Mathematical Modeling of Thermomechanical and Electrodynamic Effects in Liquid Crystals

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Mathematical model of a nematic liquid crystal under the influence of weak thermomechanical and electrodynamic perturbations is constructed. Liquid crystal medium is considered as a micropolar acoustic medium with rotating particles, the couple-stress interactions of which are taken into account in the framework of the Cosserat continuum theory, [1, 2]. The thermal and electrical processes are described with account of the anisotropy of a material due to the difference in coefficients of thermal conductivity and dielectric permeability along the axis of orientation of the particles and in the transverse direction. Parallel computational algorithm for numerical implementation of 2D dynamic model is developed. The algorithm is based on the splitting method with respect to spatial variables, Godunov's gap decay method, Ivanov's scheme with controlled dissipation of energy and the method of straight lines for finding electric field.

A simplified system of second-order equations for tangential stress and angular velocity in 2D case was solved numerically, the stability condition of finite-difference scheme was obtained, and a comparison of numerical and exact solutions was fulfilled for 1D problem. Some computations were performed by means of MATLAB and the parallel program using CUDA technology for computer systems with graphic accelerators.

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References

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