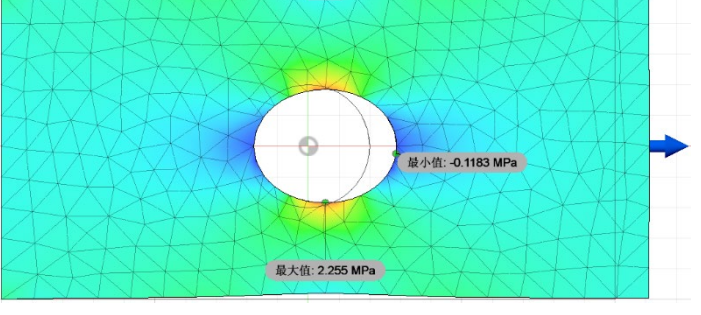

Convergence Plot

From the diagram we see at least 2 refinement is required.

Question 3

Submit <u>screenshots</u> of plots of the "Normal XX" stress component in the results of the three simulations you ran as part of this lab. Make sure the screenshots include the mesh. <u>Find the percent error of each FEA solution relative to the theoretical solution, i.e</u> $\% \; error \; = \frac{|\sigma_{theory} - \sigma_{FEA}|}{\sigma_{theory}}$. *<u>Which solution (coarse mesh, finer mesh, finer mesh with AMR) appears to be the least accurate? Which is the most accurate? Are these trends in line with your expectations?</u>*

Yes the trend matches what I expected

Coarse Mesh	$\sigma_{FEA} = 2.12 \; MPa$ $\sigma_{theory} = 2.24 \; MPa$ %***error* = 5.357%** **Least accurate**
Fine Mesh	$\sigma_{FEA} = 2.189 \; MPa$ $\sigma_{theory} = 2.24 \; MPa$ %***error* = 2.2768%**
AMR	$\sigma_{FEA} = 2.255 \; MPa$ $\sigma_{theory} = 2.24 \; MPa$ %***error* = 0.669%**