Preparation for Experiment Review

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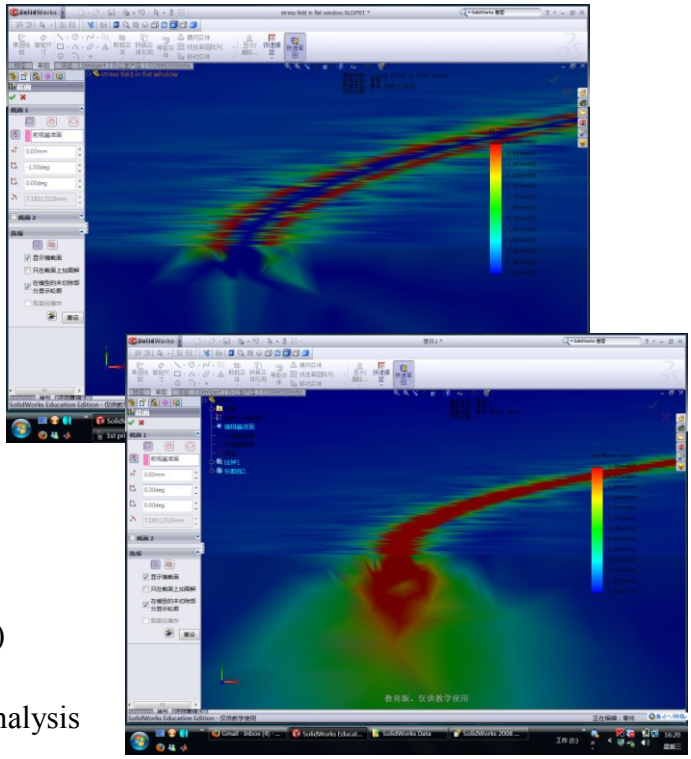
Introduction

In lens mount, there is a high stress near the contact area. The deformation in the contact area makes a compressive stress, while tensile stress will occur outside the area and will form a truncated 'cone crack' into the subsurface of the glass.

The project is to analysis this phenomena and its effect on the glass strength. First, we need to figure out how to prevent the damage. Then, to analysis how bad the damage may affect the performance and survive of the lens.

Numerical Analysis



Finite element analysis (FEA)

(Reference: Hand book of optomechanicla engineering)

Using COSMOSWorks in SolidWorks

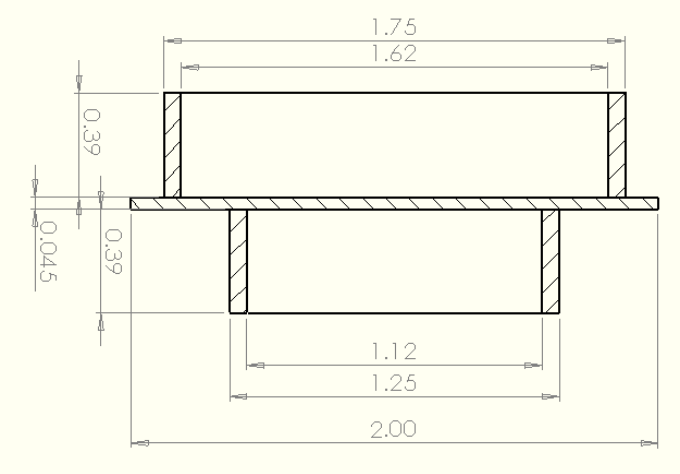
Contact mechanism
Mesh control (really important)
Nonlinear Static Analysis
(really slow running in my laptop)

Compare result with theoretical analysis

Hardware I got:

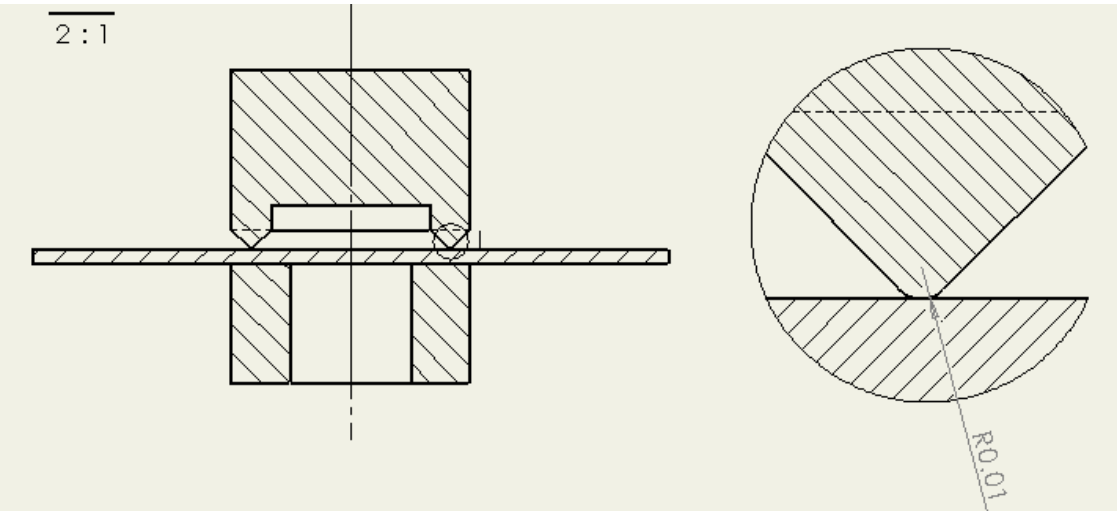
100 B270 Flat windows
2" diameter 1.15mm thick

Aluminum tube (for double ring strength test)
OD 1.25" ID 1.12"
OD 1.75" ID 1.62"



Hardware I about to get:

Three indentors with different contact radii:
Sharp edge (about .0002in)
R=0.01 in;
R=0.1 in
(With material of Al and steel)



Support metal rings
OD 0.75” ID 0.38” 3/8” height

Hardware I need:
INSTRON??
Or a set of weights? (to exert a certain force)

PSM (to inspect and classify the surface flaws)

Things for Shock load experiment

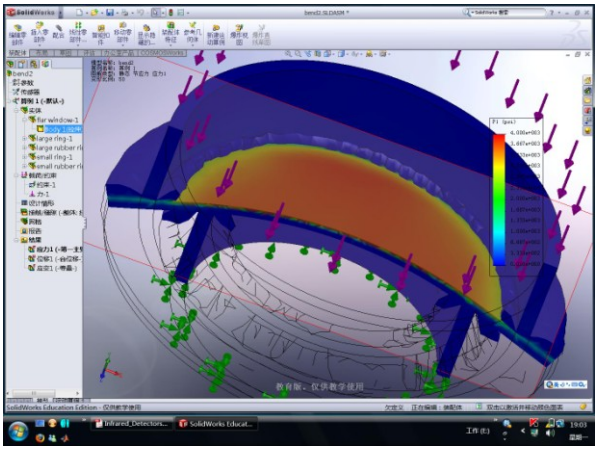
General plan for experiment
Stage 1
Try different thing to the glasses

Indenting
(I got a spreadsheet for theoretically corresponding tensile stress for different F, R, material)
1, Use different forces to make cracks
  1 lb to 50 lb
2, use different contact radii (sharp edge, 0.01 in, 0.1 in)
3, use different contact materials (Al & steel)

Al is more close to common situation, but is will easily yield during the indentation. We can inspect the deflection of Al (I just got one for each radius, so careful plan to use them is important)

Steel is to make sure that damage to the glass is due to a precise contact radius. It is used to compare with the theory calculation and FEA results.

Bending



1, need a plate on top to average the force.
2, bend glass without damage to test general glass strength.
3, Need to make enough sample suffered the same indenting force and try out different bending forces.

Need to try some different method to make sure glass and rings concentric.

Inspect and classify the surface flaws

First try some specimens, and then determine what and how to do it.

Shock load

Drop things from certain height?

Stage 2

Based on the results and experiences of stage 1, some specific schedules need to be made. For example, what force range we need to focus on, how to classify the flaws, or how to calibrate the shock load.

Stage 3

Statistical analysis use Weibull distribution method. Determine whether observational data is sufficient or not. Then do extra experiment.