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Stitching Method using White Light Scanning Interferometry

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Abstract - There are many ways to measure optical shape with nano meter accuracy. Typical methods are CMM, Null Test and stitching method. The CMM method has disadvantages that influence the shape by contact measurement and the Null Test method has disadvantages due to the cost of individual design and design for each shape. Finally, The stitching method has disadvantages due to misalignment of the equipment. In order to overcome the disadvantages of the above method, we propose a method to measure optical shape using curvature.

***Keywords*:** Curvature, Metrology, White light scanning Interferometry, Fizeau Interferometry, Stitching.

1. Introduction

The use of optical shape is increasing in various industrial fields, especially aspheric and free-form. The importance of machining and measurement evaluation for shape performance is increasing, but continuous research is needed because of difficulties in measuring aspheric and free-form.

There are many ways to measure the current optical shape. [1] Typically, CMM, Null Test, and Sub-Aperture are available. However, there are disadvantages of each of these methods. First, CMM has a disadvantage of affecting the shape during measurement by the contact type measurement method for the shape. Second, Null Test has the disadvantage that the additional cost of the individual design and the design of the shape of each generation. Finally, Sub-Aperture has the disadvantage that it is difficult to accurately measure the shape due to the misalignment of the measuring equipment.

In this paper, we introduce a new measurement method, curvature method, that overcomes the disadvantages of the proposed method.

2. Curvature Method for Optical Shape Metrology

When measuring the optical shape, the other measurement method is affected by the local profile or the slope change by the height and position of the scanning probe. However, the curvature method is not influenced by the height and position of the probe because it uses the curvature which is characteristic of the local profile. [2]

3. Experiment of Curvature Method

To verify the measurement accuracy using this curvature method, the following experimental conditions were set. First, we used two devices based on White light scanning interferometry and Fizeau interferometry. Second, the optical shape is a spherical lens with a diameter of 130 mm, the measurement point is 91 points, and the measurement point interval is 1 mm.

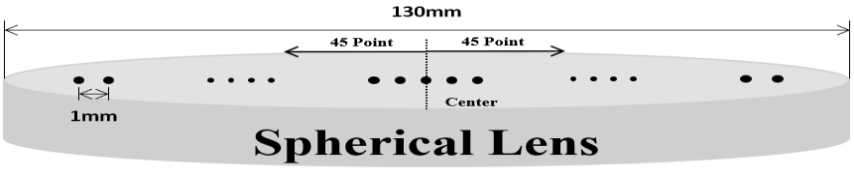

Fig. 1: Measuring Specimens Information.

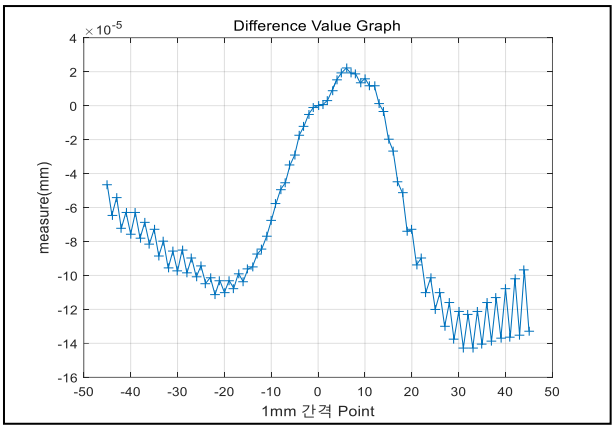

Fig. 2: White light scanning Interferometry Difference Value.

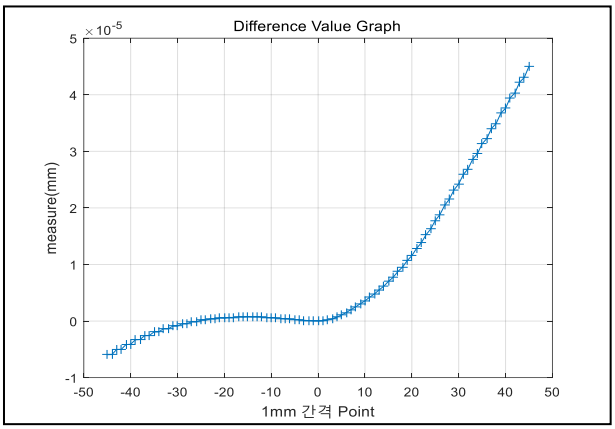

Fig. 3: Fizeau Interferometry Difference Value.

The above figure shows the error between the shape restoration value and the best fit R by UA3P using the curvature obtained through the two interferometers. The error value from the shape restoration value using the curvature measured by White light scanning interferometry is 0.16um and the error value with the shape restoration value using the curvature measured by Fizeau interferometry is 0.16um.

4. Conclusion

Measurement accuracy was confirmed by the curvature method, a new measurement method rather than the basic method for measuring optical shapes. A curvature method was applied to a spherical lens, and a measurement accuracy of 0.16um was comfirmed by comparing with two interferometry (White light scanning interferometry and Fizeau interferometry). In the future, this method will be applied to other optical shapes such as aspheric lens and Free-form to check the measurement accuracy.

References

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