

Dynamics of Polymeric Liquids, Vol. 1 Fluid Mechanics Vol. 22

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by Bird, Armstrong, and Hassager, Second Edition, Wiley Interscience

This is a fundamental text for understanding the physics and the calculation of polymeric flow. Newtonian, non-Newtonian, and viscoelastic polymers are covered, and the physics is presented for many models of material behavior. Material constants for many common polymers are given for use with the models. The approach is highly mathematical, requiring the understanding of partial differential equations. Often vector notation is used, but the text is readily useful for those not skilled in this discipline.

The text is divided into three sections. The first section describes the physics of the various polymer materials in a variety of flow geometrics. The second section presents various equations for describing the viscous behavior of Newtonian and non-Newtonian melts. The third section (about one half of the text) includes the equations for viscoelastic effects in melt behavior. The section on viscoelastic behavior requires vector calculus, and the mathematical conventions are presented in an appendix.

Models for many fundamental flow geometrics (such as flow in a slot) are given for many rheological models. Emphasis is on isothermal conditions but some cases with heat transfer are given for Newtonian materials. Dimensionless results are presented for efficient scaling of the results.

This is an advanced comprehensive text on the theory of polymeric flow in terms of mathematics. However, it is very useful to the polymer processing engineer and scientist because it contains basic information about fundamental melt flow.

- S. Derezinski