



### Liquid Crystal Displays and the Wonder of Photons( 1 )

Shunsuke KOBAYASHI

Electro-optic effects in liquid crystal displays (LCDs) will be sufficiently explained in terms of crystal optics based on the classical electromagnetism. However, once we know that light has a dual nature that behaves as a wave and a particle, we ask ourselves how LCDs are relevant to the photon nature of lights. When the light is very weak, the displayed patterns of an LCD caused by the interference of photons comprise probabilistic a distribution of light spots made of photons. In this review paper, we explain the function of dichotic polarizer and the ECB (Electrically Controlled Birefringence) effect in LCDs in terms of the crystal optics and quantum mechanics, where the latter is based on the theory of P. Dirac. Actually, when the light is

**Keywords** : LCDs, Liquid crystal, Photons, Crystal optics, Polarizers, Optical interference

### A High Performance Optical Head using a Liquid Crystal Device

Masayuki IWASAKI

Liquid crystal devices (LCD) are widely used for display applications. However, an LCD works as a phase modulator of light because the refractive index can be modulated by controlling the applied voltage. So using LCDs can arbitrarily modulate the wavefront of the laser light in optical disk systems. Then the wavefront aberration in the optical disk system can be corrected and the margins of the systems are expanded.

In this paper, the principles of the wavefront aberration using LCDs and its effects on the optical disk systems are described.

**Keywords** : Optical disk, Optical head, Wavefront aberration, Aberration correction, Coma aberration, Spherical aberration, System margin

### Expanding New Fields in Liquid Crystals with Polymer and Chiral Effects—Anomalous Kerr Effect of Isotropic Liquid Crystals

Hirotsugu KIKUCHI

Pseudo-isotropic phases and polymer-stabilized blue phases are obtained by incorporative effects of polymer networks and chirality of liquid crystal molecules. In this article, possible mechanisms, structures, dynamics and electro-optical Kerr effects observed in those phases are briefly reviewed. Optically isotropic and transparent phases appeared over a wide temperature range of the liquid crystalline phase by in-situ photopolymerization of monomers in the isotropic state of chiral nematic liquid crystals. The anomalously large Kerr effect was observed in the pseudo-isotropic phases. The polymer-stabilized blue phases also showed a large Kerr effect. The achievements can contribute toward providing new electro-optics devices with high response speeds and without using the rubbing process in their fabrication.

**Keywords** : Pseudo-isotropic phase, Blue phase, Kerr effect, Frustrated phase, Electro-optic effect

### Preparation and Magnetic Properties of Chiral All-Organic Liquid Crystals

Rui TAMURA, Naohiko IKUMA and Satoshi SHIMONO

We describe (1) the characteristics of magnetic anisotropy with respect to diamagnetic liquid crystals (LCs), paramagnetic metal-containing LCs and organic radical LCs, and (2) the history of the synthesis of organic radical LCs. Finally we describe (3) the magnetic properties of novel organic radical LCs containing a chiral five-membered cyclic nitroxide unit within the rigid core, clarified by means of magnetic susceptibility measurements and EPR spectroscopy.

**Keywords** : Chiral radical liquid crystal, Magnetic

anisotropy, Ferroelectric radical liquid crystal, Magnetoelectric effect, Liquid crystalline nitroxide radical

## **Standard Measuring Methods for Reflective LCD**

Yuji YODA

The “Technical Standardization Committee on Electronic Display Devices” of Japan Electronics and Information Technology Industries Association (JEITA) issued the “Standard measuring methods for matrix

reflective LCD modules(EIAJ ED-2523)” in March, 2001. The measurement method was standardized by choosing four types of illumination and measurement conditions, about the optical characteristics evaluation of Reflective LCD modules that were already performed under various lighting environments. This paper describes possible errors and pays particular attention to measurement, regarding the illuminating method and geometric condition that were issued using this standard.

**Keywords** : Reflective LCD, Measurement method, Standardization, JEITA, ED-252

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