

# A DIFFUSE-INTERFACE METHOD FOR SIMULATING TWO-PHASE SYSTEMS OF COMPLEX FLUIDS

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In this talk, we present an energy-based method for treating interfacial problems involving rheologically complex fluids. Introducing a phase-field variable to describe the interface, a set of governing equations are derived for all phases which hold uniformly across interfaces. This greatly simplifies the computational task since the interface no longer needs to be tracked. The surface tension comes out naturally from the minimization of the mixing energy in the phase-field formulation. The energy-based formalism is particularly convenient for incorporating complex rheology since the latter is often derivable from a free-energy as well. This general scheme applies to a wide variety of multi-phase complex fluids with internal interfaces. Using a spectral implementation, we will describe numerical results on the dynamics of drops in a matrix where both phases can be rheologically complex. In particular, we will study the elongation and retraction of a viscoelastic drop modeled by the Oldroyd-B equation, and the behavior of a nematic liquid-crystal drop modeled by an regularized Leslie-Ericksen theory. Comparison with experiments and prior simulations will be made where possible.