

Fast Measurements for LCD Retardation Films

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Fast (sub-second level), exact (0.1-0.2 nm accuracy), reliable retardation measurement method and proper software are developed. The method is used at Lab and production line for various LCD retardation films at normal and inclined light incidence. Measured and reference retardation films are positioned between parallel polarizers in light beam of Fiber CCD Spectrometer connected to computer.

Poster presentation is preferable

Conference topic: Liquid Crystal and Other Non-emissive Displays

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Objective and Background:

This development goal is to supply Lab, pilot and main line by fast (sub-second level), exact (0.1-0.2 nm accuracy) and low cost measuring method for various LCD retardation films. We have analyzed some proposed measuring methods for a retardation, but found their disadvantages. To reach indicated goals we have developed new method basing on multi-channel Fiber CCD Spectrometer and computer with proper developed software. The developed method and device arrangement is used for the LCD films retardation measurements at normal light incidence and at inclination of light beam.

Results:

The scheme of developed retardation measuring method is shown in Fig. 1. Reference film is positioned between parallel polarizers. Fast axis of reference film should be positioned at 45° with respect to polarizers axes. Fast axis of a measured LCD film should be perpendicular to the fast axis of reference film.

The measurement procedure consists of preliminary *graduation steps* which are done one time for certain film material (and is repeated only if the reference film is changed) and final *measurement steps*.

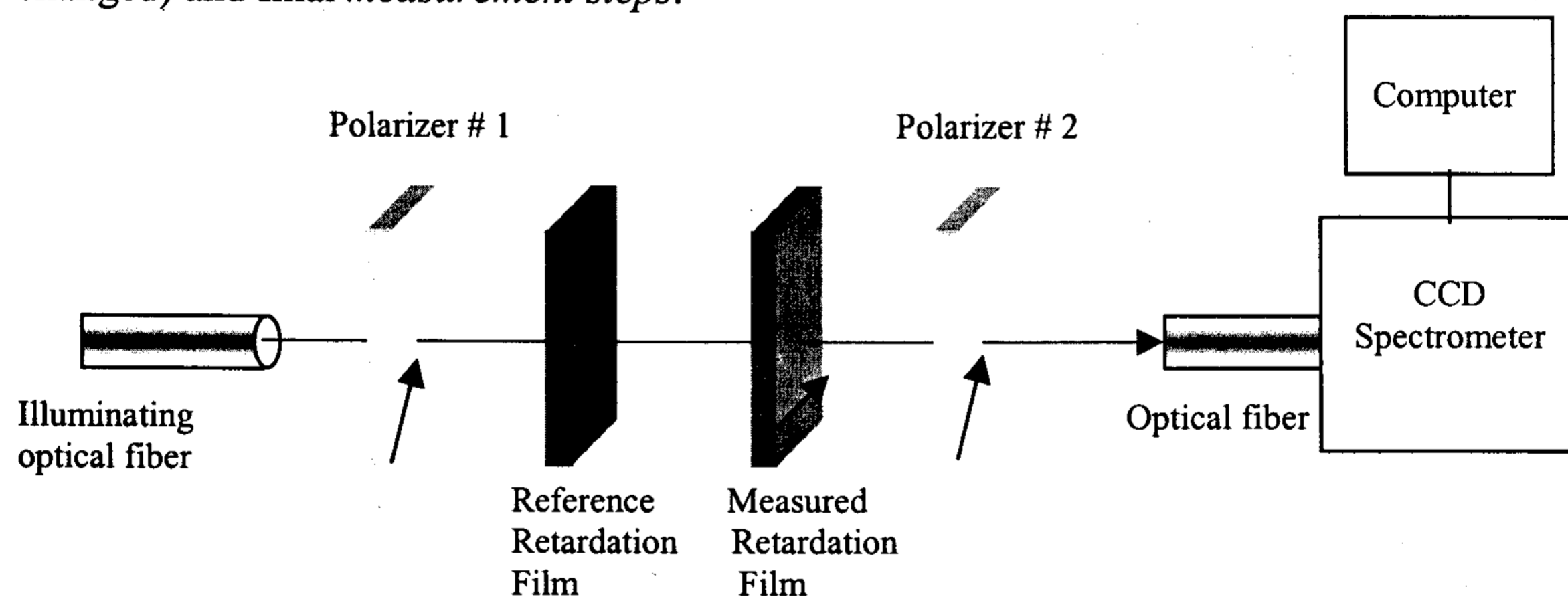


Fig. 1 Retardation measurement scheme (films axes are indicated by arrows)

Graduation steps consist of :

- Reference film retardation at certain wavelength. The exact retardation value R at this wavelength namely can be calculated from a spectral position of a transmission minimum.

- Reference film retardation at any wavelength. The improved dispersion Cauchy equation for a retardation (or birefringence) is used: $R(\lambda) = A + B / (\lambda^2 - \lambda_0^2)$, where A, B, λ_0 - are reference film material constants.

Measurement steps consist of :

- LCD film *relative* retardation at any wavelength. As result LCD film material constants A, B, λ_0 are obtained.
- LCD film retardation at certain wavelength.
- LCD film retardation at *any* wavelength from 400-700 nm range. LCD film retardation at 550 nm or 589 nm wavelength is indicated by developed proper software.

Impact :

The developed method and equipment are used now at Lab, pilot and main lines at fast (sub-second level), exact (0.1-0.2 nm accuracy) and low cost measurements for various retardation films. This method is based on the low cost multi-channel Fiber CCD Spectrometer and computer with proper developed software. The developed method and device arrangement can be used for the retardation measurements at normal light incidence and at inclination of light beam. No similar methods and equipment are known.

References:

1. H.J. Jerrard, J. Opt.Soc.Am 38(1), p.35 (1948)
2. W.J.Smith «Modern Optical Engineering: the design of optical systems», p.164, McGraw-Hill, Inc.,1990)