Preface

Mathematical Issues of Complex Fluids

This special issue "Mathematical Issues on Complex Fluids" includes a collection of invited papers that cover a wide range of hydrodynamical and rheological behaviors of various complex fluids.

Complex Fluids are a class of materials whose properties are dominated by their microstructural features including molecular conformations as well as configurations and interactions among the microstructural components. These materials can form mesoscopic structures which ultimately determine the macroscopic property. Multiphysics-Multiscale modeling of complex fluids predicts macroscopic properties and behavior from microscopic molecular processes by bridging/coupling size and time scales and linking computational processes. Such modeling and simulations reflect the wide variation in size of polymeric structures, from nanometers to centimeters, and the time scale of dynamic process completion, from femtoseconds to hours for large scale ordering processes. To handle such a wide range of size and time scales requires the understanding of the different physical systems involved of the couplings between them. It also requires sophisticated numerical algorithms and schemes that reflect such underlying structures and couplings.

Most of the work has been presented during the workshops in the Thematic Program on Multiscale Modeling of Complex Fluids during the academic year 2007 — 2008 in Peking University, Beijing, China. The program has been sponsored by the Beijing International Center for Mathematical Research (http://www.bicmr.org/). Funding from ENPC and INRIA (France) covered the travel expenses of some of participants to the program. Besides the three international workshops that includes some of the world leading experts in different areas of complex fluids (http://www.bicmr.org/sp.htm), the thematic program also includes the year-long educational program that includes more than 20 graduate students as well as postdocs and junior faculty members from around China.

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