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Computational Mathematics Seminar Series

Modeling and Numerical Analysis of the Landau-de Gennes Model**Andrew Hicks, LSU Department of Mathematics**Digital Media Center 1034
November 14, 2023 - 03:30 pm**Abstract:**

Liquid Crystals (LCs) are a key component of our life in the modern world, appearing in various technologies, such as LC displays and temperature sensors. We investigate the numerical analysis of the Landau-de Gennes (LdG) model, which utilizes a 3×3 symmetric tensor as the order parameter (the "Q-tensor"). This model is usually preferred over others, such as the Oseen-Frank model, which we briefly review. We also show how the standard LdG model can be extended to model cholesteric LCs, which have applications in droplet lasers, novel bio-sensors, and anti-counterfeiting markers.

Next, we describe a finite element discretization of the model and an L^2 gradient flow scheme for computing local minimizers, and we discuss various time-step restrictions for the gradient flow scheme to be energy decreasing. Furthermore, we prove a mesh size restriction that is critical for avoiding spurious numerical artifacts in the numerical solutions, which is not well-known in the LC literature, particularly when simulating cholesteric LCs that exhibit "twist". Finally, we present various numerical simulations in 3-D, on both slab geometries and spherical shells, and connect these results with experiments.

Speaker's Bio:

Andrew Hicks is a sixth-year graduate student in the LSU Department of Mathematics studying under Professor Shawn Walker. His current research involves numerical analysis of the Landau-de Gennes model for liquid crystals. He hopes to expand his research to other areas of applied mathematics after he graduates in May 2024.

This lecture has refreshments @ 03:00 pm