Mathematics Colloquium

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4:00 pm

PS 307

Non-local three species model for wormlike micellar fluids.

Non-local three species model for wormlike micellar fluids. Abstract : Wormlike micelles are self-assemblies of amphiphilic surfactant molecules in an aqueous solution. In an experiment of the shear flow of the wormlike micellar fluids, Liu and Pine (Physical Review Letters, 77, 2121 (1996)) observed the shear thickening in the dilute and found that such a thickening is due to a generation of some new larger structure. This large structure, known as the shear induced structure or gelation, has attracted a lot of research works since then. The gelation is oftentimes correlated with very interesting physical phenomena such as the shearthickening transition, and the continual oscillations in speed of the falling sphere and rising bubble in wormlike micellar fluids. However, they are not yet completely understood in their mathematical modelings. In this talk, we shall present a new population dynamics-based three species PDE model for modeling wormlike micellar fluids, which consist of long micelle, short micelle and the gelation. Starting at the homogeneous ODE model, we present both theoretical and numerical results, which include the global stability. The model is then extended to the partial differential equation to incorporate the inhomogeneity of the species. Using the extended model, we tackle the challenge to model the shear thickening transition. Our numerical results are clearly shown to be agreeable with the experimental results. In conclusion, we shall address some of potential applications of our model.

Refreshments will be served, for attendees, in PS 317 at: 3:30 pm