Optics 513 - Optical Testing and Testing Instrumentation Lab

Lab #9 - Scatterplate Interferometer

The purpose of this lab is to become familiar with the use of the scatterplate interferometer for the testing of mirrors.

Procedure:

- Place the scatterplate near the center of curvature of the parabolic mirror. Look at the light reflected off the parabolic mirror to make sure the scatterplate is nearly imaged back onto itself.

- Adjust the lens in the interferometer so the bright spot is imaged onto the mirror. Put the hot spot as close to the center of the mirror as possible.

- Using the image lens, image the black spot that is near the center of inversion symmetry of the scatterplate. Two images will be observed. Adjust the position of the scatterplate so the two images coincide. (Don't be fooled by stray reflections.)

- Move the image lens close to the scatterplate and find the image of the parabolic mirror. Fringes should be seen. (If fringes are not seen, the three steps above must be repeated.) Adjust the x-y-z position of the scatterplate to get the desired fringe orientation.

- Sketch the fringes as the scatterplate is moved in x-y-z.

- Setup the double-pass version of the scatterplate interferometer and note the insensitivity to vibration.

Questions:

1) Explain why the fringes change as the scatterplate is moved in x-y-z.

2) Due to spurious reflection there may be extra hot spots. Explain the source of all visible hot spots.

3) What happens if the light is not precisely focused on the mirror?

4) Why do we want to put the hot spot as close to the center of the mirror as possible?

5) How do the test results for the parabolic mirror compare with the results you obtained using other interferometers to test the same mirror.

6) Compare the ease of operation, characteristics, and interferogram quality obtained using the scatterplate, Fizeau, Shack Cube, and Twyman-Green interferometers.

7) How large can the scatterplate be? Explain.

8) Why does the "hot spot" always fall on a bright fringe?

9) If the scatterplate is used with a white light source, what is the relationship between number of fringes and allowable spectral bandwidth?

10) Does fringe visibility depend upon whether the test surface is coated?

11) Is the scatterplate interferometer sensitive to vibration? Explain. Compare the single-pass and double-pass versions of the scatterplate interferometer.

12) Which aberrations are not measured by the double-pass version of the scatterplate interferometer?

13) How would you convert the scatterplate interferometer into a phase shifting interferometer?

14) Have you ever seen anything as neat as the scatterplate interferometer?