

# The Thermodynamic Closure Approximation of Kinetic Theories for Complex Fluids

Pingwen Zhang  
School of Mathematical Sciences , Peking University

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## Abstract

A lot of closure approximations have been proposed in the past thirty years to obtain the tensor models from the kinetic theories of polymer dynamics, but it is very difficult to say which model is the best one. Now we present four criteria to evaluate the closure approximations, which also provides a guideline for the good closure moment models. By the detail numerical comparison among the second-order moment closure FENE models, we find that the quasi-equilibrium closure moment model with piecewise linear approximation (FENE-QE-PLA) is the right one according to our criteria. The quasi-equilibrium closure approximation is also employed to obtain tensor models from a general non-homogeneous Doi's kinetic theory of liquid crystalline polymers. Numerical results showed that the second-order closure model with the quasi-equilibrium approximation agrees qualitatively with the exact kinetic theory. Because of the complexity of the Doi's theory (nonlinear, phase transition etc), the higher-order closure approximations are more difficult than the FENE model and needed to give more accurate results.