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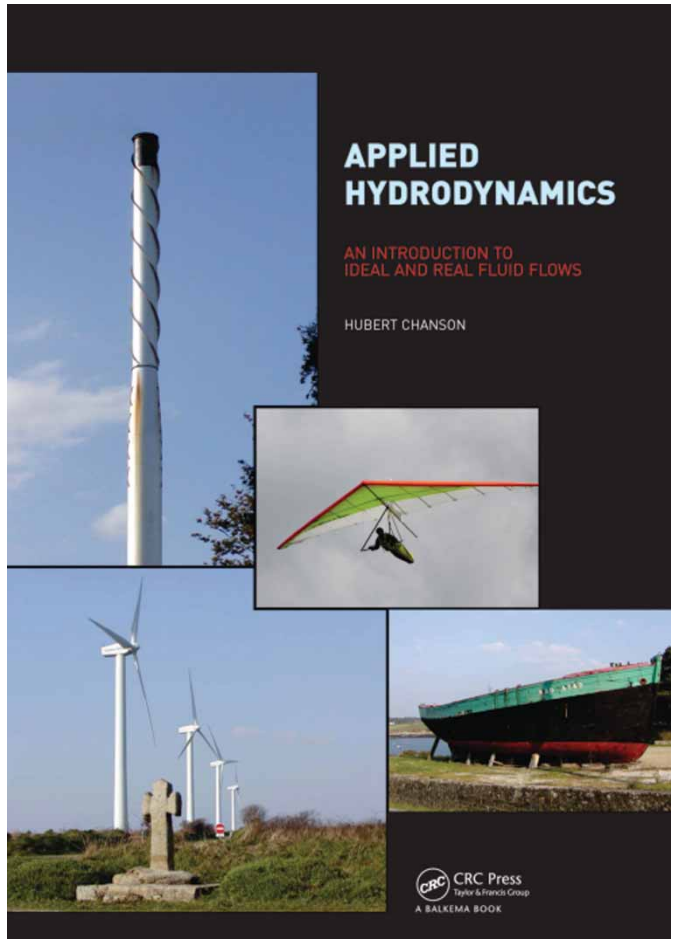
Book review

Applied hydrodynamics: an introduction to ideal and real fluid flows

by Hubert Chanson*, Boca Raton, London, New York, Leiden, CRC Press, Taylor & Francis Group, 2009, 478 pp., US$115, ISBN 978-0-415-49271-3 (hardback), ISBN 978-0-203-87626-8 (e-book)*



This book should be welcome by at least two groups of readers. First one is defined by the author: 'The lecture material is designed as an intermediate course in fluid dynamics for senior undergraduate and postgraduate students in Civil, Environmental, Hydraulic and Mechanical Engineering'.

There is a second group, existence of which may widen considerably the market for the publication. This second group is composed of engineers using all over the world commercial modelling software, especially free surface modelling software.

The book corresponds to a university-level course, a very impressive one in its coverage of the domain. When the author writes that it is at graduate or the last year undergraduate level, he does not mention the fact that when such a course is taught at an university the students can always benefit from the advice and, possibly, further explanations coming from the teacher. An individual reader of the book should have solid bases acquired before or to be prepared to look by himself for some notions or developments. On the contrary, the reviewer does not mean by this comment that the book is incomplete or cannot be understood without the professor's help: numerous references to textbooks and monographs show the way. Nevertheless, it is an advanced course and as such there are definitions and paragraphs that are customarily introduced during the first course of hydrodynamics which normally precedes the one of the book. But, again for the abovementioned second group of readers, these difficulties can be overcome and they are not only a challenge but also the way to understand better and in-depth the theoretical bases of the subject. And for both groups, the numerous exercises that are inserted literally after each subchapter of the book will be of enormous help in the acquisition of the content.

The reviewer would like to underscore specific place of hydrodynamics in the domain of engineering education especially when considered within the current context of modelling. Before simulation became generalized as engineering tool there were only *Theoretical Hydrodynamics* (considered sometimes as a branch of mathematics, e.g. the emblematic book by Lamb) and then *Fluid Mechanics*, the second one being engineering subject. The latter was dealing with ideal fluids and, eventually, after Prandtl and others, with real fluids that may be viscous and compressible (e.g. air and gases). In parallel there was hydraulics, essentially experimental engineering science, aimed at bridging the gap between Fluid Mechanics and needs of engineering that faced real-life situations. Then arrived computers and there came

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for a couple of decades a honeymoon between Numerical Analysis, Fluid Mechanics and Hydraulics. The new means allowed for approximate solutions of equations that before that period were replaced by simplified ones based on such assumptions as ideal fluids, irrotational potential flows, etc. The links of this triangular relationship somehow loosened with time: at present we have essentially the domains of computational fluid dynamics (CFD) and computational hydraulics (modelling). It seems that most people involved in those are so much preoccupied by developing complex simulation models that they somehow are separated from numerical analysis. This separation goes so far that one may sometimes have doubts about the methods used in software codes to approximate original equations. But the greatest ditch has been created between the users of commercial hydraulics simulation software and the Fluid Mechanics. There is an abyss of ignorance concerning Hydrodynamics bases among the most of the users of this software; a number of them forgot what they learnt (if their university curriculum ever provided for that) on hydrodynamics and instead of thinking in terms of the latter they follow blindly instructions of the software manuals, only too often neglecting the fact that the results they obtain are nothing else but approximate solutions of hydrodynamics equations. Thus, they are handicapped when it comes to their essential role: interpretation of the results supplied by software simulation. And this gap may only be bridged by coming back to the hydrodynamics and by understanding its bases. And this population of modellers receive now, with Hubert Chanson's book, a tool for such understanding as well as the material for individual catching up with desired knowledge profile.

There are two original aspects in this book that must be underlined. One concerns description of real-life flows as encountered in nature and corresponding illustrations, especially beautiful photographs of flows and sometimes their consequences. The idea is excellent, especially that the author brings in cases not often described in text books, e.g. undular bore in tidal rivers. However, it may sometimes be difficult to the reader to relate these illustrations to specific paragraphs of the text (e.g. undular bore propagation to description of velocity oscillations in chapter on turbulence). The difficulty arises from the fact that the illustrations concern nature and real flows while the book stays within the domain of hydrodynamics description of the real life. The title of the book is *Applied hydrodynamics*, but even the chapters on real fluids flows are forcibly very theoretical as compared with reality. But certainly the illustrations wake up interest and lead to the reflection on how our hydrodynamic representation of reality compares with the latter. At this point one may regret that the whole domain of "hydraulics" is not only out of scope of the book but even barely, if at all, mentioned. So much so that people without a basic knowledge of the subject might judge from the title that *Applied* means that corresponding chapters and theories may in a realistic way describe nature and be used as such as engineering tools. Sometimes, in very rare cases it is true. But in most cases it is not even if these theories are necessary to understand the approximations and bases of the tools actually used by engineers.

The second original aspect of the book concerns biographical notes of all people who, in history of hydraulics and hydrodynamics, gave their names to theories, formulas, and approaches. There are a couple of books on history of the matter (Hunter Rouse & Simon Ince, Willi Hager, Marcel Nordon), but they do not constitute common reading for Civil Engineering students or professionals. With the result that on average many of us know little about history of profession and are unable to tell who were people such as Chèzy, Reynolds, Froude, Manning, Prandtl, or Von Karman. That is why the insertion of these notes in the chapters of the book where they fit is an excellent initiative and one step more towards acquisition of general culture of the profession.

In conclusion, this book merits being read and even studied by a very large spectrum of people who should be able to find it on the shelves of the professional and university libraries that respect themselves.

For information, the reviewer feels useful to bring in the essentials of the Table of Contents: Part 1 deals with irrotational flow motion of ideal fluid, from basic hypotheses and equations, through 2D flows, complex potential and Joukowski transformation to the Schwarz–Christoffel theorems and applications. Part 2 gives an introduction to the turbulence and boundary layer theory and follows through applications to laminar boundary layer flows up to some 30 pages on turbulent boundary layers.

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