BOOKS

RHEOMETERS FOR MOLTEN PLASTICS: A PRACTICAL GUIDE TO TESTING AND PROPERTY MEASUREMENT, John M. Dealy, Van Nostrand, 1982, 272 pages, $37.00.

The title of this book correctly indicates it scope. Dealy has chosen a fairly narrow subject, polymer melt rheometers, and done it well. The text is limited to operating equations without derivations, experimental tips and description of instruments. However, such tips can be invaluable to the experimentalist. Chapters 1 and 2 give a very readable overview of rheology and material functions although more examples of typical data would be helpful to the experimental rheologist. Chapter 3 gives insight into the type of errors to expect in melt rheometers. Chapter 4 describes mainly capillary instruments while 5 covers rotational rheometers, both give useful equations for analyzing data. Chapter 6 provides an extensive review of the growing area of extensional rheometry methods for melts. Chapter 7 describes the use of several complex flows, especially converging flow and the fiber spinning, as rheometers. Chapters 9–11 provide the most complete description available of commercial melt rheometers (over 50) which should be particularly useful to those considering obtaining an instrument. The references for each chapter are extensive.

A bachelors level engineer or chemist and many technicians should be able to follow everything; there is very little math. The text is clear and generally free of errors. Although Dealy's chapters which describe commercial instruments will be dated in a few years the basic test geometries and experimental problems will remain. Dealy's book should be the next step after the instrument lab manual for the polymer melt rheologist. However, as the rheologist needs to gain a deeper understanding of the measurements he is making or desires to apply them to molecular and microstructural characterization and to processing operations he will need to move beyond this book. In fact Dealy suggests several such references in his Chapter 1.

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Finite Element Computational Fluid Mechanics, A. J. Baker, Hemisphere Publishing Corporation, 1983, 510 pages, $39.50.

This book provides an introduction to basic concepts of the finite element method (FEM) and applications to various fluid mechanics problems. The introduction is general, developing the FEM equations using the variational technique and, later, the method of weighted residuals. The later chapters give a description of the FEM formulations for particular classes of fluid mechanics problems and also give in-depth analyses of the sample problems.

Because of the inherent complexity of the method, this book is best read by someone already having some familiarity with the FEM. Finite element formulations are derived through the use of variational calculus techniques and the results are represented in vector, matrix, and tensor notation. Anyone not familiar with these topics may have difficulty following the material.

The majority of the book deals with applications of the FEM to particular classes of problems. The topics are arranged in a progression from simplified fluid mechanics problems to problems of increased complexity. The topics include inviscid potential flow, viscous flow in two-dimensions, and general three-dimensional flow. Attention is devoted to developing the fluid mechanics equations, formulating the finite element representation of the problem, and discussing certain aspects of the results. Several of these topics were particularly interesting: the analysis of the numerical error due to element size and order of basis, comparison of results between FEM and finite-volume solutions for the same problem, and the need for a dissipation factor to create an artificial dissipation mechanism to control numerical dispersion.

This book would be useful to anyone interested in detailed solutions to fluid mechanics problems or to users of the finite element method interested in seeing applications of the technology to other fields.

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