Review of *Applied Hydrodynamics: An Introduction to Ideal and Real Fluid Flows* by Hubert Chanson

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This book addresses the topic of applied hydrodynamics and is divided into two major sections: Section I concerns ideal fluid flow theory, and Section II considers the flow of a real fluid. The subject matter of the book is relevant for engineers dealing with fluid mechanics in their profession, including mechanical, civil, and environmental engineers.

The book begins with an introductory chapter on the importance of hydrodynamics in many branches of science. Chapter 2 addresses basic questions such as fluid properties and the fundamental equations of continuity and momentum in fluid flow. Section I of the book opens in Chapter I-1, in which the ideal fluid flow is defined, i.e., the incompressible and nonviscous fluid moving with zero vorticity. Chapter I-2 formally defines the mathematical apparatus of the ideal fluid flow theory. Chapter I-3 presents the basic equations for a two-dimensional (2D) flow, and Chapter I-4 thoroughly discusses basic flow net patterns of a 2D ideal fluid flow. Chapter I-5 introduces the important issue of the complex potential, and Chapter I-6 is devoted to the Joukowski transformation, the Kutta-Joukowski theorem, and the application to airfoils. Section I ends with an interesting chapter, in which the Schwarz-Christoffel theorem and the theory of free streamlines, or wall-separated streamlines, are presented, which is of special importance where separation takes place. Section II begins with an introductory chapter to real fluids, in which an inevitable reference to Osborne Reynolds is made, after which follows Chapter II-2 with an introduction to turbulence and the Reynolds time-averaging treatment. Chapter II-3 is devoted to the simplification of the real fluid flow equations within the theoretical framework of the boundary layer theory and the application of this theory to handling laminar flows. Chapter II-4 presents the turbulent boundary layer theory, including important aspects such as the alternative of power laws to log laws in wall-bounded turbulent flows. The book contains eight appendixes in which the author presents some interesting auxiliary material, including a mathematical summary for fluid dynamicists and the measurement of bottom shear stress using pitot tubes. Five additional sections are provided with assignments for students. The book ends with 41 beautiful color plates that will capture the eye of the reader, showing the aesthetic aspects of fluid flow.

The quality of the book is high in terms of typesetting, figures, and text organization. It is simple to move across the text, which will be of help to a fast reader looking for specific details. Technical drawings and tables are complemented with real photos that help to explain direct applications of the theory to real life. Some notes are also included, which enhance the primary text of each chapter. Historical details are given about the foundation of hydrodynamics, which will be of interest for instructors to interest students in the lessons. Each chapter contains a collection of worked examples, increasing the value of the book for teaching purposes. The coverage of topics within the book is adequate for undergraduate students, but the clarity of presentation of the theory is so well done that it may serve as a good basic reference for Ph.D. students and researchers. There is no specific coverage of open channel or pipe flows, but the theory of direct application is presented for both problems, i.e., the turbulent velocity profile of wall-bounded flows or the computation of hydrodynamic forces. I missed an additional appendix addressing some presentations of basic numerical techniques in hydrodynamics, such as the 2D solution of the Laplace equation in ideal fluid flows, or the one-dimensional computation of the turbulent boundary layer using von Kármán's equation. However, these are not real limitations of the book, and other references could be cited in this regard, such as the works of Thom and Apelt (1961) or White (1991). The book contains a good presentation of both ideal and real fluid flows in a single volume, making it a practical contribution.

In summary, Professor Chanson's book will be an important addition to the field of hydrodynamics. I am glad to recommend it to instructors, students, and researchers who are in need of a clear and updated presentation of the fundamentals of fluid mechanics and their applications to engineering practice.

References

Thom, A., and Apelt, C. (1961). *Field computations in engineering and physics*, Van Nostrand, London.

White, F. M. (1991). *Viscous fluid flow*, McGraw-Hill, New York.