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A Deflation Technique for Detecting Multiple Liquid Crystal Equilibrium States

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Multiple equilibrium states arise in many physical systems, including various types of liquid crystal structures. Having the ability to reliably compute such states enables more accurate physical analysis and understanding of experimental behavior. In this talk, we consider adapting and extending a deflation technique for the computation of multiple distinct solutions arising in the context of modeling equilibrium configurations of nematic and cholesteric liquid crystals. The deflation method is applied as part of an overall free-energy variational approach and is modified to fit the framework of optimization of a functional with pointwise constraints. It is shown that multigrid methods designed for the undeflated systems may be applied to efficiently solve the linear systems arising in the application of deflation. For the numerical algorithm, the deflation approach is interwoven with nested iteration, creating a dynamic and efficient method that further enables the discovery of distinct solutions. Finally, we present numerical simulations demonstrating the efficacy and accuracy of the algorithm in detecting important physical phenomena, including bifurcations and disclination behaviors.