An Advanced Numerical Method to Describe Order Dynamics in Nematics

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Abstract. Nematic liquid crystals are aggregates of calamitic molecules and most related experimental phenomena are well described by their mean molecular orientation, i.e. by the director and by the scalar order parameter[1], considering a perfect uniaxial symmetry. However, there exist situations in which experimental results cannot be fully described by this classic elastic approach. When the nematic distortion is very strong and it occurs over a length scale comparable with the nematic coherence length, the molecular order may be significantly altered, as in the case of the core of a defect [2]. Moreover the standard simplified elastic theory fails also for recent experimental results on phase transitions induced by nano-confinement [3] and for the electric field induced order reconstruction [4,5]. Such systems, where spatial and temporal changes of the nematic order are relevant and biaxial transient nematic configurations arise, require a full Landau-de Gennes **Q**-tensor description [4,6,7]. In this work, we will present the implementation of a **Q**-tensor numerical model, based on a one-dimensional finite element method with a r-type moving mesh technique capable to describe the dynamical electric biaxial transition between two uniaxial different topological states inside a π-cell. The use of the moving grid technique ensures no waste of computational effort in area of low spatial order variability: in fact, the technique concentrates the grid points in regions of large $\nabla \mathbf{Q}$ maintaining constant the total number of the nodes in the domain.

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