ME 557 Lab 4 Shadow Moiré

Description:

Shadow Moiré is a geometric Moiré technique used to measure out-of-plane displacement of a loaded specimen. A reference grating is mounted in front of the specimen. Collimated light is shown through the grating at an angle, and the grating lines cast a shadow onto the specimen. This shadow pattern is the specimen grating. As the specimen deforms in the out-of-plane direction, the distance between the grating and specimen changes from point to point, causing the specimen grating to stretch or contract. An observer can then observe the fringe patterns that form. The fringes are therefore related to the out-of-plane displacement field of the specimen. This makes the Shadow Moiré method useful for buckling analyses, for example.

Set-up and Current Hardware:

Figure 1 shows a sketch of the general experimental set-up. Figures 2-4 show pictures of the current set-up and hardware.

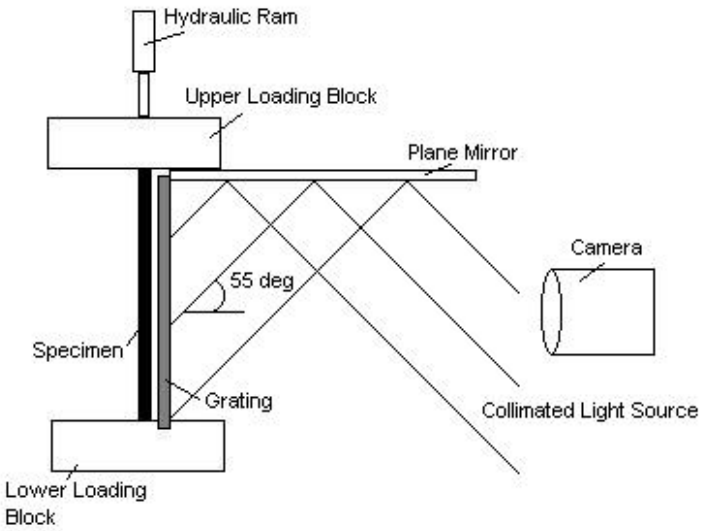


Figure 1: Shadow Moiré Basic Set-up

Collimated Light Source

Figure 2: Light Source

Load Cell Upper Loading Block

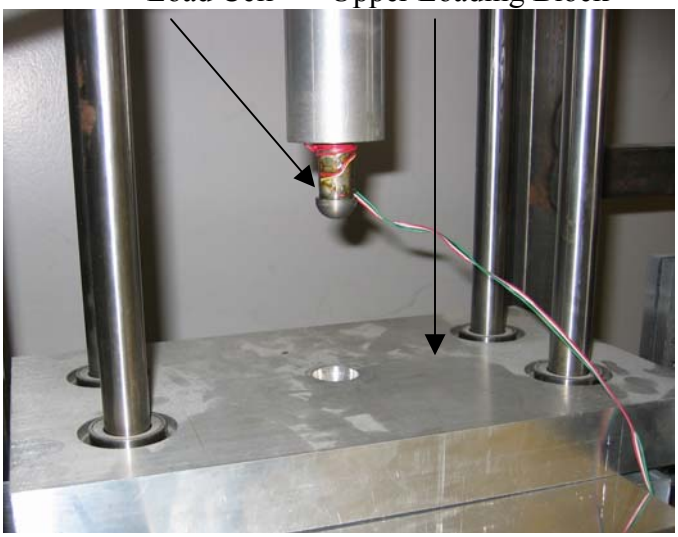
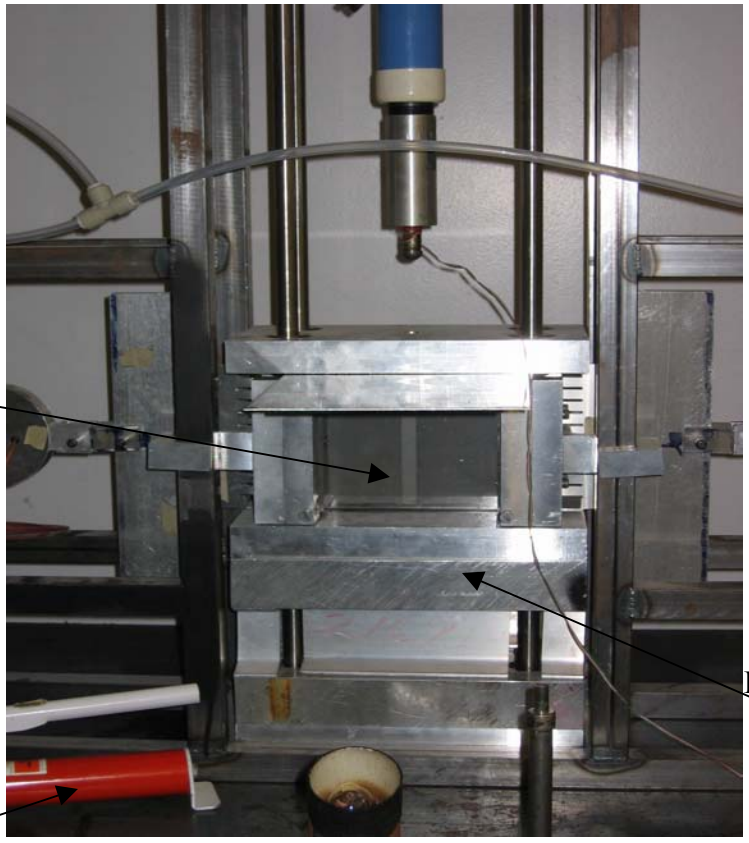


Figure 3: Load Cell and Load Block

Grating and Sample



Lower Loading Block

Hand Pump

Figure 4: Shadow Moiré Current Setup

The light source is currently mounted to a tripod with a clamp that allows the pitch to be adjusted to a desired angle. As is shown in Figure 1, a 55 degree beam angle is recommended for this set-up. A mirror is screwed into the upper loading block to reflect the light down onto the grating.

The currently mounted specimen is a composite panel with a vertical reinforcing rib along the midline.

The load cell and upper loading block are shown in figure 3. It is currently wired to a strain box, and a calibration curve is shown below. Calibration data looks linear, at least as far as 1.6kN.

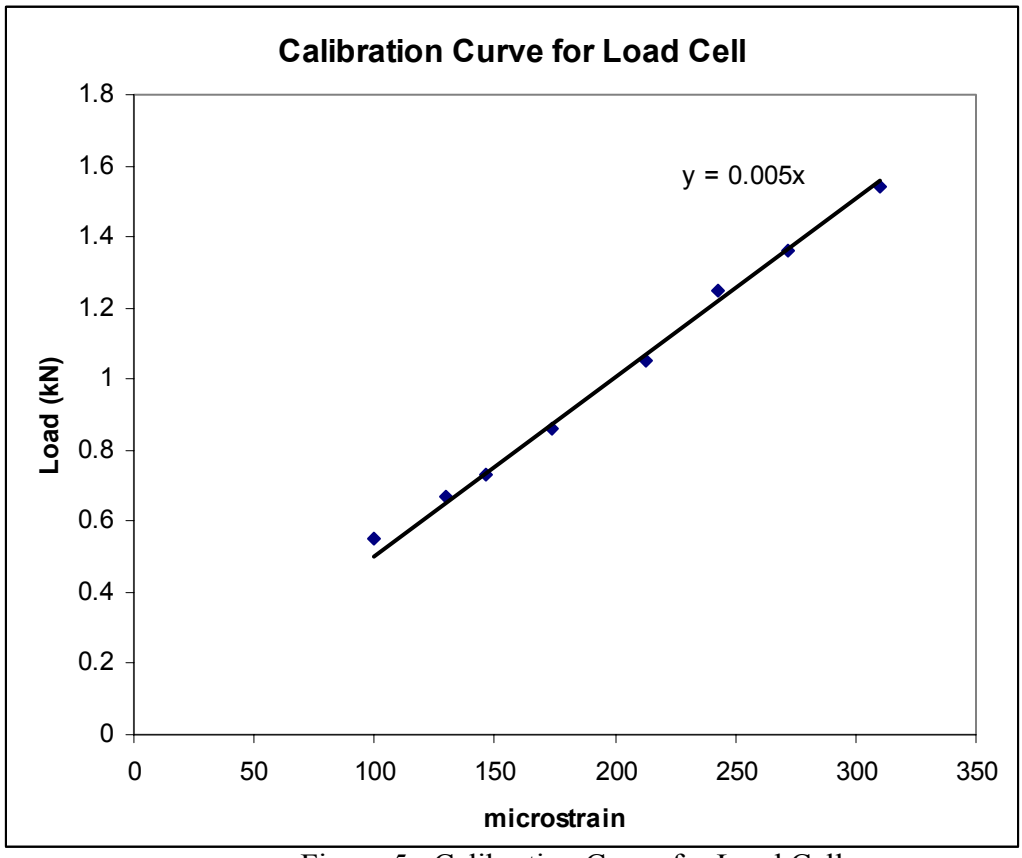


Figure 5: Calibration Curve for Load Cell

The load cell is moved up and down with a hand pump.

The light is currently mounted to a somewhat unstable tripod, and the clamp for adjusting the angle is not very precise. A stand could be made with a fixed incline of 55 degrees to provide better stability. This could either be free standing, or attached to the workbench. It could also incorporate a camera mount to eliminate the need for a camera tripod.

The calibration data given above only goes to 1.8kN. For many samples, this will not be enough to cause buckling deformations and visible fringes. The load cell should be calibrated to higher loads, possibly up to 25 kN (see "Buckling of Composite Plates Subjected to Biaxial Loading", Singhatanadgid, 2000).

The load applied to the specimen currently has to be figured out from the strain box reading and the calibration curve. A PC could be set up to read load cell output and perform data capture.

The hardware is also in place to do horizontal tension loading, but it is not currently set up. It would require calibration of the tensile loading cells, and the loading mechanism should be inspected to ensure proper set-up.

Recommended samples