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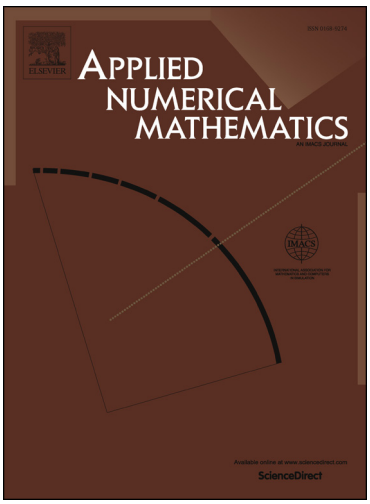

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PII: S0168-9274(18)30132-6
DOI: https://doi.org/10.1016/j.apnum.2018.05.014
Reference: APNUM 3381

To appear in: *Applied Numerical Mathematics*

Received date: 16 April 2018
Revised date: 23 May 2018
Accepted date: 25 May 2018

Please cite this article in press as: M. Fallahpour et al., Numerical Simulation of Flow in Smectic Liquid Crystals, *Appl. Numer. Math.* (2018), https://doi.org/10.1016/j.apnum.2018.05.014

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Numerical Simulation of Flow in Smectic Liquid Crystals

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Abstract

Our aim is to simulate a nonlinear system of ODEs describing the flow in smectic liquid crystals. The nonlinear system is first linearized. We present a direct approach to compute the exact analytic solution of this linear system and use this solution as a starting profile in the MATLAB package `bvpsuite2.0` to obtain the approximate solution to the nonlinear system. Although, the solution of the nonlinear system has steep boundary layers and therefore is difficult to resolve, we demonstrate that `bvpsuite2.0` can cope with the problem and provide an approximation with reasonable accuracy.

1 Introduction

Nematic liquid crystals consist of rod-like molecules that have preferred local average direction; this direction is usually characterized by a unit vector **n**, called the director. Smectic liquid crystals (SmA) tend to have more order: they occur when the molecules are arranged in parallel layers with the director parallel to the unit layer normal **a** as displayed in Figure 1.

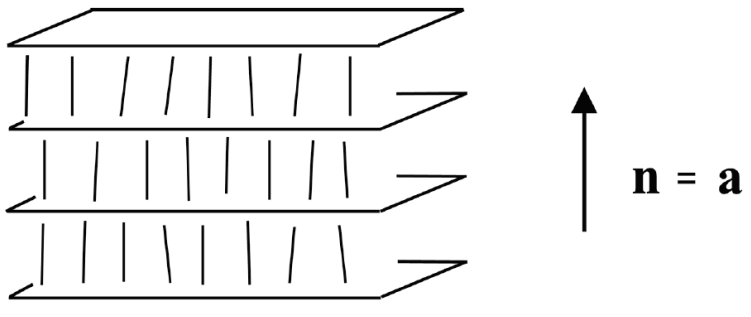

Figure 1: Undistorted SmA

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