one day late — no double side

To: T. Shield

From: Ethan Arendt   *46·.9 = 41*

Subject: Experiment 4 – Photoelastic Stress Concentration

Date: 2015-11-23

Results Summary

This is the analysis of Photoelastic stress concentration of a hole in a finite plate compared to a hole in an infinite plate in uniaxial tension.

The intensity of polarized light at 589.3 nm was measures in a dog-bone specimen with increasing loaded to measure the intensity minima corresponding to the fringes in the material shown in figure 1. The material constant 6900±300 (N/m) was determined from the slope from figure 2 of the plotted load versus fringe number obtained from figure 1.

— units not in C)

The finite plate under a load of 2900±100 (N) shown in figure 3 produced a stress concentration of 2.5±0.2 at the edge of the hole. The plate under that load produced a total of 19 resolvable fringes ranging from -4 to 14 shown by figure 4. Theory for the stress concentration for a hole in an infinite plate is 3. The calculated value of stress concentration with its uncertainty is still lower than the theoretical value. This is in part is due to the finite nature of the plate and analysis of the fringes used to calculate the value. The overall comparison of the stress along the horizontal from the edge of the hole to the edge of the plate shown by figure 6 is lower than the theoretical values. The calculated curve still shows the overall theoretical trend with a vertical asymptote at one and decays as the distance from the hole increase. The normalized stress around the hole fits well with the theory for an infinite plate shown by figure 5. The calculated curve follows the theoretical trend and the with the curves uncertainty the values follow within theory. The calculated curve as it approaches 90° begins to drop below the theoretical curve even with the curves uncertainty. These results however lower than the theoretical still show the same trend of the stress concentration.