WICHITA STATE UNIVERSITY

Department of Mathematics, Statistics & Physics

Visiting Candidate for Assistant Professor Position

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"Numerical schemes for mixtures of isotropic and nematic flows with anchoring and stretching effects modeled using a phase field approach"

Abstract:

The study of interfacial dynamics between two different components has become the key role to understand the behavior of many interesting systems. Indeed, two-phase flows composed of fluids exhibiting different microscopic structures are an important class of engineering materials. The dynamics of these flows are determined by the coupling among three different length scales: microscopic inside each component, mesoscopic interfacial morphology and macroscopic hydrodynamics. Moreover, in the case of complex fluids composed by the mixture between isotropic (newtonian fluid) and nematic (liquid crystal) flows, its interfaces exhibit novel dynamics due to anchoring effects of the liquid crystal molecules on the interface.

In this talk I will introduce a PDE system to model mixtures composed by isotropic fluids and nematic liquid crystals, taking into account viscous, mixing, nematic, stretching and anchoring effects and reformulating the corresponding stress tensors in order to derive a dissipative energy law. Then, I will present new linear unconditionally energy-stable splitting schemes that allows us to split the computation of the three pairs of unknowns (velocity-pressure, phase field-chemical potential and director vector-equilibrium) in three different steps. The fact of being able to decouple the computations in different linear sub-steps maintaining the discrete energy law is crucial to carry out relevant numerical experiments under a feasible computational cost and assuring the accuracy of the computed results.

Finally, I will present several numerical simulations in order to show the efficiency of the proposed numerical schemes, the influence of the shape of the nematic molecules (stretching effects) in the dynamics and the importance of the interfacial interactions (anchoring effects) in the equilibrium configurations achieved by the system.

Wednesday, March 6, 2019
4:00 PM in 128 Jabara Hall

Please come join us for refreshments before the lecture at 3:30 p.m. in room 353 Jabara Hall.