PSEUDO LAB 6: STRESS AND STRAIN CONCENTRATIONS

ME556 Lab Experiment
Lab Report Due Tuesday November 28

Goals:

(a) To compare stress distributions measured near an elliptical hole in a finite thin plate to those predicted for an infinite thin plate, and
(b) To compare the stress concentration factor measured for an elliptical hole in a finite thin plate to the value expected from a reference handbook.

Procedure:

(1) Watch the "Lab 6 Stress Concentrations" video available on the ME556 website (http://courses.washington.edu/mengr556/). During testing a monotonically increasing load was applied to a plate with elliptical hole. Axial and transverse strains near the hole were measured using two 10-element strip gages mounted back-to-back near the hole. See the sketches that appear on the following page.

(2) Download the "Official Data" for this lab from the ME556 website.

(3) Use the Official Data set to:
- compare measured and predicted stress distributions near an elliptical hole for the finite-size plate specimen tested versus an infinite plate (assume $E = 10.6$Msi, $\nu = 0.33$), and
- compare the stress concentration factor measured for the finite plate tested during this lab to the value expected based on a reference handbook or some other recognized source.[1]

Notes:
a. The axial strip gage is a M-M gage type SA-13-031PJ-120, Gage factor = 2.12, K_t = 2.0%
b. The transverse strip gage is a M-M gage type EA-13-031MF-120, Gage factor = 2.09, K_t = 1.2%
c. The Strain Smart System is setup to correct for different gage factors, but the measured strains must be corrected for differing transverse sensitivity coefficients. From MM Tech-Note 509 "Errors Due to Transverse Sensitivity in Strain Gages", correction equations for biaxial gages with differing transverse sensitivities are:

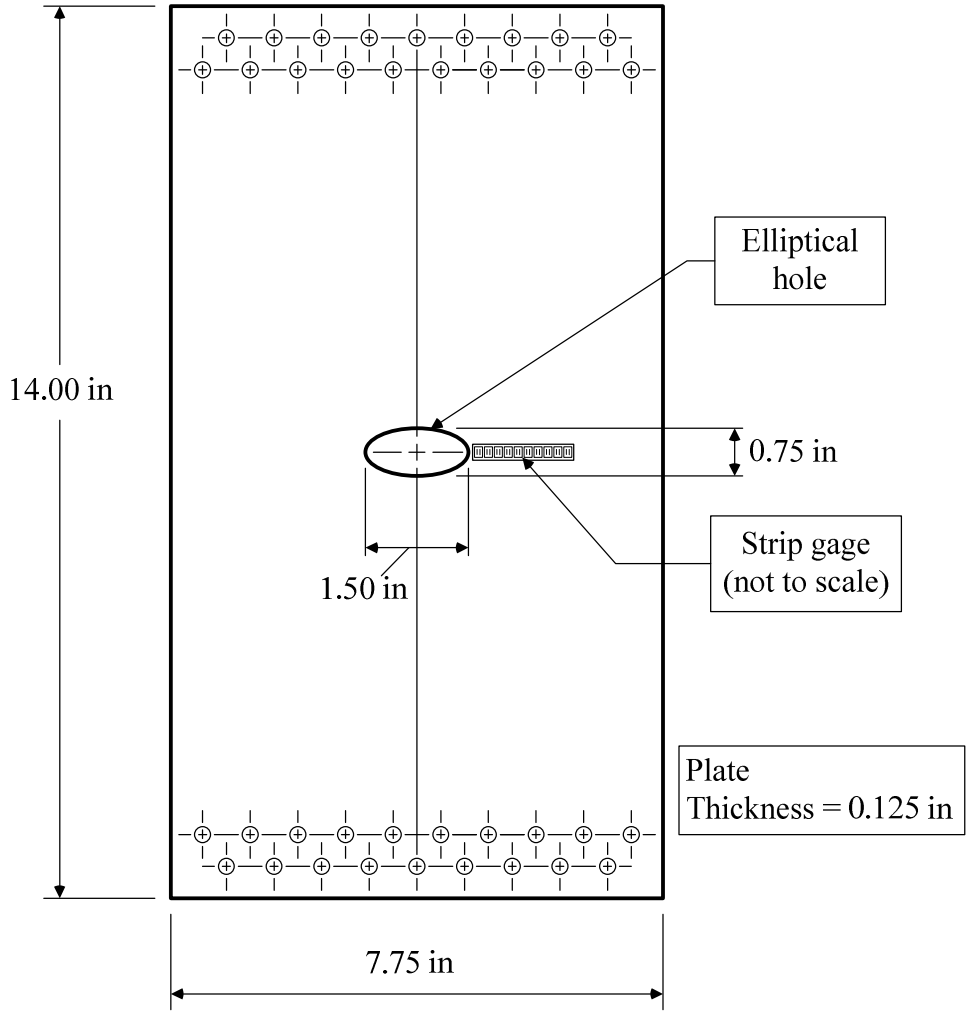
$$\varepsilon_x = \frac{(1-\nu_o K_t^x)\varepsilon_{mx} - (1-\nu_o K_t^y)K_t^x \varepsilon_{my}}{1 - K_t^x K_t^y}$$

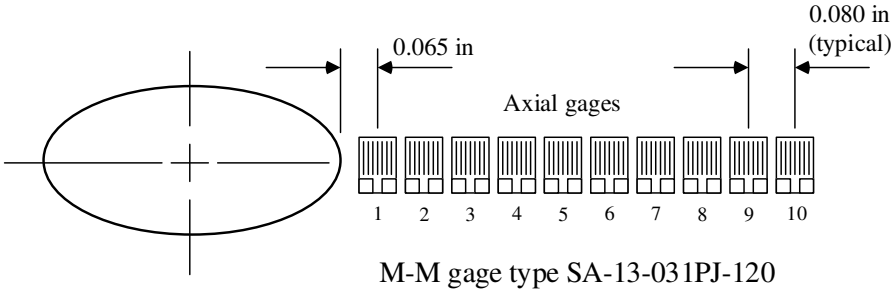
$$\varepsilon_y = \frac{(1-\nu_o K_t^y)\varepsilon_{my} - (1-\nu_o K_t^x)K_t^y \varepsilon_{mx}}{1 - K_t^x K_t^y}$$

where: $\varepsilon_{mx}, \varepsilon_{my}$ = strains measured in the x- and y-directions, respectively

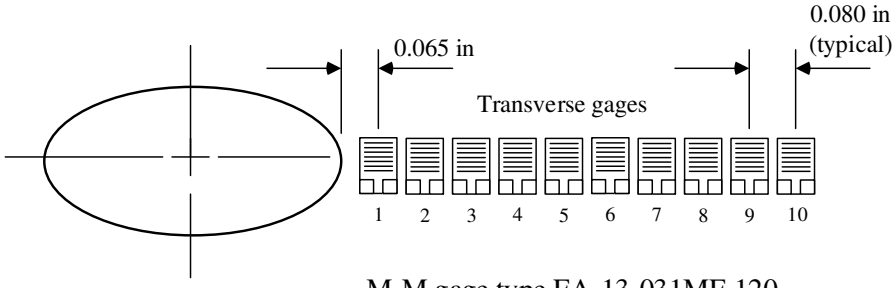
K_t^x, K_t^y = Transverse sensitivity coefficients for gages in the x- and y-directions, respectively.

[1] Examples include: Young, W.C., and Budynas, R.G., Roark's Formulas for Stress and Strain, 7th edition, McGraw-Hill, (2002) or links available at: http://www.amesweb.info/





M-M gage type SA-13-031PJ-120
Gage factor = 2.12, K_t = 2.0%



M-M gage type EA-13-031MF-120
Gage factor = 2.09, K_t = 1.2%