

Preface of German Edition

Some readers familiar with fluid mechanics who come across this book may ask themselves why another textbook on the basics of fluid mechanics has been written, in view of the fact that the market in this field seems to be more than saturated. The author is quite conscious of this situation, but he thinks all the same that this book is justified because it covers areas of fluid mechanics which have not yet been discussed in existing texts, or only to some extent, in the way treated here.

When looking at the textbooks available on the market that give an introduction into fluid mechanics, one realizes that there is hardly a text among them that makes use of the entire mathematical knowledge of students and that specifically shows the relationship between the knowledge obtained in lectures on the basics of engineering mechanics or physics and modern fluid mechanics. There has been no effort either to activate this knowledge for educational purposes in fluid mechanics. This book therefore attempts to show specifically the existing relationships between the above fields, and moreover to explain them in a way that is understandable to everybody and making it clear that the motions of fluid elements can be described by the same laws as the movements of solid bodies in engineering mechanics or physics. The tensor representation is used for describing the basic equations, showing the advantages that this offers.

The present book on fluid mechanics makes an attempt to give an introductory structured representation of this special subject, which goes far beyond the potential-theory considerations and the employment of the Bernoulli equation, that often overburden the representations in fluid mechanics textbooks. The time when potential theory and energy considerations, based on the Bernoulli equation, had to be the center of the fluid mechanical education of students is gone. The development of modern measuring and computation techniques, that took place in the last quarter of the 20th century, up to the application level, makes detailed fluid-flow investigations possible nowadays, and for this aim students have to be educated.

Using the basic education obtained in mathematics and physics, the present book strives at an introduction into fluid mechanics in such a way that each chapter is suited to provide the material for a one-week or two-week lectures, depending on the educational and knowledge level of the students. The structure of the book helps students, who want to familiarize themselves with fluid mechanics, to recognize the material which they should study in addition to the lectures to become acquainted, chapter by chapter, with the entire field of fluid mechanics. Moreover, the present text is also suited to study fluid mechanics on one's own. Each chapter is an introduction into a subfield of fluid mechanics. Having acquired the substance of one chapter, it is easier to read more profound books on the same subfield, or to pursue advanced education by reading conference and journal publications.

In the description of the basic and most important fluid characteristic for fluid mechanics, the viscosity, much emphasis is given so that its physical cause is understood clearly. The molecular-caused momentum transport, leading to the τ_{ij} -terms in the basic fluid mechanical equations, is dealt with analogously to the molecular-dependent heat conduction and mass diffusion in fluids. Explaining viscosity by internal "fluid friction" is physically wrong and is therefore not dealt with in this form in the book. This text is meant to contribute so that readers familiarizing themselves with fluid mechanics gain quick access to this special subject through physically correctly presented fluid flows.

The present book is based on the lectures given by the author at the University of Erlangen-Nürnberg as an introduction into fluid mechanics. Many students have contributed greatly to the compilation of this book by referring to unclarified points in the lecture manuscripts. I should like to express my thanks for that. I am also very grateful to the staff of the Fluid Mechanics Chair who supported me in the compilation and final proof-reading of the book and without whom the finalization of the book would not have been possible. My sincere thanks go to Dr.-Ing. C. Bartels, Dipl.-Ing. A. Schneider, Dipl.-Ing. M. Glück for their intense reading of the book. I owe special thanks to Mrs. I.V. Paulus, as without her help the final form of the book would not have come about.

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