液晶レンズ測定システム

Measurement System for Liquid Crystal Lens

電科大 [1], 成都微晶 [2] 陳暁西 [1], 李其昌 [2], 王思聡 [1], ○葉 茂 [1]

UESTC[1], MicroLCL Tech.[2], Xiaoxi Chen[1], Qichang Li[2], Sicong Wang[1], ○Mao Ye[1]

E-mail: mao_ye@uestc.edu.cn

A liquid crystal (LC) lens driven by two voltages of several volt has been proposed [1, 2]. For there is a resistive film in the cell, the properties of the lens are determined by not only the amplitudes V_1 and V_2, but also the frequency f of the voltages. The optical power and the aberrations of the LC lens are generally measured by interferometry. One has to analyze a huge amount of data to find out the optimal combinations of the three parameters V_1, V_2, and f to ensure the lens to have the tunable focus range as wide, and the aberrations as low as possible. In this work, we report an interference system for rapidly measuring and analyzing the properties of an LC lens.

The structure of the LC lens in this work is the same as that in [2] with an LC (MCL 6080 from Merck) layer of 30 μm thickness. The lens driven by square AC voltages from a function generator is placed in a Mach-Zehnder interferometer with a laser beam of 532 nm wavelength. The interference patterns are recorded by an image sensor. Figure 1 shows the interference fringes when the lens is driven by V_1 = 3.5 V_{rms}, V_2 = 1.2 V_{rms}, and f = 700 Hz. Both the function generator and the sensor are controlled by a computer. The fringes are analyzed by Fourier transform method, and the phase profile of the light wave exiting from the lens (Fig. 2) and the aberration (Fig. 3) are obtained. The response time of the LC lens is approximately 1 s, and the interval of the voltage change is set to 2.5 s. The phase profile is then fitted to the Zernik polynomials. Some of the Zernik coefficients are z3 = 1.8148 (defocus), z4 = 0.0004 (astigmatism ab.), z5 = -0.0615 (astigmatism ab.), z6 = 0.0273 (coma ab.), z7 = -0.0023 (coma ab.), and z8 = -0.0286 (spherical ab.), from which the optical power P = 3.76 1/m and the RMS aberration = 0.044 wave are known.

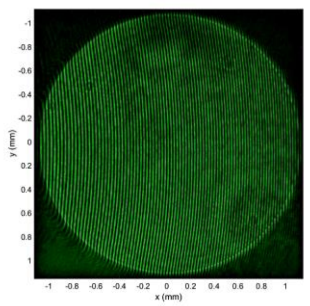

Fig. 1 interference fringes

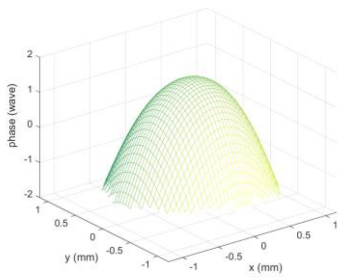

Fig. 2 phase profile

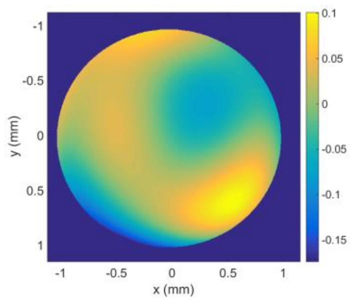

Fig. 3 aberration

[1] M. Ye, et al., *Appl. Opt.* **43** (2004) 6407.

[2] M. Ye, et al., *Jpn. J. Appl. Phys.* **49** (2010) 100204.