Mathematical analysis of viscoelastic flows

Renardy, Michael, author

Abstrak

The flow behavior of fluids such as molten plastics, biological fluids, and paints is much more varied and complex than that of traditional Newtonian fluids. The role of numerical simulation in the study of such flows has increased tremendously over the past fifteen years, and the phenomena and numerical difficulties in complex flows have led to new and challenging mathematical questions. Studying such flows presents a host of problems, as well as opportunities for mathematical analysis, including questions of asymptotics, qualitative dynamics, and adequacy of numerical methods. Mathematical Analysis of Viscoelastic Flows presents an overview of mathematical problems, methods, and results relating to research on viscoelastic flows.

This monograph is based on a series of lectures presented at the 1999 NSF-CBMS Regional Research Conference on Mathematical Analysis of Viscoelastic Flows. It begins with an introduction to phenomena observed in viscoelastic flows, the formulation of mathematical equations to model such flows, and the behavior of various models in simple flows. It also discusses the asymptotics of the high Weissenberg limit, the analysis of flow instabilities, the equations of viscoelastic flows, jets and filaments and their breakup, as well as several other topics.