Constrained Energy Minimization for a Bent-Core Liquid Crystal Model

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One of the important applications of liquid crystal materials is their use in optical and display devices. A particular material promising improvement in optical applications is made up of bow-shaped molecules, a characteristic that leads to spontaneous ferroelectricity. Under the effect of an applied electric field, two competing mechanisms of switching can be detected in the tilted structure of these materials. An important question in this setup is how the switching mechanism is affected by specific system parameters. We formulate the model as an energy minimization problem allowing us to use several variational tools in its analysis. We emphasize how we can deal with challenges that arise from constraints and nonlinearities peculiar to this problem. Our results address existence, uniqueness, and computation of solutions to the ensuing partial differential equations, providing insight into the switching behavior observed in physical experiments.

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