Jo rnal of
Comp a ional and Theore ical Nano cience
V . 7, 1 17, 2010

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A combination of analytical, numerical, and qualitative methods is used to study competing equilibrium orientational configurations in a liquid-crystal thin film. The material is a cholesteric liquid crystal and has a negative dielectric anisotropy. The system has strong homeotropic anchoring of the liquid-crystal director on the confining substrates and is subject to a voltage applied across the film thickness. A free-energy functional embodies the competing influences of the boundary conditions, the intrinsic chirality of the material, and the electric field. Attention is restricted to director fields that are functions only of the distance across the cell gap. A detailed phase and bifurcation analysis of the two equilibrium configurations of this type is presented; the control parameters are the ratio of the cell gap to the intrinsic pitch of the cholesteric and the applied voltage. The study was motivated by potential technological applications. The phase diagram contains both first-order and second-order transition lines, the former terminating at an isolated point and the latter at a triple point. The voltage-dependent nature of the total twist of the director across the cell is revealed and

T (, , -) , R f . 1, 3, 6, 10 . T f f - f ( ) , f . T (ff) , , - f .[22 27] T , fi f f , , f fi . A f

RE EARC AR C E

w 0 < < j
(0) = ( ) = 0. H w 1, 2,
. T
V_w
/P 0 = 2 /P. N
f 1, 2, f
(T I)

$$_1 \doteq -0.039, \quad _2 \doteq -0.580, \quad \bar{} \doteq -1.088 \qquad (27)$$

W f ,
(23) −

$$^2 + {}^2 = 1 \qquad (28)$$

3.3. Perturbation Analysis of Bifurcation Points

W f
F 4: fi , w ,
fi w . O (,) j
. C f f w
f
f = 0:

$$(;) = {}_1( ) + {}_3( ) {}^3 + {}_5( ) {}^5 + \cdots \qquad (29\ )$$

$$( ) = {}_0 + {}_2 {}^2 + {}_4 {}^4 + \cdots \qquad (29\ )$$

T f (w)
f w -
f ; f
f , fi
.
W f , w
f w (f):

$$\frac{4}{} \sum_0 \left(\frac{}{}\right)^2 + 3\left(\frac{}{}\right)^2 = 2 \qquad (30)$$

T fi f - -
− . T , f -
fi fw

$$O(1): \quad \frac{2}{} \sum_0 {}_1^2 = 1 \qquad (31\ )$$

$$O({}^2): \quad \frac{2}{} \sum_0 {}_1 {}_3 + {}_2^2 = 0 \qquad (31\ )$$

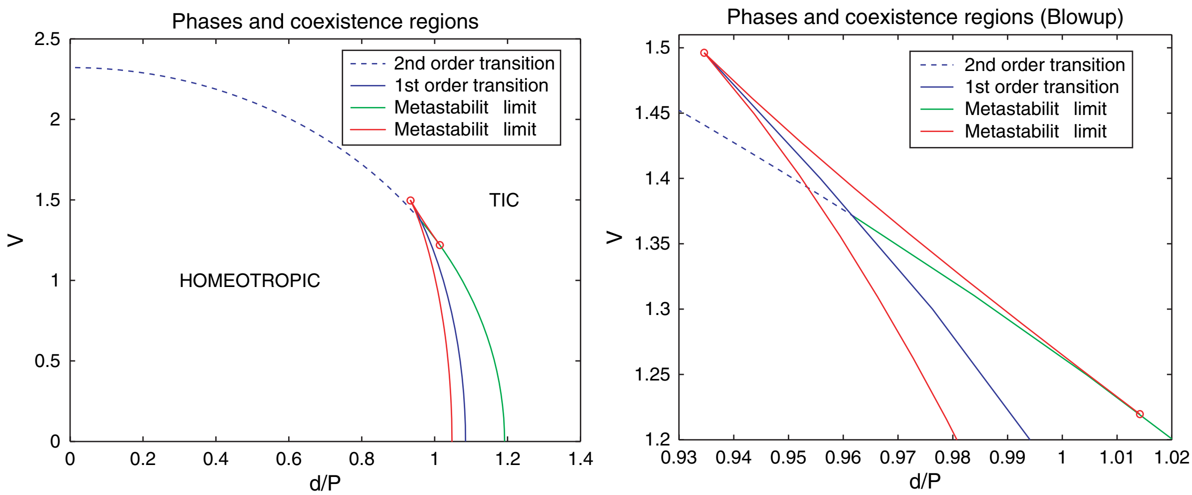
$$O({}^4): \quad \frac{9}{} \sum_0 {}_3^2 + \frac{10}{} \sum_0 {}_1 {}_5 + 12 {}_2 {}_4 = 0 \qquad (31\ )$$

F (29)
(26) w , O( ),

$_1$ + (^{2} 0J0AflZO T W.J.Zf WBJ65.I.ZD I.Z J

W

(0) = ( ) = 0, (0) = 0, ( ) = V),


Phases and coexistence regions
2nd order transition
1st order transition
Metastabilit limit
Metastabilit limit
TIC
HOMEOTROPIC
V
d/P
Phases and coexistence regions (Blowup)
2nd order transition
1st order transition
Metastabilit limit
Metastabilit limit
V
d/P

R f. 27) w w w fi
(w w w).

5. 2-D CA AB F E C C F A

T f f f CF1 fi . W w f H , , f , f w H CF1. T w , f , f L M[33] . T f (H , TIC, CF1) - (w fi) . H w fi j f f H fi w f - - w .

5.1. General Linear Stability Criterion

T f ($_0$, $_0$) w , w f w f /

— = *P*( ) (,), = 1, (ϵ((( )

9 0Tc 9(E9 ( )Tj /F71. Tf5 "( )962687301051 TD 0 24 0 18 1 Tf 1.0

E C A EA C E

T L , fi , f
, P:

$$_0( ) = \ _0 \cdot \ _0 = \ (\ _0, \ _0) = \ _0 \ \frac{V^2}{2}$$

$$P(\ _0) = \ \square + \square \qquad (63)$$

T f f , fi ,
fi f , f $_0$,
A . T

$$_0 \cdot \ = 0 \ \square \ = \ + \qquad (64)$$

T ,
(C f)

ϵ

E EA C A C E

$-K_1^2$ $-K_2^2$: j
ff f ff
$^2 \, V^2$.

E (74) $\hat{}(0,) =$ $\hat{}(,) = 0$ G ' f -
:

$$\hat{}(,) = - \sum_0 (, ;) \hat{}(,) \qquad (75)$$

w f f

$$(, ;) = \frac{2}{} \sum_{=1} \frac{}{}, \quad := {}^2$$

E -F I , T C L , -G F N D A . .

F , , = (,) = (,),

$$= {}_{,} + {}_{,} , \quad = {}_{,} - {}_{,}$$

$$( ) = \begin{matrix} {}_{,} + {}_{,} \\ {}_{,} + {}_{,} \\ {}_{,} + {}_{,} \end{matrix} \quad \text{(A3)}$$

U f f (2)
f

$$2 = K_1({}_{,} + {}_{,})^2 + K_2[{}^2_{,} + ({}_{,} - {}_{,})^2 + {}^2_{,}] + 2K_2 {}_0[- IK ,$$

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R : 6 J 2008. A : 3 J 2008.