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BOOK REVIEW

Hydrodynamics of Suspensions—Fundamentals of Centrifugal and Gravity Separation, by M. UNGARISH. Springer, Berlin (1993).

The subject of this book is quite accurately described by its complete title, whereas a more general scope is suggested by the main title given on the cover. The separation of a dispersed phase (solid particles, drops or bubbles) from a continuous phase (gas or liquid) is considered from a macroscopic point of view. The effects of particle agglomeration, change of shape and phase transitions are disregarded. As far as the basic equations are concerned, the author follows the traditional paths of modelling two-phase flows, i.e. by applying "mixture" and "two-fluid" approximations.

The text is organized in eight chapters. After a brief introduction into the subject (chapter 1), the equations of motion of a suspension are presented in chapter 2. The presentation includes a discussion of the basic problems encountered in a macroscopic description of two-phase flows. Also given, and carefully discussed, are the approximations ("models") to be used in the main chapters of the book. The preparatory part of the book is completed in chapter 3, which may serve as a introduction into the problems, as well as a summary of the more important results, of the theory of rotating, single-phase fluids.

A systematic and rather detailed analysis of separation processes, subject to the assumptions mentioned above, is given in chapters 4–7. These chapters are likely to be the most interesting ones to a majority of the readers. Chapter 4 deals with processes which depend only on time and one spatial coordinate. Exact solutions of these relatively simple problems are available from both the mixture and the two-fluid models. Next friction effects at the boundaries of rotating, cylindrical containers are analysed. Wall friction in gravity settling, however, is not considered. Chapters 6 and 7, which account for nearly one-half of the main text and one-third of the whole book, concern the effects due to walls that are inclined with respect to the (primary) body force. In gravity settling, this is known as the "Boycott effect". In centrifugal settling there are similar, yet more complex effects due to the combined action of centrifugal and Coriolis forces. A rather comprehensive analysis is given, including a competent survey on related work. Some more recent developments, however, have not been taken into account, e.g. regarding the sedimentation of nondilute suspensions in inclined settlers and the centrifugal separation in rotating buckets.

The last chapter of the main text is devoted to numerical methods that are relevant to the computation of separation processes. After a brief introduction into the discretization methods and the stability problems, specific applications are discussed. The comprehensive appendix includes details of the analysis, useful summaries of mathematical tools, and a computer program.

At the end of each chapter, a few, well-chosen exercises (without solutions) are given. These exercises could be of considerable help when the book is used for teaching. The researcher, on the other hand, is likely to be interested in the list of references, which includes very useful comments on the papers that are of particular relevance to the subject of the book. The reader should be aware, however, that the list of references is not quite complete: missing are various original contributions to problems discussed in the book as well as some recent survey articles concerning the subject.

In summary, the present book provides a comprehensive, though not fully complete, survey on recent progress in the analysis of the two-phase flow processes which govern the gravity and centrifugal separation of particles and fluids. Written by an author who has made important contributions to the field, the monograph gives a remarkably concise, unified treatment of a variety of complex flow phenomena which have been understood only recently. The book can be recommended to students, teachers and to anyone who intends to enter this fascinating field of very active research.

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