Field-induced motion of nematic disclinations

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Abstract. An individual defect in a nematic liquid crystal moves not only in response to its interaction with other defects but also in response to an external field. We analyze the motion of a wedge disclination in the presence of an applied field of strength H. We neglect backflow and seek steadily travelling patterns. The stationary picture yields a semi-infinite wall of strength π, bounded by the defect line. We find that the disclination advances into the region containing the wall at velocity $v(H)$, where v scales as $H/|\log H|$ as long as the magnetic coherence length is greater than the core radius. When the external field is applied in the presence of a pair of disclinations, their dynamics is strongly influenced. We compute the expected relative velocity of the disclinations as a function of distance and field. The natural tendency for the disclinations to annihilate each other can be overcome by a sufficiently strong field suitably directed.

2000 MSC: 76A15 – Liquid crystals