Fast-Switching Flexoelectric Display Device with High Contrast

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Abstract
The flexoelectro-optic effect provides a fast switching mechanism ($\tau_{90\,-\,10} \sim 10\,-\,100$ µs) suitable for use in field-sequential-color, full motion video displays. An in-plane field is applied to a short-pitch chiral nematic liquid crystal aligned in the Uniform Standing Helix (or Grandjean) texture [1,2]. The display performance is presented as a function of device parameters.

Background
The flexoelectro-optic effect in N* LCs is a result of flexoelectricity, which is caused by a linear coupling between the distortion of the LC and the applied electric field [3,4]. It is similar to piezoelectricity in normal, solid, crystals. Highly flexoelectric materials have been developed for use in such devices [5,6].

Switching mechanism
Short-pitch chiral nematic $\rightarrow$ birefringent uniaxial structure

Analogous to Vertically Aligned Nematic (VAN) device

Response Time
The response time is a function of the pitch
Response times are typically 10-100 µs.

Off (dark) state
The electro-optic curve plots the transmitted intensity as a function of applied electric field. (Calculated using the Berreman method [7].)

Viewing angle dependence
The viewing angle may be widened by using a c-plate compensation film.

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