

# Encyclopedia of Fluid Mechanics

Ed. Nicholas P. Chermisinoff

## Volume 1: Flow Phenomena and Measurement

## Volume 2: Dynamics of Single-Fluid Flows and Mixing

These two volumes represent a third of the total publication planned by the Gulf Publishing Company under the title of *Encyclopedia of Fluid Mechanics*. These volumes do not fit the usual concept of an encyclopedia. They are rather handbooks, in-depth presentations of both the theory and engineering data related to practical applications.

The major topics are presented as thorough reviews of the state-of-the-art with an extensive listing of references in the open literature. By the extensive use of line drawings and photographs the authors are able to present the physical phenomena which they are describing.

To summarize the contents of these volumes I have chosen to repeat the excellent summary by the Editor in the preface of each volume.

Volume 1 provides a detailed treatment of single fluid flow behaviour and measurement principles and techniques. A rigorous presentation of the principles of momentum and energy transport is given to provide a background for later volumes dealing with flow of complex mixtures.

The volume is divided into three sections. Section I, "Transport Properties and Flow Instabilities," contains nine chapters that address physical and transport properties, diffusion, micro- and macro-mixing phenomena, and turbulence structure and initiation. Detailed analytical treatment of special flow instabilities such as Rayleigh-Taylor instabilities are included.

Section II, "Flow Dynamics and Frictional Behavior," contains 26 chapters that address the theory and practical concepts of flow and turbulence, flow through irregular geometries, and non-Newtonian behaviour. Transonic flows, stability of immersed objects, and principles of aerodynamics are covered, and a state-of-the-art review of minimum energy and energy dissipation is presented. The section provides a well-balanced presentation of phenomenological and theoretical aspects of flow dynamics for both the researcher and practicing engineer requiring descriptive knowledge.

Section III, "Flow and Turbulence Measurements," contains six chapters covering experimental techniques and industrial methods/instrumentation for studying flow behaviour on micro- and macro-scales. Many techniques

discussed are applicable to multiphase flows treated in later volumes.

A total of 55 experts contributed to this volume.

Volume 2 is concerned with three specific topics of fluid mechanics and is less general than volume 1.

Section I, "Channel and Free Surface Flows," contains 11 chapters covering the dynamics of open-channel flow systems. The distinguishing feature of this class of flow system, as contrasted to pipe flow, is that the cross-sectional area is free to change in accordance with dynamic considerations instead of being fixed. The study of these flows is of importance to both industrial applications and in the control of natural and manmade waterways. The chapters presented provide both a qualitative and rigorous treatment of free-surface behaviour and bulk flow instabilities.

Section II, "Mixing Phenomena and Practices," contains 22 chapters. The theories of convective mixing turbulence and diffusion are reviewed with discussions heavily oriented towards engineering applications. Topics covered include convective diffusion, hydrodynamics of jet mixing and instability, density and thermal stratification and rollover, turbulent mixing in irregular-geometry pipe flows, pipeline mixing, mixing in industrial reactors, and mechanical agitation of Newtonian and non-Newtonian fluids. Theory and phenomenological descriptions are given for a well-balanced presentation.

Section III, "Fluid Transport Equipment," comprises 14 chapters. This section is also heavily design oriented, covering the hydraulics of pipe flow, pump system scale-up, transport of compressible fluids, and turbomachinery design. This section provides extensive hydraulic data and design practices/guidelines for process-oriented engineers.

In general these two volumes represent a good addition to any engineering library. They will serve to introduce persons to fluid mechanics and specific flow applications and to provide the practicing engineer with a state-of-the-art review of the topics discussed.

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