Preface

In complex fluids, the atoms and molecules are organized in a hierarchy of structures from nanoscopic to mesoscopic scales, which in turn make up the bulk material. Consideration of these intermediate scales of organization is essential to understand the behaviour of the complex fluids. These fluids, an important part of what is generally called soft matter, have very complex rheological responses. Many industrial substances encountered in chemical, personal care, food and other processing industries, such as suspensions, colloidal dispersions, emulsions, powders, foams, polymeric liquids and gels, exhibit this complex behaviour. In addition, understanding the behaviour of these complex fluids is also very important in biological systems.

The area of complex fluids and soft matter has been evolving with rapid advances in experimental and computational techniques. The main aim of this book is to introduce these advanced techniques, after a review of fundamental aspects. Since a study of complex fluids involves multidisciplinary tools, contributors with different backgrounds have contributed chapters to this book.

The chapters in this book are based on lectures delivered in the School on Rheology of Complex Fluids, held at Indian Institute of Technology Madras, Chennai during January 4–9, 2010. This school is a part of such series, earlier held at different institutions over the last decade in India. The aim of these schools has been to bring together young researchers and teachers from educational and R&D institutions, and expose them to the basic concepts and research techniques used in the study of rheological behaviour of complex fluids. These schools have been sponsored by the Department of Science and Technology, India.

The book begins with introductory chapters on non-Newtonian fluids, rheological response and fluid mechanics. This is followed by an exposition on how to understand multicomponent and multiphase systems, of which a lot of complex fluids are examples. Analysis of rheological behaviour has been facilitated by experimental and theoretical techniques. The next section of the book gives examples of these
in the form of large amplitude oscillatory shear, flow visualizations and stability analysis. The remaining chapters of the book cover application areas of polymers, active fluids and granular materials and their rheology.

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