Optics 513 - Optical Testing and Testing Instrumentation Lab

Lab #11 - Laser Based Fizeau Interferometer

The purpose of this lab is to become familiar with the use of a laser based Fizeau interferometer for testing spherical and flat optics, prisms, and corner cubes. Both visual observations of the interference fringes, and computerized phase shifting measurements should be performed.

Procedure:

- Using the procedures described in class and described by your TA test the concave, convex, and flat surfaces provided. Visually estimate the quality of the optics tested, and describe any aberrations present. Perform the computer analysis and compare your estimates with the computer's estimate.

- Using the radius slide and interferometer measure the radius of curvature of the concave surface by finding the two positions for null fringes – focus of transmission sphere at center of curvature of surface tested and focus at test surface.

- Measure the 90^o prism and corner cube to determine the errors in the 90^o angles.

- If you wish, bring your camera lens to test. Be careful to test the lens at the correct conjugates. If you do test a camera lens, stop down the lens a couple of f-stops and look at the improvement.

- Have fun, but do not damage the equipment.

Questions:

1) What are the quality requirements for the different components in the interferometer?

2) Quantify effects of distortion in the CCD camera and monitor. Why can the effect be less for the phase-shifting mode of operation than for visual observation of the fringes?

3) Do the fringes change if the laser frequency drifts?

4) What determines the diameter and radius of curvature of the a) concave, and b) convex surfaces that can be tested?

5) Why is it easier to do the alignment for testing concave surfaces than convex surfaces?

6) Estimate the accuracy of the 90^o angle measurements. How much could the angle depart from 90^o before the interferometer could not perform the measurement?

7) How would you use the laser-based Fizeau to test lenses? Draw a schematic. If you tested your personal camera lens, are you glad you purchased it?