part of the picture comes from the flash tube used in the experiment.)

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Marek Daszkiewicz *

Holography of Polarizing Objects

Holograms made in the usual way do not contain full information about the recorded light wave because they do not record all polarization components of the real object beam. The reconstructed wave, therefore, does not have the polarization properties of the object wave.

It is true that the application of linearly polarized reference beam [1,2] enables one to record a definite component of the polarized light. Nevertheless, the full information about the polarization state of the hologramed object remains still unknown. A method for recording both polarization components has been given by Lohmann [3]. The method consists in using two rectangularly polarized and divergent reference beams for recording and reconstruction.

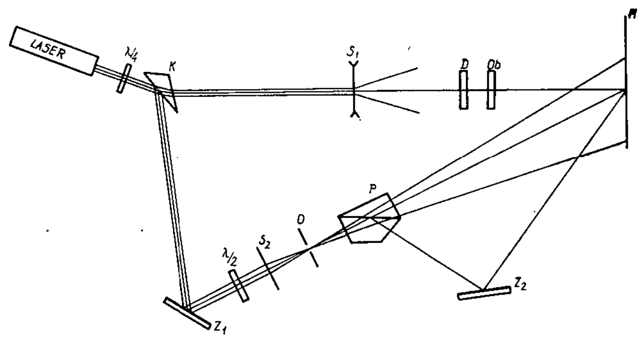

Fig. 1. Scheme of the experimental system for making holograms of polarizing objects. $\frac{\lambda}{4}$ — plate, K — glass prism, D — diffuser, Ob — object, H — hologram, $\frac{\lambda}{2}$ — plate, O — small hole, P — Glan-Thompson prism, S_1, S_2 — lenses, Z_1, Z_2 — mirrors

On the basis of the Lohmann [3] method an experimental system has been set up which enables us to record the polarization properties of the object wave. A scheme of the system is shown in Fig. 1.

A linearly polarized light beam from a He-Ne laser passes through a $\frac{\lambda}{4}$ plate and is incident onto a glass prism K. The prism divides the beam and eliminates secondary reflections. After passing the prism and the negative lens S_1, the beam scatters on the diffuser D illuminating an object Ob behind which is the hologram H. The beam reflected from the front surface of the prism is directed by the mirror Z_1 and the $\frac{\lambda}{2}$ plate onto the lens S_2 in the focus of which there is a small hole D for filtrating the beam. Behind the hole the Glan-Thompson calcite prism P has been placed for the purpose of creating two cross-polarized divergent beams. These beams serve as reference beams for the object wave; one of them being incident directly onto the hologram, the other only after the reflection from an auxiliary mirror Z_2. The $\frac{\lambda}{4}$ plate serves for obtaining circular pola-

*) Centralne Laboratorium Optyki, Zakład Optyki Fizycznej, Warszawa, ul. Kamionkowska 18, Poland.

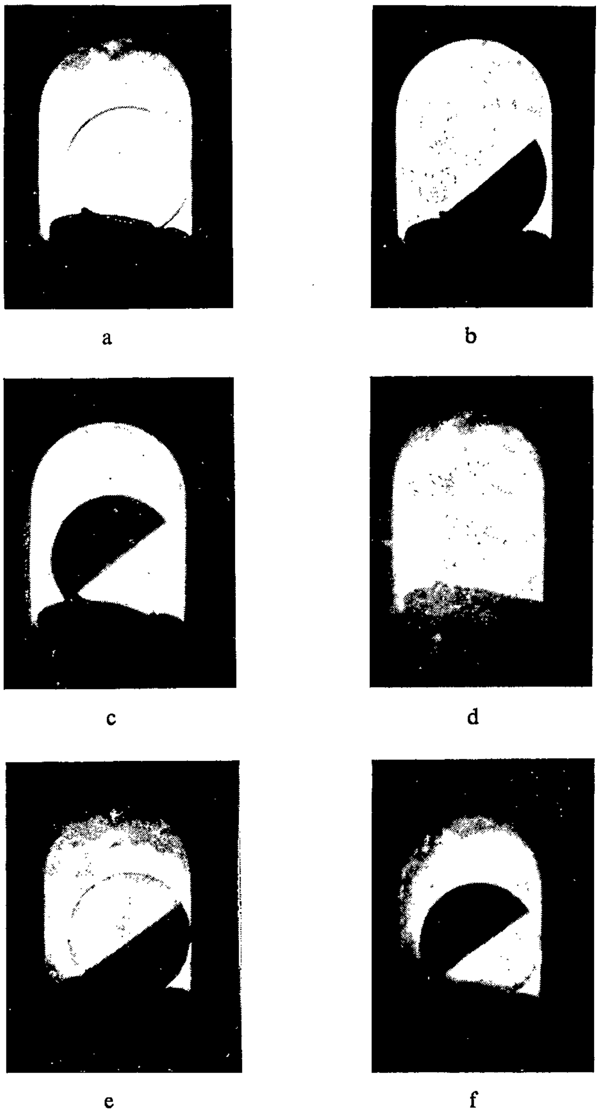

Fig. 2. Two semicircular polarization foils with perpendicular planes of polarization as seen through analyzer. At the top, the reconstructed image from the hologram: a — analyzer placed at 45° relative to the foil polarization plane, b, c — analyzer crossed with the lower and the copper foil, respectively. Below, (d, e, f) real object observed through analogously set analyzer

rization and owing to this the beam illuminating the object was depolarized in principle; wheras the $\frac{\lambda}{2}$ plate serves for keeping the intensity ratio of two reference beams constant (as a result of reflections from the K prism and Z_1 mirror surfaces the light beam becomes elliptically polarized).

The reconstruction was made in the same system by placing the developed hologram in its previous place and using the reference beams for the reconstruction; the reproduced virtual image, created by combining the two polarization components and observed through a rotating analyzer, showed all the polarization features of the real object.

Fig. 2 shows the reconstructed apparent images, as seen through the analyzer, of two semicircular polaroid foils, touching one another along the straight edges and having crossed polarization planes. In Fig. 2a the analyzer placed at 45° relative to the foil polarization planes; in Fig. 2b, c the analyzer crossed with the lower and the upper foil, respectively. Fig. 2d, e, f show the real object as observed through the analyzer placed at angles analogous to those above. Thus it is obvious that images reconstructed from the hologram show the polarization features of the real object.

The possibility of recording and reconstructing from a hologram both polarization components is of special importance in photoelastic studies [4, 5]; one necessary condition being that the same phase relation between the reconstructing beams and the hologram must be preserved during the reconstruction and recording processes [6].

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