

Zygo Interferometer

Background: Review Newton's rings and Fizeau fringes. Determine how to tell whether the test surface is concave or convex. See Chapter 4 of Prof. Milster's 505R lectures and Chapter 1 of Malacara "Optical Shop Testing". Review the following YouTube videos, the Zygo XPZ software manual and the Verifire Operating Manual. Use the "XPZ Testing Configurations" figures during your experiments. If time permits, you can also review the CaliBall document.

<https://www.youtube.com/watch?v=NGY1IeQGQzM>

<https://www.youtube.com/watch?v=HzWETUVQct4>

Introduction: ZYGO's Verifire™ XPZ interferometer is a commercial Fizeau phase shifting interferometer. It provides fast high-accuracy measurements of flat or spherical surfaces, and transmitted wavefront measurement of optical components and assemblies. The Verifire™ XPZ uses the precision of mechanical phase modulation to show fine measurement detail on the parts. During a measurement, the interferometric cavity length is precisely modulated while a 640 x 480 pixel CCD camera captures several fringe images, which are analyzed by the software to create a detailed measurement of the part being tested.

Tasks with commercial interferometer:

1. Use a reference flat in a five-axis optical mount.
2. Use the Zygo Verifire XPZ to obtain tilt fringes. Adjust the interferometer with the "align" option.
3. Measure the wavefront quality. Determine the peak-to-valley and rms wavefront.
4. Use the CaliBall in the Testing a Convex Sphere configuration. Take data and compare to (3).
5. As you have time, repeat steps 1-4 for test objects such as concave and convex surfaces, concave mirror, aspheric surfaces, lens in transmission and a few of the test samples used with the Fizeau interferometer. Compare the results obtained. You will need to have the TA change the reference sphere/flat. DO NOT CHANGE THE REFERENCE SPHERE/FLAT WITHOUT THE TA.
6. Investigate other forms of data output, like OTF and PSF, and relate it to your measurements.
7. Play with the program as much as you like.
8. Have fun.

Questions:

1. How can you determine if this error is from the reference flat or the interferometer in step 3?
2. How accurately can you determine the quality of the test piece?
3. How would you determine the quality of the reference surface?