

Dynamical Modeling Based on Energy Dissipation

Pingwen Zhang

School of Mathematical Sciences, Peking University, Peking, China

Corresponding Author : Pingwen Zhang, pzhang@pku.edu.cn

ABSTRACT

Energy dissipation for a dynamical model is important not only for the physical correctness but also for stable and robust numerical simulation. In this talk, we introduce a systemic technique for dynamical modeling and a way from energy dissipation law to dynamical equations.

We will present a new closure approximation needed for deriving effective macroscopic moment equations from the microscopic FENE kinetic theory modeling viscoelastic polymeric fluids and inhomogeneous kinetic theory of liquid crystal polymers. The simplified system coupling the moment equations and the Navier-Stokes equations still possesses an approximated energy law analogous to the original micro-macro system.

Some other examples for complicated coupled models of polymer phase separation and dynamical cell membrane are introduced to expound the whole process. Numerical results show good stability of these models as well as the numerical schemes.